Ransberg Pty Ltd-Byford Whitby Quarry

Offset Site Management Plan

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The Bannister Offset Management Plan (BOMP) was developed as a supporting document in response to the enquiry letter from the Department of Climate Change, Energy, the Environment and Water (DCCEEW) for Byford Whitby Quarry, portion of Mining Lease M701240 (EPBC ref: 2021/9045). Ransberg Pty Ltd (WA Bluemetal) are proposing to undertake clearing associated with the Byford (Whitby) Quarry operations. The proposed works will necessitate the clearing of 13.2 ha of vegetation within a boundary of the same size. The clearing will take place within Mining Tenement M70/1240 Karrakup (the Project) for storage purposes.

The key impacts to Protected Matters arising from the Project are associated with:

- the direct clearing of up to 13.2ha of habitat suitable for three (3) species of Black Cockatoo, within the Mine Development Envelope (MDE), and the possible direct loss of individuals;
- impacts to 13.2ha of Chuditch habitat;
- impacts to clearing 31 nesting hollows.

The objective of the BOMP is to:

- protect and improve the quality of existing habitat at the Bannister Offset Site that will provide nesting and foraging sites for Black Cockatoos in the future;
- protect existing suitable den logs and den sites within the Offset Site for use by native fauna, specifically Chuditch;
- protect existing habitat from future developments;
- reverse habitat alteration and decline caused by livestock grazing;
- implement fire management to improve habitat values, especially the availability of suitable Chuditch den logs and den sites, and habitat, feeding and roosting trees for Black Cockatoos;
- minimise the risk of introduction or spread of dieback;
- prevent any increases in weed cover to protect habitat values;

protect Chuditch from predation by, and competition from, introduced cats and foxes by reducing cat and fox abundance. The site will be transferred to the Western Australian (WA) Department of Biodiversity, Conservation and Attractions (DBCA) for incorporation into the Conservation Estate. The site will be managed for conservation outcomes.

Ransberg will be responsible for undertaking or providing agreed funds to the DBCA to contribute to the management of the Offset Site. Ransberg will also undertake monitoring at five (5) year intervals for the lifetime of the BOMP (20 years), starting from the following year of the approval date. An Environmental Offset Report will be published by the Company following each monitoring event.

Ransberg is in the process of securing the Offset Site by purchasing the property and having an agreement as a Memorandum of Understanding (MoU) with DBCA. Future management arrangements will be in accordance with the MoU between the DBCA and Ransberg.

1. Introduction

Ransberg Pty Ltd (WA Bluemetal) are proposing to undertake clearing associated with the Byford (Whitby) Quarry operations. The proposed works will necessitate the clearing of 13.2 ha of vegetation within a boundary of the same size. The clearing will take place within Mining Tenement M70/1240 Karrakup (the Project) for storage purposes (Figure 1-1). The Project is located within the Serpentine-Jarrahdale approximately 40 km southeast of Perth.

The proposed clearing will facilitate construction of the following elements:

- Storage and laydown areas;
- Access tracks/roads; and
- Associated quarry infrastructure.

A Clearing Permit (purpose permit) has been granted over the entirety of the proposal area (8038/1) which is valid from 5th December 2020 to 4th December 2025.

Impacts are considered to be associated with the clearing of 13.2 ha of vegetation across Mining Tenement 70/1240 including potential habitat for Black Cockatoo species and Chuditch, which are Matters of National Environmental Significance (MNES) protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The site is predominantly dominated by Jarrah-Marri Forest with an area of Marri-Wandoo woodlands on clayey soils in the east. The vegetation ranges in condition from 'Completely Degraded' to 'Excellent' (Mattiske 2017; Bamford 2022a).

The proposed action was referred to the Department of Climate Change, Energy, the Environment and Water (DCCEEW) on 5 October 2021, as a result of the potential impacts on Matters of National Environmental Significance protected under the EPBC Act. On 4 November 2021 the Delegate of the Minister for the Environment determined that the proposed action is a controlled action and will be assessed by preliminary documentation on the basis of the potential impacts to Matters of National Environmental Significance described in Table 1-1.

Table 1-1. List of MNES with the potential to be impacted by the proposed action.

MNES	Impact
Carnaby's Black Cockatoo (*Zanda latirostris* formerly *Calyptorhynchus latirostris*) – Endangered	Clearing of 13.2 ha of high-quality foraging habitat which may support potential roosting and breeding habitat for Carnaby's Black Cockatoo, Baudin's Black Cockatoo and the Forest Red-tailed Black Cockatoo.
Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) – Vulnerable	
Baudin's Black Cockatoo (*Calyptorhynchus baudinii*) – Endangered	
Chuditch, Western Quoll (*Dasyurus geoffroii*) – Vulnerable	Clearing of 13.2 ha of potential Chuditch habitat.

This Offset Management Plan has been prepared in support of the Preliminary Documentation for Byford Whitby Quarry, portion of Mining Lease M701240. As part of its implementation of the environmental offset requirements in EPBC 2021/9045, Ransberg Pty Ltd (WA Bluemetal) has identified a suitable parcel of land (Offset Site) and is in the process of purchasing the site for provision to the State of WA to add to the Conservation Estate. Ransberg Pty Ltd (WA Bluemetal), in consultation with DBCA, will also contribute funds to the DBCA for the on-going management and maintenance of the site for up to 20 years after implementation.

Figure 1-1. Site boundary and regional location of Whitby Quarry Byford, WA-Mining Lease 70/1240.

2. Environmental Offset

Ransberg has identified a significant residual impact to four (4) threatened species listed under the EPBC Act (three (3) Black Cockatoo species, and Chuditch), associated with the proposed clearing of native vegetation for the Project. Ransberg will counteract these impacts through the implementation of environmental offsets in accordance with the Australian Government's EPBC Act Environmental Offsets Policy (the Policy) (DSEWPAC 2012a).

Ransberg has been working to identify measures that, in combination, would constitute an acceptable and cost-effective package of environmental offsets that would satisfy the requirements of the Policy, as per the acceptance criteria. The *Offsets Assessment Guide* (DSEWPaC 2012b) was used to characterise and quantify the residual impacts that require offsetting under the Policy. The Policy requires that offsets must be built around direct offsets, with a minimum of 90% of the offset package to go towards directly offsetting residual impacts to the attribute of the protected matter that will be affected (Direct Offsets), with the remainder having the option of including offsets that are less directed towards the specific nature of the impact (Indirect Offsets).

The offset package includes offset actions that will be implemented across the Offset Site:

- the western portion of Lot P011005 6, 8772 Albany Highway, Bannister within the Shire of Boddington (Figure 2-1).

This Offset Management Plan (OMP) details the management measures for the Offset Site. The OMP was prepared in accordance with DCCEEW's Environmental Management Plan Guidelines and the EPBC Act Environmental Offsets Policy (2012).

2.1 Purpose of the Offset Management Plan

The purpose of the OMP is to:

- outline the management measures to be undertaken to deliver an overall conservation outcome that improves or maintains the viability of the protected matters as compared to what is likely to have occurred under the status quo, that is if neither the action nor the offset had taken place;
- describe monitoring procedures to determine the success of the habitat improvement measures;
- describe reporting requirements for the actions to be implemented in the OMP;
- describe the risks associated with the implementation of the OMP; and
- outline contingency measures and an adaptive management approach that can be utilised to support the OMP.

Existing Environment

2.2 Location

The proponent has identified a parcel of land as a potentially suitable Offset Site, being 119 ha of the western portion of Lot P011005 6, 8772 Albany Highway, Bannister within the Shire of Boddington (Figure 2-1). This property lies approximately 70 km to the southeast of the controlled action location and contains remnant vegetation with potential value for threatened fauna, and in particular for its potential to support all three species of Black Cockatoos. A "Threatened Fauna Assessment" was undertaken by Bamford (2022) that identifies the values of the site for threatened fauna and Baudins, Carnabys and Forest Red-tailed Black Cockatoos in particular (refer to Appendix A). This site is not currently managed or owned by DBCA.

The Bannister Offset Site comprises of 389 ha of native vegetation. The Offset Site is within the Northern Jarrah Forest (JAF01) subregion of the Jarrah Forest bioregion. The vegetation and soil of the Northern Jarrah Forest subregion can be described as follows: "Jarrah-Marri Forest in the west with Bullich and Blackbutt in the valleys grading to Wandoo and Marri woodlands in the east with Powder bark on breakaways. There are extensive but localised sand sheets with Banksia low woodlands. Heath is found on granite rocks and as a common understorey of forests and woodlands in the north and east. The majority of the diversity in the communities occurs on the lower slopes or near granite soils where there are rapid changes in site conditions" (Bamford 2022b).

Other than a minor patch burn, the present owner indicated that the survey area has not been burnt in at least the last 20 years. There was no evidence noted during each inspection to suggest otherwise. Most of the site is long-unburnt, intact native woodlands (Bamford 2022b).

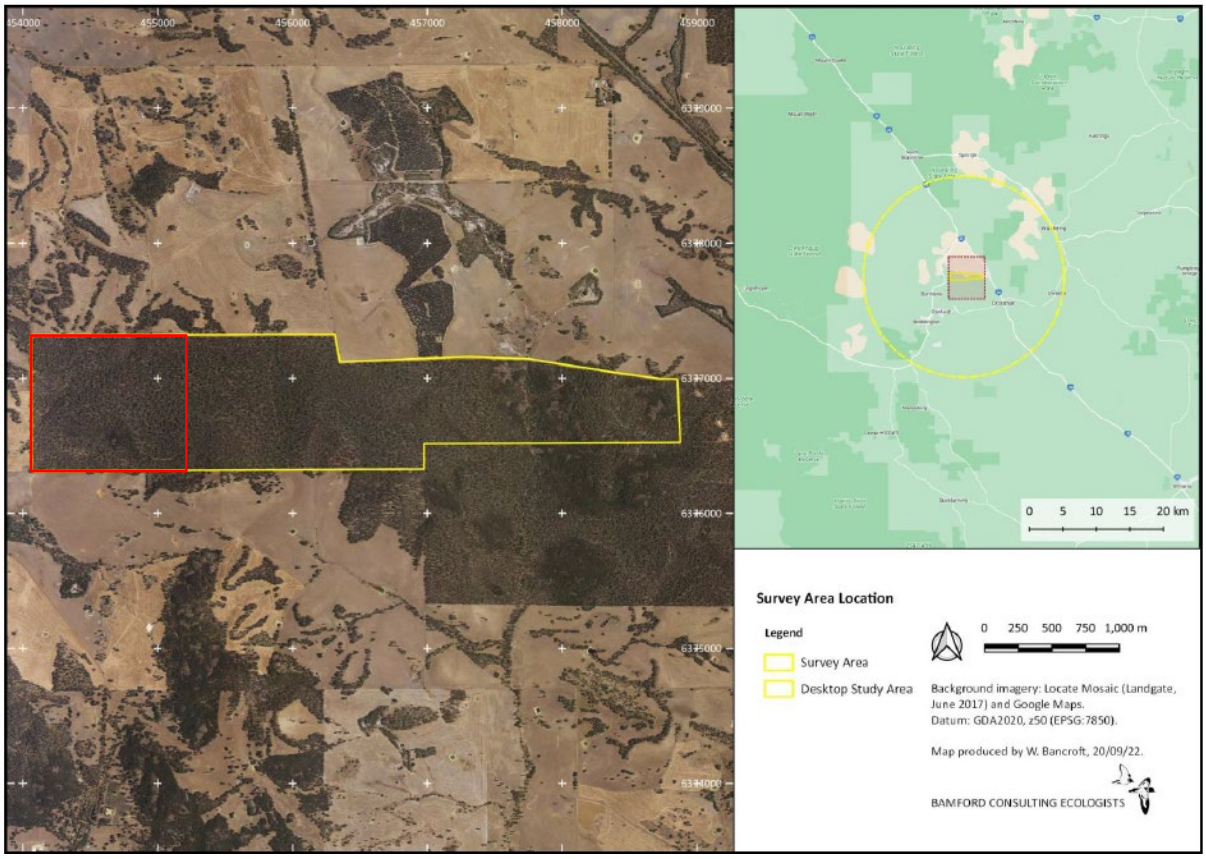

Figure 2-1. Offset Site location (the western portion of Lot P011005 6, 8772 Albany Highway, Bannister, Western Australia).

The Lot immediately to the south of the proposed offset site has recently been ceded to DBCA for conservation purposes approximately doubling the area to be included in the conservation estate and allowing for the consolidation of management of a conservation reserve in excess of 600 ha. This opportunity to provide a significant area of Black Cockatoo habitat and improved Chuditch habitat will assist with linkage of the State forest 4.5 km to the west with reserves of remnants approximately 3km to the east and approximately 4 km to the north east providing a greater connection across a heavily cleared landscape than would be achieved by parcels of land adjacent to existing extensive forested areas. This opportunity was not available in closer proximity to the impact site.

Table 2-1. Bannister Offset Site Description.

Parameter	Description*
All MNES known to be present.	• Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*); • Carnaby's Cockatoo (*Zanda latirostris*);
All MNES with potential to be present.	• Baudin's Cockatoo (*Zanda baudinii*); • Chuditch (*Dasyurus geoffroii*); and • Red-tailed Phascogale (*Phascogale calura)*.
Site topography.	The Offset Site has considerable variation in topographic relief (see Figure 2-2), with some steep changes in ground elevation and relatively little in the way of gently sloping or flat ground.
Site biogeography.	The Offset Site comprises remnant vegetation that sits within a highly modified agricultural landscape. Extensive native vegetation exists c. 5 km to the west (Dwellingup State Forest) and c. 10 km to the north (Youraling State Forest). In addition, large blocks of remnant vegetation also occur c. 2.5 km to the north-east (north and south of the West Wandering Road) and c. 4 km to the east (north of Moramocking Road) of the site (see Figure 2-1).
All water resources on site.	At least two drainage lines run through the site, and these connect to the Hotham River to the south. It is understood that at least one of these drainages has a section that provides permanent water (via a natural seep or spring). Water in these drainages was relatively fresh (at the time of inspection) and did not appear to have significant salinity issues.
Whether the site is located within a wildlife corridor or other landscape enabling it to operate as a suitable offset site.	The Offset Site comprises remnant vegetation that sits within a highly modified agricultural landscape. Extensive native vegetation exists c. 5 km to the west (Dwellingup State Forest) and c. 10 km to the north (Youraling State Forest). In addition, large blocks of remnant vegetation also occur c. 2.5 km to the north-east (north and south of the West Wandering Road) and c. 4 km to the east (north of Moramocking Road) of the site (see Figure 2-1). While not directly connected, a series of smaller belts or patches of vegetation appear to create 'stepping stones' across the landscape between the survey area and these remnants. This would likely provide sufficient passage for a wide range of vertebrate fauna, including the threatened (and priority) species for which the site is considered suitable. Discussion with the present landowner (during the field investigations) suggested that the adjoining property to the south of the Offset Site (of at least c. 300 ha, and to which it has a direct and extensive connection) has recently been secured for conservation purposes. It could be expected that this property would have similar fauna values to the Offset Site (as, together, they form a cohesive block with a shared history, as can been seen in Figure 2-1).
Description of the vegetation cover at the site	The vegetation is, broadly, in excellent condition with minimal weed incursion and almost no recent anthropogenic disturbance. It has previously been logged but does not appear to have been used for livestock grazing (at least in the last few decades). Several firebreaks and access tracks are currently maintained throughout the site. Erosion issues, pollution and litter/refuse dumping were all negligible or absent for the vast majority of the site. Similarly, there was nothing to indicate that other sources of environmental disturbance such as dust, light, noise and vibration have any appreciable impact on the survey area.
Description of the Fauna habitat at the site	***Fauna Habitat***

Parameter	Description*
	Vegetation and substrate associations within the survey area are a mosaic, largely reflecting soil types and topography. Four major vegetation and substrate associations (VSAs) were identified in relation to fauna in the Offset Site (Bamford 2022b): • **VSA 1. Wandoo woodland.** Woodland of Powderbark Wandoo (*Eucalyptus accedens*) and Wandoo (*E. wandoo*) with variable understorey; from shrub thickets dominated by Pingle (*Banksia squarrosa*) to a very open understorey of widely scattered shrubs and/or bare ground. See Plate 1 and Plate 2. • **VSA 2. Jarrah, Marri and Wandoo woodland.** Woodland dominated by Jarrah (*E. marginata*) with occasional Marri (*Corymbia calophylla*) and wandoos (*E. accedens or E. wandoo*) over dense thickets of Pingle (*B. squarrosa*) and Parrot Bush (*B. sessilis*), and other mixed shrubs. • **VSA 3. Rock Sheoak woodland.** Woodland of Rock Sheoak (*Allocasuarina huegeliana*), usually surrounding exposed granite, and ranging from almost a monoculture, to having shrub layer of Grasstrees (*Xanthorrhoea priessii*) and/or mixed heaths. • **VSA 4. Drainages.** Watercourses.
Quantification of all MNES present (including habitat quality), evaluated based on the particular attributes of the MNES, with a breakdown by vegetation sub-unit for each MNES.	**Foraging** • **Carnaby's Black Cockatoo** - Foraging habitat was present throughout the Offset Site due to the presence of one tree species (Marri, *Corymbia calophylla*) and two shrub species (Parrot Bush, *Banksia sessilis;* and Pingle, *B. squarrosa*). - There was evidence of foraging by the Carnaby's Black-Cockatoo within the Offset area. - The full 389 ha represents potential foraging habitat with 152 ha "moderate to high" value. • **Forrest red-tailed Black Cockatoo** - Foraging habitat for was present throughout the Offset Site due to the presence of Jarrah, *Eucalyptus marginata*; and Marri, - There was evidence of foraging by the Forest Red-tailed Black-Cockatoo within the Offset Site, - The forage tree species that were present occurred in varying densities, across the site, but nowhere were they notably high density. - The full 389 ha represents potential foraging habitat with 169 ha "moderate" value. • **Baudins' Black Cockatoo** - Foraging habitat was present throughout most of the Offset Site due to the presence of two tree species Jarrah and Marri. - No evidence of foraging by the Baudin's Black-Cockatoo within the Offset Site. - The full 389 ha represents potential foraging habitat with 152 ha "moderate" value. • **Chuditch** The woodlands within the survey area would provide ideal habitat for this species although competition with/predation by feral predators may be of some concern. A number of fallen, hollowed logs are present throughout the site, and these would provide excellent dens for Chuditch. While these are very wide-ranging animals with large home range and low density, the overall health of the ecosystem within the Offset Site (and surrounds) should be able to support a resident population of Chuditch. The neighbouring jarrah woodland 5 km to the west has a large population of Chuditch (Newmont Boddington Gold, 2014) that could act as a seeding population once predator control has been

Parameter	Description*
	implemented. A "Habitat Scoring System for Chuditch" (2024) has been prepared to assist in completing the offset calculator. This is provide in Appendix B. **Breeding** • **Carnaby's Black Cockatoo** - Regular breeding and/or non-breeding migrant to the site. - Estimated 721 trees with existing suitable hollows. - Likely that the Carnaby's Black-Cockatoo breeds within the local area, given the proximity to Jarrah/Marri and Wandoo forests in the region. • **Forrest red-tailed Black Cockatoo** - Likely to be a regular visitor, or possibly even resident, at the site. It is possible that this species breeds within the Offset Site. - Estimated 721 trees with existing suitable hollows. - Likely that the Forest Red-tailed Black-Cockatoo breeds within the local area, given the proximity to Jarrah/Marri forests in the region. • **Baudins' Black Cockatoo** - Likely to be a regular non-breeding visitor to the site. - Possible that the Baudin's Black-Cockatoo breeds within the local area, given the proximity to Jarrah/Marri and Wandoo forests in the region.
Description of the current management arrangements at the Bannister Offset Site	Standard rural bushfire management (firebreaks and fuel management).
Threats currently present at the Bowelling property	The following points are from the Fauna Survey Report carried out by Bamford 2022b: • It is understood that the Offset Site is presently used for (private) conservation and very low impact recreation activities such as bushwalking. • The key threats for Black Cockatoos ecology include dieback introduction, illegal shooting, habitat loss, habitat degradation, nest hollow shortage, competition for available nest hollows from other parrots and feral Honeybees (*Apis mellifera*), and illegal trade. • Feral predators such as cats and foxes present some risk to fauna within the survey area, particularly juvenile Chuditch. A fox was observed during the site inspection, fox dens are known to be present within the survey area and it is expected that cats would also occur. • There was some evidence of rabbits using the Site but there was minor to negligible impact in most places inspected. Pig diggings were noted and there are anecdotal records of pigs within the survey area. The extent to which pigs affect the fauna values of the site is not certain. • It is noted that, given the surrounding agricultural lands, over-grazing by (native) kangaroos may be a consideration.

* The information in this table has been extracted from fauna survey for the Offset Site carried out by Bamford (2022b).

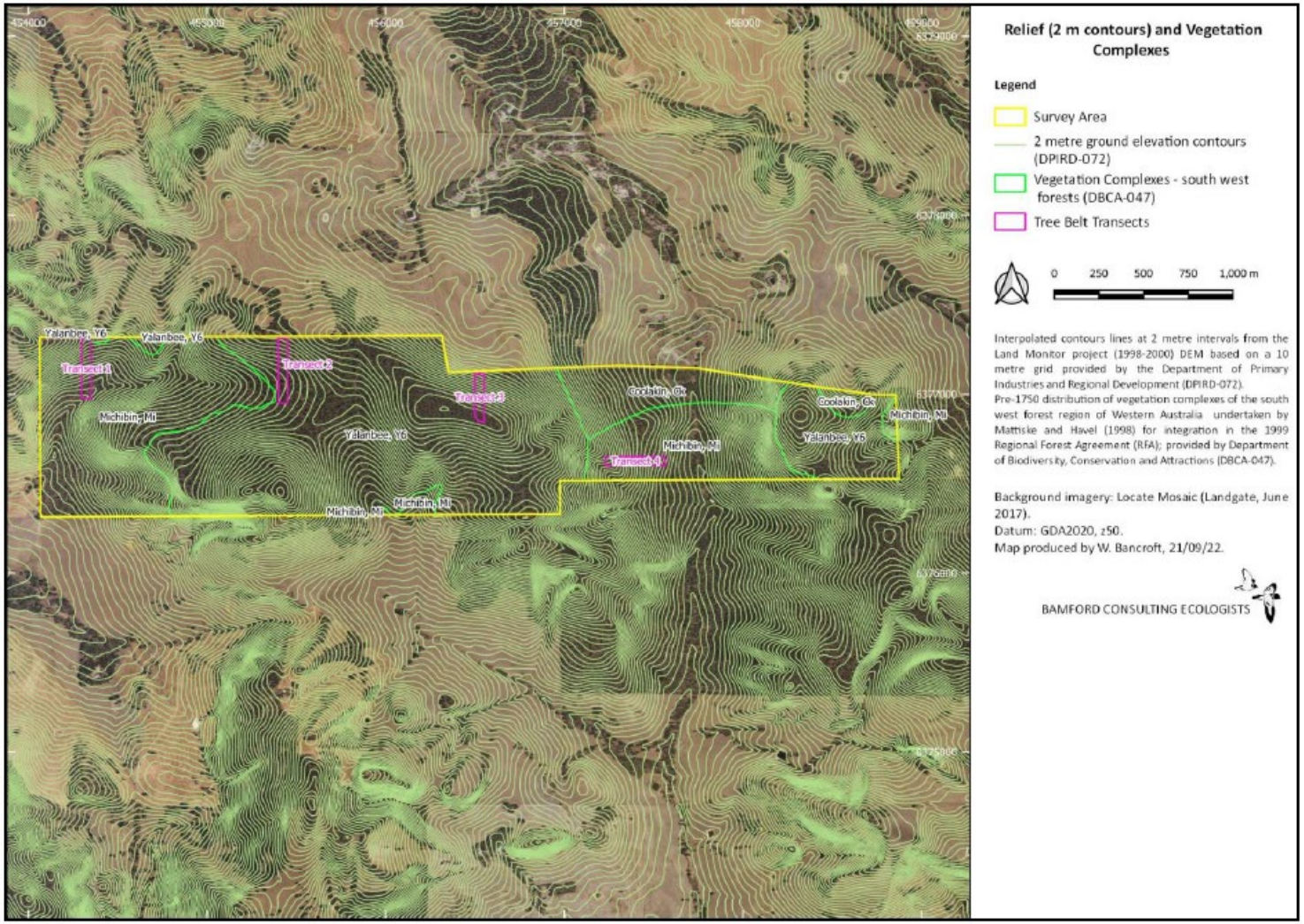

Figure 2-2. Relief (2 m contours) and vegetation complexes within the Offset Site (Bamford 2022b).

2.3 Dieback (*Phytophthora cinnamomi*)

No *Phytophthora cinnamomi* has been identified on-site. Vegetation across the site is identified as "Medium" or "High" susceptibility to Dieback (South Coast Natural Resource Management, 2024). A detailed die-back survey will be completed prior to undertaking any Offset Site Management Plan commitments on-site.

Dieback has been mapped on the State forest approximately 7km west of the offset site (South Coast Natural Resource Management, 2024). The outbreak appears to have originated from the gold mining operations in the area and is spreading east. Without active management and effective access controls it is likely this dieback will spread to the offset site significantly altering the vegetation structure and condition and reducing foraging and breeding opportunities for Black Cockatoos on-site. A Dieback Management Plan has been prepared to minimise the risk of introduction and spread of Dieback on-site (refer to Appendix C).

2.4 Flora and Vegetation

The Interim Biogeographic Regionalisation of Australia (IBRA) has identified 26 bioregions in Western Australia which are further divided into subregions (DAWE 2022a). Bioregions are classified on the basis of climate, geology, landforms, vegetation and fauna. The survey area is within the Northern Jarrah Forest (JAF01) subregion of the Jarrah Forest bioregion (Bamford 2022b).

The vegetation and soil of the Northern Jarrah Forest subregion can be described as follows: "Jarrah-Marri Forest in the west with Bullich and Blackbutt in the valleys grading to Wandoo and Marri woodlands in the east with Powder bark on breakaways. There are extensive but localised sand sheets with Banksia low woodlands. Heath is found on granite rocks and as a common understorey of forests and woodlands in the north and east. The majority of the diversity in the communities occurs on the lower slopes or near granite soils where there are rapid changes in site conditions" (Bamford 2022b).

2.4.1 Vegetation Mapping

Mattiske and Havel (1998) have defined and described broad vegetation complexes for the Southwest Forest region of Western Australia and the mapping of these is provided by DBCA (2022). Three complexes occur within the site:

- **Coolakin** (Ck) - Woodland of *Eucalyptus wandoo* with mixtures of *Eucalyptus patens*, *Eucalyptus marginata* subsp. *thalassica* and *Corymbia calophylla* on the valley slopes in arid and perarid zones.
- **Michibin** (Mi) - Open woodland of *Eucalyptus wandoo* over *Acacia acuminata* with some *Eucalyptus loxophleba* on valley slopes, with low woodland of *Allocasuarina huegeliana* on or near shallow granite outcrops in arid and perarid zones.
- **Yalanbee 6** (Y6) - Woodland of Eucalyptus wandoo – Eucalyptus accedens, less consistently open forest of Eucalyptus marginata subsp. thalassica – Corymbia calophylla Mixture of open forest of Eucalyptus marginata subsp. thalassica – Corymbia calophylla on lateritic uplands and breakaway landscapes in arid and perarid zones.

The vegetation complexes within the Offset Site are mapped in Figure 2-2 (Bamford 2022b).

2.4.2 Vegetation conditions

Vegetation and substrate associations within the Offset Site are a mosaic, largely reflecting soil types and topography. Preliminary vegetation descriptions and mapping were provided by Western Environmental. From these, and observations made during the field investigations here, four major vegetation and substrate associations (VSAs) were identified in relation to fauna in the Offset Site (Bamford 2022b) (Figure 2-3):

- **VSA 1. Wandoo woodland.** Woodland of Powderbark Wandoo (*Eucalyptus accedens*) and Wandoo (E. wandoo) with variable understorey; from shrub thickets dominated by Pingle (*Banksia squarrosa*) to a very open understorey of widely scattered shrubs and/or bare ground.
- **VSA 2. Jarrah, Marri and Wandoo woodland.** Woodland dominated by Jarrah (E. marginata) with occasional Marri (*Corymbia calophylla*) and wandoos (*E. accedens or E. wandoo*) over dense thickets of Pingle (*B. squarrosa*) and Parrot Bush (*B. sessilis*), and other mixed shrubs.
- **VSA 3. Rock Sheoak woodland.** Woodland of Rock Sheoak (*Allocasuarina huegeliana*), usually surrounding exposed granite, and ranging from almost a monoculture, to having shrub layer of Grasstrees (*Xanthorrhoea priessii*) and/or mixed heaths.
- **VSA 4. Drainages.** Watercourses.

2.5 Fauna Habitats

Based on the results of Threatened Fauna Assessment of the Bannister Offset Site carried out by Bamford (2022b), three habitat categories were defined within the Offset Site:

- **Wandoo Woodland**. Woodland of Wandoo at 20-40% overstory foliar cover. Large mature and large dead Wandoos present with hollow formation evident in some larger trees. Very open mid stratum with few shrub species. Open ground stratum. Old dead logs and leaf litter present. Occurring on skeletal and gravelly/ clay soils.
- **Jarrah, Marri and Wandoo Woodland**. Mixed woodland at 15-30% overstory foliar cover. Typically dominated by Jarrah at 10-20% foliar cover with Marri at 5-10% foliar cover and scattered Wandoo at <5% foliar cover. Large mature and large dead Jarrah and Marri present with hollow formation evident in larger trees. Shrubby midstratum present, mainly comprising *Banksia squarrosa*, *Banksia sessilis* and *Xanthorrhoea* sp. old dead logs and leaf litter present. Occurring on gravelly and laterite soils.
- **Rock Sheoak Woodland**. Woodland of *Allocasuarina huegeliana* (Rock Sheoak) at 30-40% foliar cover in groves interspersed with open patches of granites. Mid stratum of *Xanthorrhoea* sp. at 10-25% cover.

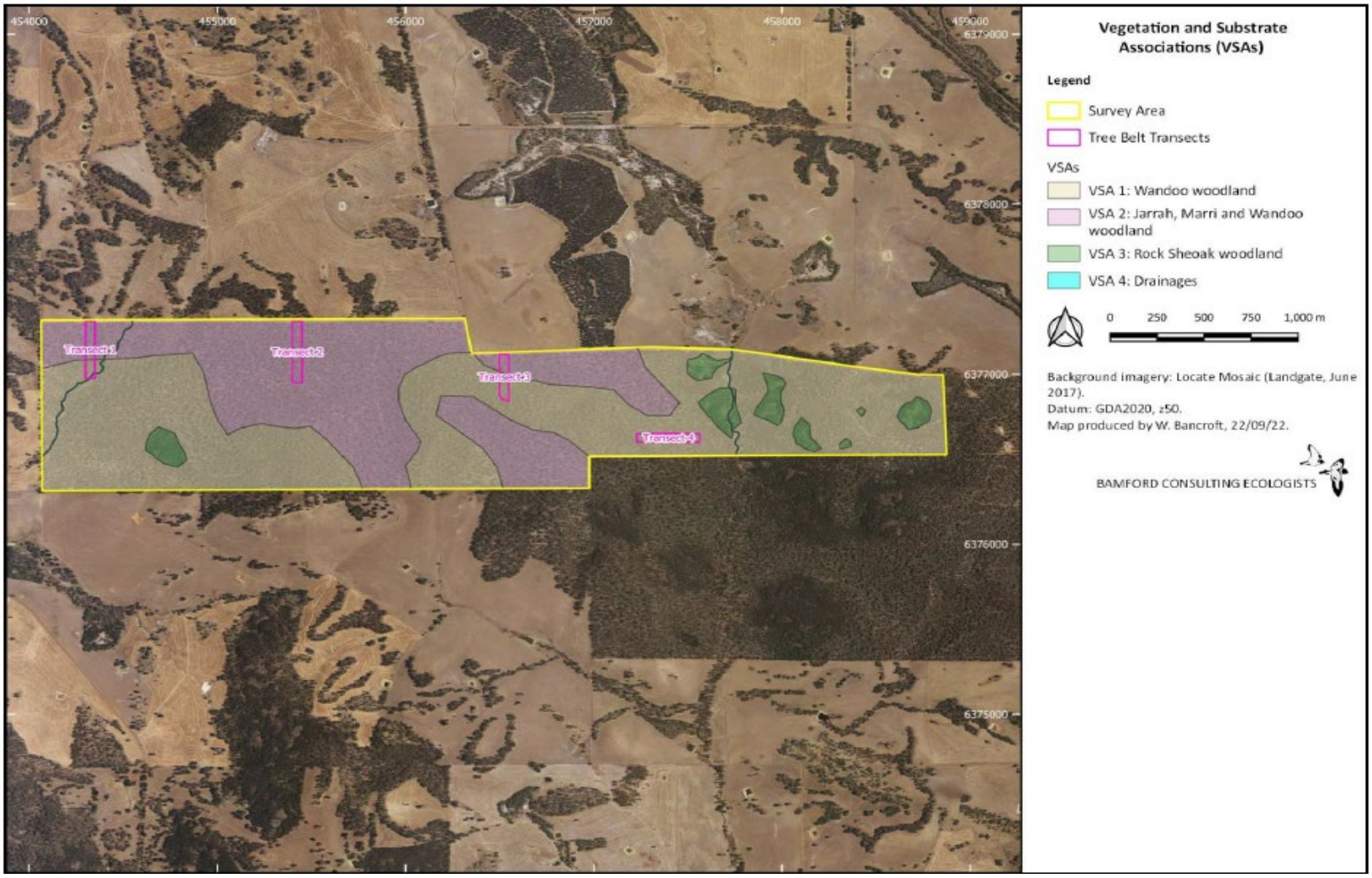

Figure 2-3. Vegetation and substrate associations.

3. Presence of Protected Matters within the Offset Site

3.1 Black Cockatoos

Only one of the three species of Black-Cockatoo known to occur in the south-west of Western Australia was directly recorded on the site during the site inspection: Carnaby's Black-Cockatoo. This was in the eastern third of the Offset Site; a flock of nine birds flew northwards, along the course of a drainage line. Anecdotal evidence suggested a number of Carnaby's Black-Cockatoos and Forest Red-tailed Black-Cockatoos had been seen in the Offset Site previously (weeks, months and years previously) and this is supported by the indirect (foraging) evidence (Bamford 2022b).

Given these direct observations, indirect (foraging) records, roosting data, and the literature review (including current species distributions), it is considered that, currently:

- Carnaby's Black-Cockatoo is likely to be a regular breeding and/or non-breeding migrant to the site.
- Forest Red-tailed Black-Cockatoo is likely to be a regular visitor, or possibly even resident, at the site. It is possible that this species breeds within the Offset Site.
- Baudin's Black-Cockatoo is likely to be a regular non-breeding visitor to the Site.

Table 3-1 summarizes the foraging habitat for each Black Cockatoo species.

The following information have been summarized from Threatened Fauna Assessment Report (Bamford 2022b) for the Bannister Offset Site:

There is approximately 81 ha of VSA 1 (Wandoo Woodland) and 38 ha of VSA 2 (Jarrah, Marri, and Wandoo Woodland) within the Offset Site. Thus, given the sampled tree densities, there is estimated to be in excess of 10,800 potential nest-trees in the survey area (6920 in VSA 1, and 3907 in VSA 2). Of these, approximately 2366 trees (1620 in VSA 1, 746 in VSA 2) are expected to bear hollows that are presently suitable for black-cockatoo nesting (rank 3) (Bamford 2022b).

Carnaby's Black Cockatoo (CBC)

- CBC has been recorded at the Offset Site;
- Foraging habitat was present throughout the Offset Site due to the presence of one tree species (Marri, Corymbia calophylla) and two shrub species (Parrot Bush, *Banksia sessilis*; and Pingle, *B. squarrosa*);
- There was evidence of foraging by the Carnaby's Black-Cockatoo within the survey area;
- Regular breeding and/or non-breeding migrant to the Site;
- Likely that the Carnaby's Black-Cockatoo breeds within the local area, given the proximity to Jarrah/Marri and Wandoo forests in the region.

Forrest red-tailed Black Cockatoo (FRTBC)

- There is anecdotal evidence for the presence of FRTBC at the Offset Site;
- Foraging habitat for was present throughout the survey area due to the presence of Jarrah, Eucalyptus marginata; and Marri,
- There was evidence of foraging by the Forest Red-tailed Black-Cockatoo within the Offset Site;
- The forage tree species that were present occurred in varying densities, across the site, but nowhere were they notably high density;

- Likely to be a regular visitor, or possibly even resident, at the site. It is possible that this species breeds within the Offset Site.
- Likely that the Forest Red-tailed Black-Cockatoo breeds within the local area, given the proximity to Jarrah/Marri forests in the region.

Baudins' Black Cockatoo (BBC)

- The presence of BBC is expected to occur at the Offset Site;
- Foraging habitat was present throughout most of the survey area due to the presence of two tree species Jarrah and Marri;
- Likely to be a regular non-breeding visitor to the Site;
- Possible that the Baudin's Black-Cockatoo breeds within the local area, given the proximity to Jarrah/Marri and Wandoo forests in the region.

3.2 Chuditch

Chuditch (*Dasyurus geoffroii*) is expected to occur at the Offset Site (Bamford 2022b). The woodlands within the Offset Area would provide ideal habitat for this species although competition with / predation by feral predators may be of some concern. A number of fallen, hollowed logs are present throughout the site, and these would provide excellent dens for Chuditch. While these are very wide-ranging animals, the overall health of the ecosystem within the Offset Site (and surrounds) should be able to support a resident population of Chuditch (Bamford 2022b).

Based on a recent GIS shapefile Chuditch record from DBCA for the Bannister area, there are a few records of Chuditch around the Offset Area with the distance of 3.28 km to 11 km from the Offset Site. The most recent record of Chuditch is from 2016 with the distance of 9 km from the Offset Site with similar vegetation type (GIS DBCA Database).

3.3 Other Significant Fauna

Bamford (2022b) has identified two other significant fauna species that could occur at the Offset Site:

- Red-tailed Phascogale (*Phascogale calura*). Expected to occur. The Rock Sheoak patches within the Offset Site provide excellent habitat for this species. While not extensive, there should be enough resources within the Site to support resident Red-tailed Phascogales.
- Woylie (*Bettongia penicillata ogilbyi*). Unlikely to currently occur but habitat is well suited to this species. While the Woylie is probably locally extinct there is an extant population in very similar habitat at Dryandra Woodland National Park to the east (connectivity to the study area is tenuous, however). With additional management (e.g., feral predator control and/or fencing), the site could be a strong potential for reintroduction of this species.

Table 3-1. Areas (ha) and proportions (%) of each category (vegetation score, combined foraging score) of foraging habitat at the survey area for Carnaby's Black-Cockatoo, Forest Red-tailed Black-Cockatoo and Baudin's Black-Cockatoo.

Vegetation Score/Value	Carnaby's Black-Cockatoo		Forest Red-tailed Black-Cockatoo		Baudin's Black-Cockatoo	
	Area (ha)	%	Area (ha)	%	Area (ha)	%
6: High	0	0.0	0	0.0	0	0.0
5: Moderate to High	152	39.2	0	0.0	0	0.0
4: Moderate	220	56.5	169	43.3	152	39.2
3: Low to Moderate	0	0.0	220	56.5	220	56.5
2: Low	17	4.4	1	0.2	1	0.2
1: Negligible	0	0.0	0	0.0	16	4.2
0: Nil	0	0.0	0	0.0	0	0.0
TOTAL	389	100.0	389	100.0	389	100.0
Context Score	2		2		2	
Species Density Score	1		1		1	

Foraging Score	Area (ha)	%	Area (ha)	%	Area (ha)	%
10	-	-	-	-	-	-
9	-	-	-	-	-	-
8	152	39.2	0	0.0	0	0.0
7	220	56.5	169	43.3	152	39.2
6	0	0.0	220	56.5	220	56.5
NA (Vegetation Score < 3)	17	4.4	1	0.2	17	4.4
TOTAL	389	100.0	389	100.0	389	100.0

4. Environmental Management Measures

4.1 Management Objectives

The objectives of the BOMP are to protect, maintain and improve the habitat values for, and secure the occurrence of Chuditch and all three species of Black Cockatoos at the Bannister Offset Site by:

- Land acquisition and conservation in perpetuity: Ransberg is planning to purchase the Bannister Offset Site and transfer the land title to DBCA. After the completion of the BOMP and providing the conditions of approval in relation to the site are met, the area will be managed as State Forest (Forest Conservation Area), for formal protection in perpetuity.
- It is intended that the western 119 ha of the site would be allocated as an offset for this project (EPBC 2021/9045) and the remaining portion would be available for use as an offset for a future project(s) by Ransberg Pty Ltd, where appropriate ("banked offset").
- Implementing management actions to improve habitat quality for the target species by:
    - Removing livestock grazing to allow natural vegetation regeneration;
    - Reducing the risk of wildfire by implementing controlled burns and maintaining firebreaks
    - Reducing the risk of introduction or spread of dieback by limiting access, strategic road upgrades, implementing quarantine procedures, installation of wash down bays if necessary;
    - Protect Chuditch from predation by, and competition from introduced cats and foxes by introducing a baiting program, in consultation with DBCA.
- Implementing management actions for maintaining and monitoring artificial hollows (targeted at all 3 species of Black Cockatoo).

These management actions are consistent with the relevant recovery plans, as detailed in Section 4.2.

The BOMP will be implemented for a period of 20 years and reviewed every five (5) years so that operational actions, targets, and budgets can be revised under an adaptive management approach. Monitoring and reporting will continue until the condition requirements are achieved. The successful attainment of the condition requirements within the timeframes are subject to the risks identified in Section 5.

4.2 Management Actions for Existing Habitat

Management actions are guided by the following species Recovery Plans:

- Chuditch (*Dasyurus geoffroii*) National Recovery Plan (DEC 2012)
- Carnaby's Cockatoo (*Calyptorhynchus latirostris*) Recovery Plan (DPaW 2013)
- Forest Black Cockatoo (Baudin's Cockatoo *Calyptorhynchus baudinii* and Forest Red-tailed Black Cockatoo *Calyptorhynchus 16banksii naso*) Recovery Plan (DEC 2008).

In development of this Offset Management Plan and following the Offset Strategy of which it forms a part, consideration has been given to aligning the actions and completion criteria to the recovery. The site will be managed in accordance with DBCA objectives, associated management plans, and land use categories with an objective to remove and/or minimise disturbance impacts to "As Low As is Reasonably Practicable" (ALARP).

Table 4-1. Management Actions (BOMP).

Management Objectives	*Key threat addressed, as per recovery plans (DEC 2008, 2012; DPaW 2013)*	*Management and Mitigation Measures*	*Trigger for Further Action*	*Monitoring in Place*	*Corrective Actions*
Protect existing habitat from future developments	<u>Chuditch:</u> • Land clearing and habitat alteration <u>Carnaby's cockatoo:</u> • Loss of breeding habitat • Loss of non-breeding foraging and night roosting habitat <u>Baudins and FRTBC:</u> • Habitat loss	• Purchase and conserve in perpetuity as a conservation reserve.	• If Conservation Reservation has not been achieved within 2 years.	• Notification of completion of land purchase and transfer to DBCA to be sent to DCCEEW within 4 weeks of finalisation.	• If Conservation Reservation has failed then a Conservation Covenant under the *Biodiversity Conservation Act 2016* will be placed over the site.
Reverse habitat alteration and decline caused by livestock grazing	<u>Chuditch:</u> • habitat alteration caused by (rabbit and) livestock grazing <u>Carnaby's:</u> • habitat degradation caused by factors including grazing	• Ensure effective fencing to exclude livestock are in place within 8 weeks of land transfer.	• Livestock in Conservation Reserve or observable breech of fence.	• No livestock on site, and fences erect and well-maintained with monthly inspection.	• If fencing is not in place or has been compromised, then it will be immediately re-instated and stock removed.
Implement fire management to improve habitat values, especially the availability of suitable Chuditch den logs and den sites, and habitat, feeding and roosting trees for Black Cockatoos	Changed fire regimes, including hot summer bushfires. • For Chuditch, fire may have the same medium-term impact as clearing due to its destructive nature. Broad scale, high intensity fires destroy den logs, protective cover and remove prey biomass (particularly large invertebrates) and homogenise large areas of habitat. • For Black Cockatoos, hot bushfires can destroy trees that contain nest hollows or that may develop hollows in the future, and can also destroy roosting trees. Fire may also affect the availability of foraging habitat.	• Maintenance of fire breaks and tracks within the Bannister Offset Site, with yearly inspections; • Locked gate and limited site access; • Fuel reduction burns every 8-10 years. • Fire management will be integrated with management of the surrounding Youraling State Forest and Conservation Park.	• If fire fuel loads reach a level unacceptable to DBCA fire control officers it will be prioritised for reduction.	• Annual inspections of fuel loads and firebreaks with addressing any maintenance if needed. • Visual inspection to ensure no unauthorised access.	• Prescribed burns are planned according to the DBCA Prescribed Fire Plan, occur at least every 10 years, and are integrated with surrounding DBCA estates. • Compliance with DBCA Fire Management strategy (https://www.dbca.wa.gov.au/parks-and-wildlife-service/fire).
Minimise the risk of introduction or spread of dieback	Dieback caused by *Phytophthora cinnamomi* <u>Carnaby's cockatoo:</u> • *Phytophthora* dieback contributes to the degradation and loss of habitat <u>Baudin's and FRTBC:</u> • *Phytophthora* dieback threatens the ecosystems that provide feeding and breeding habitat for both cockatoos.	• Yearly Inspections • Strategic road upgrades and maintenance to reduce the risk of introduction and spread of Dieback from access tracks; • Locked gate and limited site access; • Inspect all machinery, light and heavy vehicles prior to entry to the Conservation area. Any equipment with soil, weeds or seeds attached are	• Inspections identified potential dieback outbreak. • Quarantine protocols not adhered to.	• Inspections identify no *Phytophthora* dieback infestations. • Compliance with DBCA Dieback Management Manual (DBCA 2017). • Annual Inspections from Ransberg to verify compliance with hygiene management plan; • 5 yearly dieback survey confirm no introduction or spread of Dieback.	• If dieback has been confirmed on-site then the area is to be demarked and segregated with no access other than essential maintenance. • Dieback Management Plan to be reviewed and updated. • Restrict access by quarantine breechers. • Notify DCCEEW.

Management Objectives	*Key threat addressed, as per recovery plans (DEC 2008, 2012; DPaW 2013)*	*Management and Mitigation Measures*	*Trigger for Further Action*	*Monitoring in Place*	*Corrective Actions*
		to be denied entry to site until cleaned. • Further dieback surveys to be completed every 5 years to inform BOMP reviews. • Dieback management will be integrated with management within the adjoining Youraling State Forest and Conservation Park.			
Prevent any increases in weed cover to protect habitat values	<u>Carnaby's cockatoo:</u> • Weed invasions contribute to the degradation and loss of habitat <u>Baudin's and FRTBC:</u> • Weed invasions threaten the ecosystems that provide feeding and breeding habitat for both of these Cockatoos.	• Locked gate and limited site access; • Undertake weed control if monitoring shows new or increased weed occurrence. Introduced flora control will be via herbicide (chemical spray); being the most cost-effective approach for weed control. Specific weed control methodology will be developed in consultation with DBCA and will be dependent upon the species identified and observed extent, in accordance with DBCA advice and requirements.	• Introduction of new invasive species. • Weed load (cover) increase by 20% above photo monitoring baseline.	• Photo monitoring at defined areas around site. • Implementing five-year monitoring program for weed survey.	• If weed load or number of invasive species increases introduce a more targeted chemical control program.
Protect Chuditch from predation by, and competition from, introduced cats and foxes by reducing cat and fox abundance	Foxes may have a direct effect on Chuditch populations in the form of predation of young animals, or indirect effect, by competing with Chuditch for food resources. Feral cats are also believed to compete with Chuditch for food, and probably predate young Chuditch.	• Use fire to regenerate Gastrolobium thickets to provide protection for a range of vulnerable fauna including Chuditch species from fox and cat predation. • Feral fox and cat control (i.e. baiting, trapping) ensuring that detrimental impacts on Chuditch are avoided. •	• If reduction in feral fox and cat numbers is not identified after 3 years then review techniques being used.	• Annual photo monitoring of Chuditch, foxes and cats.	• Extend geographical extent of feral management program.
Maintaining artificial hollows to ensure their effectiveness to ensure the artificial hollows continue to provide opportunities to be used by Black Cockatoos.	• Invasion by bees • Being used by non-targeted species	• Installation of 35 artificial nesting hollows adjacent to the impact area, to offset the 31 trees that have been flagged by Bancroft and Bamford (2022a) as containing suitable hollows within the Proposed Action Area in accordance with the offset calculator. Specific location of the artificial hollows will be guided by recognised expert. • Protecting habitat by fencing and/or rabbit control to encourage regeneration of native vegetation;	• If no artificial nesting hollows are occupied within 3 years then location to be reviewed with recognised expert and relocated if recommended. Artificial hollows are maintained to appropriate standard for 20 years. • Artificial hollows remain pest free for 20 years.	• Annual monitoring of artificial nesting hollows.	• Any damaged or infested artificial nesting boxes to be repaired or replaced.

Management Objectives	*Key threat addressed, as per recovery plans (DEC 2008, 2012; DPaW 2013)*	*Management and Mitigation Measures*	*Trigger for Further Action*	*Monitoring in Place*	*Corrective Actions*
		• Controlling competitive species such as galahs, corellas and feral bees that may occupy hollows; • Repairing old and damaged natural nesting hollows; • Creating linkages of vegetation between nesting and feeding areas			

5. Risk Assessment

A risk assessment was undertaken for the Bannister Offset Site (Table 5-3) to consider the risks associated with achieving the objectives of the BOMP. The risks are identified and characterised as low, medium, high, or severe, as derived from the likelihood (highly likely, likely, possible, unlikely, rare) and consequence (minor, moderate, high, major, and critical) risk matrix based on the Department of Environment Guidelines for Developing Environmental Management Plans (DoE 2014) (Table 5-1 and 5-2).

The risk analysis assesses the risk of not achieving the management objectives. It may be necessary to re-evaluate and modify the risk analysis and contingency measures throughout the period of the BOMP, particularly if any unforeseen risks or issues emerge during the implementation of the BOMP.

Table 5-1. Risk Assessment Likelihood & Consequence Definitions.

Qualitative measure of likelihood (how likely is it that this event/issue will occur after control strategies have been put in place)	
Highly likely	Is expected to occur in most circumstances
Likely	Will probably occur during the life of the project
Possible	Might occur during the life of the project
Unlikely	Could occur but considered unlikely or doubtful
Rare	May occur in exceptional circumstances
Qualitative measure of consequences (what will be the consequence/result if this issue does occur rating)	
Minor	Minor incident of environmental damage that can be reversed
Moderate	Isolated but substantial instances of environmental damage that could be reversed with intensive efforts
High	Substantial instances of environmental damage that could be reversed with intensive efforts
Major	Major loss of environmental amenity and real danger of continuing
Critical	Severe widespread loss of environmental amenity and irrecoverable environmental damage

Table 5-2. Risk Assessment Matrix.

	Consequence				
	Minor	**Moderate**	**High**	**Major**	**Critical**
Highly Likely	Medium	High	High	Severe	Severe
Likely	Low	Medium	High	High	Severe
Possible	Low	Medium	Medium	High	Severe
Unlikely	Low	Low	Medium	High	High
Rare	Low	Low	Low	Medium	High

Table 5-3. Risk Management for the Bannister Offset Site.

Risk (Threat)	Likelihood	Consequence	Inherent Risk	Trigger	Risk treatments	Residual Risk
Objectives: • Protect and improve existing habitat from future developments; • Reverse habitat alteration and decline caused by livestock grazing ; • Implement fire management to improve habitat values, especially the availability of suitable Chuditch den logs and den sites, and habitat, feeding and roosting trees for Black Cockatoos • Minimise the risk of introduction or spread of dieback onsite; • Prevent any increases in weed cover to protect habitat values; • Protect Chuditch from predation by, and competition from, introduced cats and foxes by reducing cat and fox abundance; • Protect artificial nesting hollows from being damaged or invaded.						
Uncontrolled fires occur within the Offset Site	Possible	Major	High	Unplanned fire occurring within Offset Site.	DBCA undertake fire management strategies (PFP and DAS) within the Offset Site and incorporate with the surrounding Youraling State Forest and Conservation Park.	Medium
Habitat alteration and decline caused by livestock grazing	Unlikely	Moderate	Low	Evidence of livestock grazing in the Offset Site.	Fencing to exclude livestock. Fencing will be monitored and maintained during the life of management plan.	Low
Damage to vegetation from vandalism (e.g. 4wd vehicles, off-road motorbikes etc.).	Unlikely	Moderate	Low	Evidence of damage to vegetation from unauthorised entry.	Limited site access. Access is via locked gate and will only be by approval from the Ransberg.	Low

Risk (Threat)	Likelihood	Consequence	Inherent Risk	Trigger	Risk treatments	Residual Risk
Human induced Dieback spread and/or disease is significantly affecting Black Cockatoo habitat within the Offset Site	Possible	Major	High	Unexplained senescence of dieback susceptible species.	Develop and implement hygiene management plan including: • Limit site access by maintaining fencing. The property will be owned by Ransberg and access is via locked gate and will only be by approval from the Ransberg; • strategic roading upgrades and maintenance to reduce the risk of spread of Dieback from access tracks; • limit site access. Access will only be by approval from Ransberg; • Install washdown bays if required; • Further dieback surveys to be completed every 5 years to inform BOMP reviews.	Low
Predation and competition for natural resources by feral cats, foxes, and pigs.	Possible	Major	High	Evidence of feral animal presence	• Use fire to regenerate Gastrolobium thickets to provide protection for a range of vulnerable fauna from fox and cat predation. • Feral fox and cat control (i.e. baiting, trapping) ensuring that detrimental impacts are avoided. • 5 yearly monitoring of foxes and cats.	Medium
Weeds outcompeting native vegetation species	Possible	Moderate	Medium	Unexplained senescence of weed susceptible species.	• Limited site access. Access is via locked gate and will only be by approval from the DBCA Wellington Office; • Undertake campaign weed control program as and when required, in accordance with DBCA advice and requirements.	Low
• Invasion by bees • Being used by non-targeted species	Possible	Moderate	Medium	Evidence of bees in hollows	• Annual monitoring of artificial nesting hollows	Low

6. Monitoring Program

6.1 Assessment of uncertainty

The management measures implemented as part of this plan all have high degrees of certainty associated with them. Fencing to exclude livestock is a standard practise in farming operations. The possibility of failed fencing as well as risk of fire and feral animals to the Bannister Offset Site are mentioned in Table 5-3. Similarly, the weed and dieback hygiene procedures to be implemented are based on techniques that have been shown to have a very high success rate in avoiding the introduction of weeds and dieback to areas, where they are followed rigorously.

The primary uncertainty that comes into the plan is how the climate of the Offset Site may change over 10-year project period and how this may affect the vegetation present and its value as habitat for Black Cockatoos and Chuditch. This uncertainty will be managed through the ongoing process of plan review (every 5 years), which will update the plan and its included management measures should this be required as a result of climate change.

6.2 Qualitative Monitoring

Ransberg will be responsible for implementing a qualitative monitoring program at the Bannister Offset Site to document evidence that required management actions are being implemented as required by the BOMP, aimed at protecting, maintaining and improving habitat for Protected Matters, in particular Black Cockatoos and Chuditch.

Monitoring of the management actions will be undertaken by a suitably qualified professional in Spring 2024 (September to November 2024), and then at five (5) year intervals for the lifetime of the BOMP (20 years).

The results of the annual monitoring will be included in Ransberg's Annual Environmental Offset Report as described in Section 7.

The Bannister Offset Site will be evaluated against the management actions and performance indicators with respect to:

- Fire management;
- Future development in the Offset Site
- *Phytophthora* Dieback management;
- Feral animal presence;
- Artificial nesting hollows monitoriong;
- Weed management; and
- Livestock grazing.

6.3 Inspections

Ransberg will undertake yearly inspections of the Bannister Offset Site. The outcomes of these inspections will be reviewed to determine if any additional management measures are required.

Monitoring results will be reported in the Annual Environmental Offset Report as described in Section 7.

7. Reporting and Review

7.1 Reporting

Compliance reporting frequency and timing for the Bannister Offset Site will be submitted annually from 2024 in accordance with conditions of compliance reporting requirements. Ransberg will submit a compliance report annually, within 30 business days of the end of the 12-month period.
The annual compliance reports prepared by Ransberg and submitted to DCCEEW will include:

- a review of management actions and performance indicators for activities undertaken in the previous 12 months under the BOMP; and
- a summary of compliance against the BOMP.

Ransberg, in consultation with the DBCA, will notify DCCEEW of any incident at the site, non-compliance with the conditions, or non-compliance with the commitments or performance indicators made in the BOMP. The notification will be given in writing as soon as practicable after the incident or non-compliance. The notification will include the following information:

- any condition which is or may be in breach of conditions;
- the location (including coordinates), date and time of the incident and/or non-compliance; and
- a short description of the incident and/or non-compliance.

7.2 Adaptive Management

The management approach for the Bannister Offset Site will be adaptive through ongoing review and reporting measures, to ensure that it achieves the identified purpose, environmental objectives of the BOMP.

The BOMP will be formally reviewed at five (5) yearly intervals by a suitably qualified and experienced person. In addition to the scheduled review, the BOMP will be reviewed if:

- new information is learned from monitoring, or monitoring indicates that performance indicators are not being achieved;
- new information becomes available about Protected Matters (e.g., a change in conservation status of a species); or
- new requirements need to be included as a consequence of approvals being issued or modified.

Where an adaptive management response is required to respond to any issues identified in the implementation of management measures and monitoring, Ransberg will, in consultation with DBCA, identify and implement the management response in order to more effectively meet the environmental objectives of the BOMP.

The following potential adaptive management actions have been developed to respond in the event that performance indicators show that the condition of the Bowelling Offset Area is declining, or if there is an incident involving Protected Matters at the site:

- investigate cause;
- Ransberg, in consultation with DBCA, will review and revise the BOMP and management measures as required; and
- Ransberg, in consultation with DBCA, will implement additional contingency measures identified as part of the risk assessment.

8. Roles and Responsibilities

Ransberg is responsible for:

- Purchasing the Bannister property and transferring it to the State of WA for management and future reservation as State Forest, classified as a forest conservation area under the CALM Act;
- undertaking or providing agreed funds to the DBCA towards the management of the Bannister Offset Site to achieve the required standards and approval conditions;
- engaging a suitably qualified professional to undertake monitoring where required;
- reporting compliance against the BOMP;
- undertaking regular inspections of the Bannister Offset Site;
- undertaking fuel reduction prescribed burns;
- undertaking strategic roading maintenance;
- integrating the management of the Bannister Offset Area with the surrounding Youraling State Forest and Conservation Park and manage in accordance with requirements of the CALM Act and Forest Management Plan 2014-2023; and
- facilitating access by Ransberg, or their agents, to the Bannister Offset site to undertake necessary actions detailed in this BOMP, or other relevant activities to support the BOMP.

9. Glossary

Black Cockatoo habitat includes foraging, breeding, potential breeding and roosting habitat for Black Cockatoos, as defined in the *EPBC Act Referral Guidelines for three species of Western Australian Black Cockatoos: Carnaby's Black Cockatoo (Calyptorhynchus latirostris), (Endangered) Baudin's Black Cockatoo (Calyptorhynchus baudinii) (Vulnerable) and* FRTBC *(Calyptorhynchus banksii naso) (Vulnerable)* (October 2012).

Black Cockatoo/s means the EPBC Act listed Carnaby's Black Cockatoo *(Calyptorhynchus latirostris),* Baudin's Black Cockatoo *(Calyptorhynchus baudinii)* and FRTBC *(Calyptorhynchus banksii naso).*

Business day means a day that is not a Saturday, a Sunday or a public holiday in the state or territory of the action.

Clearing means the cutting down, felling, thinning, logging, removing, killing, destroying, poisoning, ringbarking, uprooting, or burning of vegetation (but not including weeds)

DBCA is the Western Australian Department of Biodiversity, Conservation and Attractions or any future entity that retains that agency's roles and responsibilities.

Department means the Australian Government agency responsible for administering the EPBC Act. Previously the Department of Agriculture, Water and the Environment (DAWE) and now (since 1 July 2022) the Department of Climate Change, Energy, the Environment and Water (DCCEEW).

EPBC Act means the *Environment Protection and Biodiversity Conservation Act 1999*.

Habitat quality means the capacity of the land to provide ecosystem services for Protected Matters.

Habitat Tree means trees having a diameter, measured at 1.3 m from the base of the tree (DBH), of 50 cm or greater that contain a hollow(s) that may be suitable for breeding by Carnaby's Black Cockatoo, Baudin's Black Cockatoo, and/or Forest Red-tailed Black Cockatoo.

Incident means any event which has the potential to, or does, impact on one or more protected matter(s}.

Protected Matter/s means a matter protected under a controlling provision in Part 3 of the EPBC Act for which this approval has effect including, but not limited to, Carnaby's Black Cockatoo *(Calyptorhynchus latirostris),* Baudin's Black Cockatoo *(Calyptorhynchus baudinii),* FRTBC *(Calyptorhynchus banksia naso), Chuditch (Dasyurus geoffroii)* and Chuditch *(Dasyurus geoffroii).*

Suitable nesting hollow means any tree bearing a hollow capable of being used by the Black Cockatoos for breeding, as identified by a suitably qualified person.

10. References

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11. Limitations

This report has been prepared for use by the client who has commissioned the works in accordance with the project brief only and has been based in part on information obtained from the client and other parties.

The advice herein relates only to this project and all results conclusions and recommendations made should be reviewed by a competent person with experience in environmental investigations, before being used for any other purpose.

JBS&G accepts no liability for use or interpretation by any person or body other than the client who commissioned the works. This report should not be reproduced without prior approval by the client or amended in any way without prior approval by JBS&G, and should not be relied upon by other parties, who should make their own enquires.

Sampling and chemical analysis of environmental media is based on appropriate guidance documents made and approved by the relevant regulatory authorities. Conclusions arising from the review and assessment of environmental data are based on the sampling and analysis considered appropriate based on the regulatory requirements.

Limited sampling and laboratory analyses were undertaken as part of the investigations undertaken, as described herein. Ground conditions between sampling locations and media may vary, and this should be considered when extrapolating between sampling points. Chemical analytes are based on the information detailed in the site history. Further chemicals or categories of chemicals may exist at the site, which were not identified in the site history, and which may not be expected at the site.

Changes to the subsurface conditions may occur subsequent to the investigations described herein, through natural processes or through the intentional or accidental addition of contaminants. The conclusions and recommendations reached in this report are based on the information obtained at the time of the investigations.

This report does not provide a complete assessment of the environmental status of the site, and it is limited to the scope defined herein. Should information become available regarding conditions at the site including previously unknown sources of contamination, JBS&G reserves the right to review the report in the context of the additional information.

Appendix A WA Limestone 8772 Albany Highway, Bannister Threatened Fauna Assessment (Bamford, 2022)

WA Limestone
8772 Albany Highway, Bannister
Threatened Fauna Assessment

Wandoo woodland within the survey area. Photo: Wes Bancroft.

Prepared for: WA Limestone
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6th October 2022

Executive Summary

WA Limestone is investigating the acquisition of properties to offset proposed expansions of their quarrying activities in and around the Perth Metropolitan area. One such property is the western portion of ***Lot P011005 6 – 8772 Albany Highway, Bannister*** (in the Shire of Boddington), Western Australia (the 'survey area'). Bamford Consulting Ecologists (BCE) was commissioned to conduct a targeted desktop assessment and site inspection to better understand the use, and potential use, of the survey area by threatened black-cockatoos, and also the potential for the site to support other species of conservation significance.

Site overview, ecological processes and vegetation and substrate associations (VSAs)

The survey area, of approximately 389 ha, wholly comprises remnant vegetation that sits within a highly modified agricultural landscape. Extensive native vegetation exists c. 5 km to the west (Dwellingup State Forest) and c. 10 km to the north (Youraling State Forest). In addition, large blocks of remnant vegetation also occur c. 2.5 km to the north-east (north and south of the West Wandering Road) and c. 4 km to the east (north of Moramocking Road) of the site. A series of smaller belts or patches of vegetation appear to create 'stepping stones' across the landscape between the survey area and these remnants.

At least two drainages run through the survey area and these connect to the Hotham River to the south. It is understood that there is a source of permanent water (via a natural seep or spring) along one of these drainages.

The survey area has not been burnt in at least the last 20 years.

While previously logged, the vegetation is, broadly, in excellent condition with minimal weed incursion and almost no recent anthropogenic disturbance. Four major vegetation and substrate associations (VSAs) were identified in relation to fauna in the survey area:

- VSA 1. Wandoo woodland.
- VSA 2. Jarrah, Marri and Wandoo woodland.
- VSA 3. Rock Sheoak woodland
- VSA 4. Drainages.

Feral predators such as cats and foxes may present some risk to fauna within the survey area.

The survey area is presently used for (private) conservation and very low impact recreation activities such as bushwalking.

Black-cockatoo habitat analysis

One species of black-cockatoo (Carnaby's Black-Cockatoo) was recorded within the survey area during the site inspection, and there was indirect evidence (foraging signs) that the Forest Red-tailed Black-Cockatoo uses the site. It is it is considered that, currently:

- Carnaby's Black-Cockatoo is likely to be a regular breeding and/or non-breeding migrant to the site.

- Forest Red-tailed Black-Cockatoo is likely to be a regular visitor, or possibly even resident, at the site. It is possible that this species breeds within the survey area.
- Baudin's Black-Cockatoo is likely to be a regular non-breeding visitor to the site.

Four belt-transects (totalling 6.47 ha) were sampled to provide an indication of the potential for breeding (nest-trees) by black-cockatoos within the survey area.

Trees that met the potential nest-tree criteria of DCCEEW (2022a, c, d) and DAWE (2022b) were recorded at a density of 31.5 trees/ha within VSA 1, and at 25.6 tree/ha within VSA 2. While no active nests (rank 1) or potential hollows with chew-marks (indicating a high likelihood of use by black-cockatoos; rank 2) were recorded during the sampling, trees with hollow entrances that appeared suitable for black-cockatoo nesting (rank 3) occurred at a density of 7.9 and 4.9 trees/ha in VSAs 1 and 2, respectively. Extrapolation of these data indicate there is in excess of 10,800 potential nest-trees in the survey area, of which c. 2366 trees are expected to bear hollows that are presently suitable for black-cockatoo nesting.

BCE foraging habitat assessment indicated that more than 95% of the site scored 7 or more (out of 10) for potential foraging by Carnaby's Black-Cockatoo, more than 99% of the site scored 6 or more (out of 10) for Forest Red-tailed Black-Cockatoo and more than 95% of the site scored 6 or more (out of 10) for Baudin's Black-Cockatoo. There was evidence of Carnaby's and Forest Red-tailed Black-Cockatoo having foraged within the survey area. Qualitatively, the survey area is, generally, of moderate to high value for foraging by the Carnaby's Black-Cockatoo, and moderate value for foraging by the Forest Red-tailed and Baudin's Black-Cockatoos.

The DCCEEW foraging quality scoring tool was used to assess survey area and it scored 10 (out of 10) for both Carnaby's and Forest Red-tailed Black-cockatoos, and 8 (out of 10) for Baudin's Black-Cockatoo.

While no black-cockatoo night-roosts are known from within the survey area (possibly due to a lack of survey effort), several are known from the region (the nearest of which is c. 3km from the site) and there is very strong potential that black-cockatoos use the site for roosting for at least some times of the year.

Several potential water sources for black-cockatoos were noted within, and adjacent to, the survey area.

MNES vertebrate fauna

A number of vertebrate species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), and that could be considered Matters of National Environmental Significance (MNES), have the potential to occur within the study area, or would be suited to re-introduction to the site. These include:

- Woylie (*Bettongia penicillata ogilbyi*)
- Chuditch (*Dasyurus geoffroii*)
- Red-tailed Phascogale (*Phascogale calura*)
- Numbat (*Myrmecobius fasciatus*)

Discussion of these species is provided.

Prioirity vertebrate fauna

The survey area may also support (or be capable of supporting) a range of DBCA-ranked Priority species, including:

- Dells' Skink (*Ctenotus delli*)
- Peregrine Falcon (*Falco peregrinus*)
- South-western Brush-tailed Phascogale (*Phascogale tapoatafa wambenger*)
- Quenda (*Isoodon fusciventer*)
- Brush Wallaby (*Notamacropus irma*)
- Tammar Wallaby (*Notamacropus eugenii derbianus*)
- Rakali/Water-rat (*Hydromys chrysogaster*)
- Western False Pipistrelle (*Falsistrellus mackenziei*)

Discussion of these species is provided.

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1 Introduction

WA Limestone is investigating the acquisition of properties to offset proposed expansions of their quarrying activities in and around the Perth Metropolitan area. One such property, the western portion of Lot P011005 6 – 8772 Albany Highway, Bannister (in the Shire of Boddington), Western Australia (the 'survey area', see Figure 1), has potential value for threatened fauna, and was noted particularly for its potential to support black-cockatoos. It is possible that all three of the black-cockatoo taxa that occur in the south-west of Western Australia may use the site:

- *Zanda latirostris* (Carnaby's Black-Cockatoo) – listed as Endangered under the Federal *Environment Protection and Biodiversity Conservation Act 1999* and also as Endangered under the Western Australian *Biodiversity Conservation Act 2016* (see Appendix 1 for more details).
- *Zanda baudinii* (Baudin's Black-Cockatoo) – Endangered under both acts (see Appendix 1).
- *Calyptorhynchus banksii naso* (Forest Red-tailed Black-Cockatoo) – Vulnerable under both acts (see Appendix 1).

In addition, a number of other listed fauna may occur on site, or the vegetation and soils may be suited to their reintroduction at a later stage.

An initial inspection of the property by Western Environmental in August 2022 was favourable and indicated that further examination of the value of the survey area for black-cockatoos, and other threatened fauna, was warranted. Bamford Consulting Ecologists (BCE) was commissioned to conduct a targeted desktop assessment and site inspection to better understand the use, and potential use, of the survey area by black-cockatoos, and also the potential for the site to support other species of conservation significance.

This report presents the findings of that survey.

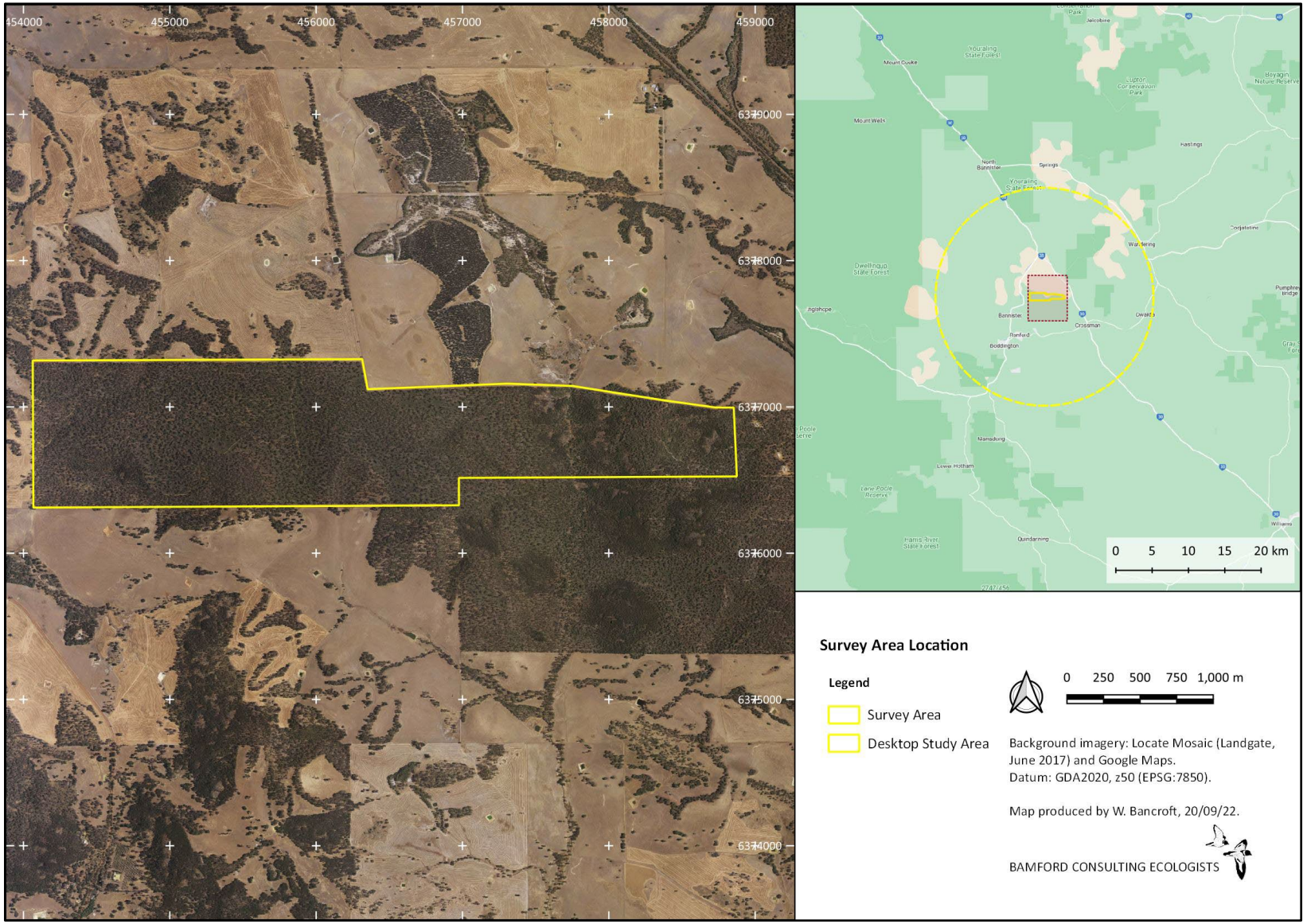

Figure 1. Location of the survey area (the western portion of Lot P011005 6, 8772 Albany Highway, Bannister, Western Australia).

1.1 Background: black-cockatoo ecology

There is considerable published information on the ecology of, and threats to, Carnaby's, Baudin's and Forest Red-tailed Black-Cockatoos. Key references include:

- Action plans (Garnett and Baker 2021);
- Recovery plans (DEC 2008; DPaW 2013);
- EPBC Act referral guidelines (DSEWPaC 2012; DAWE 2022b);
- Commonwealth listing and conservation advice (DEWHA 2009a, b; TSSC 2018);
- The federal Department of Climate Change, Energy, the Environment and Water's (DCCEEW) Species Profile and Threats (SPRAT) Database (DCCEEW 2022a, c, d);
- Scientific literature (Davies 1966; Saunders 1974, 1979a, b, 1980; Saunders *et al.* 1982; Saunders 1986; Johnstone and Storr 1998; Higgins 1999; Johnstone and Kirkby 1999, 2008; Johnstone *et al.* 2013a, b; Whitford *et al.* 2015; Johnston *et al.* 2016; Williams *et al.* 2016; Williams *et al.* 2017); and
- Major reports (Johnstone *et al.* 2011; Kabat *et al.* 2012; Peck *et al.* 2016).

Much of this information has been compiled by DCCEEW (2022a, c, d). Summarising this work further, there are several salient points for assessing the potential value of the site for black-cockatoos:

Key ecology

- All species are long-lived with low annual reproduction rates and cannot, therefore, rapidly increase their population size.
- Carnaby's and Baudin's Black-Cockatoos undergo regular, seasonal migration between breeding and non-breeding areas.
- Forest Red-tailed Black-Cockatoos are not currently considered to undergo regular migration. In recent years there appears to have been a distinct expansion of the range of this species on to the Swan Coastal Plain, including many suburbs within the Perth metropolitan area.
- It is possible that Baudin's Black-Cockatoo is also beginning a similar expansion of its range on to the Swan Coastal Plain.
- In recent years there have been considerable shifts in the breeding ecology, distribution and movement patterns of Forest Red-tailed and Carnaby's Black-Cockatoos. These may be a response to habitat degradation/clearing and/or climatic factors.

Key habitat requirements

- All species are reliant on large tree-hollows in eucalypts, in which they breed. Each species has its own preference for nesting tree species and its own geographical breeding range (although these overlap between species). There is a solid understanding of these preferences (see Appendix 2 for summary).
- All species primarily feed on plant seeds and flowers, but also consume wood-boring insect larvae when available. Each species has its own preference for food plant species (with considerable overlap). There is a solid understanding of these preferences (see Appendix 2 for summary).

Key threats

- Key threatening processes include illegal shooting, habitat loss, habitat degradation, nest hollow shortage, competition for available nest hollows from other parrots and feral Honeybees (*Apis mellifera*), and illegal trade.

1.2 Description of survey area and background environmental information

1.2.1 Survey area

For spatial terminology (i.e. definitions of project, survey and study areas) see Section 2.1.1 below.

The Bannister site ('survey area') is in the locality of Bannister (Shire of Boddington), as shown in Figure 1. The precise boundary of the survey area has yet to be determined but for the purposes of this inspection, the cadastre of Lot P011005 6 that was provided by Landgate (2022) was clipped to reflect the area of interest. The area of this region is approximately 389 ha.

1.2.2 Interim Biogeographic Regionalisation of Australia (IBRA) and landscape characteristics

The Interim Biogeographic Regionalisation of Australia (IBRA) has identified 26 bioregions in Western Australia which are further divided into subregions (DAWE 2022a). Bioregions are classified on the basis of climate, geology, landforms, vegetation and fauna (Thackway and Cresswell 1995). IBRA Bioregions are affected by a range of different threatening processes and have varying levels of sensitivity to impact (EPA 2016). The survey area is within the Northern Jarrah Forest (JAF01) subregion of the Jarrah Forest bioregion.

The vegetation and soil of the Northern Jarrah Forest subregion can be described as follows: "Jarrah-Marri Forest in the west with Bullich and Blackbutt in the valleys grading to Wandoo and Marri woodlands in the east with Powder bark on breakaways. There are extensive but localised sand sheets with Banksia low woodlands. Heath is found on granite rocks and as a common understorey of forests and woodlands in the north and east. The majority of the diversity in the communities occurs on the lower slopes or near granite soils where there are rapid changes in site conditions" (Williams and Mitchell 2001).

1.2.3 Land systems and vegetation complexes

Mattiske and Havel (1998) have defined and described broad vegetation complexes for the South West forest region of Western Australia and the mapping of these is provided by DBCA (2022f).
Three complexes occur within the site:

- **Coolakin** (Ck) - Woodland of *Eucalyptus wandoo* with mixtures of *Eucalyptus patens*, *Eucalyptus marginata* subsp. *thalassica* and *Corymbia calophylla* on the valley slopes in arid and perarid zones.
- **Michibin** (Mi) - Open woodland of *Eucalyptus wandoo* over *Acacia acuminata* with some *Eucalyptus loxophleba* on valley slopes, with low woodland of *Allocasuarina huegeliana* on or near shallow granite outcrops in arid and perarid zones.
- **Yalanbee 6** (Y6) - Woodland of *Eucalyptus wandoo* – *Eucalyptus accedens*, less consistently open forest of *Eucalyptus marginata* subsp. *thalassica* – *Corymbia calophylla* Mixture of open forest of *Eucalyptus marginata* subsp. *thalassica* – *Corymbia calophylla* on lateritic uplands and breakaway landscapes in arid and perarid zones.

Complex definitions were sourced from Mattiske (2019).

The Mattiske and Havel (1998) vegetation complexes within the survey area are mapped in Figure 2 (data provided by DBCA 2022f).

Following their August 2022 site visit, Western Environmental also defined three habitat categories within the survey area:

- **Wandoo Woodland**. Woodland of Wandoo at 20-40% overstory foliar cover. Large mature and large dead Wandoos present with hollow formation evident in some larger trees. Very open mid stratum with few shrub species. Open ground stratum. Old dead logs and leaf litter present. Occurring on skeletal and gravelly/ clay soils.
- **Jarrah, Marri and Wandoo Woodland**. Mixed woodland at 15-30% overstory foliar cover. Typically dominated by Jarrah at 10-20% foliar cover with Marri at 5-10% foliar cover and scattered Wandoo at <5% foliar cover. Large mature and large dead Jarrah and Marri present with hollow formation evident in larger trees. Shrubby midstratum present, mainly comprising *Banksia squarrosa*, *Banksia sessilis* and *Xanthorrhoea* sp. Old dead logs and leaf litter present. Occurring on gravelly and laterite soils.
- **Rock Sheoak Woodland**. Woodland of *Allocasuarina huegeliana* (Rock Sheoak) at 30-40% foliar cover in groves interspersed with open patches of granites. Mid stratum of *Xanthorrhoea* sp. at 10-25% cover.

1.2.4 Land use and tenure

The dominant land uses within the Northern Jarrah Forest (JAF01) subregion are forestry (native forests), conservation, grazing (improved pastures), cultivation (dry land agriculture), forestry (plantations), and mining (Williams and Mitchell 2001). There are lesser areas of rural residential, easements for roads, power lines etc, and urban land use.

1.2.5 Recognised sensitive sites

There are no known Ramsar Sites (DBCA 2022c), Important Wetlands (DBCA 2022b), Threatened Ecological Communities (DBCA 2022d, e), Bush Forever sites (Dell and Banyard 2000; DPLH 2022), Key Biodiversity Areas (KBA 2022) or Environmentally Sensitive Areas (DWER 2022a, b) within the survey area.

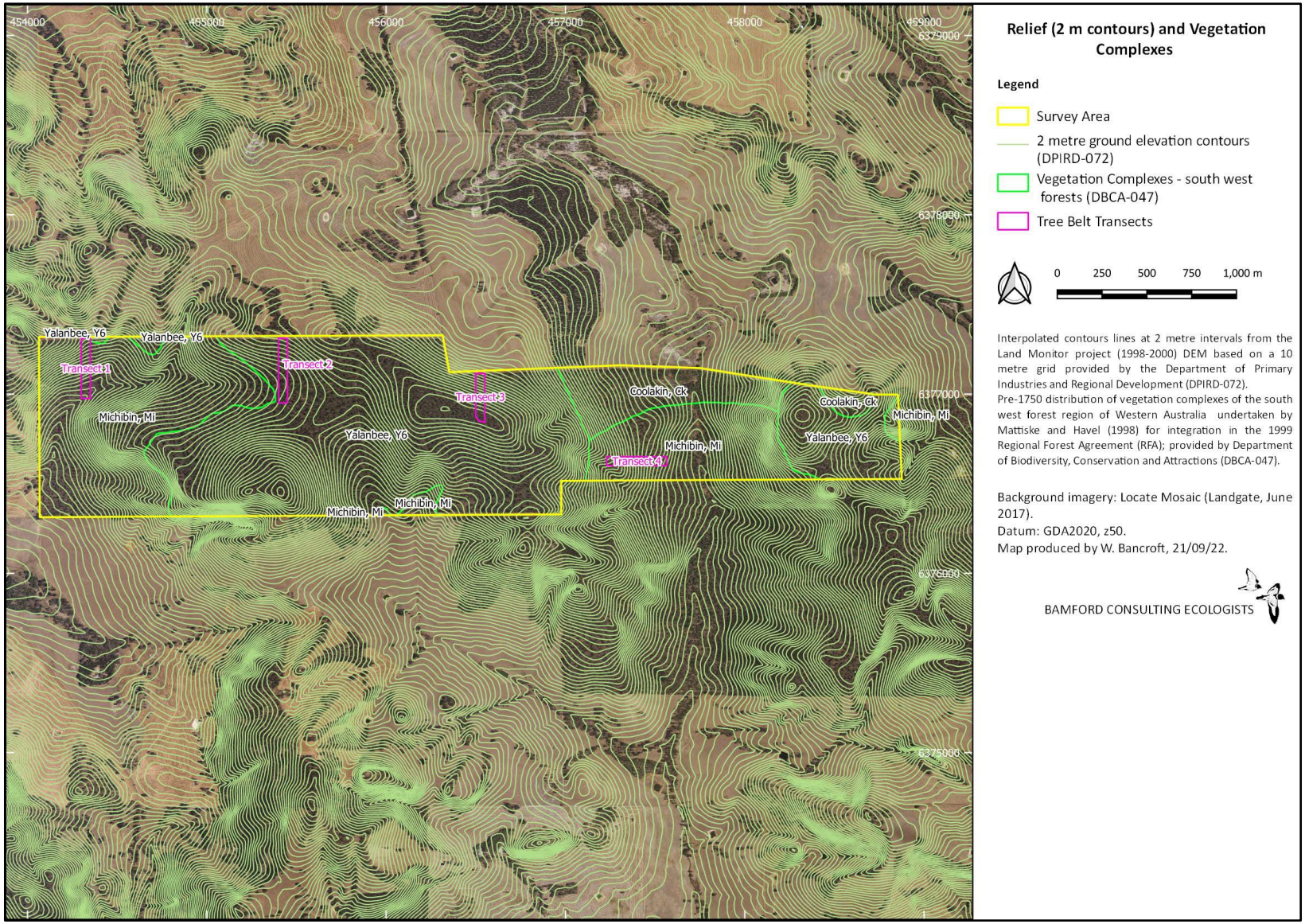

Figure 2. Relief (2 m contours) and vegetation complexes (Mattiske and Havel 1998) within the survey area.

2 Methods

2.1 Overview

2.1.1 Spatial terminology

A range of terms are used through the report to refer to the spatial environment around the proposed project, and these are defined below:

- Study area – the outermost boundary of the desktop assessment that is almost always a specified buffer distance (see Section 2.3.1 below) around the *survey area*. The study area thus encompasses the *survey area* but includes the area from which databases are sourced.
- Survey area – the *survey area* is the area to which the results of the desktop analysis are directed and/or the area within which field investigations are conducted. Note that while the term '*survey area*' is used throughout the guidance provided by EPA (2020), it does not appear to be explicitly defined and, therefore, the above definition has been developed with interpretation of both the guidance and BCE report structure.
- Project area – this may be equivalent to the *survey area* but is strictly the land over which the proponent has tenure or some control and within which on-site impacts may occur.
- Development footprint – the expected extent of land clearing and/or development.

Where available, these spatial boundaries are mapped in Figure 1.

2.2 Identification of vegetation and substrate associations (VSAs)

Vegetation and substrate associations (VSAs) combine vegetation types, the soils or other substrate with which they are associated, and the landform. In the context of fauna assessment, VSAs are the environments that provide habitats for fauna.

BCE deliberately makes the distinction between 'habitat' (a species-specific term that may encompass the whole or part of one or more VSAs and is the physical subset of an ecosystem that a given species, or species group, utilises) and 'VSA' (a general, discrete and mutually exclusive spatial division of a target area, based on soil, vegetation and topography). It is recognised, however, that, within the broader EIA literature/guidance, the former term is used more or less synonymously to indicate the latter (e.g.' habitat assessment' used by EPA 2020). Further discussion is provided in Appendix 3.

For the current assessment, VSAs were identified based on the consultant's previous experience in the area, a vegetation assessment of the site (by Western Environmental), and on observations made during the field investigations.

2.3 Desktop methods

2.3.1 Nomenclature and taxonomy

As per the recommendations of the EPA (2020), the nomenclature and taxonomic order presented in this report are generally based on the Western Australian Museum's (WAM) Checklist of the Fauna of Western Australia 2022. The authorities used for each vertebrate group were: fish (Morgan *et al.* 2014), frogs (Doughty 2022a), reptiles (Doughty 2022b), birds (BirdLife Australia 2022; Gill *et al.* 2022), and mammals (Travouillon 2022). In some cases, more widely-recognised names and naming

conventions have been followed, particularly for birds where there are national and international naming conventions in place (e.g. the BirdLife Australia working list of names for Australian Birds, and the International Ornithological Congress' 'World Bird List'). Similarly, the group name 'black-cockatoo' is consistently used for all three taxa in the South-West. English common names of species, where available, are used throughout the text; Latin names are presented with corresponding English names in tables in the appendices. The use of subspecies is limited to situations where there is an important (and relevant) geographically distinct population, or where the taxonomic distinction has direct relevance to the conservation status or listing of a taxon.

2.4 Field investigations

2.4.1 Overview

Field investigations were focussed on black-cockatoo habitat analysis (comprising breeding, foraging and roosting assessments), with the major focus on identification of trees suited to black-cockatoo nesting. Methods are detailed below.

2.4.2 Dates

The survey area was visited on the 16th September 2022.

2.4.3 Black-cockatoo habitat analysis

2.4.3.1 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 2022b) as well as the previous guidelines (DEE 2017). This includes application of the 'foraging quality scoring tool' in DAWE (2022b). In addition, survey methodology followed the recommendations listed on the DCCEEW's Species Profile and Threats Database (DCCEEW 2022a, c, d);. Ecological values for black-cockatoos within the site were based on the definitions of breeding, foraging and roosting habitat as per the EPBC Act referral guidelines for black-cockatoos (DAWE 2022b).

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 and foraging habitat.

2.4.3.2 Breeding

The aim of the breeding surveys was to sample the survey area for potential hollow-bearing trees (suitable for black-cockatoo nesting). Four 'belt transects' (as shown in Figure 2 and Figure 3) were surveyed across the site. The following information was recorded for every suitable tree[1] 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;
- tree species;
- life status;
- DBH; and
- nest-tree rank: trees were assessed (from the ground) for the potential presence/quality of nest-hollows and allocated a nesting rank (developed by BCE) as described in Table 3.

The BirdLife Australia database of black-cockatoo breeding surveys was also searched for relevant local records (see Peck 2019).

[1] the revised EPBC Act referral guidelines (DAWE 2022) note that "any species of tree may develop suitable hollows for breeding" however there are some species that are much more likely to provide breeding sites. These species are listed on the DCCEEW SPRAT database and were the focus of the field investigations here.

Table 1. Ranking system for the assessment of potential nest-trees for black-cockatoos (revised 08/01/2021).

As per DCCEEW (2022a, c, d) guidance, a potential nest-tree is any tree with a diameter at breast height >500 mm (or >300 mm for *Eucalyptus accedens, E. salmonophloia* and *E. wandoo*). Note that 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.

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

2.4.3.3 Foraging

The foraging value of the study area was assessed by calculating a foraging score for areas of similar vegetation type/condition (see Appendix 4). The foraging score provides a numerical value that reflects the significance of vegetation as foraging habitat for black-cockatoos, and this numerical value is designed to provide the sort of information needed by DCCEEW, Department of Water and Environmental Regulation (DWER) and the Environmental Protection Authority (EPA) to assess impact significance and offset requirements. The foraging value of the vegetation depends upon the type, density and condition of trees and shrubs in an area, and can be influenced by the context such as the availability of foraging habitat nearby. The BCE scoring system for value of foraging habitat has three components as detailed in Appendix 4. These three components are drawn from the DCCEEW offset calculator but with the scoring approach developed by BCE:

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

Foraging value can thus be assigned a score out of six, based upon site vegetation characteristics, or a score out of 10 if context and species density are also considered. A higher score represents better foraging value. A score out of 10 is presented for the purposes of aiding offset calculations. The approach to assigning scores for vegetation, context and species density are outlined in Appendix 4. Foraging value scores are calculated differently for the three black-cockatoo species (Appendix 4) depending upon the vegetation present; thus a separate score is given for each VSA for each species.

For comparison, the foraging quality scoring tool of DAWE (2022b) was also used to assess the foraging value of the site to black-cockatoos. The template for this tool is provided in Appendix 5.

Black-cockatoo foraging signs were also recorded in conjunction with the breeding tree surveys (see Section 2.3.4.2) and general site inspections. When observed, the location, tree species and approximate age of the foraging evidence were recorded. Black-cockatoo foraging evidence may persist for some months or years after the foraging event. There is currently no published evidence documenting the deterioration process of forage. Factors that help to establish the time since foraging include: the colour of nuts/foliage, the degree of weathering or decay of debris, the presence of small fragments of nut debris, the position/compression of the foraging debris relative to surrounding vegetation and leaf litter, and the strength of the eucalypt smell emitted. Despite the absence of empirical data, four categories of foraging activity were recognised, based on the time since foraging:

(i) Active – where birds were observed in the act of foraging;
(ii) Recent – foraging signs (e.g. chewed nuts or vegetation) were 'fresh' (i.e. foraging was likely to have occurred within days to weeks). Recent foraging signs were typically green and/or with very little sign of weathering. Approximately less than four weeks old;
(iii) Intermediate – foraging was likely to have occurred within weeks to months previously. Approximately one to six months old; and
(iv) Old – foraging was likely to have occurred months to years previously. Approximately more than six months old.

As an indication, Appendix 6 shows examples of Forest Red-tailed Black-Cockatoo foraging signs across the range of these categories (note that it is uncertain as to the exact time frame for each stage).

2.4.3.4 Night roosting

As the breeding and foraging surveys were conducted, areas likely to be used as night roosting sites (e.g. sites adjacent to watercourses with large trees) or areas that had cockatoo activity in the late-afternoon were noted.

In addition, an evening roost survey was conducted from 17:45 to 18:35 (sunset 18:11) on top of a hill (to provide a good vantage point over much of the site) along the northern boundary of the site (458373E, 6377044N; GDA2020, z50).

It is usual for the BirdLife Australia Great Cocky Count (GCC) database of roost sites to be directly searched for relevant local records (see Peck *et al.* 2019) but for this report the data from the GCC that is provided by DBCA (2022a).

2.4.4 Opportunistic observations

At all times, observations of fauna were noted when they contributed to the accumulation of information on the fauna of the site. These included such casual observations as reptiles, birds or mammals seen while travelling through and near the site.

2.5 Personnel

Personnel involved in the field investigations and report preparation are listed in Table 1.

Table 2. Personnel involved in the field investigations and report preparation.

Personnel	Consulting Experience	Field Investigations	Report Preparation
Dr Mike Bamford *BSc (Biol.), Hons (Biol.), PhD (Biol.)*	42 years		+
Dr Wes Bancroft *BSc (Zool./Microbiol.), Hons (Zool.), PhD (Zool.)*	25 years	+	+
Dr Jamie Wadey *BSc (Zoology/Ecology), Hons (Ecology), PhD (Movement Ecology)*	7 years	+	

2.6 Mapping and spatial data

Low resolution maps have been provided within the body this report. Higher resolution maps and GIS files can be supplied if required. While the recommendation of the EPA (2020) was that maps use the GDA94 datum (and are projected into the appropriate Map Grid of Australia (MGA94) zone), this has been superseded by the GDA2020 (projected to MGA2020) datum used here (and recommended by DWER 2022c).

3 Results and Discussion

3.1 Site overview and ecological processes

3.1.1 Proximity within the landscape and connectivity/ecological linkages

The survey area, of approximately 389 ha, wholly comprises remnant vegetation that sits within a highly modified agricultural landscape. Extensive native vegetation exists c. 5 km to the west (Dwellingup State Forest) and c. 10 km to the north (Youraling State Forest). In addition, large blocks of remnant vegetation also occur c. 2.5 km to the north-east (north and south of the West Wandering Road) and c. 4 km to the east (north of Moramocking Road) of the site (see Figure 1). While not directly connected, a series of smaller belts or patches of vegetation appear to create 'stepping stones' across the landscape between the survey area and these remnants. This would likely provide sufficient passage for a wide range of vertebrate fauna, including all of the threatened (and priority) species for which the site is considered suitable (as discussed in Sections 3.3, 3.4 and 3.5).

Discussion with the present landowner (during the field investigations) suggested that the adjoining property to the south of the study area (of at least c. 300 ha, and to which it has a direct and extensive connection) has recently been secured for conservation purposes. It could be expected that this property would have similar fauna values to the study area (as, together, they form a cohesive block with a shared history, as can been seen in Figure 1).

3.1.2 Topography and hydrology

The survey area has considerable variation in topographic relief (see Figure 2), with some steep changes in ground elevation and relatively little in the way of gently sloping or flat ground. At least two drainages run through the site and these connect to the Hotham River to the south. It is understood that at least one of these drainages has a section that provides permanent water (via a natural seep or spring). Water in these drainages was relatively fresh (at the time of inspection) and did not appear to have significant salinity issues.

3.1.3 Fire history

Other than a minor patch burn, the present owner indicated that the survey area has not been burnt in at least the last 20 years. There was no evidence noted during eth inspection to suggest otherwise. The vast majority of the site is long-unburnt, intact native woodlands.

3.1.4 Vegetation condition and anthropogenic disturbances

The vegetation is, broadly, in excellent condition with minimal weed incursion and almost no recent anthropogenic disturbance. It has previously been logged but does not appear to have been used for livestock grazing (at least in the last few decades). Several firebreaks and access tracks are currently maintained throughout the site. Erosion issues, pollution and litter/refuse dumping were all negligible or absent for the vast majority of the site. Similarly, there was nothing to indicate that other sources of environmental disturbance such as dust, light, noise and vibration have any appreciable impact on the survey area.

3.1.5 Fauna species interactions, including predation and competition

Feral predators such as cats and foxes may present some risk to fauna within the survey area. A fox was observed during the site inspection, fox dens are known to be present within the survey area and it is expected that cats would also occur.

There was some evince of rabbits using the site but this was minor to negligible in impact most places inspected. Pig diggings were noted and there are anecdotal records of pigs within the survey area. The extent to which pigs affect the fauna values of the site is not certain.

It is noted that, given the surrounding agricultural lands, over-grazing by (native) kangaroos may be a consideration.

3.1.6 Present land use

It is understood that the survey area is presently used for (private) conservation and very low impact recreation activities such as bushwalking.

3.2 Vegetation and substrate associations (VSAs) ['Habitat assessment']

Vegetation and substrate associations within the survey area are a mosaic, largely reflecting soil types and topography. Preliminary vegetation descriptions and mapping were provided by Western Environmental (see Section 1.2.3 above). From these, and observations made during the field investigations here, four major vegetation and substrate associations (VSAs) were identified in relation to fauna in the survey area:

VSA 1. Wandoo woodland. Woodland of Powderbark Wandoo (*Eucalyptus accedens*) and Wandoo (*E. wandoo*) with variable understorey; from shrub thickets dominated by Pingle (*Banksia squarrosa*) to a very open understorey of widely scattered shrubs and/or bare ground. See Plate 1 and Plate 2.

VSA 2. Jarrah, Marri and Wandoo woodland. Woodland dominated by Jarrah (*E. marginata*) with occasional Marri (*Corymbia calophylla*) and wandoos (*E. accedens or E. wandoo*) over dense thickets of Pingle (*B. squarrosa*) and Parrot Bush (*B. sessilis*), and other mixed shrubs. See Plate 3.

VSA 3. Rock Sheoak woodland. Woodland of Rock Sheoak (*Allocasuarina huegeliana*), usually surrounding exposed granite, and ranging from almost a monoculture, to having shrub layer of Grasstrees (*Xanthorrhoea priessii*) and/or mixed heaths. See Plate 4.

VSA 4. Drainages. Watercourses. See Plate 5.

The extent of the VSAs in the project area is mapped (based on data provided by Western Environmental) in Figure 6.

Plate 1. VSA 1: Wandoo woodland.

Note dense understorey.

Plate 2. VSA 1: Wandoo woodland.

Note open understorey.

Plate 3. VSA 2: Jarrah, Marri and Wandoo woodland.

Plate 4. VSA 3: Rock Sheoak woodland.

Plate 5. VSA 4: Drainages.

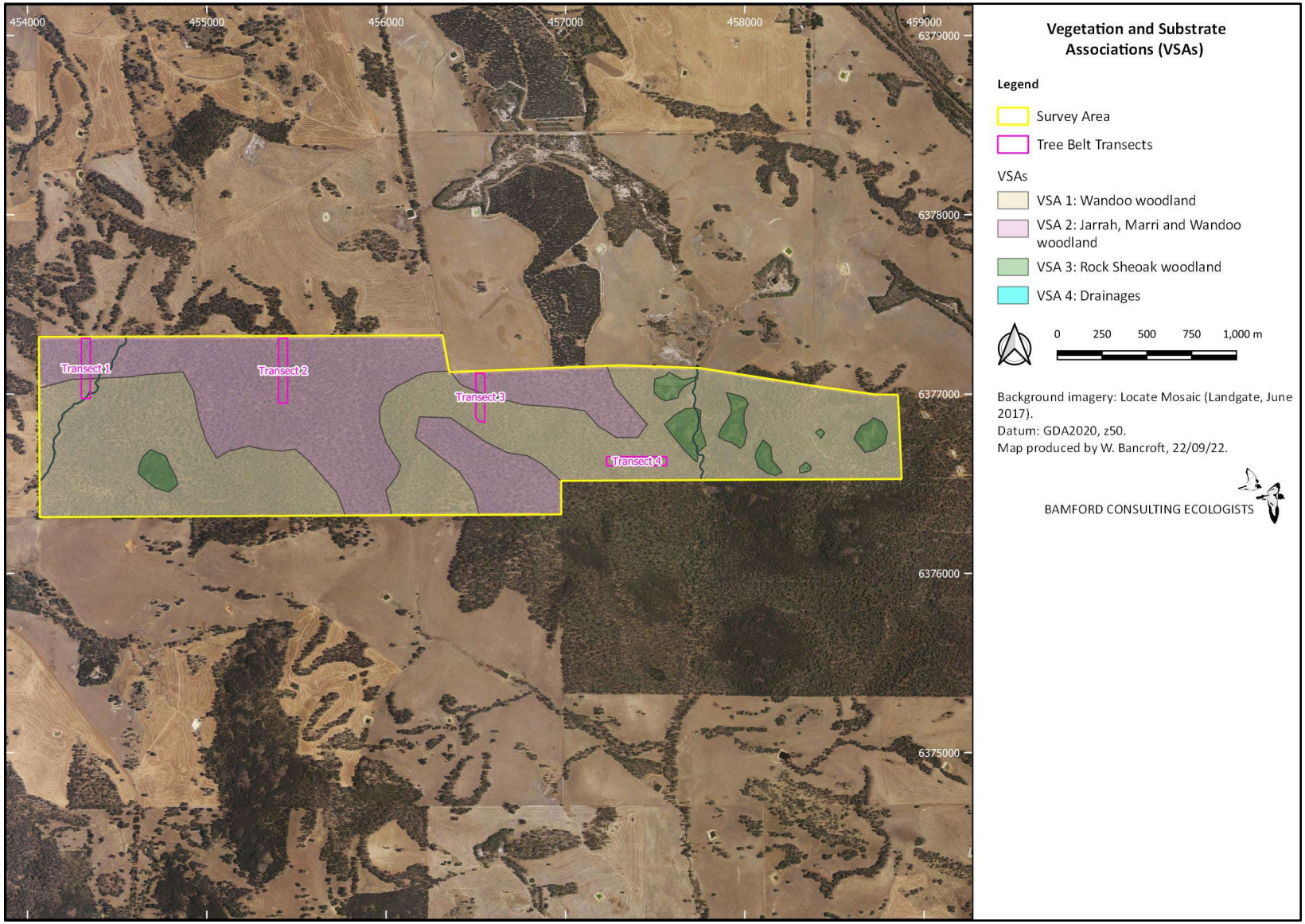

Figure 3. Vegetation and substrate associations.

3.3 Black-cockatoo habitat analysis

3.3.1 Black-cockatoo presence

Only one of the three species of black-cockatoo known to occur in the south-west of Western Australia was directly recorded on the site during the site inspection: Carnaby's Black-Cockatoo. This was in the eastern third of the survey area; a flock of nine birds flew northwards, along the course of a drainage line. Anecdotal evidence suggested a number of Carnaby's Black-Cockatoos and Forest Red-tailed Black-Cockatoos had been seen in the survey area previously (weeks, months and years previously) and this is supported by the indirect (foraging) evidence presented in Section 3.3.3 below.

Given these direct observations, indirect (foraging) records (see Section 3.3.3 below), roosting data (see Section 3.3.4 below) and the literature review (including current species distributions), it is considered that, currently:

- Carnaby's Black-Cockatoo is likely to be a regular breeding and/or non-breeding migrant to the site.
- Forest Red-tailed Black-Cockatoo is likely to be a regular visitor, or possibly even resident, at the site. It is possible that this species breeds within the survey area.
- Baudin's Black-Cockatoo is likely to be a regular non-breeding visitor to the site.

3.3.2 Black-cockatoo breeding habitat

Much of the survey area appears to be well suited to breeding by black-cockatoos (although it may be too far north to be a regular breeding location for Baudin's Black-Cockatoo) with key hollow-bearing trees such as Powderbark Wandoo (*Eucalyptus accedens*), Wandoo (*E. wandoo*), Jarrah (*E. marginata*) and Marri (*Corymbia calophlla*) present across the site.

To provide an indication of the potential for breeding, four belt transects (as shown in Figure 2 and Figure 3) were surveyed. These belt transects covered three of the four VSAs (see Section 3.2 above), with no sampling conducted in VSA 3 due to the scarcity of suitable nest-trees. Total areas of each VSA surveyed were:

VSA 1: Wandoo woodland	2.99 ha
VSA 2: Jarrah, Marri and Wandoo woodland	3.47 ha
VSA 3: Rock Sheoak woodland	0.00 ha
VSA 4: Drainages	0.02 ha
Total	*6.47 ha*

Data are summarised according to VSA in Table 3. Note that no trees were recorded within VSA 4.

Trees that met the potential nest-tree criteria of DCCEEW (2022a, c, d) and DAWE (2022b) were recorded at a density of 31.5 trees/ha within VSA 1, and at 25.6 tree/ha within VSA 2; a slightly higher rate in the wandoo woodland. Unsurprisingly, almost 90% of potential nest-trees were Powderbark Wandoo or Wandoo in this VSA 1, with the percentage of wandoos dropping to below 50% in the mixed Jarrah, Marri and Jarrah woodland of VSA 2.

No active nests (rank 1) or potential hollows with chew-marks (indicating a high likelihood of use by black-cockatoos; rank 2) were recorded but trees with hollow entrances that appeared suitable for black-cockatoo nesting (rank 3) occurred at a density of 7.9 and 4.9 trees/ha in VSAs 1 and 2, respectively (see Table 3).

Extrapolation of these data is possible (with the caveat that current assumption is of no suitable nest-trees within VSAs 3 and 4). There is approximately 220 ha of VSA 1 and 152 ha of VSA 2 within the survey area. Thus, given the sampled tree densities, there is estimated to be in excess of 10,800 potential nest-trees in the survey area (6920 in VSA 1, and 3907 in VSA 2). Of these, approximately 2366 trees (1620 in VSA 1, 746 in VSA 2) are expected to bear hollows that are presently suitable for black-cockatoo nesting (rank 3).

Table 3. The number (and density) of potential black-cockatoo nest-trees of each species in each nest-tree rank category in VSA 1 and VSA 2 (from belt transect sampling data).

See Section 2.4.2.2 for full explanation of tree categories.
Total area sampled: VSA 1 = 2.99 ha, VSA 2 = 3.47 ha.

VSA 1. Wandoo woodland.

Rank		Number of Trees			TOTAL	Total Density (trees/ha)
		Jarrah	Marri	Powderbark Wandoo/Wandoo		
1	Active nest.	0	0	0	0	0.0
2	Potential hollow with chew-marks.	0	0	0	0	0.0
3	Potential hollow, no chew marks.	1	0	21	22	7.4
4	Potential hollow, unsuitable orientation.	2	0	18	20	6.7
5	Sufficient DBH, no observable hollows.	6	1	45	52	17.4
	TOTAL:	9	1	84	94	31.5
	Percentage (of Grand Total)	9.6%	1.1%	89.4%	100.0%	

VSA 2. Jarrah, Marri and Wandoo woodland.

Rank		Number of Trees			TOTAL	Total Density (trees/ha)
		Jarrah	Marri	Powderbark Wandoo/Wandoo		
1	Active nest.	0	0	0	0	0.0
2	Potential hollow with chew-marks.	0	0	0	0	0.0
3	Potential hollow, no chew marks.	3	11	3	17	4.9
4	Potential hollow, unsuitable orientation.	2	5	1	8	2.3
5	Sufficient DBH, no observable hollows.	17	7	40	64	18.4
	TOTAL:	22	23	44	89	25.6
	Percentage (of Grand Total)	24.7%	25.8%	49.4%	100.0%	

3.3.3 Black-cockatoo foraging habitat

3.3.3.1 Carnaby's Black-Cockatoo

Foraging habitat for the Carnaby's Black-Cockatoo was present throughout the survey area. This is predominantly due to the presence of one tree species (Marri, *Corymbia calophylla*) and two shrub species (Parrot Bush, *Banksia sessilis;* and Pingle, *B. squarrosa*) known to be mainstays of the Carnaby's Black-Cockatoo diet (Groom 2011). The most widespread of these was Pingle and, where it occurred, it was generally in moderate to high density. Parrot Bush was often interspersed among the Pingle thickets, in moderate densities. Where it occurred, Marri was scattered at a moderate to low density. The areas (and percentages) of each vegetation score are shown for the Carnaby's Black-Cockatoo in Table 5.

There are approximately 31,325 ha of remnant native vegetation (as assessed by DPIRD 2022) within 15 km of the survey area, which itself has c. 378 ha of native vegetation. Therefore, the site comprises c. 1.2% of the native vegetation in the 'local area' (as per the methods outlined in Appendix 4). It is likely that the Carnaby's Black-Cockatoo breeds within the local area, given the proximity to Jarrah/Marri and Wandoo forests in the region. Thus, a 'context' score of 2 (out of 3) has been assigned to the survey area for this species (see Appendix 4).

There was evidence of foraging by the Carnaby's Black-Cockatoo within the survey area. This was foraging on Parrot Bush and Pingle (with intermediate and old-aged signs noted). The locations of these records are shown in Figure 5. It is expected that Carnaby's Black-Cockatoo will occur regularly (including foraging) within the survey area. Therefore, the survey area was assigned a species 'density' score for Carnaby's Black-Cockatoo of 1 (out of 1; see Appendix 4).

The context and density values have been added on to the vegetation scores to yield the overall foraging value scores (with areas and percentages) that are also presented in Table 5. A map of foraging scores for Carnaby's Black-Cockatoo foraging within the survey area is presented in Figure 3.

The survey area is, generally, of moderate to high value for foraging by the Carnaby's Black-Cockatoo and there was evidence to show that this species has previously used the site for feeding.

Table 4. Areas (ha) and proportions (%) of each category (vegetation score, combined foraging score) of foraging habitat at the survey area for Carnaby's Black-Cockatoo, Forest Red-tailed Black-Cockatoo and Baudin's Black-Cockatoo.

See Section 2.4.3.3 and Appendix 4 for explanation of vegetation, context, species density and (combined) foraging scores.

	Carnaby's Black-Cockatoo		Forest Red-tailed Black-Cockatoo		Baudin's Black-Cockatoo	
Vegetation Score/Value	**Area (ha)**	**%**	**Area (ha)**	**%**	**Area (ha)**	**%**
6: High	0	0.0	0	0.0	0	0.0
5: Moderate to High	152	39.2	0	0.0	0	0.0
4: Moderate	220	56.5	169	43.3	152	39.2
3: Low to Moderate	0	0.0	220	56.5	220	56.5
2: Low	17	4.4	1	0.2	1	0.2
1: Negligible	0	0.0	0	0.0	16	4.2
0: Nil	0	0.0	0	0.0	0	0.0
TOTAL	389	100.0	389	100.0	389	100.0
Context Score	2		2		2	
Species Density Score	1		1		1	
Foraging Score						
10	-	-	-	-	-	-
9	-	-	-	-	-	-
8	152	39.2	0	0.0	0	0.0
7	220	56.5	169	43.3	152	39.2
6	0	0.0	220	56.5	220	56.5
NA (Vegetation Score < 3)	17	4.4	1	0.2	17	4.4
TOTAL	389	100.0	389	100.0	389	100.0

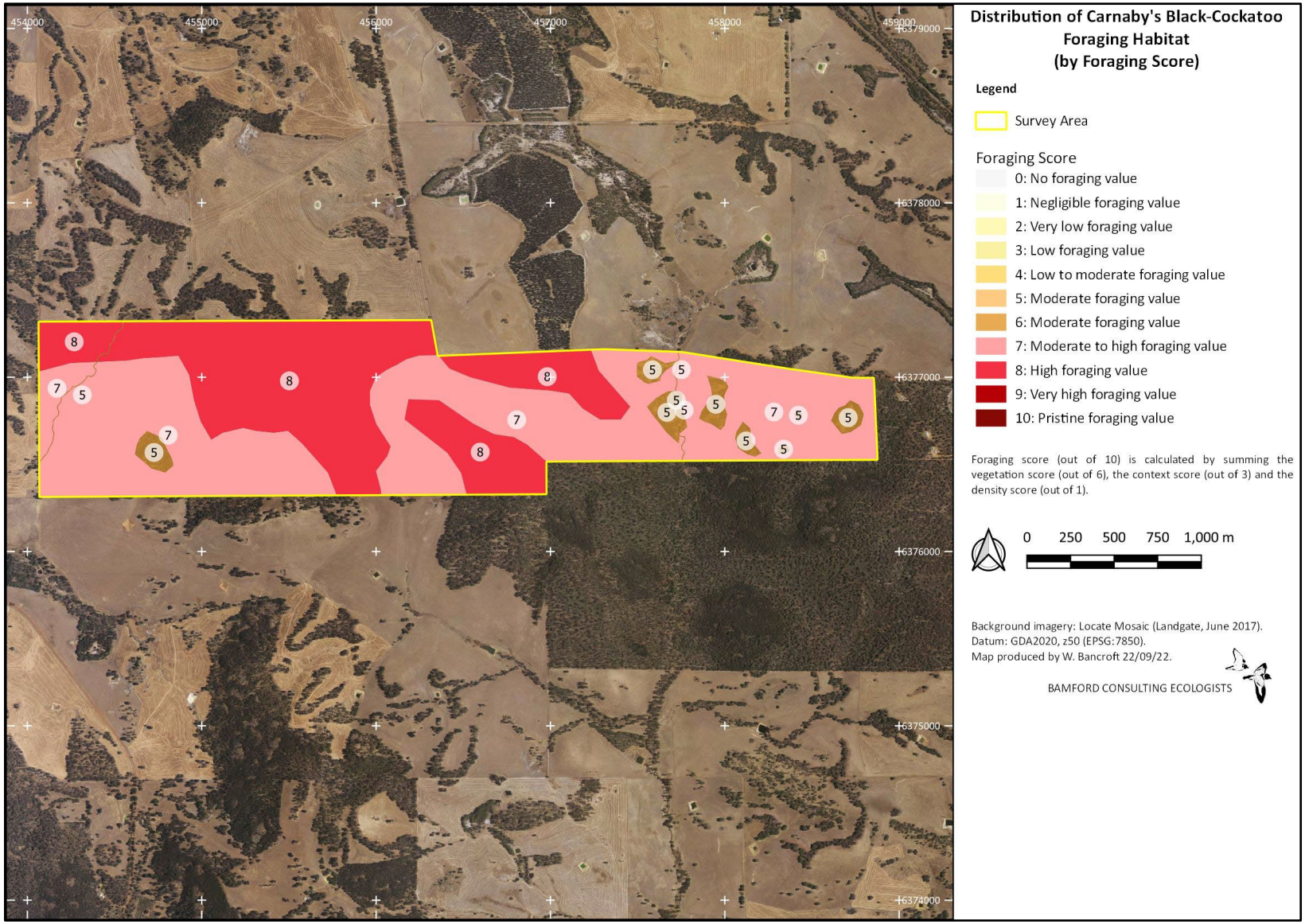

Figure 4. Distribution of Carnaby's Black-Cockatoo foraging habitat in the survey area.

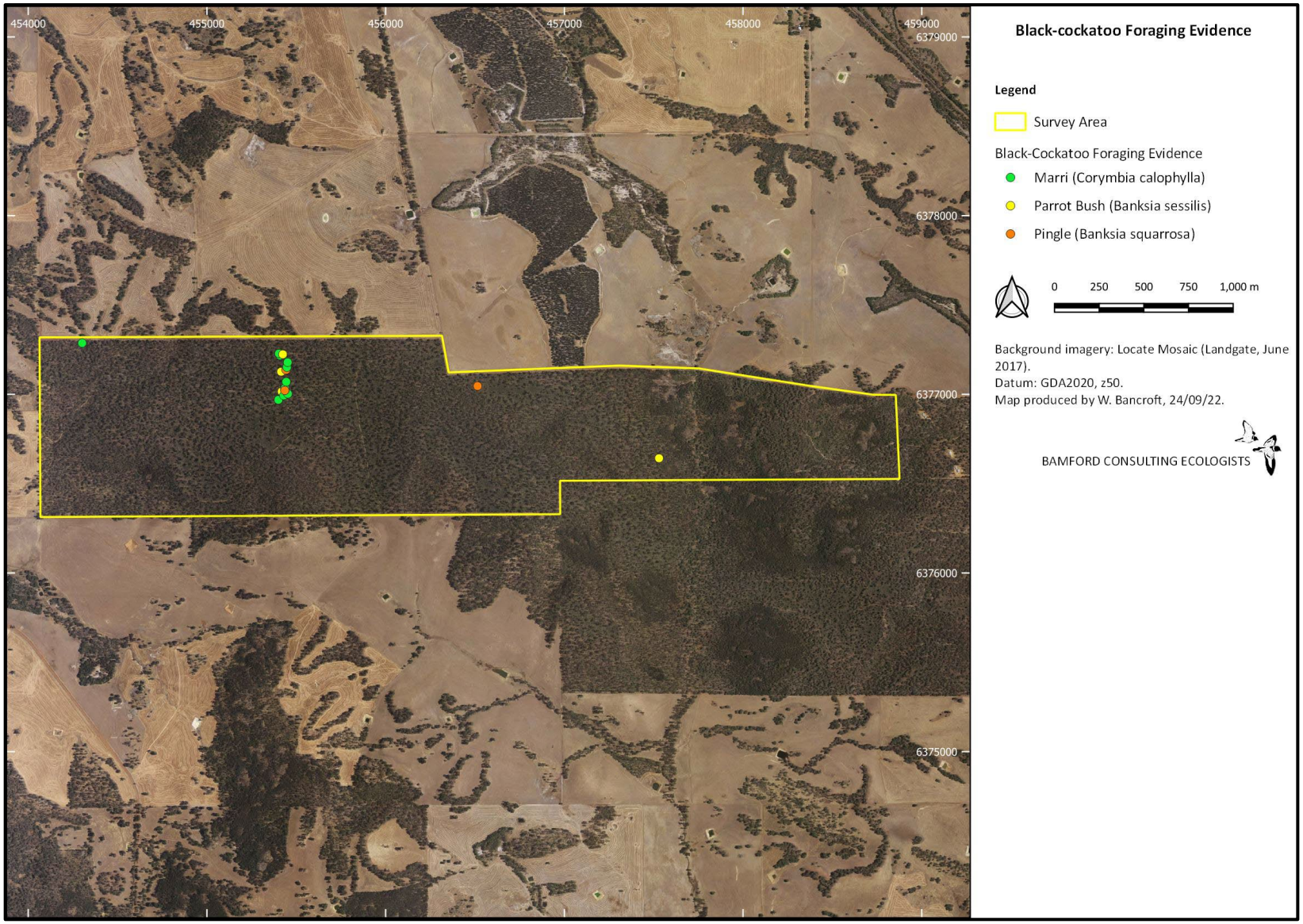

Figure 5. Location of black-cockatoo foraging records (from the September 2022 inspection) within the survey area.

3.3.3.2 Forest Red-tailed Black-Cockatoo

Foraging habitat for the Forest Red-tailed Black-Cockatoo was present throughout the survey area. This is predominantly due to the presence of two tree species known to be mainstays of the Forest Red-tailed Black-Cockatoo diet: Jarrah, *Eucalyptus marginata*; and Marri (Johnstone and Kirkby 1999; Johnstone *et al.* 2013b). The presence of Rock Sheoak, *Allocasuarina huegeliana* may also afford this species some foraging opportunity, although little mention of this food source is provided in the literature (Johnstone and Kirkby 1999; Johnstone *et al.* 2013b). There is no strong evidence to suggest that this species will feed on wandoo (Johnstone and Storr 1998; Higgins 1999; Johnstone and Kirkby 1999; Johnstone *et al.* 2013b). The forage tree species that were present occurred in varying densities, across the site, but nowhere were they notably high density. The areas (and percentages) of each vegetation score are shown for the Forest Red-tailed Black-Cockatoo in Table 5.

There are approximately 31,325 ha of remnant native vegetation (as assessed by DPIRD 2022) within 15 km of the survey area, which itself has c. 378 ha of native vegetation. Therefore, the site comprises c. 1.2% of the native vegetation in the 'local area' (as per the methods outlined in Appendix 4). It is likely that the Forest Red-tailed Black-Cockatoo breeds within the local area, given the proximity to Jarrah/Marri forests in the region. Thus, a 'context' score of 2 (out of 3) has been assigned to the survey area for this species (see Appendix 4).

There was evidence of foraging by the Forest Red-tailed Black-Cockatoo within the survey area. This was entirely foraging on Marri (with intermediate and old-aged signs noted). The locations of these records are shown in Figure 5, and a representative photo of foraging evidence is provided in Plate 6. It is expected that the Forest Red-tailed Black-Cockatoo will occur regularly (including foraging) within the survey area. Therefore, the survey area was assigned a species 'density' score for Forest Red-tailed Black-Cockatoo of 1 (out of 1; see Appendix 4).

The context and density values have been added on to the vegetation scores to yield the overall foraging value scores (with areas and percentages) that are also presented in Table 5. A map of foraging scores for Forest Red-tailed Black-Cockatoo foraging within the survey area is presented in Figure 6.

The survey area is, generally, of moderate value for foraging by the Forest Red-tailed Black-Cockatoo and there was evidence to suggest that this species has previously used the site for feeding.

Plate 6. Marri nuts foraged by Forest Red-tailed Black-Cockatoos ('intermediate' aged foraging).

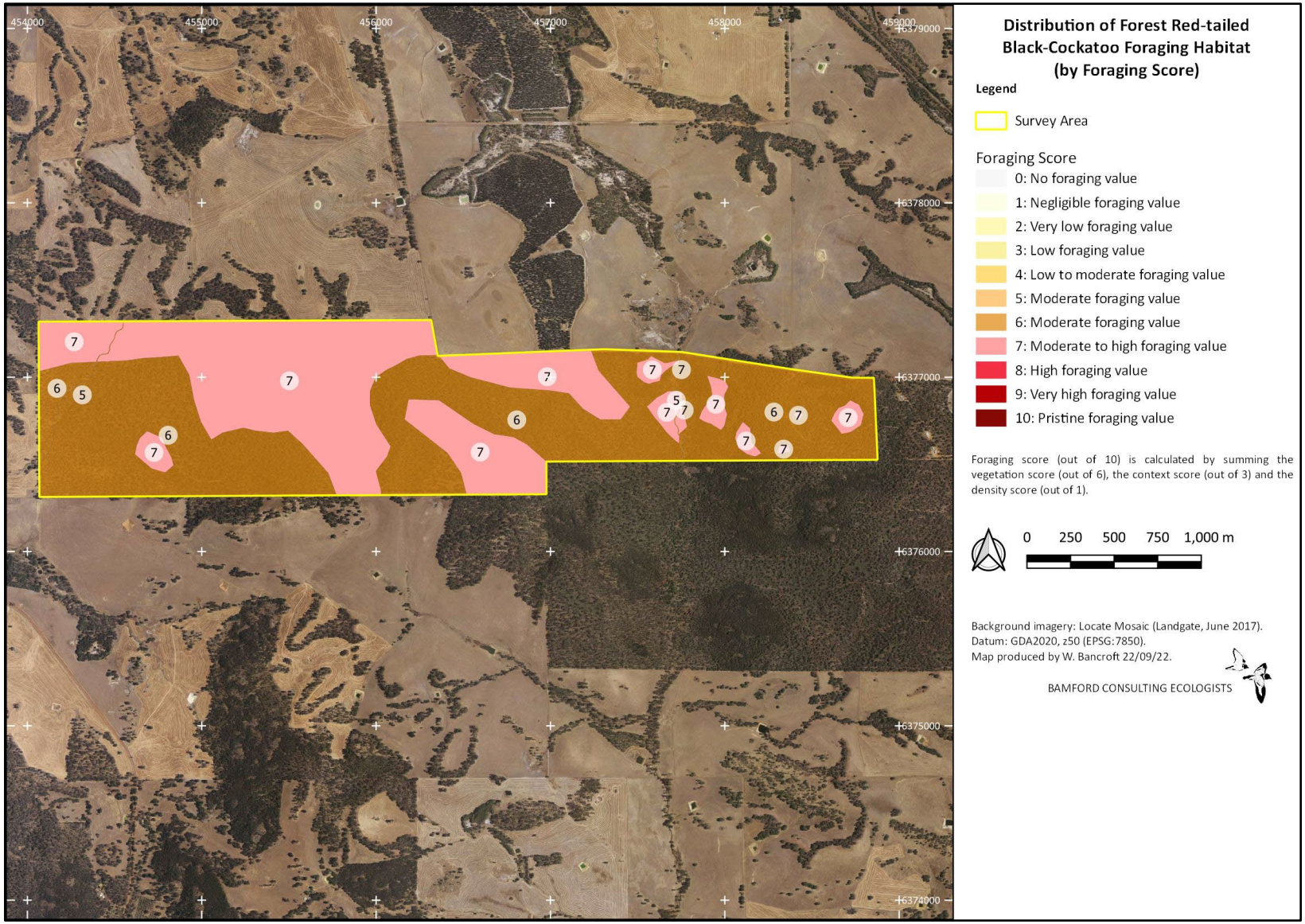

Figure 6. Distribution of Forest Red-tailed Black-Cockatoo foraging habitat in the survey area.

3.3.3.3 Baudin's Black-Cockatoo

Foraging habitat for the Baudin's Black-Cockatoo was present throughout most of the survey area. This is predominantly due to the presence of two tree species known to be mainstays of the Baudin's Black-Cockatoo diet (Jarrah and Marri) and also the presence of proteaceous shrubs (e.g. *Banksia* and *Hakea* spp.) that are also known to be supplementary food sources for this species (Johnstone and Storr 1998; Higgins 1999; Johnstone and Johnstone 2001; Lee *et al.* 2013). The forage tree species that were present occurred in varying densities, across the site, but nowhere were they notably high density. The areas (and percentages) of each vegetation score are shown for the Baudin's Black-Cockatoo in Table 5.

There are approximately 31,325 ha of remnant native vegetation (as assessed by DPIRD 2022) within 15 km of the survey area, which itself has c. 378 ha of native vegetation. Therefore, the site comprises c. 1.2% of the native vegetation in the 'local area' (as per the methods outlined in Appendix 4). It is possible that the Baudin's Black-Cockatoo breeds within the local area, given the proximity to Jarrah/Marri and Wandoo forests in the region. Thus, a 'context' score of 2 (out of 3) has been assigned to the survey area for this species (see Appendix 4).

There was no evidence of foraging by the Baudin's Black-Cockatoo within the survey area. It is expected, however, that the Baudin's Black-Cockatoo will occur regularly (including foraging) within the survey area as it is located along the main southern migration corridor (Johnstone and Kirkby 2008; DAWE 2022b). Therefore, the survey area was assigned a species 'density' score for Baudin's Black-Cockatoo of 1 (out of 1; see Appendix 4).

The context and density values have been added on to the vegetation scores to yield the overall foraging value scores (with areas and percentages) that are also presented in Table 5. A map of foraging scores for Baudin's Black-Cockatoo foraging within the survey area is presented in Figure 6.

The survey area is, generally, of moderate value for foraging by the Baudin's Black-Cockatoo.

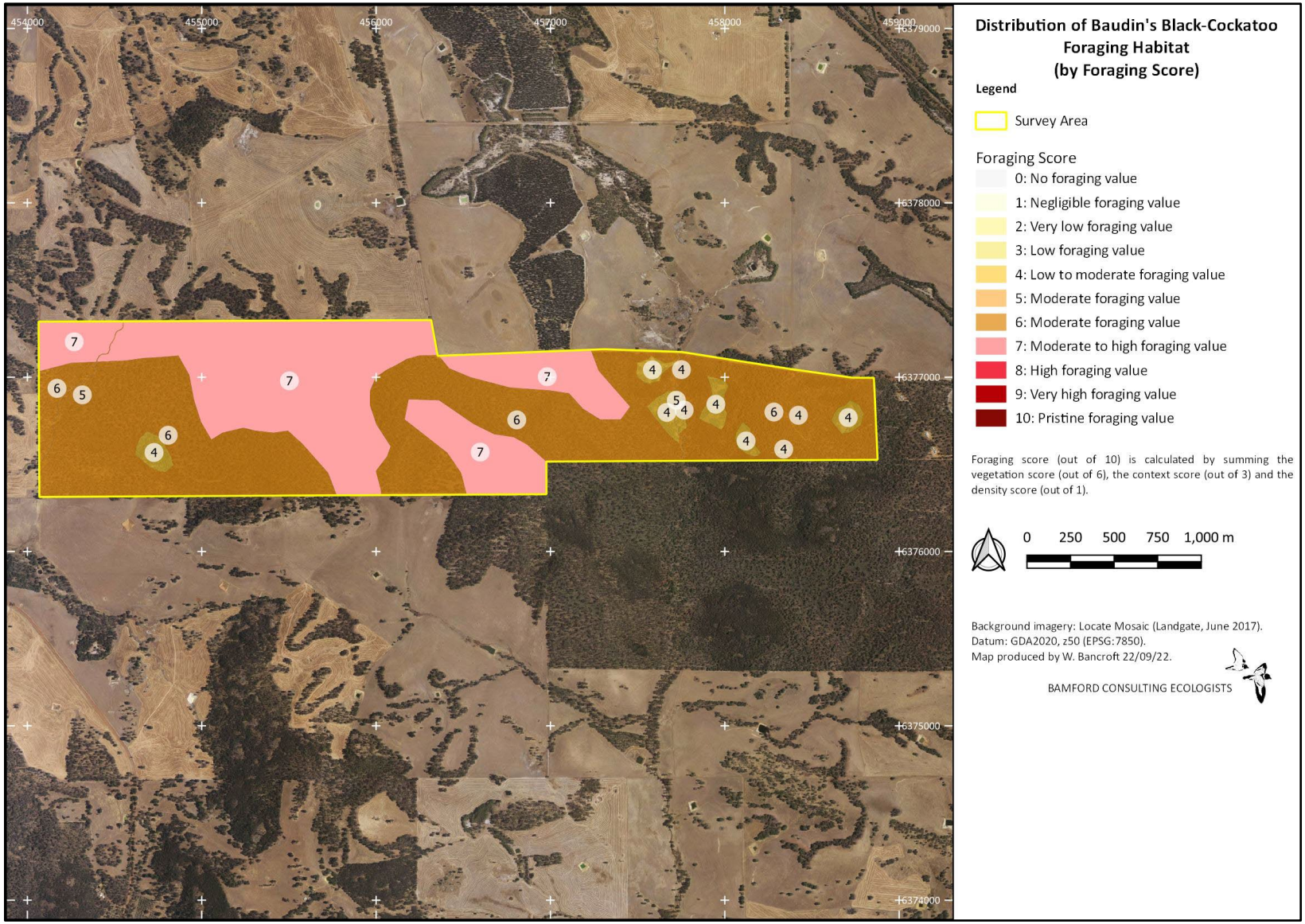

Figure 7. Distribution of Baudin's Black-Cockatoo foraging habitat in the survey area.

3.3.3.4 DCCEEW foraging quality scoring tool

The DCCEEW foraging quality scoring tool (provided by DAWE 2022b) was used to assess the site as a whole. The calculations are presented in Table 5 and these generated a total score (out of 10) for each species of black-cockatoo. The survey area scored 10 (out of 10) for both Carnaby's and Forest Red-tailed Black-cockatoos, and 8 (out of 10) for Baudin's Black-Cockatoo.

Table 5. DCCEEW foraging quality scoring tool calculations for the survey area.

Attribute	Baudin's Black-Cockatoo	Carnaby's Black-Cockatoo	Forest Red-tailed Black-Cockatoo
Starting score	10	10	10
Foraging potential	-2 (No evidence of foraging debris.)	0 (Foraging debris present.)	0 (Foraging debris present.)
Connectivity	0 (Foraging habitat within 12 km.)	0 (Foraging habitat within 12 km.)	0 (Foraging habitat within 12 km.)
Proximity to breeding	0 (Breeding habitat within 12 km.)	0 (Breeding habitat within 12 km.)	0 (Breeding habitat within 12 km.)
Proximity to roosting	0 (Known night roosting habitat within 20 km.)	0 (Known night roosting habitat within 20 km.)	0 (Known night roosting habitat within 20 km.)
Impact from significant plant disease	0 (*Phytophthora* spp. or Marri canker affects less than 50% of preferred food plants.)	0 (*Phytophthora* spp. or Marri canker affects less than 50% of preferred food plants.)	0 (*Phytophthora* spp. or Marri canker affects less than 50% of preferred food plants.)
Total Score	**8**	**10**	**10**

3.3.4 Black-cockatoo night roosting habitat

No black-cockatoos were recorded coming in to roost within, or in the vicinity of, the survey area from the single roost-watch location (on the northern boundary of the site) on the evening of 16th September 2022. The current landholder provided anecdotal evidence that at some times of the year black-cockatoos have been known to move into the survey area around dusk.

The area around the survey area has been known to support black-cockatoo roosting, however there are no known records of roost sites within the survey area itself (possibly due to a lack of survey effort). Previously known roost locations (provided by DBCA 2022a and that reflect data collected in BirdLife Australia's Great Cocky Counts) within 15 km of the survey area are mapped in Figure 7. The nearest of these known roosts is within c. 3 km of the survey area boundary. Further details on these roosts can be provided, if required, by requesting data from BirdLife Australia.

Given the established roosts within the region, anecdotal evidence and the availability of taller trees (e.g. eucalypts) preferred by black-cockatoos as roost locations within the survey area, there is very strong potential that black-cockatoos use the site for roosting for at least some times of the year.

3.3.5 Black-cockatoo watering points

Several potential water sources for black-cockatoos were noted. These included seasonal drainages through the site (including an area on one which is believed to be a perennial spring), and a number of farm dams in paddocks that surround the survey area (and would likely provide at least some water for most of the year).

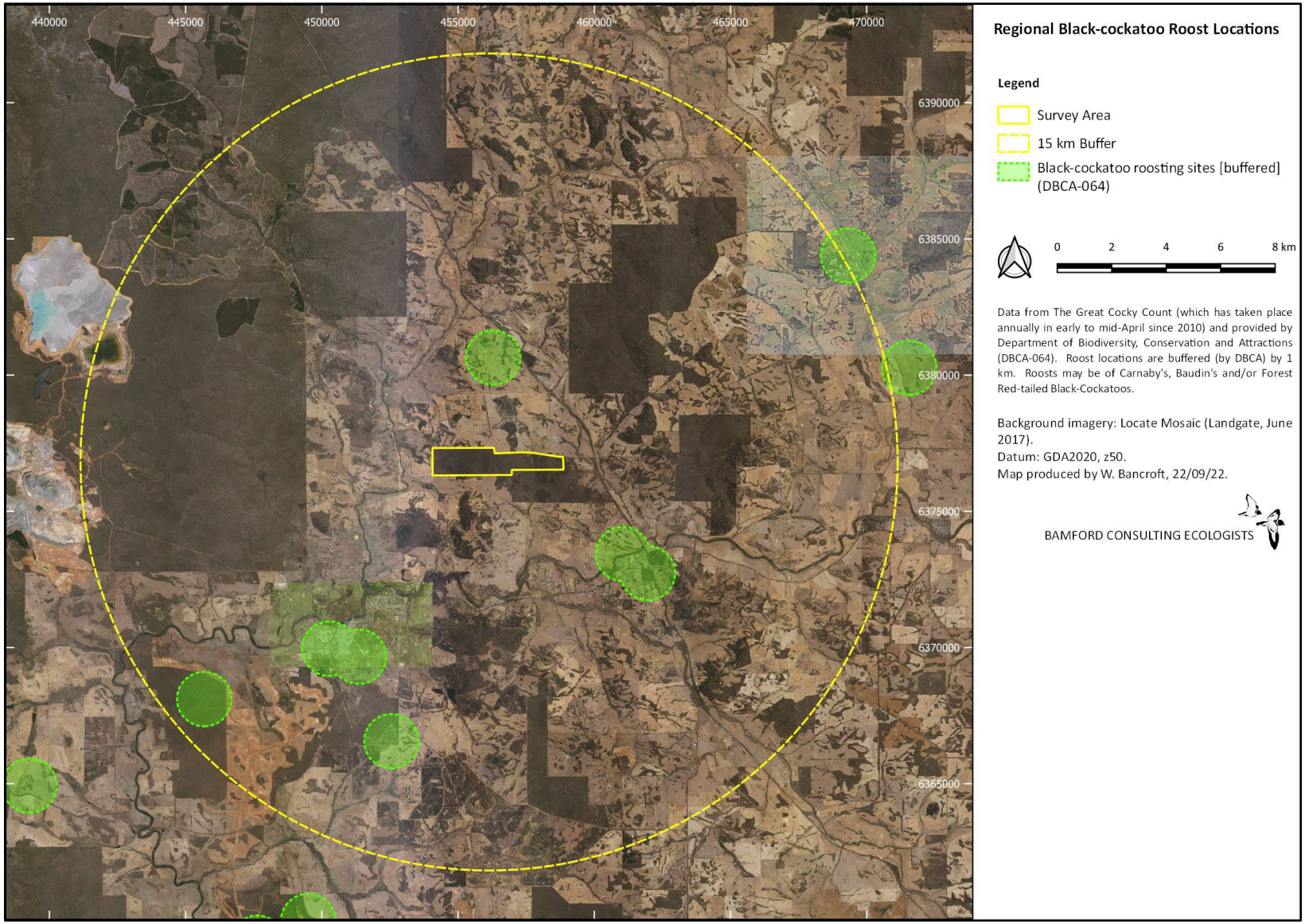

Figure 8. Known black-cockatoo roost locations within the region.

3.4 MNES vertebrate fauna

A number of vertebrate species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), and that could be considered Matters of National Environmental Significance (MNES), have the potential to occur within the study area. Using a 20 km buffer around the survey area, a search of the EPBC database (using the EPBC Protected Matters Search Tool provided by DCCEEW 2022b) yielded 12 listed threatened vertebrate species that may occur in the region. These are discussed briefly below, in relation to their likely occurrence within the survey area:

i. Malleefowl (*Leipoa ocellata*). Not expected to occur. Habitat probably unsuitable. Probably out of range.
ii. Curlew Sandpiper (*Calidris ferruginea*). Not expected to occur. Habitat unsuitable.
iii. Eastern Curlew (*Numenius madagascariensis*). Not expected to occur. Habitat unsuitable.
iv. Australian Painted-snipe (*Rostratula australis*). Not expected to occur. Habitat unsuitable. Probably out of range.
v. Carnaby's Black-Cockatoo (*Zanda latirostris*). Known to occur. See Section 3.2 above.
vi. Baudin's Black-Cockatoo (*Zanda baudinii*). Expected to occur. See Section 3.2 above.
vii. Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*). Known to occur. See Section 3.2 above.
viii. Grey Falcon (Falco hypoleucos). Not expected to occur. Habitat unsuitable. Out of range.
ix. Woylie (*Bettongia penicillata ogilbyi*). Unlikely to currently occur but habitat is well suited to this species. While the Woylie is probably locally extinct there is an extant population in very similar habitat at Dryandra Woodland National Park to the east (connectively to the study area is tenuous, however). With additional management (e.g. feral predator control and/or fencing), the site could be a strong potential for reintroduction of this species.
x. Chuditch (*Dasyurus geoffroii*). Expected to occur. The woodlands within the survey area would provide ideal habitat for this species although competition with/predation by feral predators may be of some concern. A number of fallen, hollowed logs are present throughout the site and these would provide excellent dens for Chuditch. While these are very wide ranging animals, the overall health of the ecosystem within the survey area (and surrounds) should be able to support a resident population of Chuditch.
xi. Red-tailed Phascogale (*Phascogale calura*). Expected to occur. The Rock Sheaok patches within the survey area provide excellent habitat for this species (Kitchener 1981; Short and Hide 2012; Cannella *et al.* 2018). While not extensive, there should be enough resources within the site to support resident Red-tailed Phascogales.
xii. Quokka (*Setonix brachyurus*). Not expected to occur. Habitat unsuitable (lack of preferred Swamp Peppermint thickets).

In addition to the above, it should also be noted that the site would be ideal for the EPBC-listed Numbat (*Myrmecobius fasciatus*) and that, while low likelihood, the presence of this species should not be completely discounted. This species was not returned in the EPBC search however a recent, unexpected, sighting (in 2021) in nearby Boddington gives some hope that numbats may be persisting locally (Loney 2021).

3.5 Priority vertebrate fauna

In addition to the threatened species listed under the EPBC Act, the survey area may also support (or be capable of supporting) a range of DBCA-ranked Priority species (see Appendix 1 for definitions of DBCA priority rankings). Brief comments are provided for some of these species below:

i. Dells' Skink (*Ctenotus delli*). Ranked as P4. This species may persist in the heaths and woodlands surrounding granite outcrops within the site where it often prefers sandier soils.

ii. Peregrine Falcon (*Falco peregrinus*). Listed as OS. It is likely that this species would presently use the site, at least in part (these birds have large home ranges).

iii. Masked Owl – southwest (*Tyto novaehollandiae novaehollandiae*). Ranked as P3. Could occur in forested areas and surrounding farmland may also provide some foraging opportunities.

iv. Barking Owl – southwest (*Ninox connivens connivens*). While presently ranked as P3, a recent publication (Davis *et al.* 2022) suggested that this taxon may be in a dire situation. It is probably locally extinct but there is a slim possibility of it persisting.

v. South-western Brush-tailed Phascogale (*Phascogale tapoatafa wambenger*). Ranked as CD. It is expected that this species would be present and the numerous tree-hollows observed within the survey area provide ideal refugia, as noted by Van der Ree *et al.* (2006). In a highly modified agricultural landscape (within which the survey area sits), the 'dry forested slopes' present throughout the site have been previously found to be a favoured habitat for this species (Lawton *et al.* 2021). Cannella *et al.* (2018) found both of species of phascogale to be present, in sympatry, in the broader region.

vi. Quenda (*Isoodon fusciventer*). Ranked as P4. Expected to be present. Known to occur in similar habitats within the region. The presence of feral predators may inhibit this species.

vii. Brush Wallaby (*Notamacropus irma*). Ranked as P4. Possibly present. Brush Wallabies are common in the Jarrah, Marri and Wandoo forests to the north of the survey area (W. Bancroft, pers. obs) and are likely to be similarly common in forests to the west.

viii. Tammar Wallaby (*Notamacropus eugenii derbianus*). Ranked as P4. Probably locally extinct but this species has persisted further east, around Narrogin.

ix. Rakali/Water-rat (*Hydromys chrysogaster*). Ranked as P4. Likely to occur along drainages within the survey area at least irregularly (if not resident). These water courses connect to the Hotham River (to the south of the site) and it is likely that Rakali persist along this system.

x. Western False Pipistrelle (*Falsistrellus mackenziei*). Ranked as P4. Occurs in dry sclerophyll forest, such as is present across the survey area, in the south-west of Western Australia and, as such, could be expected to be present within the site, at least as a regular visitor (if not resident).

3.6 Other Fauna

A number of threatened and priority *invertebrate* species may occur in the vicinity of the survey area. Further details and desktop assessment of these species could be provided, if required.

At least 47 vertebrate species were recorded during the site inspection. A list of these species is provided in Appendix 7.

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5 Appendices

Appendix 1. Categories used in the assessment of conservation status.

IUCN (International Union for the Conservation of Nature) categories, as outlined by IUCN (2012), and as used for the *Environment Protection and Biodiversity Conservation Act 1999*:

EX	Extinct	Taxa not definitely located in the wild during the past 50 years.
EW	Extinct in the Wild	Taxa known to survive only in captivity.
CR	Critically Endangered	Taxa facing an extremely high risk of extinction in the wild in the immediate future.
EN	Endangered	Taxa facing a very high risk of extinction in the wild in the near future.
VU	Vulnerable	Taxa facing a high risk of extinction in the wild in the medium-term future.
NT	Near Threatened	Taxa that risk becoming Vulnerable in the wild.
CD	Conservation Dependent	Taxa whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent taxon would be classed as Vulnerable or more severely threatened.
DD	Data Deficient (Insufficiently Known)	Taxa suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information.
LC	Least Concern	Taxa that are not Threatened.

Categories used in the WA *Biodiversity Conservation Act 2016:*

THREATENED SPECIES		
CR	Critically Endangered	Threatened species considered to be "facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines".
EN	Endangered	Threatened species considered to be "facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines".
VU	Vulnerable	Threatened species considered to be "facing a high risk of extinction in the wild in the medium term future, as determined in accordance with criteria set out in the ministerial guidelines".
EXTINCT SPECIES		
EX	Extinct	Species where "there is no reasonable doubt that the last member of the species has died", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).
EW	Extinct in the Wild	Species that "is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form", and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act).

SPECIALLY PROTECTED SPECIES		
MI	Migratory	Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act).
CD	Conservation Dependent	Species of special conservation need that are dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act).
OS	Other Specially Protected	Species otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act).

WA DBCA Priority species (species not listed under the *WA Biodiversity Conservation Act 2016*, but for which there is some concern).

P1	Priority 1	Poorly-known species. Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, for example, agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements for threatened listing and appear to be under immediate threat from known threatening processes. These species are in urgent need of further survey.
P2	Priority 2	Poorly-known species. Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, for example, national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements for threatened listing and appear to be under threat from known threatening processes. These species are in urgent need of further survey.
P3	Priority 3	Poorly-known species. Species that are known from several locations and the species does not appear to be under imminent threat or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. These species need further survey.

		Rare, Near Threatened and other species in need of monitoring. (a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as a conservation dependent specially protected species. (c) Species that have been removed from the list of threatened species or lists of conservation dependent or other specially protected species, during the past five years for reasons other than taxonomy. (d) Other species in need of monitoring.
P4	Priority 4	

Appendix 2. Plants known to be used for foraging, roosting and nesting by black-cockatoos in south-western Western Australia.

Data compiled from the literature (Davies 1966; Saunders 1974, 1979a, b, 1980; Saunders *et al.* 1982; Saunders 1986; Johnstone and Storr 1998; Higgins 1999; Johnstone and Kirkby 1999, 2008; Groom 2011; Johnstone *et al.* 2011; DotE 2017a, b, c).

FRTBC = Forest Red-tailed Black-Cockatoo, CBC = Carnaby's Black-Cockatoo, BBC = Baudin's Black-Cockatoo (see Table 1 for scientific names).

Plant status: blank = Western Australian native, AN = Australian native (but not naturally occurring in Western Australia), E = exotic (i.e. not native to Australia).

F = foraging, R = roosting, N or n = nesting (main and less commonly used species, respectively).

Plant Species	Plant Status	FRTBC	CBC	BBC
Acacia baileyana (Cootamundra Wattle)	AN		F	
Acacia pentadenia (Karri Wattle)			F	
Acacia saligna (Orange Wattle)			F	
Agonis flexuosa (Peppermint Tree)			F	
Allocasuarina fraseriana (Sheoak)		F		F
Anigozanthos flavidus (Tall Kangaroo Paw)				F
Araucaria heterophylla (Norfolk Island Pine)	E		F	
Banksia ashbyi (Ashby's Banksia)			F	
Banksia attenuata (Slender Banksia)			F	
Banksia baxteri (Baxter's Banksia)			F	
Banksia carlinoides (Pink Dryandra)			F	
Banksia coccinea (Scarlet Banksia)			F	
Banksia dallanneyi (Couch Honeypot Dryandra)			F	
Banksia ericifolia (Heath-leaved Banksia)	AN		F	
Banksia fraseri (Dryandra)			F	
Banksia gardneri (Prostrate Banksia)			F	
Banksia grandis (Bull Banksia)			F	F
Banksia hookeriana (Hooker's Banksia)			F	
Banksia ilicifolia (Holly Banksia)			F	F
Banksia kippistiana (Dryandra)			F	
Banksia leptophylla			F	
Banksia lindleyana (Porcupine Banksia)				F
Banksia littoralis (Swamp Banksia)			F	F
Banksia menziesii (Firewood or Menzie's Banksia)			F	
Banksia mucronulata (Swordfish Dryandra)			F	
Banksia nivea (Honeypot Dryandra)			F	
Banksia nobilis (Golden Dryandra)			F	
Banksia praemorsa (Cut-leaf Banksia)			F	F
Banksia prionotes (Acorn Banksia)			F	
Banksia quercifolia (Oak-leaved Banksia)			F	F
Banksia sessilis (Parrot Bush)			F	F
Banksia speciosa (Showy Banksia)			F	
Banksia squarrosa (Pingle)			F	F
Banksia tricuspis (Lesueur Banskia or Pine Banksia)			F	

Plant Species	Plant Status	FRTBC	CBC	BBC
Banksia undata (Urchin or Cut-leaf Dryandra)			F	
Banksia verticillata (Granite Banksia)			F	
Brassica campestris (Canola, Rape)	E		F	
Callistemon spp.				F
Callistemon viminalis (Captain Cook Bottlebrush)	AN		F	
Callitris sp.			F	
Carya illnoinensis (Pecan)	E		F	F
Casuarina cunninghamiana (River Sheoak)	AN		F	
Citrullus lanatus (Pie or Afghan Melon)	E		F	
Corymbia calophylla (Marri)		F,N	F,n,R	F,n
Corymbia ficifolia (Red Flowering Gum)			F	
Corymbia haematoxylon (Mountain Marri)			F	
Corymbia maculata (Spotted Gum)			R	
Darwinia citriodora (Lemon-scented Darwinia)	AN		F	F
Diospryros sp. (Sweet Persimmon)	E		F	F
Eremophila glabra (Tarbush)			F	
Erodium aureum (Corkscrew Grass or Storksbill)	E		F	
Erodium botrys (Corkscrew Grass or Storksbill)	E		F	F
Eucalyptus caesia (Silver Princess)			F	
Eucalyptus camaldulensis (River Red Gum)	AN		R	
Eucalyptus citriodora (Lemon Scented Gum)	AN	F	F,R	F
Eucalyptus diversicolor (Karri)		n	n	N
Eucalyptus globulus (Tasmaniam Blue Gum)	AN		R	
Eucalyptus gomphocephala (Tuart)		n	F,n,R	
Eucalyptus grandis (Flooded Gum, Rose Gum)	AN		R	
Eucalyptus longicornis (Red Morrell)			n	
Eucalyptus loxophleba (York Gum)			F,n	
Eucalyptus marginata (Jarrah)		F,N	F,n,R	F
Eucalyptus megacapa (Bullich)		n		n
Eucalyptus occidentalis (Swamp Yate)			n	
Eucalyptus patens (Blackbutt)		F	F,R	
Eucalyptus pleurocarpa (Tallerack)			F	
Eucalyptus preissiana (Bell-fruited Mallee)			F	
Eucalyptus robusta (Swamp Mahogany)			F,R	
Eucalyptus rudis (Flooded Gum)			R	
Eucalyptus salmonophloia (Salmon Gum)			F,N	
Eucalyptus salubris (Gimlet)			n	
Eucalyptus todtiana (Coastal Blackbutt or Prickley Bark)			F	
Eucalyptus wandoo (Wandoo)			F,N,R	F,n
Ficus sp. (Fig)			F	
Grevillea armigera (Prickly Toothbrushes)			F	
Grevillea bipinnatifida (Fuschia Grevillea)			F	
Grevillea hookeriana (Red Toothbrushes)			F	

Plant Species	Plant Status	FRTBC	CBC	BBC
Grevillea hookeriana subsp. *apiciloba* (Black Toothbrushes)			F	
Grevillea paniculata (Kerosene Bush)			F	
Grevillea paradoxa (Bottlebrush Grevillea)			F	
Grevillea petrophiloides (Pink Poker)			F	
Grevillea robusta (Silky Oak)			F	
Grevillea wilsonii (Native Fuchsia)				F
Hakea auriculata			F	
Hakea candolleana			F	
Hakea circumalata (Coastal Hakea)			F	
Hakea commutata			F	
Hakea conchifolia			F	
Hakea costata (Ribbed Hakea)			F	
Hakea cristata (Snail Hakea)			F	F
Hakea cucullata (Snail Hakea)			F	
Hakea cyclocarpa (Ramshorn)			F	
Hakea eneabba			F	
Hakea erinacea (Hedgehog Hakea)			F	F
Hakea falcata (Sickle Hakea)			F	
Hakea flabellifolia (Fan-leaved Hakea)			F	
Hakea gilbertii			F	
Hakea incrassata (Golfball or Marble Hakea)			F	
Hakea lasiantha (Woolly Flowered Hakea)			F	
Hakea lasianthoides			F	F
Hakea laurina (Pin-cushion hakea)			F	
Hakea lissocarpha (Honeybush)			F	F
Hakea marginata				F
Hakea megalosperma (Lesueur Hakea)			F	
Hakea multilineata (Grass Leaf Hakea)			F	
Hakea obliqua (Needles and Corks)			F	
Hakea oleifolia (Dungyn or Olive-leaved Hakea)			F	
Hakea pandanicarpa subsp. *crassifolia* (Thick-leaved Hakea)			F	
Hakea petiolaris (Sea Urchin Hakea)			F	
Hakea polyanthema			F	
Hakea preissii (Needle Tree)			F	
Hakea prostrata (Harsh Hakea)			F	F
Hakea psilorrhyncha			F	
Hakea ruscifolia (Candle Hakea)			F	F
Hakea scoparia (Kangaroo Bush)			F	
Hakea smilacifolia			F	
Hakea spathulata			F	
Hakea stenocarpa (Narrow-fruited Hakea)			F	F
Hakea sulcata (Furrowed Hakea)			F	

Plant Species	Plant Status	FRTBC	CBC	BBC
Hakea trifurcata (Two-leaved Hakea)			F	F
Hakea undulata (Wavy-leaved Hakea)			F	
Hakea varia (Variable-leaved Hakea)			F	F
Helianthus annuus (Sunflower)	E		F	
Hibiscus sp. (Hibiscus)	E		F	
Isopogon scabriusculus			F	
Jacaranda mimosifolia (Jacaranda)	E		F	F
Jacksonia furcellata (Grey Stinkwood)			F	
Kingia australis (Kingia)				F
Lambertia inermis (Chittick)			F	
Lambertia multiflora (Many-flowered Honeysuckle)			F	
Liquidamber styraciflua (Liquid Amber)	E		F	
Lupinus sp. (Lupin)	E		F	
Macadamia integrifolia (Macadamia)	E		F	F
Malus domestica (Apple)	E		F	F
Melaleuca leuropoma			F	
Melia azedarach (Cape Lilac or White Cedar)	E	F	F	
Mesomeleana sp.			F	
Persoonia longifolia (Snottygobble)		F		
Pinus canariensis (Canary Island Pine)	E		F	
Pinus caribea (Caribbean Pine)	E		F	
Pinus pinaster (Pinaster or Maritime Pine)	E		F,R	
Pinus radiata (Radiata Pine)	E		F,R	F
Protea 'Pink Ice'	E		F	
Protea repens	E		F	
Prunus amygdalus (Almond Tree)	E		F	
Pyrus communis (European Pear)	E			F
Quercus spp. (Oak spp.)	E			F
Raphanus raphanistrum (Wild Radish)	E		F	
Reedia spathacea				F
Tipuana tipu (Tipu or Rosewood Tree)	E		F	
Xanthorrhoea preissii (Grass Tree)			F	F

Appendix 3. Extended rationale for chosen methodology.

Vegetation and substrate associations (VSAs)

VSAs combine broad vegetation types, the soils or other substrate with which they are associated, and the landform. In the context of fauna assessment, VSAs are the environments that provide habitats for fauna. The term habitat is widely used in this context, but by definition an animal's habitat is the environment that it utilises (Calver *et al.* 2009), not the environment as a whole. Habitat is a function of the animal and its ecology, rather than being a function of the environment. For example, a species may occur in eucalypt canopy or in leaf-litter on sand, and that habitat may be found in only one or in several VSAs. VSAs are not the same as vegetation types since these may not incorporate soil and landform, and recognise floristics to a degree that VSAs do not. Vegetation types may also not recognise minor but often significant (for fauna) structural differences in the environment. VSAs also do not necessarily correspond with soil types, but may reflect some of these elements.

Because VSAs provide the habitat for fauna, they are important in determining assemblage characteristics. For the purposes of impact assessment, VSAs can also provide a surrogate for detailed information on the fauna assemblage. For example, rare, relictual or restricted VSAs should automatically be considered a significant fauna value. Impacts may be significant if the VSA is rare, a large proportion of the VSA is affected and/or the VSA supports significant fauna. The disturbance of even small amounts of habitat in a localised area can have significant impacts to fauna if rare or unusual habitats are disturbed.

VSA assessment was made with reference to the key attributes provided by (EPA 2020):

- soil type and characteristics
- extent and type of ground surfaces and landforms
- height, cover and dominant flora within each vegetation stratum
- presence of specific flora or vegetation of known importance to fauna
- evidence of fire history including, where possible, estimates of time since fire
- evidence and degree of other disturbance or threats, e.g. feral species
- presence of microhabitats and significant habitat features, such as coarse woody debris, rocky
- outcrops, tree hollows, water sources and caves
- evidence of potential to support significant fauna
- function of the habitat as a fauna refuge or part of an ecological linkage.

Appendix 4. Scoring system for the assessment of foraging value of vegetation for Black-Cockatoos.

Bamford Consulting Ecologists
Revised 4th April 2021

Introduction

Application of the Offset Assessment Guide (offsets guide) developed by the federal environment department for assessing Black-Cockatoo foraging habitat requires the calculation of a score out of 10. The following system has been developed by Bamford Consulting Ecologists (BCE) with assistance from Quessentia Consulting to provide an objective scoring system that is practical and can be used by trained field zoologists with experience in the environments frequented by the species.

The foraging value score provides a numerical value that reflects the significance of vegetation as foraging habitat for Black-Cockatoos, and this numerical value is designed to provide the information needed by the Federal Department of Agriculture, Water and the Environment (DAWE) to assess impact significance and offset requirements. The foraging value of the vegetation depends upon the type, density and condition of trees and shrubs in an area and can be influenced by the context such as the availability of foraging habitat nearby. The BCE scoring system for value of foraging habitat has three components as detailed above. These three components are drawn from the DAWE offsets guide but the scoring approach was developed by BCE and includes a fourth (moderation) component. Note that the scoring system can only be applied within the range of the species or at least where the species could reasonably be expected to occur based upon existing information.

Calculating the total score (out of 10) requires the following steps:

A. Site condition. Determining a score out of six for the vegetation composition, condition and structure; plus
B. Site context. Determining a score out of three for the context of the site; plus
C. Species stocking rate. Determining a score out of one for species density.
D. Determining the total score out of 10, which may require moderation for context and species density with respect to the site condition (vegetation) score. Moderation also includes consideration of pine plantations as a special case for foraging value.

The BCE scoring system places the greatest weight on site condition (scale of 0 to 6) because this has the highest influence on the foraging values of a site, which in turn is the fundamental driver in meeting ecological requirements for continued survival.

Site context has a lower weight (scale of 0 to 3) in recognition of the mobility of the species, which means they can access good foraging habitat even in fragmented landscapes, but allowing for recognition of the extent of available habitat in a region and context in relation to activity (such as breeding and roosting). The application of scoring site context is further discussed below.

Species stocking rate is given a low weight (0 to 1) as it is a means only of recognising that a species may or may not be abundant at a site, but that abundance is dependent upon site condition and context and is thus not an independent variable. The abundance of a species is also sensitive to

sampling effort, and to seasonal and annual variation, and is therefore an unreliable indicator of actual importance of a site to a species.

Calculation of scores and the moderation process are described in detail below.

A. Site condition. Vegetation composition, condition and structure scoring

Site Score	Description of Vegetation Values		
	Carnaby's Black-Cockatoo	**Baudin's Black-Cockatoo**	**Forest Red-tailed Black-Cockatoo**
0	No foraging value. No Proteaceae, eucalypts or other potential sources of food. Examples: • Water bodies (e.g. salt lakes, dams, rivers); • Bare ground; • Developed sites devoid of vegetation (e.g. infrastructure, roads, gravel pits) or with vegetation of no food value, such as some suburban landscapes. • Mown grass	No foraging value. No eucalypts or other potential sources of food. Examples: • Water bodies (e.g. dams, rivers); • Bare ground; • Developed sites devoid of vegetation (e.g. infrastructure, roads, gravel pits).	No foraging value. No eucalypts or other potential sources of food. Examples: • Water bodies (e.g. dams, rivers); • Bare ground; • Developed sites devoid of vegetation (e.g. infrastructure, roads, gravel pits).
1	Negligible to low foraging value. Examples: • Scattered specimens of known food plants but projected foliage cover of these is < 2%. This could include urban areas with scattered foraging trees; • Paddocks that are lightly vegetated with melons or other known food-source weeds (e.g. *Erodium* spp.) that represent a short-term and/or seasonal food source; • Blue Gum plantations (foraging by Carnaby's Black-Cockatoos has been reported but appears to be unusual).	Negligible to low foraging value. Scattered specimens of known food plants but projected foliage cover of these < 1%. This could include urban areas with scattered foraging trees.	Negligible to low foraging value. Scattered specimens of known food plants but projected foliage cover of these < 1%. Could include urban areas with scattered foraging trees.

Site Score	Description of Vegetation Values		
	Carnaby's Black-Cockatoo	**Baudin's Black-Cockatoo**	**Forest Red-tailed Black-Cockatoo**
2	Low foraging value. Examples: • Shrubland in which species of foraging value, such as shrubby banksias, have < 10% projected foliage cover; • Woodland with tree banksias 2-5% projected foliage cover; • Woodland with tree banksias (of key species *B. attenuata* and *B. menziesii*) with <10% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths; • Open eucalypt woodland/mallee of small-fruited species; • Paddocks that are densely vegetated with melons or other known food-source weeds (e.g. *Erodium* spp.) that represent a short-term and/or seasonal food source.	Low foraging value. Examples: • Woodland with scattered specimens of known food plants (e.g. Marri and Jarrah) 1-5% projected foliage cover; • Marri-Jarrah Woodland with <10% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths; • Parkland-cleared Eucalypt Woodland/Forest with known food plants <10% projected foliage cover (poor long-term viability without management); • Younger areas of (managed) revegetation with known food plants <10% projected foliage cover (establishing food sources with good long-term viability); • Urban areas with scattered foraging trees.	Low foraging value. Examples: • Woodland with scattered specimens of known food plants (e.g. Marri, Jarrah) 1-5% projected foliage cover; • Marri-Jarrah Woodland with <10% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths; • Sheoak Woodland with <10% projected foliage cover; • Parkland-cleared Eucalypt Woodland/Forest with known food plants <10% projected foliage cover (poor long-term viability without management); • Younger areas of (managed) revegetation with known food plants <10% projected foliage cover (establishing food sources with good long-term viability); • Urban areas with scattered food plants such as Cape Lilac, *Eucalyptus caesia* and *E. erythrocorys*.

Site Score	Description of Vegetation Values		
	Carnaby's Black-Cockatoo	**Baudin's Black-Cockatoo**	**Forest Red-tailed Black-Cockatoo**
3	Low to Moderate foraging value. Examples: • Shrubland in which species of foraging value, such as shrubby banksias, have 10-20% projected foliage cover; • Woodland with tree banksias 5-20% projected foliage cover; • Woodland with tree banksias (of key species *B. attenuata* and *B. menziesii*) with 10-40% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths; • Eucalypt Woodland/Mallee of small-fruited species; • Eucalypt Woodland with Marri < 10% projected foliage cover.	Low to Moderate foraging value. Examples: • Eucalypt Woodland with known food plants (especially Marri) 5-20% projected foliage cover; • Marri-Jarrah Woodland with 10-40% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths; • Parkland-cleared Eucalypt Woodland/Forest with known food plants 10-40% projected foliage cover (poor long-term viability without management); • Younger areas of (managed) revegetation with known food plants 10-40% projected foliage cover (establishing food sources with good long-term viability).	Low to Moderate foraging value. Examples: • Eucalypt Woodland with known food plants (especially Marri and Jarrah) 5-20% projected foliage cover; • Marri-Jarrah Woodland with 10-40% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths; • Sheoak Forest with 10-40% projected foliage cover; • Parkland-cleared Eucalypt Woodland/Forest with known food plants 10-40% projected foliage cover (poor long-term viability without management); • Younger areas of (managed) revegetation with known food plants 10-40% projected foliage cover (establishing food sources with good long-term viability).

Site Score	Description of Vegetation Values		
	Carnaby's Black-Cockatoo	**Baudin's Black-Cockatoo**	**Forest Red-tailed Black-Cockatoo**
4	Moderate foraging value. Examples: • Woodland/low forest with tree banksias (of key species *B. attenuata* and *B. menziesii*) 20-40% projected foliage cover; • Woodland/low forest with tree banksias (of key species *B. attenuata* and *B. menziesii*) with 40-60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths; • Kwongan/ Shrubland in which species of foraging value, such as shrubby banksias, have 20-40% projected foliage cover; • Eucalypt Woodland/Forest with Marri 20-40% projected foliage cover.	Moderate foraging value. Examples: • Marri-Jarrah Woodland/Forest with 20-40% projected foliage cover; • Marri-Jarrah Forest with 40-60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths; • Parkland-cleared Eucalypt Woodland/Forest with known food plants 40-60% projected foliage cover (poor long-term viability without management); • Younger areas of (managed) revegetation with known food plants 40-60% projected foliage cover (establishing food sources with good long-term viability); • Orchards with highly desirable food sources (e.g. apples, pears, some stone fruits).	Moderate foraging value. Examples: • Marri-Jarrah Woodland/Forest with 20-40% projected foliage cover; • Marri-Jarrah Forest with 40-60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths; • Sheoak Forest with 40-60% projected foliage cover; • Parkland-cleared Eucalypt Woodland/Forest with known food plants 40-60% projected foliage cover (poor long-term viability without management); • Younger areas of (managed) revegetation with known food plants 40-60% projected foliage cover (establishing food sources with good long-term viability).

Site Score	Description of Vegetation Values		
	Carnaby's Black-Cockatoo	**Baudin's Black-Cockatoo**	**Forest Red-tailed Black-Cockatoo**
5	Moderate to High foraging value. Examples: • Banksia Low Forest (of key species *B. attenuata* and *B. menziesii*) with 40-60% projected foliage cover; • Banksia Low Forest (of key species *B. attenuata* and *B. menziesii*) with > 60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths; • Kwongan/ Shrubland in which species of foraging value, such as shrubby banksias, have 40-60% projected foliage cover; • Marri-Jarrah Forest with 40-60% projected foliage cover and vegetation condition good with low weed invasion and/or low tree deaths (indicating it is robust and unlikely to decline in the medium term). • Pine plantations with trees more than 10 years old (but see pine note below in moderation section).	Moderate to High foraging value. Examples: • Marri-Jarrah Forest with 40-60% projected foliage cover; • Marri-Jarrah Forest with > 60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths; • Parkland-cleared Eucalypt Woodland/Forest with known food plants >60% projected foliage cover (poor long-term viability without management); • Younger areas of (managed) revegetation with known food plants >60% projected foliage cover (establishing food sources with good long-term viability).	Moderate to High foraging value. Examples: • Marri-Jarrah Forest with 40-60% projected foliage cover; • Marri-Jarrah Forest with > 60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths; • Sheoak Forest with > 60% projected foliage cover; • Parkland-cleared Eucalypt Woodland/Forest with known food plants >60% projected foliage cover (poor long-term viability without management); • Younger areas of (managed) revegetation with known food plants >60% projected foliage cover (establishing food sources with good long-term viability).

Site Score	Description of Vegetation Values		
	Carnaby's Black-Cockatoo	**Baudin's Black-Cockatoo**	**Forest Red-tailed Black-Cockatoo**
6	High foraging value. Example: • Banksia Low Forest (of key species *B. attenuata* and *B. menziesii*) with > 60% projected foliage cover and vegetation condition good with low weed invasion and/or low tree deaths (indicating it is robust and unlikely to decline in the medium term). • Kwongan/ Shrubland in which species of foraging value, such as shrubby banksias, have >60% projected foliage cover; • Marri-Jarrah Forest with > 60% projected foliage cover and vegetation condition good with low weed invasion and/or low tree deaths (indicating it is robust and unlikely to decline in the medium term).	High foraging value. Example: • Marri-Jarrah Forest with > 60% projected foliage cover and vegetation condition good with low weed invasion and/or low tree deaths (indicating it is robust and unlikely to decline in the medium term).	High foraging value. Example: • Marri-Jarrah Forest with > 60% projected foliage cover and vegetation condition good with low weed invasion and/or low tree deaths (indicating it is robust and unlikely to decline in the medium term).

Vegetation structural class terminology follows Keighery (1994).

B. Site context.

Site Context is a function of site size, availability of nearby habitat and the availability of nearby breeding areas. Site context includes consideration of connectivity, although Black-Cockatoos are very mobile and will fly across paddocks to access foraging sites. Based on BCE observations, Black-Cockatoos are unlikely to regularly go over open ground for a distance of more than a few kilometres and prefer to follow tree-lines.

The maximum score for site context is 3, and because it is effectively a function of presence/absence of nearby breeding and the distribution of foraging habitat across the landscape, the following table, developed by Bamford Consulting in conjunction with the Department of the Environment and Energy (DEE), provides a *guide* to the assignation of site context scores. Note that 'local area' is defined as within a 15 km radius of the centre point of the study site. This is greater than the maximum distance of 12km known to be flown by Carnaby's Black-Cockatoo when feeding chicks in the nest.

Site Context Score	Percentage of the existing native vegetation within the 'local' area that the study site represents.	
	'Local' breeding known/likely	'Local' breeding unlikely
3	> 5%	> 10%
2	1 - 5%	5 - 10%
1	0.1 - 1%	1 - 5%
0	< 0.1%	< 1%

The table above provides weighting for where nearby breeding is known (or suspected) and for the proportion of foraging habitat within 15 km represented by the site being assessed. Some adjustments may be needed based on the judgement of the assessor and in relation to the likely function of the site. For example, a small area of foraging habitat (e.g. 0.5% of such habitat within 15 km) could be upgraded to a context of 2 if it formed part of a critical movement corridor. In contrast, the same sized area of habitat, of the same local proportion, could be downgraded if it were so isolated that birds could never access it.

C. Species density (stocking rate).

Species stocking rate is described as "the usage and/or density of a species at a particular site" in the offsets guide. The description also implies that a site supports a discrete population, which is unlikely in the case of very mobile black-cockatoos. Assignation of the species density score (0 or 1) is based upon the black-cockatoo species being either abundant or not abundant. A score of 1 is used where the species is seen or reported regularly and/or there is abundant foraging evidence. Regularly is when the species is seen at intervals of every few days or weeks for at least several months of the year. A score of 0 is used when the species is recorded or reported very infrequently and there is little or no foraging evidence. Where information on actual presence of birds is lacking, a species density score can be assigned by interpreting the landscape and the site context. For example, a site with a moderate condition score that is part of a network of such habitat where a black-cockatoo species is

known would get a species density score of 1 even without clear presence data, while a species density score of 0 can be assigned to a site where the level of usage can confidently be predicted to be low.

D. Moderation of scores for the calculation of a value out of 10.

The calculation out of 10 requires the vegetation characteristics (out of 6) to be combined with the scores given for context and species density. It is considered that the context and density scores are not independent of vegetation characteristics; otherwise habitat of absolutely no value for black-cockatoo foraging (such as concrete or a wetland) could get a foraging score out of 10 as high as 4 if it occurred in an area where the species breed (context score of 3) and are abundant (species density score of 1). Similarly, vegetation of negligible or low characteristics which could not support black-cockatoos could be assigned a score as high as 6 out of 10. In that case, the score of 6 would be more a reflection of nearby vegetation of high characteristics than of the foraging value of the negligible to low scoring vegetation. The Black-Cockatoos would only be present because of vegetation of high characteristics, so applying the context and species density scores to vegetation of low characteristics would not give a true reflection of their foraging value.

For this reason, the context and species density scores need to be moderated for the vegetation characteristic score to prevent vegetation of little or no foraging value receiving an excessive score out of 10. A simple approach is to assign a context and species density score of zero to sites with a Condition score of low (2), negligible (1) or none (0), on the basis that birds will not use such areas unless they are adjacent to at least low-moderate quality foraging habitat ($\geq$3). The approach to calculating a score out of 10 can be summarised as follows:

Vegetation composition, condition and structure score	Context score	Species density score
3-6 (low/moderate to high value)	Assessed as per B above	Assessed as per C above
0-2 (no to low value)	0	0

Note that this moderation approach may require interpretation depending on the context. For example, vegetation with a condition score of 2 could be given a context score of 1 under special circumstances. Such as when very close to a major breeding area or if strategically located along a movement corridor.

Pine plantations

Pine plantations are an important foraging resource for Carnaby's Black-Cockatoo (only) but are not directly comparable with native vegetation. In comparing native vegetation with pine plantations for the purpose of calculating offsets, the following should be noted:

- Pine plantations are a commercial crop established with the intention of being harvested and thus have short-term availability (30-50 years), whereas native vegetation is available indefinitely if protected. Due to the temporary nature of pines as a food source, site condition and context differs between pines and native vegetation.
- Although pines provide a high abundance of food in the form of seeds, they are a limited food resource compared with native vegetation which provides seeds, insect larvae, flowers and nectar. The value of insect larvae in the diet of Carnaby's Black-Cockatoo has not been quantified, but in the vicinity of Perth, the birds forage very heavily on insect larvae in young cones of *Banksia attenuata* in winter, ignoring the seeds in these cones and seeds in older cones on the same trees (Scott and Black 1981; M. Bamford pers. obs.). This suggests that insect larvae are of high nutritional importance immediately prior to the breeding season.
- Pine plantations have very little biodiversity value other than their importance as a food source for Carnaby's Black-Cockatoos. They inhibit growth of other flora. While this is not a factor for direct consideration with respect to Carnaby's Black-Cockatoo, it is a factor in regional conservation planning of which offsets for the cockatoos are a part.

Taking the above points into consideration, it is possible to assign pine plantations a foraging value as follows:

- Site condition. The actual foraging value of pines is high. Stock *et al.* (2013) report that it takes nearly twice as many seeds of *Pinus pinaster* to meet the daily energy requirements for Carnaby's Black-Cockatoo compared with Marri, and three times as many *P. pinaster* seeds compared with Slender Banksia. However, pines are planted at a high density so the food supply per hectare can be high. Taking account of the lack of variety of food from pines, this suggests a site condition score of 4 or 5 out of 6 (5 is used in Section A above). As a source of food, pines are thus comparable to the best banksia woodland. This site condition score then needs to be adjusted to take account of the short-term nature of the food supply (for pine plantations to be harvested. Where pines are 'ornamental, such as in some urban contexts, they can be treated as with other trees in urban landscapes). The foraging value of a site after pines are harvested will effectively be 0, or possibly 1 if there is some retention. It is proposed that this should approximately halve the site condition score; young pine plantations could be redacted slightly less than old plantations on the basis that a young plantation provides a slightly longer term food supply. If a maximum site condition score of 5 is given, then a young plantation (>10 but <30 years old) could be assigned a score of 3, and an old plantation (>30 years old) could be assigned a score of 2. Plantations <10 years old and thus not producing large quantities of cones could also get a score of 2, but recognising they may increase in value.
- Site context. Although a temporary food source, pines can be very important for Carnaby's Black-Cockatoo in some contexts; they could be said to carry populations in areas where there is little native vegetation. The system for assigning a context score as outlined above (Section B) also applies to pines. Thus, a context score of 3 can be given where pines are a significant

proportion of foraging habitat (>5% if breeding occurs; >10% if no breeding), but where pines are a small part of the foraging landscape they will receive a context score of less than this.

- Species density. As outlined above (Section C), pines will receive a species density score of 1 where Carnaby's Black-Cockatoo are regular visitors. This is irrespective of an old plantation having a moderated condition score of 2.

Based on the above, pine plantations that represent a substantial part of the foraging landscape, such as in the region immediately north of Perth, would receive a total score (out of 10) of 6; young plantations in this area would receive a score of 7. In contrast, isolated and small plantations in rural landscapes could receive a score of just 2 if they are only a small proportion of foraging habitat and Carnaby's Black-Cockatoos are not regularly present.

Appendix 5. The foraging quality scoring tool template from DAWE (2022b).

Table A1 Foraging quality scoring tool template

Starting score		Baudin's Cockatoo	Carnaby's Cockatoo	Forest Red-tailed Black-Cockatoo
10		**Start at a score of 10** if your site is native eucalypt woodlands and forest, and proteaceous woodland and heath, particularly Marri, within the range of the species, including along roadsides and parkland cleared areas. Can include planted vegetation. **This tool only applies to sites equal to or larger than 1 hectare in size.**	**Start at a score of 10** if your site is native shrubland, kwongan heathland or woodland, dominated by proteaceous plant species such as *Banksia* spp. (including *Dryandra* spp.), *Hakea* spp. and *Grevillea* spp., as well as native eucalypt woodland and forest that contains foraging species, within the range of the species, including along roadsides and parkland cleared areas. Also includes planted native vegetation. **This tool only applies to sites equal to or larger than 1 hectare in size.**	**Start at a score of 10** if your site is Jarrah or Marri woodland and/or forest, or if it is on the edge of Karri forest, or if Wandoo and Blackbutt occur on the site, within the range of the subspecies, including along roadsides and parkland cleared areas. **This tool only applies to sites equal to or larger than 1 hectare in size.**
Attribute	Sub-tractions	Context adjustor (attributes reducing functionality of foraging habitat)		
Foraging potential	-2	**Subtract 2** from your score if there is no evidence of feeding debris on your site.	**Subtract 2** from your score if there is no evidence of feeding debris on your site.	**Subtract 2** from your score if there is no evidence of feeding debris on your site.
Connectivity	-2	**Subtract 2** from your score if you have evidence to conclude that there is no other foraging habitat within 12 km of your site.	**Subtract 2** from your score if you have evidence to conclude that there is no other foraging habitat within 12 km of your site.	**Subtract 2** from your score if you have evidence to conclude that there is no other foraging habitat within 12 km of your site.
Proximity to breeding	-2	**Subtract 2** if you have evidence to conclude that your site is more than 12 km from breeding habitat	**Subtract 2** if you have evidence to conclude that your site is more than 12 km from breeding habitat.	**Subtract 2** if you have evidence to conclude that your site is more than 12 km from breeding habitat.
Proximity to roosting	-1	**Subtract 1** if you have evidence to conclude that your site is more than 20 km from a known night roosting habitat.	**Subtract 1** if you have evidence to conclude that your site is more than 20 km from a known night roosting habitat.	**Subtract 1** if you have evidence to conclude that your site is more than 20 km from a known night roosting habitat.
Impact from significant plant disease	-1	**Subtract 1** if your site has disease present (e.g. *Phytophthora* spp. or Marri canker) and the disease is affecting more than 50% of the preferred food plants present.	**Subtract 1** if your site has disease present (e.g. *Phytophthora* spp. or Marri canker) and the disease is affecting more than 50% of the preferred food plants present.	**Subtract 1** if your site has disease present (e.g. *Phytophthora* spp. or Marri canker) and the disease is affecting more than 50% of the preferred food plants present.
Total score		*Enter score*	*Enter score*	*Enter score*
Appraisal		To support your habitat score, you should provide an overall appraisal of the habitat on the impact site and within 20km of the impact area to clearly explain and justify the score. It should include discussion on the foraging habitat's proximity to other resources (e.g. exact distance to proximate resources), frequency of use of proximate sites, the degree of evidence and description of vegetation type and condition.		

Appendix 6. Examples of Forest Red-tailed Black-Cockatoo foraging signs across the range of age categories used in this study.

Active/Recent ↔ Intermediate ↔ Old

Jarrah nuts

Jarrah leaves

Marri nuts

Appendix 7. Species recorded in the field investigations.

Species	Notes
Myobatrachidae (Ground frogs)	
Crinia pseudinsignifera	Bleating Froglet
Columbidae (Pigeons and Doves)	
Phaps chalcoptera	Common Bronzewing
Cuculidae (Cuckoos)	
Chalcites lucidus	Shining Bronze-Cuckoo
Cacomantis flabelliformis	Fan-tailed Cuckoo
Turnicidae (Button-quail)	
Turnix varius	Painted Button-quail
Accipitridae (Eagles, Kites, Goshawks)	
Lophoictinia isura	Square-tailed Kite
Aquila audax	Wedge-tailed Eagle
Accipiter fasciatus	Brown Goshawk
Alcedinidae (Kingfishers)	
Dacelo novaeguineae	Laughing Kookaburra
Cacatuidae (Cockatoos and Corellas)	
Calyptorhynchus banksii naso	Forest Red-tailed Black-Cockatoo
Calyptorhynchus latirostris	Carnaby's Black-Cockatoo
Eolophus roseicapilla	Galah
Psittaculidae (Parrots, Lorikeets and Rosellas)	
Purpureicephalus spurius	Red-capped Parrot
Barnardius zonarius	Australian Ringneck
Neophema elegans	Elegant Parrot
Glossopsitta porphyrocephala	Purple-crowned Lorikeet
Climacteridae (Treecreepers)	
Climacteris rufus	Rufous Treecreeper
Maluridae (Fairy-wrens, Emu-wrens and Grasswrens)	
Malurus splendens	Splendid Fairy-wren
Meliphagidae (Honeyeaters and Chats)	

Species		Notes
Lichmera indistincta	Brown Honeyeater	
Melithreptus chloropsis	Gilbert's Honeyeater	
Acanthorhynchus superciliosus	Western Spinebill	
Anthochaera carunculata	Red Wattlebird	
Pardalotidae (Pardalotes)		
Pardalotus punctatus	Spotted Pardalote	
Pardalotus striatus	Striated Pardalote	
Acanthizidae (Thornbills and Gerygones)		
Gerygone fusca	Western Gerygone	
Smicrornis brevirostris	Weebill	
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	
Campephagidae (Cuckoo-shrikes and Trillers)		
Coracina novaehollandiae	Black-faced Cuckoo-shrike	
Pachycephalidae (Whistlers, Shrike-thrushes and allies)		
Pachycephala rufiventris	Rufous Whistler	
Colluricincla harmonica	Grey Shrike-thrush	
Artamidae (Woodswallows, Currawongs, Butcherbirds and Magpie)		
Gymnorhina tibicen	Australian Magpie	
Rhipiduridae (Fantails)		
Rhipidura leucophrys	Willie Wagtail	
Rhipidura albiscapa	Grey Fantail	
Corvidae (Crows and Ravens)		
Corvus coronoides	Australian Raven	
Monarchidae (Monarch and Flycatchers)		
Grallina cyanoleuca	Magpie-lark	
Petroicidae (Australian Robins)		
Petroica boodang	Scarlet Robin	
Eopsaltria griseogularis	Western Yellow Robin	
Dicaeidae (Flowerpeckers)		
Dicaeum hirundinaceum	Mistletoebird	
Hirundinidae (Swallows and Martins)		

Species		Notes
Petrochelidon nigricans	Tree Martin	
Zosteropidae (White-eyes)		
Zosterops lateralis	Silvereye	
Tachyglossidae (Echidnas)		
Tachyglossus aculeatus acanthion	Short-beaked Echidna	Diggings
Peramelidae (Bandicoots)		
Isoodon fusciventer	Quenda	(Possible diggings)
Phalangeridae (Brushtail possums)		
Trichosurus vulpecula hypoleucus	Brushtail Possum	Tree scratches
Macropodidae (Kangaroos)		
Macropus fuliginosus melanops	Western Grey Kangaroo	
Leporidae (Rabbits and hares)		
Oryctolagus cuniculus	Rabbit	Diggings, scats
Canidae (Dogs)		
Vulpes vulpes	Red Fox	
Suidae (Pigs)		
Sus scrofa	Pig	Diggings

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Appendix B 2/02/2024 Habitat Scoring System for Chuditch

16/02/2024 Habitat Scoring System for Chuditch

This habitat scoring system describes elements indicative of suitable habitat for Chuditch (Western Quoll (*Dasyurus geoffroii*)) in Western Australia. It must be supported by survey information (i.e. den surveys, species presence, vegetation condition), undertaken by suitably experienced experts, in accordance with the Department's *Survey Guidelines for Australia's Threatened Mammals*.

Appropriate scores will best fit a description. Not all components of the 'detail' column must be met, but a majority should be.

Site condition is given the largest weighting, 40%. Site condition is considered the prime indicator for Chuditch presence. Species stocking rate can vary considerably in various seasons; it is not as accurate or precise as an indicator of habitat quality. Both site context and species stocking rate are given a weighting of 30%.

Species surveys for the life of offset management should be commensurate with the species stocking rate to be maintained or attained. For example, proposing to maintain species stocking rate at a score of 3 (as detailed in the table below) means surveys must be undertaken at least once every two years.

For an offset site to be considered, it must have a start score of at least 1 for each indicator (e.g: there must be a species stocking rate score of at least 1).

Indicator	Score	Detail	Impact site quality	Offset start quality	Quality without offset	Quality with offset	Justification
Site Condition							
Vegetation condition and structure. Diversity of habitat species present. Habitat features	4	**Habitat quality**: High – Moist, dense vegetation in steep-sloping forest or sparser vegetation with many areas of pronounced topography (e.g., hills, rocky outcrops) and/or riparian vegetation. High den[1] density (50-100 per 400ha). Large variety of prey[2] species available. Very limited to no habitat damage by herbivores or previous land management activities. Low density of introduced predator species[3] present. Little fire within site in the last 15-20 years.				4	QUALITY WITH OFFSET - Vegetation quality is good, extensive denning opportunities with permanent water available through on-site soak. Baiting for predators will provide high quality habitat
	3	**Habitat quality**: Medium – Moist, dense vegetation in steep-sloping forest or sparser vegetation with	3				IMPACT SITE QUALITY - Impact site has "habitat suitable for this species" (Bamford, 2022) with one animal detected during survey. The site also has areas of sparse understorey reducing value for

[1] dens: actively used hollow logs, earth burrows, rocky crevices, or hollows in termitaria (cemented termite mounds) used by chuditch

[2] prey: beetles and other large invertebrates, small-medium mammals, birds and reptiles (some additional species, including medium-large mammals, may be consumed as carrion)

[3] introduced predator species: foxes and cats. Density is % of observations and/or secondary evidence (e.g. scats) per survey.

		some areas of pronounced topography (e.g., hills and rocky outcrops), and/or riparian vegetation. Moderate density of denning opportunities[4]. Variety of prey species available. Limited habitat damage by herbivores. Low density of introduced predator species. Little fire within site in the last 10-15 years.					chuditch refuge. 1 fox and 1 cat were also detected during the Bamford (2022) survey showing predators are present.
	2	**Habitat quality**: Low. Sparse vegetation in mostly flat areas in poor condition. Limited denning opportunities. Some prey species available. Habitat damage by herbivores evident. Moderate density of introduced predator species. Noticeable impacts from fire within site in the last 5-10 years.					
	1	**Habitat quality**: Marginal. Sparse vegetation in flat areas in degraded condition. Almost no denning opportunities. Limited prey species available. Extensive habitat damage by herbivores or previous land management activities. High density of introduced predator species.		1	1		OFFSET START QUALITY - Vegetation condition in good condition, many denning opportunities however high predator load significantly reduces site suitability to support resident population. QUALITY WITHOUT OFFSET - Without offset, no change.
	0	**Habitat**: Absent – Little to no vegetation, no denning opportunities and/or suitable prey on site.					
Site Context							
Movement patterns of the species.	3	Site is connected to more than one patch of contiguous native vegetation[5]. Site is within 'known'	3				IMPACT SITE QUALITY – The impact site is currently surrounded on 3 sides by good quality vegetation and within the known

[4] denning opportunities: hollow logs, rock crevices and suitable burrows, including in termitaria

[5] contiguous native vegetation of suitable habitat: multiple patches of native vegetation sharing borders, next together in sequence, comprising a larger, continuous area

Proximity of the site in relation to others of suitable habitat. Overall population or extent of species.		distribution of species[6], or within 'likely' distribution and 2km of 'known' distribution of species.					distribution of chuditch and was recorded during the Bamford (2022) survey.
	2	Site is within 'known' or 'likely' distribution of the species, or within 4km of 'known' distribution of species and connected to at least one patch of contiguous native vegetation.		2	2	2	OFFSET START QUALITY – Offset site is within the historical distribution of chuditch and within the current likely distribution (DEC, 2012). The offset site is connected along southern boundary with a DBCA reserve. QUALITY WITHOUT OFFSET – Offset site is within the historical distribution of chuditch and within the current likely distribution (DEC, 2012). The offset site is connected along southern boundary with a DBCA reserve. QUALITY WITH OFFSET - Offset site is within the historical distribution of chuditch and within the current likely distribution (DEC, 2012). The offset site is connected along southern boundary with a DBCA reserve.
	1	Site is within the 'likely' distribution of the species and separated from suitable habitat by cleared areas of up to 1 km. There is evidence[7] chuditch are capable of migrating across these cleared areas.					
	0	Site is located within the 'likely' distribution of the species but separated from suitable habitat by cleared areas more than 1 km, or site is not located within the known or likely distribution of the species.					
Species Stocking Rate							
Usage and/or	3	Verified record(s) [8] of species presence averaged[9] across site in					

[6] distribution of species as documented in Wylie, or another evidenced source

[7] evidence may include: peer reviewed research or the opinion of a suitably qualified species expert

[8] verified records: primary (e.g. camera detections or trap records) or secondary (e.g. scats, tracks, hairs) evidence.

[9] averaged: distributed evenly, evened out

density of a species. Role of the site population in regard to overall species population viability.		last 12 months (chuditch observed onsite in last 12 months and/or evidence of breeding population[10]). Site is adjacent to verified / published records in last 12 months. High density/abundance of Chuditch[11].					
	2	Verified record(s) of species presence onsite in last 3 years (chuditch observed onsite in last 3 years and / or evidence of breeding population in last 4 years). Site is within 2 km of verified/published records within last 3 years. Medium density/abundance of chuditch.				2	QUALITY WITH OFFSET – The Bamford (2022) report describes the vegetation condition as very good and extensive denning opportunities for Chuditch. With the removal of the predator threat, the area is expected to become good quality Chuditch habitat.
	1	Record(s) of species presence onsite in last 5 years (chuditch observed onsite in last 5 years). Site is within 4 km of verified/published records within last 5 years, connected by contiguous habitat. Low density/abundance of chuditch.	1	1	1		IMPACT SITE QUALITY – The Bamford (2022) survey recorded one chuditch at the impact site confirming that chuditch occur in the area but suggesting at low density. OFFSET START QUALITY - No evidence of individuals were recorded on-site during the survey (no camera trapping was undertaken). Vertebrate surveys in the jarrah forest approximately 5km to the west of the site captured a "large number of Chuditch" (Newmont Boddington Gold Pty Ltd, 2014) suggesting a large seeding population with removal of predators. QUALITY WITHOUT OFFSET – No change.
	0	No record of species presence onsite, or within 4km within last 5 years. [**Note:** if surveys at impact site are not undertaken in accordance with the survey guidelines and do not detect chuditch presence, species					

[10] evidence of breeding population may include: male chuditch appear in irregular locations during breeding period (~April-July) and/or juvenile chuditch observed outside of dens as they start weaning (~September-November). Must be supported by robust survey evidence over sufficient time to confirm likely breeding, e.g., available data sets for location.

[11] Density/abundance based on % of total camera detections and/or trap success for total nights surveyed, and/or % total secondary evidence across all surveys within relevant period.

		stocking rate score is assumed as 0.]					
Totals			7	4	4	8	

Legend	
	Unlikely to be considered a suitable habitat/offset site.

References

Bamford Consulting Ecologists (2022) *WA Limestone Byford Quarry Expansion Supporting Information for Matters of National Environmental Significance (Fauna),* for WA Limestone, Bibra Lake, WA.

Department of Environmental and Conservation (2012) *Fauna Profiles – Chuditch* Dasyurus geoffroii *(Gould, 1841),* Government of Western Australia, Perth.

Newmont Boddington Gold (2014) *Terrestrial Fauna Management Plan*, for Newmont Asia Pacific, Boddington, WA.

Appendix C Dieback Management Plan – Bannister Offset Site

Dieback Management Plan – Bannister Offset Site

WA Limestone

Report

JBS&G 62543 | 157,331

22 March 2024

We acknowledge the Traditional Custodians of Country throughout Australia and their connections to land, sea and community.

We pay respect to Elders past and present and in the spirit of reconciliation, we commit to working together for our shared future.

Caring for Country The Journey of JBS&G
Artist: Patrick Caruso, Eastern Arrernte

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Executive Summary

This Dieback Management Plan has been prepared to provide management recommendations to minimise the risk of introduction and spread of *Phytophthora cinnamomi (*dieback) at Lot P011005 6, 8772 Albany Highway, Bannister. This site has been identified as a potential offset site (and advanced offset) for proposed clearing at WA Limestone's quarrying operation at WA Mining Lease 70/1240 in Whitby in Western Australia.

No dieback has been identified on site however the vegetation type is considered highly susceptible to impact should the pathogen be introduced. Dieback has been identified in State Forest approximately 7km to the west of this site. The key management actions relate to:

1. Signs.
2. Inductions and procedures.
3. Access and vehicular/ machinerymovement.
4. Bulk earth workswithin conservation area.
5. Drainage.
6. Basic raw material/borrow pits (source of fill, etc) and construction materials.
7. Mulching.
8. Clean down points and procedures.
9. Dust management.

The Western Australian Department of Biodiversity, Conservation and Attractions (DBCA) is proposed to take management responsibility for the offset site and will be responsible for ensuring the implementation of the management recommendations. WA Limestone, as the entity responsible for undertaking the action in relation to EPBC 2021/9045, will retain legal responsibility for ensuring any EPBC conditions are satisfied.

1. Introduction

Ransberg Pty Ltd (WA Bluemetal) are proposing to undertake clearing associated with the Byford (Whitby) Quarry operations. The proposed works will necessitate the clearing of 13.2 ha of vegetation within a boundary of the same size. The clearing will take place within Mining Tenement M70/1240 Karrakup (the Project) for storage purposes (Figure 1-1). The Project is located within the Serpentine - Jarrahdale approximately 40 km southeast of Perth.

As part of the approvals for the project an environmental offset site has been identified at 8772 Albany Highway, Bannister that will offset the potential environmental impacts to the Matters of National Environmental Significance (MNES) from the project. To ensure the protection of the environmental values of the site, this Dieback Management Plan (DMP) has been prepared to minimise the risk of introduction and spread of *Phytophthora cinnamomi* across the highly susceptible vegetation on-site (South Coast Natural Resource Management, 2024).

1.1 Project description

The proposed clearing will facilitate construction of the following elements:

- Storage and laydown areas;
- Access tracks/roads; and
- Associated quarry infrastructure.

The proposed action was referred to the Department of Climate Change, Energy, the Environment and Water (DCCEEW) on 5 October 2021 and it was determined that the proposed action is a controlled action and will be assessed by preliminary documentation on the basis of the potential impacts to Matters of National Environmental Significance described in Table 1-1.

Table 1.1. List of MNES with the potential to be impacted by the proposed action.

MNES	Impact
Carnaby's Black Cockatoo (*Zanda latirostris* formerly *Calyptorhynchus latirostris*) – Endangered	Clearing of 13.2 ha of high-quality foraging habitat which may support potential roosting and breeding habitat for Carnaby's Black Cockatoo, Baudin's Black Cockatoo and the Forest Red-tailed Black Cockatoo.
Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) – Vulnerable	
Baudin's Black Cockatoo (*Calyptorhynchus baudinii*) – Endangered	
Chuditch, Western Quoll (*Dasyurus geoffroii*) – Vulnerable	Clearing of 13.2 ha of potential Chuditch habitat.

Figure 1.1: Development site boundary and regional location.

Due to the residual environmental impacts after avoidance, minimisation and rehabilitation had been implemented, an environmental offset site was required. The property at 8772 Albany Highway, Bannister Figure 1.2 was identified as suitable for offsetting this project and the remainder of the site used as an advanced environmental offset. To protect the environmental values of the site from potential dieback infestation into the future, this DMP has been prepared.

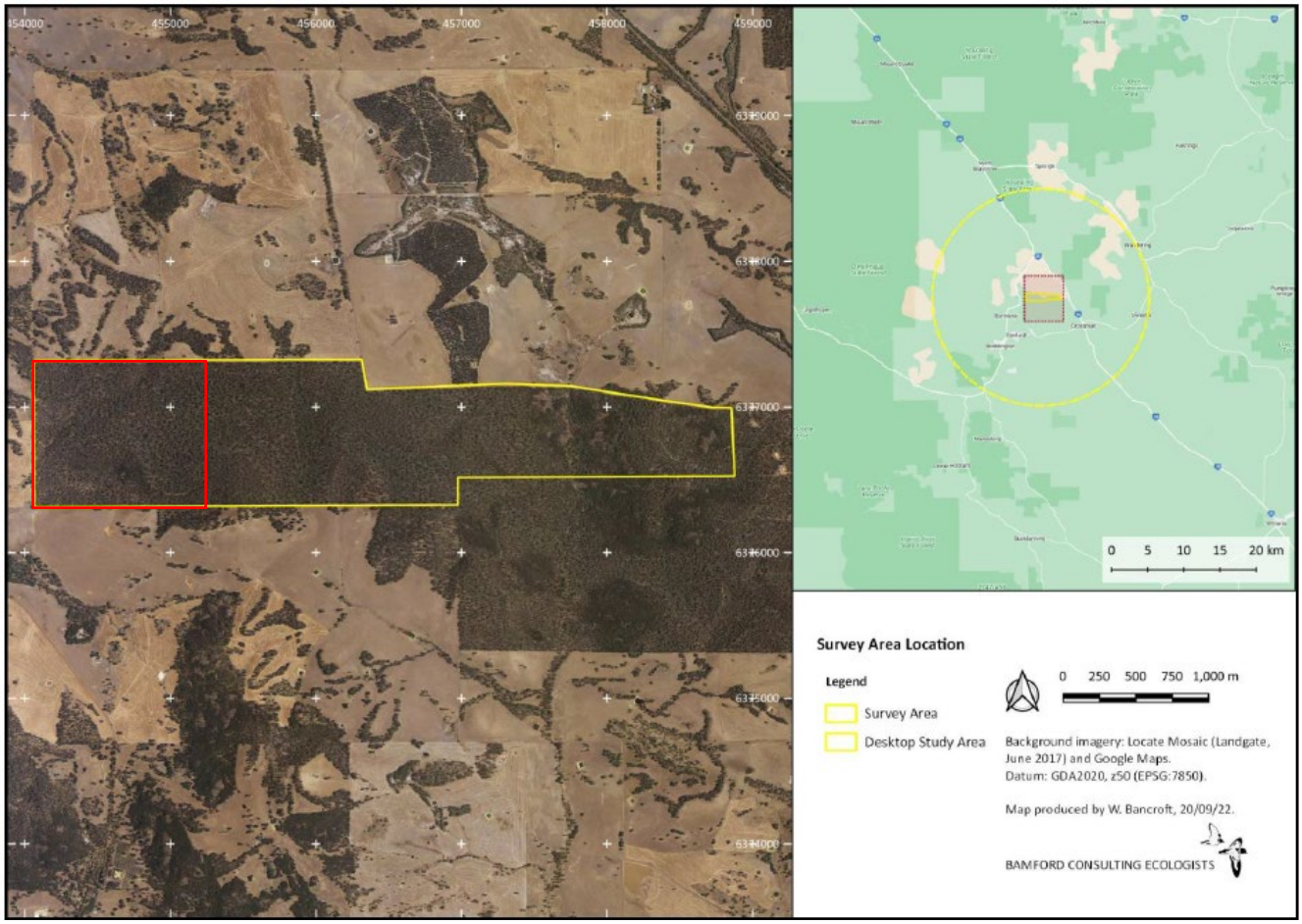

Figure 1.2: Offset site property including advanced offset.

1.2 Dieback in the Offset Area

Dieback is a term referring to the plant disease (and the effect) caused by a microscopic 'water mould' (Oomycete) of the genus Phytophthora, which survives on the root and stem tissue of living plants. It is spread through the movement of contaminated vegetation or soil on vehicles, equipment and footwear. It can also be spread through the movement of soil by water erosion or via soil root zones in vegetated areas. Dieback destroys the structure and diversity of vegetation communities, ultimately affecting native fauna through reduction in food and habitat. Residual dieback in soil can also kill non-native landscaping and agricultural species if they are planted in infested soil.

No dieback has been identified on site however the vegetation type is considered highly susceptible to impact should the pathogen be introduced. Dieback has been identified in State Forest approximately 7km to the west of the offset site.

1.3 Purpose of this report

The purpose of the DMP is to assist WA Limestone (and potentially the Department of Biodiversity Conservation and Attractions (DBCA)) to implement dieback protection measures to minimise the risk of introduction or spread of dieback (if exclusion measures fail) within the offset area. This includes on-going monitoring and vigilance within this site and the adjacent property to the south.

2. Environmental objectives, targets and performance indicators

2.1 Aspects of Offset Site requiring management

Dieback could potentially be introduced or spread into the Offset Site by the following activities:

- Vehicles, equipment clothing and boots from other sites importing dieback into the Offset Site if not washed down of soil before arriving.
- import of road building materials, mulch or fill containing infected soil or vegetative material.
- surface (alterations to drainage lines) or subsurface flow washing soil from affected areas to unaffected areas.
- If introduced to the site, movement of topsoil, mulch and fill from dieback infested areas spreading dieback from infested areas on-site to uninfested areas on-site and other sites outside of the Offset Site.
- Unauthorised vehicles (trail bikes, mountain bikes etc) could also bring infested soil into the site.
- Feral animals (eg pigs) could potentially transport infested soil in to the Offset Site (DCCEEW, 2024).

2.2 Environmental objectives, targets and performance indicators

With these aspects in mind, the environmental objectives, targets and key performance indicators for dieback management at the Bannister Offset site are detailed in Table 2.1.

Table 2.1: Environmental targets and key performance indicators for dieback management

Management objective	Target	Key performance indicator
Ensure no introduction of dieback from outside the Project Area.	Any soil, gravel or fill used for road construction and imported into Project Area shall be certified or otherwise verified as dieback free.	Certificates from imported material documented as being dieback free.
	Maintain fencing and site access restrictions to prevent unauthorised access through the Site.	No reported unauthorised access.
	Implement feral animal control program	Reduction in number of large feral animals traversing the site.
	All vehicles and machinery are free of soil before arriving on site.	Vehicle/machinery logs confirm mandatory check for soil material before proceeding beyond the carpark at the eastern end of the property.
If established, prevent the spread of dieback from existing infected areas.	No movement of soil or mulch from known infected areas into uninfected or uninterpretable areas.	Vehicle/machinery logs indicate either no movement from dieback infested area to other areas (preferred), or recorded clean down on designated hard stand between vehicle/machinery use in infested area in the uninfested areas.

Management objective	Target	Key performance indicator
	No events relating to vehicles or machinery entering retained bushland areas without authorisation and unless for rehabilitation purposes during construction.	Inspections of clearing boundaries and fencing around retained bushland areas.
	No new areas of dieback infestation in retained bushland areas.	No decline in vegetation health due to dieback in previously uninfested retained bushland areas.

2.3 Roles and responsibilities

DBCA will be responsible for on ground management of the site. WA Limestone will retain responsibility for compliance with any conditions of approval of the project.

All personnel undertaking constructions activities on-site (road constructions, fencing, etc) will undergo some basic induction which will include hygiene training to ensure they are aware of the requirements to prevent the spread of weeds and diseases both into and out of the Offset site.

3. Dieback Management actions

Primary hygiene measures shall be focussed on clean on entry, maintenance of border fencing and control of materials arriving on site.

Table 3.1: Dieback management actions.

Procedure	Action	Timing	Responsibility
1. Fencing and Signs.	Install fencing around the site and signs at the site entrance indicating the dieback controls in place. Signage will include the requirement that all vehicles and personnel must report to the DBCA office for inspection (location of inspection bay to be determined when fencing alignment determined).	Prior to fencing / road works.	DBCA
	Install signs on fencing demarcating unauthorised entry prohibited.	After fencing installed.	DBCA
2. Inductions and procedures.	Induct any construction staff in the hygiene requirements of the site to prevent the introduction of weeds and diseases. Include in the induction procedures for topsoil and dieback management, appropriate training for site personnel on the importance of site hygiene and the correct use of hygiene facilities (e.g. wash / clean down prior to entry to site).	Prior to personnel commencing work on-site.	Construction Manager and DBCA

Procedure	Action	Timing	Responsibility
3. Access and vehicular/ machinery movement.	Conduct clean down of plant, machinery, material, equipment, tools and footwear prior to arrival.	During any site works.	All personnel.
	All vehicles, personnel and equipment will only enter and exit conservation area via the entry and exit inspection point.	During any site works.	Construction Manager and HSE Officer.
4. Bulk earth workswithin conservation area.	Minimise the transport of bulk earth works around the site to minimise the risk of spread of unidentified dieback.	During any site works.	Construction Manager and HSE Officer.
5. Drainage.	Maintain natural drainage pathways on-site with any road/ track improvements.	During any site works.	Construction Manager and HSE Officer.
6. Basic raw material/borrow pits (source of fill, etc) and construction materials.	Obtain certification confirming the pathogen-free status of borrow pits used as sources of fill, limestone and other raw materials.	During any site works.	Construction Manager and HSE Officer.
	Ensure construction materials (pipes, stone pitching etc) are free of mud and soil when brought on to site.	During any site works.	Construction Manager and HSE Officer.
	Store construction materials on a hard, dry, well drained surface that does not drain towards vegetation.	During any site works.	Construction Manager and HSE Officer.
7. Mulching	Obtain certification confirming, or otherwise verify, any mulch sourced from outside the site will be certified or otherwise verified as Dieback free.	During any site works.	Construction Manager and HSE Officer.
	Use on-site mulched material only from areas that are dieback free.	During any site works.	Construction Manager and HSE Officer.
8. Clean down points and procedures	Inspect all machinery, light and heavy vehicles prior to entry to the Conservation area. Any equipment with soil, weeds or seeds attached are to be denied entry to site until cleaned.	Prior to and during any site works.	Construction Manager and HSE Officer.
9. Dust management	Source water for dust suppression only from scheme, bore or sterilised water.	During construction	Construction Manager and HSE Officer.

4. Monitoring

Table 4.1 provides monitoring actions to enable an assessment of the effectiveness of the dieback management actions in place.

Table 4.1: Dieback monitoring program

Parameter	Frequency/ Duration	Location	Purpose	Responsibility
Visible signs of dieback	Weekly.	Conservation area.	Visual inspection of potential signs of dieback introduction.	Ranger.
Fencing and signage.	Monthly.	Conservation area.	To maintain integrity of fencing and signage around the site to prevent unauthorised access.	Ranger
Erosion and water accumulation.	Monthly.	Conservation area.	To ensure natural drainage patterns are maintained to minimise potential spread of dieback, if introduced.	Ranger
Hygiene inspection station and register.	Weekly.	Entry and exit hygiene point into Conservation area.	Ensure inspection point is clear of vegetation and soil and register is up to date.	Ranger

5. Remedial actions

Remedial actions have been developed to be enacted if monitoring indicates that the environmental objectives and targets for dieback management are not going to be achieved (Table 5.1).

Table 5.1: Remedial actions for the dieback and topsoil management actions

Trigger	Action	Responsibility
Observations suggest that dieback has been introduced or spread into conservation area.	1. Confirm that visible signs are the result of dieback. 2. Identify potential sources of dieback introduction and determine likely cause (using suitably qualified specialist). 3. Update mapped distribution of dieback affected areas. 4. Review treatment and control methods, seeking further advice from relevant authorities if required. Control methods may include phosphate treatment to minimise the spread of dieback. 5. Implement revised dieback control methods and continue monitoring.	Ranger, DBCA officers
Non-adherence to hygiene procedure, or weekly environmental inspection indicates an	1. Review procedures, which could include: ◦ review of hygiene measures to determine the requirement for modification / actions additional to current requirements.	Ranger

issue e.g. vehicles not washed down as required, machinery access across TMZ without clean down, etc.	◦ improvement of induction for staff/contractor ◦ improvement to fencing and demarcation of soil quarantine areas. 2. Assess need for remedial action (e.g. removal of infected soil) to avoid infection areas across the site. 3. Monitor the effectiveness of remedial action (i.e. monitor up to five years to assess whether new dieback infestation results).	
Fencing and signage not inplace.	Reinstate fencing or signage as per management action requirements.	Ranger
Erosion or water accumulation observed within the conservation area.	Reshape surface of the area in concern, or re-install / cleanout drain to ensure maintenance of existing drainage lines.	Ranger

6. Review and revision

Implementation will continue to be predominantly managed by the on-site Ranger from DBCA.

The management plan should be reviewed for compliance and effectiveness every 5 years (for at least 20 years) or more frequently if required. Upon review, the document shall be revised and re-issued where appropriate. In addition, continued improvement of the plan will occur in response to environmental incident resolutions and monitoring findings.

7. Limitations

Scope of services

This report ("the report") has been prepared by JBS&G in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and JBS&G. In some circumstances, a range of factors such as time, budget, access and/or site disturbance constraints may have limited the scope of services. This report is strictly limited to the matters stated in it and is not to be read as extending, by implication, to any other matter in connection with the matters addressed in it.

Reliance on data

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Environmental conclusions

Within the limitations imposed by the scope of services, the preparation of this report has been undertaken and performed in a professional manner, in accordance with generally accepted environmental consulting practices. No other warranty, whether express or implied, is made.

The advice herein relates only to this project and all results conclusions and recommendations made should be reviewed by a competent person with experience in environmental investigations, before being used for any other purpose.

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Dieback Working Group (2021) "Best Practice Guidelines for the Management of *Phytophthora* Dieback in the Basic Raw Materials Industries" Dieback Working Group, WA.

South Coast Natural Resource Management (2024) From WA Dieback Map found here: "Dieback Public Map - Project Dieback", Perth, WA.

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