Flora and vegetation, and Black Cockatoo habitat assessment for residential fire management clearance.

Prepared for Euan and Katie de Kock

February 2024

Final Report

Date	Revision Notes
12 February 2024	Initial Version incl TEC and Cockatoo
23 February 2024	Added Leafless Rock Wattle
	Final Version

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EXECUTIVE SUMMARY

Euan and Katie de Kock own a property located at Lot 26, Harvey Road, Mokine. This property is 7.37 ha in size. The property is located in the Shire of Northam, and is zoned as "Rural Smallholding", but has no residential buildings established yet. They are proposing to build a house and ancillary buildings on the property.

The property has had an initial Bushfire Attack Level (BAL) assessment carried out and it has been determined that the proposed residential site has a BAL level of *Fire-Zone* (BAL-FZ).

To reduce the fire hazard to a safe level (BAL-29), a bushfire mitigation plan has been proposed that requires an area of land surrounding the residence to be cleared of all trees and significant under-story vegetation. In addition, some further clearance will be required adjacent to the bushfire mitigation area to allow for the siting of water tanks and a shed.

During the initial Design Approval application process, the Northam council has advised the owners that this property is situated in an area that may contain vegetation that forms part of the "*Eucalypt Woodlands of the Western Australian Wheatbelt*" Threatened Ecological Community (TEC).

Further desktop analysis has indicated that it is possible that Carnaby's Cockatoo, Baudin's Cockatoo or Forest Red-tailed Black Cockatoo may use the site for habitation and/or foraging.

As part of the pre-referral consultation with the Department of Climate Change, Energy, the Environment and Water (DCCEEW), it was identified that the *Leafless Rock Wattle* (*Acacia Aphylla*) habitat may occur within area.

The study area has been limited to the combined area where clearing is required as the area is already significantly cleared and the impact from the additional clearance is likely to have a small impact. The study area covers an area of 4147m^2 (0.4 ha).

A desktop review was undertaken prior to the detailed survey to determine the likelihood of the area being considered part of the "*Eucalypt Woodlands of the Western Australian Wheatbelt*" Threatened Ecological Community (TEC), and to assess the proximity to confirmed and unconfirmed breeding and roosting sites for Carnaby's Cockatoo, Baudin's Cockatoo and Forest Red-tailed Black Cockatoo. A desktop survey was also conducted to identify the likely range of the *Leafless Rock Wattle*.

The detailed flora and vegetation survey included sampling within the whole study area, targeted searches for significant species and vegetation, as well as traversing the study area to record additional flora taxa present at the time of the survey and condition of the vegetation. Assessment and mapping of the extent of the "*Eucalypt Woodlands of the Western Australian Wheatbelt*" Threatened Ecological Community (TEC) was undertaken using the conservation advice for the TEC. The survey for

Carnaby's Cockatoo, Baudin's Cockatoo and Forest Red-tailed Black Cockatoo habitat included assessment and mapping of potential breeding trees, breeding habitat and foraging habitat, as well as opportunistic records of foraging and feeding residues.

Due to the small total area, an extensive search was conducted across the entire study area to identify any *Leafless Rock Wattle* specimens.

Out of a total of 39 trees in the study area, 11 are classified as mature, having a DBH greater than 30cm, with two exceeded 50cm. These were all assessed for potential breeding hollows. Three hollows were identified, at a height of 1m, 1m and 3m. None of the hollows showed any signs of occupation or use. None of the tree locations in the study area showed any signs of foraging or feeding residue.

An assessment of likely feeding vegetation was also conducted across the study area with no significant good-quality Black Cockatoo food sources being identified.

Anecdotal discussions with the property owners and neighbours indicated that no Black Cockatoos have been sighted within the study area within the last 4 years, and very few have been seen in the general area. This is borne out by the data provided through the Department of Biodiversity, Conservation and Attraction's (DBCA) *Threatened and Priority Fauna Database* targeted search which has one recorded sighting in 2023 for a Baudin's Cockatoo taken into care, 6 sightings in 2020 and only 5 in 2018.

It is unlikely that the study area would be considered as forming part of the "*Eucalypt Woodlands of the Western Australian Wheatbelt*" Threatened Ecological Community, however as an actual determination of whether the study area is within the "*Eucalypt Woodlands of the Western Australian Wheatbelt*" Threatened Ecological Community is hard to make with the limited data sources available, it is recommended that the clearing action be referred for a determination.

There is a small possibility that the clearing actions may cause an impact on Black Cockatoos. While this is likely not significant, it does require that the action be referred under the precautionary principle.

INTRODUCTION

Background

Euan and Katie de Kock own a property located at Lot 26, Harvey Road, Mokine. This property is 7.37 ha in size. The property is located in the Shire of Northam, and is zoned as “Rural Smallholding”, but has no residential buildings established yet. They are proposing to build a house and ancillary buildings on the property. The title deeds do not indicate a defined building envelope. The chosen site has been selected as it provides a good compromise between a good outlook, suitable elevations for a septic system and rain water collection, and is placed within the most degraded vegetation location to minimise any impact on the existing flora and fauna.

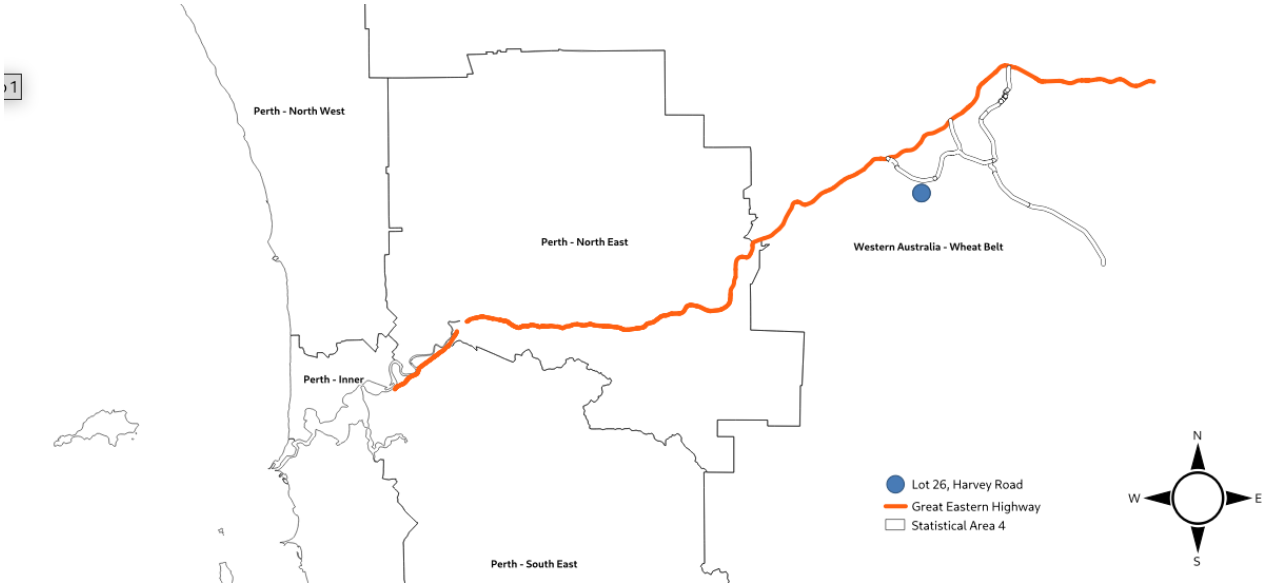

Figure 1: Location of the study area

Note: Unless specifically identified on the map, all maps are shown with North facing upwards.

Figure 2: Site boundaries and study area

Figure 3: Detailed view of the study area

The property has had an initial Bushfire Attack Level (BAL) assessment carried out and it has been determined that the proposed residential site has a BAL level of *Fire-Zone* (BAL-FZ).

To reduce the fire hazard to a safe level (BAL-29), a bushfire mitigation plan has been proposed that requires an area of land surrounding the residence to be cleared of all trees and significant under-story vegetation. In addition, some further clearance will be required adjacent to the bushfire mitigation area to allow for the siting of water tanks and a shed.

Scope of work

Vegetation survey and TEC assessment

To assess the area to be cleared to see if it was contained within a patch of remnant vegetation that forms part of the "*Eucalypt Woodlands of the Western Australian Wheatbelt*" Threatened Ecological Community (TEC). Conduct a self-assessment and determine if the area that is proposed to be cleared should be referred for assessment under the EPBC act.

Black Cockatoo survey and referral assessment

Conduct a high-level assessment of the vegetation within the study area to assess their foraging habitat quality, and/or the presence of feeding debris from Carnaby's Cockatoo, Baudin's Cockatoo or Forest Red-tailed Black Cockatoo.

Conduct a detailed on-site survey of all trees in the study area for the presence of likely and actual hollows that could be suitable for nesting. Assess any existing hollows to determine if nesting had occurred previously.

Apply the methodologies referenced in the "*Referral guideline for 3 WA threatened black cockatoo species*" document and complete the assessment guideline steps as outlined, including the foraging quality scoring tool if required.

2 METHODS

Desktop review

Flora and vegetation

Prior to conducting a field survey, all available datasets were consulted to determine the presence of any significant flora and vegetation within the study area.

As part of the desktop review, searches of relevant technical databases were undertaken to identify records and habitat of significant flora and vegetation. Searches and reviews of relevant biological databases were undertaken of the survey area and include:

- Department of Climate Change, Energy, the Environment and Water (DCCEEW) Protected Matters Search Tool.
- Data WA GIS data sources.
    - Threatened Ecological Communities (DBCA-038) (Scale limited)
    - Native Vegetation Extent (DPIRD-005)
    - Cadastre Address (LGATE-002) - Large Scale
- National Vegetation Information System (NVIS) Version 6.0
- Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) Approved Conservation Advice (including listing advice) for the Eucalypt Woodlands of the Western Australian Wheatbelt
- Species Profile and Threats Database (SPRAT)

Black Cockatoos

Prior to conducting a field survey, all available datasets were consulted to determine the location and proximity of all confirmed and likely breeding and roosting sites. Additionally research was done on feeding habits and the distribution of food sources within a 20km radius of the study area.

As part of the desktop review, searches of relevant technical databases were undertaken to identify records and habitat of significant flora and vegetation. Searches and reviews of relevant biological databases were undertaken of the survey area and include:

- Department of Climate Change, Energy, the Environment and Water (DCCEEW) Protected Matters Search Tool.

- Department of Biodiversity, Conservation and Attraction's (DBCA) Threatened and Priority Fauna Database targeted search. (Ref: FAUNA#8130)
- Department of Climate Change, Energy, the Environment and Water (DCCEEW) Referral guideline for 3 WA threatened black cockatoo species
- Survey guidelines for Australia's threatened birds (DCCEEW)
- Data WA GIS data sources.
    - Black Cockatoo Breeding Sites - Buffered (DBCA-063)
    - Black Cockatoo Roosting Sites - Buffered (DBCA-064)
    - Carnabys Cockatoo Confirmed Roost Sites (DBCA-050)
    - Carnabys Cockatoo Unconfirmed Roost Sites (DBCA-051)
    - Carnabys Cockatoo Confirmed Breeding Areas within the Swan Coastal Plain and Jarrah Forest IBRA Regions (DBCA-054)
- Species Profile and Threats Database (SPRAT)

Detailed Studies

Flora and vegetation survey

The detailed flora and vegetation survey was conducted over several two-day periods between October 2023 and February 2024. As the study area is fairly small and the tree cover is limited, it was decided to conduct a full site survey rather than using a quadrant based sampling methodology.

All location data was recorded using the GDA2020 (MGA Zone 50) (EPSG:7850) coordinate reference system. All data points were recorded using an RTK corrected handheld GPS device.

The location, species, DBH (diameter at breast height) and approximate crown area were recorded for all the trees within the study area. For each significant groupings of trees photographs were also recorded.

Black Cockatoo survey

A survey for Carnaby's Cockatoo, Baudin's Cockatoo and Forest Red-tailed Black Cockatoo breeding, roosting and foraging habitats was carried out concurrently with the detailed flora and vegetation survey over several 2 day periods between October 2023 and February 2024.

The methodology was based on the guidelines in the DCCEEW Referral guideline for 3 WA threatened black cockatoo species document and the DEHWA Survey Guidelines for Australia's Threatened Birds. EPBC Act survey guidelines 6.2 document.

All the trees in the study area with a DBH in excess of 30cm were assessed for potential breeding hollows. The trees were examined from ground level, and any potential hollow bearing trees were also observed and photographed from above using a drone.

Each tree was assessed as a potential food source, and the area around the tree was examined for any feeding debris.

3 RESULTS

Desktop review

Flora and vegetation

The study area straddles the western boundary of the "*Eucalypt Woodlands of the Western Australian Wheatbelt*" Threatened Ecological Community as this aligns with the boundary between the *Avon Wheatbelt* and *Northern Jarrah Forest* IBRA regions.

The "*Threatened Ecological Communities (DBCA-038)*" data source has a public visibility limited to 1:200, 000, and can only be used as a rough guide. But it does show the study area as potentially forming part of the "*Eucalypt Woodlands of the Western Australian Wheatbelt*" Threatened Ecological Community.

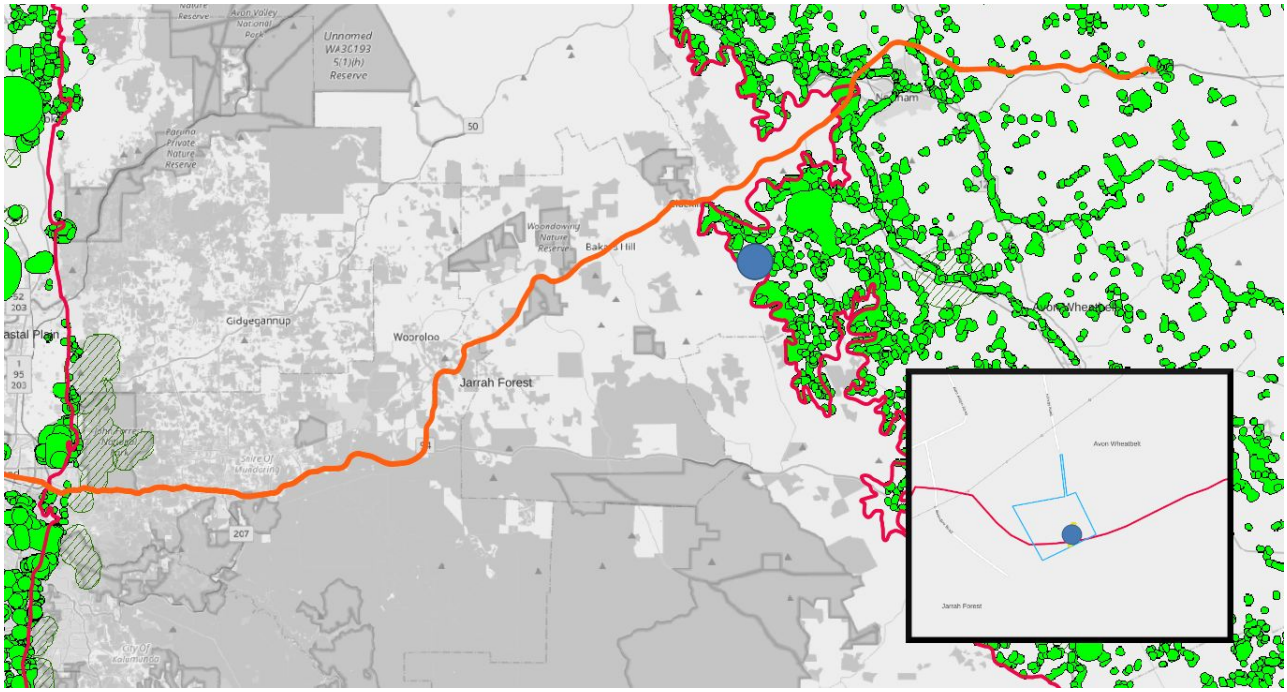

Figure 4: Threatened Ecological Communities (DBCA-038) Overview

The IBRA regional boundaries do not form an absolute boundary for the "*Eucalypt Woodlands of the Western Australian Wheatbelt*" Threatened Ecological Community, as the *Northern Jarrah Forest* IBRA region may also contain remnant vegetation that meets the criteria. We have treated the entire study area as potentially being considered.

Both the NVIS extant native vegetation mapping and the "*Native Vegetation Extent (DPIRD-005)*" mapping exclude the majority of the study area from the native vegetation coverage. Under the NVIS mapping, the majority of the study area falls under the MVG 25/MVS 98 - "*Cleared, non-native vegetation, buildings*" classification.

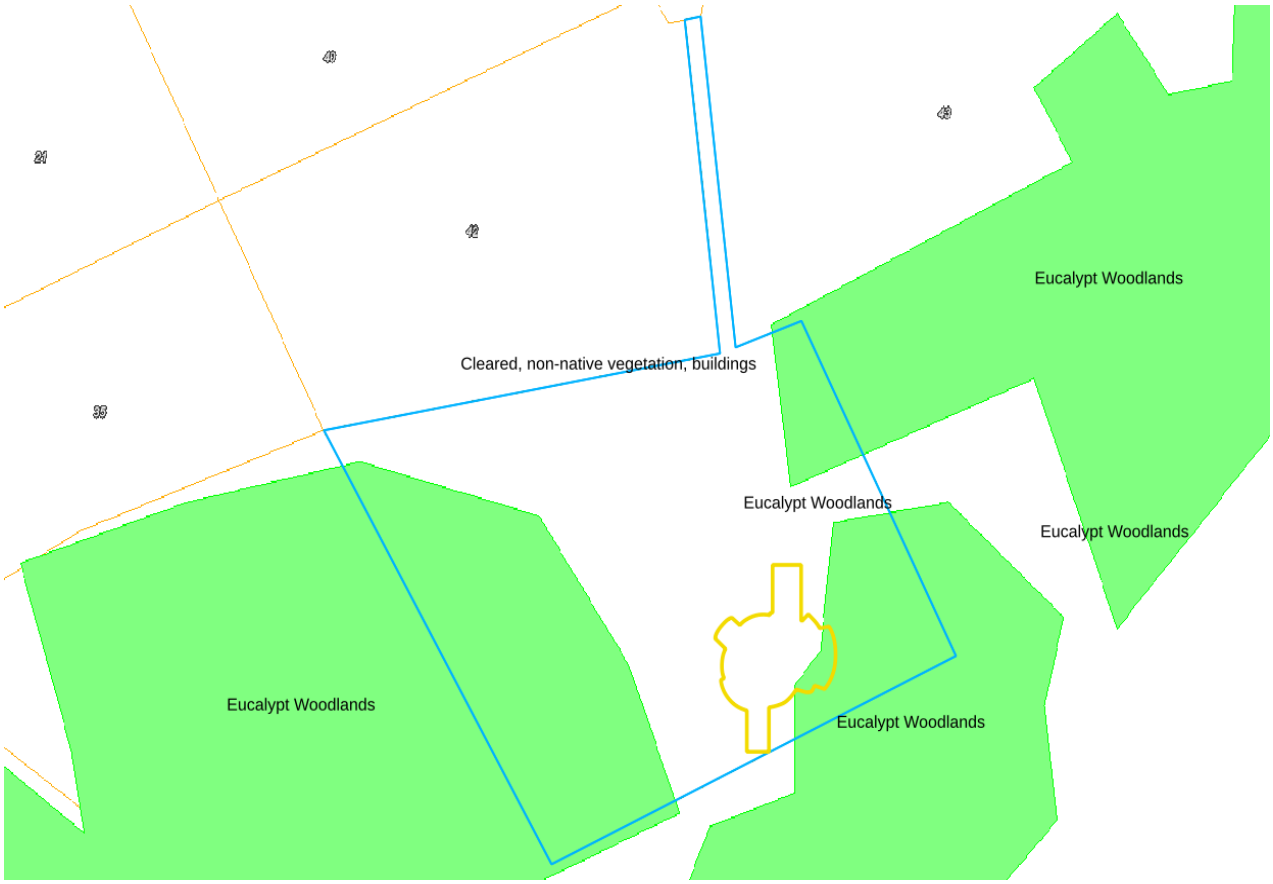

Figure 5: NVIS/DPIRD-005 Native Vegetation Extent

Black Cockatoos

An initial search was requested from the Department of Biodiversity, Conservation and Attraction's DBCA *Threatened and Priority Fauna Database in January 2024.* As per the guidelines, this was requested within a 20km radius of the study area.

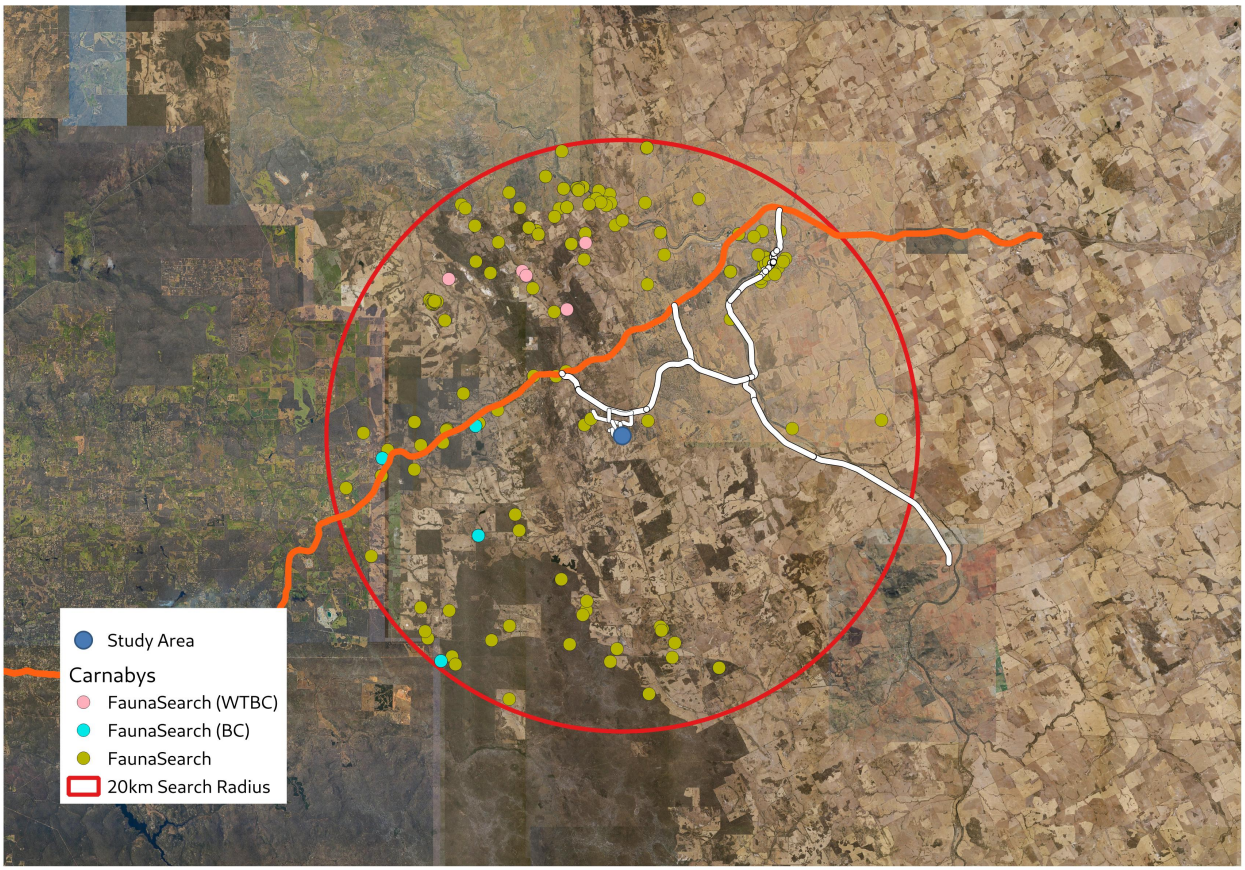

Figure 6: DBCA - Threatened and Priority Fauna Database search

Several other data sources were consulted to understand the likely distribution of Black cockatoos adjacent to the study area, but they were of little use as they predominantly focussed on the Swan Coastal Plain and the Jarrah Forest IBRA regions.

- Data WA GIS data sources.
  - Black Cockatoo Breeding Sites - Buffered (DBCA-063)
  - Black Cockatoo Roosting Sites - Buffered (DBCA-064)
  - Carnabys Cockatoo Confirmed Roost Sites (DBCA-050)
  - Carnabys Cockatoo Unconfirmed Roost Sites (DBCA-051)

- Carnabys Cockatoo Confirmed Breeding Areas within the Swan Coastal Plain and Jarrah Forest IBRA Regions (DBCA-054)

Leafless Rock Wattle (*Acacia Aphylla*)

The Protected Matters search tool identifies the *Leafless Rock Wattle* as “Habitat likely to occur” at two sites to the west and east of the study area, and classifies the actual study area as “Habitat may occur”.

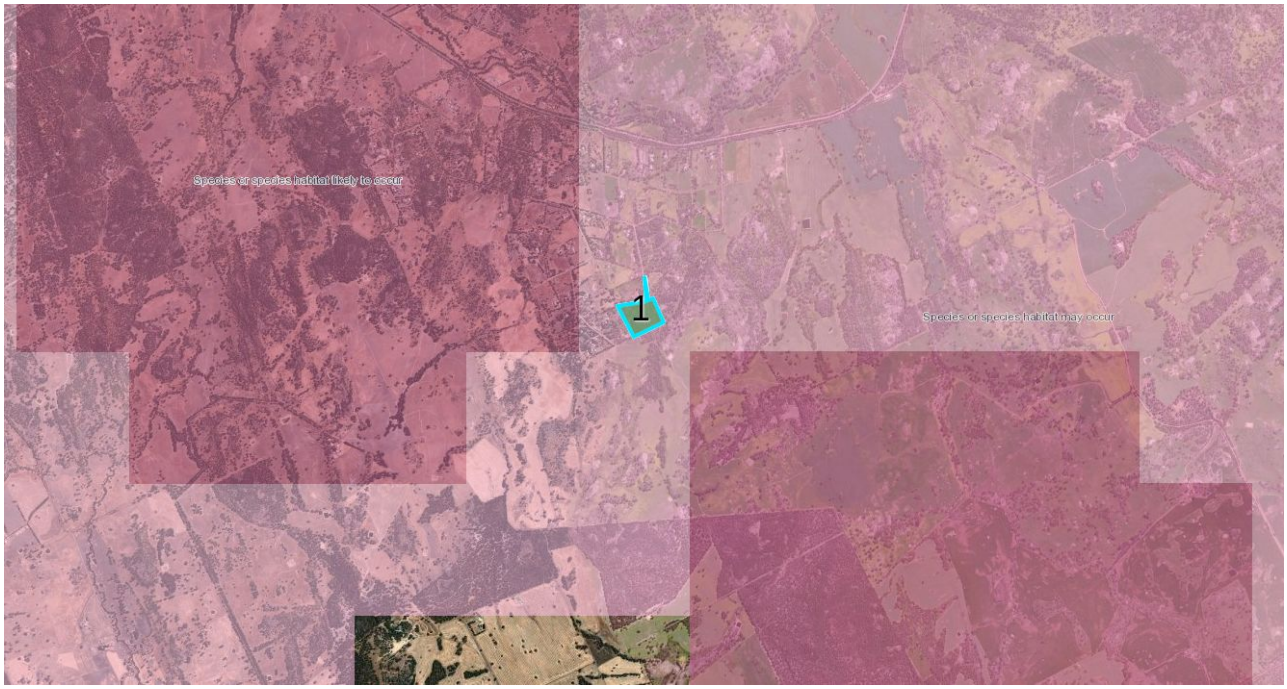

Figure 7: Protected Matters Search for Leafless Rock Wattle

Field survey

Flora and vegetation

The remnant vegetation in the study area generally conforms to a single vegetation community: NVIS MVG 5, MVS 8 “Eucalyptus woodlands with a shrubby understory”. (Equivalent to “*EloxSheoak”* - Keighery, and “*352 - Medium woodland; York gum”* - Beard Vegetation association number and name).

Table 1: NVIS Level 6 (sub-association)

U1+	^Eucalyptus loxophleba (York Gum) ^Tree - Height 10-30 m (Class 7)
U2	Allocasuarina huegeliana (Rock Sheoak) ^Tree - Height <10 m (Class 6)
M	^Acacia acuminata (Jam Tree) Shrub - Height >2 m (Class 4)

Figure 8: Vegetation - Spring

Figure 9: Vegetation - Summer

The lower understory of the study area is covered by grasses, predominantly *Ehrharta longiflora* with some *Ehrharta Calycina* present.

A large part of the study area is regularly cleared with a weed killer as it forms a significant firebreak and access road. This area is predominantly covered in broad leafed

weeds predominantly *Malva parviflora,* with *Citrullus lanatus and Rumex hypogaeus* present, prior to the annual spraying program.

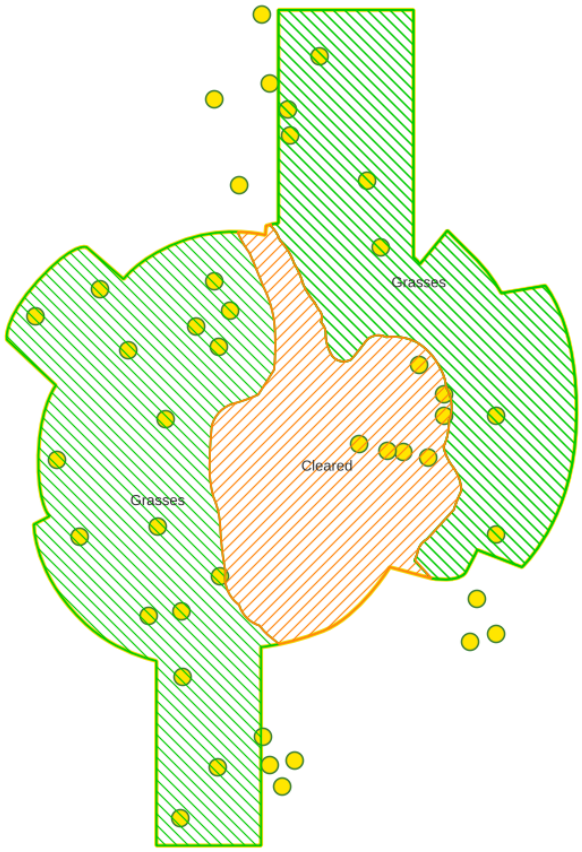

Figure 10: Understory Vegetation Types

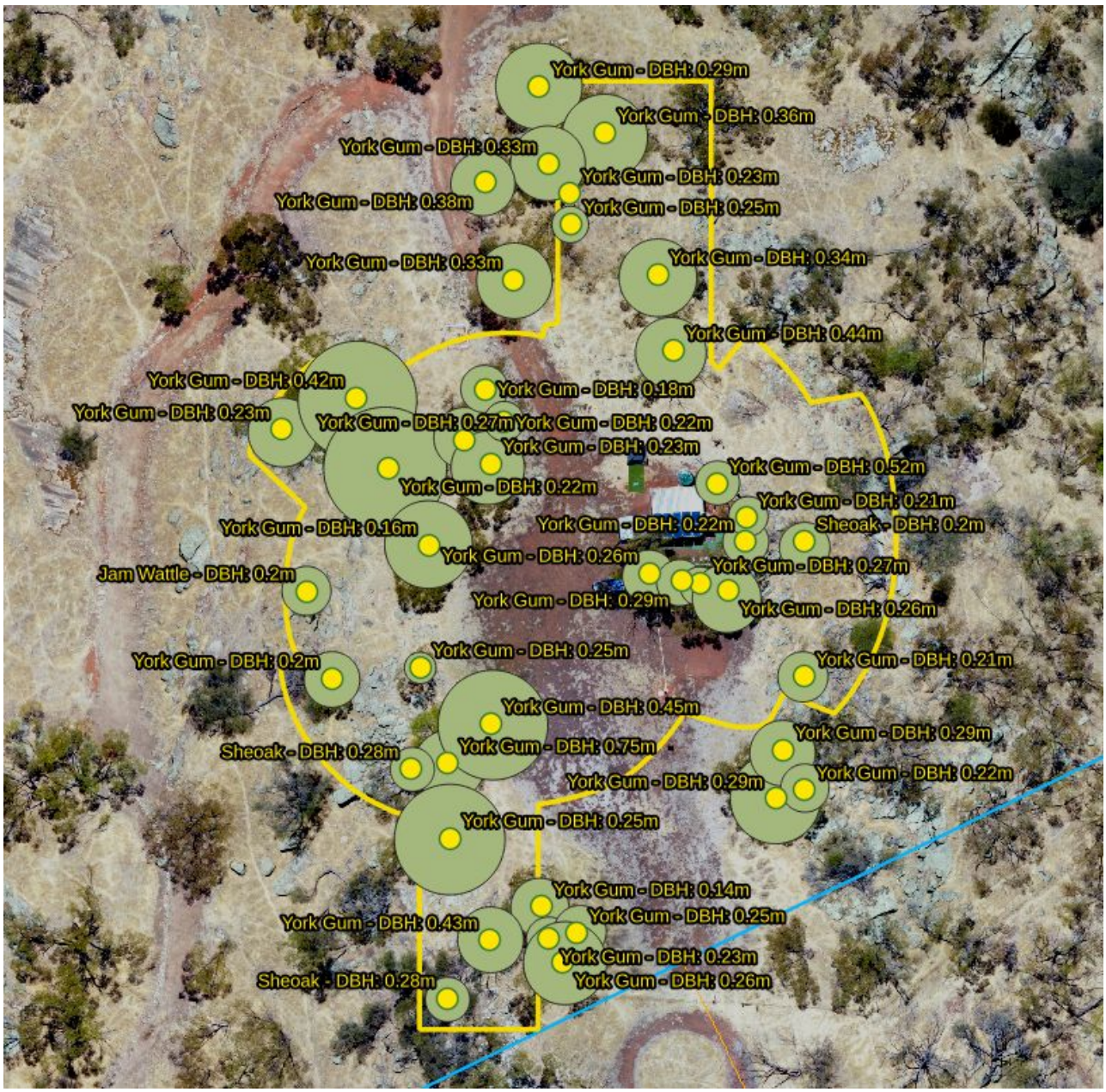

Figure 11: Coverage of trees within the study area

Table 2: List of all trees with DBH readings (> 30cm highlighted)

Easting	Northing	Common Name	Species	DBH
458936.970	6486289.230	York Gum	Eucalyptus Loxophleba	0.14
458924.090	6486331.030	York Gum	Eucalyptus Loxophleba	0.16
458930.560	6486349.090	York Gum	Eucalyptus Loxophleba	0.18
458912.810	6486315.600	York Gum	Eucalyptus Loxophleba	0.20
458909.970	6486325.700	Jam Wattle	Acacia acuminata	0.20
458967.450	6486331.410	Sheoak	Allocasuarina huegeliana	0.20
458960.740	6486334.230	York Gum	Eucalyptus Loxophleba	0.21
458967.420	6486315.870	York Gum	Eucalyptus Loxophleba	0.21

458919.300	6486340.010	York Gum	Eucalyptus Loxophleba	0.22
458932.680	6486345.240	York Gum	Eucalyptus Loxophleba	0.22
458960.620	6486331.440	York Gum	Eucalyptus Loxophleba	0.22
458937.870	6486285.530	York Gum	Eucalyptus Loxophleba	0.23
458907.010	6486344.450	York Gum	Eucalyptus Loxophleba	0.23
458931.200	6486340.460	York Gum	Eucalyptus Loxophleba	0.23
458940.240	6486371.690	York Gum	Eucalyptus Loxophleba	0.23
458941.080	6486286.110	York Gum	Eucalyptus Loxophleba	0.25
458926.440	6486297.100	York Gum	Eucalyptus Loxophleba	0.25
458923.080	6486316.830	York Gum	Eucalyptus Loxophleba	0.25
458940.410	6486368.190	York Gum	Eucalyptus Loxophleba	0.25
458939.480	6486282.760	York Gum	Eucalyptus Loxophleba	0.26
458949.570	6486327.800	York Gum	Eucalyptus Loxophleba	0.26
458958.640	6486325.880	York Gum	Eucalyptus Loxophleba	0.26
458928.140	6486343.220	York Gum	Eucalyptus Loxophleba	0.27
458955.390	6486326.670	York Gum	Eucalyptus Loxophleba	0.27
458926.150	6486278.610	Sheoak	Allocasuarina huegeliana	0.28
458921.920	6486305.180	Sheoak	Allocasuarina huegeliana	0.28
458936.800	6486384.130	York Gum	Eucalyptus Loxophleba	0.29
458953.220	6486326.850	York Gum	Eucalyptus Loxophleba	0.29
458933.800	*6486361.770*	*York Gum*	*Eucalyptus Loxophleba*	*0.33*
458937.850	*6486375.120*	*York Gum*	*Eucalyptus Loxophleba*	*0.33*
458950.510	*6486362.290*	*York Gum*	*Eucalyptus Loxophleba*	*0.34*
458944.400	*6486378.710*	*York Gum*	*Eucalyptus Loxophleba*	*0.36*
458930.480	*6486372.990*	*York Gum*	*Eucalyptus Loxophleba*	*0.38*
458915.610	*6486348.100*	*York Gum*	*Eucalyptus Loxophleba*	*0.42*
458931.050	*6486285.300*	*York Gum*	*Eucalyptus Loxophleba*	*0.43*
458952.330	*6486353.590*	*York Gum*	*Eucalyptus Loxophleba*	*0.44*
458931.220	*6486310.390*	*York Gum*	*Eucalyptus Loxophleba*	*0.45*
458957.370	*6486338.110*	*York Gum*	*Eucalyptus Loxophleba*	*0.52*
458926.160	*6486305.740*	*York Gum*	*Eucalyptus Loxophleba*	*0.75*

Black Cockatoos

Out of a total of 42 trees in the study area, 11 are classified as mature, having a DBH greater than 30cm, with two exceeding 50cm.

Note: The tree count reported here differs with the Flora and vegetation study as some trees outside the clearance area were also examined.

The study area was divided into six zones to simplify the field study. The zones were placed to ensure all trees were in a zone, with locally grouped mallee formations being kept within a single zone. The zones were designed to simplify reporting, and were not used to reduce the study area or as a statistical "quadrat" sub-sample – all trees and surrounding understory were measured and examined.

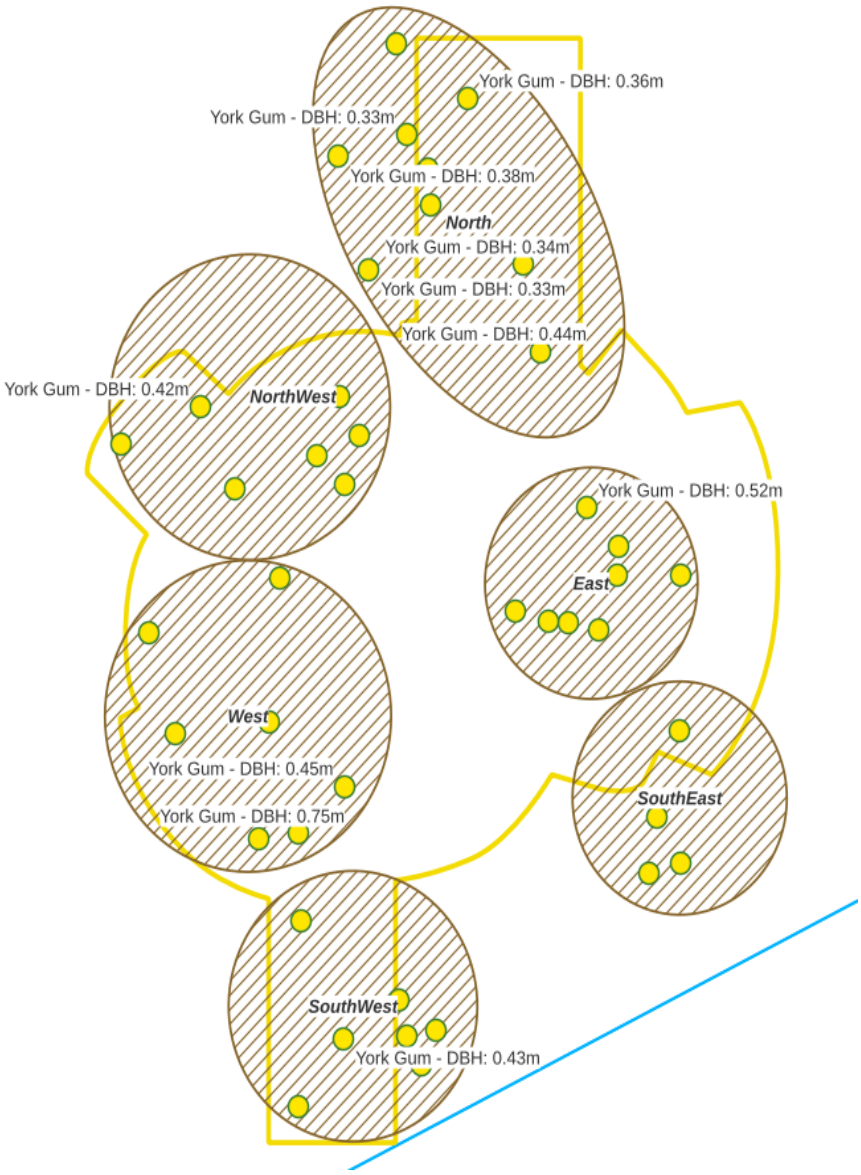

Figure 12: Search zones

Search Zone	Number of Trees	Number of hollow candidates (DBH > 30cm)
North	9	6
East	8	1
South East	4	0
South West	7	1
West	7	2
North West	7	1

All the trees with a DBH in excess of 30cm were assessed for potential breeding hollows. The trees were examined from ground level, and any potential hollow bearing trees were also observed from above using a drone.

A total of three hollows were identified:

One in the West zone, in a tree with a DBH of 75cm at a height of 1m above ground.

Figure 13: View of the West zone showing one potential hollow

Figure 14: West zone Hollow close up view

Two in the East zone, in a tree with a DBH of 52cm at a height of 1m and 3m.

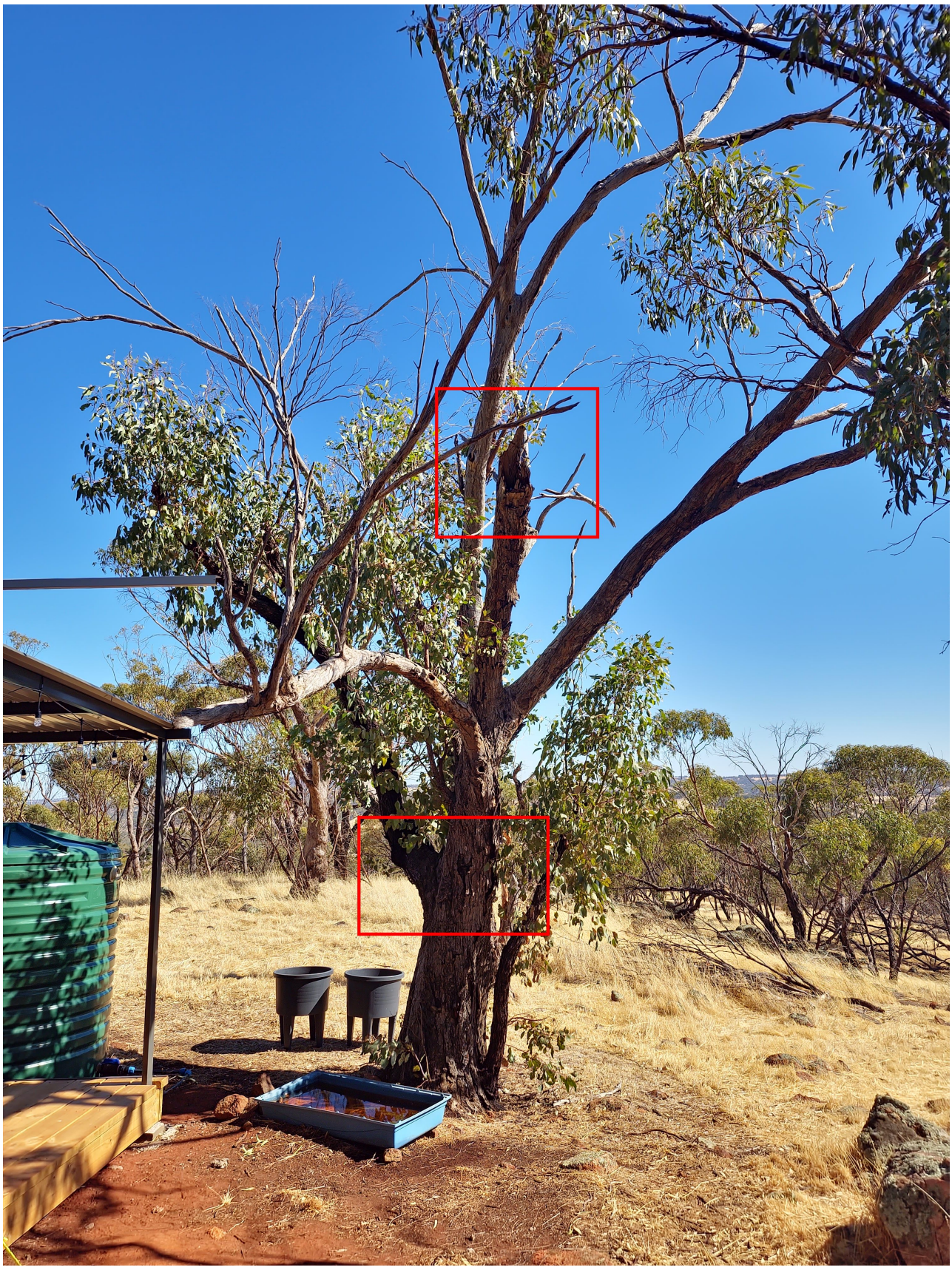

Figure 15: View of the East zone tree showing two potential hollows

Figure 16: Close up of East Zone hollow at 3m

Figure 17: Close up of East Zone hollow at 1m height

None of the three identified hollows showed any signs of current or prior occupation by Black Cockatoos.

An assessment of likely feeding vegetation was also conducted across the study area with no high-quality Black Cockatoo food sources being identified. The predominant canopy tree, Eucalyptus Loxophleba (York Gum) is considered a poor-quality food source for Black Cockatoos.

None of the tree locations in the study area showed any signs of foraging or feeding residue.

Anecdotal discussions with the property owners and neighbours indicated that no Black Cockatoos have been sighted within the study area within the last 4 years, and very few have been seen in the general area.

This is borne out by the data provided through the Department of Biodiversity, Conservation and Attraction's (DBCA) *Threatened and Priority Fauna Database* targeted search of a 20km radius of the study area, which has one recorded sighting in 2023 for a Baudin's Cockatoo, taken into care, 6 sightings in 2020, and only 5 in 2018.

TEC assessment

Diagnostic 1:

The study area is within the "*Eucalypt Woodlands of the Western Australian Wheatbelt*" Threatened Ecological Community.

Continue to Diagnostic 2

Diagnostic 2:

The total crown coverage was measured as approximately 36% (1512m^2), which is greater than the 10% threshold required.

Continue to Diagnostic 3

Diagnostic 3:

The study area forms part of the vegetation community: NVIS MVG 5, MVS 8 "Eucalyptus woodlands with a shrubby understory" which is considered part of the "*Eucalypt Woodlands of the Western Australian Wheatbelt*" Threatened Ecological Community.

Continue to Diagnostic 4

Diagnostic 4:

Predominantly non-native understory, but with > 10% tree cover. Indeterminate TEC status.

Continue to Diagnostic 5

Diagnostic 5:

The study area falls into the "Degraded" to "Completely Degraded" rating due to the very high presence of exotic vegetation in the understory.

A total of 11 of the 35 identified Eucalypt trees would be classified as mature. This is greater than the 5 trees per hectare requirement for TEC consideration, however due to the open patchy nature of the study area it would not meet the requirement for a minimum patch size of 5 hectares.

Not TEC

Black Cockatoo referral assessment

The assessment follows the methodology used in the Referral guideline for 3 WA threatened black cockatoo species.

The Foraging quality scoring tool was not used as the area being cleared falls below the minimum required threshold of 1 hectare for the tool.

Step 1:

Familiarise yourself with the EPBC Act assessment and approval process, Significant Impact Guidelines 1.1 and each of the black cockatoo species' ecology and recovery needs.

Continue to Step 2

Step 2:

Identify and familiarise yourself with the context (region) of your impact area.

Continue to Step 3

Step 3:

Will your action(s) directly or indirectly impact on black cockatoo habitat?

My action will result in the removal of 2 eucalypt trees with 3 potential breeding hollows, and 9 trees with a DBH > 30cm with a potential for hollows to form in the future.

YES: Continue to Step 4

Step 4:

Does your action involve loss of any breeding habitat (i.e. known, suitable or potential nesting trees)
OR
part of a night roosting site
OR
>1 ha of high quality foraging habitat
OR
>10 ha of low quality foraging habitat for one of the black cockatoo species

The site does contain two trees with potential breeding hollows.

The total area being cleared is 4147m^2 (0.4ha). This is below the required threshold for a low qualify foraging habitat.

YES: Referral required

Step 5:

Step 6:

Have you adopted the mitigation standards to remove the likelihood of significant impact?

The area being cleared has been selected as the location likely to have the least impact on the removal of native vegetation. The chosen area is already partially managed as a fire break and road access.

Clearing will be conducted from July to November to ensure we don't clear during the normal breeding season of black cockatoos.

There is very limited evidence of any black cockatoo activity in the area and none in the study area, so it is unlikely that our actions will have a significant impact on black cockatoos nesting.

Leafless Rock Wattle

The entire study area was examined extensively to identify any *Leafless Rock Wattle* specimens, but none were found in the area.

4 CONCLUSION

It is unlikely that the study area would be considered as forming part of the "*Eucalypt Woodlands of the Western Australian Wheatbelt*" Threatened Ecological Community, however as an actual determination of whether the study area is within the "*Eucalypt Woodlands of the Western Australian Wheatbelt*" Threatened Ecological Community is hard to make with the limited data sources available, it is recommended that the clearing action be referred for a determination.

There is a small possibility that the clearing actions may cause an impact on Black Cockatoos. While this is likely not significant, it does require that the action be referred under the precautionary principle.

There appears to be no existing *Leafless Rock Wattle* Specimens in the study area, so the clearance will not impact on this species.

5 REFERENCES

- Data WA GIS data sources.
  - Threatened Ecological Communities (DBCA-038) (Scale limited)
  - Native Vegetation Extent (DPIRD-005)
  - Cadastre Address (LGATE-002) - Large Scale
- National Vegetation Information System (NVIS) Version 6.0
- *Department of the Environment (2015). Approved Conservation Advice (including listing advice) for the Eucalypt Woodlands of the Western Australian Wheatbelt.*
- DCCEEW Species Profile and Threats Database (SPRAT)
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- Data WA GIS data sources.
  - Black Cockatoo Breeding Sites - Buffered (DBCA-063)
  - Black Cockatoo Roosting Sites - Buffered (DBCA-064)
  - Carnabys Cockatoo Confirmed Roost Sites (DBCA-050)

6 APPENDICES

TEC assessment

The TEC Assessment process followed is based on the advice provided in the following document:

Department of the Environment (2015). Approved Conservation Advice (including listing advice) for the Eucalypt Woodlands of the Western Australian Wheatbelt.

Diagnostic 1:

The distribution of the ecological community is limited to these IBRA bioregions and subregions:

- Avon Wheatbelt bioregion - subregions AVW01 Merredin and AVW02 Katanning.
- Mallee bioregion - MAL02 Western Mallee only.
- Jarrah Forest – outlying patches in the eastern parts of JAF01 Northern Jarrah Forests and JAF02 Jarrah Forests adjacent to the Avon Wheatbelt, that are off the Darling Range, and receive less than 600 mm mean annual rainfall. They are effectively an extension of the Avon Wheatbelt landscape in that they comprise areas subject to similar climate, landscape and threats.

Continue to Diagnostic 2

Diagnostic 2:

The structure of the ecological community is a woodland in which the minimum crown cover of the tree canopy in a mature woodland is 10% (crowns measured as if they are opaque).

Notes: The maximum tree canopy cover usually is up to 40%. It may be higher in certain circumstances, for instance: trees with a mallet growth form may be more densely spaced; or disturbances such as fire may result in an increased cover of canopy species during regeneration.

Recent disturbances, such as fire, may cause the loss of a mature tree canopy and a shift to a different, regenerative state for a woodland. Under these circumstances, the loss of a tree canopy is likely to be a temporary phenomenon, if natural regeneration is not interrupted.

There should be evidence that:

1. The key eucalypt species typical of the ecological community were formerly present at a site by the presence of stumps, logs, photos, past surveys/knowledge

2. That the tree canopy will regenerate from seedlings, saplings or epicormic regrowth. Some wheatbelt woodland eucalypts, including the mallets, gimlet and salmon gum, are killed by fire and regenerate from seeds only, so it may take decades for a mature woodland structure to re-establish (Gosper et al, 2013a). This temporary regenerative

state is included as part of the ecological community where seedling and sapling eucalypts are clearly present and the other diagnostic features and condition thresholds are met.

Continue to Diagnostic 3

Crown cover of trees less than 10% but area recently disturbed (e.g. fire), presence of seedlings and/or saplings.

Continue to Diagnostic 3

Crown cover of trees less than 10%, no evidence of recent disturbance, no presence of seedlings or saplings.

Not TEC

Diagnostic 3:

The key species of the tree canopy are species of *Eucalyptus* as identified in Table 4, above. These are species that typically have a single trunk.

- One or more of the tree species in Table 4 are dominant or co-dominant within a patch of the ecological community. If other species are present in the tree canopy (e.g. species in Table 5 or other taxa) then these collectively do not occur as dominants in the tree canopy.

Note: Some woodlands may have a lower tree layer of mallee or non-eucalypt tree species. In this case, the upper tree canopy must comprise mainly of key woodland species in Table 2a and have an upper canopy cover of 10% or more. This helps distinguish woodland with a mallee subcanopy from true mallee communities which may have woodland trees as sparse or occasional emergents.

Additional Note for Eucalyptus Loxophleba: Only stands dominated by subspecies loxophleba are included in the WA Wheatbelt Woodlands ecological community. Unlike most wheatbelt woodland trees, subspecies loxophleba can be multi-stemmed but is still considered a tree, rather than mallee. However, subspecies lissophloia and gratiae are recognised to have a mallee growth form, while subspecies supralaevis is limited to the far northern wheatbelt, extending into adjacent bioregions to the north and east. Stands dominated by the latter three subspecies are not part of the WA Wheatbelt Woodlands ecological community.

One or more of the key tree species in Table 4 are dominant or co-dominant, the trees are predominantly single trunked, not mallee (multi-stemmed).

Continue to Diagnostic 4

Other species are present in the tree canopy (e.g. species in Table 5 or other taxa) but these collectively do not occur as dominants in the tree canopy.

Continue to Diagnostic 4

Dominant woodlands with a mallee subcanopy (lower tree layer of mallee or non-eucalypt tree species). Upper eucalypt tree canopy must be present dominated by key woodland species in Table 4 and have cover of 10% or more.

Continue to Diagnostic 4

Other species are present in the tree canopy (e.g. species in Table 5 or other taxa) and these collectively do occur as dominants in the tree canopy.

Not TEC

Diagnostic 4:

A native understorey is present but is of variable composition, being a combination of grasses, other herbs and shrubs. A list of key species is summarised in tables Table 6, Table 7, Table 8, Table 9 and Table 10. Any one of the structural understorey categories may or may not be present.

Bare to sparse understorey (e.g. under some mallet woodlands).

Continue to Diagnostic 5

Herbaceous understorey – a ground layer of forbs and/or graminoids though a few, scattered shrubs may be present.

Continue to Diagnostic 5

Scrub or heath understorey – comprises a mixture of diverse shrubs of variable height and cover. A ground layer of herbs and grasses is present to variable extent.

Continue to Diagnostic 5

Chenopod-dominated understorey – a subset of the scrub category in which the prominent species present are saltbushes, bluebushes and related taxa (e.g. Atriplex, Enchylaena, Maireana, Rhagodia
and Sclerolaena).

Continue to Diagnostic 5

Thickets of taller shrub species understorey (e.g. Melaleuca pauperiflora, M. acuminata, M. uncinata, M. lanceolata, M. sheathiana, M. adnata, M. cucullata and/or M. lateriflora, Allocasuarina campestris with Melaleuca hamata or M. scalena). A range of other shrub and ground layer species may occur among or below the thickets.

Continue to Diagnostic 5

Salt tolerant species understorey (e.g. samphire, Tecticornia spp.).

Continue to Diagnostic 5

Shrublands or herblands in which the tree canopy layer is very sparse to absent, either naturally or maintained so through long-term disturbance. Native vegetation where a tree canopy was formerly present is often referred to as ‘derived’ or ‘secondary’ vegetation. These sites would fall below the 10 per cent minimum canopy cover threshold for a woodland.

Not TEC

Diagnostic 5:

Minimum condition for patches of the WA Wheatbelt Woodlands ecological community. For each category, both the weed cover and mature tree presence criteria must apply plus one of either patch size or patch width, depending on whether the patch is a roadside remnant or not.

Table 3: Vegetation condition rating (EPA 2016b, adapted from Keighery (1994))

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

Category A:

Patch corresponds to a condition of pristine / excellent / very good (Keighery, 1994) or a high RCV (RCC, 2014). Exotic plant species account for 0 to 30% of total vegetation cover in the understorey layers (i.e. below the tree canopy). Mature trees (diameter at breast height (dbh) of 30 cm or above) may be present or absent. Patch size (non-roadside) 2 ha or more with no gap in native vegetation cover exceeding 50 m width.

TEC

Patch width roadside only (based on the native understorey component not width of the tree canopy) 5 m or more.

TEC

Patch corresponds to a condition of pristine / excellent / very good (Keighery, 1994) or a high RCV (RCC, 2014). Exotic plant species account for 0 to 30% of total vegetation cover in the understorey layers (i.e. below the tree canopy). Mature trees (diameter at breast height (dbh) of 30 cm or above) may be present or absent. Patch size (non-roadside) less than 2 ha.

Not TEC

Patch width roadside only (based on the native understorey component not width of the tree canopy) less than 5 m.

Not TEC

Category B:

Patch corresponds to a condition of good (Keighery, 1994) or a medium-high RCV (RCC, 2014). Exotic plant species account for more than 30, to 50% of total vegetation cover in the understorey layers (i.e. below the tree canopy). Mature trees are present with at least 5 trees per 0.5 ha. Patch size (non-roadside) 2 ha or more with no gap in native vegetation cover exceeding 50 m width.

TEC

Patch width roadside only (based on the native understorey component not width of the tree canopy) 5 m or more.

TEC

Patch corresponds to a condition of good (Keighery, 1994) or a medium-high RCV (RCC, 2014), AND retains important habitat features. Exotic plant species account for more than 30, to 50% of total vegetation cover in the understorey layers (i.e. below the tree canopy). Mature trees are present with at least 5 trees per 0.5 ha. Patch size (non-roadside) less than 2 ha.

Not TEC

Patch width roadside only (based on the native understorey component not width of the tree canopy) less than 5 m.

Not TEC

Category C:

Patch corresponds to a condition of good (Keighery, 1994) or a medium-high RCV (RCC, 2014), AND retains important habitat features. Exotic plant species account for more than 30, to 50% of total vegetation cover in the understorey layers (i.e. below the tree canopy). Less than 5 mature trees per 0.5 ha are present. Minimum patch size (non-roadside) 5 ha or more.

TEC

Patch size (non- roadside) less than 5 ha

Not TEC

Category D:

Patch corresponds to a condition of degraded to good (Keighery, 1994) or a medium-Low to medium- high RCV (RCC, 2014). Exotic plant species account for more than 50 to 70% of total vegetation cover in the understorey layers (i.e. below the tree canopy). Mature trees are present with at least 5 trees per 0.5 ha. Minimum patch size (non-roadside) 5 ha or more.

TEC

Patch width roadside only (based on the native understorey component not width of the tree canopy) 5 m or more

TEC

Patch corresponds to a condition of degraded to good (Keighery, 1994) or a medium-low to medium- high RCV (RCC, 2014). Exotic plant species account for more than 50 to 70% of total vegetation cover in the understorey layers (i.e. below the tree canopy). Less than 5 mature trees per 0.5 ha are present.

Not TEC

Tree canopy species of the WA Wheatbelt Woodlands ecological community.

Within a given patch of the ecological community, one or more of these species are dominant or co-dominant. Note that some taxa may occur both as a tree or mallee form.

Table 4: Key eucalypt species. One or more of these species are dominant or co-dominant within a given patch of the ecological community.

Scientific name	**Common name/s**
Eucalyptus accedens	powder-bark; powder-bark wandoo
Eucalyptus aequioperta	Welcome Hill gum
Eucalyptus alipes	Hyden mallet
Eucalyptus astringens subsp. astringens	brown mallet
Eucalyptus capillosa	wheatbelt wandoo
Eucalyptus densa subsp. densa	narrow-leaved blue mallet
Eucalyptus extensa	yellow mallet
Eucalyptus falcata	silver mallet
Eucalyptus gardneri subsp. gardneri	blue mallet
Eucalyptus goniocarpa	Lake King mallet
Eucalyptus kondininensis	Kondinin blackbutt
Eucalyptus longicornis	red morrel
Eucalyptus loxophleba subsp. loxophleba	York gum
Eucalyptus melanoxylon	black morrel
Eucalyptus mimica subsp. continens	hooded mallet
Eucalyptus mimica subsp. mimica	Newdegate mallet
Eucalyptus myriadena	small-fruited gum; blackbutt
Eucalyptus occidentalis	flat-topped yate
Eucalyptus ornata	ornamental silver mallet; ornate mallet
Eucalyptus recta	Mt Yule silver mallet; Cadoux mallet
Eucalyptus rudis subsp. rudis	flooded gum
Eucalyptus salicola	salt gum; salt salmon gum
Eucalyptus salmonophloia	salmon gum
Eucalyptus salubris	gimlet
Eucalyptus sargentii subsp. sargentii	salt river gum
Eucalyptus singularis	ridge-top mallet

Eucalyptus spathulata subsp. spathulata	swamp mallet
Eucalyptus spathulata subsp. salina	Salt River mallet
Eucalyptus urna	merrit
Eucalyptus wandoo subsp. pulverea	wandoo
Eucalyptus wandoo subsp. wandoo	wandoo

Table 5: Associated canopy species that may be present within the ecological community but are not dominant or co-dominant. The list is not comprehensive and presents the more common taxa encountered.

Scientific name	**Common name/s**
Acacia acuminata	jam
Allocasuarina huegeliana	rock sheoak
Corymbia calophylla	marri
Eucalyptus annulata	prickly-fruited mallee
Eucalyptus arachnaea subsp. arachnaea	black-stemmed mallee
Eucalyptus arachnaea subsp. arrecta	black-stemmed mallet
Eucalyptus armillata	flanged mallee
Eucalyptus calycogona subsp. calycogona	square-fruited mallee
Eucalyptus camaldulensis subsp. arida	river red gum
Eucalyptus celastroides subsp. virella	wheatbelt mallee
Eucalyptus cylindriflora	Goldfields white mallee
Eucalyptus decipiens	redheart; moit
Eucalyptus drummondii	Drummond's mallee
Eucalyptus eremophila	sand mallee
Eucalyptus erythronema subsp. erythronema	red-flowered mallee
Eucalyptus erythronema subsp. inornata	yellow-flowered mallee
Eucalyptus eudesmioides	Kalbarri mallee
Eucalyptus flocktoniae subsp. flocktoniae	Flockton's mallee
Eucalyptus gittinsii subsp. illucida	northern sandplain mallee
Eucalyptus incrassata	ridge-fruited mallee
Eucalyptus kochii subsp. plenissima	Trayning mallee
Eucalyptus leptopoda subsp. leptopoda	Merredin mallee; Tammin mallee
Eucalyptus loxophleba subsp. gratiae	Lake Grace mallee

Eucalyptus loxophleba subsp. lissophloia	smooth-barked York gum
Eucalyptus loxophleba subsp. supralaevis	blackbutt York gum
Eucalyptus macrocarpa	mottlecah
Eucalyptus marginata	jarrah
Eucalyptus moderata	redwood mallee
Eucalyptus obtusiflora	Dongara mallee
Eucalyptus olivina	olive-leaved mallee
Eucalyptus orthostemon	diverse mallee
Eucalyptus perangusta	fine-leaved mallee
Eucalyptus phaenophylla	common southern mallee
Eucalyptus phenax subsp. phenax	white mallee
Eucalyptus pileata	capped mallee
Eucalyptus platypus subsp. platypus	moort
Eucalyptus polita	Parker Range mallet
Eucalyptus sheathiana	ribbon-barked mallee
Eucalyptus sporadica	Burngup mallee
Eucalyptus subangusta subsp. subangusta	grey mallee
Eucalyptus tenera	glazed mallee
Eucalyptus tephroclada	Holleton mallee
Eucalyptus thamnoides	brown mallee
Eucalyptus transcontinentalis	redwood
Eucalyptus vegrandis	Ongerup mallee; Cranbrook mallee
Eucalyptus wubinensis	Wubin mallee
Eucalyptus yilgarnensis	yorrel

Key native plant species of the "*Eucalypt Woodlands of the Western Australian Wheatbelt*" Threatened Ecological Community (TEC).

Given the WA wheatbelt is a region of high natural biodiversity, this plant species list does not include all plant species that may be encountered in the "*Eucalypt Woodlands of the Western Australian Wheatbelt*" Threatened Ecological Community (TEC).

Source: Compiled from the community and sub-community descriptions in Harvey and Keighery (2012). Communities and sub-communities not dominated by the key eucalypt species or that are limited to a particular area outside the WA wheatbelt are not included.

Table 6: Canopy species - Trees

Scientific name	**Common name(s)**
Acacia acuminata	jam
Allocasuarina huegeliana	rock sheoak
Callitris canescens	cypress pine
Callitris columellaris	white cypress pine
Callitris preissii	Rottnest Island pine
Callitris roei	Roe's cypress pine
Casuarina obesa	swamp sheoak
Corymbia calophylla	marri
Eucalyptus accedens	powderbark wandoo
Eucalyptus alipes	Hyden mallet
Eucalyptus annulata	prickly-fruited mallee
Eucalyptus arachnaea subsp. arachnaea	black-stemmed mallee
Eucalyptus arachnaea subsp. arrecta	black-stemmed mallet
Eucalyptus armillata	flanged mallee
Eucalyptus astringens	brown mallet
Eucalyptus comitae-vallis	Cowcowing mallee
Eucalyptus calycogona subsp. calycogona	square-fruited mallee
Eucalyptus capillosa	wheatbelt wandoo
Eucalyptus celastroides subsp. virella	wheatbelt mallee
Eucalyptus cylindriflora	Goldfields white mallee
Eucalyptus decipiens	redheart; moit
Eucalyptus drummondii	Drummond's mallee

Eucalyptus eremophila	sand mallee
Eucalyptus erythronema subsp. erythronema	red-flowered mallee
Eucalyptus erythronema subsp. inornata	yellow-flowered mallee
Eucalyptus extensa	yellow mallet
Eucalyptus falcata	silver mallet
Eucalyptus flocktoniae subsp. flocktoniae	Flockton's mallee
Eucalyptus gardneri	blue mallet
Eucalyptus gittinsii subsp. illucida	northern sandplain mallee
Eucalyptus incrassata	ridge-fruited mallee
Eucalyptus kochii subsp. plenissima	Trayning mallee
Eucalyptus kondininensis	Kondinin blackbutt
Eucalyptus leptocalyx	Hopetoun mallee
Eucalyptus leptopoda	Merredin mallee; Tammin mallee
Eucalyptus longicornis	red morrel
Eucalyptus loxophleba subsp gratiae	Lake Grace mallee
Eucalyptus loxophleba subsp lissophloia	blackbutt York gum
Eucalyptus loxophleba subsp. loxophleba	York gum
Eucalyptus loxophleba subsp. supralaevis	smooth-barked York gum
Eucalyptus marginata	jarrah
Eucalyptus melanoxylon	black morrel
Eucalyptus mimica subsp. continens	hooded mallet
Eucalyptus mimica subsp. mimica	Newdegate mallet
Eucalyptus moderata	redwood mallee
Eucalyptus myriadena subsp. myriadena	small-fruited gum; blackbutt
Eucalyptus obtusiflora	Dongara mallee
Eucalyptus occidentalis	flat-topped yate
Eucalyptus olivina	olive-leaved mallee
Eucalyptus ornata	ornamental silver mallet; ornate mallet
Eucalyptus orthostemon	diverse mallee
Eucalyptus perangusta	fine-leaved mallee
Eucalyptus phaenophylla	common southern mallee
Eucalyptus phenax	white mallee
Eucalyptus pileata	capped mallee

Eucalyptus platypus	moort
Eucalyptus polita	Parker Range mallet
Eucalyptus recta	Mt Yule silver mallet; Cadoux mallet
Eucalyptus rudis	flooded gum
Eucalyptus salicola	salt gum; salt salmon gum
Eucalyptus salmonophloia	salmon gum
Eucalyptus salubris	gimlet
Eucalyptus sargentii	salt river gum
Eucalyptus sheathiana	ribbon-barked mallee
Eucalyptus singularis	ridge-top mallet
Eucalyptus spathulata subsp. spathulata	swamp mallet
Eucalyptus spathulata subsp. salina	Salt River mallet
Eucalyptus sporadica	Burngup mallee
Eucalyptus subangusta subsp. pusilla	ember mallee
Eucalyptus subangusta subsp. subangusta	grey mallee
Eucalyptus tenera	glazed mallee
Eucalyptus tephroclada	Holleton mallee
Eucalyptus thamnoides	brown mallee
Eucalyptus transcontinentalis	redwood
Eucalyptus urna	Merrit
Eucalyptus vegrandis	Ongerup mallee; Cranbrook mallee
Eucalyptus wandoo	wandoo
Eucalyptus wubinensis	Wubin mallee
Eucalyptus yilgarnensis	yorrel

Table 7: Understorey species – Shrubs

Scientific name	**Common name(s)**
Acacia acuaria	
Acacia colletioides	wait-a-while
Acacia erinacea	
Acacia hemiteles	
Acacia lasiocalyx	silver wattle
Acacia lasiocarpa	panjang
Acacia leptospermoides	

Acacia mackeyana	
Acacia merrallii	
Acacia microbotrya.	manna wattle
Acacia pulchella	prickly moses
Allocasuarina acutivalvis	
Allocasuarina campestris	
Allocasuarina humilis	dwarf sheoak
Allocasuarina lehmanniana	dune sheoak
Allocasuarina microstachya	
Argyroglottis turbinata	
Astroloma epacridis	
Banksia armata	prickly dryandra
Banksia sessilis	parrot bush
Beyeria brevifolia	
Bossiaea divaricata	
Bossiaea eriocarpa	common brown pea
Bossiaea halophila	
Callistemon phoeniceus	lesser bottlebrush
Calothamnus quadrifidus	one-sided bottlebrush
Calothamnus quadrifidus subsp. asper	one-sided bottlebrush
Comesperma integerrimum	
Conostylis setigera	
Dampiera lavandulacea	
Darwinia sp. Karonie	
Daviesia nematophylla	
Daviesia triflora	
Dodonaea bursariifolia	
Dodonaea inaequifolia	
Dodonaea pinifolia	
Dodonaea viscosa	sticky hopbush
Eremophila decipiens	slender fuchsia
Eremophila ionantha	violet-flowered eremophila
Eremophila oppositifolia	weeooka
Eremophila scoparia	broom bush

Exocarpos aphyllus	leafless ballart
Gastrolobium microcarpum	sandplain poison
Gastrolobium parviflorum	
Gastrolobium spinosum	prickly poison
Gastrolobium tricuspidatum	
Gastrolobium trilobum	bullock poison
Grevillea acuaria	
Grevillea huegelii	
Grevillea tenuiflora	tassel grevillea
Hakea laurina	pincushion hakea
Hakea lissocarpha	honey bush
Hakea multilineata	grass-leaf hakea
Hakea petiolaris	sea urchin hakea
Hakea preissii	needle tree
Hakea varia	variable-leaved hakea
Hibbertia commutata	
Hibbertia exasperata	
Hibbertia hypericoides	yellow buttercups
Hovea chorizemifolia	holly-leaved hovea
Hypocalymma angustifolium	white myrtle
Leptomeria preissiana	
Leptospermum erubescens	roadside teatree
Lycium australe	Australian boxthorn
Melaleuca acuminata	
Melaleuca adnata	
Melaleuca atroviridis	
Melaleuca brophyi	
Melaleuca cucullata	
Melaleuca cuticularis	saltwater paperbark
Melaleuca halmaturorum	
Melaleuca hamata	
Melaleuca hamulosa	
Melaleuca lanceolata	Rottnest teatree
Melaleuca lateriflora	gorada

Melaleuca marginata	
Melaleuca pauperiflora	boree
Melaleuca radula	graceful honeymyrtle
Melaleuca rhaphiophylla	swamp paperbark
Melaleuca scalena	
Melaleuca strobophylla	
Melaleuca teuthidoides	
Melaleuca thyoides	
Melaleuca uncinata group	broom bush
Melaleuca viminea	mohan
Olearia muelleri	Goldfields daisy
Olearia sp. Kennedy Range	
Petrophile divaricata	
Petrophile shuttleworthiana	
Petrophile squamata	
Petrophile striata	
Phebalium filifolium	slender phebalium
Phebalium lepidotum	
Phebalium microphyllum	
Phebalium tuberculosum	
Pimelea argentea	silvery-leaved pimelea
Pittosporum angustifolium	
Platysace maxwellii	karno
Rhadinothamnus rudis	
Santalum acuminata	quandong
Santalum spicatum	sandalwood
Scaevola spinescens	currant bush
Senna artemisioides	
Styphelia tenuiflora	common pinheath
Templetonia sulcata	centipede bush
Trymalium elachophyllum	
Trymalium ledifolium	
Westringia cephalantha	
Xanthorrhoea drummondii	

Table 8: Understorey species – Chenopods

Scientific name	**Common name(s)**
Atriplex acutibractea	toothed saltbush
Atriplex paludosa	marsh saltbush
Atriplex semibaccata	berry saltbush
Atriplex stipitata	mallee saltbush
Atriplex vesicaria	bladder saltbush
Enchylaena lanata / tomentosa complex	barrier saltbush
Maireana brevifolia	small-leaf bluebush
Maireana erioclada	
Maireana marginata	
Maireana trichoptera	downy bluebush
Rhagodia drummondii	
Rhagodia preissii	
Sclerolaena diacantha	grey copperburr
Tecticornia spp.	samphire
Threlkeldia diffusa	coast bonefruit

Table 9: Understory species – Forbs

Scientific name	**Common name(s)**
Actinobole uliginosum	flannel cudweed
Asteridea athrixioides	
Blennospora drummondii	
Borya nitida	pincushions
Borya sphaerocephala	pincushions
Brachyscome ciliaris	
Brachyscome lineariloba	
Caesia micrantha	pale fringe-lily
Caladenia flava	cowslip orchid
Calandrinia calyptrata	pink purslane
Calandrinia eremaea	twining purslane
Calotis hispidula	bindy eye
Carpobrotus modestus	inland pigface

Centipeda crateriformis subsp. crateriformis	
Chamaescilla corymbosa	blue squill
Chamaexeros serra	little fringe-leaf
Cotula coronopifolia	waterbuttons
Crassula colorata	odense stonecrop
Crassula exserta	
Dampiera juncea	rush-like dampiera
Dampiera lindleyi	
Daucus glochidiatus	Australian carrot
Dianella brevicaulis	
Dichopogon capillipes	
Disphyma crassifolium	round-leaved pigface
Drosera macrantha	bridal rainbow
Erodium cygnorum	blue heronsbill
Gilberta tenuifolia	
Gnephosis drummondii	
Gnephosis tenuissima	
Gnephosis tridens	
Gonocarpus nodulosus	
Goodenia berardiana	
Helichrysum leucopsideum	
Helichrysum luteoalbum	Jersey cudweed
Lagenophora huegelii	
Lawrencella rosea	
Lepidium rotundum	veined peppercress
Podolepis capillaris	wiry podolepis
Podolepis lessonii	
Podotheca angustifolia	sticky longheads
Poranthera microphylla	small poranthera
Pterostylis sanguinea	
Ptilotus spathulatus	
Rhodanthe laevis	
Senecio glossanthus	slender groundsel

Spergularia marina	
Stylidium calcaratum	book triggerplant
Thysanotus patersonii	
Trachymene cyanopetala	
Trachymene ornata	spongefruit
Trachymene pilosa	native parsnip
Velleia cycnopotamica	
Waitzia acuminata	orange immortelle
Zygophyllum ovatum	dwarf twinleaf

Table 10: Understorey species – Graminoids

Scientific name	**Common name(s)**
Amphipogon caricinus - strictus complex	greybeard grass
Austrostipa elegantissima	
Austrostipa hemipogon	
Austrostipa nitida	
Austrostipa trichophylla	
Centrolepis polygyna	wiry centrolepis
Desmocladus asper	
Desmocladus flexuosus	
Gahnia ancistrophylla	hook-leaf saw sedge
Gahnia australis	
Harperia lateriflora	
Juncus bufonius	toad rush
Lachnagrostis filiformis	blowngrass
Lepidosperma leptostachyum	
Lepidosperma resinosum	
Lepidosperma sp. aff. tenue	
Lepidosperma tenue	
Lepidosperma viscidum	sticky sword sedge
Lomandra effusa	scented matrush
Lomandra micrantha subsp. micrantha	small-flower matrush
Lomandra nutans	
Meeboldina coangustata	

Mesomelaena preissii	
Neurachne alopecuroides	foxtail mulga grass
Rytidosperma caespitosum	
Rytidosperma setaceum group	
Schoenus nanus	tiny bog-rush
Schoenus sculptus	gimlet bog-rush
Schoenus subfascicularis	

Referral guideline for 3 WA threatened black cockatoo species.

Adopted from the DCCEEW Referral guideline for 3 WA threatened black cockatoo species.

Step 1:

Familiarise yourself with the EPBC Act assessment and approval process, Significant Impact Guidelines 1.1 and each of the black cockatoo species' ecology and recovery needs.

Continue to Step 2

Step 2:

Identify and familiarise yourself with the context (region) of your impact area.

Continue to Step 3

Step 3:

Will your action(s) directly or indirectly impact on black cockatoo habitat?

YES: Continue to Step 4

NO: Continue to Step 5

Step 4:

Does your action involve loss of any breeding habitat (i.e. known, suitable or potential nesting trees)
OR
part of a night roosting site
OR
>1 ha of high quality foraging habitat
OR
>10 ha of low quality foraging habitat for one of the black cockatoo species

YES: Referral required

NO: Continue to Step 6

Step 5:

Is there a high likelihood your action may interfere with the recovery of one or more of the black cockatoo species Will the action impact use of habitat or physically impact the species (i.e. increased vehicle strike)

YES: Continue to Step 6

NO: Referral not required

Step 6:

Have you adopted the mitigation standards to remove the likelihood of significant impact?

Yes: Referral not required

NO: Referral required

Views of all the tree zones included in the study area.

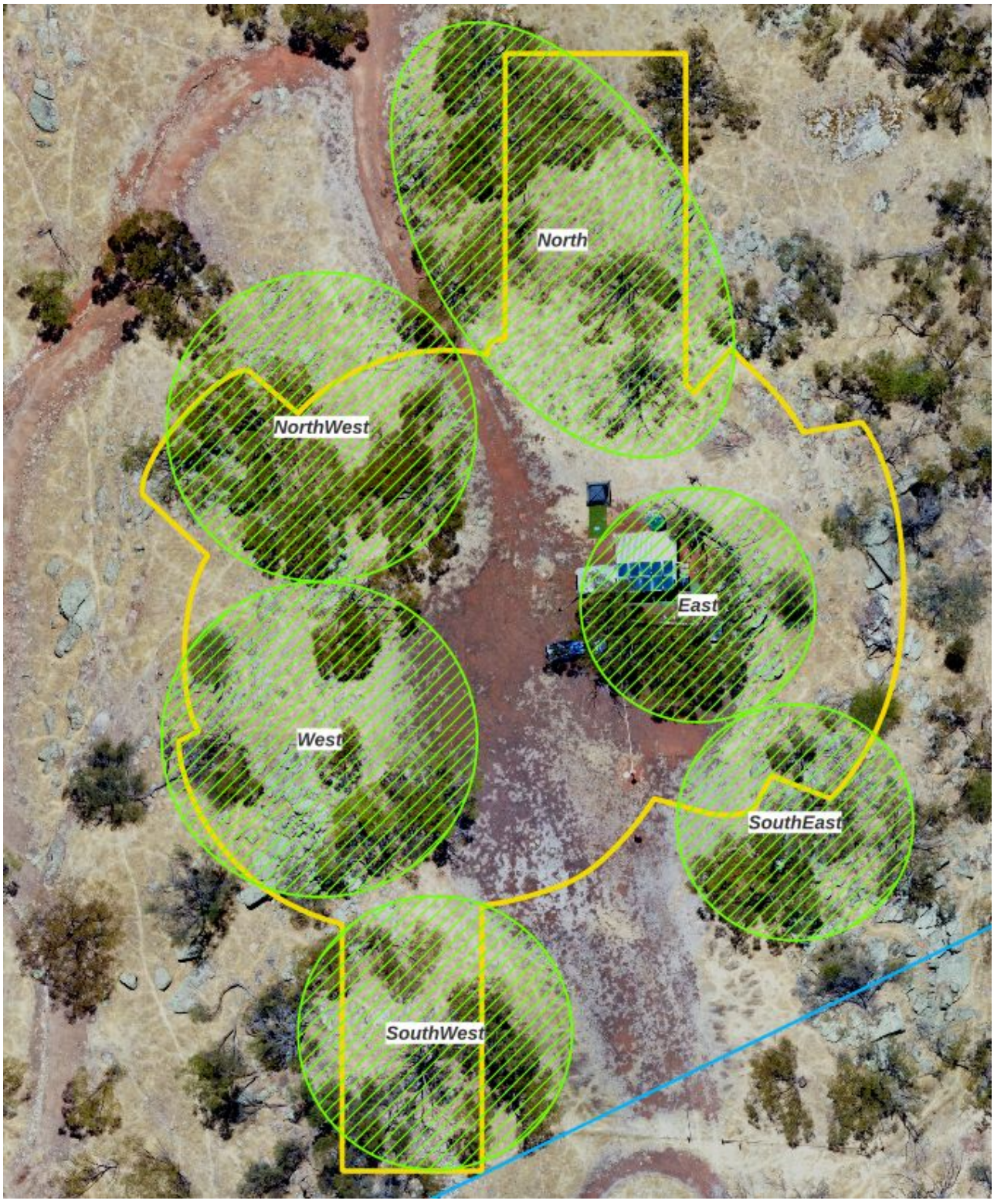

Figure 18: Zones defined in the study area

Figure 19: West side of the North Zone - Looking NNE

Figure 20: East side of the North Zone - Looking NNE

Figure 21: East Zone - Looking NNE

Figure 22: South East Zone - Looking SE

Figure 23: South West Zone - Looking SW

Figure 24: West Zone - Looking West

Figure 25: North West Zone - Looking NW