Pre-clearance survey progress report – November 2024 to July 2025.

South32 Boddington Operations

Ecology Matters Australia Pty Ltd

September 2025

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AUSTRALIA

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1 Introduction

South 32 Worsley Alumina Pty Ltd (Worsley) operates a bauxite mine extending through Boddington, Quindanning and Marradong and is proposing to expand its operations. Ecology Matters Australia (EMA) was commissioned to undertake pre-clearance surveys for Threatened fauna in areas proposed to be cleared.

The four significant taxa considered in this assessment are the three threatened black-cockatoo species that occur in the area:

- Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*); Vulnerable
- Carnaby's Cockatoo (Z*anda latirostris)*; Endangered
- Baudin's Cockatoo (*Zanda baudinii)*; Endangered
- Chuditch (*Dasyurus geoffroii*); Vulnerable.

This report summarises the areas assessed by EMA between February and July 2025, and Bamford Consulting Ecologists (Bamford) in November 2024.

2 Methods

2.1 Survey area

The survey areas are the areas in which potential black-cockatoo nest-tree surveys have been conducted (Figure 2-1). The survey area comprises of a number of polygons totalling 1,109.5 ha, comprising 927.3 ha surveyed by EMA between February and July 2025, and 182.2 ha by Bamford in November 2024.

Occasional, opportunistic surveys are undertaken outside of the provided survey area, where high-value black-cockatoo nest-trees occur, potential black-cockatoo nest-trees, and potential Chuditch ground refugia.

2.2 Black-cockatoo nest-tree terminology

The definition of 'Potential' nest trees in this report is consistent with the use by Bamford (2024). Distinction needs to be drawn between the definition of 'potential' black-cockatoo nest-tree by DAWE (2022) and by BCE.

For the purposes of this report, and unless explicitly stated otherwise, a "potential" nest-tree is one which meets the minimum criterion of DAWE (2022) and/or DCCEEW (2024a, 2024b, 2024c)) and that may or may not bear hollow entrances suited to black-cockatoo breeding. It should be noted that this (unless explicitly stated otherwise) is not the non-hollow-bearing subset of trees that may support black-cockatoo breeding as defined by DAWE (2022); this subset is identified as BCE 'Rank 5' nest-trees (Section 2.3.2.2).

'Potential nest-tree' is used in this report as a general term to indicate that a tree may be of notable value in the context of black-cockatoo breeding.

Similarly, the term 'suitable' is used in this report in a general sense and implies that a tree's characteristics (such as nest-entrance size, height and orientation) fall within the known parameters of trees used by black-cockatoos to breed. It should be noted that this (unless explicitly stated otherwise) is not the hollow-bearing subset of trees that may support black-cockatoo breeding as defined by DAWE (2022); this subset is identified as BCE 'Rank 2 or 3' nest-trees.

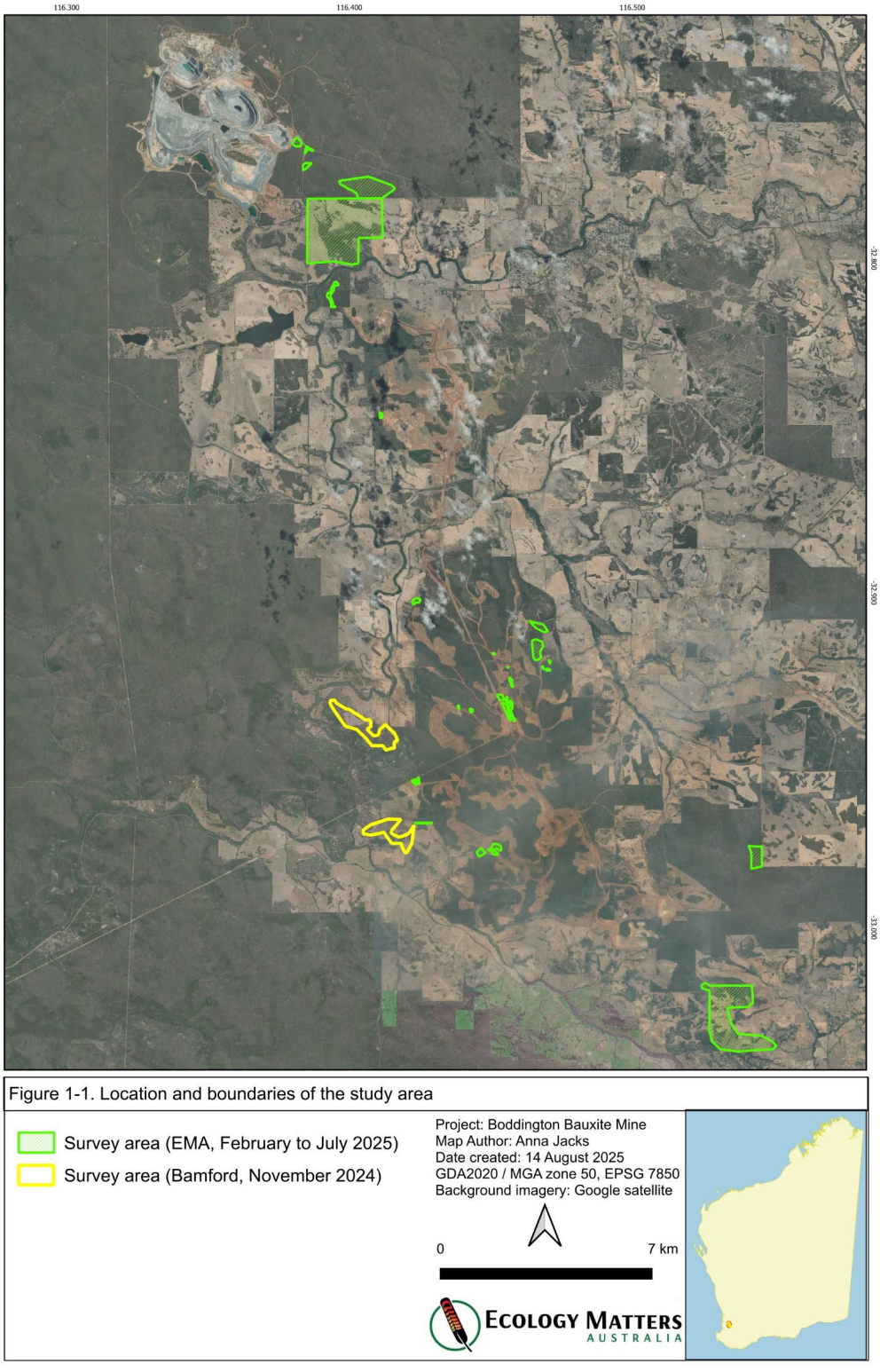

Figure 2-1. Survey area

2.3 Field Assessment

2.3.1 Assessment dates

The assessment dates are presented in Table 2-1.

Table 2-1 Field assessment dates

Date	Area surveyed	Personnel
11 – 13 November 2024	182.2 ha	Tim Gamblin, Nathan Ducker (for BCE)
3 – 7 February 2025	98.2 ha	Jamie Wadey, Tim Gamblin, Nathan Ducker, Joe Porter, Ruby Albury, Andreas Olbrich, Alyse Lupardo
3 – 7 March 2025	273 ha	Jamie Wadey, Tim Gamblin, Nathan Ducker, Joe Porter, Ruby Albury, Andreas Olbrich, Alyse Lupardo
31 March – 4 April 2025	493.9 ha	Jamie Wadey, Tim Gamblin, Nathan Ducker, Alice Reavely, Andreas Olbrich
21 – 25 July 2025	69.1 ha	Tim Gamblin and Nathan Ducker

2.3.2 Black-cockatoo potential nest-trees

2.3.2.1 Guidelines

The Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) provides guidelines for the referral of actions that may result in impact to black-cockatoos (for assessment under the EPBC Act).

The survey and analysis reported here have been conducted with strong reference to both the existing guidelines (DAWE, 2022) as well as the previous guidelines (DEE, 2017). In addition, survey methodology followed the recommendations listed on the DCCEEW's Species Profile and Threats Database (DCCEEW, 2024a, 2024b, 2024c). Ecological values for black-cockatoos within the site were based on the definitions of breeding habitat as per the EPBC Act referral guidelines for black-cockatoos (DAWE, 2022).

The DBCA has also indicated that the methodology developed and applied previously by BCE (e.g. Bancroft and Bamford 2021), and as described below, is an acceptable approach to score nesting value.

2.3.2.2 Potential nest-trees

The aim of the potential nest-tree surveys was to assess the survey area for potential hollow-bearing nest-trees (suitable for black-cockatoo nesting). All trees that were considered known, suitable or potential nest-trees as defined in the DAWE (2022)) guidance document were assessed (Rank 1, 2, 3, 4 and 5 trees as explained in Table 1). This, in effect, includes trees with unsuitable hollows (size, height or orientation) and those with no hollows that still meet minimum tree diameter criteria outlined in the guidance. Recording of potential habitat trees with a rank 1 to 3 was done throughout the survey areas. Recording of all potential habitat trees (rank 1 to 5) trees was undertaken in large forest blocks to provide a representative density of trees in the forest block.

The hollows recorded during the survey have not been verified by a camera survey of potential hollows. Therefore the ranks (particularly rank 2 and 3), remain tentative until confirmation of within hollow inspection using a camera.

Where, applicable, the following information was recorded for every potential tree with a diameter at breast height (DBH) equal to or greater than 500 mm (or equal to or greater than 300 mm for *Eucalyptus accedens* and *E. wandoo*):

- Tree location (using a handheld GPS);
- Tree species;
- Life status;
- DBH (to the nearest 100 mm); and
- Nest-tree rank: trees were assessed (from the ground) for the potential presence/quality of nest-hollows and allocated a nesting rank (Table 1)
- hollow orientation (chimney/side entrance/spout etc) and subjective value (standard, very good or excellent).

Table 2-2 Ranking system for the assessment of potential nest-trees for black-cockatoos (BCE, 2024)

Rank	Description of tree and hollows/activity
1	Potential nesting tree (DBH >300mm for Wandoo and Powderbark Wandoo, and >500 mm for all other eucalypts) with 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, eggs or feathers in hollow is observed.
2	Potential nesting tree (DBH >300mm for Wandoo and Powderbark Wandoo, and >500 mm for all other eucalypts) with hollow of suitable size visible with chew marks around entrance. Record if chew-marks are recent or old. Note: Chew marks are not always present (or at least visible) around a hollow used by black-cockatoos.
3	Potential nesting tree (DBH >300mm for Wandoo and Powderbark Wandoo, and >500 mm for all other eucalypts) with a 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 Cockatoo will nest in hollows <5m so in a Wheatbelt breeding site a lower criterion may be more appropriate. Note: 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.
4	Potential nesting tree (DBH >300mm for Wandoo and Powderbark Wandoo, and >500 mm for all other eucalypts) 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	Potential nesting tree (DBH >300mm for Wandoo and Powderbark Wandoo, and >500 mm for all other eucalypts). Tree lacking large hollows or broken branches that might have large hollows; a tree with more or less intact branches and a spreading crown.

2.3.3 Ground refugia (Chuditch)

Key aspects are required for Chuditch survival in an area. These include adequate den resources such as hollow logs, burrows or rock crevices (DEC 2012). In order to quantify the availability of ground-based refugia that may provide shelter/denning sites for Chuditch, systematic quadrat surveys were

conducted in conjunction with black-cockatoo potential nest-tree assessments. 25 m square quadrats were stratified across the survey areas. For each quadrat, the number of potential ground-based refugia were categorised and counted. The following categories of potential refugia were recognised:

- Solid log – a fallen log that is not hollow (or has an internal hollow with a diameter of less than 150mm) and does not provide any shelter-sites that are suitable for use by Chuditch. While currently not-suited to use by Chuditch, these logs may develop usable refugia into the future (e.g. through the action of fire, termites, burrowing species, etc.);
- Refuge log – a fallen log that is otherwise 'solid' (i.e. without a hollow core) but that provides a shelter site that is deemed of a size suitable for use by Chuditch. These shelter sites include overhangs, burnt 'pockets' or semi-burrow-like structures at the interface of the log base with the ground surface;
- Hollow log – a fallen log that has an internally hollow core of a suitable diameter (greater than 150mm preferably with a chamber of >300mm) for use by Chuditch;
- Buttress hollow – a hollow, shelter-site or burrow-like structure that is created by, or beneath, the buttress roots of a standing tree or stump and is deemed of a size suitable for use by Chuditch.
- Rock pile – a grouping of rocks that provide a crevices or inter-rock space that is deemed of a size suitable for use by Chuditch.

Example photographs of each of these categories are provided in Appendix 1.

The above categories were further classified into two size classes. Logs (or structures) that have a diameter:

i. between 300 mm and 500 mm;
ii. greater than 500 mm.

Fallen timber with a diameter of less than 300 mm was not considered suitable for use by Chuditch and was not included in the assessment.

It should be noted that logs may have been either naturally fallen or the result of timber-cutting activities (but that this is unlikely to affect use by Chuditch).

The above assessment allowed the calculation of a (current) potential ground-refugia density (i.e. by summing all refugia categories with the exception of 'solid logs' and standardising for area surveyed). This can then be used to compare survey blocks or extrapolate to include unsurveyed areas, if required.

2.3.4 Other conservation significant fauna

During the survey, evidence or suitable habitat for conservation significant species were opportunistically recorded (such as Peregrine Falcon nests, Woylie thickets, Malleefowl mounds).

2.3.5 Opportunistic observations

At all times, observations of fauna were noted when they contributed to the accumulation of information on the fauna of the site; this was particularly important when relating to conservation significant or feral species. These included such casual observations as reptiles, birds or mammals seen while travelling through and near the site.

2.4 Personnel

Personnel involved in the field investigations and report preparation are listed in Table 2-3.

Table 2-3 Personnel involved in the field investigations and report preparation

Personnel	Consulting Experience	Field Investigations	Report Preparation
Dr Jamie Wadey	BSc (Zoology/Ecology), Hons (Ecology), PhD (Movement Ecology)	10 years	Y
Mr Tim Gamblin	BSc (Zoology), Cert Env Mngmt	20 years	
Alice Reaveley	BSc (Zoology)	20 years	
Mr Nathan Ducker	Bed	3 years	
Ruby Albury	BSc (Zoology)	7 years	
Joe Porter	BSc (Zoology)	7 years	
Alyse Lupardo	BSc (Zoology)	3 years	
Andreas Olbrich	BSc (Zoology)	1 year	
Anna Jacks	BSc (Env. Sci.), Hons (Biol.)	20 years	Y

3 Results

3.1 Potential black-cockatoo nest-trees

A total of 1,570 potential black-cockatoo nest-trees were recorded between November 2024 and July 2025. A summary of the numbers of potential nest-trees of each species recorded in each ranking category is shown in Table 3-1. The majority of Potential nest-trees recorded were Rank 3 (trees with potentially suitable hollows). No Rank 1 hollows were recorded. The average DBH of potential nest-trees was 688 mm, and the median was 500 mm, with most trees recorded falling into the category of 500 to 599 mm (Figure 3-1). The locations of all potential nest-trees are shown in Figure 3-2 to Figure 3-4.

Previous surveys of potential black-cockatoo nest-tree within the Boddington area were undertaken between February 2023 and September 2024 (Bamford, 2024). From these surveys, a total of 1,654 ha was surveyed for high-value black-cockatoo nest-trees (Ranks 1, 2 and 3) and of this, 328 ha was surveyed for all trees which meet the requirements for Ranks 1 to 5.

Some survey work was also conducted in October 2022 by Bamford, but that the data for this survey is not available.

Table 3-1. The number of potential nest trees of each species in each nest-tree rank category recorded between November 2024 and July 2025.

Rank	Jarrah	Marri	Wandoo	Eucalyptus sp.	Total
2	3	1	2		6
3	767	107	181	3	1,058
4	21	5	2		28
5	285	110	83		478
Total	1,076	223	268	3	1,570

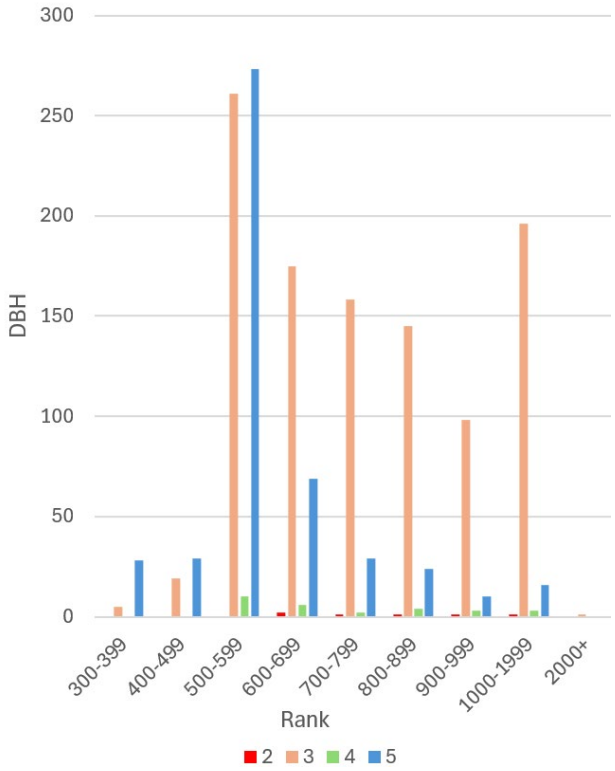

Figure 3-1. Ranks of potential nest trees in relation to DBH

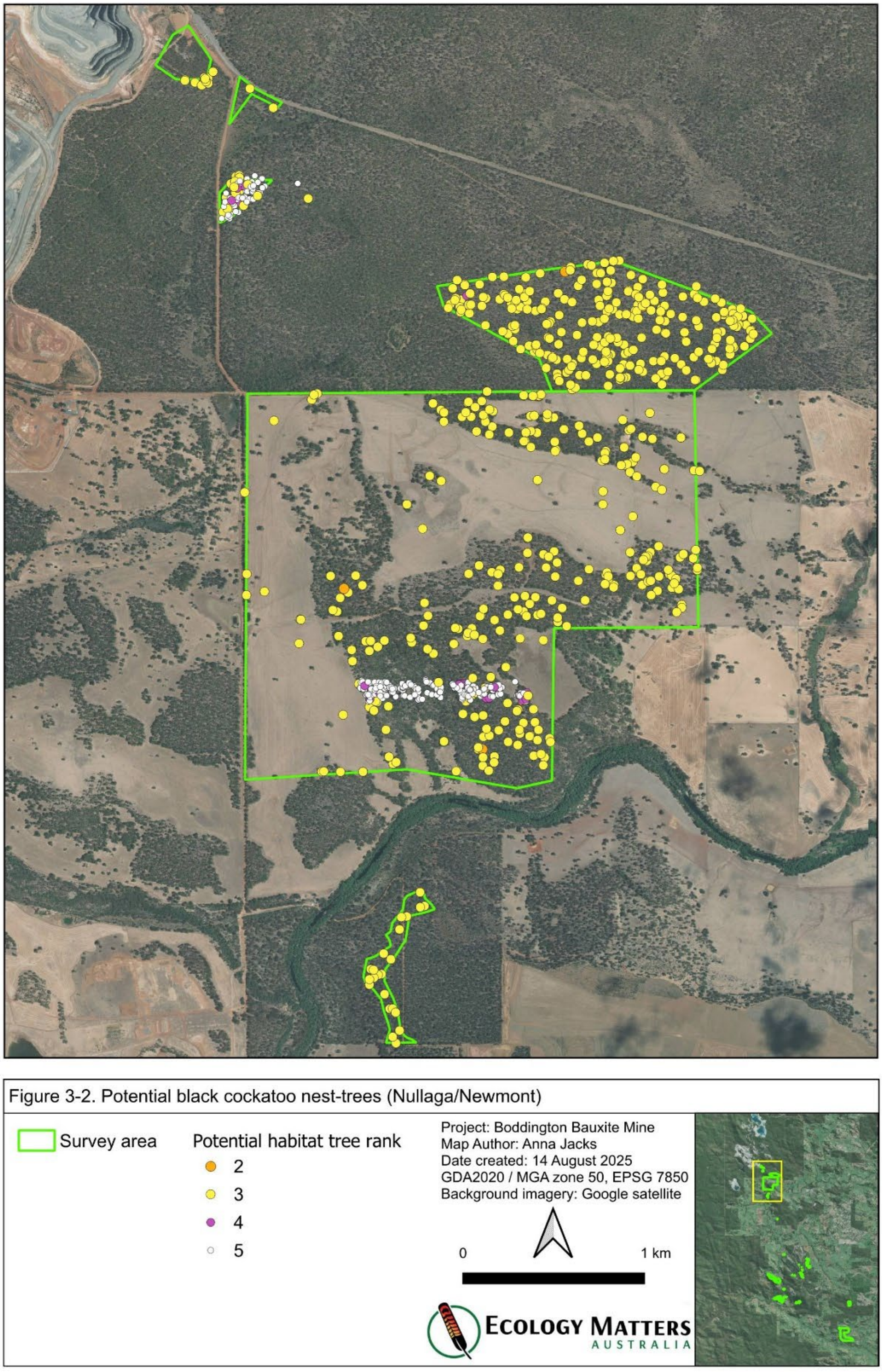

Figure 3-2. Potential black-cockatoo nest-trees (Nullaga/Newmont)

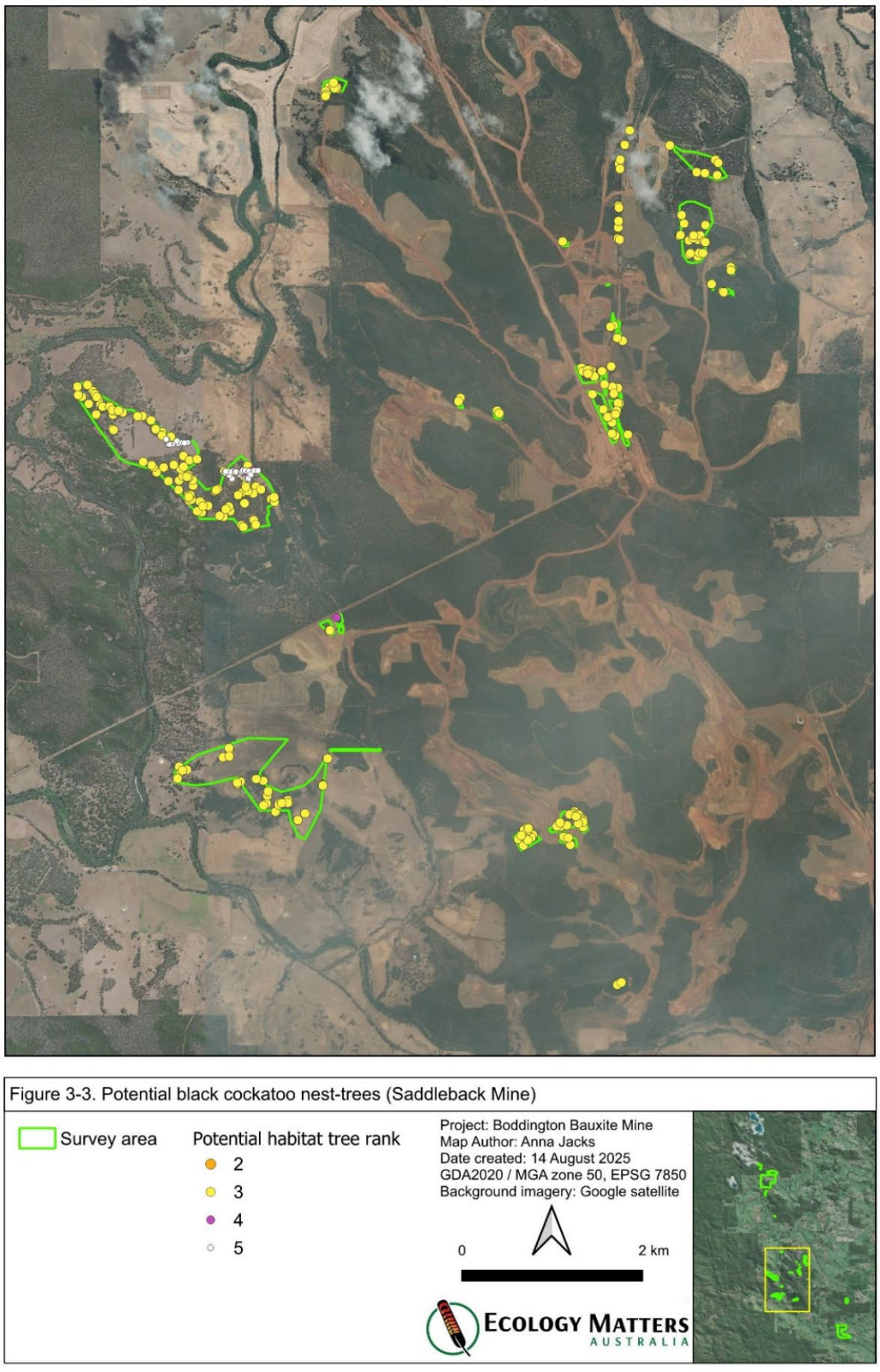

Figure 3-3. Potential black-cockatoo nest-trees (Saddleback Mine)

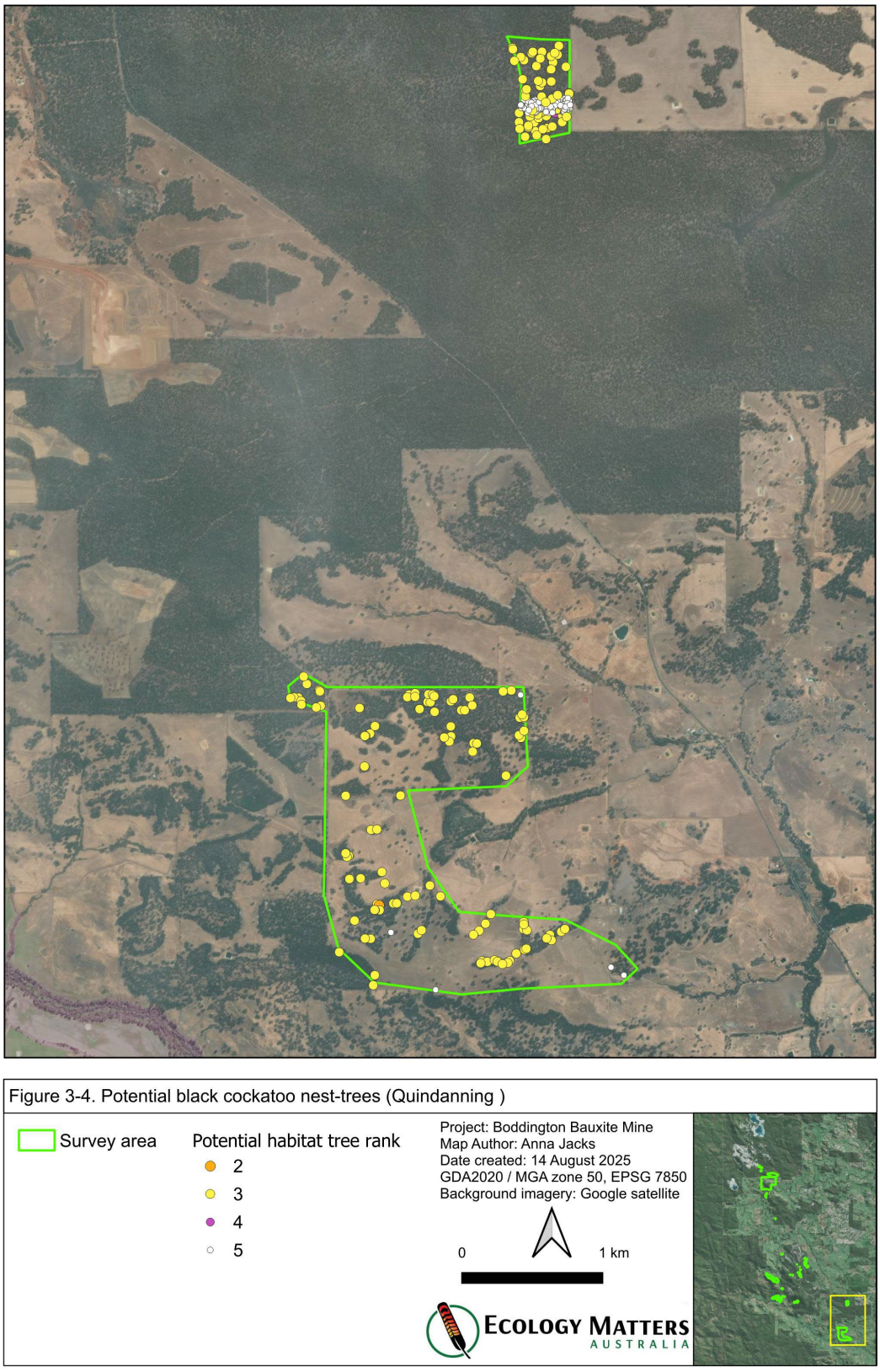

Figure 3-4. Potential black-cockatoo nest-trees (Quindanning)

3.2 Ground refugia (Chuditch)

A total of 89 ground refugia quadrats have been assessed across the survey area between February and July 2025. Of these, 62 contained refugia for Chuditch (Figure 3-5). There was an average of 2.4 refugia type per quadrat, with solid logs being the most common refugia type within each quadrat, followed by refuge logs (Figure 3-5 and Figure 3-6). A further 28 were surveyed west of Saddleback Mine in November 2024 by Bamford, of which 13 contained between one and three refugia for Chuditch and 15 had no refugia.

The locations of all quadrats are shown in Figure 3-7 to Figure 3-9.

Previous surveys up to September 2024 placed 669 ground refugia quadrats in areas adjacent to the survey area (Bamford, 2024).

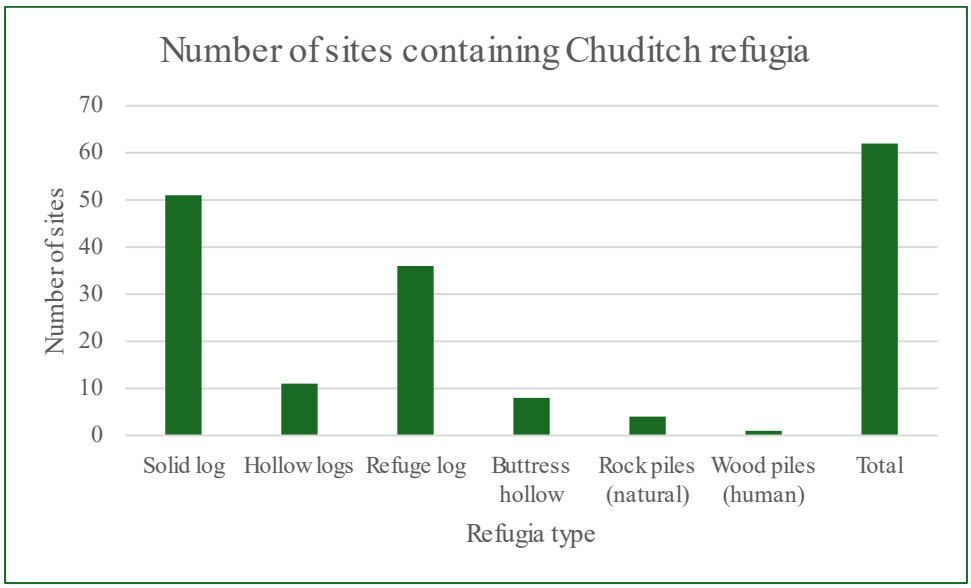

Figure 3-5. Number of sites containing Chuditch refugia (Feb to July 2025)

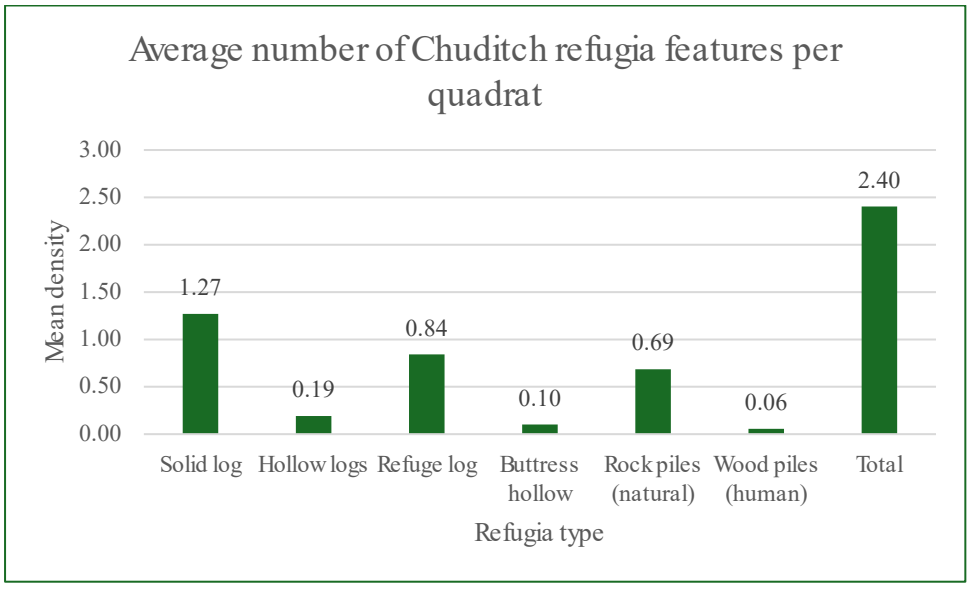

Figure 3-6. Average number of Chuditch refugia features per quadrat (Feb to July 2025)

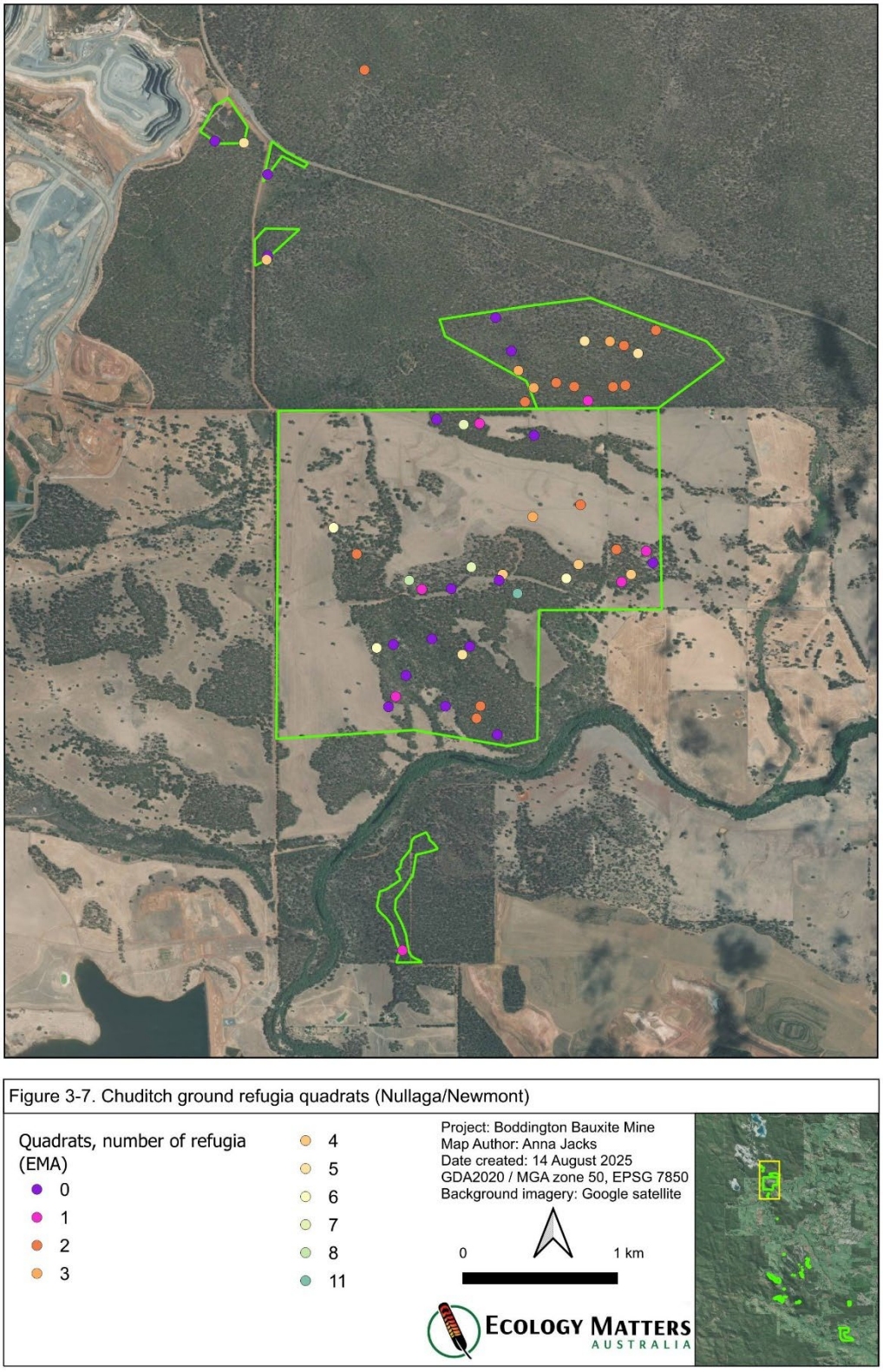

Figure 3-7. Chuditch ground refugia quadrats (Nullaga/Newmont)

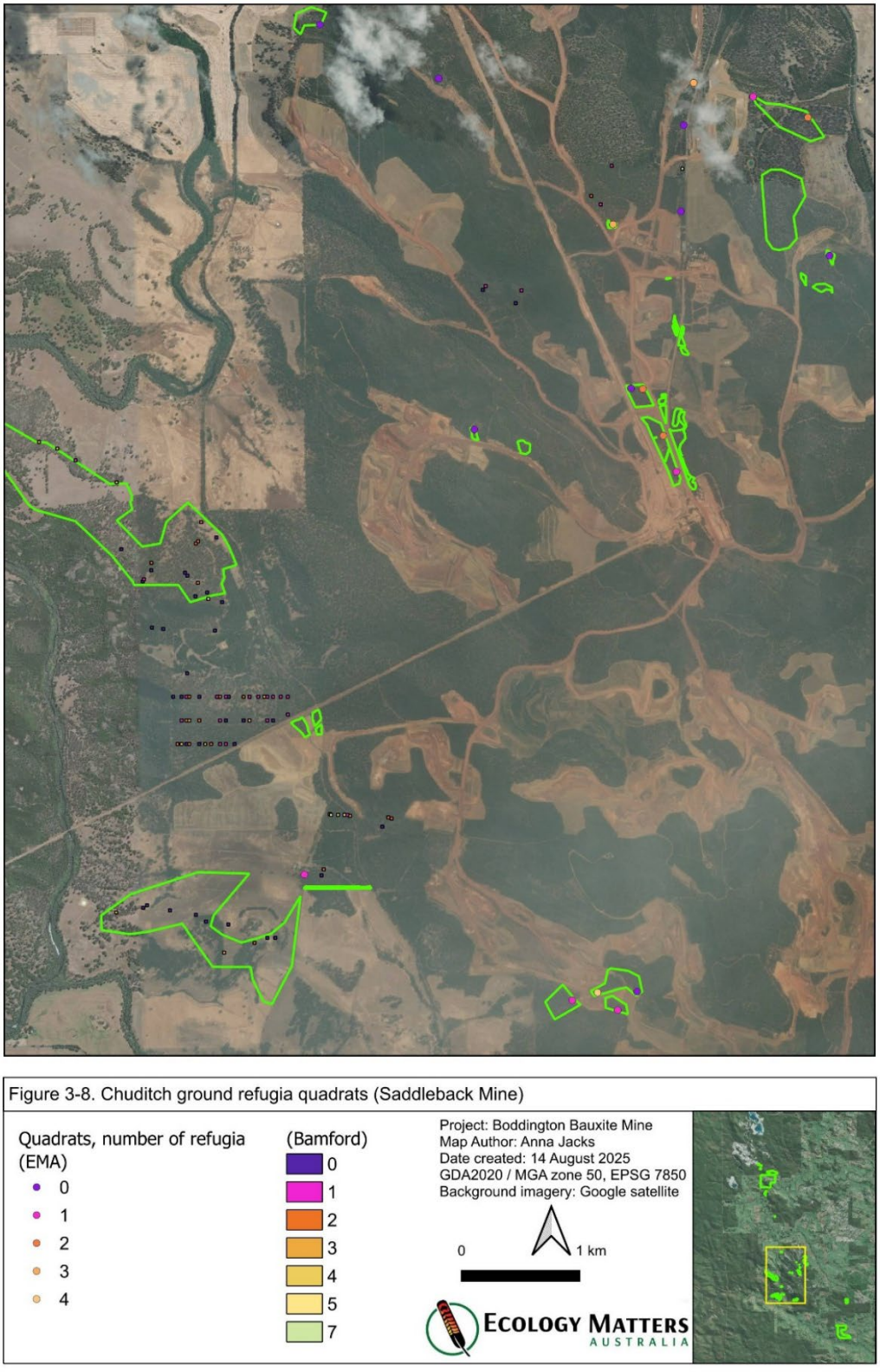

Figure 3-8. Chuditch ground refugia quadrats (Saddleback Mine)

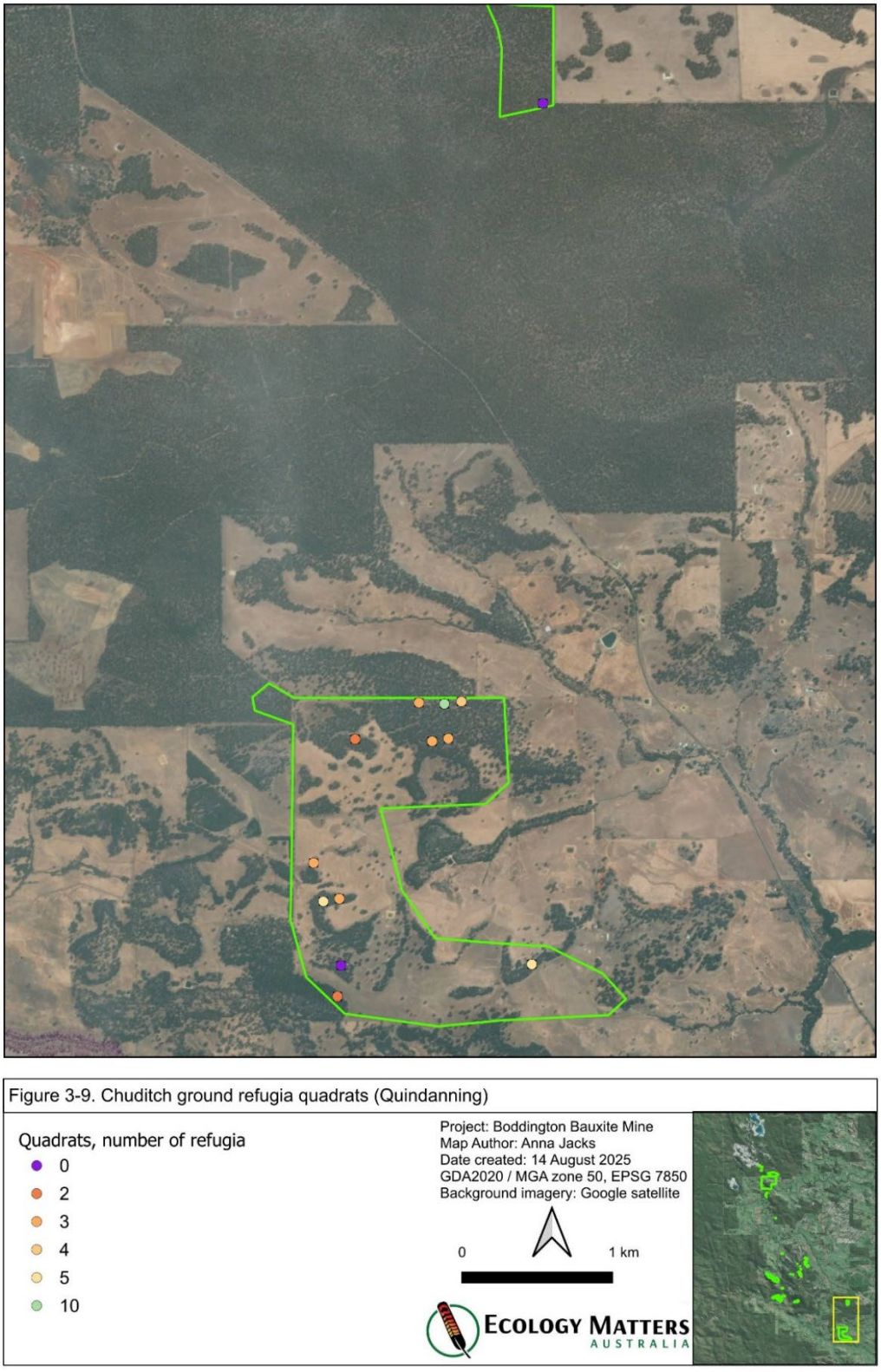

Figure 3-9. Chuditch ground refugia quadrats (Quindanning)

4 References

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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, Australian Capital Territory.

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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, Canberra, Australian Capital Territory.

Appendix 1. Example photographs of ground refugia 'types'.

Solid Log

Refuge Log

Hollow Log

Buttress Hollow

Rock Pile

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