Black-Cockatoo Artificial Hollow Installation and Monitoring
Gibbs Offset Property

Part A: Site Assessment

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AUSTRALIA

Ecology Matters Australia Pty Ltd

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Black-Cockatoo Artificial Hollow Installation and Monitoring on Gibbs Offset Property

Part A: Site Assessment

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Images on front cover: Forest red-tailed black-cockatoos congregating in a tree after rain at the site (photo: Jamie Wadey); foraging evidence on Marri nut by Forest red-tailed black-cockatoo (photo: Nathan Ducker).

Contents

1 Introduction

1.1 Background

South32 Worsley Alumina Pty Ltd (S32) has a proposal currently under assessment by the Environmental Protection Authority (EPA) to expand its bauxite mining operations near Boddington. As part of the Environmental Impact Assessment process, a number of Offset Implementation Plans have been prepared to support the Biodiversity Offset Plan. S32 has committed to installing 72 artificial breeding hollows for black-cockatoos to offset disturbance of 24 high-potential black-cockatoo habitat trees. S32 has procured a number of COCKATUBEs® ('cockatubes') as recommended by BirdLife Australia (built by SJ Landcare) and in addition are trialing a novel black-cockatoo nest box designed by Habitat Innovations (modular artificial hollow or 'MAH'). The latter nest boxes are being trialed in order to investigate uptake by forest red-tailed black-cockatoos which have not exhibited high success rate in cockatubes in the southwest.

S32 has requested Ecology Matters Australia Pty Ltd (EMA) to provide a proposal to conduct a site assessment of the Gibbs Offset Property (the site) to assess the suitability of the site for installing the above-mentioned artificial hollows for use by forest red-tailed black-cockatoos, followed by recommendations on installation design. The current report describes findings regarding suitability of the site for artificial hollows (based on a desktop review and site visit), as well as recommendations for installation design.

1.2 Forest red-tailed black-cockatoo

In southwest Western Australia, the forest red-tailed black cockatoo (*Calyptorhynchus banksii naso*) is listed as Vulnerable under the federal Environment Protection and Biodiversity Conservation Act (1999) and on Schedule 2 Division 3 (Vulnerable) under the Western Australia Biodiversity Conservation Act (2016). Forest red-tailed black cockatoos face several major threats, including a shortage of suitable nesting hollows because of habitat loss and damage, a lack of new trees with hollows, and competition of hollows with galahs, corellas, and feral European honeybees (DBCA, 2023). Artificial hollows provide an opportunity to alleviate the decreasing number of natural hollows (DBCA 2023), however, there is limited success with forest red-tailed black cockatoos. Very little is known about their breeding choices in natural hollows. One of the few studies that exists found the average height of natural hollows to be 14.49 m from the ground (Johnstone et. al. 2013) and theorized the clustering of nests found in the landscape was due to the importance of social interactions within the flock (Johnstone et. al. 2013).

1.3 Survey area

The Gibbs Offset Property is 518 hectares in size and located approximately 18 km south of Boddington in Western Australia. Nearly half is cleared with the remainder remnant vegetation or rehabilitated areas. The previous study by Biologic (2024) reported seven habitat types within the survey:

- Cleared (246.31 ha, 47.53%);
- Jarrah Woodland (103.13 ha, 19.90%);
- Rehabilitated (60.12 ha, 11.60%);

- Wandoo Woodland (52.55 ha, 10.14%);
- Drainage Area/ Drainage Line (48.04 ha, 9.27%);
- Acacia Woodland (5.92 ha, 1.14%); and
- Marri Woodland (2.12 ha, 0.41%).

1.4 Criteria for suitable site

DBCA (2023) list five criteria for a site to be considered suitable for installation of artificial hollows:

1. Site is eucalypt woodland within breeding range.
2. Breeding is known or suspected at site and there is evidence of lack of suitable hollows within the site.
3. Artificial hollows can be installed close to feeding areas (within 12 km).
4. Site manager is committed to ensuring long-term security and annual maintenance of hollows.
5. A suitable artificial hollow design is used.

In addition, DBCA (2023) state that artificial hollows which were installed within 2 km of known breeding were regularly taken up. These criteria are largely based on studies on Carnaby's black-cockatoo, but given the similar requirements of the forest red-tailed black-cockatoo, the criteria provide a basis for understanding important features of an artificial hollow site.

1.5 Artificial hollows

1.5.1 Description of artificial hollows

Two artificial hollows are discussed here – the cockatube and the modular artificial hollow (MAH) by Habitat Innovations.

The cockatube is an artificial hollow that has been designed specifically for black-cockatoos and developed through research by SJ Landcare Inc. in collaboration with the WA Museum and the Department of Parks and Wildlife (DPAW). This artificial hollow was designed for all species of black-cockatoo found in Western Australia, however, they have been successfully used Australia-wide (SJ Landcare 2024). The cockatube has been estimated to last over 50 years if annual maintenance is undertaken (DBCA 2023; Saunders et. al. 2023).

The main components of a cockatube are:

- Polyproplene pipe (375mm internal diameter and 1200mm length), double-walled.
- Galvanised chain; to attach to tree.
- Internal ladder; to allow entering and exiting.
- Chewing post (untreated Jarrah, Marri, Wandoo); important for cockatoos.

The MAH by Habitat Innovations was designed specifically for the gang-gang cockatoo (*Callocephalon fimbriatum*), however, it has been suggested to be suitable for all black-cockatoos. The main components of the MAH are:

- Polyproplene pipe, double-walled.
- Mounting bracket.
- Timber-lined internal chamber.

The three main differences between a cockatube and the MAH are:

1) The hollow entrance in a cockatube is open (same size as the hollow diameter: 375mm), while the MAH can be customised to the diameter of the black-cockatoo.
2) Attachment of the cockatube can be either by chain or looped fork (see following section), while the MAH uses a mounting bracket designed to allow the tree to scar or grow over it.
3) The cockatube uses a wooden post for chewing, while the MAH hollow lines the inside of the hollow with wood and exposes a section of the trunk of the tree to the nesting chamber.

1.5.2 Methods of installation

In Western Australia, two common methods for attaching artificial hollows to trees for black-cockatoos are:

1) Chains - securing to the tree with large, linked chains and timber hex head screws (DBCA 2023). This can be installed anywhere on the trunk and the trunk can be slightly off-vertical. Figure 1-1 shows an example of a cockatube installed using this method.

2) Looped Fork - securing to the tree with a rubber protected wire that loops between a fork of a tree or opposing branch on a vertical trunk (Biodiversity Conservation Trust, 2020; Cherriman, S.C. 2015; Hollow Log Holmes, 2024). This requires a completely vertical trunk with a fork or opposing branch at installation height. Figure 1-2 shows an example of a nest box installed using this method.

An additional method that has not been extensively utilised in Western Australia for black-cockatoos is:

3) Mounting bracket – secures to the tree with a plate and four large timber screws as with the MAH by Habitat Innovations, which uses a mounting plate with four large timber screws to which the artificial hollow attaches to.

There are pros and cons to each installation method and these are described in Table 1-1 below.

Table 1-1. Pro and cons of different artificial hollow installation methods

Method	Pros	Cons
1 – Chains	• Time-efficient • Greater number of suitable trees available because of flexible installation position. Any tree suitable for method 2 will be suitable for method 1.	• Potential to impact tree health due to use of screws into tree, and chains will become tighter as tree grows, potentially causing stress to tree or causing chain to break with consequent hollow detachment; however, the latter has not been documented to occur as yet.
2 – Looped Fork	• Supports tree health due to lack of screws into tree and protected wire which can 'grow' with tree.	• Fewer number of suitable trees because of opposing fork/branch requirement.
3 - Mounting Bracket	• Greater number of suitable trees available because of flexible installation position. • Can 'grow' with tree.	• Currently limited to use only with artificial hollows by Habitat Innovations. • Potential to impact tree health due to need to scar the tree and use of screws into tree.

Figure 1-1 Installation of artificial hollow (Cockatube®) by attaching to the tree with chains (attachment method 1). Photo R.Dawson (DBCA 2023).

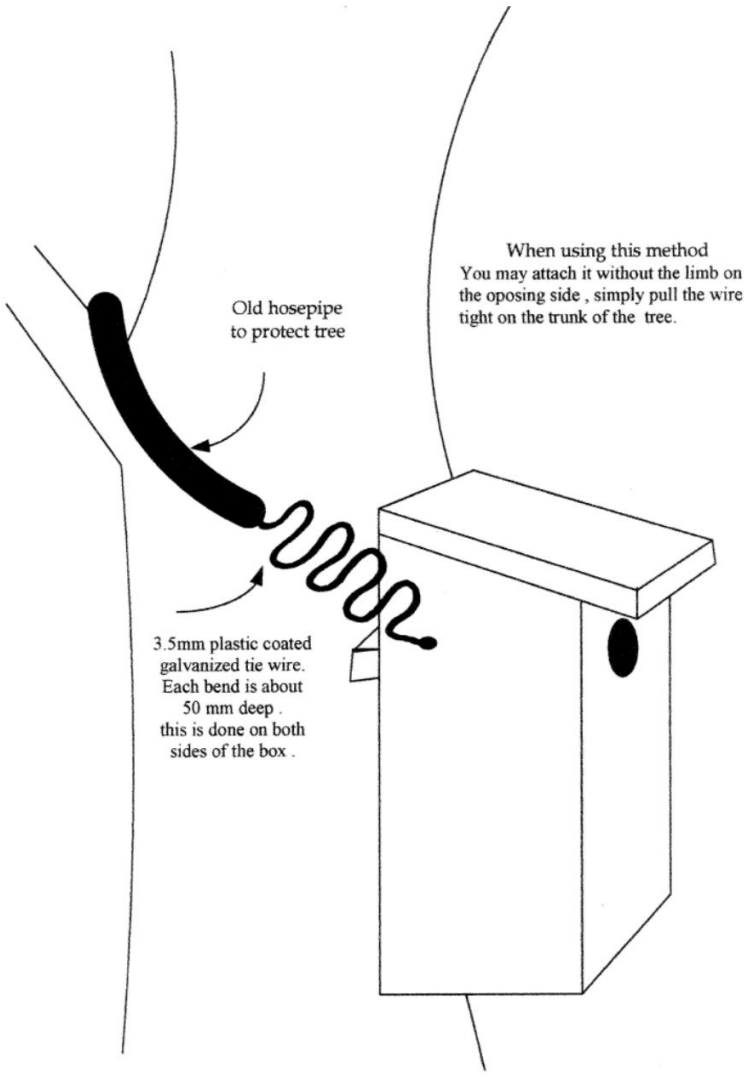

Figure 1-2. Installing using the looped fork method (Hollow Log Homes, 2024)

2 Methods

2.1 Personnel

Personnel involved in this assessment are listed in Table 2-1.

Table 2-1. Personnel involved in the current assessment.

Name and qualifications	Experience	Field investigations	Report preparation
Dr Jamie Wadey (BSc., Hons., PhD.)	10 years' experience	+	+
Nathan Ducker (B.Ed., Env.Ed)	4 years' experience	+	
Natalia Huang (BSc., Hons., MBA)	18 years' experience		+
Dr Amanda Kristancic (BSc., Hons., PhD.)	10 years' experience		+

2.2 Desktop study

The desktop study involved assessing the suitability of the site for artificial hollow installation in the context of the greater landscape. This involved understanding the proximity of known breeding and roosting sites to the survey area through examination of existing data. Understanding the distance to known breeding locations is important as it has been reported that artificial hollows that have been installed within 2 km of known breeding are regularly taken up by Carnaby's black-cockatoos (DBCA 2023).

S32 have conducted extensive surveys throughout the greater landscape with previous survey reports on black-cockatoos retrieved from the S32 mining expansion proposal assessment on the Environmental Protection Agency website (www.epa.wa.gov.au). In addition, Biologic (2024) undertook a basic fauna assessment with targeted survey for black-cockatoos within the survey area, which included full desktop assessment and literature review, including database searches such as breeding and roosting data from BirdLife.

Information regarding black-cockatoo records and known breeding and roosting locations in the region was obtained from previous reports. Recent black-cockatoo breeding data from an adjacent area was obtained and used with permission from S32 Worsley Alumina Pty Ltd (Black-cockatoo Breeding Tree Survey of the Quindanning Timber Reserve Unpublished data 2023). A summary of previous reports and data on breeding and roosting in the area is given in Table 2-2.

Table 2-2. Previous reports and data regarding known breeding and roosting locations for black-cockatoos.

Reference/Title	Findings
S32 Worsley Alumina Pty Ltd (Black-cockatoo Breeding Tree Survey of the Quindanning Timber Reserve Unpublished data. Bamford Consulting Ecologists. 2023.	Confirmed breeding hollow (forest red-tailed black-cockatoo) 2.3 km of current site, and four suitable hollow with chew marks indicating likely use by black-cockatoos) trees within 1-2 km of current site.
Bamford Consulting Ecologists (2023). South32 Collie Offset Areas Threatened Fauna Assessment	Survey area c. 50 to 60 km from current site. 5 active black-cockatoo nests observed; estimated via extrapolation that 89 active black-cockatoo nests expected across entire survey area.
Phoenix 2021. Black Cockatoo Breeding Habitat Assessment for the Worsley Mine Expansion Project Prepared for South32,	One confirmed breeding nest (forest red-tailed black-cockatoo) within 1.5 km of boundary of current site. Seven additional confirmed breeding hollows (6x forest red-

Reference/Title	Findings
Perth, Western Australia	tailed black-cockatoo and 1x Carnaby's black-cockatoo) c. 4-6 km from current site.
Phoenix Environmental Sciences (2023). Black Cockatoo breeding habitat assessment for the Worsley Mine Expansion Project	Based on desktop/database results: - Confirmed Carnaby's black-cockatoo breeding area within c. 10 km of current site - Three confirmed breeding trees within c. 1 km of current site (Worsley pre-clearance surveys database) - Additional five confirmed breeding trees within c. 5 km (Worsley pre-clearance surveys database)
Biostat (2021). Worsley Mine Expansion, Offset Fauna Habitat Assessment, Ecological Values	Offset Area C is c. 6 km from current site, Areas A and B c. 12 km from current site. Offset Areas A and B: evidence of foraging by forest red-tailed black-cockatoo. Likely to contain nesting hollows. Offset Area C: minimal foraging habitat, unlikely to contain sufficient hollows to support breeding.
Biologic (2024). Gibbs Offset Property, Quindanning, Targeted Vertebrate Fauna Survey	Only provided information about potential black-cockatoo breeding trees (not known locations of confirmed breeding). Estimated that there are 133 potential breeding trees within the site. Known roosting sites from desktop: Carnaby's: two within 8 km Baudin's: two within 8km forest red-tailed: one c. 5 km away
BirdLife Australia (2023), black-cockatoo roosting dataset	Forest red-tailed black-cockatoos: two confirmed roost sites within 6 km (one is a joint roost) White-tailed black-cockatoos: 2 confirmed roost sites within 8 km (one is a joint roost)

2.3 Field component

The site was visited from 29th July to 2nd August by Jamie Wadey and Nathan Ducker; GPS tracks are shown in Figure 2-1. The field investigations involved:

- Assessing habitat throughout the site, including foraging habitat.
- Assessing suitability of the site for installation of artificial hollows.
- Revisiting trees which were previously identified by Biologic (2024) as 'suitable' for breeding to conduct a breeding assessment on them.
- Conducting roost surveys.
- Identification of at least 100 trees that are suitable for installation of artificial hollows, including ground-truthing of access for elevated work platform (EWP) for use during installation of artificial hollows.

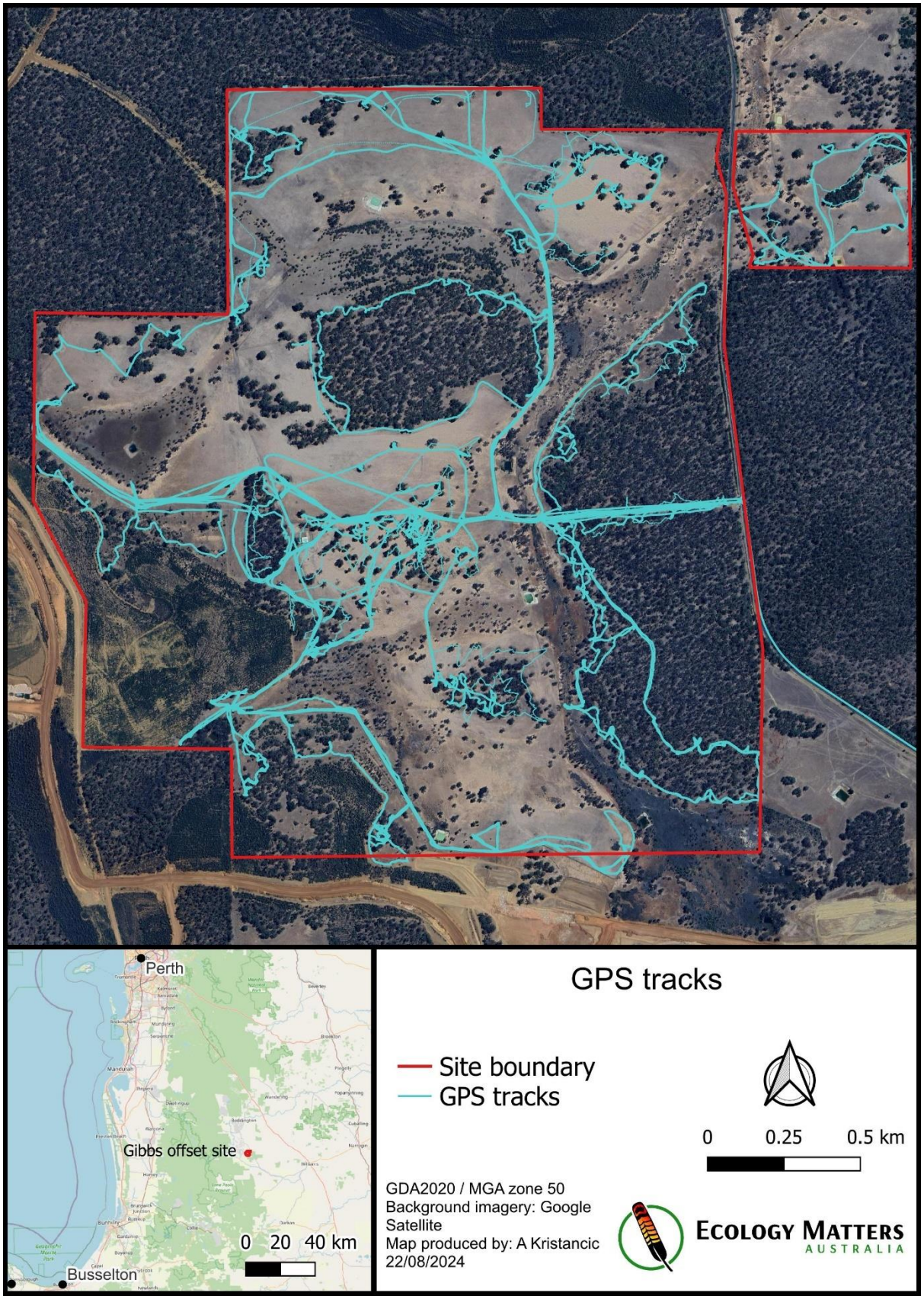

Figure 2-1. GPS tracks of Ecology Matters personnel during field investigations.

2.3.1 Roosting assessment

Potential roost locations were identified by the presence of build-up of faecal deposits on the ground under the tree or by visual observation of birds congregating in trees around sunset. Across the four-day survey potential roost locations were observed in the evenings during or after sunset and again in the early mornings (prior to sunrise). This allowed confirmation of the exact locations where black-cockatoos were roosting overnight.

2.3.2 Nesting assessment

Trees identified by Biologic (2024) as 'suitable' breeding trees (n = 3) were visited to examine if it was currently being used by black-cockatoo. This involved tapping on the outside of each tree to flush possible occupants. In addition, any trees with suitable hollows (based on ground observation) were tapped as part of the survey. These trees were opportunistically encountered throughout the site visit. Trees identified by Biologic (2024) as 'possible' breeding trees (n = 25) could not be revisited as coordinates for their locations could not be obtained. All trees assessed for installation were examined for the presence of any hollows which may be suitable for black-cockatoos.

2.3.3 Identification of suitable trees for installation of artificial hollows

Certain characteristics are required or preferred when identifying suitable trees for installation of artificial hollows; this is based on guidance (DBCA 2023), expert advice and client preferences. For the current assessment, the following attributes were the minimum requirements for a tree to be considered a candidate for installation of an artificial hollow:

- Tree in good health (tree appeared completely healthy with full foliage; dead or partly-dead trees were excluded).
- Accessible via light vehicle, ground relatively level and there were no significant obstacles (such as large rocks or fallen branches) around the base of the tree.
- Trunk of tree vertical or almost vertical with opposing limb to allow installation at suitable height (between 5-20 m from the ground) for the Looped Fork installation method.
- Diameter of the tree at installation height (DIH) of at least 200 mm. Trees that were narrower than 200 mm at installation height were excluded (as per recommendation by S. Cherriman, pers. comm.).
- Foliage cover of tree or density of surrounding trees sufficient to provide shade to artificial hollow. Isolated paddock trees were excluded unless they had sufficient foliage cover to provide shade for the artificial hollow.

Trees that met the minimum requirements were then awarded grades (A, B or C) according to how suitable they were for hollow installation based on suitability for black-cockatoos (height of hollow, sufficient shading of hollow) and ease of installation (access, trunk and opposing limb attributes). Grade A trees were considered the most ideal tree for hollow installation. The factors considered when grading trees are given in Table 2-3.

Table 2-3. Features considered when grading trees for installation of artificial hollows.

Tree grades were A: met all four criteria; B: met two or three criteria and C: met only one criterion.

Feature	Description
Access	Good access. Vehicle and elevated work platform can be driven directly to the tree with no obstacles to navigate around; clear line of sight from ground to installation point on tree; no small branches that may impede vertical movement of elevated work platform from ground to installation point.
Trunk	Trunk at installation point completely vertical.
Height of installation point	Height of installation point is at least 10 m above the ground.
Orientation of installation point	Artificial hollow can be installed with south or south-east orientation.

An example of a tree that met the minimum requirements is shown in Plate 1, with the proposed installation point and opposing branch used for installation purposes highlighted in yellow. This tree was awarded a Grade A based on it having good access, with vertical trunk at least 10 m above ground and with hollow facing south or south-east.

Plate 1 Tree suitable for installation of artificial hollow, with proposed installation point and opposing branch (used for installation purposes) highlighted in yellow. This tree was classed as a Grade A tree.

3 Results

3.1 Identification of suitable trees for artificial hollow installation

Of the 456 trees that met the minimum requirements for hollow installation (see Section 2.3.3), 313 were classed as grade A, 108 classed as grade B and 35 classed as grade C. Note that all grade A, B and C trees are suitable for installation of hollows, but grade A trees are expected to provide conditions more favourable for use by black-cockatoos, and/or allow for easier installation of an artificial hollow. Locations of trees assessed are shown in Figure 3-1 and details are provided in Appendix 1.

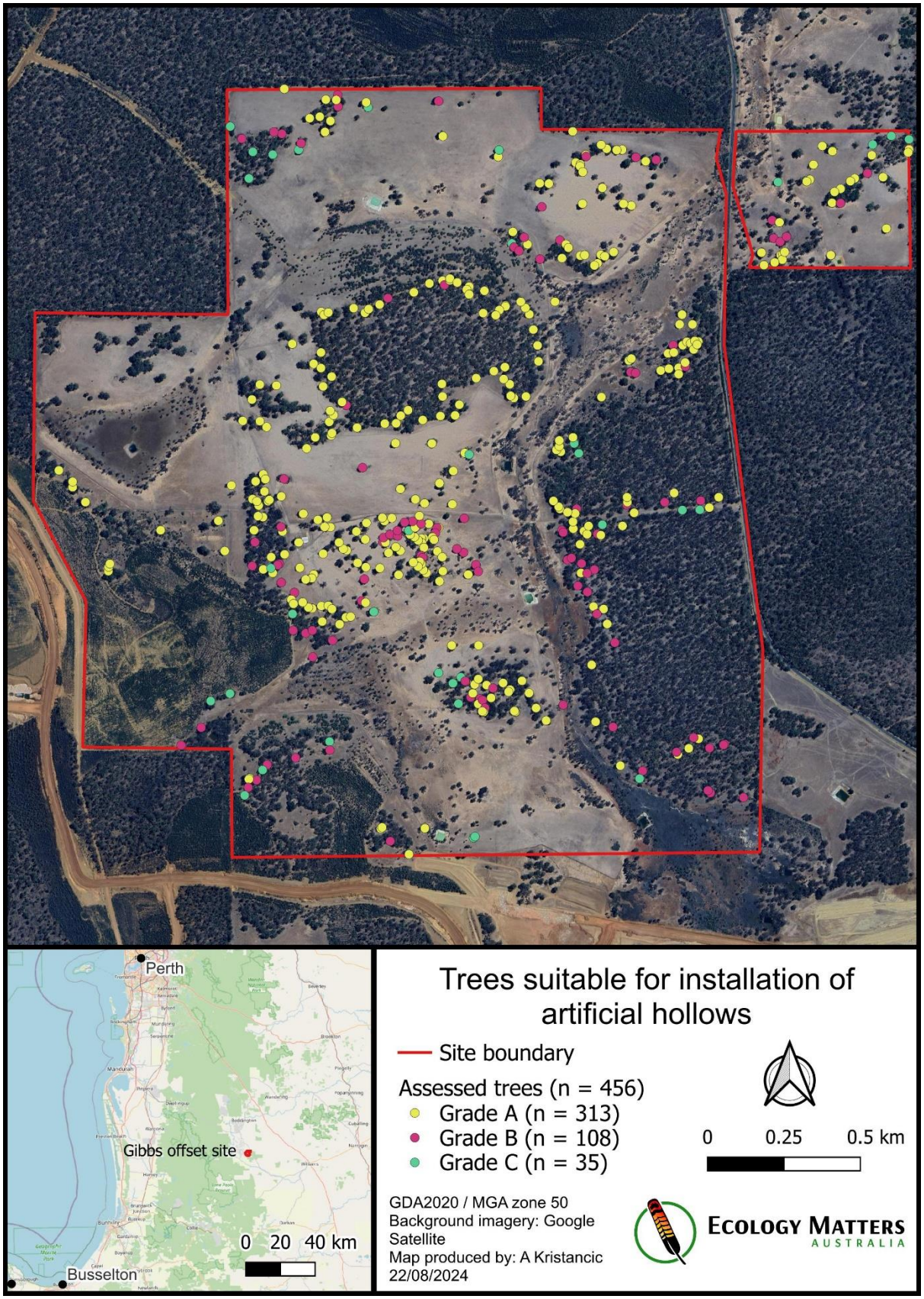

Figure 3-1. Locations of Grade A, B and C trees identified during field investigations.

3.2 Inspection of previous 'suitable' nesting trees

The three trees previously identified by Biologic (2024) were visited and were confirmed as being suitable nesting trees for black-cockatoos. They each contained one or more hollows of suitable size entrance and chamber, with chambers being vertical or leading into main trunk, and the tree was of suitable DBH and height. There was no evidence that any hollows were currently being used (no occupants were flushed when tree was knocked and there no chew marks were observed).

3.3 Suitability of site for artificial hollow installation

3.3.1 Presence of black-cockatoos

At least 20 individual forest red-tailed black-cockatoos were observed at the site every day during the site visit. In addition, personnel from Formosa Flora have visited the site multiple times over the past 12 months and have observed forest red-tailed black-cockatoos at the site during each visit (Keith Smith, pers. comm.). This indicates the species is resident at the site and likely uses the site or areas within the vicinity of the site for breeding, foraging and roosting.

3.3.2 Desktop findings

Previous reports and data indicated breeding by black-cockatoos is known to occur at several confirmed locations within 1 to 5 km of the site. The closest known breeding location is 1.2 km northwest of the site by Phoenix Environmental Services (2021). This distance is under the 2 km distance specified by DBCA (2023) as being important for artificial hollow uptake. The second closest locations were confirmed by Bamford Consulting Ecologists; these locations are shown in Figure 3-2. This known breeding location is 2.3 km from the site and was of a female forest red-tailed black-cockatoo observed at a hollow, which assumes breeding was confirmed in this hollow (see Figure 3-2).

There are confirmed roosting sites 5 to 6 km from the site for the forest red-tailed black-cockatoo and 6 to 8 km from the site for white-tailed black-cockatoos. The presence of roosting sites this close by suggest the species occur regularly or are resident in the area.

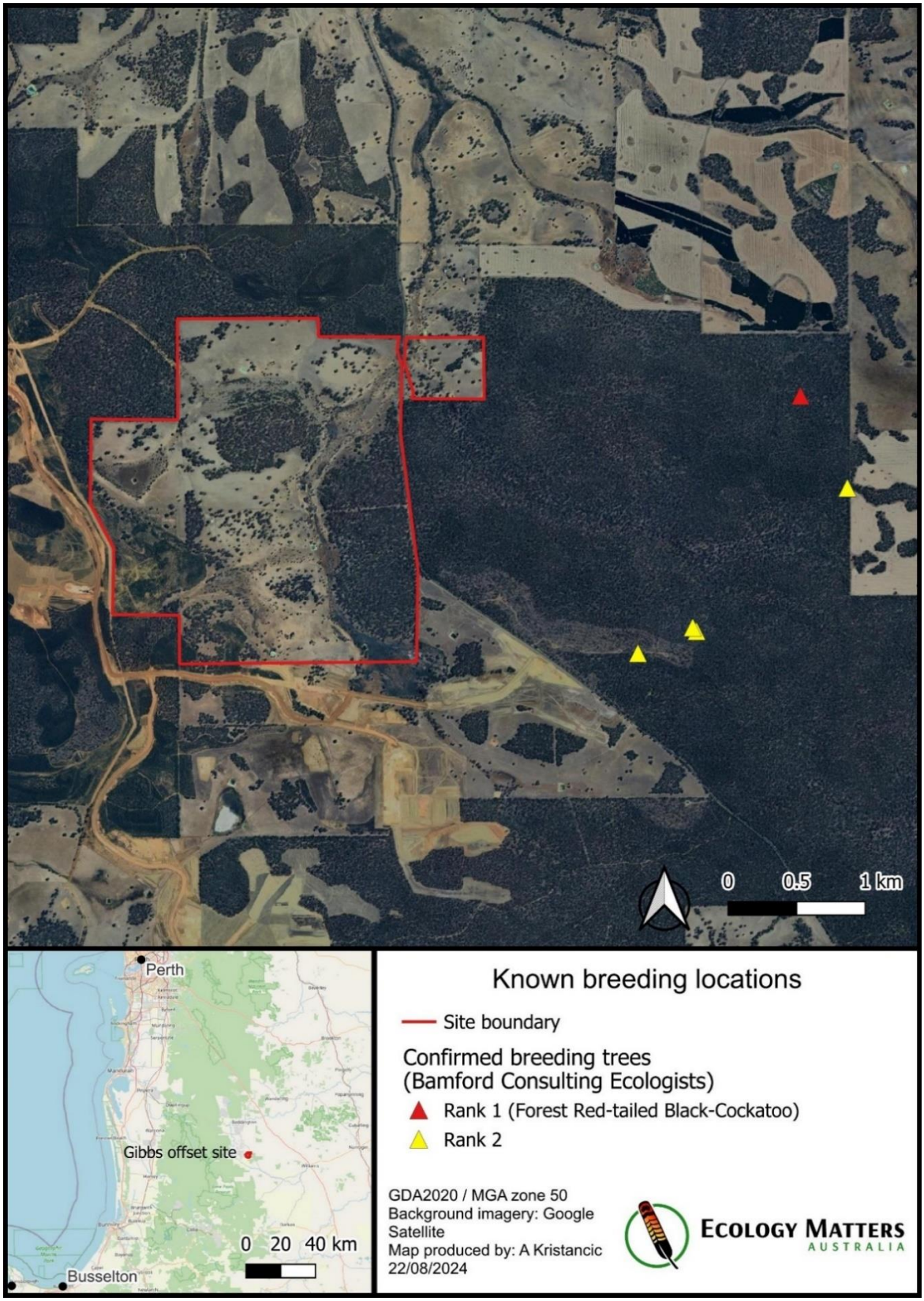

Figure 3-2. Location of the closest known breeding trees recorded by BCE. Note there is a hollow located closer than those indicated but coordinates were not available at the time of writing. Ranks follow BCE methodology; Rank 1 tree indicates black-cockatoo was recorded inside hollow; Rank 2 tree indicates at least one suitable hollow with chew marks at the entrance. The hollow in the Rank 1 tree was occupied by a female forest red-tailed black-cockatoo, indicating that it is extremely likely that breeding was occurring in this hollow.

3.3.3 Roost survey

Six locations within the survey area were identified as night roost locations for forest red-tailed black-cockatoos. These locations are indicated on Figure 3-3. Identification of these sites as roost sites was based on observation of individuals flying into the trees before sunset or departing at sunrise and/or observation of large amounts of faecal deposits on the ground under trees. An example of such faecal deposits is shown in Plate 2.

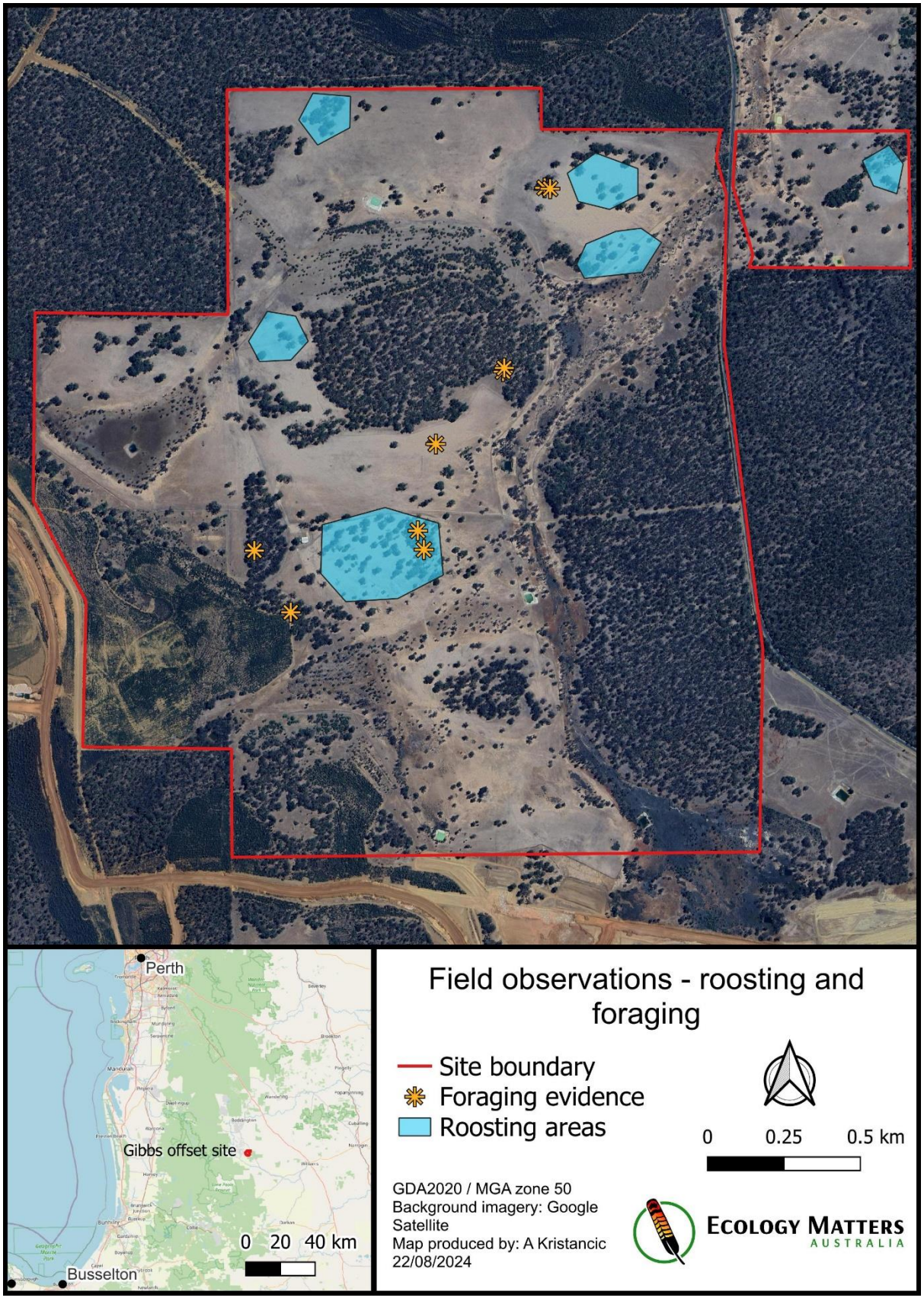

Figure 3-3. Locations of roosting areas and foraging evidence observed during field investigations. Noted that foraging evidence was recorded through out the site.

Plate 2. Example of faecal deposits indicating likely roosting site above.

3.3.4 Foraging habitat

Remnant native vegetation on the site and immediately surrounding the site is comprised predominantly of Jarrah and Marri trees, the latter of which is a preferred foraging species for the forest red-tailed black-cockatoo. Initially, locations of foraging evidence by the species were recorded, and these are shown on Figure 3-3. However, it became obvious that foraging evidence was prevalent wherever Marri trees occurred so foraging evidence was recorded throughout the survey area. Examples of this foraging evidence are shown in Plate 3 and 4. Foraging evidence ranged from fresh to old, indicating that forest red-tailed black-cockatoos have foraged on Marri within this site for an extended period of time and have done so recently.

Plate 3. Abundant recent foraging evidence of forest red-tailed black-cockatoos on Marri.

Plate 4. Evidence of old foraging on Marri by black-cockatoos; note the long/wide marks from the lower mandible and the torn rim that are diagnostic of foraging by a forest red-tailed black-cockatoo.

3.3.5 Watering points

There are several dams within the site which provide drinking water for black-cockatoos. Drinking water nearby is considered important to support successful breeding by Carnaby's Black-Cockatoo (DPaW 2013) and therefore also likely to be important for other black-cockatoo species.

3.3.6 Future forest loss

As the majority of the site has been previously cleared, the abundance of available hollows on the site itself is expected to be lower than in nearby forests. Although it is not certain that a lack of breeding hollows is preventing breeding in this area (as per criteria from DBCA), existing forest and therefore existing nesting hollows within the vicinity of the current site will be lost in the future (e.g. parts of Quindanning Timber Reserve). Therefore, it is expected that there will be an increased need for artificial hollows in this area in the future.

3.3.7 S32 commitments

An artificial hollow installation project is only as successful as the implementing organisation and person/s appointed as responsible for executing the project. Appropriate installation is not enough; it is critical to ensure maintenance of hollows is conducted on an annual basis to maximise success of the artificial hollows. S32 has a strong commitment to ensure the artificial hollow project at its Gibbs Offset Property is supporting its Biodiversity Offset Plan and has adequate resources to ensure the installation, maintenance and ongoing monitoring of hollows is conducted.

4 Conclusion

The Gibbs Offset Property represents a suitable site for installation of artificial hollows for use by forest red-tailed black-cockatoos. It meets all criteria listed by DBCA (2023) as being essential for a site to be considered suitable for installation of artificial hollows (see Section 1.4) and contains additional favorable factors. Factors which contribute to the site being suitable include:

- Forest red-tailed black-cockatoos regularly present and regularly foraging within the site.
- Known breeding nearby (1.2 km from site).
- Known roost sites at several locations within the site, indicating spatial use by the species. Other known nearby roost sites within 6 km of the site.
- Foraging habitat within and surrounding the site.
- Water sources (dams) within the site.
- Presence of an abundance of trees suitable for artificial hollow installation (at least 313 Grade A trees).
- Relatively low abundance of natural hollows within the site due to previous clearance.
- Future forest loss in the surrounding landscape.
- Ongoing commitment by S32 to maintain and monitor artificial hollows.

The following section presents recommendations on installation design of artificial hollows at the Gibbs Offset Property.

5 Recommended Artificial Hollow Installation Design

5.1 Number and type of artificial hollows

Based on the total number of individual forest red-tailed black-cockatoos recorded at the time of survey (n=20), and assuming all are of breeding age, there would be a maximum of ten breeding pairs regularly occurring in the site. Therefore, the 72 artificial hollows S32 are committed to install are more than sufficient to support breeding of these ten breeding pairs.

5.2 Proposed locations

As there is a lack of information on forest red-tailed black cockatoos breeding in artificial hollows, this project provides the opportunity to trial several installation design methods to examine which variables best influence uptake by the species. Variables included installation height, habitat types and spacing between hollows. Specifically, proposed locations of artificial hollows were selected based on the following:

- Only Grade A trees were chosen for safety, practicality and efficiency of installing artificial hollows.
- Even spatial distribution across the survey area as far as possible to ensure coverage.
- Ensuring spacing between hollows is conducive to social interactions, as was highlighted as important by Johnstone et. Al. (2013). Spacing distance was selected to be a minimum of 50 m apart to avoid competition and a maximum of 500 m apart to maintain social interactions within the flock.
- Representation across each habitat type (Jarri, Marri, Wandoo).
- Variable heights of hollow installation point (between 6 m and 20 m) to investigate the influence of installation height on breeding uptake.

Proposed locations of artificial hollows are shown in Figure 5-1.

Cockatubes are proposed to be spread throughout the site and across installation methods. There will only be a number of MAH and these are proposed to be spatially-distributed as evenly as possible with duplicates in each height class where possible. Final installation design will be confirmed following discussion with S32.

5.3 Timing

Forest red-tailed black cockatoos are known to breed throughout the year (Johnstone et. al. 2013), however, there are known peaks of breeding between April and June and again between August and October (DBCA 2023). It is recommended to install the artificial hollows two to three months before the peak periods of breeding. This will allow sufficient time for breeding pairs to prospect and become familiar with the artificial hollows.

5.4 Hollow modification

The recommended attachment method for artificial hollows is to attach by chain to the tree (DBCA 2023). However, as highlighted in Table 1-1 there are downsides to this approach. We suggest considering modifying the already-purchased cockatubes by removing the chain and using the

looped fork method as described in section 1.5.2. This will allow the cockatube to 'grow' with the tree and require less resources and management in the future (such as adjusting chain length to suit tree growth).

Another modification we suggest is adding an additional ladder within the cockatubes that is smaller in aperture to the standard mesh (which is 50 mm x 50 mm). By-catch in the form of non-target species are known to perish in black-cockatoo artificial hollows because the aperture of the ladder is too large for non-target species to exit the hollow. For example, possums, ducks and small birds have been recorded dead in the bottom of black-cockatoo artificial hollows (Cherriman 2021). Furthermore, it is suspected that black-cockatoos would be deterred from nesting in the hollow if there is decaying or dead bodies present. The recommended size aperture for non-target species is 10 mm x 10 mm (Cherriman 2021).

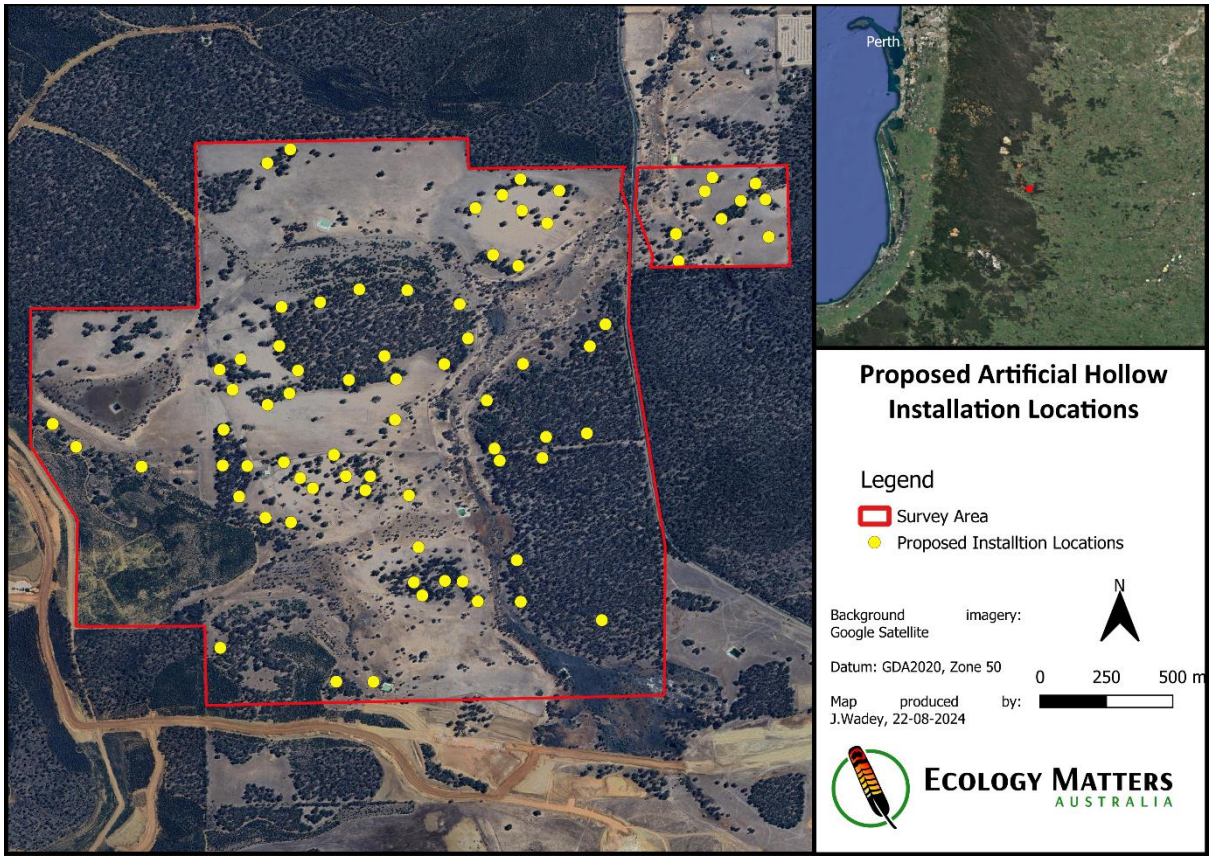

Figure 5-1. Proposed locations of artificial hollows in survey area.

5.5 Summary

There is little evidence of forest red-tailed black cockatoos breeding in artificial hollows. As such, the results from this ground-breaking installation project will be critical in building a better understanding of the species' usage of artificial hollows and has ramifications for the species across its range. As this is an innovative research project, the installation design will likely undergo several iterations prior to, and perhaps during and after, installation as part of the adaptive management process of research.

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7 Appendices

Appendix 1. Details of trees graded A, B and C, suitable for installation of artificial hollows.

DBH = Diameter at breast height, Status = Alive or Dead, DIH = Diameter at installation height, Access = good access (GA) or average access (AA). See section 2.3.3 for details on variable definitions.

Easting	Northing	Tree species	DBH (mm)	Status	Installation height (m)	DIH	Orientation	Access	Grade
453345	6350228	*Eucalyptus wandoo*	600	Alive	6	300	S	GA	C
453041	6350258	*Eucalyptus marginata*	700	Alive	10	300	SE	AA	A
452655	6350452	*Eucalyptus wandoo*	400	Alive	10	300	SE	AA	C
452611	6350423	*Corymbia calophylla*	600	Alive	15	400	S	GA	A
452597	6350368	*Corymbia calophylla*	600	Alive	16	300	SE	AA	B
452390	6350530	*Corymbia calophylla*	500	Alive	15	250	NW	GA	B
453671	6351240	*Corymbia calophylla*	700	Alive	10	400	SE	GA	A
453693	6351189	*Eucalyptus wandoo*	400	Alive	10	250	S	GA	A
453696	6351095	*Eucalyptus wandoo*	600	Alive	10	300	SW	GA	A
453686	6351053	*Eucalyptus wandoo*	300	Alive	15	200	SW	GA	B
453737	6350985	*Eucalyptus wandoo*	500	Alive	17	300	N	GA	A
453770	6350977	*Eucalyptus wandoo*	800	Alive	15	300	S	GA	A
453782	6350928	*Eucalyptus wandoo*	500	Alive	10	300	S	GA	A
453731	6350794	*Eucalyptus wandoo*	500	Alive	10	300	S	GA	A
453744	6350608	*Eucalyptus wandoo*	500	Alive	10	250	SE	GA	A
453825	6350464	*Eucalyptus wandoo*	400	Alive	10	300	SW	GA	A
454120	6350375	*Eucalyptus wandoo*	700	Alive	10	300	SE	GA	B
454228	6350360	*Eucalyptus wandoo*	600	Alive	15	300	N	GA	B
454166	6350535	*Eucalyptus marginata*	600	Alive	10	300	S	GA	B
454081	6350552	*Eucalyptus marginata*	600	Alive	15	300	S	GA	A
454049	6350521	*Eucalyptus marginata*	600	Alive	10	300	SW	GA	A
454013	6350501	*Eucalyptus marginata*	500	Alive	10	300	SW	GA	A
453670	6351263	*Eucalyptus wandoo*	1200	Alive	15	500	S	GA	A

Easting	Northing	Tree species	DBH (mm)	Status	Installation height (m)	DIH	Orientation	Access	Grade
453706	6351232	*Corymbia calophylla*	800	Alive	10	400	SW	GA	A
453716	6351222	*Corymbia calophylla*	800	Alive	10	400	SW	GA	A
453766	6351253	*Eucalyptus marginata*	700	Alive	10	300	E	GA	C
453832	6351249	*Eucalyptus wandoo*	600	Alive	10	300	SW	GA	A
454116	6351309	*Eucalyptus marginata*	900	Alive	20	300	S	GA	A
453198	6351256	*Corymbia calophylla*	800	Alive	10	300	SW	GA	A
453182	6351208	*Corymbia calophylla*	800	Alive	15	300	SE	GA	A
453174	6351208	*Corymbia calophylla*	600	Alive	10	300	S	GA	A
453175	6351194	*Corymbia calophylla*	500	Alive	10	200	S	GA	B
453175	6351194	*Corymbia calophylla*	600	Alive	10	300	NE	GA	A
453182	6351178	*Eucalyptus marginata*	800	Alive	10	300	SW	GA	A
453173	6351152	*Eucalyptus marginata*	1200	Alive	15	500	SW	GA	B
453178	6351145	*Corymbia calophylla*	600	Alive	16	300	SW	GA	B
453163	6351202	*Corymbia calophylla*	700	Alive	15	300	S	GA	A
453151	6351213	*Eucalyptus marginata*	600	Alive	8	200	SE	GA	A
453137	6351221	*Eucalyptus marginata*	700	Alive	8	300	S	GA	A
453132	6351234	*Corymbia calophylla*	1200	Alive	15	300	NE	GA	C
453153	6351244	*Corymbia calophylla*	900	Alive	15	300	SE	GA	A
453173	6351256	*Corymbia calophylla*	600	Alive	8	200	SW	GA	B
453167	6351282	*Eucalyptus marginata*	800	Alive	15	300	SW	GA	A
453145	6351264	*Corymbia calophylla*	1000	Alive	15	300	SW	GA	B
453053	6351265	*Corymbia calophylla*	1000	Alive	10	300	W	GA	A
452994	6351259	*Corymbia calophylla*	1200	Alive	10	500	SW	GA	A
452961	6351231	*Corymbia calophylla*	1000	Alive	10	300	W	GA	A
452876	6351245	*Corymbia calophylla*	1200	Alive	10	500	S	GA	A
452857	6351246	*Corymbia calophylla*	1000	Alive	10	300	S	GA	A
452865	6351277	*Corymbia calophylla*	1000	Alive	10	500	SE	GA	A
452835	6351269	*Corymbia calophylla*	1200	Alive	15	500	SW	GA	A
452787	6351289	*Corymbia calophylla*	1200	Alive	15	500	S	GA	A

Easting	Northing	Tree species	DBH (mm)	Status	Installation height (m)	DIH	Orientation	Access	Grade
452715	6351346	*Corymbia calophylla*	2000	Alive	15	800	S	GA	A
452724	6351403	*Eucalyptus marginata*	900	Alive	10	300	SW	GA	B
452981	6351440	*Eucalyptus marginata*	1000	Alive	10	500	N	GA	B
453089	6351520	*Corymbia calophylla*	900	Alive	10	400	SW	GA	A
453316	6351488	*Eucalyptus marginata*	800	Alive	10	300	SW	GA	A
453312	6351162	*Eucalyptus marginata*	800	Alive	10	300	N	GA	B
453290	6351174	*Corymbia calophylla*	900	Alive	10	300	E	GA	B
453230	6350768	*Corymbia calophylla*	800	Alive	10	300	SW	GA	C
453277	6350734	*Eucalyptus wandoo*	500	Alive	10	200	SW	GA	C
453295	6350667	*Eucalyptus wandoo*	600	Alive	8	200	SW	GA	C
453303	6350754	*Eucalyptus wandoo*	500	Alive	15	200	SW	GA	C
453317	6350741	*Eucalyptus wandoo*	400	Alive	10	300	NW	GA	B
453335	6350688	*Eucalyptus wandoo*	400	Alive	10	200	SW	GA	B
453366	6350683	*Eucalyptus wandoo*	800	Alive	10	300	SW	GA	B
453360	6350666	*Eucalyptus wandoo*	600	Alive	10	300	SW	GA	A
453374	6350679	*Eucalyptus wandoo*	800	Alive	10	300	NW	GA	B
453382	6350653	*Eucalyptus wandoo*	700	Alive	10	300	SW	GA	B
453377	6350640	*Eucalyptus wandoo*	700	Alive	10	300	SW	GA	A
453402	6350686	*Eucalyptus wandoo*	500	Alive	10	300	SE	GA	A
452987	6351075	*Eucalyptus wandoo*	700	Alive	8	300	SW	GA	B
452978	6351004	*Eucalyptus wandoo*	600	Alive	15	300	N	GA	B
452991	6350998	*Eucalyptus wandoo*	800	Alive	10	400	SW	GA	A
453018	6350968	*Corymbia calophylla*	1200	Alive	15	500	S	GA	C
452709	6351125	*Eucalyptus wandoo*	500	Alive	10	200	S	GA	B
452703	6351121	*Eucalyptus wandoo*	400	Alive	10	200	S	GA	B
452726	6351156	*Eucalyptus marginata*	600	Alive	10	300	SW	GA	A
452719	6351231	*Eucalyptus wandoo*	500	Alive	10	300	NW	GA	A
452714	6351246	*Corymbia calophylla*	600	Alive	10	300	NW	GA	B
452655	6351278	*Eucalyptus wandoo*	700	Alive	10	300	SW	GA	A

Easting	Northing	Tree species	DBH (mm)	Status	Installation height (m)	DIH	Orientation	Access	Grade
452639	6351281	*Corymbia calophylla*	800	Alive	15	300	SW	GA	A
452641	6351316	*Eucalyptus wandoo*	500	Alive	10	200	SW	GA	A
452672	6351330	*Eucalyptus marginata*	600	Alive	15	300	SW	GA	A
452676	6351334	*Corymbia calophylla*	1000	Alive	10	500	SW	GA	A
452660	6351362	*Eucalyptus marginata*	700	Alive	10	300	SW	GA	A
454350	6352136	*Corymbia calophylla*	1200	Alive	10	500	NW	GA	A
454357	6352139	*Corymbia calophylla*	900	Alive	10	400	SW	GA	A
454355	6352121	*Corymbia calophylla*	1000	Alive	15	400	SW	GA	A
454330	6352112	*Corymbia calophylla*	1000	Alive	8	400	S	GA	A
454295	6352103	*Corymbia calophylla*	900	Alive	10	400	W	GA	A
454287	6352144	*Corymbia calophylla*	1000	Alive	10	400	NW	GA	A
454515	6352136	*Eucalyptus wandoo*	900	Alive	8	400	SW	GA	B
454696	6352223	*Corymbia calophylla*	1200	Alive	10	600	S	GA	A
454770	6352482	*Eucalyptus marginata*	700	Alive	10	300	W	GA	A
454712	6352526	*Eucalyptus marginata*	800	Alive	10	400	SW	AA	C
454519	6352476	*Corymbia calophylla*	900	Alive	15	400	SE	GA	A
454486	6352493	*Eucalyptus marginata*	800	Alive	10	300	NW	GA	A
454457	6352432	*Eucalyptus marginata*	1000	Alive	10	400	SE	GA	A
454445	6352383	*Corymbia calophylla*	1200	Alive	10	400	S	GA	A
453627	6351305	*Eucalyptus wandoo*	700	Alive	10	300	W	GA	A
453623	6351312	*Eucalyptus wandoo*	700	Alive	10	400	S	GA	A
453606	6351331	*Corymbia calophylla*	700	Alive	10	400	N	GA	A
453689	6351487	*Eucalyptus marginata*	700	Alive	8	300	SW	AA	C
453674	6351519	*Eucalyptus marginata*	600	Alive	10	300	W	GA	C
453630	6351492	*Corymbia calophylla*	800	Alive	8	300	NW	GA	A
453616	6351498	*Corymbia calophylla*	800	Alive	10	400	N	GA	A
453625	6351510	*Eucalyptus marginata*	800	Alive	10	400	N	GA	A
453625	6351529	*Corymbia calophylla*	600	Alive	10	300	SW	GA	A
453670	6351539	*Corymbia calophylla*	800	Alive	10	400	SW	GA	A

Easting	Northing	Tree species	DBH (mm)	Status	Installation height (m)	DIH	Orientation	Access	Grade
453859	6351753	*Corymbia calophylla*	900	Alive	10	400	N	GA	B
453875	6351750	*Corymbia calophylla*	900	Alive	10	400	SW	GA	B
453853	6351791	*Corymbia calophylla*	700	Alive	10	400	S	GA	A
453861	6351797	*Corymbia calophylla*	400	Alive	10	200	S	GA	A
453998	6351841	*Corymbia calophylla*	900	Alive	10	400	NW	GA	B
454029	6351841	*Eucalyptus marginata*	600	Alive	10	300	SW	GA	A
454043	6351852	*Eucalyptus marginata*	600	Alive	10	200	SW	GA	A
454055	6351847	*Eucalyptus marginata*	900	Alive	15	400	R	GA	A
454080	6351853	*Eucalyptus marginata*	700	Alive	15	300	SW	GA	A
454019	6351909	*Eucalyptus marginata*	900	Alive	10	400	NW	GA	A
453568	6352294	*Corymbia calophylla*	1200	Alive	10	600	NW	GA	B
453701	6352304	*Corymbia calophylla*	1200	Alive	10	600	NW	GA	A
453766	6352356	*Corymbia calophylla*	1200	Alive	15	600	SW	GA	A
453861	6352298	*Corymbia calophylla*	1200	Alive	10	600	NW	GA	A
453835	6352304	*Corymbia calophylla*	1200	Alive	10	600	NW	GA	A
453942	6352448	*Eucalyptus marginata*	900	Alive	8	300	SW	GA	B
453908	6352443	*Eucalyptus marginata*	900	Alive	10	400	SW	GA	A
453876	6352456	*Eucalyptus marginata*	900	Alive	8	400	SW	GA	B
453831	6352481	*Eucalyptus marginata*	900	Alive	10	400	NW	GA	A
453813	6352480	*Eucalyptus marginata*	900	Alive	10	400	NW	GA	A
453780	6352484	*Eucalyptus marginata*	600	Alive	10	300	SW	GA	A
453762	6352497	*Corymbia calophylla*	600	Alive	10	300	S	GA	A
453712	6352464	*Corymbia calophylla*	1100	Alive	10	400	NW	GA	A
453521	6352171	*Eucalyptus marginata*	900	Alive	10	400	NW	GA	A
453473	6352212	*Eucalyptus marginata*	700	Alive	10	400	SW	GA	A
453470	6352174	*Corymbia calophylla*	700	Alive	10	300	N	GA	C
453477	6352162	*Corymbia calophylla*	700	Alive	10	400	SW	AA	B
453493	6352150	*Corymbia calophylla*	900	Alive	15	400	SW	AA	B
453510	6352194	*Eucalyptus marginata*	800	Alive	10	300	SW	GA	B

Easting	Northing	Tree species	DBH (mm)	Status	Installation height (m)	DIH	Orientation	Access	Grade
453562	6352123	*Eucalyptus marginata*	900	Alive	10	400	NW	GA	B
452725	6352680	*Eucalyptus marginata*	1100	Alive	17	450	SW	GA	A
452586	6352517	*Eucalyptus marginata*	1100	Alive	17	700	S	GA	B
452548	6352557	*Eucalyptus marginata*	1100	Alive	16	350	N	GA	C
452622	6352474	*Corymbia calophylla*	1000	Alive	18	1500	SE	AA	C
452609	6352387	*Eucalyptus marginata*	1100	Alive	15	300	NW	AA	C
452687	6352465	*Eucalyptus marginata*	800	Alive	15	300	W	AA	C
452772	6352481	*Eucalyptus marginata*	900	Alive	15		NW	AA	C
452780	6352502	*Eucalyptus marginata*	2000	Alive	15	300	S	GA	B
452717	6352533	*Eucalyptus marginata*	1000	Alive	15	400	S	AA	B
452691	6352539	*Eucalyptus marginata*	1000	Alive	10	300	S	GA	B
452808	6352584	*Eucalyptus marginata*	1300	Alive	10	450	SE	GA	A
452841	6352589	*Corymbia calophylla*	800	Alive	14	350	W	GA	A
452858	6352539	*Eucalyptus marginata*	1400	Alive	13	500	SE	AA	A
452876	6352575	*Corymbia calophylla*	1000	Alive	14	300	NW	GA	A
452901	6352622	*Eucalyptus marginata*	1000	Alive	13	300	SE	GA	B
452900	6352660	*Eucalyptus marginata*	1000	Alive	13	300	W	GA	B
452895	6352644	*Corymbia calophylla*	800	Alive	13	300	SE	GA	A
452861	6352645	*Corymbia calophylla*	1200	Alive	15	700	S	GA	A
452999	6352620	*Eucalyptus marginata*	700	Alive	11	300	S	GA	C
452993	6352636	*Corymbia calophylla*	1000	Alive	10	400	N	GA	A
453425	6352458	*Corymbia calophylla*	1500	Alive	17	400	S	GA	A
453428	6352480	*Corymbia calophylla*	1500	Alive	17	400	S	AA	C
453244	6352525	*Corymbia calophylla*	1600	Alive	8	400	S	GA	A
453230	6352640	*Eucalyptus marginata*	1000	Alive	7	300	SE	GA	B
453669	6352541	*Eucalyptus marginata*	1600	Alive	16	400	SE	GA	A
453713	6352459	*Corymbia calophylla*	1000	Alive	8	400	S	GA	B
453701	6352408	*Corymbia calophylla*	900	Alive	8	600	SE	GA	B
453349	6350232	*Eucalyptus wandoo*	600	Alive	6	300	S	GA	C

Easting	Northing	Tree species	DBH (mm)	Status	Installation height (m)	DIH	Orientation	Access	Grade
453185	6350259	*Eucalyptus wandoo*	1000	Alive	11	500	S	GA	A
453045	6350262	*Eucalyptus marginata*	700	Alive	9	300	W	GA	A
453133	6350174	*Corymbia calophylla*	1200	Alive	8	700	S	GA	A
453072	6350217	*Eucalyptus marginata*	1000	Alive	6	450	SW	GA	B
452873	6350543	*Corymbia calophylla*	1000	Alive	9	400	S	GA	C
452874	6350515	*Corymbia calophylla*	1000	Alive	8	400	SE	GA	B
452762	6350490	*Corymbia calophylla*	700	Alive	6	300	E	GA	B
452669	6350467	*Eucalyptus marginata*	600	Alive	7	350	W	GA	B
452654	6350450	*Eucalyptus wandoo*	500	Alive	7	300	W	GA	C
452634	6350417	*Corymbia calophylla*	800	Alive	8	350	S	GA	B
452609	6350420	*Corymbia calophylla*	700	Alive	8	350	S	GA	A
452607	6350393	*Corymbia calophylla*	500	Alive	6	300	W	GA	B
452595	6350367	*Eucalyptus marginata*	800	Alive	15	300	SE	GA	C
452484	6350676	*Eucalyptus marginata*	700	Alive	10	300	E	AA	C
452547	6350700	*Corymbia calophylla*	700	Alive	10	300	E	AA	C
452453	6350589	*Corymbia calophylla*	700	Alive	10	300	W	AA	B
452387	6350531	*Corymbia calophylla*	500	Alive	10	300	NW	GA	B
452818	6350820	*Eucalyptus wandoo*	900	Alive	8	500	SW	GA	B
453634	6351235	*Eucalyptus wandoo*	400	Alive	12	400	SW	GA	B
453638	6351228	*Eucalyptus wandoo*	600	Alive	8	400	W	GA	B
453652	6351138	*Eucalyptus wandoo*	500	Alive	8	300	S	GA	B
453665	6351144	*Eucalyptus wandoo*	400	Alive	7	300	S	GA	B
453698	6351126	*Eucalyptus wandoo*	350	Alive	7	250	S	GA	B
453740	6351106	*Corymbia calophylla*	700	Alive	9	300	S	GA	B
453716	6351094	*Eucalyptus wandoo*	400	Alive	9	300	S	GA	B
453717	6351033	*Eucalyptus marginata*	600	Alive	12	250	S	GA	B
453748	6350961	*Eucalyptus wandoo*	600	Alive	12	250	S	GA	B
453807	6350867	*Eucalyptus wandoo*	800	Alive	12	350	S	GA	B
453638	6350663	*Eucalyptus wandoo*	800	Alive	10	400	S	GA	B

Easting	Northing	Tree species	DBH (mm)	Status	Installation height (m)	DIH	Orientation	Access	Grade
453801	6350591	*Eucalyptus wandoo*	800	Alive	11	400	S	GA	B
453898	6350447	*Eucalyptus wandoo*	450	Alive	10	300	N	GA	B
453888	6350422	*Eucalyptus wandoo*	450	Alive	10	300	E	GA	C
454112	6350383	*Eucalyptus wandoo*	500	Alive	10	300	E	GA	B
454163	6350532	*Eucalyptus marginata*	600	Alive	10	300	E	GA	B
454117	6350522	*Eucalyptus marginata*	600	Alive	10	300	E	GA	B
454065	6350556	*Corymbia calophylla*	500	Alive	10	300	S	GA	B
454009	6350509	*Corymbia calophylla*	600	Alive	10	400	E	GA	B
453721	6351249	*Eucalyptus marginata*	600	Alive	10	400	S	GA	A
453750	6351223	*Eucalyptus wandoo*	450	Alive	10	300	S	GA	B
453761	6351219	*Corymbia calophylla*	700	Alive	10	350	S	GA	A
453870	6351292	*Eucalyptus marginata*	1000	Alive	11	350	W	GA	A
454028	6351301	*Eucalyptus wandoo*	500	Alive	10	300	N	GA	C
454085	6351302	*Eucalyptus wandoo*	500	Alive	10	300	S	GA	C
453230	6351243	*Eucalyptus marginata*	1000	Alive	10	350	E	GA	A
453225	6351243	*Eucalyptus marginata*	800	Alive	8	300	E	GA	B
453219	6351226	*Eucalyptus marginata*	700	Alive	8	250	SE	GA	B
453210	6351212	*Eucalyptus marginata*	500	Alive	8	250	SE	GA	A
453215	6351204	*Eucalyptus marginata*	500	Alive	8	200	E	GA	A
453226	6351166	*Corymbia calophylla*	700	Alive	8	300	E	GA	A
453242	6351147	*Corymbia calophylla*	900	Alive	7	300	N	GA	A
453244	6351101	*Corymbia calophylla*	700	Alive	10	250	N	GA	A
453233	6351068	*Eucalyptus marginata*	900	Alive	8	250	E	GA	A
453190	6351095	*Corymbia calophylla*	700	Alive	8	350	SE	GA	A
453180	6351105	*Corymbia calophylla*	1200	Alive	11	400	W	GA	A
453174	6351125	*Corymbia calophylla*	1200	Alive	11	500	S	GA	A
453168	6351132	*Corymbia calophylla*	800	Alive	11	350	NE	GA	A
453163	6351116	*Corymbia calophylla*	600	Alive	11	350	W	GA	A
453147	6351130	*Corymbia calophylla*	800	Alive	12	350	SE	GA	A

Easting	Northing	Tree species	DBH (mm)	Status	Installation height (m)	DIH	Orientation	Access	Grade
453099	6351089	*Eucalyptus marginata*	800	Alive	13	350	NE	GA	A
453105	6351168	*Corymbia calophylla*	800	Alive	13	350	NE	GA	A
453090	6351180	*Corymbia calophylla*	800	Alive	13	350	S	GA	A
453066	6351161	*Corymbia calophylla*	900	Alive	9	350	SW	GA	A
453038	6351111	*Corymbia calophylla*	1000	Alive	13	400	NE	GA	A
452992	6351114	*Corymbia calophylla*	800	Alive	12	300	E	GA	A
453048	6351196	*Corymbia calophylla*	800	Alive	12	300	SW	GA	B
453056	6351195	*Corymbia calophylla*	700	Alive	11	300	W	GA	A
453050	6351211	*Eucalyptus marginata*	700	Alive	10	300	SE	GA	B
453071	6351221	*Corymbia calophylla*	700	Alive	10	300	SW	GA	B
453096	6351216	*Eucalyptus marginata*	700	Alive	10	300	W	GA	B
453095	6351234	*Corymbia calophylla*	700	Alive	10	300	S	GA	B
453119	6351261	*Eucalyptus marginata*	700	Alive	10	300	S	GA	B
453077	6351275	*Corymbia calophylla*	1400	Alive	10	400	SW	GA	A
453046	6351276	*Corymbia calophylla*	1000	Alive	8	400	SE	GA	A
452990	6351205	*Corymbia calophylla*	1000	Alive	10	350	SW	GA	A
452965	6351128	*Eucalyptus marginata*	1000	Alive	10	350	NE	GA	A
452929	6351169	*Eucalyptus marginata*	800	Alive	7	350	S	GA	A
452918	6351174	*Eucalyptus marginata*	800	Alive	7	350	S	GA	A
452904	6351195	*Eucalyptus wandoo*	1000	Alive	7	500	S	GA	A
452852	6351158	*Corymbia calophylla*	1000	Alive	7	500	S	GA	A
452821	6351090	*Eucalyptus marginata*	1200	Alive	11	300	NE	GA	A
452815	6351078	*Corymbia calophylla*	1400	Alive	10	550	N	GA	A
452795	6351074	*Eucalyptus marginata*	800	Alive	11	300	S	GA	A
452776	6351112	*Eucalyptus marginata*	1400	Alive	13	300	SW	GA	A
452772	6351195	*Corymbia calophylla*	1400	Alive	13	300	S	GA	A
453275	6351320	*Eucalyptus marginata*	1000	Alive	8	500	S	GA	A
453278	6351429	*Corymbia calophylla*	1000	Alive	10	300	NE	GA	A
453233	6351389	*Corymbia calophylla*	1200	Alive	8	450	W	GA	A

Easting	Northing	Tree species	DBH (mm)	Status	Installation height (m)	DIH	Orientation	Access	Grade
453184	6351323	*Corymbia calophylla*	900	Alive	12	450	SW	GA	A
453154	6351336	*Eucalyptus marginata*	900	Alive	8	450	SE	GA	A
453105	6351370	*Eucalyptus marginata*	600	Alive	10	400	SW	GA	A
453208	6351519	*Corymbia calophylla*	1400	Alive	13	500	SW	GA	A
453330	6351483	*Eucalyptus marginata*	600	Alive	8	300	E	AA	C
453314	6351274	*Eucalyptus marginata*	600	Alive	8	NA	E	AA	B
453352	6351122	*Eucalyptus marginata*	800	Alive	5	NA	N	GA	B
453360	6351100	*Eucalyptus marginata*	800	Alive	14	NA	SE	GA	B
453327	6351090	*Corymbia calophylla*	700	Alive	8	NA	SW	GA	A
453273	6350858	*Eucalyptus wandoo*	600	Alive	8	NA	W	GA	A
453361	6350858	*Eucalyptus wandoo*	6500	Alive	8	NA	SW	GA	A
453503	6350742	*Eucalyptus wandoo*	500	Alive	8	NA	SW	GA	A
453526	6350702	*Eucalyptus wandoo*	500	Alive	8	NA	S	GA	A
453549	6350653	*Eucalyptus wandoo*	500	Alive	6	NA	N	GA	A
453582	6350612	*Eucalyptus wandoo*	1000	Alive	6	NA	E	GA	A
453481	6350640	*Eucalyptus wandoo*	400	Alive	6	NA	SW	GA	A
453478	6350643	*Eucalyptus marginata*	800	Alive	9	NA	S	GA	A
453373	6350642	*Eucalyptus wandoo*	600	Alive	7	NA	SW	GA	A
453342	6350701	*Eucalyptus wandoo*	400	Alive	7	NA	SW	GA	A
453348	6350730	*Eucalyptus marginata*	800	Alive	7	NA	SW	GA	A
453360	6350748	*Eucalyptus marginata*	400	Alive	6	NA	S	GA	A
453387	6350728	*Eucalyptus wandoo*	600	Alive	6	NA	NW	GA	A
453408	6350718	*Corymbia calophylla*	700	Alive	8	300	NW	GA	B
453441	6350735	*Eucalyptus wandoo*	500	Alive	10	300	W	GA	A
453464	6350713	*Eucalyptus wandoo*	500	Alive	6	300	S	GA	A
453459	6350706	*Eucalyptus wandoo*	500	Alive	6	300	S	GA	A
452758	6351031	*Corymbia calophylla*	800	Alive	9	450	N	GA	B
452715	6351064	*Eucalyptus marginata*	800	Alive	9	450	N	GA	B
452846	6350987	*Corymbia calophylla*	1100	Alive	6	500	SW	GA	A

Easting	Northing	Tree species	DBH (mm)	Status	Installation height (m)	DIH	Orientation	Access	Grade
452869	6350988	*Eucalyptus marginata*	700	Alive	6	500	SW	GA	A
452881	6350977	*Corymbia calophylla*	700	Alive	7	500	N	GA	A
452849	6350936	*Corymbia calophylla*	700	Alive	12	300	S	GA	A
452927	6350950	*Eucalyptus wandoo*	450	Alive	6	NA	E	GA	A
452942	6350952	*Eucalyptus wandoo*	500	Alive	6	NA	SE	GA	A
452906	6350927	*Eucalyptus marginata*	600	Alive	6	NA	SE	GA	A
452883	6350874	*Eucalyptus wandoo*	400	Alive	6	NA	SE	GA	B
452795	6350898	*Eucalyptus wandoo*	400	Alive	6	NA	S	GA	B
452817	6350907	*Eucalyptus marginata*	900	Alive	7	NA	SW	GA	B
452816	6350979	*Corymbia calophylla*	900	Alive	12	NA	S	GA	A
452804	6350982	*Corymbia calophylla*	900	Alive	12	NA	S	GA	A
452785	6350999	*Corymbia calophylla*	900	Alive	10	NA	S	GA	A
452748	6351008	*Eucalyptus marginata*	900	Alive	11	NA	N	GA	A
452755	6350994	*Eucalyptus marginata*	700	Alive	8	NA	N	GA	A
452752	6350961	*Corymbia calophylla*	300	Alive	5	NA	N	GA	C
452754	6350907	*Eucalyptus marginata*	600	Alive	12	NA	W	GA	B
452687	6351095	*Eucalyptus wandoo*	450	Alive	12	250	N	GA	A
452656	6351107	*Eucalyptus wandoo*	350	Alive	8	250	NW	GA	A
452681	6351111	*Eucalyptus wandoo*	300	Alive	6	200	NW	GA	C
452620	6351118	*Eucalyptus marginata*	450	Alive	7	300	S	GA	B
452682	6351147	*Eucalyptus wandoo*	350	Alive	8	300	W	GA	A
452629	6351196	*Eucalyptus wandoo*	500	Alive	10	200	S	GA	B
452626	6351235	*Eucalyptus wandoo*	400	Alive	8	200	N	GA	A
452621	6351337	*Eucalyptus wandoo*	450	Alive	8	300	N	GA	A
452635	6351330	*Eucalyptus wandoo*	500	Alive	9	350	S	GA	A
452631	6351395	*Eucalyptus wandoo*	600	Alive	10	350	S	GA	A
452656	6351418	*Corymbia calophylla*	1200	Alive	8	650	W	GA	A
452663	6351402	*Corymbia calophylla*	1200	Alive	8	650	W	GA	A
454341	6352375	*Eucalyptus wandoo*	900	Alive	6	400	E	AA	C

Easting	Northing	Tree species	DBH (mm)	Status	Installation height (m)	DIH	Orientation	Access	Grade
454322	6352250	*Eucalyptus marginata*	700	Alive	7	200	W	GA	B
454346	6352243	*Corymbia calophylla*	700	Alive	7	400	E	GA	A
454327	6352191	*Corymbia calophylla*	600	Alive	7	300	S	GA	B
454348	6352180	*Corymbia calophylla*	600	Alive	12	300	W	GA	B
454369	6352196	*Eucalyptus marginata*	600	Alive	8	300	E	GA	B
454363	6352146	*Corymbia calophylla*	1600	Alive	14	700	S	GA	A
454514	6352136	*Eucalyptus wandoo*	800	Alive	8	400	W	GA	A
454518	6352307	*Corymbia calophylla*	900	Alive	11	400	W	GA	A
454546	6352306	*Corymbia calophylla*	1000	Alive	9	500	SW	GA	B
454634	6352404	*Eucalyptus marginata*	900	Alive	8	300	E	GA	B
454685	6352391	*Corymbia calophylla*	1300	Alive	8	500	W	GA	A
454767	6352472	*Corymbia calophylla*	800	Alive	6	400	E	GA	A
454770	6352515	*Eucalyptus marginata*	300	Alive	6	300	NE	GA	C
454651	6352498	*Eucalyptus marginata*	500	Alive	6	300	N	GA	C
454648	6352463	*Corymbia calophylla*	1200	Alive	7	400	N	GA	A
454592	6352387	*Corymbia calophylla*	800	Alive	6	400	E	GA	A
454578	6352378	*Eucalyptus marginata*	600	Alive	6	300	NE	GA	A
454546	6352353	*Eucalyptus marginata*	600	Alive	6	300	NE	GA	A
454526	6352343	*Corymbia calophylla*	900	Alive	7	600	NE	GA	A
454435	6352377	*Corymbia calophylla*	1000	Alive	13	600	SE	GA	A
454147	6351343	*Eucalyptus marginata*	600	Alive	10	500	W	GA	A
454088	6351332	*Eucalyptus marginata*	350	Alive	5	250	W	GA	B
454001	6351357	*Eucalyptus marginata*	800	Alive	7	500	W	GA	A
453970	6351327	*Eucalyptus marginata*	500	Alive	5	300	N	GA	B
453846	6351318	*Corymbia calophylla*	600	Alive	6	400	NE	GA	B
453848	6351327	*Eucalyptus marginata*	400	Alive	9	300	SW	GA	A
453847	6351343	*Corymbia calophylla*	700	Alive	11	300	SE	GA	A
453682	6351305	*Eucalyptus wandoo*	300	Alive	7	200	SE	GA	B
453677	6351290	*Corymbia calophylla*	1000	Alive	12	600	NE	GA	A

Easting	Northing	Tree species	DBH (mm)	Status	Installation height (m)	DIH	Orientation	Access	Grade
453652	6351294	*Eucalyptus marginata*	600	Alive	11	300	SW	GA	A
453763	6351671	*Eucalyptus marginata*	500	Alive	7	200	N	GA	A
453957	6351758	*Eucalyptus marginata*	2000	Alive	9	300	SE	GA	A
453984	6351764	*Corymbia calophylla*	2000	Alive	9	500	W	GA	A
453981	6351814	*Eucalyptus marginata*	800	Alive	8	300	E	GA	A
454000	6351817	*Eucalyptus marginata*	1000	Alive	10	300	SE	GA	A
454016	6351767	*Corymbia calophylla*	450	Alive	10	200	NE	GA	A
454016	6351746	*Eucalyptus marginata*	500	Alive	13	300	N	GA	A
454038	6351771	*Eucalyptus marginata*	400	Alive	8	200	S	GA	B
454037	6351784	*Corymbia calophylla*	500	Alive	10	300	S	GA	A
454065	6351827	*Eucalyptus marginata*	900	Alive	10	300	SE	GA	A
454069	6351855	*Eucalyptus marginata*	900	Alive	10	300	SE	GA	A
454076	6351843	*Eucalyptus marginata*	400	Alive	9	300	N	GA	A
454061	6351909	*Eucalyptus marginata*	800	Alive	8	350	SW	GA	A
454027	6351941	*Eucalyptus marginata*	500	Alive	8	250	S	GA	A
453561	6352371	*Corymbia calophylla*	500	Alive	6	250	S	GA	A
453591	6352370	*Corymbia calophylla*	700	Alive	7	250	SW	GA	A
453679	6352439	*Corymbia calophylla*	700	Alive	9	500	SW	GA	A
453694	6352433	*Corymbia calophylla*	900	Alive	9	600	SW	GA	A
453693	6352427	*Corymbia calophylla*	900	Alive	9	600	SW	GA	A
453702	6352408	*Corymbia calophylla*	900	Alive	12	700	NE	GA	A
453627	6352185	*Eucalyptus marginata*	600	Alive	12	300	N	GA	B
453647	6352171	*Eucalyptus marginata*	600	Alive	8	300	N	GA	A
453655	6352160	*Corymbia calophylla*	1100	Alive	9	600	E	GA	A
453694	6352134	*Eucalyptus marginata*	800	Alive	8	500	W	GA	A
453708	6352136	*Corymbia calophylla*	1000	Alive	11	500	S	GA	A
453761	6352137	*Corymbia calophylla*	1000	Alive	10	500	S	GA	A
453803	6352146	*Corymbia calophylla*	1000	Alive	8	350	W	GA	A
453774	6352132	*Eucalyptus marginata*	600	Alive	7	350	NW	GA	A

Easting	Northing	Tree species	DBH (mm)	Status	Installation height (m)	DIH	Orientation	Access	Grade
453750	6352109	*Corymbia calophylla*	1200	Alive	7	350	W	GA	A
453740	6352102	*Corymbia calophylla*	700	Alive	7	350	W	GA	A
453634	6352126	*Eucalyptus marginata*	1100	Alive	11	400	SE	GA	A
453611	6351983	*Eucalyptus marginata*	2000	Alive	12	600	SW	GA	A
453476	6351668	*Eucalyptus marginata*	600	Alive	8	300	W	GA	A
453466	6351675	*Corymbia calophylla*	900	Alive	6	500	W	GA	A
453463	6351713	*Eucalyptus marginata*	600	Alive	7	300	E	GA	A
453443	6351730	*Eucalyptus marginata*	500	Alive	7	300	E	GA	A
453447	6351769	*Corymbia calophylla*	500	Alive	7	300	S	GA	A
453411	6351756	*Eucalyptus wandoo*	500	Alive	7	300	W	GA	A
453353	6351733	*Eucalyptus marginata*	500	Alive	7	300	W	GA	A
453298	6351646	*Eucalyptus marginata*	500	Alive	9	300	S	GA	A
453241	6351714	*Corymbia calophylla*	700	Alive	9	300	S	GA	A
453243	6351673	*Corymbia calophylla*	700	Alive	9	300	E	GA	A
453284	6351611	*Eucalyptus marginata*	700	Alive	6	300	S	GA	A
453236	6351609	*Corymbia calophylla*	700	Alive	11	300	N	GA	A
453178	6351596	*Corymbia calophylla*	700	Alive	11	300	S	GA	A
453130	6351628	*Eucalyptus marginata*	700	Alive	12	300	SW	GA	A
453106	6351610	*Eucalyptus marginata*	700	Alive	6	300	SE	GA	A
453091	6351585	*Eucalyptus marginata*	700	Alive	12	300	SE	GA	A
453054	6351584	*Corymbia calophylla*	800	Alive	10	300	SE	GA	A
452963	6351571	*Eucalyptus marginata*	800	Alive	11	300	S	GA	A
452878	6351545	*Eucalyptus marginata*	500	Alive	8	300	E	GA	A
452881	6351553	*Corymbia calophylla*	500	Alive	8	300	E	GA	A
452826	6351539	*Eucalyptus marginata*	800	Alive	8	400	S	GA	A
452798	6351503	*Eucalyptus marginata*	500	Alive	8	300	E	GA	A
452667	6351573	*Eucalyptus marginata*	2000	Alive	13	800	E	GA	A
452645	6351592	*Eucalyptus marginata*	600	Alive	8	300	SW	GA	A
452589	6351593	*Corymbia calophylla*	1000	Alive	12	500	E	GA	A

Easting	Northing	Tree species	DBH (mm)	Status	Installation height (m)	DIH	Orientation	Access	Grade
452619	6351663	*Corymbia calophylla*	1000	Alive	12	500	SE	GA	A
452645	6351712	*Corymbia calophylla*	1000	Alive	10	500	SE	GA	A
452699	6351709	*Corymbia calophylla*	500	Alive	10	500	N	GA	A
452751	6351845	*Eucalyptus marginata*	1500	Alive	9	500	W	GA	A
452821	6351780	*Corymbia calophylla*	1100	Alive	9	500	E	GA	A
452872	6351590	*Corymbia calophylla*	800	Alive	9	500	N	GA	A
453540	6351892	*Corymbia calophylla*	800	Alive	9	500	E	GA	A
453554	6351840	*Corymbia calophylla*	600	Alive	9	500	S	GA	A
453557	6351788	*Corymbia calophylla*	600	Alive	9	500	E	GA	A
453516	6351673	*Eucalyptus wandoo*	600	Alive	7	300	S	GA	A
453527	6351942	*Eucalyptus marginata*	1300	Alive	7	400	S	GA	A
453514	6351963	*Eucalyptus marginata*	700	Alive	7	400	S	GA	A
453499	6351983	*Corymbia calophylla*	700	Alive	7	300	S	GA	A
453449	6351971	*Eucalyptus marginata*	700	Alive	7	300	E	GA	A
453449	6351968	*Eucalyptus marginata*	700	Alive	9	350	E	GA	A
453429	6351956	*Corymbia calophylla*	700	Alive	9	350	N	GA	A
453417	6351939	*Corymbia calophylla*	700	Alive	9	350	NE	GA	A
453376	6351946	*Eucalyptus marginata*	500	Alive	9	350	NE	GA	A
453380	6352019	*Eucalyptus marginata*	800	Alive	7	350	NE	GA	A
452074	6351327	*Corymbia calophylla*	1000	Alive	7	350	S	AA	A
452032	6351376	*Corymbia calophylla*	1200	Alive	7	350	N	AA	A
452032	6351394	*Corymbia calophylla*	1100	Alive	7	350	S	AA	A
451987	6351431	*Corymbia calophylla*	900	Alive	7	400	S	AA	A
452149	6351101	*Eucalyptus marginata*	600	Alive	11	300	N	AA	A
452150	6351115	*Corymbia calophylla*	500	Alive	9	300	NE	AA	A
452154	6351125	*Corymbia calophylla*	900	Alive	9	350	SW	AA	A
452552	6351382	*Eucalyptus marginata*	1000	Alive	10	250	SE	GA	A
452886	6351612	*Eucalyptus marginata*	800	Alive	10	300	SW	GA	A
452875	6351626	*Eucalyptus marginata*	900	Alive	10	400	SW	GA	A

Easting	Northing	Tree species	DBH (mm)	Status	Installation height (m)	DIH	Orientation	Access	Grade
452928	6351644	*Corymbia calophylla*	900	Alive	10	400	SW	GA	B
452914	6351655	*Eucalyptus marginata*	900	Alive	10	400	SW	GA	A
452852	6351706	*Eucalyptus marginata*	900	Alive	10	400	SW	GA	A
452880	6351738	*Eucalyptus marginata*	900	Alive	10	400	SW	GA	A
452845	6351766	*Corymbia calophylla*	900	Alive	15	400	SW	GA	A
452845	6351817	*Eucalyptus marginata*	900	Alive	15	400	SW	GA	A
452846	6351950	*Eucalyptus marginata*	900	Alive	10	400	E	GA	A
452855	6351940	*Eucalyptus marginata*	700	Alive	10	300	S	GA	A
452869	6351948	*Eucalyptus marginata*	600	Alive	7	300	SW	GA	A
452952	6351962	*Corymbia calophylla*	700	Alive	10	400	SW	GA	A
452989	6351947	*Corymbia calophylla*	1200	Alive	10	400	SW	GA	A
453001	6351959	*Corymbia calophylla*	500	Alive	6	300	SW	GA	A
453037	6351974	*Corymbia calophylla*	600	Alive	10	300	SW	GA	A
453064	6351995	*Corymbia calophylla*	900	Alive	15	400	SW	GA	B
453149	6352014	*Eucalyptus marginata*	700	Alive	10	400	S	AA	A
453200	6352043	*Eucalyptus marginata*	600	Alive	10	300	S	GA	A
453243	6352052	*Corymbia calophylla*	800	Alive	10	400	S	GA	A
453249	6352038	*Eucalyptus marginata*	900	Alive	10	400	SW	GA	B
453267	6352053	*Corymbia calophylla*	900	Alive	15	400	S	GA	A
453267	6352059	*Corymbia calophylla*	500	Alive	10	200	SW	GA	A
453291	6352046	*Corymbia calophylla*	600	Alive	10	300	W	GA	A
453330	6352033	*Corymbia calophylla*	800	Alive	15	400	S	GA	A
453322	6352023	*Eucalyptus marginata*	700	Alive	10	400	S	GA	A
453330	6352007	*Corymbia calophylla*	800	Alive	10	400	NE	GA	A
452509	6351266	*Corymbia calophylla*	1200	Alive	10	600	SW	GA	A
452530	6351167	*Eucalyptus marginata*	1500	Alive	10	600	NE	GA	A
452320	6351235	*Corymbia calophylla*	900	Alive	8	500	SW	GA	A

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