



CLEARING PERMIT

Granted under section 51E of the Environmental Protection Act 1986

Purpose Permit number:	CPS 9307/1
Permit Holder:	Shire of Goomalling
Duration of Permit:	From 7 July 2023 to 7 July 2038

The permit holder is authorised to clear native vegetation subject to the following conditions of this permit.

PART I – CLEARING AUTHORISED

1. Clearing authorised (purpose)

The permit holder is authorised to clear native vegetation for the purpose of road widening.

2. Land on which clearing is to be done

Calingiri-Goomalling Road reserve (PINs 11502043, 11720387, 11720392, 11720390, 3702293, 11731752, 11722008, 11731751, 11429894)

3. Clearing authorised

The permit holder must not clear more than 4.56 hectares of native vegetation within the area cross-hatched yellow in Figure 1a, Figure 1b, Figure 1c and Figure 1d of Schedule 1.

4. Type of clearing authorized

This permit authorises the permit holder to clear native vegetation for the activities described in condition 1 of this permit to the extent that the permit holder has the power to carry out works involving clearing for those activities under the *Local Government Act 1995* or any other written law.

5. Period during which clearing is authorised

The permit holder must not clear any native vegetation after 7 July 2028.

PART II – MANAGEMENT CONDITIONS

6. Avoid, minimise, and reduce impacts and extent of clearing

In determining the native vegetation authorised to be cleared under this permit, the permit holder must apply the following principles, set out in descending order of preference:

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

7. Weed and dieback management

When undertaking any clearing authorised under this permit, the permit holder must take the following measures to minimise the risk of 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 known 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.

8. Priority flora management

Prior to undertaking any clearing authorised under this Permit, the permit holder must:

- (a) Engage an *environmental specialist* to demarcate 20-metre buffers of all *priority flora* species identified and listed in Table 1, within the area cross-hatched yellow in Figure 1a, Figure 1b, Figure 1c and Figure 1d of Schedule 1.
- (b) If demarcating of 20-metre buffers under condition 8(a) is not practical, engage an *environmental specialist* to demarcate all individuals of *priority flora* species listed in Table 1, within the area cross-hatched yellow in Figure 1a, Figure 1b, Figure 1c and Figure 1d of Schedule 1.
- (c) The *permit holder* is not authorised to clear the priority flora species described in Table 1.
- (d) The permit holder must engage an *environmental specialist* to undertake a pre-clearance survey of the application area prior to the commencement of the clearing for any other *priority flora* within the application area. The permit holder is not authorised to clear any *priority flora* species.

Table 1 - Priority flora identified within the application area.

ID	Taxon	Easting	Northing
1	<i>Eucalyptus sargentii</i> subsp. <i>onesis</i> .	465037.4194	6553571.893
2	<i>Eucalyptus sargentii</i> subsp. <i>onesis</i> .	465045.8536	6553572.245
3	<i>Eucalyptus sargentii</i> subsp. <i>onesis</i> .	465044.7774	6553556.813
4	<i>Eucalyptus sargentii</i> subsp. <i>onesis</i> .	465044.6931	6553553.936
5	<i>Eucalyptus sargentii</i> subsp. <i>onesis</i> .	465044.2851	6553528.684
6	<i>Eucalyptus sargentii</i> subsp. <i>onesis</i> .	465051.4189	6553472.833

- (e) Within two months of undertaking any clearing authorised under this permit within the combined areas cross-hatched yellow on Figure 1a, Figure 1b, Figure 1c and Figure 1d of Schedule 1, the permit holder must provide the results of the *priority flora* survey in a report to the *CEO*.

9. Threatened flora management – pre-clearance survey

- (a) Prior to undertaking any clearing authorised under this permit within the combined areas cross-hatched yellow in Figure 1a, Figure 1b, Figure 1c and Figure 1d of Schedule 1, the permit holder must engage an *environmental specialist* to conduct a targeted flora survey of the permit area for the presence of the *threatened flora* (*Acacia ataxiphylla* subsp. *magna*) listed under the *Biodiversity Conservation Act 2016*.
- (b) Where *threatened flora* is identified under condition 9(a), the permit holder must not cause or allow:
 - (i) clearing within 50 metres of the identified *threatened flora*; and
 - (ii) clearing of the identified threatened flora.
- (c) Within two months of undertaking any clearing authorised under this permit within the combined areas cross-hatched yellow on Figure 1a, Figure 1b, Figure 1c and Figure 1d of Schedule 1, the permit holder must provide the results of the *targeted flora survey* in a report to the *CEO*.
- (d) If any threatened flora are identified within the areas cross-hatched yellow on Figure 1a, Figure 1b, Figure 1c and Figure 1d of Schedule 1, the *targeted flora survey* report must include the following:
 - (i) the location of *Acacia ataxiphylla* subsp. *magna* identified under condition 9(a), either as the location of individual plants, or where this is not practical, the area extent of the population and an estimate of the number of plants, recorded using a Global Positioning System (GPS) unit set to Geocentric Datum Australia 2020 (GDA2020), expressing the geographical coordinates in Eastings and Northings or decimal degrees;
 - (ii) the methodology used to survey the permit area.

10. Fauna management – black cockatoo habitat

- (a) Prior to undertaking any clearing authorised under this permit within the areas cross-hatched yellow in Figure 1a, Figure 1b, Figure 1c and Figure 1d of Schedule 1, the permit holder must engage a *fauna specialist* to conduct a *fauna survey* of the permit area to identify *black cockatoo habitat tree/s* being utilised by *Zanda lateriosis* (Carnaby's cockatoo).
- (b) Where black cockatoo habitat tree/s are identified under condition 10(a), the permit holder must engage a *fauna specialist* to map *black cockatoo habitat tree/s* within the permit area.
- (c) Each *black cockatoo habitat tree* identified must be inspected by a *fauna specialist* for *evidence* of current or past breeding use by *black cockatoo* species.
- (d) Where a *black cockatoo* habitat tree with no *evidence* of current or past use by *black cockatoo species* is identified in accordance with condition 10(a), that tree must only be cleared immediately after the inspection.
- (e) Where a *black cockatoo habitat tree* is identified within the areas cross-hatched yellow in Figure 1a, Figure 1b, Figure 1c and Figure 1d of Schedule 1 and that tree shows *evidence* of current or past breeding use by *black cockatoo species*

under condition 10(c), and clearing of that tree cannot be avoided, that tree must be monitored by a *fauna specialist* to determine when it is no longer in use for that breeding season.

- (f) Any *black cockatoo habitat tree* with evidence of current breeding use by *black cockatoo species* must not be cleared whilst it is in use for that breeding season as determined by the *fauna specialist* under condition 10(e).
- (g) The permit holder must install a total of five (5) artificial black cockatoo nesting hollows as calculated by the WA offset metric calculator, to account for the loss of four (4) suitably sized hollows for black cockatoo nesting that cannot be avoided.
- (h) Each artificial black cockatoo nesting hollow required by condition 10(g) must be installed prior to commencement of the next black cockatoo breeding season following clearing of the related *black cockatoo habitat tree(s)*.
- (i) In relation to the total of five (5) artificial black cockatoo nest hollow(s) required by condition 10(g) of this permit:
 - (i) five (5) hollows must be installed within the area cross-hatched green in Figure 2 of Schedule 1 (Reserve 15442);
 - (ii) must be designed and placed in accordance with the specifications detailed in Schedule 2; and
 - (iii) must be monitored and maintained in accordance with the specifications detailed in Schedule 2, for a period of at least 10 years.
- (j) Within two months of clearing authorised under this permit within the areas cross-hatched yellow in Figure 1a, Figure 1b, Figure 1c and Figure 1d of Schedule 1, the permit holder must provide the results of the *fauna survey* in a report to the CEO.
- (k) The *fauna survey* report must include the following;
 - (i) the time(s) and date(s) of inspection(s) by the *fauna specialist*;
 - (ii) a description of the *fauna specialist* inspection methods used;
 - (iii) the location of the *black cockatoo habitat tree(s)* recorded using a Global Positioning System (GPS) unit set to Geocentric Datum Australia 2020 (GDA2020), expressing the geographical coordinates in Eastings and Northings or decimal degrees;
 - (iv) the location of any fauna species listed in condition 10(a), if identified, recorded using a GPS unit set to GDA2020, expressing the geographical coordinates in Eastings and Northings or decimal degrees;
 - (v) the name and amount of each fauna species identified;
 - (vi) whether the *black cockatoo habitat tree/s* identified show current or past use by black cockatoo species;
 - (vii) a photo of the *black cockatoo habitat tree(s)* identified; and
 - (viii) a description of the *black cockatoo habitat tree(s)* identified, including the:
 - (a) species of *black cockatoo habitat tree(s)*; and
 - (b) condition of the *black cockatoo habitat tree(s)*
 - (ix) the time and date each *black cockatoo habitat tree* with evidence of current or past breeding use was cleared.

11. Offset – revegetation

Within 12 months of the commencement of clearing, the permit holder must implement and adhere to the *Revegetation plan*, including but not limited to the following actions:

- (a) Retain the vegetative material and topsoil removed by clearing authorised under this Permit and stockpile the vegetative material and topsoil in an area that has already been cleared;
- (b) Commence *revegetation* and *rehabilitation* of 6.6-hectares which includes *revegetation* of 287 individual plants of known black cockatoo foraging species at minimum, within the areas cross-hatched red in Figure 2 of Schedule 1 by:
 - (i) laying the vegetative material and topsoil retained under condition 11(a) within 18 months of its removal within the *offset site*.
 - (ii) deliberately planting *native vegetation* that will result in similar species composition, structure and density of native vegetation to the surrounding vegetation within the *offset site*; and
 - (iii) ensuring only *local provenance* seeds and propagating material are used to *revegetate* and *rehabilitate* the area;
- (c) Rip the *offset site* to remove any areas of compaction or other obstruction that could prevent root penetration of seedlings;
- (d) Undertake weed control in accordance with Section 4.3.2 of the *Revegetation plan*;
- (e) Establish twelve 10 x 10 metre quadrat monitoring sites across the *offset site*.
- (f) Conduct *pest animal* control;
- (g) Ensure the fence of the *offset site* is in a suitable condition;
- (h) Remove rubbish from the *offset site*;
- (i) Maintain a four-metre trafficable firebreak that complies with the Shire of Goomalling requirements around the interior perimeter fence of the *offset site* on an ongoing basis;
- (j) Water planted vegetation between November and March during the first two years following planting;
- (k) Undertake weed control activities on an ‘as needs’ basis to maintain a minimum 80 per cent weed free state of the *offset site* by the end of the project maintenance period;
- (l) Achieve the following completion criteria no later than within a 5-year monitoring period for areas *revegetated* and *rehabilitated* under this Permit and for the vegetation to be maintained for a period of two years from the date of the completion criteria having been met.

Item	Criterion	Completion targets	Completion criteria	Monitoring
1a	Species richness	Return dominant overstorey species present at <i>reference sites</i> .	For each target revegetation type, the revegetation needs to support the dominant overstorey species from the target <i>reference sites</i> .	Annually in spring by an <i>environmental specialist</i> until completion criterion has been met and maintained for two years (i.e. three successive monitoring events).
1b	Species richness	Minimum of 60 per cent of native species in each structural layer returned, based on <i>reference sites</i> .	For each target revegetation type, the revegetation needs to achieve a minimum species richness of at least 60 per cent of the average recorded at the <i>reference sites</i> .	Annually in spring by an <i>environmental specialist</i> until completion criterion has been met and maintained for two years (i.e. three successive monitoring events).
2a	Cover and density	Minimum of 60 per cent of stems/ha for dominant overstorey species returned based on <i>reference sites</i> .	For each target revegetation type, the revegetation needs to support 60 per cent of stems/ha of the dominant overstorey species from the target <i>reference sites</i> .	Annually by an <i>environmental specialist</i> until completion criterion has been met and maintained for two years (i.e. three successive monitoring events).
2b	Cover and density	Minimum of 60 per cent of plants /ha in each structural layer returned, based on <i>reference sites</i> .	For each target revegetation type, the revegetation needs to achieve a minimum species richness of at least 60 per cent of the average record at the <i>reference sites</i> .	Annually by an <i>environmental specialist</i> until completion criterion has been met and maintained for two years (i.e. three successive monitoring events).
3a	Weeds	Weed cover is no greater than at <i>reference sites</i> .	For each target revegetation type, the revegetation needs a weed cover no greater than that recorded at the targeted <i>reference sites</i> .	Annually in winter/spring by an <i>environmental specialist</i> until completion criterion has been met and maintained for two years (i.e. three successive monitoring events).
3b	Weeds	No priority, high impact or highly invasive weeds present	No weeds present that are listed as Priority Alert, High Impact or Rapid invasiveness on the DBCA Wheatbelt Region Impact and Invasiveness Ratings list as updated from time to time.	Annually in winter/spring by an <i>environmental specialist</i> until completion criterion has been met and maintained for two years (i.e. three successive monitoring events).
4	Bare ground	No more than 5 per cent greater than at the <i>reference sites</i> .	For each target revegetation type, the <i>offset sites</i> must not have more than 30m ² of bare ground.	Annually in Summer by an <i>environmental specialist</i> until completion criterion has been met and maintained for two years (i.e. three successive monitoring events).
5	Gates and boundary fence	Gates and boundary fence to be in good condition with no obvious damage that will enable the entry of fauna, including rabbits and/or kangaroos into the <i>rehabilitation</i> area.	N/A	Annually by an <i>environmental specialist</i> until completion criteria 1 – 4 has been met.

- (m) Undertake remedial action for areas *the offset site* where monitoring indicated that revegetation has not met the completion criteria, outlined in condition 11(l) of this permit, including:
- (i) revegetate the area by deliberately *planting native vegetation* that will result in the minimum target set out in condition 11(l) of this permit and ensuring only *local provenance* seeds and propagating material are used;
 - (ii) undertake further weed control activities;
 - (iii) undertake further watering activities; and
 - (iv) annual monitoring by an *environmental specialist* of *the offset site* following the three years of biannual monitoring outlined in condition 11(l), until the completion criteria, outline in condition 11(l) of this Permit are met.

PART III - RECORD KEEPING AND REPORTING

12. Records that must be kept

The permit holder must maintain records relating to the listed relevant matters in accordance with the specifications detailed in Table 1.

Table 1: Records that must be kept

No.	Relevant matter	Specifications
1.	In relation to the authorised clearing activities generally	<ul style="list-style-type: none"> (a) the species composition, structure, and density of the cleared area; (b) the location where the clearing occurred, recorded using a Global Positioning System (GPS) unit set to Geocentric Datum Australia 2020 (GDA2020), expressing the geographical coordinates in Eastings and Northings; (c) the date that the area was cleared; (d) the size of the area cleared (in hectares); (e) actions taken to avoid, minimise, and reduce the impacts and extent of clearing in accordance with condition 6; and (f) actions taken to minimise the risk of the introduction and spread of <i>weeds</i> and <i>dieback</i> in accordance with condition 7.
2.	In relation to flora management pursuant to condition 8 and 9.	<ul style="list-style-type: none"> (a) the name and location of each <i>priority/threatened</i> flora species, recorded using a Global Positioning System (GPS) unit set to Geocentric Datum Australia 2020 (GDA2020), expressing the geographical coordinates in Eastings and Northings; (b) actions taken to demarcate each <i>priority/threatened</i> flora species recorded and their relevant buffers; and (c) actions taken to avoid the clearing of <i>priority/threatened flora</i> species. (d) copy of the results from the priority and threatened

No.	Relevant matter	Specifications
		flora survey.
3.	In relation to black cockatoo fauna management pursuant to condition 10 of this permit	<ul style="list-style-type: none"> (a) the time(s) and date(s) of inspection(s) of the suitable <i>black cockatoo habitat tree</i> by the <i>fauna specialist</i>; (b) a description of the inspection methodology employed by the <i>fauna specialist</i>; (c) the species name of any fauna determined by the <i>fauna specialist</i> to be occupying the suitable <i>black cockatoo habitat tree</i>; (d) where the suitable <i>black cockatoo habitat tree</i> is determined by the <i>fauna specialist</i> to be occupied by <i>black cockatoo species</i>: <ul style="list-style-type: none"> (i) the time and date that it was determined to be no longer occupied; and (ii) a description of the evidence by which it was determined to be no longer occupied; and (e) the time and date that the suitable <i>black cockatoo habitat tree</i> was cleared.
4.	In relation to the <i>revegetation</i> and <i>rehabilitation</i> areas pursuant to condition 11 of this permit	<ul style="list-style-type: none"> (a) the location of any areas revegetated and rehabilitated, recorded using a Global Positioning System (GPS) unit set to Geocentric Datum Australia 2020 (GDA2020), expressing the geographical coordinates in Eastings and Northings or decimal degrees; (b) the number of black cockatoo foraging species planted; (c) the date the fence and firebreak were installed and evidence of maintenance; (d) the date rubbish was removed from the <i>revegetation</i> and <i>rehabilitation</i> area; (e) pest animal and weed control measures undertaken; (f) a description of the <i>revegetation</i> and <i>rehabilitation</i> activities undertaken; (g) the size of the area <i>revegetated</i> and <i>rehabilitated</i> (in hectares); (h) the species composition, structure and density of <i>revegetation</i> and <i>rehabilitation</i>; (i) the number of plants and species installed; (j) the assessment of the <i>revegetation</i> and <i>rehabilitation</i> against criterion outlined in condition 11(l); (k) any remedial actions undertaken in accordance with condition 11(m); and (l) a copy of the environmental specialist's report.

13. Reporting

- (a) 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 12 of this Permit; and
 - (ii) concerning activities done by the Permit Holder under this Permit between 1 January and 31 December of the preceding calendar year.
- (b) If no clearing authorised under this Permit was undertaken between 1 January to 31 December of the preceding calendar year, 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.
- (c) Prior to 7 April 2038, the permit holder must provide to the *CEO* a written report of records required under condition 12 of this Permit, where these records have not already been provided under condition 13(a) of this Permit.

DEFINITIONS

In this permit, the terms in Table 2 have the meanings defined.

Table 2: Definitions

Term	Definition
Black cockatoo habitat trees	means trees that have a diameter measured over bark at 130 centimetres from the base of the tree of 50 centimetres or greater (or 30 centimetres or greater for <i>Eucalyptus salmonophloia</i> or <i>Eucalyptus wandoo</i>) that contain hollows suitable for breeding by black cockatoo species.
Black cockatoo species	means one or more of the following species: <i>Zanda latirostris</i> (Carnaby's cockatoo); <i>Zanda Calyptorhynchus</i> (Baudin's cockatoo); and/or <i>Calyptorhynchus banksii naso</i> (Forest red-tailed black cockatoo).
Botanist	means a person who holds a tertiary qualification specialising in environmental science or equivalent, and has a minimum of two (2) years work experience in Western Australian flora identification and undertaking flora surveys native to the bioregion being inspected or surveyed, or who is approved by the CEO as a suitable environmental specialist for the bioregion, and who holds a valid flora licence issued under the <i>Biodiversity Conservation Act 2016</i> .
CEO	Chief Executive Officer of the department responsible for the administration of the clearing provisions under the <i>Environmental Protection Act 1986</i> .
Clearing	has the meaning given under section 3(1) of the EP Act.
Condition	a condition to which this clearing permit is subject under section 51H of the EP Act.
Department	means the department established under section 35 of the <i>Public Sector Management Act 1994</i> (WA) and designated as responsible for the administration of the EP Act, which includes Part V Division 3.
Dieback	means the effect of <i>Phytophthora</i> species on native vegetation.
Direct seeding	means a method of re-establishing vegetation through establishment of a seed bed and the introduction of seeds of the desired plant species.
Environmental specialist	means a person 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, or who is approved by the <i>CEO</i> as a suitable environmental specialist.
EP act	<i>Environmental Protection Act 1986</i> (WA)
Fauna specialist	means a person who holds a tertiary qualification specialising 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 <i>Biodiversity Conservation Act 2016</i> .
Fill	means material used to increase the ground level, or to fill a depression.
Local provenance	means native vegetation seeds and propagating material from natural sources

Term	Definition
	within 100 kilometres and the same Interim Biogeographic Regionalisation for Australia (IBRA) subregion of the area cleared.
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.
Native vegetation	has the meaning given under section 3(1) and section 51A of the EP Act.
Offset site	Means the areas cross-hatched red on Figure 2 of Schedule 1.
Optimal time	means the period from April to June for undertaking <i>planting</i> and <i>seeding</i> .
Pest animal	Animals that are known to impact the survival of revegetation/rehabilitation i.e. rabbits.
Planting	means the re-establishment of vegetation by creating favourable soil conditions and planting seedlings of the desired species.
Priority flora	means those plant taxa described as priority flora classes 1, 2, 3, or 4 in the Department of Biodiversity, Conservation and Attractions <i>Threatened and Priority Flora List for Western Australia</i> (as amended from time to time).
Reference sites	Means: a) For Crown Reserves 15442, Goomalling, the four 10m x 10m quadrat reference sites that were identified (CPS 8832/2, 2021) along Berring Rd located immediately west of the <i>revegetation</i> and <i>rehabilitation</i> area to identify remnant native vegetation species composition and structure, condition, density and weed cover.
Regeneration	means revegetation that can be established from in situ seed banks contained either within the topsoil or seed-bearing mulch.
Rehabilitate, rehabilitated and rehabilitation	means actively managing an area containing native vegetation in order to improve the ecological function of that area using methods such as natural <i>regeneration</i> , <i>direct seeding</i> and/or <i>planting</i> , so that the species composition, structure and density is similar to pre-clearing vegetation types in that area.
Revegetation plan	Means plan developed by the permit holder for the <i>revegetation</i> and <i>rehabilitation</i> of a site in accordance with condition 9 of this Permit: “ <i>Shire of Goomalling – Offset Site Revegetation Plan – Calingiri- Goomalling Road SLK 0.00-SLK30.32</i> ”.
Targeted flora survey	means a field-based investigation, including a review of established literature, of the biodiversity of flora and vegetation of the permit area, focusing on habitat suitable for flora species that are being targeted and carried out during the optimal time to identify those species. Where target flora are identified in the permit area, the survey must also include a minimum of a 10 metre radius of the surrounding areas to place the permit area into local context.
Threatened flora	means those plant taxa listed as threatened flora under the <i>Biodiversity Conservation Act 2016</i> .
Weeds	means any plant – (a) that is a declared pest under section 22 of the <i>Biosecurity and Agriculture Management Act 2007</i> ; 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.

END OF CONDITIONS


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Ryan Mincham
 MANAGER
 NATIVE VEGETATION REGULATION

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

14 June 2023

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Schedule 1: Plans 9307/1

The boundary of the area authorised to be cleared is shown in the maps below (Figure 1a, Figure 1b, Figure 1c and Figure 1d).

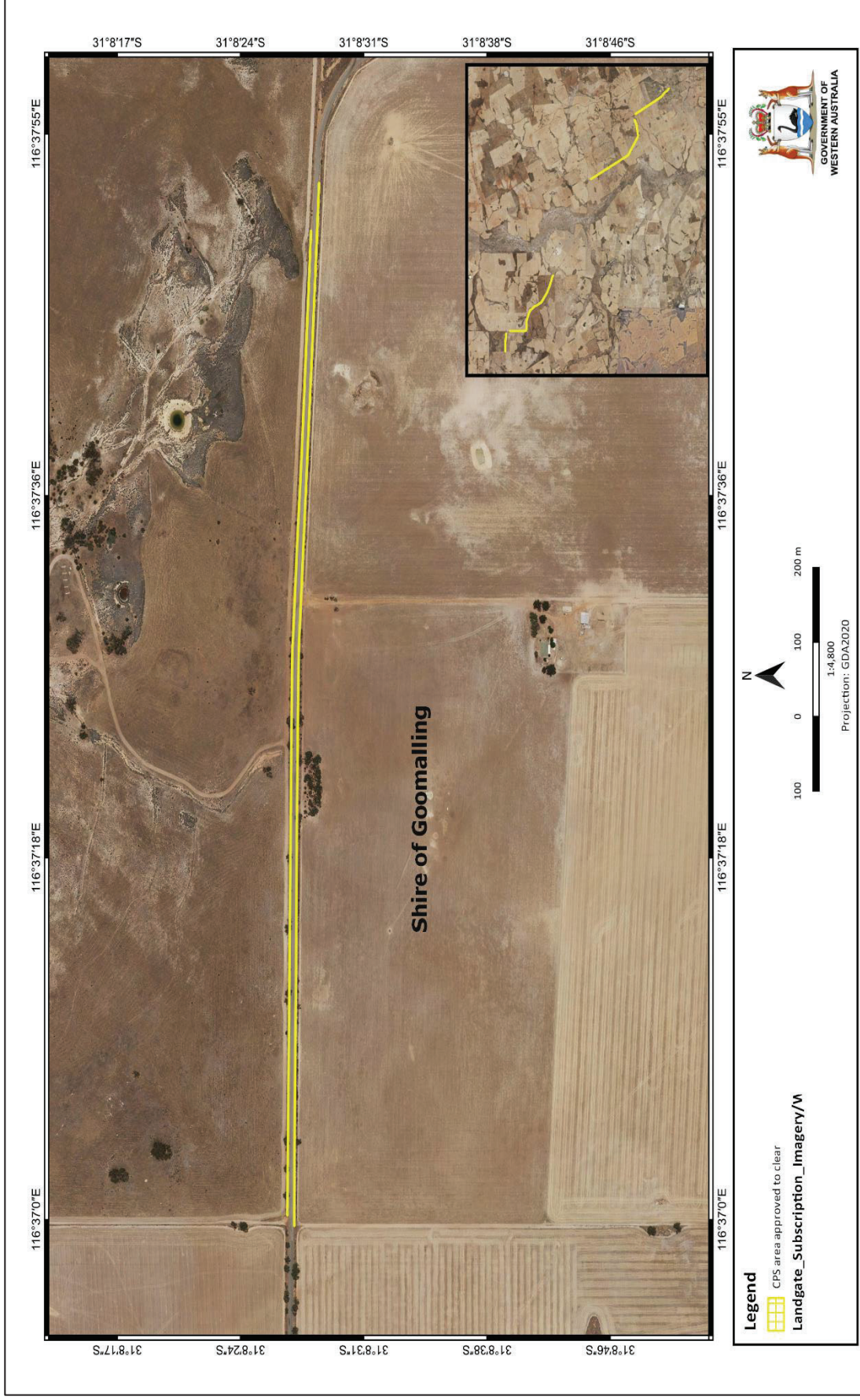


Figure 1a: Map of the boundary of the area within which clearing may occur

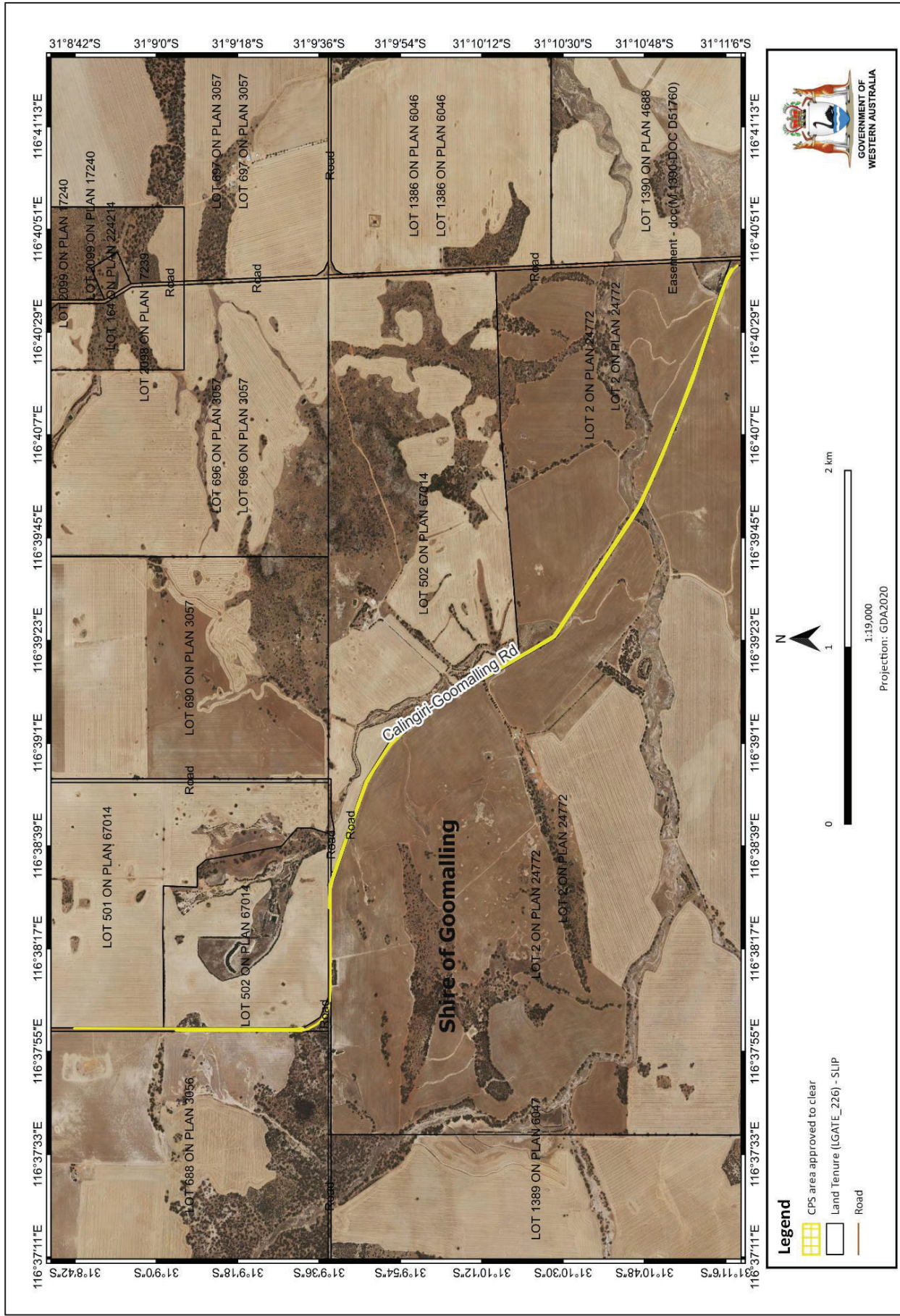


Figure 1b: Map of the boundary of the area within which clearing may occur



Figure 1c: Map of the boundary of the area within which clearing may occur

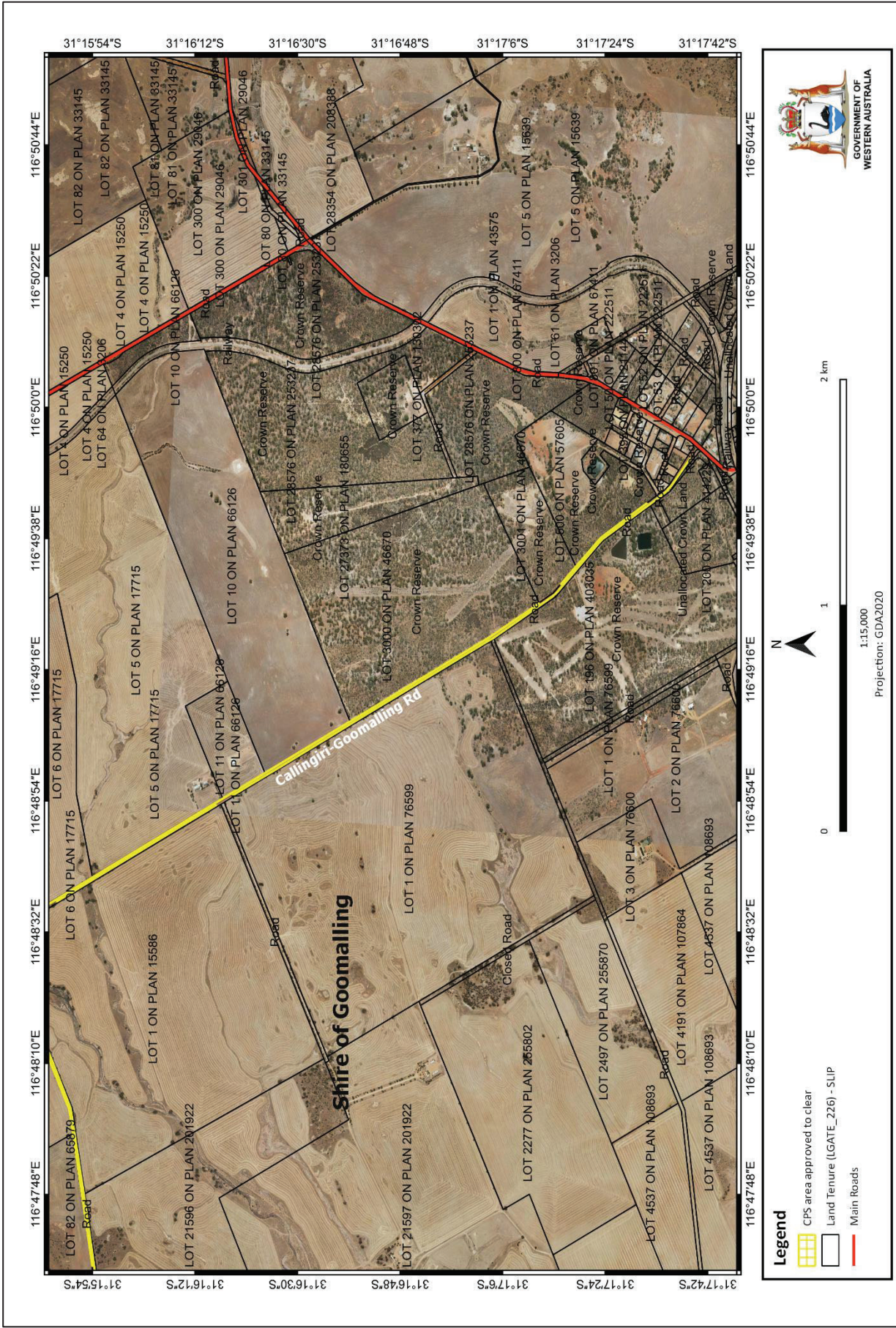


Figure 1d: Map of the boundary of the area within which clearing may occur



Figure 2: Map of the boundary of the area cross-hatched red which will be revegetated in accordance with the offset condition of this permit. The area cross-hatched green indicates the area where installation of five (5) artificial black cockatoo nesting hollows must occur.

Schedule 2: How to design, monitor and maintain artificial hollows for Carnaby's cockatoo

Artificial Hollows for Black Cockatoos

There are three species of threatened black cockatoos in the southwest of Western Australia (WA): Baudin's cockatoo *Zanda baudinii* (previously *Calyptorhynchus baudinii*), Carnaby's cockatoo *Zanda latirostris* (previously *Calyptorhynchus latirostris*) and forest red-tailed black cockatoo *Calyptorhynchus banksii naso*. Some of the main threats to the three species include nest hollow shortages due to ongoing and extensive habitat loss and degradation, lack of recruitment of new hollow bearing trees, and competition with galahs, corellas, and feral European honey bees.

Artificial hollows can be used to help conserve these threatened black cockatoos by enabling them to breed in areas where natural hollows are limited. This Fauna Note provides advice on how to select an appropriate site, guidelines on how to design and place artificial hollows, and advice on how to maintain and monitor artificial hollows. The information presented here is based on experience with Carnaby's cockatoo which have many examples of successful use of artificial hollows and forest red-tailed black cockatoo which have a few known examples of use. However, to date there are no records of Baudin's cockatoo using artificial nest hollows.

Sometimes a site may not be suitable for artificial hollows. This Fauna Note includes options for alternative conservation actions that are important to the conservation of black cockatoos and can also be used to complement the placement of artificial hollows.

It is important to remember that the retention of both old and dead trees (stags) that have suitable hollows for black cockatoos is crucial for breeding, and natural replacement of hollow bearing trees for future breeding is vital for the long-term survival of the species. The installation of artificial hollows should not be used to justify the removal of natural hollow-bearing trees.

It is important to remember that the retention of both old and dead trees (stags) that have suitable hollows for black cockatoos is crucial for breeding, and natural replacement of hollow bearing trees for future breeding is vital for the long-term survival of the species. The installation of artificial hollows should not be used to justify the removal of natural hollow-bearing trees.

When to Use Artificial Hollows

Artificial hollows may be useful at sites where natural hollows are a limiting resource. However, cockatoos may not always use artificial hollows, for example if provided in non-traditional nesting areas. Artificial hollows that are installed within 2 km of current breeding sites are regularly taken up. There are ways to select sites for artificial hollows that will increase the chance that they will be used and that birds will be able to successfully raise chicks.

Where do black cockatoos nest?

Black cockatoos nest in the hollows of mature trees in uncleared or remnant Eucalypt woodland or forest, as well as in remnant paddock trees. Trees may take more than 120 years to develop hollows that are a suitable size, and cockatoos use hollows in both living and dead trees. Refer to the maps at the end of this document for the known breeding range of the three species of black cockatoo.

Carnaby's cockatoos generally breed in Wandoo and Salmon Gum in the Wheatbelt, Marri in forested areas, and Tuart along the Swan Coastal Plain. They are also known to nest in Jarrah, Flooded Gum, York Gum, Gimlet, Powderbark Wandoo, and Karri.

Baudin's cockatoos generally nest in Jarrah, Marri, and Karri in densely forested areas. They are also known to nest in hollows in Wandoo and Tuart.



Carnaby's cockatoo nestlings in an artificial hollow. Note this chewing post will require replacement following breeding.

Photo: Rick Dawson

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The breeding habitat for forest red-tailed black cockatoos is in uncleared forest or remnant patches of old Marri. They are also known to nest in Karri, Wandoo, Bullich, Blackbutt, Tuart, and Jarrah.

Is my site suitable for artificial hollows?

It is recommended that artificial hollows be used in known nesting areas where there has been a decrease in the availability of natural nesting hollows. Trials have shown that Carnaby’s cockatoo and forest red-tailed black cockatoos will nest in artificial hollows if installed in suitable areas and are of a satisfactory design. However, putting up artificial hollows may not be the best way to help black cockatoos in your area.

Indeed, attracting birds to attempt to breed in unsuitable areas may result in increased risk of harm to adult birds or their chicks. The installation of artificial hollows in built up and urbanized areas of the metropolitan Perth and Peel regions, and other urban centres in the southwest is not recommended and should not be undertaken. This is due to the increased risk in this area, including car strike to young inexperienced birds, attack by predators such as Australian ravens and pets, and in highly urbanised and cleared areas there may not be sufficient food resource for the adults to successfully raise chicks).

To decide if your site is suitable for artificial hollows you need to consider five essential criteria (Table 1). If your site does not match all criteria, you may wish to consider alternative conservation actions including:

- protecting habitat by fencing and/or rabbit and stock control to encourage regeneration of native vegetation;
- controlling competitive species such as galahs, corellas and feral bees that may occupy hollows;
- repairing old and damaged natural nesting hollows;
- providing access to fresh water;
- revegetating with preferred food species and nesting trees; and/or
- creating linkages of vegetation between nesting and feeding areas.

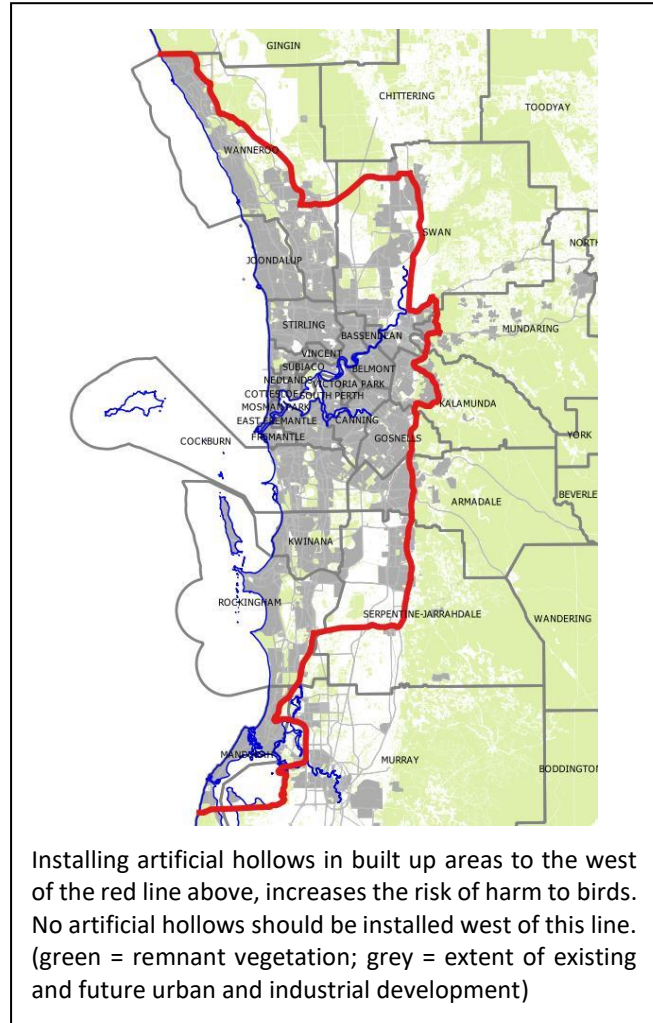


Table 1: Essential criteria for a site to be considered suitable for installation of artificial hollows, with alternative conservation actions suggested for each criterion that is not met.

1.	The site is Eucalypt woodland or forest within the known breeding range of the species	
	<i>Important consideration</i>	Carnaby’s cockatoos tend to nest in Wandoo and Salmon Gum in the Wheatbelt, Marri in forested area and Tuart along the Swan Coastal Plain. Baudin’s cockatoos generally nest in Jarrah, Marri, and Karri and forest red-tailed black cockatoos usually nest in Marri.
	<i>Alternative conservation actions</i>	If the site is not within the known current breeding range of black cockatoos, then it is unlikely that the installation of artificial hollows will attract the birds to the site. However, black cockatoos are highly mobile species that also require habitat for feeding and roosting which means that it is important to protect and manage habitat visited by the cockatoos by fencing, and carrying out other management, such as rabbit and stock control, to retain existing habitat, and to encourage regeneration of native vegetation. It is also important to revegetate areas within the breeding and non-breeding areas with preferred food species, and to create linkages of vegetation to assist the movement of the birds through the landscape.
2.	Breeding by Black cockatoos is known or suspected at the site. There must also be evidence that a lack of suitable available tree hollows is preventing breeding that would otherwise occur in the area.	

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	<i>Important consideration</i>	If the lack of available hollows is due to nest competitors such as galahs, western long-billed corellas or feral bees then any attempt to install artificial hollows must be accompanied by efforts to deter or control these competitors. Alternatively, successful control of competitors may mean that artificial hollows are not needed.
	<i>Alternative conservation actions</i>	<p>If sufficient suitable natural hollows are available in an area, then there is no need to install artificial hollows. This overcomes the need for ongoing maintenance of unnecessary artificial hollows.</p> <p>If breeding is already occurring at the site and there are plenty of available hollows, efforts can be redirected towards caring for existing or future nesting hollows. This may involve repairing old or damaged nesting hollows by covering cracks, removing debris blocking access to hollows or replacing rotted wood in the hollow so that the depth of the nest floor is manageable for the birds. Future hollows can be protected by preventing compaction of ground around trees, fencing and/or rabbit and stock control to encourage regeneration to produce future nesting trees, fire management, and the strategic pruning of limbs to prevent limbs breaking and tearing open hollows. Efforts can also be aimed at enhancing the success of existing breeding by revegetating with preferred food and nesting species, as well as creating linkages of suitable vegetation and fresh water between nesting and feeding areas.</p> <p>If breeding is not occurring at the site despite hollows being available, then there may be a range of factors making the site unsuitable for breeding. These factors must be identified and addressed before breeding can resume in the area (if at all possible). Lack of sufficient food could be the cause, and this can be addressed by revegetating with preferred food species and increasing connectivity in the landscape.</p> <p>To compile a list of plant species suitable for revegetation at your site, refer to the document Plants Used by Carnaby's Black Cockatoo available on the Department of Biodiversity, Conservation and Attractions (DBCA) black cockatoo webpage.</p>
3.	The artificial hollows can be located in close proximity to adequate feeding areas – within a 12 km radius.	
	<i>Important consideration</i>	Feeding areas commonly contain proteaceous species such as banksias (including dryandras) and hakeas. A list of food plants can be obtained by use of the document Plants Used by Carnaby's Black Cockatoo .
	<i>Alternative conservation actions</i>	If the site is not close to adequate food, then the black cockatoos will not be able to successfully raise young. Cockatoos require sufficient food close to nesting areas in order to be able to forage during the day and return to feed nestlings. Existing feeding habitat close (within 12km) to breeding areas can be protected by fencing and/or undertaking rabbit and stock control to encourage regeneration of native vegetation. The amount of feeding habitat in an area can be increased by planting or revegetating with preferred food species.
4.	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 artificial hollows.
	<i>Alternative conservation actions</i>	Artificial hollows can be subject to nest robbing and vandalism. It is highly recommended that artificial hollows are not put in exposed or easily accessible areas such as road verges unless they are above 8m and placed on the side of trees away from roads. If the site is considered at high risk of nest robbing or vandalism then alternative actions to assist the conservation of the species are recommended including: revegetation, fencing, repairing old or damaged natural nesting hollows and planting vegetation linkages to connect nesting and feeding areas.
5.	A suitable artificial hollow design is used.	
	<i>Important consideration</i>	For greatest chance of success, please refer to the sections below on how to design and place artificial hollows.
	<i>Alternative conservation actions</i>	If an alternative design is proposed, it is recommended that Department of Biodiversity, Conservation and Attractions, BirdLife Australia, or WA Museum are contacted to discuss and approve design.

How to Design and Place Artificial Hollows

A wide variety of artificial hollow designs have been previously used with mixed success. Evidence suggests that, while artificial hollows 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.

Successful artificial hollows have been constructed from sections of salvaged natural hollows, or black and white industrial pipe. Research results show that the most effective artificial hollows are made of plastic culvert pipe which is readily available, durable, light, cheap, and easy to install and maintain (see right picture below). When using non-natural materials care must be taken to ensure there are no toxic residues, and that the materials are safe to ingest.

Below are three examples of successful artificial hollows that have been used by black cockatoos for nesting:

- natural log with cut side entrance (left);
- white industrial pipe with top entrance (centre); and
- DBCA recommended polypropylene pipe design (right)

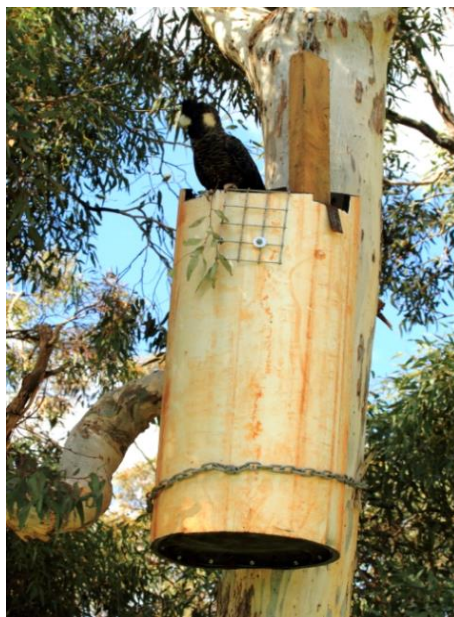


Photo: Christine Groom (left), Rick Dawson (centre and right)

The notes below provides general guidance on design and construction of artificial hollows for black cockatoos. Additional specifications are provided at the end of this Fauna Note which outline current best practice and may be considered recommendations for minimum requirements.

Walls, size, base, and entrance design

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

- durable enough to withstand exposure to elements for at least 20 years; and
- able to simulate the thermal properties of a natural tree hollow.

Artificial hollows should be:

- not less than 375 mm in internal diameter; and
- preferably 1200 mm deep overall with 200 mm of substrate/nesting material covering the base.

The base of the artificial hollow must be:

- securely fixed to the walls and able to support the weight of an adult and nestling(s);
- durable enough to last the life of the nest, and survive chewing by cockatoos;
- free draining;

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- at least 375 mm in diameter; and
- covered with 200 mm of sterile, dry, free draining substrate/nesting 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 hard plastic, thick hardwood timber slab or marine ply (not chipboard or MDF). The base material must be cut to fit internally with sharp or rough edges ground away or curled inwards, be fixed securely to the walls and have small drainage holes.

The entrance of the artificial hollow:

- must have a diameter of at least 375 mm; and
- preferably be top entry which will minimise use by non-target species.

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

Adding ladders and sacrificial chewing posts

For artificial hollows made of non-natural materials, or of processed boards, it is necessary to provide a ladder to enable the birds access to the hollow, and sacrificial chewing posts so that birds can chew material, and so that non-target species can exit the hollow. The post can also assist in providing further material to the substrate, however research has shown that not all posts are heavily chewed.

The ladder must be:

- securely mounted to the inside of the hollow;
- made from an open heavy wire mesh with a mesh size of 30 - 50 mm (such as WeldMesh™); or heavy chain; and
- reach to, or below the level of substrate/nesting material.

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.

Do not use material for ladders that the birds can chew, including galvanised metal because the birds may grip or chew the ladder, and ingest harmful compounds.

The sacrificial chewing posts must be:

- made of untreated hardwood such as Jarrah, Marri or Wandoo;
- thick enough to satisfy the birds' needs between maintenance visits;
- extended beyond the top of the hollow as an aid to see whether the nest is being used and reach to the floor of the hollow;
- placed on the inside of the hollow; and
- attached in such a way that they are easy to replace (e.g. a 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 one chewing post is provided. Posts 70 x 50 mm have been used but require monitoring at least every second breeding season when the nest is active and replacing when found to be no longer reaching the nesting material or otherwise significantly chewed. Birds do vary in their chewing habits, and therefore the frequency at which the chewing posts require replacement will also vary.

Mounting and placement

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

The height at which artificial hollows should be placed is variable, between 4 - 8m for Carnaby's cockatoo, and the average height of natural hollows in dominant tree species in the area is a good guide. If located in an area that the general public cannot access, such as a private property, the hollows can be placed as low as 4 m from the ground so that they are easily accessible by ladder. If located in an area where the general public are allowed access, hollows should be placed at least 8 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.

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Black cockatoos 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; and
- fitted on the side where the most shade can be obtained.

Artificial hollows must be mounted such that:

- the fixings used will last the duration of the nest e.g. galvanized bracket or chain and fixed with galvanized coach screws;
- it is secured by more than one anchor for security and stability;
- it is positioned vertically or near vertically; and
- where possible living trees are to be used to provide shade.

Artificial hollows should not be placed in the open on poles, as this may result in excessive exposure to sun during very hot weather.

Safety

Care needs to be taken when placing artificial hollows to ensure human safety is paramount.

Monitoring and Maintaining Artificial Hollows

It is important to monitor and maintain artificial hollows after they have been erected to ensure their effectiveness and so that problems with pest species or maintenance requirements can be identified and resolved. This will ensure the artificial hollow continues to provide opportunities to be used and that birds will be able to successfully raise chicks

Without regular maintenance, artificial hollows are likely to fail to achieve their objective to provide safe nesting opportunities for threatened black cockatoos. Therefore, it is important to continue a regime of regular maintenance for however long the artificial hollow is required. It may be several (to many) decades until a natural replacement hollow is available. Artificial hollows erected as a condition of development to offset the loss of natural hollows may be required to be available and maintained for the life of the development approval.

How do I monitor artificial hollows?

Before undertaking monitoring of artificial hollows for black cockatoos, it is recommended that you seek advice from the Department of Biodiversity, Conservation and Attractions, BirdLife Australia, or the WA Museum. It is also important to contact the Department's Wildlife Licensing Section, to determine if a lawful authority required (<https://www.dbca.wa.gov.au/licences-permits>).

Monitoring artificial hollows requires keen observation, and naturalist skills. It is often not possible to observe direct evidence of breeding (i.e. nestlings or eggs) and therefore inferences must be made based on other observations. It is also important to limit disturbance to breeding birds. There are many techniques available to monitor artificial hollows, and a combination of several is likely to achieve the best results (**Table 2**).

Monitoring of artificial hollows should consider and record:

- the condition of the tree, hollow fixings and general hollow condition;
- condition and connection of sacrificial chewing posts, ladder and substrate/nesting material inside hollow;
- any use by black cockatoos and nature of activity (adult birds, chewing, eggs, chicks etc.)
- details of use by non-target species (native or pest);
- identify any problems with pest species or maintenance requirements; and
- maintenance actions undertaken to resolve any problems.

The information collected from 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

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frequently monitoring a larger number of artificial hollows, you can put the details into a spreadsheet or use the black cockatoo monitoring forms available on the [DBCA website](http://www.dbca.wa.gov.au). Records should be submitted to the Department by emailing fauna.data@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 can also be reported via the same email.

Table 2: Techniques for monitoring artificial hollows

Technique	Description of Technique								
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 a hollow	<p>The behaviour of parent birds around a hollow can indicate an approximate age of young in the nest.</p> <table border="1"> <thead> <tr> <th>Parent Behaviour</th> <th>Approximate Stage and Age of Young</th> </tr> </thead> <tbody> <tr> <td>Prospecting for hollow</td> <td>Unborn</td> </tr> <tr> <td>Male only seen out of hollow</td> <td>Egg or very young nestling (< 3 - 4 weeks)</td> </tr> <tr> <td>Both parents seen entering/exiting the hollow</td> <td>Nestling(s) has hatched (> 3 - 4 weeks)</td> </tr> </tbody> </table>	Parent Behaviour	Approximate Stage and Age 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) has hatched (> 3 - 4 weeks)
Parent Behaviour	Approximate Stage and Age 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) has hatched (> 3 - 4 weeks)								
Observing feeding flocks	Flocks of all male birds can indicate that 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 to flush female	<p>When females are sitting on eggs they will usually respond to tapping or scraping at the base of their tree by appearing at the entrance or flying from the hollow opening. This is not a guarantee of breeding activity, but an indication that breeding is possibly occurring in the hollow.</p> <p>Tapping or scraping is best undertaken between 10 am - 3 pm when females will most likely to be sitting.</p>								
Observing insect activity around a nest	Faecal matter produced by nestlings attracts insects, especially flies and ants. The type and number of these insects will help to 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 the entrance of a nest usually indicate that a death has occurred.								
Listening for nestling	With experience it is possible to determine if nestlings are present, and a broad estimate of age based on the type and volume of noises they make.								
Looking inside a 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 organize. Also keep in mind that it is important to limit disturbance to breeding birds. 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 to reach nests to undertake observations.								

When do 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, frequency, and timing of monitoring (Table 3).

Breeding by the three southwest black cockatoos varies, and the timing of monitoring of artificial hollows should accommodate the breeding of the likely target species. The Commonwealth Department of Climate Change, Energy,

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the Environment and Water (DCCEEW) Species Profile and Threats Database (SPRAT) database records the breeding periods of each of the species as:

- Carnaby's cockatoo - July to November (with peak between August to September)
- Baudin's cockatoo - October to January
- Forest red-tailed black cockatoo - every month, with peaks in April to June and August to October

The age of Carnaby's cockatoo nestlings can be determined by using the following publication:

Saunders, D. A., Dawson, R. and Nicholls, A. O. (2015). Aging nestling Carnaby's cockatoo, *Calyptorhynchus latirostris*, and estimating the timing and length of the breeding season. *Nature Conservation* **12**: 27-42
<http://dx.doi.org/10.3897/natureconservation.12.4863>

This document provides a series of photographs to illustrate changes in size and plumage of nestlings over the 10–11 weeks of the nestling period which can be used to estimate the approximate age of Carnaby's cockatoo nestlings, up to about nine weeks, by comparing appearance with the nestlings illustrated in the photographs.

Any monitoring that involving disturbance or handling of black cockatoos, requires lawful authority (<https://www.dbca.wa.gov.au/licences-permits>). Such activity requires specialist skills and authorisation under the *Biodiversity Conservation Act 2016*.

Table 3: Recommended frequency for monitoring artificial hollows, as determined by the aim of the monitoring

Monitoring Aim	Frequency of Visits	Monitoring Techniques
To determine possible use by black cockatoos	At least once during peak breeding season.	<ul style="list-style-type: none"> • Looking for signs of use (evidence of chewing) • Observing behaviour of adults around a hollow • Tapping or scraping to flush female • Listening for nestlings • Looking inside nest
To confirm use by black cockatoos	At least two visits during peak breeding season.	<ul style="list-style-type: none"> • Looking for signs of use (evidence of chewing) • Observing behaviour of adults around a hollow • Tapping or scraping to flush female • Listening for nestlings • Looking inside a nest <p>Observing breeding evidence from at least two of the techniques confirms use by black cockatoos.</p>
To determine nesting success by black cockatoos	Preferably fortnightly visits between July and December. As a minimum, at least 3 visits spread throughout breeding season.	<ul style="list-style-type: none"> • Observing insect activity around a nest • Listening for nestlings • Looking inside a nest <p>The presence of eggs or nestlings inside a nest will help to determine nesting success.</p>
To determine use by any species	As often as possible.	<p>As a minimum, inspection from the ground:</p> <ul style="list-style-type: none"> • Looking for signs of use <p>To confirm:</p> <ul style="list-style-type: none"> • Looking inside a nest
To determine maintenance requirements	At least every two years and preferably annually.	A basic maintenance check can be undertaken from the ground. Looking inside the nest using a telescopic pole with camera or mirror enables inspection of the sacrificial chewing posts and level of substrate/nesting material. A ladder or elevated work platform will be required for a comprehensive check, and to replace sacrificial chewing posts and carry out other maintenance.

How do I maintain artificial hollows?

Natural hollows used by black cockatoos are typically present for many decades and if artificial hollows are expected to provide a similar role, then they will require maintenance to ensure they continue to function as potential nesting locations for black cockatoos for the long term.

In many cases artificial hollows are required as a condition of development to offset loss of natural hollows, in which case State and Commonwealth offset policy expects that the artificial hollows continue to provide that function for the duration of the impact (or alternatively the expected period of time the natural hollow would have persisted, or the life of the environmental approval). As part of establishing artificial hollows the responsibility and regime for long term monitoring and maintenance should also be established.

Periodic maintenance checks should be undertaken at least every two years, preferably annually, for as long as the artificial hollow is required. Maintenance actions should be completed prior to the breeding season.

Any problems identified during monitoring or maintenance checks should be addressed as soon as possible and will require similar specialist skills and equipment as used in installation. If breeding is currently occurring, maintenance may need to be delayed if it is likely to disturb the parents or nestling. 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. Likely maintenance includes:

- replacement of sacrificial chewing posts (frequently);
- top-up or replacement of nesting substrate to ensure it reaches the ladder and chewing posts (occasionally);
- replacement of nest bases (occasionally);
- repair or replacement of attachment points (infrequently); and/or
- repair of any cracks to wooden hollows (infrequently).

For artificial hollows known to be used, spare chewing posts should be taken into the field when undertaking maintenance checks as these are likely to need replacement.

Artificial hollows are likely to need to be completely replaced after many years, and other circumstances may require the relocation of artificial hollows (e.g. if the tree they are in becomes damaged).

Applying this guidance to forest red-tailed black cockatoo and Baudin's cockatoo

The information presented here is based on experience with Carnaby's cockatoo, for which many examples of successful use of artificial hollows exist, and forest red-tailed black cockatoo for which a few known examples of use exist. However, to date there are no records of Baudin's cockatoo using artificial nest hollows.

A definite reason for this lack of use is not yet known but may relate to the location of artificial hollows installed to date (few or none placed in Baudin's cockatoo breeding sites where breeding is occurring and natural hollows are limiting) or design or installation issues, such as hollows not being installed high enough in tall forest canopy.

Before deciding to install artificial hollows for forest red-tailed black cockatoo or Baudin's cockatoo, it is recommended that you discuss your proposal with, and/or seek advice from, the Department of Biodiversity, Conservation and Attractions, BirdLife Australia, or the WA Museum.



Maps of Black Cockatoo Breeding Range

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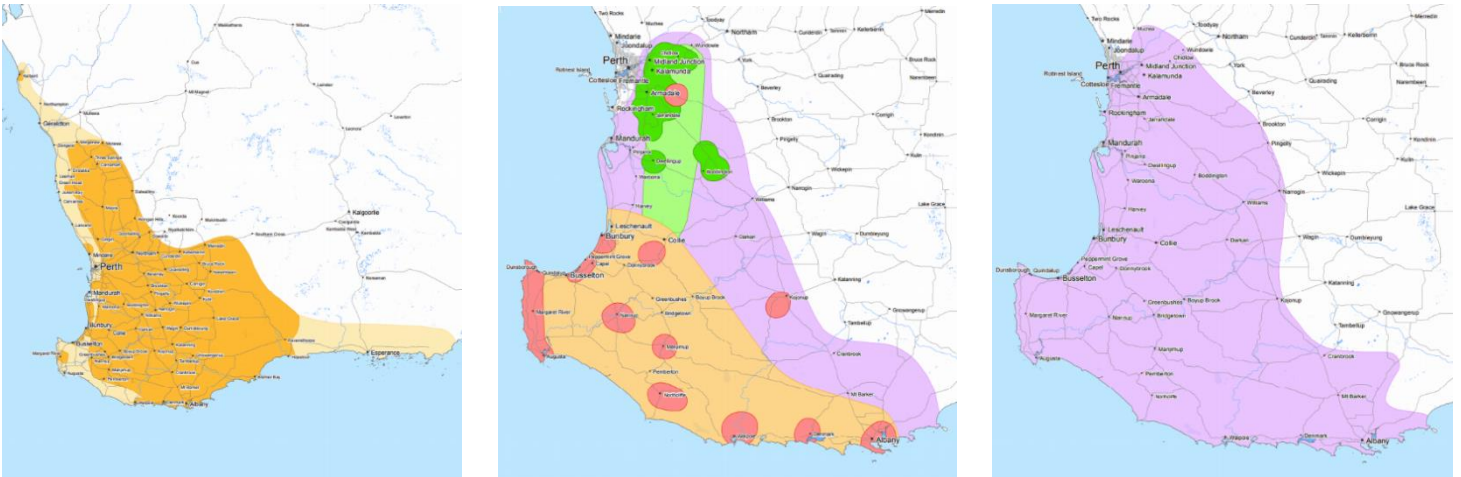


Image: [Commonwealth of Australia, 2011](#)

The maps show the modelled distributions of Carnaby's cockatoo (left), Baudin's cockatoo (centre) and forest red-tailed black cockatoo (right). For Baudin's cockatoo, the breeding range is indicated by the red (known breeding areas) and yellow (predicted breeding range), and for Carnaby's cockatoo, the breeding range is indicated by the orange.

Artificial Hollows – best current design and installation specifications

The specifications below outline the most recent detailed specifications for artificial hollow construction installation and maintenance. These would provide for a well-constructed and installed artificial hollow that is most likely to have an adequate lifespan (minimum 50-years). To ensure longevity, regular maintenance will be required on the nesting material, sacrificial post, and removal of debris from the hollow.

It is highly recommended that any artificial hollows installed as a condition of environmental approval (for example where the artificial hollow is expected to provide benefit for a long period), or installed on DBCA managed lands would meet these specifications as a minimum.

Artificial Hollow Construction Specifications

- Dimensions:** internal diameter 375mm (430 mm external), 1200 mm in height, and installed a minimum of 4 m above ground on private property and 8 m on public land.
- Pipe material:** Fifty-year UV rated culvert pipe (polypropylene material used with corrugated outer wall and thin inner sleeve. Recommended brand or similar: The 'Vinidex StormPRO' pipes are twin wall, corrugated, polypropylene pipes for non-pressure stormwater and drainage applications, which meet all the requirements for artificial hollows.
- Chain:** 6 mm galvanised (not zinc plated). The hollows will be attached to the tree by chain and fixed by 4 points.
- Fixings:** Galvanised M10 coach screws four x 75 mm. Two on the weight bearing chain at the top and one each side of the hollow.
- Ladder:** 50 x 50 mm square galvanised weldmesh 4mm thick.
- Chewing posts:** Untreated Jarrah, Marri or Wandoo that meet requirements in "Adding ladders and sacrificial chewing posts" above.

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Artificial hollow design, the fixing method, and the sacrificial chewing post extending above the hollow rim. Left image shows the side chains that are to be at a 30-degree upwards angle to allow the hollow to move up the tree as the tree grows. Right image shows the top weight bearing fixing which is to be 100 mm above the hollow to allow upwards movement.



Left image shows the internal view, including substrate material placed on the floor to line the hollow, and the internal weld mesh ladder. Substrate material must be coarse, hard, wood chips at least 200 mm deep.

Centre image shows one hard wood sacrificial post which is to fit and connect to the rim of the hollow by a hook screwed to the post to ensure it does not come loose, block the hollow or injure the occupants.

Right image shows the hard plastic floor which is to be securely fixed with a minimum of 12 small drainage holes. Larger holes may result in the occupants chewing the base.

Monitoring and Maintaining Artificial Hollows

It is important to continue a regime of regular maintenance for however long the artificial hollow is required. Artificial hollows erected as a condition of development to offset the loss of natural hollows may be required to be available and maintained for the life of the development approval. As part of establishing artificial hollows the responsibility and regime for long term monitoring and maintenance should also be established.

Periodic maintenance checks should be undertaken at least every two years, preferably annually, for as long as the artificial hollow is required. Maintenance actions should be completed prior to the breeding season.

Further Reading

DBCA webpage and fauna profiles: [Black cockatoos](#)

Department information sheets: [Fauna Note – Corellas and other flocking cockatoos](#)

BirdLife Australia webpage and brochure: [Identify your Black cockatoo](#)

Western Australian Museum webpage and fact sheets: [Cockatoo Care](#)

Saunders DA et al. (2022) Artificial nesting hollows for the conservation of Carnaby's cockatoo *Calyptorhynchus latirostris*: definitely not a case of erect and forget. *Pacific Conservation Biology* [doi:10.1071/PC21061](https://doi.org/10.1071/PC21061)

Acknowledgements

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Clearing Permit Decision Report

1 Application details and outcome

1.1. Permit application details

Permit number:	CPS 9307/1
Permit type:	Purpose permit
Applicant name:	Shire of Goomalling
Application received:	28 May 2021
Application area:	4.56 hectares of native vegetation within a 70.89-hectare footprint.
Purpose of clearing:	Widening of the existing road carriageway
Method of clearing:	Mechanical removal
Property:	Calingiri-Goomalling Road reserve (PINs 11502043, 11720387, 11720392, 11720390, 3702293, 11731752, 11722008, 11731751, 11429894)
Location (LGA area/s):	Shire of Goomalling
Localities (suburb/s):	Goomalling and Karranadgin

1.2. Description of clearing activities

The vegetation proposed to be cleared is within a long, linear strip of the Calingiri-Goomalling Road reserve (see Figure 1, Section 1.5). The initial application proposed to clear up to 7.58 hectares of native vegetation within a 70.89-hectare footprint along Calingiri-Goomalling Road reserve (Shire of Goomalling, 2021). However, during the assessment of the clearing permit application and following avoidance and minimisation measures, the Shire of Goomalling was able to reduce the clearing area to 4.56 hectares. The vegetation types proposed for clearing are Eucalyptus Woodland and Samphire Open Low Heath (Natural Area, 2020).

1.3. Decision on application

Decision:	Granted
Decision date:	14 June 2023
Decision area:	4.56 hectares (revised) of native vegetation, as depicted in Section 1.5, below.

1.4. Reasons for decision

This clearing permit application was submitted, accepted, assessed and determined in accordance with sections 51E and 51O of the *Environmental Protection Act 1986* (EP Act). The Department of Water and Environmental Regulation (DWER) advertised the application for 21 days and one submission was received. Consideration of matters raised in the public submission is summarised in Appendix B.

In making this decision, the Delegated Officer had regard for the site characteristics (see Appendix C), relevant datasets (see Appendix H.1), the findings of a biological survey, tree assessment, revegetation plan, offset proposal (see Appendix G), the clearing principles set out in Schedule 5 of the EP Act (see Appendix D), relevant planning instruments and any other matters considered relevant to the assessment (see Section 3). The Delegated Officer also took into consideration the purpose of the clearing is to improve road safety and that avoidance, minimisation and mitigation actions had been implemented by the Shire of Goomalling.

The assessment identified that the proposed clearing will result in:

- the loss of 4.56 hectares of native vegetation representing a significant remnant of native vegetation in an area that has been extensively cleared;
- the loss of 192 trees/shrubs representing low to moderate foraging habitat for the endangered Carnaby's cockatoo;
- the loss of four hollows providing potential breeding opportunities for Carnaby's cockatoos;
- the potential introduction and spread of weeds and dieback into adjacent vegetation, which could impact on the quality of the adjacent vegetation and its habitat values;
- potential clearing of riparian vegetation;
- potential impact to priority and threatened flora species.

After consideration of the available information, as well as the applicant's minimisation and mitigation measures (see Section 3.1), the Delegated Officer determined that the applicant has suitably demonstrated avoidance and minimisation measures, and the offset provided counterbalances the impacts to black cockatoo foraging habitat, potential breeding habitat and a significant remnant of native vegetation in an area that has been extensively cleared (see Section 4).

The Delegated Officer decided to grant a clearing permit subject to conditions to:

- avoid, minimise to reduce the impacts and extent of clearing;
- take hygiene steps to minimise the risk of the introduction and spread of weeds and dieback;
- provide an offset to counterbalance the significant residual impacts to 192 Carnaby's cockatoo foraging trees/shrubs and 4.56 hectares of native vegetation representing a significant remnant of native vegetation in an area that has been extensively cleared. An offset to revegetate 6.6 hectares of an old gravel reserve (reserve 15442) to a good condition (Keighery, 1994) is considered appropriate to address the significant residual impacts;
- engage a fauna specialist to inspect the four Carnaby's cockatoo breeding habitat trees for evidence of breeding use prior to clearing; any breeding habitat tree with evidence of current breeding use must not be cleared whilst it is in use for that breeding season;
 - the applicant must install and maintain five artificial Carnaby's cockatoo nest hollows, and
 - all artificial nesting hollows must be installed prior to commencement of the next Carnaby's cockatoo breeding season following clearing of the related breeding habitat trees.
- the applicant must engage an environmental specialist to demarcate 20-metre buffers of all priority flora species that were identified during the flora and vegetation survey (Natural Area Consulting, 2020)
 - if demarcating a 20m buffer around the priority flora is not practical, engage the environmental specialist to demarcate all individuals of priority flora species through flagging or documented by GPS coordinates accessible to persons undertaking the clearing.
 - the botanist must undertake a pre-clearance survey of the application area for any other priority flora species;
- prior to undertaking any clearing, the permit holder must engage a botanist to conduct a targeted flora survey of the application area for the presence of the threatened flora species *Acacia ataxiphylla* subsp. *magna*.
- the permit holder is not authorised to clear any priority or threatened flora identified within the application area during the inspection undertaken by the botanist.

1.5. Site maps

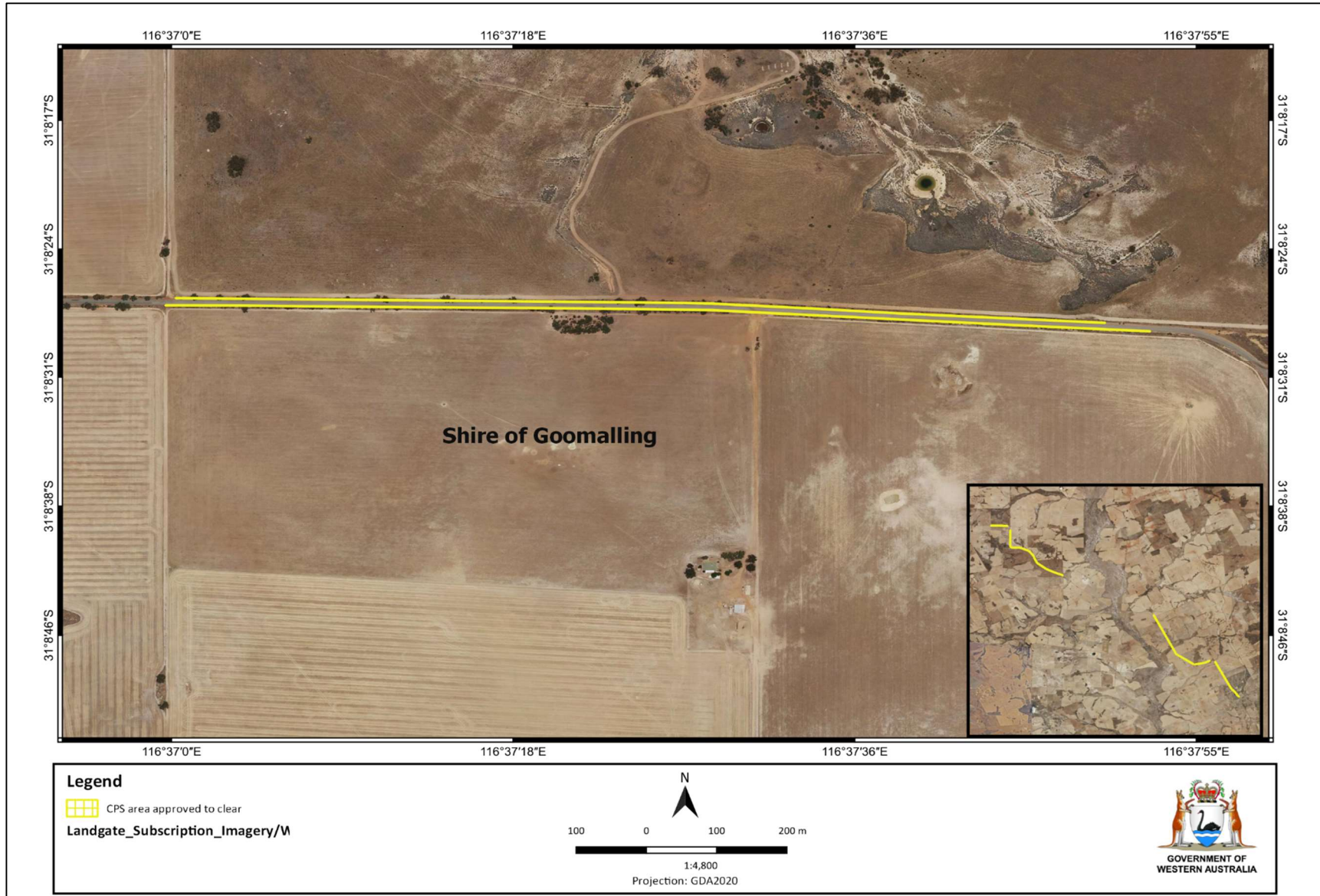


Figure 1a Map of the application area

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

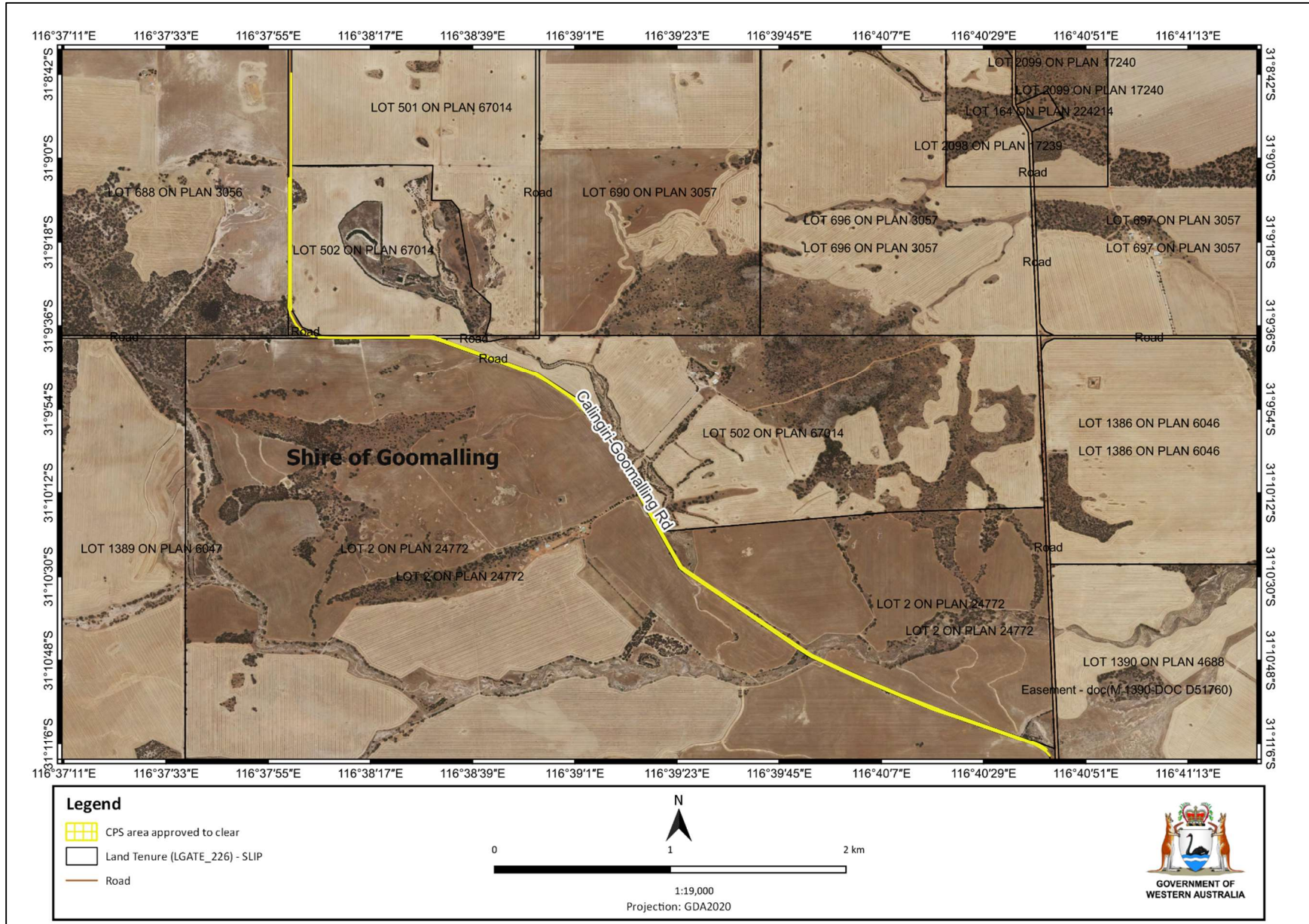


Figure 1b Map of the application area

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

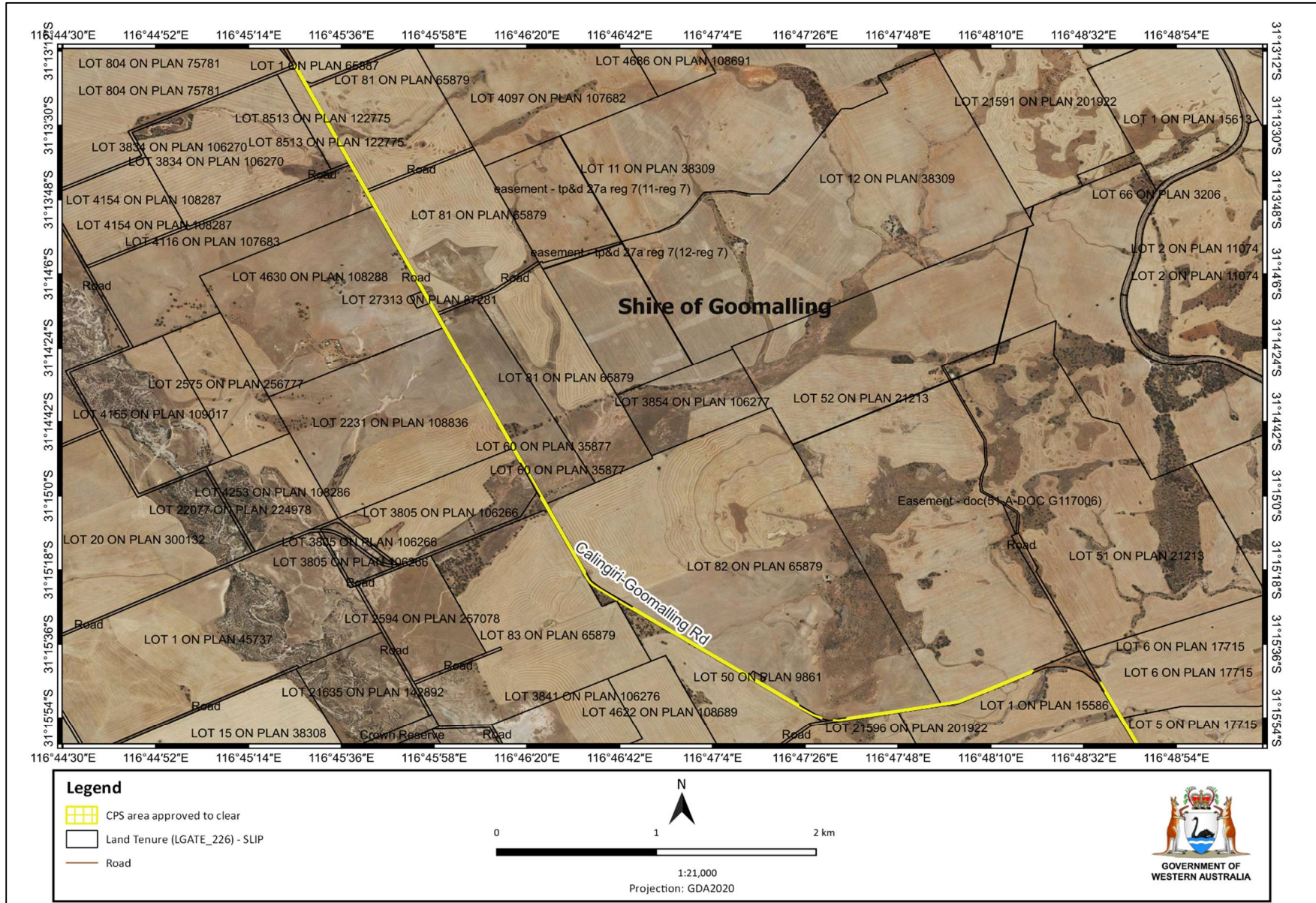


Figure 1c Map of the application area

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

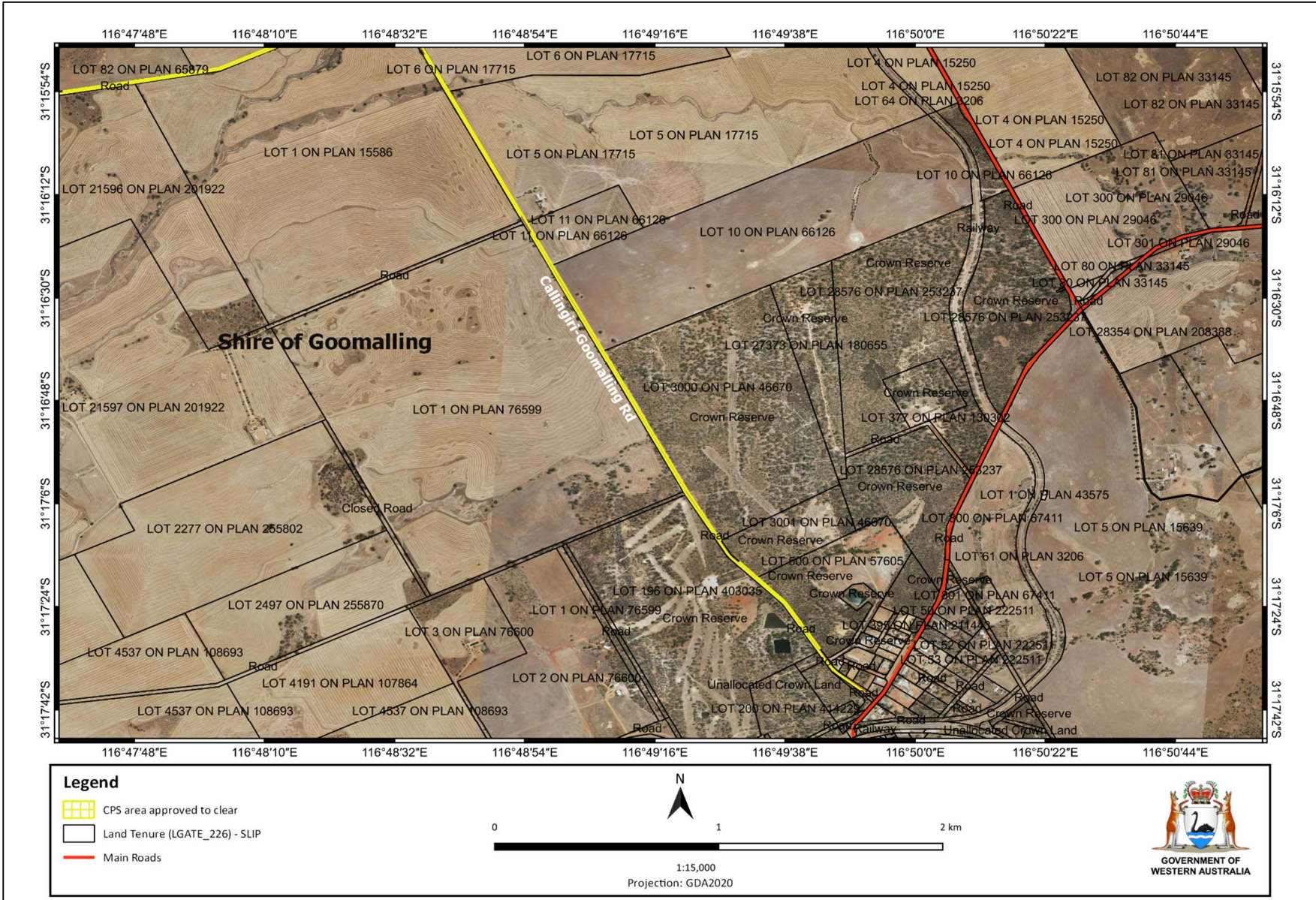


Figure 1d Map of the application area

The areas cross-hatched yellow indicate the areas 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 1.4), the Delegated Officer has also had regard to the objects and principles under section 4A of the EP Act, particularly:

- the precautionary principle
- the principle of intergenerational equity
- the polluter pays principle
- 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)
- *Conservation and Land Management Act 1984* (WA) (CALM Act)
- *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act)
- *Rights in Water and Irrigation Act 1914* (RIWI Act)

Relevant policies considered during the assessment include:

- *Environmental Offsets Policy* (2011)

The key guidance documents which inform this assessment are:

- *A guide to the assessment of applications to clear native vegetation* (DER, December 2013)
- *Procedure: Native vegetation clearing permits* (DWER, October 2019)
- *Environmental Offsets Guidelines* (August 2014)
- Technical guidance – *Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA, 2016)
- Technical guidance – *Terrestrial Fauna Surveys for Environmental Impact Assessment* (EPA, 2016)

3 Detailed assessment of application

3.1. Avoidance and mitigation measures

Based on the information provided by the Shire of Goomalling, the current cleared area for the road is 11.5 metres, with a new requirement for 14 metres of cleared area (road and batters). This will result in the requirement for an additional 1.25 metres on either side of the existing road. To facilitate the proposed road widening work and to improve the safety of the roads, native vegetation clearing is necessary along the Calingiri-Goomalling Road reserve (Shire of Goomalling, 2021).

The applicant has advised that in total there were 635 trees or shrubs in the clearing area proposed to be removed, including 224 trees and 411 large shrubs. During the design of the proposal, a total of 110 trees within the clearing area were marked as 'trees to be kept' as these were located on the border of the clearing area and were able to be retained as part of the on-ground mitigation efforts by Shire of Goomalling. The Shire has advised that the road alignment was diverted to the side of the road with the least number of trees to reduce the amount of vegetation proposed to be removed (Shire of Goomalling, 2021). The original application area submitted to the department for assessment was 7.58 hectares, however, it was determined that the actual clearing area is less than 7.58 hectares given certain portions of the area were not currently vegetated. As a result, the Shire revised the application area down to 4.56 hectares within a 70.89-hectare footprint.

According to the survey data provided by Natural Area consulting (Natural Area), four trees within the application area provide potential breeding opportunities for the endangered Carnaby's Cockatoo. Based on the road design, the four trees cannot be avoided, and the Shire have committed to commission a fauna specialist to inspect the hollows in these trees prior to commencement of clearing to ensure hollows are not occupied (Natural Area Consulting, 2021). If the hollows are occupied, the department has conditioned on the clearing permit that the proposed clearing is delayed until it is confirmed by the fauna specialist that the hollow is no longer in use for that breeding season. The Shire has further committed to installing five artificial nesting boxes to mitigate the clearing of the four potential breeding trees.

On 8 February 2023, DWER wrote to the applicant advising that the proposed clearing has the potential to cause impact on the Priority three (P3) flora species, *Eucalyptus sargentii* subsp. *onesis* given this species was identified within the application area. The department requested that the Shire avoid the clearing of this species if possible. On

behalf of the Shire, Natural Area consulting responded to the department stating that the Shire has committed to avoiding the clearing of the *Eucalyptus sargentii* subsp. *onesis* flora species located within the application area.

The Delegated Officer was satisfied that the applicant has undertaken reasonable measures to avoid and mitigate potential impacts of the proposed clearing on environmental values.

After consideration of avoidance and mitigation measures, it was determined that an offset is required to counterbalance the significant residual impacts to significant remnant native vegetation in an area that has been extensively cleared which also provide foraging and potential breeding habitat for Carnaby's black cockatoos. In accordance with the Government of Western Australia's *Environmental Offsets Policy* and *Environmental Offsets Guidelines*, these significant residual impacts have been addressed through the conditioning of environmental offset requirements on the permit. The Shire has proposed to revegetate an old gravel reserve located within the Shire of Goomalling and amending the reserve purpose from 'Gravel' to 'Conservation' as an offset. The nature and suitability of the offset is summarised in Section 4 and the 'offset calculator' values justification is provided in Appendix F.

3.2. Assessment of impacts on environmental values

In assessing the application, the Delegated Officer has had regard for the site characteristics (see Appendix C) and the extent to which the impacts of the proposed clearing present a risk to biological, conservation, or land and water resource values.

The assessment against the clearing principles (see Appendix D) identified that the impacts of the proposed clearing present a risk to fauna habitat, priority flora and significant remnant vegetation and may have indirect impact to ecological communities of conservation significance. The consideration of these impacts, and the extent to which they can be managed through conditions applied in line with sections 51H and 51I of the EP Act, is set out below.

3.2.1. Biological values – flora and ecological communities (Clearing Principles a and c)

Assessment

The application area is located within the Calingiri-Goomalling Road reserve and contains 4.56 hectares of native vegetation across six different broad scale mapped plant communities. The application area consists of seventeen species of native trees and shrubs (Natural Area Consulting, 2021).

The application area is mapped within the Avon Wheatbelt 2 (AW2) IBRA subregion. This region is characterised by gently undulating landscapes, with some breakaways. Soils are generally comprised of lateritic uplands and sandplain lowlands, with formation through in situ weathering or colluvial action (DPIRD, 2019).

The information provided by the applicant includes a level two flora and vegetation survey conducted over two days on 20 September 2019 and 26 September 2019. The survey site was approximately 30 kilometres in length along the Calingiri-Goomalling Road reserve, starting in the town of Goomalling (SLK 0.00) and ending at the Shire of Goomalling's border (SLK 30.32) (Natural Area Consulting, 2020). The applicant has also provided a tree assessment which indicates the location of the trees/shrubs and the number of each species that are proposed for clearing (Natural Area Consulting, 2021).

According to the flora and vegetation survey, two vegetation types were identified, namely Eucalyptus Woodland and Samphire Open Low Heath. The application area consists of seventeen species of native trees and shrubs in a completely degraded to very good condition utilising the vegetation condition scale of Keighery (1994), with the majority of the site (70%) being assessed as degraded (Keighery, 1994) or completely degraded (Keighery, 1994). The areas identified as degraded and completely degraded (Keighery, 1994) are the result of previous road clearing activities and agricultural land use in the adjoining properties. The structure of the vegetation is no longer intact with no native understorey in these areas (Natural Area Consulting, 2020).

Flora

The desktop assessment identified four threatened and 18 priority flora species in the 10-kilometre radius local area. In forming a view on the likelihood of these species occurring within the application area, the preferred habitat types of these species and their recorded proximity to the application area were considered, along with the vegetation/soil types and landforms within the application area.

Following a likelihood of occurrence analysis of the species identified from the local area, it was determined that the application area may contain suitable habitat for four threatened and ten priority flora species recorded from habitats broadly similar to vegetated areas of the application area, and from soil and/or vegetation types similar to those mapped within the application area. The four threatened species are further considered below.

- *Acacia ataxiphylla* subsp. *magna*: Florabase (Western Australian Herbarium, 1998-) indicates that this species is known from 33 recorded populations (some records may overlap) in the local government areas of Goomalling to Merredin. The Florabase website describes this species as a large-fruited Tammin Wattle;

spreading to ascending shrub 0.3-0.6 metres high with flowers in June to July, growing in sandy soils over laterite. This species is associated with shrubland including *Acacia* spp., *Melaleuca* spp., *Banksia* spp., *Allocasuarina* spp., *Eucalyptus* spp., *Hakea* spp., *Leptospermum* spp., and *Gastrolobium* spp and has been observed in roadside vegetation (DCCEEW, n.d). The most recent record is approximately 0.37 kilometres from the application area. Although this species is likely to occur within the application area, the survey did not identify this species over the application area (Natural Area Consulting, 2020). However, given the survey was undertaken after the species flowering period, there may be a possibility that this species was unable to be identified during the survey. To confirm the presence of this species, a botanist must inspect the application area for this species prior to the commencement of clearing.

- *Caladenia drakeoides* (Hinged Dragon Orchid): Florabase (Western Australian Herbarium, 1998-) indicates that this species is known from 11 recorded populations (some records may overlap) in the local government areas of Coorow to Goomalling. The Florabase website describes this species as a tuberous, perennial, herb 0.12-0.3 meters high with green flowers in September to October, growing in grey clayey sand and red sandy loam. This species is associated margins of salt lakes in seasonally moist sands, usually in shrubland including *Melaleuca* spp., *Acacia* spp., *Hakea* spp., *Callistemon* spp., *Baeckea* spp., *Crassula* spp., *Goodenia* spp., and *Pterostylis* spp (DCCEEW, n.d). The most recent record is approximately 0.06 kilometres from the application area. Based on the above description, this species is unlikely to occur within the application area. If present, this species would have been flowering to be detected during the flora and vegetation survey. *Caladenia drakeoides* was not identified during the survey (Natural Area Consulting, 2020).
- *Daviesia euphorbioides* (Wongan cactus): Florabase (Western Australian Herbarium, 1998-) indicates that this species is known from 15 recorded populations (some records may overlap) in the local government areas of Dowerin, Goomalling, Wongan-Ballidu. The Wongan cactus is endemic to the Merredin District of Western Australia. The Florabase website describes this species as a Shrub, 0.4-0.8 metres high with yellow and red flowers in July to September, growing in clayey sand, sandy gravel, flats and sandplains. The Wongan cactus is associated with heath dominated by *Casuarina* and *Actinostrobus* species. The species is often found growing with *Hemigenia viscida* (sticky hemigenia). The Wongan cactus is likely to be a disturbance opportunist that lives for only a few years, reaching maturity relatively quickly (DCCEEW, n.d). The most recent record is approximately 8.12 kilometres from the application area. Based on the above description, it is unlikely this species will occur within the application area. If present, this species would have been flowering to be detected during the flora and vegetation survey. This species was not identified during the survey (Natural Area Consulting, 2020).
- *Grevillea christineae*: Florabase (Western Australian Herbarium, 1998-) indicates that this species is known from 43 recorded populations (some records may overlap) in the local government areas of Northampton to Perth. The Florabase website describes this species as an erect, wiry shrub, 0.5-0.6 metres high with white-cream flowers in August to September, growing in clay loam to sandy clay soils. This species is associated with moist areas such as drainage lines or outcropping granite; typically, in tall shrubland or low woodland of wandoo, *Eucalyptus loxophleba*, *Acacia* spp., *Allocasuarina* spp., *Melaleuca* spp., *Drosera* spp., and *Tribonanthes* spp.; has been observed in degraded roadside vegetation with high weed invasion (DCCEEW, n.d). The most recent record is approximately 8.68 kilometres from the application area. Although this species is likely to occur within the application area, the survey did not identify this species over the application area. If present, this species would have been flowering to be detected during the flora and vegetation survey (Natural Area Consulting, 2020).

Findings from the survey

The survey undertaken by Natural Area recorded 199 flora species from 50 families of which 147 were native and 52 were introduced species. No declared rare or threatened flora species were found during the survey. However, the presence of six individuals of the Priority 3 *Eucalyptus sargentii* subsp. *onesis*. (Figure 15) was confirmed within the survey area. Two individuals of this species were recorded in, or adjacent to quadrat five of the survey. The identification of this species was not confirmed in the field. Therefore, according to the survey report, it was uncertain at the time how many additional plants are present in this area (Natural Area Consulting, 2020). The Tree assessment that was undertaken subsequently recorded six individuals of *Eucalyptus sargentii* subsp. *onesis* within the survey area with a further 24 in the remaining road reserve area, and approximately 50 or more in the population located in the adjacent property (Natural Area Consulting, 2021).

The department requested that the Shire avoid clearing the *Eucalyptus sargentii* subsp. *onesis* flora located within the application area. The Shire has committed to the avoidance of the six individual flora species from the proposed clearing. To avoid accidental clearing of this species, the department has imposed conditions on the clearing permit to demarcate a 20-metre buffer around these individuals, if possible, prior to the commencement of clearing. If demarcation of the buffer is not practicable, the department requires that the individuals are demarcated prior to the commencement of clearing.

There was a single individual of a *Frankenia* species found within quadrat three of the Samphire open low heath vegetation type which could not be identified down to species level. It is likely this species may be the Priority four *Frankenia glomerata* (Natural Area Consulting, 2020). *Frankenia glomerata* (P4) has a preferred soil type of white sand as found within the survey area and is associated often with edges of salt lakes or on flood plains; associated with shrubland including *Tecticornia* spp., *Melaleuca* spp., *Lawrencia* spp., *Darwinia* spp., *Austrostipa* spp., *Carpobrotus* spp., *Disphyma* spp., *Olearia* spp., and *Hakea* spp (WA Herb, 1998). Given the uncertainty, the department requires that a pre-clearance survey is undertaken to search for the *Frankenia glomerata* (P4) flora and if found, the clearing of any individuals of this species be avoided. In addition, the survey must search for any other priority flora within the application area and if found, the clearing of any priority flora must be avoided. The department has imposed a condition on the permit to restrict clearing of any priority flora species identified within the application area prior to clearing.

Ecological communities

According to the available databases, the most southern portion of the application area falls within the Eucalyptus woodland of the Western Australian Wheatbelt (Eucalypt Woodlands). Based on the information provided by Natural Area (2020), the flora species proposed for clearing within the DBCA mapped Eucalyptus woodland are namely *Acacia acuminata* and three trees of *Eucalyptus loxophleba* subsp. *loxophleba*. According to the available databases, the Priority one Red Morrel Woodlands of the Wheatbelt is mapped approximately 230 metres from the application area. Eucalypt Woodlands is listed as a Threatened Ecological Community (TEC) under the EPBC Act (CR), and a Priority 3 Priority Ecological Communities (PEC) by the DBCA. Eucalypt Woodlands have been mapped throughout the local area.

The approved conservation advice for the Eucalypt Woodlands community is detailed by DoE (2015), and the Commonwealth of Australia (2016) provide a guide to identify and assess the Eucalypt Woodlands community. Patch size and vegetation condition are important determinants in assessing the presence of the Eucalypt Woodlands community (Commonwealth of Australia 2016; DoE, 2015). The vegetation condition thresholds to confirm the Eucalypt Woodlands community generally exclude degraded patches such as roadside remnants that are too small and narrow, or where the tree canopy has become discontinuous, and the understorey has lost considerable elements of its native structure and diversity (DoE, 2015). The minimum patch width for roadsides should be over five metres based upon the native understorey component (DoE, 2015). The proposed clearing does not meet the five-metre minimum patch width along the road given the proposed clearing is approximately 1.25 metres on either side of the road reserve.

The survey undertaken during 2019, confirmed that there were no threatened or priority ecological communities present within the Calingiri-Goomalling Road site. Of the 10 Eucalypt species identified during the survey, the *Eucalyptus loxophleba* (York Gum) is the dominant species within the DBCA mapped Eucalypt Woodlands of the WA Wheatbelt ecological community (Natural Area Consulting, 2020). Although the survey concluded the application area is not representative of the community, the condition of the vegetation mapped within the most southern portion of the application area was mapped as 'good' (Keighery, 1994) but given the width of the native understorey proposed to be cleared along this area of the road reserve is less than five metres, the proposed clearing is unlikely to impact Wheatbelt Woodland TEC.

It is recognised that the Eucalypt Woodland ecological community is present within nearby bushland area adjacent to the application area. The disturbance caused by the proposed clearing may impact the mapped Eucalyptus woodland through an increase of weeds and dieback. Weed and dieback management practices will assist in mitigating this risk.

Conclusion

For the reasons set out above, it is considered that the impacts of the proposed clearing on significant ecological communities and priority flora species can be managed by implementing the applicant's avoidance and minimisation strategies and minimising the risk of the introduction and spread of weeds and dieback. Conditions imposed on the clearing permit will further mitigate any potential impacts to priority and threatened flora.

Conditions

It is considered that the impacts outlined above can be appropriately managed. To address these impacts, the following management measures will be required as conditions on the clearing permit:

- avoid and minimise clearing, to minimise the direct impacts to native vegetation.
- weed and dieback management, to minimise the risk of the introduction and spread of weeds and dieback into adjacent native vegetation.
- engage an environmental specialist to survey the application area for *Acacia ataxiphylla* subsp. *magna* species prior to clearing and the permit holder is not permitted to clear this species if recorded;
- demarcate the six individuals of the *Eucalyptus sargentii* subsp. *onesis* prior to undertaking any clearing.
- engage an environmental specialist to undertake a pre-clearance survey for other priority flora. The permit holder is not permitted to undertake clearing of any other priority flora.

3.2.2. Biological values – fauna (Clearing Principal b)

Fauna

The desktop assessment identified six conservation significant fauna species that include of three bird species, one invertebrate species and two mammal species within the ten-kilometres radius buffer of the application area. Of the six species identified, one migratory/protected bird under an international agreement have been recorded in the local area. In forming a view on the likelihood of these species occurring within the application area, the preferred habitat types and typical home range of the species recorded and their recorded proximity to the application area were considered, along with the type and condition (Keighery, 1994) of the vegetation within the application area.

Opportunistic fauna observations were undertaken during the flora and vegetation survey which included direct observation and noting evidence of fauna presence through tracks, scats and calls (Natural Area Consulting, 2020). A separate tree assessment along the proposed clearing area was also conducted to inspect each of the trees for hollows (Natural Area Consulting, 2021).

An analysis on the likelihood of species identified from the local area utilising the application area was undertaken. It was determined that the application area may contain suitable habitat only for the Endangered Carnaby's Cockatoo.

Zanda latirostris (Carnaby's cockatoo) were recorded from eight locations within the local area. The nearest record is approximately 0.50 kilometres from the application area. Information provided by the applicant indicates that Carnaby's cockatoo may utilise the application area based on the vegetation present (Natural Area Consulting, 2021). An inspection of the trees proposed for clearing concluded that four of the trees identified within the application area contain hollows that may become suitable as black cockatoo breeding although no evidence of black cockatoos, or evidence of use of hollows were observed (Natural Area Consulting, 2021). To offset the impact to black cockatoo breeding habitat, the applicant is conditioned to install five artificial hollows within the proposed offset area.

When considering the native vegetation identified for clearing, the application area has value as foraging habitat. Carnaby's cockatoos forage on the seeds, nuts and flowers of a variety of plants, including proteaceous species (banksia, hakea and grevillea), as well as allocasuarina and eucalyptus species, marri and a range of introduced species (Valentine and Stock, 2008).

Carnaby's cockatoos generally forages within six (and up to 12 kilometres) of its nesting or night roost site (Commonwealth of Australia, 2012). The closest breeding site is located approximately eight kilometres from the application area and the closest known roost site is 480 metres from the application area. The foraging habitat within the application area is considered to be of 'high quality' based on the Commonwealth scoring tool. Whilst approved to clear 4.56 hectares of native vegetation, the number of potential Carnaby's cockatoo foraging trees/shrubs total 192 of which 144 of the trees are *Eucalyptus loxophleba* subsp. *loxophleba*. *Eucalyptus loxophleba* subsp. *loxophleba* is considered a low-quality foraging species for Carnaby's cockatoos. However, given the application area is located within an extensively cleared landscape, all foraging species are considered valuable to support Carnaby's cockatoo populations within the Wheatbelt area. Therefore, the applicant was requested to commit to an offset that will effectively counterbalance the significant residual impact resulting from the proposed clearing. The applicant will be planting 287 native trees that provides black cockatoo foraging value within an old gravel pit and this area is to be secured under a management order vested for the purpose of conservation.

There is one known black cockatoo roost site identified within a six-kilometre radius buffer from the application area. According the DBCA data available, this roost site was last utilised by nine white tailed black cockatoos in 2011. This roost site is located within an area reserved for water supply. No roosting sites are identified within any road reserves within the local area. 'Roosting habitat' include groups or individual tall trees but generally is the tallest tree in an area. Roost sites are located within six kilometres of water and food resources, with additional foraging ranging within 12 kilometres (DAWE, 2022). Although the application area is close to food sources and watercourses, based on the lack of roost site records within the local area, linear configuration of the application area located along a public road

and the lack of recent black cockatoo records in the vicinity of the application area, the use of trees within the application area as night-roosts is considered unlikely.

According to the survey, a total of 15 vertebrate fauna species (ten birds, two mammals and three reptiles) were recorded during the September 2019 survey with no conservation significant species identified, nor indicators of their presence found (Natural Area Consulting, 2020).

Conclusion

Based on the above assessment, the proposed clearing will result in the removal of four trees providing potential breeding opportunities for Carnaby's Cockatoo, and foraging habitat largely in the form of scattered *Eucalyptus loxophleba* trees and the occasional *Eucalyptus salmonophloia* and *Eucalyptus wandoo* subsp. *wandoo* trees. Impacts of the proposed clearing on fauna species potentially present at the time of clearing can be managed by an inspection of potential black cockatoo hollows prior to clearing. To counterbalance the significant residual impact the proposed clearing will have on the Carnaby's cockatoo foraging vegetation, an offset has been proposed to revegetate an old gravel reserve using black cockatoo foraging species and to amend the vesting of the reserve from 'gravel' to 'conservation'.

Conditions

To address the above impacts, the following management measures will be required as conditions on the clearing permit:

- avoid and minimise to reduce the impacts and extent of clearing;
- a fauna specialist is to inspect the four potential Carnaby's cockatoo breeding habitat trees for evidence of breeding use prior to clearing;
 - any breeding habitat tree with evidence of current breeding use must not be cleared whilst it is in use for that breeding season;
 - the applicant must install and maintain five artificial Carnaby's cockatoo nest hollows;
 - any artificial nesting hollow must be installed prior to commencement of the next Carnaby's cockatoo breeding season following clearing of the related breeding tree(s); and
- provide an offset to counterbalance the significant residual impact of clearing 192 trees/shrubs of Carnaby's cockatoo foraging habitat.

3.2.3. Significant remnant vegetation - Clearing Principles (e)

Assessment

The national objectives and targets for biodiversity conservation in Australia has a target to prevent clearance of ecological communities with an extent below 30 per cent of that present pre-1750, below which species loss appears to accelerate exponentially at an ecosystem level (Commonwealth of Australia, 2001). The application area is located within the Avon Wheatbelt Interim Biogeographic Regionalisation of Australia (IBRA) bioregion, which retains approximately 18.51 per cent of its pre-European vegetation extent.

Four vegetation associations as described by Shepherd et al. (2001) have been mapped within the application area; vegetation association 988, vegetation association 1049, vegetation association 142 and vegetation association 694. The predominant vegetation association mapped within the application area is vegetation association 1049 described as woodland of *Eucalyptus loxophleba* (York gum) and *Eucalyptus salmonophloia* (Salmon gum). Association 1049 has just 6.79 per cent of its pre-European vegetation extent remaining (Government of Western Australia 2019). York gum and Salmon gum are both present within the application area. Therefore, this community is representative within the application area.

The minor occurrences of the remaining vegetation associations retain less than the 30 per cent of their pre-European vegetation extent. Vegetation association 988 is described as *Tecticornia* spp. with *Melaleuca* spp and *Acacia* spp. The remaining vegetation associations are described as woodland of *Eucalyptus loxophleba* (York gum) and *Eucalyptus salmonophloia* (Salmon gum).

Approximately 14,087 hectares of native vegetation remains within the 10 kilometres radius of the application area representing 16.17 per cent of its original pre-European extent, on which basis the application area represents approximately 0.03 per cent of the remaining vegetation within the local area.

Noting the extent of native vegetation remaining within the IBRA bioregion and local area and given the mapped vegetation associations retain less than 30 per cent of their pre-European vegetation extent, the application area is considered to be within an extensively cleared area. The application area contains conservation significant flora and supports conservation significant fauna species. Therefore, the application area is considered to be a significant as a remnant of native vegetation within an extensively cleared area.

Ecological linkage

Given the length and width of the vegetation corridor associated with the Calingiri-Goomalling Road reserve which includes patches of vegetation in good condition (Keighery, 1994), the application area is likely to provide service as an ecological corridor for fauna movement within the local area. It is noted that the application area connects areas of remnant vegetation within an extensively cleared area.

The Calingiri-Goomalling Road reserve is at least 20 metres in width in the location of the proposed clearing. According to the information provided, the currently cleared area for the road is 11.5 metres, with a new requirement for 14 metres of cleared area, which includes the road and the batters. The proposed clearing is an additional 1.25 metres on either side of the existing road, with over three metres of native vegetation remaining on each side of the road. It is noted that the proposed clearing will not require the removal of all the vegetation within the clearing footprint, with the applicant committing to the retention of numerous trees within the application area. Figure 2 below provides illustration of the trees that will be retained within the application area.



Figure 2: Trees proposed to be retained within the application area.

As discussed under section 3.1, the applicant's avoidance and mitigation measures has reduced the impact to ecological linkage function through the reduction of the application area by approximately 40 per cent. As a result of this revision, the proposed clearing area has also been separated into four sections, leaving remnant vegetation intact between each section. The reduction in the clearing footprint has also avoided clearing across the highly saline Mortlock River.

Although the ecological corridor will be reduced as a result of the proposed clearing, the connectivity along the length of the road reserve will not be severed. The applicant has provided an offset to counterbalance the significant residual impact resulting from the proposed clearing, which will further reduce the extent of vegetation remaining within the local area. The offset includes revegetating 6.6 hectares of a completely degraded (Keighery, 1994) parcel of land located within the wheatbelt, to a good condition (Keighery, 1994). Once the revegetation is established, this parcel of land will also provide ecological linkage services within an area which is extensively cleared.

Conclusion

For the reasons set out above, it is considered that the impacts of the proposed clearing on a significant remnant of native vegetation in an area that has been extensively cleared cannot be mitigated by the applicant's avoidance and minimisation strategies and an offset is required to counterbalance the significant residual impact remaining consistent with the Government of Western Australia's Environmental Offsets Policy and Environmental Offsets Guidelines.

Conditions

To address the above impacts, the following management measures will be required as conditions on the clearing permit:

- avoid, minimise to reduce the impacts and extent of clearing;
- take hygiene steps to minimise the risk of the introduction and spread of weeds and dieback; and
- provide an offset to counterbalance the significant residual impacts to 4.56 hectares of native vegetation representing a significant remnant of native vegetation in an area that has been extensively cleared.

3.3. Relevant planning instruments and other matters

The proposed clearing for the road upgrades is located within the Avon River Catchment Surface Water Area proclaimed under the *Rights in Water Irrigation Act 1914* (RiWI Act). Any activities that interfere with the bed or banks of a watercourse may require a permit under the RiWI Act from the Department of Water and Environmental Regulations (DWER). On 29 July 2022, the applicant was granted a permit to interfere with bed and banks under the RiWI Act by DWER's Swan Avon Region (DWER, 2022).

According to the available databases, no Aboriginal sites of significance have been mapped within the application area. There is one Aboriginal site mapped immediately adjacent to the most southern section of the application area (Place ID 30601) which is the Goomalling Aboriginal Reserve. 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.

4 Suitability of offsets

The applicant has provided evidence of avoidance and minimisation which are listed below and further described under Section 3.1.

- the application area was reduced from 7.58 hectares down to 4.56 hectares.
- clearing of 110 trees was avoided by working around these trees when finalising the initial clearing footprint.
- the road alignment was diverted to the side of the road with the least number of trees to reduce the amount of vegetation proposed for removal.

Through the detailed assessment outlined in Section 3.2 above, the Delegated Officer has determined that the following significant residual impacts remain after the application of the avoidance and mitigation measures summarised in Section 3.1:

- loss of 4.56 hectares of native vegetation representing a significant remnant of native vegetation in an area that has been extensively cleared.
- loss of 192 trees/shrubs considered suitable as Carnaby's cockatoo (*Zanda latirostris*) foraging habitat.
- loss of four trees with four suitable sized hollows which provide suitable nesting habitat for Carnaby's cockatoos (*Zanda latirostris*).

To offset the significant residual impacts, the applicant has submitted an environmental offset proposal along with a revegetation plan prepared by a botanist at Natural Area Consulting (Natural Area Consulting, 2022). The proposal involves rehabilitation and revegetation of an old gravel pit located at Lot 29464 on Deposited Plan 194839, approximately 9.3 kilometres east of the proposed application area within the Shire of Goomalling. The proposed offset gravel pit is currently in a completely degraded (Keighery, 1994) condition. However, there is approximately 0.87 hectares of remnant native vegetation consisting of overstorey canopy only on site situated in the north-west corner of the gravel pit and along the pit boundary. The revegetation will aim to restore the site to a self-sustaining ecosystem that extends the existing areas of vegetation and restoration of a wheatbelt vegetation community which is representative of the region (Natural Area Consulting, 2022).

The Shire of Goomalling submitted an application with the Department of Planning, Lands and Heritage (DPLH) to alter the vesting/zoning of the proposed offset parcel of land from a gravel reserve to a conservation reserve. This proposed change was approved by DPLH on 17 February 2023 with a management order issued in favour of the Shire of Goomalling. On 23 February 2023, the Shire submitted a copy of the official approval to the department.

In assessing whether the proposed offset is adequately proportionate to the significance of the environmental values being impacted, a calculation using the WA offset metric calculator was undertaken. The calculation has identified that the rehabilitation/revegetation of the old gravel pit with the implementation of the revegetation plan and completion criteria conditions on the clearing permit will be sufficient to adequately address the significant residual

impacts of the proposed clearing. The calculation was based on the rehabilitation/revegetation to improve the current vegetation condition and provide long-term security over the Reserve 15442.

The start quality score for the impact site is based on the average condition of the vegetation within the application area, as determined from the supporting information available to the department at the time of the assessment. The calculation assumes that rehabilitation of the completely degraded (Keighery, 1994) gravel pit will improve the vegetation condition within this site to a good condition (Keighery, 1994). This improvement will be achieved through weed control, rabbit control and other management measures. If the expected condition is not achieved within the 5-year monitoring period, additional actions such as infill planting will be required to be implemented by the Shire to achieve the intended condition threshold.

The proposed offset will deliver an environmental outcome which adequately counterbalances the impacts of the clearing. The offset strategy is also consistent with the principle from the Regional and Local Ecological Linkages report by Nadine Guthrie (2010) from DBCA, which states that *“Simply put, a larger, more compact remnant vegetation patch in good or better condition is more viable in the long term than a patch that is similar in area but is long and narrow or has an uneven shape, or several small patches equalling the same total area.”*

The offset calculation has determined that:

- to offset the clearing of 4.56 hectares of native vegetation within an extensively cleared area, an area of 6.6 hectares of rehabilitation/revegetation is required.
- to offset the clearing of 192 trees/shrubs of black cockatoo foraging habitat, 287 black cockatoo foraging trees are required to be planted.

In addition to the above, to offset the clearing of suitable black cockatoo hollows, the Shire of Goomalling is proposing to install five artificial nesting boxes within the proposed offset area where a stand of mature trees is located in the northwest section of the offset site. The Shire proposes to install all artificial hollows prior to the commencement of the next black cockatoo breeding season following the clearing of the identified habitat trees. The artificial hollows are to be designed, placed, monitored and maintained in accordance with the specifications detailed in the document *“Artificial hollows for black cockatoos”*, (Department of Biodiversity, Conservation and Attractions, 2023).

Given the above, the offset proposed by the applicant adequately counterbalances the significant residual impacts listed above, representing 100 per cent of the offset contribution consistent with the WA Environmental Offset Policy. The Delegated Officer considers that this adequately counterbalances the significant residual impacts resulting from the proposed clearing. The justification for the values used in the offset calculation is provided in Appendix F.

End

Appendix A. Additional information provided by the applicant

Information	Description
CPS 9307/1 application (Shire of Goomalling, 2021)	Native vegetation clearing permit application provided by the Shire of Goomalling for application CPS 9307/1.
CPS 9307/1 – Supporting information - Flora and Vegetation Survey (Natural Area consulting, 2020)	<p>Natural Area Consulting was employed by Shire of Goomalling to provide information regarding the flora and vegetation values within the site. The scope of the work included.</p> <ul style="list-style-type: none"> • Desktop review of the site and surrounds. • Dataset searches for threatened flora, fauna and ecological communities. • Identification of potential habitat for conservation significant flora and fauna and an assessment of likelihood of occurrence. • Targeted search for conservation significant flora. • Creating maps which represent plant communities, vegetation condition (Keighery, 1994). • Assessment against the clearing principals.
CPS 9307/1 – Supporting Information - Tree assessment (Natural Area Consulting, 2021)	Natural Area Consulting was employed by Shire of Goomalling to undertake a tree assessment through the proposed clearing area to identify the types of trees proposed for clearing. The assessment identified trees that are likely to contain potential hollows for black cockatoo breeding habitat. This assessment further identified all the trees that will be retained from the clearing within the broader application footprint.
Offset Plan (Natural Area Consulting, 2022)	Natural Area consulting prepared an offset proposal using the departments 'Appendix A – Clearing permit offset proposal form'.
Offset revegetation plan	<p>Natural Area consulting was contracted by the Shire of Goomalling to prepare a revegetation plan for the proposed offset site. The offset site is 6.6 hectares in area. The revegetation plan aims to:</p> <ul style="list-style-type: none"> • identify appropriate reference sites based on soil landscape and other conditions; • identify flora species within the offset site and nearby vegetated areas, including native and weed species; • assessment of vegetation condition • consideration of other issues that could reduce the success of rehabilitation outcomes, such as the presence of pest species; • development of success and monitoring criteria to be implemented after the initial installation of tubestock.

Appendix B. Details of public submissions (Submission, 2021)

Summary of comments	Consideration of comment
Impacts on the Wheatbelt Eucalypt Woodland TEC	See section 3.2.1 of the decision report regarding the department's assessment of the impact to the Wheatbelt Eucalypt Woodland TEC.
Lack of an offset plan being submitted by the Shire within this application.	The Shire submitted an offset proposal to the department using the Appendix A – Clearing permit offset proposal form. The Shire further submitted an offset revegetation plan to support the offset plan. A summary of the proposed offset is under Section 4 of the decision report.
Priority flora will be impacted	<p>As set out under section 3.2.1, the Department's assessment has had regard for the characteristics of the application area, relevant flora datasets including records of threatened flora in the local area, supporting information provided by the application, and any other information considered to be relevant.</p> <p>The Shire of Goomalling has avoided clearing of any priority flora species within the application area. Conditions are imposed on the clearing permit to undertake further pre-clearance surveys to identify if priority flora and threatened flora occur within the application area and to prevent the Shire from clearing any priority and threatened flora that may occur within the application area.</p>
The Shire should be requested to identify how many trees and shrubs require removal and how many sections would result in removal of all the remnant vegetation present.	The Shire has engaged Natural Area Holdings to undertake a tree assessment of the application area where each tree and shrub species proposed to be cleared and proposed to be kept were marked on a map. The tree assessment assisted the department in determining the number of black cockatoo foraging species proposed for clearing.
Revegetation should aim to restore all species recorded in the areas to be cleared and ensure that local-provenance seed is used. Monitoring of the revegetation should continue until the full species richness has been maintained and that weed presence is unlikely to diminish the long-term sustainability of the revegetation.	<p>The Shire has engaged Natural Area Holdings to prepare a revegetation plan to describe and guide revegetation activities over a five-year period from site preparation works, installation and plan establishment and a three-year post-installation monitoring and maintenance program. The development of the revegetation plan involved the following activities.</p> <ul style="list-style-type: none"> • identification of appropriate reference sites based on soil landscape and other conditions. • identification of flora species within the offset site and nearby vegetated areas, including native and weed species. • considering other issues that could reduce the success of rehabilitation outcomes, such as the presence of pest species. • development of success and monitoring criteria to be implemented after the initial installation of tubestock. <p>The Shire's proposed planting list includes species that have the highest probability of being sourced as local provenance stock from nurseries and were recorded in the local remnant vegetation areas.</p>

Summary of comments	Consideration of comment
	See condition 11 (offset-revegetation) outlined in the clearing permit regarding the revegetation completion criteria targets and conditions imposed by the department.

Appendix C. Site characteristics

C.1. 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 the assessment. This information was used to inform the assessment of the clearing against the Clearing Principals, contained in Appendix D.

Characteristic	Details
Local context	<p>The area proposed to be cleared is comprised of roadside vegetation with an extensively cleared landscape in an extensive land use zone of Western Australia.</p> <p>The application area is located within the northern portion of the Avon Wheatbelt IBRA bioregion of Thackway and Cressell (1995). Spatial data indicates the local area (10-kilometre radius from the area proposed to be cleared) retains approximately 16.17 per cent of the original native vegetation cover.</p>
Ecological linkage	<p>Proposed clearing is not located within an Environmentally Sensitive Area (ESA), or any recognised ecological linkage.</p> <p>The Calingiri-Goomalling Road reserve has vegetation rated as medium to high as determined by the Roadside Conservation Committee (RSD, 2010) applying the Roadside Conservation Values as assessed in 2008, with the majority of vegetation on the right-hand side rated at 8 (medium to high) and majority of the left-hand side rated at 8 (medium to high). That is, weeds identified and '<i>A range of native plants present; fairly good cover of native vegetation; small weedy patches; some habitat features present</i>'.</p> <p>Although the survey (Natural Area Consulting, 2020) has mapped the majority of the vegetation within the application area to be in a degraded condition (Keighery, 1994), given the proposed clearing is within an extensively cleared area that connects with surrounding remnant vegetation, the remnant vegetation within the proposed clearing area is likely to provide service as an ecological corridor for fauna movement.</p>
Conservation areas	The only conservation area mapped within the local area is the Wyening Nature Reserve, located 9.7 kilometres southwest of the application area.
Vegetation description	<p>The vegetation survey (Natural Area Consulting, 2020) identified two vegetation types within the application area and these include:</p> <ul style="list-style-type: none"> • <i>Eucalyptus</i> woodland dominated by <i>Eucalyptus</i> spp., over <i>Acacia acuminata</i>, <i>Santalum spicatum</i>, <i>Grevillea</i> spp. and <i>Allocasuarina</i> spp., with an understory of mixed <i>Acacia</i> spp. shrubs, <i>Dianella revoluta</i>, <i>Austrostipa</i> spp. and a mix of herbs and weedy grasses. • Samphire Open Low Heath dominated by <i>Tecticornia</i> spp., *<i>Juncus acutus</i> over <i>Atriplex</i> spp., <i>Cotula cotuloides</i> and a mix of weedy grasses and herbs. <p>Representative photos and the survey descriptions and maps are available in Appendix G.</p> <p>The broad scale mapped vegetation types include:</p>

Characteristic	Details
	<ul style="list-style-type: none"> • Goomalling-988, which is described as <i>Tecticornia</i> spp. with <i>Melaleuca</i> spp. <i>Acacia</i> spp • Goomalling-1049 which is described as <i>Eucalyptus loxophleba</i> (York gum), <i>Eucalyptus salmonophloia</i> (Salmon gum). • Victoria Plains 142 which is described as <i>Eucalyptus loxophleba</i> (York gum), <i>Eucalyptus salmonophloia</i> (Salmon gum). • Victoria Plains-694 which is described as <i>Eucalyptus loxophleba</i> (York gum), <i>Eucalyptus salmonophloia</i> (Salmon gum). • Walebing-142 which is described as <i>Eucalyptus loxophleba</i> (York gum), <i>Eucalyptus salmonophloia</i> (Salmon gum). <p>The vegetation extent remaining for the mapped vegetation types listed above are included in Table C.2.</p>
Vegetation condition	<p>The vegetation survey (Natural Area Consulting, 2020) indicates the vegetation condition within the proposed clearing area ranges from completely degraded to Very Good (Keighery, 1994) with few areas of Good to Very Good vegetation (Keighery, 1994).</p> <p>The full Keighery (1994) condition rating scale is provided in Appendix E.</p> <p>Representative photos and the full survey descriptions and mapping are available in Appendix G.</p>
Climate and landform	<p>The climate experienced in the area is semi-arid warm Mediterranean, with dry, hot summers and cool, dry winters. According to the Bureau of Meteorology (2019), Goomalling (Site number 010058) climate and weather averages include (Natural Area Consulting, 2020):</p> <ul style="list-style-type: none"> • rainfall of 365 mm pa, with the majority falling between May and August • winds are predominantly from the west or north-west during winter and the east or south-east during summer, with average speeds ranging from 5.9 – 10.8 km/h, with gusts of more than 100 km/h possible during storm events.
Soil description	<p>The application area is located within five soil landscape mappings.</p> <ul style="list-style-type: none"> • Greenhills York 4 Phase: Mainly sandy and loamy duplex, alkaline sandy and loamy duplex, sandy earth. • Ewatts 1 Phase: Hillslopes containing sand and loamy sand over yellowish clay soils, with some gravel ridges, and some heavier soils that often occur immediately below a breakaway. • Greenhills York 3 Phase: Undulating rises to undulating low hills. on Migmataitic rocky outcrops. in the sandy earth, shallow and deep sandy duplex, shallow to deep loamy duplex, deep sandy gravel and stony soil. • Greenhills York Subsystem: Areas of soils derived from freshly exposed rock. This unit is typified by the red soils of the Avon Valley but also includes areas of similar, but often greyer and lighter textured soils to the east of the valley. • Goomalling Mortlock Subsystem: Valley floors of the Mortlock River and other similar creeks that predominantly contain sand over yellowish clay soils. Prone to salinity and waterlogging.
Waterbodies	<p>The desktop assessment and aerial imagery indicated that numerous minor, non-perennial watercourses transect the area proposed to be cleared. No major watercourse transects the application area.</p>
Hydrogeography	<p>The application area is located within the Swan Avon-Mortlock hydrographic catchment within the Southwest division. Also located within the Northern Zone of Rejuvenated Drainage hydrological zone of Western Australia. This zone is described as erosional surface of gently undulating rises to low hills with continuous stream channels that flow in most years.</p> <p>The application area falls within the Avon River Catchment surface water area proclaimed under the RiWI Act.</p>

Characteristic	Details
Flora	The desktop assessment identified 22 conservation significant flora species within the 10-kilometre radius local area, which include four threatened and 18 priority flora species. According to the flora survey and tree assessment, six individual species of the Priority three <i>Eucalyptus sargentii</i> subsp. <i>onesis</i> and one individual of a <i>Frankenia</i> species was recorded within the application area (Natural Area Consulting, 2020).
Ecological communities	No Threatened Ecological Communities (TECs) endorsed by the Western Australian Minister for Environment have been mapped within ten kilometres of the application area. The Eucalypt woodlands of the Western Australian Wheatbelt TEC, listed as Critically Endangered under the <i>Environment Protection and Biodiversity Conservation Act 1999</i> (Cth) and as a Priority 3 Priority Ecological Communities (PEC) by DBCA has been mapped over the application area. The available database shows that the Priority one Red Morrel Woodlands of the Wheatbelt is mapped approximately 230 metres from the application area.
Fauna	The desktop assessment identified five conservation significant fauna species recorded within the local area, which include three bird species, one invertebrate species and two mammal species from the local area. The closest record identified was the endangered Carnaby's cockatoo recorded 0.5 kilometres from the application area. The most recorded species was also the Carnaby's cockatoos. One black cockatoo roost site is recorded within the local area, approximately 480 metres from the application area. According to available databases, 41 White tailed black cockatoo breeding sites were identified from the local area. Of the 41 identified hollows, 17 hollows were confirmed breeding hollows and 24 were potential breeding hollows. Of the 41, 37 were natural hollows and four were artificial hollows.

C.2. Vegetation extent

	Pre-European extent (ha)	Current extent (ha)	Extent remaining (%)	Current extent in all DBCA managed land (ha)	Current proportion (%) of pre-European extent in all DBCA managed land
IBRA bioregion*					
Avon Wheatbelt	9,517,109.95	1,761,187.42	18.51	174,980.68	1.84
Beard vegetation associations					
988	94,338.35	27,553.73	29.21	3,656.83	3.88
1049	833,384.77	56,618.34	6.79	3,375.83	0.43
142	637,707.53	79,309.95	12.44	2,381.71	0.37
694	173,921.56	12,637.36	7.27	1,820.10	1.05
Local area					
10 km radius	87,074.14	14,087.84	16.17	-	-

*Government of Western Australia (2019)

C.3. Flora analysis table

With consideration for the site characteristics set out above, relevant datasets (see Appendix H.1), and biological survey information, impacts to the following conservation significant flora required further consideration.

Species name	Conservation status	Suitable habitat features? [Y/N]	Distance of closest record to application area (km)	Number of known records (total)	Did survey identify? [Y, N, N/A]
<i>Acacia ataxiphylla</i> subsp. <i>magna</i>	T	Y	0.37	3	N
<i>Acacia campylophylla</i>	3	Y	0.37	1	N
<i>Acacia trinalis</i>	1	Y	10.31	9	N
<i>Caladenia drakeoides</i>	T	N	0.06	2	N
<i>Conospermum eatoniae</i>	3	Y	0.57	3	N
<i>Conostylis caricina</i> subsp. <i>elachys</i>	1	Y	0.57	5	N
<i>Cryptandra beverleyensis</i>	3	Y	7.90	2	N
<i>Daviesia euphorbioides</i>	T	Y	8.12	1	N
<i>Daviesia nudiflora</i> subsp. <i>drummondii</i>	3	Y	0.57	4	N
<i>Eucalyptus sargentii</i> subsp. <i>onesis</i>	3	Y	1.98	5	Y
<i>Frankenia glomerata</i>	4	Y	1.92	2	Maybe
<i>Grevillea christineae</i>	T	Y	8.68	4	N
<i>Guichenotia impudica</i>	3	Y	0.91	11	N
<i>Scholtzia halophila</i> subsp. <i>mortlockensis</i>	3	Y	1.74	2	N

C.4. Fauna analysis table

The following conservation significant fauna species were considered likely to occur within the application area and were considered further in the assessment.

Species scientific name	Species common name	Conservation status	Year of the most recent record	Number of known records (total)	Distance of closest record to application area (km)
<i>Calyptrorhynchus latirostris</i>	Carnaby's cockatoo	EN	2016	28	0.49
<i>Calyptrorhynchus</i> sp. 'white-tailed black cockatoo'	White-tailed black cockatoo	EN	2018	4	0.48

Appendix D. Assessment against the clearing principles

Assessment against the clearing principles	Variance level	Is further consideration required?
Environmental value: biological values		
<p>Principle (a): <i>“Native vegetation should not be cleared if it comprises a high level of biodiversity.”</i></p> <p><u>Assessment:</u></p> <p>The area proposed to be cleared contains locally significant flora, habitat for Carnaby’s cockatoo and is considered significant remnant vegetation within an extensively cleared landscape.</p> <p>A portion of the application area is mapped as the ‘Eucalypt woodlands of the Western Australian Wheatbelt’ (Priority 3) priority ecological community (PEC). The survey confirmed that there were no threatened or priority ecological communities present within the Calingiri-Goomalling Road site (Natural Area Consulting, 2020). Of the 10 Eucalypt species identified during the survey, the <i>Eucalyptus salmonophloia</i> (Salmon Gum) and <i>Eucalyptus loxophleba</i> (York Gum) are listed as being dominant species of the Eucalypt Woodlands of the WA Wheatbelt ecological community. However, associated middle and understorey species for this community were absent, the patch size was small, and the dominant condition of the survey area was Degraded or Completely Degraded (70% of the site) (Keighery, 1994), meaning that the vegetation on site does not meet the definition of this community type.</p>	At variance	Yes <i>Refer to Section 3.2.1, above.</i>
<p>Principle (b): <i>“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.”</i></p> <p><u>Assessment:</u></p> <p>The area proposed to be cleared contain foraging habitat and hollows suitable for breeding for Carnaby’s black cockatoos.</p>	At variance	Yes <i>Refer to Section 3.2.2, above.</i>
<p>Principle (c): <i>“Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, threatened flora.”</i></p> <p><u>Assessment:</u></p> <p>The area proposed to be cleared may contain habitat for one threatened flora species listed under the BC Act. The survey did not identify any threatened flora species within the application area.</p>	May be at variance	Yes <i>Refer to Section 3.2.1, above.</i>
<p>Principle (d): <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></p> <p>The area proposed to be cleared does not contain species representative of a threatened ecological community.</p>	Not likely to be at variance	No
Environmental value: significant remnant vegetation and conservation areas		
<p>Principle (e): <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></p> <p>The extent of the mapped vegetation types and the native vegetation in the local area is inconsistent with the national objectives and targets for biodiversity conservation in Australia. Therefore, the vegetation within the</p>	At variance	Yes <i>Refer to Section 3.2.3, above.</i>

Assessment against the clearing principles	Variance level	Is further consideration required?
application area is considered significant as a remnant of native vegetation in an area that has been extensively cleared.		
<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></p> <p>Given the distance to the nearest conservation area, the proposed clearing is not likely to have an impact on the environmental values of nearby conservation areas.</p>	Not likely to be at variance	No
Environmental value: 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></p> <p>Given the mapped boundaries of a number of minor tributaries of the Mortlock North River crossover the application area, the proposed clearing is likely to result in clearing of vegetation growing in association with minor, non-perennial watercourses. The Delegated officer noted the degraded to completely degraded (Keighery, 1994) condition of the vegetation and the extent of riparian vegetation proposed for clearing is limited to a maximum width of 1.25 metres on one side of the road. The applicant also holds a bed and banks permit under the <i>RIWI Act</i> (DWER, 2022). The impacts to riparian habitat are considered to be minimal.</p>	May be at variance	No
<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></p> <p>On average, the wind erosion risk is mapped as medium across the application area, with a small area mapped as high risk (DPIRD, 2019). With standard road construction methodologies in place, any localised wind erosion impacts can be managed. The proposed end land use is not expected to contribute to phosphorus export or salinity and waterlogging risk can be managed by implementing standard road work design. The proposed clearing is not expected to result in an increased risk of changes to pH, salinity, or eutrophication and standard design features and roadwork construction methodologies are likely to mitigate wind and water erosion risks.</p> <p>Considering the mapped land degradation risks considered above, the condition of the vegetation (Keighery, 1994) along the road reserve, extent of the proposed clearing and the linear configuration of the application area, the proposed clearing is not likely 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></p> <p>Given the non-perennial nature of the tributaries that cross the application area, that there are no wetlands or Public Drinking Water Sources Areas recorded within the application area and noting the standard design features and roadwork construction methodologies implemented, the proposed clearing is unlikely to impact surface or ground water quality.</p> <p>The department has advised that the applicant required a bed and banks permit to undertake the proposed clearing (DWER, 2022). The applicant has</p>	Not likely to be at variance	No

Assessment against the clearing principles	Variance level	Is further consideration required?
<p>advised the department that a bed and banks permit is obtained under the <i>RiWI Act</i> for the watercourse that maybe impacted (DWER, 2022).</p> <p>The groundwater salinity is mapped between 14,000 to 35,000 milligrams per litre total dissolved solids (classified as saline) within approximately 80 per cent of the application area. The salinity levels over approximately 20 per cent of the application area is mapped as over 35,000 milligrams per litre total dissolved solids. Given the nature of the proposal, the proposed clearing is not likely to contribute to increased salinity.</p>		
<p>Principle (j): <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></p> <p>Given the proposed clearing is approximately 4.56 hectares within a linear footprint and that the majority of the application area is in a degraded (Keighery, 1994) to completely degraded (Keighery, 1994) condition, the proposed clearing is not likely to cause, or exacerbate the incidence or intensity of flooding.</p>	Not likely to be at variance	No

Appendix E. 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.

Considering its location, the scale below was used to measure the condition of the vegetation proposed to be cleared. This scale has been extracted from Keighery, B.J. (1994) *Bushland Plant Survey: A Guide to Plant Community Survey for the Community*. Wildflower Society of WA (Inc). Nedlands, Western Australia.

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 F. Offset calculators' value justification

Calculation 1: Extensively cleared landform – Area calculation.

Field Name	Description	Justification for value used
Area of impact (habitat/community) or Quantum of impact (features/individuals)	The area of habitat/community impacted or number of features/individuals impacted	4.56 hectares of native vegetation located within an extensively cleared landscape
Quality of impacted area (habitat/community)	The quality score for area of habitat/community being impacted - a measure of how well a particular site supports a particular threatened species or ecological community and contributes to its ongoing viability	4 - Remanent native vegetation in a good to completely degraded condition including four mature hollow bearing trees, within a highly cleared landscape. Majority of the site (approximately 70% is in a degraded to completely degraded condition)
Time over which loss is averted (habitat/community)	This describes the timeframe over which changes in the level of risk to the proposed offset site can be considered and quantified	20 - The offset site will be under a management order vested for 'conservation'. 20 years is the maximum value associated with this field.
Time until ecological benefit (habitat/community) or Time horizon (features/individuals)	This describes the estimated time (in years) that it will take for the main benefit of the quality (habitat/community) or value (features/individuals) improvement of the proposed offset to be realised	11 - It is assumed that the environmental values obtained from revegetation will not be evident until 10 years post revegetating. One addition year is added to allow for site preparation.
Start area (habitat/community) or Start value (features/individuals)	The area of habitat/community or number of features/individuals proposed to offset the impacts	6.60 hectares - A revegetation area of this size would be required to adequately offset the loss of native vegetation considered significant in an extensively cleared landscape
Start quality (habitat/community)	The quality score for the area of habitat/community proposed as an offset - a measure of how well a particular site supports a particular threatened species or ecological community and contributes to its ongoing viability	0 – The proposed offset site is an old gravel pit and is in a completely degraded condition. Site is approximately 99% cleared.
Future quality without offset (habitat/community) or Future value without offset (features/individuals)	The predicted future quality score (habitat/community) or value (features/individuals) of the proposed offset site without the offset	0 - It is assumed that the potential revegetation area would maintain its completely degraded condition and the completely cleared nature of the pit should no revegetation and ongoing management occur.
Future quality with offset (habitat/community) or Future value with offset (features/individuals)	The predicted future quality score (habitat/community) or value (features/individuals) of the proposed offset site with the offset	4 - It is assumed that the potential revegetation, if undertaken successfully, could improve the condition of the vegetation to a largely good condition. The animal control, weed management and ongoing monitoring will assist to reach the good condition vegetation.
Risk of loss (%) without offset (habitat/community)	This describes the chance that the habitat/community on the proposed offset site will be completely lost (i.e. no longer hold any value for the protected matter of concern) over the foreseeable future without an offset	0% - 99% of the offset site currently does not contain vegetation hence, no risk of loss in situ biodiversity values as there are none present.
Risk of loss (%) with offset (habitat/community)	This describes the chance that the habitat/community on the proposed offset site will be completely lost (i.e. no longer hold any value for the protected matter of concern) over the foreseeable future with an offset	10% - The revegetation area, placed under a conservation management order, should have a risk of loss of 10%. The risk of catastrophic events (fire, dieback etc.) remain.
Confidence in result (%)	The capacity of measures to mitigate risk of loss of the proposed offset site	80% - revegetation and on-ground management is proposed with a revegetation management plan in place. There is medium confidence that the revegetation in accordance with the revegetation plan will achieve result. Infill planting is proposed to restore required diversity and annual reporting of the revegetation success will be conditions on the permit.
% of impact offset	% of the significant residual impact that would be offset by the proposed offset (note: the offset calculations combined should equate to 100% for each residual impact)	100% - Obtained through the input of variables explained above.

Calculation 2: Carnaby's cockatoo – Feature calculation.

Field Name	Description	Justification for value used
Quantum of impact (features/individuals)	The area of habitat/community impacted or number of features/individuals impacted	192 trees/shrubs – According to the Tree Assessment that was undertaken by Natural Area Consulting, 192 individual trees/shrubs that support Carnaby's cockatoos are proposed for clearing.
Time until ecological benefit (habitat/community) or Time horizon (features/individuals)	This describes the estimated time (in years) that it will take for the main benefit of the quality (habitat/community) or value (features/individuals) improvement of the proposed offset to be realised	15 - It is assumed that the environmental values obtained from revegetation will not be evident until 15 years post-revegetation.
Start value (features/individuals)		0 - The offset site is 99% cleared and only contains a strand of trees in the north-western section of the offset area. a value of zero is used however, this number does not influence the calculation.
Future value without offset (features/individuals)	The predicted future quality score (habitat/community) or value (features/individuals) of the proposed offset site without the offset	0 - It is assumed that the potential revegetation area would maintain its completely degraded condition should no revegetation and ongoing management occur.
Future value with offset (features/individuals)	number of features/individuals proposed to offset the impacts	287– the number of trees/shrubs that need to be planted to offset the impact from the proposed clearing.
Confidence in result (%)	The capacity of measures to mitigate risk of loss of the proposed offset site	80% - revegetation and on-ground management is proposed with a revegetation management plan in place. There is medium confidence that the revegetation in accordance with the revegetation plan will achieve result. Infill planting is proposed to restore required diversity and annual reporting of the revegetation success will be conditions on the permit.
% of impact offset	% of the significant residual impact that would be offset by the proposed offset (note: the offset calculations combined should equate to 100% for each residual impact)	100% - Obtained through the input of variables explained above.

Appendix G. Biological survey information excerpts and photographs of the vegetation (Natural Area Consulting, 2020; Natural Area Consulting, 2021)



Vegetation Type	Description	Photo
Eucalyptus Woodland	<i>Eucalyptus</i> woodland dominated by <i>Eucalyptus</i> spp., over <i>Acacia acuminata</i> , <i>Santalum spicatum</i> , <i>Grevillea</i> spp. and <i>Allocasuarina</i> spp., with an understory of mixed <i>Acacia</i> spp. shrubs, <i>Dianella revoluta</i> , <i>Austrostipa</i> spp. and a mix of herbs and weedy grasses.	
Samphire Open Low Heath	Samphire Open Low Heath dominated by <i>Tecticornia</i> spp., * <i>Juncus acutus</i> over <i>Atriplex</i> spp., <i>Cotula cotuloides</i> and a mix of weedy grasses and herbs.	

Figure 3: Vegetation type and description within the survey area.

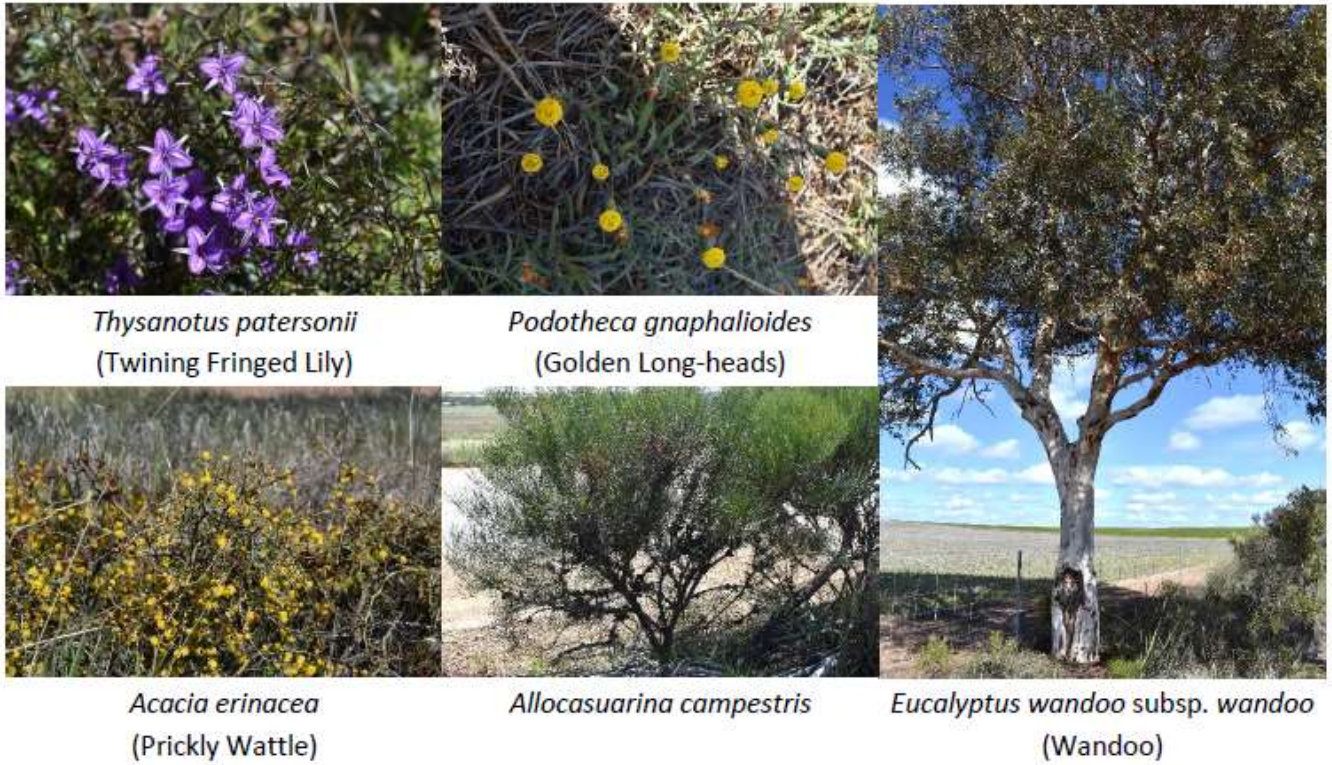


Figure 4: Native flora species recorded within the survey area.

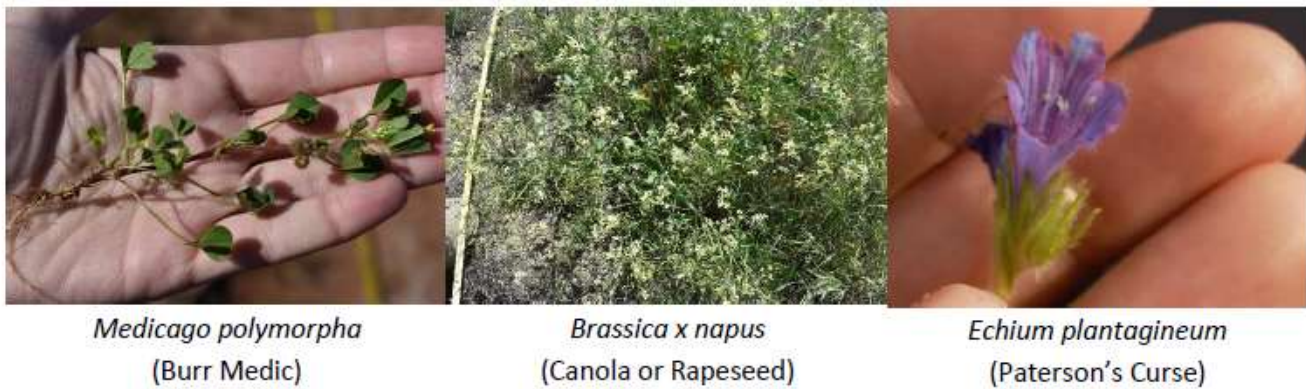


Figure 5: Weed flora species recorded within the survey area.



Figure 6: Photographs of the Priority three flora identified within the application area (*Eucalyptus sargentii* subsp. *onesis*)

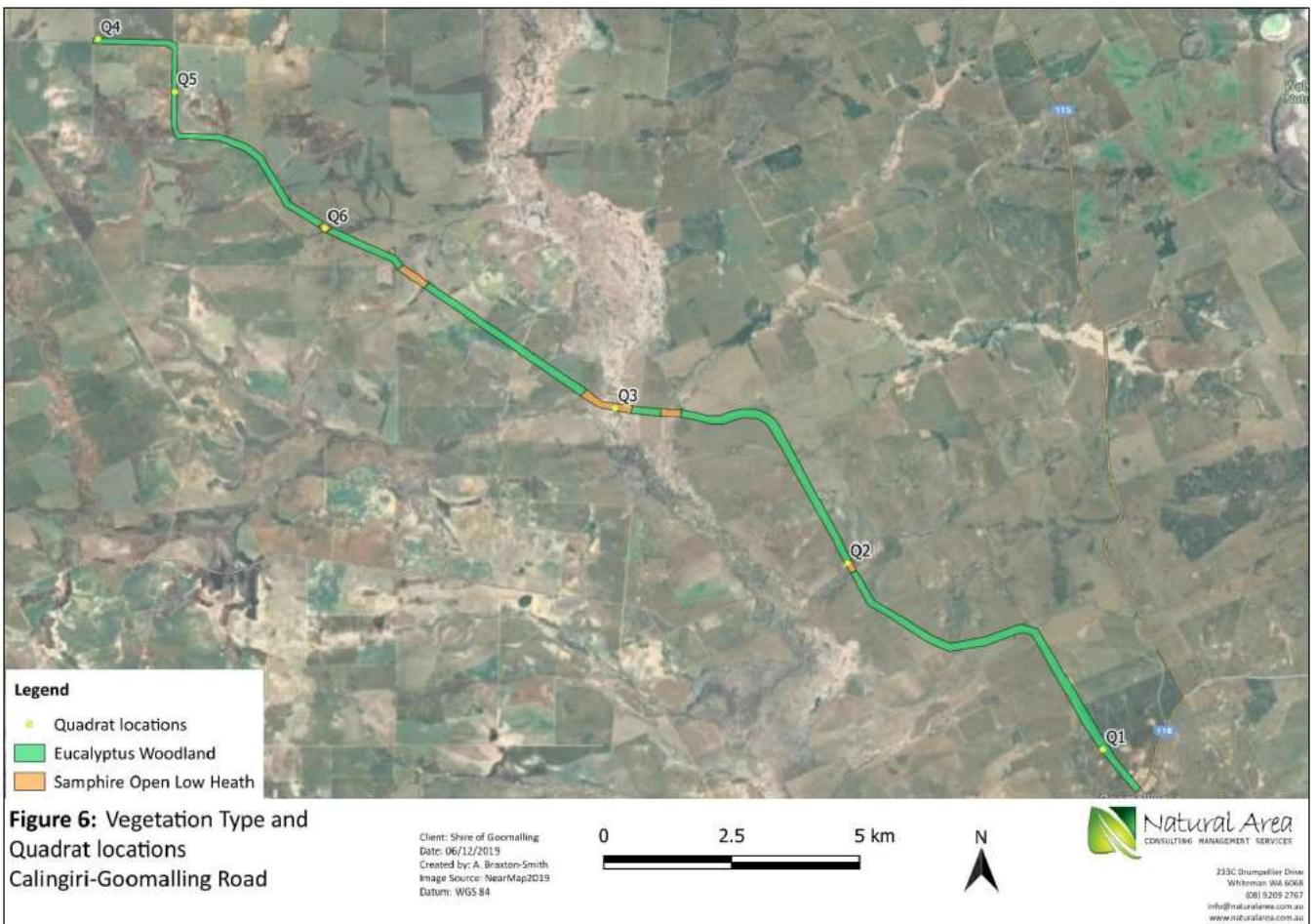


Figure 7: A map of the vegetation type and the location of the quadrats within the survey area.

Table 7: Vegetation condition

Vegetation Condition	Excellent	Very Good	Good	Degraded	Completely Degraded	Total
Area (ha)	0	10.53	42.97	86.20	43.56	183.26
Area (%)	0	5.75	23.45	47.04	23.77	100

Note: These are based on estimates due to the quality of the aerial imagery and the linear nature of the site.

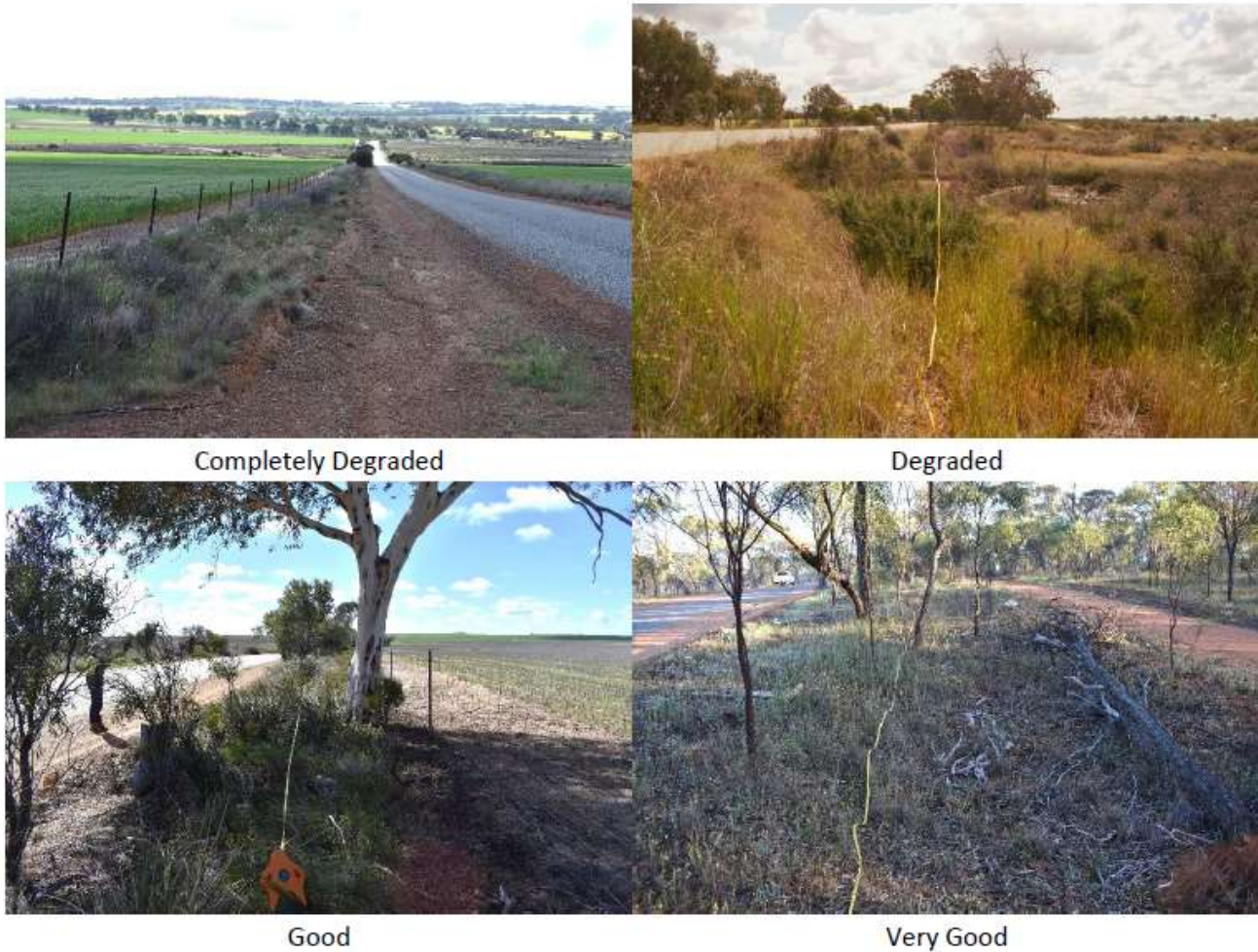


Figure 7: Examples of Vegetation Condition along Calingiri-Goomalling Road

Figure 8: Vegetation condition and the photographs of the survey area.

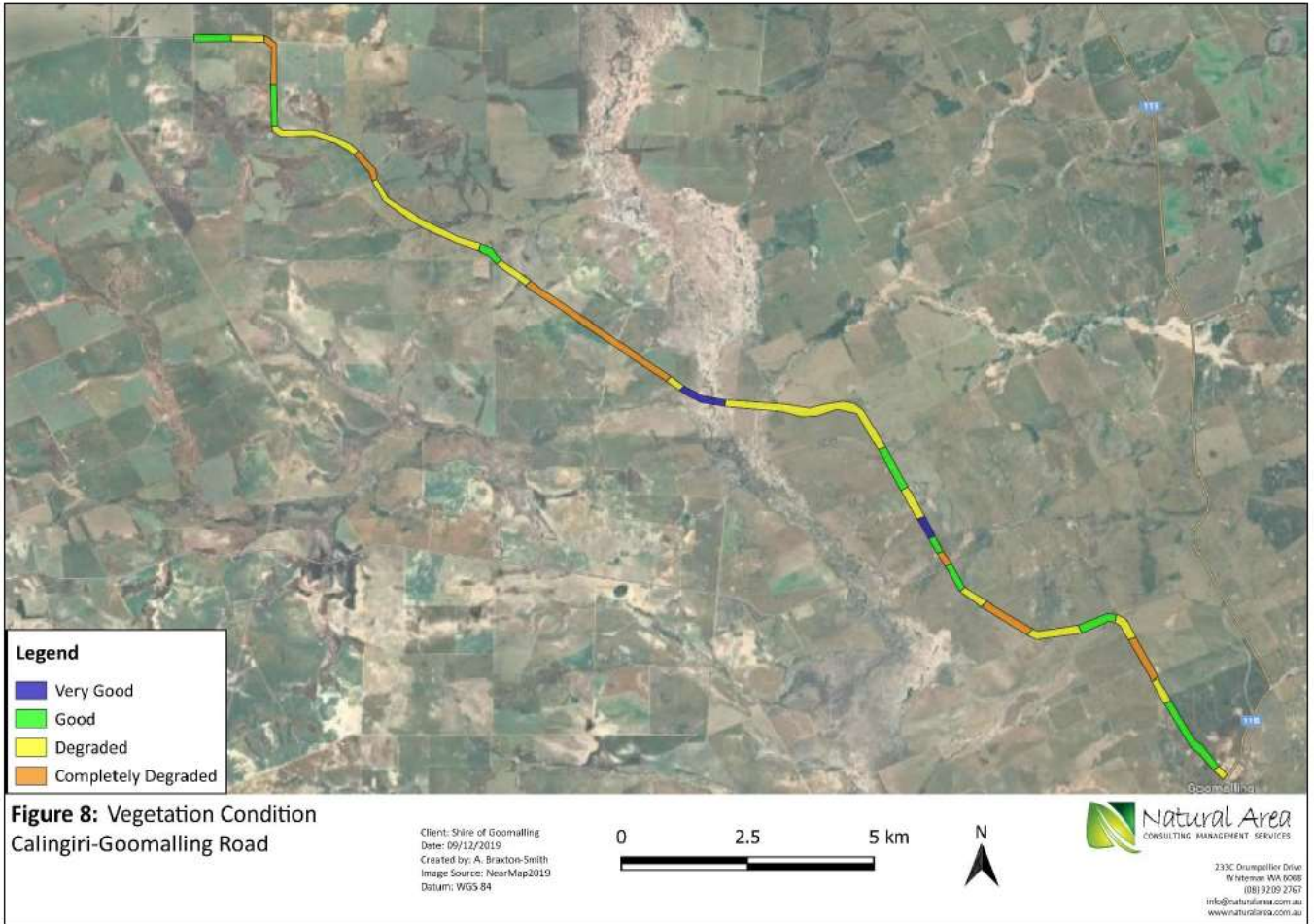


Figure 9: A map of the vegetation condition of the survey area.



Mulga Snake



Bobtail Lizard



Buchanan's Snake-eyed Skink



Brown Falcon



Kangaroo



Welcome Swallow

Figure 9: Examples of Fauna species recorded

Figure 10: Fauna species recorded during the biological survey.

*Locations are found in Figure 6.

Quadrat Number: 1
Survey Date: 20/09/2019
Personnel: HT, ABS
Latitude: -31.2873
Longitude: 116.8246
Location: Calingiri-Goomalling Road
Topography: Upper slope
Aspect: North north west
Slope: 1-3%
Soil: Red/Brown silty sandy clay
Rock: 0%
Leaf Litter: 2%
Bare Ground: 1%
Drainage: Well drained
Condition: Very Good



Notes: Eucalyptus Woodland

Native Species	Cover (%)	Height (m)	Native Species	Cover (%)	Height (m)
<i>Acacia acuminata</i>	40	5	<i>Wahlenbergia gracilentia</i>	0.1	0.1
<i>Austrostipa elegantissima</i>	1	0.5	<i>Waitzia acuminata</i> var. <i>acuminata</i>	7	0.1
<i>Austrostipa tenuifolia</i>	0.5	0.2	<i>Vincetoxicum lineare</i>	0.5	0.5
<i>Calandrinia eremaea</i>	0.1	0.1	Invasive Species	Cover (%)	Height (m)
<i>Diuris hazeliae</i>	0.5	0.2	* <i>Aira cupaniana</i>	2	0.1
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	0.5	0.1	* <i>Arctotheca calendula</i>	0.5	0.1
<i>Eucalyptus myriadena</i>	10	14	* <i>Avena barbata</i>	0.1	0.5
<i>Gonocarpus nodulosus</i>	0.1	0.1	* <i>Briza maxima</i>	7	0.2
<i>Grevillea paniculata</i>	4	1	* <i>Bromus rubens</i>	0.5	0.2
<i>Hydrocotyle pilifera</i>	0.1	0.1	* <i>Cotula bipinnata</i>	0.1	0.1
<i>Millotia tenuifolia</i>	0.5	0.1	* <i>Erodium botrys</i>	0.5	0.1
<i>Phyllangium sulcatum</i>	0.1	0.1	* <i>Hypochaeris radicata</i>	5	0.2
<i>Podolepis lessonii</i>	2	0.1	* <i>Lupinus cosentinii</i>	0.1	0.2
<i>Rytidosperma acerosum</i>	20	0.1	* <i>Monoculus monstrosus</i>	0.1	0.2
<i>Thysanotus patersonii</i>	0.1	0.5	* <i>Moraea lewisiae</i>	0.5	0.1
<i>Trachymene cyanopetala</i>	3	0.1	* <i>Moraea setifolia</i>	0.1	0.1
<i>Trachymene ornata</i>	2	0.1	* <i>Oxalis pes-caprae</i>	0.1	0.1
<i>Tricoryne elatior</i>	0.5	0.2	* <i>Ursinia anthemoides</i>	0.1	0.2

Figure 11: Data gathered from quadrat number one within the survey area.

Quadrat Number: 2
Survey Date: 20/09/2019
Personnel: HT, ABS
Latitude: -31.248183
Longitude: 116.771746
Location: Calingiri-Goomalling Road
Topography: Basin
Aspect: Flat
Slope: 0%
Soil: Brown silty clay
Rock: 0%
Leaf Litter: 0%
Bare Ground: 0%
Drainage: Poorly drained
Condition: Good



Note: Samphire Open Low Heath

Native Species	Cover (%)	Height (m)	Invasive Species	Cover (%)	Height (m)
<i>Cotula cotuloides</i>	2	0.1	* <i>Arctotheca calendula</i>	0.5	0.1
<i>Eragrostis dielsii</i>	0.5	0.1	* <i>Bromus driandrus</i>	0.1	0.2
<i>Eucalyptus obtusiflora</i>	1	2	* <i>Bromus rubens</i>	15	0.2
<i>Maireana brevifolia</i>	2	1	* <i>Lolium rigidum</i>	1	0.2
<i>Stylobasium australe</i>	0.5	0.3	* <i>Medicago polymorpha</i>	3	0.1
<i>Tecticornia indica</i>	15	0.5	* <i>Mesembryanthemum nodiflorum</i>	5	0.1
			* <i>Plantago coronopus</i> subsp. <i>commutata</i>	0.1	0.1
			* <i>Trifolium tomentosum</i>	0.1	0.1

Figure 12: Data gathered from quadrat number two within the survey area.

Quadrat Number: 3
Survey Date: 20/09/2019
Personnel: HT, ABS
Latitude: -31.21660
Longitude: 116.72399
Location: Calingiri-Goomalling Road
Topography: Basin
Aspect: East
Slope: 0%
Soil: Light grey silty sandy clay
Rock: 0%
Leaf Litter: 0%
Bare Ground: 40%
Drainage: Poorly drained
Condition: Very Good



Note: Saphire Open Low Heath

Native Species	Cover (%)	Height (m)	Invasive Species	Cover (%)	Height (m)
<i>Atriplex hymenotheca</i>	1	0.3	* <i>Arctotheca calendula</i>	0.1	0.1
<i>Crassula colorata</i> var. <i>colorata</i>	0.5	0.1	* <i>Bromus hordaceus</i>	0.5	0.2
<i>Frankenia</i> sp	0.5	0.5	* <i>Cotula coronopifolia</i>	5	0.1
<i>Hyalochlamys globifera</i>		0.1	* <i>Lolium rigidum</i>	1	0.2
<i>Pogonolepis stricta</i>	5	0.1	* <i>Monoculus monstrosus</i>	0.1	0.2
<i>Tecticornia indica</i>	20	0.5	* <i>Plantago coronopus</i> subsp. <i>commutata</i>	0.1	0.1
<i>Tecticornia pergranulata</i> subsp. <i>divaricata</i>	10	1	* <i>Romulea rosea</i>	1	0.1
<i>Triglochin calcitrapa</i>	0.1	0.1	* <i>Trifolium tomentosum</i>	0.5	0.1

Figure 13: Data gathered from quadrat number three within the survey area.

Quadrat Number: 4
Survey Date: 20/09/2019
Personnel: HT, ABS
Latitude: -31.140878
Longitude: 116.617756
Location: Calingiri-Goomalling Road
Topography: Mid slope
Aspect: West
Slope: 1-3%
Soil: Light brown silty sand
Rock: 0%
Leaf Litter: 4%
Bare Ground: 1%
Drainage: Well drained
Condition: Very Good



Note: Eucalyptus Woodland

Native Species	Cover (%)	Height (m)	Native Species	Cover (%)	Height (m)
<i>Acacia lasiocarpa</i> var. <i>sedifolia</i>	1.5	1	<i>Opercularia vaginata</i>	1	0.2
<i>Acacia sulcata</i> var. <i>platyphylla</i>	1	1	<i>Rhagodia drummondii</i>	4	0.8
<i>Allocasuarina campestris</i>	25	2	<i>Rhagodia preissii</i>	2	1
<i>Astroloma serratifolium</i>	0.5	0.5	<i>Santalum spicatum</i>	10	3
<i>Austrostipa elegantissima</i>	25	0.5	<i>Scholtzia drummondii</i>	1	1
<i>Austrostipa tenuifolia</i>	2	0.2	Invasive Species	Cover (%)	Height (m)
<i>Caesia occidentalis</i>	0.1	0.3	* <i>Arctotheca calendula</i>	0.5	0.1
<i>Dampiera lavandulacea</i>	1.5	0.2	* <i>Bromus rubens</i>	5	0.2
<i>Desmocladus asper</i>	1	0.2	* <i>Ehrharta longiflora</i>	10	1
<i>Dianella revoluta</i>	10	0.8	* <i>Eragrostis curvula</i>	3	0.8
<i>Eucalyptus wandoo</i> subsp. <i>wandoo</i>	10	20	* <i>Hordeum leporinum</i>	0.5	0.2
<i>Hakea scoparia</i> subsp. <i>scoparia</i>	5	2.5	* <i>Monoculus monstrosus</i>	0.5	0.2
<i>Lepidosperma tenue</i>	0.1	0.4	* <i>Moraea setifolia</i>	0.5	0.2
<i>Lomandra effusa</i>	4	0.2	* <i>Ornithopus compressus</i>	0.1	0.1
<i>Melaleuca concreta</i>	1.5	1	* <i>Raphanus raphanistrum</i>	0.1	0.5
<i>Melaleuca hamata</i>	1.5	2	* <i>Trifolium tomentosum</i>	0.5	0.1
<i>Melaleuca marginata</i>	5	1			

Figure 14: Data gathered from quadrat number four within the survey area.

Quadrat Number: 5
Survey Date: 20/09/2019
Personnel: HT, ABS
Latitude: -31.151620
Longitude: 116.633480
Location: Calingiri-Goomalling Road
Topography: Lower slope
Aspect: South
Slope: 1-3%
Soil: Light brown silty sand
Rock: 0%
Leaf Litter: 5% 2 cm
Bare Ground: 0%
Drainage: Well drained
Condition: Very Good



Note: Eucalyptus Woodland

Native Species	Cover (%)	Height (m)	Invasive Species	Cover (%)	Height (m)
<i>Austrostipa elegantissima</i>	3	0.5	* <i>Aira cupaniana</i>	0.1	0.1
<i>Austrostipa tenuifolia</i>	1	0.3	* <i>Arctotheca calendula</i>	1	0.1
<i>Calandrinia eremaea</i>	0.1	0.1	* <i>Bromus rubens</i>	0.5	0.2
<i>Comesperma integerrimum</i>	0.5	0.3	* <i>Cotula coronopifolia</i>	0.1	0.1
<i>Dianella revoluta</i>	0.5	0.5	* <i>Ehrharta longiflora</i>	20	1
<i>Enchylaena lanata</i>	0.1	0.2	* <i>Hypochaeris radicata</i>	0.1	0.2
<i>Eucalyptus sargentii</i> subsp. <i>onesis</i>	20	4	* <i>Lolium rigidum</i>	0.1	0.3
<i>Eucalyptus sporadica</i>	10	4	* <i>Mesembryanthemum crystallinum</i>	0.5	0.1
<i>Melaleuca haplantha</i>	7	2	* <i>Monoculus monstrosus</i>	0.1	0.2
<i>Melaleuca marginata</i>	4	1.6			
<i>Melaleuca scalena</i>	10	2.2			
<i>Santalum spicatum</i>	2	1.5			
<i>Thysanotus manglesianus</i>	0.1	0.6			
<i>Trachymene cyanopetala</i>	0.5	0.1			

Figure 15: Data gathered from quadrat number five within the survey area.

Quadrat Number: 6
Survey Date: 26/09/2019
Personnel: HT, ABS
Latitude: -31.179708
Longitude: 116.664392
Location: Calingiri-Goomalling Road
Topography: Drainage line
Aspect: North
Slope: Flat
Soil: Brown sandy clay
Rock: 0%
Leaf Litter: 0%
Bare Ground: 6%
Drainage: Poorly drained
Condition: Degraded



Note: Sampire Open Low Heath

Native Species	Cover (%)	Height (m)	Invasive Species	Cover (%)	Height (m)
<i>Atriplex semilunaris</i>	0.5		* <i>Hordeum leporinum</i>	3	
<i>Maireana brevifolia</i>	10		* <i>Hypochaeris radicata</i>	0.5	
<i>Rhagodia drummondii</i>	0.1		* <i>Juncus acutus</i>	4	1
<i>Tecticornia indica</i>	8		* <i>Lolium rigidum</i>	20	
Invasive Species	Cover (%)	Height (m)	* <i>Mesembryanthemum nodiflorum</i>	0.1	
* <i>Arctotheca calendula</i>	1		* <i>Monoculus monstrosus</i>	0.1	
* <i>Avena barbata</i>	1		* <i>Moraea setifolia</i>	0.1	
* <i>Cotula bipinnata</i>	0.5		* <i>Ornithopus compressus</i>	0.1	
* <i>Cynodon dactylon</i>	4		* <i>Sagina apetala</i>	0.1	
* <i>Ehrharta longiflora</i>	7.5		* <i>Trifolium resupinatum</i>	0.5	
* <i>Eragrostis curvula</i>	1		* <i>Trifolium tomentosum</i>	0.1	

Figure 16: Data gathered from quadrat number six within the survey area.

Table 2: Tree/shrub summary within clearing boundary

Species	Habit	Number of trees/shrubs to be cleared	Number of trees/shrubs to be kept
<i>Acacia acuminata</i>	Shrub	305	71
<i>Acacia aestivalis</i>	Shrub	2	0
<i>Acacia microbotrya</i> subsp. <i>microbotrya</i>	Shrub	55	13
<i>Acacia saligna</i>	Shrub	27	2
<i>Allocasuarina huegeliana</i>	Tree	19	1
<i>Eucalyptus accedens</i>	Tree	11	5
<i>Eucalyptus camaldulensis</i>	Tree	15	2
<i>Eucalyptus capillosa</i>	Tree	5	2
<i>Eucalyptus loxophleba</i> subsp. <i>loxophleba</i>	Tree	144	58
<i>Eucalyptus salmonophloia</i>	Tree	8	26
<i>Eucalyptus sargentii</i> subsp. <i>onesis</i> (P3)	Tree	6	0
<i>Eucalyptus sp.</i>	Tree	2	0
<i>Eucalyptus stricklandii</i>	Tree	3	1
<i>Eucalyptus wandoo</i> subsp. <i>wandoo</i>	Tree	11	15
<i>Hakea preissii</i>	Shrub	1	1
<i>Leptospermum erubescens</i>	Shrub	1	0
<i>Pittosporum angustifolium</i>	Shrub	20	0

Figure 17: Number of trees/shrubs to be cleared and number of trees/shrubs to be kept within the survey area.

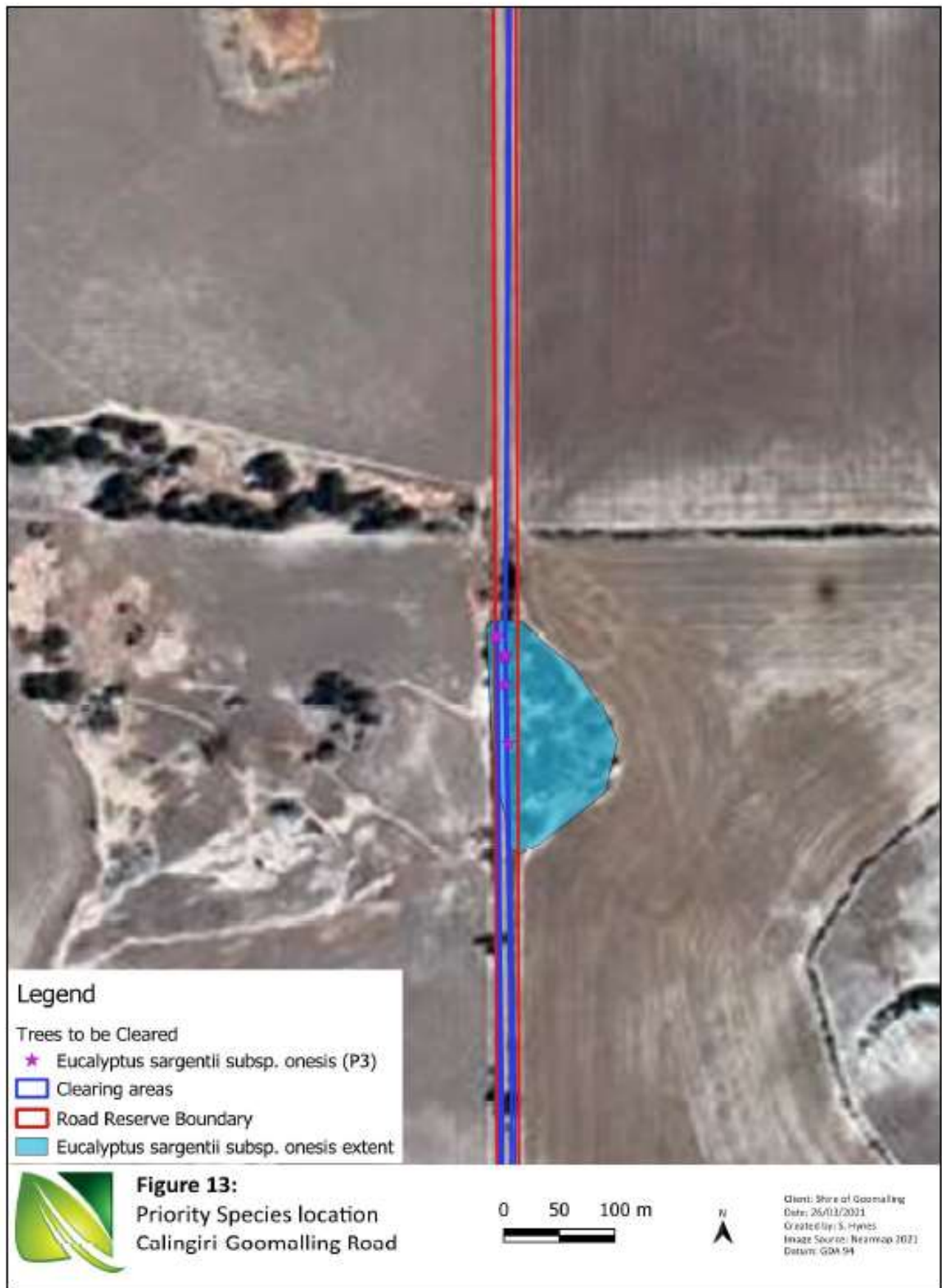


Figure 18: A map representing the location and the extent of the Priority three flora *Eucalyptus sargentii* subsp. *onensis* of the application area.

Appendix H. Sources of information

H.1. GIS databases

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

- 10 Metre Contours (DPIRD-073)
- Aboriginal Heritage Places (DPLH-001)
- Aboriginal Heritage Places (DPLH-001)
- Cadastre (LGATE-218)
- 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)
- Hydrography – Inland Waters – Waterlines
- Hydrological Zones of Western Australia (DPIRD-069)
- IBRA Vegetation Statistics
- Imagery
- Local Planning Scheme – Zones and Reserves (DPLH-071)
- Native Title (ILUA) (LGATE-067)
- Offsets Register – Offsets (DWER-078)
- Pre-European Vegetation Statistics
- Public Drinking Water Source Areas (DWER-033)
- Ramsar Sites (DBCA-010)
- Regional Parks (DBCA-026)
- Remnant Vegetation, All Areas
- RIWI Act, Groundwater Areas (DWER-034)
- RIWI Act, Surface Water Areas and Irrigation Districts (DWER-037)
- Soil Landscape Land Quality – Flood Risk (DPIRD-007)
- Soil Landscape Land Quality – Phosphorus Export Risk (DPIRD-010)
- Soil Landscape Land Quality – Subsurface Acidification Risk (DPIRD-011)
- Soil Landscape Land Quality – Water Erosion Risk (DPIRD-013)
- Soil Landscape Land Quality – Water Repellence Risk (DPIRD-014)
- Soil Landscape Land Quality – Waterlogging Risk (DPIRD-015)
- Soil Landscape Land Quality – Wind Erosion Risk (DPIRD-016)
- Soil Landscape Mapping – Best Available
- Soil Landscape Mapping – Systems
- Wheatbelt Wetlands Stage 1 (DBCA-021)

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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