KEYSBROOK MINERAL SANDS PROJECT

KEYSBROOK WESTERN EXTENSION MINERAL SANDS OFFSET STRATEGY

DOCUMENT REFERENCE

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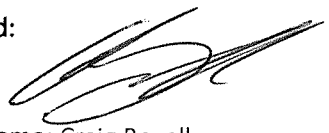
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29 Aug 2025	6	Updated to incorporate EPA comments	DB	CB

DECLARATION OF ACCURACY

I declare that:

1. To the best of my knowledge, all the information contained in, or accompanying this Land Acquisition Offset Strategy is complete, current and correct.
2. I am duly authorised to sign this declaration on behalf of the approval holder.
3. I am aware that:
    a. Section 490 of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) makes it an offence for an approval holder to provide information in response to an approval condition where the person is reckless as to whether the information is false or misleading.
    b. Section 491 of the EPBC Act makes it an offence for a person to provide information or documents to specified persons who are known by the person to be performing a duty of carrying out a function under the EPBC Act or the *Environment Protection and Biodiversity Conservation Regulations 2000* (Cth) where the person knows the information or document is false or misleading.
    c. The above offences are punishable on conviction by imprisonment, a fine or both.

Signed:



Full Name: Craig Bovell

Organisation: Doral Mineral Sands Pty Ltd

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1. INTRODUCTION

1.1. OVERVIEW OF PROPOSED ACTION

Keysbrook Leucoxene Pty Ltd (KLPL), a subsidiary of Doral Mineral Sands Pty Ltd (Doral), is proposing a significant amendment of an approved project under Section 40AA of the *Environmental Protection Act 1986* (EP Act). The Proposal was referred to EPA on 8 September 2023 and was set a level of assessment as 'Referral Information with additional information (required under s.40(2)(a) of the EP Act and public review' on 31 October 2023.

The Proposal (i.e. Proposed Action) was also referred to the Department of Climate Change, Energy, the Environment and Water (DCCEEW) in December 2023 under Section 68 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and was determined to be a Controlled Action on 8 May 2024 (EPBC 2023/09718), due to potential impacts to the following listed Threatened Species (Section 18 and 18A):

- Carnaby`s Black-Cockatoo (CBC) *Zanda latirostris* – listed as Endangered under the *BC Act* and *EPBC Act*.
- Forest Red-tailed Black-Cockatoo (FRBC) *Calyptorhynchus banksii naso* – listed as Vulnerable under the *BC Act* and *EPBC Act.*

Although DCCEEW did not determine potential impacts to Baudins Black Cockatoo (BBC) *Zanda baudinii* as a Controlled Action, this species is listed as Endangered under the *BC Act* and *EPBC Act*, and as such KLPL will also provide an Offset for residual impacts to this species

A Request for Information (RFI) was provided by EPA pursuant to section 40(2)(a) of the EP Act on 24 June 2024, including comments from DCCEEW. The Proposal/Proposed Action is being assessed as an accredited assessment by EPA.

Specifically, KLPL are seeking to expand its current mining operation for the Keysbrook Mineral Sands Project, which operates under Ministerial Statement No. 810 and No. 1089 and EPBC 2005/2016, to include an additional 512.94ha of mining area located immediately to west of the current operations. The Proposal/Proposed Action is a referred to as the 'Western Extension' to the Keysbrook Mineral Sands Mine.

Significant residual impacts associated with the Proposed Action, after consideration of other mitigation measures to be applied, are anticipated to be:

- Clearing of 27.13ha of Black Cockatoo foraging habitat (21.15ha of native vegetation and 5.98ha of planted non-native vegetation) including:
    - 18 trees with suitable DBH containing possibly suitable hollows, but no evidence of use.
    - 122 trees considered to be potential roosting habitat (within 500m of a known roost tree).

This Offset Strategy has been prepared to support the environmental assessment of the Proposed Action by the EPA and DCCEEW, in respect to the impact mitigation measures implemented and proposed offset measures for impacts to the three species of Black Cockatoo's that are likely to result from the Proposal/Proposed Action.

1.2. PURPOSE AND SCOPE

The Offset Strategy has been prepared to demonstrate how the selected offsets address the *Environment Protection Biodiversity Conservation Act 1999 Environmental Offsets Policy* (DSEWPaC, 2012a) and the WA Environmental Offsets Policy (Government of Western Australia, 2011). The Offset Strategy also includes DCCEEW's RFI items issued as part of the EPA's RFI as per the table below.

TABLE 1: RFI - DCCEEW

DCCEEW INFORMATION REQUEST
Avoidance and Mitigation measures - Please provide an updated avoidance and mitigation strategy taking into consideration the following: i. The updated project envelope and disturbance footprints. ii. All relevant black cockatoo surveys and assessments. Potential direct and indirect impacts (including the area of habitat that would be impacted by the proposed activities) to the fauna species discussed under point 3, IF identified within the area of the project envelope.
Updated Offset Strategy Please provide an updated offset strategy that addresses, but is not limited to the following information: i. The updated project envelope and disturbance footprint. ii. All relevant black cockatoo surveys and assessments. Potential impacts and benefits to the fauna species (including the area of habitat that would benefit from the proposed offset area) discussed

2. DESCRIPTION OF THE ACTION

2.1. LOCATION

The Proposed Action is located in the Shire of Serpentine Jarrahdale and Shire of Murray, as shown in Figure 2-1, approximately:

- 55km south of the Perth Central Business District;
- 35km south of the Armadale Regional Centre;
- 25km south east of the Rockingham Regional Centre;
- 23km north east of the Mandurah Regional Centre;
- 7.5km north west of the North Dandalup Town Site;
- 2.5km west of the Keysbrook Town Site.

2.2. LANDUSE

The Proposed Action is predominantly cleared pasture used for stock grazing but there are some remnant bushland patches, large paddock trees and established gardens around farm buildings. The degraded nature of the vegetation, presence of stock and absence of any understorey within native vegetation areas are considered to be of limited value to ground dwelling fauna.

2.1. LAND TENURE

The legal description of the Proposed Action is detailed in the following table.

TABLE 2: LEGAL DESCRIPTION OF PROPOSED ACTION

LOT	ADDRESS	PLAN / DIAGRAM	VOLUME	FOLIO	OWNERSHIP
20	1491 Hopeland Rd, Keysbrook	41621	2567	177	Private/KLPL
62 Comprises: 31 32 33 34	 NA NA NA 1391 Hopeland Rd, North Dandalup	 408493 408493 408493 408493	 2932 2932 2932 2932	 228 229 230 231	 Private/KLPL
63	1265 Hopeland Rd, Keysbrook	739	1049	169	Private/KLPL
64	603 Elliott Rd, Keysbrook	739	1667	630	Private
201	580 Elliott Rd, Keysbrook	68316	2765	289	Private/KLPL
508	630 Elliott Rd, Keysbrook	91207	2115	24	Private
507	Elliot Road, Keysbrook	91207	2115	23	Private/KLPL

2.2. PROPOSAL DESCRIPTION

The Proposed Action will allow KLPL to continue its current mining operation for the Keysbrook Mineral Sands Project, which operates under MS810 and MS1089, and EPBC2005/2016, by including an additional 512.94ha of mining area located immediately to west of the current operations (i.e. the Western Extension) (Figure 2-2).

The Keysbrook Mineral Sands Project consists of a shallow, low grade ore deposit. The current Mine operates 24 hours a day, 7 days a week, however during evening and night time periods (7pm-7am) all mining earthworks activities cease and only the feed prep screening plant fed by a front-end loader and wet Concentrator plant remain in operation.

The Proposed Action is to include an additional 512.94ha of mine area located to the west of the currently approved Proposal, which would increase the total mine area from approximately 1,745ha to 2,257ha (~22.5% increase). The additional disturbance area includes 21.15ha of native vegetation, with the remainder comprising cleared pasture (485.81ha) and some planted non-native vegetation (5.98ha). The Development Envelope (DE) for the Proposed Action is shown in Figure 2-2, with the majority of the Proposed Action located within the existing EPA DE, however a minor extension to include part Lot 64, Lot 507 and Lot 20 has been included.

Ore from the deposit (proposed amendment area) will be mined progressively via a series of shallow open-cut pits using dry mining techniques to a maximum depth of ~5-6mbgl. The average depth of mining however for the proposed amendment area is ~1-2mbgl. Dewatering of groundwater inflows into the pit will be required to enable dry mining to occur during wetter times of the year. Mining will be staged in order to minimise the area of disturbance (at any one time) with the aim of achieving focused and effective management of the environmental factors at each pit location, prior to moving onto the next pit location.

Processing of ore will commence in-pit and then slurry will be pumped from the feed preparation plant to the existing wet concentration plant for further processing. Waste clay and sand materials from processing of this ore will be combined and backfilled into the mine voids using co-flocculation (co-disposal system) where possible. The mined area will be rehabilitated back to pasture, consistent with the post-mine land use requirements.

HMC produced at the wet Concentrator plant will be stockpiled on site prior to transport to Doral's Picton Dry Separation Plant, located ~120km south of the mine, for separation using magnetic and electrostatic processes. The Picton Dry Separation Plant has a licence to process HMC sourced from Doral's Mines. Processing of HMC into products of zircon, ilmenite, and leucoxene has occurred since the Picton Dry Separation Plant was approved by MS484 in 1998. Once processed, HMC products are hauled by truck to either the Bunbury Port or Fremantle Port for export. Processing activities at the Picton Dry Separation Plant and exporting of product remain unaffected by this proposal and thus are not part of this request under Section 38.

Mining within the Western Extension is proposed to operate for 65 months (i.e. 5.5 years), commencing in the first quarter (Q1) of 2026 (i.e. January 2026) and finishing in Q2 of 2031 (i.e. May 2031).

2.3. TIMING

A summary of the Proposed Mining Schedule – Western Extension is presented in the following Table.

TABLE 3: SUMMARY OF PROPOSED MINING SCHEDULE – WESTERN EXTENSION

MINING SECTION	MINING LOTS	MINING BLOCK NUMBERS	MINING PERIOD
Section 1	201, 507 and 508	403-473	January 2026 to February 2028
Section 2	64	332-400	February 2028 to December 2029
Section 3	63	273, 277, 309, 319, 320, 321, 328, 329	December 2029 to May 2030, & May 2031
Section 4	62 and 20	211-269	May 2030 to April 2031

3. MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

3.1. LISTED THREATENED SPECIES AND COMMUNITIES (S18 AND 18A)

Following referral of the Proposed Action to DCCEEW, it was determined that the following MNES listed under the EPBC Act were likely to be impacted by the Proposed Action:

- Carnaby`s Black-Cockatoo (CBC) *Zanda latirostris* – listed as Endangered under the *BC Act* and *EPBC Act*.
- Forest Red-tailed Black-Cockatoo (FRTBC) *Calyptorhynchus banksii naso* – listed as Vulnerable under the *BC Act* and *EPBC Act.*

Although DCCEEW did not determine impacts to Baudins Black Cockatoo (BBC) (*Zanda baudinii)* as a Controlled Action, the species is also listed as Endangered under the BC Act and EPBC Act, and as such KLPL will provide an Offset for significant residual impacts to the species.

The status, distribution and habitat preferences, along with the results of targeted surveys and threats to the threatened species identified within the DE (i.e. Black Cockatoos) are outlined in the following tables.

TABLE 4: CARNABY'S BLACK-COCKATOO (*Zanda latirostris*)

Species	Carnaby's Black-Cockatoo *Zanda latirostris*
EPBC Status and Distribution	Endangered. It is endemic to and widespread in the southwest of Western Australia. Occurring mostly in the Wheatbelt in areas that receive 300-750mm of rainfall annually, it is also found in wetter regions in the far southwest. Its range extends north to the lower Murchison River and east to Nabawa, Wilroy, Waddi Forest, Nugadong, Manmanning, Durokoppin, Noongar (Moorine Rock). Lake Cronin, Ravensthorpe Range, head of Oldfield River, 20km east-southeast of Condingup and Cape Arid. It has also occasionally been seen on Rottnest Island (Johnstone & Storr, 1998). The extent of occurrence is estimated at 32,000km² based on Birdlife International GIS. This estimate is considered to be of medium reliability (Garnett & Crowley, 2000). The range of Carnaby's Black-Cockatoo is said to have contracted by more than 30% since the late 1940s (Mawson, 1997) and the species is also said to have disappeared from more than a third of its former breeding range between 1968 and 1990 (Saunders & Ingram, 1998).
Habitat Preference	Carnaby's Black-Cockatoo prefers forest, woodlands, heathlands and farm environments where it feeds on Banksia, Hakea and Marri. This species has specific nesting site requirements - nests are mostly in smooth-barked Eucalypts with the nest hollows ranging from 2.5 to 12m above the ground, an entrance from 23-30cm diameter and a depth of 0.1-2.5m (Johnstone & Storr, 1998). Breeding occurs in winter/spring mainly in eastern forest and wheatbelt where they can find mature hollow bearing trees to nest in (Morcombe, 2004). Judging from records in the Storr-Johnstone Bird Data Bank, this species is currently expanding its breeding range westward and south into Jarrah-Marri forest of the Darling Scarp and into the Tuart forests of the SCP including the region between Mandurah and Bunbury. Carnaby's Black-Cockatoo has been known to breed close to the town of Mandurah, as well as Dawesville, Lake Clifton and Baldivis

Species	Carnaby's Black-Cockatoo *Zanda latirostris*
	(Ron Johnstone, WA Museum, pers. comm.) and there are small resident populations on the southern SCP near Mandurah, Lake Clifton and near Bunbury. At each of these sites the birds forage in remnant vegetation and adjacent pine plantations (Johnstone, 2008). Carnaby's Black-Cockatoo lays eggs from July or August to October or November, with most clutches being laid in August and September (Saunders, 1986). Most of the breeding is in September through to December (Ron Johnstone pers comms). Birds in inland regions may begin laying up to three weeks earlier than those in coastal areas (Saunders, 1977). The female incubates the eggs over a period of 28-29 days. The young depart the nest 10-12 weeks after hatching (Smith & Saunders, 1986).
Results of Targeted Surveys	Small areas of low-quality foraging habitat present within Proposal's DE. No evidence of foraging (such as chewed marri fruits and pine cones) observed during either Survey. Clearing for the Proposal will affect 21.15ha of the ~123ha present. One potentially suitable nest tree is present within the disturbance area, although no evidence of recent use has been observed. This tree is a large, very unstable burnt stag and is likely to fall over during high winds. This tree will be avoided from disturbance. No roosting sites were identified within the Proposal's DE; however, 4 known roost sites surround the Project area. A total of 122 tress with suitable DBH are present within 500m of the roost tree within Lot 202 which is considered to represent potentially suitable roosting habitat.
Mapping	Figure 3-1 to 3-3
Threats	The decline of Carnaby's Black-Cockatoo is due primarily to the loss and fragmentation of habitat. This has been caused by the clearing of native vegetation, mainly for agricultural purposes, since the middle of the 20th century (Cale, 2003) (Mawson & Johnstone, 1997) (Saunders, 1986). Carnaby's Black Cockatoo is a highly mobile species. They move sequentially through the landscape, utilising different habitat types at different times of the year, makes them especially vulnerable to the loss, fragmentation or degradation of any one component of the landscape. The long-term survival of Carnaby's Black-Cockatoo depends on the persistence of suitable breeding habitat (i.e., woodland), nest-sites (i.e., tree hollows) and foraging habitat (e.g., heathlands) capable of providing enough food to sustain the population. At present, the loss of foraging habitat is thought to pose the greatest risk to the species (Saunders & Ingram, 1998). The breeding habitat of Carnaby's Black-Cockatoo has also been extensively cleared (Garnett & Crowley, 2000). Hollow-bearing trees that are suitable for nesting are now located in remnant patches of woodland and at sites where selected trees have been retained in areas that have otherwise been cleared of native vegetation (Saunders & Ingram, 1998). The impact of clearing has also had other consequences for the remaining habitat. In some areas, the remnant native vegetation has become threatened by an increase in the salinity of soils (Mawson & Johnstone, 1997). Clearing also exposes remnant habitats to invasion by weeds and, potentially, other processes that will degrade the habitat.

Species	Carnaby's Black-Cockatoo *Zanda latirostris*
	Other threats include Competition for nest hollows, Illegal trade predation by Wedge-tailed Eagles *Aquila audax*, collisions with cars, drowning and entrapment in tree hollows (Saunders, 1982). Carnaby's Black-Cockatoo is a long-lived species (Saunders & Ingram, 1998) that does not breed until four years of age (Saunders, 1982, 1986), has an estimated generation time of 15 years (Cale, 2003) (Garnett & Crowley, 2000) and has a low rate of productivity (i.e. most successful pairs fledge only one young per year) (Saunders, 1982). These characteristics limit the potential of the species to sustain numbers or to recover in the presence or aftermath of a threatening process.

TABLE 5: FOREST RED-TAILED BLACK-COCKATOO (*Calyptorhynchus banksii naso*)

Species	Forest Red-tailed Black-Cockatoo *Calyptorhynchus banksii naso*
EPBC Status and Distribution	Vulnerable. The FRTBC is endemic to southwest WA from Gingin in the north and east to Mt Helena, Christmas Tree Well, West Dale, North Bannister, Mt Saddleback, Kojonup, Rocky Gully, upper King River and east to the Green Range (Johnstone and Storr, 1998). Small isolated breeding populations are on the Swan Coastal Plain and can be found during the fruiting season of Cape Lilac (*Melia azederach*) (CALM, 2006) (Stranger, 1997).
Habitat Preference	The FRTBC prefers Eucalypt forests where it feeds on Marri, Jarrah, Blackbutt, Karri, Sheoak and Snottygobble and nests in the large hollows of Marri, Jarrah and Karri (Johnstone & Kirkby, 1999). In Marri the nest hollows of the Forest Red-tailed Black-Cockatoo range from 9-14m above ground, the entrance is 12-41cm in diameter and the depth is 1.5m (Johnstone & Storr, 1998). There are few records of breeding of the FRTBC (Johnstone and Storr, 1998). Recent data however indicates that breeding in all months of the year occurs with peaks in spring and in autumn-winter (Ron Johnstone pers comms). Eggs are typically laid in October and November (Johnstone, 1997) (Johnstone & Storr, 1998) with an incubation period of 29-31 days. Young fledge at 8 to 9 weeks (Simpson & Day, 2004).
Results of Targeted Surveys	Small areas of low-quality foraging habitat present within the Dev Env. Throughout the site visit small flocks (approx. 2 to 10 individuals) of were (BCE, 2021). They were observed actively feeding on all three days on site, mostly in Marri but also within introduced Eucalypts along the driveway in Lot 64. Foraging evidence on Marri fruit was abundant throughout the three Lots during the Survey. One potentially suitable nest tree is present within the disturbance area, although no evidence of recent use has been observed. This tree is a large, very unstable burnt stag and is likely to fall over during high winds. This tree will be avoided from disturbance. No roosting sites were identified within the Proposal's DE; however, 4 known roost sites surround the Project area. A total of 122 tress with suitable DBH are present within 500m of the roost tree within Lot 202, which is considered to represent potentially suitable roosting habitat.

Mapping	Figure 3-1 to 3-3
Threats	The main threats to the Forest Red-tailed Black-Cockatoo are habitat loss, nest hollow shortage, competition for available nest hollows from other species, injury or death from the European Honeybee (*Apis mellifera*), illegal shooting (Chapman, 2005) and fire (CALM, 2006).

TABLE 6: BAUDIN'S BLACK-COCKATOO (*Zanda baudinii*)

Species	Baudin's Black-Cockatoo *Zanda baudinii*
EPBC Status and Distribution	Endangered. The range of the species is confined to the southwest of Western Australia, north to Gidgegannup, east to Mount Helena, Wandering, Quindanning, Kojonup, Frankland and King River and west to the eastern strip of the Swan Coastal Plain including West Midland, Byford, Nth Dandalup, Yarloop, Wokalup and Bunbury (Johnstone & Storr, 1998). Breeding has been recorded in the far south of the range (Higgins, 1999) (Saunders, 1979b) (Storr, 1991) . The extent of occurrence is estimated at 40,000km² based on published maps, and this estimate is considered highly reliable (Garnett & Crowley, 2000). No specific information is available on past changes in the extent of occurrence; however, it is likely to have declined due to the clearance of habitat (Blyth, 2005 pers. comm.).
Habitat Preference	The preferred habitat of Baudin's Black-Cockatoo is mainly Eucalypt forests where it feeds primarily on Marri seeds (Morcombe, 2004), *Banksia, Hakeas* and *Erodium* sp. They also strip bark from trees in search of Beetle larvae (Johnstone & Storr, 1998). Nests are built in large hollows in tall eucalypts, especially Karri, Marri and Wandoo (Johnstone & Storr, 1998) (Higgins, 1999) (Saunders, 1974) (Saunders, 1979b). As with other black cockatoos, Baudin's Black-Cockatoo nests in large vertical hollows of very long-lived trees. Trees with hollows suitable for Baudin's Black-Cockatoo are likely to be >50cm DBH. As trees approaching this size are close to developing suitable hollows, trees below 50cm DBH are considered to have the potential to develop hollows and are therefore also important resources for Baudin's Black-Cockatoo. Preferred roosts are in areas with a dense canopy close to permanent sources of water, providing the birds with protection from weather conditions (Johnstone & Kirkby, 2008).
Results of Targeted Surveys	Small areas of low-quality foraging habitat present within Proposal's DE. No evidence of foraging (such as chewed marri fruits and pine cones) observed during either Survey. Clearing for the Proposal will affect 21.04ha of the ~118.5ha present. One potentially suitable nest tree is present within the disturbance area, although no evidence of recent use has been observed. This tree is a large, very unstable burnt stag and is likely to fall over during high winds. This tree will be avoided from disturbance. No roosting sites were identified within the Proposal's DE; however, 4 known roost sites surround the Project area. No disturbance to a known roost tree will occur as a result of implementing the Proposal, however it is noted that 122 trees considered to represent roosting habitat (i.e. trees within 500m of a known roost tree) will be directly impacted by the Proposal as shown on Figure 6-3.
Mapping	Figure 3-1 to 3-3

Species	Baudin's Black-Cockatoo *Zanda baudinii*
Threats	Loss of habitat was formerly the major threat to Baudin's Black-Cockatoo; however, the threat has abated for several reasons: the clearing of forest for agricultural purposes has largely ceased; areas of forest that contain nest sites, or that are likely to contain nest sites, are protected from harvest or clearing; and logging practices are monitored (Blyth, 2005 pers. comm.). The major threats to the species at present appear to be illegal shooting and competition with introduced bees for nest hollows (Blyth 2005, pers. comm.). Baudin's Black-Cockatoo can feed on and do damage to cultivated fruit in orchards (Halse, 1986) (Long, 1985). To prevent such damage, the species was subject to shooting under an Open Season Notice from the 1950s until 1989, when the notice was revoked (Mawson & Johnstone, 1997). The species has been protected since 1996 (Mawson & Johnstone, 1997), but illegal shooting may still be occurring (Garnett & Crowley, 2000). Baudin's Black-Cockatoo has a low annual reproductive rate of 0.6 young per pair (Storr, 1991), which limits the potential of the species to recover in the presence or aftermath of a threatening process

3.2. BLACK COCKATOO SURVEYS

The following Fauna Surveys have been used as the basis to assess impacts to MNES:

- Survey 1 – Assessment of the nesting and foraging values of three Lots (508, 201 and 64) near Keysbrook for Doral Mineral Sands Pty Ltd, Keysbrook Mineral Sands Mine (EPA, 2016a).
    - The survey was undertaken on 3 and 9 December 2020 and 5 July 2021 in accordance with *EPBC Act Referral guidelines for three threatened black cockatoo species (DSEWPaC, 2012b)* and the revised draft guidelines (DEE, 2017) (current guidance at the time of assessment).
- Survey 2 – Assessment of Nesting, Foraging and Roosting Values for Three Species of Black-Cockatoo in Lots 62, 63, 20 and 507 near Keysbrook, Western Australia (BCE, 2022).
    - The survey was undertaken on 2 and 3 of July 2022 in accordance with the *EPBC Act Referral guidelines for three threatened black cockatoo species* (DAWE, 2022).

In addition to the above surveys, additional targeted assessment of potential nesting trees (identified by BCE) were undertaken by Australian Black-Cockatoo Specialists (ABCS, 2023a; 2023b) and (BCE, 2024).These include:

- Assessment of 11 trees for nesting values for three species of Black-Cockatoo in Lot 63 Hopeland Rd Keysbrook, Western Australia (ABCS, 2023a):
    - Survey completed 4 April 2023.
- Assessment of 28 trees for nesting values for three species of Black-Cockatoo in Lots 64, 201, 507 and 508, Keysbrook, Western Australia (ABCS, 2023b):
    - Survey completed 3 and 4 May 2023.
- Re-assessment of potential nest trees for Black-Cockatoos in the Keysbrook area (BCE, 2024):
    - Surveyed completed in June/July 2024.

- Assessment of tree #1567 for its nesting value for three species of Black Cockatoo in Lot 508 Elliot Rd Keysbrook, Western Australia (ABCS, 2025).
    - Survey completed March 2025.

The (BCE, 2024) targeted assessment also included an assessment of suitable habitat for Chuditch, Quokka and Carters Freshwater Mussell.

Phoenix Environmental Sciences completed a Short-Range Endemic (SRE) desktop assessment to determine the likelihood of occurrence of SRE invertebrate taxa and potential SRE habitat within the Proposed Action:

- *Short-range endemic desktop review for the Keysbrook Mineral Sands Project (Western Extension). April 2024* (Phoenix, 2024).

A summary of the surveys relevant to the assessment of potential impacts to MNES (Black Cockatoo habitat) is provided in the following sections.

3.3. BLACK COCKATOO FORAGING HABITAT

The Proposed Action provides value for Black-Cockatoo species for foraging and to a lesser degree potential nesting. A total area of ~123.58ha (Ecoedge, 2021, 2022 and 2023) of native vegetation/foraging habitat is present within the DE, which although assessed as low-quality foraging habitat includes some patches that are at least of moderate foraging quality for both species. The presence of feeding FRTBC's during the site visits in Survey 1 (BCE, 2021) confirmed the importance of the general Site area for foraging for that species.

Foraging habitat (native vegetation and planted species) to be impacted by the Proposed Action is shown in Figure 3-1.

Foraging habitat and value for Black-Cockatoos was assessed by inspecting the vegetation and reviewing vegetation descriptions in the Flora and Vegetation survey reports (Ecoedge 2021, 2022 and 2023). The foraging value of the vegetation depends upon the type, density and condition of trees and shrubs in an area, and can be influenced by the context such as the availability of foraging habitat nearby. The BCE scoring system for value of foraging habitat has three components as detailed in Appendix 2 of (BCE, 2021) (BCE, 2022) assessment. These three components are drawn from the DCCEEW offset calculator but with the scoring approach developed by BCE:

- A score out of six for the vegetation composition, condition and structure;
- A score out of three for the context of the site;
- A score out of one for species density.

Foraging value can thus be assigned a score out of six, based upon site vegetation characteristics, or a score out of 10 if context and species density are also considered. The score out of 10 is calculated only for vegetation of at least Low to Moderate foraging value (vegetation characteristics score of ≥ 3). Vegetation with No, Negligible or Low foraging value is effectively assigned context and species density scores of '0' because the context and species density are of little relevance if the vegetation does not support regular foraging by the birds. Foraging value scores are calculated differently for each black-cockatoo species (Appendix 2 of BCE, 2021 and BCE, 2022) depending upon the vegetation present.

The following foraging habitat assessment is provided based on the two Black Cockatoo surveys.

Foraging Assessment - Lots 62, 63, 20 and 507 (BCE, 2022)

The majority of the Proposal area, comprising Lots 62, 63, 20 and 507, provides minimal foraging value for Black-Cockatoos (BCE, 2022). The majority of the vegetation within these Lots are limited to paddocks with isolated scattered trees. There are no areas of native bushland, and the highest quality habitat were clumps of natives with a weedy understorey. Five vegetation types were recognised by (BCE, 2022):

- Creekline. There were minor drainage lines surrounded by pasture with remnant Flooded Gum, Marri, Melaleuca. Rows of introduced Eucalypts have become established along the creeklines in Lot 62; particularly the northern creekline.
- Introduced Eucalypts. Introduced eucalypts were mostly planted along creeklines, driveways and surrounding homesteads. FRTBC's were seen foraging on introduced eucalypts during the earlier Black Cockatoo survey (BCE, 2021); however, none were observed during the (BCE, 2022) survey within Lots 62, 63, 20 and 507.
- Wetland. Intermittent flooding occurs with low-lying areas becoming inundated during the winter months. A 100m buffer surrounding wetlands is excluded from proposed development areas. These low-lying areas were in paddocks with scattered trees and were classed as 'cleared with sparse trees' for the assessment of foraging habitat.
- Pine. A single stand of pine trees is located in the southern section of Lot 62.
- Cleared with sparse trees. This vegetation type consisted of mostly isolated paddock trees with some small clusters of Marri and Melaleuca. Marri represented the most common species followed by Melaleuca with a few Jarrah, Flooded Gum and Tuart trees. There were occasional Sheoak and Woody Pear trees present. In Lot 63 there were large areas where trees were absent.

The above descriptions were used to assess the quality of foraging habitat for Black-Cockatoos based on the BCE scoring tool, with foraging values based upon vegetation characteristics, context and species density provided for each species in Tables 7-9. For the purpose of the foraging value assessment, seasonally inundated areas and creeklines were included in 'cleared with sparse trees', as they were small in area and with similar vegetation characteristics.

Cleared with sparse trees was assigned vegetation characteristics score of 2 (out of 6) for each species. This value was based on the low density of forage trees (mostly Marri) and with paddocks having some foraging value from the seed of weeds. It is influenced by the presence of some clusters of Marri.

Introduced eucalypts were assigned differing values based on vegetation characteristics, as CBC's appear to make less use of introduced eucalypts than the FRTBC or BBC.

Context score is based upon the proportion of regional foraging habitat represented within a project area, the vegetation characteristics score and the presence (or absence) of breeding nearby. As outlined in Appendix 2 of (BCE, 2022), a context score of 0 may be assigned where the vegetation characteristics score is <3, but a low context score can be given where vegetation with a low characteristic's score has some ecological function. This is the case for Lots 62, 63, 20 and 507 due to extensive clearing, where low quality vegetation is a large proportion of what is left. Therefore, a context score of 1 was assigned to all vegetation types for all species except for pines. Pines were assigned a context score of 2 for CBC, as pines are a valuable food source for this species, and they were assigned a context score of 1 for BBC and 0 for the FRTBC, which rarely if ever forages on pines.

Appendix 2 of (BCE, 2022) recommends a species density score of 0 where the score for vegetation characteristics is <3, irrespective of the presence or absence of records of the birds. No Black-Cockatoos

were observed during the site inspection, and there was only one tree where recent evidence of foraging by FRTBC's was observed. In previous studies for the other areas of the Proposed Action (BCE, 2021) at least the FRTBC was regularly observed. Assigning an overall species density value of 0 appeared to most accurately reflect the abundance of birds and the vegetation characteristics in the area (BCE, 2022).

TABLE 7: CARNABY'S BLACK-COCKATOO FORAGING ASSESSMENT

VEGETATION TYPE	VEGETATION CHARACTERISTICS (6)	CONTEXT (3)	SPECIES DENSITY (1)	TOTAL (10)
Cleared with sparse trees	2	1	0	3
Introduced Eucalypts	1	1	0	2
Pines	4	2	0	6

TABLE 8: FOREST RED-TAILED BLACK-COCKATOO FORAGING ASSESSMENT

VEGETATION TYPE	VEGETATION CHARACTERISTICS (6)	CONTEXT (3)	SPECIES DENSITY (1)	TOTAL (10)
Cleared with sparse trees	2	1	0	3
Introduced Eucalypts	2	1	0	3
Pines	1	0	0	1

TABLE 9: BAUDIN'S BLACK-COCKATOO FORAGING ASSESSMENT

VEGETATION TYPE	VEGETATION CHARACTERISTICS (6)	CONTEXT (3)	SPECIES DENSITY (1)	TOTAL (10)
Cleared with sparse trees	2	1	0	3
Introduced Eucalypts	1	1	0	2
Pines	1	1	0	2

Foraging Assessment – Lots 64, 201 and 508 (BCE, 2021)

Lots 64, 201 and 508 contains foraging vegetation that is suitable for all three Black-Cockatoo species (BCE, 2021). There are several different vegetation types, as documented in the (MBS, 2004) assessment, most of which displayed a variable density of eucalypt canopy cover and distinctive mid and lower strata floristics. These are discussed below (BCE, 2021).

Native vegetation in the north-east corner of Lot 64 (vegetation type Bank_Sheo_Mar) consisted of an open canopy of Marri and Jarrah over Slender Banksia *attenuata,* Firewood Banksia *B. menziesii* and Sheoak *Allocasuarina fraseriana*. Marri and Jarrah provide a foraging resource for all three species, while proteaceous trees (Banksia) will benefit CBC, and Sheoak fruit will provide a resource for FRTBC and BBC.

The eastern section of this remnant patch included an intact shrub and ground layer, which was rare across the survey area (BCE, 2021). Further west transitioned to seasonal wetlands.

The remnant native vegetation in the north-western corner of Lot 64 (vegetation type Kunz_Jar_Bank) is of lesser value as it is mostly dominated by dense thickets of Spearwood *Kunzea glabrescens,* however it does contain an open overstory of Jarrah, Holly-leafed Banksia *B. ilicifolia*, Sheoak and the occasional Firewood Banksia.

The bushland remnant in the central eastern section of Lot 201 (vegetation type Jar_Bank_Xant) is a low closed forest of Jarrah, Slender Banksia with scattered Firewood Banksia over Grass trees *Xanthorrhoea sp.* and a weedy understorey.

The largest remnant in Lot 508 (vegetation type Mar_Jar_Xylo) contains an open woodland of Marri and Jarrah over the occasional Banksia and Woody pear *Xylomelum occidentale.*

Throughout the Proposal area there were small stands of Jarrah and Marri with little to no mid-strata and a grazed ground cover of weeds (vegetation type Jar_Mar_graze). Almost all paddock trees are eucalypts and are included in this vegetation type.

Throughout the site visit (BCE, 2021), small flocks (approximately 2 to 10 individuals) of FRTBC were encountered. They were observed actively feeding on all three days on site, mostly in Marri. Foraging evidence on Marri fruit was abundant throughout the three Lots.

The remaining category consists of a mixed assemblage of native but mostly introduced plants of many varieties (vegetation type Mixed Veg). These may provide foraging value for Black-Cockatoos but the precise value is unknown and not included in the assessment.

The above descriptions were used by (BCE, 2021) to assess the vegetation characteristics value in Tables 10-12. Using the BCE scoring system, the site context value was calculated with a value of 2 for all three species. This value was determined by the prospect that Black-Cockatoos were likely to use the local area for breeding and that 1 to 5% of the existing vegetation in the local area remained. Both CBC and FRTBC are abundant in the area, therefore they are allocated a score of 1 for species density, whereas BBC is more likely to remain further east on the Darling Scarp, therefore obtaining a score of 0.

TABLE 10: CARNABY'S BLACK-COCKATOO FORAGING ASSESSMENT

VEGETATION TYPE	VEGETATION CHARACTERISTICS (6)	CONTEXT (3)	SPECIES DENSITY (1)	TOTAL HQS (10)
Jar_Mar_graze	3	2	1	6
Mar_Jar_Xylo	4	2	1	7
Jar_Bank_Xant	5	2	1	8
Kunz_Jar_Bank	3	2	1	6
Bank_Sheo_Mar	4	2	1	7
Int. Eucs	1	0	0	1

TABLE 11: FOREST RED-TAILED BLACK-COCKATOO FORAGING ASSESSMENT

VEGETATION TYPE	VEGETATION CHARACTERISTICS (6)	CONTEXT (3)	SPECIES DENSITY (1)	TOTAL HQS (10)
Jar_Mar_graze	3	2	1	6
Mar_Jar_Xylo	4	2	1	7
Jar_Bank_Xant	3	2	1	6
Kunz_Jar_Bank	2			2
Bank_Sheo_Mar	4	2	1	7
Int. Eucs	3	2	1	6

TABLE 12: BAUDIN'S BLACK-COCKATOO FORAGING ASSESSMENT

VEGETATION TYPE	VEGETATION CHARACTERISTICS (6)	CONTEXT (3)	SPECIES DENSITY (1)	TOTAL HQS (10)
Jar_Mar_graze	3	2	0	5
Mar_Jar_Xylo	4	2	0	6
Jar_Bank_Xant	3	2	0	5
Kunz_Jar_Bank	2	0	0	2
Bank_Sheo_Mar	4	2	0	6
Int. Eucs	1	0	0	1

TABLE 13: SUMMARY OF FORAGING HABITAT TO BE IMPACTED

VEGETATION TYPE	AREA TO BE IMPACTED (HA)	CARNABY (HQS)	BAUDIN (HQS)	FRTBC (HQS)
Int. Eucs	5.98	1	1	6
Jan_Mar_Graze	4.09	6	5	6
Jar Bank Xant	3.62	8	5	6
Kunz_Jar Bank	2.74	6	2	2
Mar_Jar_Xylo	8.95	7	6	7
Cleared with Sparse Trees	1.75	3	3	3
TOTAL AREA	**27.13**	-	-	-

3.4. POTENTIAL NESTING HABITAT

The Proposal area's suitability for potential nesting habitat was assessed by checking for large, potentially hollow-bearing trees that may facilitate breeding by Black-Cockatoos, and assigning trees a rank using a system developed by Bamford Consulting Ecologists (BCE). (DSEWPaC, 2012b) and DAWE (2022) considers trees that meet the basic criterion of having a DBH >500mm (or >300mm for Wandoo) as being potential Black-Cockatoo breeding trees. The BCE ranking system allows trees that meet this criterion to be assessed as to the likelihood of a tree actually being used for nesting (BCE, 2021). Trees with a rank of 4 or 5 are extremely unlikely to contain hollows that could be used for breeding, although could eventually develop hollows of suitable size. Trees ranked from 1 to 3 are either being used (rank of 1), have been recently used based on chew marks around a suitable hollow entrance (rank of 2), or have potentially suitable hollows that have not been recently used (rank of 3).

All trees within the DE were inspected and those that met the basic DBH criterion of (DSEWPaC, 2012b) and DAWE (2022) were numbered and co-ordinates taken with a hand-held GPS, Diameter at Breast Height (DBH) recorded, species and live status recorded, and they were assigned a rank as to their potential for breeding (as outlined in Appendix 1 of both surveys).

Within the disturbance area, a total of 636 potential nesting trees (i.e. DBH>500mm) are present, including 135 rank 3 trees and two rank 2 trees. The majority of these trees however were rank 5 (372). These trees are shown on Figure 3-2.

To determine the actual suitability and evidence of use of the rank 2 and 3 trees, Australian Black-Cockatoo Specialists (ABCS, 2023a) (ABCS, 2023b) (ABCS, 2025) and (BCE, 2024) completed a close visual inspection of all Rank 2 and Rank 3 trees within the proposed disturbance area using a camera pole, drone and/or ladder. Any evidence of nesting/suitability of the hollow was then photographed and details or any use (including non-target species) was also recorded. Results of the inspections identified 18 x rank 3 trees containing possibly suitable hollows within the disturbance area (Figure 3-1). No evidence of actual use was recorded. It is noted that the two x rank 2 trees were downgraded following the additional inspections.

3.5. ROOSTING HABITAT

Results of the Black Cockatoo Habitat assessments, confirmed 12 Black-Cockatoo roost sites are present within a 12km buffer of the DE since 2010 (Birdlife 2022). Of these, four confirmed Black-Cockatoo roost sites are in close proximity to the DE (Figure 6 in BCE, 2022) (Birdlife 2022, DBCA 2022). The closest roost site to the Proposal area ('Roost 3') is within Lot 62 (central east), which is within open Eucalypt woodland. The second nearest roost site ('Roost 2') is in quality Marri and Jarrah woodland approximately 1.1km east of Lot 507, in Doral's Offset Site (Lot 202) as part of the Original Project approvals (EPBC 2005/2016). A third roost site is in a small patch of woodland 1.5km east-southeast of Lot 62 ('Roost 4'). The furthest roost site is approximately 2.7km west of Lot 507 ('Roost 1').

White-tailed black-cockatoos (most likely CBC) have been observed using Roost 1 more than FRTBC (Table 5 and 6 in BCE, 2022). There have been 10 Great Cocky Count surveys conducted at Roost 1 since 2010 for white-tailed Black-Cockatoos, with numbers ranging from 0 to 100 per survey (Table 6 in BCE, 2022). This has resulted in a total of 249 white-tailed Black-Cockatoos since 2010 compared to only 3 FRTBC observed at Roost 1 since 2014.

In contrast, only FRTBC have been observed to use Roosts 2, 3, and 4. No white-tailed Black-Cockatoos were counted at these roosts. Since 2017, a total of 54 FRTBC were observed at Roost 2 (maximum single count

of 26 birds), eight at Roost 3 (maximum single count of 8 birds) and nine at Roost 4 (maximum single count of 6 birds) (Table 5 and Table 6 in BCE, 2022)

Roost 2 is in quality Marri and Jarrah woodland approximately 1.1 km east of Lot 507 (in Lot 202), whereas Roost 3 (Lot 62) has been used infrequently by only small numbers of birds, and are in much smaller remnant patches. The presence of these roosts in the region supports the conclusion that birds are likely to forage across the project areas, at least occasionally.

Figure 3-3 shows the location of Roost 2 and 3, with potentially suitable roosting habitat (trees with DBH>500mm) within a 500m radius also shown.

4. ASSESSMENT OF IMPACTS

4.1. SUMMARY OF IMPACTS

This section addresses the Proposed Action's potential direct and indirect impacts on MNES (as well as Baudin's Black Cockatoo) that are likely to occur. The potential impacts on each species are assessed in accordance with *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (DotE, 2013). Conservation advice, recovery plans and other relevant guidance were considered where applicable to specific MNES/species. A summary of the potential impacts of the Proposed Action is provided in the following table.

TABLE 14: SUMMARY OF IMPACTS

SPECIES	DIRECT IMPACT	INDIRECT IMPACT
Carnaby's Black-Cockatoo (CBC) *Zanda latirostris* Forest Red-tailed Black-Cockatoo (FRTBC) *Calyptorhynchus banksii naso* Baudins Black Cockatoo (BBC) (*Zanda baudinii*	Loss of Black Cockatoo habitat including: • Clearing of up to 21.15ha of low-quality foraging habitat. • Clearing of 5.98ha of planted trees (Tasmanian blue gums). • Clearing of up to 636 suitable DBH trees (co-located located with vegetation to be cleared) • Clearing of 18 suitable DBH trees containing potentially suitable hollows. • No loss of known roosting trees, however 122 trees with suitable DBH considered to be potentially suitable roosting habitat.	Black Cockatoo habitat could be subject to potential indirect impacts on vegetation within the DE including: • Introduction and/or spread of dieback. • Increased fire risk. • Increased risk from dust generation. However subject to implementation of management and mitigation measures detailed in Section 6, the residual indirect impacts MNES (Black Cockatoos) are expected to be negligible in the local context.

4.2. DIRECT IMPACTS

The following direct impacts are likely to occur as a result of the Proposed Action.

- Loss of up to 21.15ha of Black Cockatoo foraging habitat (mapped as native vegetation).
    - CBC:
        - 3.62ha x HQS 8
        - 8.95ha x HQS 7
        - 6.83ha x HQS 6
        - 1.75ha x HQS 3
    - FRTBC:
        - 8.95ha x HQS 7

        - 7.71ha x HQS 6
        - 1.75ha x HQS 3
        - 2.74ha x HQS 2
    - BBC:
        - 3.62ha x HQS 8
        - 8.95ha x HQS 6
        - 7.71ha x HQS 5
        - 1.75ha x HQS 3
        - 2.74ha x HQS 2
- Loss of up to 5.98ha of planted trees (Tasmanian blue gums):
    - CBC and BBC:
        - 5.98 x HQS 1
    - FRTBC:
        - 5.98 x HQS 6
- Clearing of up to 636 suitable DBH trees (co-located located with vegetation to be cleared).
- Clearing of 18 suitable DBH trees containing potentially suitable hollows.
- No loss of known roosting trees.
- Loss of 122 trees with suitable DBH considered to be potential roosting habitat.

4.3. INDIRECT IMPACTS

4.3.1. INTRODUCTION AND/OR SPREAD OF WEEDS AND DIEBACK

Three Declared plants or Weeds of National Significance were identified within the DE during the surveys (Ecoedge, 2021; 2022; 2023). The majority of these are however located outside of proposed disturbance areas in Lot 20 and Lot 64. Two locations of Cape Tulip are within proposed disturbance areas within Lot 62 and will be managed in accordance with the Weed and Dieback Management Plan (MS810 Condition 9).

Phytophthora Dieback surveys conducted by BARK Environmental (2021a; 2021b; 2023), assessed for the potential presence of *Phytophthora* Dieback within the Proposal area. All of the proposed disturbance area within the Proposal was mapped as Excluded given it is mostly cleared pasture with little to no vegetation or indicator species. Dieback will continue to be managed as per the Weed and Dieback Management Plan (MS810 Condition 9) and is therefore unlikely to pose any risk of spread or introduction into other areas of vegetation as a result of mining activities.

4.3.2. DUST GENERATION

An extensive dust monitoring program is already in place at the Keysbrook Mine. Dust emissions are within limits set under Condition 15 of MS810. Elevated dust levels are recorded on occasions, particularly under seasonally dry soil conditions and sustained strong winds. Dust deposition is generally not evident on remnant vegetation and there has been no decline in vegetation condition within or around the mine site,

based on visual assessment and wetland vegetation condition monitoring. Inclusion of the Proposal area is unlikely to increase the risk of dust deposition on native vegetation, and KLPL will continue to implement the Air Quality and Dust Management Plan as per Condition 15 of MS810.

4.3.3. INCREASED RISK OF FIRE

Fire may have an indirect impact on the condition of native vegetation comprising Black Cockatoo habitat. Fire may alter the vegetation structure via mortality of native flora and the spread of introduced flora/weeds. The most common risk of fire ignition source is hot works such as grinding or welding of steel during the construction, or vehicles driving over grassy vegetation, but the risk of fire from the project is considered low and will be managed as per the exiting Mine operations and management measures. As such the Proposed Action is not expected to result in increased risk of fire that could result in significant impacts to Black Cockatoos.

4.4. ASSESSMENT OF IMPACTS ON MNES

This section provides an assessment of the significance of the impacts of the Proposed Action on protected matters (as well as Baudins Black Cockatoo), assessed against the Significant Impact Guidelines 1.1 (DotE, 2013).

Overview of Impacts

The Proposed Action will result in the following impacts to CBC, BBC and FRTBC:

- Clearing of up to 21.15ha of native vegetation (inc 636 trees with DBH >500mm) considered to be Black Cockatoo foraging habitat.
- Clearing of 5.98ha of planted trees (Tasmanian blue gums) considered to be low-quality foraging habitat.
- Clearing a total of 18 potential nesting trees with possibly suitable hollows;
- Clearing of 122 trees with suitable DBH considered to be potential roosting habitat.

The following table provides an assessment of the potential impacts of the Proposed Action on Black Cockatoos using the Endangered (CBC and BBC) and Vulnerable (FRTBC) species significant impact criteria (DotE, 2013).

TABLE 15: ASESSMENT OF POTENTIAL IMPACTS OF PROPSOED ACTION TO CARNABYS BLACK COCKATOO

SIGNIFICANT IMPACT CRITERIA	ASSESSMENT FOR CBC AND BBC
Lead to a long-term decrease in the size of a population	Not Significant The Proposed Action is not expected to lead to a long-term decrease in population size of CBC or BBC as: • It will not result in clearing of any known roosting trees. • Clearing will remove 636 trees with DBH>500mm, however at least 487 trees with DBH>500mm within the DE will remain. Furthermore 1738 trees with DBH>500mm within Lot 56, ~500m east of Proposed Action will also remain. • Black Cockatoos are highly mobile species and are expected to forage outside of the DE in areas of better-quality vegetation to the

SIGNIFICANT IMPACT CRITERIA	ASSESSMENT FOR CBC AND BBC
	east on the Darling Scarp. A total of 2,041ha in State managed lands occur within 6km and 15,158ha within 12km of the Proposed Action. In addition, suitable foraging habitat and a known roosting tree is present immediately adjacent to the DE in Lot 202 (KLPL Offset Site for EPBC2005/2016). • Clearing 21.15ha of native vegetation represents ~4% of the total disturbance area for the Proposed Action and ~102ha of native vegetation within the DE has been avoided. • KLPL will revegetate an area of ~30ha of native vegetation with suitable species for Black Cockatoo habitat.
Reduce the area of occupancy of the species	Not Significant The Proposed Action is located within the mapped distribution of CBC and BBC (DSEWPaC, 2012b), however no evidence of either species was identified during the field surveys (BCE, 2022) (BCE, 2024). The distribution for each species are slightly different, with the CBC extending into the Wheatbelt north to Kalbarri and east to Esperance, and the BBC occurring predominately within the Jarrah Forest and Swan Coastal Plain zones, approximately from Northan and Muchea near Pert, and south to Albany. Given the presence of available habitat to the east, which includes 2,041ha within 6km and 15,158ha within 12km, as well as the immediate vegetation with Lot 202 and 56 (50ha and 85ha respectively), the proposed clearing of 27.13ha foraging habitat (21.15ha native vegetation and 5.98 planted trees) is unlikely to significantly reduce the area of occupancy of the species.
Fragment an existing population into two or more	Not Significant Clearing of 27.13ha foraging habitat (21.15ha native vegetation and 5.98 planted trees) is not expected to fragment populations of the CBC or BBC due to the following: • The area of clearing is primarily within cleared agricultural areas; • 102ha of native vegetation with the DE has been avoided, and adjacent areas immediately to the east containing 135ha will remain, noting that Lot 202 is an EPBC Offset Site and any clearing within Lot 56 would require assessment under the EPBC Act. • Black Cockatoos are highly mobile species and are expected to forage outside of the DE, including 2,041ha within 6km and 15,158ha within 12km of foraging resources.
Adversely affect habitat critical to the survival of a species	Potentially Significant Habitat critical to the survival of CBC and BBC has been addressed in the Recovery Plan and Conservation Advice (DPaW, 2013) (TSSC, 2018). The Proposed Action will remove up to 18 potentially suitable hollows, although none are currently in use.

SIGNIFICANT IMPACT CRITERIA	ASSESSMENT FOR CBC AND BBC
	Results of the Black Cockatoo Habitat assessments, confirmed 12 Black-Cockatoo roost sites are present within a 12km buffer of the DE (Birdlife 2022). Of these, four confirmed roost sites are in close proximity to the DE (Figure 6 in BCE, 2022) (Birdlife 2022, DBCA 2022). The closest roost site ('Roost 3') is within Lot 62 (central east), which is within open Eucalypt woodland (in KLPL Offset Site). The second nearest roost site ('Roost 2') is in quality Marri and Jarrah woodland to the east of the DE, within Lot 202 (KLPL Offset Site). Both of the Offset sites are part of the Original Project approvals (EPBC 2005/2016). A third roost site is in a small patch of woodland 1.5km east-southeast of Lot 62 ('Roost 4'). The furthest roost site is approximately 2.7km west of Lot 507 ('Roost 1'). There are no roost sites within the DE, however due to the presence of the 4 nearby roost sites, the presence of foraging habitat within the DE has value in supporting these roosting sites. A total of 2,041ha in State managed lands occur within 6km and 15,158ha within 12km of the Proposed Action (Figure 4-1), as well as the immediate vegetation with Lot 202 and 56 (135ha). Clearing of 21.15ha of native vegetation/foraging habitat represents a reduction of ~1% within 6km and ~0.14% within 12km in this extent. Based on the above, the proposed clearing of 27.13ha foraging habitat (21.15ha native vegetation and 5.98 planted trees) for CBC and BBC is considered potentially significant, however it is a small decline in habitat critical to the survival of the species in the local area.
Disrupt the breeding cycle of a population	Not Significant The Proposed Action is not expected to disrupt the breeding cycle of a population of CBC or BBC as no known breeding occurs within the DE. There are also 12 Black-Cockatoo roost sites present within a 12km buffer of the DE (Birdlife 2022). The Proposed Action is also outside of the predicted or known breeding range of the BBC (DSEWPaC, 2012b).
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Not Significant The Proposed Action is not expected to impact the availability or quality of habitat to the extent that CBC or BBC are likely to decline. The Proposed Action will result in clearing of 27.13ha of foraging habitat (21.15ha native vegetation and 5.98 planted trees), 636 suitable DBH trees including 18 with possibly suitable hollows (none in use). This reduction in foraging and potential future breeding habitat for CBC and BBC may result in a minor residual impact associated with the Proposed Action. However, it is not expected to result in the decline of the species, due to the availability of suitable habitat remaining within the DE (~102ha) as well as outside of the DE in larger continuous patches. A total of 2,041ha in State managed lands occur within 6km and 15,158ha within 12km of the Proposed Action.
Result in invasive species that are harmful to a critically endangered,	Not Significant

SIGNIFICANT IMPACT CRITERIA	ASSESSMENT FOR CBC AND BBC
endangered species becoming established in the endangered or critically endangered species habitat	Three Declared plants or Weeds of National Significance were identified within the DE during the Flora and Vegetation surveys (Ecoedge, 2021; 2022; 2023). The majority of these are however located outside of proposed disturbance areas in Lot 20 and Lot 64. Two locations of Cape Tulip are within proposed disturbance areas within Lot 62 and will be managed in accordance with the Weed and Dieback Management Plan (MS810 Condition 9). With implementation of the Weed and Dieback Management Plan, the Proposed Action is unlikely to result in the introduction or spread of new weed species to the area and as such the overall impact to CBC and BBC is not considered significant.
Introduce disease that may cause the species to decline	Not Significant The Proposed Action includes implementation of the Weed and Dieback Management Plan, and as such the Proposed Action is unlikely to result in the introduction or spread of dieback to the area and as such the overall impact to CBC and BBC is not considered significant. Carnaby's Black Cockatoo Recovery Plan (DPaW, 2013) identifies potential bird diseases such as Beak and Feather Disease (BFDV), Avian Polymovirus (APV) and Carnaby's Hindlimb Paralysis (CHiPs) that could pose a threat to Black Cockatoos but does not identify any high-risk activities for spreading disease or management measures that could prevent the disease. The presence of any disease within the DE or surround is unknown. It is assumed that the highest risk of introducing/spreading of disease would be associated with handling of Black Cockatoos. The Proposed Action is expected to involve no handling of Black Cockatoos, other than rescue. A suitably qualified fauna handler (with an understanding of animal disease control) will be engaged to undertake this task, if required. Therefore, the Proposed Action is considered unlikely to result in introduction of any disease that could cause the species to decline.
Interfere with the recovery of the species	Not Significant The Proposed Action is not inconsistent with the Black Cockatoo Recovery Plans as detailed in Section 6. The Recovery Plans and Conservation Advice (DPaW, 2013) (TSSC, 2018) provide measures for the species recovery. These include identifying, protecting and managing important habitat. The Proposed Action will result in clearing of 27.13ha foraging habitat (21.15ha native vegetation and 5.98 planted trees) and potential breeding habitat for CBC, however, this loss is unlikely to interfere with the recovery of the species in the local area. It is noted that the Proposed Action is not within the predicted or known breeding range of the BBC (DSEWPaC, 2012b).

TABLE 16: ASESSMENT OF POTENTIAL IMPACTS OF PROPSOED ACTION TO FOREST RED-TAILED BLACK COCKATOO

SIGNIFICANT IMPACT CRITERIA	ASSESSMENT FOR FOREST RED-TAILED BLACK COCKATOO (FRTBC)
Lead to a long-term decrease in the size of a population	Not Significant The Proposed Action is not expected to lead to a long-term decrease in population size of FRTBC as: • It will not result in clearing of any known roosting trees. • Clearing will remove 636 trees with DBH>500mm, however at least 487 trees with DBH>500mm within the DE will remain. Furthermore 1738 trees with DBH>500mm within Lot 56, ~500m east of Proposed Action will also remain. • Black Cockatoos are highly mobile species and are expected to forage outside of the DE in areas of better-quality vegetation, predominantly to the east on the Darling Scarp. A total of 2,041ha in State managed lands occur within 6km and 15,158ha within 12km of the Proposed Action. In addition, suitable foraging habitat and a known roosting tree is present immediately adjacent to the DE in Lot 202 (KLPL Offset Site for EPBC2005/2016). • Clearing 27.13ha foraging habitat (21.15ha native vegetation and 5.98 planted trees) represents ~4% of the total disturbance area for the Proposed Action and ~102ha of native vegetation within the DE has been avoided. • KLPL will revegetate an area of ~30ha of native vegetation with suitable species for Black Cockatoo habitat.
Reduce the area of occupancy of the species	Not Significant The Proposed Action is located within the mapped distribution of FRTBC (DSEWPaC, 2012b), with their confirmed presence identified during the field surveys (BCE, 2029) (BCE, 2022) (BCE, 2024). FRTBC distribution extents from north of Perth to Albany and also around Mt Helena in the east. Given the presence of available habitat to the east which includes 2,041ha in State managed lands within 6km and 15,158ha within 12km of the Proposed Action (Figure 4-1), as well as the immediate vegetation with Lot 202 and 56 (135ha), the proposed clearing of 27.13ha foraging habitat (21.15ha native vegetation and 5.98 planted trees) is unlikely to significantly reduce the area of occupancy of the species.
Fragment an existing population into two or more	Not Significant Clearing of 27.13ha foraging habitat (21.15ha native vegetation and 5.98 planted trees) is not expected to fragment populations of FRTBC due to the following: • The area of clearing is primarily within cleared agricultural areas;

SIGNIFICANT IMPACT CRITERIA	ASSESSMENT FOR FOREST RED-TAILED BLACK COCKATOO (FRTBC)
	• 102ha of native vegetation with the DE has been avoided, and adjacent areas immediately to the east containing 135ha will remain, noting that Lot 202 is an EPBC Offset Site and any clearing within Lot 56 would require assessment under the EPBC Act. • Black Cockatoos are highly mobile species and are expected to forage outside of the DE, including 2,041ha in State managed lands within 6km and 15,158ha within 12km of the Proposed Action.
Adversely affect habitat critical to the survival of a species	**Potentially Significant** Habitat critical to the survival of FRTBC has been addressed in the Conservation Advice (DEWHA, 2009). The Proposed Action will remove up to 18 potentially suitable hollows, although none are currently in use. Results of the Black Cockatoo Habitat assessments, confirmed 12 Black-Cockatoo roost sites are present within a 12km buffer of the DE (Birdlife 2022). Of these, four confirmed roost sites are in close proximity to the Dev Env (Figure 6 in BCE, 2022) (Birdlife 2022, DBCA 2022). The closest roost site ('Roost 3') is within Lot 62 (central east), which is within open Eucalypt woodland (in KLPL Offset Site). The second nearest roost site ('Roost 2') is in quality Marri and Jarrah woodland to the east of the DE, within Lot 202 (KLPL Offset Site). Both of the Offset sites are part of the Original Project approvals (EPBC 2005/2016). A third roost site is in a small patch of woodland 1.5km east-southeast of Lot 62 ('Roost 4'). The furthest roost site is approximately 2.7km west of Lot 507 ('Roost 1'). There are no roost sites within the DE, however due to the presence of the 4 nearby roost sites, the presence of foraging habitat within the DE has value in supporting these roosting sites. Foraging habitat within 6km of nesting sites is considered most important for nesting success, however foraging habitat up to 12km away has value (DPaW, 2013). The Proposed Action will remove foraging habitat within 6km of a known nesting Site, however, there is an estimated 2,041ha of suitable foraging habitat within 6km of the nearest nesting site to the DE and 15,158ha within 12km. Clearing of 27.13ha foraging habitat (21.15ha native vegetation and 5.98 planted trees) represents a reduction of ~1% (6km) and ~0.14% (12km) in this extent. Based on the above, the proposed clearing of 27.13ha of foraging habitat for FRTBC is considered potentially significant, however it is a small decline in habitat critical to the survival of the species in the local area.
Disrupt the breeding cycle of a population	**Not Significant** The Proposed Action is not expected to disrupt the breeding cycle of a population of FRTBC as no known breeding occurs within the DE and there is availability of other foraging resources (2,041ha within State Managed lands) within 6km of the closest nesting site. There are also 12 Black-Cockatoo roost sites present within a 12km buffer of the DE (Birdlife 2022) and 15,158ha of state managed lands.

SIGNIFICANT IMPACT CRITERIA	ASSESSMENT FOR FOREST RED-TAILED BLACK COCKATOO (FRTBC)
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Not Significant The Proposed Action is not expected to impact the availability or quality of habitat to the extent that FRTBC are likely to decline. The Proposed Action will result in clearing of 27.13ha foraging habitat (21.15ha native vegetation and 5.98 planted trees), 636 suitable DBH trees including 18 with possibly suitable hollows (none in use). This reduction in foraging and potential future breeding habitat for FRTBC may result in a minor residual impact associated with the Proposed Action. However, it is not expected to result in the decline of the species, due to the availability of suitable habitat remaining within the DE (~102ha) as well as outside of the DE in larger continuous patches (i.e. 2,041ha within 6km and 15,158ha within 12km of the Proposed Action).
Result in invasive species that are harmful to a critically endangered, endangered species becoming established in the endangered or critically endangered species habitat	Not Significant Three Declared plants or Weeds of National Significance were identified within the DE during the Flora and Vegetation surveys (Ecoedge, 2021; 2022; 2023). The majority of these are however located outside of proposed disturbance areas in Lot 20 and Lot 64. Two locations of Cape Tulip are within proposed disturbance areas within Lot 62 and will be managed in accordance with the Weed and Dieback Management Plan (MS810 Condition 9). With implementation of the Weed and Dieback Management Plan, the Proposed Action is unlikely to result in the introduction or spread of new weed species to the area and as such the overall impact to FRTBC is not considered significant.
Introduce disease that may cause the species to decline	Not Significant The Proposed Action includes implementation of the Weed and Dieback Management Plan, and as such the Proposed Action is unlikely to result in the introduction or spread of dieback to the area and as such the overall impact to FRTBC is not considered significant. Carnaby's Black Cockatoo recovery plan (DPaW, 2013) identifies potential bird diseases such as Beak and Feather Disease (BFDV), Avian Polymovirus (APV) and Carnaby's Hindlimb Paralysis (CHiPs) that could pose a threat to Black Cockatoos (assuming to FRTBC as well) but does not identify any high-risk activities for spreading disease or management measures that could prevent the disease. The presence of any disease within the DE or surrounds is unknown. It is assumed that the highest risk of introducing/spreading of disease would be associated with handling of Black Cockatoos. The Proposed Action is expected to involve no handling of Black Cockatoos, other than rescue. A suitably qualified fauna handler (with an understanding of animal disease control) will be engaged to undertake this task, if required. Therefore, the Proposed Action is considered unlikely to result in introduction of any disease that could cause the species to decline.
Interfere with the recovery of the species	Not Significant

SIGNIFICANT IMPACT CRITERIA	ASSESSMENT FOR FOREST RED-TAILED BLACK COCKATOO (FRTBC)
	The Proposed Action is not inconsistent with the FRTBC conservation advice as detailed in Section 6. The Conservation Advice (DEWHA, 2009) identifies threats to the species. These include habitat loss and restricted quantity of suitable nesting hollows. The proposed action will not involve clearing of any known roosting trees, however 18 trees with potentially suitable hollows will be cleared. The Proposed Action is likely to result in minor residual impacts to FRTBC including foraging and potential breeding habitat, however this loss is unlikely to interfere with the recovery of the species.

5. AVOIDANCE, MITIGATION AND REHABILITATION MEASURES

5.1. AVOIDANCE

The Proposed Action has been designed to utilise existing cleared pasture areas (i.e. 485.81ha) and avoid the need for clearing native vegetation/foraging habitat as far as practicable. This has resulted in ~102ha of native vegetation being successfully avoided from disturbance for vegetation within the DE. In addition, one rank 2 tree containing potentially suitable hollows will be avoided from disturbance within Lot 64 with a 10m buffer being placed around this tree. A setback of 10m from mine voids to native vegetation will also be in place for the Proposed Action.

5.2. MINIMISE

KLPL will implement several key mitigation and management measures to reduce where practicable impacts to Black Cockatoo habitat. These include:

Black Cockatoo Surveys

In order to minimise impacts to Black Cockatoo habitat, KLPL engaged BCE to conduct Black Cockatoo surveys to identify suitable foraging and potential nesting habitat within the DE. Following these surveys, additional targeted assessment of trees with suitable DBH that contained possibly suitable hollows were undertaken to confirm suitability for potential nesting was undertaken by BCE and ABCS (see Section 3). This information allowed KLPL to avoid ~102ha of foraging habitat and potential nesting trees as far as practicable.

During commencement of the Action to further minimise impacts to Black Cockatoo habitat, KLPL will implement the following management measures:

- Clearing boundaries will be demarcated and approved by KLPL Environmental Officer.
- Vegetation and trees to be retained to be clearly demarcated prior to the commencement of clearing;
- Access into the DE will be restricted as far as practicable during clearing activities;
- During Black Cockatoo breeding season, any tree with a hollow suitable for Black Cockatoos (18 trees) will be inspected by a suitably qualified fauna consultant within seven days of clearing.
- If Black Cockatoo breeding is detected in any of the 18 trees with potential suitable hollows, then all trees within 10m of the hollow will be demarcated and retained until hollows are no longer in use.
- Revegetation activities (see section 6.1.3) will incorporate Black Cockatoo habitat species endemic to the region, where practicable.

Existing Ministerial Condition's

In accordance with MS810, KLPL will continue to implement the following key management measures to minimise impacts to terrestrial fauna values:

- MS810 Condition 6 - Protection of Native Vegetation.
    - 6-3 The proponent shall not clear any native vegetation within the Proposal area unless the land to be cleared is required for the extraction of mineral ore within 6 months of the date of clearing.
- MS810 Condition 7 - Protection of Watercourses and wetlands.

- 7-1 The proponent shall not clear vegetation or undertake mining activities:
    a. Within 20m of the banks of watercourses shown in Fig 9 of the PER document.
    b. Within 100m of the boundary of a conservation category wetland.

- MS810 Condition 9 - Weed and Dieback Management.
    - 9-1 Prior to the commencement of operations, the proponent shall prepare and submit a Dieback and Weed Management Plan to the requirements of the CEO.
    - 9-2 The proponent shall implement the Plan.

5.3. REHABILITATE

Clearing of 21.15ha native vegetation, will be revegetated in accordance with the requirements of the approved Rehabilitation Management Plan (MS810 Condition 8). This will include revegetation of ~30ha of local native provenance species (i.e. at a ratio of 1.4ha:1ha of native vegetation) within the DE. The revegetation will be undertaken with the objective of contributing to enhanced natural ecosystem function in the local area (e.g., such as by extending/establishing a native vegetation) and providing additional Black Cockatoo foraging habitat.

5.4. SUMMARY OF MITIGATION MEASURES

In accordance with the hierarchy of on-site mitigation measures presented in the Offset Guidelines, the following tables summarises the mitigation measures to avoid, minimise and rehabilitate impacts prior to the application of environmental offsets.

TABLE 17: SUMMARY OF MITIGATION MEASURES AND RESIDUAL IMPACTS

ENVIRONMENTAL VALUE	APPLICABLE LEGISLATION	IMPACT MITIGATION			SIGNIFICANT RESIDUAL IMPACT
		AVOID	MINIMISE	REHABILITATE	
CBC, FRTBC and BBC foraging, potential nesting and potential roosting habitat.	*Biodiversity Conservation Act 2016* *EPBC listed species and communities (s18 and 18A)*	KLPL has avoided clearing ~102ha of Black Cockatoo potential nesting and foraging habitat (including 1 x Rank 2 tree), by utilising as far as practicable, cleared agricultural land which has resulting in all but 4% of the disturbance area being located on cleared pasture. One tree with suitable DBH containing a potentially suitable hollow has also been avoided from disturbance within Lot 64 with a 10m setback provided.	Targeted assessment of all trees with suitable DBH containing possibly suitable hollows was conducted to assist with design of the Proposed Action. Prior to clearing for the Proposed Action, KLPL will ensure the following: • Clearing boundaries will be demarcated and approved by KLPL Environmental Officer; • Vegetation and trees to be retained to be clearly demarcated prior to the commencement of clearing; • Access into the DE will be restricted as far as practicable during clearing activities; • During Black Cockatoo breeding season, any tree with a hollow suitable for Black	Progressively staged mining and rehabilitation of vegetation at the rate of 1ha:1.4ha (as per MS810, Condition 8), resulting in creation of ~30ha of Black Cockatoo habitat.	27.13ha of Black Cockatoo foraging habitat (comprising 21.15ha of native vegetation and 5.98ha of non-native planted species), 18 potential nesting trees and 122 trees representing potential roosting habitat.

ENVIRONMENTAL VALUE	APPLICABLE LEGISLATION	IMPACT MITIGATION			SIGNIFICANT RESIDUAL IMPACT
		AVOID	MINIMISE	REHABILITATE	
			Cockatoos (18 trees) will be inspected by a suitably qualified fauna consultant within seven days of clearing; • If Black Cockatoo breeding is detected in any of the 18 hollows, then all trees within 10m of the hollow will be demarcated and retained until hollows are no longer in use; KLPL will also implement the existing MS810 conditions including: • MS810 Condition 6 - Protection of Native Vegetation. • Condition 7 - Protection of Watercourses and wetlands • Condition 9 - Weed and Dieback Management.		

5.5. EFFECTIVENESS OF AVOIDANCE AND MITIGATION MEASURES

Doral has a strong track record of developing and implementing best practice in environmental management and implementation of mitigation measures relevant to Black Cockatoos. The measures proposed have been successfully implemented in past Projects subject to EPBC conditions and management measures including the following:

- Keysbrook Mineral Sands Project (EPBC 2005/2016);
- Burekup Western Extension to the Dardanup Mineral Sands Project (EPBC 2008/4673);
- Southern Extension to the Dardanup Mineral Sands Project (EPBC 2011/6087);
- Waterloo Heavy Mineral Mining Project (EPBC 2013/6879);
- Yoongarillup Mineral Sands Project (EPBC 2012/6521);
- Yalyalup Mineral Sands Project (EPBC 2017/8094).

KLPL (and Doral) is not subject to any past or present proceedings under Commonwealth or State law for protection of the environment or conservation and sustainable sue of natural resources. KLPL (and Doral) track record indicates a history of effective implementation and monitoring of management measures to ensure effectiveness. KLPL (and Doral) have also demonstrated effective implementation of corrective actions when effectiveness does not meet completion criteria.

5.6. SUMMARY OF SIGNIFICANT RESIDUAL IMPACTS

Significant residual impacts associated with the Proposed Action, after consideration of other mitigation measures to be applied, are anticipated to be:

- Clearing of 27.13ha of Black Cockatoo foraging habitat (21.15ha of native vegetation and 5.98ha of planted non-native vegetation) including:
    - 18 trees with suitable DBH containing possibly suitable hollows, but no evidence of use.
    - 122 trees considered to be potential roosting habitat (within 500m of a known roost tree).

These key mitigation measures together with the offsets package to be negotiated and secured (as discussed in the following sections), KLPL believes that there would be a 'net environmental benefit' resulting from implementation of the Proposal/Proposed Action, in accordance with EPA/DCCEEW goals.

5.7. ASSESSMENT AGAINST RECOVERY PLANS

The relevant recovery plans considered during the assessment of the Proposed Action are outlined in the following table.

TABLE 18: ASSESSMENT AGAINST RECOVERY AND THREAT ABATEMENT PLANS

RECOVERY PLAN	PRIORITY ACTIONS	ASSESSMENT AGAINST PLAN
Carnaby's Black Cockatoo (CBC) Carnaby's (*Calyptorhynchus latirostris*) Recovery Plan, Department of Parks and Wildlife, Perth, WA (DPaW, 2013).	The objective of this Recovery is to stop further decline in the distribution and abundance of CBC by protecting the birds throughout their life stages and enhancing habitat critical for survival throughout their breeding and non-breeding range, ensuring that the reproductive capacity of the species remains stable or increases. The recovery actions within the Plan include: • Protect and manage breeding habitat and associated feeding habitat. • Protect and manage non-breeding habitat. • Undertake regular monitoring. • Conduct research to inform management. • Manage other impacts. • Engage with the broader community. • Undertake information and communication activities. The Plan specifies activities that will adversely affect CBC should be avoided and then minimise or mitigate if avoidance cannot be achieved.	The Proposed Action is consistent with the recommendations of the Recovery Plan through the following: • The Proposed Action will involve clearing 27.13ha of foraging habitat for CBC. However, one offset site will be purchased and secured in perpetuity for conservation purposes. The Offset Site will be revegetated with suitable foraging species as detailed in the Offset Management Plan (Western Botanical, 2025b). • The Proposed Action has been designed to utilise the existing cleared farmland as far as practicable which has resulted in the avoidance of ~102ha of native vegetation within the DE. • The Proposed Action will not involve clearing of any known roosting or nesting trees, however 18 trees with suitable DBH contain potentially suitable hollows and 122 trees with suitable DBH are considered to be potential roosting habitat. • BCE conducted surveys for Black Cockatoos within the DE and the assessment included consideration of CBC habitat mapping. • The Proposed Action has been planned and designed to minimise clearing of potential

RECOVERY PLAN	PRIORITY ACTIONS	ASSESSMENT AGAINST PLAN
		nesting trees and foraging habitat for CBC, which has resulted in the avoidance of ~102ha of native vegetation within the DE. • The Proposed Action incorporates design, construction and management measures to protect potential nesting and foraging habitat in adjacent vegetation within the DE. • Planning and design of the Proposed Action has involved consultation with relevant stakeholders including the broader community. The Proposed Action is not inconsistent with the Carnaby's Black Cockatoo Recovery Plan (DPaW, 2013).
Baudin's Black Cockatoo (BBC) Conservation Advice *Calyptorhynchus baudinii* Baudins Cockatoo	The Recovery Plan adopted for the species ceased to be in effect from 1 October 2021 and has not been replaced. However, the approved Conservation Advice is considered sufficient for assessing the Proposed Action. The primary threats listed in the conservation advice include: • Habitat loss from land clearing activities. • Nest hollow shortages. • Fire events. • Competition with native and invasive species (European Honeybees).	The Proposed Action is not inconsistent with the recommendations of the Conservation Advice through the following: • The Proposed Action will involve clearing 27.13ha of foraging habitat for BBC. However, one offset site will be purchased and secured in perpetuity for conservation purposes. Portions of the Offset Site will also be revegetated with suitable foraging species as detailed in the Offset Management Plan. • The Proposed Action has been designed to utilise the existing cleared farmland as far as practicable which has resulted in the

RECOVERY PLAN	PRIORITY ACTIONS	ASSESSMENT AGAINST PLAN
	• Injury or death from invasive species (European Honeybees). • Illegal shooting. • Phytopathogens. • Climate change. The priority actions include: • Limiting the amount of illegal shooting. • Increasing the number of nest hollows through limiting the loss of mature trees. With respect to habitat loss, disturbance and modifications, the priorities include: • Develop and implement a policy for the identification of old growth forest areas for retention and protection of existing hollow bearing trees and future habitat trees that may develop hollows in the next 50-100 years. • Undertake habitat restoration by revegetating suitable areas with key tree species. • Manage fire regime. • Develop and implement control program for reduction of feral European honeybees. • Implement management actions to reduce spread of phytopathogens, manage and contain infested areas and protect non-infected areas.	avoidance of ~102ha of native vegetation within the DE. • The Proposed Action will not involve clearing of any known roosting or nesting trees, however 18 trees with suitable DBH contain potentially suitable hollows and 122 trees with suitable DBH are considered to be potential roosting habitat. It is noted the Proposed Action is outside of the known or predicted breeding range for BBC. • BCE conducted surveys for Black Cockatoos within the DE and the assessment included consideration of BBC habitat mapping by DBCA. • The Proposed Action is not expected to increase the prevalence of feral honeybees or risk of illegal shooting. • The Proposed Action has been planned and designed to minimise clearing of potential nesting trees and foraging habitat for BBC, which has resulted in the avoidance of ~102ha of native vegetation within the DE. • The Proposed Action incorporates design, construction and management measures to protect potential nesting and foraging habitat in adjacent vegetation within the DE. • Planning and design of the Proposed Action has involved consultation with relevant

RECOVERY PLAN	PRIORITY ACTIONS	ASSESSMENT AGAINST PLAN
		stakeholders including the broader community. The Proposed Action is not inconsistent with the approved Conservation Advice for BBC.
Forest Red-tailed Black Cockatoo (FRTBC) Conservation Advice *Calyptorhynchus banksia naso* Forest red-tailed Black Cockatoo (DEWHA, 2009)	The Recovery Plan adopted for the species ceased to be in effect from 1 October 2021 and has not been replaced. However, the approved Conservation Advice is considered sufficient for assessing the Proposed Action. The primary threats listed in the conservation advice include: • Habitat loss from land clearing and fire. • Nest hollow shortages. • Competition with other species. • Injury or death from invasive species (European Honeybees). • Illegal shooting. The priority actions include: • Determine and implement measures to reduce effect of the Proposed Action. • Determine and implement measures to manage forest for the conservation of the species.	The Proposed Action is not inconsistent with the recommendations of the Conservation Advice through the following: • The Proposed Action will involve clearing 27.13ha of foraging habitat for FRTBC. However, one offset site will be purchased and secured in perpetuity for conservation purposes. Portions of the Offset Site will also be revegetated with suitable foraging species as detailed in the Offset Management Plan. • The Proposed Action has been designed to utilise the existing cleared farmland as far as practicable which has resulted in the avoidance of ~102ha of native vegetation within the DE. • The Proposed Action will not involve clearing of any known roosting or nesting trees, however 18 trees with suitable DBH contain potentially suitable hollows and 122 trees with suitable DBH are considered to be potential roosting habitat. • BCE conducted surveys for Black Cockatoos within the DE and the assessment included

RECOVERY PLAN	PRIORITY ACTIONS	ASSESSMENT AGAINST PLAN
	• Develop and implement management plan for the control and reduction of feral European Honeybees.	consideration of FRTBC habitat mapping by DBCA. • The Proposed Action is not expected to increase the prevalence of feral honeybees or risk of illegal shooting. • The Proposed Action has been planned and designed to minimise clearing of potential nesting trees and foraging habitat for FRTBC, which has resulted in the avoidance of ~102ha of native vegetation within the DE. • The Proposed Action incorporates design, construction and management measures to protect potential nesting and foraging habitat in adjacent vegetation within the DE. • Planning and design of the Proposed Action has involved consultation with relevant stakeholders including the broader community. • The Proposed Action is not inconsistent with the approved Conservation Advice for FRTBC.

6. OFFSET FRAMEWORK

6.1. RATIONALE FOR OFFSET STRATEGY

KLPL has developed this offset strategy to counterbalance the significant residual impacts of the Proposed Action to Black Cockatoo habitat after application of the avoidance and mitigation measures. The proposed offset site is Freehold land that will be placed under a restrictive Conservation Covenant with the National Trust of WA.

The land acquisition of like-for-like habitat is becoming increasingly challenging in Western Australia and it is not always possible to find available remnant vegetation of the same type on privately owned property.

The initial Offset Strategy provided to DCCEEW for assessment as part of the Referral of the Proposed Action, was considered to be of too higher quality foraging and breeding habitat, with little improvements to the Habitat Quality Score (HQS) (i.e. conservation gain) deemed possible by DCCEEW. As such an alternative Offset Site has been identified where it is considered possible to provide an increase to the quality of foraging habitat thus providing a significant enhancement to the existing potential nesting and breeding habitat and connectivity with neighbouring lands held under State Forest and Conservation.

6.2. REGULATORY FRAMEWORK

Consideration of environmental offsets is required by both the WA State Government and Australian Government to ensure a proposal results in a net environmental benefit. Where a Proposal is being assessed in parallel under the EP Act and the EPBC Act, agencies will endeavour to align offset requirements.

6.3. POLICY FRAMEWORK

Where a significant residual environmental impact has been identified, both the WA Government and the Australian Government have policies regarding offsets. These are:

- *WA Environmental Offsets Policy, September 2011* (Government of Western Australia, 2011)*;*
- *WA Environmental Offsets Guidelines* (Government of Western Australia, 2014)*;*
- *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy Oct 2012* (DSEWPaC, 2012a)*.*
- *Public Advice: Considering environmental offsets at a regional scale* (EPA, 2024)*.*

6.4. WA ENVIRONMENTAL OFFSETS POLICY & CONSERVATION ADVICE

6.4.1. WA OFFSETS POLICY

Offsets are used to compensate for residual environmental impacts and are designed to achieve long-term outcomes, building on existing conservation programs and initiatives. Where a significant residual environmental impact has been identified, the WA Environmental Offsets Policy (Government of Western Australia, 2011) (Offsets Policy) seeks to ensure that environmental offsets are applied in a transparent manner to engender certainty and predictability, while acknowledging that there are some environmental values that are not readily replaceable (Government of Western Australia, 2011).

When considering proposed environmental offsets, the EPA is guided by the following principles as outlined in the Offsets Policy (Government of Western Australia, 2011):

- Environmental offsets will only be considered after avoidance and mitigation options have been pursued;
- Environmental offsets are not appropriate for all projects;
- Environmental offsets will be cost-effective, as well as relevant and proportionate to the significance of the environmental value being impacted;
- Environmental offsets will be based on sound environmental information and knowledge;
- Environmental offsets will be applied within a framework of adaptive management;
- Environmental offsets will be focussed on longer term strategic outcomes.

6.4.2. WA ENVIRONMENTAL OFFSETS GUIDELINES

The WA Government Environmental Offsets Guidelines (Government of Western Australia, 2014) (Offset Guidelines) are intended to complement the Offsets Policy by clarifying the determination and application of environmental offsets in Western Australia (Government of Western Australia, 2014). The Offsets Guidelines outline the methodology for determining an appropriate offset by identifying the key elements that should be considered to ensure that decisions made on environmental offsets are consistent and accountable under the EP Act.

The Offset Guidelines outline the framework for consideration of offsets required under the environmental approvals process, including demonstrated application of the mitigation measures and assessment of the residual impacts in relation to relevant EPA environmental factors (Government of Western Australia, 2014). The provision of offsets is the final mitigation option available to help manage significant adverse impacts.

A detailed assessment of how the offset package complies with principles 1-6 is provided in Section 10.

6.4.3. DBCA ADVICE

The Strategy considers the DBCA, Threatened Ecological Community Fact Sheet for '*Corymbia calophylla* woodlands on heavy soils of the southern Swan Coastal Plain (floristic community type 1b as originally described in Gibson et. Al. 1994)'.

6.4.4. EPA CONSIDERATION OF REGIONAL OFFSETS

This Public Advice was published by EPA (in March 2024) to 'Provide independent strategic advice that improves environmental protection and policy' and is consistent with its functions and powers under sections 16 and 17 of the EP Act. The Advice notes that offsets are the final component of the mitigation hierarchy and should only be considered after all measures to avoid, minimise, and mitigate impacts from the implementation of a proposal or scheme have been fully exhausted. Once applied, offsets are the principal method for proposals to contribute to regional environmental enhancement. Through consideration of the regional scale, there is an opportunity to allow offsets and other enhancement measures to contribute to delivering nature-positive outcomes by enhancing the resilience, connectedness and quality of environmental values.

Guiding values for Offsets at a regional scale are:

1. Restoration – Prioritisation of restoration offsets is needed to address the cumulative effects of past environmental impacts and achieve nature-positive outcomes.
2. Regional scale management – Environmental offsets should improve ecological linkages, provide environmental buffers and/or manage threatening processes, consistent with regional level management.
3. Resilient systems – Environmental offsets should be designed in a way that builds and maintains resilience in ecological functions and ecosystem services.
4. Expanding scientific knowledge – Environmental offsets should contribute to environmental knowledge of a region, for example, through research into knowledge gaps which are likely to contribute to enhanced protection, or restoration trials. Periodic performance monitoring, evaluation and reporting of the environmental outcomes of offsets in a way that expands scientific knowledge should also be required.
5. Like for like, and similar, values – Like-for-similar environmental offsets can be considered where a regional environmental need and benefit can be demonstrated.
6. Connectedness – Environmental offsets that demonstrate connectedness of the physical or ecological function values with those being impacted should be prioritised.
7. Co-benefits for social surroundings – Environmental offsets that provide greater co-benefits for the same environmental outcome should be prioritised.

6.5. EPBC POLICY, GUIDANCE AND CONSERVATION ADVICE

6.5.1. EPBC GUIDANCE

This Strategy has used the following policy, guidelines and conservation advice to identify a suitable offset site to counterbalance the significant residual impacts of the Proposed Action:

- EPBC Act Environmental Offsets Policy (DSEWPaC, 2012a);
- EPBC Act Offsets Policy Principles (DCCEEW, 2022a);
- How to use the Offsets Assessment Guide (DSEWPaC, 2012b);
- Offsets Assessment Guide (DCCEEW, 2022c);

DCCEEW has defined 8 offset principles that outline criteria of an offset site, and two additional principles are listed that provide guidance on how the minister will assess offset proposals.

A detailed assessment of how the offset package complies with principles 1-8 is provided in Section 9.

6.5.2. CONSERVATION ADVICE

This strategy considers the following EPBC approved conservation advice for each MNES relevant to the Proposed Action:

- Referral guideline for 3 WA threatened Black Cockatoo species (DAWE, 2022);
- EPA Technical Report: Carnaby's Cockatoo in Environmental Impact Assessment in the Perth and Peel Region (EPA, 2019).

- Carnaby's (*Calyptorhynchus latirostris*) Recovery Plan, Department of Parks and Wildlife, Perth, WA (DPaW, 2013);
- Conservation Advice (*Calyptorhynchus banksia naso)* Forest red-tailed Black Cockatoo (DEWHA, 2009).
- Conservation Advice (*Calyptorhynchus baudinii*) Baudin's Cockatoo (TSSC, 2018).

6.6. SCALE OF OFFSETS TO COUNTERBALANCE SIGNIFICANT IMPACTS

The EPBC Act Offset Calculator Tool was used to evaluate how suitable the identified Offset site is to counterbalance potential significant residual impacts.

The Offsets package presented in Section 8 demonstrates that significant residual impacts can be sufficiently counterbalanced. The offset selected counterbalance at least 100% of the residual impacts to CBC, FRTBC and BBC.

7. BLACK COCKATOO OFFSET STRATEGY

7.1. SUMMARY OF OFFSET SITE

The Proposed Action will clear up to 27.13ha of Black Cockatoo foraging habitat with HQS ranging from HQS 1 to 8 (CBC), HQS 2 to 7 (FRTBC) and HQS 1 to 6 (BBC). Clearing also includes 18 trees with possibly suitable hollows and 122 trees with suitable DBH considered to be potential roosting habitat (i.e. within 500m of Roost 2, Lot 202).

KLPL have identified a Site to offset the foraging and potential nesting and roosting habitats for all three species of Black Cockatoos, with starting HQS ranging from 0 to 5. The total percentage is at least 100% for all Black Cockatoo species.

(DAWE, 2022) defines 'high quality' Black Cockatoo foraging habitat as an area of at least 1ha, that contains native vegetation used for foraging, and scores between 5-10 using the foraging quality scoring tool. Scores lower than 5 are deemed as 'low foraging quality'.

During the breeding season, breeding pairs of Black Cockatoos will forage in areas up to 12km from their nest and in the non-breeding season, up to 20km from night roosting sites, but may travel further (DAWE, 2022). Black Cockatoo movements range from year-round residency to semi-migratory, depending on the breeding patterns of the individuals, vegetation density and local rainfall (Lee, Finn, & Calver, 2013).

The Black Cockatoo Conservation Management Project (BCCMP) undertaken by Murdoch University (Murdoch University, 2022) used GPS tracking devices to record movement patterns for all three Black Cockatoo species. The initial data reported in the Annual Report shows Black Cockatoos travel considerable distances (100-200km) over short periods, as flocks, as pairs or as individuals during the breeding migrations. It is also noted that other flocks will take much longer to travel the same distance during their breeding migration - and importantly, outside of breeding migrations, Black Cockatoos need sufficient foraging habitat to sustain all members of their flock, within a 6km radius of their roost.

7.2. POTENTIAL OFFSET SCARCITY

7.2.1. AVAILABILITY OF SIMILAR HABITAT

The Proposed Action is located on the Swan Coastal Plain, approximately 5-6km west of the Darling Scarp. A 60km radius from the Proposed Action was selected to gather information on the extent of Black Cockatoo habitat in the surrounding area. The majority of remnant native vegetation within 60km is located east within State managed lands.

To identify the estimated available foraging habitat for Black Cockatoos, the current mapped extent of the vegetation associations were used (DPIRD, 2020) to determine the available habitat excluding cleared and developed areas (Figure 7-1).

The estimated foraging habitat for both species within 60km is as follows:

- 510,621ha of estimated foraging habitat available;
- 463,112ha (~91%) is within DBCA protected lands (i.e. National Parks, State Forest etc);
- 47,509ha (~9%) is within available freehold land;

This desktop assessment of remnant vegetation determined that ~91% of the estimated foraging habitat for all three species of Black Cockatoos surrounding the Proposed Action is already within protected land tenure

managed by the State, and only ~9% is within freehold land. This demonstrates that there is limited availability of properties containing suitable like for like Black Cockatoo habitat in the vicinity of the Proposed Action which can be acquired as an Offset. The proposed Offset site is within 60km of the Proposed Action and is located between the Youraling State Forest and the Boyagarring Conservation Park. Securing the proposed offset, despite being located ~60km from the Proposed Action, is not inconsistent with several guiding values and recommended priorities listed in the Regional Scale Environmental Offsets public advice (EPA, 2024), including regional scale management through removal of threatening processes, as well as building and maintaining resilient ecological functions and connectedness through improvements of ecological linkages and conservation areas within a neighbouring region that should be improved or protected.

7.2.2. CONFIDENCE IN OFFSET BENEFIT

The Offset Strategy comprises 100% land acquisition and revegetation, which has been shown to be the most effective in producing measurable environmental benefits (May, Hobbs, & Valentine, 2017).

Conservation of habitat is consistent with the definition of a direct offset in accordance with the Offsets Policy (Government of Western Australia, 2011) and the EPBC Environmental Offsets Policy (DSEWPaC, 2012a). The proposed offset is expected to result in the protection, enhancement and management of additional land currently at risk of loss in its current form. Protection of habitat is also consistent with the principles of the following Recovery Plans and Conservation Advice:

- *Carnaby's (Calyptorhynchus latirostris) Recovery Plan, Department of Parks and Wildlife, Perth, WA (DPaW, 2013);*
- *Conservation Advice (Calyptorhynchus banksia naso) Forest red-tailed Black Cockatoo (DEWHA, 2009);*
- *Conservation Advice (Calyptorhynchus baudinii) Baudin's Cockatoo (TSSC, 2018).*

The land acquisition for the Black Cockatoo offset will provide a measurable environmental conservation gain against the residual impacts for the Proposed Action (DSEWPaC, 2012a). The conservation gain of land acquisition and management is represented by a reduction in or mitigation of threats to Black Cockatoos.

The land acquisition offset will include management actions such as fencing to exclude grazing, weed control and restricting human access to the Site. Details of revegetation methods, species and timing as well as revegetation success monitoring is detailed in the Offset Management Plan (Appendix 5).

Placement of the land under conservation covenant will provide long term security and prevent future degradation to the offset site, as well as provide for active management of threats including introduced animals, pests (such as rabbits/kangaroos, which will potentially impact vegetation condition into the future).

Implementation of management, monitoring and revegetation actions and placement of the land under Conservation Covenant will commence immediately upon approval of this Offset Strategy by EPA and DCCEEW, which would provide the Offset prior to ground disturbing activities or clearing of vegetation.

7.2.3. RESTORATION SUCCESS

The Proposed Action will clear up to 27.13ha of Black Cockatoo foraging habitat primarily comprising open woodland or stands of Marri and Jarrah vegetation with little to no mid-strata and a grazed ground cover of weeds.

The Carnaby's Recovery Plan (DPaW, 2013) recognises protection and enhancement of existing habitat to be an efficient and effective solution to maintaining and improving habitat quality. The Plan encourages planting of foraging tree species to support CBC as this has been found to be effective over the long term in improving suitable habitat (DPaW, 2013). A Murdoch University study (Lee, Finn, & Calver, 2013) conducted a three-year study of cockatoo activity at a post-mining rehabilitation Site, which determined that foraging activity returned to most sites within 8 years of revegetation for all three species of Black Cockatoos. The study found that fast growing proteaceous shrubs and Marri regrowth were the most successful plants for foraging success (Lee, Finn, & Calver, 2013).

The proposed offset site (Jelcobine Offset) will be rehabilitated with various species including proteaceous species suitable to increase foraging habitat. A complete list of proposed species is provided in the Offset Management Plan (Appendix 5). The Jelcobine Offset currently contains low quality foraging habitat and a subset of the total Site was initially assessed in November 2024 (Appendix 2) for potential nesting trees with hollows, which identified 32 trees with potential hollows within the Cadastral boundary of the Offset Site. A reassessment of potential nesting trees with hollows was undertaken in May 2025 (Appendix 3) which recorded a total of 47 trees with potential hollows primarily within Wandoo vegetation.

Following a review of both datasets for potential nesting trees within the proposed revegetation zones, it was identified that 3 trees had been counted twice and 13 trees from Nov 2024 were located outside of the proposed revegetation zones. The consolidated number of potential nest trees within the proposed revegetation zones is provided in the following table. It is also important to note that the entire area has not been searched thoroughly, and that significantly more trees with potential hollows is likely, however the purpose was to ensure the minimum number of trees with hollows are present at the Site to use as an offset (and meet the DCCEEW calculator of 56 trees).

TABLE 19: CONSOLIDATED NO. OF TREES WITH POTENTIAL HOLLOWS

VEG ZONE	VEGETATION DESCRIPTION	REVISED NO. OF TREES WITH HOLLOWS (MAY 2025)	REVISED NO. OF TREES WITH HOLLOWS (NOV 2024)	TOTALS
1	Remnant E. wandoo woodland	11	19	30
2	Mid to lower slopes, laterite gravel	5	-	5
3	Winter wet low lying area	1	-	1
5	Drainage line with narrow incised channel	27	-	27
Total		**44**	**19**	**63**

The existence of some already established low quality Black Cockatoo foraging habitat, potential nesting trees, and the (Lee, Finn, & Calver, 2013) study supports a lesser time until ecological benefit (10 years) for improved foraging habitat compared to a Site that requires rehabilitation in its entirety.

7.3. LAND PURCHASE AND FINANCIAL ARRANGEMENTS

KLPL have entered into a purchase agreement for the proposed Jelcobine Offset Site and will assume all financial responsibilities to implement the offset detailed in this Plan.

7.4. LAND TRANSFER AND MANAGEMENT

KLPL will seek to provide long-term protection of the Jelcobine Offset by entering into a conservation covenant with the National Trust within one year of approval of this Plan and to be finalised within 4 years.

TABLE 20: OFFSET ASSESSMENT

Existing environment/ Impact	*Mitigation*			*Significant Residual Impact*	*Offset Calculation Methodology*				
	Avoid and minimise	*Rehabilitation Type*	*Likely Rehab Success*		*Type*	*Risk*	*Likely Offset Success*	*Time Log*	*Offset Quantification*
Direct impact from clearing 27.13ha of Black Cockatoo foraging habitat, 18 potentially suitable nesting trees (no evidence of use) and 122 trees considered to be potential nesting habitat.	**Avoid** - The Proposed Action has been designed as far as practicable to utilise existing cleared pasture rather than clearing native vegetation. This has resulted in the avoidance of ~102ha of Black Cockatoo foraging habitat within the DE. **Minimise**- The following plans and strategy will be prepared and implemented to minimise impacts to Black Cockatoo foraging habitat values: 1. A Weed and Dieback Management Plan (MS810 Condition 9) 2. Air Quality and Dust Management Plan (MS810 Condition 15). 3.Rehabilitation Management Plan (MS810 Condition 8)	KLPL will revegetate ~30ha of Black Cockatoo foraging habitat using local species as per MS810 Condition 8 to counterbalance direct clearing impacts of the Proposal. Revegetation areas are to cover at least 1.4ha for every 1ha of native vegetation cleared for the Project (MS810 Condition 8). Planned revegetation areas will be assessed to enable selection of suitable plant species for each area, according to the soil type and local hydrology. Specifically, the revegetation will aim to establish plant species which: •Provide foraging habitat for Carnaby's and Forest Red-Tailed Black Cockatoos; •Are associated with the Bassendean Dunes and Pinjarra Plain on the Swan Coastal Plain; •Include species typical of overstory, mid and lower strata from the Bassendean Dune and Pinjarra Plain systems.	<u>Can the environmental values be rehabilitated/Evidence?</u> Yes, Black Cockatoo foraging habitat can be established and be self-sustaining within 8 years. <u>Operator experience in undertaking rehabilitation?</u> Yes, KLPL/Doral have conducted successful rehabilitation programs with KLPL offset areas and at Doral's Dardanup and Yoongarillup sites in accordance with DCCEEW and DBCA/EPA approval conditions. <u>What is the type of vegetation being rehabilitated?</u> Foraging habitat for Black Cockatoo utilising local provenance species. <u>Time lag?</u> 8 years for foraging habitat to be established and self-sustaining. <u>Credibility of the rehabilitation proposed (evidence of demonstrated success)</u> KLPL/Doral have successfully rehabilitated three Offset areas as part of other mine operations. Two additional Offset areas for the Project have been secured as per MS810 Condition 6.	<u>Extent</u> 27.13ha of Black Cockatoo foraging habitat 18 trees with suitable DBH containing possibly suitable hollows (no evidence of use) 122 trees with suitable DBH (within 500m of roost tree) considered to be potentially suitable roosting habitat. <u>Quality</u> Assessed as low-moderate quality foraging habitat during the Black-Cockatoo Site assessments (BCE, 2021) (BCE, 2022).	Land acquisition	Low – Land to be secured and protected under Conservation Covenant.	High – Black cockatoo foraging and potential breeding habitat will be acquired, enhanced and protected under Conservation Covenant.	Secures habitat upon agreement - no time delay.	Total Offset area of 114.02ha (CBC), 132.02ha (FRTBC) and 102.02ha (BBC) (including at least 56 trees with possibly suitable hollows) of land acquisition and protection as outlined in Section 8. The land acquisition and revegetation area has been calculated using the DCCEEW Offset Calculator (Appendix 4).

8. DESCRIPTION OF OFFSETS PACKAGE

8.1. OVERVIEW OF OFFSET

In order to compensate the significant residual impacts of the Proposed Action, KLPL is proposing a land acquisition and revegetation offset which comprises Black Cockatoo foraging and potential nesting habitat.

The Offset Policy requires environmental offsets to be based on sound environmental information and knowledge. The Strategy confirms the values of these offsets through referencing detailed surveys to quantify residual impacts and offset gains.

The offset package is supported by the following environmental surveys:

- (Western Botanical, 2024a) *Vegetation and Rehabilitation, Lot DP 90037 Jelcobine, as a Potential Offset Package* (Appendix 1).
- (Western Botanical, 2024b) *Assessment for Black Cockatoo Habitat, Lot DP 90037, as a Potential Offset Package* (Appendix 2).
- (Western Botanical, 2025a) Jelcobine Offset Technical Memo WB1067 (Appendix 3).

A summary of the Offset package for Black Cockatoo habitat is provided in the following sections.

8.2. SITE DESCRIPTION

The proposed Offset Site (Jelocbine Offset) is freehold land located at DP 90037, Jelcobine, WA on the east side of the Darling Scarp, in between two State managed reserves; Boyagarring Conservation Park to the east and Youraling State Forest to the west. The Jelcobine Offset is within the Shire of Brookton, 60km east of the Proposed Action, and is within the Northern Jarrah Forest subregion of the Jarrah Forest bioregion and is approximately 162ha in size.

The Jelcobine Offset is an east facing slope op ~40m over a length of 1km, with slopes of between 2 and 15 degrees. Soils are shallow sandy lateritic pizolitic sandy gravels, with occasional outcropping ferricrete on hill tops and ridges, likely overlying kaolinitic materials and weathered granite. These surface soils have high infiltration capacity and relatively low erodibility.

KLPL commissioned Western Botanical (2024a, 2024b and 2025) to undertake biological surveys of the Jelcobine Offset, with a focus on Black Cockatoo habitat (i.e. foraging, nesting and roosting) and an initial assessment for a proposed Rehabilitation Plan. A summary of the sites soils and vegetation are provided as follows.

8.2.1. SOILS

(Western Botanical, 2024a) reviewed mapping from DPIRD-064 which shoes the Jelcobine Offset lies within the Western Darling Range and encompasses two soils systems. The Western Darling Range Zone is described as 'Moderately dissected lateritic plateau on granite with deeply incised valleys; includes the Darling Scarp on the western margin. Sils are formed in laterite, lateritic colluvium, granite weathered in-situ and gneiss.

The two soil systems present at the Site are regional units mapped at the 1:250,000 scale, with the majority of the Site being the Clackline System, with a small section in the southeast being the Boyagin System. These are described as:

- Clackline System: Moderately dissected areas with gravelly slopes and ridges and minor rock outcrop on the eastern side of the Darling Plateau over weathered granite and granitic gneiss. Loamy gravels, shallow duplexes and pale deep sands common. Wandoo Woodlands.
- Boyagin System: Large duricrust remnants surrounded by stripped terrain of rock outcrops and fresh soils in eastern Darling Range Zone. Gravels have Jarrah-Marri-Parrotbush Forest. Loams and duplexes with York and Wandoo. Mallet and Powderbark on scarp footslope.

8.2.2. VEGETATION MAPPING

Vegetation mapping (DBA-047) indicates three vegetation types are present across the Jelcobine Offset as documented in (Western Botanical, 2024a):

- Mitchibin (subcategory – Valleys) is described as 'Open woodland of *Eucalyptus wandoo* over Acacia acuminata with some *Eucalyptus loxophleba* on valley slopes, with low woodland of *Allocasuarina huegeliana* on or near shallow granite outcrops in arid and perarid zones'.
- Williams (subcategory – Valley floors and swamps) is described as 'Mixed of woodland of *Eucalyptus rudis-Melaleuca rhaphiophylla*, low forest of *Casuarina obesa* and tall shrubland of *Melaleuca* spp. on major valley systems in arid and perarid zones'.
- Coolakin (subcategory – Valleys) is described as 'Woodlands of *Eucalyptus wandoo* with mixtures of *Eucalyptus patens, Eucalyptus marginata* supsp. *Thalassica* and *Corymbia calophylla* on the valley slopes in arid and perarid zones'.

8.2.3. VEGETATION TYPES

The vegetation mapped by (Western Botanical, 2024a) reflecting the soils and landscape, appear to fall wholly within the Clackline System.

Nine landuse types, including five vegetation types were observed at the Site. Some areas had little or no vegetation (i.e. farm dams) or were used for cropping (canola). These are listed in the following table and shown on Figure 8-1.

TABLE 21: VEGETATION TYPES AT JELCOBONE OFFSET

VEGETATION ZONE	AREA (HA)	DESCRIPTION	SPECIES SUITABLE FOR BLACK COCKATOOS
1	64.7	Remnant *Eucalypts wandoo* woodland, occasional *E. marginata* (mostly dead) and *E. accedens* on ferricrete outcrops, with little extant understory, few weeds. Species include:	*Acacia urophylla* *Corymbia calophylla* *Eucalyptus accedens* *Eucalyptus marginata subsp. thalassica* *Eucalyptus wandoo* *Banksia grandis* *Banksia sessilis* *Hakea lissocarpha*

VEGETATION ZONE	AREA (HA)	DESCRIPTION	SPECIES SUITABLE FOR BLACK COCKATOOS
2	14.68	Mid to lower slopes, laterite gravel. No vegetation present.	n/a
3	4.76	Winter wet low-lying area. Dense grass and herb ground cover.	n/a
4	4.45	Planted *Eucalyptus* and *Casuarina* trees, grass and herbs understory. Wet area.	*Casuarina obesa* *Eucalyptus rudis*
5	38.36	Drainage line with narrow incised channel, *Eucalyptus wandoo, E. rudis* to 25m over grasses and herbs. Saline at depth.	*Casuarina obesa* *Eucalyptus camaldulensis* *Eucalyptus leucoxylon* *Eucalyptus occidentalis* *Eucalyptus rudis* *Eucalyptus wandoo*
6	1.13	Farm dams and drainage, seepage, likely permanent water.	n/a
7	32.95	Crop (canola in 2024)	*Corymbia calophylla*
8	1.27	Fallow (no crop in 2024)	n/a
9	0.14	Farm dam, Typha spp. dominated, permanent water.	n/a
TOTAL	**162.43**	**Total area of DP 90037**	

Note: Only Zones 1, 2, 3, 5 and 7A will be revegetated to meet the offset requirements as per the calculator values.

8.3. SUITABILITY OF SITE AS AN OFFSET

Western Botanical (2024b) (2025a) completed an assessment of Black Cockatoo foraging and nesting habitat within the proposed Jelcobine Offset. Key findings of the assessment include:

- The Site contains relatively intact wandoo woodland and mixed woodland of Jarrah, Marri and Powerbark, both of which have healthy trees over a degraded (historically grazed) understorey. The understorey is dominated by weedy grasses, with scattered geophytes such as orchids and sundews and a few of the larger shrubs typical of local woodlands. An area within the central southern portion of the Site is cleared and generally void of native vegetation.
- Black Cockatoos are abundant in the area, with CBC or BBC observed flying across the Site and feeding in the adjacent Youraling Forest Reserve ~240m to the west. FRTBC were observed 2.1km north of the Site. Feeding traces of CBC or BBC and FRTBC were observed on Pike Rd, ~2km north of the Site and adjacent to Boyagarring Conservation Park.
- The Site currently offers good resources for Black Cockatoos in the way of potential roosting and nesting trees, with a baseline number of 63 trees containing possibly suitable hollows identified within the proposed revegetation areas (refer to Table 19). Significantly more trees with potential

hollows are likely to be present within the revegetation zones, as the entire area has not been assessed.

- The stands of *Eucalyptus rudis* (flooded gum) and planted non-native *Eucalyptus spp*. (ironbark, river red gum) in the drainage channel (Zone 5) may be potential roosting trees for Black Cockatoos. The value of these potential roosting is increased by the presence of two small farm dams which appear to be spring fed and may offer permanent water.
- Understorey plants suitable for Black Cockatoo foraging were observed in the adjacent Youraling Forest Reserve and Boyagarring Conservation Park, including patches of *Banksia sessilis* (Parrotbush), *B. squarrosa* (Pingle) and *Hakea undulata* (Wavy-leafed Hakea). Both the Reserve and Park are close enough to be utilised by Black Cockatoo nesting at the Site.
- The foraging values of the proposed Jelcobine Offset is currently limited and with the addition of suitable foraging species within select areas of the Site via a rehabilitation program provided in the Offset Management Plan, would increase the availability of food and likelihood of nesting within the Site and also provide connectivity between the two State managed reserves.

8.4. OFFSET VALUES TO COUNTERBALANCE RESDIUAL IMPACTS

The proposed Offset Site is considered suitable to offset >100% of the total quantum of impact for each of the three Black Cockatoo species for the following reasons:

- The Site is located in between two State managed reserves; Boyagarring Conservation Park to the east and Youraling State Forest to the west.
- Consistent with (EPA, 2024) *public advice for consideration of environmental offsets at a regional scale*, through provision of regional scale management via improvement of ecological linkages/connectivity and management of threatening processes.
- Suitable foraging habitat for Black Cockatoos is present at and surrounding the offset Site, although is generally degraded and has been subject to significant grazing pressures.
- At least 63 trees with suitable DBH containing possibly suitable hollows are present within the Offset Site, and stands of *Eucalyptus rudis* (flooded gum) and planted non-native *Eucalyptus spp*. (ironbark, river red gum) in the drainage channel (Zone 5) may be potential roosting trees for Black Cockatoos. The value of these potential roosting trees is increased by the presence of two small farm dams.
- Black Cockatoos are abundant in the area, with CBC or BBC observed flying across the Site and feeding in the adjacent Youraling Forest Reserve ~240m to the west. FRTBC were observed 2.1km north of the Site. Feeding traces of CBC or BBC and FRTBC were observed on Pike Rd, ~2km north of the Site and adjacent to Boyagaring Conservation Park.
- Rehabilitation of the Site will improve the existing foraging habitat and vegetation structure from low quality to moderate to high quality, whilst also providing greater connectivity between the two State managed reserves, as supported by the Offset Management Plan (Western Botanical, 2025b) (Appendix 5).
- Confidence on achieving the relevant HQS's for all three species of Black Cockatoos after rehabilitating the Site in accordance with the Offset Management Plan (Western Botanical, 2025b) has been set at 70%, based on KLPL's experience in revegetation programs and offsets for previous mineral sands mines.

- Ecological benefit will be reached within 8 years based on Murdoch University study (Lee, Finn, & Calver, 2013), which determined that foraging activity returned to most sites within 8 years of revegetation for all three species of Black Cockatoos.
- Figure 8-1 shows the Jelcobine Offset with Vegetation Zones that will be rehabilitated for Black Cockatoo Foraging Habitat.

8.5. CONSERVATION GAIN FOR THE PROTECTED MATTER

The proposed Jelcobine Offset is within the distribution range for all three species of Black Cockatoos. The Site provides an extension and connectivity of the existing remnant bushland between the Youraling Forest Reserve to the west and Boyagaring Conservation Park to the east.

The Offset Management Plan (Western Botanical, 2024a) (Appendix 5) includes a description of the proposed species selection, rehabilitation process for cleared and vegetated areas, seed provenance methods, fertiliser application rates, timing of revegetation, insect control and monitoring. The revegetation efforts will focus on Zones 1, 2, 3, 5 and 7A to achieve the relevant completion criteria in order to meet the proposed HQS's.

8.6. OFFSET CALCULATOR VALUES

The proposed Jelcobine Offset will be revegetated with a combination of tube stock and seeds, allowing for a Time Until Ecological Benefit of 10 years to be achieved. This is supported by the Murdoch University study (Lee, Finn, & Calver, 2013), which determined that foraging activity returned to most sites within 8 years of revegetation for all three species of Black Cockatoos. Scores of 0% for risk of loss, both with and without offset have also been used.

Start HQS values for the Vegetation Zones within the Offset Site were assessed as HQS 0 and 4 for CBC, FRTBC and BBC (Western Botanical 2024b) using the same habitat scoring criteria used at the impact site by (BCE, 2021; 2022). HQS without offset were assigned 1 HQS point less due to the likely degradation of the Site from ongoing continued grazing pressures. With implementation of the revegetation activities creating additional foraging habitat to the Site, in conjunction with the protection of the trees with possibly suitable hollows, the HQS values are anticipated to increase. A total offset area of 114.02ha is proposed to provide a net benefit for the CBC, 132.02ha for the FRTBC and 102.02ha for the BBC.

The DCCEEW Calculator spreadsheets are provided as Appendix 4.

TABLE 22: OVERVIEW OF OFFSET PACKAGE – CBC

IMPACT			OFFSET OF SIGNIFICANT RESIDUAL IMPACT					
VEG TYPE	AREA (HA)	CARNABY (HQS)	AREA(HA)	VEGETATION ZONE (FIGURE 8-1)	HQS START QUALITY	HQS WITHOUT OFFSET	HQS WITH OFFSET	% OF IMPACT OFFSET
Int. Eucs	5.98	1	4.76	3	0	0	3	148.36
Cleared with Sparse Trees	1.75	3	14	2	0	0	3	1,145.30
			18.26	7A	0	0	3	
Jar_Mar_Graze Kunz_Jar Bank	6.83	6	34	1	4	3	6	154.64
Mar_Jar_Xylo	8.95	7	31	1	4	3	7	122.97
Jar Bank Xant	3.62	8	12	5	4	3	8	114.25
TOTAL AREA (HA)	**27.13**		**114.02**					

TABLE 23: OVERVIEW OF OFFSET PACKAGE – FRTBC

IMPACT			OFFSET OF SIGNIFICANT RESIDUAL IMPACT					
VEG TYPE	AREA (HA)	FRTBC (HQS)	AREA(HA)	VEGETATION ZONE (FIGURE 8-1)	HQS START QUALITY	HQS WITHOUT OFFSET	HQS WITH OFFSET	% of IMPACT OFFSET
Kunz_Jar Bank	2.74	2	4.76	3	0	0	3	178.80
Cleared with Sparse Trees	1.75	3	14	2	0	0	3	1,264.87
			18.26	7A	0	0	3	
Jar Bank Xant	3.62	6	10	5	4	3	7	126.36
Jan_Mar_Graze	4.09	6	20	5	4	3	6	167.76
Int. Eucs	5.98	6	34	1	4	3	6	195.06
Mar_Jar_Xylo	8.95	7	31	1	4	3	7	135.81
TOTAL AREA (HA)	**27.13**	-	**132.02**					

TABLE 24: OVERVIEW OF OFFSET PACKAGE – BBC

IMPACT			OFFSET OF SIGNIFICANT RESIDUAL IMPACT					
VEG TYPE	AREA (HA)	BAUDIN (HQS)	AREA(HA)	VEGETATION ZONE (FIGURE 8-1)	HQS START QUALITY	HQS WITHOUT OFFSET	HQS WITH OFFSET	% OF IMPACT OFFSET
Int. Eucs	5.98	1	4.76	3	0	0	3	148.36
Cleared with Sparse Trees	1.75	3	7	2	0	0	3	896.78
			18.26	7A	0	0	3	
Kunz_Jar Bank	2.74	2	7	2	0	0	3	238.08
Jar_Mar_Graze Jar Bank Xant	7.71	5	34	1	4	3	6	164.39
Mar_Jar_Xylo	8.95	6	31	1	4	3	7	127.33
TOTAL AREA (HA)	**27.13**		**102.02**					

9. APPLICATION OF THE EPBC ACT ENVIRONMENTAL OFFSETS POLICY

The proposed Offset Strategy is consistent with the Principles of the EPBC Act Environmental Offsets Policy (DSEWPaC, 2012a) as detailed in the following sections. The Policy overarching principles which have been considered in preparing the preliminary offsets package are:

- Suitable offsets must deliver an overall conservation outcome that improves or maintains the viability of the protected matter.
- Suitable offsets must be built around direct offsets but may include other compensatory measures.
- Suitable offsets must be in proportion to the level of statutory protection that applies to the protected matter.
- Suitable offsets must be of a size and scale proportionate to the residual impacts on the protected matter.
- Suitable offsets must effectively account for and manage the risks of the offset not succeeding.
- Suitable offsets must be additional to what is already required, determined by law or planning regulations, or agreed to under the schemes or programs.
- Suitable offsets must be efficient, effective, timely, transparent, scientifically robust and reasonable.
- Suitable offsets must have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced.

9.1. BLACK COCKATOO SPECIES

The Proposed Action will clear up to 27.13ha of CBC, FRTBC and BBC foraging habitat (including 18 trees with possibly suitable hollows) with has been assessed by (BCE, 2021; BCE, 2022) as having HQS values ranging from HQS1 to 8 (CBC), HQS2 to 7 (FRTBC) and HQS1 to 6.

9.1.1. SUITABLE OFFSETS MUST DELIVER AN OVERALL CONSERVATION OUTCOME THAT IMPROVES OR MAINTAINS THE VIABILITY OF THE PROTECTED MATTER

The proposed Offset Strategy will comprise land acquisition and rehabilitation comprising a minimum 100% of the total offset required. Land acquisition offsets and land rehabilitation have been shown to be the most effective in producing measurable environmental benefit (May, Hobbs, & Valentine, 2017). As shown in Tables 22-24, the conservation outcome at a minimum will maintain (offset by 100%) and improve (any offset additional to 100%) the foraging habitat for all three species of Black Cockatoo, whilst also providing connectivity between the two State managed reserves .

9.1.2. SUITABLE OFFSETS MUST BE BUILT AROUND DIRECT OFFSETS BUT MAY INCLUDE OTHER COMPENSATORY MEASURES

The Offset Strategy is built around 100% direct offsets, via land acquisition and rehabilitation to achieve a conservation gain for three species of Black Cockatoo.

9.1.3. SUITABLE OFFSETS MUST BE IN PROPORTION TO THE LEVEL OF STATUTORY PROTECTION THAT APPLIES TO THE PROTECTED MATTER

The Offsets for each species was calculated using the Offset Assessment Guide. This included an input for the current listing of the MNES to ensure the direct offset is in proportion to the level of statutory protection of the protected matter.

9.1.4. SUITABLE OFFSETS MUST BE OF A SIZE AND SCALE PROPORTIONATE TO THE RESIDUAL IMPACTS ON THE PROTECTED MATTER

The provision of direct offsets is based on completed offset assessment guide calculations, based on the HQS's of both the impact Site and Offset site, after implementation of the proposed rehabilitation.

9.1.5. SUITABLE OFFSETS MUST EFFECTIVELY ACCOUNT FOR AND MANAGE THE RISKS OF THE OFFSET NOT SUCCEEDING

The estimate of direct offsets is based on completed offset assessment guide calculations, incorporating a conservative assessment of confidence in results of the offset succeeding (70%) as well as Doral's track record for achieving Land Acquisition and rehabilitation of offset sites (for Black Cockatoo foraging habitat) and placing them under Conservation Covenant. These projects include:

- EPBC 2011/6087 Dardanup Southern Extension, Henty WA
- EPBC 2013/6897 Waterloo Heavy Mining Project, Henty WA
- EPBC 2005/2163 Keysbrook Mineral Sands Mine, WA
- EPBC 2012/6521 Yoongarillup Mineral Sands Project, WA
- EPBC 2017/8094 Yalyalup Mineral Sands Project, Busselton WA

In addition to offsets, as part of approval conditions for Doral's projects, significant revegetation works have been undertaken at the Dardanup mine (Willoughby Offset 24ha), Yoongarillup Mine (8.9ha of State Forest SF33 revegetation), Yalyalup Mine (3.4ha Busselton Ironstone), Keysbrook Mine (164ha) however some impacted by bushfire in 2023.

Other Management actions proposed to be undertaken for the Jelcobine Offset includes:

- Access control, such as fencing and gate security;
- Regular monitoring of vegetation health;
- Maintaining fire breaks;
- Weed control;
- Dieback assessment and management.

These actions will prevent the decline or deterioration of the protected matter within the Offset Site.

The Jelcobine Offset Site is also located between and directly adjacent to two State managed reserves; Boyagarring Conservation Park to the east and Youraling State Forest to the west, which provides additional assurance that rehabilitation actions will be able to improve the foraging value of the Site to similar levels to that which surround the Site, whilst also providing connectivity between the existing two State managed reserves.

Contingency actions in the event that the offset targets are at risk of not being met are incorporated into the Offset Management Plan and include the following:

- Evaluate the cause of revegetation failure or issues;
- Determine the appropriate corrective actions, which may include:
    - Changes to species lists and planting densities.
    - Altered weed control scheduling and management technique.
    - Pest management.

9.1.6. SUITABLE OFFSETS MUST BE ADDITIONAL TO WHAT IS ALREADY REQUIRED, DETERMINED BY LAW OR PLANNING REGULATIONS, OR AGREED TO UNDER THE SCHEMES OR PROGRAMS

The proposed offsets have been selected specifically to counterbalance significant residual impacts to Black Cockatoo foraging and potential nesting habitat, in order to meet the requirements of Commonwealth and State policy. The offsets are in addition to any other requirement.

9.1.7. SUITABLE OFFSETS MUST BE EFFICIENT, EFFECTIVE, TIMELY, TRANSPARENT, SCIENTIFICALLY ROBUST AND REASONABLE

The offsets selected are deemed efficient as they aim to meet both the Commonwealth and State regulatory requirements for significant impacts to MNES (Black Cockatoo habitat). One large offset site is proposed to be secured and placed under conservation covenant in order to reduce management requirements and ensure that efficient use of resources (i.e. labour and mobilisation costs) and further validates the effectiveness of the offset based on the protection and enhancement of a large-scale suitable foraging habitat Site.

Management actions for the Jelcobine Offset site will include installation of fences and weed control which will be conducted in accordance with the works schedule provided in the Offset Management Plan. Acquisition of the land by KLPL will occur immediately upon acceptance of this Offset Strategy by DCCEEW and EPA.

Details of the Offset site have been provided in Section 8. Information has been acquired from literature research papers and from vegetation and fauna assessments completed by (Western Botanical, 2024a), (Western Botanical, 2024b) and (Western Botanical, 2025a) which were conducted specifically for the purpose of informing the current characteristics and values of the Site, as well as informing the rehabilitation requirement's to achieve the offset. All information has been presented in a clear and concise manner stating facts and summarising details as they are provided in referenced documents.

9.1.8. SUITABLE OFFSETS MUST HAVE TRANSPARENT GOVERNANCE ARRANGEMENTS INCLUDING BEING ABLE TO BE READILY MEASURED, MONITORED, AUDITED AND ENFORCED

This Offset Strategy has been developed to demonstrate that KLPL is able to adequately counterbalance significant residual impacts of the Proposed Action to the relevant MNES (Black Cockatoo habitat). The governance of the Offset Site will include monitoring, auditing and reporting as required by future conditions of approval.

10. APPLICATION OF THE EPA OFFSETS POLICY PRINCIPLES

The proposed Offset Strategy is consistent with the Principles of the EPA Offsets Policy (Government of Western Australia, 2011) as detailed in the following sections. The Policy overarching principles which have been considered in preparing the preliminary offsets package are

- Environmental offsets will only be considered after avoidance and mitigation options have been pursued;
- Environmental offsets are not appropriate for all projects;
- Environmental offsets will be cost-effective, as well as relevant and proportionate to the significance of the environmental value being impacted;
- Environmental offsets will be based on sound environmental information and knowledge;
- Environmental offsets will be applied within a framework of adaptive management;
- Environmental offsets will be focussed on longer term strategic outcomes.

10.1. BLACK COCKATOO SPECIES

The Proposed Action will clear up to 27.13ha of CBC, FRTBC and BBC foraging habitat (including 18 trees with possibly suitable hollows) which has been assessed by (BCE, 2021; BCE, 2022) as having HQS values ranging from HQS1 to 8 (CBC), HQS 2 to 7 (FRTBC) and HQS1 to 6.

10.1.1. ENVIRONMENTAL OFFSETS WILL ONLY BE CONSIDERED AFTER AVOIDANCE AND MITIGATION OPTIONS HAVE BEEN PURSUED

KLPL have implemented the mitigation hierarchy as far as practicable to eliminate and/or minimise impacts to MNES. Avoidance, mitigation and rehabilitation actions are detailed in section 5 and summarised as follows:

- Avoidance:
    - Proposed Action designed to utilise existing cleared pasture areas resulting in 485.81ha of the 512.94ha total disturbance area occurring within cleared areas (~96%).
    - One tree with suitable DBH containing a possibly suitable hollow located within Lot 64 has been avoided from disturbance with a 10m buffer being placed around tree.
- Mitigation:
    - Clearing boundaries will be demarcated and approved by KLPL Environmental Officer.
    - Vegetation and trees to be retained to be clearly demarcated prior to the commencement of clearing;
    - Access into the DE will be restricted as far as practicable during clearing activities;
    - During Black Cockatoo breeding season, any tree with a hollow suitable for Black Cockatoos (18 trees) will be inspected by a suitably qualified fauna consultant within seven days of clearing.
    - If Black Cockatoo breeding is detected in any of the 18 hollows, then all trees within 10m of the hollow will be demarcated and retained until hollows are no longer in use.

  - Continued implementation of existing MS810 Condition 6 - Protection of Native Vegetation
  - Continued implementation of MS810 Condition 7 - Protection of Watercourses and wetlands
  - Continued implementation MS810 Condition 9 - Weed and Dieback Management
- Rehabilitation:
  - Revegetation of 30ha of local native provenance species (i.e. at a ratio of 1.4ha:1ha of native vegetation) within the DE (as per MS810 Condition 8). The revegetation will be undertaken with the objective of contributing to enhanced natural ecosystem function in the local area (e.g., such as by extending/establishing a native vegetation) and providing additional Black Cockatoo foraging habitat.

10.1.2. ENVIRONMENTAL OFFSETS ARE NOT APPROPRIATE FOR ALL PROJECTS

KLPL have applied the mitigation hierarchy to avoid, minimise and rehabilitate impacts to MNES as far as practicable, however a significant residual impact of 27.13ha to Black Cockatoo habitat remains. As such Environmental Offsets are considered an appropriate form of mitigation for biological impacts associated with clearing.

10.1.3. ENVIRONMENTAL OFFSETS WILL BE COST-EFFECTIVE, AS WELL AS RELEVANT AND PROPORTIONATE TO THE SIGNIFICANCE OF THE ENVIRONMENTAL VALUE BEING IMPACTED

KLPL believes the proposed Offset represents a cost-effective solution that is relevant and proportionate to the environmental value being impacted by the Proposed Action. The Offset Site currently contains generally low-quality foraging habitat (and potential nesting habitat) which will be enhanced and secured via conservation covenant, with additional habitat created in order to be equivalent or higher to the quality of habitat being impacted by the Proposed Action, whilst also providing connectivity between the existing two State managed reserves.

10.1.4. ENVIRONMENTAL OFFSETS WILL BE BASED ON SOUND ENVIRONMENTAL INFORMATION AND KNOWLEDGE

The proposed Jelcobine Offset has been selected based on sound environmental information and knowledge including site specific surveys of vegetation and Black Cockatoo habitat.

10.1.5. ENVIRONMENTAL OFFSETS WILL BE APPLIED WITHIN A FRAMEWORK OF ADAPTIVE MANAGEMENT

The proposed Jelcobine Offset will be purchased by KLPL and placed under Conservation Covenant and managed by KLPL within an adaptive management framework to ensure the quality of offset is maximised.

The Offset Strategy is based on outcome-based completion criteria with specified monitoring requirements and contingency measures to be applied where monitoring indicates a potential failure to meet those completion criteria. As such, the proposed offsets will be based on an adaptive cycle of actions, monitoring, review of measures, and adoption of revised actions where monitoring learnings show potential failure. The

specification of outcome-based completion criteria mean actions will be adaptive, to be amended where necessary to achieve the desired outcome and effectively achieve the required offset.

10.1.6. ENVIRONMENTAL OFFSETS WILL BE FOCUSSED ON LONGER TERM STRATEGIC OUTCOMES

The proposed Jelcobine Offset represents a significant area of remnant native vegetation that is currently being grazed by cattle. The Offset is located between two State managed reserves; Boyagarring Conservation Park to the east and Youraling State Forest to the west, and will provide connectivity between the two.

11. REPORTING

All environmental offsets required as part of approvals under WA legislation are now made public via the WA Environmental Offsets Register. Progress of environmental offsets are tracked via the register as actions listed as 'complete' or 'not complete'. For projects approved under Part IV of the EP Act, the Offsets Register is administered by DWER. Once a Statement is issued, the EPA/DWER will upload the relevant details into the register. The offsets 'condition milestones' are based on the conditions in the Ministerial Statement.

KLPL currently submits an Annual Environmental Report (AER) to the EPA, DWER and DCCEEW that reports on progress in operating their mines and implementing progressive rehabilitation. KLPL will be required to provide an annual report (or as required in accordance with the Ministerial Statement) to EPA/DWER and DCCEEW detailing the progress of the offset strategy or as a result of an action arising from a Ministerial Statement condition.

In addition, KLPL shall report to the CEO on the outcomes of the actions, objectives, and targets in the Keysbrook Western Extension Mineral Sands Project Land Acquisition Offset Strategy as required.

12. REFERENCES

ABCS. (2023a). *Assessment of 11 trees for Nesting values for three species of Black-Cockatoo in Lot 63 Hopeland Rd, Keysbrook, Western Australia. April 2023.*

ABCS. (2023b). *Assessment of 28 identified trees for Nesting values for Black-Cockatoos in Lot 64, 201, 508, 507 Keysbrook WA. Unpublished report prepared for Doral Mineral Sands. May 2023.*

ABCS. (2025). *Assessment of tree #1567 for its nesting value for three species of Black Cockatoo in Lot 508 Elliot Rd Keysbrook, Western Australia.*

BCE. (2021). *Assessment of the nesting and foraging values of three Lots near Keysbrook for Doral Pty Ltd Keysbrook Mineral Sands Mine. Unpublished report prepared for Doral Mineral Sands Pty Ltd. 12 July 2021.*

BCE. (2022). *Assessment of Nesting, Foraging and Roosting Values for Three Species of Black-Cockatoo in Lots 62, 63, 20 and 507 near Keysbrook, Western Australia. Unpublished report prepared for Doral Mineral Sands Pty Ltd. 9 September 2022.*

BCE. (2024). *Re-assessment of potential next trees for Black-Cockatoos in the Keysbrook Project Area. Unpublished report prepared for Doral Mineral Sands Pty Ltd. 9 September 2024.*

Cale, B. (2003). *Carnaby's Black Cockatoo (Calyptorhynchus latirostris) Recovery Plan 2002-2012. CALM, Wanneroo.*

Chapman, T. (2008). *Forest Black Cockatoo (Baudin's Cockatoo Calyptorhynchus baudinii and Forest Redtailed Black Cockatoo Calyptorhynchus banksii naso) Recovery Plan. Department of Environment and Conservation, Western Australia.*

DAWE. (2022). *Referral guideline for 3 WA threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black- cockatoo, Department of Agriculture, Water and the Environment, Canberra, February 2022.*

DCCEEW. (2022a). *EPBC Act Offset Policy Principles. Department of Climate Change, Energy, the Environment and Water. Australian Government. Canberra.*

DCCEEW. (2022c). *Offsets Asessment Guide. Department of Climate Change, Energy, the Environment and Water. Australian Government. Canberra.*

DEE. (2017). *Revised draft referral guideline for three threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black Cockatoo. Department of the Environment and Energy, Commonwealth of Australia, 2017, Canberra, Australian C.*

DEWHA. (2009). *Conservation Advice Calyptorhynchus banksii naso Forest Red-tailed Black Cockatoo.*

DotE. (2013). *Matters of National Environmental Significance: Significant Impact Guidelines 1.1 .*

DotEE. (2017). *Guidance for deriving 'Risk of Loss' estimates when evaluating biodiversity offset proposals under the EPBC Act. Report to the National Environmental Science Programme. Department of the Environment and Energy. April 2017. .*

DPaW. (2013). *Carnaby's Cockatoo (Calyptorhynchus latirostris) Recovery Plan. Department of Parks and Wildlife, Perth, Western Australia. .*

DPIRD. (2020). *Native Vegetation Extent (DPIRD-005). Government of Western AUstralia, Department of Primary Industries and Regional Development.*

DSEWPaC. (2012a). *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy.* Canberra, ACT: Australian Government.

DSEWPaC. (2012b). *EPBC Act Referral guidelines for three threatened black cockatoo species: Carnaby's cockatoo (endangered) Calyptorhynchus latirostris, Baudin's cockatoo (vulnerable) Calyptorhynchus baudinii, Forest red-tailed black cockatoo (vulnerable) Calyptorhynchus b.* Australian Government.

DSEWPaC. (2012b). *How to use the offsets assessment guide .*

Ecoedge. (2023). *Targeted Black Cockatoo Habitat Survey North Dandalup. Prepared by Ecoedge for Doral Mineral Sands. August 2023.*

EPA. (2016a). *Environmental Factor Guideline - Flora and Vegetation.* Perth, WA.

EPA. (2019). *EPA Technical Report: Carnaby's Cockatoo in Environmental Impact Assessment in the Perth and Peel Region. Environmental Protection Authority, Western Australia. .*

EPA. (2024). *Public Advice: Considering environmental offsets at a regional scale. March 2024.*

Gibson, N., Keighery, G., & Keighery, B. (2000). Threatened plant Communities of Western Australia. 1 The Ironstone Communities of the Swan and Scott Coastal Plains. *Journal of the Royal Society of Western Australia, 83*, 1-11.

Government of Western Australia. (2011). *Environmental Offsets Policy.* Perth, Western Australia.

Government of Western Australia. (2014). *Environmental Offsets Guidelines.* Perth, Western Australia.

Johnstone, R., & Storr, G. (1998). *Handbook of Western Australian Birds: Volume 1 – Non-passerines (Emu to Dollarbird). Western Australian Museum, Perth Western Australia.*

Lee, J., Finn, H., & Calver, M. (2013). Feeding activity of threatened Black Cockatoos in mine-site rehabilitation in the jarrah forest of south-western Australia. *Australian Journal of Zoology, 61 (2)*, pp. 119-131.

Mawson, P., & Johnstone, R. (1997). *Conservation status of parrots and cockatoos in Western Australia. Eclectus 2, 4-9.*

May, J., Hobbs, R., & Valentine, L. (2017). Are offsets effective? An evaluation of recent environmental offsets in Western Australia. *Biological Conservation 206.*, 249-257.

MBS. (2004). *Vegetation and Fauna Assessment of Exploration Licence 70/2407, Keysbrook. Prepared for Olympia Resources Limited. Unpublished report.*

Meissner, R., & English, V. (2005). *Shrubland Association on Souther Swan Coastal Plan Iron stone (Busslton area) (Souther Ironston Association) Interim recovery plan no. 215.* Department of Environment and Conservation, Species and Communties Branch.

Molloy, S., Wood, J., Hall, S., Wallrodt, S., & Whisson, G. (2009). *South West Regional Ecological Linkages Technical Report, Western Australia.* Local Government Association and Department of Environment and Conservation Perth.

Murdoch University. (2022). *Black Cockatoo Conservation Management Project, Annual Progress Report, August 2022.*

Phoenix. (2024). *Short-range endemic desktop review for the Keysbrook Mineral Sands Project. Unpublished report prepared for Doral Mineral Sands Pty Ltd. 4 April 2024.*

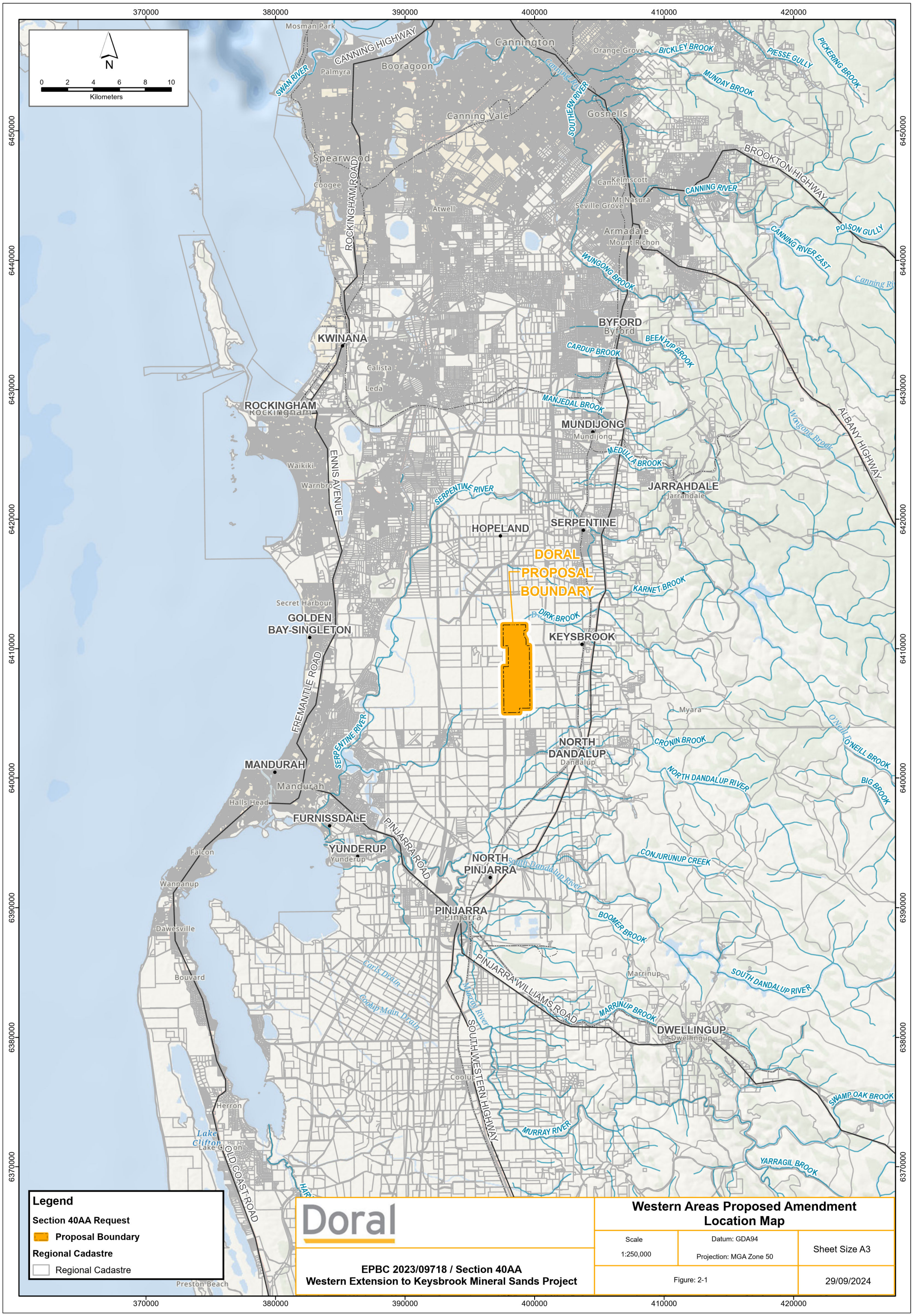
Saunders, D. (1982). *The breeding behaviour and biology of the short-billed form of the White-tailed Black Cockatoo Calyptorhynchus funereus. Ibis 124, 422-455.*

Western Botanical. (2024a). *Vegetation and Rehabilitation, Lot DP DP 90037 Jelcobine, as a Potential Offset Package. Unpublished report prepared for Doral Mineral Sands Pty Ltd. Report Ref: WB1054.*

Western Botanical. (2024b). *Assessment for Black Cockatoo Habitat, Lot DP 90037, as a Potential Offset Package. Unpublished report prepared for Doral Mineral Sands Pty Ltd. Report Ref: WB1053.*

Western Botanical. (2025). *Offset Management Plan for Jelcobine, Lot DP90037. Unpublished report prepared for Doral Mineral Sands Pty Ltd. Ref: WB1058.*

FIGURE 2-1: REGIONAL SITE LOCATION



Legend

Section 40AA Request

Proposal Boundary

Regional Cadastre

Regional Cadastre

Doral

EPBC 2023/09718 / Section 40AA
Western Extension to Keysbrook Mineral Sands Project

Western Areas Proposed Amendment Location Map

Scale	Datum: GDA94	Sheet Size A3
1:250,000	Projection: MGA Zone 50	
Figure: 2-1		29/09/2024

FIGURE 2-2: PROPOSED ACTION

396000 399000 402000

N

0 250 500 750 1,000 1,250
Meters

6411000 6408000 6405000 6402000

Lot 2 Lot 66 Lot 54 Lot 1 DIRK RD
Lot 67 Lot 4964
Lot 1 Lot 7 Lot 8
Offset Area Lot 202
Lot 507 Lot 508 Lot 201 Lot 56
Lot 2
Lot 5 Lot 9 Lot 11 Lot 12
WESCOTT RD BADEN RD
ELLIOTT RD
Lot 4965
Lot 20 Lot 12 Lot 57 Lot 1
Lot 64
Lot 701 Lot 52
Lot 700
Lot 105 Lot 101 Lot 111 Lot 105 Lot 50 Lot 1
Lot 103 Lot 104 PAGE RD
Lot 112 Lot 104
Lot 63
Lot 70 Lot 6 Lot 1
HOPELAND RD
Lot 113 Lot 103
Lot 62 Lot 59 Lot 300 Lot 301
Offset Area Lot202
Lot 71 ATKINS RD
Lot 20
Lot 1 Lot 101 Lot 506 Lot 505 Lot 100
Lot 5
Lot 12 Lot 102 WESTCOTT RD ST BLAZE GR
Lot 110
READHEADS RD
MCMAHON RD BEAU SOVEREIGN CT
JENNIE PL SOUTH WESTERN HWY

Legend

MS810 / EPBC2005/2016
- Development Envelope
- Lot 202 Offset Area
- Lot 62 Offset Area
- Approved Mining Area

EPBC2023/09718 / Section 40AA Request
- Proposed Project Area
- Proposed Mining Area

Section 45C Request (Lot 56 & 63)
- Amendment Area

Regional Cadastre
- Regional Cadastre

Doral

EPBC 2023/09718 / Section 40AA
Western Extension to Keysbrook Mineral Sands Project

Proposal Area

Scale	Datum: GDA2020	Sheet Size A3
1:30,000	Projection: MGA Zone 50	
Figure: 2-2		29/09/2024

396000 399000 402000

FIGURE 3-1: BLACK COCKATOO FORAGING HABITAT AND POTENTIAL HOLLOWS

N

0 150 300 450 600 750

Meters

396000 396500 397000 397500 398000 398500 399000 399500 400000 400500 401000

6412000 6411500 6411000 6410500 6410000 6409500 6409000 6408500 6408000 6407500 6407000 6406500 6406000 6405500 6405000 6404500

Lot 66
Lot 4
Lot 1
Lot 77
Lot 2
Lot 507
Lot 508
Lot 201
Lot 202
Lot 56
Lot 502
Lot 500
Lot 20
Lot 12
Lot 64
Lot 57
Lot 701
Lot 503
Lot 700
Lot 105
Lot 101
Lot 103
Lot 104
Lot 75
Lot 70
Lot 63
Lot 6
Lot 62
Lot 59
Lot 20
Lot 506

Legend

EPBC Referral 2023/09718 / MS 810

Proposed Project Area

EPBC 2005/2163

Approved Mining Area

Regional Cadastre

Bounadries

Proposed Mining Area

Vegetation Units

Planted

Black Cockatoo Habitat

Foraging Habitat

Potential Habitat

Habitat Trees

BCE Rank

3

Doral

EPBC 2023/09718 / Section 40AA

Western Extension to Keysbrook Mineral Sands Project

Black Cockatoo Foraging Habitat and Potential Nesting Trees

Scale	Datum: GDA2020	Sheet Size A3
1:20,000	Projection: MGA Zone 50	
Figure: 6-2		09/04/2025

FIGURE 3-2: BLACK COCKATOO TREES WITH SUITABLE DBH

N

0 150 300 450 600 750

Meters

396000 396500 397000 397500 398000 398500 399000 399500 400000 400500 401000

6412000 6411500 6411000 6410500 6410000 6409500 6409000 6408500 6408000 6407500 6407000 6406500 6406000 6405500 6405000 6404500

Lot 66 Lot 4 Lot 1 Lot 77 Lot 2 Lot 507 Lot 508 Lot 201 Lot 202 Lot 56 Lot 502 Lot 500 Lot 20 Lot 12 Lot 64 Lot 57 Lot 701 Lot 503 Lot 700 Lot 105 Lot 101 Lot 103 Lot 104 Lot 75 Lot 70 Lot 63 Lot 6 Lot 62 Lot 59 Lot 20 Lot 506

Legend

EPBC Referral 2023/09718 / MS 810

Proposed Project Area

EPBC 2005/2163

Approved Mining Area

Regional Cadastre

Bounadries

Proposed Mining Area

Vegetation Units

Planted

Black Cockatoo Habitat

Foraging Habitat

Potential Habitat

Habitat Trees

BCE Rank

2 (2)

3 (152)

4 (110)

5 (372)

Doral

EPBC 2023/09718 / Section 40AA

Western Extension to Keysbrook Mineral Sands Project

Black Cockatoo Potential Nest Trees (DBH>500mm)

Scale	Datum: GDA2020	Sheet Size A3
1:20,000	Projection: MGA Zone 50	
Figure: 6-1		11/09/2024

FIGURE 3-3: BLACK COCKATOO ROOST TREES

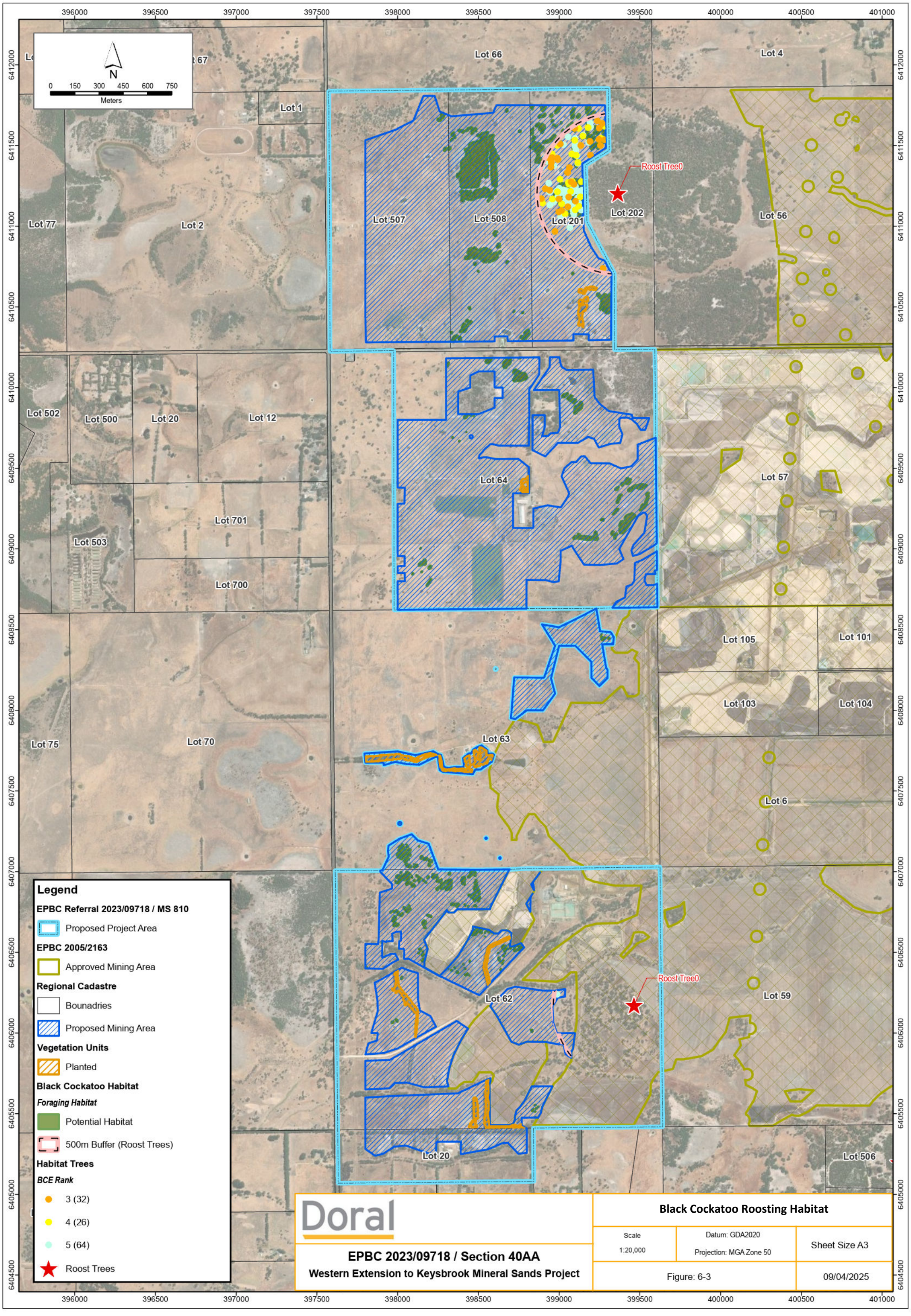

N
0 150 300 450 600 750
Meters
Lot 66
Lot 4
Lot 1
Lot 77
Lot 2
Lot 507
Lot 508
Lot 201
Roost Tree0
Lot 202
Lot 56
Lot 502
Lot 500
Lot 20
Lot 12
Lot 64
Lot 57
Lot 701
Lot 503
Lot 700
Lot 105
Lot 101
Lot 103
Lot 104
Lot 75
Lot 70
Lot 63
Lot 6
Lot 62
Lot 59
Lot 20
Lot 506
Legend
EPBC Referral 2023/09718 / MS 810
Proposed Project Area
EPBC 2005/2163
Approved Mining Area
Regional Cadastre
Bounadries
Proposed Mining Area
Vegetation Units
Planted
Black Cockatoo Habitat
Foraging Habitat
Potential Habitat
500m Buffer (Roost Trees)
Habitat Trees
BCE Rank
3 (32)
4 (26)
5 (64)
Roost Trees
Doral
EPBC 2023/09718 / Section 40AA
Western Extension to Keysbrook Mineral Sands Project
Black Cockatoo Roosting Habitat
Scale
1:20,000
Datum: GDA2020
Projection: MGA Zone 50
Sheet Size A3
Figure: 6-3
09/04/2025

FIGURE 4-1: LEGISLATED LANDS WITHIN 6KM AND 12KM

N

0 1 2 3 4
Kilometers

385000 390000 395000 400000 405000 410000 415000

6425000 6420000 6415000 6410000 6405000 6400000 6395000 6390000 6385000

Wellard
Mundijong
Baldivis
Jarrahdale
Serpentine River
Serpentine
Serpentine National Park
Keysbrook
Myara
North Dandalup
North Dandalup Dam
Goegrup Lake
Conjurunup Creek
Pinjarra
Tailings Ponds
Marrinup
Lake Banksiadale

Legend

Ministerial Statement 810
- Development Envelope
- Approved Mining Area

Section 40AA Request
- Proposed Development Envelope
- Proposed Mining Area

Section 45C Request
- Amendment Area

Conservation Area
- Offsets

Legislated Lands and Waters (DBCA)
- National Park
- Nature Reserve
- Section 5(1)(h) Reserve
- State Forest
- Crown Freehold - Dept Managed

Buffers
- 12km Buffer
- 6km Buffer

Doral

Keysbrook Mineral Sands Project

State Managed Lands

Scale	Datum: GDA2020	Sheet Size A3
1:125,000	Projection: MGA Zone 50	
Figure: 4-1		29/01/2025

FIGURE 7-1: REGIONAL AVAILABILITY OF SIMILAR HABITAT

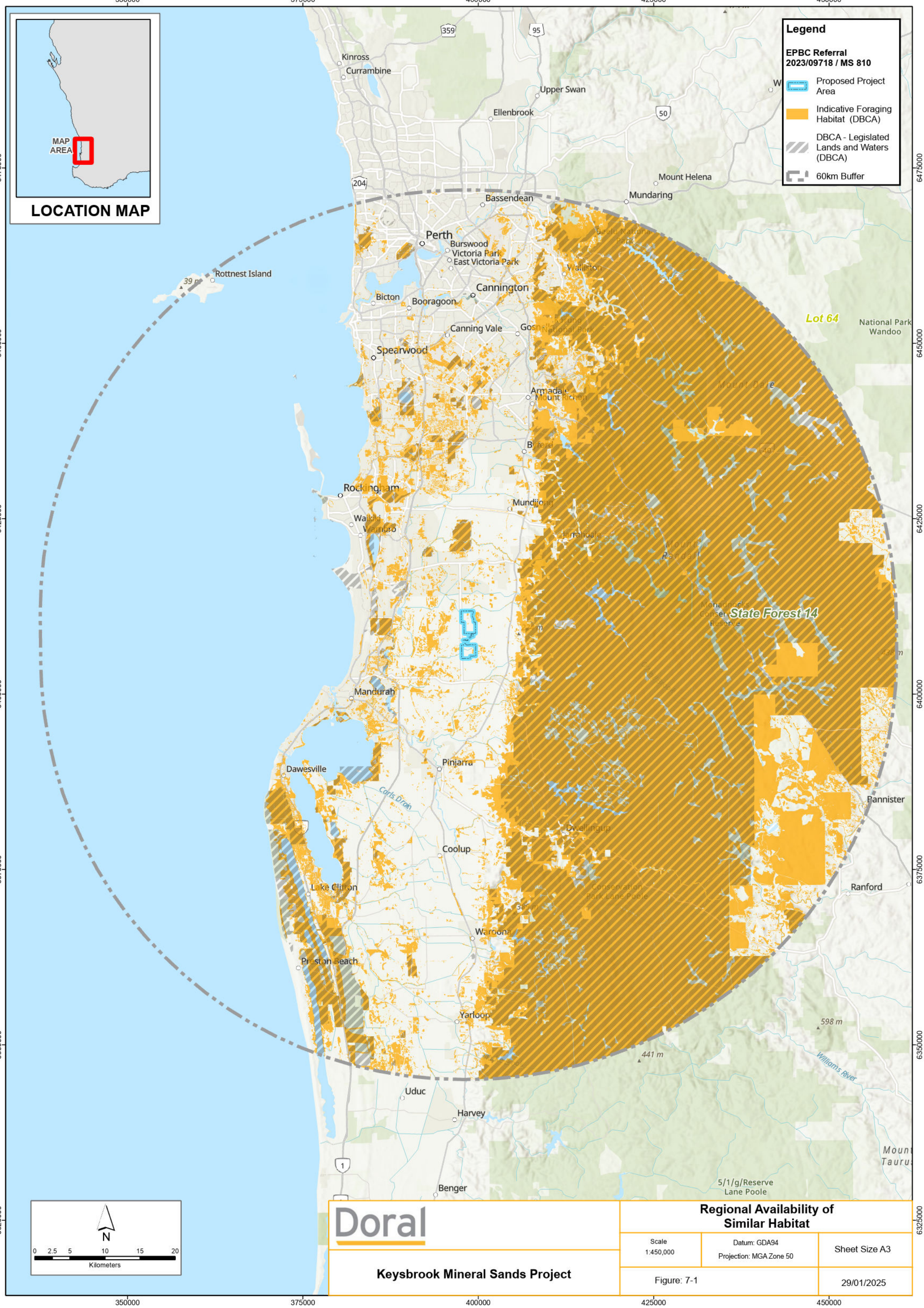
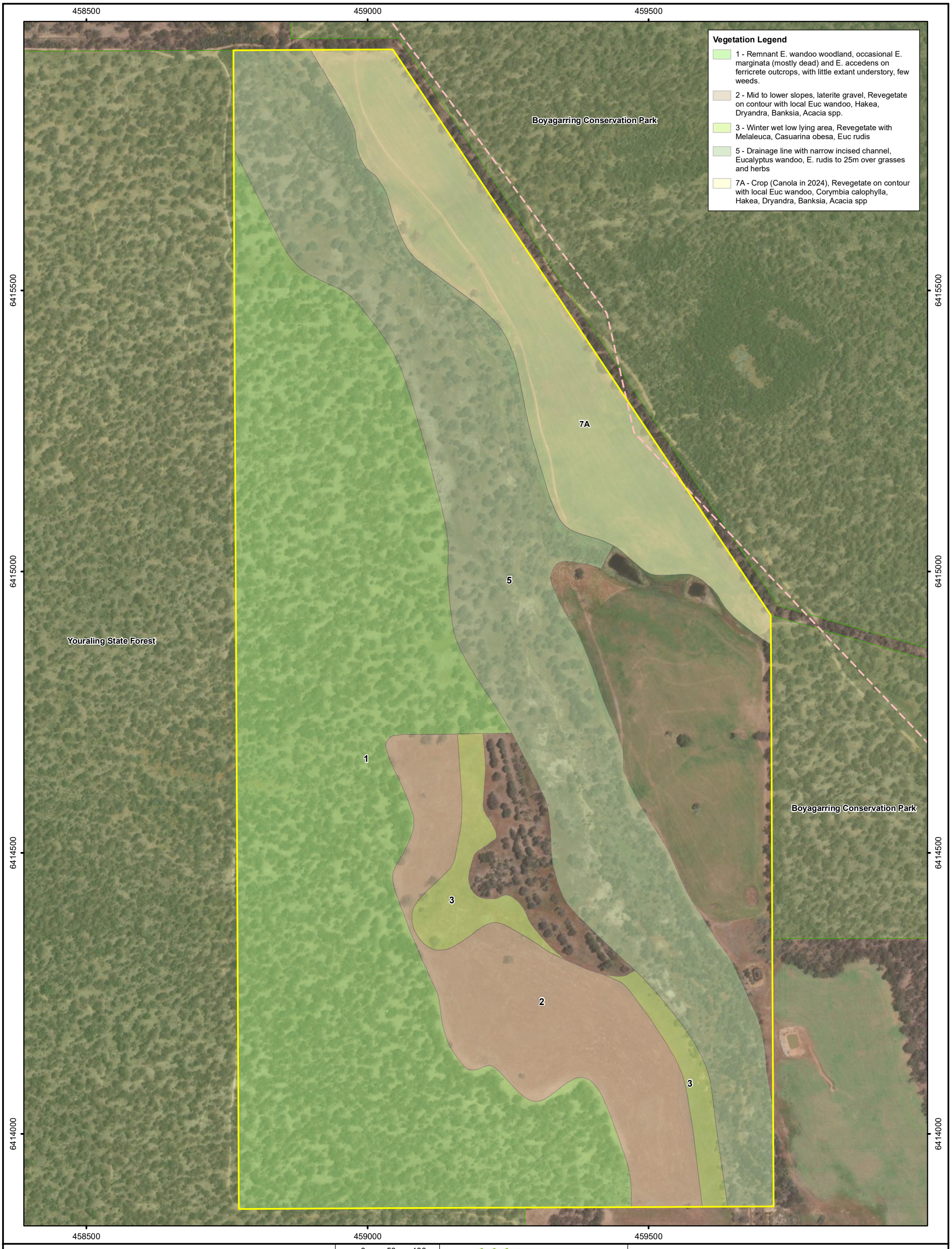

LOCATION MAP
MAP AREA
Legend
EPBC Referral 2023/09718 / MS 810
Proposed Project Area
Indicative Foraging Habitat (DBCA)
DBCA - Legislated Lands and Waters (DBCA)
60km Buffer
Kinross
Currambine
Upper Swan
Ellenbrook
Mount Helena
Mundaring
Bassendean
Perth
Burswood
Victoria Park
East Victoria Park
Rottnest Island
Cannington
Bicton
Booragoon
Canning Vale
Spearwood
Lot 64
National Park
Wandoo
Armadale
Rockingham
Byford
Mundijong
Waikiki
Warnbro
State Forest 14
Mandurah
Dawesville
Pinjarra
Dwellingup
Coolup
Pannister
Lake Clifton
Ranford
Waroona
Preston Beach
Yarloop
598 m
441 m
Williams River
Uduc
Harvey
Benger
5/1/g/Reserve
Lane Poole
N
0 2.5 5 10 15 20
Kilometers
Doral
Keysbrook Mineral Sands Project
Regional Availability of Similar Habitat
Scale 1:450,000
Datum: GDA94
Projection: MGA Zone 50
Sheet Size A3
Figure: 7-1
29/01/2025
350000
375000
400000
425000
450000
6475000
6450000
6425000
6400000
6375000
6350000
6325000

FIGURE 8-1: JELCOBINE OFFSET AND REVEGETATION ZONES

Imagery: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community



Legend
- Survey Area
- Legislated Lands
- Track

0 50 100m
Scale: 1:6,000
MGA94 (Zone 50)

CAD Ref: a3087_F002_01
Date: Aug 2025 | Rev: A | A3

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Doral Mineral Sands Pty Ltd
Jelcobine Project
Revegetation Areas

APPENDIX 1: VEGETATION SURVEY AND INITIAL REHABILITATION PLAN

Western Botanical

Vegetation and Rehabilitation, Lot DP 90037 Jelcobine, as a Potential Offset Package

Prepared for: Doral Mineral Sands Pty Ltd

Report Ref: WB1054



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This report has been designed for double-sided printing

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List of acronyms used in this report

Acronym	Meaning
ALA	Atlas of Living Australia
AOI	Area of Interest (i.e. Lot DP 90037)
BCE	Bamford Consulting Ecologists
EPBC	Commonwealth of Australia *Environmental Protection and Biodiversity Conservation Act 1999*
DBCA	WA Department of Biodiversity, Conservation and Attractions
DPIRD	WA Department of Primary Industries and Regional Development
WABC	Western Australian *Biodiversity Conservation Act 2016*

Executive Summary

Keysbrook Leucoxene Pty Ltd (KLPL), a subsidiary of Doral Mineral Sands Pty Ltd, (Doral) engaged Western Botanical in 2024 to undertake an assessment of the relative conservation values of Lot DP 90037 Jelcobine (Area of Interest, AOI). This site is a proposed offset package for future development at the Keysbrook Mineral Sands Project. The Keysbrook Mineral Sands Project, operates under Ministerial Statement No. 810 and No. 1089 and EPBC 2005/2016, and proposes to include an additional 512.94 ha of mining area located immediately to the west of the current operations. The Proposal/proposed Action is referred to as the "Western Extension" to the Keysbrook Mineral Sands Mine.

The focus of the assessment was on (i) Black-Cockatoo habitat, *i.e.* forage, roosting and nesting potential; and (ii) an initial site assessment to develop a proposed Rehabilitation Plan. The AOI is located in Jelcobine on the east side of the Darling Scarp, sandwiched between two DBCA Managed Reserves: Boyagarring Conservation Park to the east, and Youraling State Forest to the west.

The AOI was assessed by Western Botanical senior botanist Geoff Cockerton and senior ecologist Linda Dalgliesh over a four-day period inclusive of travel to and from site, 12th to 15th November 2024. The field survey focused on the potential of the AOI for Black-Cockatoo forage, nesting and roosting, encompassing: (i) assessment of Black-Cockatoo forage potential of the vegetation with regard to future vegetation rehabilitation; (ii) calculation of the availability of habitat trees for nesting and roosting; and (iii) presence and activities of Black-Cockatoos on site, (Western Botanical 2024). Site characteristics relevant to a proposed nature-positive Rehabilitation Plan included on-ground conditions (incorporating an assessment of surface soil, drainage/waterlogging potential, aspect, and impacts of grazing, etc) and existing vegetation (vegetation types and species composition) are presented in this report.

This report presents:

- Vegetation associations mapped with reference to landscape position, surface soils, dominant flora species and vegetation condition within and adjacent to Lot DP 90037, Jelcobine.
- Site characteristics relevant to a proposed Rehabilitation Plan specifically addressing site augmentation for a nature-positive outcome for Black-Cockatoo roosting, foraging and nesting habitat.
- Recommended species lists and quantities for revegetation of former pastured land and augmentation of remnant Wandoo woodland with understory species which have been chosen specifically for the forage habitat values of each species.

1. Introduction

In 2021, Black-Cockatoo habitat was identified in three Lots near Keysbrook for Doral Pty Ltd's Keysbrook Mineral Sands Mine (McCreery and Bamford 2021). Three threatened Black-Cockatoo species occur in the Keysbrook area; Forest Red-tailed (*Calyptorhynchus banksii naso*), Carnaby's (*Zanda latirostris*, previously *Calyptorhynchus latirostris*) and Baudin's (*Zanda baudinii*, previously *Calyptorhynchus baudinii*).

The conservation significance of these species under the federal *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC) and Western Australia's *Biodiversity Conservation Act 2016* (WABC) is listed below:

Forest Red-tailed Black-Cockatoo	Vulnerable (EPBC)	Vulnerable (WABC)
Carnaby's Black-Cockatoo	Endangered (EPBC)	Endangered (WABC)
Baudin's Black-Cockatoo	Endangered (EPBC)	Endangered (WABC)

The presence of Black-Cockatoo habitat within the Keysbrook Mineral Sands Mine area triggered the requirement for an offset under the EPBC.

Doral Pty Ltd (Doral) engaged Western Botanical to undertake an assessment of the relative conservation values of Lot DP 90037 (Area of Interest, AOI) as a proposed offset package, with a focus on (i) Black-Cockatoo habitat, *i.e.* forage, roosting and nesting and (ii) an initial site assessment for a proposed Rehabilitation Plan. The AOI is located in Jelcobine on the east side of the Darling Scarp, sandwiched between two reserves: Boyagarring Conservation Park to the east, and Youraling State Forest to the west.

2. Methods

2.1. Desktop Review and Preliminary

A desktop review of the AOI was conducted to evaluate the potential environmental conditions of the AOI (soils and vegetation). A variety of databases including geological (DPIRD-064) and botanical (DBCA-047) map layers from Data WA (2024) were reviewed prior to the field survey.

2.2. Field Survey

The AOI was assessed by Western Botanical senior botanist Geoff Cockerton and senior ecologist Linda Dalgliesh over a four-day period inclusive of travel to and from site, 12th to 15th November 2024.

The field survey focused on the potential of the AOI for Black-Cockatoo forage, nesting and roosting, encompassing: (i) assessment of Black-Cockatoo forage potential of the vegetation

with regard to future vegetation rehabilitation; (ii) calculation of the availability of habitat trees for nesting and roosting; and (iii) presence and activities of Black-Cockatoos on site. Site characteristics relevant to a proposed Rehabilitation Plan included on-ground conditions (soil, drainage, aspect, and impacts of grazing, etc) and existing vegetation (vegetation types and species composition).

Plant specimen data were entered into Western Botanical proprietary Fulcrum databases with an accuracy of +/- 2.5m for point data. Field notes were entered directly into iPads running the ARCGIS Field Maps application with background satellite imagery available at all times.

3. Results and Discussion

3.1. Desktop Review

The AOI is in the Northern Jarrah Forest subregion of the Jarrah Forest bioregion, with the Katanning subregion of the Avon Wheatbelt bioregion approximately 17 km to the east. The AOI to be assessed covers approximately 162.3 ha.

3.1.1. Landform and Soils

Mapping from DPIRD-064 (Data WA 2024) shows the AOI lies within the Western Darling Range Zone, and encompasses two soil systems. The Western Darling Range Zone is described as "Moderately dissected lateritic plateau on granite with deeply incised valleys; includes the Darling Scarp on the western margin. Soils are formed in laterite, lateritic colluvium, granite weathered *in-situ* and gneiss." (Schoknect *et al* 2004). A digital elevation model (DEM) is presented in Figure 1.

Two soil systems are regional units mapped at the 1:250,000 scale (Schoknect *et al* 2004). The majority of the AOI is Clackline System, with a small section in the south-east being Boyagin System (Data WA 2024). Note that due to the limitations of the ARCGIS attribute table, descriptions are truncated at 240 characters.

Clackline System: "Moderately dissected areas with gravelly slopes and ridges and minor rock outcrop on the eastern side of the Darling Plateau over weathered granite and granitic gneiss. Loamy gravels, shallow duplexes and pale deep sands common. Wandoo woodlands."

- Boyagin System: "Large duricrust remnants surrounded by stripped terrain of rock outcrops and fresh soils in Eastern Darling Range Zone. Gravels have Jarrah-Marri-Parrot bush forest. Loams and duplexes with York and Wandoo. Mallet and Powderbark on scarp footslope."

3.1.2. Vegetation

Vegetation mapping (DBCA-047) for the AOI indicates the presence of three vegetation types: Michibin, Williams, and Coolakin. These are all vegetation types of the Darling Plateau within the South West Forest Subregion.

- Michibin (Subcategory – Valleys) is described as "Open woodland of *Eucalyptus wandoo* over *Acacia acuminata* with some *Eucalyptus loxophleba* on valley slopes, with low woodland of *Allocasuarina huegeliana* on or near shallow granite outcrops in arid and perarid zones." (Data WA 2024)
- Williams (Subcategory – Valley floors and swamps) is described as "Mixture of woodland of *Eucalyptus rudis-Melaleuca rhaphiophylla*, low forest of *Casuarina obesa* and tall shrubland of *Melaleuca* spp. on major valley systems in arid and perarid zones." (Data WA 2024)
- Coolakin (Subcategory – Valleys) is described as "Woodland of *Eucalyptus wandoo* with mixtures of *Eucalyptus patens*, *Eucalyptus marginata* subsp. *thalassica* and *Corymbia calophylla* on the valley slopes in arid and perarid zones." (Data WA 2024)

3.2. Vegetation Types

The vegetation of the AOI, reflecting the soils and landscape, appear to fall wholly within the Clackline System of Schoknect *et al* 2004.

Nine land use types including five vegetation types were observed across the AOI (Figure 2). Some areas had little or no vegetation (e.g. farm dam) or were used for cropping. These are listed in Table 1 with approximate areas, brief descriptions and the dominant component species, with some notes on rehabilitation recorded during the field survey.

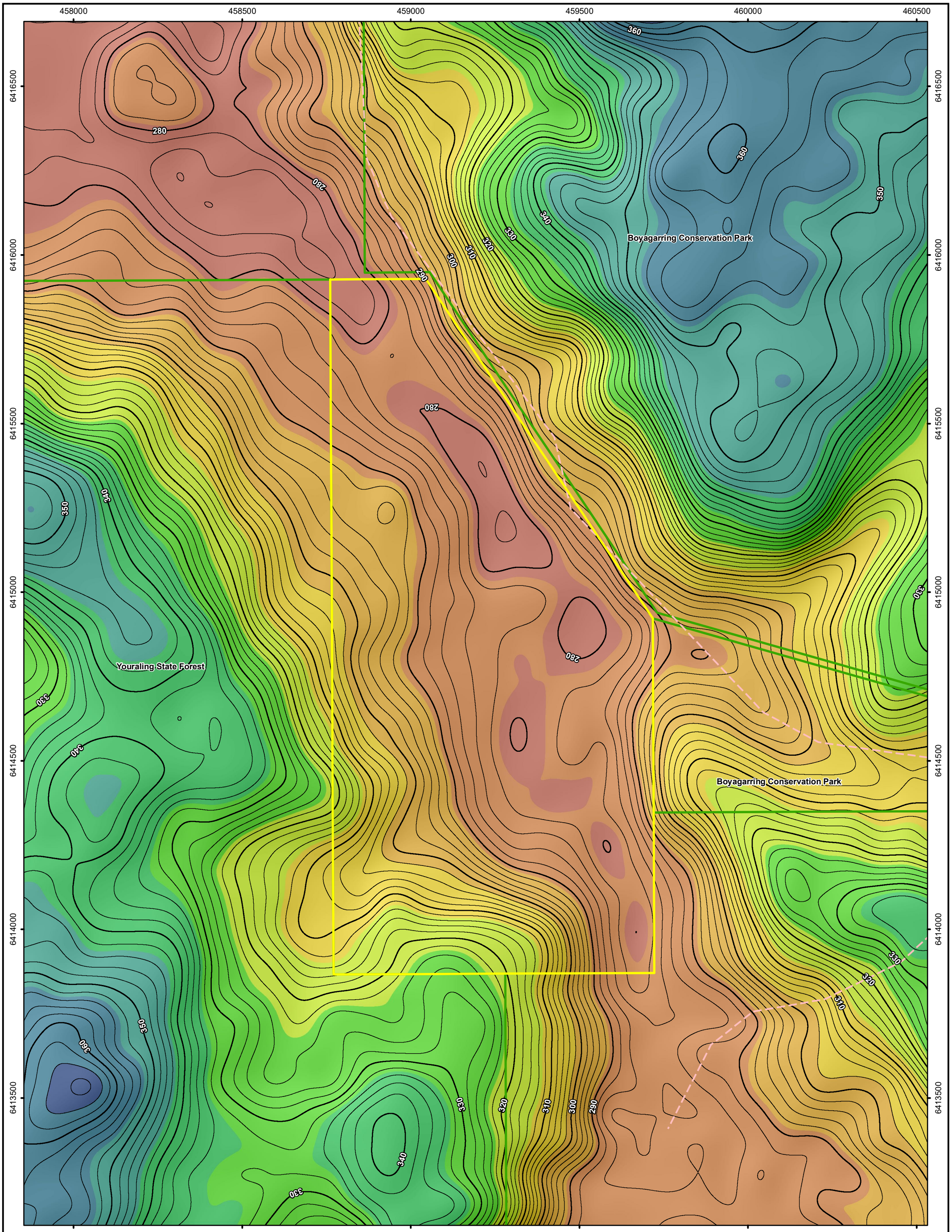
The vegetation types observed on the AOI do not match exactly with the vegetation types previously mapped by DBCA-047, due to matters of scale, the latter being at the 1:50,000 scale.

Table 1: Vegetation Types and Rehabilitation Notes

Veg Type	Area (ha)	Description	Rehabilitation Notes
1	64.70	Remnant *Eucalyptus wandoo* woodland, occasional *E. marginata* (mostly dead) and *E. accedens* on ferricrete outcrops, with little extant understory, few weeds.	Can augment understory with seedlings of local *Acacia, Hakea, Banksia* spp., improving feeding habitat for Black Cockatoo.
2	14.68	Mid to lower slopes, laterite gravel, Revegetate on contour with local *Eucalyptus wandoo, Hakea, Banksia, Acacia* spp.	Will provide good feeding habitat for Black-Cockatoos (Proteaceae spp.). Survey in contours for ripping and revegetation operation, ensuring stability. Suggest depth of gravely soil over kaolinitic clay be mapped across this area.
3	4.76	Winter wet low-lying area. Dense grass and herb ground cover.	Revegetate with *Melaleuca*, *Casuarina obesa*, *Eucalyptus patens.*
4	4.45	Planted *Eucalyptus* and *Casuarina* trees, grass and herbs understory. Wet area.	Outside proposed revegetation program
5	38.36	Drainage line with narrow incised channel, *Eucalyptus wandoo, E. rudis* to 25m over grasses and herbs. Saline at depth.	Revegetate with *Eucalyptus* spp, *Casuarina obesa, Hakea preissii.*
6	1.13	Farm dams and drainage, seepage, likely permanent water	Outside proposed revegetation program
7	32.95	Crop (Canola in 2024)	Outside proposed revegetation program
8	1.27	Fallow (no crop in 2024)	
9	0.14	Farm dam, *Typha* spp. dominated, permanent water	Outside proposed revegetation program
TOTAL	162.43	Entire AOI	

Figure 1. Digital Elevation Model of the Area of Interest

Topography: Shuttle Radar Topography Mission (SRTM) - NASA and the Department of Defence's National Imagery and Mapping Agency (NIMA).



Legend

- Survey Area
- Legislated Lands
- Track
- Contours (2m interval)

0 150m

Scale: 1:10,000
MGA94 (Zone 50)

CAD Ref: a3087_F004

Date: Jan 2025 | Rev: A | A3

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Doral Mineral Sands Pty Ltd

Jelcobine Project

Topography

Figure 2. Vegetation Types of the Study Area

Imagery: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

458500 459000 459500

6415500 6415000 6414500 6414000

Vegetation Legend

- 1 - Remnant E. wandoo woodland, occasional E. marginata (mostly dead) and E. accedens on ferricrete outcrops, with little extant understory, few weeds.
- 2 - Mid to lower slopes, laterite gravel, Revegetate on contour with local Euc wandoo, Hakea, Dryandra, Banksia, Acacia spp.
- 3 - Winter wet low lying area, Revegetate with Melaleuca, Casuarina obesa, Euc rudis
- 4 - Planted Eucalyptus and Casuarina trees, grass and herbs understory
- 5 - Drainage line with narrow incised channel, Eucalyptus wandoo, E. rudis to 25m over grasses and herbs
- 6 - Farm dams and drainage, seepage, likely permanent water
- 7 - Crop (Canola in 2024)
- 8 - Fallow
- 9 - Farm dam, Typha dominated, permanent water

Boyagarring Conservation Park

Youraling State Forest

Boyagarring Conservation Park

1 2 3 4 5 6 7 8 9

458500 459000 459500

Legend

- Survey Area
- Legislated Lands
- Track

0 50 100m

Scale: 1:6,000
MGA94 (Zone 50)

CAD Ref: a3087_F002

Date: Nov 2024 | Rev: A | A3

Western Botanical

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Doral Mineral Sands Pty Ltd

Jelcobine Project

Vegetation Types

3.3. Vegetation and Landscape

The AOI represents an east-facing slope with relief of approximately 40 m metres over a length of 1km, and slopes estimated at between 2 and 15 degrees. Soils are shallow sandy lateritic pizolitic sandy gravels, with occasional outcropping ferricrete on hill tops and ridges, likely overlying kaolinitic materials and weathered granite. These surface soils have high infiltration capacity and relatively low erodibility.

The eastern portion of the site represents a narrow minor incised saline drainage line which has been revegetated (est. 20 yrs. ago) with a range of native tree species. An approximately 20 ha area west of the drainage line with sandy-gravely soil has been previously cleared for agriculture and supports pasture species and is available for revegetation.

Lower slopes and flats adjacent and to the west of the drainage line support remnant *Eucalyptus wandoo* woodland on sandy clay soil with little midstory (due to grazing) and a good representation of persistent herbaceous species and native grasses to 20 cm high, with few weeds present.

The upper hill slope and hill tops support remnant *Eucalyptus wandoo*, *E. accedens* woodlands with trees in good to excellent condition, with minor inclusion of *Eucalyptus marginata* and *Corymbia calophylla*. The latter two species are not performing well in the current climatic conditions, with many deaths of trees noted. Little understory is present due to prior grazing (last grazed approximately 2016, pers. comm. Mr. Vince Pike) and the maturity of the eucalypt woodland in this landscape.

Three small spring-fed fresh water dams are present within the parcel of land being considered for purchase as an offset, adjacent to the Study Area in Figure 1.

The entire region, inclusive of the State Forest adjacent, has been logged in the past.

Representative photographs of the areas proposed to be revegetated or augmented with understory are presented in Appendix 2.

3.4. Flora

The flora assessment was aimed at identifying the dominant species on site for the purposes of vegetation description and habitat assessment. The species list is therefore truncated and is not a complete representation of all the flora on the property. Further, not all flora recorded are fully identified, however, the species list is adequate for the purpose of habitat description and assessment of Black Cockatoo habitat.

A total of 79 species from 31 families were observed during the field survey (Appendix 1). Of these, the majority are widely distributed within the northern Jarrah Forest and Wandoo Woodland. However, one species recorded outside the AOI has similarities to *Tetratheca*

phoenix Priority 2 flora (poorly known in WA) and if confirmed, this would represent a southwards range extension for this species.

Seven weed species were observed with six of these being considered pasture species. One species, *Gomphocarpus physocarpus* (Apocynaceae), was recorded in a moist area down-slope of the lower dam on the cropped portion of the property, is a Declared Pest in Western Australia (DPIRD 2024) and should be actively managed.

3.5. Rehabilitation

Areas of remnant Wandoo woodland vegetation provide some nesting habitat for Black Cockatoo, however, there is a lack of foraging habitat within the AOI. Revegetation with proven forage species suited to the soils and prevailing climate, inclusive of a minor component of local tree species, is intended to provide a significant nature-positive outcome by addressing the gap in food source species.

Given the gravelly lateritic pizolitic soils present throughout the study area, there is excellent potential for revegetation of previously pastured land and augmentation of remnant *Eucalyptus wandoo*, *E. accedens* woodland.

3.5.1. Project Sub-units

The project area is divided into five sub-units for revegetation planning and implementation purposes. These are also presented in Figure 3.

Revegetation Category	Area (ha)
Pastured Paddock - Low in Landscape	13.5
Pastured Paddock - High in Landscape	6.1
Remnant Wandoo Woodland, Low in Landscape	40.7
Remnant Wandoo Woodland, High in Landscape	31.0
Drainage line, add to existing revegetation	35.7
Total Area	**127.00**

Figure 3. Proposed Revegetation Sub-units within the AOI

Imagery: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

458500 459000 459500

6415500 6415000 6414500 6414000

Boyagarring Conservation Park

Youraling State Forest

Boyagarring Conservation Park

260 290 300 310 320 330 340 350

Legend

- Survey Area
- Legislated Lands
- Contours (2m interval)
- Pasture, High in Landscape
- Pasture, Low in Landscape
- Remnant Vegetation, High in Landscape
- Remnant Vegetation, Low in Landscape
- Drainage line, add to existing revegetation

0 50 100m

Scale: 1:6,000
MGA94 (Zone 50)

CAD Ref: a3087_F005

Date: Jan 2025 | Rev: A | A3

Western Botanical

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Doral Mineral Sands Pty Ltd
Jelcobine Project
Proposed Revegetation Plan

3.5.2. Species Selection

The species recommended are focussed on providing foraging habitat for Black Cockatoo within (i) former pasture on a gravely hill slope with easterly aspect and (ii) remnant Wandoo and Powderbark Wandoo woodland vegetation that has been grazed and which is lacking mid story. The drainage line within the property requires salt tolerant species to be utilised. An emphasis has been placed on utilising local species where these provide forage habitat for Black Cockatoo (BC) as well as including some tall trees to provide roosting habitat in future within formerly pastured paddock.

The species list has been prepared using a broad range of local species plus additional species that are known BC forage species, produce relatively large amounts of large seeds but which may not be local and will likely perform well on the soil types present and within the local climatic zone. Species such as *Eucalyptus marginata* and *Corymbia calophylla* are on the eastern fringe of their environmental tolerance and are only included in minor proportions. These recommendations are open to some substitutions following similar principles, if availability of some species is an issue.

Banksia and *Hakea* species which have large seeds that are relatively difficult to obtain, available in relatively modest quantities and are therefore costly are recommended to be planted as tubestock. Similarly, *Allocasuarina, Casuarina, Corymbia* and *Eucalypts* species are recommended in relatively low densities to provide some taller trees for vegetation structure in future rehabilitation of pasture.

Acacia and *Xanthorrhoea* species have been recommended for inclusion to provide (i) quick foliar cover and mid story structure and nitrogen fixing by the legumes; and (ii) longer-term forage habitat in the case of the local *Xanthorrhoea* species. Note that the quantity of *Xanthorrhoea* is aspirational only and availability of local seed will determine the quantity to be used.

Totals of 140,125 seedling tubestock and 13.325 kg of native seeds for direct seeding are recommended. Species recommendations with quantities noted are presented in Appendix 3 for Tubestock (T) Planting, and Appendix 4 for Direct Seeding (DS).

3.5.3. Rehabilitation Processes for Previously Pastured Land

Approximately 21 ha of previously pastured land can be revegetated using tubestock and direct seeding with a range of local species focussing on *Eucalyptus wandoo* as roosting habitat; *Hakea*, *Banksia* (formerly *Dryandra*), and *Banksia* sens. str. species providing feeding habitat, and local understory native legumes (e.g. *Acacia*, *Gastrolobium*, *Gompholobium*, *Kennedia*, and *Templetonia*) for nitrogen fixation and further feeding habitat.

Appendix 3 presents a core list of species and quantities suggested for rehabilitation in previously pastured land. This can be added to if a more diverse understory is deemed warranted.

It is recommended that an experienced revegetation contractor be contracted to prepare the site and undertake planting of tubestock. We recommend Chatfields Tree Nursery, Tammin.

A site preparation program should be implemented during the Summer prior to a planting program. The site preparation program should include:

- Detailed planning and mapping of planting areas and a review of site treatments required.
- Herbicide application (glyphosate or similar recommended) to existing pasture prior to seeding and planting of tubestock to minimise competition.
- Ripping at 1.5 to 2 m spacings, 20 to 30 cm deep on the contour using a grader or front-end loader with a tool bar. It is important that the ripped contour lines are surveyed and rip lines are discontinuous to minimise the chance of erosion on the moderate to steeper slopes.
- Species list has been prepared with reference to soil and site conditions.
- Planting and direct seeding can be implemented by hand or utilising a tractor-drawn tree planter.

3.5.4. Rehabilitation Processes for Remnant *Eucalyptus wandoo, E. accedens* woodland

Remnant *Eucalyptus wandoo*, *E. accedens* woodlands, which has been historically grazed and is devoid of mid story species encompassing about 70 ha in the AOI, can be augmented with understory species to provide improved forage habitat for Black-Cockatoo.

This can be achieved with a combination of:

- As the soil surface here is relatively non-compacted, and existing near-surface tree roots are intact, no ripping of the soil surface is recommended.
- However, a light surface scarification of the surface will help prepare planting areas for tubestock and a seed bed for direct-seeded species. This can be achieved using a small tractor with a light scarifier bar to scratch the surface to a depth of no more than 5 cm, avoiding damage to existing understory species.
- Tubestock planting of Proteaceae amongst the remnant woodland trees by and (operators using planting tubes) without any significant site disturbance.

- Direct seeding of legumes and some Proteaceae (as seed availability allows) throughout the remnant woodland.

3.5.5. Rehabilitation Processes for Drainage line with existing revegetation

- As this 35.7 ha site is relatively saline and has been previously revegetated and supports a good range of *Eucalyptus* species and *Casuarina pauper*, it is recommended that a mid-story of *Hakea preissii* be hand planted throughout to augment the potential food source for Black Cockatoo.

- Tubestock planting of *Hakea preissii* is therefore recommended at a low rate, 250 stems per ha.

- The site should not require any ripping or herbicide treatment and the tubestock can be hand planted between existing trees.

Appendix 4 presents a core list of species and quantities suggested for rehabilitation in remnant *Eucalyptus wandoo* and *E. accedens* woodland.

3.5.6. Seed Provenance

The availability of seeds of suitable provenances and suitable species for propagation will be crucial to the success of to the rehabilitation of the AOI. Therefore, a locally-focussed seed collection program should be implemented in 2025 to collect sufficient seed for nursery propagation and direct seeding. Some preferred species from suitable provenances may be available commercially.

Planting and direct seeding should occur in the Autumn following site preparation.

3.5.7. Fertilizer application

Fertilizer application should be minimal to avoid detrimental impacts to Proteaceae (i.e. *Banksia*, *Grevillea*, *Hakea,* and *Persoonia*) as these plants are susceptible to phosphate toxicity. Recommendations for a low-phosphate fertiliser application should be sought from the revegetation contractor.

3.5.8. Timing of Revegetation Operations

Optimal results are achieved in direct seeding and seedling planting programs when soil moisture is reliable and temperatures are warmer, meaning a mid to late Autumn planting is preferable. This hinges on the occurrence and quantity of rainfall and should be assessed at the time.

3.5.9. Insect Control for Direct Seeding

Successful direct seeding in former pasture is best achieved when seeds are spread in early Autumn, so that germination occurs as temperatures drop and autumn rainfall occurs. If seeding is deferred until the winter months, pasture pests such as Cut Worm and Red Legged Earth Mite (RLEM) can cause total failure of direct seeding operations as the pests ravage the germinating seedlings at the cotyledon stage. If direct seeding is undertaken in the cold winter months, effective misting of the direct seeded areas with an appropriate insecticide in old pasture will greatly improve the direct seeding outcomes.

3.5.10. Monitoring

Revegetation Success monitoring is recommended on an annual basis from years 1 to 5, and thereafter every second year for a reasonable timeframe, to assess success of the revegetation operation, assessing survival, flowering and fruiting events. If food-source species are found to not persist, the reason for poor performance should be investigated and either (i) the species be re-planted following addressing of the cause for poor performance (eg: grazing by rabbits, kangaroos); or (ii) poor performance of a species may indicate unsuitable site conditions and the species should not be replaced.

Fauna Utilisation monitoring on an annual basis is recommended from years 3 onwards (when flowering and fruiting of many species is likely to commence) to assess fauna (Black-Cockatoo) forage utilisation.

4. List of Participants

Staff Member	Field Surveys	Specimen Identification	Data Analysis	Report Preparation
Linda Dalgliesh B.Sc. Hons 1 (Zoology) Flora Taking (Biological Assessment) License No. – FB62000613	**1**	**1**	**1**	**1**
Geoff Cockerton B.Sc. (Biology) Flora Taking (Biological Assessment) License No. – FB62000046	**1**	**1**	**1**	**1**

5. References

Data WA (2024) Databases DPIRD-064 and DBCA-047. Available from https://www.data.wa.gov.au/ Accessed 11 November 2024.

DAWE 2022. Referral guideline for 3 WA threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black-cockatoo, Department of Agriculture, Water and the Environment, Canberra, February. ISBN 978-1-76003-330-9. Available from https://www.dcceew.gov.au/sites/default/files/documents/referral-guideline-3-wa-threatened-black-cockatoo-species-2022.pdf Accessed 29 October 2024.

Department of Primary Industries and Regional Development (DPIRD) (2024). Western Australian Organism List (WAOL). Online database available at: https://www.agric.wa.gov.au/organisms

McCreery, A. and Bamford, M. (2021) *Assessment of the nesting and foraging values of three Lots near Keysbrook for Doral Pty Ltd Keysbrook Mineral Sands Mine.* MJ & AR Bamford, Consulting Ecologists. Consultant's report prepared for Doral Pty Ltd.

Schoknecht, N.R., Tille, P.J. and Purdie, B.R. (2004) Soil-landscape mapping in south-Western Australia: an overview of methodology and outputs. Resource management technical report 280, Department of Agriculture and Food, Western Australia, Perth. November 2004. Available from https://library.dpird.wa.gov.au/cgi/viewcontent.cgi?article=1262&context=rmtr Accessed 4 November 2024.

Valentine, L. E., & Stock, W. (2008). Food resources of Carnaby's black-cockatoo (*Calyptorhynchus latirostris*) in the Gnangara sustainability strategy study area. Western Australian Department of Environment and Conservation. Available from https://ro.ecu.edu.au/ecuworks/6147 Accessed 17 December 2024.

Western Botanical (2024) *Assessment for Black Cockatoo Habitat, Lot DP 90037 Jelcobine, as a Potential Offset Package.* Consultant's report to Doral Mineral Sands Pty Ltd, Report Ref: WB1053.

Appendix 1. Representative Photographs of Vegetation Units

Remnant *Eucalyptus wandoo* woodland on upper slopes on free-draining gravely lateritic pizolitic soil, occasional *E. marginata* (mostly dead) and *E. accedens* on ferricrete outcrops, with little extant understory, few weeds.





Remnant Wandoo Woodland on lower slopes, shallow laterite gravel with sandy clay subsoil, subject to waterlogging.



Planted *Eucalyptus* and *Casuarina* trees, grass and herbs understory. Saline, wet area with sandy clay soil. Subject to waterlogging.

This proposal includes supplementary planting of *Hakea preissii* within this unit as a salt-tolerant and waterlogging-tolerant Black Cockatoo forage species.



Drainage line with narrow incised channel, *Eucalyptus wandoo, E. rudis* to 25m over grasses and herbs. Saline at depth, sandy clay soil subject to waterlogging.

These areas are excluded from the proposed rehabilitation plan as salt tolerant Black Cockatoo forage species are not known.



Dams, damp areas, fallow pasture



Canola Crop



Appendix 2. Flora Species Observed During the Field Survey

Family	Taxon	Common name	Status	BC Habitat value	Location	
					Veg Unit Within AOI [1]	Outside AOI
Amaranthaceae	*Ptilotus declinatus*	Curved Mulla Mulla		n/a	1	Y
Amaranthaceae	*Ptilotus manglesii*	Pom Poms		n/a	1	Y
Apocynaceae	*Gomphocarpus physocarpus*		Weed, Declared Pest	n/a	6 (near dams)	
Asteraceae	*Cotula coronopifolia*	Waterbuttons	Weed	n/a	6 (near dams)	
Asteraceae	*Podolepis gracilis*	Slender Podolepis		n/a	1, 5	Y
Asteraceae	*Siloxerus filifolius*			n/a	1, 5	Y
Asteraceae	*Waitzia acuminata* sens. lat.	Orange Immortelle		n/a		Y
Asteraceae	*Waitzia suaveolens* subsp. *suaveolens*	Fragrant Waitzia		n/a	5	Y
Asteraceae	*Xerochrysum macranthum*			n/a		Y
Boryaceae	*Borya* aff. *lacinata*			n/a	1, 5	Y
Brassicaceae	*Brassica napus* subsp. *napus*	Canola		Short term		
Casuarinaceae	*Allocasuarina huegeliana*	Rock Sheoak		Moderate		Y

[1] See Figure 3

Family	Taxon	Common name	Status	BC Habitat value	Location	
					Veg Unit Within AOI [1]	Outside AOI
Casuarinaceae	*Allocasuarina humilis*	Dwarf Sheoak		Moderate		Y
Casuarinaceae	*Casuarina obesa*	Swamp Sheoak	Planted	Low	4, 5	
Celastraceae	*Stackhousia monogyna*			n/a		Y
Cyperaceae	*Cyperaceae* sp. 10 cm			n/a	6	
Cyperaceae	*Cyperaceae* sp. GCLD 2408			n/a		Y
Cyperaceae	*Cyperaceae* sp. GCLD 2416			n/a	6	
Cyperaceae	*Lepidosperma* sp.			n/a		Y
Dilleniaceae	*Hibbertia ?prolata*			n/a		Y
Dilleniaceae	*Hibbertia commutata*			n/a	5	Y
Dilleniaceae	*Hibbertia parvula* ms (sp. Mt Helena)			n/a		Y
Dilleniaceae	*Hibbertia polystachya*			n/a		Y
Droseraceae	*Drosera gigantea*	Giant Sundew		n/a	5	Y
Elaeocarpaceae	*Tetratheca ?phoenix*		Priority 2	n/a		Y
Fabaceae	*Acacia celastrifolia*	Glowing Wattle		Moderate		Y
Fabaceae	*Acacia lasiocarpa* var. *sedifolia*			Low		Y
Fabaceae	*Acacia urophylla*			Moderate	1	Y
Fabaceae	*Gastrolobium calycinum*	York Road Poison		n/a	1	Y

Family	Taxon	Common name	Status	BC Habitat value	Location	
					Veg Unit Within AOI [1]	Outside AOI
Fabaceae	*Gastrolobium* sp.			n/a		Y
Goodeniaceae	*Goodenia* sp.			n/a	1, 5	Y
Haemodoraceae	*Anigozanthos bicolor*	Little Kangaroo Paw		n/a	5	Y
Haemodoraceae	*Conostylis* sp. (hairy leaves)			n/a	1	Y
Haloragaceae	*Gonocarpus cordiger*			n/a		Y
Hemerocallidaceae	*Agrostocrinum scabrum*	Blue Grass Lily		n/a	1	Y
Iridaceae	*Patersonia rudis*	Hairy Flag		n/a		Y
Liliaceae	*Liliaceae* sp.			n/a	5	Y
Loganiaceae	*Logania micrantha*			n/a		Y
Myrtaceae	*Corymbia calophylla*	Marri		High	1, 7	Y
Myrtaceae	*Eucalyptus accedens*	Powderbark		High	1	Y
Myrtaceae	*Eucalyptus camaldulensis*	Red River Gum	Planted	High	5	
Myrtaceae	*Eucalyptus leucoxylon*	Yellow Gum	Planted	High	5	
Myrtaceae	*Eucalyptus marginata* subsp. *thalassica*	Blue-leaved Jarrah		High	1	Y
Myrtaceae	*Eucalyptus occidentalis*	Flat-topped Yate	Planted	High	5	
Myrtaceae	*Eucalyptus patens*	Blackbutt		High		Y

Family	Taxon	Common name	Status	BC Habitat value	Location	
					Veg Unit Within AOI [1]	Outside AOI
Myrtaceae	*Eucalyptus rudis*	Flooded Gum		High	4, 5	Y
Myrtaceae	*Eucalyptus wandoo*	Wandoo		High	1, 5	Y
Myrtaceae	*Hypocalymma suave*	Tall White Myrtle		n/a	5	Y
Myrtaceae	*Leptospermopsis erubescens*	Roadside Teatree		n/a		Y
Myrtaceae	*Melaleuca aspalathoides*			n/a		Y
Myrtaceae	*Melaleuca viminea*	Mohan		n/a	5	Y
Orchidaceae	*Disa bracteata*	South African Orchid	Weed	n/a	5	Y
Orobanchaceae	*Bellardia trixago*	Bellardia	Weed	n/a	5	Y
Pittosporaceae	*Billardiera fraseri*	Elegant Pronaya		n/a	1, 5	Y
Poaceae	*Austrostipa* sp.			n/a	1, 5	Y
Poaceae	*Hordeum* sp.		Weed	n/a	2, 3, 4, 5	
Poaceae	*Phalaris* sp.		Weed	n/a	5, 6	
Poaceae	*Poaceae sp.*		Weed	n/a	2, 3, 4, 5	
Proteaceae	*Banksia dallanneyi* subsp. *dallanneyi*	Couch Honeypot		Low		Y
Proteaceae	*Banksia grandis*	Bull Banksia		High	1	Y
Proteaceae	*Banksia sessilis*	Parrot Bush		High	1	Y

Family	Taxon	Common name	Status	BC Habitat value	Location	
					Veg Unit Within AOI [1]	Outside AOI
Proteaceae	*Banksia squarrosa*	Pingle		High		Y
Proteaceae	*Hakea cyclocarpa*	Ramshorn		High		Y
Proteaceae	*Hakea lissocarpha*	Honey Bush		High	1	Y
Proteaceae	*Hakea prostrata*	Harsh Hakea		High		Y
Proteaceae	*Hakea trifurcata*	Two-leaf Hakea		High		Y
Proteaceae	*Hakea undulata*	Wavy-leaved Hakea		High		Y
Proteaceae	*Persoonia quinquenervis* (Jarrah Forest form)			Low		Y
Rutaceae	*Diplolaena graniticola* sens. lat.			n/a	1	Y
Sapindaceae	*Dodonaea* sp. GCLD 2407			n/a		
Stylidiaceae	*Stylidium* sp. bushy			n/a		Y
Thyphaceae	*Typha domingensis*			n/a	9	
Xanthorrhoaceae	*Xanthorrhoea gracilis*			Moderate		Y
Xanthorrhoaceae	*Xanthorrhoea* aff. *reflexa* (GCLD 2019)			Moderate		Y
Xanthorrhoaceae	*Xanthorrhoea drummondii*			Moderate		Y
Xanthorrhoaceae	*Xanthorrhoea* sp. Jelcobine (GCLD 2416)			Moderate		Y
Zamiaceae	*Macrozamia riedlei*	Zamia		n/a	1	Y

Appendix 3. Plant Species Suggested for Tubestock Propagation and Planting

Species Recommendations					Tubestock Recommended (stems per ha)					
					Pastured Paddock - Low in Landscape; Area (ha)	Pastured Paddock - High in Landscape; Area (ha)	Remnant Woodland, Low in Landscape; Area (ha)	Remnant Woodland, High in Landscape; Area (ha)	Drainage Line; Area (ha)	Total
Species	**Common Name**	**Height (m)**	**Source**	**Habitat Provided**	**14**	**7**	**46**	**30**	**35.7**	**Qty Tubestock Required**
Acacia celastrifolia		2.5	T & DS	Feeding	200	200	200			13,400
Acacia urophylla		2.5	T & DS	Feeding	200	200				4,200
Allocasuarina humilis	Dwarf Sheoak	2	T	Feeding	200	200	200			13,400
Banksia grandis		8	T	Feeding	50	50	100	25		6,400
Banksia nobilis subsp. nobilis		2.5	T	Feeding		200				1,400
Banksia sessilis var. sessilis		3	T	Feeding		400		100		5,800
Banksia squarrosa subsp. squarrosa		2.5	T	Feeding		400				2,800
Banksia undata		1.5	T	Feeding		200		50		2,900
Casuarina huegeliana	Rock Sheoak	10	T	Feeding		50				350
Corymbia calophylla		20	T	Roosting, Feeding	50		50			3,000
Eucalyptus accedens	Powderbark Wandoo	20	T	Roosting		50				350
Eucalyptus patens	Blackbutt	20	T	Roosting, Feeding	50					700

Species Recommendations					Tubestock Recommended (stems per ha)					
					Pastured Paddock - Low in Landscape; Area (ha)	Pastured Paddock - High in Landscape; Area (ha)	Remnant Woodland, Low in Landscape; Area (ha)	Remnant Woodland, High in Landscape; Area (ha)	Drainage Line; Area (ha)	Total
Species	**Common Name**	**Height (m)**	**Source**	**Habitat Provided**	**14**	**7**	**46**	**30**	**35.7**	**Qty Tubestock Required**
Eucalyptus wandoo	Wandoo	20	T	Roosting	100	100				2,100
Hakea laurina			T	Feeding	200	200	200	50		14,900
Hakea lissocarpha			T	Feeding	100	100	100	100		9,700
Hakea multilineata			T	Feeding		200	200	50		12,100
Hakea petiolaris subsp. trichophylla			T	Feeding	200	200	200	50		14,900
Hakea preissii			T	Feeding					250	8,925
Hakea prostrata			T	Feeding	100	100	100	50		8,200
Hakea undulata			T	Feeding	200	200	200	50		14,900
Kennedia coccinea subsp. coccinea			DS	Feeding						
Kennedia prostrata			DS	Feeding						
Xanthorrhoea sp. Jelcobine (GCLD 2416)	Jelcobine Grasstree		DS	Feeding	200	200	200	200		
					1,850	**3,250**	**1,750**	**725**		**140,425**

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Appendix 4. Species Recommended for Direct Seeding

Species Recommendations					Direct Seeding Qty Seed Per Rehabilitation Unit (grams)					
Species	**Common Name**	**Height (m)**	**Source**	**Habitat Provided**	**Qty per Ha (g)**	**Pastured Paddock, Low in Landscape; Area (ha)**	**Pastured Paddock, High in Landscape; Area (ha)**	**Remnant Woodland, Low in Landscape; Area (ha)**	**Remnant Woodland, High in Landscape; Area (ha)**	**Total Qty Required (g)**
Acacia celastrifolia		2.5	T & DS	Feeding	100	1400	700	4600		6,700
Acacia urophylla		2.5	T & DS	Feeding	50	700	350			1,050
Allocasuarina humilis	Dwarf Sheoak	2	T	Feeding						
Banksia grandis		8	T	Feeding						
Banksia nobilis subsp. nobilis		2.5	T	Feeding						
Banksia sessilis var. sessilis		3	T	Feeding						
Banksia squarrosa subsp. squarrosa		2.5	T	Feeding						
Banksia undata		1.5	T	Feeding						
Casuarina huegeliana	Rock Sheoak	10	T	Feeding						
Corymbia calophylla		20	T	Roosting, Feeding						
Eucalyptus accedens	Powderbark Wandoo	20	T	Roosting						
Eucalyptus patens	Blackbutt	20	T	Roosting, Feeding						
Eucalyptus wandoo	Wandoo	20	T	Roosting						

Species Recommendations					Direct Seeding Qty Seed Per Rehabilitation Unit (grams)					
Species	**Common Name**	**Height (m)**	**Source**	**Habitat Provided**	**Qty per Ha (g)**	**Pastured Paddock, Low in Landscape; Area (ha)**	**Pastured Paddock, High in Landscape; Area (ha)**	**Remnant Woodland, Low in Landscape; Area (ha)**	**Remnant Woodland, High in Landscape; Area (ha)**	**Total Qty Required (g)**
Hakea laurina			T	Feeding						
Hakea lissocarpha			T	Feeding						
Hakea multilineata			T	Feeding						
Hakea petiolaris subsp. trichophylla			T	Feeding						
Hakea prostrata			T	Feeding						
Hakea undulata			T	Feeding						
Xanthorrhoea sp. Jelcobine (GCLD 2416)	Jelcobine Grasstree		DS	Feeding	25	350	175	1,150	750	2,425
Kennedia coccinea subsp. coccinea			DS	Feeding	75	75	75	75	75	1,575
Kennedia prostrata			DS	Feeding	75	75	75	75	75	1,575
TOTAL SEED REQUIRED (g)					**175**	**2,450**	**1,225**	**5,750**	**750**	**13,325**



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APPENDIX 2: BLACK COCKATOO HABITAT ASSESSMENT

Western Botanical

Assessment for Black-Cockatoo Habitat, Lot DP 90037, as a Potential Offset Package

Prepared for: Doral Mineral Sands Pty Ltd

Report Ref: WB1053



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Executive Summary

Keysbrook Leucoxene Pty Ltd, a subsidiary of Doral Mineral Sands Pty Ltd, engaged Western Botanical to undertake an assessment of the relative conservation values of Lot DP 90037 as a proposed offset package for Black-Cockatoo habitat. Lot DP 90037 is located in Jelcobine on the east side of the Darling Scarp, sandwiched between two reserves: Boyagarring Conservation Park to the east, and Youraling State Forest to the west.

Summary Findings

Black-Cockatoos are abundant in the area. During the survey, White-tailed Black-Cockatoos (i.e. either Carnaby's or Baudin's Black-Cockatoo) were observed flying across Lot DP 90037 and feeding in the adjacent Youraling Forest Reserve approximately 240 m to the west. Forest Red-tailed Black-Cockatoos were observed approximately 2.1 km north of Lot DP 90037. Feeding traces of Carnaby's Black-Cockatoo and Forest Red-tailed Black-Cockatoo were observed on Pike Road approximately 2 km north of the AOI and adjacent to Boyagarring Conservation Park.

Lot DP 90037 currently offers good resources for Black-Cockatoos in the way of roosting and nesting trees, plus permanent water in two farm dams on the Lot DP 90037. A total of 32 Nest trees, suitable for Black-Cockatoo breeding, were assessed in 8 ha of remnant wandoo and mixed woodland, and 3 ha of drainage line during the survey. Assuming a more or less consistent density across each vegetation type, it was estimated that there are up to 204 Nest trees within the 64.7 hectares of wandoo and mixed woodland, and up to 25 Nest trees within the 38.36 ha of drainage line vegetation within the Lot.

Understorey plants suitable for Black-Cockatoo forage were observed in the adjacent Youraling Forest Reserve and Boyagarring Conservation Park, including patches of *Banksia sessilis* (Parrot Bush), *B. squarrosa* (Pingle) and *Hakea undulata* (Wavy-leaved Hakea). Both the Reserve and the Park are close enough to be utilised by Black-Cockatoos nesting in the AOI.

The forage value of Lot DP 90037 is currently limited. The addition of suitable plants in selected areas on Lot DP 90037 via a rehabilitation program would greatly improve the forage value, creating an ideal situation to encourage Black-Cockatoo breeding on Lot DP 90037, thus providing a satisfactory offset.

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List of acronyms used in this report:

Acronym	Meaning
ALA	Atlas of Living Australia
AOI	Area of Interest (i.e. Lot DP 90037)
BCE	Bamford Consulting Ecologists
DAWE	Federal Department of Agriculture, Water and the Environment
DBCA	WA Department of Biodiversity, Conservation and Attractions
DCCEEW	Federal Department of Climate Change, Energy, the Environment and Water
DBH	Tree Diameter at Breast Height (measured at 130cm above ground)
EPBC	*Environment Protection and Biodiversity Conservation Act 1999*
HQS	Habitat Quality Scoring
KLPL	Keysbrook Leucoxene Pty Ltd
MNES	Matters of National Environmental Significance
WABC	Western Australian *Biodiversity Conservation Act 2016*

1. Introduction

Keysbrook Leucoxene Pty Ltd (KLPL), a subsidiary of Doral Mineral Sands Pty Ltd, are seeking to expand current mining operations for the Keysbrook Mineral Sands Project, which operates under Ministerial Statement No. 810 and No. 1089 and EPBC 2005/2016, to include an additional 512.94 ha of mining area located immediately to the west of the current operations. The Proposal/proposed Action is referred to as the "Western Extension" to the Keysbrook Mineral Sands Mine.

The Proposed Action was determined to be a Controlled Action by the federal Department of Climate Change, Energy, the Environment and Water (DCCEEW) under the federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC) due to potential impacts to the following Matters of National Environmental Significance (MNES):

Carnaby's Black-Cockatoo (*Zanda latirostris*) – listed as Endangered under EPBC and Endangered under WABC

Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*) – listed as Vulnerable under EPBC and Vulnerable under WABC

KLPL engaged Western Botanical to undertake an assessment of the relative conservation values of Lot DP 90037 (Area of Interest, AOI) as a proposed offset package, with a focus on Black-Cockatoo habitat, *i.e.* forage, roosting and nesting. The AOI is located in Jelcobine on the east side of the Darling Scarp, sandwiched between two reserves: Boyagarring Conservation Park to the east, and Youraling State Forest to the west.

2. Methods

2.1. Desktop Review and Preliminary

A desktop review of the AOI was conducted to evaluate the potential environmental conditions of the AOI (soils, vegetation), the breeding and forage requirements of Black-Cockatoos, and to check for local nesting and roosting records. The desktop was extended to check for records of other fauna of conservation interest in the AOI. Searches included Atlas of Living Australia (ALA), and the Western Australian government databases Dandjoo and Data WA.

Dr. Mike Bamford of Bamford Consulting Ecologists (BCE) assisted in the preliminaries by providing a foraging assessment scoring system and nest tree assessment system, both of which had been used previously (McCreery and Bamford 2021). These systems were incorporated into Western Botanical proprietary Fulcrum apps for used in the field surveys (Appendix 1 and

Appendix 2 respectively). A list of Black-Cockatoo food plants (Appendix 3) was compiled from factsheets (Johnstone 2010a, 2010b and 2010c) and other sources (DAWE 2022, DEC 2008, Valentine and Stock 2011) for use in identifying potential forage plants on site. Appendix 4 illustrates bird feeding traces on *Corymbia calophylla* (Marri) gumnuts, for identifying the use of this tree as a food source by Black-Cockatoos in the field.

2.2. Field Survey and Analysis

The AOI was assessed by Western Botanical senior botanist Geoff Cockerton and senior ecologist Linda Dalgliesh over a four-day period (inclusive of travel to and from site), 12th to 15th November 2024. The field survey focused on the potential of the AOI for Black-Cockatoo forage, nesting and roosting, encompassing: (i) assessment of Black-Cockatoo forage potential of the vegetation with regard to future vegetation rehabilitation; (ii) calculation of the availability of Nest trees for nesting and roosting; (iii) presence and activities of Black-Cockatoos on site.

Due to the difficulties of distinguishing individuals of Baudin's Black-Cockatoo from Carnaby's Black-Cockatoo in the field, these two species were grouped together as White-tailed Black-Cockatoo in most observations.

Black-Cockatoo forage assessments were conducted at four sites across the AOI during on-foot traverses. Surveillance for Black-Cockatoos was conducted at the northern end of the AOI from 0630 to 0830 on 13th November 2024.

Potential nest trees were located and assessed at seven locations (Areas) within the AOI during on-foot traverses. The diameter at breast height (at 1.3m above ground) (DBH) was measured where possible with a DBH tape, or estimated where this was more appropriate due to inaccessibility of the lower trunk. Trees were scored with a rank of 1 to 5 using BCE's Nest tree scoring system. Trees with a ranking of 5 (i.e. "Tree lacking large hollows or broken branches…") were generally not recorded as these were considered not likely to be used as nest trees by Black-Cockatoos. An exception was made for *Corymbia calophylla* (Marri) as these trees are valuable as a food source (seeds and borers) for Black-Cockatoos, as well as for other fauna.

Nest tree data, forage assessments and fauna observations were entered into Western Botanical proprietary Fulcrum databases with an accuracy of +/- 2.5m for point data. Field notes and locations of Nest trees were entered directly into iPads running the ARCGIS Field Maps application with background satellite imagery available at all times. Nest tree density was calculated for each vegetation type by summing the number of trees in each Area, and extrapolating across the vegetation type in which the Area/s were located.

Incidental fauna observations of animals, their calls, tracks, scats and feeding traces, were also recorded during the survey.

A motion-sensor camera (Signify™ Wildlife Camera) was set up at 1915 PM on Tuesday 12th November to record incidental nocturnal and diurnal fauna moving through the drainage line. The camera was set to record black and white video footage and photographs at night by infra-red light, and colour photographs and video footage by daylight. The camera was dismantled at 1100 AM on Friday 15th November. The total run time encompassed three nights and two days. Photographs and video footage from the camera were later uploaded to a laptop to check for recorded wildlife.

Habitat Quality Scores were calculated for Carnaby's and Forest Red-tailed Black-Cockatoo, and each vegetation type observed and mapped during the flora survey (Western Botanical 2024). The Habitat Quality Scores were calculated in a spreadsheet using BCE's method outlined in Appendix 2 of Bleby, Bamford & McCreery (2022).

3. Results and Discussion

3.1. Desktop Review

Modelling by the Australian Government (2012) shows the AOI is within the breeding range for Carnaby's Black-Cockatoo. Baudin's Black-Cockatoo may occur in the AOI but it isn't modelled as part of the breeding range. There is a known breeding site for Baudin's to the west of the AOI. The Forest Red-tailed Black-Cockatoo may occur in the AOI. None of these species have been recorded in the AOI (Dandjoo 2024).

There is a Black-Cockatoo roosting site recorded approximately 12km to the west-northwest, and another roosting site approximately 12 km to the east-southeast (Black-Cockatoo Roosting Sites - Buffered (DBCA-064) data from Birdlife Australia) (Data WA 2024). No breeding sites have been recorded within 20 km of the study area (Black-Cockatoo Breeding Sites - Buffered (DBCA-063) data from Birdlife Australia) (Data WA 2024).

Several fauna species of conservation significance were identified as potentially within the AOI, either as resident or visiting animals (Table 1).

Table 1. List of Fauna potentially within the AOI

Species and common name	Conservation significance *WABC Act	Conservation significance *EPBC Act	Notes
Peregrine Falcon (*Falco peregrinus*)	Other Specially Protected	Not listed	Recorded within 10km[a] of the AOI and AOI is within natural range[b]
Barking Owl southwest subpopulation (*Ninox connivens connivens*)	P3	Not listed	AOI is within natural range[b]
Masked Owl southwest (*Tyto novaehollandiae novaehollandiae*)	P3	Not listed	AOI is within natural range[b]
Chuditch (*Dasyurus geoffroii*)	Vulnerable	Vulnerable	AOI is within natural range[b]
Darling Range southwest Ctenotus (*Ctenotus delli*)	Vulnerable	Vulnerable	AOI is within natural range[b]
Western Brush Wallaby (*Notamacropus irma*)	P4	Not listed	AOI is within natural range[b]
Quenda (*Isoodon fusciventer*)	P4	Not listed	AOI is within natural range[b]

*WABC Act = Western Australian *Biodiversity Conservation Act 2016, EPBC Act* = Federal *Environment Protection and Biodiversity Conservation Act 2001.* [a]*Atlas of Living Australia,* [b]*Dandjoo*

3.2. Black-Cockatoo observations

White-tailed Black-Cockatoos were observed at several locations around the AOI during the survey. Birds were heard at 1215 PM on the 12th November 2024 and pairs of Black-Cockatoos were observed at a distance flying across the AOI during the survey but were not photographed. A single Black-Cockatoo was observed calling to a nearby flock from a dead tree at 0657 AM on 13th November 2024 (Figure 1).

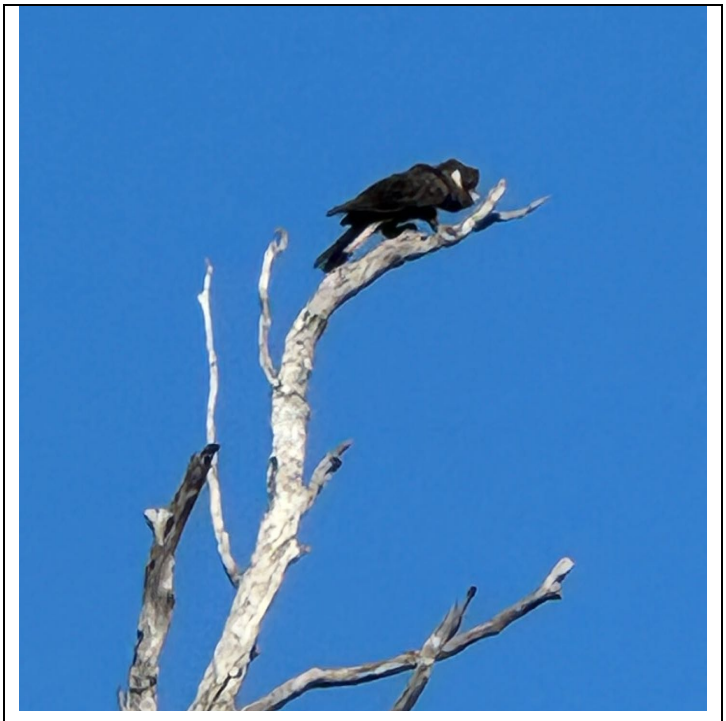


Figure 1: White-tailed Black-Cockatoo in a dead tree on site.

Small groups of White-tailed Black-Cockatoos were heard and seen in the wandoo woodlands of Youraling Forest Reserve, including a group of four White-tailed Black-Cockatoos observed about 0545 AM on 14th November 2024 as they fed in understorey low shrubs of *Hakea undulata* (wavy-leaved Hakea) and on the ground approximately 240m west of the AOI.

Although no Forest Red-tailed Black-Cockatoos were observed on the AOI, a pair was seen and heard at Mr Vince Pike's residence, approximately 2.1 km north of the AOI, at about 1815 PM on 13th November 2024.

An inspection of Marri fruit under a tree on nearby Pike Road in Boyagarring Conservation Park revealed feeding traces of Forest Red-tailed Black-Cockatoo (Figure 2) and Carnaby's Black-Cockatoo (Figure 3).



Figure 2: Feeding traces of Forest Red-tailed Black-Cockatoo on Marri fruit



Figure 3: Feeding traces of Carnaby's Black-Cockatoo on Marri fruit

These observations suggest a species density score of 1 (abundant) using the BCE system, for Forest Red-tailed Black-Cockatoo and Carnaby's Black-Cockatoo. It seems likely that Baudin's Black-Cockatoo would be also in the area, and also abundant.

3.3. Nest trees

A total of thirty-two potential Nest trees (recorded as Habitat trees) was assessed across the AOI during on-foot traverses (Figure 4).

Four species of potential Nest tree were recorded in the AOI; *Corymbia calophylla* (Marri), *Eucalyptus accedens* (Powderbark), *E. marginata* (Jarrah) and *E. wandoo* (Wandoo).

The assessed trees had a DBH range of 600 to 1260 mm.

Imagery: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

458500 459000 459500

6415500 6415000 6414500 6414000

Boyagarring Conservation Park

Area 7 (3.00ha)

Area 6 (1.90ha)

Area 5 (2.92ha)

Youraling State Forest

Boyagarring Conservation Park

Area 3 (1.05ha)

Area 4 (1.13ha)

Area 1 (1.00ha)

Area 2 (3.99ha)

458500 459000 459500

Legend

- Survey Area
- Legislated Lands
- Track
- Habitat Tree Search Area
- Habitat tree

0 50 100m

Scale: 1:6,000
MGA94 (Zone 50)

CAD Ref: a3087_F003

Date: Dec 2024 | Rev: A | A3

Western Botanical

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Doral Mineral Sands Pty Ltd

Jelcobine Project

Habitat Tree Search Area

The majority of trees assessed as having potential for nesting were ranked 3 or 4 (ie. trees with suitable hollows, or suboptimal hollows respectively, neither having evidence of current use for breeding). Many trees had more than one suitable hollow visible from the ground (Figure 5 and Figure 6).



Figure 5: A typical *Eucalyptus wandoo* tree with hollows



Figure 6: Close-up of the hollows in a typical *Eucalyptus wandoo* tree

One tree, a Marri, (*Corymbia calophylla*) was ranked as 5 (i.e. no hollows), nevertheless was recorded because this species provides a valuable food source for Black-Cockatoos. This huge old Marri tree was situated in the middle of a paddock of canola, and has damage to bark and lower limbs from recent paddock fires.

A total of 27 potential Nest trees was recorded in the combined Areas (Areas 1, 3, 4, 5 and 6, on Figure 4, totalling 8 ha) of the wandoo woodland and mixed woodland (Vegetation type 1). The Nest tree density for the wandoo woodland was therefore calculated to be 3.375 trees per hectare. There were 64.7 ha of wandoo woodland and mixed woodland in the AOI, minus 3.99 ha of ferricrete with no suitable Nest trees, resulting in 60.71 ha of woodland with potential Nest trees. Therefore, it is expected that there would be (3.375 x 60.71=) 204 Nest trees each with one or more hollows in the wandoo woodland and mixed woodland.

A total of three potential Nest trees were recorded in the drainage line (Vegetation type 5), with two trees recorded in Area 7 (3.0 ha). The Nest tree density was calculated to be (2 ÷ 3 =) 0.67

trees per hectare. The drainage line covers 38.36 hectares, and extrapolation gives an expected (38.36 x 0.67=) 25 Nest trees each with one or more hollows suitable for nesting.

Trees in the AOI considered currently not suitable for nesting, due to having no visible hollows and/or a trunk with a DBH well below 600mm, were not recorded. These trees were generally not old enough to have reached the girth necessary for suitable hollow formation, i.e. 200 years or more for hollow formation to occur (DAWE 2022), with DBH of at least 300 to 500 mm (DAWE 2022). It is expected that these trees will develop hollows as they age.

A compilation of the species and ranking of the Nest trees is provided in Table 2. A comprehensive database of the Nest trees recorded is presented in Appendix 5.

The drainage line has stands of *Eucalyptus rudis* (Flooded Gum) and planted non-native *Eucalyptus* spp. (such as Ironbark, River Red Gum) which may be potential roosting trees for Black-Cockatoos. Two small farm dams on the east side of the AOI appear to be spring-fed and may offer permanent water. The proximity of farm dams to potential roosting trees offers a good roosting resource for Black-Cockatoos.

Table 2: Nest trees recorded in six areas within the AOI

Tree species	Common name	Ranking (adapted from Bamford Consulting Ecologists)	Number of trees assessed
Corymbia calophylla	Marri	5 - Tree lacking large hollows or broken branches that might have large hollows	1
Eucalyptus accedens	Powderbark	3 - Potentially suitable hollow visible but no chew marks present at entrance, or potentially suitable hollow suspected to be present.	4
Eucalyptus marginata	Jarrah	3 - Potentially suitable hollow visible but no chew marks present at entrance, or potentially suitable hollow suspected to be present.	1
Eucalyptus wandoo	Wandoo	3 - Potentially suitable hollow visible but no chew marks present at entrance, or potentially suitable hollow suspected to be present.	23
		4 - Tree with large hollows or broken branches that might contain large hollows, but hollows or potential hollows are not vertical or near-vertical	3

3.4. Black-Cockatoo forage assessments

Black-Cockatoo forage assessments were conducted at four sites across the AOI during on-foot traverses; three sites within wandoo woodland (Wandoo and Powderbark) and one site in mixed woodland (Jarrah, Wandoo and Powderbark).

The entire area of wandoo woodland and mixed woodland within the AOI has been grazed by sheep as recently as 2016 (Mr. Vince Pike pers. comm.), and has an understorey dominated by grasses, geophytes such as orchids and sundews, and small shrubs. None of the shrubs observed in the grazed area are forage for Black-Cockatoo, and there were no Proteaceous shrubs such as *Hakea* or *Banksia*. In some places, the ground was bare gravel (laterite) or exposed rock (ferricrete). There were no *Corymbia calophylla* (Marri) found in the grazed woodlands.

Although large trees of Wandoo and Powderbark are valuable for roosting, and utilised for nesting when they have suitable hollows, these species are not favoured as forage by Black-Cockatoos. These two species have much smaller seeds than those of Marri, the favoured food tree of Black-Cockatoos (Cooper *et al* 2003, Lee *et al* 2013). Jarrah (*Eucalyptus marginata*) has some value as a food source for Forest Red-tailed Black-Cockatoos (Johnstone 2010c), Carnaby's Black-Cockatoo (Valentine and Stock 2008) and Baudin's Black-Cockatoo (Johnstone 2020b).

The current forage potential of the wandoo woodland within the AOI was therefore considered to be Low. The current forage potential of the mixed woodland was considered to be Negligible to Low. Revegetation of these areas of wandoo and mixed woodland with suitable locally-indigenous plants could improve their forage potential for Black-Cockatoos, and may also benefit other wildlife in the area such as Black-gloved Wallabies, Red-capped Parrots and Quenda.

Figure 7, **Figure 8** and Figure 9 show typical views of the grazed wandoo woodland.

Figure 10 shows a view typical of the grazed mixed woodland.

The rehabilitation potential of the wandoo and mixed woodlands, and other vegetation types within the AOI, is discussed in the flora/vegetation report WB 1054 (Western Botanical 2025).



Figure 7: Grazed wandoo woodland, west side of AOI



Figure 8: Grazed wandoo woodland, NW side of AOI



Figure 9: Grazed wandoo woodland, NW side of AOI



Figure 10: Grazed mixed woodland, SW corner of AOI

3.5. Habitat Quality Scoring

Habitat Quality Scoring for Carnaby's Black-Cockatoo (Table 3) and Forest Red-tailed Black-Cockatoo (Table 4) are presented for each vegetation type within the AOI. Note that these are colour-coded to match vegetation types presented in WB 1054 (Western Botanical, 2025).

Three assumptions for the Habitat Quality Scoring (HQS) were;

1. In areas naturally covered by Wandoo woodland, it would be difficult to establish Marri, Jarrah and Sheoak due to likely unfavourable climatic conditions in a drying climate. These areas would be better augmented with Wandoo woodland understorey species such as local *Acacia* sp. and *Hakea* sp. shrubs.

2. Carnaby's and Forest Red-tailed Black-Cockatoos are abundant (as defined in Appendix 2 of Bleby, Bamford and McCreery, 2022) giving a species density score of 1 for each species.

3. Carnaby's Black-Cockatoo are likely to breed in the area, and it is possible that Forest Red-tailed Black-Cockatoos would breed in the area, thereby giving a site context of 1 for these two species.

Table 3: Habitat Quality Scoring for Carnaby's Black-Cockatoo

Vegetation Key	Vegetation Legend Description	Area within AOI (ha)	A: Veg Comp	B: Context	C: Density	D: Total (HQS)	To be revegetated?
1	Remnant *E. wandoo* woodland, occasional *E. marginata* (mostly dead) and *E. accedens* on ferricrete outcrops, with little extant understory, few weeds.	64.70	2	1	1	4	YES
2	Mid to lower slopes, laterite gravel. Revegetate on contour with local *Euc wandoo*, *Hakea*, *Dryandra*, *Banksia*, *Acacia* spp.	14.68	0	1	1	2	YES
3	Winter wet low lying area, Revegetate with *Melaleuca*, *Casuarina obesa*, *Euc rudis,* etc	4.76	1	1	1	3	YES
4	Planted *Eucalyptus* and *Casuarina* trees, grass and herbs understory	4.45	2	1	1	4	NO
5	Drainage line with narrow incised channel, *Eucalyptus wandoo*, *E. rudis* to 25m over grasses and herbs	38.36	2	1	1	4	YES
6	Farm dams and drainage, seepage, likely permanent water	1.13	0	1	1	2	NO
7	Crop (Canola in 2024)	32.95	1	1	1	3	NO
8	Fallow	1.27	0	1	1	2	NO
9	Farm dam, *Typha* dominated, permanent water	0.14	0	1	1	2	NO

Table 4: Habitat Quality Scoring for Forest Red-tailed Black-Cockatoo

Vegetation Key	Vegetation Legend Description	Area within AOI (ha)	A: Veg Comp	B: Context	C: Density	D: Total (HQS)	To be revegetated?
1	Remnant *E. wandoo* woodland, occasional *E. marginata* (mostly dead) and *E. accedens* on ferricrete outcrops, with little extant understory, few weeds.	64.70	1	1	1	3	YES
2	Mid to lower slopes, laterite gravel, Revegetate on contour with local *Euc wandoo*, *Hakea*, *Dryandra*, *Banksia*, *Acacia* spp.	14.68	0	1	1	2	YES
3	Winter wet low lying area, Revegetate with *Melaleuca*, *Casuarina obesa*, *Euc rudis*	4.76	1	1	1	3	YES
4	Planted *Eucalyptus* and *Casuarina* trees, grass and herbs understory	4.45	2	1	1	4	NO
5	Drainage line with narrow incised channel, *Eucalyptus wandoo*, *E. rudis* to 25m over grasses and herbs	38.36	2	1	1	4	YES
6	Farm dams and drainage, seepage, likely permanent water	1.13	0	1	1	2	NO
7	Crop (Canola in 2024)	32.95	0	1	1	2	NO
8	Fallow	1.27	0	1	1	2	NO
9	Farm dam, *Typha* dominated, permanent water	0.14	0	1	1	2	NO

3.6. Other fauna

Besides Black-Cockatoos, a total of 31 bird species, six mammal and two reptile species were observed in the AOI during the surveys (Table 5). Note that observations were not limited to sightings, and included calls, feeding traces, scats and tracks.

One species, Diamond Dove (*Geopelia cuneata*) is a range extension; this species is usually found at least 280 km north of the AOI (Atlas of Living Australia 2024) and may be an aviary escapee.

Four introduced animals were recorded during the survey; Laughing Kookaburra (*Dacelo novaeguineae*), Feral Cat (*Felis catus*), Feral Pig (*Sus scrofa*) and Rabbit (*Oryctolagus cuniculus*). The presence of Feral Pig and Rabbit could impact a rehabilitation program and these animals may require pest management.

Table 5: List of fauna other than Black-Cockatoos observed in or near the AOI

Group	Common name	Species	Comments
Bird	Emu	*Dromaius novaehollandiae*	
	Grey teal	*Anas gracilis*	Breeding on farm dam
	Diamond dove	*Geopelia cuneata*	Range extension
	Fan-tailed cuckoo	*Cacomantis flabelliformis*	
	Horsfield's bronze-cuckoo	*Chrysococcyx basalis*	
	Shining bronze-cuckoo	*Chrysococcyx lucidus*	
	Wedge-tailed eagle	*Aquila audax*	
	Laughing kookaburra	*Dacelo novaeguineae*	Introduced
	Sacred kingfisher	*Todiramphus sanctus*	
	Rainbow bee-eater	*Merops ornatus*	
	Regent parrot	*Polytelis anthopeplus*	
	Elegant parrot	*Neophema elegans*	
	Australian ringneck	*Barnadius zonarius*	
	Western rosella	*Platycercus icterotis*	

Group	Common name	Species	Comments
Bird	Red-capped parrot	*Purpureicephalus spurius*	
	Purple-crowned lorikeet	*Parvipsitta porphyrocephala*	
	Rufous tree-creeper	*Climacteris rufa*	
	Singing honeyeater	*Gavicalis virescens*	
	Brown honeyeater	*Lichmera indistincta*	
	New Holland honeyeater	*Phylidonyris novaehollandiae*	
	White-cheeked honeyeater	*Phylidonyris niger*	
	Yellow-plumed honeyeater	*Ptilotula ornata*	
	Brown-headed honeyeater	*Melithreptus brevirostris*	
	Striated pardalote	*Pardalotus striatus*	
	Western gerygone	*Gerygone fusca*	
	Rufous whistler	*Pachycephala rufiventris*	
	Dusky woodswallow	*Artamus cyanopterus*	
	Willie wagtail	*Rhipidura leucophrys*	
	Australian raven	*Corvus coronoides*	
	Rufous songlark	*Cincloramphus mathewsi*	
	Tree martin	*Petrochelidon nigricans*	
Mammal	Western brush wallaby	*Notamacropus irma*	Conservation significant (WABC) as P4
	Western grey kangaroo	*Macropus fuliginosus*	
	Echidna	*Tachyglossus aculeatus aculeatus*	
	Rabbit	*Oryctolagus cuniculus*	Introduced
	Feral pig	*Sus scrofa*	Introduced
	Feral cat	*Felis catus*	Introduced
Reptile	Gould's monitor	*Varanus gouldii*	
	Bobtail	*Tiliqua rugosa*	

4. Summary

The AOI currently offers good resources for Black-Cockatoos in the way of roosting and nesting trees. The AOI contains relatively intact wandoo woodland and mixed woodland of jarrah/Marri/Powderbark, both of which have healthy trees over a degraded (historically grazed) understorey. The understorey is dominated by weedy grasses, with scattered geophytes such as orchids and sundews, and few of the larger shrubs typical of local woodlands.

There is good understorey forage available for Black-Cockatoos in the adjacent Youraling Forest Reserve and Boyagarring Conservation Park, including patches of *Banksia sessilis* (Parrot Bush), *B. squarrosa* (Pingle) and *Hakea undulata* (Wavy-leaved Hakea). Both the Reserve and the Park are close enough to be utilised by Black-Cockatoos nesting in the AOI.

The stands of *Eucalyptus rudis* (flooded gum) and planted non-native *Eucalyptus* spp. (ironbark, river red gum) in the drainage channel may be potential roosting trees for Black-Cockatoos. The value of these potential roosting trees is increased by the presence of two small farm dams which appear to be spring-fed and may offer permanent water.

The Nest tree density for the wandoo and mixed woodland was calculated to be 3.375 trees per hectare, with an extrapolated 204 Nest trees with hollows that may be suitable for breeding within the 64.7 ha of this vegetation type. Similarly, the Nest tree density for the drainage line was calculated to be 0.67 trees per hectare, with an extrapolated 25 Nest trees with hollows that may be suitable for breeding within the 38.36 ha of this vegetation type. Although no active nesting sites were observed during the survey, the AOI is likely to be a good breeding resource for Black-Cockatoos.

Habitat Quality Scores for the various vegetation types varied from 2 (e.g. for Fallow land for all three Black-Cockatoo species) up to a maximum of 4 (e.g. for Remnant *E. wandoo* woodland for Carnaby's Black-Cockatoo).

The addition of Black-Cockatoo forage plants in selected areas on the AOI via a rehabilitation program would increase the availability of food and the likelihood of nesting in the AOI. These improvements to the AOI would create a suitable offset.

5. List of Participants

Staff Member	Field Surveys	Specimen Identification	Data Analysis	Report Preparation
Geoff Cockerton B.Sc. (Biology) Flora Taking (Biological Assessment) License No. – FB62000046	**1**	**1**	**1**	**1**
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6. References

Atlas of Living Australia (2024) Website at http://www.ala.org.au/ Accessed 8 June 2024.

Bleby, K., Bamford, M., & McCreery, A. (2022) Assessment of Nesting, Foraging and Roosting Values for Three Species of Black-Cockatoo in Lots 62, 63, 20 and 507 near Keysbrook, Western Australia. Consultant's report prepared for Doral Mineral Sands. 9th September 2022.

Cooper, C., Withers, P., Mawson, P. R., Johnstone, R., Kirkby, T., Prince, J., Bradshaw, D., & Robertson, H. (2003) Characteristics of Marri (*Corymbia calophylla*) fruits in relation to the foraging behaviour of the Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*). *Journal of the Royal Society of Western Australia*, *86*(4), 139-142. Available from https://research-repository.uwa.edu.au/en/publications/characteristics-of-marri-corymbia-calophylla-fruits-in-relation-t Accessed 18 December 2024.

Dandjoo (2024) Website at https://dandjoo.bio.wa.gov.au/ Accessed 29 October 2024.

Data WA (2024) Website at https://www.data.wa.gov.au/ Accessed 11 November 2024.

DAWE (2022) Referral guideline for 3 WA threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black Cockatoo, Department of Agriculture, Water and the Environment, Canberra, February. Available from https://www.dcceew.gov.au/sites/default/files/documents/referral-guideline-3-wa-threatened-black-cockatoo-species-2022.pdf Accessed 11 November 2024.

DEC (2008) Forest Black Cockatoo (Baudin's Cockatoo *Calyptorhynchus baudinii* and Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso*) Recovery Plan. Department of Environment and Conservation. Available at https://www.dcceew.gov.au/sites/default/files/documents/wa-forest-black-cockatoos-recovery-plan.pdf Accessed 11 November 2024.

Johnstone, R. (2010a) Information Sheet, Baudin's Cockatoo *Calyptorhynchus baudinii*. Department of Terrestrial Vertebrates, Western Australian Museum. November 2010.

Available at https://museum.wa.gov.au/sites/default/files/Baudin%27s%20Cockatoo%20-%20English.pdf

Johnstone, R. (2010b) Information Sheet, Carnaby's Cockatoo *Calyptorhynchus latirostris*. Department of Terrestrial Vertebrates, Western Australian Museum. November 2010. Available at https://museum.wa.gov.au/sites/default/files/Carnaby%27s%20Cockatoo%20-%20English%20-%20Info%20Sheet.pdf

Johnstone, R. (2010c) Information Sheet, Forest Red-tailed Black Cockatoo *Calyptorhynchus banksia naso*. Department of Terrestrial Vertebrates, Western Australian Museum. November 2010. Available at https://museum.wa.gov.au/sites/default/files/Forest%20Red-tail%20Black%20Cockatoo%20-%20English%20-%20Info%20Sheet.pdf

Lee, J.G. H., Finn, H. C. and Calver, M. C. (2013) Ecology of Black Cockatoos at a Mine-site in the Eastern Jarrah-Marri Forest, Western Australia. Pacific Conservation Biology Vol. 19: 76–90. Surrey Beatty & Sons, Sydney. 2013. Available at https://www.epa.wa.gov.au/sites/default/files/PER_documentation2/Appendix%20L13%20-%20Ecology%20of%20Black%20Cockatoos%20at%20a%20Mine-site%20in%20the%20Eastern%20Jarrah%20-Marri%20Forest%2C%20WA.pdf Accessed 18 December 2024

McCreery, A. and Bamford, M. (2021) *Assessment of the nesting and foraging values of three Lots near Keysbrook for Doral Pty Ltd Keysbrook Mineral Sands Mine.* MJ & AR Bamford, Consulting Ecologists. Consultant's report prepared for Doral Mineral Sands Pty Ltd.

Valentine, L. E., and Stock, W. (2008) Food resources of Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) in the Gnangara sustainability strategy study area. Western Australian Department of Environment and Conservation. Available at https://ro.ecu.edu.au/ecuworks/6147

Western Botanical (2025) *Vegetation rehabilitation, Lot DP 90037, Jelcobine, as a potential offset package.* Consultant's report prepared for Doral Mineral Sands Pty Ltd. Report reference WB 1054.

Appendix 1. Black-Cockatoo foraging assessment scoring system (adapted from Bamford Consulting Ecologists)

Site Score	Carnaby's Black Cockatoo	Baudin's Black Cockatoo	Forest Red-tailed Black Cockatoo
0 NO VALUE	No Proteaceae, eucalypts or other potential sources of food. Examples: Water bodies (e.g. salt lakes, dams, rivers); Bare ground; Developed sites devoid of vegetation (e.g. infrastructure, roads, gravel pits) or with vegetation of no food value, such as some suburban landscapes. Mown grass	No foraging value. No eucalypts or other potential sources of food. Examples: Water bodies (e.g. dams, rivers); Bare ground; Developed sites devoid of vegetation (e.g. infrastructure, roads, gravel pits).	
1 NEGLIGIBLE TO LOW	Scattered specimens of known food plants but projected foliage cover of these is < 2%. This could include urban areas with scattered foraging trees; Paddocks that are lightly vegetated with melons or other known food-source weeds (e.g. *Erodium* spp.) that represent a short-term and/or seasonal food source; Blue Gum plantations (foraging by Carnaby's Black-Cockatoos has been reported but appears to be unusual).	Negligible to low foraging value. Scattered specimens of known food plants but projected foliage cover of these < 1%. This could include urban areas with scattered foraging trees.	
2 LOW VALUE	Shrubland in which species of foraging value, such as shrubby banksias, have < 10% projected foliage cover; Woodland with tree banksias 2-5% projected foliage cover; Eucalypt woodland/mallee of small-fruited species; Paddocks that are densely vegetated with melons or other known food-source weeds (e.g. *Erodium* spp.) that represent a short-term and/or seasonal food source.	Woodland with scattered specimens of known food plants (e.g. Marri and Jarrah) 1-5% projected foliage cover; Urban areas with scattered foraging trees. Paddocks with *Erodium* spp. and other weeds	Woodland with scattered specimens of known food plants (e.g. Marri, Jarrah or Sheoak) 1-5% projected foliage cover; Urban areas with scattered food plants such as Cape Lilac, *Eucalyptus caesia* and *E. erythrocorys*. Paddocks with *Erodium* spp. and other weeds.
3 LOW TO MODERATE	Shrubland in which species of foraging value, such as shrubby banksias, have 10-20% projected foliage cover; Woodland with tree banksias 5-20% projected foliage cover; Eucalypt Woodland with Marri 5- 10% projected foliage cover. Eucalypt Woodland/Forest with known food plants such as Marri 10-40% projected foliage cover but badly degraded understorey (poor long-term viability without management).	Eucalypt Woodland with known food plants (especially Marri) 5-10% projected foliage cover; Eucalypt Woodland/Forest with known food plants such as Marri 10-40% projected foliage cover but badly degraded understorey (poor long-term viability without management); Managed revegetation with known food plants 10-40% projected foliage cover	Eucalypt Woodland with known food plants (especially Marri and Jarrah) 5-20% projected foliage cover; Parkland-cleared Eucalypt Woodland/Forest with known food plants such as Marri 10-40% projected foliage cover but badly-degraded understorey (poor long-term viability without management);

Site Score	Carnaby's Black Cockatoo	Baudin's Black Cockatoo	Forest Red-tailed Black Cockatoo
		(establishing food sources with good long-term viability). Paddocks with *Erodium* spp. and other weeds at a high density or close to high value forest.	Managed revegetation with known food plants 10-40% projected foliage cover (establishing food sources with good long-term viability).
4 MODERATE	Woodland/low forest with tree banksias (of key species *B. attenuata* and *B. menziesii*) 20-40% projected foliage cover; Kwongan/ Shrubland in which species of foraging value, such as shrubby banksias, have 20-40% projected foliage cover; Eucalypt Woodland/Forest with Marri 20-60% projected foliage cover. Depending on understorey condition (and thus long-term viability) and Marri density, may downgrade to 3 or upgrade to 5.	Marri-Jarrah Woodland/Forest with 20-40% projected foliage cover; Marri-Jarrah Forest with 40-60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths. Eucalypt Woodland/Forest with diverse, healthy understorey and known food trees (especially Marri) 10-20% projected foliage cover. Orchards with highly desirable food sources (e.g. apples, pears, some stone fruits).	Marri-Jarrah Woodland/Forest with 20-40% projected foliage cover; Marri-Jarrah Forest with 40-60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths; Sheoak Forest with 40-60% projected foliage cover.
5 MODERATE TO HIGH	Banksia Low Forest (of key species *B. attenuata* and *B. menziesii*) with 40-60% projected foliage cover; Banksia Low Forest (of key species *B. attenuata* and *B. menziesii*) with > 60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths; Pine plantations with trees > 10 years old (but see pine note in moderation section).	Marri-Jarrah Forest with 40-60% projected foliage cover; Marri-Jarrah Forest with > 60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths.	Marri-Jarrah Forest with 40-60% projected foliage cover; Marri-Jarrah Forest with > 60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths. Sheoak Forest with > 60% projected foliage cover.
6 HIGH VALUE	Banksia Low Forest (of key species *B. attenuata* and *B. menziesii*) with > 60% projected foliage cover and vegetation condition good with low weed invasion and/or low tree deaths (indicating it is robust and unlikely to decline in the medium term).	Marri-Jarrah Forest with > 60% projected foliage cover and vegetation condition good with low weed invasion and/or low tree deaths (indicating it is robust and unlikely to decline in the medium term).	Marri-Jarrah Forest with > 60% projected foliage cover and vegetation condition good with low weed invasion and/or low tree deaths (indicating it is robust and unlikely to decline in the medium term).

Appendix 2. Nest tree assessment system (from Bamford Consulting Ecologists)

Appendix 1. Approach to the valuation of nesting habitat for black-cockatoos (revised 6th September 2024)

Aim of the assessment is to identify the current value of a site for nesting by black-cockatoos. It is thus limited to trees with have a structure that is potentially suitable to contain a hollow that can be used by the birds. Before even looking to see if a tree might have a potentially suitable hollow, there are several factors that need to be considered.

- **Size of tree.** Studies have found that actual nest trees (ie trees with active nests in them and thus with suitable hollows) have a DBH (at 1.3m) >500mm (most tree species including Marri, Jarrah, Karri and Tuart), but that a few tree species form suitable hollows when the DBH is >300mm (Wandoo (three species) and Salmon Gum). It should be noted that this DBH criterion is only a guide. We have seen a Jarrah with a DBH of ca. 450mm but with black-cockatoo chew marks around the entrance to a hollow. Importantly, the tree species is not important; what is important is the presence of a hollow that is suitable for black-cockatoos. In theory, a she-oak could form a suitable hollow, as could non-native eucalypts (although non-native eucalypts in the SW of Western Australia are mostly too young to have formed large hollows). The tree can be alive or dead.
- **Structure of tree.** A tree with a large DBH also has to have stems of sufficient diameter, and at sufficient height, to contain a hollow attractive to black-cockatoos. Trees with a large DBH that branch close to the ground will not provide suitable hollows. The birds appear to favour high hollows, but this can be contextual. For example, in the Wheatbelt, there may be no suitable hollows >10m, whereas in the tall forests of the South-West, there may be suitable hollows >20m. Where there are suitable hollows at great height, low hollows are very unlikely to be used, but especially in the Wheatbelt where hollows of suitable size are a limited resource, very low hollows may be used. At a Wheatbelt site, J. Wadey (pers. comm.) has reported CBC using a hollow with an entrance at 2m. Such a hollow would almost certainly not be used in the tall forests, where a minimum suitable hollow height of 8m is suggested by studies. When assessing the suitability of a tree, its structure needs to be considered in the context of the surround nesting resource.
- **Angle of nest-chamber.** Black-cockatoos favour a vertical or near-vertical nest-chamber, but the entrance can either be at the top (a chimney), in the side or access may be gained through a horizontal spout. BUT.....nests have been recorded where the nest chamber is close to horizontal.
- **Size of nest-chamber.** Black-cockatoos favour a wide and deep hollow. Depths of several metres have been reported, and the minimum depth, in an area with very few available hollows, is about 500mm. As with hollow height, hollow depth may be contextual with short hollows used in the Wheatbelt but not in the tall forests. Hollow internal diameter can be <300mm but is generally greater than this. Therefore, the trunk in which a possible hollow may be located needs to be at least 300mm in external diameter, and probably substantially more than this.
- **Size of entrance.** Black-cockatoos favour wide entrances; for example a chimney hollow may have the same internal diameter from the entrance to the nest-chamber. Active nests have, however, been recorded with an entrance of as little as ca. 100mm. Turpin and Cherriman (2013) report on an active nest (one chick successfully fledged)

with an entrance about 100mm wide and 500mm long, entering a chamber 480mm in diameter and 1050mm in depth. It was in a Karri and 15m above ground level.

The above factors are considered in a system for ranking trees (see Table 1). It should be stressed that this is a system based usually upon ground inspection, with follow-up use of a pole camera and/or drone possible later, which can allow for reassessment. ANY level of inspection leaves some uncertainty. For example, if a hollow cannot be seen or is not suspected based upon the initial assessment, a follow-up with camera/drone will not take place. As there can be thousands of trees, inspecting them all is not practical. Furthermore, a concealed hollow may not be seen even with a pole camera or drone. Similarly, a camera and even a drone can only do so much, as not all hollows can be accessed with such devices. The assessment presented here provides a valuation of a site for cockatoo nesting; it is not a total nest tree survey.

Note that Rank 3 trees are the most problematic and are also of great interest to regulators. They are the most subject to context; for example a low hollow of suitable size might be a Rank 3 in the Wheatbelt, but not in tall forests. Likewise, a hollow with an entrance diameter of 150mm (wide enough for the birds) but in a trunk of only 200mm diameter (too narrow for a nest chamber of adequate diameter) would not give a tree a rank 3 in the southern forests, but might in the Wheatbelt. Provide comments on Rank 3 trees, and clear notes on Rank 1 and 2 trees.

Table 1. BCE ranking system for the assessment of potential nest trees for Black-Cockatoos (revised 6/09/2024).

Ranks	Description of tree and hollows/activity
1	Activity at hollow observed; adult (or immature) bird seen entering or emerging from hollow. Can also be used for a known nest tree active in the previous 12 months (although this should be noted in the description). Note that activity at a hollow does not absolutely mean that breeding is occurring unless a young bird in hollow is observed.
2	Hollow of suitable size visible with chew marks around entrance. Record if chew-marks are recent or old.
3	Potentially suitable hollow visible but no chew marks present at entrance; or potentially suitable hollow suspected to be present - as suggested by structure of tree, such as large, vertical trunk broken off at a height of >8m; but note that hollow height is contextual. Carnaby's Black-Cockatoo will nest in hollows <5m so in a Wheatbelt breeding site a lower criterion may be more appropriate.
4	Tree with large hollows or broken branches that might contain large hollows, but hollows or potential hollows are not vertical or near-vertical; thus a tree with or likely to have hollows of sufficient size but not to have hollows of the angle preferred by Black-Cockatoos. Also, a tree with hollows that might be large enough for a black-cockatoo, but in a trunk or branch of insufficient diameter to contain a hollow of preferred size. Trees with low but otherwise suitable hollows can also be assigned a rank or 4, depending on the context (eg south-west forest or Wheatbelt).
5	Tree lacking large hollows or broken branches that might have large hollows; a tree with more or less intact branches and a spreading crown.

NB. Black-cockatoos favour vertical hollows for the nest chamber, but the hollow entrance may be vertical (a chimney hollow), have a side entrance or have a horizontal spout entrance.

Appendix 3. List of Black-Cockatoo forage plants

Black-Cockatoo food plants (* = non-native species)

ALTINGIACEAE	**Liquidambar styraciflua*
ANACARDIACEAE	**Harpephyllum caffrum* (South African plum tree)
ARALIACEAE	**Schefflera actinophylla* (umbrella tree)
ASTERACEAE	**Helianthus annuus* (sunflower)
BIGNONIACEAE	**Jacaranda mimosifolia*
BRASSICACEAE	**Brassica napus* **Raphanus raphanistrum*
CASUARINACEAE	**Casuarina cunninghamiana* *Allocasuarina fraseriana* *Allocasuarina* spp.
EBENACEAE	**Diospyros* spp. (persimmon)
FABACEAE	*Acacia saligna*
GERANIACEAE	*Erodium botrys* *Erodium* spp.
HAEMODORACEAE	*Anigozanthos flavidus*
IRIDACEAE	**Romulea rosea*
JUGLANDACEAE	**Carya illinoinesis* (pecan tree)
MALVACEAE	**Hibiscus* spp.
MELIACEAE	**Melia azedarach*
MORACEAE	**Ficus* spp.
MYRTACEAE	*Agonis flexuosa* **Callistemon viminalis* *Callistemon* spp. *Corymbia calophylla* **Corymbia citriodora* *Corymbia ficifolia* *Corymbia haemotoxylon* *Eucalyptus accedens* *Eucalyptus caesia* **Eucalyptus camaldulensis* *Eucalyptus decipiens*

Black-Cockatoo food plants (* = non-native species)

MYRTACEAE (CONT)	*Eucalyptus diversicolor* **Eucalyptus globulus* *Eucalyptus gomphocephala* **Eucalyptus grandis* *Eucalyptus lehmannii* *Eucalyptus loxophleba* **Eucalyptus maculata* *Eucalyptus marginata* *Eucalyptus megacarpa* *Eucalyptus occidentalis* *Eucalyptus patens* *Eucalyptus rudis* *Eucalyptus salmonophloia* *Eucalyptus staeri* *Eucalyptus todtiana* *Eucalyptus wandoo* *Eucalyptus* spp. **Eucalyptus* spp.
PINACEAE	**Pinus pinaster* **Pinus radiata* **Pinus* spp.
POLYGONACEAE	**Emex australis*
PROTEACEAE	*Banksia ashbyi* *Banksia attenuata* *Banksia fraseri* *Banksia grandis* *Banksia ilicifolia* *Banksia littoralis* *Banksia menziesii* *Banksia nivea* *Banksia nobilis* *Banksia prionotes* *Banksia prolata* *Banksia sessilis* *Banksia splendida* *Banksia tricuspis* *Banksia undata* *Banksia verticillata* *Banksia* spp. *Grevillea armigera* *Grevillea hookeriana* *Grevillea paniculata* *Grevillea paradoxa* *Grevillea petrophiloides* *Grevillea* spp.

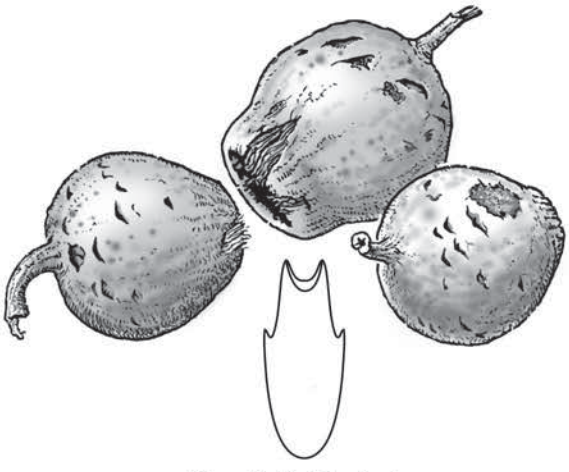
Black-Cockatoo food plants (* = non-native species)

PROTEACEAE (CONT)	*Hakea auriculata* *Hakea circumalata* *Hakea conchifolia* *Hakea cyclocarpa* *Hakea falcata* *Hakea gilbertii* *Hakea incrassata* *Hakea laurina* *Hakea lissocarpha* *Hakea multilineata* *Hakea obliqua* *Hakea pandanicarpa* *Hakea prostrata* *Hakea ruscifolia* *Hakea scoparia* *Hakea sulcata* *Hakea trifurcata* *Hakea undulata* *Hakea varia* *Hakea* spp. *Isopogon scabriusculus* *Lambertia multiflora* **Macadamia integrifolia* **Macadamia* spp. *Persoonia longifolia*
ROSACEAE	**Malus* spp. (apple) **Prunus amygdalus* (almond) **Pyrus* spp. (pear)
XANTHORRHOEACEAE	*Xanthorrhoea preissii*

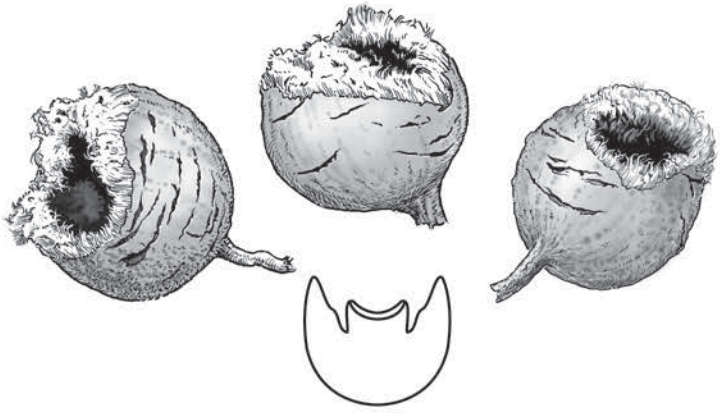
Appendix 4. Feeding traces of Black-Cockatoo and other birds on *Corymbia calophylla* (Marri) gumnuts

Identification of chewed Marri nuts eaten by cockatoos and parrots

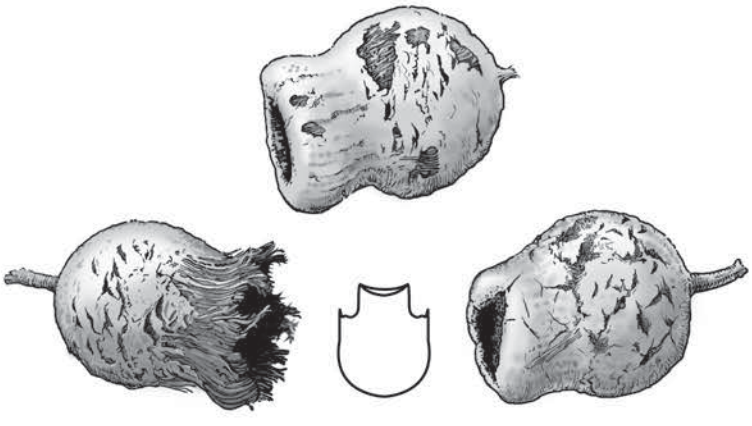
with an end-on view of lower mandible of each species



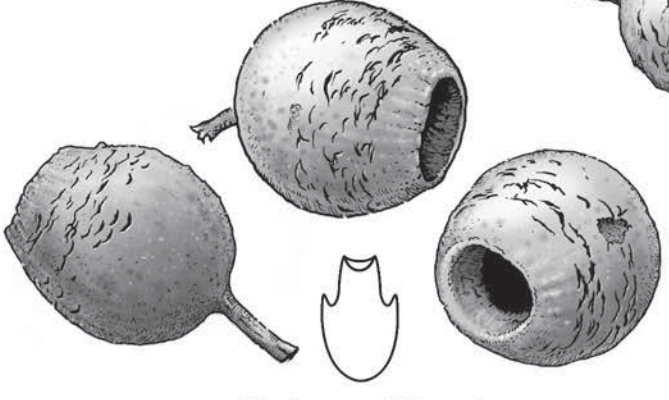
Baudin's Cockatoo



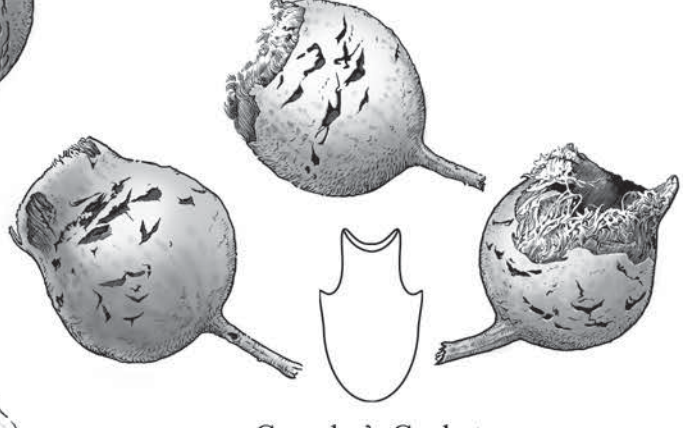
Forest Red-tailed Black Cockatoo



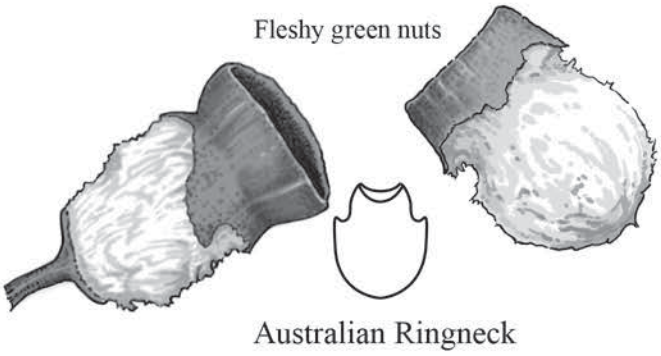
Butler's Corella
(*Muir's Corella is similar*)



Red-capped Parrot



Carnaby's Cockatoo



Australian Ringneck

Not only is Marri an important food source (seeds and nectar) for black cockatoos and other parrots, it also provides nesting hollows for these species.

Cockatoo Care

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Appendix 5. Database of the Nest trees recorded

Tree species	Latitude	Longitude	DBH in mm	Number of Visible Hollows	BCE Rank	Description/structure
Corymbia calophylla **(Marri)**	-32.4039334	116.5700652	970	0	5	Multi-trunked (3 trunks dividing into 6) from about 2m above ground. Very old paddock tree with new growth.
Eucalyptus accedens **(Powderbark)**	-32.4109099	116.5622986	640	2	3	Upright trunk with good hollow in fork
Eucalyptus accedens **(Powderbark)**	-32.410615	116.5622438	990	3	3	Huge upright tree with large dead central branch
Eucalyptus accedens **(Powderbark)**	-32.4108919	116.5623061	640	2	3	Big upright trunk, full crown with dead branches retained
Eucalyptus accedens **(Powderbark)**	-32.3962454	116.5617036	1200	1	3	Big squat upright tree with healthy crown
Eucalyptus marginata **(Jarrah)**	-32.410569	116.5619624	780	2	3	Thick upright leaning tree with broken crown
Eucalyptus wandoo **(Wandoo)**	-32.3965637	116.5636841	1000	3	3	Big old trunk with healthy regrowth and younger crown off to side
Eucalyptus wandoo **(Wandoo)**	-32.3956844	116.5622366	800	2	3	Big trunk with many broken branches

Tree species	Latitude	Longitude	DBH in mm	Number of Visible Hollows	BCE Rank	Description/structure
***Eucalyptus wandoo* (Wandoo)**	-32.3951979	116.5621389	900	2	3	Big trunk with many broken branches, top half looks dead
***Eucalyptus wandoo* (Wandoo)**	-32.3950505	116.5624566	1000	2	3	Big trunk with many broken branches
***Eucalyptus wandoo* (Wandoo)**	-32.411236	116.5617613	900	1	3	Big upright trunk broken off 5m up
***Eucalyptus wandoo* (Wandoo)**	-32.395242	116.5616786	920	1	3	Big upright trunk snapped off, Macrozamia growing in it, 6m up
***Eucalyptus wandoo* (Wandoo)**	-32.3952444	116.561591	600	1	3	Upright trunk with snapped off branch 7m up
***Eucalyptus wandoo* (Wandoo)**	-32.4079118	116.5637864	800	2	3	Big upright tree
***Eucalyptus wandoo* (Wandoo)**	-32.407647	116.5621291	860	2	3	Big upright tree
***Eucalyptus wandoo* (Wandoo)**	-32.4077637	116.5620257	955	2	3	Big upright tree
***Eucalyptus wandoo* (Wandoo)**	-32.4077489	116.5618976	960	3	3	Big upright tree
***Eucalyptus wandoo* (Wandoo)**	-32.4075977	116.5616784	865	3	3	Big upright tree with healthy crown
***Eucalyptus wandoo* (Wandoo)**	-32.4073765	116.5616085	850	2	3	Big upright tree with healthy crown

Tree species	Latitude	Longitude	DBH in mm	Number of Visible Hollows	BCE Rank	Description/structure
***Eucalyptus wandoo* (Wandoo)**	-32.4075391	116.5616092	1010	2	3	Big upright tree with healthy crown
***Eucalyptus wandoo* (Wandoo)**	-32.398677	116.5627107	1065	5	3	Big upright tree with healthy crown
***Eucalyptus wandoo* (Wandoo)**	-32.3982349	116.5626647	800	2	3	Big upright tree with healthy crown
***Eucalyptus wandoo* (Wandoo)**	-32.3979662	116.5625786	850	3	3	Big upright tree with healthy crown
***Eucalyptus wandoo* (Wandoo)**	-32.3978039	116.5620972	1260	5	3	Big upright tree with healthy crown
***Eucalyptus wandoo* (Wandoo)**	-32.3977818	116.5624153	1220	1	3	Big upright tree with healthy crown
***Eucalyptus wandoo* (Wandoo)**	-32.3976447	116.5622444	890	3	3	Big upright tree with healthy crown
***Eucalyptus wandoo* (Wandoo)**	-32.3969153	116.5626647	900	3	3	Big upright tree with healthy crown
***Eucalyptus wandoo* (Wandoo)**	-32.3969354	116.5621126	1200	5	3	Big upright tree with healthy crown
***Eucalyptus wandoo* (Wandoo)**	-32.3964216	116.5621191	1200	1	3	Big upright tree with healthy crown
***Eucalyptus wandoo* (Wandoo)**	-32.4075026	116.5622178	790	2	4	Upright thick trunk, broken branch at 7m,

Tree species	Latitude	Longitude	DBH in mm	Number of Visible Hollows	BCE Rank	Description/structure
						small hollow on NE side, broken branch at 10m, medium hollow
***Eucalyptus wandoo* (Wandoo)**	-32.408046	116.5640544	1235	4	4	Upright, multiple stout branches
***Eucalyptus wandoo* (Wandoo)**	-32.3960177	116.5616296	1010	4	4	Big healthy tree with some old broken branches



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www.westernbotanical.com.au

APPENDIX 3: JELCOBINE OFFSET TECHNICAL MEMO (TREE HOLLOW ASSESSMENT)

Thursday 29 May 2025

Craig Bovell

Doral Leucoxene Pty Ltd

Via email to: Craig.Bovell@Doral.com.au

Re: Jelcobine Offset Technical Memo WB1067

Good afternoon Craig,

Geoff and I have completed the Black-Cockatoo (BC) nest hollow assessment at Jelcobine, Lot DP 90037 (the AOI). We have summarised our findings below.

1. During our May 2025 survey of potential nest hollows in habitat trees, we took georeferenced photos, which we can share with you if required. These are large images, typically 8 to 11 MB each. Three examples are presented below (Figures 1, 2 and 3).
2. During the May 2025 survey, we recorded a total of **90 visible hollows** that may be suitable for BC nesting in 47 trees, all with a Bamford Consulting Ecologists (BCE) rank of 3, across the AOI (presented in Figure 4). Hollows with a BCE rank of 4 or 5 were not recorded because they were considered less suitable for nesting. No hollows with a BCE rank of 2 or 1 were observed because the survey was conducted outside the breeding season and there were no chew marks and no nesting activity.
3. Our May 2025 survey track logs are presented in Figure 5.
4. Our records of tree locations, species, number of hollows and BCE rank for the May 2025 survey are presented in Table 1.

We hope this information is sufficient for your requirements. If you have any queries, please don't hesitate to contact me.

Kind regards

Linda Dalgliesh



Figure 1: *Eucalyptus wandoo* stag at WP27 with 1 suitable hollow and a DBH of 102 cm (Photo 1856).



Figure 2: *Eucalyptus wandoo* at WP27 with 6 suitable hollows and a DBH of 155 cm (Photo 1870).



Figure 3: *Eucalyptus wandoo* at WP 47 with 3 suitable hollows and a DBH of 152 cm (Photo 1904).

Figure 4: Habitat tree locations mapped on vegetation types in May 2025

Imagery: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

458500 459000 459500

6415500 6415000 6414500 6414000

Vegetation Legend

- 1 - Remnant E. wandoo woodland, occasional E. marginata (mostly dead) and E. accedens on ferricrete outcrops, with little extant understory, few weeds.
- 2 - Mid to lower slopes, laterite gravel, Revegetate on contour with local Euc wandoo, Hakea, Dryandra, Banksia, Acacia spp.
- 3 - Winter wet low lying area, Revegetate with Melaleuca, Casuarina obesa, Euc rudis
- 4 - Planted Eucalyptus and Casuarina trees, grass and herbs understory
- 5 - Drainage line with narrow incised channel, Eucalyptus wandoo, E. rudis to 25m over grasses and herbs
- 6 - Farm dams and drainage, seepage, likely permanent water
- 7 - Crop (Canola in 2024)
- 8 - Fallow
- 9 - Farm dam, Typha dominated, permanent water

Boyagarring Conservation Park

Youraling State Forest

Boyagarring Conservation Park

WP 15 WP 14 WP 17 WP 16 WP 12 WP 13 WP 18 WP 11 WP 10 WP 9 WP 1 WP 8 WP 7 WP 4 WP 3 WP 2 WP 6 WP 5 WP 20 WP 21 WP 19 WP 48 WP 26 WP 22 WP 23 WP 24 WP 25 WP 27 WP 28 WP 29 WP 30 WP 31 WP 32 WP 33 WP 39 WP 38 WP 40 WP 35 WP 34 WP 41 WP 42 WP 37 WP 43 WP 36 WP 44 WP 47 WP 45 WP 46

1 2 3 4 5 6 7 8 9

Legend

- Habitat tree
- Survey Area
- Legislated Lands
- Track

0 50 100m

Scale: 1:6,000
MGA94 (Zone 50)

CAD Ref: a3087_F007_01

Date: May 2025 | Rev: A | A3

Western Botanical

Author: L. Dalgliesh

Drawn: CAD Resources ~ www.cadresources.com.au
Tel: (08) 9246 3242 ~ Fax (08) 9246 3202

Doral Mineral Sands Pty Ltd

Jelcobine Project

Vegetation Types and Habitat Trees

Figure 5: May 2025 Survey Track logs

Imagery: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

458500 459000 459500

6415500 6415000 6414500 6414000

Boyagarring Conservation Park

Youraling State Forest

Boyagarring Conservation Park

Legend

- Survey Area
- Legislated Lands
- Survey Track Log
- Track

0 50 100m

Scale: 1:6,000
MGA94 (Zone 50)

CAD Ref: a3087_F008

Date: May 2025 | Rev: A | A3

Western Botanical

Author: L. Dalgliesh

Drawn: CAD Resources ~ www.cadresources.com.au
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Doral Mineral Sands Pty Ltd

Jelcobine Project

Survey Track Logs

Table 1: Trees recorded with potential nest hollows suitable for Black-Cockatoos

WP	Tree species	Live or dead	DBH (cm)	BCE rank	Number of visible hollows	Image Number	Latitude (GDA)	Longitude (GDA)	Veg Unit*	Notes
1	*Eucalyptus wandoo*	L	118	3	3	1840	-32.3956	116.5632	5	
2	*Eucalyptus wandoo*	L	93	3	2	1843	-32.3962	116.5628	5	
3	*Eucalyptus wandoo*	L	92	3	2	1844	-32.3961	116.5626	5	
4	*Eucalyptus wandoo*	L	93	3	2	1845	-32.3960	116.5623	1	
5	*Eucalyptus wandoo*	L	109	3	3	1847	-32.3964	116.5622	1	
6	*Eucalyptus wandoo*	L	85	3	1	1848	-32.3963	116.5617	1	
7	*Eucalyptus wandoo*	L	101	3	2	1849	-32.3960	116.5616	1	
8	*Eucalyptus wandoo*	L	91.5	3	1	1850	-32.3957	116.5615	1	
9	*Eucalyptus wandoo*	L	101.5	3	3	1851	-32.3952	116.5622	5	
10	*Eucalyptus wandoo*	L	104	3	1	1852	-32.3951	116.5624	5	
11	*Eucalyptus wandoo*	D	69.5	3	1	1853	-32.3948	116.5628	5	Stag, vertical trunk
12	*Eucalyptus wandoo*	D	91	3	2	1854	-32.3942	116.5622	5	Stag, vertical trunk with branches
13	*Eucalyptus wandoo*	D	105	3	1	1855	-32.3942	116.5624	5	Stag, vertical trunk, ringbarked
14	*Eucalyptus wandoo*	D	102	3	1	1856	-32.3936	116.5619	5	Stag
15	*Eucalyptus wandoo*	D	76	3	1	1857	-32.3932	116.5619	5	Stag
16	*Eucalyptus rudis*	D	79	3	2	1858	-32.3940	116.5628	5	Stag, lignotuber over 2m diameter

WP	Tree species	Live or dead	DBH (cm)	BCE rank	Number of visible hollows	Image Number	Latitude (GDA)	Longitude (GDA)	Veg Unit*	Notes
17	*Eucalyptus wandoo*	D	99.5	3	1	1859	-32.3936	116.5632	5	Stag
18	*Eucalyptus wandoo*	D	85	3	1	1860	-32.3945	116.5635	5	Stag
19	*Eucalyptus wandoo*	L	117.5	3	1	1862	-32.3969	116.5630	1	
20	*Eucalyptus wandoo*	L	107.5	3	2	1863	-32.3966	116.5638	5	
21	*Eucalyptus rudis*	L	78.5	3	1	1864	-32.3968	116.5642	5	
22	*Eucalyptus wandoo*	L	121	3	2	1865	-32.3979	116.5655	5	
23	*Eucalyptus wandoo*	L	108	3	3	1866	-32.3980	116.5654	5	
24	*Eucalyptus wandoo*	L	92	3	1	1867	-32.3982	116.5656	5	
25	*Eucalyptus wandoo*	L	103	3	1	1868	-32.3983	116.5656	5	Alive at base only
26	*Eucalyptus wandoo*	D	73.5	3	1	1869	-32.3978	116.5667	5	Stag, branched
27	*Eucalyptus wandoo*	L	155	3	6	1870	-32.3989	116.5660	5	Massive tree
28	*Eucalyptus wandoo*	L	98.5	3	1	1871	-32.4009	116.5655	1	(also 2 less suitable hollows)
29	*Eucalyptus wandoo*	L	89.5	3	1	1872	-32.4009	116.5657	5	
30	*Eucalyptus wandoo*	L	86	3	2	1873	-32.4014	116.5654	1	
31	*Eucalyptus wandoo*	L	105	3	1	1875	-32.4018	116.5655	1	
32	*Eucalyptus wandoo*	L	128	3	4	1876	-32.4021	116.5662	5	
33	*Eucalyptus wandoo*	D	114	3	1	1877	-32.4038	116.5666	5	Stag, ringbarked

WP	Tree species	Live or dead	DBH (cm)	BCE rank	Number of visible hollows	Image Number	Latitude (GDA)	Longitude (GDA)	Veg Unit*	Notes
34	*Eucalyptus wandoo*	L	124	3	5	1883	-32.4056	116.5673	4	
35	*Eucalyptus wandoo*	L	121	3	4	1884	-32.4056	116.5669	4	
36	*Eucalyptus wandoo*	D	96.5	3	4	1885	-32.4072	116.5669	2	Stag
37	*Eucalyptus wandoo*	D	103.5	3	2	1886	-32.4067	116.5685	5	Stag
38	*Eucalyptus wandoo*	L	105.5	3	2	1887	-32.4039	116.5654	2	
39	*Eucalyptus wandoo*	L	121.5	3	1	1888	-32.4039	116.5649	2	
40	*Eucalyptus wandoo*	D	110	3	1	1889	-32.4043	116.5644	1	Stag, recently dead
41	*Eucalyptus wandoo*	L	117	3	3	1891	-32.4062	116.5653	2	
42	*Eucalyptus wandoo*	L	108.5	3	2	1892	-32.4066	116.5648	2	
43	*Eucalyptus wandoo*	L	85.5	3	1	1893	-32.4073	116.5653	3	
44	*Eucalyptus wandoo*	L	128	3	1	1894	-32.4076	116.5685	4	
45	*Eucalyptus wandoo*	L	97	3	2	1895	-32.4093	116.5714	5	Dead central trunk, alive at base
46	*Eucalyptus wandoo*	D	89.5	4	0	1897	-32.4101	116.5714	5	Stag, no suitable hollows
47	*Eucalyptus wandoo*	L	152	3	3	1904	-32.4090	116.5714	5	Large tree
48	*Eucalyptus wandoo*	L	78.5	3	1	1915	-32.3974	116.5646	5	Top snapped off
	Total hollows				90					

APPENDIX 4: DCCEEW OFFSET CALCULATORS

Appendix 4A: CBC

Appendix 4B: FRTBC

Appendix 4C: BBC

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Carnaby's BC
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	**1.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes		**Area**	5.98	Hectares	
			Quality	**1**	Scale 0-10	
			Total quantum of impact	0.60	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	Yes				Count	
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Threatened species habitat																				
Area of habitat	Yes	0.60	Adjusted hectares	4.76	**Time over which loss is averted (max. 20 years)**	20	**Start area (hectares)**	4.76	**Risk of loss (%) without offset**	0%	**Risk of loss (%) with offset**	0%	0.00	95%	0.00	0.00	0.89	148.36%	Yes	
									Future area without offset (adjusted hectares)	4.8	**Future area with offset (adjusted hectares)**	4.8								
					Time until ecological benefit	10	**Start quality (scale of 0-10)**	**0**	**Future quality without offset (scale of 0-10)**	**0**	**Future quality with offset (scale of 0-10)**	**3**	3.00	70%	2.10	1.86				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	Yes		Count										0		0.00	0.00	#DIV/0!	#DIV/0!		
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0	0.00	#DIV/0!	**#DIV/0!**	$0.00	#DIV/0!	#DIV/0!
Condition of habitat	0				$0.00		$0.00
Area of habitat	0.598	0.89	148.36%	**Yes**	$0.00	N/A	$0.00
Area of community	0				$0.00		$0.00
					$0.00	**#DIV/0!**	**#DIV/0!**

Offsets Assessment Guide

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2 October 2012

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Matter of National Environmental Significance	
Name	Carnaby's BC
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	**1.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes		**Area**	1.75	Hectares	
			Quality	**3**	Scale 0-10	
			Total quantum of impact	0.53	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	Yes				Count	
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Threatened species habitat																				
Area of habitat	Yes	0.53	Adjusted hectares	32.26	**Time over which loss is averted (max. 20 years)**	20	**Start area (hectares)**	32.26	**Risk of loss (%) without offset**	0%	**Risk of loss (%) with offset**	0%	0.00	95%	0.00	0.00	6.01	1145.30%	Yes	
									Future area without offset (adjusted hectares)	32.3	**Future area with offset (adjusted hectares)**	32.3								
					Time until ecological benefit	10	**Start quality (scale of 0-10)**	**0**	**Future quality without offset (scale of 0-10)**	**0**	**Future quality with offset (scale of 0-10)**	**3**	3.00	70%	2.10	1.86				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	Yes		Count										0		0.00	0.00	#DIV/0!	#DIV/0!		
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0	0.00	#DIV/0!	**#DIV/0!**	$0.00	#DIV/0!	#DIV/0!
Condition of habitat	0				$0.00		$0.00
Area of habitat	0.525	6.01	1145.30%	**Yes**	$0.00	N/A	$0.00
Area of community	0				$0.00		$0.00
					$0.00	**#DIV/0!**	**#DIV/0!**

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

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Matter of National Environmental Significance	
Name	Carnaby BC
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	**1.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes		**Area**	6.83	Hectares	
			Quality	**6**	Scale 0-10	
			Total quantum of impact	4.10	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	Yes				Count	
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Threatened species habitat																				
Area of habitat	Yes	4.10	Adjusted hectares	34	**Time over which loss is averted (max. 20 years)**	20	**Start area (hectares)**	34	**Risk of loss (%) without offset**	0%	**Risk of loss (%) with offset**	0%	0.00	95%	0.00	0.00	6.34	154.64%	Yes	
									Future area without offset (adjusted hectares)	34.0	**Future area with offset (adjusted hectares)**	34.0								
					Time until ecological benefit	10	**Start quality (scale of 0-10)**	**4**	**Future quality without offset (scale of 0-10)**	**3**	**Future quality with offset (scale of 0-10)**	**6**	3.00	70%	2.10	1.86				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	Yes		Count										0		0.00	0.00	#DIV/0!	#DIV/0!		
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0	0.00	#DIV/0!	**#DIV/0!**	$0.00	#DIV/0!	#DIV/0!
Condition of habitat	0				$0.00		$0.00
Area of habitat	4.098	6.34	154.64%	**Yes**	$0.00	N/A	$0.00
Area of community	0				$0.00		$0.00
					$0.00	**#DIV/0!**	**#DIV/0!**

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

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Matter of National Environmental Significance	
Name	Carnaby BC
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	**1.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes		**Area**	8.95	Hectares	
			Quality	7	Scale 0-10	
			Total quantum of impact	6.27	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	Yes				Count	
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Threatened species habitat																				
Area of habitat	Yes	6.27	Adjusted hectares	31	**Time over which loss is averted (max. 20 years)**	20	**Start area (hectares)**	31	**Risk of loss (%) without offset**	0%	**Risk of loss (%) with offset**	0%	0.00	95%	0.00	0.00	122.97%	Yes		
									Future area without offset (adjusted hectares)	31.0	**Future area with offset (adjusted hectares)**	31.0				7.70				
					Time until ecological benefit	10	**Start quality (scale of 0-10)**	4	**Future quality without offset (scale of 0-10)**	3	**Future quality with offset (scale of 0-10)**	7	4.00	70%	2.80	2.49				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	Yes		Count										0		0.00	0.00	#DIV/0!	#DIV/0!		
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0	0.00	#DIV/0!	**#DIV/0!**	$0.00	#DIV/0!	#DIV/0!
Condition of habitat	0				$0.00		$0.00
Area of habitat	6.265	7.70	122.97%	**Yes**	$0.00	N/A	$0.00
Area of community	0				$0.00		$0.00
					$0.00	**#DIV/0!**	**#DIV/0!**

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Carnaby BC
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	**1.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes		**Area**	3.62	Hectares	
			Quality	**8**	Scale 0-10	
			Total quantum of impact	2.90	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	Yes				Count	
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Threatened species habitat																				
Area of habitat	Yes	2.90	Adjusted hectares	12	**Time over which loss is averted (max. 20 years)**	20	**Start area (hectares)**	12	**Risk of loss (%) without offset**	0%	**Risk of loss (%) with offset**	0%	0.00	95%	0.00	0.00	3.31	114.25%	Yes	
									Future area without offset (adjusted hectares)	12.0	**Future area with offset (adjusted hectares)**	12.0								
					Time until ecological benefit	20	**Start quality (scale of 0-10)**	**4**	**Future quality without offset (scale of 0-10)**	**3**	**Future quality with offset (scale of 0-10)**	**8**	5.00	70%	3.50	2.76				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	Yes		Count										0		0.00	0.00	#DIV/0!	#DIV/0!		
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0	0.00	#DIV/0!	**#DIV/0!**	$0.00	#DIV/0!	#DIV/0!
Condition of habitat	0				$0.00		$0.00
Area of habitat	2.896	3.31	114.25%	**Yes**	$0.00	N/A	$0.00
Area of community	0				$0.00		$0.00
					$0.00	**#DIV/0!**	**#DIV/0!**

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Carnaby's BC
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	**1.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes		**Area**		Hectares	
			Quality		Scale 0-10	
			Total quantum of impact	0.00	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	Yes	Possibly suitable	18		Count	Fauna surveys
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Threatened species habitat																				
Area of habitat	Yes		Adjusted hectares		**Time over which loss is averted (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**		0.00		0.00	0.00	#DIV/0!	#DIV/0!		
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**		0.00		0.00	0.00				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	Yes	18	Count	56	20		56		27		56		29	80%	23.20	18.28	101.53%	Yes		
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	18	18.28	101.53%	**Yes**	$0.00	N/A	$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	0	0.00	#DIV/0!	**#DIV/0!**	$0.00	#DIV/0!	#DIV/0!
Area of community	0				$0.00		$0.00
					$0.00	**#DIV/0!**	**#DIV/0!**

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Forest Red Tailed black cockatoo
EPBC Act status	Vulnerable
Annual probability of extinction Based on IUCN category definitions	**0.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes		**Area**	2.74	Hectares	
			Quality	**2**	Scale 0-10	
			Total quantum of impact	0.55	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	Yes				Count	
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Threatened species habitat																				
Area of habitat	Yes	0.55	Adjusted hectares	4.76	**Time over which loss is averted (max. 20 years)**	20	**Start area (hectares)**	4.76	**Risk of loss (%) without offset**	0%	**Risk of loss (%) with offset**	0%	0.00	95%	0.00	0.00	0.98	178.80%	Yes	
									Future area without offset (adjusted hectares)	4.8	**Future area with offset (adjusted hectares)**	4.8								
					Time until ecological benefit	10	**Start quality (scale of 0-10)**	**0**	**Future quality without offset (scale of 0-10)**	**0**	**Future quality with offset (scale of 0-10)**	**3**	3.00	70%	2.10	2.06				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	Yes		Count										0		0.00	0.00	#DIV/0!	#DIV/0!		
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0	0.00	#DIV/0!	**#DIV/0!**	$0.00	#DIV/0!	#DIV/0!
Condition of habitat	0				$0.00		$0.00
Area of habitat	0.548	0.98	178.80%	**Yes**	$0.00	N/A	$0.00
Area of community	0				$0.00		$0.00
					$0.00	**#DIV/0!**	**#DIV/0!**

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Forest Red Tailed black cockatoo
EPBC Act status	Vulnerable
Annual probability of extinction Based on IUCN category definitions	**0.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes		**Area**	1.75	Hectares	
			Quality	**3**	Scale 0-10	
			Total quantum of impact	0.53	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	Yes				Count	
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Threatened species habitat																				
Area of habitat	Yes	0.53	Adjusted hectares	32.26	**Time over which loss is averted (max. 20 years)**	20	**Start area (hectares)**	32.26	**Risk of loss (%) without offset**	0%	**Risk of loss (%) with offset**	0%	0.00	95%	0.00	0.00	6.64	1264.87%	Yes	
									Future area without offset (adjusted hectares)	32.3	**Future area with offset (adjusted hectares)**	32.3								
					Time until ecological benefit	10	**Start quality (scale of 0-10)**	**0**	**Future quality without offset (scale of 0-10)**	**0**	**Future quality with offset (scale of 0-10)**	**3**	3.00	70%	2.10	2.06				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	Yes		Count										0		0.00	0.00	#DIV/0!	#DIV/0!		
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0	0.00	#DIV/0!	**#DIV/0!**	$0.00	#DIV/0!	#DIV/0!
Condition of habitat	0				$0.00		$0.00
Area of habitat	0.525	6.64	1264.87%	**Yes**	$0.00	N/A	$0.00
Area of community	0				$0.00		$0.00
					$0.00	**#DIV/0!**	**#DIV/0!**

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Forest Red Tailed black cockatoo
EPBC Act status	Vulnerable
Annual probability of extinction Based on IUCN category definitions	**0.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes		**Area**	3.62	Hectares	
			Quality	**6**	Scale 0-10	
			Total quantum of impact	2.17	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	Yes				Count	
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Threatened species habitat																				
Area of habitat	Yes	2.17	Adjusted hectares	10	**Time over which loss is averted (max. 20 years)**	20	**Start area (hectares)**	10	**Risk of loss (%) without offset**	0%	**Risk of loss (%) with offset**	0%	0.00	95%	0.00	0.00	2.74	126.36%	Yes	
									Future area without offset (adjusted hectares)	10.0	**Future area with offset (adjusted hectares)**	10.0								
					Time until ecological benefit	10	**Start quality (scale of 0-10)**	**4**	**Future quality without offset (scale of 0-10)**	**3**	**Future quality with offset (scale of 0-10)**	**7**	4.00	70%	2.80	2.74				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	Yes		Count										0		0.00	0.00	#DIV/0!	#DIV/0!		
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0	0.00	#DIV/0!	**#DIV/0!**	$0.00	#DIV/0!	#DIV/0!
Condition of habitat	0				$0.00		$0.00
Area of habitat	2.172	2.74	126.36%	**Yes**	$0.00	N/A	$0.00
Area of community	0				$0.00		$0.00
					$0.00	**#DIV/0!**	**#DIV/0!**

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Forest Red Tailed black cockatoo
EPBC Act status	Vulnerable
Annual probability of extinction Based on IUCN category definitions	**0.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes		**Area**	4.09	Hectares	
			Quality	**6**	Scale 0-10	
			Total quantum of impact	2.45	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	Yes				Count	
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Threatened species habitat																				
Area of habitat	Yes	2.45	Adjusted hectares	20	**Time over which loss is averted (max. 20 years)**	20	**Start area (hectares)**	20	**Risk of loss (%) without offset**	0%	**Risk of loss (%) with offset**	0%	0.00	95%	0.00	0.00	4.12	167.76%	Yes	
									Future area without offset (adjusted hectares)	20.0	**Future area with offset (adjusted hectares)**	20.0								
					Time until ecological benefit	10	**Start quality (scale of 0-10)**	**4**	**Future quality without offset (scale of 0-10)**	**3**	**Future quality with offset (scale of 0-10)**	**6**	3.00	70%	2.10	2.06				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	Yes		Count										0		0.00	0.00	#DIV/0!	#DIV/0!		
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0	0.00	#DIV/0!	**#DIV/0!**	$0.00	#DIV/0!	#DIV/0!
Condition of habitat	0				$0.00		$0.00
Area of habitat	2.454	4.12	167.76%	**Yes**	$0.00	N/A	$0.00
Area of community	0				$0.00		$0.00
					$0.00	**#DIV/0!**	**#DIV/0!**

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Forest Red Tailed black cockatoo
EPBC Act status	Vulnerable
Annual probability of extinction Based on IUCN category definitions	**0.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes		**Area**	5.98	Hectares	
			Quality	**6**	Scale 0-10	
			Total quantum of impact	3.59	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	Yes				Count	
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Threatened species habitat																				
Area of habitat	Yes	3.59	Adjusted hectares	34	**Time over which loss is averted (max. 20 years)**	20	**Start area (hectares)**	34	**Risk of loss (%) without offset**	0%	**Risk of loss (%) with offset**	0%	0.00	95%	0.00	0.00	7.00	195.06%	Yes	
									Future area without offset (adjusted hectares)	34.0	**Future area with offset (adjusted hectares)**	34.0								
					Time until ecological benefit	10	**Start quality (scale of 0-10)**	**4**	**Future quality without offset (scale of 0-10)**	**3**	**Future quality with offset (scale of 0-10)**	**6**	3.00	70%	2.10	2.06				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	Yes		Count										0		0.00	0.00	#DIV/0!	#DIV/0!		
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0	0.00	#DIV/0!	**#DIV/0!**	$0.00	#DIV/0!	#DIV/0!
Condition of habitat	0				$0.00		$0.00
Area of habitat	3.588	7.00	195.06%	**Yes**	$0.00	N/A	$0.00
Area of community	0				$0.00		$0.00
					$0.00	**#DIV/0!**	**#DIV/0!**

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Forest Red Tailed black cockatoo
EPBC Act status	Vulnerable
Annual probability of extinction Based on IUCN category definitions	**0.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes		**Area**	8.95	Hectares	
			Quality	7	Scale 0-10	
			Total quantum of impact	6.27	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	Yes				Count	
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Threatened species habitat																				
Area of habitat	Yes	6.27	Adjusted hectares	31	**Time over which loss is averted (max. 20 years)**	20	**Start area (hectares)**	31	**Risk of loss (%) without offset**	0%	**Risk of loss (%) with offset**	0%	0.00	95%	0.00	0.00	8.51	135.81%	Yes	
									Future area without offset (adjusted hectares)	31.0	**Future area with offset (adjusted hectares)**	31.0								
					Time until ecological benefit	10	**Start quality (scale of 0-10)**	4	**Future quality without offset (scale of 0-10)**	3	**Future quality with offset (scale of 0-10)**	7	4.00	70%	2.80	2.74				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	Yes		Count										0		0.00	0.00	#DIV/0!	#DIV/0!		
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0	0.00	#DIV/0!	**#DIV/0!**	$0.00	#DIV/0!	#DIV/0!
Condition of habitat	0				$0.00		$0.00
Area of habitat	6.265	8.51	135.81%	**Yes**	$0.00	N/A	$0.00
Area of community	0				$0.00		$0.00
					$0.00	**#DIV/0!**	**#DIV/0!**

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Red Tailed BC
EPBC Act status	Vulnerable
Annual probability of extinction Based on IUCN category definitions	**0.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes		**Area**		Hectares	
			Quality		Scale 0-10	
			Total quantum of impact	0.00	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	Yes	Possibly suitable	18		Count	Fauna surveys
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)	Start area and quality	Future area and quality without offset	Future area and quality with offset	Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																
Area of community	No				**Risk-related time horizon (max. 20 years)**	**Start area (hectares)**	**Risk of loss (%) without offset**	**Risk of loss (%) with offset**								
							Future area without offset (adjusted hectares) 0.0	**Future area with offset (adjusted hectares)** 0.0								
					Time until ecological benefit	**Start quality (scale of 0-10)**	**Future quality without offset (scale of 0-10)**	**Future quality with offset (scale of 0-10)**								
Threatened species habitat																
Area of habitat	Yes		Adjusted hectares		**Time over which loss is averted (max. 20 years)**	**Start area (hectares)**	**Risk of loss (%) without offset**	**Risk of loss (%) with offset**	0.00		0.00	0.00	0.00	#DIV/0!	#DIV/0!	
							Future area without offset (adjusted hectares) 0.0	**Future area with offset (adjusted hectares)** 0.0								
					Time until ecological benefit	**Start quality (scale of 0-10)**	**Future quality without offset (scale of 0-10)**	**Future quality with offset (scale of 0-10)**	0.00		0.00	0.00				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**	**Start value**	**Future value without offset**	**Future value with offset**	**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	Yes	18	Count	56	20	56	27	56	29	80%	23.20	22.29	123.84%	Yes		
Condition of habitat Change in habitat condition, but no change in extent	No															
Threatened species																
Birth rate e.g. Change in nest success	No															
Mortality rate e.g Change in number of road kills per year	No															
Number of individuals e.g. Individual plants/animals	No															

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	18	22.29	123.84%	**Yes**	$0.00	N/A	$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	0	0.00	#DIV/0!	**#DIV/0!**	$0.00	#DIV/0!	#DIV/0!
Area of community	0				$0.00		$0.00
					$0.00	**#DIV/0!**	**#DIV/0!**

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Barnaby's BC
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	**1.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes		**Area**	5.98	Hectares	
			Quality	**1**	Scale 0-10	
			Total quantum of impact	0.60	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	Yes				Count	
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Threatened species habitat																				
Area of habitat	Yes	0.60	Adjusted hectares	4.76	**Time over which loss is averted (max. 20 years)**	20	**Start area (hectares)**	4.76	**Risk of loss (%) without offset**	0%	**Risk of loss (%) with offset**	0%	0.00	95%	0.00	0.00	0.89	148.36%	Yes	
									Future area without offset (adjusted hectares)	4.8	**Future area with offset (adjusted hectares)**	4.8								
					Time until ecological benefit	10	**Start quality (scale of 0-10)**	**0**	**Future quality without offset (scale of 0-10)**	**0**	**Future quality with offset (scale of 0-10)**	**3**	3.00	70%	2.10	1.86				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	Yes		Count										0		0.00	0.00	#DIV/0!	#DIV/0!		
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0	0.00	#DIV/0!	**#DIV/0!**	$0.00	#DIV/0!	#DIV/0!
Condition of habitat	0				$0.00		$0.00
Area of habitat	0.598	0.89	148.36%	**Yes**	$0.00	N/A	$0.00
Area of community	0				$0.00		$0.00
					$0.00	**#DIV/0!**	**#DIV/0!**

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Baudin BC
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	**1.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes		**Area**	2.74	Hectares	
			Quality	**2**	Scale 0-10	
			Total quantum of impact	0.55	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	Yes				Count	
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Threatened species habitat																				
Area of habitat	Yes	0.55	Adjusted hectares	7	**Time over which loss is averted (max. 20 years)**	20	**Start area (hectares)**	7	**Risk of loss (%) without offset**	0%	**Risk of loss (%) with offset**	0%	0.00	95%	0.00	0.00	1.30	238.08%	Yes	
									Future area without offset (adjusted hectares)	7.0	**Future area with offset (adjusted hectares)**	7.0								
					Time until ecological benefit	10	**Start quality (scale of 0-10)**	**0**	**Future quality without offset (scale of 0-10)**	**0**	**Future quality with offset (scale of 0-10)**	**3**	3.00	70%	2.10	1.86				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	Yes		Count										0		0.00	0.00	#DIV/0!	#DIV/0!		
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0	0.00	#DIV/0!	**#DIV/0!**	$0.00	#DIV/0!	#DIV/0!
Condition of habitat	0				$0.00		$0.00
Area of habitat	0.548	1.30	238.08%	**Yes**	$0.00	N/A	$0.00
Area of community	0				$0.00		$0.00
					$0.00	**#DIV/0!**	**#DIV/0!**

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Baudin's BC
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	**1.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes		**Area**	1.75	Hectares	
			Quality	**3**	Scale 0-10	
			Total quantum of impact	0.53	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	Yes				Count	
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Threatened species habitat																				
Area of habitat	Yes	0.53	Adjusted hectares	25.26	**Time over which loss is averted (max. 20 years)**	20	**Start area (hectares)**	25.26	**Risk of loss (%) without offset**	0%	**Risk of loss (%) with offset**	0%	0.00	95%	0.00	0.00	4.71	896.78%	Yes	
									Future area without offset (adjusted hectares)	25.3	**Future area with offset (adjusted hectares)**	25.3								
					Time until ecological benefit	10	**Start quality (scale of 0-10)**	**0**	**Future quality without offset (scale of 0-10)**	**0**	**Future quality with offset (scale of 0-10)**	**3**	3.00	70%	2.10	1.86				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	Yes		Count										0		0.00	0.00	#DIV/0!	#DIV/0!		
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0	0.00	#DIV/0!	**#DIV/0!**	$0.00	#DIV/0!	#DIV/0!
Condition of habitat	0				$0.00		$0.00
Area of habitat	0.525	4.71	896.78%	**Yes**	$0.00	N/A	$0.00
Area of community	0				$0.00		$0.00
					$0.00	**#DIV/0!**	**#DIV/0!**

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Baudin BC
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	**1.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes		**Area**	7.71	Hectares	
			Quality	**5**	Scale 0-10	
			Total quantum of impact	3.86	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	Yes				Count	
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Threatened species habitat																				
Area of habitat	Yes	3.86	Adjusted hectares	34	**Time over which loss is averted (max. 20 years)**	20	**Start area (hectares)**	34	**Risk of loss (%) without offset**	0%	**Risk of loss (%) with offset**	0%	0.00	95%	0.00	0.00	6.34	164.39%	Yes	
									Future area without offset (adjusted hectares)	34.0	**Future area with offset (adjusted hectares)**	34.0								
					Time until ecological benefit	10	**Start quality (scale of 0-10)**	**4**	**Future quality without offset (scale of 0-10)**	**3**	**Future quality with offset (scale of 0-10)**	**6**	3.00	70%	2.10	1.86				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	Yes		Count										0		0.00	0.00	#DIV/0!	#DIV/0!		
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0	0.00	#DIV/0!	**#DIV/0!**	$0.00	#DIV/0!	#DIV/0!
Condition of habitat	0				$0.00		$0.00
Area of habitat	3.855	6.34	164.39%	**Yes**	$0.00	N/A	$0.00
Area of community	0				$0.00		$0.00
					$0.00	**#DIV/0!**	**#DIV/0!**

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Baudin BC
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	**1.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes		**Area**	8.95	Hectares	
			Quality	**6**	Scale 0-10	
			Total quantum of impact	5.37	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	Yes				Count	
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Threatened species habitat																				
Area of habitat	Yes	5.37	Adjusted hectares	31	**Time over which loss is averted (max. 20 years)**	20	**Start area (hectares)**	31	**Risk of loss (%) without offset**	0%	**Risk of loss (%) with offset**	0%	0.00	95%	0.00	0.00	6.84	127.33%	Yes	
									Future area without offset (adjusted hectares)	31.0	**Future area with offset (adjusted hectares)**	31.0								
					Time until ecological benefit	20	**Start quality (scale of 0-10)**	**4**	**Future quality without offset (scale of 0-10)**	**3**	**Future quality with offset (scale of 0-10)**	**7**	4.00	70%	2.80	2.21				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	Yes		Count										0		0.00	0.00	#DIV/0!	#DIV/0!		
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0	0.00	#DIV/0!	**#DIV/0!**	$0.00	#DIV/0!	#DIV/0!
Condition of habitat	0				$0.00		$0.00
Area of habitat	5.37	6.84	127.33%	**Yes**	$0.00	N/A	$0.00
Area of community	0				$0.00		$0.00
					$0.00	**#DIV/0!**	**#DIV/0!**

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Baudin's BC
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	**1.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes		**Area**		Hectares	
			Quality		Scale 0-10	
			Total quantum of impact	0.00	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	Yes	Possibly suitable	18		Count	Fauna surveys
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)	Start area and quality	Future area and quality without offset	Future area and quality with offset	Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																
Area of community	No				**Risk-related time horizon (max. 20 years)**	**Start area (hectares)**	**Risk of loss (%) without offset**	**Risk of loss (%) with offset**								
							Future area without offset (adjusted hectares) 0.0	**Future area with offset (adjusted hectares)** 0.0								
					Time until ecological benefit	**Start quality (scale of 0-10)**	**Future quality without offset (scale of 0-10)**	**Future quality with offset (scale of 0-10)**								
Threatened species habitat																
Area of habitat	Yes		Adjusted hectares		**Time over which loss is averted (max. 20 years)**	**Start area (hectares)**	**Risk of loss (%) without offset**	**Risk of loss (%) with offset**	0.00		0.00	0.00 0.00 0.00	#DIV/0!	#DIV/0!		
							Future area without offset (adjusted hectares) 0.0	**Future area with offset (adjusted hectares)** 0.0								
					Time until ecological benefit	**Start quality (scale of 0-10)**	**Future quality without offset (scale of 0-10)**	**Future quality with offset (scale of 0-10)**	0.00		0.00	0.00				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**	**Start value**	**Future value without offset**	**Future value with offset**	**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	Yes	18	Count	56	20	56	27	56	29	80%	23.20	18.28	101.53%	Yes		
Condition of habitat Change in habitat condition, but no change in extent	No															
Threatened species																
Birth rate e.g. Change in nest success	No															
Mortality rate e.g Change in number of road kills per year	No															
Number of individuals e.g. Individual plants/animals	No															

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	18	18.28	101.53%	**Yes**	$0.00	N/A	$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	0	0.00	#DIV/0!	**#DIV/0!**	$0.00	#DIV/0!	#DIV/0!
Area of community	0				$0.00		$0.00
					$0.00	**#DIV/0!**	**#DIV/0!**

APPENDIX 5: OFFSET MANAGEMENT PLAN

Western Botanical

Offset Management Plan for Jelcobine, Lot DP 90037

Prepared for: Doral Mineral Sands Pty Ltd

Report Ref: WB1058



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Citation: Western Botanical (2025) *Offset Management Plan for Jelcobine, Lot DP 90037*. Consultant's report prepared for Doral Mineral Sands Pty Ltd. Report reference WB1058.

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Version 4	L. Dalgliesh, G. Cockerton	21st July 2025	21st July 2025
Version 5	L. Dalgliesh, G. Cockerton	27th August 2025	27th August 2025

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This report has been designed for double-sided printing

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List of acronyms used in this report:

Acronym	Meaning
AOI	Area of Interest (i.e. Lot DP 90037) which includes the Offset Site
BC	Black-Cockatoo
BC Act	*Biodiversity Conservation Act 2016* (Western Australia)
BBC	Baudin's Black-Cockatoo (*Zanda baudinii*)
CBC	Carnaby's Black-Cockatoo (*Zanda latirostris*)
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DPIRD	Department of Primary Industries and Regional Development (Western Australia)
DS	Direct Seeding
DWER	Department of Water and Environmental Regulation (Western Australia)
EP Act	*Environmental Protection Act 1986* (Western Australia)
EPA	Environmental Protection Authority (Western Australia)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Australia)
FRTBC	Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*)
KLPL	Keysbrook Leucoxene Pty Ltd
T	Tubestock

1. Introduction

Keysbrook Leucoxene Pty Ltd (KLPL), a subsidiary of Doral Mineral Sands Pty Ltd, engaged Western Botanical to prepare an Offset Management Plan for portions of Lot 17976, also known as Lot DP 90037, to support the proposed Offset Strategy proposed by KLPL for the Jelcobine Offset. The Jelcobine Offset is required to offset significant residual impacts to Black-Cockatoo foraging and potential nesting and roosting habitat associated with impacts from the Keysbrook Western Extension Mineral Sands Project. The Black-Cockatoo species impacted by the Proposal include:

- Carnaby`s Black-Cockatoo (CBC) *Zanda latirostris* – listed as Endangered under the *BC Act* and *EPBC Act*.
- Forest Red-tailed Black-Cockatoo (FRTBC) *Calyptorhynchus banksii naso* – listed as Vulnerable under the *BC Act* and *EPBC Act.*
- Baudin's Black Cockatoo (BBC) *Zanda baudinii* – listed as Endangered under the *BC Act* and *EPBC Act*

The Proposed Offset Site is located in Jelcobine on the east side of the Darling Scarp, sandwiched between two reserves: Boyagarring Conservation Park to the east, and Youraling State Forest to the west. White-tailed (CBC and/or Baudin's Black-Cockatoo) and FRTBC are abundant in the area (Western Botanical, 2025a).

The Keysbrook Western Extension (i.e. Proposal or Proposed Action) is being assessed by accredited assessment by the Western Australian EPA (as per *EP Act 1986*) and the Commonwealth DCCEEW (as per *EPBC Act 1999*).

2. Background Information

2.1. Ownership, vesting and zoning

The proposed Offset Site is portions of Lot 17976, also known as Lot DP 90037, and is Zoned Rural in the Shire of Brookton, WA. The land is freehold and signed land acquisition agreements are currently in place between KLPL and the landowners subject to regulatory approval of the Proposed Offset Strategy.

2.2. Site description

The proposed Offset Site is located in the Northern Jarrah Forest subregion of the Jarrah Forest bioregion, with the boundary of the Katanning subregion of the Avon Wheatbelt bioregion being approximately 17 km to the east. The total Lot covers approximately 162.3

ha, of which 113.76 ha is proposed to be used to offset impacts to FRTBC and 95.76 ha for CBC.

The Offset Site represents an east-facing slope with relief of approximately 40 metres over a length of 1 km, and slopes estimated at between 2 and 15 degrees (Figure 1).

Soils are shallow sandy lateritic pizolitic sandy gravels, with occasional outcropping ferricrete on hill tops and ridges, likely overlying kaolinitic materials and weathered granite. These surface soils have high infiltration capacity and relatively low erodibility.

The eastern portion of the site represents a narrow minor incised drainage line, potentially impacted by salinity in some areas, which has been revegetated (est. 20 yrs. ago) with a range of native tree species. An approximately 20 ha area west of the drainage line with sandy-gravelly soil has been previously cleared for agriculture, supports pasture species, and is available for revegetation.

Lower slopes and flats adjacent and to the west of the drainage line support remnant *Eucalyptus wandoo* woodland on sandy clay soil with little midstorey (due to grazing) and a good representation of persistent herbaceous species and native grasses to 20 cm high, with few weeds present.

The upper hill slope and hilltops support remnant *Eucalyptus wandoo*, *E. accedens* woodlands with trees in good to excellent condition, with minor inclusion of *Eucalyptus marginata* and *Corymbia calophylla*. The latter two species are not performing well in the current climatic conditions, with the deaths of many trees noted. The understorey is sparse due to prior grazing (last grazed approximately 2016, pers. comm. Mr. Vince Pike) and the maturity of the eucalypt woodland in this landscape.

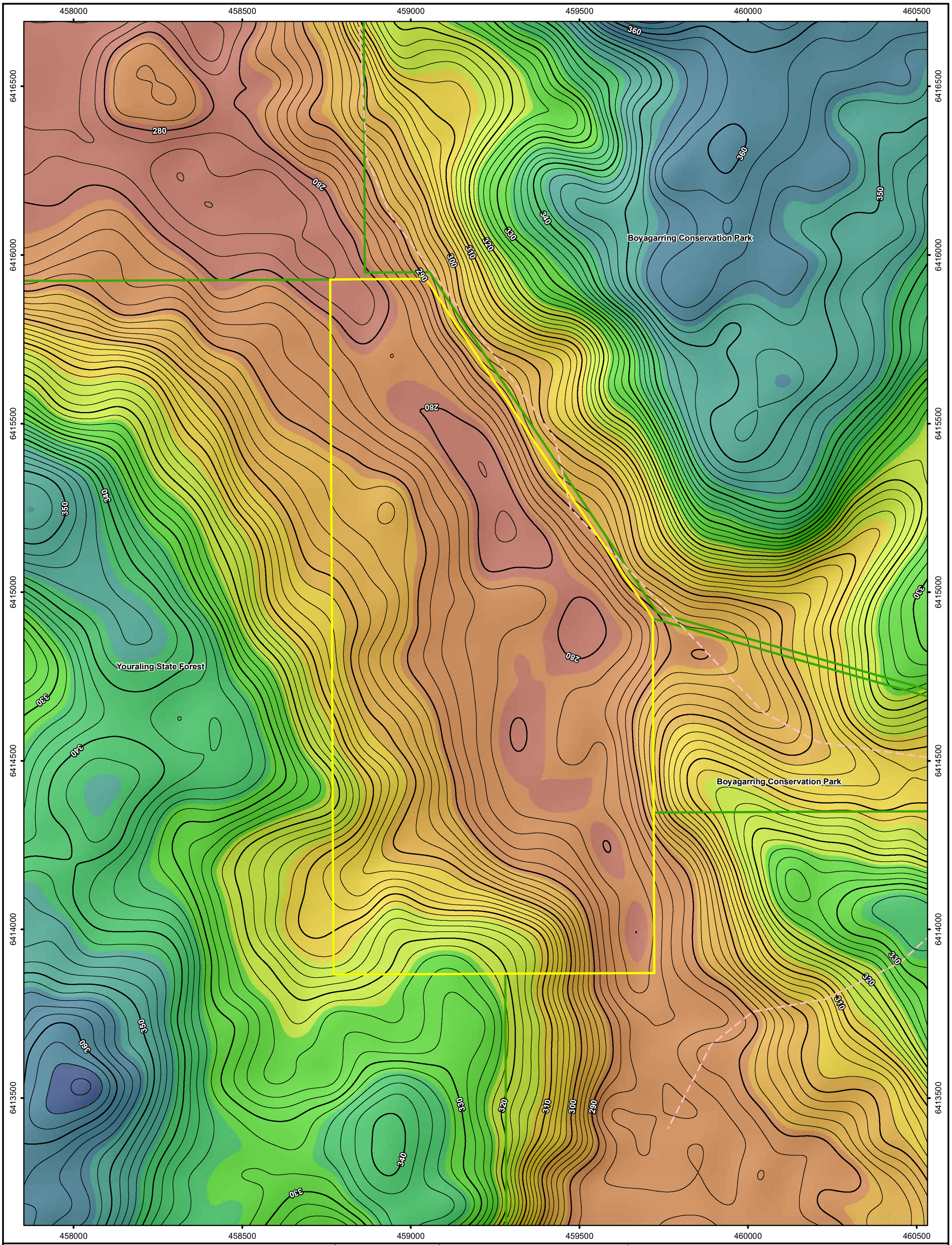
Three small spring-fed freshwater dams are present within the parcel of land being considered for purchase as an offset. Vegetation units for proposed revegetation are given in Figure 2.

2.3. Site History

The entire region, inclusive of the State Forest adjacent, has been logged in the past. The 65 ha of remnant wandoo woodland and mixed woodland within the Offset Site was grazed by sheep as recently as 2016 (Mr. Vince Pike pers. comm.). In 2024, there were 32.95 ha under canola cropping, outside the areas proposed for revegetation, and 1.27 ha fallow.

Figure 1: Topography

Topography: Shuttle Radar Topography Mission (SRTM) - NASA and the Department of Defence's National Imagery and Mapping Agency (NIMA).



Legend

- Survey Area
- Legislated Lands
- Track
- Contours (2m interval)

0 150m

Scale: 1:10,000
MGA94 (Zone 50)

CAD Ref: a3087_F004

Date: Jan 2025 | Rev: A | A3

Western Botanical

Author: G. Cockerton, L. Dalgliesh

Drawn: CAD Resources ~ www.cadresources.com.au
Tel: (08) 9246 3242 ~ Fax (08) 9246 3202

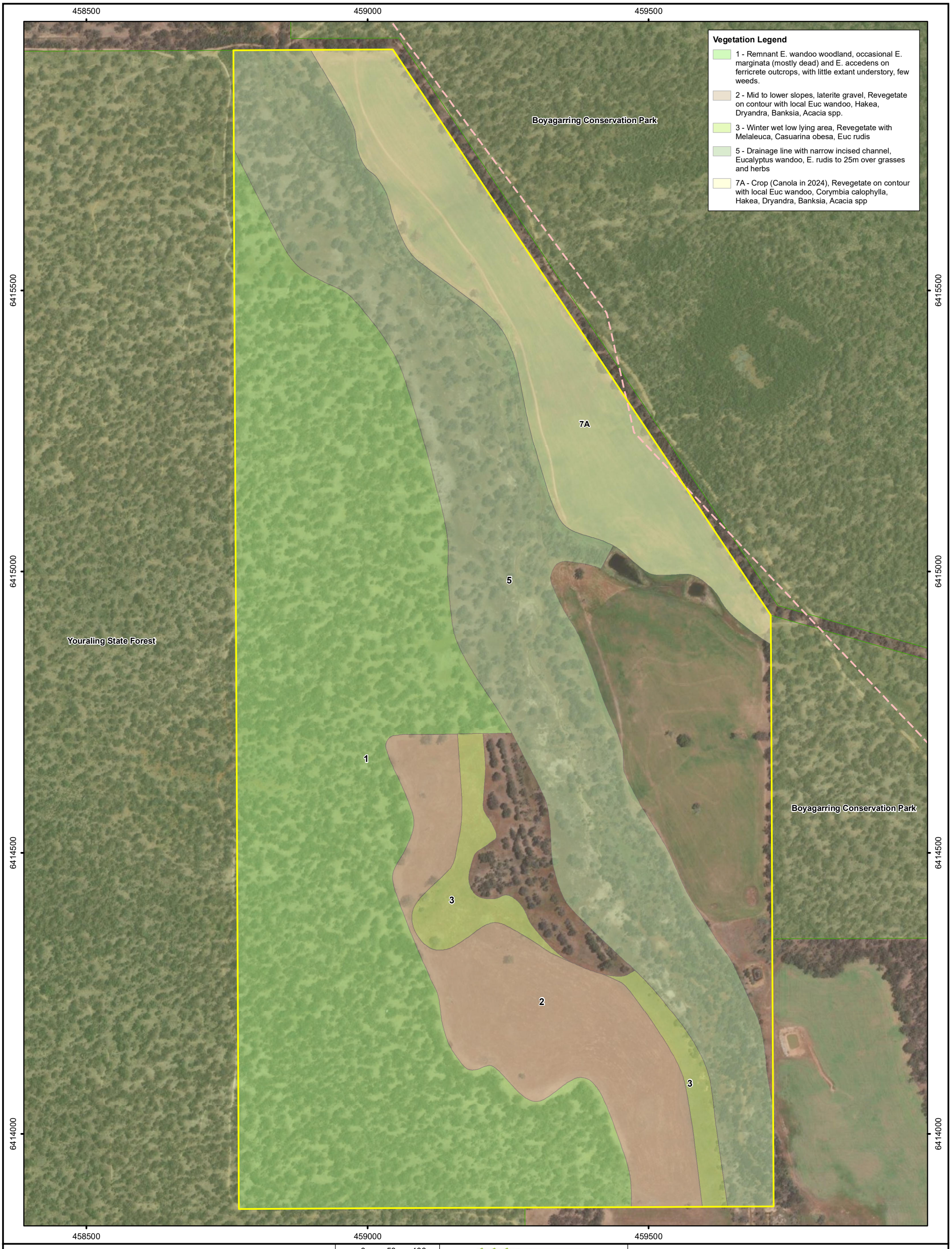
Doral Mineral Sands Pty Ltd

Jelcobine Project

Topography

Figure 2: Proposed Revegetation Plan showing vegetation types

Imagery: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community



Legend
- Survey Area
- Legislated Lands
- Track

0 50 100m
Scale: 1:6,000
MGA94 (Zone 50)

CAD Ref: a3087_F002_01
Date: Aug 2025 | Rev: A | A3

Western Botanical

Author: G. Cockerton, L. Dalgliesh
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Doral Mineral Sands Pty Ltd
Jelcobine Project
Revegetation Areas

2.4. Disturbances and threats

Seven weed species have been recorded on site with six of these being considered pasture species (Western Botanical 2025b). One species, *Gomphocarpus fruticosus* (Apocynaceae) (narrow leaf cotton bush), recorded in a moist area down-slope of the lower dam on the cropped portion of the property, is a Declared Pest in Western Australia (DPIRD 2023) and will be actively managed through regular monitoring and herbicide or hand removal.

Evidence of Feral Pig (*Sus scrofa*) and Rabbit (*Oryctolagus cuniculus*) activity exists within the Offset Site (Western Botanical 2025a). These two species can cause degradation to native vegetation and pose a risk to revegetation survival by grazing, ring-barking, trampling, and root exposure by digging. Presently no control methods are in place however as per this plan, effective controls including fencing and ongoing control via 1080 baits, trapping and or shooting will be undertaken to manage these risks

The adjacent Youraling Forest Reserve has a vehicle track west of the western boundary of the Offset Site, with evidence of vehicle (trailbike, and possibly quadbike and 4WD) intrusion onto the proposed Offset Site through gaps in the presently degraded fence. The potential for unauthorised vehicle access into the Offset Site from Youraling Forest Reserve poses a threat to the existing native vegetation and the proposed revegetation program, and shall be controlled by new fencing and signage.

Observed fire damage as a result of historic and indiscriminate paddock burning by a previous land manager was evident in a large old paddock marri in the Offset Site, which would typically be a valuable food source to BCs (Western Botanical 2025a). Although fire is a natural occurrence in Australian ecosystems, inappropriate fire regimes (too hot, wrong time of the year, too frequent) can decrease the seed-set, growth and longevity of plants and may impact the success of revegetation. Fire management of the neighbouring State Forest is managed by DBCA and whilst the risk of bushfire exists, DBCA are aware of the proposed offset program and effective communications regarding fire management to reduce the risk of impact to the offset site shall be maintained.

The increasing heat, aridity and extreme storm events associated with climate change may impact a revegetation program by reducing seed germination and limiting seedling growth. Careful timing of planting and direct seeding should help mitigate these impacts.

2.5. Existing conditions

The Offset Site currently offers good resources for Black-Cockatoos (BC) in the way of roosting and potential nesting trees, plus permanent water in two farm dams. Representative site photos (Appendix 6) demonstrate the structure of the remnant *Eucalyptus wandoo*, *E. accedens* woodlands and the previously pastured lands.

The BC foraging value of the Offset Site is currently limited. The addition of suitable species of plants in selected areas/zones in the Offset Site via a rehabilitation program would greatly improve the foraging value, which will provide a measurable environmental conservation gain against the residual impacts for the Proposed Action.

Understorey plants suitable for BC forage were observed in the adjacent Youraling Forest Reserve and Boyagarring Conservation Park in patches of Proteaceous shrubs such as *Banksia sessilis* (Parrot Bush), *B. squarrosa* (Pingle) and *Hakea undulata* (Wavy-leaved Hakea). Both the Reserve and the Park are close enough to be utilised by BC nesting in the Offset Site.

2.6. Access agreements

Access to the north end and east side of the Offset Site is currently via Pike Road (public road) from the Brookton Highway. Access to the west side and south side is as above, then limited 4WD access along a track in Youraling Forest Reserve (public access) on the west.

3. Revegetation methodology

3.1. Revegetation commitments

3.1.1. Vision

The intention of the revegetation is to establish suitable self-sustaining foraging habitat for CBC and FRTBC that emulates the existing habitat in nearby woodlands.

3.1.2. Objectives

The key objective of the offset project is to undertake a significant restoration program to enhance the existing Black Cockatoo habitat through the protection and revegetation of the site with a resilient and self-sustaining suite of local native plant species suitable as a food resource for CBC and FRTBC. Vegetation that is 'self-sustaining' is healthy enough to reach maturity and able to produce the next generation of plants *in situ*.

There may be additional beneficial outcomes such as prevention of further erosion around the drainage line, and provision of habitat for other native fauna; however, as these are not included in the offset calculator, they are not current objectives.

3.2. Species selection

The species selection is focused on providing foraging habitat for BC within (i) former pasture on a gravelly hill slope with an easterly aspect and (ii) remnant Wandoo and Powderbark Wandoo woodland vegetation that has been grazed and which is lacking low to

medium understorey. The species selection for the drainage line within the property shall include salt-tolerant species to be utilised.

A strong emphasis has been placed on utilising local plant species that could provide foraging habitat for BC within a timeframe of 8-10 years.

The species list has been prepared using a broad range of local species plus additional species that are known BC foraging species, produce relatively large amounts of large seeds but may not be local and will likely perform well on the soil types present and within the local climatic zone. Existing species such as *Eucalyptus marginata* subsp. *thalassica* and *Corymbia calophylla* are on the eastern fringe of their environmental tolerance and are only included in minor proportions. The species selection criteria is open to some substitutions following similar principles if the availability of some species is an issue.

It may be difficult to establish a diverse range of BC foraging species in areas impacted by salinity (*i.e.* parts of the drainage line). *Hakea preissii* is the only known forage species with some degree of salt tolerance.

Banksia and *Hakea* species which have large seeds that are relatively difficult to obtain, available in relatively modest quantities and therefore costly, will be planted as tubestock. Similarly, *Allocasuarina*, *Casuarina*, *Corymbia* and *Eucalyptus* species will be in relatively low densities to provide some taller trees for vegetation structure.

Acacia and *Xanthorrhoea* species have been included to provide (i) quick foliar cover and mid-storey structure and nitrogen-fixing by the legumes; and (ii) longer-term forage habitat in the case of the local *Xanthorrhoea* species. *Xanthorrhoea* sp. Jelcobine (GCLD 2416) is potentially a new species in the *Xanthorrhoea preissii* complex, the taxonomy of which is being assessed by Western Botanical and the Western Australian Herbarium.

Botanical names in this document follow those used by the Western Australian Herbarium (1998–).

3.3. Site exclusion fencing

Fencing shall be installed in order to provide security, and deterrence to nuisance animals such as kangaroos and feral pigs. Fence design is proposed to be a minimum 1.2m ringlock and a single base strand of barbed wire. Lockable gates should be installed in the fence to permit only authorised access for planting, weed control and monitoring. Signage will be erected to deter unauthorised vehicle access, by notification of private property and/or pest control.

3.4. Fertiliser application

Fertiliser application will be minimal to avoid detrimental impacts to Proteaceae (i.e. *Banksia*, *Grevillea*, *Hakea,* and *Persoonia*) as these plants are highly susceptible to phosphate toxicity. Recommendations for a low-phosphate fertiliser application should be sought from the revegetation contractor.

3.5. Timing of revegetation operations

Direct seeding and seedling planting programs shall be implemented when soil moisture is reliable and temperatures are warmer, meaning a mid to late Autumn planting is preferable. This hinges on the occurrence and quantity of rainfall and should be assessed at the time.

Successful direct seeding in former pasture is best achieved when seeds are spread in early Autumn, so that germination occurs as temperatures drop and autumn rainfall occurs.

If seeding is deferred until the winter months, pasture insect pests such as Cut Worm and arachnid pests Red Legged Earth Mite (RLEM) can cause total failure of direct seeding operations as the pests ravage the germinating seedlings at the cotyledon stage.

If direct seeding is undertaken in the cold winter months, effective misting of the direct seeded areas with an appropriate insecticide in areas of old pasture will greatly improve the direct seeding outcomes.

3.6. Site preparation

The project area is divided into five revegetation sub-units (Table 1) for revegetation planning and implementation purposes, as presented in Figure 2. Any access tracks and firebreaks will need to be constructed before other activities.

Table 1. Sub-units of the proposed revegetation plan

Revegetation Category		Approximate area (ha)
Previously pastured land –		
Zone 2 is 14ha, 3 is 4.76ha and northern part of 7 (7A) is 18.26ha		**37.02**
Pastured Paddock - Low in Landscape	30.86	
Pastured Paddock - High in Landscape	6.16	

Remnant *Eucalyptus wandoo*, *E. accedens* woodland – Zone 1		**65**
Remnant Wandoo Woodland, Low in Landscape	38	
Remnant Wandoo Woodland, High in Landscape	27	
Drainage line with existing revegetation – Zone 5		**30**
Total Approximate Area (ha)		**132.02**

3.6.1. Previously pastured land (Zones 2, 3 and 7A)

Approximately 37.02 ha (Zone 2, 3 and the northern portion of 7, designated as 7A) of previously pastured land will be revegetated using tubestock and direct seeding with a range of local species focusing on *Eucalyptus wandoo* as roosting habitat; *Hakea*, *Banksia* (formerly *Dryandra*), and *Banksia* sens. str. species providing feeding habitat, and local understorey native legumes (e.g. *Acacia*, *Gastrolobium*, *Gompholobium*, *Kennedia*, and *Templetonia*) for nitrogen fixation and further feeding habitat.

Appendix 1 presents a core list of species and quantities suggested for rehabilitation in previously pastured land (Zone 2, 3 and 7A). This can be added to if a more diverse understorey is deemed warranted.

The site preparation program shall be implemented during the Summer prior to a planting program. The site preparation program should include:

- Detailed planning and mapping of planting areas and a review of site treatments required.
- Species list prepared with reference to soil and site conditions.
- Herbicide application (glyphosate or similar recommended) to existing pasture prior to seeding and planting of tubestock to minimise competition.
- Ripping at 1.5 to 2 m spacings, 20 to 30 cm deep on the contour using a grader or front-end loader with a tool bar.
    - It is important that the ripped contour lines are surveyed and rip lines are discontinuous to minimise the chance of erosion on the moderate to steeper slopes.
    - Pre-planting weed control is most effective before ripping. Ideally, weed control should be undertaken a year before to reduce weed seed soil bank. Ground

preparation should be implemented in April/May after the second round of weed control.

- Tubestock planting to be done by hand using Pottiputki tree planters in riplines.
- Direct seeding to be implemented by hand or utilising a tractor-drawn tree planter in ground areas that have been scarified.

3.6.2. Remnant *Eucalyptus wandoo, E. accedens* woodland (Zone 1)

Remnant *Eucalyptus wandoo*, *E. accedens* woodland has been historically grazed and is devoid of mid-storey species, encompasses approximately 65 ha in the Offset Site, and can be augmented with understorey species to provide improved foraging habitat for BC.

This can be achieved with a combination of:

- Light scarification of the surface to help prepare a seedbed for direct-seeded species. This can be achieved using a small tractor with a light scarifier bar to scratch the surface to a depth of no more than 5 cm, avoiding damage to existing understorey species.
- Infill planting of tubestock following direct seeding in this area.
- Tubestock planting of Proteaceae amongst the remnant woodland trees by operators using planting tubes, without any significant site disturbance.
- Direct seeding of legumes and some Proteaceae (as seed availability allows) throughout the remnant woodland.

As the soil surface here is relatively non-compacted, and existing near-surface tree roots are intact, no ripping of the soil surface is recommended.

Appendix 2 presents a core list of species and quantities to be included into the rehabilitation in remnant *Eucalyptus wandoo* and *E. accedens* woodland.

3.6.3. Drainage line with existing vegetation (Zone 5)

The drainage line (Zone 5) has been previously revegetated, appears to include some areas of observed salinity impacts, and supports a good range of *Eucalyptus* species and *Casuarina pauper*. It is proposed that a mid-storey of *Hakea preissii* be hand-planted throughout to augment the potential food source for Black Cockatoo. Tubestock planting of *Hakea preissii* is therefore planned at a rate of 250 stems per hectare. The total area of drainage line in the Offset Strategy is 30 ha, which would require at least 7,500 tubestock stems of *Hakea preissii* for complete coverage.

The site should not require any ripping or herbicide treatment. Tubestock can be hand-planted between existing trees.

3.7. Seed provenance

The availability of seeds of suitable provenances and suitable species for propagation will be crucial to the success of the rehabilitation of the Offset Site. Therefore, a locally focused seed collection program should be implemented in 2025 to collect sufficient seed for nursery propagation and direct seeding.

Some preferred species from suitable provenances may be available commercially.

Seed collection, processing and storage will be guided by the RIAWA (2025) Seed Standards.

3.8. Quantities for Tubestock Planting and Direct Seeding

Totals of 170,686 seedling tubestock (Appendix 3) and 27.207 kg of native seeds for direct seeding (Appendix 4) are proposed.

Species selection with quantities noted are presented in Appendix 3 for Tubestock (T) Planting, and Appendix 4 for Direct Seeding (DS). Seedlings will either be propagated from seed, cuttings or tissue culture from the use of provenance material by a trusted, accredited nursery.

Note that the quantity of *Xanthorrhoea* at 200 stems per hectare is aspirational only and is to be introduced via Direct Seeding. The availability of local seed will determine the quantity to be used.

3.9. Schedule of Works

An experienced revegetation contractor shall be contracted to prepare the site and undertake the planting of tubestock. Chatfields Tree Nursery, Tammin, experienced in numerous successful native revegetation projects, has been consulted in the development of this plan.

Planting and direct seeding should occur in the Autumn following site preparation.

A schedule of works is proposed in Appendix 5.

3.10. Completion criteria information as per guideline

Completion criteria are the measures against which the implementation objectives can be assessed. The criteria aim to ensure rehabilitated areas will display self-sustaining characteristics of surrounding areas and provide Regulators and other key stakeholders confidence that, to the maximum possible extent, they can be managed in the long term

according to the intended land use, using normal management practices without the input of additional resources. Vegetation that is 'self-sustaining' is healthy enough to reach maturity and able to produce the next generation of plants *in situ*.

Management Approach

The assessment of rehabilitation against the completion criteria is applied throughout the various stages of the rehabilitation operations (Table 2).

Completion criteria are subject to review and revision on a regular basis to allow for learnings from trials, monitoring, improved knowledge, industry practices and changes in standards.

Table 2: Completion criteria

CLOSURE OUTCOME		COMPLETION CRITERIA	MEASUREMENT TOOL	CORRECTIVE ACTIONS	TIMING
1	Exclusion of grazing animals (rabbits, kangaroos, etc) to secure revegetation success	Erection of suitable perimeter fence to be installed and provide an effective barrier to prevent or reduce impacts to revegetation area	Observed installation and maintenance of perimeter fence visual inspection for presence of kangaroos and rabbits	Maintain fence Remove or control kangaroos or rabbits	Spring 2026
2	Overstorey vegetation is self-sustaining and suitable for future habitat, roosting or foraging use by Carnaby's Black Cockatoo and Forest Red-tailed Black Cockatoo.	Within 5 years (and maintained for 10, 15 and 20 years) a total abundance of planted overstorey woodland species is over 1000 stems/ha.	Visual inspection (Tree count) to assess the survival, flowering and fruiting events which is indicative of self-sustaining.	Additional planting of overstorey woodland species using tube stock following yearly review of number of surviving overstorey species	Spring 2031, 2036, 2041, 2046

	CLOSURE OUTCOME	COMPLETION CRITERIA	MEASUREMENT TOOL	CORRECTIVE ACTIONS	TIMING
3	Understorey structure is similar to the adjacent Youraling Forest Reserve vegetation communities	Within 5 years (and maintained for 10, 15 and 20 years): Species richness is at least 50% of revegetation species list. Species density is at least 2,000 stems/ha.	Quadrats	Additional planting of tubestock and application of direct seeding to be undertaken following yearly review of species richness and diversity.	2031, 2036, 2041, 2046
4	Plants used in rehabilitation to be of local provenance.	The mix of species is comprised of species recruited from direct seeding and species introduced as tube stock grown from seed, cuttings or whole plants salvaged from within 20km of the revegetation site.	Audit of rehabilitation records for sources of plant materials used in rehabilitation.	Purchase or collection of additional local provenance seed of target species.	2026

CLOSURE OUTCOME		COMPLETION CRITERIA	MEASUREMENT TOOL	CORRECTIVE ACTIONS	TIMING
5	Vegetation resilient to weeds - Weeds not out-competing revegetation	Within 5 years (and maintained for 10, 15 and 20 years): Weed cover is reduced to under 30% (currently 80-100% in understorey). Invasive weed coverage is sustained without weed control between 4th and 5th year's respective seasons. No Declared weeds are present within the revegetation area.	Quadrats	Weed control methods such as chemical application will be modified as required to achieve the best practice solution. The use of targeted spray applications and adaptive techniques such as weed wipers or rope wick technology will be implemented where required to selectively treat weeds	2031,2036, 2041, 2046
6	Dieback	No dieback is present within the revegetation area at 5 years post-establishment and maintained to be dieback free at years 10, 15 and 20.	Dieback survey	Exclusion and signage. Possible phosphite treatment	2031, 2036, 2041, 2046

CLOSURE OUTCOME		COMPLETION CRITERIA	MEASUREMENT TOOL	CORRECTIVE ACTIONS	TIMING
7	Black-Cockatoo Utilisation	Black Cockatoo are or have been present in the revegetation area and are or have been using the revegetation area for nesting/roosting/foraging	Fauna survey	Infill planting where required	2031, 2036, 2041, 2046

4. Revegetation monitoring plan

4.1. Monitoring of Vegetation

Monitoring of the establishment of vegetation in each revegetation zone is recommended on an annual basis from years 1 to 5, and thereafter every five years at year 10, 15 and 20 to assess the survival, flowering and fruiting events, which is indicative of vegetation that is 'self-sustaining'.

Monitoring of vegetation should include the recording of species richness (i.e. number of species present), relative abundance of species either by counts (suitable for trees and large shrubs) or percentage cover (suitable for small shrubs, grasses and understorey plants), and vegetation condition. Vegetation condition should be assessed using the Keighery scale (1994) as specified in DWER (2018).

Statistical assessment of the progress of the revegetation should include comparisons of data from at least ten representative quadrats, three to five from each of the revegetation units in the Offset Site with that of three to five quadrats in the neighbouring woodlands of Youraling State Forest and/or Boyagarring Nature Reserve (known as "Control").

Data collected from each quadrat will typically include species richness, vegetation condition, percentage foliar cover or density of trees and large shrubs using stems per hectare, as specified in DWER (2018). A photo monitoring point will be set up at each quadrat (as recommended by DWER 2018) to allow comparison amongst revegetation zones, treatments and controls. Monitoring will include recording a list of species for each site (vegetation unit or revegetation zone) including weeds.

Descriptive statistics (i.e. graphs) will be used to demonstrate the differences, if any, amongst data from different sites, or across seasons.

4.2. Black-Cockatoo monitoring

A targeted BC Habitat survey was undertaken in May 2025 (refer Appendix 7) and gave evidence for more than 90 potentially suitable hollows amongst 48 trees inspected within revegetation sections 1, 2, 3, 4 and 5. A targeted BC habitat survey undertaken in November 2025 assessed 31 trees within revegetation sections 1 and 5, and extrapolated to give an estimate of 204 trees, each with one or more potentially suitable hollows, in revegetation section 1 (Western Botanical 2025a).

Since the purpose of the offset is to provide habitat for BCs, monitoring revegetation for BC presence and utilisation is recommended on an annual basis. It is recommended that the

Offset Site be monitored from year 3, and at years 5, 10, 15 and 20 when flowering and fruiting of many plant species in the revegetation program is likely to commence.

BC monitoring should aim to identify:

- if BCs are abundant in the area;
- if BCs are using the revegetated areas in the Offset Site as a food source;
- which revegetated areas are being used by BCs;
- which plants are utilised as food sources by BCs; and
- if BCs are nesting and/or roosting in trees in the Offset Site.

5. Maintenance and contingency measures

5.1. Post-planting weed control

Spot-spraying or hand weeding may be used when monitoring indicates that weeds are impacting plant establishment. However, given the pasture species present, this is not considered likely to be an issue.

5.2. Remedial planting and seeding

Remedial planting and seeding will be guided by revegetation monitoring. If BC food-source species are found not to persist, the reason for poor performance should be investigated and either;

(i) the species be replanted following addressing the cause for poor performance (*e.g.* grazing by rabbits and kangaroos); or
(ii) the species be replaced with a species that has environmental tolerances more suited to the site conditions.

5.3. Inspection and maintenance of fencing

Fences will be inspected at each visit during revegetation activities and monitoring. Repairs will be implemented as soon as possible after damage is recorded. The proposed scope of works includes fence maintenance in the five years post-revegetation to cover potential tree fall damage or vandalism and at 5-year increments (years 10, 15 and 20). Access tracks or fire breaks may need maintenance to facilitate fence inspection and maintenance.

5.4. Pest control

Post-planting pest control will be implemented when monitoring indicates that damage is occurring to plants at an unacceptable level. The proposed scope of works includes pest control measures to cover potential outbreaks of biological agents of damage, such as rabbits, pigs or mites.

6. References

DPIRD (2023) Narrow leaf cotton bush: declared pest. Available at https://www.agric.wa.gov.au/declared-plants/narrow-leaf-cotton-bush-declared-pest (Accessed 4/6/2025)

DWER (2018) *A Guide to Preparing Revegetation Plans for Clearing Permits under Part V of the* Environmental Protection Act 1986. Department of Water and Environmental Regulation, Government of Western Australia, March 2018. Available at https://www.der.wa.gov.au/images/documents/our-work/consultation/Revegetation-plan/A_Guide_to_Preparing_Revegetation_Plans_for_Clearing_Permits.pdf (Accessed 21/2/2025).

RIAWA (2025) *Seed Standards – Guiding Principles Vol 2: May 2025*. Revegetation Industry Association of Western Australia. 17/3/2025. Available at https://www.riawa.com.au/assets/documents/RIAWA-Seed-Standards-V2.pdf (Accessed 4/6/2025).

Western Australian Herbarium (1998–) Florabase—the Western Australian flora. Department of Biodiversity, Conservation and Attractions. Available at https://florabase.dbca.wa.gov.au/ (Accessed 26/2/2025).

Western Botanical (2025a) *Assessment for Black-Cockatoo Habitat, Lot DP 90037, as a Potential Offset Package.* Consultant's report prepared for Doral Mineral Sands Pty Ltd. Report reference WB1053.

Western Botanical (2025b) *Vegetation and Rehabilitation, Lot DP 90037, Jelcobine, as a Potential Offset Package.* Consultant's report prepared for Doral Mineral Sands Pty Ltd. Report reference WB1054.

7. List of Participants

Staff Member	Field Surveys	Specimen Identification	Data Analysis	Report Preparation
Linda Dalgliesh B.Sc. Hons 1 (Zoology) Flora Taking (Biological Assessment) License No. – FB62000613	**1**	**1**	**1**	**1**
Geoff Cockerton B.Sc. (Biology) Flora Taking (Biological Assessment) License No. – FB62000046	**1**	**1**	**1**	**1**

Appendix 1: Core list of species and quantities suggested for rehabilitation in previously pastured land

Core species suggested for Previously Pastured Land				Quantities per Pastured Paddock – tubestock stems plus direct seed grams per hectare		Total required – tubestock stems plus grams of seed
Species	**Common Name**	**Height (m)**	**Habitat Provided**	**Pastured Paddock – Low in Landscape** **Area 30.86 ha**	**Pastured Paddock – High in Landscape** **Area 6.16 ha**	
Acacia celastrifolia	Glowing Wattle	2.5	Feeding	200 stems plus 100 g	200 stems plus 100 g	7,404 stems plus 3,702 grams
Acacia urophylla	Veined Wattle	2.5	Feeding	200 stems plus 50 g	200 stems plus 50 g	7,404 stems plus 1,851 grams
Allocasuarina humilis	Dwarf Sheoak	2	Feeding	200 stems	200 stems	7,404 stems
Banksia grandis	Bull Banksia	8	Feeding	50 stems	50 stems	1,851 stems
Banksia nobilis subsp. *nobilis*	Golden Dryandra	2.5	Feeding	-	200 stems	1,232 stems
Banksia sessilis var. *sessilis*	Parrot Bush	3	Feeding	-	400 stems	2,464 stems
Banksia squarrosa subsp. *squarrosa*	Pingle	2.5	Feeding	-	400 stems	2,464 stems
Banksia undata	Urchin Dryandra	1.5	Feeding	-	200 stems	1,232 stems
Casuarina huegeliana	Rock Sheoak	10	Feeding	-	50 stems	308 stems
Corymbia calophylla	Marri	20	Roosting, Feeding	50 stems	-	1,543 stems

Core species suggested for Previously Pastured Land				Quantities per Pastured Paddock – tubestock stems plus direct seed grams per hectare		Total required – tubestock stems plus grams of seed
Species	**Common Name**	**Height (m)**	**Habitat Provided**	**Pastured Paddock – Low in Landscape** **Area 30.86 ha**	**Pastured Paddock – High in Landscape** **Area 6.16 ha**	
Eucalyptus accedens	Powderbark Wandoo	20	Roosting	-	50 stems	308 stems
Eucalyptus patens	Blackbutt	20	Roosting, Feeding	50 stems	-	1,543 stems
Eucalyptus wandoo	Wandoo	20	Roosting	100 stems	100 stems	3,702 stems
Hakea laurina	Pincushion Hakea	2 - 6	Feeding	200 stems	200 stems	7,404 stems
Hakea lissocarpha	Honey Bush	0.4 - 3	Feeding	100 stems	100 stems	3,702 stems
Hakea multilineata	Grass Leaf Hakea	1.5 - 6	Feeding	-	200 stems	1,232 stems
Hakea petiolaris subsp. *trichophylla*	Sea Urchin Hakea	3 - 9	Feeding	200 stems	200 stems	7,404 stems
Hakea prostrata	Harsh Hakea	1 - 3	Feeding	100 stems	100 stems	3,702 stems
Hakea undulata	Wavy-leafed Hakea	1 - 2	Feeding	200 stems	200 stems	7,404 stems
Kennedia coccinea subsp. *coccinea*	Running postman	Twining or climbing	Feeding	75 g	75 g	2,777 grams
Kennedia prostrata	Scarlet Runner	Prostrate or twining	Feeding	75 g	75 g	2,777 grams

Core species suggested for Previously Pastured Land				Quantities per Pastured Paddock – tubestock stems plus direct seed grams per hectare		Total required – tubestock stems plus grams of seed
Species	**Common Name**	**Height (m)**	**Habitat Provided**	**Pastured Paddock – Low in Landscape** **Area 30.86 ha**	**Pastured Paddock – High in Landscape** **Area 6.16 ha**	
Xanthorrhoea sp. Jelcobine (GCLD 2416)	Jelcobine Grasstree	2	Feeding	(Aspirational 200 stems from DS) 25 g	(Aspirational 200 stems from DS) 25 g	(Aspirational 7,404 stems from DS) 925 grams

Appendix 2: Core list of species and quantities suggested for rehabilitation in remnant *Eucalyptus wandoo* and *E. accedens* woodland

Core species suggested for remnant *Eucalyptus wandoo* and *E. accedens* woodland				Quantities for Remnant Woodland – tubestock stems per hectare plus direct seed grams per ha		Total required – tubestock stems plus grams of seed
Species	**Common Name**	**Height (m)**	**Habitat Provided**	**Remnant Woodland – Low in Landscape** **Area 38 ha**	**Remnant Woodland – High in Landscape** **Area 27 ha**	
Acacia celastrifolia	Glowing Wattle	2.5	Feeding	200 stems plus 100g	-	7,600 stems plus 3,800 g
Allocasuarina humilis	Dwarf Sheoak	2	Feeding	200 stems	-	7,600 stems
Banksia grandis	Bull Banksia	8	Feeding	100 stems	25 stems	4,475 stems
Banksia sessilis var. *sessilis*	Parrot Bush	3	Feeding	-	100 stems	2,700 stems
Banksia undata	Urchin Dryandra	1.5	Feeding	-	50 stems	1,350 stems
Corymbia calophylla	Marri	20	Roosting, Feeding	50 stems	-	1,900 stems
Hakea laurina	Pincushion Hakea	2 - 6	Feeding	200 stems	50 stems	8,140 stems
Hakea lissocarpha	Honey Bush	0.4 - 3	Feeding	100 stems	100 stems	6,500 stems
Hakea multilineata	Grass Leaf Hakea	1.5 - 6	Feeding	200 stems	50 stems	8,950 stems
Hakea petiolaris subsp. *trichophylla*	Sea Urchin Hakea	3 - 9	Feeding	200 stems	50 stems	8,950 stems
Hakea prostrata	Harsh Hakea	1 - 3	Feeding	100 stems	50 stems	5,150 stems

Core species suggested for remnant *Eucalyptus wandoo* and *E. accedens* woodland				Quantities for Remnant Woodland – tubestock stems per hectare plus direct seed grams per ha		Total required – tubestock stems plus grams of seed
Species	**Common Name**	**Height (m)**	**Habitat Provided**	**Remnant Woodland – Low in Landscape** **Area 38 ha**	**Remnant Woodland – High in Landscape** **Area 27 ha**	
Hakea undulata	Wavy-leafed Hakea	1 - 2	Feeding	200 stems	50 stems	8,950 stems
Kennedia coccinea subsp. *coccinea*	Running postman	Twining or climbing	Feeding	75 g	75 g	4,875 g
Kennedia prostrata	Scarlet Runner	Twining or climbing	Feeding	75 g	75 g	4,875 g
Xanthorrhoea sp. Jelcobine (GCLD 2416)	Jelcobine Grasstree	2	Feeding	(Aspirational 200 stems from DS) 25 g	(Aspirational 200 stems from DS) 25 g	(Aspirational 13,000 stems from DS) 1,625 g

Appendix 3: Species recommendations with quantities for Tubestock planting

Species Recommendations for Tubestock				Tubestock Recommended (stems per ha)					
Species	**Common Name**	**Height (m)**	**Habitat Provided**	**Pastured Paddock - Low in Landscape; Area 30.86 ha**	**Pastured Paddock - High in Landscape; Area 6.16 ha**	**Remnant Woodland, Low in Landscape; Area 38 ha**	**Remnant Woodland, High in Landscape; Area 27 ha**	**Drainage Line; Area 30 ha**	
				30.86	**6.16**	**38**	**27**	**30**	**Total Qty Tubestock Required**
Acacia celastrifolia	Glowing Wattle	2.5	Feeding	200	200	200	-	-	15,004
Acacia urophylla		2.5	Feeding	200	200	-	-	-	7,404
Allocasuarina humilis	Dwarf Sheoak	2	Feeding	200	200	200	-	-	15,004
Banksia grandis	Bull Banksia	8	Feeding	50	50	100	25		6,326
Banksia nobilis subsp. *nobilis*	Golden Dryandra	2.5	Feeding	-	200	-	-	-	1,232
Banksia sessilis var. *sessilis*	Parrot Bush	3	Feeding	-	400	-	100	-	5,164
Banksia squarrosa subsp. *squarrosa*	Pingle	2.5	Feeding	-	400	-	-	-	2,464
Banksia undata	Urchin Dryandra	1.5	Feeding	-	200	-	50	-	2,582

Species Recommendations for Tubestock				Tubestock Recommended (stems per ha)					
Species	**Common Name**	**Height (m)**	**Habitat Provided**	**Pastured Paddock - Low in Landscape; Area 30.86 ha**	**Pastured Paddock - High in Landscape; Area 6.16 ha**	**Remnant Woodland, Low in Landscape; Area 38 ha**	**Remnant Woodland, High in Landscape; Area 27 ha**	**Drainage Line; Area 30 ha**	
				30.86	**6.16**	**38**	**27**	**30**	**Total Qty Tubestock Required**
Casuarina huegeliana	Rock Sheoak	10	Feeding	-	50	-	-	-	308
Corymbia calophylla	Marri	20	Roosting, Feeding	50	-	50	-	-	3,443
Eucalyptus accedens	Powderbark Wandoo	20	Roosting	-	50	-	-	-	308
Eucalyptus patens	Blackbutt	20	Roosting, Feeding	50	-	-	-	-	1,543
Eucalyptus wandoo	Wandoo	20	Roosting	100	100	-	-	-	3,702
Hakea laurina	Pincushion Hakea	2 - 6	Feeding	200	200	200	50	-	16,354
Hakea lissocarpha	Honey Bush	0.4 - 3	Feeding	100	100	100	100	-	10,202
Hakea multilineata	Grass Leaf Hakea	1.5 - 6	Feeding	-	200	200	50	-	10,182

Species Recommendations for Tubestock				Tubestock Recommended (stems per ha)					
Species	**Common Name**	**Height (m)**	**Habitat Provided**	**Pastured Paddock - Low in Landscape; Area 30.86 ha**	**Pastured Paddock - High in Landscape; Area 6.16 ha**	**Remnant Woodland, Low in Landscape; Area 38 ha**	**Remnant Woodland, High in Landscape; Area 27 ha**	**Drainage Line; Area 30 ha**	
				30.86	**6.16**	**38**	**27**	**30**	**Total Qty Tubestock Required**
Hakea petiolaris subsp. *trichophylla*	Sea Urchin Hakea	3 - 9	Feeding	200	200	200	50	-	16,354
Hakea preissii	Needle Tree	2 - 6	Feeding	-	-	-	-	250	7,500
Hakea prostrata	Harsh Hakea	1 - 3	Feeding	100	100	100	50	-	8,852
Hakea undulata	Wavy-leafed Hakea	1 - 2	Feeding	200	200	200	50	-	16,354
Xanthorrhoea sp. Jelcobine (GCLD 2416)	Jelcobine Grasstree	2	Feeding	200	200	200	200		20,404
Totals per Area				**1,850**	**3,250**	**1,750**	**725**	**250**	**170,686**

Appendix 4: Species recommendations with quantities for Direct Seeding

Species Recommendations for Direct Seeding					Direct Seeding Quantity Seed Per Rehabilitation Unit (grams)					
Species	**Common Name**	**Height (m)**	**Habitat Provided**	**Qty per ha (g)**	**Pastured Paddock, Low in Landscape; Area 30.86 ha**	**Pastured Paddock, High in Landscape; Area 6.16 ha**	**Remnant Woodland, Low in Landscape; Area 38 ha**	**Remnant Woodland, High in Landscape; Area 27 ha**	**Drainage Line; Area Area 30 ha**	**Total Qty Required (g)**
Acacia celastrifolia	Glowing Wattle	2.5	Feeding	100	3,086	616	3,800	-	-	**7,502**
Acacia urophylla		2.5	Feeding	50	1,543	308	-	-	-	**1,851**
Kennedia coccinea subsp. *coccinea*	Running Postman	Twining or climbing	Feeding	75	2,315	462	2,850	2,025	-	**7,652**
Kennedia prostrata	Scarlet Runner	Twining or climbing	Feeding	75	2,315	462	2,850	2,025	-	**7,652**
Xanthorrhoea sp. Jelcobine (GCLD 2416)	Jelcobine Grasstree	2	Feeding	25	772	154	950	675	-	**2,551**
TOTAL SEED REQUIRED (g)					**4,095**	**2,002**	**10,450**	**4,725**	**-**	**27,207**

Appendix 5: A schedule of works for revegetation and monitoring

Activity	Timing	Responsibility	Notes	Resources required	Budget
Native seed collection					
Field collection of native seed	2025	Revegetation consultant		Collection equipment	
Processing and storage of seed	2025	Revegetation consultant		Processing equipment	
Cutting material collection	2025	Revegetation consultant		Collection equipment	
Cutting material preparation for nursery propagation	2025	Revegetation consultant		Nursery system or external subcontractor	
Seed preparation for nursery propagation	2025	Revegetation consultant		Nursery system or external subcontractor	
Site preparation					
Construction/maintenance of access tracks and firebreaks	Winter 2025	Grader operator	To facilitate access to various areas for machinery	Grader or similar	
Installation of fencing and gates	Winter 2025	Fencing contractor	To limit unauthorised vehicle access from Youraling State Forest Exclusion of grazing animals (kangaroos, rabbits).	Fencing materials Gates	
Installation of signage	Winter 2025	KLPL	To notify the public of private property boundary	Signage	
Weed control - Autumn	2026	Revegetation consultant		Herbicides, spray equipment	
Weed control - Spring	2026	Revegetation consultant		Herbicides, spray equipment	

Activity	Timing	Responsibility	Notes	Resources required	Budget
Weed control - Autumn	2027	Revegetation consultant		Herbicides, spray equipment	
Site ripping	2026	Revegetation consultant		Machinery	
Rabbit control	2025	Pest management contractor		Baits/traps	
Rabbit control	2026	Pest management contractor		Baits/traps	
Pig control	2026	Pest management contractor			
Pig control	2027	Pest management contractor			
Vegetation Establishment					
Tubestock planting	May-June 2026	Revegetation consultant	Optimal time in the South West is May-June (DWER 2018)	Tubestock	
Direct seeding	April-June 2026	Revegetation consultant	Optimal time in the South West is April-June (DWER 2018)	Seed	
Maintenance and contingency					
Weed control	Summer 2025	Revegetation consultant		Herbicides, spray equipment	
Weed control	Autumn 2026	Revegetation consultant		Herbicides, spray equipment	
Weed control	Summer 2026	Revegetation consultant		Herbicides, spray equipment	
Weed control	Autumn 2027	Revegetation consultant		Herbicides, spray equipment	
Remedial revegetation	Autumn 2028	Revegetation consultant	Seed/tubestock to be sourced 1 year prior	Seed and/or tubestock	
Remedial revegetation	Autumn 2030	Revegetation consultant	Seed/tubestock to be sourced 1 year prior	Seed and/or tubestock	
Fencing inspection and repair	Winter 2026	Fencing contractor		Fencing materials	
Fencing inspection and repair	Winter 2028	Fencing contractor		Fencing materials	
Revegetation monitoring					
Quadrat set up	Spring 2026	Revegetation consultant		Quadrat markers	
Quadrat monitoring	Spring 2026	Revegetation consultant		Monitoring equipment	
Quadrat monitoring	Spring 2027	Revegetation consultant	To inform need for	Monitoring equipment	

Activity	Timing	Responsibility	Notes	Resources required	Budget
			remedial revegetation		
Quadrat monitoring	Spring 2028	Revegetation consultant		Monitoring equipment	
Quadrat monitoring	Spring 2029	Revegetation consultant	To inform need for remedial revegetation	Monitoring equipment	
Quadrat monitoring	Spring 2030	Revegetation consultant		Monitoring equipment	
Quadrat monitoring	Spring 2031	Revegetation consultant		Monitoring equipment	
Fauna monitoring					
Black-Cockatoo surveys	Spring Year 3 (2029)	Fauna consultant	3 years after revegetation commenced		
Black-Cockatoo surveys	Spring Year 4 (2030)	Fauna consultant			
Black-Cockatoo surveys	Spring Year 5 (2031)	Fauna consultant			
Black-Cockatoo surveys	Spring Year 6 (2032)	Fauna consultant			
Black-Cockatoo surveys	Spring Year 7 (2033)	Fauna consultant			
Dieback survey					
Dieback monitoring	2031	Dieback Practitioner		Phosphite treatments	

Appendix 6. Representative photos



Plate 1: Pastured Paddock, High in Landscape. Looking downhill and east across drainage line toward Boyagarring Nature Reserve. (Photo: Western Botanical)



Plate 2: Pastured Paddock, High in Landscape. Looking north-north-east and downhill to drainage line. (Photo: Western Botanical)



Plate 3: Pastured Paddock, Low in Landscape. Looking north-west from drainage line. (Photo: C. Bovell)



Plate 4: Pastured Paddock, Low in Landscape. Looking west upslope from drainage line. (Photo: C. Bovell)



Plate 5: Remnant Woodland, High in Landscape. Evidence of historic logging. (Photo: Western Botanical)



Plate 6: Remnant Woodland, High in Landscape; sparse *Eucalyptus wandoo* and *E. accedens* with occasional *E. marginata* subsp. *thalassica* over minimal understorey on lateritic gravels and outcropping (Photo: Western Botanical)



Plate 7: Remnant Woodland, Low in Landscape (Photo: Western Botanical)



Plate 8: Remnant Woodland, Low in Landscape, on west side and near drainage line (Photo: Western Botanical)



Plate 9: Drainage Line, western side, looking south (Photo: Western Botanical)



Plate 10: Drainage Line, south side looking north-east, with non-native tree plantings. (Photo: C. Bovell)

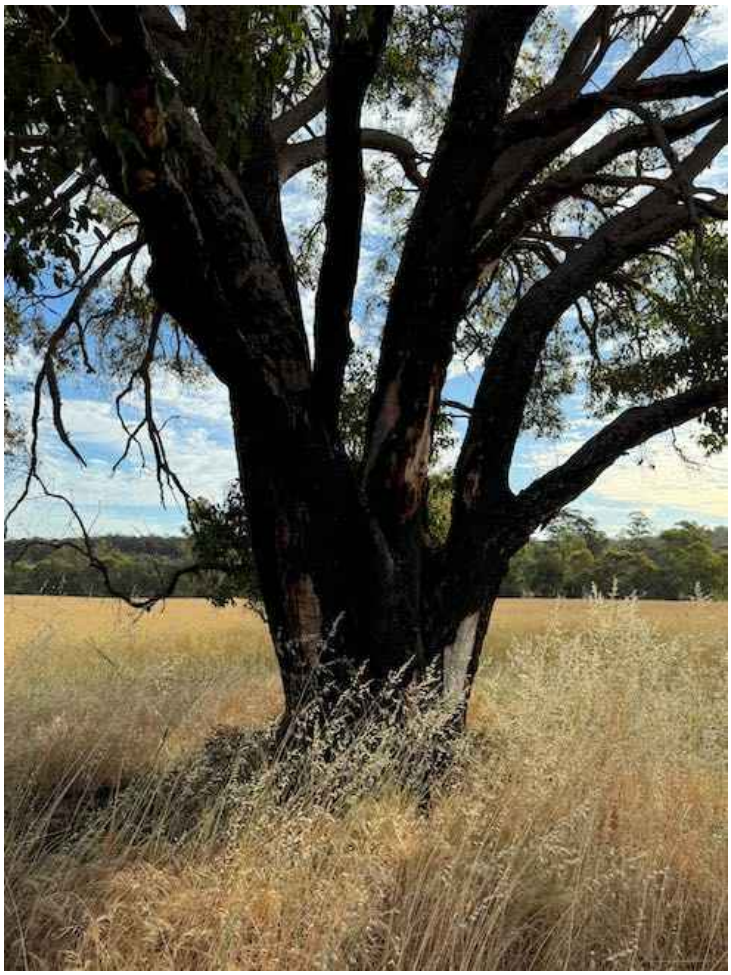


Plate 11: Burnt marri (*Corymbia calophylla*) in canola paddock

Appendix 7. Results from BC Habitat survey May 2025

Thursday 29 May 2025

Craig Bovell

Doral Leucoxene Pty Ltd

Via email to: Craig.Bovell@Doral.com.au

Re: Jelcobine Offset Technical Memo WB1067

Good afternoon Craig,

Geoff and I have completed the Black-Cockatoo (BC) nest hollow assessment at Jelcobine, Lot DP 90037 (the AOI). We have summarised our findings below.

1. During our May 2025 survey of potential nest hollows in habitat trees, we took georeferenced photos, which we can share with you if required. These are large images, typically 8 to 11 MB each. Three examples are presented below (Figures 1, 2 and 3).
2. During the May 2025 survey, we recorded a total of **90 visible hollows** that may be suitable for BC nesting in 47 trees, all with a Bamford Consulting Ecologists (BCE) rank of 3, across the AOI (presented in Figure 4). Hollows with a BCE rank of 4 or 5 were not recorded because they were considered less suitable for nesting. No hollows with a BCE rank of 2 or 1 were observed because the survey was conducted outside the breeding season and there were no chew marks and no nesting activity.
3. Our May 2025 survey track logs are presented in Figure 5.
4. Our records of tree locations, species, number of hollows and BCE rank for the May 2025 survey are presented in Table 1.

We hope this information is sufficient for your requirements. If you have any queries, please don't hesitate to contact me.

Kind regards

Linda Dalgliesh



Figure 1: *Eucalyptus wandoo* stag at WP27 with 1 suitable hollow and a DBH of 102 cm (Photo 1856).

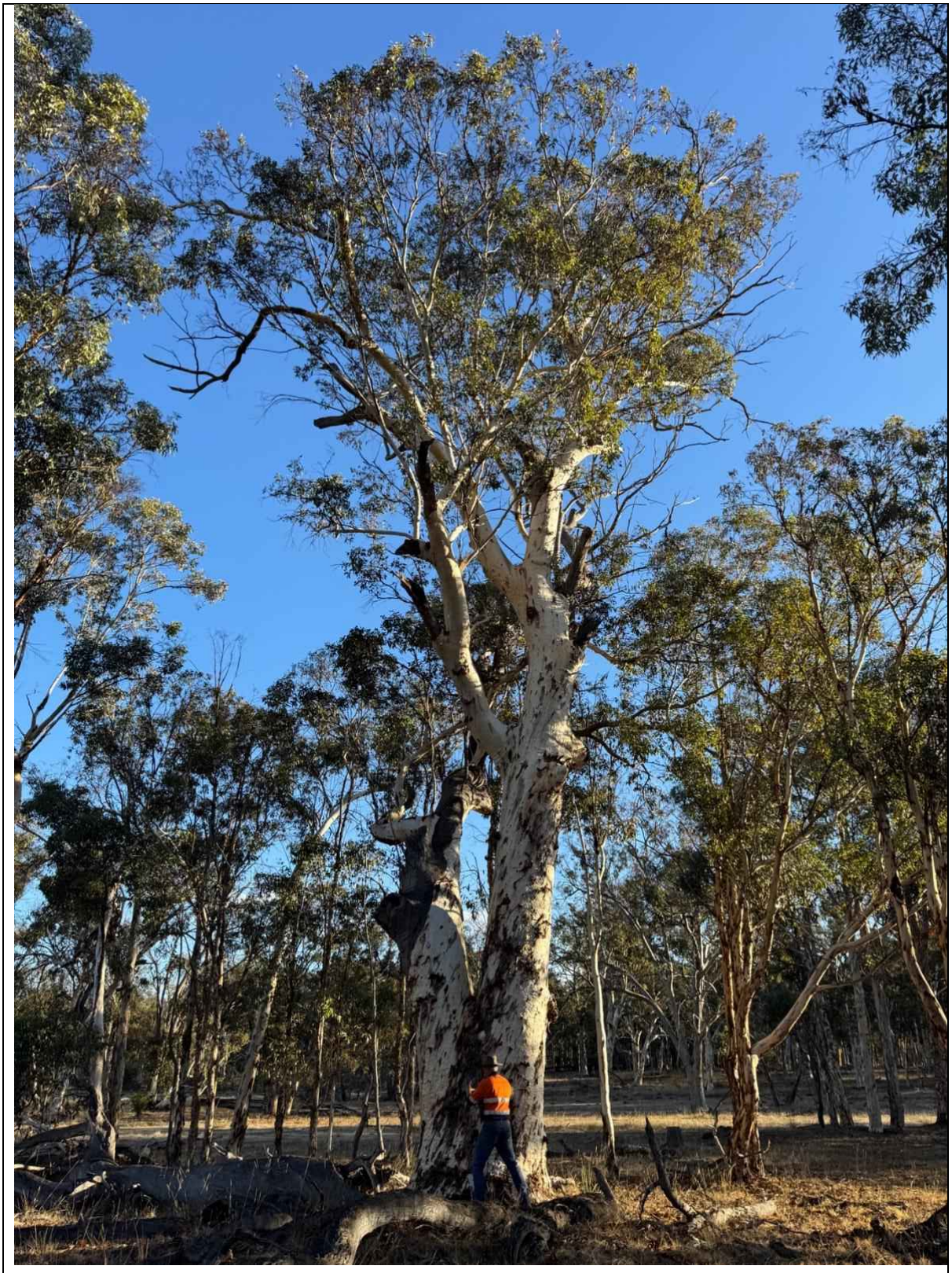


Figure 2: *Eucalyptus wandoo* at WP27 with 6 suitable hollows and a DBH of 155 cm (Photo 1870).



Figure 3: *Eucalyptus wandoo* at WP 47 with 3 suitable hollows and a DBH of 152 cm (Photo 1904).

Figure 4: Habitat tree locations mapped on vegetation types in May 2025

Imagery: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

458500 459000 459500

6415500 6415000 6414500 6414000

Vegetation Legend

- 1 - Remnant E. wandoo woodland, occasional E. marginata (mostly dead) and E. accedens on ferricrete outcrops, with little extant understory, few weeds.
- 2 - Mid to lower slopes, laterite gravel, Revegetate on contour with local Euc wandoo, Hakea, Dryandra, Banksia, Acacia spp.
- 3 - Winter wet low lying area, Revegetate with Melaleuca, Casuarina obesa, Euc rudis
- 4 - Planted Eucalyptus and Casuarina trees, grass and herbs understory
- 5 - Drainage line with narrow incised channel, Eucalyptus wandoo, E. rudis to 25m over grasses and herbs
- 6 - Farm dams and drainage, seepage, likely permanent water
- 7 - Crop (Canola in 2024)
- 8 - Fallow
- 9 - Farm dam, Typha dominated, permanent water

Boyagarring Conservation Park

Youraling State Forest

WP 15 WP 14 WP 17 WP 16 WP 12 WP 13 WP 18 WP 11 WP 10 WP 9 WP 1 WP 8 WP 7 WP 4 WP 3 WP 2 WP 6 WP 5 WP 20 WP 21 WP 19 WP 48 WP 26 WP 22 WP 23 WP 24 WP 25 WP 27 WP 28 WP 29 WP 30 WP 31 WP 32 WP 33 WP 39 WP 38 WP 40 WP 35 WP 34 WP 41 WP 42 WP 37 WP 43 WP 36 WP 44 WP 47 WP 45 WP 46

1 2 3 4 5 6 7 8 9

Legend

- Habitat tree
- Survey Area
- Legislated Lands
- Track

0 50 100m

Scale: 1:6,000
MGA94 (Zone 50)

CAD Ref: a3087_F007_01

Date: May 2025 | Rev: A | A3

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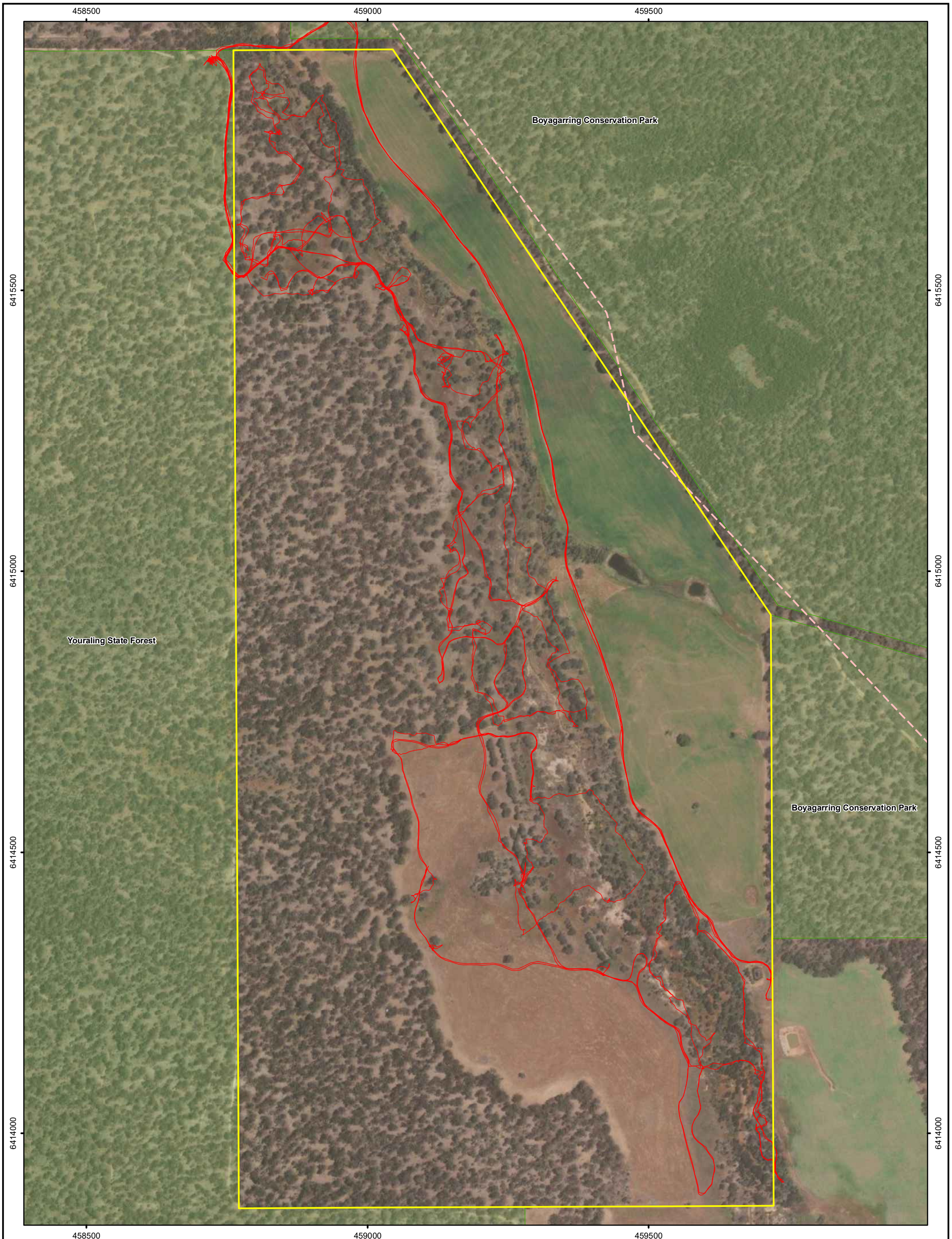
Author: L. Dalgliesh

Drawn: CAD Resources ~ www.cadresources.com.au
Tel: (08) 9246 3242 ~ Fax (08) 9246 3202

Doral Mineral Sands Pty Ltd
Jelcobine Project
Vegetation Types and Habitat Trees

Figure 5: May 2025 Survey Track logs

Imagery: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community



Legend

- Survey Area
- Legislated Lands
- Survey Track Log
- Track

0 50 100m

Scale: 1:6,000
MGA94 (Zone 50)

CAD Ref: a3087_F008

Date: May 2025 | Rev: A | A3

Western Botanical

Author: L. Dalgliesh

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Doral Mineral Sands Pty Ltd

Jelcobine Project

Survey Track Logs

Table 1: Trees recorded with potential nest hollows suitable for Black-Cockatoos

WP	Tree species	Live or dead	DBH (cm)	BCE rank	Number of visible hollows	Image Number	Latitude (GDA)	Longitude (GDA)	Veg Unit*	Notes
1	*Eucalyptus wandoo*	L	118	3	3	1840	-32.3956	116.5632	5	
2	*Eucalyptus wandoo*	L	93	3	2	1843	-32.3962	116.5628	5	
3	*Eucalyptus wandoo*	L	92	3	2	1844	-32.3961	116.5626	5	
4	*Eucalyptus wandoo*	L	93	3	2	1845	-32.3960	116.5623	1	
5	*Eucalyptus wandoo*	L	109	3	3	1847	-32.3964	116.5622	1	
6	*Eucalyptus wandoo*	L	85	3	1	1848	-32.3963	116.5617	1	
7	*Eucalyptus wandoo*	L	101	3	2	1849	-32.3960	116.5616	1	
8	*Eucalyptus wandoo*	L	91.5	3	1	1850	-32.3957	116.5615	1	
9	*Eucalyptus wandoo*	L	101.5	3	3	1851	-32.3952	116.5622	5	
10	*Eucalyptus wandoo*	L	104	3	1	1852	-32.3951	116.5624	5	
11	*Eucalyptus wandoo*	D	69.5	3	1	1853	-32.3948	116.5628	5	Stag, vertical trunk
12	*Eucalyptus wandoo*	D	91	3	2	1854	-32.3942	116.5622	5	Stag, vertical trunk with branches
13	*Eucalyptus wandoo*	D	105	3	1	1855	-32.3942	116.5624	5	Stag, vertical trunk, ringbarked
14	*Eucalyptus wandoo*	D	102	3	1	1856	-32.3936	116.5619	5	Stag
15	*Eucalyptus wandoo*	D	76	3	1	1857	-32.3932	116.5619	5	Stag
16	*Eucalyptus rudis*	D	79	3	2	1858	-32.3940	116.5628	5	Stag, lignotuber over 2m diameter

WP	Tree species	Live or dead	DBH (cm)	BCE rank	Number of visible hollows	Image Number	Latitude (GDA)	Longitude (GDA)	Veg Unit*	Notes
17	*Eucalyptus wandoo*	D	99.5	3	1	1859	-32.3936	116.5632	5	Stag
18	*Eucalyptus wandoo*	D	85	3	1	1860	-32.3945	116.5635	5	Stag
19	*Eucalyptus wandoo*	L	117.5	3	1	1862	-32.3969	116.5630	1	
20	*Eucalyptus wandoo*	L	107.5	3	2	1863	-32.3966	116.5638	5	
21	*Eucalyptus rudis*	L	78.5	3	1	1864	-32.3968	116.5642	5	
22	*Eucalyptus wandoo*	L	121	3	2	1865	-32.3979	116.5655	5	
23	*Eucalyptus wandoo*	L	108	3	3	1866	-32.3980	116.5654	5	
24	*Eucalyptus wandoo*	L	92	3	1	1867	-32.3982	116.5656	5	
25	*Eucalyptus wandoo*	L	103	3	1	1868	-32.3983	116.5656	5	Alive at base only
26	*Eucalyptus wandoo*	D	73.5	3	1	1869	-32.3978	116.5667	5	Stag, branched
27	*Eucalyptus wandoo*	L	155	3	6	1870	-32.3989	116.5660	5	Massive tree
28	*Eucalyptus wandoo*	L	98.5	3	1	1871	-32.4009	116.5655	1	(also 2 less suitable hollows)
29	*Eucalyptus wandoo*	L	89.5	3	1	1872	-32.4009	116.5657	5	
30	*Eucalyptus wandoo*	L	86	3	2	1873	-32.4014	116.5654	1	
31	*Eucalyptus wandoo*	L	105	3	1	1875	-32.4018	116.5655	1	
32	*Eucalyptus wandoo*	L	128	3	4	1876	-32.4021	116.5662	5	
33	*Eucalyptus wandoo*	D	114	3	1	1877	-32.4038	116.5666	5	Stag, ringbarked

WP	Tree species	Live or dead	DBH (cm)	BCE rank	Number of visible hollows	Image Number	Latitude (GDA)	Longitude (GDA)	Veg Unit*	Notes
34	*Eucalyptus wandoo*	L	124	3	5	1883	-32.4056	116.5673	4	
35	*Eucalyptus wandoo*	L	121	3	4	1884	-32.4056	116.5669	4	
36	*Eucalyptus wandoo*	D	96.5	3	4	1885	-32.4072	116.5669	2	Stag
37	*Eucalyptus wandoo*	D	103.5	3	2	1886	-32.4067	116.5685	5	Stag
38	*Eucalyptus wandoo*	L	105.5	3	2	1887	-32.4039	116.5654	2	
39	*Eucalyptus wandoo*	L	121.5	3	1	1888	-32.4039	116.5649	2	
40	*Eucalyptus wandoo*	D	110	3	1	1889	-32.4043	116.5644	1	Stag, recently dead
41	*Eucalyptus wandoo*	L	117	3	3	1891	-32.4062	116.5653	2	
42	*Eucalyptus wandoo*	L	108.5	3	2	1892	-32.4066	116.5648	2	
43	*Eucalyptus wandoo*	L	85.5	3	1	1893	-32.4073	116.5653	3	
44	*Eucalyptus wandoo*	L	128	3	1	1894	-32.4076	116.5685	4	
45	*Eucalyptus wandoo*	L	97	3	2	1895	-32.4093	116.5714	5	Dead central trunk, alive at base
46	*Eucalyptus wandoo*	D	89.5	4	0	1897	-32.4101	116.5714	5	Stag, no suitable hollows
47	*Eucalyptus wandoo*	L	152	3	3	1904	-32.4090	116.5714	5	Large tree
48	*Eucalyptus wandoo*	L	78.5	3	1	1915	-32.3974	116.5646	5	Top snapped off
	Total hollows				90					



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