



## CLEARING PERMIT

*Granted under section 51E of the Environmental Protection Act 1986*

<b>Purpose Permit number:</b>	CPS 8701/1
<b>Permit Holder:</b>	B & J Catalano Pty Ltd
<b>Duration of Permit:</b>	From 16 September 2023 to 16 September 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 gravel extraction.

**2. Land on which clearing is to be done**

Lot 41 on Deposited Plan 410793, Chittering  
Lot 42 on Deposited Plan 410794, Chittering

**3. Clearing authorised**

The permit holder must not clear more than 2.23 hectares of *native vegetation* within the area cross-hatched yellow in Figure 1 and 2 of Schedule 1.

**4. Period during which clearing is authorised**

The permit holder must not clear any *native vegetation* after 16 September 2028.

### **PART II – MANAGEMENT CONDITIONS**

**5. 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.

## 6. 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.

## 7. Directional clearing

The permit holder must conduct clearing activities in a slow, progressive manner towards adjacent *native vegetation*, to allow fauna to move into adjacent *native vegetation* ahead of the clearing activity.

## 8. Fauna management – black cockatoo habitat

- (a) Within 72 hours prior to undertaking any clearing authorised under this permit within the areas cross-hatched yellow in Figure 1 and 2 of Schedule 1, the permit holder must engage a fauna specialist to inspect all black cockatoo habitat tree/s identified in the Donningtons Quarry Gt Northern Highway Chittering Flora and Vegetation (Plantecology Consulting, 2019) for evidence of current or past breeding use by *Zanda latirostris* (Carnaby's black cockatoo) and *Calyptorhynchus banksii naso* (forest red-tailed black cockatoo).
- (b) Where a black cockatoo habitat tree with no evidence of current or past use by Carnaby's or forest red-tailed black cockatoo is identified in accordance with condition 8(a), that tree must only be cleared within 72 hours after inspection.
- (c) Where a *black cockatoo habitat tree* is identified within the combined areas crosshatched yellow on Figures 1 and 2 of Schedule 1 and that tree shows evidence of current or past breeding use by Carnaby's or forest red-tailed black cockatoo under condition 8(a), 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.
- (d) Any *black cockatoo breeding tree* with evidence of current breeding use by Carnaby's black cockatoo must not be cleared whilst it is in use for that breeding season as determined by the *fauna specialist* under condition 8(c).
- (e) Where a *black cockatoo habitat tree* is cleared, the permit holder must install at least six artificial black cockatoo nest hollows for every suitable hollow identified in a *black cockatoo habitat tree* cleared.
- (f) Each artificial black cockatoo nesting hollow required by condition 8(e) must be installed prior to commencement of the next black cockatoo breeding season following clearing of the related *black cockatoo habitat tree/s*.
- (g) The artificial black cockatoo nest hollow/s required by condition 8(e) of this permit must:
  - (i) be installed in consultation with, and on Lot 41 on Deposited Plan 410793 and Lot 42 on Deposited Plan 410794, Chittering, within the areas crosshatched in green in Figure 2 of Schedule 2, in consultation with the Department of Biodiversity, Conservation and Attractions;

- (ii) be designed and placed in accordance with the specifications detailed in Schedule 3; and
  - (iii) be monitored and maintained in accordance with the specifications detailed in Schedule 3, for a period of at least ten years.
- (h) Within two months of clearing authorised under this permit within the areas cross-hatched yellow in Figure 1 and 2 of Schedule 1, the permit holder must provide the results of the *fauna specialist's* inspection in a report to the *CEO*.
- (i) The *fauna specialist's* inspection report must include the following;
- (i) the location of any fauna species listed in *condition* 8(a), if identified, recorded using a GPS unit set to GDA2020, expressing the geographical coordinates in Eastings and Northings or decimal degrees;
  - (ii) the name and amount of each fauna species identified;
  - (iii) whether the *black cockatoo habitat tree/s* identified show current or past use by black cockatoo species;
  - (iv) the methodology, used to survey the permit area;
  - (v) a photo of the *black cockatoo habitat tree(s)* identified;
  - (vi) a description of the *black cockatoo habitat tree(s)* identified, including the:
    - i. species of *black cockatoo habitat tree(s)*; and
    - ii. condition of the *black cockatoo habitat tree(s)*; and
  - (vii) the location of the artificial hollows installed 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.

## 9. Offset – revegetation and rehabilitation

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 6.52 hectares within the areas cross-hatched red in Figure 1 of Schedule 2 by:
  - (i) Laying the vegetative material and topsoil retained under Condition 9(a) on the cleared area;
  - (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) Establish three 10 x 10 metre quadrat monitoring sites across the *offset site*.
- (e) Conduct *pest animal* control.
- (f) Fence the *offset site*.
- (g) Remove rubbish from the *offset site*.
- (h) Install a four-metre trafficable firebreak that complies with the Shire of Chittering requirements around the interior perimeter fence of the *offset site*.
- (i) Water planted vegetation between November and March during the first two years following planting.

- (j) 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.
- (k) Achieve the Completion Criteria, outlined in Table 1 of Schedule 2 (Completion Criteria) of this permit, after the 5 year monitoring period for areas revegetated and *rehabilitated* under this permit:
- (l) Undertake remedial action for areas in the *offset site* where monitoring indicated that *revegetation* has not met the Completion Criteria, outlined in Table 1 of Schedule 2 of this permit, including:
  - (i) *revegetate* the area by deliberately *planting native vegetation* that will result in the minimum target set out in the Completion Criteria and ensuring only *local provenance* seeds and propagating material are used;
  - (ii) undertake further weed control activities;
  - (iii) undertake further watering activities;
  - (iv) annual monitoring by an *environmental specialist* of the *offset site* following the three years of biannual monitoring, until the Completion Criteria, outlined in Table 1 of Schedule 2 of this permit, are met; and
  - (v) where an *environmental specialist* has determined that the completion criteria, outlined in Table 1 of Schedule 2 (Completion Criteria) has been met, that report is to be provided to the *CEO*.

**10. Offset – Lot 42 on Plan 410794, Chittering**

Within 24 months of commencing *revegetation* and *rehabilitation* in accordance with Condition 9 of this permit, the permit holder must:

- (a) place a conservation covenant under section 30B of the *Soil and Land Conservation Act 1945*, setting aside the area cross-hatched red on Figure 1 of Schedule 2 for the protection and management of vegetation in perpetuity; and
- (b) provide the *CEO* a copy of the executed conservation covenant.

**PART III - RECORD KEEPING AND REPORTING**

**11. 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"> <li>(a) the species composition, structure, and density of the cleared area;</li> <li>(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;</li> <li>(c) the date that the area was cleared;</li> <li>(d) the size of the area cleared (in hectares);</li> <li>(e) actions taken to avoid, minimise, and reduce the impacts and extent of clearing in accordance with condition 5;</li> <li>(f) actions taken to minimise the risk of the introduction and spread of</li> </ul>

No.	Relevant matter	Specifications
		<p><i>weeds</i> and <i>dieback</i> in accordance with condition 6; and</p> <p>(g) actions taken to undertake directional clearing in accordance with condition 7.</p>
2.	In relation to black cockatoo fauna management pursuant to condition 8 of this permit	<p>(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>;</p> <p>(b) a description of the inspection methodology employed by the <i>fauna specialist</i>;</p> <p>(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>;</p> <p>(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>:</p> <p style="padding-left: 20px;">(i) the time and date that it was determined to be no longer occupied; and</p> <p style="padding-left: 20px;">(ii) a description of the evidence by which it was determined to be no longer occupied; and</p> <p>(e) the time and date that the suitable <i>black cockatoo habitat tree</i> was cleared.</p>
3.	In relation to the installation of artificial black cockatoo nest hollows pursuant to condition 8 of this permit	<p>(a) the date that each artificial black cockatoo nest hollow was installed;</p> <p>(b) the total number of artificial hollows installed.</p> <p>(c) the location where each artificial black cockatoo nest hollow was installed recorded using a GPS unit set to GDA2020, expressing the geographical coordinates in Eastings and Northings or decimal degrees;</p> <p>(d) a photo of each installed artificial black cockatoo nest hollow;</p> <p>(e) the dates each artificial black cockatoo nest hollow installed was monitored;</p> <p>(f) a description of the monitoring methods employed for each artificial black cockatoo nest hollow installed;</p> <p>(g) a description of the monitoring observations for each artificial black cockatoo nest hollow installed;</p> <p>(h) the date/s each artificial black cockatoo nest hollow installed was maintained; and</p> <p>(i) a description of the maintenance activities undertaken for each artificial black cockatoo nest hollow installed.</p>
4.	In relation to the <i>revegetation</i> area pursuant to condition 9 and 10 of this permit	<p>(a) a description of the <i>revegetation</i> and <i>rehabilitation</i> activities undertaken;</p> <p>(b) the size of the area <i>revegetated</i> and <i>rehabilitated</i>;</p> <p>(c) the date/s on which the <i>revegetation</i> and <i>rehabilitation</i> was undertaken;</p> <p>(d) the boundaries of the area <i>revegetated</i> and <i>rehabilitated</i> (recorded digitally as a shapefile);</p> <p>(e) any remediation works undertaken;</p> <p>(f) the date that completion criteria are considered to be met; and</p> <p>(g) other actions taken in accordance with condition 9 and 10.</p>

## 12. Reporting

The permit holder must provide to the *CEO* the records required under *condition 11* of this permit when requested by the *CEO*.

## DEFINITIONS

In this Permit, the terms in Table Table Table 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 <i>black cockatoo species</i> .
Black cockatoo species	means one or more of the following species: a) <i>Calyptorhynchus latirostris</i> (Carnaby's cockatoo); and b) <i>Calyptorhynchus banksii naso</i> (forest red-tailed black cockatoo).
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 CEO 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 <i>native vegetation</i> seeds and propagating material from natural sources 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 area cross-hatched red on Figure 2 of Schedule 1 of this permit.
Optimal time	means the period from April to June for undertaking <i>planting and 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.
Reference site	Means the survey site indicated by the cross-hatched green area in Figure 3 of Schedule 1 on Lot 42 on Deposited Plan 410794, Chittering (Plantecology Consulting, 2019) to identify 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 <i>native vegetation</i> in order to improve the ecological function of that area using methods such as <i>regeneration, direct seeding and/or planting</i> , so that the species composition, structure and density is similar to pre-clearing vegetation types in that area.
Revegetate/ed/ion	means the re-establishment of a cover of local provenance <i>native vegetation</i> in an area using methods such as natural regeneration, direct seeding and/or planting, so that the species composition, structure and density is similar to pre-clearing vegetation types in that area
Revegetation area	Means the area cross-hatched red on Figure 3 of Schedule 1.

Term	Definition
Revegetation plan	Means plans developed by the permit holder for the <i>revegetation</i> and <i>rehabilitation</i> of a site in accordance with condition 11 of this Permit: “ <i>Offset Revegetation Plan (version 5) - Lot 42 on Deposited Plan 410794 14 Eatha Road, Chittering (Lundstrom Environmental Consultants Pty Ltd, 2023)</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.

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**END OF CONDITIONS**




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Mathew Gannaway  
MANAGER  
NATIVE VEGETATION REGULATION

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

23 August 2023

# Schedule 1

The boundary of the area authorised to be cleared is shown in the map below (Figure 111Figure 11Figure 1).

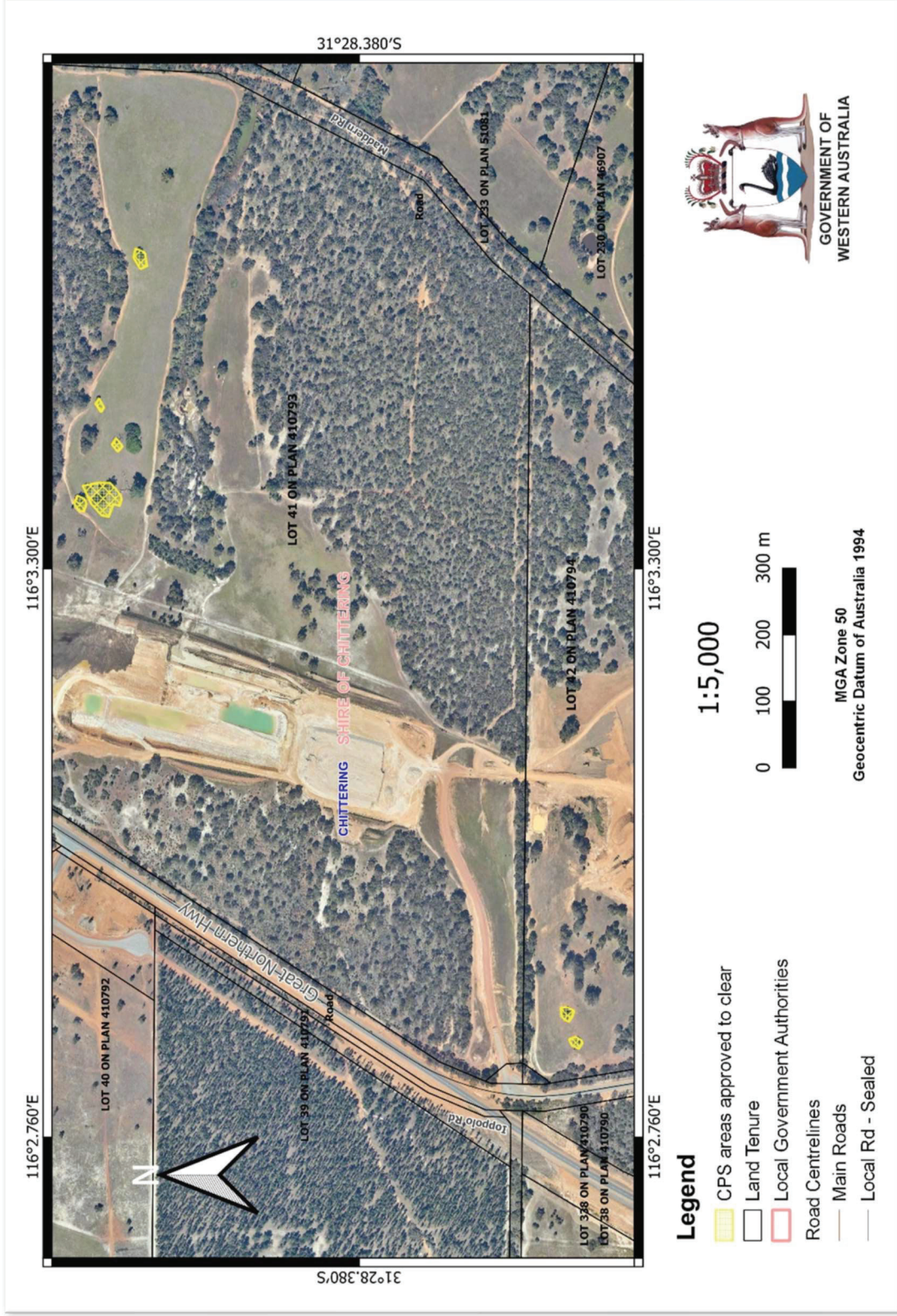


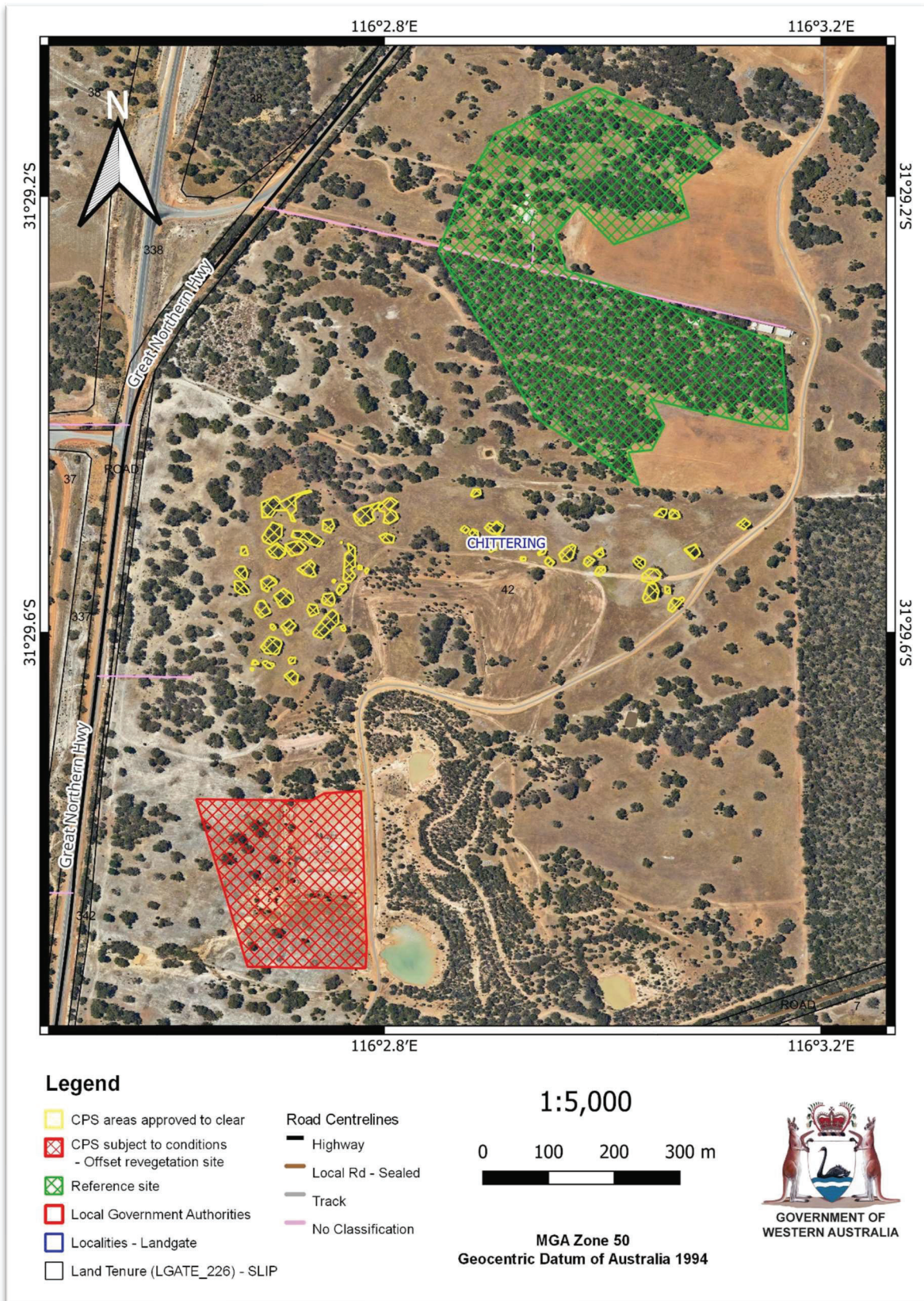
Figure 111: Map of the boundary of the area (cross-hatched yellow) within which clearing may occur.





Figure 2: Map of the boundary of the area (cross-hatched yellow) within which clearing may occur.

## Schedule 2 - Location of Offsets



**Figure 1: Map of the boundary of the area cross-hatched red which will be revegetated in accordance with the offset conditions of this permit and the boundary of the area cross-hatched green which indicates the reference site for the revegetation and rehabilitation.**



**Legend**

-  Location in which artificial hollows are to be installed
-  Granted Clearing Permit area CPS 8701-1
-  Local Government Authorities
-  Localities - Landgate
-  Land Tenure (LGATE\_226) - SLIP

1:3,000



MGA Zone 50  
Geocentric Datum of Australia 1994



**Figure 2: The area cross-hatched yellow indicates of the boundary of the area within which clearing may occur. The area cross-hatched green indicates the boundary of the area where a minimum of six black cockatoo nesting hollows must be installed and maintained.**

## Completion Criteria

Table 1: Completion criteria for the rehabilitation within the areas cross-hatched red in Figure 1 of Schedule 2.

Item	Criterion	Completion targets	Completion criteria	Monitoring
1	Carnaby's and forest red-tailed black cockatoo foraging plant diversity and density	The site must be fully revegetated to at least 80% cover or density of the reference sites using native food plants for Carnaby's and forest red-tailed black cockatoo, and high to medium priority food species.	At least 145 stems per hectare of <i>Banksia tree species</i> . Presence of all Carnaby's and forest red-tailed black cockatoo foraging species from the <i>reference site</i> : <ul style="list-style-type: none"> <li>• <i>Allocasuarina fraseriana</i></li> <li>• <i>Corymbia calophylla</i></li> <li>• <i>Banksia grandis</i></li> <li>• <i>Eucalyptus marginata</i></li> <li>• <i>Eucalyptus wandoo subsp. wandoo</i></li> <li>• <i>Banksia attenuata</i></li> <li>• <i>Banksia dallanneyi var. dallanneyi</i></li> <li>• <i>Banksia menziesii</i></li> <li>• <i>Banksia sessilis</i></li> <li>• <i>Callistemon spp.</i></li> <li>• <i>Hakea lissocarpa</i></li> <li>• <i>Hakea stenocarpa</i></li> <li>• <i>Hakea ruscifolia</i></li> <li>• <i>Xanthorrhoea preissii</i></li> <li>• <i>Calytrix spp.</i></li> </ul>	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) and no later than within five years from the commencement of the <i>revegetation</i> .
2	Weeds	No more than five percent greater than at the <i>reference site</i> .	For each target <i>revegetation type</i> , the <i>revegetation</i> must not have a weed cover greater than five percent.	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) and no later than within five years from the commencement of the <i>revegetation</i> .
3	Bare ground	No more than five percent greater than at the <i>reference site</i> .	For each target <i>revegetation type</i> , the <i>offset sites</i> must not have more than seven percent 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).
4	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 area</i> .	N/A	Annually by an <i>environmental specialist</i> until completion criteria 1 – 4 has been met.

## Schedule 3 – Guidance for artificial hollows for black cockatoo



Department of Biodiversity,  
Conservation and Attractions

### FAUNA NOTES

#### 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.

#### 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

### FAUNA NOTES – Artificial Hollows for Black Cockatoos

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.

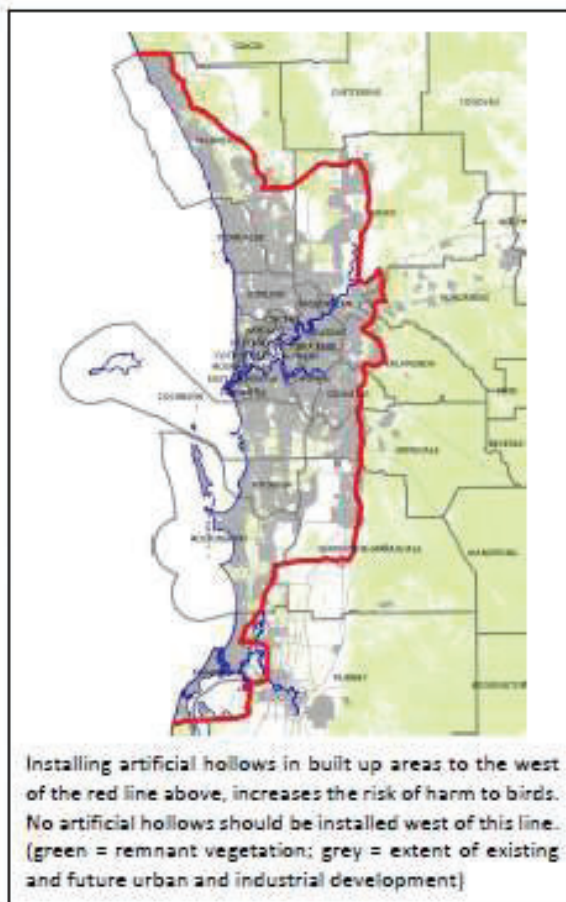
#### Is my site suitable for artificial hollows?

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.	<b>The site is Eucalypt woodland or forest within the known breeding range of the species</b>	
	<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.	<b>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.</b>	

FAUNA NOTES – Artificial Hollows for Black Cockatoos

	<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 <a href="#">Plants Used by Carnaby's Black Cockatoo</a> available on the Department of Biodiversity, Conservation and Attractions (DBCA) <a href="#">black cockatoo webpage</a>.</p>
3.	<b>The artificial hollows can be located in close proximity to adequate feeding areas – within a 12 km radius.</b>	
	<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 <a href="#">Plants Used by Carnaby's Black Cockatoo</a> .
	<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.	<b>The hollows are placed in secure locations and the owner/manager of these areas is supportive and willing to provide the necessary long-term security and annual maintenance for the entire time that the artificial hollow will be in place.</b>	
	<i>Important consideration</i>	For advice on the monitoring and maintenance requirements, please refer to the section on how to monitor and maintain 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.	<b>A suitable artificial hollow design is used.</b>	
	<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 nesting(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<sup>®</sup>), 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](#). Records should be submitted to the Department by emailing [fauna\\_data@dbca.wa.gov.au](mailto: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	The behaviour of parent birds around a hollow can indicate an approximate age of young in the nest.								
	<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 (&lt; 3 - 4 weeks)</td> </tr> <tr> <td>Both parents seen entering/exiting the hollow</td> <td>Nestling(s) has hatched (&gt; 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	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.  Tapping or scraping is best undertaken between 10 am - 3 pm when females will most likely to be sitting.								
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"> <li>• Looking for signs of use (evidence of chewing)</li> <li>• Observing behaviour of adults around a hollow</li> <li>• Tapping or scraping to flush female</li> <li>• Listening for nestlings</li> <li>• Looking inside nest</li> </ul>
To confirm use by black cockatoos	At least two visits during peak breeding season.	<ul style="list-style-type: none"> <li>• Looking for signs of use (evidence of chewing)</li> <li>• Observing behaviour of adults around a hollow</li> <li>• Tapping or scraping to flush female</li> <li>• Listening for nestlings</li> <li>• Looking inside a nest</li> </ul> <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"> <li>• Observing insect activity around a nest</li> <li>• Listening for nestlings</li> <li>• Looking inside a nest</li> </ul> <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"> <li>• Looking for signs of use</li> </ul> <p>To confirm:</p> <ul style="list-style-type: none"> <li>• Looking inside a nest</li> </ul>
To determine maintenance requirements	At least every two years and preferably annually.	<p>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.</p>

## 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

## FAUNA NOTES – Artificial Hollows for Black Cockatoos



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

This Fauna Note is a joint initiative of the Department of Biodiversity, Conservation and Attractions, Birdlife Australia, and the Western Australian Museum. Many individuals have contributed to its preparation, including members of the department's Carnaby's cockatoo and forest black cockatoo recovery teams, with significant contributions from Rick Dawson (DBCA Research Associate), Ron Johnstone (WAM), Alan Elliot (Serpentine-Jarrahdale Landcare Centre), and Denis Saunders (CSIRO). This document was prepared by David Mitchell, Geoff Barrett, Kim Williams, Rebecca Bloomfield, Amie Raycraft, Brooke Richards, Teagan Johnston and Martin Dziminski.

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Department of Biodiversity,  
Conservation and Attractions





# Clearing Permit Decision Report

## 1 Application details and outcome

### 1.1. Permit application details

<b>Permit number:</b>	CPS 8701/1
<b>Permit type:</b>	Purpose permit
<b>Applicant name:</b>	B & J Catalano Pty Ltd
<b>Application received:</b>	26 September 2019
<b>Application area:</b>	2.23 hectares (revised)
<b>Purpose of clearing:</b>	Gravel extraction
<b>Method of clearing:</b>	Mechanical Clearing
<b>Property:</b>	Lot 41 on Deposited Plan 410793 Lot 42 on Deposited Plan 410794
<b>Location (LGA area/s):</b>	Shire of Chittering
<b>Localities (suburb/s):</b>	Chittering

### 1.2. Description of clearing activities

The application originally proposed to clear 7.99 hectares of native vegetation within Lot 41 on Deposited Plan 410793 and Lot 42 on Deposited Plan 410794, Chittering, for the purpose of gravel extraction.

The application is to clear native vegetation to extract gravel in accordance with an approved Extractive Industry Licence (EIL). The application was revised several times during the assessment process, to align with the Development Approval (DA) and EIL requirements, as well as avoidance and minimisation measure to conserve environmental values. As a result, the proposed area to be cleared has been reduced from 7.99 hectares to 2.23 hectares areas within Lot 41 on Deposited Plan 410793 and Lot 42 on Deposited Plan 410794, Chittering (Figure 1 and 2, Section 1.5).

The final land use of the area proposed to be cleared, after extraction activities have ceased, will be general farming practices (Lundstrom, 2022).

### 1.3. Decision on application

<b>Decision:</b>	Granted
<b>Decision date:</b>	23 August 2023
<b>Decision area:</b>	2.23 hectares of native vegetation, as depicted in Figure 1 and 2 of 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 (the Department) 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), flora and vegetation surveys, site inspection, and a fauna habitat survey and a site inspection (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 (Section 3). The Delegated Officer also took into consideration that the application area has been identified as a 'Significant Geological Supply' location according to *State Planning Policy 2.4 (SPP2.4)*. These supply areas are identified as the highest priority extraction areas for basic raw material (BRM), which represent strategic, long-term supplies of BRM.

The assessment identified that the proposed clearing will result in:

- the loss of native vegetation that is suitable foraging and breeding habitat for *Zanda latirostris* (Carnaby's black cockatoo), and *Calyptorhynchus banksii naso* (forest red-tailed black cockatoo); and
- 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.

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 some of the impacts of the proposed clearing, including the potential to facilitate the introduction of weeds and dieback, can be minimised and managed to unlikely lead to an unacceptable risk to environmental values through permit conditioning. However, impacts to foraging and breeding habitat for black cockatoos remained significant even after the application of avoidance and minimisation measures, and constituted a significant residual impact.

The Delegated Officer determined that an offset to counterbalance the significant residual impacts to the foraging and breeding habitat for Carnaby's and forest red-tailed black cockatoo was necessary. In accordance with the Government of Western Australia's Environmental Offsets Policy and Environmental Offsets Guidelines, the Delegated Officer considered the revegetation and rehabilitation of 6.52 hectares of suitable foraging habitat for Carnaby's cockatoo within Lot 42 on Deposited Plan 410794, Chittering, and conserved in perpetuity, was sufficient to counterbalance the significant residual impacts of the proposed clearing. The nature and suitability of the offset provided are summarised in Section 4.

To mitigate the impact of clearing one tree with a large hollow suitable for black cockatoos, the applicant has committed to the installation and maintenance of six artificial black cockatoo nesting hollows within Lots 41 and 42. To further minimise impacts to fauna, progressive one directional clearing is required and pre-inspection for black cockatoos to allow individuals present at the time of clearing to move to adjacent vegetation is required.

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

- Avoid, minimise to reduce the impacts and extent of clearing;
- Directional clearing, which requires slow, progressive, one directional clearing to allow terrestrial fauna to disperse ahead of the clearing activity should they occur on site at the time of clearing;
- Fauna management (black cockatoos), which requires inspection of habitat trees by a fauna specialist for the presence of Carnaby's and forest red-tailed black cockatoos prior to clearing. The applicant will not be permitted to clear trees where Carnaby's or forest red-tailed black cockatoos have been identified, until a fauna specialist has verified that the hollow/s are no longer being utilised for nesting;
- Fauna management (install black cockatoo nesting hollow), which requires the installation and maintenance of six artificial black cockatoo nesting hollows within Lot 41 on Deposited Plan 410793 and Lot 42 on Deposited Plan 410794, Chittering;
- Offset – revegetation and rehabilitation, which requires the revegetation and rehabilitation of 6.52 hectares of suitable foraging habitat for Carnaby's cockatoo from a Degraded to Good (Keighery, 1994) condition within Lot 42 on Deposited Plan 410794, Chittering, conservation in perpetuity; and
- take hygiene steps to minimise the risk of the introduction and spread of weeds and dieback.

## 1.5. Site maps

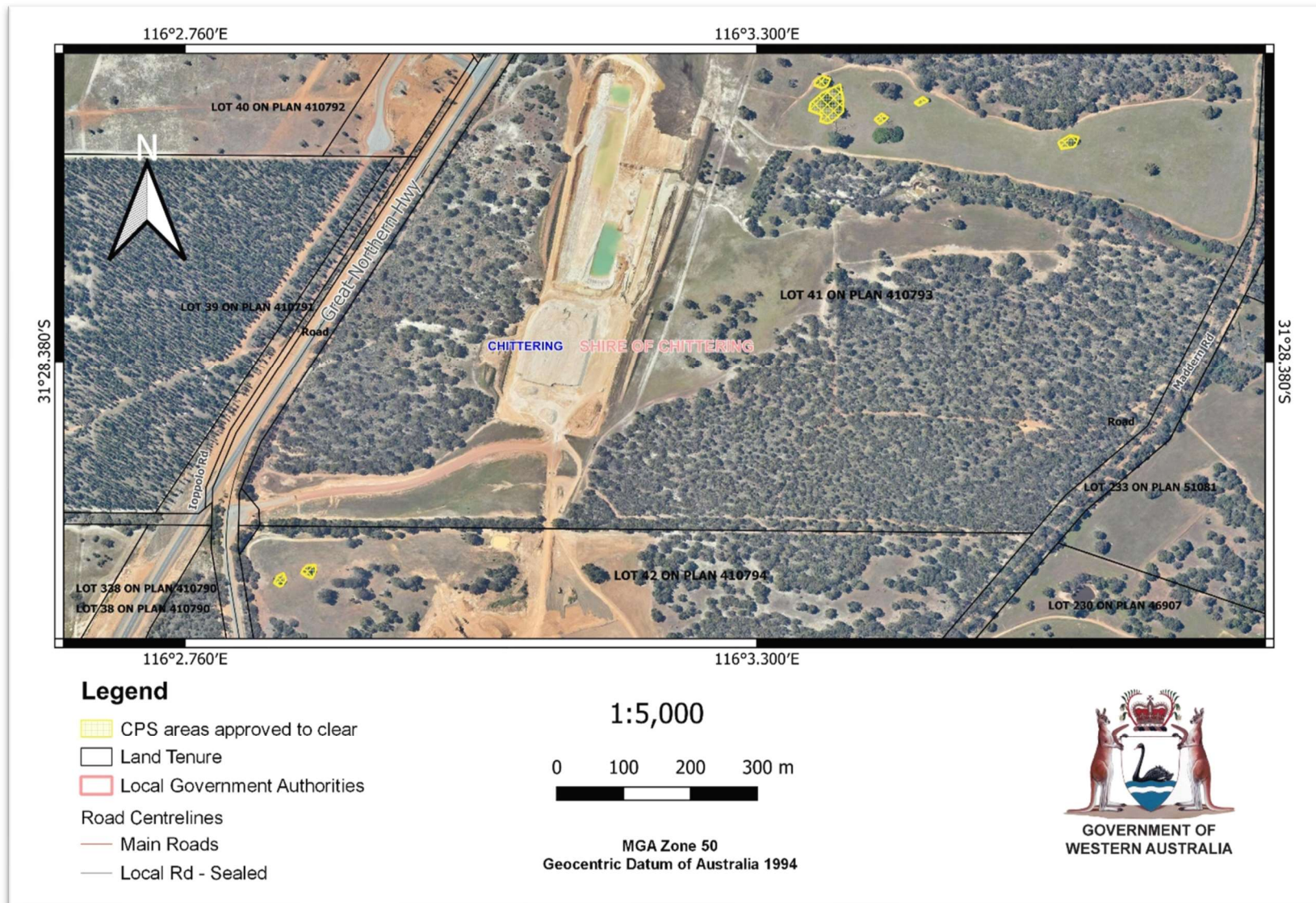


Figure 1: Map of the northern and central application areas. The areas crosshatched yellow indicate the areas authorised to be cleared under the granted clearing permit.



Figure 2: Map of the southern application areas. The areas crosshatched 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 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)
- *Planning and Development Act 2005* (WA) (P&D Act)
- *Soil and Land Conservation Act 1945* (WA)

Relevant policies considered during the assessment include:

- *Environmental Offsets Policy* (2011)
- *State Planning Policy No 2.4: Basic Raw Materials* (2018)

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

The application was amended a number of times during the validation stage of the application, reducing the application area from 16.2 hectares to 7.99 hectares of native vegetation (B & J Catalano Pty Ltd, 2019). The application form submitted by B & J Catalano states that the areas proposed to be cleared were selected from areas of degraded vegetation and higher quality vegetation was avoided (B & J Catalano Pty Ltd, 2019).

Through avoidance and minimisation measures during the assessment stage, the application area was further reduced from 7.99 to 2.23 hectares of native vegetation (Figure 3 and 4) (Lundstrom Environmental Consultants, 2019c and 2022a). These minimisation and mitigation measures included the exclusion of several large native trees from within the application area, through advice received from two fauna habitat surveys completed by Western Wildlife (see Figures 7 to 16) (Western Wildlife, 2019 and 2020). One large *Eucalyptus* tree with a DBH greater than 500 millimetres containing a hollow was identified within the application area during the site inspection (DWER, 2020). Through avoidance measures implemented by B & J Catalano, this tree was removed from the area proposed to be cleared. An additional tree containing a large hollow was unable to be avoided within Lot 42.

After consideration of avoidance and mitigation measures, it was determined that an offset to counterbalance the significant residual impacts to black cockatoo foraging habitat was necessary. 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 nature and suitability of the offset provided are summarised in Section 4.

To mitigate the impact to clearing of a tree with a large hollow, the permit holder proposed to install six artificial hollows within Lots 41 and 42 (Lundstrom Environmental Consultants, 2023b).

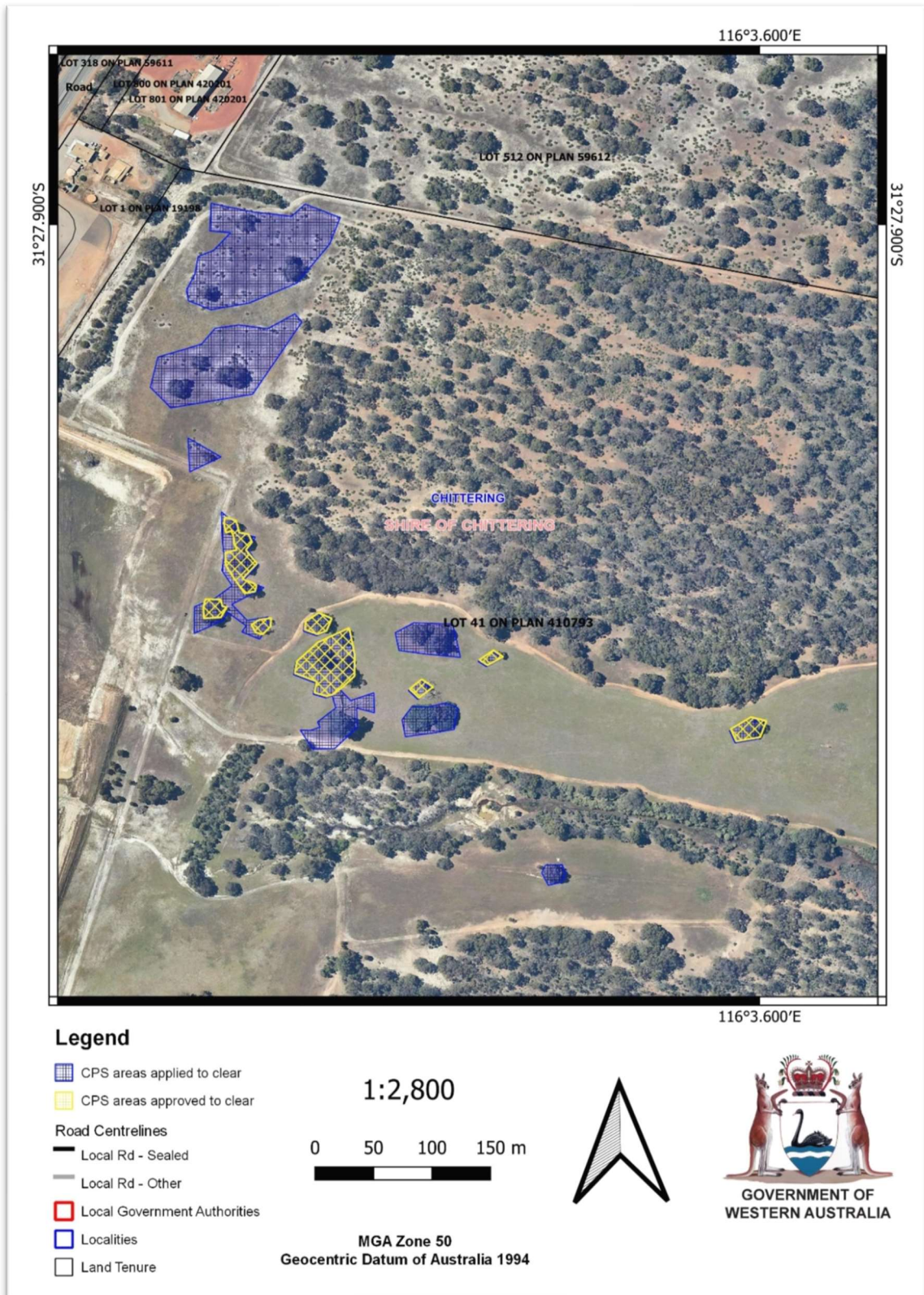


Figure 3: Map demonstrating the initial northern application areas for CPS 8701/1, in comparison to the final area proposed to be cleared, as a result of avoidance and minimisation measures taken by B & J Catalano Pty Ltd.

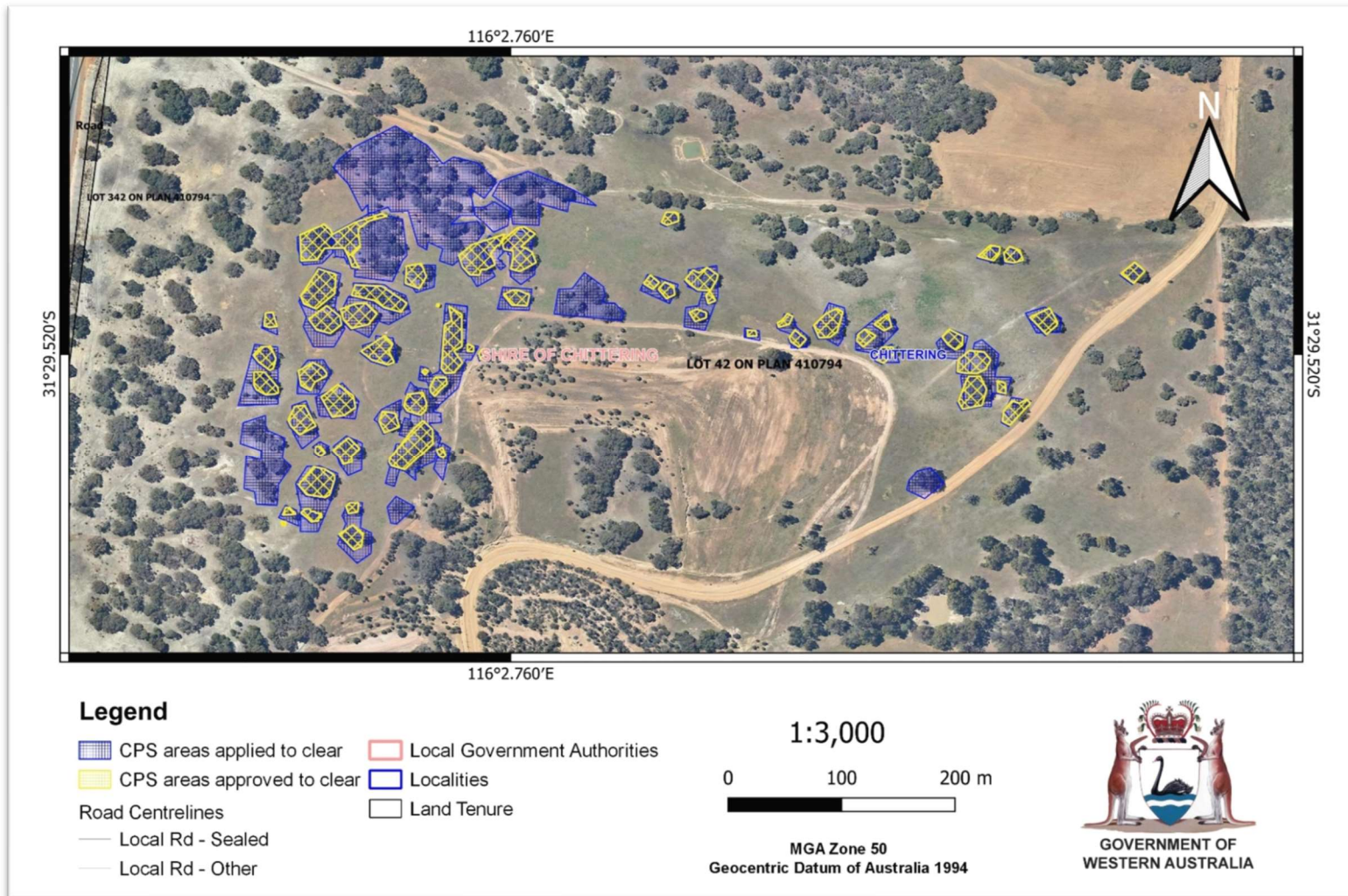


Figure 4: Map demonstrating the initial southern application areas for CPS 8701/1, in comparison to the area proposed to be cleared, as a result of avoidance and minimisation measures taken by B & J Catalano Pty Ltd.

### 3.2. Assessment of impacts on environmental values

In assessing the application, the Delegated Officer has had regard for the site characteristics (see 0) 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 0) identified the impacts of the proposed clearing present a risk to ecological communities, flora, fauna and land degradation. 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. Environmental Value - biological values (ecological communities) – clearing principles (a and d)

##### Assessment

##### **Threatened and Priority Ecological Communities**

A review of available databases determined that 'Banksia Dominated Woodlands of the Swan Coastal Plain IBRA Region' (Banksia Woodland), a Priority 3 listed priority ecological community (PEC) and recognised as an endangered threatened ecological community (TEC) under the EPBC Act, is mapped within 30 metres from the application area. The application area is situated within the mapped TEC buffer for this community.

The conservation advice for the Banksia Woodland TEC states that areas considered critical to the survival of the banksia woodlands encompass all patches that meet the key diagnostic characteristics and condition thresholds, in addition to the buffer zones, particularly where this comprises surrounding native vegetation (Threatened Species Scientific Committee, 2016). Notably, to be considered part of the ecological community a patch should at least include the vegetation in good condition and be within a minimum patch size of two hectares. The size of the patch is determined by measuring the area of all native vegetation contiguous with the vegetation in good condition and described as banksia woodland TEC (Threatened Species Scientific Committee, 2016). A site inspection (DWER, 2020) and survey of the application area (Lundstrom Environmental Consultants, 2023a) found no PECs or TECs within the proposed extraction area. Given the above, the vegetation within the application area is not considered to represent the Banksia Woodland TEC/PEC.

Given the presence of a mapped TEC adjacent to the application area, it is acknowledged that the proposed clearing may cause degradation of adjacent and nearby remnant native vegetation by facilitating the spread of weeds and dieback. A weed and dieback management condition is considered to minimise this risk, and it is not considered likely that the proposed clearing will have a significant impact on adjacent remnant vegetation.

##### Conclusion

Noting the vegetation types present within the application area and the 'Degraded' to 'Completely Degraded' (Keighery, 1994) (Chalwell, 2019a and 2019b) condition, the vegetation within the application area is not likely to represent a TEC or PEC. The proposed clearing has the potential to facilitate the spread of weeds and dieback into the remaining vegetation. It is considered that the impact of clearing can be mitigated through weed and dieback minimisation measures on the permit.

##### Conditions

To address the above impacts, the following management measure will be required as a condition on the clearing permit:

- take hygiene steps to minimise the risk of the introduction and spread of weeds and dieback.

#### 3.2.2. Environmental Value - biological values (flora) – clearing principles (a and c)

##### Assessment

##### **Flora**

A review of available databases determined that 41 conservation significant flora species have been recorded in the local area (10 kilometre radius of the application area), which include 12 threatened flora, 13 Priority 2, ten Priority 3 and six Priority 4 species (Western Australian Herbarium, 1998-). None of these records occur within the application area.

Noting habitat preferences, including soil type and vegetation complexes, the vegetation within the original application area (7.99 hectares) was considered to comprise suitable habitat for the following conservation significant flora species:

- *Thelymitra stellata* (EN)
- *Hypocalymma sylvestre* (EN)
- *Grevillea corrugata* (EN)
- *Adenanthos cygnorum* subsp. *chamaephyton* (Priority 3)
- *Drosera sewelliae* (Priority 2)



- *Gastrolobium nudum* (Priority 2)
- *Hypolaena robusta* (Priority 4)
- *Millotia tenuifolia* var. *laevis* (Priority 2)
- *Tetratheca pilifera* (Priority 3)
- *Verticordia serrata* var. *linearis* (Priority 3).

During the assessment, the clearing area was minimised to 2.23 hectares, which encompass isolated trees within open paddock with no native understorey (Chalwell, 2019a).

A site inspection of the application area (DWER, 2020) found that the northern sites of the application area (Lot 41) contained vegetation consistent with the South West Forest Coolakin and Yalanbee vegetation complexes, mapped within the application area (Mattiske and Heddle, 1998). The majority of the vegetation was considered to be in 'Degraded' condition due to the absence of native understorey and the presence of dried non-native grasses (DWER, 2020).

The 2019 flora and vegetation surveys undertaken within Lot 42 found the remaining vegetation remnants do not represent vegetation types of conservation significance and no Threatened or Priority Flora were recorded during the survey (Figure 17 to 21) (Chalwell, 2019a; 2019b).

#### Conclusion

The proposed clearing has been revised to only include isolated trees within completely degraded, open paddock with no native understorey. It is unlikely that any conservation significant flora will be impacted by the proposed clearing.

#### Conditions

No conditions required in relation to this environmental value.

### **3.2.3. Environmental Value - biological values (fauna) – clearing principle (b)**

#### Assessment

According to available databases, ten terrestrial fauna species of conservation significance (not associated with marine and freshwater environments) have been recorded within the local area (DBCA, 2007-). Of these, six are listed under the EPBC Act, and four are listed as priority species (DBCA, 2007-). The vegetation within the application area is dominated by marri, jarrah, salmon gum, *Eucalyptus wandoo* (wandoo) and other *Eucalyptus* spp. with a typically absent native understorey, comprising of dried non-native grasses (DWER, 2020; survey reference). Old wood piles were observed within the application area, with one showing evidence of use as a rabbit warren (DWER, 2020).

Noting the above, the application area may provide suitable habitat for:

- *Zanda latirostris* (Carnaby's black cockatoo)
- *Calyptorhynchus banksii naso* (forest red-tailed black cockatoo)

One species, identified as *Calyptorhynchus* sp. (white-tailed black cockatoo) were recorded within the local area (DBCA, 2007-). It is noted that this likely to represent Carnaby's cockatoo (listed as endangered under the BC Act and the EPBC Act) records. *Calyptorhynchus* sp. (white-tailed black cockatoo) are obtained when the data collector could not definitively distinguish if they spotted a *Zanda latirostris* (Carnaby's black cockatoo) or a *Zanda baudinii* (Baudin's black cockatoo), therefore the white-tailed black cockatoo category was created to incorporate these records. It is likely that the white-tailed black cockatoo records in this area are Carnaby's black cockatoos, as the presence of Baudin's black cockatoos is unlikely, as it is outside of the known distribution of this species (DAWE, 2022).

#### **Black cockatoos**

To assess the potential impacts the proposed clearing will have on black cockatoos, relevant databases and information recorded from a site visit conducted by DWER (DWER, 2020) were utilised. In addition, B & J Catalano commissioned black cockatoo habitat surveys. A targeted black cockatoo habitat survey was undertaken on Lot 42 on Deposited Plan 410794 (Western Wildlife, 2019) and Lot 41 on Deposited Plan 410793 (Western Wildlife, 2020).

### Breeding

Black cockatoos breed in large hollow-bearing trees, generally within woodlands, forests or isolated trees (DAWE, 2022). Breeding habitat is described as trees of species known to support breeding within the range of black cockatoos, which either have a suitable nest hollow or are of a suitable diameter at breast height (DBH) to develop a nest hollow. Suitable DBH for nest hollows is 500 millimetres for most tree species, however, is reduced to 300 millimetres for wandoo and salmon gum (DAWE, 2022). According to available datasets, the application area is situated within an area mapped as Carnaby's and red-tailed black cockatoo distribution areas within the Swan Coastal Plain and Jarrah Forest Interim Biogeographic Regionalisation for Australia (IBRA) regions, and buffered breeding sites (DBCA, 2007-). These species nest in the hollows of live or dead karri, marri, wandoo, tuart, salmon gum, jarrah, flooded gum, York gum, powder bark, bullich and blackbutt (DAWE, 2022).

According to available databases and the black cockatoo habitat assessments, the application area is within the known and/or predicted breeding range of Carnaby's cockatoo. The forest red-tailed black cockatoo is on the northern edge of its range, and are unlikely to breed in the application area (DAWE, 2022; Western Wildlife, 2020). In the application area, Carnaby's cockatoo may potentially use wandoo, powder bark wandoo, jarrah or marri trees for breeding. Lots 41 and 42 contain potential breeding habitat for Carnaby's Black-Cockatoo, as it contains tree species of suitable size within the known breeding range. Possible evidence of nesting (chewed hollows) was noted, where 63 potential nesting hollows appeared to be present within Lot 42 (Figure 7) (Western Wildlife, 2019). On Lot 41, two trees with large existing hollows were recorded, but no evidence of chewing by cockatoos was present. The remaining trees had small hollows or no visible hollows (Figure 8) (Western Wildlife, 2020).

Through avoidance measures, out of the 65 trees identified as containing large hollows potentially suitable for breeding within Lots 41 and 42, only one tree containing a potential hollow could not be avoided and therefore remains in the clearing application. Other marri and jarrah trees with a DBH greater than 500 millimetres, and wandoo and salmon gum with a DBH greater than 300 millimetres, were also observed within the application area (DWER, 2020). These trees may provide suitable future breeding habitat for black cockatoos, however, none contained hollows presently (Western Wildlife, 2019; 2020).

### Roosting

Carnaby's cockatoo and forest red-tailed cockatoo roost sites have been mapped within 400 metres and 600 metres respectively of the application area (DBCA, 2007-).

Black cockatoos are known to roost in pines and tall eucalypts, often near riparian environments (Shah 2006, Burnham et al. 2010). A site inspection undertaken by DWER found that the canopy within Lots 41 and 42 is dominated by a combination of marri, jarrah, wandoo, salmon gum and other *Eucalyptus* species (DWER, 2020). The 2019 black cockatoo habitat assessment found the application area contained tall eucalypts and is adjacent to several farm dams. Although no evidence of roosting by black cockatoos (e.g. feathers, scats) was recorded during the assessment, Carnaby's black cockatoo is a seasonal migrant and is not present in an area year-round. Birds may roost nearby when foraging in the area, then move on. If Carnaby's black cockatoo roost in the application area, the most likely locations are in taller trees near the farm dams, which are outside but adjacent to the application area. The Forest red-tailed black cockatoo may roost in eucalypts on the edges of the pasture, for which there are many potentially suitable locations, but this species is unlikely to be common in the area (Western Wildlife, 2019).

For the reasons above, it is unlikely that the application area is of particular significance for roosting black cockatoos, though birds may roost there on occasion.

### Foraging

Black cockatoos forage on a range of plant species, predominantly the seeds and flowers of marri, jarrah, *Callistemon* species, and Proteaceous species such as *Banksia*, *Hakea*, and *Grevillea* species (DAWE, 2022; DBCA, 2013; Valentine and Stock, 2008). Black cockatoos also forage on the seeds of introduced species (e.g. *Pinus* and *Erodium* species, canola and almonds), insects and insect larvae (DAWE, 2022). According to available databases, the nearest mapped occurrence of Carnaby's cockatoo feeding habitat within Jarrah Forest and Swan Coastal Plain Interim Biogeographic Regionalisation for Australia (IBRA) regions is within 15 metres of the application area. The canopy within the application area is dominated by marri, jarrah, wandoo, salmon gum and other *Eucalyptus* species, therefore comprising species suitable for foraging (Western Wildlife, 2019; 2020; DWER, 2020). Black cockatoos generally forage within six to 12 kilometres from their nesting sites (DAWE, 2022).

Evidence of foraging by Carnaby's black cockatoo was recorded in the application area (Western Wildlife, 2019; 2020). Areas of jarrah, marri and *Banksia* are foraging habitat for black cockatoos. Within Lot 42, several areas were identified as high value foraging habitat, mainly due to the presence of marri, an important food plant (Western Wildlife, 2019). As the survey area is within 12 kilometres of known breeding sites of Carnaby's black cockatoo, the foraging habitat is likely to be important for supporting breeding birds.

Local conservation groups have confirmed sightings of forest red-tailed black cockatoos feeding in the large marri trees on this property and they believe numbers appear to be increasing. They believe this is due to the reduction in available marri foraging habitat as a result of Marri Canker, residential development and clearing for fire management (Submission, 2020).

#### Summary of impacts to black cockatoos

Noting the presence of black cockatoo roosts within the local area and evidence of foraging within the application area, the proposed clearing comprises significant foraging habitat for black cockatoos. The loss of 2.23 hectares of black cockatoo foraging habitat represents a significant residual impact. To offset the loss of foraging habitat, B & J Catalano have agreed to the revegetation of 6.52 hectares of suitable foraging habitat for Carnaby's and forest red-tailed black cockatoos within Lot 42 on Deposited Plan 410794, Chittering, and to conserve the area in perpetuity.

Additionally, the loss of one tree that contains a large hollow and therefore potential habitat will leave a significant residual impact on breeding habitat for black cockatoos. B & J Catalano have committed to install six artificial hollows within the reference sites located within Lot 42 (Figure 6) to offset the impact of clearing one tree with a large hollow suitable for black cockatoo breeding. Inspecting the hollow at the time of clearing will ensure that no impacts occur to individuals that may be present at the time of clearing.

#### **Other fauna**

*Isoodon fusciventer* (quenda, southwestern brown bandicoot), *Phascogale tapoatafa wambenger* (south-western brush-tailed phascogale) and *Dasyurus geoffroii* (chuditch, western quoll) have been recorded in the local area. Due to their habitat and foraging preferences and the lack of understorey and midstorey vegetation within the reduced application area, the area proposed to be cleared is not likely to provide significant habitat for these species. During the 2019 black cockatoo habitat assessment, none of these conservation significant species were observed within the application area (Western Wildlife, 2019). Suitable fauna management conditions will manage potential impacts to fauna, if present.

#### Conclusion

Based on the above assessment, the proposed clearing will result in the loss of 2.23 hectares of significant foraging habitat and a significant potential breeding tree for Carnaby's cockatoo. For the reasons set out above, it is considered that the impacts of the proposed clearing to significant habitat for Carnaby's cockatoo constitutes a significant residual impact. In accordance with the Government of Western Australia's *Environmental Offsets Policy* (2011) and *Environmental Offsets Guidelines* (2014), this significant residual impact has been addressed through the conditioning of environmental offset requirements, as outlined under Section 4.

Based on the degraded condition of the application area, the extent and isolated nature of the 66 separate areas, and the lack of connectivity to other remnants of native vegetation, the proposed clearing is not considered likely to result in significant impacts to any other conservation significant fauna species, or to significantly impact the dispersal of fauna through the landscape. It is considered that the potential for direct impacts to any ground-dwelling fauna that may be utilising the application area at the time of the proposed clearing can be managed through a directional clearing condition.

#### Conditions

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

- Avoidance and minimisation measures;
- Directional clearing, which requires slow, progressive, one directional clearing to allow terrestrial fauna to disperse ahead of the clearing activity should they occur on site at the time of clearing;
- Fauna management (black cockatoos), which requires inspection of habitat trees by a fauna specialist for the presence of Carnaby's and forest red-tailed black cockatoos prior to clearing. The applicant will not be permitted to clear trees where Carnaby's or forest red-tailed black cockatoos have been identified, until a fauna specialist has verified that the hollow/s are no longer being utilised for nesting;
- Fauna management (install black cockatoo nesting hollow), which requires the installation of six artificial black cockatoo nesting hollows within Lot 42 on Deposited Plan 410794, Chittering; and
- Offset – (revegetation and rehabilitation), which requires the revegetation and rehabilitation of 6.52 hectares of suitable foraging habitat for Carnaby's and forest red-tailed black cockatoos, from a Degraded to Good (Keighery, 1994) condition within Lot 42 on Deposited Plan 410794, Chittering, and conserve the area in perpetuity within 24 months of commencing revegetation and rehabilitation.

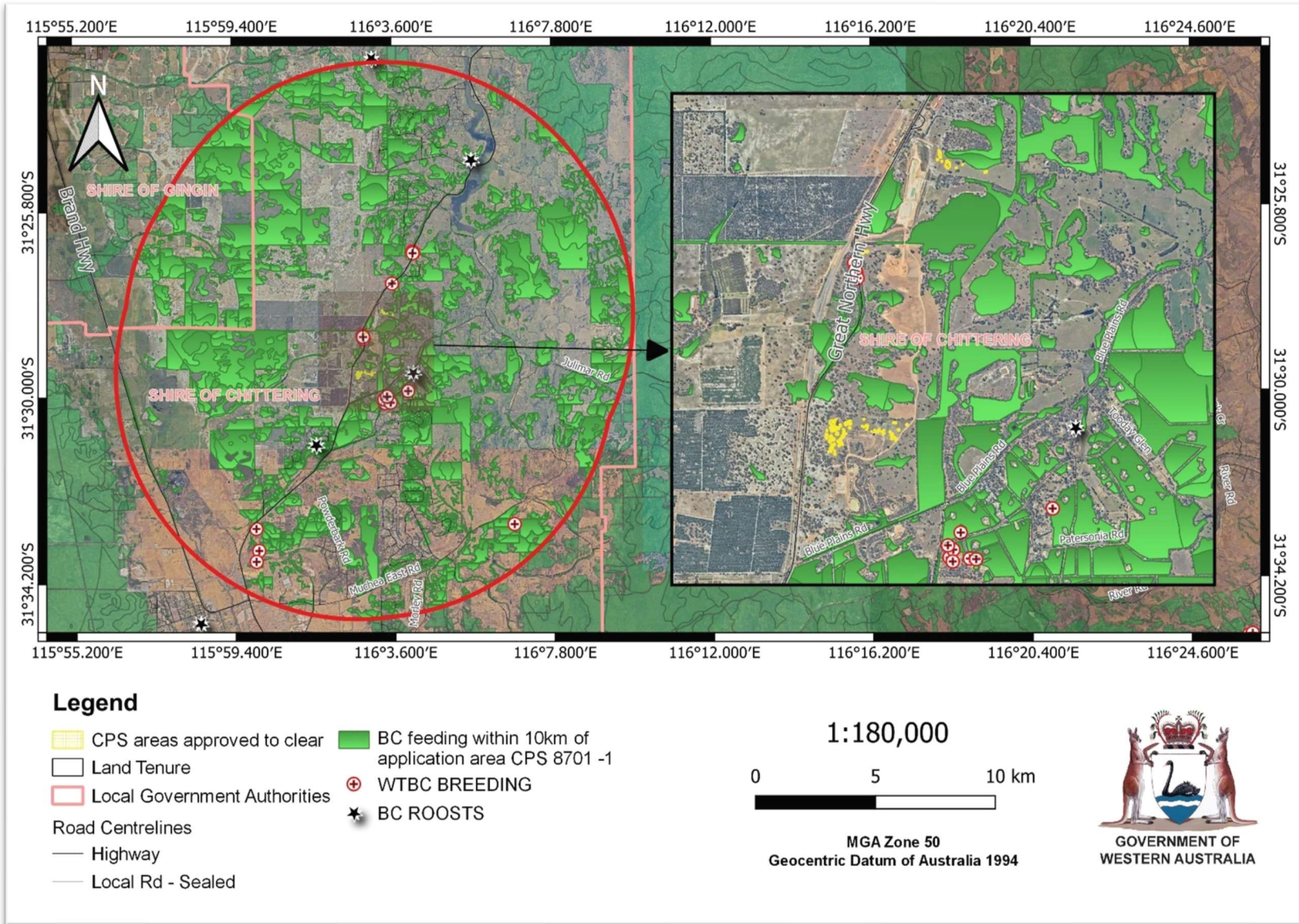


Figure 5: Black cockatoo roosts and feeding within 10 kilometres of application area CPS 8701/1, from available databases.

### **3.2.4. Environmental Value - land and water resources (land degradation) – Clearing principle (g)**

#### Assessment

According to available mapping, the soil complexes on which the areas proposed to be cleared are located, are at high risk for wind erosion and sub-surface acidification, and at medium risk of phosphorus export (see Appendix C.6).

This area has been studied closely since the early 1990s because of the acid saline seepages that expressed themselves on the property down slope on the western side of Great Northern Hwy at that time Lot 83 (now known as Lot 41 and 42) and an upgrade of Great Northern Hwy in the 1980s had been the causal. Further clearing of large trees will exacerbate this problem (Submission, 2020).

It is believed that further loss of trees will also have an effect on the Toodyay Creek (Poison Gully) which has also suffered increased salinisation resulting from clearing at the top of the sub catchment. Considerable rehabilitation work has been undertaken by the Landcare Group in this area to try and mitigate the salinity problem (Submission, 2020).

Noting general farming practices will be the end land use following extraction and the possible risk to land degradation, the Department requested advice from the CSLC. The CSLC obtained expert advice from their regional hydrologist and soil scientist, who concluded that from their site visit, survey and assessment of the subject land, no significant change is expected as the risk of land degradation is low (CSLC, 2020). They reported that the proposed removal of single or small groups of trees, is not expected to have a significant effect on the risk of land degradation by wind or water erosion, eutrophication, salinity, waterlogging or flooding. The proposed areas to clear are generally areas of shallow gravel which will be rehabilitated for general farming practices, so the risk of wind erosion will not significantly increase. The increased risk of water erosion is unlikely due to the soil types present (Appendix C.3) and again, the area will be rehabilitated for general farming practices. Conditions within the Development Approval, Prescribed Premise Works Approval and Extractive Industry Licence (EIL) will further mitigate any possible risk of land degradation through the extractive practices that will occur on the property after the clearing occurs (Lundstrom Environmental Consultants, 2021, 2022b, 2023b).

Within the Revegetation Plan, Lundstrom Environmental Consultants have also detailed the erosion control measures that will be implemented at the commencement of mining and continued through to the end of the monitoring period (Lundstrom Environmental Consultants, 2023a). These include:

- During the initial post mining surface rehabilitation, contour banks will be constructed as described in the Surface Water Management Plan associated with the EIL proposal;
- Prior to planting tubestock, the re-topsoiled surface will be ripped to create mounds; and
- Spreading of cleared vegetation material in windrows or the use of wind fences are additional options if erosion in the vegetated area is a problem.

#### Conclusion

In accordance with advice received and outlined above, as well as the further reduction in the clearing area since the CSLC advice was received, it was concluded that the proposed clearing was unlikely to cause appreciable land degradation.

#### Conditions

No conditions required in relation to this environmental value.

### **3.3. Relevant planning and other matters**

Other relevant authorisations required for the proposed land use include:

- Development approvals under the *Planning and Development Act 2005* (issued by the Shire of Chittering).
- EIL (issued by the Shire of Chittering).
- Licence issued under Part V Division 3 of the EP Act (Prescribed Premises Works Approval).

The Shire of Chittering advised DWER that local government approvals are required (Shire of Chittering, 2020). Lundstrom Environmental Consultants confirmed that B & J Catalano has Shire approvals for all stages and confirmed that gravel extraction activity will be occurring within all stages that have been granted by the Shire (Lundstrom Environmental Consultants, 2023b).

Development Approvals for Lot 41 and 42 were approved for a term of 5 years commencing from the date of issue of an EIL. These approvals were determined on 20 October 2021 (Lundstrom Environmental Consultants, 2021). EIL's for Lot 41 and 42 were issued on 15 November 2021, which is valid until 6 September 2027 and shall only remain valid while there is an appropriate Development Approval in place (Lundstrom Environmental Consultants, 2022b).

DWER issued a Works Approval for Lot 42, on 16 August 2022, which is valid until the 16 August 2027, covering Stages 9 and 10 on Lot 42 of the planned extractive practices (Lundstrom Environmental Consultants, 2023b). Lundstrom Consultants informed DWER that the third stage (Lot 41) of extraction has not been included in the current Works Approval as this activity will not occur for several years. The activity on Lot 41 will be added as a licence amendment to the current Works Approval as it is the final approval organised in the industry process due to it only relating to the crushing and screening operations, and not the actual extraction (Lundstrom Environmental Consultants, 2023b).

The areas proposed to be cleared are located with a SPP2.4 identified 'Significant Geological Supplies' area. These areas have been allocated the highest priority extraction sites to ensure the long-term sustainability of the BRM industry. The Policy outlines that these areas should be used as the initial sources for BRM materials, as they have been selected based on environmental values, resource conflicts or for planning reasons (WAPC, 2018).

The applicant has advised DWER that they will not be requiring a Licence to abstract water under the *Rights in Water and Irrigation Act 1914* (RIWI Act) (Lundstrom Environmental Consultants, 2023c). The application area is located within the Swan River System Surface Water Area and the Gingin Groundwater Area as proclaimed under the RIWI Act. Any groundwater abstraction within this proclaimed area may be subject to licensing by DWER. It is the applicant's responsibility to ensure that any obligations under the RIWI Act are fulfilled.

The applicant may have notification responsibilities under the EPBC Act for impacts Carnaby's black cockatoo, as set out in the EPBC Act and Referral Guidelines for Black Cockatoo (DAWE, 2022). It is the applicant's responsibility to contact the federal Department of Climate Change, Energy, the Environment and Water (DCCEEW) to discuss EPBC Act referral requirements.

The application area is located within the boundaries of the registered Native Title area of the Whadjuk People Indigenous Land Use Agreement (WI2017/015)N. No Aboriginal sites of significance have been mapped within the application area, however, several Aboriginal sites of significance have been mapped within the local area. It is the permit holder's responsibility to ensure that no Aboriginal Sites of Significance are damaged through the clearing process.

#### **4 Suitability of offsets**

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:

- The loss of 2.23 hectares of significant black cockatoo foraging habitat.
- The loss of one tree with a suitable hollow for black cockatoo breeding.

Noting the above, the applicant proposed an offset that includes the following environmental values and qualities, relevant to this proposal:

- The revegetation and rehabilitation of 6.52 hectares of native vegetation from a 'Degraded'/'Completely Degraded' to 'Good' (Keighery, 1994) condition on land placed under a conservation covenant, within Lot 42 on Deposited Plan 410794, Chittering, that comprises of significant foraging habitat for Carnaby's and forest red-tailed black cockatoo on the Swan Coastal Plain (Figure 6); and
- The installation, monitoring and maintenance of six artificial nesting hollows for black cockatoo species within the reference site located on Lot 41 on Deposited Plan 410793 and Lot 42 on Deposited Plan 410794, Chittering (Figure 6).

B & J Catalano, together with Lundstrom Environmental Consultants, have developed a comprehensive revegetation plan, that ensures 6.52 hectares of significant foraging habitat for Carnaby's cockatoo (see Figure 17) is revegetated and rehabilitated from a 'Degraded'/'Completely Degraded' (Keighery, 1994) condition to at least a 'Good' (Keighery, 1994) condition (Lundstrom Environmental Consultants, 2023a). This 6.52 hectare area is located on the south-east corner of Lot 42 along the access road, south of Stage 9 extraction area. The majority of this area has previously been disturbed for stockpile storage from the adjacent clay extraction pit and is considered to be 'Completely Degraded' (Keighery, 1994) condition (Lundstrom Environmental Consultants, 2023a). A letter of agreement from the registered owner of Lot 42 on Deposited Plan 410794, Chittering, was received on 29 November 2021 (Lundstrom Environmental Consultants, 2021), to initially revegetate 4.74 hectares specified in the Revegetation Plan and place it under a conservation covenant. On the 4 July 2023, Lundstrom Environmental Consultants notified the Department that B & J Catalano have agreed to revegetate an additional 1.78 hectares and place the entire 6.52 hectare offset area under conservation covenant within 12 months of undertaking the clearing (Lundstrom Environmental Consultants, 2023d). This Offset requirement has been outlined within B & J Catalano's Revegetation Plan with specific completion criteria and has been conditioned on the permit.

The vegetation to be cleared, from the proposed extraction areas to the north, will be retained for use in the offset area. Cleared vegetation will be used for windrows/mulching, erosion management and habitat replacement. Large logs should be strategically placed throughout the offset site to create habitat for reptiles, small mammals, and invertebrates (Lundstrom Environmental Consultants, 2023a).

Effective ongoing weed management in this area will occur to maintain a low weed burden. This is most likely to be a combination of mechanical, manual, and chemical measures (Lundstrom Environmental Consultants, 2023a).

Seedlings, grown in forestry tubes from provenance seed and or plant material, will be sourced from local and specialist nurseries. Seedlings will be planted at a rate of 800 plants/hectare in the offset revegetation area. The number of seedlings per species was estimated based on the survey of the reference site with the Foliage Projective Cover (FPC), as recorded during the survey of the reference site (Figure 6) (Lundstrom Environmental Consultants, 2023a).

Comprehensive completion criteria, objectives, and interim targets were included in the Revegetation Plan, including survival rate should be 100% after Year 5 for species considered to be suitable for foraging by black cockatoos (Figure 22) (Lundstrom Environmental Consultants, 2023a).

In assessing whether the proposed offset is adequately proportionate to the significance of the habitat values being impacted, DWER undertook a calculation using the WA Environmental Offsets Metric. The calculation determined that the revegetation and rehabilitation and conservation in perpetuity of at least of 6.52 hectares of native vegetation from a 'Degraded'/'Completely Degraded' to 'Good' (Keighery, 1994) condition within Lot 42 is adequate to counterbalance the significant residual impacts for black cockatoo foraging habitat. The installation, monitoring and maintenance of six artificial nesting hollows for black cockatoo species within Lots 41 and 42 is adequate to counterbalance the significant residual impacts for black cockatoo breeding habitat.

The Delegated Officer considers that the proposed offset is consistent with the *Environmental Offsets Policy* (2011) and the *Environmental Offsets Guidelines* (2014), and adequately counterbalances the significant residual impacts to Carnaby's and forest red-tailed black cockatoo foraging and breeding habitat. The justification for the values used in the offset calculation is provided in Appendix F.

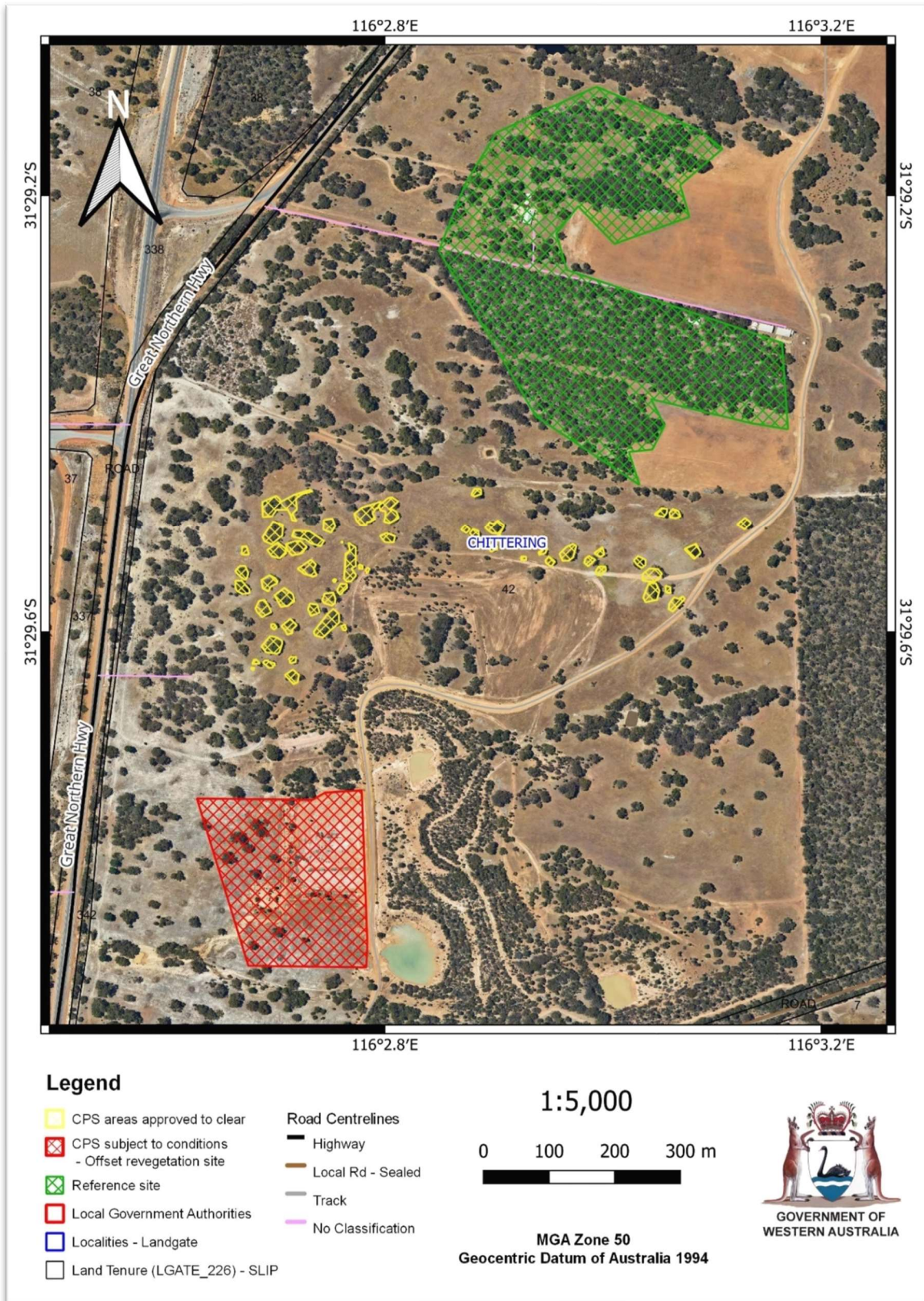


Figure 6: Mapped location of proposed Offset area (6.52 hectares) and the location of the reference site for the Offset plan, in relation to the location of the most southern areas proposed to be cleared.

**End**



## Appendix A. Additional information provided by applicant

Summary of comments	Consideration of comment
The applicant provided an initial Offset Revegetation Plan on the 2 February 2021. The Plan was revised several times, with the final Plan being provided on the 30 January 2023 (Lundstrom Environmental Consultants, 2023a).	The additional information provided was considered in <i>Assessment of impacts on environmental values</i> (see Section 3.2.3) and <i>Suitability of Offset</i> (see Section 4).
The applicant provided a black cockatoo habitat assessment undertaken within Lot 42 in November 2019, in response to a formal Request for Further Information issued by DWER (Lundstrom Environmental Consultants, 2020a).	The additional information provided was considered in <i>Assessment of impacts on environmental values</i> (see Section 3.2.3), <i>Suitability of Offset</i> (see Section 4) and Details of public submissions (see Appendix B).
The applicant provided a black cockatoo habitat assessment undertaken within Lot 41 in December 2019, in response to a formal Request for Further Information issued by DWER (Lundstrom Environmental Consultants, 2020a).	The additional information provided was considered in <i>Assessment of impacts on environmental values</i> (see Section 3.2.3), <i>Suitability of Offset</i> (see Section 4) and Details of public submissions (see Appendix B).
The applicant provided a flora and vegetation survey undertaken within Lot 41 in September and October 2019, in response to a formal Request for Further Information issued by DWER (Lundstrom Environmental Consultants, 2020b).	The additional information provided was considered in <i>Assessment of impacts on environmental values</i> (see Section 3.2.2).
The applicant provided a copy of the Development Approvals granted by the Shire of Chittering (Lundstrom Environmental Consultants, 2021).	The additional information provided was considered in <i>Relevant planning and other matters</i> (see Section 3.3) and Details of public submissions (see Appendix B).
The applicant provided confirmation of the final reduced application area and shapefile on 1 Jun 2022.	The additional information provided was considered in the assessment of the application (see Section 3 and Appendix D) and <i>Suitability of Offset</i> (see Section 4).
The applicant provided a copy of the Extractive Industry Licences granted by the Shire of Chittering (Lundstrom Environmental Consultants, 2022b).	The additional information provided was considered in <i>Relevant planning and other matters</i> (see Section 3.3) and Details of public submissions (see Appendix B).
The applicant provided a copy of the Works Approval granted by DWER (Lundstrom Environmental Consultants, 2023b).	The additional information provided was considered in <i>Relevant planning and other matters</i> (see Section 3.3) and Details of public submissions (see Appendix B).

## Appendix B. Details of public submissions

Summary of comments	Consideration of comment
<p>No Development Approval or EIL to extract gravel from Lot 41 and Lot 42 Great Northern Hwy.</p>	<p>B &amp; J Catalano supplied DWER with two Development Approvals, dated 15 November 2021, for both Lot 41 and 42, 14 Eatha Road, Chittering, on 29 November 2021 (Lundstrom Environmental Consultants, 2021).</p> <p>On 7 September 2022, EILs were received for Lot 41 and 42, 14 Eatha Road, Chittering (Lundstrom Environmental Consultants, 2022b).</p> <p>In addition to this, a Prescribed Premises Works approval was received on the 30 January 2023 (Lundstrom Environmental Consultants, 2023b).</p>
<p>Black cockatoo habitat clearing concerns, with particular concern of the decline in Marri trees due to Marri Canker throughout the Darling Range, residential development and bushfire management.</p>	<p>Impacts to black cockatoo habitat are addressed in this assessment against clearing principle (b) (see Section 3.2.2).</p> <p>It was concluded that the proposed clearing would have a significant residual impact on black cockatoo, therefore a Revegetation Plan was formed (Lundstrom Environmental Consultants, 2023a) and an Offset was conditioned in the Clearing Permit (see Appendix F).</p>
<p>Acid saline groundwater risk for the downslope catchment to the west and the freshwater Yalyal Brook, within the Ellen Brook (priority catchment for water quality) and Swan Canning Catchments.</p>	<p>According to available databases, the areas proposed to be cleared are not mapped within the Acid Sulphate Soil Risk area.</p> <p>In the Development Approval obtained by B &amp; J Catalano, Condition 13 ensures the extractive operations shall not occur less than two metres from the highest known water table level at any time (Lundstrom Environmental Consultants, 2021).</p> <p>Within the Works Approval (Lundstrom Environmental Consultants, 2023b) there are Stormwater Management Infrastructure conditions to regulate the storage and environmental protection from potentially contaminated stormwater.</p> <p>Within the Revegetation Plan (Lundstrom Environmental Consultants, 2023a), erosion control methods that will be undertaken by the Permit holder include:</p> <ul style="list-style-type: none"> <li>• During the initial post mining surface rehabilitation, contour banks will be constructed as described in the Surface Water Management Plan associated with the EIL proposal.</li> <li>• Prior to planting tubestock, the re-topsoiled surface will be ripped to create mounds.</li> <li>• Spreading of cleared vegetation material in windrows or the use of wind fences are additional options if erosion in the vegetated area is a problem.</li> </ul> <p>In addition, the CSLC (2020) advised that there is not likely to be any land degradation impacts as a result of the proposed clearing.</p>
<p>Degrading of the vegetation on the flora roads and within the remnant vegetation with dust coating the leaves.</p>	<p>The Development Approval (Lundstrom Environmental Consultants, 2021) has ensured a Prescribed Premises Works Approval (Lundstrom Environmental Consultants, 2023a) under Schedule 1, <i>Environmental Protection Regulations 1987</i> was obtained for the extraction activities that will take place after the proposed clearing. Requirements outlined within this approval regulate the control of dust emissions, ensuring:</p> <ul style="list-style-type: none"> <li>• wetting down unsealed roads and exposed areas with a water truck;</li> <li>• wetting down stockpiles and dust generating operational areas;</li> <li>• ceasing dust-generating activities during strong wind conditions until such time as adequate watering has occurred or wind conditions have changed;</li> </ul>

Summary of comments	Consideration of comment
	<ul style="list-style-type: none"> <li>• ensuring truck loads are fully covered prior to leaving the Premises;</li> <li>• a water cart must be available at all times at the Premises during operation phase to manage dust emissions in and around the plant area, product stockpile areas and unsealed access roads; and</li> <li>• limiting all vehicle traffic within operational areas and along haulage routes and roads to speeds of less than 30km/hr.</li> </ul>
<p>The effect the clearing will have on increasing surface water flow and raising the water table, in turn bringing salt closer to the surface in the eastern sub-catchment.</p> <p>AND</p> <p>The excavation of the overburden will result in faster infiltration of rainwater to groundwater which will lead to more rapid degradation downslope with larger saline seepages and raising the water table rapidly to a point where the vegetation cannot cope with the saline groundwater causing slow death of the vegetation.</p>	<p>DWER obtained advice from CSLC for this matter (CLSC, 2020). The CLSC concluded that the proposed clearing was not expected to significantly change the on-site or off-site salinity, and therefore, the risk of salinity causing land degradation is low.</p> <p>The Development Approval (Lundstrom Environmental Consultants, 2021) has ensured a Prescribed Premises Works Approval (Lundstrom Environmental Consultants, 2023a) under Schedule 1, <i>Environmental Protection Regulations 1987</i> was obtained for the extraction activities that will take place after the proposed clearing. Requirements outlined within both of these approvals regulate the control of surface water emissions, ensuring:</p> <ul style="list-style-type: none"> <li>• Four detention ponds to be constructed in Stage 9 and one in Stage 10, for the collection of sediment laden stormwater runoff and to serve as silt traps;</li> <li>• Storage capacity of each detention pond within the excavation areas is to be designed and constructed as outlined in Works Approval;</li> <li>• Design capacity of each detention pond must be sized to contain a two hour, 10% (1 in 10 year) AEP rainfall event;</li> <li>• Cut-off drains to be constructed using topsoil along the southern edge of Stage 9 and the eastern and northern edges of Stage 10 to ensure stormwater runoff is directed away from operational areas.</li> <li>• Potentially contaminated stormwater to be captured and prevented from being released in the environment;</li> <li>• Ensure that uncontaminated stormwater is kept separate from contaminated or potentially contaminated stormwater; and</li> <li>• Sedimentation basins must be inspected on a weekly basis and following significant rainfall events to prevent overflowing of contaminated stormwater.</li> </ul> <p>In addition to these measures, B &amp; J Catalano have developed an Acid Sulphate Soil Monitoring and Management Plan which has been approved by the Shire of Chittering through the Development Approval.</p>

## Appendix C. Site characteristics

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

### C.1. Site characteristics

Characteristic	Details
Local context	<p>The proposed clearing areas consists of separate patches of native vegetation within Lot 41 on Deposited Plan 410793 and Lot 42 on Deposited Plan 410794, Chittering. The properties are located approximately ten kilometres south of Bindoon town site, on the eastern side of the Great Northern Highway, within the Shire of Chittering.</p> <p>The vegetation is in close proximity to the existing quarry and with some patches of vegetation being within a predominantly cleared paddock, which has been previously used for cattle grazing and gravel extraction.</p> <p>Aerial imagery and spatial data indicates the local area (10 kilometre radius of the proposed clearing area) retains approximately 15,312.32 hectares of remnant vegetation which is approximately 39.0 percent of the pre-European vegetation and comprises farming land, tree plantations, extractive industries, and rural lots.</p>
Ecological linkage	<p>Available databases show that within the local area (10-kilometre radius from the centre of the application area), there is an approximate 1807 hectare area, 5.95 kilometres east-north-east of the application area allocated to the Gnangara Mound Ecological Linkages. Proposed clearing is not likely to sever that linkage.</p>
Conservation areas	<p>Both roads surrounding the application area, Great Northern Hwy and Maddern Rd, have been surveyed under the Roadside Conservation - Road Centreline (DBCA-030) and been allocated as Roadside Reserves (objected – 29474 Great Northern Hwy and 29364 Maddern Rd) due to their high environmental values. The proposed clearing is not going to impact on these road reserves.</p>
Vegetation description	<p>DWER site inspection indicate the vegetation within the proposed clearing area predominantly consists of <i>Eucalyptus</i> species, including <i>Eucalyptus marginata</i> (jarrah), <i>Eucalyptus wandoo</i>, <i>Eucalyptus salmonophloia</i> (salmon gum) and other <i>Eucalyptus</i> species.</p> <p>Lot 41 is mapped as the Darling Plateau – Coolakin Complex, which is described as a Woodland of <i>Eucalyptus wandoo</i> with mixtures of <i>Eucalyptus patens</i>, <i>Eucalyptus marginata</i> subsp. <i>thalassica</i> and <i>Corymbia calophylla</i> on the valley slopes in arid and perarid zones. This is consistent with the findings of the Department’s site inspection (DWER, 2020) and surveys (Chalwell, 2019a).</p> <p>Lot 42 is mapped as a combination of (Webb et al. 2016):</p> <ul style="list-style-type: none"> <li>• Dandaragan Plateau - Mogumber Complex-South, which is described as an Open woodland of <i>Corymbia calophylla</i>, with some admixture of <i>Eucalyptus marginata</i> (jarrah) and a second storey of <i>Eucalyptus todtiana</i> (pricklybark) - <i>Banksia attenuata</i> - <i>Banksia menziesii</i> (firewood Banksia) - <i>Banksia ilicifolia</i> (holly-leaved Banksia).</li> <li>• Darling Plateau - Yalanbee Y6 Complex, which is described as a Woodland of <i>Eucalyptus wandoo</i>-<i>Eucalyptus accedens</i>, less consistently open forest of <i>Eucalyptus marginata</i> subsp. <i>thalassica</i>-<i>Corymbia calophylla</i> on lateritic uplands and breakaway landscapes in arid and perarid zones.</li> </ul> <p>The 2019 flora and vegetation survey (Chalwell, 2019a) identified a section of Lot 42 (outside of the application area) where the vegetation is consistent with being part of the Commonwealth-listed TEC ‘Banksia dominated woodlands of the Swan Coastal Plain IBRA region’ (Chalwell, 2019a). The remaining remnant patches within Lot 42 (surrounding the application areas) are variously dominated by combinations of</p>

Characteristic	Details
	<p><i>Eucalyptus marginata</i>, <i>Corymbia calophylla</i>, <i>Eucalyptus wandoo</i> and <i>Eucalyptus accedens</i> (Figure 17 to 19) (Chalwell, 2019a).</p> <p>The application areas and surrounds appear to have been extensively cleared for grazing and extraction purposes (DWER, 2020).</p> <p>The mapped vegetation types retain approximately 39 percent of the original extent within the local area (Government of Western Australia, 2019b). For further details, see Vegetation extent table in Appendix C.2.</p>
Vegetation condition	<p>The application area has previously been largely cleared for pasture with some remnants of native vegetation. The remnants are mostly smaller than one hectare and are in a 'Completely Degraded' (Keighery, 1994) condition (Figure 20 to 21) (Chalwell, 2019a).</p> <p>The full Keighery (1994) condition rating scale is provided in Appendix E.</p>
Climate and landform	<p>Rainfall: 800 millimetres</p> <p>Evapotranspiration: 700 millimetres</p> <p>Groundwater Salinity (Total Dissolved Solids): 1000-3000 mg/L</p>
Soil description	<p>The soil is mapped as four different soil unit throughout the application area. The dominant soil system is 253Ga_4b, which covers approximately 67.7 percent of the application area and is described as having Moderate mid and upper slopes with some paleo breakaways. Bleached sand over pale yellow sands over laterite. Low woodland and shrubland of <i>E marginata</i>, <i>Acacia spp.</i> and <i>Banksia spp.</i> The remaining areas proposed to be cleared are located within the Gabbla 4x Phase (17.5 per cent), Gabbla 2x Phase (2.7 per cent) and Mogumber 1 Subsystem Phase (12.0 per cent) soil systems. Detailed descriptions of these soil systems can be found in Appendix C.3.</p>
Land degradation risk	<p>According to available databases, the areas proposed to be cleared have a high risk of wind erosion and sub-surface acidification and a medium risk of phosphorus export (see Appendix C.6).</p> <p>During Department's site inspection, the only evidence of erosion identified was water erosion observed directly adjacent to the southern application areas (DWER, 2020).</p>
Waterbodies	<p>The desktop assessment and aerial imagery indicates that there are no watercourse or waterways located within the application area. According to available datasets, no watercourses or wetlands are mapped within the application area. The Department's site inspection also noted that no watercourses or wetlands were observed within the application and that no riparian vegetation was observed within the application area (DWER, 2020).</p> <p>A number of non-perennial minor waterlines associated with Brockman River and Ellen Brook occur more than approximately 50 metres from the application area. The Brockman River and Gingin Brook are situated approximately 3.9 kilometres east and 18 kilometres north west from the application area, respectively. Toodyay Creek lies approximately 1.7 kilometres east and Yalyal Brook lies approximately 1.5 kilometres west from the application area. One resource enhancement (sumpland) category geomorphic wetland of the Swan Coastal Plain is located approximately 1.4 kilometres west from the application area.</p> <p>Available mapping indicates that there are six perennial earth dams located throughout Lot 41 and 42.</p>
Hydrogeography	<p>The majority of the area proposed to be cleared (approximately 88 per cent) lie within the Eastern Darling Range hydrological zone (HZ13_EDR) - Groundwater discharge may occur in drainage lines and on valley floors in cleared catchments within the hydrozone (George &amp; Bennett, 1998). Discharge associated with dolerite dykes is the dominant discharge process in mid- to upper-slope landscape positions. Mainly low-</p>

Characteristic	Details
	<p>yielding saprolite aquifers (brackish to saline). Palaeochannels and sandy Eocene aquifers occur in some valleys (fresh to brackish). Approximately 12 percent of the application area lies within the Dandaragan Plateau hydrological zone (HZ06_DP) - occurs within the Perth Basin. Discharging as seeps and springs over the Otorowiri Member. Important aquifer: Parmelia Fm (sandstone, minor siltstone and claystone). Groundwater is unconfined and of low salinity; flows westward.</p> <p>The application area is in the Coastal Plain hydrological zone which is comprised of major aquifers: Leederville, Yarragadee and Cockleshell Gully Fms. The eastern Yoganup Fm, is a major recharge area; discharge to the Indian Ocean. The application area also lies within the Swan River System Surface Water Area (UFI 22) and Gingin Groundwater Area (UFI 45), both proclaimed under the RIWI Act.</p> <p>Available databases indicate that the application area is located within the South West Catchment Division and the Swan Coastal Basin. The northern portion is located in the upper reaches of the Brockman River Catchment, a sub-catchment of the Swan Avon - Main Avon Catchment Swan (UFI – 164), which flows generally to the east. While the central and southern portion is located in the upper reaches of the Ellenbrook Catchment, a sub-catchment of the Swan Avon, Lower Swan Catchment (UFI – 162), which flows generally to the south west.</p> <p>According to available databases, the groundwater salinity ranges from 1000 to 3000 milligrams to litres total dissolved solids which can be described as brackish to saline.</p>
Flora	<p>There are records of 41 conservation significant flora within the local area, 12 of which are on the list of Threatened species and 29 on the Priority list. The closest record is a Threatened species <i>Thelymitra stellata</i> which has been listed as Endangered, which has been recorded approximately 740 metres from the edge of the application area.</p> <p>During the 2019 flora survey, no Threatened Flora listed under the BC Act nor EPBC Act were recorded. One species listed as Priority Flora by the Parks and Wildlife Society was recorded during the survey. <i>Haemodorum loratum</i> (P3) was recorded at most sites, (Chalwell, 2019a). The species was ubiquitous throughout the site and too numerous to count, but the population is estimated to be in the thousands, although only a few were flowering at the time of the survey (Chalwell, 2019a). As the application area has been reduced to trees over pasture, <i>Haemodorum loratum</i> is unlikely to be located within the application area.</p>
Ecological communities	<p>There are two TECs within the local area (10 kilometre radius of the application area), both endangered under the EPBC Act. The most dominant TEC within the local area, and closest to the application area, is <i>Banksia</i> Dominated Woodlands of the Swan Coastal Plain IBRA Region. This TEC is mapped in several locations between the application areas and wider out to the west. <i>Banksia attenuata</i> woodlands over species rich dense shrublands (floristic community type 20a as originally described in Gibson et al. (1994)) TEC was also found, however, the closest mapped location was found approximately 3.66 kilometres from the application area.</p> <p>There are two Priority Ecological Communities (PEC) within the local area, the closest being <i>Banksia</i> woodland of the Gingin area restricted to soils dominated by yellow to orange sands, which is approximately 2.67 kilometres west of the application areas. Wooded wetlands PEC, which support colonial waterbird nesting areas, was also found within the local area, approximately 7.66 kilometres north-west from the application area.</p> <p>No TEC/PECs recorded within the application area (Chalwell, 2019a).</p>

Characteristic	Details
Fauna	<p>According to available datasets, 16 conservation significant fauna species have been recorded within the local area. Of these 16 species, 11 are listed in the Threatened species list and five are listed as Priority by DBCA.</p> <p>The application area is within the mapped distribution of Carnaby's and forest red-tailed black cockatoo, which are listed as endangered and vulnerable, respectively, under the BC Act and the Commonwealth EPBC Act.</p> <p>There are three records of black cockatoo roosts within 10 kilometres of the application area, the closest being approximately 1.6 kilometres from the area proposed to be cleared. There are 21 records of white-tailed black cockatoo roosts within the local area, with the closest being approximately 110 metres from the application area.</p> <p>Local reports confirmed sightings of the red-tailed black cockatoos feeding on the large marris within the area proposed to be cleared and stated that the numbers appear to be increasing (Submission, 2020).</p> <p>The black cockatoo habitat survey identified a combination of 1,063 native trees, consisting of wandoo, marri and jarrah, with a DBH greater than 500 millimetres (300 millimetres or more for wandoo), with 65 containing hollows large enough to be utilised by black cockatoos (Figure 7). Of these 65 trees containing suitable hollows, through avoidance and minimisation measures, only one remains in the clearing application (Chalwell, 2019a).</p> <p>The 2019 habitat survey and DWER site inspection found evidence of cockatoo foraging in the form of chewed marri and Banksia nuts which were repeatedly observed throughout Lot 41 and 42. Non-native pinecones also showed potential signs of foraging (Chalwell, 2019a; DWER, 2020). A number of log piles were observed outside the final application area that potentially provides habitat for small mammals and reptiles. Evidence of use of these log piles as a rabbit warren was observed within Lot 41 (DWER, 2020).</p>

## 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
<b>IBRA bioregion**</b>					
Swan Coastal Plain	1,501,221.93	579,813.47	38.62	222,916.97	14.85
Jarrah Forest	4,506,660.25	2,399,838.15	53.25	1,673,614.25	37.14
<b>Swan Coast Plain (Hedde) Vegetation complex in IBRA Bioregion*</b>					
Dandaragan Plateau - Mogumber Complex-South	14,821.71	5,720.70	38.60	1,029.42	6.95
<b>South West Forest (Mattiske) Vegetation complexes in IBRA Bioregion*</b>					
Darling Plateau - Coolakin	163,991.68	64,204.65	39.15	33,002.38	20.12
Darling Plateau - Yalanbee Y6	197,849.01	92,080.88	46.54	41,703.16	21.08
<b>Local area</b>					
10km radius from application area	39,246.68	15,312.32	39.0	-	-

\*Government of Western Australia (2019a)

\*\*Government of Western Australia (2019b)

## C.3. Soil Systems

Soil Unit	Soil Phase/System	Description	Percent within application area
253Ga_4x	Gabbla 4x Phase	Very gentle to gentle (<10%) mid and upper slopes. Shallow sandy and gravelly loams underlain by country rock but with some pockets of deeper sands and clay.	17.5%
253Ga_2x	Gabbla 2x Phase	Gentle to moderate hill slopes (<10%) with some breakaways. Generally not gravelly or steep. Deep yellow and red duplex soils with some uniform fine soils. All soils may be somewhat gravelly and are moderately prone to salinity.	2.7%
222Mb_1	Mogumber 1 Subsystem	Undulating broad crests and very gentle upper slopes <10% with common lateritic duricrust outcrop and shallow gravelly sands. Low woodland and shrubland of, <i>E.todtiana</i> and <i>Acacia spp.</i>	12.0%
253Ga_4b	253Ga_4b	Moderate mid and upper slopes with some paleo breakaways. Bleached sand over pale yellow sands over laterite. Low woodland and shrubland of <i>E marginata</i> , <i>Acacia spp</i> and <i>Dryandera spp.</i>	67.7%



#### C.4. Fauna analysis table

Species name	Conservation status	Suitable habitat features? [Y/N]	Suitable vegetation type? [Y/N]	Distance of closest record to application area (km)	Number of known records (total)	Are surveys adequate to identify? [Y, N, N/A]
<i>Zanda latirostris</i> (Carnaby's cockatoo)	EN	Y	Y	0.40	146	Y
<i>Calyptorhynchus banksii naso</i> (forest red-tailed black cockatoo)	VU	Y	Y	0.54	11	Y
<i>Calyptorhynchus sp.</i> (white-tailed black cockatoo)	EN	Y	Y	0.90	5	Y
<i>Dasyurus geoffroyi</i> (Chuditch, western quoll)	VU	Y	Y	3.81	7	Y
<i>Westralunio carteri</i> (Carter's freshwater mussel)	VU	N	N	4.40	4	N/A
<i>Calidris acuminata</i> (sharp-tailed sandpiper)	MI	N	N	4.80	1	N/A
<i>Tringa nebularia</i> (common greenshank)	MI	N	N	4.80	2	N/A
<i>Phascogale tapoatafa wambenger</i> (south-western brush-tailed phascogale)	CD	N	N	8.28	1	N/A
<i>Galaxiella nigrostriata</i> (black-stripe minnow, black-striped dwarf galaxias)	EN	N	N	8.31	1	N/A
<i>Plegadis falcinellus</i> (glossy ibis)	MI	N	N	8.93	1	N/A
<i>Falco peregrinus</i> (Peregrine falcon)	OS	N	N	9.61	1	N/A
<i>Isoodon fusciventer</i> (quenda, southwestern brown bandicoot)	P4	N	N	3.62	363	N/A
<i>Notamacropus irma</i> (western brush wallaby)	P4	N	N	4.23	1	N/A
<i>Oxyura australis</i> (blue-billed duck)	P4	N	N	4.50	6	N/A
<i>Idiosoma mccllementsorum</i> (Julimar shield-backed trapdoor spider)	P2	N	N	4.58	2	N/A
<i>Idiosoma sigillatum</i> (Swan Coastal Plain shield-backed trapdoor spider)	P3	N	NN	5.81	1	N/A

T: threatened, CR: critically endangered, EN: endangered, VU: vulnerable, P: priority

### C.5. Ecological community analysis table

Community name	Conservation status	Suitable habitat features? [Y/N]	Suitable vegetation type? [Y/N]	Suitable soil type? [Y/N]	Distance of closest record to application area (km)	Number of known records (total)	Are surveys adequate to identify? [Y, N, N/A]
Banksia Dominated Woodlands of the Swan Coastal Plain IBRA Region	Priority 3 (State Cat.) / Endangered (Comm. Cat.)	Y	Y	Y	32.92	327	Y
Banksia woodland of the Gingin area restricted to soils dominated by yellow to orange sands	Priority 2	N	Y	Y	2674.20	14	Y
Banksia attenuata woodlands over species rich dense shrublands (floristic community type 20a as originally described in Gibson et al. (1994))	Endangered	N	N	Y	3660.52	2	Y
Wooded wetlands which support colonial waterbird nesting areas	Priority 2	N	N	N	7659.30	1	Y

T: threatened, CR: critically endangered, EN: endangered, VU: vulnerable, P: priority

### C.6. Land degradation risk table

Risk Categories	Application Area – All soil complexes
Wind erosion	H2: >70% of map unit has a high to extreme wind erosion risk
Water erosion	L2: 3-10% of map unit has a high to extreme water erosion risk
Water logging	L1: <3% of map unit has a moderate to very high waterlogging risk
Water Repellence	L1: <3% of map unit has a high water repellence risk
Sub-surface Acidification	H2: >70% of map unit has a high subsurface acidification risk or is presently acid
Phosphorous export	M1: 10-30% of map unit has a high to extreme phosphorus export risk
Salinity	L1: 30-50% of map unit has a moderate to high salinity risk or is presently saline
Flooding	L1: <3% of the map unit has a moderate to high flood risk

## Appendix D. Assessment against the clearing principles

Assessment against the clearing principles	Variance level	Is further consideration required?
<b>Environmental value: biological values</b>		
<p><u>Principle (a):</u> <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 and regionally significant fauna habitat, however, is not likely to contain any locally and regionally significant flora.</p>	At variance	Yes  <i>Refer to Section 3.2.1 and 3.2.2, above.</i>
<p><u>Principle (b):</u> <i>“Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna.”</i></p> <p><u>Assessment:</u></p> <p>The area proposed to be cleared contains foraging, roosting and breeding habitat for conservation significant fauna.</p>	At variance	Yes  <i>Refer to Section 3.2.3, above.</i>
<p><u>Principle (c):</u> <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 areas proposed to be cleared is unlikely to contain Threatened flora.</p>	Not likely to be at variance	Yes  <i>Refer to Section 3.2.2, above.</i>
<p><u>Principle (d):</u> <i>“Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a threatened ecological community.”</i></p> <p><u>Assessment:</u></p> <p>The area proposed to be cleared does not contain species that indicate a TEC. However, the application area occurs directly adjacent to a mapped TEC and is included in the buffer boundary for the TEC.</p>	Not likely to be at variance	Yes  <i>Refer to Section 3.2.1, above.</i>
<b>Environmental value: significant remnant vegetation and conservation areas</b>		
<p><u>Principle (e):</u> <i>“Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.”</i></p> <p><u>Assessment:</u></p> <p>The extent of the mapped vegetation types is consistent with the national objectives and targets for biodiversity conservation in Australia. The vegetation proposed to be cleared is not considered to be part of a significant ecological linkage in the local area.</p>	Not at variance	No
<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 at variance	No
<b>Environmental value: land and water resources</b>		

Assessment against the clearing principles	Variance level	Is further consideration required?
<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 no watercourses or wetlands are recorded within the application area or property in which the application area is located, the proposed clearing is not in an environment associated with a watercourse or wetland.</p>	Not 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>The mapped soils are highly susceptible to wind erosion and sub-surface acidification, and moderately susceptible to nutrient export.</p>	May be at variance	Yes <i>Refer to Section 3.2.4, above.</i>
<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 no water courses, wetlands or Public Drinking Water Sources Areas are recorded within the application area, the proposed clearing is unlikely to impact surface or ground water quality. The properties combined contain six perennial earth dams, however, none are located within the application areas.</p>	Not likely to be at variance	No
<p><u>Principle (j):</u> <i>“Native vegetation should not be cleared if the clearing of the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.”</i></p> <p><u>Assessment:</u></p> <p>The mapped soils and topographic contours in the surrounding area do not indicate the proposed clearing is likely to contribute to increased incidence or intensity of flooding.</p> <p>Given no water courses are recorded within the application area, the proposed clearing is unlikely to contribute to waterlogging.</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 Calculation and Justification (WA Environmental Offset Calculator, 2022)

### WA Environmental Offsets Calculator Rationale for scores used in the offset calculator

Calculation	Score (Area)	Rationale
<b>Conservation significance</b>		
Description	Black cockatoo	Application area contains significant foraging habitat for <i>Zanda latirostris</i> (Carnaby's black cockatoo), and <i>Calyptorhynchus banksii naso</i> (forest red-tailed black cockatoo).
Type of environmental value	Species (Flora/Fauna)	Supporting foraging habitat for two species of black cockatoo.
Conservation significance of environmental value	Rare/Threatened Species - endangered	Carnaby's cockatoo is listed as endangered under the BC Act and EPBC Act, so have used the highest conservation ranking.
Landscape level value impacted	Yes/No	Yes
<b>Significant impact</b>		
Description	2.23	Quality foraging habitat was identified within the application area.

Calculation	Score (Area)	Rationale
Significant impact (hectares)	2.23	2.23 hectares of suitable foraging habitat for black cockatoos
Quality (scale)	8	Habitat assessment determined moderate to good value foraging habitat for black cockatoo species within application area. Foraging habitat is located in close proximity to known breeding and roosting habitat.
<b>Rehabilitation credit</b>		
N/A	N/A	B & J Catalano advised the Department that they will be returning the clearing area to pasture, so onsite revegetation will not be taking place.
<b>Offset</b>		
Description	Revegetation and placing a Conservation covenant	Revegetation and rehabilitation of existing cleared areas with black cockatoo foraging habitat.
proposed offset (area in hectares)	6.52	6.52 hectares is proposed to be revegetated with suitable black cockatoo habitat.
Current quality of offset site	1	Condition of revegetation site in a completely degraded (Keighery, 1994) condition with minimal value for black cockatoos.
Future quality WITHOUT offset	1	Condition of revegetation site in a completely degraded (Keighery, 1994) condition with minimal value for black cockatoos. Condition not likely to change without intervention.
Future quality WITH offset	5	It is expected for vegetation to improve to good condition (Keighery, 1994) and provide low to moderate quality foraging habitat in 15 years.
Time until ecological benefit (years)	16	15 years minimum to achieve foraging resource, plus 1 year for revegetation to commence
Confidence in offset result (%)	80	80% confidence that with an adequate revegetation plan the proposed revegetation will adequately achieve black cockatoo foraging habitat.
Duration of offset implementation (maximum 20 years)	20	Maximum value to be used. It is expected that the site will not be impacted in the future.
Time until offset site secured (years)	2	One year for revegetation to commence, and one year for conservation covenant to be placed over revegetation.
Risk of future loss WITHOUT offset (%)	15%	There is a moderate risk of loss. The site is within an extractive industry area adjacent to extraction activities and is zoned rural. Whilst the area has been extracted in the past, other types of development may still be possible.
Risk of future loss WITH offset (%)	5%	Placing a conservation covenant on the property would reduce the potential impact of development and restrict the type of activities that can occur.
Offset ratio (Conservation area only)	N/A	
Landscape level values of offset?	N/A	

## Appendix G. Biological survey information excerpts

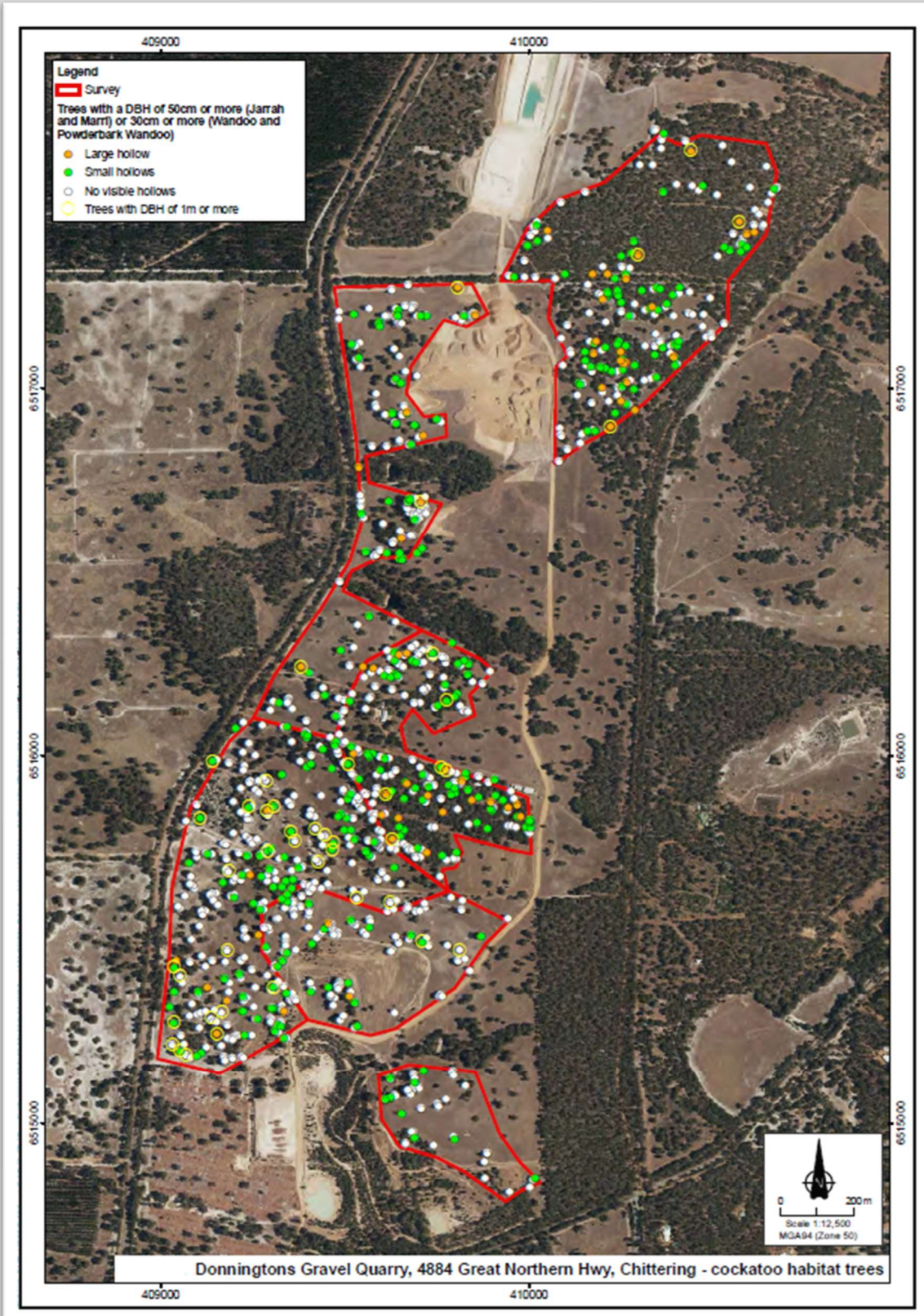


Figure 7: Habitat tree locations identified in survey conducted in November 2019 (Western Wildlife, 2019)

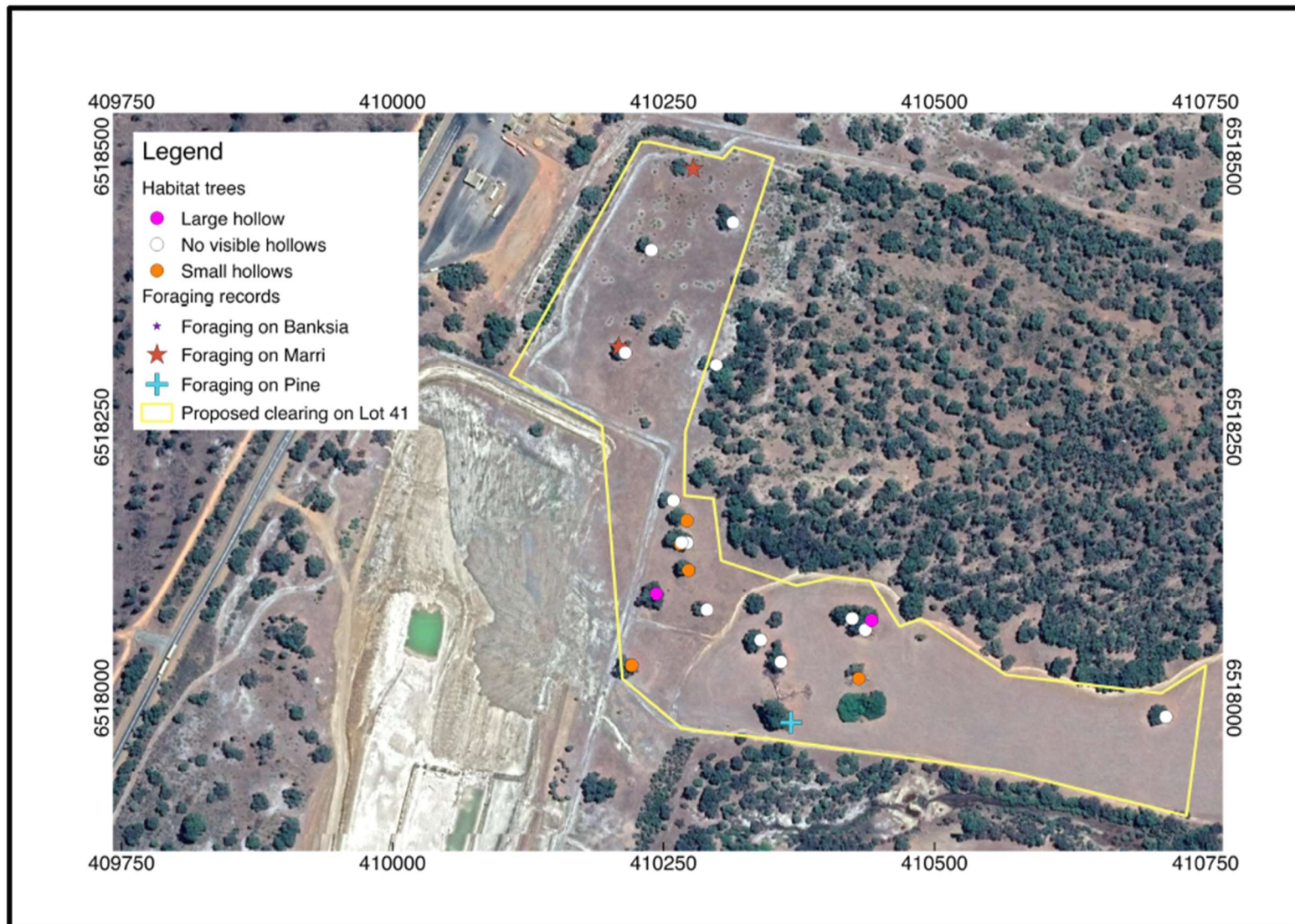


Figure 8: Habitat tree locations identified in survey conducted in December 2019 (Western Wildlife, 2020)





Figure 9: Mature trees bearing potential large (left) and small (right) hollows (Western Wildlife, 2020)



Figure 10: Evidence of cockatoo foraging on Marri (left) and pine (right) (Western Wildlife, 2020)



Figure 11: Pasture with scattered trees, which represents a large portion of the application area (Western Wildlife, 2019)



Figure 12: Small stands of trees with little or no native understorey, which represents the outer areas and adjacent areas of the application area (Western Wildlife, 2019)



Figure 13: Wandoo woodland with a sparse native understorey, which represents the areas adjacent to the application area (Western Wildlife, 2019)



Figure 14: Jarrah / marri forest with a native understorey, which represents the areas adjacent to the application area (Western Wildlife, 2019)



Figure 15: Regrowth forest with windrows of historically cleared trees (Western Wildlife, 2019)

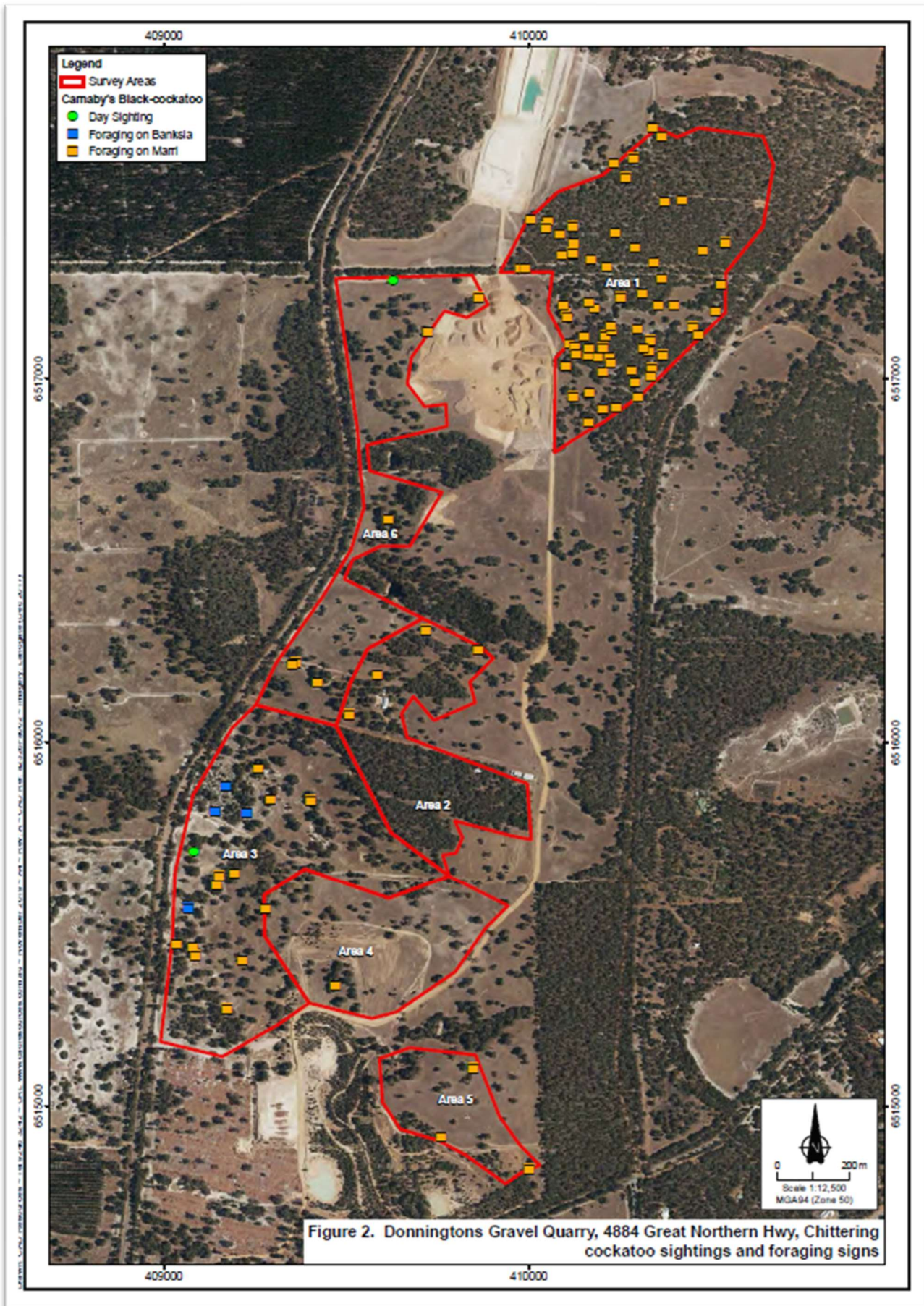
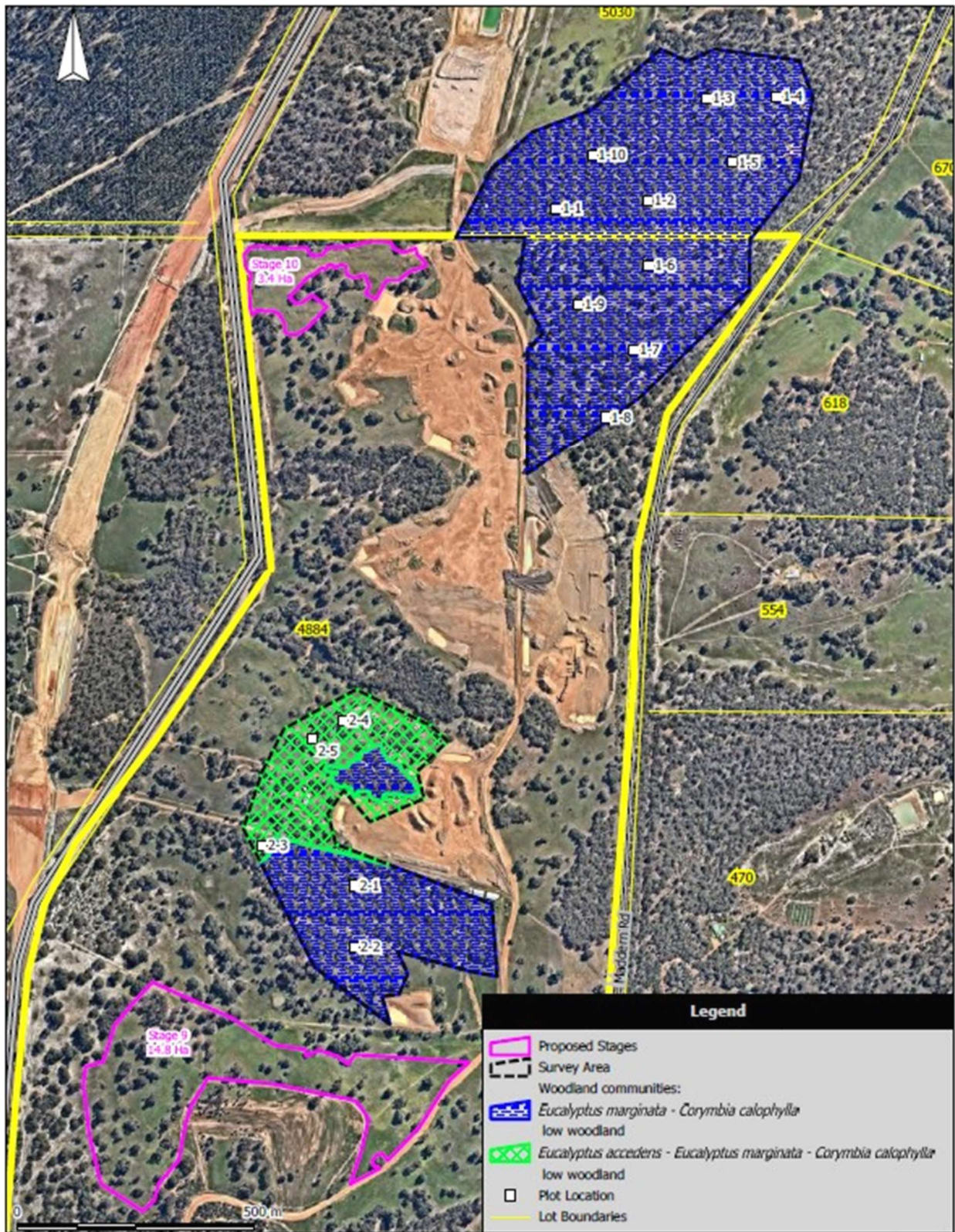


Figure 16: Mapped cockatoo sightings and foraging signs recording during the 2015 survey (Western Wildlife, 2019)



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 mikelund1@bigpond.com

Scale: 1:10000  
 Original Size: A4  
 Air Photo Source: Neamap Sep 2019  
 Datum: GDA94  
 Projection: Australia MGA94 (50)

Client: B & J Catalano  
 Project: Gravel Extraction  
 Location: 4884 Great Northern Hwy Chittering

**Plant Communities**

\\ieserver\data\Catalano\Donningtons\_BoCh\_Gravel\2019 Application\2019 Veg and Flora Survey\Drawings - Survey 2\F2 Plant Communities.map 7/01/2020

Figure 17: Survey sites and plant communities in reference sites from Plant Ecology Consulting's 2019 flora and vegetation survey (Chalwell, 2019b)



 <p><b>Lundstrom Environmental Consultants Pty Ltd</b>          Leeming WA 6149          Mob: 0417934863          mikelund1@bigpond.com</p>	<p>Scale: 1:7200          Original Size: A4          Air Photo Source: Nearemap Sep 2019          Datum: GDA94          Projection: Australia MGA94 (50)</p>	<p>Client: B &amp; J Catalano          Project: Gravel Extraction          Location: 4884 Great Northern Hwy Chittering</p>	<p><b>Plant Communities</b></p>
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Figure 18: Survey sites and plant communities throughout Lot 41 from Plant Ecology Consulting's 2019 flora and vegetation survey (Chalwell, 2019a).

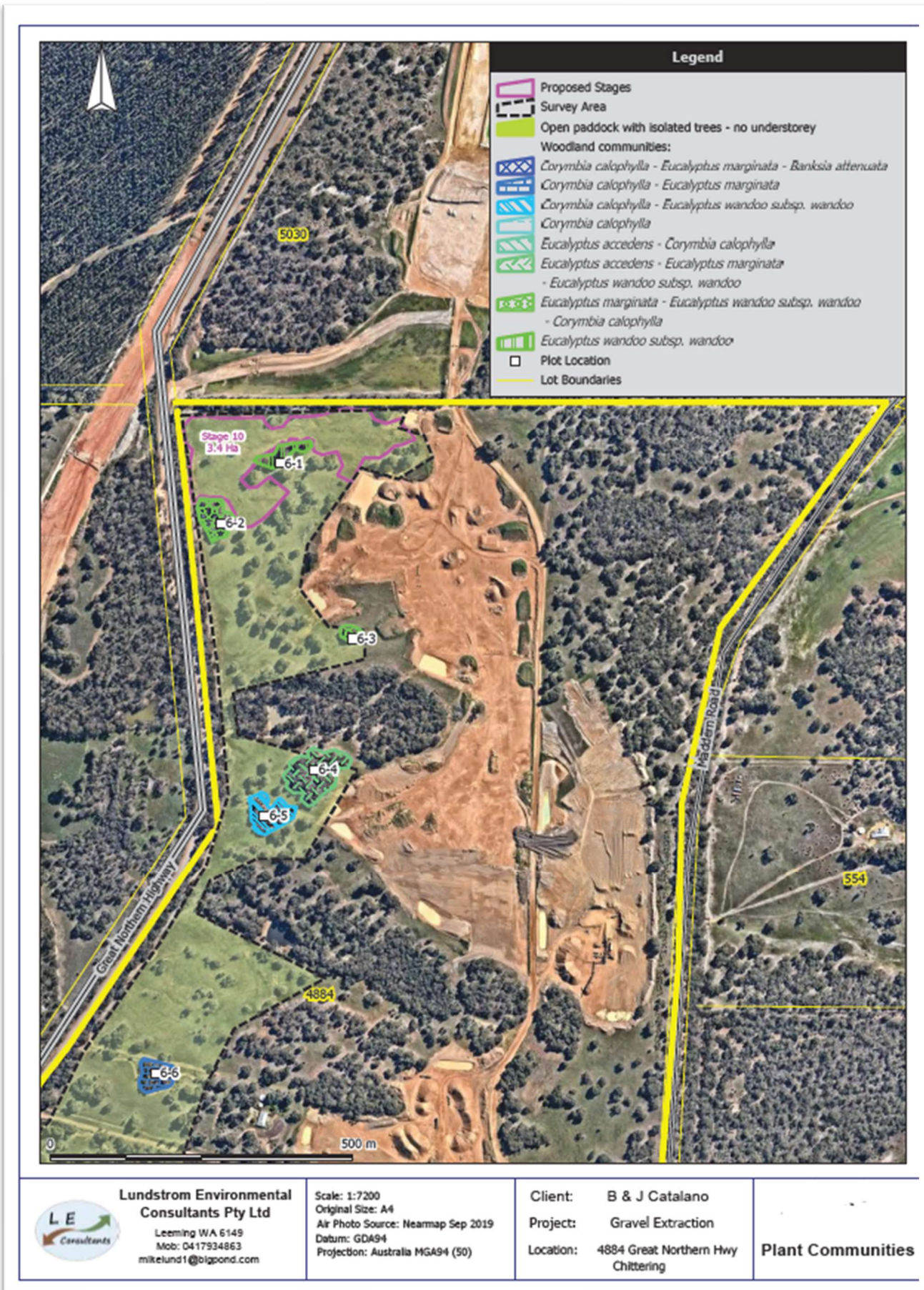


Figure 19: Survey sites and plant communities throughout Lot 41 from Plant Ecology Consulting's 2019 flora and vegetation survey (Chalwell, 2019a).

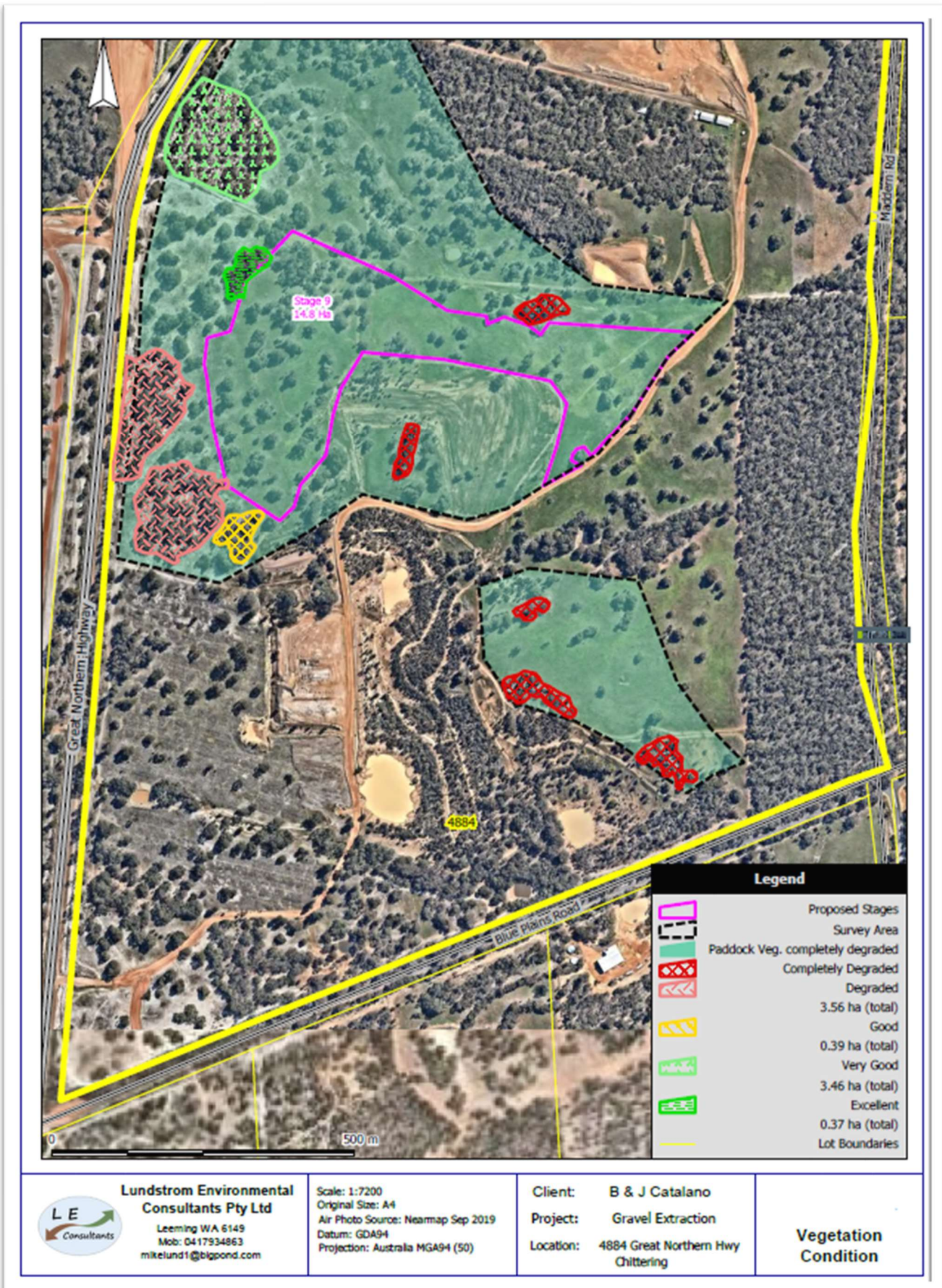
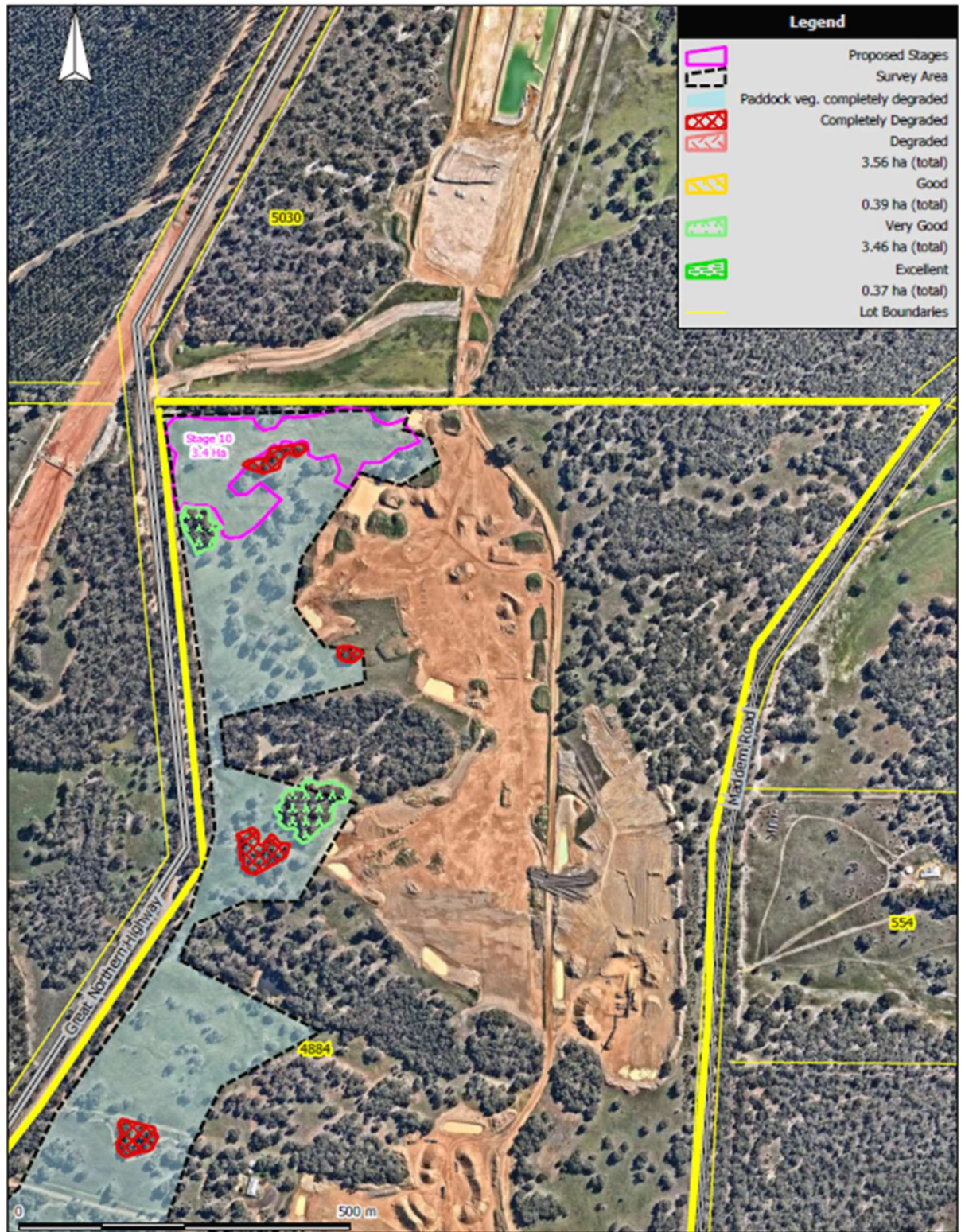


Figure 20: Vegetation Condition results throughout Lot 41 from Plant Ecology Consulting's 2019 flora and vegetation survey (Chalwell, 2019a).





 <p><b>Lundstrom Environmental Consultants Pty Ltd</b> Leeming WA 6149 Mob: 04 17934863 mikelund1@bigpond.com</p>	<p>Scale: 1:7200 Original Size: A4 Air Photo Source: Nearmap Sep 2019 Datum: GDA94 Projection: Australia MGA94 (50)</p>	<p>Client: B &amp; J Catalano Project: Gravel Extraction Location: 4884 Great Northern Hwy Chittering</p>	<p><b>Vegetation Condition</b></p>
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Figure 21: Vegetation Condition results throughout Lot 41 from Plant Ecology Consulting's 2019 flora and vegetation survey (Chalwell, 2019a).

Closure Criteria	Objective	Interim target
Revegetation	Site species richness is based on non-recalcitrant species identified as present within the reference site, at approximately 41 species +/- 10 species/ not able to grow in viable numbers. Survival rates 55% or higher by end of Year 5. For species considered to be suitable for foraging by black cockatoos, the survival rate should be 100% after Year 5.	55% survival of planted tube stock at the end of Year 5. For species considered to be suitable for foraging by black cockatoos, the survival rate should be 100% after Year 5.
	Species diversity 55% or higher by end of Year 5.	65% of planted/tube stock species diversity remaining at the end of Year 1.
	Rehabilitated area to meet the criteria of "Good" condition across upperstory, midstory and understory.	Achievement of the above 'revegetation' objectives will ensure that this objective is met.
Weeds & Bare Ground	Weed cover 20% or less by end of Year 5. Bare ground not more than 60% by Year 5.	No more than 20% weeds at any time throughout the rehabilitation.
Erosion/soil stability	Site hydrology does not prevent the establishment of desired vegetation. No erosion scars by end of Year 5.	Stormwater is retained within the site. Identification and mitigation of potential erosion scars during rehabilitation. Direct autumn return of topsoil in areas to be revegetated.
Fauna	Native fauna are using rehabilitation areas by end Year 5.	Some fauna using rehabilitation area. It is likely that ants and then reptiles will be the first to recolonise the site. Evidence through observation of individuals, scats, and tracks.

Figure 22: Completion criteria, objectives, and interim targets proposed in Revegetation Plan (Lundstrom Environmental Consultants, 2023a)

## Appendix H. Sources of information

### H.1. GIS databases

Publicly available GIS Databases used (sourced from [www.data.wa.gov.au](http://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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