CZR Resources Ltd

Robe Mesa Iron Ore Project

Fauna Assessment

Western edge of Mesa F (M. Bamford).

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Executive Summary

CZR Resources Limited is proposing to develop its Robe Mesa Iron Ore Project (the project) on Mesa F, 29 km WSW of Pannawonica. Bamford Consulting Ecologists (BCE) was commissioned by CZR to assess the project area for its values for vertebrate fauna, with some preliminary observations on significant invertebrate fauna. A comprehensive desktop assessment was prepared followed by field investigations in May and October/November 2021, with a strong emphasis on targeted surveys for threatened fauna in areas likely to be directly impacted by mining operations on Mesa F. Subsequently, field investigations for a detailed (level 2) survey were conducted in July and September 2022. This report presents the findings of the desktop assessment and field investigations.

BCE uses a 'values and impacts' assessment process with the following components (based upon federal and state regulator guidance):

- The identification of fauna values:
    - Assemblage characteristics: uniqueness, completeness and richness;
    - Species of conservation significance;
    - Recognition of ecotypes or vegetation/substrate associations (VSAs) that provide habitat for fauna, particularly those that are rare, unusual and/or support significant fauna;
    - Patterns of biodiversity across the landscape;
    - Ecological processes upon which the fauna depend.
- The review of impacting processes such as:
    - Habitat loss leading to population decline;
    - Habitat loss leading to population fragmentation;
    - Degradation of habitat due to weed invasion leading to population decline;
    - Ongoing mortality from operations;
    - Species interactions including feral and overabundant native species;
    - Hydrological change;
    - Altered fire regimes;
    - Disturbance (dust, light, noise).

This report focusses on the fauna values and the review of impacting processes with respect to vertebrate fauna.

Description of project area

The project area lies on the western edge of the Hamersley Ranges and is situated along the Robe Valley with the Robe River to the north and Mungarathoona Creek, a tributary of the Robe River, immediately to the east. The surrounding areas have a history of mining activities along the Robe valley with Mesa formations targeted for their Iron deposits. Exploration lease E 08/1060 and E 08/1686 and Mining Lease M(A) 08/519 encompass an area of 3,181 Hectares (ha). Mining operations are proposed for the northern part of the Mesa formation, referred to as Mesa F, situated in E 08/1060, and the north-west portion of E 08/1686. The area proposed for infrastructure development is to the east and south of the area targeted for extraction of ore. The proposed infrastructure development includes two haul road route options: the southern and northern routes.

Fauna values

Vegetation and Substrate Associations (VSAs). The project area encompasses eight VSAs which reflect landscape position and soil type: Mesa top (VSA 1), Mesa edge (VSA 2A), Rocky hills and slopes (VSA 2B), Plains and flats (VSA 3), Bloodwood and acacia woodland (VSA 4), *Eucalyptus victrix* woodland (VSA 5), Malaleuca and eucalypt gallery forest (VSA 6), and Pools (VSA 7). These are all typical of the broader region, with the most extensive being VSA 3. VSA 2A (Mesa edge) is small in size and restricted to the area immediately surrounding the mesa. Other VSAs are restricted in extent but occur across the landscape often in narrow corridors.

Fauna assemblage. The desktop study identified 294 vertebrate fauna species as potentially occurring in the project area: six fish, seven frogs, 96 reptiles, 144 birds and 41 mammals (36 native and five introduced species). The presence of 155 vertebrate fauna species was confirmed across all field investigations. This included three fish, two frogs, 43 reptiles, 80 birds and 19 mammals (24 native and three introduced). Of the 294 species potentially occurring in the project area, 28 are of conservation significance. The fauna assemblage is broadly typical of the Pilbara region. The assemblage is likely to be substantially complete except for the mammal component, with six native mammal species considered locally extinct. The assemblage is likely to relatively rich in a regional context as the environment contains a variety of VSAs that support a wide range of vertebrate fauna, including conservation significant species.

Species of conservation significance. Three broad levels of conservation significance are used in this report:

- Conservation Significance 1 (CS1) – species listed under State or Commonwealth Acts (one fish, one reptile, nine birds and 4 mammals).
- Conservation Significance 2 (CS2) – species listed as Priority by DBCA but not listed under State or Commonwealth Acts (one fish, two reptiles, one bird and three mammals).
- Conservation Significance 3 (CS3) – species not listed under Acts or in publications but considered of at least local significance because of their pattern of distribution (four birds and two mammals).

The majority of the 28 conservation significant vertebrate species expected in the project area are likely to be residents or regular visitors, with five considered irregular visitors and three considered vagrants. Ten conservation significant species were confirmed. The northern Quoll (CS1) was abundant around the mesa edge, with records also along drainage lines across the surrounding plains. The Pilbara Leaf-nosed Bat and Ghost Bat (CS1) were also confirmed and were common but in small numbers around the mesa, with some animals foraging across the plains). There was no evidence of a maternity roost and caves around Mesa F appeared unsuitable, being shallow and lacking the deep, humid recesses favoured by the species. Such a roost is known about 650m south of the lease on Mesa F. The Pilbara Olive Python (CS1) is almost certainly present and likely to move seasonally between major drainage lines and the rocky edge of the mesa. The Blind Cave Eel (CS1) is likely to occur in subterranean waters associated with the Robe River and its tributaries, and the nearest record 12km to the east. Other CS1 species, such as migratory waterbirds and some birds of prey, are expected to occur only in small numbers. Several species listed as priority by DBCA (CS2) are associated with rocky landscapes, and the Ngadji (Western Pebble-mound Mouse) was recorded along the southern haul road option but with no active or even inactive mounds in the mine area. Two CS2

species recorded were the Fortescue Grunter, in pools of the Robe River/Mungarathoona Creek, and Gane's Blind-Snake, in dense, moist leaf-litter along a branch of the creek. Locally significant species (CS3) recorded were the Striated Grasswren, Rufous-crowned Emu-wren, Bush Stone-curlew, Star Finch, Brush-tailed Possum and Rothschild's Rock-Wallaby. All were associated with the mesa edge, mesa slopes or drainage lines. Few significant species appear to be associated with the broad plains of the region; possibly the Short-tailed Mouse (CS2) and the Crevice Skink. Overall, a rich assemblage of significant fauna with close associations with mesa edges and other rocky landscapes, and with major drainage systems, is expected.

Patterns of biodiversity. The most important patterns of biodiversity for impact assessment are the concentrations of conservation significant species on the margins of mesas and along major drainage lines. Systematic sampling found some heightened species richness in Bloodwood thickets close to minor drainage lines, and associated with sandier soils on the plains.

Key ecological processes. The ecological processes that currently have major effects upon the fauna assemblage include:

- Landscape permeability/connectivity – key landscapes, including mesas and rocky hills, and drainage systems, are linear features and important for a suite of significant fauna.
- Hydrology – drainage systems are a key part of the landscape, with associated distinctive vegetation and reliant significant fauna.
- Fire – likely to have impacted fauna and contributed to locale extinctions due to changed regimes.
- Feral species – includes introduced predators and introduced livestock that have landscape-scale impacts across the environment.

Threatening processes

The risk from most threatening processes is negligible or negligible to minor. This is due largely to the small scale of the impact across a vast and still largely intact landscape. Impacts that may be of concern are:

- Mortality of the Ngadji due to clearing along the southern haul road option; this passes through the only active or probably active mounds found during field investigations.
- Disturbance of fauna along the mesa edge (such as through noise and vibration) as a result of mining across the top of the mesa. To mitigate this, mesa edges will be avoided and a buffer between the mining area and the mesa edge will be employed.
- Population fragmentation due to roads and other infrastructure crossing linear features such as drainage lines.
- Ongoing mortality of a range of species such as the Northern Quoll and Pilbara Olive Python due to roadkill.
- Hydrological change at crossings of major drainage lines and where sheet flow occurs across parts of the plains.
- Species interactions; in particular an increase in the abundance of native and introduced predators that can occur around remote area mine sites.
- Altered fire regimes; the fauna assemblage is probably already sensitive to altered fire regimes, but there is potential for an improved fire regime.

- Disturbance and in particular light spill that will be novel to the landscape and has been demonstrated elsewhere to result in large scale invertebrate mortality and an increase in the abundance of native predators.

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1 Introduction

CZR Resources Limited is proposing to develop its Robe Mesa Iron Ore Project (the project) on Mesa F, 29 km WSW of Pannawonica (see Figure 1). Bamford Consulting Ecologists (BCE) was commissioned by CZR to assess the project area for its values for vertebrate fauna, with some preliminary observations on significant invertebrate fauna. A comprehensive desktop assessment was prepared (McCreery and Bamford 2020), followed by field investigations in May and October/November 2021, with a strong emphasis on targeted surveys for threatened fauna in areas likely to be directly impacted by mining operations on Mesa F. Subsequently, field investigations for a detailed (level 2) survey were conducted in July and September 2022. This report presents the findings of the desktop assessment, field investigations and targeted surveys from May and October/November 2021, and the level 2 survey from July and September 2022. It includes some observations on short range endemic (SRE) and other conservation significant fauna, but Biota (2022b) carried out a more comprehensive invertebrate assessment.

1.1 General approach to fauna impact assessment

The purpose of impact assessment is to provide government agencies with the information they need to decide upon the significance of impacts of a proposed development, and to provide information to proponents to help them to develop appropriate strategies for avoiding and minimising impacts of their activities. This relies on information on the fauna assemblage and its environment, and BCE uses an approach with the following components:

- The identification of **fauna values**:
  - Assemblage characteristics: uniqueness, completeness and richness;
  - Species of conservation significance;
  - Recognition of ecotypes or vegetation/substrate associations (VSAs) that provide habitat for fauna, particularly those that are rare, unusual and/or support significant fauna;
  - Patterns of biodiversity across the landscape; and
  - Ecological processes upon which the fauna depend.
- The review of **threatening processes** such as:
  - Habitat loss leading to population decline;
  - Habitat loss leading to population fragmentation;
  - Degradation of habitat due to weed invasion leading to population decline;
  - Ongoing mortality from operations;
  - Species interactions including feral and overabundant native species;
  - Hydrological change;
  - Altered fire regimes; and
  - Disturbance (dust, light, noise).

- The **recommendation** of actions to mitigate impacts (if requested).

Based on the impact assessment process above, the objectives of the study are therefore to:

1. Conduct a literature review and searches of Commonwealth and State fauna databases;
2. Review the list of fauna expected to occur on the site in the light of fauna habitats present, with a focus on investigating the likelihood of significant species being present;
3. Identify significant or fragile fauna habitats within the project area;
4. Identify any ecological processes in the project area upon which fauna may depend;
5. Identify general patterns of biodiversity within or adjacent to the project area, and
6. Identify potential impacts upon fauna and propose recommendations to minimise impacts.

Descriptions and background information on these values and processes can be found in Appendices 1 to 4. Based on this impact assessment process, the objectives of investigations are to: identify fauna values; review impacting processes with respect to these values and the proposed development; and provide recommendations to mitigate these impacts.

1.2 Description of project area and background environmental information

1.2.1 Project area

The project area lies on the western edge of the Hamersley Ranges and is situated along the Robe Valley (Figure 1). The Robe River lies to the north and Mungarathoona Creek, a tributary of the Robe River, lies immediately to the east. The surrounding areas have a history of mining activities along the Robe valley with Mesa formations targeted for their Iron deposits. Exploration lease E 08/1060 and E 08/1686 and Mining Lease M(A) 08/519 encompass an area of 3,181 Hectares (ha). Mining operations are proposed for the Mesa formation, referred to as Mesa F, situated in E 08/1060, and the north-west portion of E 08/1686. The northern part of Mesa F is the area targeted for ore extraction and covers approximately 68 ha (Figure 1, Figure 2). The area proposed for infrastructure development encompasses approximately 89 ha and includes mine plant, utilities and village. The proposed infrastructure development footprint includes two haul road route options: the southern and northern routes (Figure 1), which together cover 120 ha. In total, the proposed development footprint encompasses 277 ha.

For spatial terminology (i.e. definitions of project, survey and study areas) see Section 2.1.2.

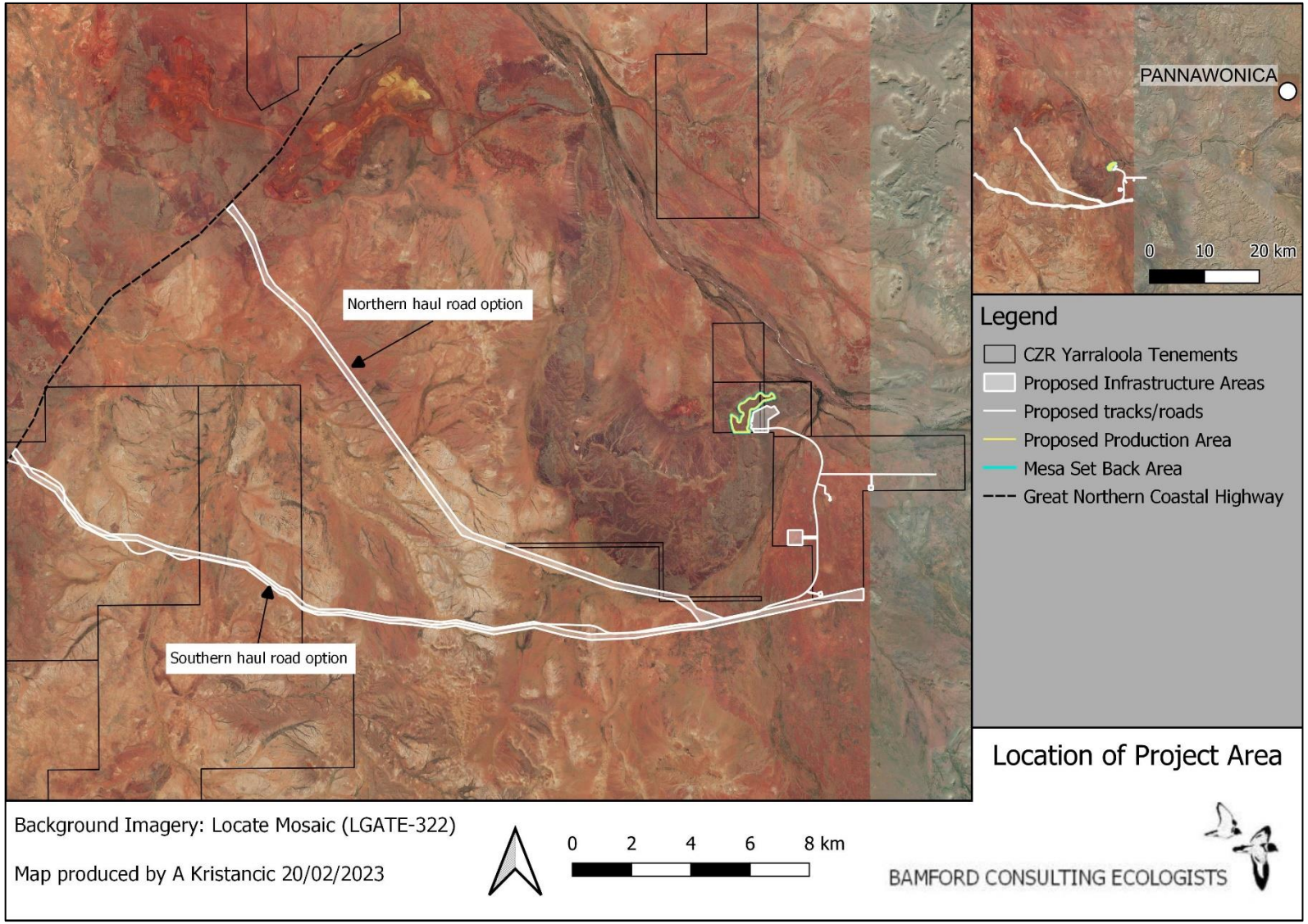

Figure 1. Location of project area, showing proposed production area (for ore extraction), and proposed infrastructure and haul roads.

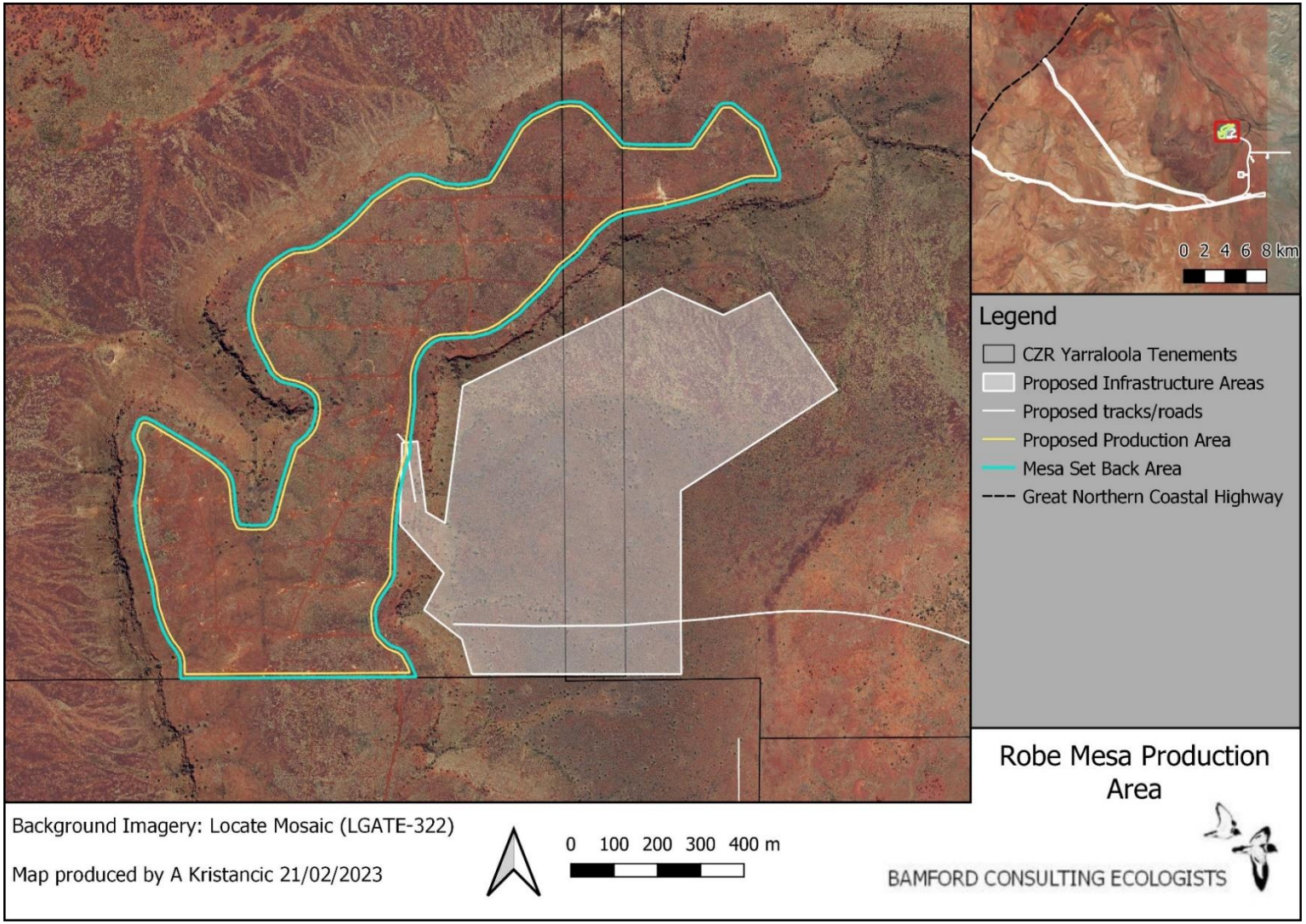

Figure 2. Detailed view of proposed production area (mine area, top of mesa), mesa set back buffer (40m from edge of mesa), and top-soil storage infrastructure area.

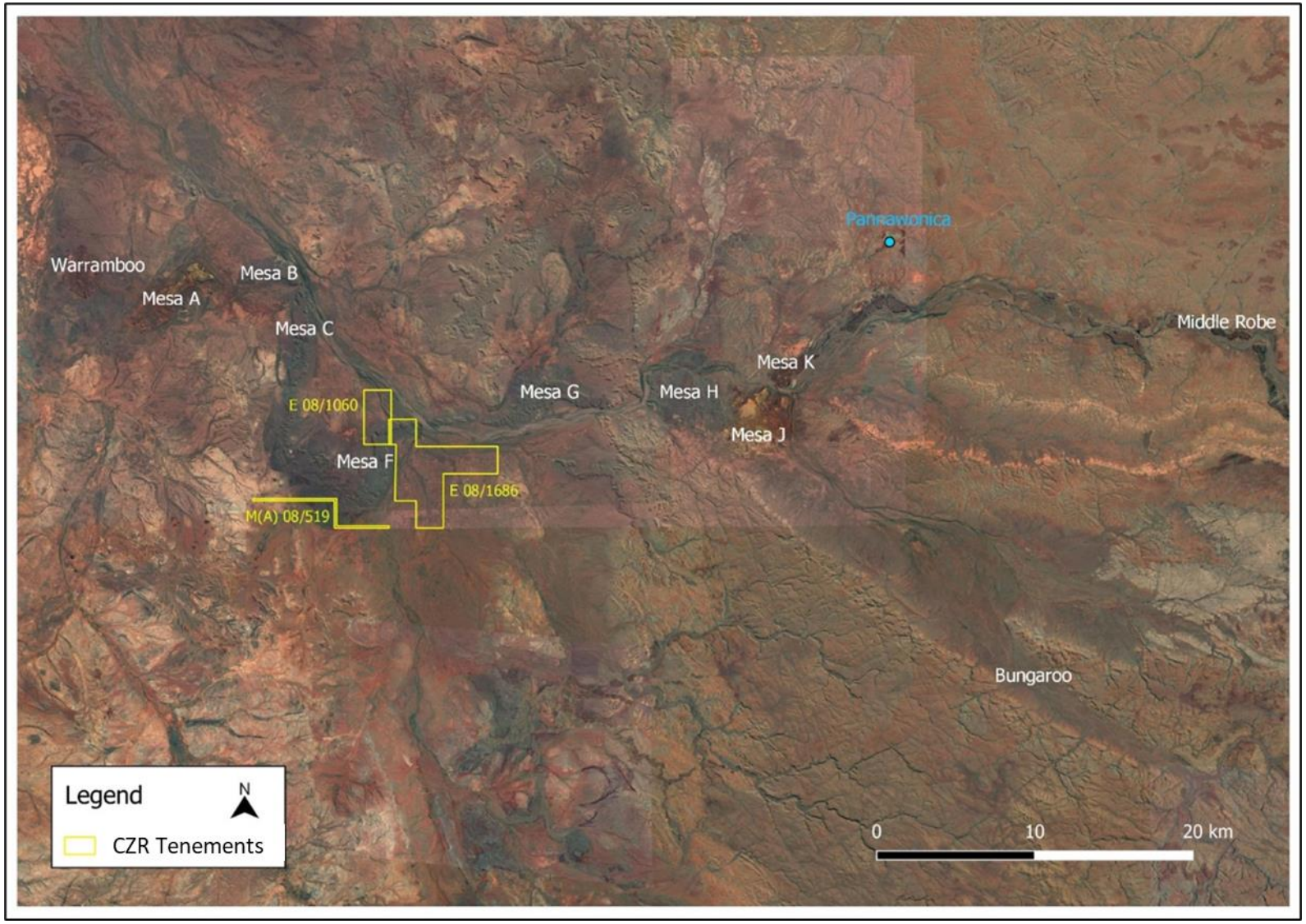

Figure 3. Robe Mesa tenements (yellow) and surrounding area including mesas and areas where previous surveys have been undertaken.

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 2023). 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 2016b). The project area is in the Pilbara bioregion, in the north-western part of the Hamersley (PIL03) subregion, on the western edge of the Hamersley ranges (Figure 5).

The Pilbara Bioregion is characterised by vast coastal plains and inland mountain ranges with cliffs and deep gorges. The vegetation composition is mainly Mulga low woodlands or Eucalyptus over Hummock grasses. The Hamersley sub-region, described by Kendrick (2003), is located in the southern section of the Pilbara craton and is characterised by a mountainous area of Proterozoic sedimentary ranges and plateaux, dissected by gorges. Vegetation consists of a mix of mulga low woodland over hummock and tussock grasses on fine-textured soils, and *Eucalyptus sp*. over hummock grasses on skeletal soils of the ranges. Drainage flows into the Fortescue, Ashburton and Robe Rivers.

The Pilbara bioregion falls within the Bioregion Group 2 (Eremaean Botanical Province) classification of the EPA (2016b) where “native vegetation is largely contiguous but used for commercial grazing”.

1.2.3 Land systems

Payne (2004) identified 102 land systems for the Pilbara region, with the proposed mine area and infrastructure development areas located across nine of these (see Figure 6):

- Boolgeeda Land System – Stony lower slopes and plains below hill systems;
- River Land System – Active floodplains and major rivers;
- Urandy Land System -Alluvial plains with soft spinifex grasslands;
- Capricorn Land System – Hills and ridges of sandstone and dolomite;
- Sherlock Land System – Stony alluvial plains;
- Robe Land System – Low limonite mesas and buttes;
- Stuart Land System – Gently undulating stony plains;
- Nanutarra Land System – Low mesas and hills of sedimentary rocks;
- Peedamulla Land System – Gravelly plains.

These systems fall within Payne’s (2004) broader ‘Land Type’ categories 1 (hills and ranges with spinifex grasslands), 8 (Stony plains with spinifex grasslands), 13 (Alluvial plains with soft spinifex grasslands), 15 (Alluvial plains with snakewood shrublands), and 17 (River plains with grassy woodlands and shrublands and tussock grasslands).

1.2.4 Land use and tenure

Dominant land uses in the Hamersley subregion include grazing by cattle, mining, UCL and Crown reserves, Conservation, native pastures and urban (Kendrick 2003).

1.2.5 Recognised sensitive sites

There are no known Ramsar Sites (DBCA, 2023b), Important Wetlands (DBCA, 2023a), Threatened Ecological Communities (DBCA, 2023d, 2023c), Key Biodiversity Areas (KBA 2020) or Environmentally Sensitive Areas (DWER, 2023a, 2023b) within the project area. The project area overlaps with or is near several Priority Ecological Communities (PECs; Figure 4), all of which relate to either vegetation or subterranean invertebrate fauna.

The DBCA categorises ecological systems that are under threat as Threatened or Priority Ecological Communities. A Threatened Ecological Community (TEC) is protected under the EPBC Act and is grouped into one of the following categories: "presumed totally destroyed", "critically endangered", "endangered" or "vulnerable". Possible TECs that do not meet survey criteria are added to DBCA Priority Ecological Community (PEC) Lists under Priorities 1, 2 and 3. Ecological Communities that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

One Priority 1 PEC, "Subterranean invertebrate communities of mesas in the Robe Valley region", is of particular interest as it intersects with the proposed area of ore extraction on Mesa F (Figure 5). Priority 1 PECs are poorly-known with few and restricted distributions. The description for the PEC that occurs on Mesa F is as follows: A series of isolated mesas occur in the Robe Valley in the state's Pilbara Region. The mesas are remnants of old valley infill deposits of the palaeo Robe River. The troglobitic faunal communities occur in an extremely specialised habitat and appear to require the particular structure and hydrogeology associated with mesas to provide a suitable humid habitat. Short range endemism is common in the fauna. The habitat is the humidified pisolitic strata. The main threat is considered to be removal of substrate for mining and associated hydrological changes (DBCA, 2022a).

The furthest extent of the northern haul road option overlaps with a Priority 1 PEC described as "Subterranean invertebrate community of the pisolitic hills in the Pilbara". The troglofauna of these isolated low undulating hills are being identified as having very short-range distributions (DBCA, 2022a).

Eastern portions of the proposed development area are c. 2-3km from a Priority 3 PEC, "*Triodea pisoliticola* assemblages of mesas of the West Pilbara". This is described as:

"This community is typically restricted to mesas and cordillo landforms where the plant assemblages are dominated by or contain *Triodia pisoliticola* and are indicative of inverted landscapes; that is, where *Triodia pisoliticola* occurs in combination with species that are considered 'out-of-context' from their normal habitat. The community is a combination of *Triodia pisoliticola* with *Acacia pruinocarpa* and *A. citrinoviridis* on slopes or peaks of mesas. These two Acacias are generally found associated with Pilbara creeklines, and their occurrence is probably indicative of the genesis of the mesa surfaces in wetlands, then erosion of the landscape and 'inversion of the landscape' such that the mesa slopes and peaks that were previously low in the landscape become high points." (DBCA, 2022a, page 3). Main threats are considered to be clearing for mining and associated infrastructure and altered fire regimes.

Wetlands of subregional significance encompass springs and pools of the Robe River, containing running spring ecosystems with large, deep permanent pools from 40km east of Pannawonica to the North-West Coastal Highway (Kendrick 2003). This area is also associated with possible stygofauna communities associated with aquifers near mining activities. This passes just north of the project area.

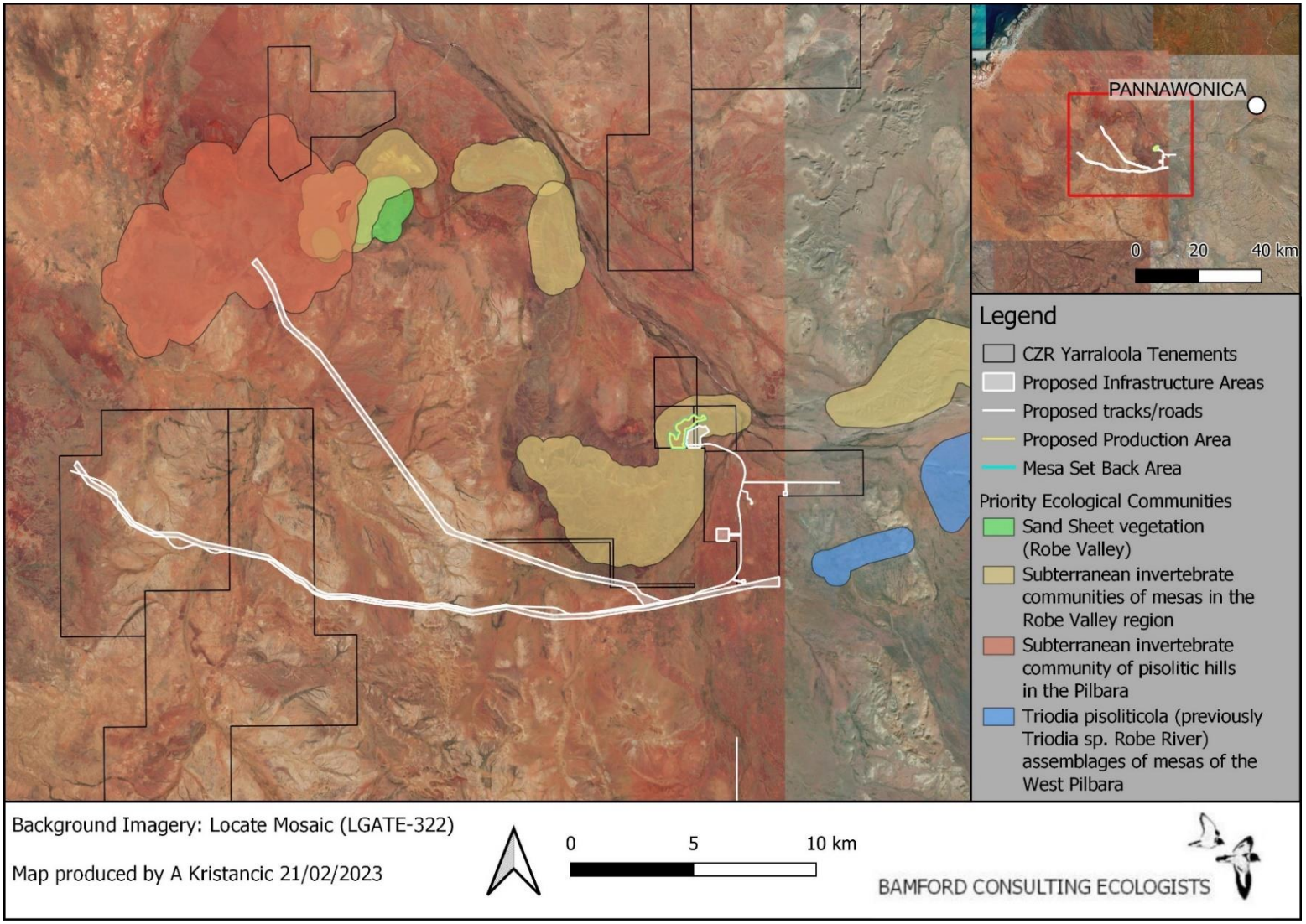

Figure 4. Priority Ecological Communities in the region of the project area

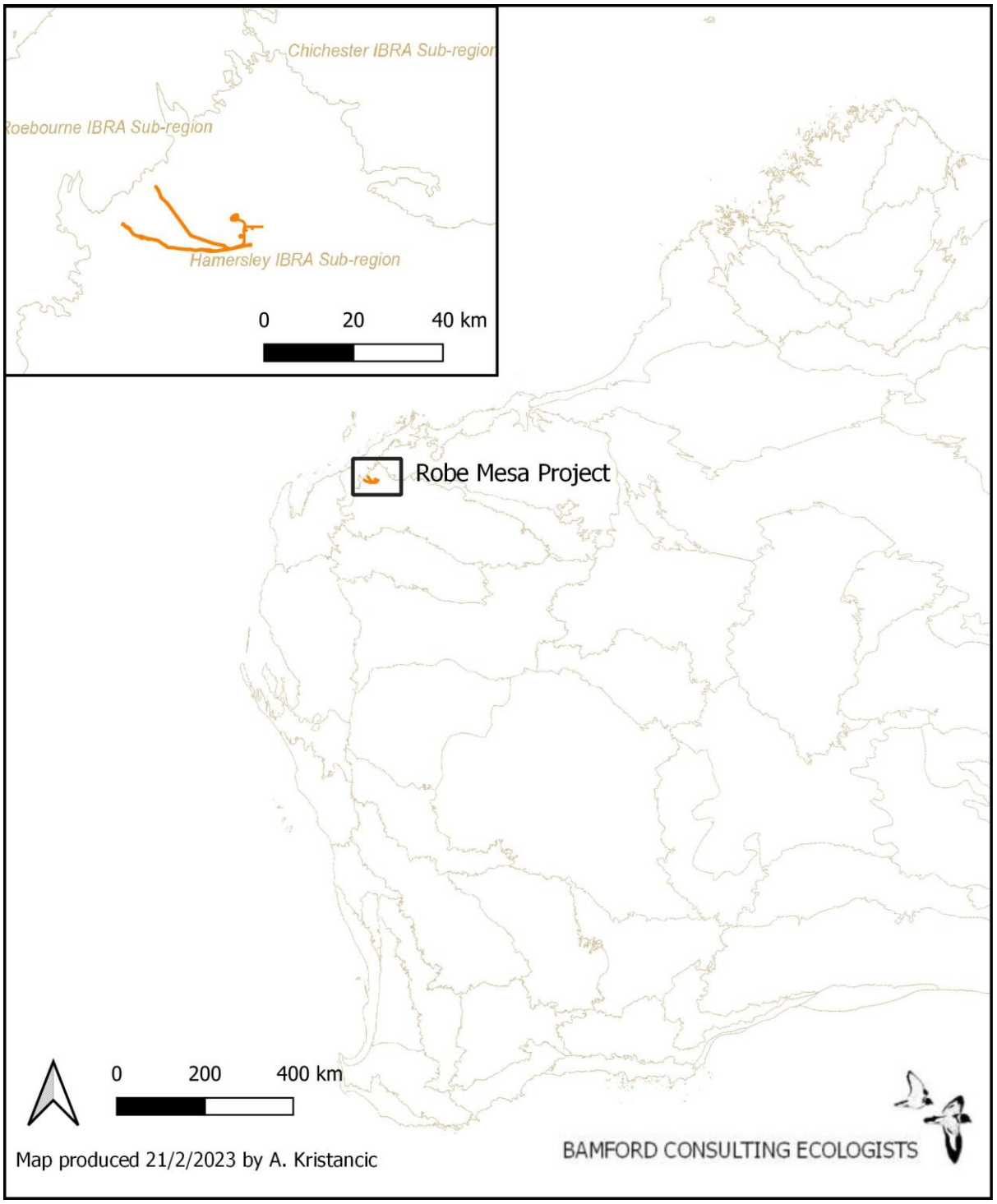

Figure 5. Project location within the Interim Biogeographic Regionalisation of Australia (IBRA).

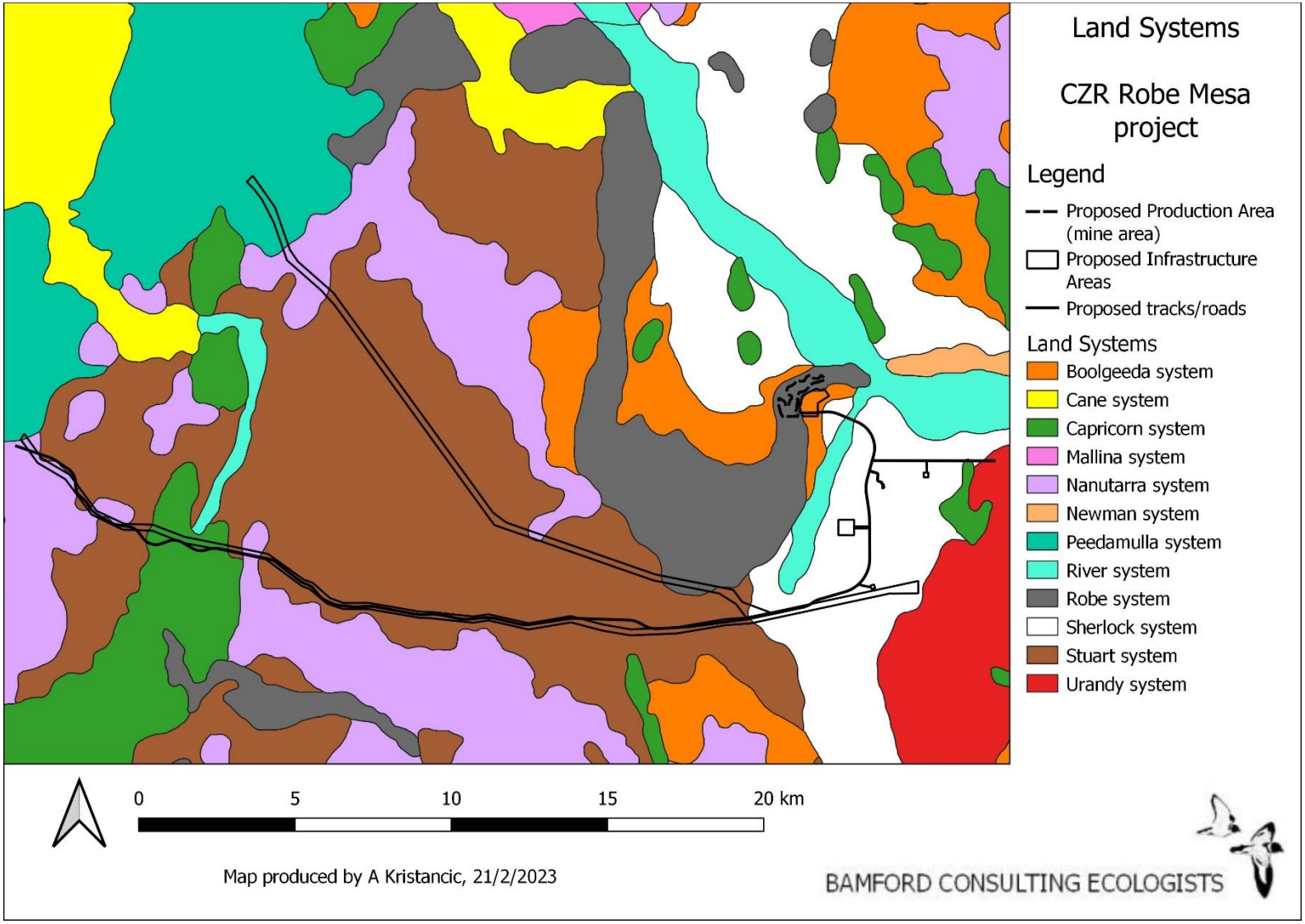

Figure 6. Land Systems (Payne 2004) in the vicinity of the CZR Robe Mesa Project.

1.2.6 Climate information

The Pilbara bioregion falls within the Eremaean Botanical Province (EPA 2016b, 2020), temperatures increase along a northward latitudinal gradient and rainfall is summer-dominated in the north and more evenly spread across the year in the south (EPA 2020). Episodic summer thunderstorms and rain-bearing depressions are key bioclimatic activators and hence drive vertebrate activity (EPA 2020).

The Hamersley sub-region has a Semi-desert tropical climate, with an average of 300mm rainfall, usually occurring in summer cyclonic or thunderstorm events (Kendrick 2003). Winter rain is not uncommon, and drainage occurs into the Fortescue, Ashburton, or Robe River systems.

A summary of climate for the project area, as provided by BOM (2022), is presented in Table 1.

Table 1. Climate averages for the closest open meteorological station to the project area.

Data from BOM (2022) for: *Site name* = PANNAWONICA *Site number* = 005069

Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Years		Plot	Map
Temperature																	
Mean maximum temperature (°C)	41.0	39.7	38.5	35.8	30.6	27.0	26.7	28.8	32.4	36.1	38.5	40.5	34.6	33	1971 2005		
Mean minimum temperature (°C)	25.2	25.2	24.4	21.8	17.2	14.0	12.6	13.7	15.9	19.0	21.5	24.0	19.5	33	1971 2005		
Rainfall																	
Mean rainfall (mm)	78.9	104.5	71.2	19.8	33.8	33.5	14.4	7.0	1.5	1.7	6.8	30.5	404.1	44	1971 2022		
Decile 5 (median) rainfall (mm)	63.0	67.2	38.4	6.0	14.2	11.3	3.3	0.6	0.0	0.0	0.6	17.8	387.0	49	1971 2022		
Mean number of days of rain ≥ 1 mm	6.2	7.0	5.0	1.8	2.2	2.3	1.5	1.0	0.3	0.3	0.7	2.9	31.2	49	1971 2022		
Other daily elements																	
Mean daily sunshine (hours)																	
Mean number of clear days	8.9	6.3	8.1	8.7	12.5	12.7	16.5	16.7	18.5	19.2	17.0	12.6	157.7	33	1971 2005		
Mean number of cloudy days	4.1	5.4	4.2	3.9	5.1	4.5	3.5	1.9	1.0	0.5	1.1	2.0	37.2	33	1971 2005		

2 Methods

2.1 Overview

This approach to fauna impact assessment has been developed with reference to guidelines and recommendations set out by the Western Australian Environmental Protection Authority (EPA) on fauna surveys and environmental protection (EPA 2002, 2016b, c, 2020), and Commonwealth biodiversity legislation (DotE 2013; DSEWPaC 2013a). The EPA (2020) recommends three levels of investigation that differ in their approach for field investigations:

- **Basic** – a low-intensity survey, conducted at the local scale to gather broad fauna and habitat information (formerly referred to as 'Level 1'). The primary objectives are to verify the overall adequacy of the desktop study, and to map and describe habitats. A basic survey can also be used to identify future survey site locations and determine site logistics and access. The results from the basic survey are used to determine whether a detailed and/or targeted survey is required. During a basic survey, opportunistic fauna observations should be made and low-intensity sampling can be used to gather data on the general faunal assemblages present. While referred to as 'basic', this level of survey is involved and powerful, and should be considered the primary level of assessment. Other levels of assessment (where deemed necessary) add information to inform this primary level.
- **Detailed** – a detailed survey to gather quantitative data on species, assemblages and habitats in an area (formerly referred to as 'Level 2'). A detailed survey requires comprehensive survey design and should include at least two survey phases appropriate to the biogeographic region (bioregion). Surveys should be undertaken during the seasons of maximum activity of the relevant fauna and techniques should be selected to maximise the likelihood that the survey will detect most of the species that occur, and to provide data to enable some community analyses to be carried out.
- **Targeted** – to gather information on significant fauna and/or habitats, or to collect data where a desktop study or field survey has identified knowledge gaps. Because impacts must be placed into context, targeted surveys are not necessarily confined to potential impact areas. A targeted survey usually requires one or more site visits to detect and record significant fauna and habitats. For areas with multiple significant species there may not be a single time of year suitable to detect all species. In these cases, multiple visits, each targeting different species or groups, should be conducted.

The level of assessment recommended by the EPA (2020) is determined by geographic position, with a generic statement that detailed surveys are expected across all of the state except the south-west, but also recommending that site and project characteristics be considered, such as the survey objectives, existing available data, information required, the scale and nature of the potential impacts of the proposal and the sensitivity of the surrounding environment in which the disturbance is planned. These aspects should be considered in the context of the information acquired by the desktop study. When determining the type of survey required, the EPA (2020) suggested that the following be considered:

- level of existing regional knowledge
- type and comprehensiveness of recent local surveys
- degree of existing disturbance or fragmentation at the regional scale

- extent, distribution and significance of habitats
- significance of species likely to be present
- sensitivity of the environment to the proposed activities
- scale and nature of impact.

The EPA (2016b) also indicates that the scale and nature of the proposal can be used to determine the appropriate level of investigations, with for example, large scale projects requiring higher levels of investigations. This sort of advice from the EPA (2016b, 2020) provides a framework for determining the appropriate level of field investigations. Combined with some other factors based on long experience in fauna investigations for impact assessment, this framework is applied to the current project in Table 2. The results of this application are summarised in Table 3 to ensure the approach undertaken in the current investigations is consistent with the range of guidance. Because the CZR Robe mesa project is complex and consists of three parts, the mine area (mesa top), infrastructure area (plains) and haul road routes, the framework is applied to each of these parts separately.

A high intensity of assessment is suggested for the mine area, but for the vertebrate fauna this is almost entirely based upon the likely presence of species of high conservation significance on the edge of the mesa. While these species are well-studied in the region, site-specific information is important for impact assessment and therefore targeted investigations into these species is suggested.

In contrast, only a moderate level of investigation is indicated for the infrastructure area, and low to moderate for the haul road routes. Plains and drainage lines appear to have been less-sampled than rocky hills in the region, due to the link between environmental investigations and the location of mining activity, and therefore in the infrastructure area a targeted approach supplemented with some detailed sampling is suggested. For the haul road routes, that have a very narrow footprint, only a targeted approach and familiarisation with landscapes that provide habitat for fauna is suggested.

Guidance for field investigations methods is provided by the EPA (2016b, 2020) and by Bamford *et al.* (2013).

Table 2. Assessment of site and project characteristics for level of assessment.

Factor: site and project characteristic	Rationale for decision on level of investigations	Application to current project
Level of existing regional knowledge.	*Existing data reduces need for baseline survey. Similarity/uniformity of environments need to be high to extrapolate from regional knowledge*	Mine area: Extensive regional knowledge from previous basic, detailed and targeted investigations. Infrastructure area: Extensive regional knowledge from previous basic, detailed and targeted investigations Haul road routes: Extensive regional knowledge from previous basic, detailed and targeted investigations
Type and comprehensiveness of recent local surveys.	*Previous surveys, if adequate, will provide extensive baseline data and therefore reduce the need for additional baseline survey effort. Similarity/uniformity of environments need to be high to extrapolate from regional knowledge*	Mine area: Multiple recent surveys undertaken in region and in similar landscapes for other mining projects. Wide range of detection techniques (trapping, cameras, aural, searching). Infrastructure area: Possibly less intense regional surveys than in mine area as focus in region is on mining areas. Haul road routes: Possibly less intense regional surveys than in mine area as focus in region is on mining areas.
Degree of existing disturbance or fragmentation at the regional scale.	*The type and scale of existing impacts affect the need for survey. A broadly degraded landscape may need less effort due to the likely loss of biodiversity, but a fragmented landscape may need greater effort as remaining biodiversity may be high in remnant vegetation and this can be an important value to confirm*	Mine area: Broad landscape is intact and well-connected immediately around Mesa F, but extensively disturbed further west. Future nearby developments likely to increase level of disturbance around Mesa F. Infrastructure area: Broad landscape intact and well-connected, but somewhat degraded by livestock grazing. Haul road routes: Broad landscape intact and well-connected, but somewhat degraded by livestock grazing. Some development to north (existing mines).
Extent, distribution and significance of environments	*In general, rare, unusual, restricted and/or environments linked to significant species need more investigation that broad and widely-represented environments due to their likely higher significance for fauna*	Mine area: Restricted environments especially around mesa edge. Infrastructure area: Restricted environments along drainage lines but otherwise environments very extensive.

Factor: site and project characteristic	Rationale for decision on level of investigations	Application to current project
		Haul road routes: Mostly very extensive and uniform plains but some drainage line crossings.
Significance of species likely to be present	*Species of conservation significance require additional effort to confirm their presence (if possible; or likelihood of presence), and the identification of habitats and processes, such as connectivity, important for them*	Mine area: Rich assemblage of significant species associated with mesa edge and subterranean environments, but not the top of the mesa. Subterranean environments addressed separately (Biota). Infrastructure area: Possibly some significant species associated with lower slopes of hills and drainage systems. Haul road routes: Possibly some significant species associated with lower slopes of hills and drainage systems.
Sensitivity of the environment to the proposed action.	*Sensitivity is complex. Environments can be considered sensitive to impacts if the environments are restricted, fragmented or vulnerable to change such as hydrological change or any other alteration caused by the action. Off-site environments may need to be considered*	Mine area: Mesa edge not subject to direct (clearing) impact but exposure to disturbance from factors such as noises, light and vibration. Infrastructure area: Plains may be sensitive to hydrological change and development will cause fragmentation. Haul road routes: Plains may be sensitive to hydrological change and development will cause fragmentation.
Scale and nature of impact. Geographic position.	*How big is the impact; what proportion of surrounding environments will be impacted; is the impact loss or modification; will there be rehabilitation (ie is the impact a permanent change or can at least some fauna values return?); is the impact ongoing (eg long-term change to hydrology or a high proportion of the landscape altered). More information on fauna is needed in situations such as where the impact area is large or proportionally large, impacts are upon significant environments and or fauna assemblages, and where baseline data may be needed for ongoing management*	Mine area: Major impact on top of mesa only; same part of landscape affected at nearby mining projects. Fauna assemblage on mesa expected to be simple and widespread, but subterranean assemblage may be rich and restricted in distribution. Mesa edge only very small area of impact with buffer from mine area. Infrastructure area: A large but localised impact on plains east of mine area. Generally small proportional impact except along drainage lines. Haul road routes: A small and narrow (linear) impact across a uniform landscape. Small proportional impact.)

Factor: site and project characteristic	Rationale for decision on level of investigations	Application to current project
Potential value of presence, abundance and distributional data.	*There is low value in confirming the presence of common and widespread species within their known range unless this forms part of on-going monitoring such as of rehabilitation, impacts of management or to monitor on-site and/or off-site impacts. There is value where even widespread and common species are very poorly-known or where records even of such species are of conservation interest (islands, highly fragmented landscapes). There is generally high value in developing an understanding of significant species in an area. There is value if data address an ecological question (such as impact of fire).*	Mine area: Mine area on top of mesa has simple and widespread terrestrial fauna assemblage. Suite of conservation significant species present and mostly associated with mesa edge. Value in gathering information on these, and in monitoring impacts. Infrastructure area: A few poorly-known species (not threatened but in some cases Priority) may be present. Haul road routes: A few poorly-known species (not threatened but in some cases Priority) may be present.

Table 3. Level of assessment suggested for the project.

- Low – a low level of additional assessment suggested by the factor. Site inspection.
- Moderate – a moderate level of additional assessment suggested by the factor. Site inspection and targeted surveys.
- High – a high level of additional assessment suggested by the factor. Site inspection, targeted and detailed surveys.

	Suggested intensity of assessment		
Factor: site and project characteristic	**Mine area**	**Infrastructure area**	**Haul road routes**
Level of existing regional knowledge.	Low	Low	Low
Type and comprehensiveness of recent local surveys.	Low	Moderate	Moderate
Degree of existing disturbance or fragmentation at the regional scale.	Moderate	Moderate	Low
Extent, distribution and significance of environments	High	Moderate	Moderate
Significance of species likely to be present	High	Moderate	Moderate
Sensitivity of the environment to the proposed action.	Moderate	Moderate	Low
Scale and nature of impact.	Moderate	Moderate	Low
Potential value of presence, abundance and distributional data.	Moderate	Low	Low

2.1.1 Approach to investigations

The approach and methods utilised in this report are divided into two groupings that relate to the stages and the objectives of impact assessment in identifying the fauna values listed in 1.1. The two methods groupings are:

- **Desktop assessment.** The purpose of the desktop review is to produce a species list that can be considered to represent the vertebrate fauna assemblage of the project area based on unpublished and published data using a precautionary approach.
- **Field investigations.** The field investigations have multiple purposes:
    - Gather information on the vegetation and soil associations (VSAs) ('habitats') that support the fauna assemblage, which allows the output of the desktop review to be interpreted in the context of the study areas environment.
    - Conduct targeted surveys of species of conservation significance to determine the importance of the project area for these species, and in particular to identify key

locations of importance. Targeted surveys also provide baseline data for future reference/monitoring.

- Conduct general fauna observations and detailed surveys to gather abundance and distribution data on the general vertebrate fauna assemblage and confirm the presence of species returned from the database search. Detailed surveys can also provide baseline data for future reference/monitoring.

Subsequently, **Impact assessment** is carried out to determine how the fauna assemblage may be affected by the proposed development based on the interaction of the project with a suite of ecological and threatening processes.

2.1.2 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:

- Development footprint – the expected extent of land clearing and/or development; usually a subset of the project area but in some cases this will be equivalent to project area (where the entire project area is proposed to be developed).
- Project area – the outermost boundary within which the proposed project will be located (the maximum envelope in which development could occur). This will usually be a lease area or land over which the proponent has some tenure. In this report, the project area comprises the three leases/tenements as described in Section 1.2.1.
- Survey area – the outermost boundary of the environmental impact assessment (including the area to which the results of the desktop analysis are directed and/or the area where field investigations are conducted). While the minimum survey area boundary is equivalent to project area, often this boundary will exceed that of the project area where reference, contextual or regional information is sourced (including field investigations outside of the project area; i.e. outside the land over which the proponent has tenure). 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.
- Study area – the outermost boundary of the desktop assessment that is almost always a specified buffer distance (see Section 2.3.1) around the project area, or the project area centroid. This is generally the area from which databases records are sourced.

Where available, these spatial boundaries are mapped in Figure 7.

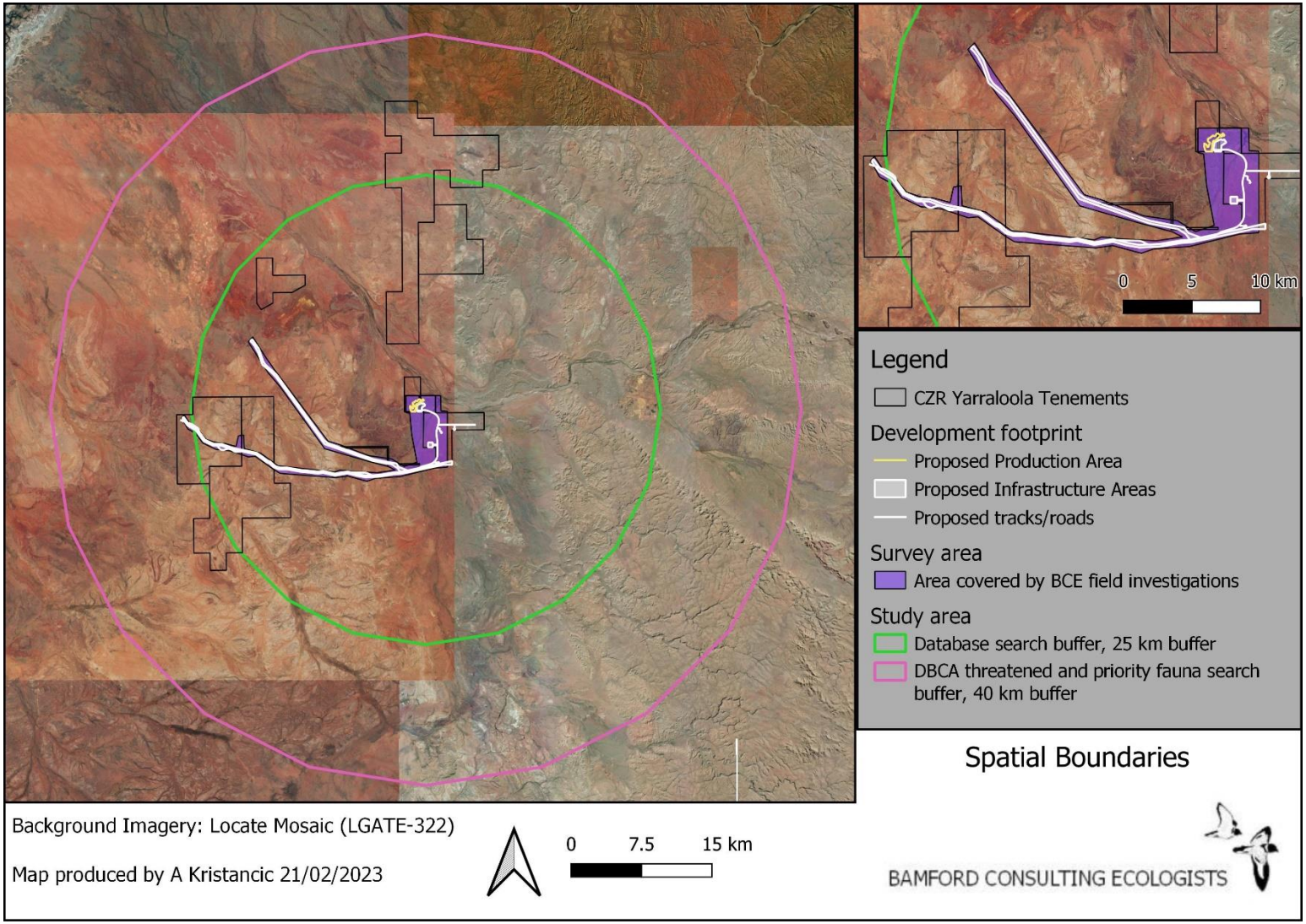

Figure 7. Spatial boundaries and terminology used throughout this report. Note that a subset of the Yarraloola tenements makes up the project area.

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 1.

For the current assessment, VSAs were identified based on the consultant's previous experience in the area and observations made during the field investigations. Maps of VSAs were created based on vegetation surveys conducted by Biota (2022a).

2.3 Desktop assessment of expected species

2.3.1 Sources of information

As per the recommendations of EPA (2020), information on the fauna assemblage of the project area was drawn from a range of sources including databases (as listed in Table 4 and reports from other fauna surveys in the region (as listed in Table 5). There have been multiple studies by other consultants in the region, particularly for the Rio Tinto Mesa A to H iron ore operations. Most species records from these studies are likely to be contained in the NatureMap database which was consulted as part of the desktop assessment. Information from these sources was supplemented with species expected in the area based on general patterns of distribution. Sources of information used for these general patterns are listed in Table 6.

Table 4. Databases searched for the desktop review; accessed September 2020.

Database	Type of records held in database	Area searched
BCE Database	Fauna recorded by BCE in the vicinity of the project area.	25 km buffer around the centroid of the project area (399000E, 7593000N).
Atlas of Living Australia (ALA 2021)	Fauna records from Australian museums and conservation/research bodies, including records from BirdLife Australia's Atlas (Birdata) Database.	25 km buffer around the centroid of the project area (399000E, 7593000N).
NatureMap (DBCA 2021)	Records from the Western Australian Museum (WAM) and Department of Biodiversity, Conservation and Attractions (DBCA) databases, including historical data.	25 km buffer around the centroid of the project area (399000E, 7593000N).
DBCA Threatened and Priority Fauna (DBCA, 2022b)	Threatened fauna records held by the Department of Biodiversity, Conservation and Attractions.	25 km buffer around the centroid of the project area (399000E, 7593000N). **Updated search conducted 2nd July 2022** (40km buffer around 399000E, 7593000N)
EPBC Protected Matters Search Tool (DCCEEW, 2023)	Records on MNES protected under the EPBC Act.	25 km buffer around the centroid of the project area (399000E, 7593000N).
Index of Biodiversity Surveys for Assessment (IBSA) (DWER, 2023c)	Flora and fauna data contained in EIA biodiversity survey reports.	25 km buffer around the centroid of the project area (399000E, 7593000N).

Table 5. Details of previous fauna assessments in the region of the CZR project.

Author	Title
BC Iron Ltd (2016)	Mining Proposal for the Buckland Project Mine and Haul Road
Astron (2017b)	Warramboo Level 2 fauna assessment
Astron (2017a)	Mesa H Ghost Bat *Macroderma gigas* – contextual study
Astron (2016c)	Mesa H Level 2 fauna assessment
Astron (2016b)	Middle Robe and East Deepdale Level 2 Fauna Assessment
Astron (2016a)	Bungaroo Level 2 Fauna Assessment
Astron (2014)	Mesa H - Level 1 Flora, Vegetation and Fauna Assessment
Bat Call (2017c)	Robe Valley Mesas A and C, Ghost Bat roost cave assessment
Bat Call (2017b)	Robe Valley Mesas H, Ghost Bat roost cave assessment
Bat Call (2017a)	Robe Valley Mesas A to Mesa 2405A, Ghost Bat presence and activity.
Bat Call (2016)	Mesa H Survey, Pilbara WA, September-October 2015 / May-June 2016: Echolocation Survey of Bat Activity
Biologic (2014)	Targeted Survey at Yarraloola
Biota (2005)	Mesa A and G Fauna assessment
Biota (2006a)	Mesa A Transport Corridor and Warramboo fauna assessment
Biota (2007)	Mesa K targeted fauna survey
Biota (2009a)	West Pilbara Iron Ore Project rail corridor fauna assessment
Biota (2009b)	West Pilbara Iron Ore Project Rail Corridor Fauna and Flora Assemblages Survey
Biota (2010)	Robe Valley Mesas fauna assessment
Ecologia (2013)	Middle Robe and East Deepdale Fauna assessment

Table 6. Sources of information used for general patterns of fauna distribution.

Taxa	Sources
Fish	Morgan *et al.* (1998), Allen *et al.* (2003), Morgan *et al.* (2014), DoF (2020).
Frogs	Tyler and Doughty (2009), Anstis (2017).
Reptiles	Storr *et al*. (1983, 1990, 1999, 2002), Bush and Maryan (2011), Wilson and Swan (2021).
Birds	Johnstone and Storr (1998, 2005), Menkhorst *et al*. (2017).
Mammals	Van Dyck and Strahan (2008), Churchill (2009), Menkhorst and Knight (2011).

2.3.2 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 2020. The authorities used for each vertebrate group were: fish (Morgan *et al.* 2014), frogs (Doughty 2021a), reptiles (Doughty 2021b), birds (BirdLife Australia 2019; Gill *et al.* 2021), and mammals (Travouillon 2021). 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'). 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.

2.3.3 Interpretation of species lists

2.3.3.1 Expected occurrence

Species lists generated from the review of sources of information are generous as they include records drawn from a large region (the study area, see Figure 7) and possibly from environments not represented in the project area. Therefore, some species that were returned by one or more of the database and literature searches have been excluded because their ecology, or the environment within the project area, determine that it is highly unlikely that these species will be present. Such species can include, for example, seabirds that might occur as extremely rare vagrants at a terrestrial, inland site, but for which the site is of no importance. Species returned from the databases and not excluded on the basis of ecology or environment are therefore considered potentially present or expected to be present in the project area at least occasionally, whether or not they were recorded during field surveys, and whether or not the project area is likely to be important for them. This list of expected species is therefore subject to interpretation by assigning each a predicted status, the expected occurrence, in the project area. The status categories used are:

- **Resident:** species with a population permanently present in the project area;
- **Regular migrant or visitor:** species that occur within the project area regularly in at least moderate numbers, such as part of an annual cycle;
- **Irregular Visitor:** species that occur within the project area irregularly such as nomadic and irruptive species. The length of time between visitations could be decades but when the species is present, it uses the project area in at least moderate numbers and for some time;
- **Vagrant:** species that occur within the project area unpredictably, in small numbers and/or for very brief periods. Therefore, the project area is unlikely to be of importance for the species; and
- **Locally extinct:** species that would have been present but has not been recently recorded in the local area and therefore is almost certainly no longer present in the project area.

These status categories make it possible to distinguish between vagrant species, which may be recorded at any time but for which the site is not important in a conservation sense, and species which use the site in other ways but for which the site is important at least occasionally. This is particularly useful for birds that may naturally be migratory or nomadic, and for some mammals that can also be mobile or irruptive, and further recognises that even the most detailed field survey can fail to record species which will be present at times. The status categories are assigned conservatively based on the precautionary principle. For example, a lizard known from the general area is assumed to be a resident unless there is very good evidence the site will not support it, and even then it may be classed as a vagrant rather than assumed to be absent if the site might support dispersing individuals. It must be stressed that these status categories are predictions only and that often very intensive sampling would be required to confirm a species' status.

The results of the database searches were reviewed and interpreted, and obvious errors and out of date taxonomic names were deleted.

2.3.3.2 Conservation significance

All expected species were assessed for conservation significance as detailed in Appendix 1. Three broad levels of conservation significance are used in this report:

- Conservation Significance 1 (CS1) – species listed under State and/or Commonwealth Acts such as the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or the Western Australian *Biodiversity Conservation Act 2016* (BC Act);
- Conservation Significance 2 (CS2) – species listed as Priority by DBCA but not listed under State or Commonwealth Acts; and
- Conservation Significance 3 (CS3) – species not listed under Acts or in publications, but considered of at least local significance because of their pattern of distribution.

See Appendix 1 for an expanded discussion of these categories and Appendix 2 for a description of the categories used in the legislation (EPBC and BC Acts) and by the DBCA. Note that these conservation significance levels also apply to invertebrates. Invertebrates identified as or possibly as Short Range Endemic (SRE) species have no formal listing, so are therefore CS3.

2.4 Field investigations

2.4.1 Overview

The approach to field investigations was developed to be consistent with the intent of guidance as outlined in Section 2.1. Four field trips were conducted: two were site inspections and targeted surveys of the mine area and adjacent mesa edges (May and Oct/Nov 2021), and two (July and September 2022) involved site inspections, targeted and detailed surveys that encompassed the mine area, infrastructure area and haul road routes. A summary of field investigations is provided here; further information is provided in subsequent sections.

May 2021 – focus on western portion of proposed development area

- Targeted surveys for Northern Quoll, Rock-wallaby, Western Pebble-mound Mouse, Pilbara Leaf-nosed Bat, Ghost Bat, and Pilbara Olive Python
    - Motion sensitive cameras and bat detectors
    - Searching for signs (e.g. scats, tracks, feeding debris) of significant species
    - Evening observations at known and suspected bat roosts
- Bird area searches
- Opportunistic fauna observations
- Identification of Vegetation and Substrate Associations (VSAs) in the mine area.

Oct/Nov 2021 – focus on eastern portion of proposed development area

- Targeted surveys for Northern Quoll, Pilbara Leaf-nosed Bat, Ghost Bat, and Olive Python
    - Including motion sensitive cameras and bat detectors
- Opportunistic fauna observations

July 2022

- Phase 1 of detailed survey across infrastructure area
    - Including pitfall traps, funnel traps, motion sensitive cameras, bat detectors, hand-searching and head-torching
- Inspection of potential haul road routes via helicopter including searching for evidence of significant species
- Searching for evidence of significant species along the lower slopes of Mesa F
- Opportunistic fauna observations.
- Identification of Vegetation and Substrate Associations (VSAs) in the infrastructure area and haul road routes.

September 2022

- Phase 2 of detailed survey across infrastructure area (repeat of pitfall traps, funnel traps, motion-sensitive cameras, bat detectors and head-torching)
- Evening observations and bat-detectors along mesa edge (to coincide with use of maternity roosts by Pilbara Leaf-nosed Bats and Ghost Bats).
- Opportunistic fauna observations.

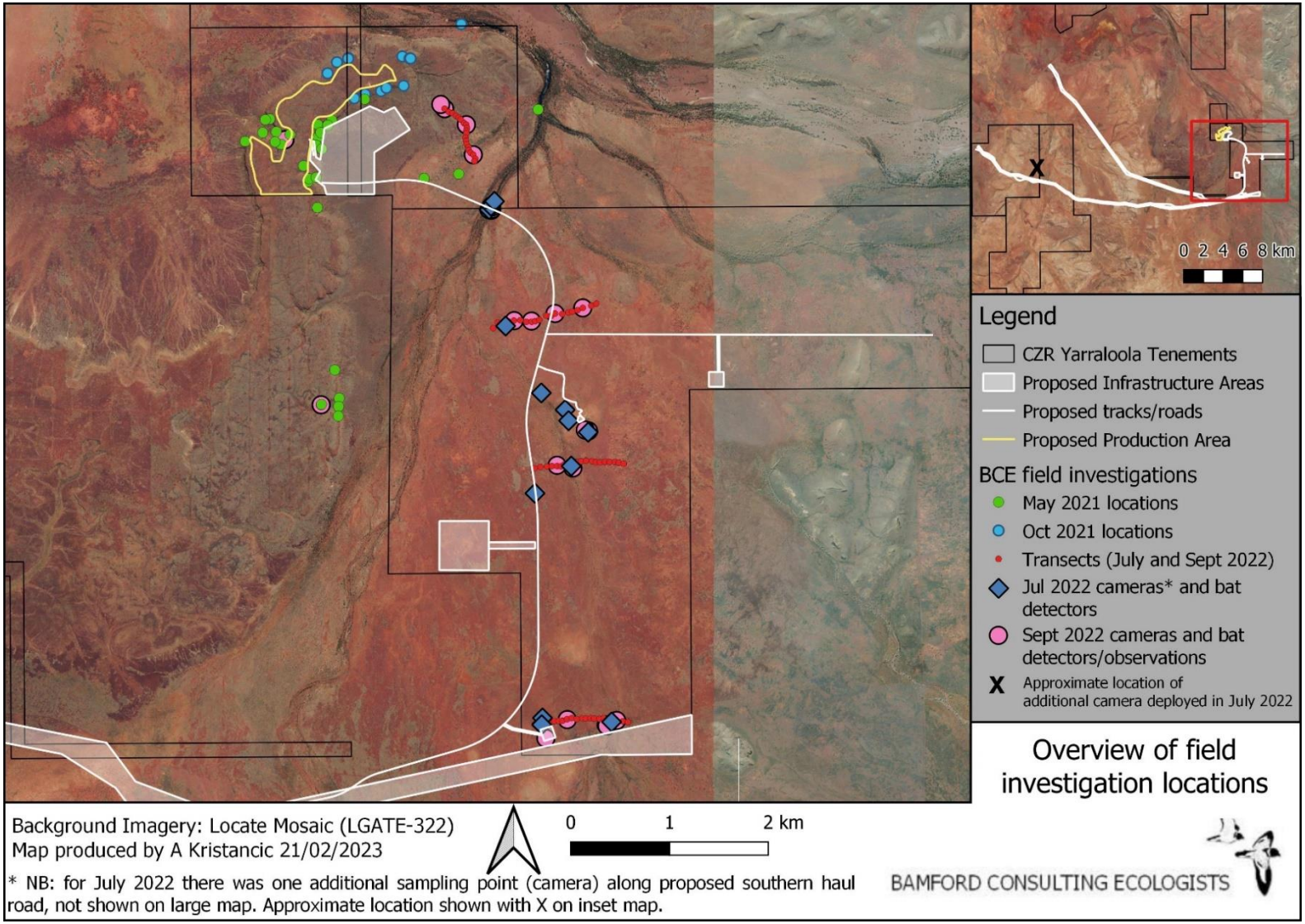

Figure 8. Overview of locations of field investigations. Note: this does not show GPS tracks; these are shown in separate figures.

2.4.2 Personnel and permits

Personnel involved in the field investigations and report preparation (including desktop review) are listed in Table 7. The field investigations were carried out under Regulation 27 licence BA27000654 and Wildlife Animal Ethic Committee permit number WAEC 22-02-22.

Table 7. Personnel involved in the field investigations and report preparation.

Personnel	EIA Experience	Site inspection/ targeted surveys		Detailed survey		
		May 2021	Oct/Nov 2021	July 2022	Sept 2022	Report Preparation
Dr Mike Bamford *BSc (Biology), Hons (Biology), PhD (Biology)*	40 years	+	+	+	+	+
Mr Brenden Metcalf *BSc, Hons*	25 years	+				+
Mr Tim Gamblin *BSc*	15 years	+				
Mr Andy McCreery *BSc*	15 years	+				+
Dr Jamie Wadey *BSc, Hons, PhD*	5 years		+			
Ms Natalia Huang *BSc (Zoology), Hons (Conservation Biology), MBA*	25 years					+
Samantha Lostrom BSc	10 years			+	+	
Peter Smith *Assoc. Dip. Ag. (Farm Management)*	35 years			+	+	
Eliza-Joyce Mellersh	5 years			+	+	
Dr Amanda Kristancic *BSc (Zoology), Hons (Zoology), PhD (Parasitology)*	2 years					+

2.4.3 General Description of Methods

General descriptions of the key sampling methods are provided below, with details of their application in field trips provided in field trip accounts. Note that descriptions of sampling methods can also be found in Bamford *et al.* (2013). Pitfall traps, funnel traps and bird censussing are systematic methods that have a standardised effort and allow for measures of abundance to be determined. Other sampling methods can only be roughly standardised and really only provide confirmation of presence, but in some cases can also give an indication of abundance.

2.4.3.1 Pitfall traps

The pitfall traps used were 20 litre plastic buckets, with a drainage hole (covered in fine mesh); these were deployed in transects of usually 20 pitfalls, with the pitfalls at 30-40m intervals. Each pitfall was assisted with a three-way driftfence 1.2m in length. Pitfalls were generally checked by mid-morning, and in some cases were re-checked around midday to avoid animals caught after the morning check being in the pitfall through the heat of the day.

2.4.3.2 Funnel traps

These were placed on every second pitfall trap on an extended driftfence. Funnel traps were covered with a shade. On hot days funnels were left open after being checked in the morning and reset in the evening to reduce stress and mortality of captured fauna.

2.4.3.3 Bird censussing

Bird censussing occurred at each pitfall trap when it was being checked, with all birds within 25m identified and counted as far as practical. This gave about five census events at each pitfall in each of the July and September field trips. Other bird species outside 25m were recorded each time a pitfall transect was checked.

2.4.3.4 Motion sensitive cameras

Motion-sensitive cameras were used to target ground-dwelling fauna and particular conservation significant mammals. Generally, cameras were set with a non-accessible lure: tinned fish, rolled oats, peanut paste in a perforated PVC tube, as recommended by Moore *et al.* (2020). In September 2022, some cameras were aimed at pits along transects, and these were not set with a lure.

2.4.3.5 Bat detectors

Autonomous recording units (ARUs) were used to detect bats, particularly the two conservation significant species expected in the area, the Ghost Bat and Pilbara Leaf-nosed Bat. These devices were deployed in areas where bats were expected, and were set to record ultrasonic calls of bats from just before sunset to just after sunrise. Acoustic recordings are then analysed and compared with characteristics of calls from known bat species. Acoustic recordings were analysed by Brenden Metcalf in order to identify bat species present within the detection area of each ARU. The ARUs used were Song Meters (four SM2s and four SM4s) and one Anabat Swift (October 2021 only). Useful recordings were obtained from ARUs in May 2021 and September 2022. In October 2021 and July 2022, the devices used did not function correctly or recorded no bat calls.

2.4.3.6 Hand-searching

Hand-searching involves turning over rocks and logs, raking through leaf-litter and generally searching for reptiles. It is a highly effective technique to find cryptic species that may not enter traps, and is best carried out in the cooler months when reptiles are slow-moving and often shelter close to the surface under debris. It can be carried out at during the day or at night.

2.4.3.7 Head-torching and spotlighting

Head-torching involves searching for animals (usually nocturnal reptiles) at night, on foot and using a head-torch. Spotlighting is vehicle-based with animals either being seen in the headlights or detected to one side in a hand-held spotlight. Head-torching for reptiles is best carried out on warm evenings and can include searching.

2.4.3.8 Opportunistic observations

These observations can be made at all times when in the field, and also around camp (which was on-site during all field trips except October 2021). Opportunistic observations can confirm the presence of a large proportion of the bird assemblage, and is also when some large reptiles and mammals are recorded.

2.4.3.9 Significant invertebrates

While Biota (2022b) carried out detailed assessment for significant invertebrates, including SRE species, some work was carried out during BCE surveys. The total active search effort for invertebrates by BCE personnel was about 30 person-hours, including 20 hours on the mesa top (mine area); 16 hours in daylight and four hours at night. Invertebrates were also sampled opportunistically via pitfall traps, and general opportunistic observations during other field work. Details for invertebrate search methods are as follows:

May 2021. Searching across the mesa top (mine area) and on the mesa edge, including turning over rocks, logs and piles of vegetation pushed up along tracks. The entrances to caves were also checked by turning over debris. Four people for about four hours, although much longer spent opportunistically. Also searched under woody debris, branches, loose bark and leaf litter along major drainage lines. Four people for about an hour. Areas visited indicated on Figure 9.

July and September 2022. All pitfalls checked for potential significant invertebrates (e.g. slaters, scorpions and trapdoor spiders). Special attention on trapdoor spiders at the request of D. Kamien (Biota) due to this group not being well-represented in the Biota invertebrate surveys. In July, also searching under leaf-litter and loose soil pushed up along tracks in the infrastructure area (two people for an hour), and along the major drainage line where accumulations of deep litter under large trees was targeted (four people for an hour; near site 5). Searching under litter and piles of soft soil and plant material also carried out at night in the infrastructure area in July (four people for an hour) and on top of the mesa in the mine area in September (four people for an hour). Areas visited indicated on Figure 14.

Invertebrate specimens collected during the above investigations were provided to Biota for inclusion in their work.

Table 8. Summary of sampling methods used in the project area across the four field trips.

Sampling method	May 2021	Oct 2021	July 2022	Sept 2022
Overall approach	Site reconnaissance and targeted surveys mesa area and adjacent	Targeted surveys mesa area	Phases 1 and 2 of level 2 (Detailed) survey (infrastructure areas) and reconnaissance and targeted surveys of haul road options and mesa area	
Pitfall trapping	-	-	510 trapnights	510 trapnights
Funnel trapping	-	-	238 trapnights	258 trapnights
Bird censussing	6x "20 minute, 2 hectare area search count" (2 on mesa top, 4 elsewhere)	-	505 census events	510 census events
Motion-sensitive cameras	9 locations; 13 camera-nights	10 locations; 30 camera-nights	10 locations; 37 camera nights	20 locations; 61 camera-nights
ARUs	9 locations; 10 unit-nights	4 locations over 4 nights but device failed	4 locations over 8 nights but devices failed, or recorded no bat calls	5 locations; 13 unit-nights
Hand-searching	c. 20 person-hours	Some opportunistic	10 person-hours	Four person-hours
Head-torching	Three evenings; four personnel	One evening; two personnel	Four evenings; four personnel	Four evenings; four personnel
Evening bat roost observations	Three evenings with four personnel.	One evening with two personnel	-	Two evenings; four personnel
Opportunistic observations	Four personnel, four days; including nights (camped on site)	Two personnel, four days; one evening	Four personnel, eight days. Mine camp adjacent to site so some evening observations	Four personnel, eight days. Mine camp adjacent to site so some evening observations
Significant Invertebrates	16 person-hours (mesa top and edge, daylight), + 4 person-hours (infrastructure area, daylight), + opportunistically	-	Pitfalls, + 6 person-hours (infrastructure area, daylight), + 4 person-hours (infrastructure area, night)	Pitfalls, + 4 person-hours (mesa top, night)

2.4.4 Targeted Surveys (May and Oct/Nov 2021)

Two targeted survey trips were conducted: 26th to 29th May 2021 and 30th October to 3rd November 2021. During each field trip, a site inspection was conducted to familiarise the consultants with the project area. These survey trips focussed on the mining area and adjacent landscapes, and involved looking around as much of the project area as possible; including walking through areas that did not have direct vehicle access. These field trips enabled:

- identification of VSAs (that provide fauna habitats);
- targeted searches for significant fauna and an assessment of their likelihood of occurrence based on VSAs present;
- continuous recording of bird species encountered; and
- opportunistic fauna observations.

The proposed area for ore extraction is in the northern part of Mesa F therefore that was the focus of the field investigations. Secondary effort was focused on critical habitat for Conservation Significant (CS) species surrounding the proposed area for ore extraction. The ore extraction area within Mesa F consisted of the mesa plateau, but the mesa edge of gorge and gully formations, with breakaways, caves, overhangs and crevices along this edge, is adjacent to the mine area. These formations were searched for signs of CS fauna, in particular: Northern Quoll, Pilbara Leaf-nosed Bat, Ghost Bat and Pilbara Olive Python. Scats, feeding debris, tracks and other traces were searched for and recorded. As well as CS species, all vertebrate fauna observed were recorded and included in Appendix 8.

2.4.4.1 May 2021

2.4.4.1.1 Summary

The field investigations in May 2021 focussed on the western section of the area of proposed ore extraction (Figure 9, Figure 10). During this visit, four personnel conducted targeted searches for signs of Conservation Significant fauna: specifically Northern Quoll, Rock-wallabies, bats, and Ngadji (western pebble-mound mouse). Motion sensitive cameras and bat detectors were also deployed. Figure 9 illustrates the survey effort with GPS tracks from the four personnel showing areas covered. Note that personnel camped on site, allowing observations to be made well into the evening and from sunrise each day. During multiple consecutive evenings, personnel watched for Ghost Bats at a known maternity roost or other areas expected to be frequented by this species (locations shown on Figure 10 and Table 11). Several 20 minute, 2 hectare bird searches were conducted during May 2021, with details as follows:

- 27th May 2021
    - Mesa top
    - Flats near camp
- 28th May 2021
    - Flats near camp
    - Along draining line near Robe Pool
- 29th May 2021
    - Flats near camp
    - Mesa top

Due to forecast of excessive rain, field investigations were finalised on 29th May 2021.

2.4.4.1.2 Motion sensitive cameras

In May 2021, nine motion sensitive cameras were deployed; six were deployed in rocky areas where Northern Quoll and rock-wallabies are likely to be found. Two cameras were placed on waterbodies; one at a permanent waterhole along Robe Pool and one on a gnamma hole (in a rocky area) on Mesa F. One camera was set in thickets on the mesa flats. The coordinates and dates of cameras are displayed in Table 9, and locations are indicated in Figure 10.

Table 9. Details of motion sensitive cameras deployed in the project area during May 2021.

Camera ID	UTM coordinates (Zone 50 K)	Date deployed	Date retrieved	Description
BCE14	398167 7593577	28/05/2021	29/05/2021	Cave on mesa edge
BCE16	398499 7593789	28/05/2021	29/05/2021	Cave on mesa edge
BCE02	398029 7593406	28/05/2021	29/05/2120	Mesa edge at base of rocky crevices
BCE20	398021 7592693	27/05/2021	29/05/2021	Cave on mesa edge
BCE04	397290 7593362	27/05/2021	29/05/2021	Cave on mesa edge
BCE11	397653 7593333	27/05/2021	29/05/2021	Cave on mesa edge
BCE13	397925 7592955	27/05/2021	29/05/2021	Gnamma hole on mesa
BCE03	400256 7593685	28/05/2021	29/05/2021	Shoreline of Robe Pool
BCE10	397880 7593115	28/05/2021	29/05/2021	Thicket on top of mesa

2.4.4.1.3 Bat detectors and observations

In May 2021, bat detectors were deployed at 9 locations; seven of these were near significant caves within Mesa F or elsewhere along the mesa formation, and two were on river flats in-between Mesa F and Robe Pool to detect bats flying overhead (camp & river flats). Sites near caves were selected on the potential of the cave to provide roosting habitat for bats; those being large caves with the appearance of depth and height that give rise to humid and stable conditions. Location details are provided in Table 10 and Figure 10.

The three evenings on site were dedicated to bat-observation. This method was employed primarily to detect Ghost Bats. It involved 4 personnel standing 100-200 metres apart at a targeted location to observe bats flying from their diurnal roosts. Observations occurred from approximately sunset until after twilight; between 40 – 60 minutes after sunset. The locations were chosen based on the presence of large caves and previously known Ghost Bat records in the area. The location on the 26th (night 1) was selected due to the large cave entrances in the gully on the western edge of Mesa F. This location is also in close proximity to the proposed mining area. The location on night 2 was chosen due to the historical knowledge of the maternal roost approximately 2 km south of the mining area and 750 metres west of the proposed haul road. This location is not in the project area. The third

night focussed along the eastern edge of Mesa F where many potential roost caves occur. This area is also in close proximity to the direct impact area. Details are presented in Table 11 and Figure 10.

Table 10. Details of bat detectors deployed in the project area in May 2021.

Detector type and ID	UTM coordinates (Zone 50 K)	Date deployed	Date retrieved	Location
Swift - MoE	399101 7592988	26/05/2021	27/05/2021	Camp
SM4 - 01240	399101 7592988	27/05/2021	28/05/2021	Camp
SM4 - 01240	399452 7593033	26/05/2021	27/05/2021	River flats, east of Camp
SM4 - 01247	397539 7593589	27/05/2021	28/05/2021	Cave at West of area
Swift - MoE	397744 7593432	27/05/2021	28/05/2021	Gully at eastern end of Western gorge
SM4 - MoE	398059 7590698	27/05/2021	28/05/2021	Ghost Bat Roost (Suspected)
SM4 - 01247	397935 7592985	28/05/2021	29/05/2021	East Cliff A
Swift - MoE	398008 7593323	28/05/2021	29/05/2021	East Cliff B
SM4 - MoE	398025 7593532	28/05/2021	29/05/2021	East Cliff C
SM4 - 01240	398197 7591050	28/05/2021	29/05/2021	Ghost Bat Roost (Actual)

Table 11. Dates and times of the evening bat-observations during May 2021.

Date	Pers.	UTM coordinates (Zone 50 K)	Start time	End time	Location description
26/05/2021	BM	397494 7593582	17:40	18:25	Gully on western edge of Mesa F
	AM	397605 7593459	17:35	18:20	
	TG	397593 7593358	17:35	18:25	
	MB	397468 7593451	17:40	18:25	
27/05/2021	TG	398242 7590765	17:40	18:20	Gully on suspected maternal roost
	MB	398236 7590681	17:35	18:25	
	AM	398062 7590702	17:45	18:30	
	BM	398233 7590584	17:40	18:25	
28/05/2021	TG	398054 7593452	17:40	18:20	Eastern edge of Mesa F
	MB	398064 7593286	17:35	18:20	
	AM	398126 7593526	17:35	18:30	
	BM	398008 7592996	17:40	18:20	

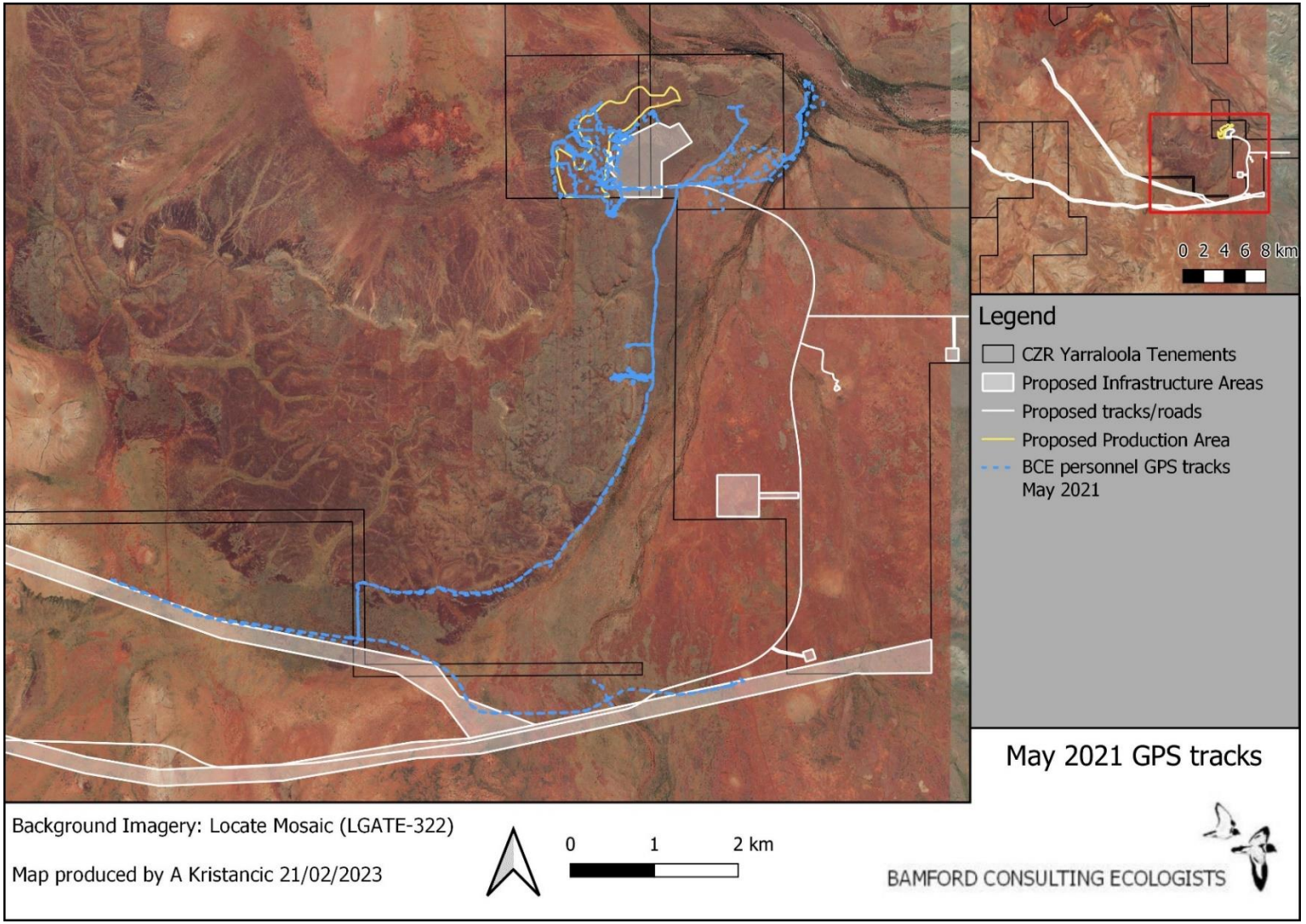

Figure 9. GPS tracks of BCE personnel during field investigations in May 2021. Searching for SRE invertebrates took place across the mesa top and along the mesa edge.

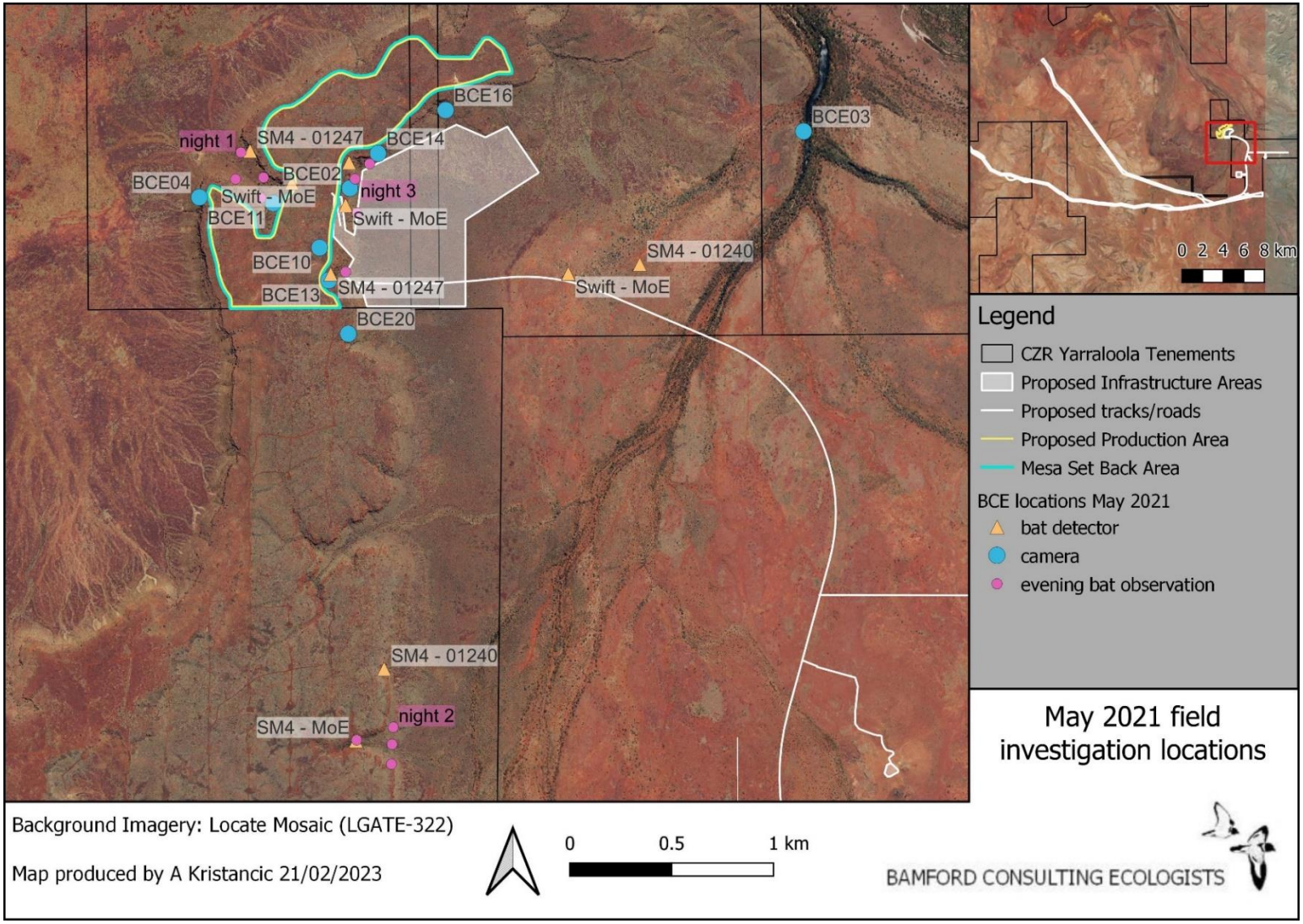

Figure 10. Locations of bat detectors, motion sensitive cameras and evening bat-observations during May 2021. The known Ghost Bat roost is in the vicinity of the label 'night 2'.

2.4.4.2 October/November 2021

2.4.4.2.1 Summary

In October/November 2021, field investigations focussed on the eastern section of the area of proposed ore extraction (Figure 8, Figure 12), and involved setting motion sensitive cameras, bat detectors and evening bat observations. Opportunistic fauna observations were also made.

2.4.4.2.2 Motion sensitive cameras

In Oct/Nov 2021, nine motion sensitive cameras were deployed; 8 were deployed along a cliff line directed at caves or shelters, and one was deployed on top of the mesa, close to the area of proposed direct impact. Locations for cameras were chosen to target Northern Quoll and rock-wallabies. Motion sensitive cameras were deployed with sealed bait tubes to attract fauna. Details and locations of cameras are provided in
Table 12 and Figure 12.

2.4.4.2.3 Bat detectors and observations

During Oct/Nov 2021, one Anabat Swift bat detector was deployed for one night at each of four locations. On the evening of 2nd November 2021, two personnel watched for emerging bats at two locations at the top of the mesa, near caves that were thought to be suitable for Ghost Bats and Pilbara Leaf-nosed Bats. Locations and details for bat detectors and observations are provided in

Table 13 and Figure 12. The bat detector deployed in Oct/Nov 2021 failed and no recordings were obtained.

Table 12. Details of motion sensitive cameras deployed in the project area during field investigations in Oct/Nov 2021 (UTM Zone 50 K).

Camera ID	Easting	Northing	Date deployed	Date retrieved	Location description
BCE32	398124	7594051	30/10/2021	3/11/2021	Cliffline directed at cave
BCE16	398219	7594163	30/10/2021	3/11/2021	Cliffline directed at cave
BCE02	398334	7594208	30/10/2021	3/11/2021	Cliffline directed at cave
BCE23	398881	7594222	30/10/2021	3/11/2021	Cliffline directed at cave
BCE33	398954	7594201	30/10/2021	3/11/2021	Cliffline directed at cave
BCE20	398665	7593871	30/10/2021	3/11/2021	Cliffline directed at cave
BCE13	398494	7593834	30/10/2021	3/11/2021	Cliffline directed at cave
BCE06	398720	7593903	30/10/2021	3/11/2021	Cliffline directed at cave
BCE10	398894	7593925	30/10/2021	3/11/2021	On top of mesa
BCE30	398396	7593799	30/10/2021	3/11/2021	Within cave

Table 13. Details of evening bat observations and bat detectors (ARUs) deployed in the project area in Oct/Nov 2021 (Zone 50K).

Method	ARU type and ID	Easting	Northing	Date deployed	Date retrieved	Location
Evening bat observation	(Waypoint C11)	398124	7594051	2/11/2021	n/a	Caves thought suitable for CS bat species
Evening bat observation	(Waypoint C12)	398219	7594163	2/11/2021	n/a	Caves thought suitable for CS bat species
ARU	AnaBat1, Bat 1	398504	7593840	30/10/2021	31/10/2021	Cave entrance on south side of mesa
ARU	AnaBat1, Bat 2	398333	7594200	31/10/2021	1/11/2021	Cave entrance on north side of mesa
ARU	AnaBat1, Bat 3	399478	7594548	1/11/2021	2/11/2021	Robe River
ARU	AnaBat1, Bat 4	398964	7594201	2/11/2021	3/11/2021	Cave entrance on north side of mesa

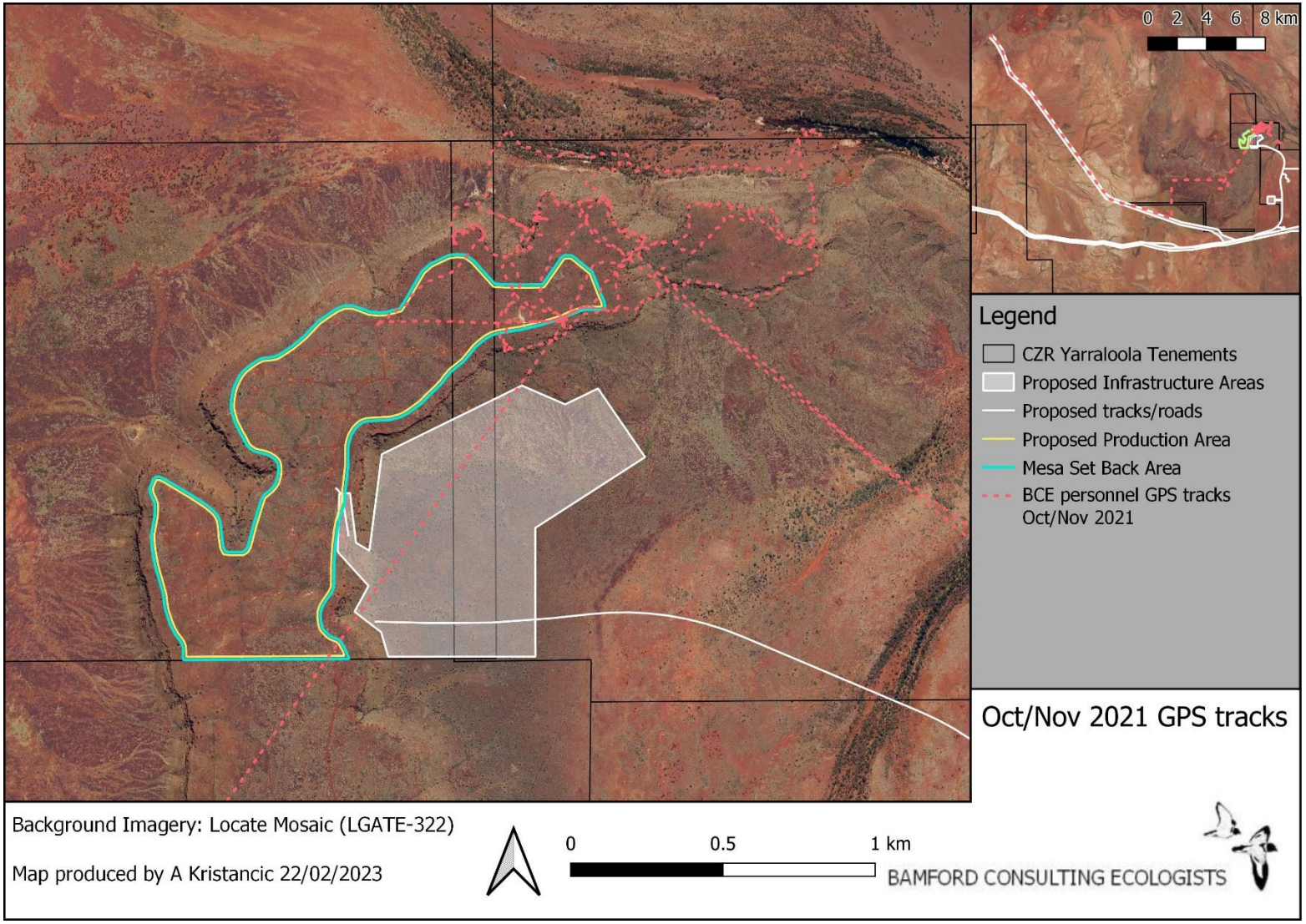

Figure 11. GPS tracks of BCE personnel during field investigations in Oct/Nov 2021

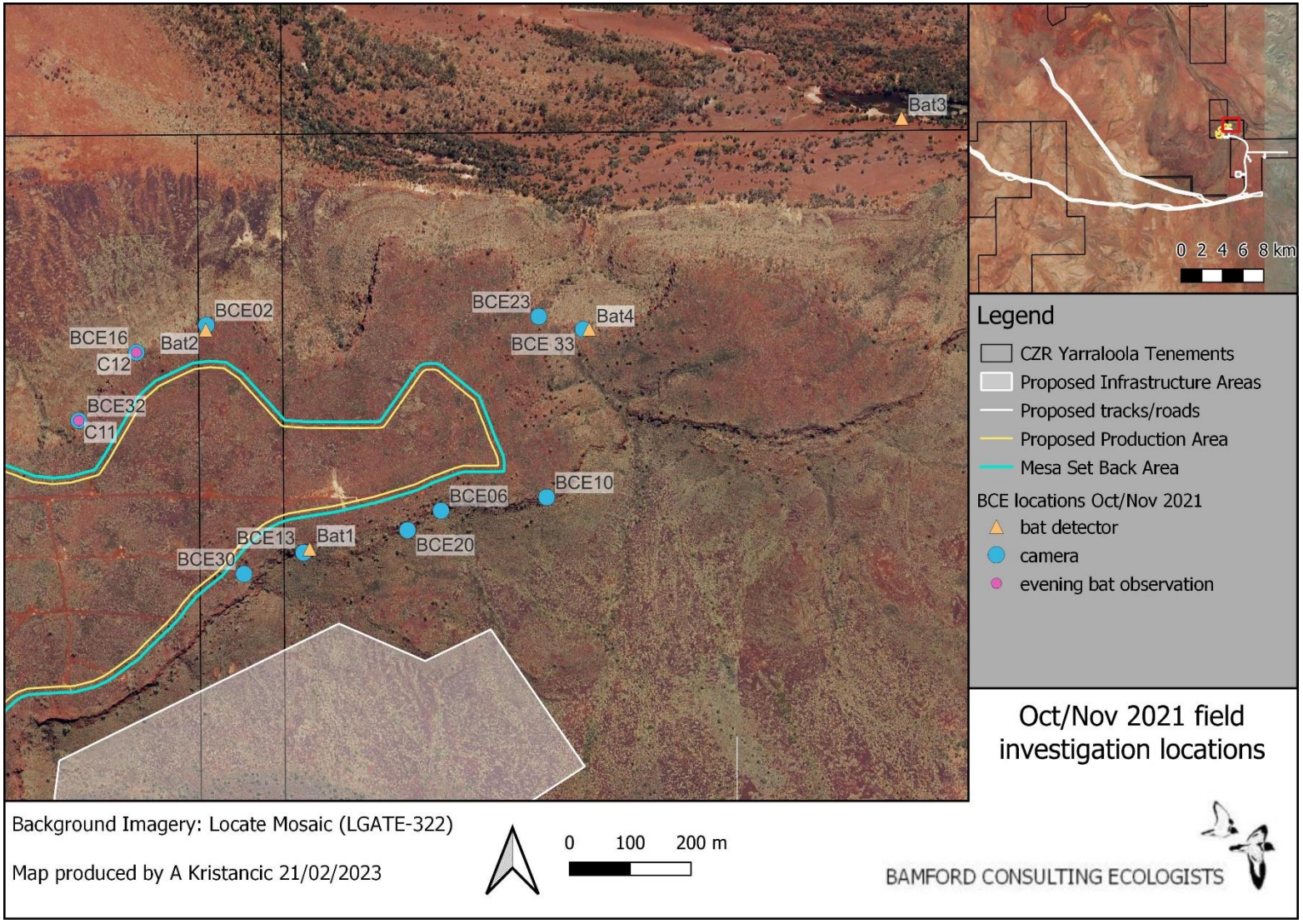

Figure 12. Locations of motion sensitive cameras, bat detectors and evening bat observations during Oct/Nov 2021 field investigations.

2.4.5 Detailed Surveys (1st to 9th July and 19th to 26th September 2022)

The field investigations comprising the detailed (level 2) survey focused on the flats and foothills of disturbance areas linked to infrastructure to the east and south of the mine area (Figure 1, Figure 8). Five sampling transects were installed (Figure 17), along which trapping and bird censusing were conducted in both July and September 2022. During both field trips (July and September), motion sensitive cameras and bat detectors were also deployed, and head-torching and active searches were conducted. In July 2022, the northern and southern potential haul road routes were inspected via helicopter.

2.4.5.1 Transects; pitfall traps, funnel traps and bird censusing

Locations of transects were chosen in order to sample across the landscape and through different environments. An overview of transect locations is shown in Figure 17 and detailed maps are provided for each transect as detailed below. Trapping and censussing did not include the mesa top as discussed in Section 2.1; the terrestrial vertebrate fauna of the mesa top is well-documented from previous regional studies, is depauperate due to the harsh landscape (limited range of vegetation structure, very shallow soils) and lacks species of conservation significance. The mesa top was the focus of site reconnaissance and targeted searching in earlier field trips.

Transect 1 to 4 each consisted of 20 sampling points, with a pitfall trap at each point and a funnel trap on every second point (thus 10 funnels on each transect). Transect 5 had only five pitfall traps and three funnel traps to target a small area of riverine environment and to avoid heritage areas. Pitfall and funnel traps were installed between 2nd-4th of July 2022, and were removed after the September field trip (25-26th September 2022). Bird censussing was carried out as outlined in Section 2.3.3, with each sampling point a bird census point (birds counted within 25m of each point), and with birds outside 25m also noted. Trapping and bird censusing effort are detailed in Table 14; there were over 1,000 pitfall nights and over 1,000 bird census events across the two field trips. Pitfalls and funnels were run for up to six nights in each of July and September, with some early closure due to weather conditions and to reduce risk of mortality (particularly with funnel traps). This had no effect on the recording of species; of the 43 reptile species recorded in the project area, only 23 were trapped (all others found by searching and/or opportunistic observation), and only nine species were found only by trapping (compared with 20 species found only by searching/opportunistic). In the September 2022 field trip when capture rates were high, only one species was added to the list by trapping after the fifth night (the goanna *Varanus brevicauda* on the sixth night; a species widespread across the Pilbara). Trapping recorded no species that were not expected to be present.

Transect 1 – Open tall shrubland of *Acacia* over spinifex, on gravelly loam and clayey loam flats. See Figure 18.

Transect 2 – Open low woodland of Bloodwood and open tall shrubland of *Acacia* over spinifex on gravelly loam and clayey loam flats, but crosses drainage line at CZ2.09. Taller eucalypts and mixed herbs/grasses, including Buffel, in red loams along drainage line, then over a low rocky rise (CZ2.10 to CZ2.12). From CZ2.13 to CZ2.20 passes through *Acacia* and *Cassia* tall shrubland with scattered bloodwood and very tall spinifex on red sandy loam. See Figure 19.

Transect 3 – Runs from gravelly foothills of mesa supporting spinifex with scattered shrubs, across a broad valley of *E. victrix* over Buffel Grass on deep red loam, past a seasonal pool, then onto low gravelly rise with scattered eucalypts, *Hakea* and spinifex. See Figure 20.

Transect 4 – Spinifex and occasional acacia thickets on gravelly loam flat. Crosses creekline with *E. victrix* in east. See Figure 21.

Transect 5 - Melaleuca riparian forest over rushes on dark loam soil with river gravel and rocks. Pools present and water flowing. See Figure 22.

Table 14. Details for sampling along transects in July and September 2022.

Transect	Pitfall and funnel traps		Bird censusing		Sampling effort		
July	Opened	Closed	First	Last	pits	funnels	Census
Transect 1	2/07/2022	8/07/2022	3/07/2022	8/07/2022	120	60	120
Transect 2	2/07/2022	8/07/2022	3/07/2022	8/07/2022	120	60	120
Transect 3	3/07/2022	9/07/2022	4/07/2022	9/07/2022	120	60	120
Transect 4	4/07/2022	10/07/2022*	5/07/2022	10/07/2022	120	40	120
Transect 5	4/07/2022	9/07/2022	5/07/2022	9/07/2022	30	18	25
					510	**238**	**505**
September							
Transect 1	20/09/2022	26/09/2022	21/09/2022	26/09/2022	120	60	120
Transect 2	20/09/2022	26/09/2022	21/09/2022	26/09/2022	120	60	120
Transect 3	20/09/2022	26/09/2022	21/09/2022	26/09/2022	120	60	120
Transect 4	19/09/2022	25/09/2022	20/09/2022	25/09/2022	120	60	120
Transect 5	20/09/2022	26/09/2022	21/09/2022	26/09/2022	30	18	30
					510	**258**	**510**
					1,020	**496**	**1,015**

* Funnels closed on 8/07/2022 on Transect 4.

2.4.5.2 Head torching and active searching

Head-torching and active searching were undertaken in both July and September 2022 (GPS tracks for these are shown in Figure 13 and Figure 14.

6/07/22. Head-torching. Four people in vicinity of Transect 5 and along watercourse. From about half an hour after sunset for an hour. Spotlighting on drive out and back to camp. Barking Owl call playback used briefly.

7/07/22. Active searching. Four people walked from near Transect 5 to easternmost outlying mesa; direct line c. 1.8km. Did active searching in litter and flood spoil along drainage line, then general searching during walk across to mesa with focus on looking for Ngadji (Pebble-mound Mouse) mounds.

8/07/22. Head-torching. Four people just north of Transect 2, around and over a small rocky hill ("Fig Tree Hill"). From about 20 minutes after sunset for 1.5 hours. Spotlighting on drive back to camp.

9/07/22. Head-torching. Two people around Transect 1 from 20 minutes after sunset for about 40 minutes. Spotlighting on drive back to camp.

22/09/22. Head-torching. Four people in vicinity of Transect 5 and along watercourse. From about half an hour after sunset for an hour. Spotlighting on drive out and back to camp. Active searching also carried out.

23/09/22. Head-torching. Four people just north of Transect 2, around and over a small rocky hill ("Fig Tree Hill"). From about 20 minutes after sunset for one hours. Spotlighting on drive back to camp.

24/09/22. Head-torching and active searching. Two people walked from Transect 2 across the mesa in daylight, searching under debris and litter for reptiles, then four people conducted head-torching and searching on mesa in mine area from half an hour after sunset for about an hour (Figure 14).

25/09/22. Head-torching and active searching. Parallel to and south of Transect 4, including around a stock watering point and drainage line near eastern end of Transect 4.

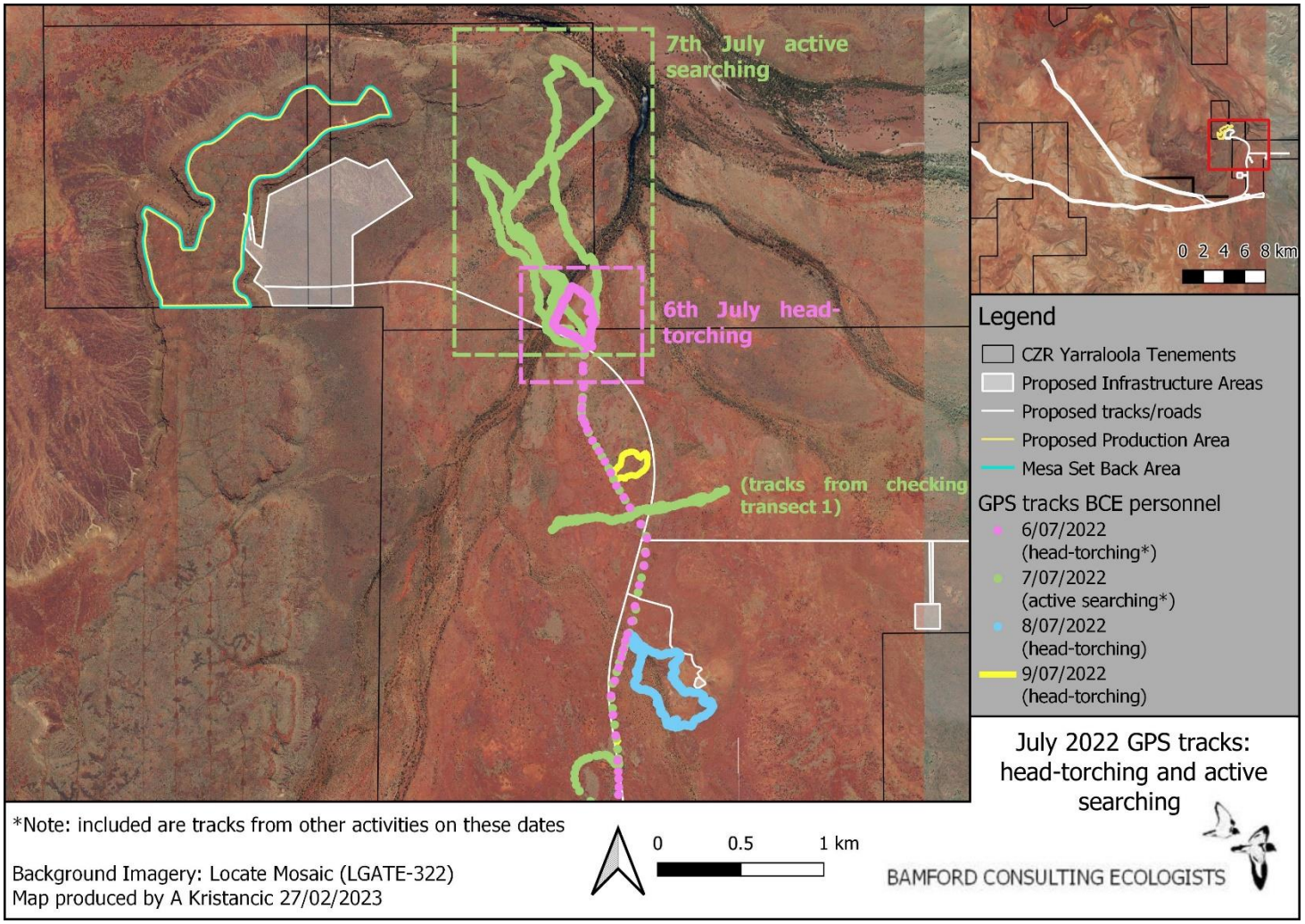

Figure 13. GPS tracks for head-torching and active searching in July 2022.

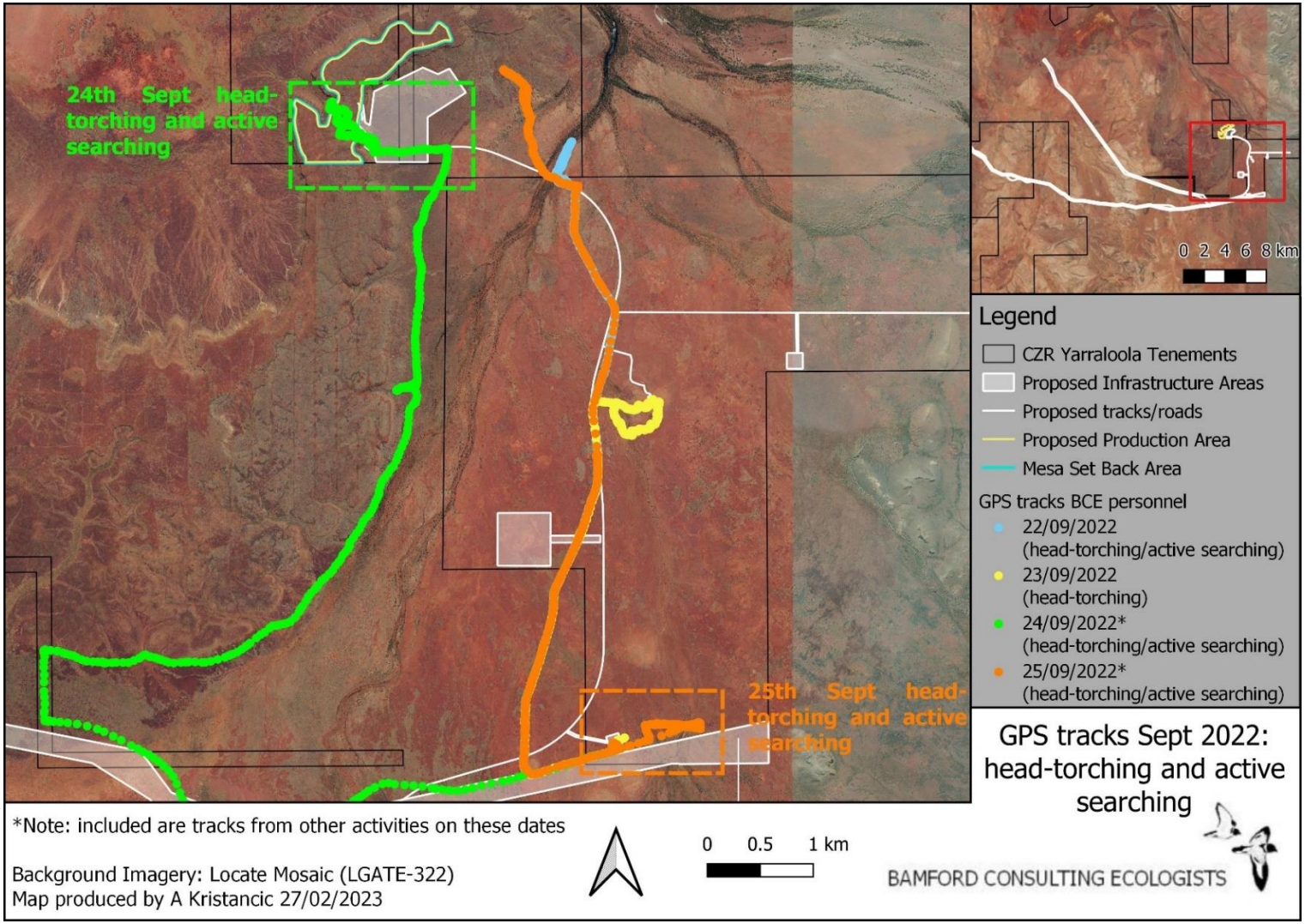

Figure 14. GPS tracks for head-torching and active searching in September 2022. Active searching on the watercourse on 22/09/23 and the mesa on 24/09/22 including searching for invertebrates.

2.4.5.3 Motion sensitive cameras

Motion sensitive cameras were deployed in both July and September 2022 with details in Table 15 and Table 16 and locations on Figure 15 and Figure 16. Ten locations were sampled in July 2022 and 20 locations in September, with 13 of the September locations being pitfall traps to examine what animals might be attracted to pitfalls but not get caught, including predators that may be 'raiding' pitfalls. One camera (in July) was set along the southern haul road option, on Warramboo Creek. The total sampling effort with cameras was 98 camera-nights.

Table 15. Details of motion sensitive cameras deployed in July 2022. Coordinates are for UTM Zone 50.

Camera ID	Date set	Date retrieved	Easting	Northing	Location description
BCE18	4/07/2022	9/07/2022	400300	7587530	western end of T4 in acacia shrubland and spinifex on loam flat
BCE42	4/07/2022	9/07/2022	401000	7587490	eastern end of T4 on E. victrix on river bank
BCE13	4/07/2022	9/07/2022	399760	7592673	T5 overlooking small pool
BCE30	4/07/2022	9/07/2022	399779	7592707	T5 on raised root mass near water
AUD08	5/07/2022	8/07/2022	400529.2	7590647	cave on small hill N of eastern end of T2
AUD05	5/07/2022	8/07/2022	399927	7591495	western end of T1
AUD09	5/07/2022	8/07/2022	400564.5	7590537	cave on Fig Tree Hill
BCE40	5/07/2022	8/07/2022	400591.5	7590078	river bed in east of T2
BCE02	5/07/2022	8/07/2022	400762.4	7590421	cave on Fig Tree Hill
AUD29163	5/07/2022	7/07/2022	379270	7589950	waterhole on Warramboo Ck along southern access option

Table 16. Details of motion sensitive cameras deployed in September 2022. Coordinates are for UTM Zone 50.

Camera ID	Date set	Date retrieved	Easting	Northing	Location description
BCE06	22/09/22	25/09/22	399599.2	7593227	Transect 3, pit 3.18
BCE42	22/09/22	25/09/22	399528.8	7593531	Transect 3, pit 3.08
BCE13a	22/09/22	25/09/22	399309.7	7593693	Transect 3, pit 3.01
AUD05	22/09/22	25/09/22	400426.8	7591621	Transect 1, pit 1.13
AUD08	22/09/22	25/09/22	400707.8	7591678	Transect 1, pit 1.18
BCE41	22/09/22	24/09/22	399760	7592673	On creek near T5
BCE03	22/09/22	24/09/22	399270	7593736	Northern end of transect 3
BCE41	24/09/22	25/09/22	399785.8	7592675	Transect 5, pit 5.02
BCE03	24/09/22	25/09/22	399784.2	7592666	Transect 5, pit 5.01
BCE04	21/09/22	25/09/22	400607.9	7590059	Transect 2 on creekline
BCE02	21/09/22	25/09/22	400447.7	7590086	Transect 2, pit 2.05
BCE14	21/09/22	26/09/22	400944.9	7587460	Stock trough overflow
BCE11	21/09/22	25/09/22	401050.6	7587505	Transect 4, pit 4.18
BCE20	21/09/22	25/09/22	400551.2	7587514	Transect 4, pit 4.08
AUD01	22/09/22	25/09/22	400013.7	7591549	Transect 1, pit 1.03
AUD09	22/09/22	25/09/22	400188.5	7591545	Transect 1, pit 1.08
BCE30	22/09/22	24/09/22	399780.1	7592707	Near Transect 3, on river-bed
BCE13b	22/09/22	24/09/22	399759.8	7592673	Near Transect 3, on river-bed
BCE30	24/09/22	25/09/22	399786	7592675	Transect 5, pit 5.02
BCE18	22/09/22	25/09/22	400766	7590434	On Fig Tree Hill near Transect 2

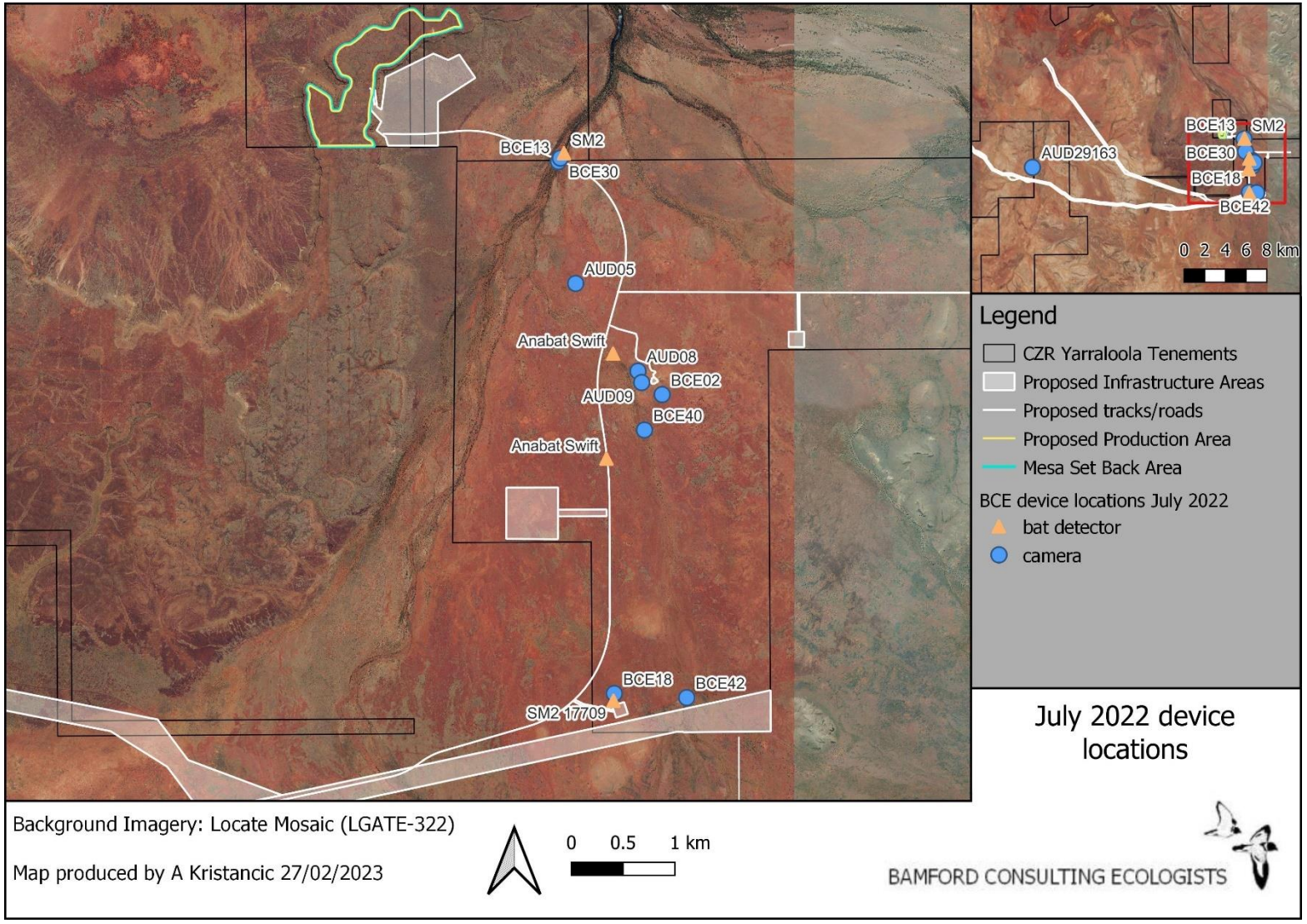

Figure 15. Locations of bat detectors and motion sensitive cameras deployed in July 2022.

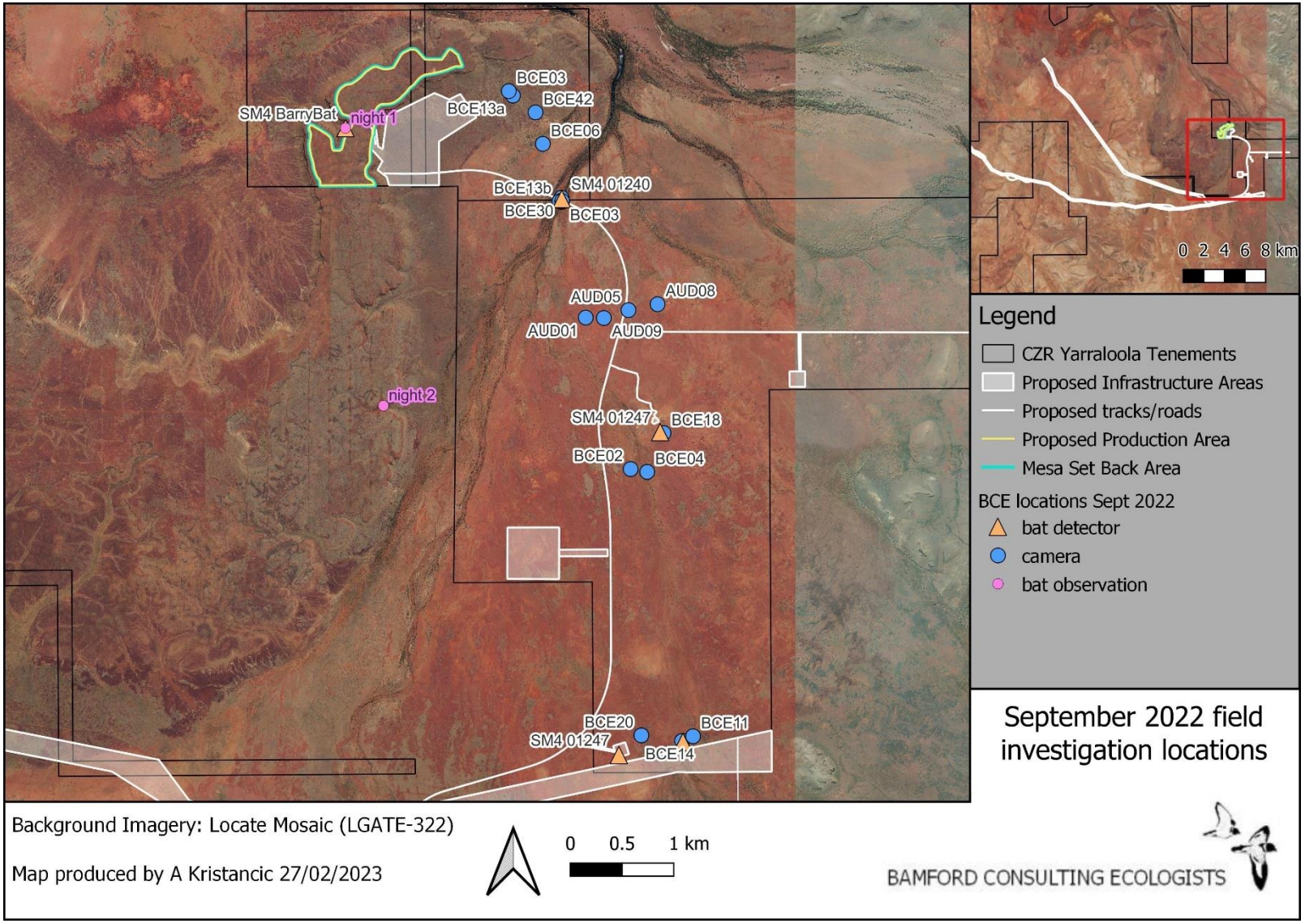

Figure 16. Locations of evening bat observations, and bat detectors and motion sensitive cameras deployed in September 2022.

2.4.5.4 Bat detectors and observations

In July and September 2022, ARUs were set for bats at four and five locations respectively. Locations were chosen to target areas of likely high bat activity, such as a rocky hill near Transect 2, pools of water near Transect 5 and overlooking caves on the edge of the mesa, but with some locations on the plains to determine what bat species might be traversing open country in the proposed infrastructure area. Descriptions, and dates for each location are given in Table 17 and Table 18. Locations are indicated on Figure 15 and Figure 16. The bat detectors deployed in July 2022 did not record any useful recordings; one detector did not function, and the other did not capture recordings of any bat calls.

In addition to deployment of ARUs, two evenings on site were dedicated to bat-observation in September (Figure 16). This method was employed primarily to detect Ghost Bats and involved 4 personnel standing 100-200 metres apart at a targeted location to observe bats flying from their diurnal roosts. Observations occurred from approximately sunset until after twilight; between 40 – 60 minutes after sunset. The locations were chosen based on the presence of large caves and previously known Ghost Bat records in the area. Observation details are outlined below:

21st September. Four personnel overlooking entrances of large caves in gully on western side of mesa, with the caves along the sides of a valley. Top of valley at 397692mE, 7593379mN. These caves are close to the mining area and small numbers of Ghost Bats were observed in the area in May 2021.

24th September. Four personnel stood on the plain adjacent to a large valley in the mesa south of the CZR project area; this valley has previously been identified as containing a Ghost Bat maternity roost, with 70 individuals found to be present in 2017 (Bat Call WA 2017a). It had also been observed in May 2021; entrance to valley at 398059mE, 7590698mN.

Table 17. Details of acoustic recording units deployed in July 2022 to detect bat vocalisations. Coordinates are for UTM Zone 50.

ARU type and ID	Date set	Date retrieved	Easting	Northing	Location description
Anabat Swift	5/07/2022	7/07/2022	400288	7590818	Between T1 and T2 on edge of bloodwood woodland and spinifex.
SM2 17709	5/07/2022	7/07/2022	400292	7587462	Near T2 CZ2.02 in acacia shrubland and spinifex about 200m north of camp.
Anabat Swift	7/07/2022	9/07/2022	400224	7589803	Just south of T1 in area of Snakewood.
SM2 17709	7/07/2022	9/07/2022	399814	7592756	Set on main drainage line near T5.

Table 18. Details of acoustic recording units deployed in September 2022 to detect bat vocalisations. Coordinates are for UTM Zone 50.

ARU type and ID	Date set	Date retrieved	Easting	Northing	Location description
SM4 BarryBat	21/09/22	24/09/22	397692	7593379	Top of mesa valley
SM4 01147	21/09/22	25/09/22	400953	7587450	Stock well east of camp
SM4 01247	21/09/22	23/09/22	400733	7590443	Fig Tree Hill near Transect 2
SM4 01240	22/09/22	25/09/22	399782	7592695	Creek near T5
SM4 01247	24/09/22	26/09/22	400334	7587324	Camp

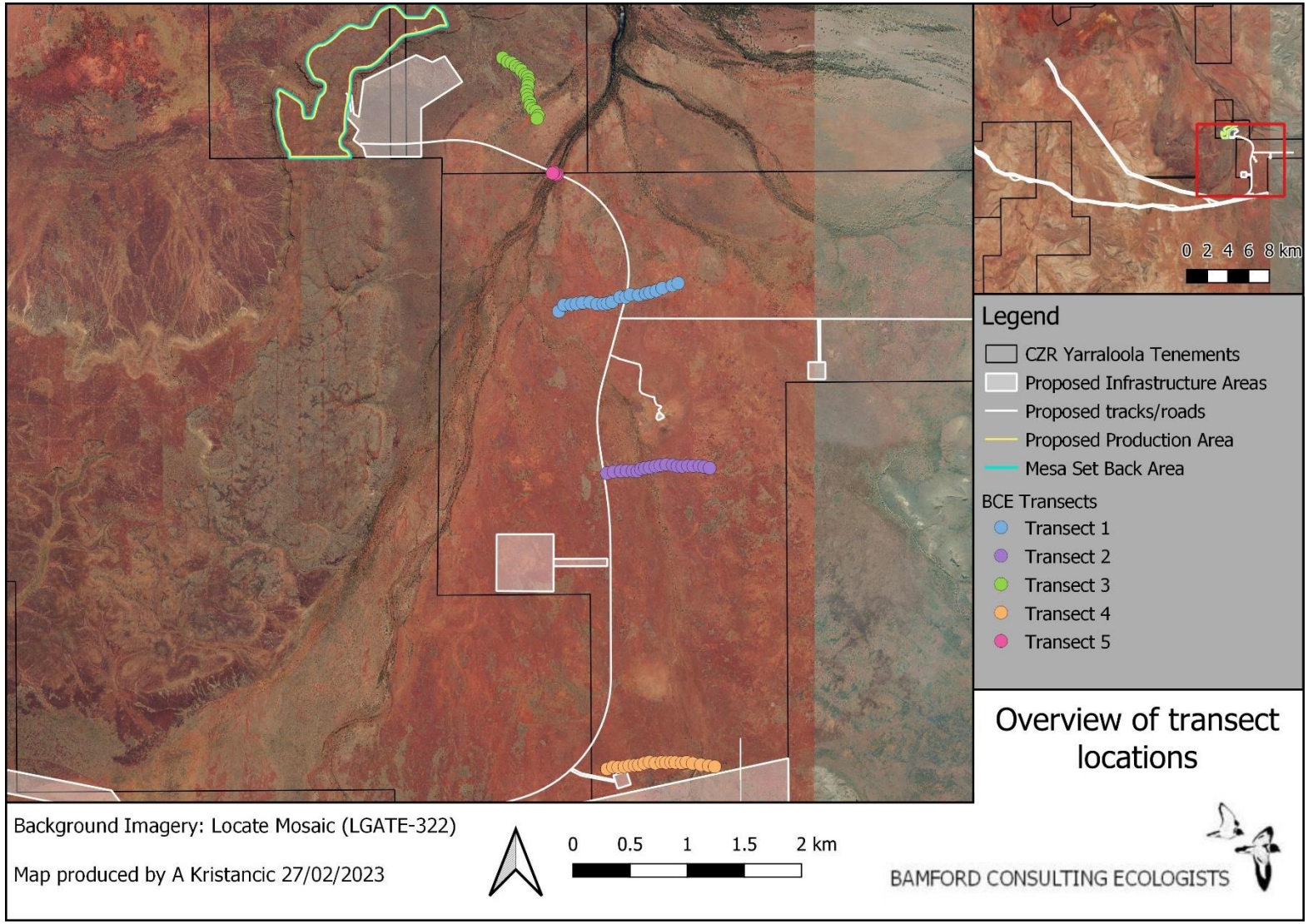

Figure 17. Overview of transect locations used for detailed survey in July and September 2022.

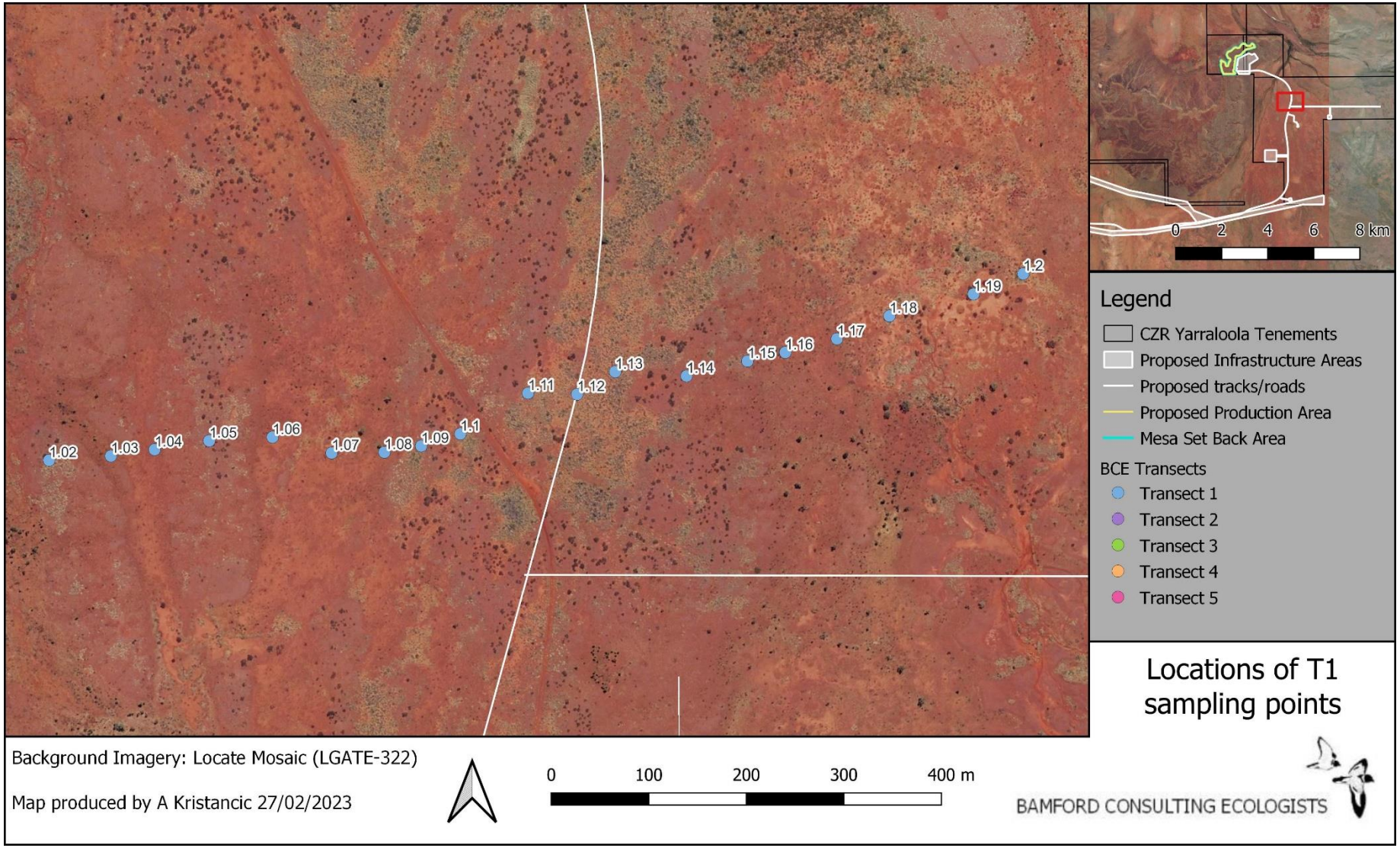

Figure 18. Locations of sampling points comprising Transect 1.

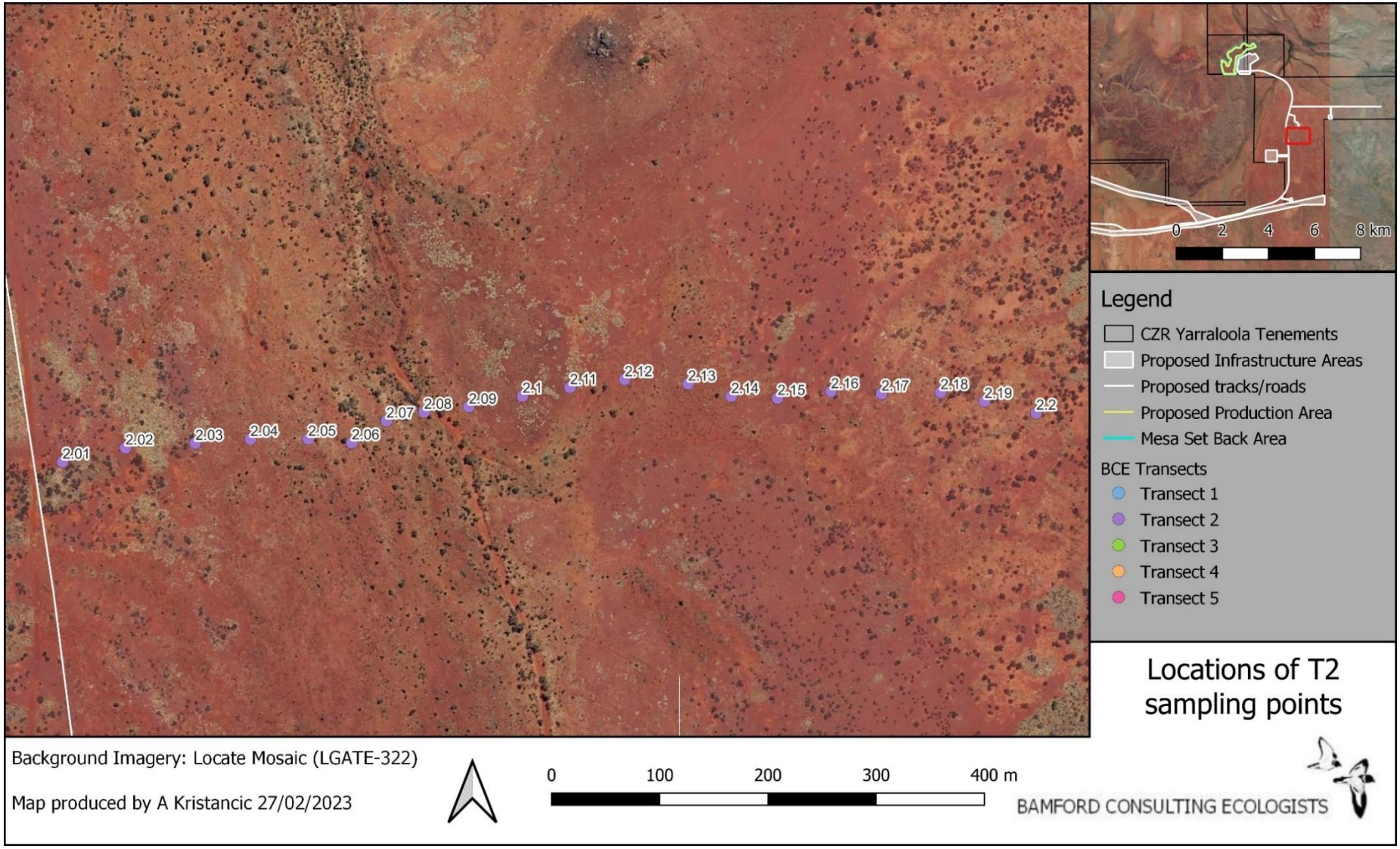

Figure 19. Locations of sampling points comprising Transect 2.

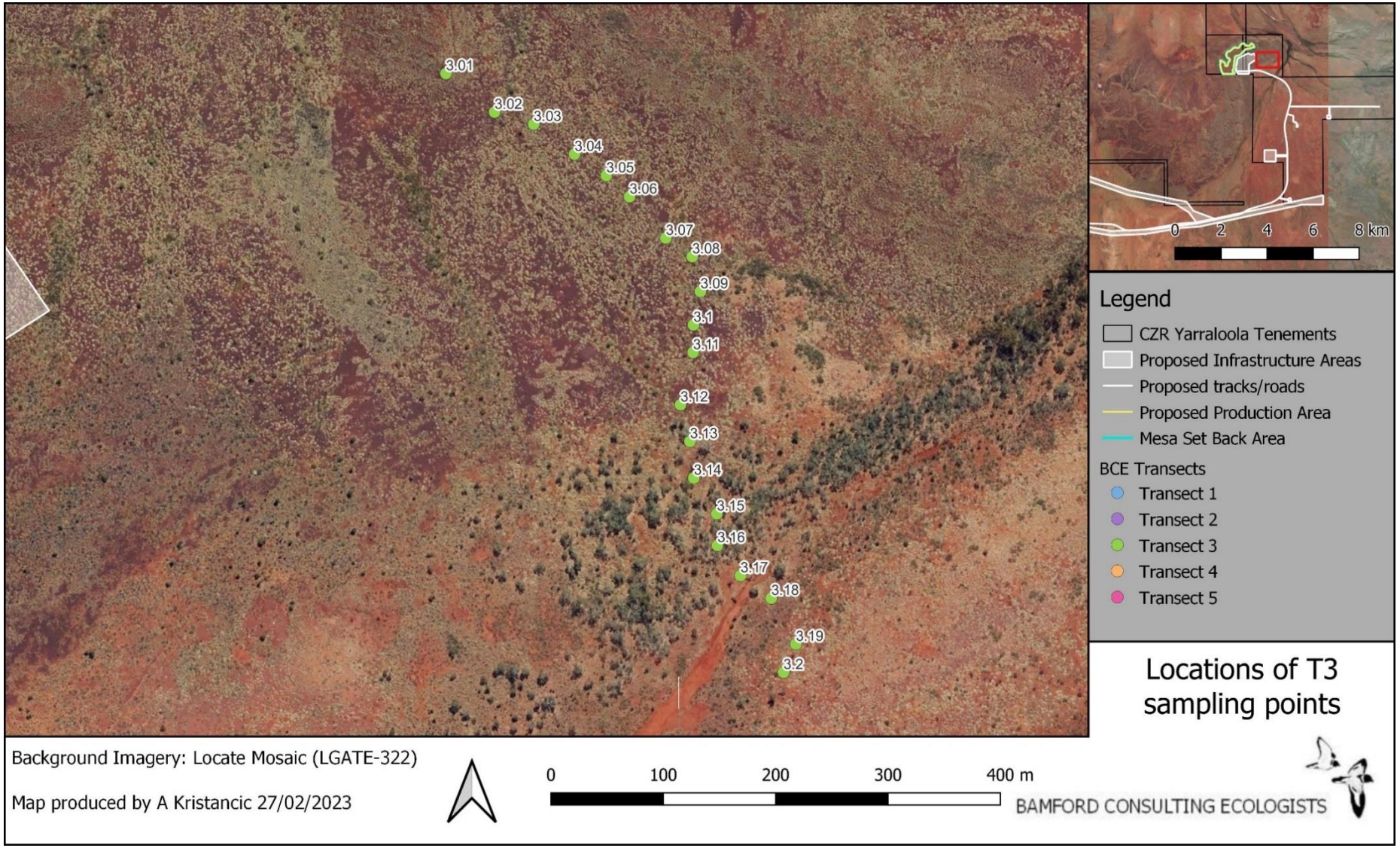

Figure 20. Location of sampling points comprising transect 3.

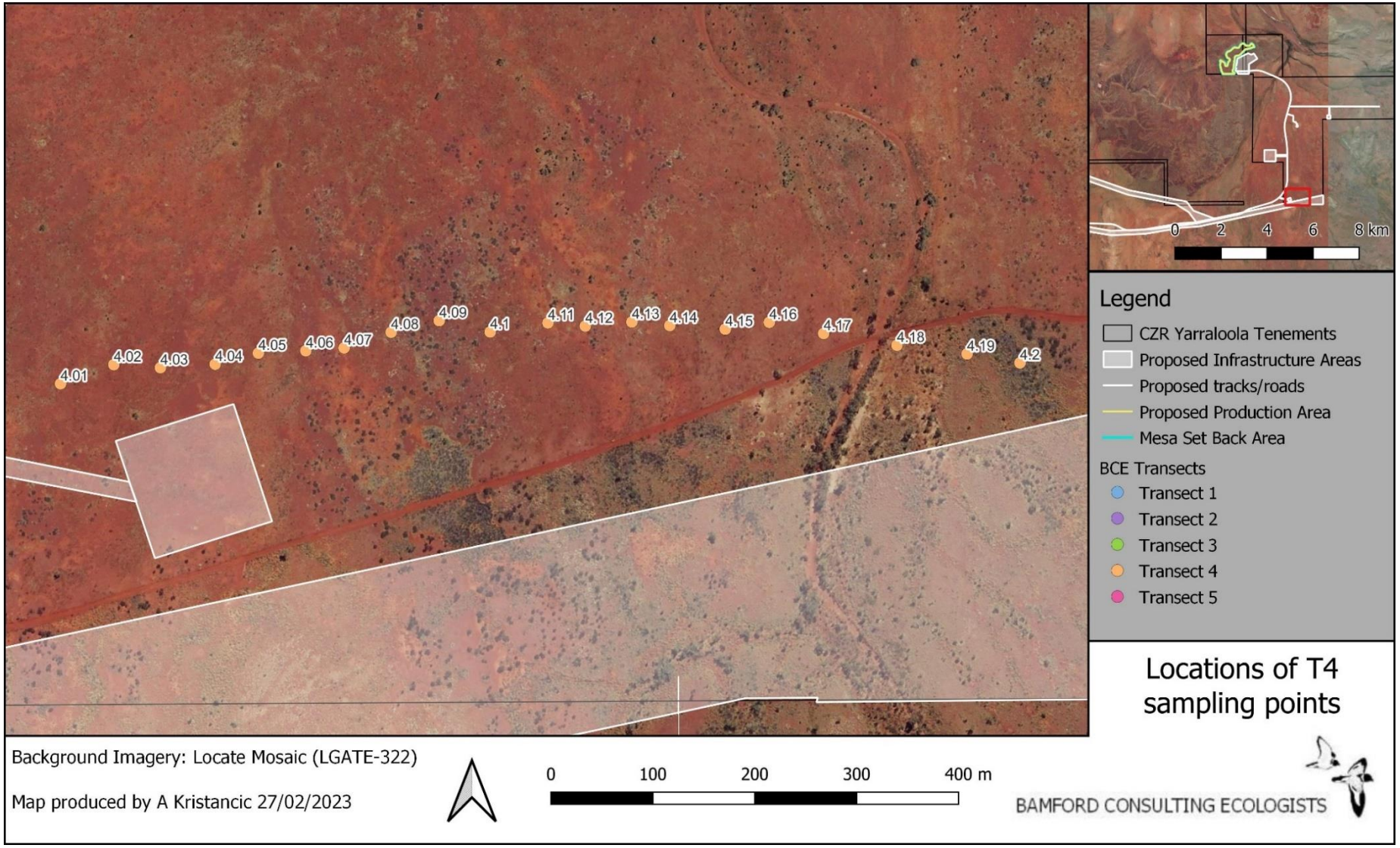

Figure 21. Locations of sampling points comprising Transect 4.

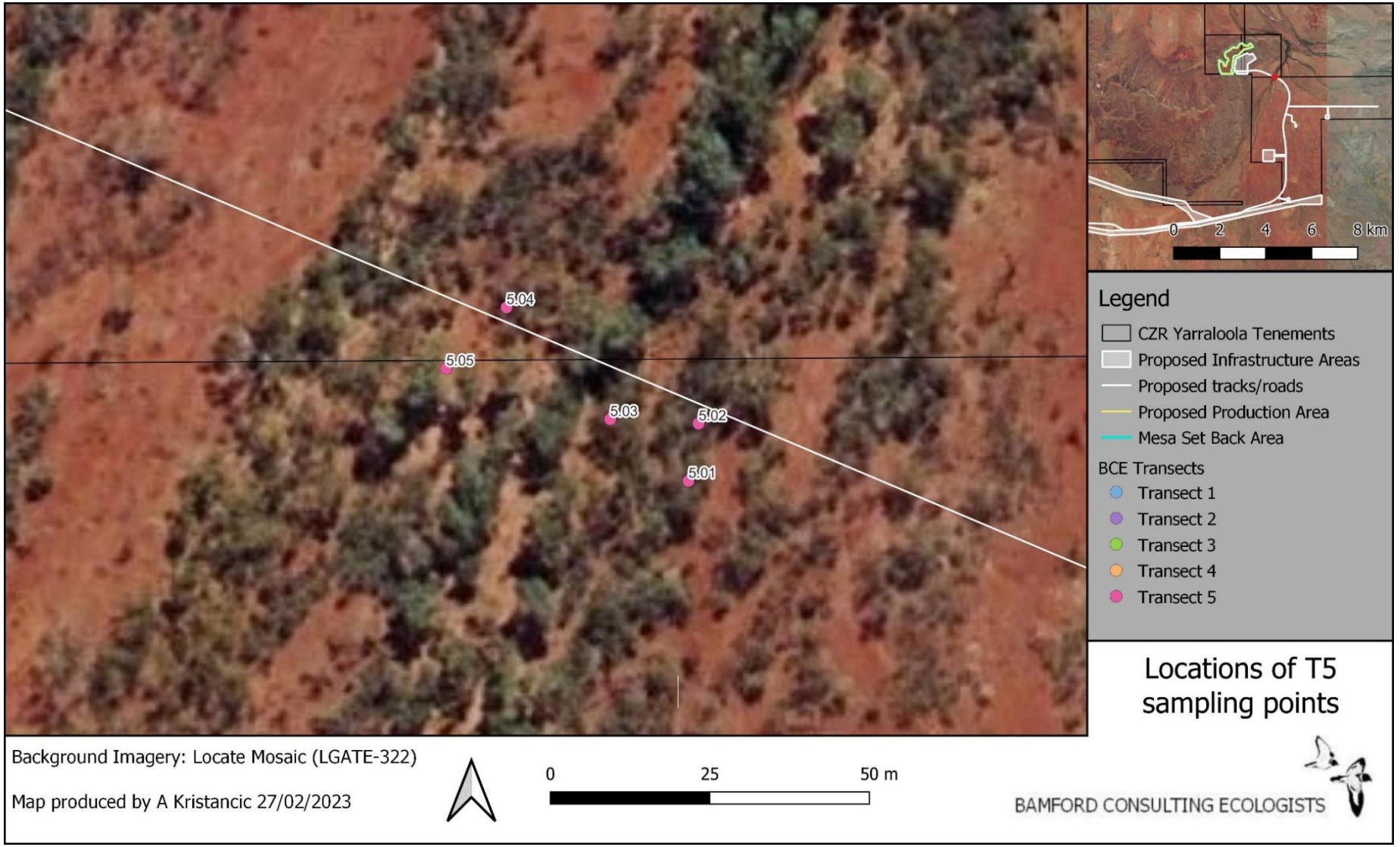

Figure 22. Locations of sampling points comprising Transect 5.

2.4.5.5 Inspection of haul road routes

The northern and southern haul road options were inspected on 5th and 6th July 2022. The southern option passes 'cross-country' with no reliable vehicular access, so was accessed via a helicopter. This flew low along the entire route and made several stops for ground inspections, notably at Warramboo Creek which is a major watercourse crossing of this route. Flying close to the ground enabled the identification of vegetation types, landscape features and it was possible to search for the mounds of the Ngadji (Western Pebble-mound Mouse). The northern option largely follows the existing unsealed road into site from the highway. This was also flown so that aerial observations could be made, but it was also revisited on the ground.

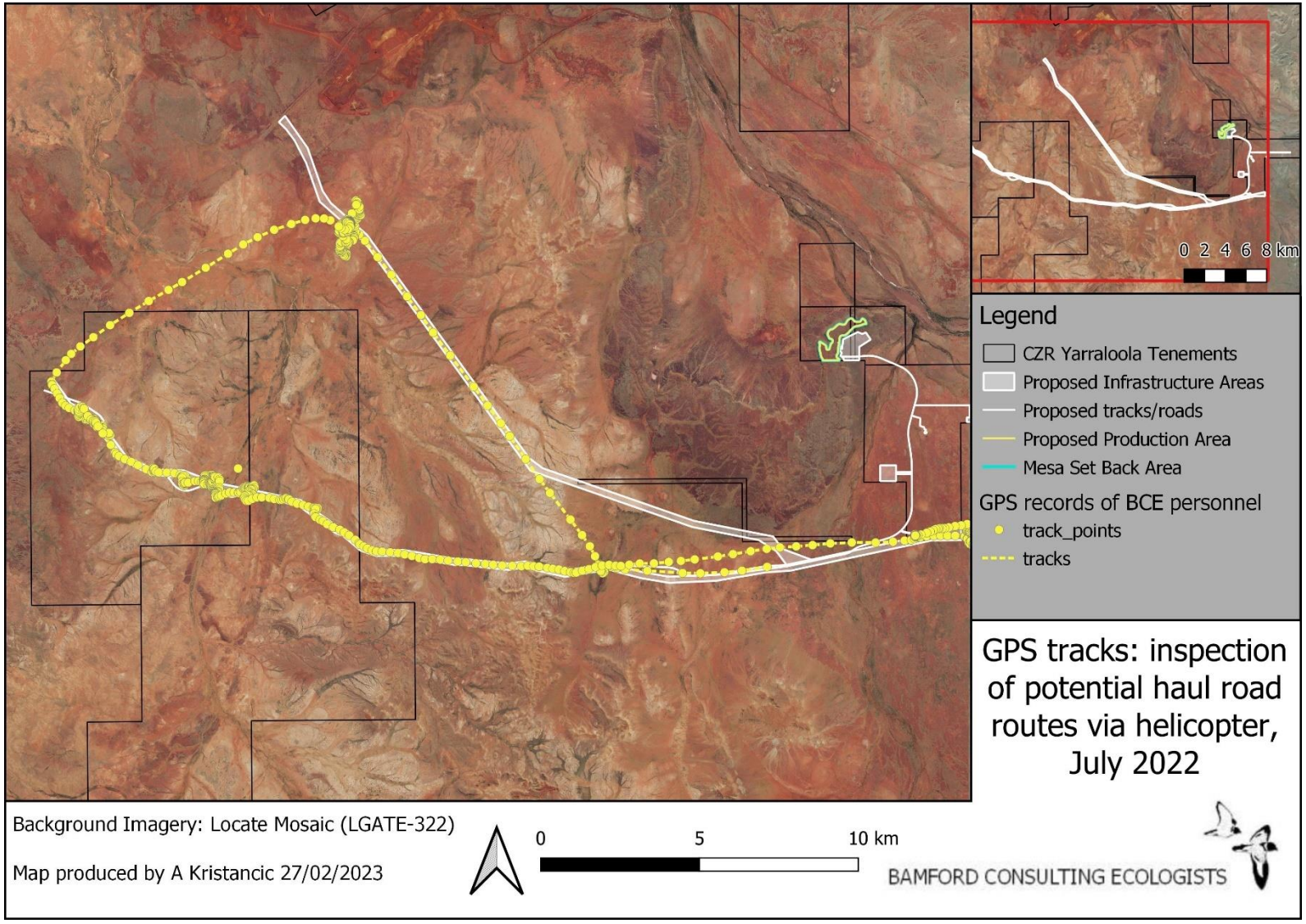

Figure 23. GPS tracks from helicopter inspection of haul road options. Note that all of the northern route was flown but the GPS failed on one flight.

2.5 Survey limitations

The EPA Guidance Statement 56 (EPA 2004) and the EPA (2020) outline a number of limitations that may arise during field investigations for Environmental Impact Assessment. These survey limitations are discussed in the context of the BCE investigation of the project area in Table 19. No limitations were identified.

Table 19. Survey limitations as outlined by EPA (2020).

EPA Survey Limitations	BCE Comment
Availability of data and information	Sufficient information from databases and previous studies (see Section 2.3.1). Not a limitation.
Competency/experience of the survey team, including experience in the bioregion surveyed	The ecologists have had extensive experience in conducting desktop reviews and reconnaissance surveys for environmental impact assessment fauna studies, and have undertaken a number of studies within the region. See also 2.4.2 for further details. Not a limitation.
Scope of the survey (e.g. were faunal groups excluded from the survey)	The survey focused on terrestrial vertebrate fauna and fauna values. Some information on threatened invertebrates was available from databases but this group was addressed by Biota (2022b). Not a limitation.
Timing, weather and season	Conducting four field trips to the project area provided a good opportunity to inspect the region under a range of conditions. The May 2021 field trip was cut short by approaching heavy rainfall but the work planned for that trip was completed in October 2021. Not a limitation.
Disturbance that may have affected results	None. Not a limitation.
The proportion of fauna identified, recorded or collected	All fauna observed were identified. Not a limitation.
Adequacy of the survey intensity and proportion of survey achieved (e.g. the extent to which the area was surveyed)	The site was adequately surveyed through trapping, walking, use of a helicopter to the level appropriate for a Basic level assessment. Fauna database searches covered a 25 km radius beyond the centroid of the project area. Not a limitation.
Access problems	There were no access problems encountered. Not a limitation.
Problems with data and analysis, including sampling biases	There were no data problems. The 'usual' sampling biases were encountered, with pitfall and funnel trapping. Not a limitation.

2.6 Presentation of results for Impact Assessment

While some impacts are unavoidable during a development, of concern are long-term, deleterious impacts upon biodiversity. This is reflected in documents such as the Significant Impact Guidelines provided by DSEWPaC (2013a, 2013b), as summarised in Appendix 4. Significant impacts may occur if:

- There is direct impact upon a VSA and the VSA is rare, a large proportion of the VSA is affected and/or the VSA supports significant fauna.
- There is direct impact upon conservation significant fauna.
- Ecological processes are altered and this affects large numbers of species or large proportions of populations, including significant species.

The impact assessment process therefore involves reviewing the fauna values identified through the desktop assessment and field investigations with respect to the project and impacting processes. The severity of impacts on the fauna assemblage and conservation significant fauna can then be quantified on the basis of predicted population change.

The presentation of this assessment follows the general approach to impact assessment as given in Section 1.1, but modified to suit the characteristics of the site. Key components to the general approach to impact assessment are addressed as follows:

Fauna values

This section presents the results of the desktop and field investigations in terms of key fauna values (described in detail in Appendix 1) and includes:

- Recognition of ecotypes or vegetation/substrate associations (VSAs);
- Assemblage characteristics (uniqueness, completeness and richness);
- Species of conservation significance;
- Patterns of biodiversity across the landscape; and
- Ecological processes upon which the fauna depend.

Impact assessment

This section reviews threatening processes (as described in detail in Appendix 3) with respect to the proposed development and examines the potential effect these impacts may have on the faunal biodiversity of the project area. It thus expands upon Section 1.1 and discusses the contribution of the project to impacting processes, and the consequences of this with respect to biodiversity. A major component of impact assessment is consideration of threats to species of conservation significance as these are a major and sensitive element of biodiversity. Therefore, the impact assessment section includes the following:

- Review of impacting processes; will the proposal result in:
    - Habitat loss leading to population decline, especially for significant species;
    - Habitat loss leading to population fragmentation, especially for significant species;
    - Weed invasion that leads to habitat degradation;
    - Ongoing mortality;
    - Species interactions that adversely affect native fauna, particularly significant species;

  - Hydrological change;
  - Altered fire regimes; or
  - Disturbance (dust, light, noise)?
- Summary of impacts upon significant species, and other fauna values.

The impact assessment concludes with recommendations for impact mitigation, based upon predicted impacts. Note that the terms direct and indirect impacts are avoided in this report as the term 'indirect impact' implies that it is an impact not necessarily due to the action; for further explanation see **Appendix 3**.

2.6.1 Criteria for impact assessment

Impact assessment criteria are based on the severity of impacts on the fauna assemblage and conservation significant fauna, and quantified on the basis of predicted population change (Table 20). Population change can be the result of direct habitat loss and/or impacts upon ecological processes.

The significance of population change is contextual. The EPA (2016b) suggested that the availability of fauna habitats within a radius of 15 km can be used as a basis to predict low, moderate or high impacts. In this case, a high impact is where the impacted environment and its component fauna are rare (less than 5% of the landscape within a 15 km radius or within the Bioregion), whereas a low impact is where the environment is widespread (e.g. >10% of the local landscape). Under the Ramsar Convention, a wetland that regularly supports 1% of a population of a waterbird species is considered to be significant. These provide some guidance for impact assessment criteria. In the following criteria (Table 20), the significance of impacts is based upon percentage population decline within a 15 km radius (effectively local impact) and upon the effect of the decline upon the conservation status of a recognised taxon (recognisably discrete genetic population, sub-species or species). Note that percentage declines can usually only be estimated on the basis of the distribution of a species derived from the extent of available habitat while for a few species, such as the Black-Cockatoos, there is guidance for the assessment of impact significance.

The impact assessment concludes with recommendations based upon predicted impacts and designed to mitigate these.

Table 20. Assessment criteria for impacts upon fauna.

Impact Category	Observed Impact
Negligible	Effectively no population decline; at most few individuals impacted and any decline in population size within the normal range of annual variability.
Minor	Population decline temporary (recovery after end of project such as through rehabilitation) or permanent, but < 1% within 15 km radius of centre-point of impact area (or within bioregion if this is smaller). No change in viability or conservation status of taxon.
Moderate	Permanent population decline 1-10% within 15 km radius. No change in viability or conservation status of taxon.
Major	Permanent population decline 10-50% within 15 km radius. No change in viability or conservation status of taxon.
Critical	Taxon decline > 50% (including local extinction) within 15 km and/or change in viability or conservation status of taxon.

2.7 Mapping

High resolution aerial imagery was used during desktop and field investigations and can be supplied if required. Maps produced for this report have used a slightly lower resolution to reduce file size. Higher resolution maps and GIS files can be supplied if required. As per the recommendation of EPA (2020), maps use the GDA94 datum and are projected into the appropriate Map Grid of Australia (MGA94) zone.

2.8 Data

Raw data from trapping and other sampling are presented in Appendices 10 and 11. Where appropriate, data summaries are presented in the following sections.

3 Fauna values

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

The overall project area encompasses a mesa, scattered rocky hills, plains, and drainage systems that range from minor creeklines to large river systems. Seven major Vegetation and Substrate Associations were identified in the overall project area:

VSA 1. Mesa top. Acacia low shrubland with scattered eucalypts over spinifex on shallow gravelly soil with some exposed rock. Often patches of several hectares with spinifex and no other vegetation. Occurs in the mining area. See Plate 1, Plate 2, Plate 3.

VSA 2A. Mesa edge. Exposed rock often vertical with caves and overhangs. Scattered eucalypts, Rock Fig, shrubs and spinifex where plants able to 'get a hold'. Scree slope variable in width; steep with lot of loose rock but bout 50% spinifex cover and occasional shrub. A major feature of the margin of the mesa. See Plate 4 and Plate 6.

VSA 2B. Rocky hills and slopes. Lower scree slope around mesa edge, but also occurs as isolated rocky and in some cases gravelly hills. See Plate 5 and Plate 6.

VSA 3. Plains and flats. These are very extensive. Mostly scattered acacia thickets (*Acacia xiphophylla*) over spinifex *(Triodea)* on gravelly loam soil to sandy loam flats. Some slightly rocky rises merged with VSA 2B. See Plate 7, Plate 8, Plate 9.

VSA 4. Bloodwood and acacia low woodland and thickets on alluvial loams along minor drainage lines and in shallow valleys of plains. See Plate 10, Plate 11, Plate 12.

VSA 5. *Eucalyptus victrix* woodland to forest over mixed grasses, including Buffel Grass, on alluvial loams; effectively floodplain of larger drainage lines. See Plate 13.

VSA 6. Melaleuca and eucalypt gallery forest along seasonal and permanent pools on brown loam and gravel. See Plate 14, Plate 15, Plate 16.

VSA 7. Pools. Main Robe Pool is permanent and supports Typha and Phragmites beds, with some submerged aquatics. Substrate is loam and clay so water turbid with suspended sediments. Also semi-permanent pools of Warramboo Creek where the southern access route option crosses. See Plate 15, Plate 16, Plate 17, Plate 18.

These VSAs have been mapped based on vegetation mapping produced by Biota and provided to BCE by CZR. This mapping combines vegetation types from Biota (2022a) and RPS (2021) which has been interpreted in order to match up vegetation types with corresponding BCE VSAs. Table 21 provides information regarding these corresponding categories, and mapping is provided in Figures 24 to 26. Note that VSA 6 and VSA 7 largely occur outside the project area but are significant environments for fauna and so have been included.

Table 21. Allocation of vegetation types from Biota (2022a) and RPS (2021) into Vegetation and Substrate Associations.

VSA description and notes	Combined (Biota and RPS) veg mapping shapefile	Biota (2022a) VT	RPS (2021) VT
VSA 1. Mesa top.	A6 - Acacia arida over Triodia wiseana.	A6	Aar.Tw
VSA 2A. Mesa edge.	• El.Aa.TwTp - Eucalyptus leucophloia Low Isolated Clumps of Trees over Acacia arida Isolated Clumps of Shrubs over Triodia wiseana and T. pisoliticola Sparse Hummock Grassland		El.Aa.TwTp;
VSA 2B. Rocky hills and slopes.	• T1 - Triodia longiceps open hummock grassland. • T2 - Triodia epactia hummock grassland. • A5 - Mixed Acacia spp. over Triodia longiceps. • A7 - Acacia bivenosa over Triodia wiseana. • S1 - Senna spp. and Acacia bivenosa over Triodia wiseana. • E1 - Eucalyptus leucophloia subsp. leucophloia over mixed Acacia spp. over Triodia wiseana. • El.AtuGr - Eucalyptus leucophloia Low Open Woodland over Gossypium robinsonii and Acacia tumida var. pilbarensis Tall Open Shrubland over Acacia arida Mid Open Shrubland Over Triodia wiseana, (Triodia pisoliticola) Open Hummock Grassland	T1, T2, A5, A7, S1	El.Ab.Tw; Ab.Tw, El.AtuGr
VSA 3. Plains and flats.	• A1 - Acacia xiphophylla tall shrubland over Triodia epactia open hummock grassland. • A2 - Acacia xiphophylla tall shrubland over	E1, A1, A2, A3, A4, C1	All other vegetation types

VSA description and notes	Combined (Biota and RPS) veg mapping shapefile	Biota (2022a) VT	RPS (2021) VT
	Triodia wiseana very open hummock grassland. • A3 - Mixed Acacia spp. over Triodia wiseana. • A4 - Mixed Acacia spp. over Triodia epactia. • C1 - Corymbia hamersleyana over mixed Acacia spp. over Triodia epactia. • Asy.EcrTe - Acacia synchronicia Mid Open Shrubland over Triodia epactia Open Hummock Grassland (with intermittent clay pans with ephemeral Open Forbland and Open Tussock Grassland)		
VSA 4. Bloodwood and acacia low woodland and thickets.	• C2 - Corymbia candida subsp. candida over mixed Acacia spp. over Triodia epactia. • C3 - Corymbia deserticola subsp. deserticola over mixed Acacia spp. over Triodia epactia. • C4 - Corymbia zygophylla over mixed Acacia spp. over Triodia spp. • C5 - Corymbia hamersleyana over mixed Acacia spp. over Triodia epactia. • AsyAsc.Te - Eucalyptus victrix and Corymbia hamersleyana Low Isolated Trees over Acacia synchronicia and A. sclerosperma subsp. sclerosperma Tall Sparse Shrubland over a mixed Low Open Shrubland / Forbland over Triodia epactia Sparse Hummock Grassland	C2, C3, C4, C5,	Ch.Ac.Te; Asy.Asc.Te

VSA description and notes	Combined (Biota and RPS) veg mapping shapefile	Biota (2022a) VT	RPS (2021) VT
VSA 5. Eucalyptus victrix woodland to forest over mixed grasses.	• E2 - Eucalyptus victrix (Eucalyptus camaldulensis subsp. refulgens) and Melaleuca spp. over mixed Acacia spp. over *Cenchrus spp. • MaEc.Mg.Cv - Melaleuca argentea and Eucalyptus camaldulensis subsp. refulgens Mid Open Forest over Melaleuca glomerata Tall Open Shrubland over Cyperus vaginatus Open Sedgeland	E2	Ec.Ev.Mg; Cc.Te
VSA 6. Cajeput (*Melaleuca* sp.) and eucalypt gallery forest. Largely outside the project area as only along permanent to near-permanent pools. North-east of mining area and just north of southern alignment along Warramboo Creek.		None applicable	None applicable
VSA 7. Pools. These are outside the actual project area; they form an arc to the north-east of the mining area. There are also pools along Warramboo Creek just north of the southern proposed alignment.		None applicable	None applicable

Plate 1. VSA 1: Mesa top.
Eucalypts on mesa top; edge of mine area.

Plate 2. VSA 1: Mesa top.
Scattered eucalypts, open shrubland and *Triodia* on rocky ground on mesa top; mine area.

Plate 3. VSA 1: Mesa top.
Mesa top with sparse spinifex and no trees; mine area.

Plate 4. VSA 2A. Mesa edge.
Eucalypts on vertical mesa edge.

Plate 5. VSA 2B. Rocky hills and slopes.
Scree slope below mesa edge.

Plate 6. VSA 2A and VSA 2B. Mesa edge (VSA 2A) cliffline with caves in background, and rocky hills and slopes (VSA 2B) in foreground.
Cliffline with caves in valley in west of mesa. Scientists on left give scale.

Plate 7. VSA 3: Plains and flats.
Gravelly rise on plain, with Bloodwood along creekline (Transect 2).

Plate 8. VSA 3: Plains and flats.
Shrubs and spinifex on plain (Transect 1).

Plate 9. VSA 3: Plains and flats.
Spinifex and snakewood on gravelly plain (Transect 1).

Plate 10. VSA 4: Bloodwood and acacia low woodland.
Bloodwood open woodland over shrubland over spinifex on gravelly loam (Transect 2).

Plate 11. VSA 4: Bloodwood and acacia low woodland.
Bloodwood and *Acacia* thicket along minor creekline (Transect 2).

Plate 12. VSA 4: Bloodwood and acacia low woodland.
Minor creekline with Bloodwood and thickets (Transect 2).

Plate 13. VSA 5: *Eucalyptus victrix* woodland.
Eucalyptus victrix woodland over Buffel Grass on alluvial soils near river (Transect 3).

Plate 14. VSA 6: Malaleuca and eucalypt gallery forest.
Malaleuca gallery forest on loam soil in river-bed (near Transect 5).

Plate 15. VSA 6/7: Malaleuca and eucalypt gallery forest/Pools.
Riverine pool and gallery forest of malaleuca (near Transect 5).

Plate 16. VSA 6/7: Malaleuca and eucalypt gallery forest/Pools.
Pool along Mungarathoona Creek (near Transect 5).

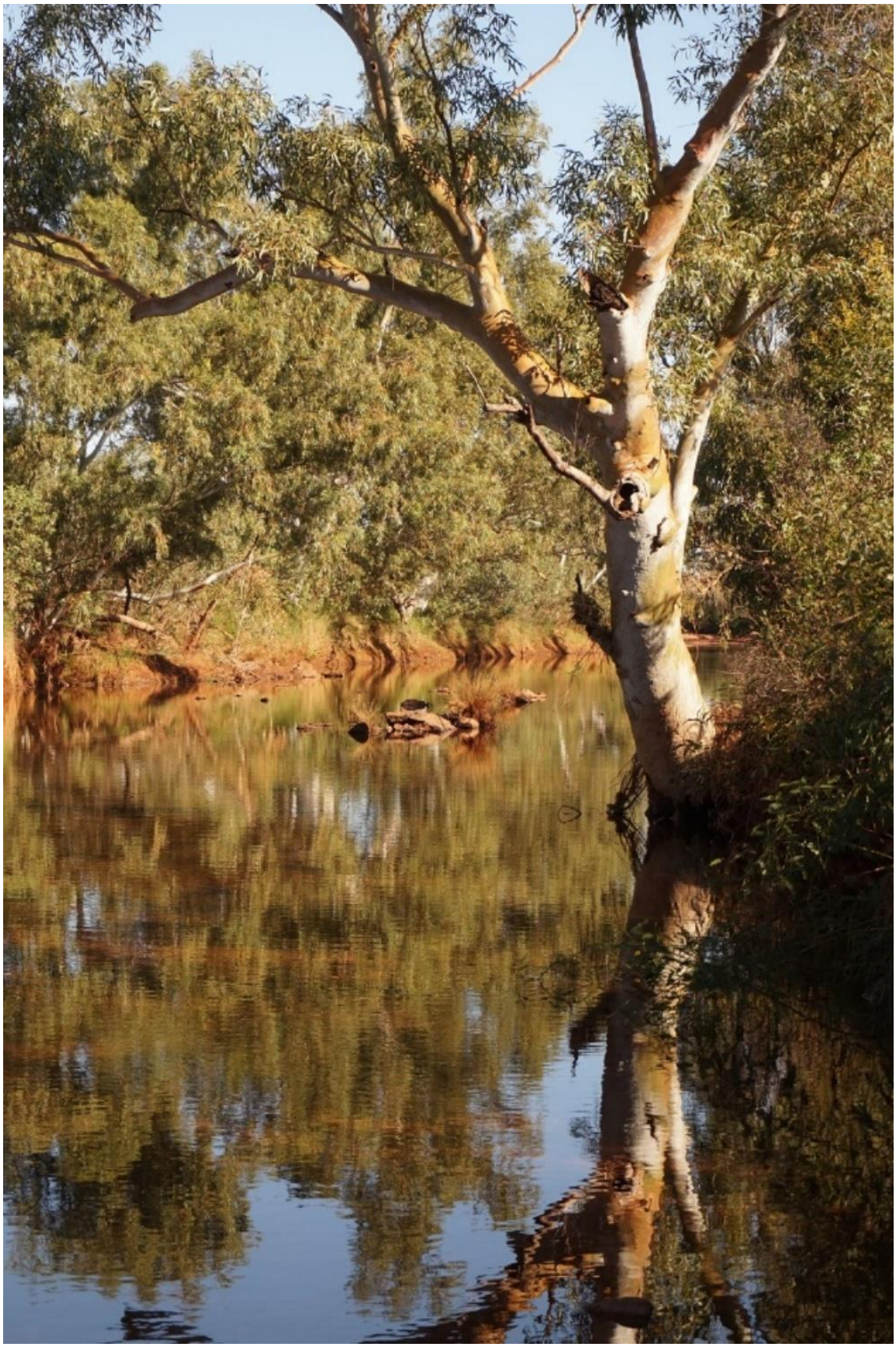

Plate 17. VSA 7: Pools.
Pool along Warramboo Creek, that will be crossed by southern haul road option.

Plate 18. VSA 7: Pools.
Pool along Warramboo Creek near proposed southern haul road route crossing.

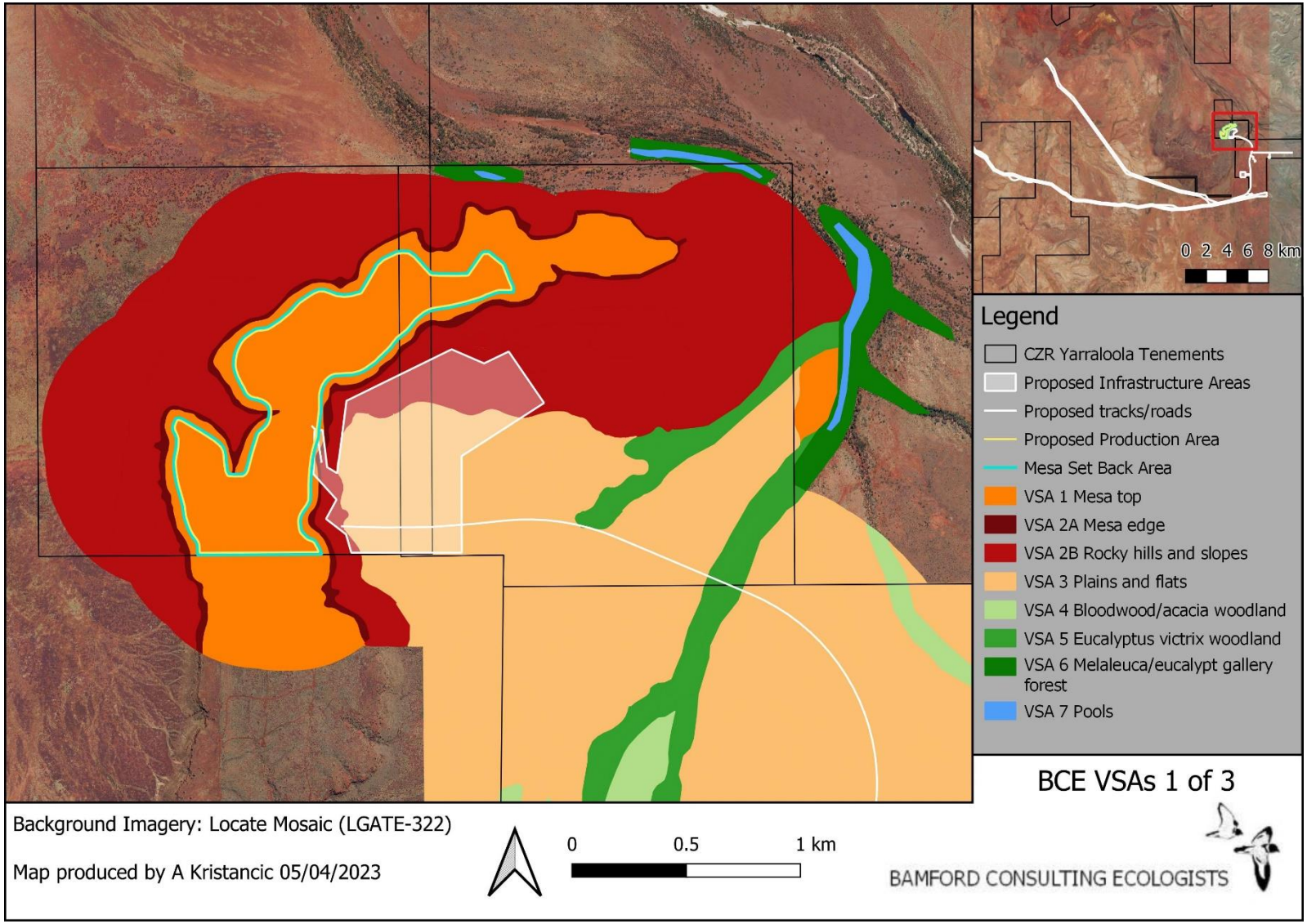

Figure 24. VSA map 1 of 3. The distribution of VSAs in the mine area; based on vegetation maps from Biota (2022a) and RPS (2021).

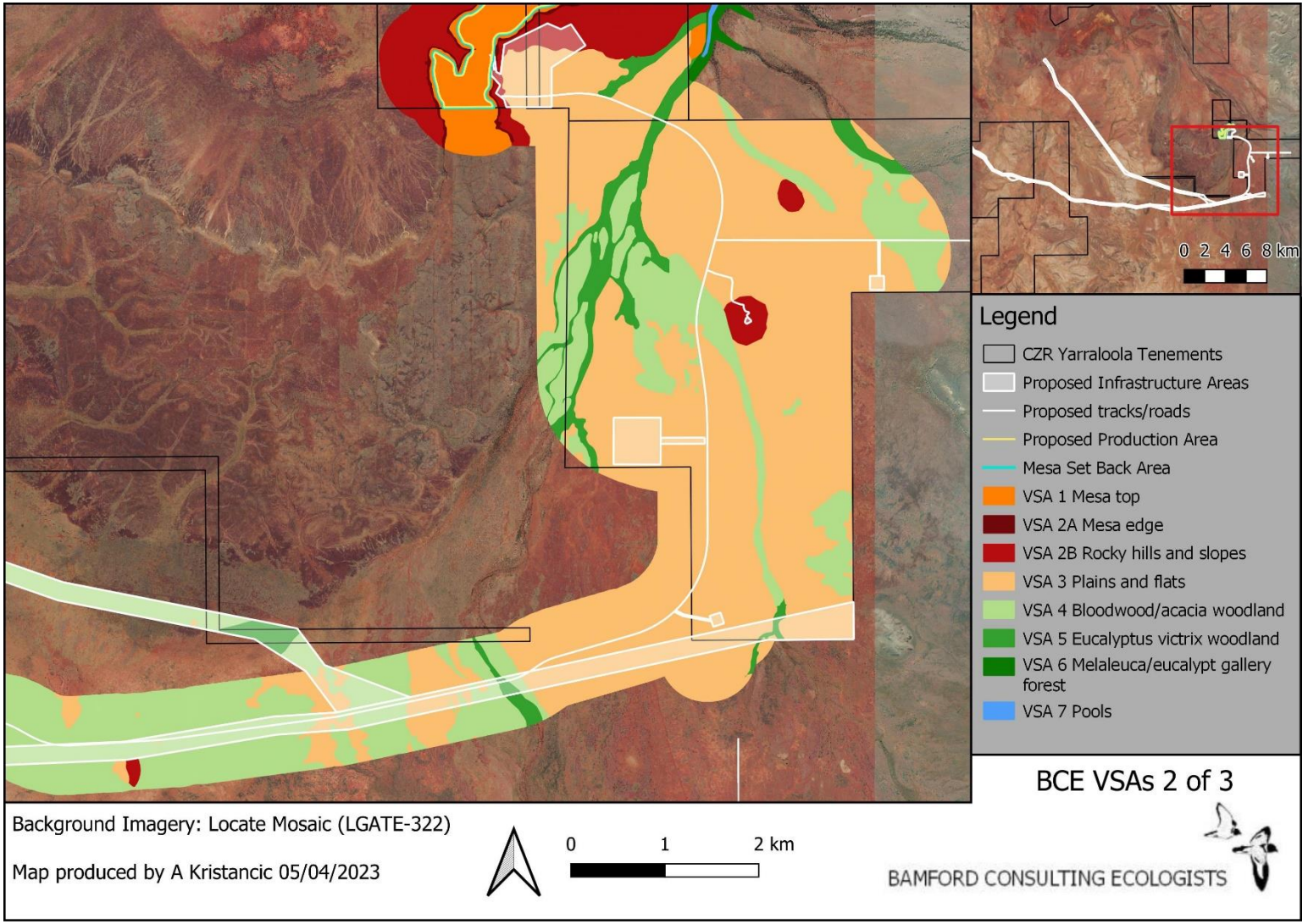

Figure 25. VSA map 2 of 3. The distribution of VSAs in the infrastructure area and eastern section of proposed haul road options. Based on vegetation mapping from Biota (2022a) and RPS (2021).

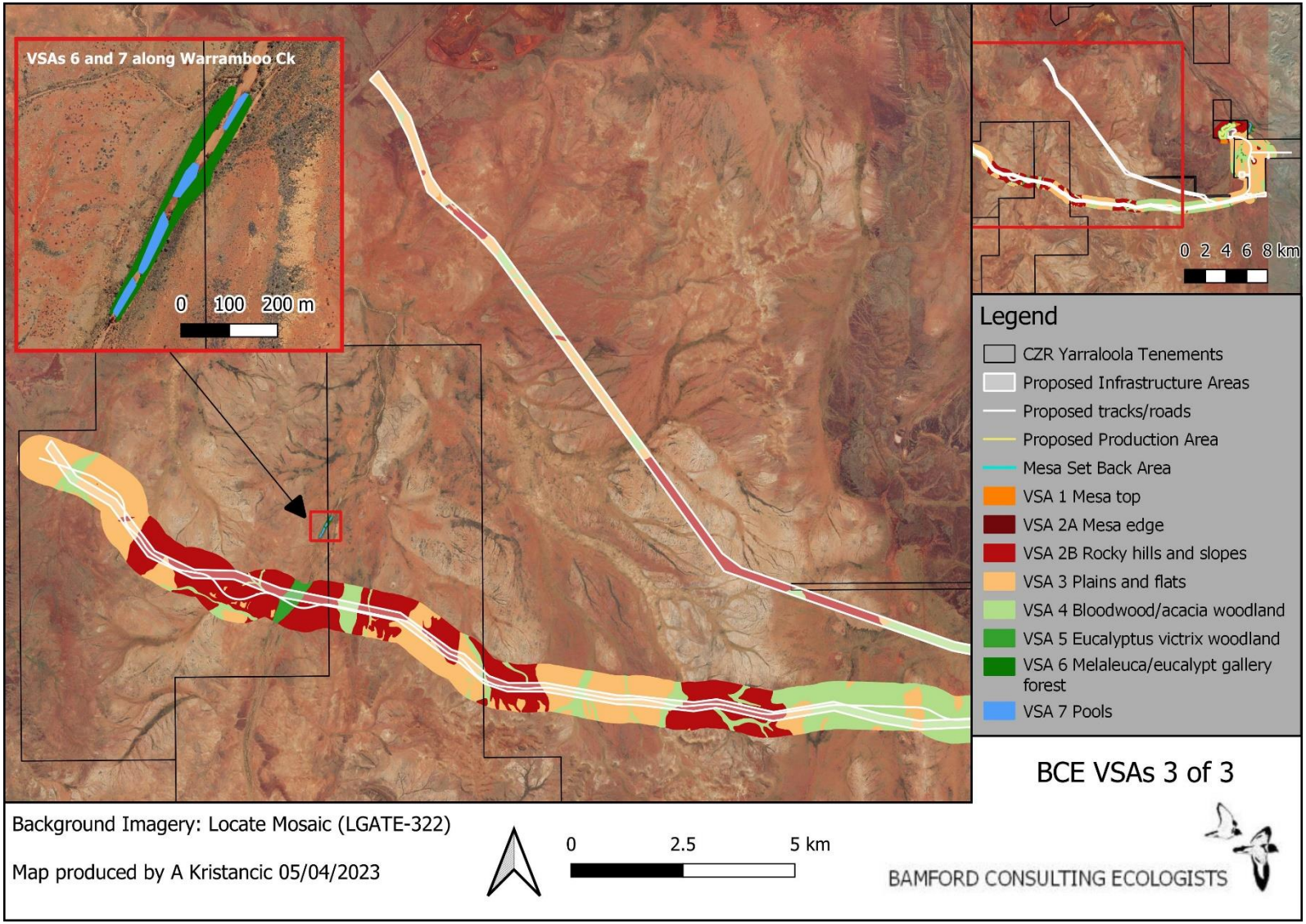

Figure 26. VSA map 3 of 3. The distribution of VSAs along the proposed haul road options; based on vegetation mapping from Biota (2022a).

3.2 Northern and Southern haul road route options

The two haul road route options run from the southern end of the mine infrastructure area (near the current (September 2022) exploration camp) across to the North-West Coastal Highway. This is broadly a landscape of plains with scattered rocky hills and minor drainage lines, but with one larger drainage system, Warramboo Creek, that intersects with the southern option.

Southern Route. This follows existing road initially from camp, then across largely undisturbed land. Passes mostly over slightly undulating plains (VSA 3) in east, supporting acacia shrubland with scattered bloodwood over spinifex on gravelly loam (VSA 3). Crosses a lot of minor drainage lines (VSA 4) and rocky hills and slopes, and close to small mesas (VSA 2B). The Warramboo Creek crossing a complex area, being close to mesas with gravelly rises and valleys, and the creek itself with large pools lined with *Eucalyptus victrix* and some *Melaleuca* sp. (VSA 6/7). Some pools >100m long and spread over about 1km through and downstream of alignment. No fish present, suggesting pools are seasonal and often isolated from the main river system for long periods, but tadpoles (*Litoria rubella*) abundant. Northern Quoll tracks in sand and silt all round pool. From Warramboo Creek, alignment passes over a series of slightly rocky/gravelly rises, then alternating gravelly loam flats and a few low rocky/gravelly rises before highway (mixture of VSA 2B and VSA 3). See Plate 17, Plate 18, Plate 19, Plate 20.

Northern Route. This follows the existing access road but lies slightly to the south. Almost the entire route passes over plains (VSA 3) with acacia/snakewood shrubland over spinifex on gravelly loam flats, and a few minor drainage lines with Bloodwood thickets (VSA 4). The existing road has interfered with surface hydrology, resulting in vegetation decline in the drainage shadow of the road (See Plate 21). Crosses only minor drainage lines but evidence of flow interference and vegetation decline in the drainage shadow of the existing road. Near the highway, the existing road passes through a gap in a rocky ridge, but alignment passes over the ridge (Plate 22).

Plate 19. Southern access route. Bloodwood thickets along minor drainage line in foreground (VSA 4), plains in middle distance (VSA 3) and mesas in background (VSAs 1 and 2). Alignment passes between mesas.

Plate 20. Southern access route. Plains (VSA 3) with rocky hills (VSA 2B) in background. Alignment passes just right of the conical hill in the background.

Plate 21. Existing road alongisde the northern access route; note change in vegetation due to disruption of surface flow by road.

Plate 22. Northern access route traverses just to the right of the existing road and through the rock hills in the background.

3.3 Regional development

The project area is located within a substantially intact natural landscape, with some existing disturbance due to mining activities. Much of the landscape has been subject to long-term grazing by livestock, with impact greatest low in the landscape and especially along watercourses. Figure 27 illustrates the existing extent of development in a 15 km radius from the midpoint of the infrastructure area. Other than roads, there are no existing developments within this buffer; mines alongside the highway to the west lie just outside the buffer. The proposed development of mine and infrastructure has a total area of c. 277 ha, including 120 ha for the two haul road options, of which only one will be developed.

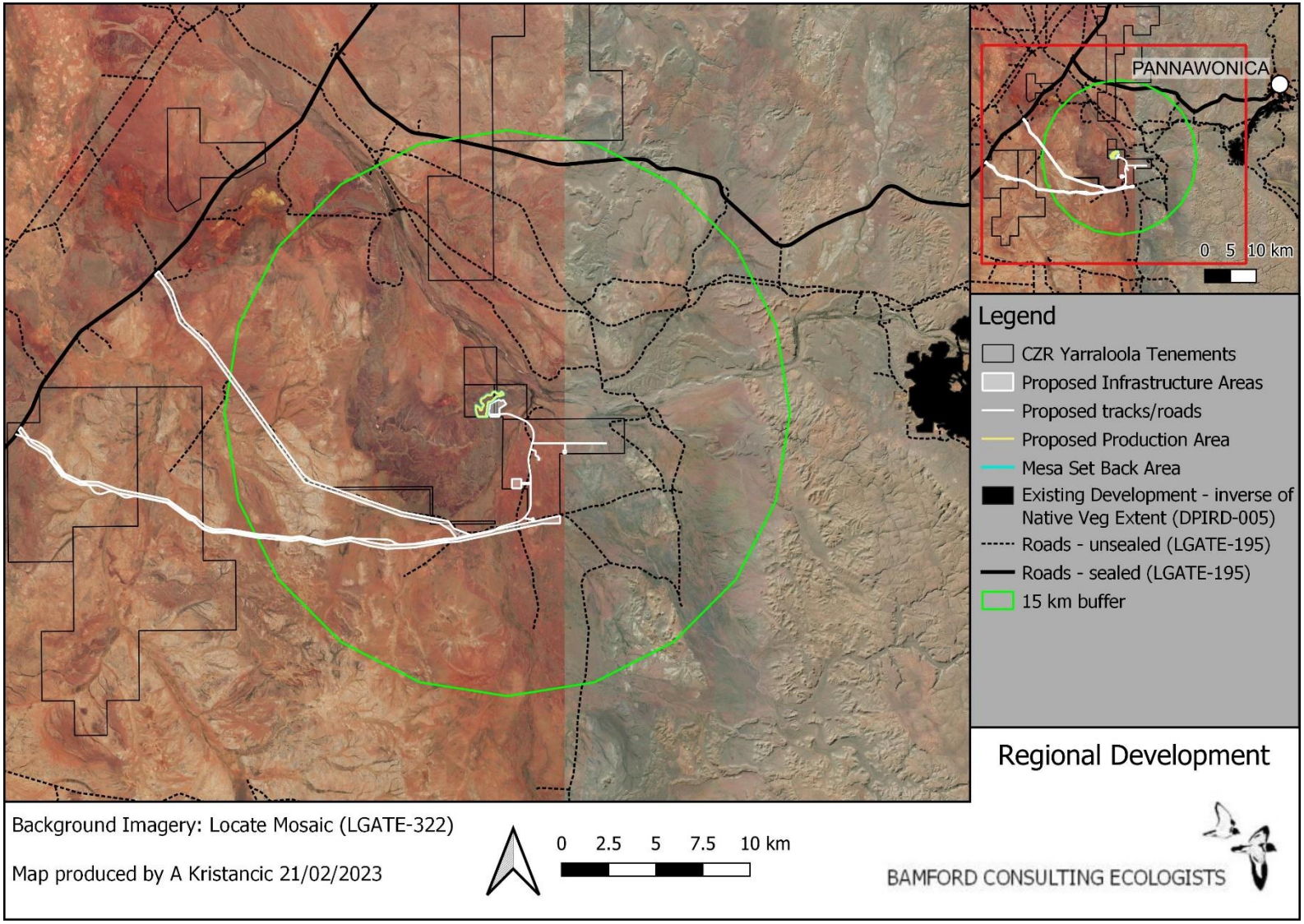

Figure 27. Estimated existing development within the region (15 km).

3.4 General fauna assemblage

3.4.1 Overview of vertebrate fauna assemblage

The desktop study identified 294 vertebrate fauna species as potentially occurring in the project area: six fish, seven frogs, 96 reptiles, 144 birds and 41 mammals (36 native and five introduced species). A summary of the vertebrate fauna assemblage is provided in Table 22 and the full list of expected species is given in Appendix 6. This assemblage is broadly typical of the region (western Pilbara) and is well-documented in previous studies. Most species are documented to be widespread but there is a suite of conservation significant species, discussed below.

Twenty-four species were returned from databases searches but have been omitted from the expected species list because of habitat or range limitations, or because they are now considered locally extinct. Based on the general literature, six native mammals would have been present historically and are now considered locally extinct: the Greater Bilby, Golden Bandicoot, Spectacled Hare-Wallaby, Western Chestnut Mouse, Greater Stick-nest Rat and Pale Field-Rat. The list of omitted species is presented in Appendix 7.

Across all field investigations (May, October 2021, July and September 2022), 147 vertebrate fauna species were confirmed to be present in the project area. This included three fish, two frogs, 43 reptiles, 80 birds and 19 mammals (17 native and 2 introduced). For fish, frogs, reptiles and mammals, all species observed were expected to be resident in the project area. For birds, almost all of the observed species were considered either resident or regular visitors in the project area, while two observed species were considered irregular visitors. All fauna records from the four field trips have been compiled into an annotated species list in Appendix 8.

Table 22. Overall composition of vertebrate fauna assemblage of the project area (Confirmed).

Taxon	Expected Species	Number of species in each status category				
		Resident	Regular visitor	Irregular visitor	Vagrant	*Locally extinct*
Fish	6 (3)	6 (3)	0	0	0	*0*
Frogs	7 (2)	7 (2)	0	0	0	*0*
Reptiles	96 (43)	96 (43)	0	0	0	*0*
Birds	144 (80)	75 (59)	35 (19)	29 (2)	5	*0*
Mammals	41 (27)	37 (26)	1	2	1	*6*
Total	**294 (155)**	**221 (133)**	**36 (19)**	**31 (2)**	**6**	***6***

NB: Total and number of expected species exclude species considered locally extinct.

3.4.2 Expected vertebrate fauna

Fish. Up to six fish species may be present in the project area and three were confirmed present in Robe Pool in May 2021. All fish species in the area require flowing or permanent free-standing water to persist, with one expected species present in subterranean waters. Aside from Robe Pool, which is

just outside the project area, it does not appear that a permanent surface waterbody persists in the project area. Warramboo Creek appears to be seasonal where it intersects with the southern haul road option. However, temporary free-standing water is almost certain during times of seasonal inundation therefore all fish are classed as regular visitors. Two fish species (Fortescue Grunter and Blind Cave Eel) are of conservation significance and are discussed below in Section 3.5.2.

Frogs. Up to seven frog species may be present in the project area and all are considered to be resident. Two species, the Little Red Tree-Frog and Niccholl's Toadlet, were recorded. All species either burrow or shelter in moist refugia when not active and rely on seasonal rains for breeding; they are likely to breed in pools along the Robe River and tributaries. Only one species, *Pseudophryne douglasi*, requires a permanent waterbody to persist. None of the frogs is of conservation significance.

Reptiles. Up to 96 reptile species may be present in the project area and all are considered to be resident; 43 were confirmed present. The assemblage of 96 species is almost certainly an over-estimate, but a rich reptile assemblage is expected due to the variety of environments present, from rocky gorges and gravelly plains to some sandy loam areas and moist soils along major drainage lines. The assemblage includes one freshwater tortoise, *Chelodina steindachneri,* which persists in isolated drainage lines, is able to tolerate ephemeral waterways and is capable of extended aestivation and lengthy overland movements. Three reptile species (Lined Soil-crevice Skink, Gane's Blind Snake and Pilbara Olive Python) are of conservation significance and are discussed below in Section 3.5.2.

Birds. Up to 144 bird species may be present in the project area and most (76%) are considered to be residents or regular visitors. Eighty species were observed across the four field trips. The assemblage includes waterbirds that will regularly visit wetlands within or very close to the project area. There is likely to be a high seasonal abundance of nectivorous birds present in the project area when vegetation is in flower, and there are also likely to be species that irrupt, becoming very abundant for short periods of time but often being absent or very uncommon. The bird assemblage is generally widespread with some arid and Pilbara specialists. Several species are of conservation significance and are discussed in Section 3.5.2.

Mammals. Up to 41 mammal species may be present in the project area and 38 of these are considered residents; this is probably an over-estimate but a rich assemblage can be expected because of the complex environment. Seventeen native and two introduced species were recorded during field investigations. The mammal assemblage is depauperate, with the loss of six species (Greater Bilby, Golden Bandicoot, Spectacled Hare-Wallaby, Western Chestnut Mouse, Greater Stick-nest Rat and Pale Field-Rat) that are considered to have become locally extinct due to introduced predators, altered fire regimes and possibly altered landscapes due to livestock grazing. Old nests of the Greater Stick-nest Rat were found in caves along the edge of the mesa (mine area). The extant native mammal assemblage includes 13 species of bat including two species of conservation significance: Ghost Bat and Pilbara Orange Leaf-nosed Bat. Six species are introduced (feral) species, of which two (Red Fox and Cat) are predators likely to severely impact several native fauna species. Including the Ghost Bat and Pilbara Leaf-nosed Bat, nine mammal species are of conservation significance and are discussed in Section 3.5.2.

Key Features Summary

- **Uniqueness**: The assemblage is likely to be distinctive to the western Pilbara due to the type and complexity of habitats present.
- **Completeness**: The assemblage of species from the project area is missing a number of native mammal species but is otherwise intact.
- **Richness**: The assemblage is rich in species and richness is likely to be moderately stable due to the high proportion of resident fauna, although there will be some annual variation according to climatic conditions and movements of mobile species.

3.5 Conservation significant fauna

3.5.1 Vertebrate fauna of conservation significance

Of the 294 species of vertebrate fauna that are expected to occur in the project area (Section 3.4.1 above), 28 are considered to be of conservation significance (15 CS1, seven CS2 and five CS3; see Appendix 1 for descriptions of these CS (conservation significance) levels). A summary of the numbers in each vertebrate class is presented in Table 23. These species of conservation significance are indicated in the complete species list (Appendix 6) but are also listed with details of their conservation significance in Table 24. The majority of conservation significant species are expected as residents or regular visitors (19 species), with some irregular visitors (5 species) or vagrants (3 species).

Table 23. The number of conservation significant species in each vertebrate class.

See Appendix 1 for full explanation of Conservation Significance (CS) levels: CS1 = listed under WA State and/or Commonwealth legislation; CS2 = listed as Priority by DBCA; CS3 = considered locally significant.

CLASS	CONSERVATION SIGNIFICANCE			
	CS1	CS2	CS3	Total
Fish	1	1	0	**2**
Frogs	0	0	0	**0**
Reptiles	1	2	0	**3**
Birds	9	1	4	**14**
Mammals	4	3	2	**9**
Total	**15**	**7**	**6**	**28**

The desktop assessment identified multiple records of conservation significant fauna in the wider area with results generated from the DBCA threatened species search and from the review of nearby survey reports mapped on Figure 28 to Figure 30. Across all field investigations, 12 species of conservation significance were confirmed as present in the project area (one fish, one reptile, 3 birds and 6 mammals; Table 24). All conservation significant species expected to be at least an irregular visitor in the project area are discussed below.

Table 24. Conservation significant fauna species expected to occur and confirmed present (bold).
Species are listed in taxonomic order. CS1, CS2, CS3 = (summary) levels of conservation significance.
EPBC Act listings: E = Endangered, V = Vulnerable, M = Migratory, Mar = Marine.
WA *Biodiversity Conservation Act 2016* listings: S1 to S7 = Schedules 1 to 7.
DBCA Priority species: P1 to P4 = Priority 1 to 4.

Species	Common name	Status	Expected occurrence	Confirmed			
				May 2021	Oct 2021	July 2022	Sept 2022
Leiopotherapon aheneus	Fortescue Grunter	CS2 (P4)	**Resident**	X	X		
Ophisternon candidum	Blind Cave Eel	CS1 (V, S3)	Resident				
Notoscincus butleri	Lined Soil-Crevice Skink	CS2 (P4)	Resident				
Anilios ganei	Gane's Blind Snake	CS2 (P1)	**Resident**			X	
Liasis olivaceus barroni	Pilbara Olive Python	CS1 (V, S3)	Resident				
Elanus scriptus	Letter-winged Kite	CS2 (P4)	Vagrant				
Erythrotriorchis radiatus	Red Goshawk	CS1 (V, S3)	Vagrant				
Apus pacificus	Fork-tailed Swift	CS1 (M, S5)	Irregular Visitor				
Falco peregrinus	Peregrine Falcon	CS1 (OS, S7)	Resident				
Falco hypoleucos	Grey Falcon	CS1 (V, S3)	Regular Visitor				
Burhinus grallarius	Bush Stone-curlew	CS3	**Resident**				X
Tringa glareola	Wood Sandpiper	CS1 (M, S5)	Irregular Visitor				
Actitis hypoleucos	Common Sandpiper	CS1 (M, S5)	Irregular Visitor				
Calidris acuminata	Sharp-tailed Sandpiper	CS1 (M, S5)	Irregular Visitor				
Glareola maldivarum	Oriental Pratincole	CS1 (M, S5)	Irregular Visitor				
Pezoporus occidentalis	Night Parrot	CS1 (C, S1)	Vagrant				
Stipiturus ruficeps	Rufous-crowned Emu-wren	CS3	**Resident**	X		X	X
Amytornis striatus	Striated Grasswren	CS3	**Resident**	X	X		
Neochmia ruficauda	Star Finch	CS3	**Resident**	X	X		
Dasyurus hallucatus	Northern Quoll	CS1 (E, S2)	**Resident**	X	X	X	X
Sminthopsis longicaudata	Long-tailed Dunnart	CS2 (P4)	Resident				
Trichosurus velpecula	Brushtail Possum	CS3	**Resident**			X	
Petrogale lateralis	Black-flanked Rock-Wallaby	CS1 (V, S3)	Vagrant				
Petrogale rothschildi	Rothschild's Rock-Wallaby	CS3	**Resident**	X	X		
Leggadina lakedownensis	Short-tailed Mouse	CS2, (P4)	Resident				
Pseudomys chapmani	Ngadji or Western Pebble-mound Mouse	CS2 (P4)	**Resident**			X	
Rhinonicteris aurantia	Pilbara Leaf-nosed Bat	CS1 (V, S3)	**Resident**	X			
Macroderma gigas	Ghost Bat	CS1 (V, S3)	**Resident**	X	X		

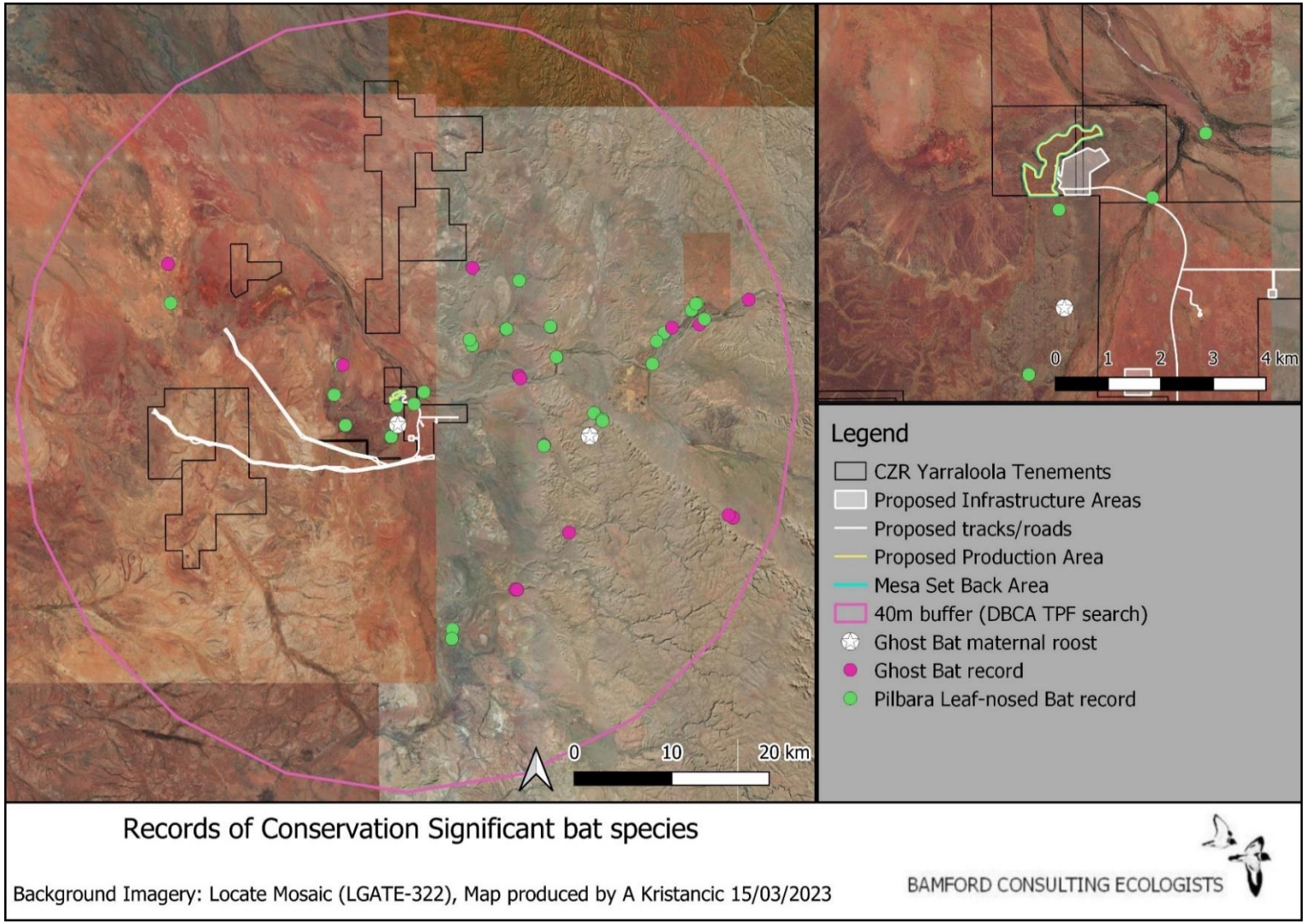

Figure 28. Database records (DBCA threatened fauna database and reports) of conservation significant bat species across the region. Coordinates for locations are provided in Appendix 9.

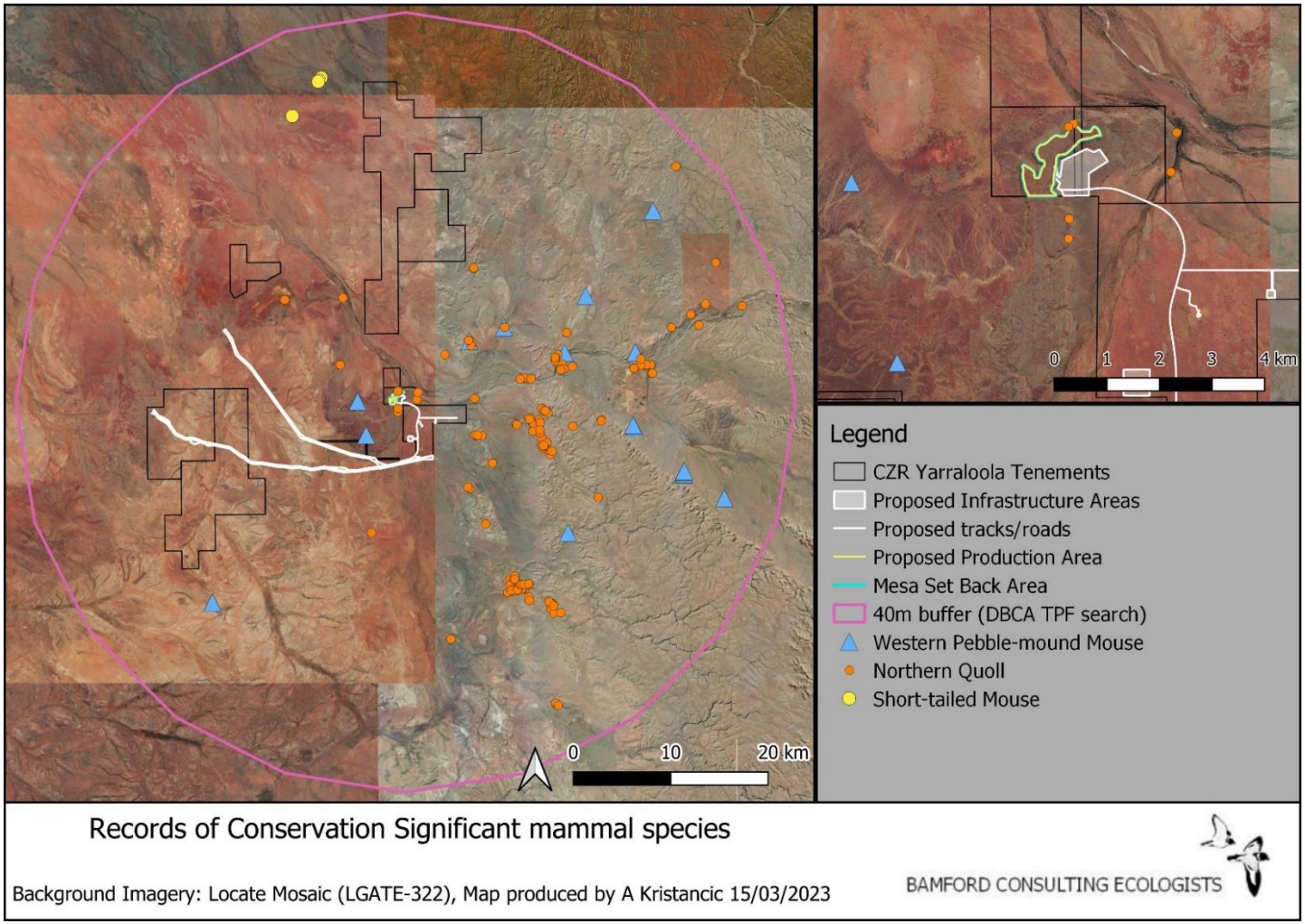

Figure 29. Database records (DBCA threatened fauna database and reports) of conservation significant mammals across the region. Coordinates for locations are provided in Appendix 9.

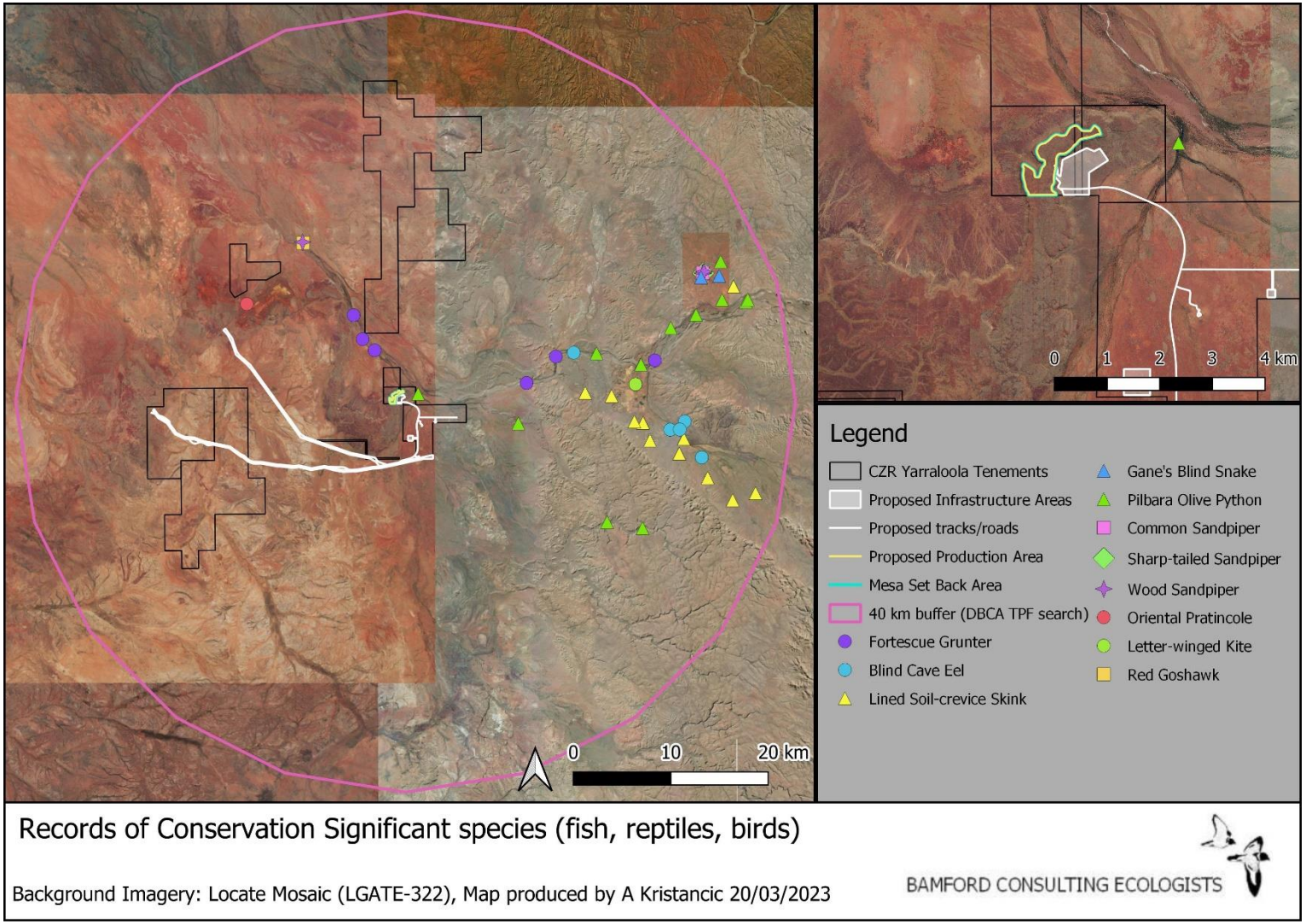

Figure 30. Database records (DBCA threatened fauna database) of conservation significant fauna (fish, reptiles, and birds) across the region. Coordinates for locations are provided in Appendix 9.

3.5.2 Conservation significant species accounts

A list of all 28 conservation significant vertebrate species expected within the project area is provided in Table 24 (see also Section 3.5). Information on the conservation status, distribution and habitat, salient ecology, records in the project area (where applicable) and expected occurrence is provided for those species expected to occur at least as irregular visitors (see below). Species expected only as vagrants are not discussed as the project area is of no conservation value for them. Conservation significant invertebrates collected during investigations by BCE are discussed by Biota (2022b).

3.5.2.1 Conservation Significance 1

Blind Cave Eel (*Ophisternon candidum*) CS1 (V, S3)

Conservation status: Vulnerable under the EBPC Act and Schedule 3 under the BC Act. The key threats to the Blind Cave Eel are sedimentation from mining and construction, canal development, water abstraction, point source pollution from sewage, landfill, dumping and mining, and diffuse pollution from urban development (TSSC 2008).

Distribution and habitat: Populations were thought to have existed only on Cape Range however discoveries along Robe River and Barrow Island in recent years have expanded its known distribution (Moore *et al.* 2018). Genetic analysis suggest that the three populations are isolated and unlikely to mix (MWA 2018). This species persists in stratified waters ranging from freshwater at the surface to seawater salinities at depth and is known to traverse this range (TSSC 2008). These waters lack surface connection to the sea.

Ecology: This species is one of only three vertebrate animals known from Australia that are restricted to subterranean waters and caves. It is a predator of small invertebrates but little is known of its biology.

Expected occurrence: Resident. Nine records lie within the vicinity of the project area, the closest of which is 12 km to the east (Figure 28). Five records are from the DBCA threatened species search and four from a biological survey undertaken for Rio Tinto for the assessment of Mesa H (Rio Tinto 2019). All records span an area in the Robe River north and east of Mesa J and along Jimmawurrada creek, which supports the likelihood of habitat connectivity and features between the creek/river systems. The subterranean water of the Robe River and Mungarathoona Creek within the project area is likely to connect with the aquifers only 12 km to the east therefore this species is highly likely to be present.

Pilbara Olive Python (*Liasis olivaceus barroni*) CS1 (V,S3)

Conservation status: Vulnerable under the EBPC Act and Schedule 3 under the BC Act.

Distribution and habitat: This species occurs in the Hamersley Ranges, Dampier Archipelago, Pannawonica, Millstream, Tom Price and Burrup Peninsula as scattered populations within the Pilbara region, and has been recorded east to near Marble Bar and Nifty on the edge of the Great Sandy Desert (M. Bamford pers obs.). It is found in rocky areas with a preference for deep gorges with streams and permanent pools (Pearson 1993, Burbidge 2004). Waterholes are an important feature for this species as they wait there to ambush prey (Pearson 2006). In the warmer months there is a preference for riparian habitats while in the cooler times, Olive Pythons utilise rocky habitats such as escarpments, mesas, caves and gorges (Doughty *et al.* 2011).

Ecology: Usually found in proximity to water, although breeding males and juveniles may disperse widely (Burbidge 2004). Males can travel distances of up to 4 km during the breeding season (June to August) to locate females (Pearson 1993). An ambush predator that feeds predominately on mammals and birds (Burbidge 2004). There may be seasonal movement between watercourses and upland rocky landscapes (Doughty *et al.* 2011).

Expected occurrence: Resident. The DBCA threatened database search identified 24 records within the surrounding area. The majority of these records lie further east along the Robe River with the nearest being 5km from the project area. The Rio Tinto Mesa H report (2019) documented an additional six along the Robe Valley including one record at the northern stretch of Mungarathoona Creek at a permanent waterhole which is located within 300 metres of the project area (Figure 30). Biological surveys undertaken by environmental consultants have recent records within the vicinity at Mesa H (Astron 2016), Bungaroo (Astron 2016a) Middle Robe/East Deepdale (Astron 2016b) and Yarraloola (Biologic 2014). While the species was not detected during field investigations, the major watercourses (such as Mungarathoona Creek just east of the mine area and Warramboo Creek at the southern haul road route) provide suitable habitat, and rocky areas including the mesa of the mine area may be used for shelter during the cooler months.

Fork-tailed Swift (*Apus pacificus*) CS1 (M,S5)

Conservation status: Migratory under the EPBC Act and Schedule 5 under the BC Act.

Distribution and habitat: The swift is a largely aerial species of unpredictable occurrence in Western Australia. There are scattered records from the south coast, widespread in coastal and subcoastal areas between Augusta and Carnarvon, scattered along the coast from south-west Pilbara to the north and east Kimberley region. Sparsely scattered inland records, especially in the Wheatbelt, but more common in the north and north-west Gascoyne Region, north through much of the Pilbara Region, and the south and east Kimberley (Higgins 1999; DAWE 2021a). Aerial, usually flying in excess of 300 m above the ground but sometimes almost at ground level.

Ecology: A diurnal, aerial insectivore, this species often forages along the edge of low pressure systems in flocks of ten to 1000 birds (Higgins 1999; DAWE 2021a). Breeds in Siberia (April to July) and spends the non-breeding season (October to mid-April) in Australia. Being aerial, it is effectively independent of terrestrial ecosystems when in Australia.

Expected occurrence: Irregular visitor. Likely to be occasionally and unpredictably present within the region and to pass over the project area on an occasional basis.

Grey Falcon (*Falco hypoleucos*) CS1 (V, S3)

Conservation status: Vulnerable under the EPBC Act and Schedule 3 under the BC Act.

Distribution and habitat: Sparsely distributed through central, northern and north-western Australia, this species appears to have a distribution that is centred around wooded ephemeral or permanent drainage lines (Menkhorst *et al.* 2017).

Ecology: An aerial, diurnal predator that predominantly forages on pigeons and parrots, although may also take invertebrates, reptiles and small mammals (Debus 2019). Sedentary when seasonal conditions are favourable, nomadic in times of drought (Debus 2019).

Expected occurrence: Regular visitor. Given the proximity of the Robe River valley and associated riparian woodlands, the species is expected to be at least a regular visitor to the northern part of the project area and could also forage along Warramboo Creek. It was not recorded during field investigations and is usually quite conspicuous, but may still be present regularly. Records on Birdlife Birdata website show the nearest sightings 37 km north and 40 km south-west along the North-West Coastal Highway.

Peregrine Falcon (*Falco peregrinus*) CS1 (S7)

Conservation status: Schedule 7 under the BC Act.

Distribution and habitat: More or less cosmopolitan and occurs throughout Australia (Menkhorst *et al.* 2017). This species occurs in a variety of environments but is usually reliant on cliff faces or tall trees for nesting (Debus 2019).

Ecology: A highly adept aerial predator that predominantly forages on birds, although will also occasionally take invertebrates, fish, reptiles and mammals (Debus 2019). Mostly diurnal or crepuscular.

Expected occurrence: Resident. The project area is likely to be within the home range of a pair, and cliff faces in the project area provide suitable nest sites for breeding. The Peregrine Falcon have been recorded 37 and 47 km south-east in the Hamersley ranges in gorge habitats through the DBCA threatened species search. The study area may provide suitable habitat for breeding and foraging given the likely presence of cliffs and large trees.

Migratory waders (shorebirds) (at least four species; see Table 24) CS1 (M, S5 [C, S2,S3])

Conservation status: Migratory under the EPBC Act and Schedule 5 under the BC Act, with some species also listed as Schedule 2 or 3 under the BC Act.

Distribution and habitat: Migratory wader species that may occur in any areas of suitable habitat throughout Australia, including wetlands, coasts, rivers, lakes, mudflats, mangal and man-made water bodies (e.g. salt ponds and sewage ponds), although some species (e.g. pratincoles, Little Curlew) also utilise dryland habitats (Hayman *et al.* 1991). These species are not just reliant on permanent water bodies and will also regularly use ephemeral wetlands and drainages when suitable conditions prevail (Hayman *et al.* 1991).

Ecology: Migratory waders generally forage diurnally for aquatic invertebrates from wetland substrates and, within the group, have a diverse range of foraging strategies and body forms (e.g. bill morphology) to reflect specialisations towards specific foraging niches (Hayman *et al.* 1991; Rogers *et al.* 2003). These species breed in the higher latitudes of the northern hemisphere and migrate south (including Australia) for the non-breeding season (Hayman *et al.* 1991; Rogers *et al.* 2003). While some species make this journey almost non-stop, most require stopover points along the route to 'refuel' and internationally important staging sites have been identified by Bamford *et al.* (2008). Migratory waders are most abundant in Australia in the non-breeding season (the austral summer) but some birds may be present at any time of year (especially in northern Australia).

Expected occurrence: Irregular visitors. The project area provides little habitat for these species, but small number may occasionally visit drainage systems, and temporary flooding of claypans may also provide small areas of habitat for brief periods. The Oriental Pratincole can appear in large numbers for short periods of time to catch flying insects.

Northern Quoll (*Dasyurus hallucatus*) CS1 (E,S2)

Conservation status: Endangered under the EBPC Act and Schedule 2 under the BC Act. With a former range from The Pilbara and the Kimberley across to south-eastern Queensland, the species has suffered a large population decline due to many factors, but most recently linked to the spread of the introduced Cane Toad. The Pilbara population is considered to have been declining since the mid-1980s with the precise causes unknown (DAWE 2021c).

Distribution and habitat: In Western Australia this species is often associated with rocky areas in the Pilbara (but also occurs along watercourses and beaches) and occurs through forests, savannahs and dissected rocky environments in the Kimberley (Van Dyck and Strahan 2008; DAWE 2021c). It also occurs, patchily, across northern Australia to Queeensland (Van Dyck and Strahan 2008; DAWE 2021c).

The Pilbara population inhabits complex, rocky areas across the north, central and west Pilbara, and with recent records from the far eastern Pilbara (Turpin and Bamford 2015). According to Nature Map location records (Cramer *et al.*, 2016). It is less common through the south and east of the Hamersley Ranges than elsewhere in the Pilbara. High quality habitat is considered to be rugged, rocky areas associated with ironstone ridges, basalt mesas and gorges generally in close association with permanent water (Begg 1981; Schmitt et al. 1989; Braithwaite and Griffiths 1994; Oakwood 1997). Northern Quoll den sites are often in rock crevices, with surrounding vegetated habitats used for foraging and dispersal (TSSC 2005). Den sites may also include tree hollows, logs, termite mounds and goanna burrows but these are used less frequently than rocky habitats. Rocky areas also provide refuge from feral cats, fire and livestock.

The region around the project area is a stronghold for this species with the DBCA search documenting 502 records within a 50km radius. Previous surveys as part of a biological survey west of Mesa H (10-15 km E) recorded Northern Quoll on 27 occasions (Astron 2016). The majority of records were found in the breakaway habitat with some records in the riverine and gorge habitats. There appears to be a significant population along the western edge of Mesa H with several dozen recorded on the DBCA threatened species search.

Ecology: A predominantly nocturnal predator of invertebrates, amphibians, reptiles, birds and small mammals (Van Dyck and Strahan 2008). Northern Quoll may be both terrestrial and arboreal (Van Dyck and Strahan 2008). This species undergoes a post-breeding male-die off (semelparity), with most individuals (including females) only surviving for one or two breeding seasons (Van Dyck and Strahan 2008). Home ranges are overlapping; on average 35 ha for females and 100 ha for males (Oakwood 2008; Hernandez-Santin *et al.* 2021).

Expected occurrence:

Resident. In addition to the large number of records across the region, there have been several recent nearby records including Mesa A (Biota 2005) (12km NW) and North of Red Hill (Biota 2009) (7km S). During field investigations, the Northern Quoll was recorded on all field trips on cameras (23 locations), and with secondary evidence in the form of tracks and scats being widespread. Records were on the mesa edge, on top of the mesa, on an isolated rocky hill near Transect 1 (Plate 23), along drainage lines (including Warramboo Creek along the southern haul road route; Plate 24) and even on sandy flats several hundred metres from rocky landscapes. Locations of all records are plotted on Figure 31, with record details in Appendices 10 and 11. The major rocky landscapes were clearly the focus of the population, with the majority of cameras set around the mesa edge recording the species, but drainage lines were also supporting the species, and individuals were moving across the plains.

Plate 23. Northern Quoll caught on camera (rocky hill near Transect 1) in September 2022.

Plate 24. Sandy bank of Warramboo Creek near the southern haul road route showing multiple Northern Quoll tracks (July 2022).

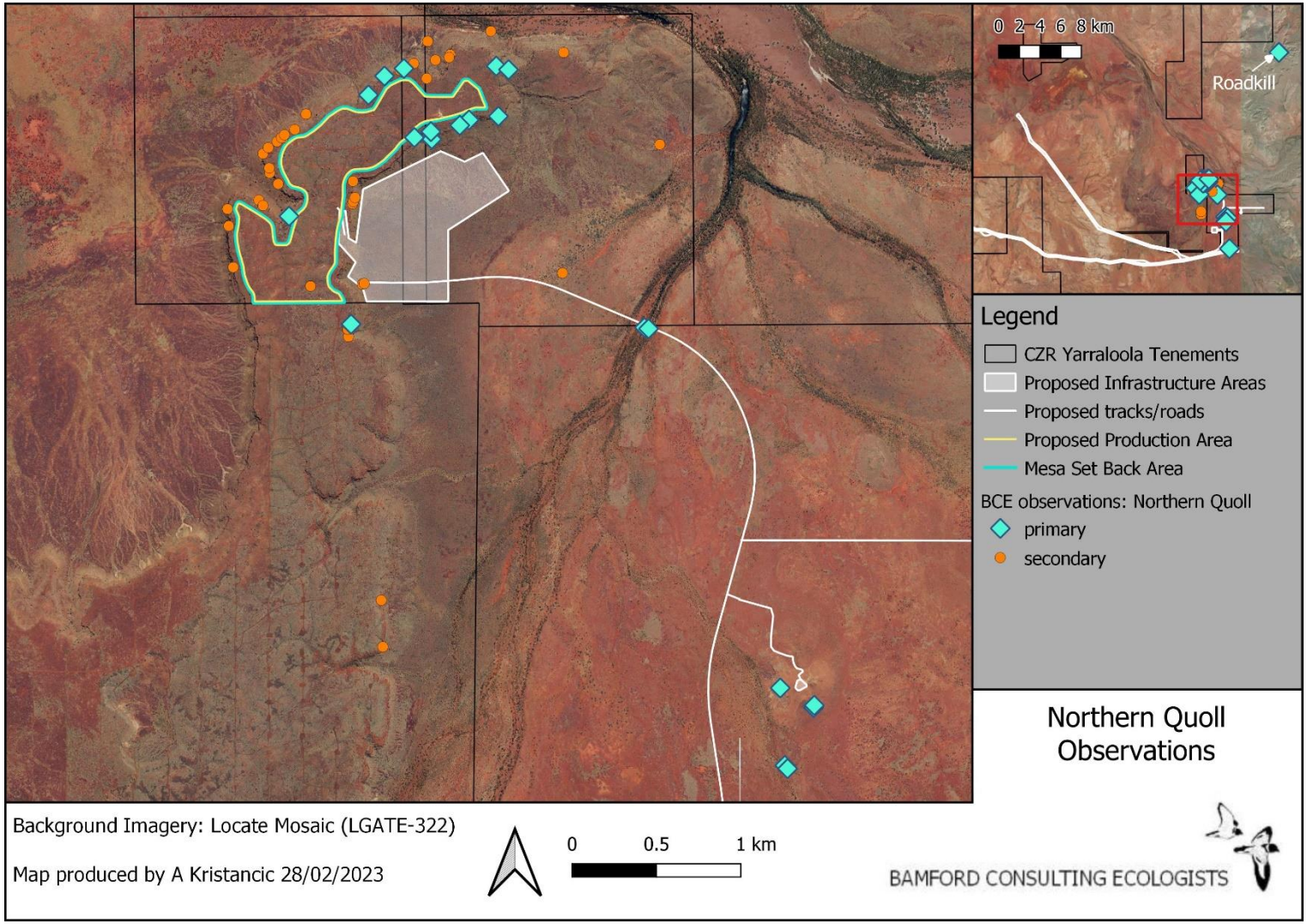

Figure 31. Locations where Northern Quoll were observed by BCE during field investigations. Secondary observations include scats and tracks. Location on Warramboo Creek along the southern haul road option not shown.

Ghost Bat (*Macroderma gigas*) CS1 (V, S3)

Conservation status: Vulnerable under the EPBC Act and Schedule 3 under the BC Act. The major threat to Ghost Bat populations are habitat loss and degradation due to mining activities (TSSC 2016). Ghost Bats are easily disturbed when roosting and disturbance threatens the viability of roosts with unregulated human visitation. The Cane Toad is also a threat and there are anecdotal reports of Ghost Bats disappearing from the eastern Kimberley following arrival of the Cane Toad. The Pilbara Ghost bat population is estimated at 1500-2000 individuals (Bat Call 2017; TSSC 2016). Current population estimates in the Hamersley and Chichester subregions are approximately 350 and 1500 respectively. The current Pilbara population is discontinuous, with geographically disjunct colonies occurring. The Pilbara population has decreased by at least 30% and a future estimated decline of 30% over the next 20 years with a decrease in range expected, particularly in the central and eastern Hamersley Range (TSSC 2016).

Distribution and habitat: Occurs in discontinuous populations through northern Australia, including a Pilbara population and a Kimberley-Northern Territory population (Van Dyck and Strahan 2008; Churchill 2009; TSSC 2016b). The Ghost Bat occurs in a broad range of environments including grasslands, forests, open woodlands and rainforests (Churchill 2009; TSSC 2016b). Ghost Bats require foraging habitat and suitable roosting opportunities. There are two types of roosts: maternity roosts that may be permanent and support breeding, and non-breeding roosts roost that may be permanent or semi-permanent and support non-breeding animals. A key feature of maternity roosts is an interior chamber that is rising toward the rear thereby trapping warmer and more humid air at the top, allowing suitable conditions to form when reproductive females and pups are present (Armstrong and Anstee 2000; Churchill 1991; Churchill and Helman 1990). For a population to persist, Bat Call WA (2017) describes the requirement for an “apartment block” of roosting opportunities, with at least one deep cave that has characteristics of a maternity roost, multiple caves/shelters and overhangs in close proximity offering nocturnal feeding and refuge opportunities, a productive set of gullies and gorges locally, a productive foraging area within 5-10 km radius, usually including a good quality riparian line or ephemeral fresh water, and appropriate protection from human interference.

Ecology: A nocturnal predator of vertebrates including frogs, reptiles, birds and mammals, including other bats (Van Dyck and Strahan 2008; Churchill 2009; Claramunt *et al.* 2019). Ghost Bats may also take large invertebrates (TSSC 2016b). Unlike other microchiropteran bats, the Ghost Bat hunts visually (rather than using echolocation continuously) and may either perch in vegetation and ambush prey, or glean prey off ‘surfaces’ such as the ground (Van Dyck and Strahan 2008; TSSC 2016b). Ghost bats use daytime roosts in caves, rock crevices and old mines with a relatively stable temperature of 23°−28°C and a moderate to high relative humidity (Churchill 2009; TSSC 2016b).

Expected occurrence:

Resident. There are multiple existing records of the Ghost Bat in the region (75 records within 50km in the DBCA threatened fauna database; Figure 28), and these records include at least one confirmed maternity roost in a gully on the mesa about 650m south of the project area. This roost supported about 70 animals in 2017 (Bat Call WA 2017). Two further possible maternity roosts are known from nearby (Astron 2017), and a recent population estimate suggested the lower to mid Robe Valley supports about 150 Ghost Bats (Bat Call 2017; TSSC 2016). In May 2021 there were 16 primary records of Ghost Bats (observed; other records were of scats at the entrance to caves), with most of these observed animals along the mesa edge but one over the camp on the plain (Figure 32). Most of these observations came from the evening 'bat-watches' summarised in Table 31 (Appendix 11). The highest count was of seven animals emerging from the known maternity roost area south of the project area (27/05/21), while the highest count within the project area was of three animals (28/05/21). These animals in the project area emerged from caves in the gully on the western side of the mesa, but there were also records from the east of the mesa. There were two records (three animals) from the evening bat-watch along the west side of the mesa in October 2021, while no Ghost Bats were seen during evening watches on two evenings in September 2022. This included one evening observing the known maternity roost, and while observations were made on only one night at this location, results suggest that the maternity roost was not in use in that year. Ghost Bat records were scattered around the margins of the mesa in the project area (Figure 32), but numbers seen were always low. Evening bat-watches took place in the breeding season in 2021 and 2022, and result suggest that the caves along the mesa edge in the project area are used by small numbers of non-breeding animals. This is consistent with the structure of the caves, which were generally shallow, going back up to about 10m but lacking the vertical interior chamber suggested to be important for maternity roosts. A total count could not be made across the project area, but across three evening and in different locations in May 2021, eight Ghost Bats were counted.

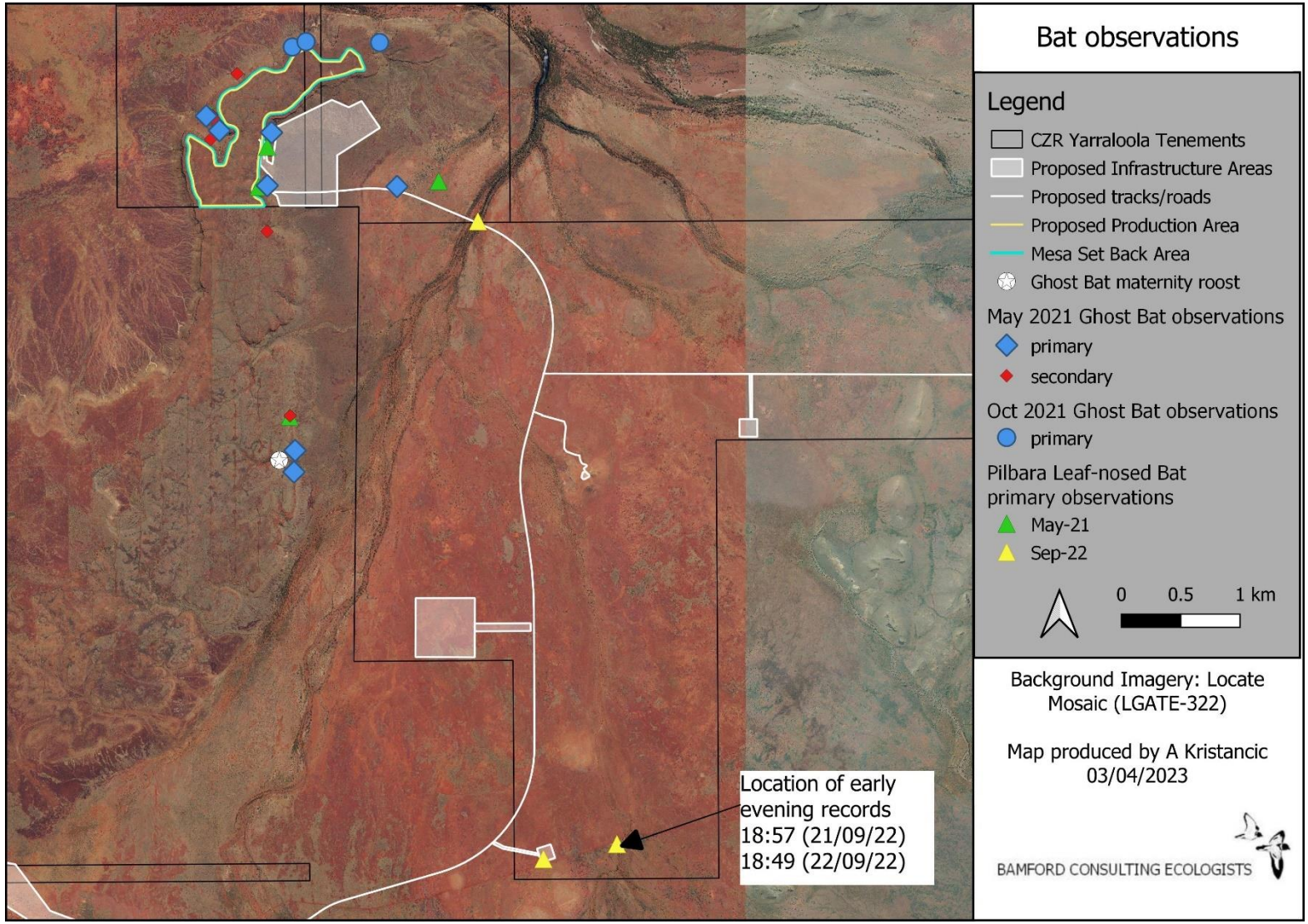

Figure 32. Locations where conservation significant bat species were recorded during field investigations.

Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia* (Pilbara)) CS1 (V,S3)

Conservation status: Vulnerable under the EBPC Act and Schedule 3 under the BC Act. The Pilbara Leaf-nosed Bat is under threat due to expanding mining activities in the Pilbara and future collapse of mine adits currently used for roosting (Cramer *et al*. 2016; TSSC 2016). Most of the known natural roosting sites coincide with areas of current or future interest for mining development; hence mining activities are an identified threat to Pilbara populations of the species (DotEE 2017b).

Distribution and habitat: The Pilbara Leaf-nosed Bat occurs within the Pilbara where it is limited in distribution by the availability of very hot (28-32 °C) and very humid (96-100%) roost sites in caves and/or abandoned mine voids (Armstrong 2001; Van Dyck and Strahan 2008). These are especially important as maternity roosts. Populations of the Pilbara Leaf-nosed Bat are found in three distinct areas: in the mines of the eastern Pilbara, scattered throughout the Hamersley range in small colonies, and in sandstone formations south of the Hamersley Range (Armstrong 2001). There are also populations of the non-Pilbara form of the Orange Leaf-nosed Bat (*R. aurantia*) in the Kimberley and Northern Territory (Van Dyck and Strahan 2008).

Ecology: A nocturnal, aerial insectivore (DAWE 2021d). Populations spread from diurnal roosts to satellite roosts when wet season conditions allow, to then consolidate back to permanent sites during dry periods (Bat Call 2013). Foraging habitat is diverse and includes riparian vegetation, hummock grassland, and sparse tree and shrub savannah for this insectivorous bat (Duncan, Baker, and Montgomery 1999). It is known to have a usual foraging range up to 20 km from its primary roost caves but appears to require a permanent water site within 5 km (Bat Call 2013).

Expected occurrence: The Pilbara Leaf-nosed Bat (Vu, S3) has been recorded 119 times across the Robe Valley according to DBCA threatened species search and Rio Tinto database (Rio Tinto 2019). The records are concentrated around areas of significant roost sites, often associated with disused mine infrastructure. Within the vicinity of the project area there are four records, one along Mungarathoona Creek (just south of Robe Pool) and three records within 1 km of the project area: one along the Robe River to the north and two on Mesa F. The Rio Tinto report (Rio Tito 2019) states that Mesa F was surveyed for potential roosts and no Pilbara Leaf-nosed Bat roosts were discovered.

During the May 2021 survey, five of the ten bat detectors recorded Pilbara Leaf-nosed Bat calls (Table 32). Three records were on the margins of the mesa (both east and west), while one was detected over camp and one at the known Ghost Bat maternity roost site south of the project area (Figure 32). As with the Ghost Bat, the cave structures within Mesa F appeared suitable for seasonal roosting Pilbara Leaf-nosed Bats, but were probably not suitable for maternity roosts. Pilbara Leaf-nosed Bat records were generally made late at

night or about an hour before sunrise, suggesting the animals had travelled some distance from a roost site before they were detected.

In September 2022, the species was recorded at three of the five locations sampled, and was recorded most often along a eucalypt-lined creek near a stock well about 1km east of camp. It was also recorded over the camp (Table 25). The earliest of the records at the stock well were 39 minutes after sunset and 17 minutes after last light, suggesting a roost within a few kilometres. The last records were consistently between 02:30 and 03:30 hours. The stock well is alongside a tree-lined creek and possibly the bats were following this line of vegetation. Given the consistent lack of large numbers of records in the mesa area and the time of year, this observation suggests that there may be a maternity roost to the south or south-east of the stock well location. There are some existing records to the south and many to the east (Figure 28).

Table 25. Pilbara Leaf-nosed Bat results from ARUs, September 2022, indicating times of first and last records each night. At Pannawonica, sunset on 21/09/22 was at 18:10 hours, while last light was at 18:32 hours.

ARU identity	Location	Night	First record	Last record	Total number of records
SM4 1147	Stock well east of camp	21-22/09/22	18:57	02:25	8
		22-23/09/22	18:49	03:30	15
		23-24/09/22	19:57	02:50	28
		24-25/09/22	21:36	02:50	41
SM4 1240	Mungaraththoona Creek	22-23/09/22			0
		23-24/09/22	21:46	-	1
		24-25/09/22			0
SM4 01247	Camp	24-25/09/22	22:32	01:01	2
		25-26/09/22	20:31	00:53	8

NB. Location details given on Table 18. ARUs with no records are not shown.

3.5.2.2 Conservation Significance 2

Fortescue Grunter (*Leiopotherapon aheneus*) CS1 (P4)

Conservation status: Listed as Priority 4 by DBCA.

Distribution and habitat: Restricted to the Fortescue, Robe and upper Ashburton Rivers (Allen *et al.* 2002). Occurs in permanent water but will disperse into seasonal waters during flood periods.

Ecology: Poorly known; feeds mainly on small invertebrates and requires permanent water.

Expected occurrence: Resident. There are database records from the nearby Robe River (Figure 30), and the species was observed in pools north-east of the project area in May 2021.

Lined Soil-crevice Skink *(Notoscincus butleri)* CS2 (P4)

Conservation status: Listed as Priority 4 by DBCA. It has a somewhat limited distribution and is believed to be threatened by altered fire regimes and invasive Buffel grass.

Distribution and habitat: Once thought to be restricted to coastal areas between Karratha and Port Hedland, it is more widespread than originally thought, encompassing most of the western Pilbara from Dampier Peninsula, Pannawonica and Karijini National Park (Teale *et al*. 2017). This species is associated with spinifex-dominated areas near creek and river margins in arid, rocky areas (Wilson and Swan 2021).

Ecology: A species that forages in leaf litter and feeds on invertebrates.

Expected occurrence: Resident. Assumed to be resident on a precautionary basis but not found during field investigations. If present, areas of sandy soils close to drainage lines on the plains may provide suitable habitat. The DBCA threatened species search documented 72 records within the vicinity, all east of the project area. Astron (2016) recorded five individuals approximately 15 km east on loamy/stony plains and low hill habitat types on Mesa H. It has also been recorded at Bungaroo (Astron 2016a; Biota 2010), Middle Robe/East Deepdale (Astron 2016b) and Warramboo (20 km NW) (Biota 2006).

Gane's Blind-Snake (Pilbara) *(Anilios ganei)* CS2 (P1)

Conservation status: Listed as Priority 1 by DBCA.

Distribution and habitat: A fossorial snake with a patchy and poorly documented distribution from Newman to Pannawonica, and thought to be associated with moist soils of gorges and gullies (Wilson and Swan 2021).

Ecology: Burrows in soil and leaf mould and probably feeds mainly on ant larvae and pupae (like most blind-snakes).

Expected occurrence: Resident. One specimen (Plate 25) found beneath very dense and moist litter at base of a eucalypt near Transect 3 (Figure 36). It is probably restricted to the major drainage lines in and north of the project area.

Plate 25. Gane's Blind-Snake found in July 2022.

Long-tailed Dunnart *(Sminthopsis longicaudata)* CS2 (P4)

Conservation status: Listed as Priority 4 by DBCA.

Distribution and habitat: Occurs across much of the Pilbara, Gascoyne and across into the southern Northern Territory, but distribution not well-known and the species is not often encountered. Generally associated with rocky landscapes and scree slopes (van Dyke *et al.* 2013).

Ecology: A nocturnal insectivore that is probably sedentary and breeds annually, but biology poorly-known.

Expected occurrence: Resident. Not recorded during field investigations but assumed to be a resident as suitable habitat is present on the mesas and rocky hills, and the project area lies within the range of the species and there are nearby records from databases (Figure 29).

Short-tailed Mouse (*Leggadina lakedownensis*) CS2 (P4)

Conservation status: Listed as Priority 4 by DBCA.

Distribution and habitat: Northern Pilbara through the Kimberley and into northern Australia (Van Dyck and Strahan 2008), inhabiting a range of environments including spinifex and tussock grasslands, samphire and sedgelands, *Acacia* shrublands, tropical *Eucalyptus* and *Melaleuca* woodlands and stony ranges (Van Dyck and Strahan 2008). Usually associated with areas that are seasonally inundated on red or white sandy-clay soils (Van Dyck and Strahan 2008). The Pilbara population, which may represent a distinct taxon (Van Dyck and Strahan 2008), has a preference for cracking clay/gilgai soils (B. Metcalf pers. obs.).

Ecology: Nocturnal and solitary, the Short-tailed Mouse feeds predominately on invertebrates but may supplement its diet with plant material (Van Dyck and Strahan 2008). Populations of the Short-tailed Mouse appear to fluctuate dramatically, probably in response to environmental conditions and food availability.

Expected occurrence: Resident. Not recorded during field investigations but assumed to be a resident as suitable habitat is present on the plains where there are areas of heavy soils. Because of annual fluctuations in abundance, the species may be undetectable in some years.

Ngadji or Western Pebble-mound Mouse (*Pseudomys chapmani*) CS2 (P4)

Conservation status: Listed as Priority 4 by DBCA.

Distribution and habitat: This species is found through much of the Pilbara and prefers rocky soils in grassland and acacia woodland. It tends to be restricted to gentle slopes and rises with a veneer of coarse gravel/cobbles with which it constructs its characteristic mounds

Ecology: The Ngadji lives in groups in burrows surrounded by and beneath mounds of pebbles. These mounds re constructed by the animals. Mounds are typically found on low gravelly and stony rises.

Expected occurrence: Resident. There are several database records within 20km of the project area (Figure 28), the most recent of which is from 2015. One old and disused mound was found in the north of the infrastructure area, with another probable old mound in the east. Several active or recently active mounds (Plate 26) were found along the southern haul road route in July 2022 (Figure 33 and Figure 34). indicating that the species is currently resident in close proximity to the proposed development area. All inactive and active/potentially active mounds were found on gravely to rocky slopes and rises, including the slopes of mesas. No mounds were found across the top of Mesa F (the mine area) despite walked searches across this area.

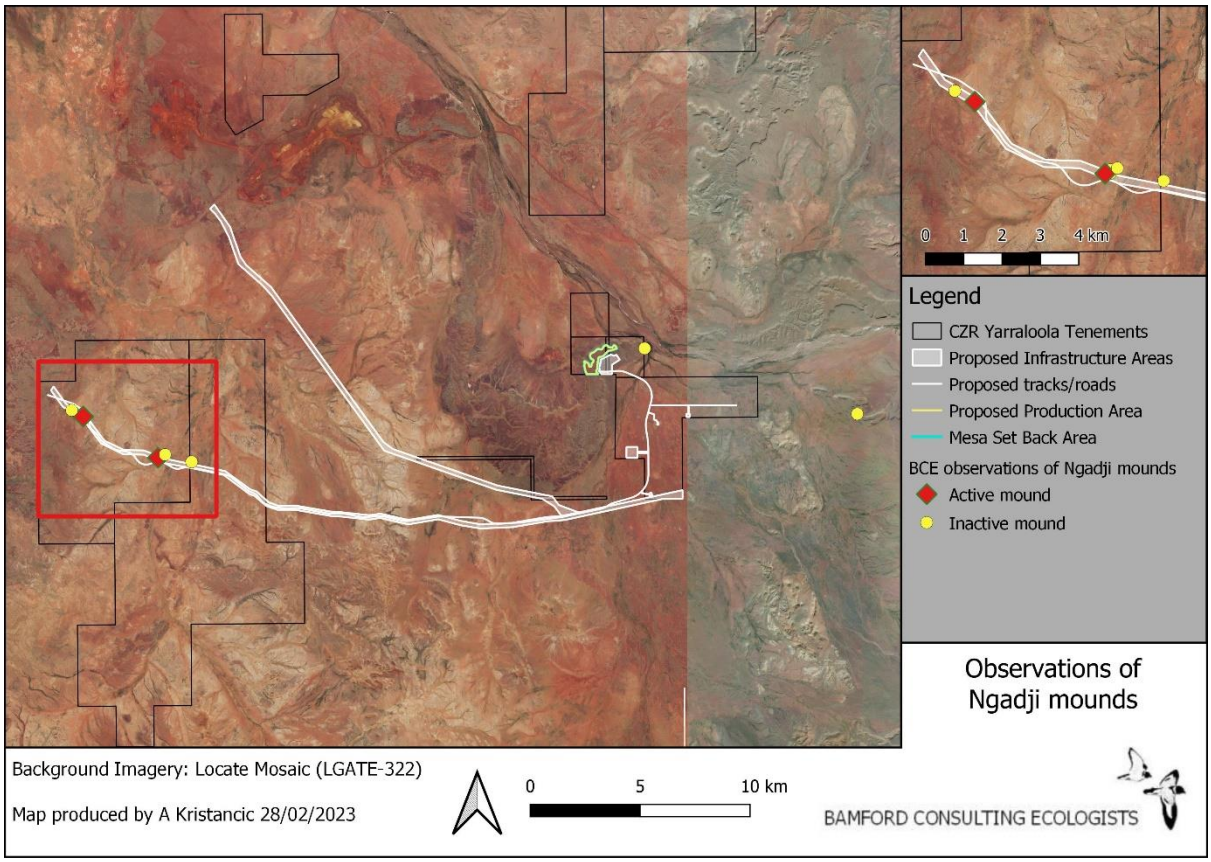

Figure 33. Ngadji (Western Pebble-mound Mouse) mounds recorded during BCE field investigations.

Plate 26. An active or recently active mound of the Ngadji (Western Pebble-mound Mouse) found along the southern haul road option. This environment of a fine gravelly surface on a slight rise is typical for the species.

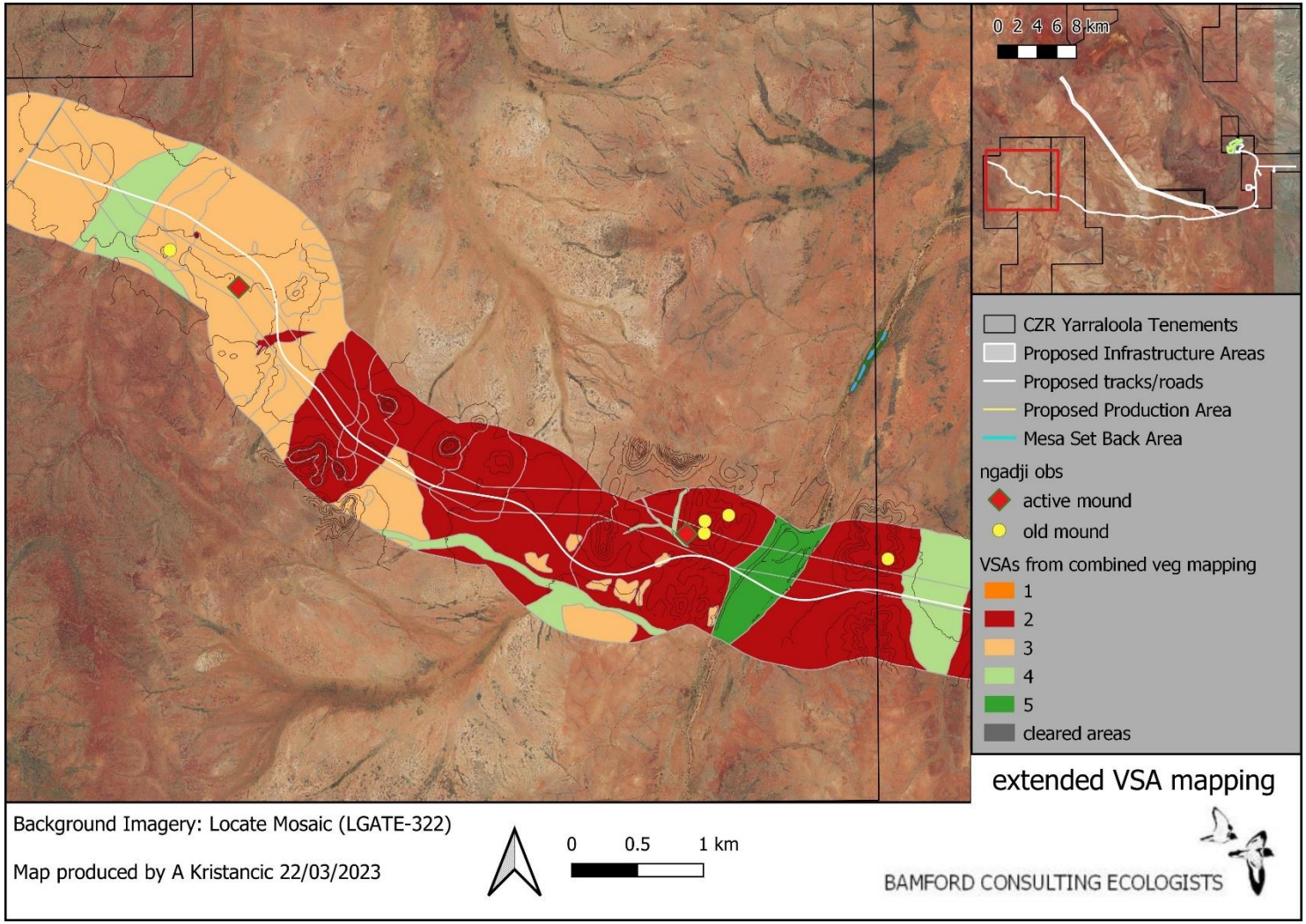

Figure 34. Details of Ngadji records in relation to VSAs along the southern haul route.

3.5.2.3 Conservation Significance 3

Bush Stone-curlew (*Burhinus grallarius*) CS3 (LS)

Conservation status: The Bush Stone-curlew has experienced historic declines across southern Australia, associated with habitat loss and impacts from introduced species (e.g. predation from foxes and feral cats). It appears to be locally common in the Pilbara.

Distribution and habitat: The Bush Stone-curlew occurs throughout Australia, with the exception of the central desert areas, but has declined and is extinct across much of the southern part of its range (Menkhorst *et al.* 2017). It occurs in grassy woodlands and open forests (Johnstone and Storr 1998; Menkhorst *et al.* 2017), and in the Pilbara often occurs along drainage systems including dry river-beds.

Ecology: The stone-curlew is predominantly nocturnal and is largely an insectivore, (Johnstone and Storr 1998; Menkhorst *et al.* 2017).

Expected occurrence: Resident. Heard and seen regularly along drainage systems within the infrastructure area and along Warramboo Creek.

Striated Grasswren (*Amytornis striatus*) and Rufous-crowned Emu-wren (*Stipiturus ruficeps*) CS3 (LS)

Conservation status: These species are patchily distributed in the Pilbara and often associated with long-unburnt spinifex.

Distribution and habitat: Both species prefer tall, dense unburnt spinifex on plains and rocky hills.

Ecology: Insectivorous and granivorous, both species are secretive and stay close to cover.

Expected occurrence: Residents. Both species were confirmed present in the project area. The Rufous-crowned Emu-wren was observed on all trips except October 2021. The Striated Grasswren was observed in May and October 2021, including photographs on motion-sensitive cameras (Plate 27). Locations of records are illustrated in Figure 36 and record details are in Appendices 10 and 11. Both species were recorded almost entirely in tall, dense spinifex on the slopes and at the base of Mesa F.

Plate 27. Striated Grasswrens (four birds) investigating a bait tube at the entrance to a small cave on the edge of the mesa.

Star Finch (*Neochmia ruficauda*) CS3 (LS)

Conservation status:	This species is patchily distributed and was formerly listed as priority by DBCA.
Distribution and habitat:	Distributed patchily from the Pilbara to north-eastern Queensland. Its preferred habitat is grasslands associated with drainage systems. Usually seen in flocks close to dense vegetation and even rushes.
Ecology:	A granivore that often feeds on the ground.
Expected occurrence:	Resident. Confirmed present in the project area during field investigations in May 2021. Small flock present along the watercourse north-east of mesa F.

Brush-tailed Possum (*Trichosurus vulpecula*) CS3 (LS)

Conservation status: This species is considered locally significant as it is recorded infrequently in the Pilbara (Anderson *et al.* in prep.). It has declined throughout its range in Western Australia. The taxonomic affinities of Brush-tailed Possums in the Pilbara are uncertain; the northern sub-species (*T. vulpecula arnhemensis*) of the Kimberley is considered Vulnerable (EPBC Act) and Schedule 3 (BC Act).

Distribution and habitat: Formerly distributed across almost the whole of Australia, the Brush-tailed Possum's range has now been reduced in Western Australia to the south-west, the Kimberley and an isolated population within the north-western Pilbara, including offshore islands (Van Dyck and Strahan 2008). There may be other outlying Pilbara records (M. Bamford, pers. obs). It occurs in a wide variety of environments that usually encompass trees, including forests, woodlands, riparian zones and urban areas, but it also persists in treeless landscapes such as Barrow Island (Van Dyck and Strahan 2008). The Robe Valley area appears to be a possible stronghold for the Pilbara population (Anderson *et al.* in prep).

Ecology: A nocturnal herbivore, its preferred diet is predominantly leaves, flowers and fruits (Van Dyck and Strahan 2008).

Expected occurrence: Resident. Confirmed present in the project area during field investigations in July 2022 (on motion sensitive camera near transect 2; Plate 28 and Figure 36), in an area of Bloodwood along a drainage line (VSA 4). Scats were found in the same area.

Plate 28. Brush-tailed Possum recorded in July 2022 along Transect 2.

Rothschild's Rock-Wallaby (*Petrogale rothschildi*) CS3 (LS)

Conservation status: This species is considered locally significant due to its restricted distribution.

Distribution and habitat: Distributed patchily in the Pilbara region. Its preferred habitat is rocky hills.

Ecology: A nocturnal herbivore which prefers to shelter in caves and rocky outcrops during the day but may forage away from rocky hills at night.

Expected occurrence: Resident. Confirmed present in the project area during field investigations in May and October 2021. Abundant scats and some tracks were found in caves and on flats in May 2021. In October 2021, an individual was flushed from a rock hollow. The species was also captured on motion sensitive cameras during May and October 2021 field trips (Plate 29). Locations of records are illustrated in Figure 36 and record details are in Appendices 10 and 11. The Black-flanked Rock-Wallaby is of higher significance and occurs in a few locations in the Pilbara, but there are no records of this species nearby, and all photographs were of Rothschild's Rock-Wallaby.

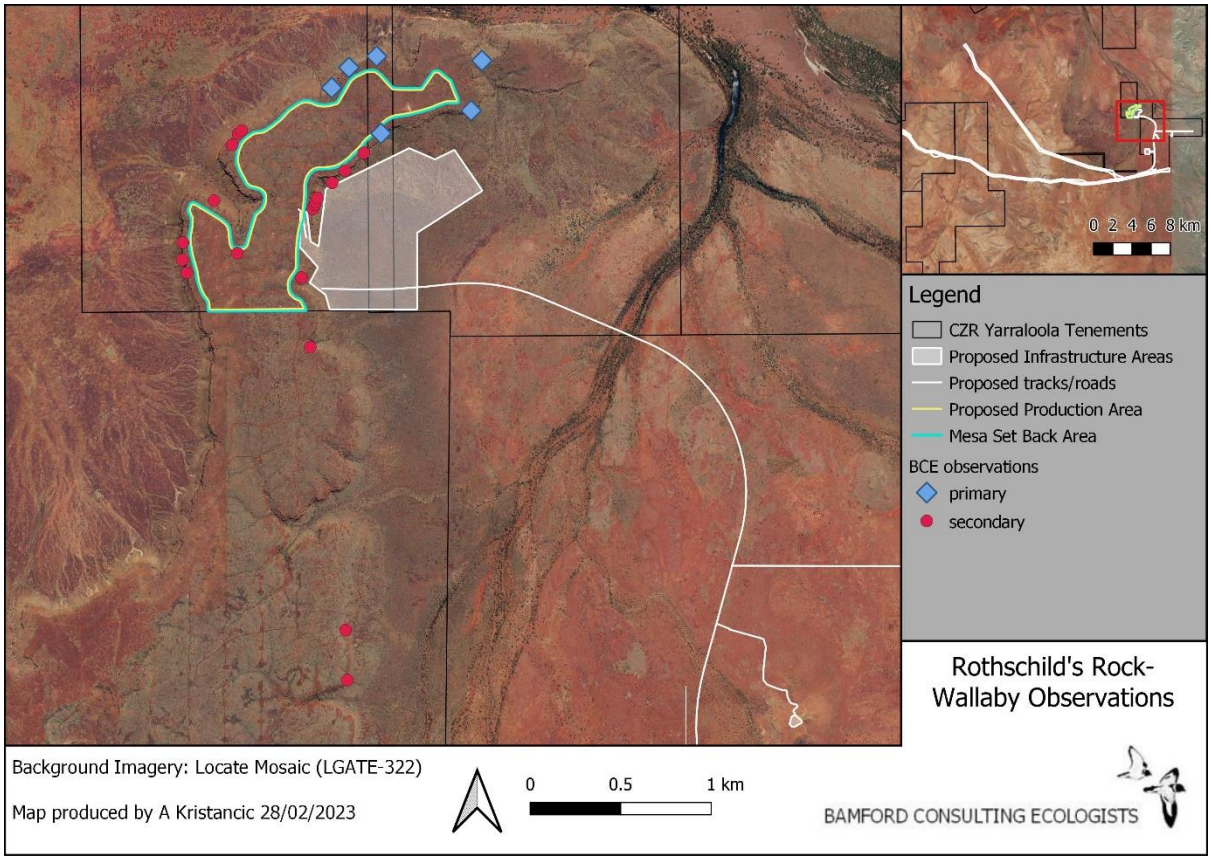

Figure 35. Rothchild's Rock-Wallaby observations.

Plate 29. Rothschild's Rock-Wallaby and a Northern Quoll investigating the same bait-tube in a shallow cave on the edge of Mesa F, November 2021.

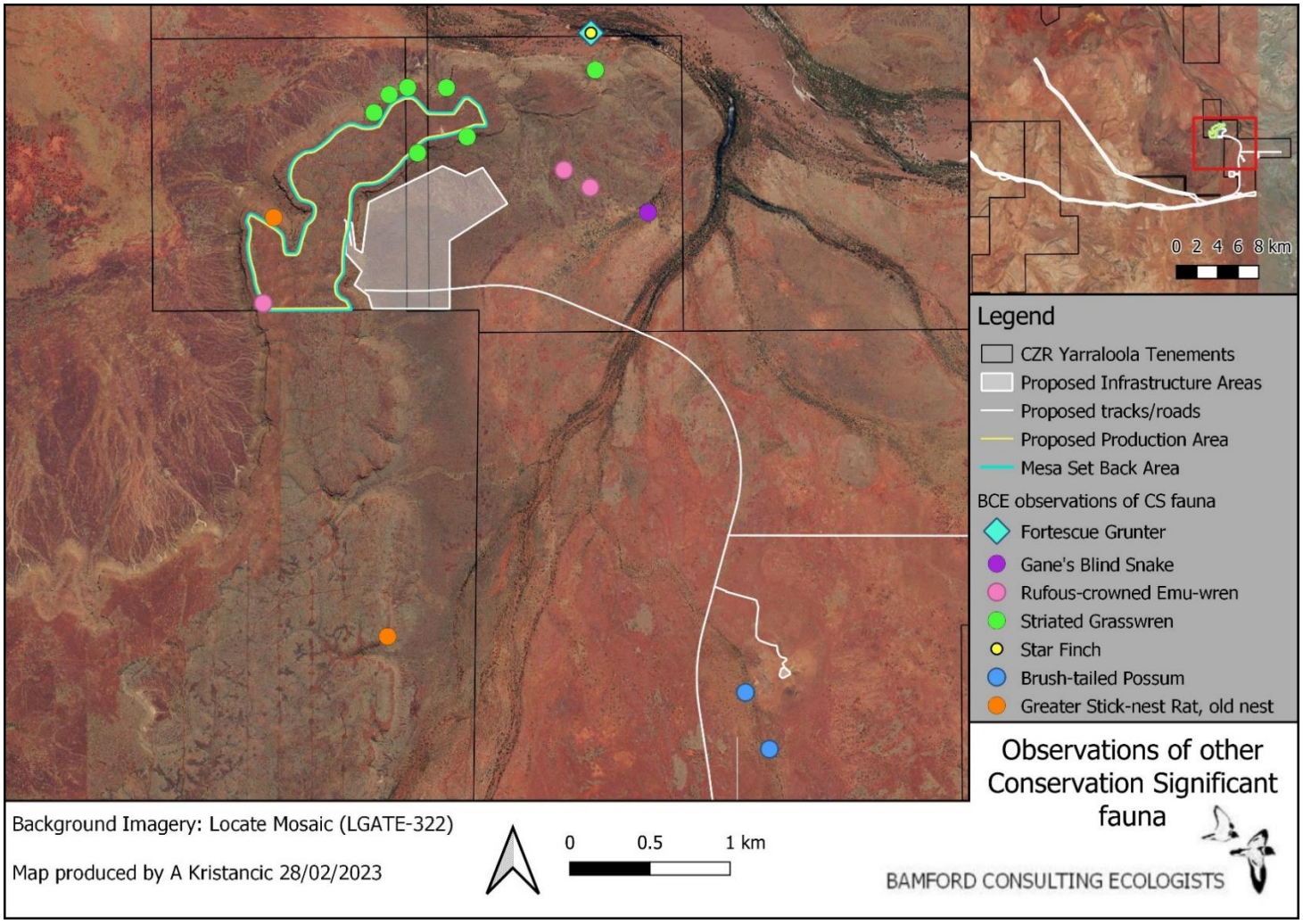

Figure 36. Locations of conservation significant fish, reptiles and birds, and some mammals, observed during BCE field investigations. Note: Northern Quoll, Rothschild's Rock-Wallaby, Ngadji, Ghost Bat and Pilbara Leaf-nosed Bat are shown on separate figures.

3.6 Patterns of biodiversity

3.6.1 Overview

Investigating patterns of biodiversity can be complex and are often beyond the scope even of comprehensive field investigations, but it is possible to draw some general conclusions based upon the different landscapes in the project area, the previous studies that have taken place in the vicinity and the field investigations conducted in 2021-2022. Trapping and bird censusing in July and September 2022 are particularly useful for the development of an understanding of how the fauna assemblage is organised across the landscape. Species of conservation significance were generally not detected in the systematic trapping and bird censussing but their relationship with the landscape is discussed for each species above.

All the vertebrate species recorded by trapping and censusing were expected to be present based upon past records and interpretation of the environment. The sampling therefore contributed little to an understanding of the assemblage composition (i.e., the species that make up the assemblage), but results are examined below to determine if they contribute to an understanding of assemblage organisation (such as variation in abundance and local distribution of species). For example, the five sampling transects (described in 2.4.5.1) passed through some different landscapes which may differ in the species present, and in their abundance (although abundance can vary greatly from year to year). Environments of the five transects are:

- Transect 1 (Figure 18) passes across a fairly uniform landscape of plains (VSA3).
- Transect 2 (Figure 19) passes through plains (VSA3) but also crosses an area of Bloodwood thicket (VSA4) and over a low, rocky hill (VSA2). The eastern end lies in an area of dense acacia on heavy loam soil (VSA3).
- Transect 3 (Figure 20) is complex, passing mostly through plains (VSA3), but crossing an area of VSA5 (*Eucalyptus victrix* woodland over Buffel Grass) and in the north entering rocky hills on the edge of a low mesa (VSA2).
- Transect 4 (Figure 21) lies almost uniformly across plains (VSA3) but in the east crosses a moderately large creekline with a narrow belt of large *Eucalyptus victrix* along the banks of a watercourse (a simple example of VSA6).
- Transect 5 (Figure 22) consisted of just five sampling points placed within riparian forest (VSA6) on dark grey-brown clay.

3.6.2 Pitfall and funnel trapping

The pitfall and funnel sampling in July and September 2022 recorded five mammal, 22 reptile and one bird species, with a total of 200 captures (Table 26 and Table 27; raw data in Appendix 11). The numbers of species and captures varied between transects. Transect 5 had few captures (only 4 captures across two field trips); despite the lower number of sampling locations (five compared with 20 at other transects) this was much lower than other transects which had a range of 39 (Transect 2) to 63 (Transect 4) captures. Transect 5 was restricted to the heavy loam-clay soils close to a drainage system and this probably limits the species richness, especially for reptiles which often burrow.

Transect 3 was notable for a high number of captures (53) and the highest number of species (20; compared with 13 to 17 species at transects with comparable sampling effort. Transect 3 crossed the greatest range of environments and included lower gravelly slopes of a mesa, thus high species richness is to be expected.

Most species were caught in low numbers across the transects but a few displayed patterns in abundance.

- The Pilbara Ningaui was almost confined to Transect 3 (16 of 19 captures), with most captures on the lower gravelly slopes.
- The Sandy Inland Mouse was caught mostly on Transect 1 (14 captures with the next highest captures of five on Transect 4). Both these transects had areas of sandy loam soils and thick clumps of spinifex.
- The Leopard Ctenotus was more abundant on Transects 1 and 4 (8 and 10 captures respectively), with only four captures on each of Transects 2 and 3.
- The Dwarf Bearded Dragon was most abundant on Transect 4 (13 captures), with just two to four captures on other transects. Interestingly, the majority of captures were gravid females probably on the ground (the species is partly arboreal) to lay eggs in the sandy soils along Transect 4.

Table 26. Summary of trapping data from July 2022.
Captures in pitfall and funnel traps are pooled.

Species	**Common name**	**T1**	**T2**	**T3**	**T4**	**T5**	**TOTAL**
Mammals							
Ningaui timealeyi	Pilbara Ningaui			2			**2**
Pseudomys desertor	Desert Mouse				1		**1**
Pseudomys hermansbergensis	Sandy Inland Mouse	5		3	3		**11**
Sminthopsis macroura	Stripe-faced Dunnart				1		**1**
Reptiles							
Ctenophorus caudicinctus	Ring-tailed Dragon		2	1	2		**5**
Ctenophorus isolepis	Central Military Dragon	2	6	2	3		**13**
Ctenotus grandis			1				**1**
Ctenotus helenae	Clay-soil Ctenotus			1	1		**2**
Ctenotus pantherinus	Leopard Ctenotus	3	3	2	5		**13**
Ctenotus saxatilis	Rock Ctenotus			1			**1**
Diplodactylus bilybara	Fat-tailed Gecko		4		1		**5**
Gowidon longirostris	Long-nosed Dragon		3	2			**5**
Lucasium stenodactylum			1				**1**
Menetia greyii	Common Dwarf Skink	1		1	1		**3**
Pogona minor	Dwarf Bearded Dragon	1	3	1	7		**12**
TOTAL # individuals		**12**	**23**	**16**	**25**	**0**	**76**
TOTAL # species		**5**	**8**	**10**	**10**	**0**	**15**

Table 27. Summary of trapping data from September 2022.
Captures in pitfall and funnel traps are pooled. Note sampling effort was lower in Transect 5.

Species	**Common name**	**T1**	**T2**	**T3**	**T4**	**T5**	**TOTAL**
Birds							
Turnix velox	Little Button-quail		1				1
Mammals							
Dasykaluta rosamondae	Kaluta	1		1			2
Ningaui timealeyi	Pilbara Ningaui		2	14	1		17
Pseudomys hermansbergensis	Sandy Inland Mouse	9	4	1	2	1	17
Sminthopsis macroura	Stripe-faced Dunnart				1		1
Reptiles							
Anilios hamatus		1					1
Anilios pilbarensis	Pilbara Blind Snake			1			1
Carlia munda	Shaded-litter Rainbow-Skink			2			2
Ctenophorus caudicinctus	Ring-tailed Dragon		1				1
Ctenophorus isolepis	Central Military Dragon	2	2	2	4		10
Ctenotus helenae	Clay-soil Ctenotus		1				1
Ctenotus pantherinus	Leopard Ctenotus	5	1	2	5		13
Ctenotus saxatilis	Rock Ctenotus			1	1		2
Diplodactylus bilybara	Fat-tailed Gecko	2		3	3		8
Eremiascincus isolepis						2	2
Gehyra variegata	Variegated Dtella	2	1	1	5		9
Gowidon longirostris	Long-nosed Dragon					1	1
Heteronotia binoei	Bynoe's Gecko	2	2	1			5
Lerista clara				2	1		3
Lerista muelleri				1	1		2
Lucasium stenodactylum					2		2
Menetia greyii	Common Dwarf Skink			1	2		3
Nephrurus cinctus				1			1
Pogona minor	Dwarf Bearded Dragon	1	1	1	6		9
Strophurus elderi	Jewelled Gecko			3			3
Varanus acanthurus	Spiny-tailed Monitor				1		1
Varanus brevicauda	Short-tailed Pygmy Monitor	1					1
Varanus bushi	Pilbara Mulga Monitor	1			3		4
Varanus eremius	Pygmy Desert Monitor	1					1
TOTAL # individuals		**28**	**16**	**38**	**38**	**4**	**124**
TOTAL # species		**12**	**10**	**17**	**15**	**3**	**29**

3.6.3 Bird census

Overall, 584 individuals of 41 bird species were recorded during the systematic bird censusing.

During July 2022, 195 individuals of 34 bird species were recorded within 25m of the transects during the systematic bird census, with an additional 15 species being recorded only outside the transects (Table 28). Transect 2 had the highest bird abundance and species richness (72 individuals of 27 species) and transect 5 had a very low bird abundance and species richness (2 individuals of 2 species); to some extent this can be explained by there only being 5 sampling points on this transect, compared to 20 points on all other transects, but it remains a proportionally low number of records for effort. Transects 1, 3 and 4 had moderate bird abundance and species richness (Table 28).

In September 2022, 389 individuals of 36 bird species were recorded within 25m of transects during the systematic bird census, with an additional 11 species being recorded only outside the transects (Table 29). Transect 4 had the highest bird abundance and species richness (155 individuals of 25 species), while transects 1, 2, and 3 had moderate to high abundance and species richness. Transect 5 again had the lowest bird abundance and species richness, but at 36 individuals of 12 species, both metrics were much higher than what was recorded for this transect in July 2022.

Generally speaking, both bird abundance and species richness were higher in September than July. Seasonal differences in bird abundance and species richness are shown in Figure 37. This difference was more pronounced for some transects than others, and Transect 2 showed the opposite pattern, with both bird abundance and species richness higher in July than September. Transect 4 is notable for species richness and abundance, and Transect 2 for species richness. Both cross drainage lines and Transect 2 in particular passes through a large area of Bloodwood thicket (VSA 4; Plates 10 to 12).

There were few strong patterns of distribution among the bird species, with most being recorded in low numbers along most or all transects. The White-plumed Honeyeater was closely associated with Bloodwood and other eucalypts along Transects 3 and 4, as was the Yellow-throated Miner. Such close associations with floristics and/or structure are typical of birds, and can also be linked to social behaviour; for example the White-winged Fairy-wren was almost only recorded in one area along Transect 4 where there was a resident party. Distributions of species and abundance was reviewed along the transects and while there were few clear patterns there were some strong seasonal trends as illustrated on Figure 38 and Figure 39 for Transect 4. There was a clear change in distribution of individuals between July and September 2022, with an aggregation of birds in the east in September. This was due to a stock watering point nearby and presumably to the increased reliance of birds on a water source during warmer weather.

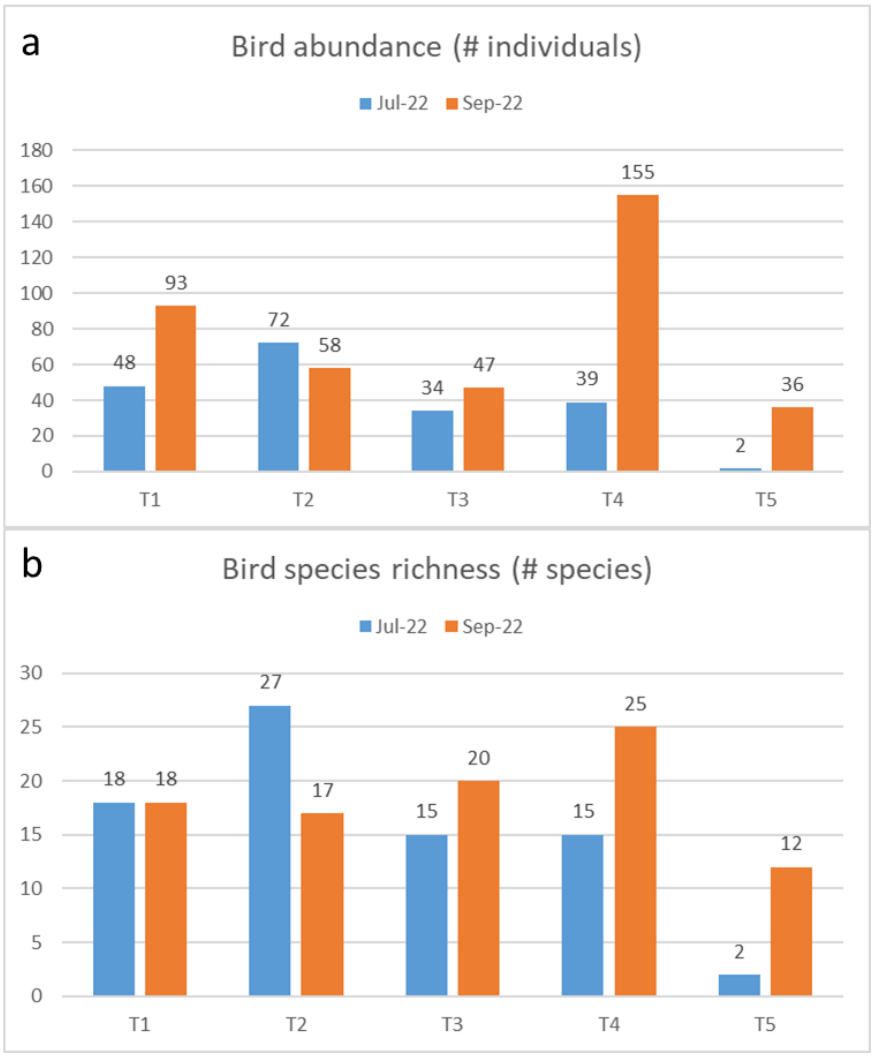

Figure 37. Seasonal difference in a) bird abundance and b) species richness across all the bird census transects (T1-T5).

Table 28. Summary of bird census data for each transect (T1-T5), from July 2022.
Species recorded outside but not within 25m are indicated (X), and marked with an asterisk.

Species	T1	T2	T3	T4	T5
Australian Ringneck	1	X	2	X	
Black Honeyeater	X				
Black-eared Cuckoo					X
Black-faced Cuckoo-shrike		1	1		
*Black-faced Woodswallow	X	X	X	X	
*Blue-winged Kookaburra	X		X		
*Brown Falcon	X	X			
Brown Honeyeater	4	1	9		X
Brown Quail	1	1	X		
Budgerigar	1	3	X	2	
Cockatiel		1	2	1	
*Common Bronzewing			X	X	
Crested Bellbird	3	3	X	X	X
Crested Pigeon	1	1	2	2	X
Diamond Dove		6		1	X
Galah	2	2	X	3	
*Grey Shrike-thrush		X			X
*Grey-crowned Babbler	X	X	X		X
*Grey-headed Honeyeater			X		
*Hooded Robin		X			
Horsfield's Bronze-Cuckoo	3	3	X	1	X
Little Button-quail	3	1	1	2	
Little Corella	5	2	X	X	X
Little Woodswallow		2	X		
Magpie-lark		X	1	1	X
Pallid Cuckoo	X	1	X	X	X

Species	T1	T2	T3	T4	T5
Peaceful Dove		1	X	X	X
*Pied Butcherbird	X			X	
*Pied Honeyeater		X			
Purple-backed Fairy-wren	2	1	1		
*Rainbow Bee-eater	X	X	X		
Red-backed Kingfisher		1			
*Rufous Songlark		X			
Rufous Whistler	X	2	X	X	X
Rufous-crowned Emu-wren			1		
Sacred Kingfisher		1			
Singing Honeyeater	7	12	2	3	
Spinifex Pigeon	3	5	1	4	
Spinifexbird	6	3	X	X	
*Spotted Harrier	X				
Torresian Crow	X	X	1	X	X
Tree Martin	1	4		1	
Weebill					1
White-plumed Honeyeater	X	11	2	X	1
White-winged Fairy-wren	1			2	
White-winged Triller		1			
Willie Wagtail		1		2	X
Yellow-throated Miner	1	1	7	12	
Zebra Finch	3	X	1	2	
TOTAL # individuals	**48**	**72**	**34**	**39**	**2**
TOTAL # species (<25m)	**18**	**27**	**15**	**15**	**2**
TOTAL # species (ALL)	**30**	**39**	**32**	**27**	

Table 29. Summary of bird census data for each transect (T1-T5), from September 2022.
Species recorded outside but not within 25m are indicted (X).

Species	T1	T2	T3	T4	T5
Australian Bustard	1			X	
Australian Magpie				X	
Australian Ringneck			1	X	
Black-chinned Honeyeater					X
Black-faced Cuckoo-shrike	X	X	3	2	3
Black-faced Woodswallow	5	1		2	
Black-fronted Dotterel				X	
Blue-winged Kookaburra			X	X	X
Brown Falcon	1	X	2	1	
Brown Honeyeater	6	1	5	1	7
Brown Quail		1	1		
Budgerigar	16	10	2	3	3
Cockatiel		X	1	1	1
Common Bronzewing				4	
Crested Bellbird	2	X		1	
Crested Pigeon	1		2	11	
Crimson Chat	X				
Diamond Dove	4	5	2	13	
Galah	2	2	3	7	
Grey Shrike-thrush				X	X
Grey Teal				X	
Grey-crowned Babbler			X	X	X
Horsfield's Bronze-Cuckoo	X	X	1	2	
Little Corella	X		X	2	
Magpie-lark	X	1		1	2
Masked Woodswallow	17	1		7	1
Pallid Cuckoo		4	1	2	

Species	T1	T2	T3	T4	T5
Peaceful Dove			X		1
Pheasant Coucal				X	
Pied Butcherbird				X	
Purple-backed Fairy-wren			X		X
Rainbow Bee-eater	X	X	X		X
Red-browed Pardalote				X	
Rufous Songlark		2			
Rufous-crowned Emu-wren			1		
Rufous Whistler		X	X		X
Sacred Kingfisher			X		2
Singing Honeyeater	8	12	X	21	
Spinifex Pigeon	4	2	2	24	
Spinifexbird	1	1	4	2	
Torresian Crow	2		X	X	
Variegated Fairy-wren			5		
Weebill	1				X
White-faced Heron			1		
White-plumed Honeyeater	3	9		6	11
White-winged Fairy-wren	X			5	
White-winged Triller	7	4	1	5	
Willie Wagtail	X	1		1	1
Yellow-throated Miner			8	26	3
Zebra Finch	12	1	1	5	1
TOTAL # individuals	**93**	**58**	**47**	**155**	**36**
TOTAL # species (<25m)	**18**	**17**	**20**	**25**	**12**
TOTAL # species (all)	**26**	**24**	**30**	**37**	

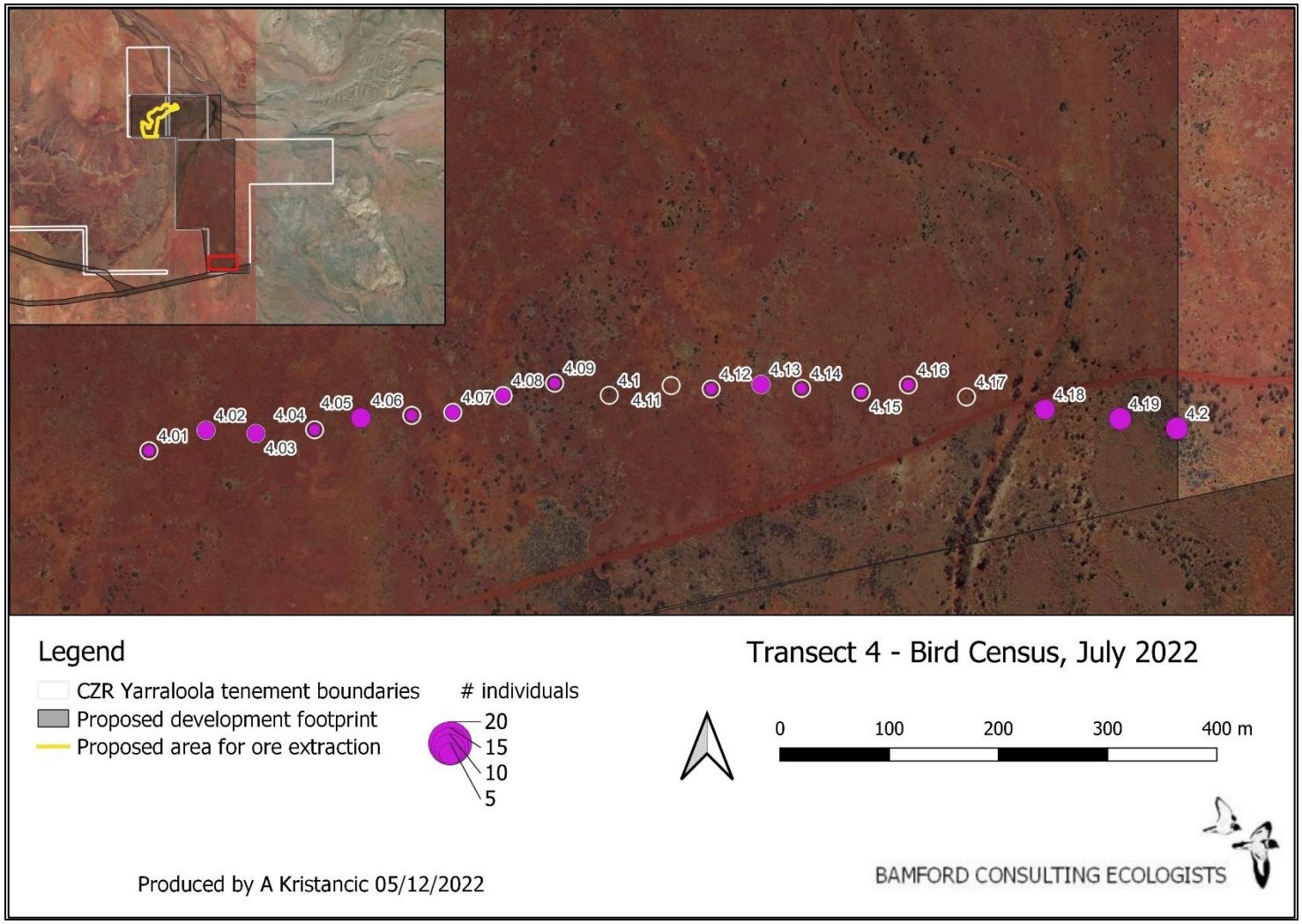

Figure 38. Distribution of bird records (all species pooled) along Transect 4 in July 2022.

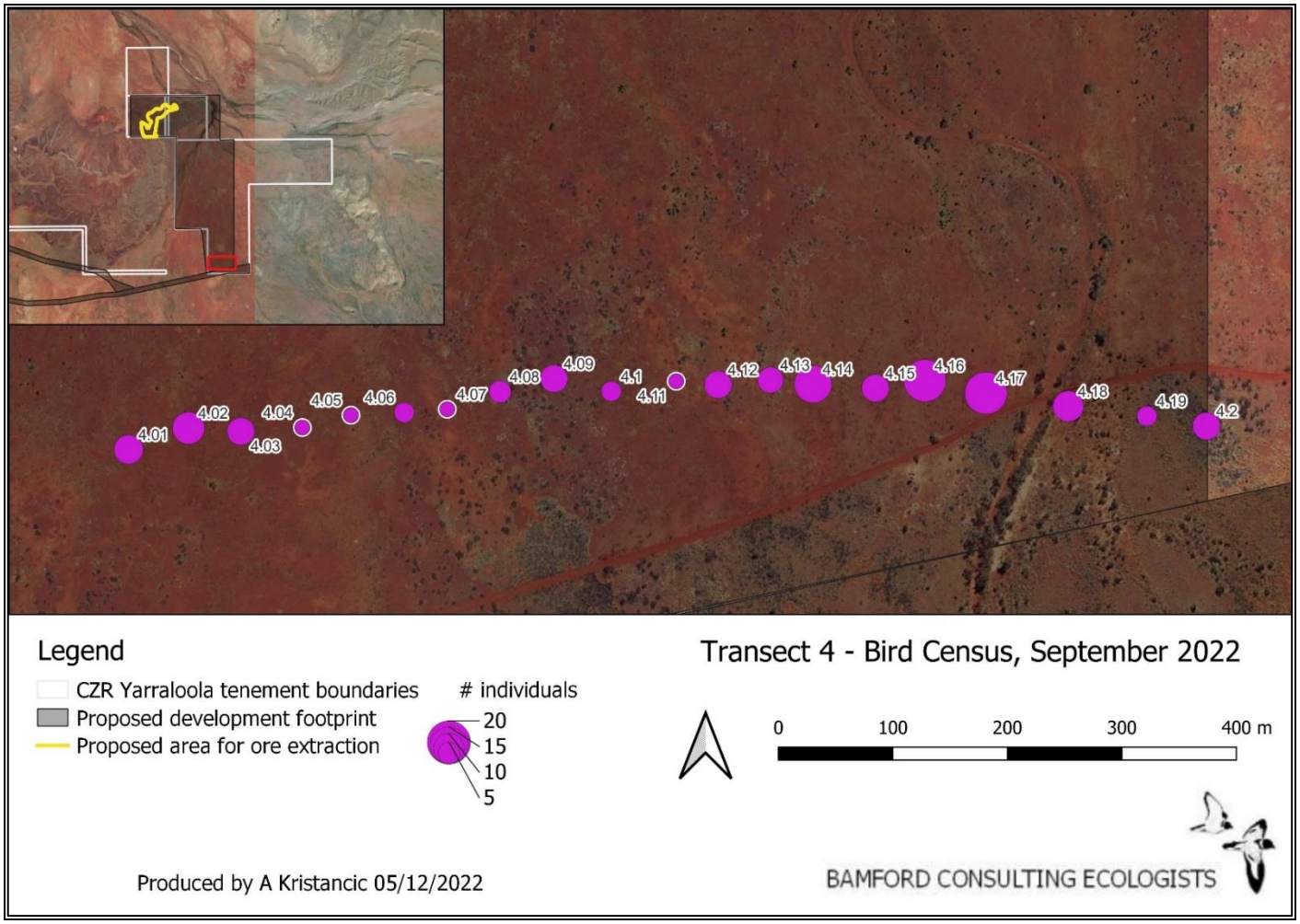

Figure 39. Distribution of bird records (all species pooled) along Transect 4 in September 2022.

3.7 Ecological processes

The nature of the landscape and the fauna assemblage indicate some of the ecological processes that may be important for ecosystem function (see Appendix 1 for descriptions and other ecological processes). These include the aspects discussed below.

Connectivity and landscape permeability. The project area is part of a large and continuous natural landscape with limited development in the immediate vicinity, but the landscape has strong linear features that will affect movement and dispersal of fauna. These linear features are drainage lines that vary from major river systems lined with large trees (VSA 6), to minor drainage lines lined with Bloodwood thickets (VSA 4), and the mesas and rocky hills. Some species are closely associated with these linear features and therefore movement of individuals, and gene flow, will be restricted. This sort of linear connectivity may extend to groundwater systems.

Local hydrology. The project area is part of the Robe River drainage system that is one of the major river valley systems of the western Pilbara. There is permanent water in the nearby Robe River and probably in Mungarathoona Creek. The plains around the mesas are criss-crossed with minor drainage lines that carry water intermittently and may have seasonal pools. Distinct vegetation and therefore fauna habitats are associated with the drainage network, and this vegetation may be reliant upon groundwater. A subterranean fauna assemblage is present and includes at least one vertebrate species, the Blind Cave Eel, that occurs in the groundwater (Stygofauna).

Fire. Native vegetation throughout the project area is subject to fire and is likely to be burnt on a regular basis. There was evidence of recent fires particularly along Transect 4, and along parts of the current access road. While appropriate fire regimes can benefit biodiversity, inappropriate regimes can lead to a loss of biodiversity. Recent fire history is likely to have contributed to the local extinction of some mammal species, and may be affecting the abundance of some components of the current fauna. Note that fire may interact with other factors, such as feral species, in determining impacts on fauna.

Feral species and interactions with over-abundant native species. Feral species occur throughout Western Australia. The Feral Cat was recorded during field investigations including sightings, tracks and one on a camera (Plate 30), but there were no records of several other introduced species that impact native fauna. For example, while the Red Fox is expected to be present, it was not observed. Several other introduced species would appear not to be present regularly as they are generally conspicuous and easy to detect. Domestic Cattle are present across the plains and along watercourses, but tend not to occur on the rocky slopes and mesas. They are an ongoing presence on the landscape and are likely to have altered the composition and structure of the vegetation. The Dingo was present and while technically introduced, it was a long-term component of the fauna assemblage for over 3,000 years at the time of European settlement. There remains debate about the ecological function of the Dingo and to what extent it is a threat native species, and to what extent it protects native species by supressing more recently-introduced predators (Augusteyn *et al.* 2021). Feral Bees may be competing with native nectarivores.

Plate 30. Feral Cat recorded on a motion-sensitive camera in September 2022.

3.8 Summary of fauna values

The desktop study identified 294 vertebrate fauna species as potentially occurring in the project area: six fish, seven frogs, 96 reptiles, 144 birds and 41 mammals (36 native and five introduced species). The presence of 147 vertebrate fauna species was confirmed across all field investigations. This included three fish, two frogs, 43 reptiles, 80 birds and 19 mammals (17 native and two introduced). Of the 294 species potentially occurring in the project area, 28 are of conservation significance.

Fauna assemblage. The fauna assemblage is broadly typical of the Pilbara region. The assemblage is likely to be substantially complete except for the mammal component, with six native mammal species considered locally extinct. The assemblage is likely to relatively rich in a regional context as the environment contains a variety of VSAs that support a wide range of vertebrate fauna, including conservation significant species.

Species of conservation significance. The majority of the 28 conservation significant vertebrate species (including two fish, three reptiles, 14 birds and nine mammals) expected in the project area are likely to be residents or regular visitors, with five considered irregular visitors and 3 considered vagrants. Fifteen of the expected conservation significant species are listed under WA State and/or Commonwealth legislation (category CS1; one fish, one reptile, nine birds and 4 mammals), while seven species are listed as Priority by DBCA (category CS2; one fish, two reptiles, one bird and three mammals), and the remaining six species are considered locally significant (category CS3; four birds and two mammals). Several of the species of highest conservation significance (CS1) are associated with mesa edges (Northern Quoll, Pilbara Leaf-nosed Bat, Ghost Bat), but were also recorded more widely. Importantly, the Northern Quoll was abundant and was also recorded along drainage lines and the population in the project area is part of a widespread regional population with multiple nearby records. While both bat species were present, no maternity roosts were found in the project area, while a nearby maternity roost appeared not to be active (although use of this roost may vary

annually). There is possibly a maternity roost of the Pilbara Leaf-nosed bat south or east (and outside) of the project area. Both species, but particularly the Leaf-nosed Bat, were moving well away from the mesa edge. The CS1 Pilbara Olive Python makes seasonal use of rocky landscapes (otherwise it is associated with drainage systems); it was not found but is difficult to detect and is almost certainly present. Several species listed as priority by DBCA (CS2) also are associated with rocky landscapes, and the Ngadji (Western Pebble-mound Mouse) was recorded along the southern haul road option but with no active or even inactive mounds in the mine area. There was one inactive mound on the lower slopes on Mesa F. The species is thus regionally present but not abundant (although abundance can vary annually). The Long-tailed Dunnart, while not recorded, is known from the region and favours rocky landscapes. Drainage systems with heavy soils and riparian forest are important for a few species, being used seasonally by the Pilbara Olive Python and supporting a local population of Gane's Blind-Snake (CS2). The Fortescue Grunter (CS2) is also present in permanent and seasonal waters along drainage systems, while the Blind Cave Eel (CS1) occurs in subterranean waters of the Robe Valley. Migratory waterbirds may be present but only in small numbers. Among locally significant species (CS3), rocky landscapes are also important (Striated Grasswren, Rufous-crowned Emu-wren, Rothschild's Rock-Wallaby), while the only records of the Brush-tailed Possum came from Bloodwood thickets along a minor drainage line, and the only record of the Star Finch from riparian rushes along Mungarathoona Creek. Few significant species appear to be associated with the broad plains of the region; possibly the Short-tailed Mouse (CS2) and the Crevice Skink. Overall, a rich assemblage of significant fauna with close associations with mesas and other rocky landscapes, and with major drainage systems.

Vegetation and Substrate Associations (VSAs). The project area encompasses eight VSAs which reflect landscape position and soil type: Mesa top (VSA 1), Mesa edge (VSA 2A), Rocky hills and slopes (VSA 2B), Plains and flats (VSA 3), Bloodwood and acacia woodland (VSA 4), Eucalyptus victrix woodland (VSA 5), Melaleuca and eucalypt gallery forest (VSA 6), and Pools (VSA 7). These are all typical of the broader region, with the most extensive being VSA 3. Other VSAs are restricted in extent but occur across the landscape often in narrow corridors.

Patterns of biodiversity. The most important patterns of biodiversity for impact assessment are the concentrations of conservation significant species on the margins of mesas and along major drainage lines. Systematic sampling found some heightened species richness in Bloodwood thickets close to minor drainage lines, and associated with sandier soils on the plains (VSA 3). Artificial water sources were having a seasonal effect on bird abundance and richness. This sampling also found that one small mammal, the Pilbara Ningaui, was most abundant on the rocky slopes of the mesa.

Key ecological processes. The ecological processes that currently have major effects upon the fauna assemblage include:

- Landscape permeability/connectivity – key landscapes, including mesas and rocky hills, and drainage systems, are linear features and important for a suite of significant fauna.
- Hydrology – drainage systems are a key part of the landscape, with associated distinctive vegetation and reliant significant fauna.
- Fire – likely to have impacted fauna and contributed to locale extinctions due to changed regimes.
- Feral species – includes introduced predators and introduced livestock that have landscape-scale impacts across the environment.

4 Impact assessment

4.1 Review of threatening processes

Threatening processes have to be considered in the context of fauna values, the surrounding landscape and the nature of the proposed action, and are examined below. Landscape context is important, as the project area contains areas of previously cleared or disturbed lands and is in a local, and regional, landscape that is relatively continuous and intact. Impact categories are defined in Table 20.

Habitat loss leading to population decline. *Negligible to Minor*

The areas to be cleared are small in the regional context so while population loss as a result of habitat loss is inevitable, it will be small in that context. Impacts on landscapes particularly rich in species and especially significant species (mesa edge, major drainage lines) are small in extent. Off-site impacts may be more of a concern and are considered below. This also does not consider cumulative effects if nearby projects affecting the same parts of the landscape are to proceed. Risk to the Ngadji (Western Pebble-mound Mouse) may be a concern as all active or recently active mounds were within or very close to the southern haul road route in one area just west of Warramboo Creek. The population dynamics of the Ngadji are not well-known, but it may vary in abundance greatly over several years in response to annual conditions, with the result that it may be vulnerable during poor years when the population is reduced to small 'pockets' of which the location just west of Warramboo Creek may be an example. Note that the mine area is intended to be restricted to the top of Mesa F, with the mesa edge not planned to be impacted except for access at one location. This assumes that the caves and overhangs of the mesa edge will not be disturbed by nearby mining activity.

Habitat loss leading to population fragmentation. *Minor*

The development envelopes in the mine and infrastructure areas will cross linear landscape features such as the edge of Mesa F and drainage lines. This can potentially fragment populations, interfere with dispersal, lead to an increase in mortality (see below) and in the long term reduce gene flow. Most vulnerable species would be those with limited ability to disperse, such as reptiles, small mammals and invertebrates.

Degradation of habitat due to weed invasion. *Minor*

There is already extensive weed invasion in some areas, notably by Buffel Grass along drainage lines. There is potential for the proposed development to increase the spread of weeds and to introduce new weeds, but standard hygiene measures are likely to be in place to reduce this risk.

Mortality during construction. *Negligible to Minor*

This is a concern mostly on animal welfare grounds, as the development footprint is small in the context of the overall landscape. Animals will inevitably be killed during clearing but there are standard practices for reducing fauna mortality during such activities. This is pertinent for species of conservation significance where it is practical to conduct trapping/capture and translocation. This includes Northern Quoll, rock-wallabies and the larger reptiles. The timing of clearing and earthworks can also reduce mortality risk by avoiding breeding periods.

Ongoing mortality. *Minor to Moderate*

This results mainly from roadkill due to vehicle movements but can also result from fauna striking infrastructure and effects of lighting. With infrastructure areas and transport corridors crossing linear landscapes, such as drainage lines and mesa edges, there may be risk to species such as Northern Quoll, Pilbara Olive Python and Brush-tailed Possum. Populations of some of these species may be small and therefore sensitive to the regular loss of even a small number of individuals.

Species interactions. *Minor*

Feral species are already present on the site, but feral species may be attracted to work-sites and increase in abundance. Impacts to native fauna can be kept to Negligible/Minor through standard practices such as not feeding wildlife, managing waste and even implementing some feral species control. Reduction in the grazing pressure from livestock, which may be required to protect vehicles, could benefit native wildlife. An increase in water and food for predatory birds has been found to have adverse impacts upon smaller, prey species around minesites in remote landscapes. The increase in food for predatory birds appears in at least some cases to be due to insects attracted to lights (Read *et al.* 2015), which means that it can be managed.

Hydrological change. *Minor to moderate*

Hydrology is an important function in the landscape, with key environments along drainage lines and vegetation almost certainly groundwater dependent. Plate 21 illustrates the effect upon vegetation of the disruption of surface flow caused by a minor road. Such surface flow is likely to occur across broad areas of the plains before the water feeds into drainage lines. Alteration to hydrology could result in large areas of vegetation decline and therefore will need to be carefully managed. The main access road to the mine area crosses Mungarathoona Creek, while the southern haul road option crosses Warramboo Creek, and at both locations there is potential for disruption to key flows of water.

Altered fire regimes. *Minor*

The vegetation of the project area is tolerant of and to some extent dependent on fire, but the fire regime is important. There have been recent fires that are likely to have affected the fauna, and any increase in fire frequency is likely to have adverse impacts. The proposed development has the potential to lead to increased fire frequency, but through positive action can also result in the development of a fire mosaic with some areas left long-unburnt.

Disturbance (dust, noise, light). *Minor*

The level of dust, noise and light during development and operation has the potential to result in some impacts; this can include changes in the balance of predator and prey bird species (Read *et al.* 2015). There are standard management procedures to minimise dust and noise. In a landscape where there is currently virtually no anthropogenic light, lighting should be managed to minimise spill into surrounding areas. Impacts will be localised but potentially cumulative as there may be other developments proposed in the region.

4.2 Overview

The risk from most threatening processes is negligible or negligible to minor. This is due largely to the small scale of the impact across a vast and still largely intact landscape. Impacts that may be of concern are:

- Mortality of the Ngadji due to clearing along the southern haul road; this haul road option passes through the only active or probably active mounds found during field investigations.
- Disturbance along the mesa edge (such as through noise and vibration) as a result of mining across the top of the mesa. To mitigate this, mesa edges will be avoided and a buffer between the mining area and the mesa edge will be employed.
- Population fragmentation due to roads and other infrastructure crossing linear features such as drainage lines.
- Ongoing mortality of a range of species such as Northern Quoll and Pilbara Olive Python due to roadkill.
- Hydrological change at crossings of major drainage lines and where sheet flow occurs across parts of the plains.
- Species interactions; in particular an increase in the abundance of native and introduced predators that can occur around remote area mine sites.
- Altered fire regimes; the fauna assemblage is probably already sensitive to altered fire regimes, but there is potential for an improved fire regime.
- Disturbance and in particular light spill that will be novel to the landscape and has been demonstrated elsewhere to result in large scale invertebrate mortality and an increase in the abundance of native predators.

5 References

ALA. (2021). Atlas of Living Australia. http://www.ala.org.au

Allen, G. R., Midgley, S. H. and Allen, M. (2003). Field Guide to the Freshwater Fishes of Australia. Western Australian Museum, Perth, Western Australia.

Anstis, M. (2017). Tadpoles and Frogs of Australia. New Holland Publishers, Chatswood, New South Wales.

Astron (2014). Mesa H - Level 1 Flora, Vegetation and Fauna Assessment, unpublished report to Rio Tinto Iron Ore by Astron Environmental Services, East Perth.

Astron (2016a). Bungaroo Iron Ore Mine and Infrastructure Project, Level 2 Fauna Assessment, unpublished report to Rio Tinto Iron Ore by Astron Environmental Services, East Perth.

Astron (2016b). Middle Robe and East Deepdale Level 2 Fauna Assessment, unpublished report to Rio Tinto Iron Ore by Astron Environmental Services, East Perth.

Astron (2016c). Mesa H Level 2 Fauna assessment. Unpublished report for Robe River Mining Company Pty Ltd by Astron Environmental Services, East Perth.

Astron (2017a). Mesa H Ghost Bat, Macroderma gigas - Contextual Study. Unpublished report for Robe River Mining Company Pty Ltd by Astron Environmental Services, East Perth.

Astron (2017b). Warramboo Level 2 fauna assessment.

Augusteyn, A., Rich, M., Story, G. and Noaln, B. (2021). Canids potentially threaten bilbies at Astrebla Downs National Park. Australian Mammalogy, 2021, 43, 300–310 https://doi.org/10.1071/AM20034

Bat Call WA (2016). Mesa H Survey, Pilbara WA, September-October 2015 / May-June 2016: Echolocation Survey of Bat Activity, unpublished report to Astron Environmental Services.

Bat Call WA (2017a). Robe Valley Mesa A to Mesa 2405A, impact of mining on Ghost bat presence and activity, April 2017, including assessment of caves on Mesas F and G. unpublished report to Rio Tinto Iron Ore.

Bat Call WA (2017b). Robe Valley Mesa H, Ghost bat roost cave assessment.

Bat Call WA (2017c). Robe Valley Mesas A and C, Ghost Bat roost cave assessment.

BC Iron Ltd. (2016). Mining Proposal for the Buckland Project Mine and Haul Road.

Biologic. (2014). Dietary Analysis Results from Scats Collected During a Targeted Survey for Northern Quolls, Pilbara Olive Pythons and Pilbara Leaf-nosed Bats at Yarraloola, unpublished report to Rio Tinto Iron Ore by Biologic Environmental Sciences.

Biota (2005). Fauna Habitats and Fauna Assemblages of Mesa A and G, near Pannawonica. Unpublished report for Robe River Iron Associates by Biota Environmental Sciences, Leederville.

Biota (2006a). Fauna Habitats and Fauna Assemblage of the Mesa A Transport Corridor and Warramboo, unpublished report to Robe River Iron Associates by Biota Environmental Sciences.

Biota (2006b). Mesa A and Robe Valley Mesas Troglobitic Fauna Survey, Subterranean Fauna Assessment. Unpublished report for Robe River Iron Associates by Biota Environmental Sciences, Leederville.

Biota (2007). Mesa K Targeted Fauna Survey. Unpublished report for Pilbara Iron by Biota Environmental Sciences, Leederville.

Biota (2009a). West Pilbara Iron Ore Project Mine Areas Seasonal Fauna Survey. Unpublished report for API Management by Biota Environmental Sciences, Leederville.

Biota (2009b). West Pilbara Iron Ore Project Rail Corridor Fauna and Flora Assemblages Survey. Unpublished report for API Management by Biota Environmental Sciences, Leederville.

Biota (2010). Robe Valley Mesas fauna survey. Unpublished report for Rio Tinto Iron Ore by Biota Environmental Sciences, Leederville.

Biota (2017). Mesa A Hub: Mesas B and C Troglobitic Fauna Assessment. Unpublished report for Rio Tinto by Biota Environmental Sciences, Leederville.

Biota (2019). Mesa H Project Subterranean Fauna Habitat and Impact Risk Assessment. Unpublished report for Rio Tinto by Biota Environmental Sciences, Leederville.

Biota (2022a). Robe Mesa Project; detailed flora and vegetation survey. Unpubl. report to CZR by Biota Environmental Science.

Biota (2022b). SRE/Fauna survey report. Unpubl. report to CZR by Biota Environmental Science.

BirdLife Australia. (2019). The BirdLife Australia Working List of Australian Birds; Version 3.0. www.birdlife.org.au/documents/BWL-BirdLife_Australia_Working_List_v3.xlsx

BOM. (2022). Climate Data Online. Commonwealth of Australia, Bureau of Meteorology. http://www.bom.gov.au/climate/data/index.shtml?bookmark=200&view=map

Burbidge, A. A. (2004). Threatened Animals of Western Australia. Department of Conservation and Land Management, Kensington, Western Australia.

Burbidge, A. A. and McKenzie, N. L. (1989). Patterns in the modern decline of Western Australia's vertebrate fauna: causes and conservation implications. Biological Conservation 50: 143-198.

Bush, B. and Maryan, B. (2011). Field Guide to Snakes of the Pilbara. Western Australian Museum, Welshpool, Western Australia.

Calver, M. C., Lymbery, A. J., McComb, J. and Bamford, M. J. (2009). Environmental Biology. Cambridge University Press, Melbourne, Australia.

Churchill, S. (2009). Australian Bats. Allen & Unwin, St Leonards, New South Wales.

Clevenger, A. P. and Waltho, N. (2000). Factors influencing the effectiveness of wildlife underpasses in Banff National Park, Alberta, Canada. Conservation Biology 14: 1-11.

DAWE. (2020a). List of marine species. Department of Agriculture, Water and the Environment. https://www.environment.gov.au/marine/marine-species/marine-species-list

DAWE. (2020b). Protected marine species - Identification guide. Department of Agriculture, Water and the Environment. https://www.environment.gov.au/marine/publications/protected-marine-species-identification-guide.

DAWE. (2021a). *Apus pacificus* - Fork-tailed Swift in Species Profile and Threats Database. Department of Agriculture, Water and the Environment. Available from: http://www.environment.gov.au/sprat

DAWE. (2021c). *Dasyurus hallucatus* in Species Profile and Threats Database. Department of Agriculture, Water and the Environment. Available from: http://www.environment.gov.au/sprat

DAWE. (2021d). *Rhinonicteris aurantia* in Species Profile and Threats Database. Department of Agriculture, Water and the Environment. Available from: http://www.environment.gov.au/sprat

DAWE. (2023). Australia's bioregions (IBRA). Department of Agriculture, Water and the Environment. http://www.environment.gov.au/land/nrs/science/ibra#ibra

DBCA. (2021). NatureMap. Department of Biodiversity, Conservation and Attractions. https://naturemap.dbca.wa.gov.au/

DBCA. (2022a). Priority Ecological Communities For Western Australia Version 34. Species and Communities Program, Department of Biodiversity, Conservation, and Attractions. https://www.dpaw.wa.gov.au/images/images/documents/plants-animals/threatened-species/Listings/Priority%20Ecological%20Communities%20list.pdf

DBCA. (2022b). Threatened and Priority Fauna List. Department of Biodiversity, Conservation and Attractions.

DBCA. (2023a). Directory of Important Wetlands in Australia—Western Australia (DBCA-045). Department of Biodiversity, Conservation and Attractions. https://catalogue.data.wa.gov.au/tr/dataset/directory-of-important-wetlands-in-western-australia

DBCA. (2023b). Ramsar Sites (DBCA-010). Department of Biodiversity, Conservation and Attractions. https://catalogue.data.wa.gov.au/tr/dataset/ramsar-sites

DBCA. (2023c). Threatened ecological communities. Department of Biodiversity, Conservation and Attractions. https://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/wa-s-threatened-ecological-communities

DBCA. (2023d). Threatened Ecological Communities (DBCA-038). Department of Biodiversity, Conservation and Attractions. https://catalogue.data.wa.gov.au/tr/dataset/threatened-ecological-communities

DCCEEW. (2023). Protected Matters Search Tool. Department of Climate Change, Energy, the Environment and Water. https://www.environment.gov.au/epbc/protected-matters-search-tool

Debus, S. (2019). Birds of Prey of Australia: A Field Guide. CSIRO Publishing, Australia.

Dell, J. and Banyard, J. (Eds). (2000). Bush Forever. Department of Environmental Protection, Perth, Western Australia.

DoF. (2020). Freshwater Fish Distribution in Western Australia. Department of Fisheries. http://freshwater.fish.wa.gov.au/

DotE. (2013). Matters of National Environmental Significance. Significant impact guidelines 1.1. Environment Protection and Biodiversity Conservation Act 1999 Department of the Environment, Canberra, Australia.

Doughty, P. (2021a). Checklist of the Frogs of Western Australia. Department of Terrestrial Zoology, Western Australian Museum, Welshpool, Western Australia.

Doughty, P. (2021b). Checklist of the Reptiles of Western Australia. Department of Terrestrial Zoology, Western Australian Museum, Welshpool, Western Australia.

DSEWPaC. (2013a). Actions on, or impacting upon, Commonwealth land, and actions by Commonwealth agencies. Significant impact guidelines 1.2. Environment Protection and Biodiversity Conservation Act 1999 Department of Sustainability, Environment, Water, Population and Communities, Canberra, Australia.

DSEWPaC. (2013b). Matters of National Environmental Significance. Significant impact guidelines 1.1. Environment Protection and Biodiversity Conservation Act 1999 Department of Sustainability, Environment, Water, Population and Communities, Canberra, Australia.

Dufty, A. C. (1989). Some population characteristics of *Perameles gunnii* in Victoria. Wildlife Research 18: 355-365.

DWER. (2023a). Clearing Regulations—Environmentally Sensitive Areas (DWER-046). Department of Water and Environmental Regulation. https://catalogue.data.wa.gov.au/tr/dataset/clearing-regulations-environmentally-sensitive-areas-dwer-046

DWER. (2023b). Environmentally Sensitive Areas. Department of Water and Environmental Regulation. https://www.der.wa.gov.au/your-environment/environmentally-sensitive-areas

DWER. (2023c). Index of Biodiversity Surveys for Assessments (IBSA). Department of Water and Environmental Regulation. https://biocollect.ala.org.au/ibsa#max%3D20%26sort%3DdateCreatedSort

Ecologia (2013). Middle Robe and East Deepdale Flora, Vegetation, Vertebrate and Invertebrate Fauna Survey, unpublished report to Rio Tinto Iron Ore by Ecologia Environment.

EPA. (2002). Terrestrial Biological Surveys as an Element of Biodiversity Protection. Position Statement No. 3. Environmental Protection Authority, Perth, Western Australia.

EPA. (2004). Guidance for the assessment of environmental factors: Terrestrial fauna surveys for environmental impact assessment in Western Australia. No. 56. Environmental Protection Authority, Perth, Western Australia.

EPA. (2016a). Environmental Factor Guideline - Terrestrial Fauna. Environmental Protection Authority, Perth, Western Australia.

EPA. (2016b). Technical Guidance: Terrestrial Fauna Surveys. Environmental Protection Authority, Perth, Western Australia.

EPA. (2020). Technical Guidance - Terrestrial vertebrate fauna surveys for environmental impact assessment. Environmental Protection Authority, Perth, Western Australia.

Fox, B. J. (1982). Fire and mammalian secondary succession in an Australian coastal heath. Ecology 63: 1332-1341.

Gill, A. M., Groves, R. H. and Noble, I. R. (Eds). (1981). Fire and the Australian Biota. Australian Academy of Science, Canberra, Australian Capital Territory.

Gill, F., Donsker, D. and Rasmussen, P. (2021). IOC World Bird List (v 11.1). Available at www.worldbirdnames.org/

Gleeson, J. and Gleeson, D. (2012). Reducing the Impacts of Development on Wildlife. CSIRO Publishing, Collingwood, Victoria, Australia.

Harrington, R. (2002). The effects of artificial watering points on the distribution and abundance of avifauna in an arid and semi-arid mallee environment. PhD thesis. Department of Zoology, Univesity of Melbourne, Melbourne, Victoria.

Harvey, M. S. (2002). Short-range endemism among the Australian fauna: some examples from non-marine environments. Invertebrate Systematics 16: 555-570.

Hernandez-Santin, L., Henderson, M., Molloy, S.W., Dunlop, J.A. and Davis, R.A. 2021. Spatial ecology of an endangered carnivore, the Pilbara northern quoll, Australian Mammalogy, 43, 235-242.

Higgins, P. J. (Ed.) (1999). Handbook of Australian, New Zealand and Antarctic Birds. Volume 4: Parrots to Dollarbird. Oxford University Press, Melbourne, Australia.

IUCN. (2012). IUCN Red List Categories and Criteria, Version 3.1. Second edition. International Union for the Conservation of Nature, Gland, Switzerland and Cambridge, UK.

Jackson, S. D. and Griffin, C. R. (2000). A Strategy for Mitigating Highway Impacts on Wildlife. In: Messmer, T. A. and West, B. (Eds), Wildlife and Highways: Seeking Solutions to an Ecological and Socio – economic Dilemma, pp. 143-159. The Wildlife Society,

Johnstone, R. E. and Storr, G. M. (1998). Handbook of Western Australian birds. Volume 1: Non-passerines (Emu to Dollarbird). Western Australian Museum, Perth, Western Australia.

Johnstone, R. E. and Storr, G. M. (2005). Handbook of Western Australian birds. Volume 2: Passerines (Blue-winged Pitta to Goldfinch). Western Australian Museum, Perth, Western Australia.

Jones, M. E. (2000). Road upgrade, road mortality and remedial measures: impacts on a population of Eastern Quolls and Tasmanian Devils. Wildlife Research 27: 289-296.

KBA. (2020). Key Biodiversity Areas. Key Biodiversity Areas. http://www.keybiodiversityareas.org/kba-data

Kendrick, P. (2003). Pilbara 3 (PIL3 – Hamersley subregion). In: CALM (Ed.) A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002, pp. 568-580. Department of Conservation and Land Management, Perth, Western Australia. Available online:

https://www.dpaw.wa.gov.au/images/documents/about/science/projects/waaudit/pilbara03_p568-580.pdf

Kofoed, P. (1998). A wizard with wavelengths. Ecos 96: 32-35.

Letnic, M., Dickman, C. R., Tischler, M. K., Tamayo, B. and Beh, C. L. (2004). The responses of small mammals and lizards to post-fire succession and rainfall in arid Australia. Journal of Arid Environments 59: 85-114.

McCreery, A. and Bamford, M. (2020). CZR Resources Ltd. Robe Mesa Iron Ore Project. Assessment of Fauna Values. Unpubl. report to CZR Resources by Bamford Consulting Ecologists, Kingsley.

Menkhorst, P. and Knight, F. (2011). A Field Guide to the Mammals of Australia. Oxford University Press, Melbourne, Victoria.

Menkhorst, P., Rogers, D., Clarke, R., Davies, J., Marsack, P. and Franklin, K. (2017). The Australian Bird Guide. CSIRO Publishing, Clayton South, Victoria, Australia.

Morgan, D. L., Gill, H. S. and Potter, I. C. (1998). Distribution, identification and biology of freshwater fish in south-western Australia. Records of the Western Australian Museum Suppl. No. 56.

Morgan, D. L., Unmack, P. J., Beatty, S. J., Ebner, B. C., Allen, M. G., Keleher, J. J., Donaldson, J. A. and Murphy, J. (2014). An overview of the 'freshwater fish' of Western Australia. Journal of the Royal Society of Western Australia 97: 263-278.

Oakwood, M. (1997). The ecology of the northern quoll, Dasyurus hallucatus. PhD thesis thesis. Australian National University, Canberra.

Oakwood, M. (2008). Northern quoll Dasyurus hallucatus. In: Van Dyck, S. & R. Strahan, eds. The Mammals of Australia (3rd ed). Page(s) 57-59. Sydney, NSW: Reed New Holland.

Payne, A. L. (2004). Land Systems. In: Van Vreeswyk, A. M. E., Payne, A. L., Leighton, K. A. and Hennig, P. (Eds), Technical Bulletin No. 92: An Inventory and Condition Survey of the Pilbara Region, Western Australia, pp. 175-384. Department of Agriculture, South Perth, Western Australia.

Read, J. L., Parkhurst, B. and Delean, S. (2015). Can Australian bush birds be used as canaries? Detection of pervasive environmental impacts at an arid Australian mine site. Emu-Austral Ornithology 115: 117-125.

Rich, C. and Longcore, T. (Eds). (2006). Ecological Consequences of Artificial Night Lighting. Island Press, Washington D.C., USA.

Rio Tinto (2019). Mesa H Proposal (Revision to the Mesa J Iron Ore Development). Assessment No. 2121. Unpublished report for Rio Tinto.

Scheick, B. K. and Jones, M. D. (1999). Locating wildlife underpasses prior to expansion on Highway 64 in North Carolina. In: Evink, G. L., Garrett, P. and Ziegler, D. (Eds), Proceedings of the Third International Conference on Wildlife Ecology and Transportation, pp. 247-252. Florida Department of Transportation, Tallahassee, Florida, USA.

Soule, M. E., Mackey, B. G., Recher, H. F., Williams, J. E., Woinarski, J. C. Z., Driscoll, D., Dennison, W. C. and Jones, M. E. (2004). The role of connectivity in Australian conservation Pacific Conservation Biology 10: 266-279.

Storr, G. M., Smith, L. A. and Johnstone, R. E. (1983). Lizards of Western Australia. II. Dragons and Monitors. Western Australian Museum, Perth, Western Australia.

Storr, G. M., Smith, L. A. and Johnstone, R. E. (1990). Lizards of Western Australia. III. Geckos and Pygopods. Western Australian Museum, Perth, Western Australia.

Storr, G. M., Smith, L. A. and Johnstone, R. E. (1999). Lizards of Western Australia. I. Skinks. Western Australian Museum, Perth, Western Australia.

Storr, G. M., Smith, L. A. and Johnstone, R. E. (2002). Snakes of Western Australia. Western Australian Museum, Perth, Western Australia.

Thackway, R. and Cresswell, I. D. (1995). An Interim Biogeographic Regionalisation for Australia: A framework for establishing the national system of reserves, Version 4.0. Australian Nature Conservation Agency, Canberra, Australia.

Travouillon, K. (2021). Checklist of the Mammals of Western Australia. Department of Terrestrial Zoology, Western Australian Museum, Welshpool, Western Australia.

Turpin, J. and Bamford, M. (2015). A new population of the Northern Quoll (Dasyurus hallucatus) on the edge of the Little Sandy Desert, Western Australia. Aust. Mammal. 37: 86-91.

Tyler, M. J. and Doughty, P. (2009). Field Guide to Frogs of Western Australia. Western Australian Museum, Welshpool, Western Australia.

Van Dyck, S. and Strahan, R. (Eds). (2008). Mammals of Australia. New Holland Publishers, Sydney, New South Wales.

Wilson, S. and Swan, G. (2021). A Complete Guide to Reptiles of Australia New Holland, Australia.

6 Appendices

Appendix 1. Explanation of fauna values.

Fauna values are the features of a site and its fauna that contribute to biodiversity, and it is these values that are potentially at threat from a development proposal. Fauna values can be examined under the five headings outlined below. It must be stressed that these values are interdependent and should not be considered equal, but contribute to an understanding of the biodiversity of a site. Understanding fauna values provides opportunities to predict and therefore mitigate impacts.

Assemblage characteristics

Uniqueness. This refers to the combination of species present at a site. For example, a site may support an unusual assemblage that has elements from adjacent biogeographic zones, it may have species present or absent that might be otherwise expected, or it may have an assemblage that is typical of a very large region. For the purposes of impact assessment, an unusual assemblage has greater value for biodiversity than a typical assemblage.

Completeness. An assemblage may be complete (i.e. has all the species that would have been present at the time of European settlement), or it may have lost species due to a variety of factors. Note that a complete assemblage, such as on an island, may have fewer species than an incomplete assemblage (such as in a species-rich but degraded site on the mainland).

Richness. This is a measure of the number of species at a site. At a simple level, a species rich site is more valuable than a species poor site, but value is also determined, for example, by the sorts of species present.

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.

Patterns of biodiversity across the landscape

This fauna value relates to how the assemblage is organised across the landscape. Generally, the fauna assemblage is not distributed evenly across the landscape or even within one VSA. There may be zones of high biodiversity such as particular environments or ecotones (transitions between VSAs). There may also be zones of low biodiversity. Impacts may be significant if a wide range of species is affected even if most of those species are not significant per se.

Species of conservation significance

Species of conservation significance are of special importance in impact assessment. The conservation status of fauna species in Australia is assessed under Commonwealth and State Acts such as the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the Western Australian *Biodiversity Conservation Act 2016* (BC Act). In addition, the Western Australian Department of Biodiversity, Conservation and Attractions (DBCA) recognises priority levels, while local populations of some species may be significant even if the species as a whole has no formal recognition. Therefore, three broad levels of conservation significance can be recognised and are used for the purposes of this report, and are outlined below. A full description of the conservation significance categories, schedules and priority levels mentioned below is provided in Appendix 2.

Conservation Significance (CS) 1: Species listed under State or Commonwealth Acts.

Species listed under the EPBC Act are assigned to categories recommended by the International Union for the Conservation of Nature and Natural Resources (IUCN 2012), or are listed as migratory. Migratory species are recognised under international treaties such as the China Australia Migratory Bird Agreement (CAMBA), the Japan Australia Migratory Bird Agreement (JAMBA), the Republic of South Korea Australia Migratory Bird Agreement (ROKAMBA), and/or the Convention on the Conservation of Migratory Species of Wild Animals (CMS; also referred to as the Bonn Convention). The *Wildlife Conservation Act 1950* uses a series of seven Schedules to classify conservation status that largely reflect the IUCN categories (IUCN 2012).

Conservation Significance (CS) 2: Species listed as Priority by DBCA but not listed under State or Commonwealth Acts.

In Western Australia, DBCA has produced a supplementary list of Priority Fauna, being species that are not considered threatened under the *Wildlife Conservation Act 1950* but for which DBCA feels there is cause for concern.

Conservation Significance (CS) 3: Species not listed under Acts or in publications, but considered of at least local significance because of their pattern of distribution.

This level of significance has no legislative or published recognition and is based on interpretation of distribution information, but is used here as it may have links to preserving biodiversity at the genetic level (EPA 2002). If a population is isolated but a subset of a widespread (common) species, then it may not be recognised as threatened, but may have unique genetic characteristics. Conservation significance is applied to allow for the preservation of genetic richness at a population level, and not just at a species level. Species on the edge of their range, or that are sensitive to impacts such as habitat fragmentation, may also be classed as CS3, as may colonies of waterbirds. The Western Australian Department of Environmental Protection, now DBCA, used this sort of interpretation to identify significant bird species in the Perth metropolitan area as part of the Perth Bushplan (Dell and Banyard 2000).

Marine-listed species

Some conservation significant species may also be listed as 'Marine' under the EPBC Act. This listing protects these species in 'Commonwealth areas' which include "marine areas beyond the coastal waters of each State and the Northern Territory, and includes all of Australia's Exclusive Economic Zone (EEZ)" (DAWE 2020b). The EEZ extends to 200 nautical miles (approximately 350 kilometres) from the coast (DAWE 2020b). This may mean that the 'Marine' listing does not apply to the project/survey area (depending on its location). Therefore, when a species is otherwise protected (under the EPBC Act or BC Act) or priority-listed (by the DBCA) then the Marine listing is also noted but it does not have site-specific relevance. In cases where a species is solely Marine-listed (for a list see DAWE 2020a) and a project/survey area is not within a Commonwealth area then it is treated like all other fauna.

Invertebrates

Invertebrate species considered to be short range endemics (SREs) also fall within the CS3 category, as they have no legislative or published recognition and their significance is based on interpretation of distribution information. Harvey (2002) notes that the majority of species that have been classified as short-range endemics have common life history characteristics such as poor powers of dispersal or confinement to discontinuous habitats. Several groups, therefore, have particularly high instances of short-range endemic species: Gastropoda (snails and slugs), Oligochaeta (earthworms), Onychophora (velvet worms), Araneae (mygalomorph spiders), Pseudoscorpionida (pseudoscorpions), Schizomida (schizomids), Diplopoda (millipedes), Phreatoicidea (phreatoicidean crustaceans), and Decapoda (freshwater crayfish). The poor understanding of the taxonomy of many of the short-range endemic species hinders their conservation (Harvey 2002).

Introduced species

In addition to these conservation levels, species that have been introduced (INT) are indicated throughout the report. Introduced species may be important to the native fauna assemblage through effects by predation and/or competition.

Ecological processes upon which the fauna depend

These are the processes that affect and maintain fauna populations in an area and as such are very complex; for example, populations are maintained through the dynamic of mortality, survival and recruitment being more or less in balance, and these are affected by a myriad of factors. The dynamics of fauna populations in a project area may be affected and effectively determined by processes such as:

- fire regime.
- landscape patterns (such as fragmentation and/or linkage).
- the presence of feral species.
- hydrology.

Some of the threatening processes as outlined in Appendix 3 are effectively the ecological processes that can be altered to result in impacts upon fauna.

Appendix 2. 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* and the Western Australian *Biodiversity Conservation Act 2016*.

Extinct	Taxa not definitely located in the wild during the past 50 years.
Extinct in the Wild (Ex)	Taxa known to survive only in captivity.
Critically Endangered (CR)	Taxa facing an extremely high risk of extinction in the wild in the immediate future.
Endangered (E)	Taxa facing a very high risk of extinction in the wild in the near future.
Vulnerable (V)	Taxa facing a high risk of extinction in the wild in the medium-term future.
Near Threatened	Taxa that risk becoming Vulnerable in the wild.
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.
Data Deficient (Insufficiently Known)	Taxa suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information.
Least Concern.	Taxa that are not Threatened.

Schedules used in the WA *Biodiversity Conservation Act 2016*

Schedule 1 (S1)	Critically Endangered fauna.
Schedule 2 (S2)	Endangered fauna
Schedule 3 (S3)	Vulnerable Migratory species listed under international treaties.
Schedule 4 (S4)	Presumed extinct fauna
Schedule 5 (S5)	Migratory birds under international agreement
Schedule 6 (S6)	Conservation dependant fauna
Schedule 7 (S7)	Other specially protected fauna

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

Priority 1 (P1)	Taxa with few, poorly known populations on threatened lands.
Priority 2 (P2)	Taxa with few, poorly known populations on conservation lands; or taxa with several, poorly known populations not on conservation lands.
Priority 3 (P3)	Taxa with several, poorly known populations, some on conservation lands.
Priority 4. (P4)	Taxa in need of monitoring. Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change.
Priority 5 (P5)	Taxa in need of monitoring. Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years (IUCN Conservation Dependent).

Appendix 3. Explanation of threatening processes.

Potential impacts of proposed developments upon fauna values can be related to threatening processes. This is recognised in the literature and under the EPBC Act, in which threatening processes are listed (see Appendix 4). Processes that may impact fauna values are discussed below. Rather than being independent of one another, processes are complex and often interrelated. They are the mechanisms by which fauna can be affected by development. Impacts may be significant if large numbers of species or large proportions of populations are affected.

Note that the terms direct and indirect impacts are used by the DotE (2013), DSEWPaC (2013b) and EPA (2016a), but there is some inconsistency in how these are defined. The federal guidance does not define direct impact but has a very broad definition of indirect, and makes the statement (DotE 2013) '*Consideration should be given to all adverse impacts that could reasonably be predicted to follow from the action, whether these impacts are within the control of the person proposing to take the action or not. Indirect impacts will be relevant where they are sufficiently close to the proposed action to be said to be a consequence of the action, and they can reasonably be imputed to be within the contemplation of the person proposing to take the action*.' Indirect impacts therefore can even include what the DotE (2013) calls facilitated impacts, which are the result of third party actions triggered by the primary action. In contrast, the EPA (2016a) defines direct impacts to '*include the removal, fragmentation or modification of habitat, and mortality or displacement of individuals or populations.*' This document then lists as indirect impacts what in many cases are the consequences of the removal, fragmentation or modification of habitat. For example, '*disruption of the dispersal of individuals required to colonise new areas inhibiting maintenance of genetic diversity between populations'* is a consequence of habitat fragmentation. Impacts of light, noise and even roadkill are defined as indirect but they are clearly the result of the action and in control of the person taking the action. Roadkill is as direct a form of mortality as can be observed, but it is considered as an indirect impact in the context of a development presumably because it is not directly linked to land clearing. The EPA (2016a) makes a strong distinction between removal of vegetation (direct impact) and the consequences of such clearing and other aspects of a development (indirect impacts). It is not obvious how this distinction between direct and indirect impacts is helpful in the EIA process, as the key aim is to ensure that all impacts that result from a project are addressed in this assessment process. Interestingly, Gleeson and Gleeson (2012), in a major review of impacts of development on wildlife, do not use the terms direct or indirect. In the following outlines of threatening processes that can cause impacts, the emphasis is upon interpreting how a threatening process will cause an impact. For example, loss of habitat (threatening process) can lead to population decline and to population fragmentation, which are two distinct impacts, with population decline considered a direct impact and fragmentation an indirect impact by the EPA (2016a).

Loss of habitat affecting population survival

Clearing for a development can lead to habitat loss for a species with a consequent decline in population size. This may be significant if the smaller population has reduced viability. Conservation significant species or species that already occur at low densities may be particularly sensitive to habitat loss affecting population survival.

Loss of habitat leading to population fragmentation

Loss of habitat can affect population movements by limiting movement of individuals throughout the landscape as a result of fragmentation (Soule *et al.* 2004; Gleeson and Gleeson 2012). Obstructions associated with the development, such as roads, pipes and drainage channels, may also affect movement of small, terrestrial species. Fragmented populations may not be sustainable and may be sensitive to effects such as reduced gene flow.

Degradation of habitat due to weed invasion leading to population decline

Weed invasion, such as through introduction by human boots or vehicle tyres, can occur as a result of development and if this alters habitat quality, can lead to effects similar to habitat loss.

Increased mortality

Increased mortality can occur during project operations; for example from roadkill, animals striking infrastructure and entrapment in trenches. Roadkill as a cause of population decline has been documented for several medium-sized mammals in eastern Australia (Dufty 1989; Jones 2000). Increased mortality due to roadkill is often more prevalent in habitats that have been fragmented (Scheick and Jones 1999; Clevenger and Waltho 2000; Jackson and Griffin 2000).

Increased mortality of common species during development is unavoidable and may not be significant for a population. However, the cumulative impacts of increased mortality of conservation significant species or species that already occur at low densities may have a significant impact on the population.

Species interactions, including predation and competition

Changes in species interactions often occur with development. Introduced species, including the feral Cat, Red Fox and Rabbit may have adverse impacts upon native species and development can alter their abundance. In particular, some mammal species are very sensitive to introduced predators and the decline of many mammals in Australia has been linked to predation by the Red Fox, and to a lesser extent the feral Cat (Burbidge and McKenzie 1989). Introduced grazing species, such as the Rabbit, Goat, Camel and domestic livestock, can also degrade habitats and deplete vegetation that may be a food source for other species.

Changes in the abundance of some native species at the expense of others, due to the provision of fresh watering points, can also be a concern. Harrington (2002) found the presence of artificial fresh waterpoints in the semi-arid mallee rangelands to influence the abundance and distribution of certain bird species. Common, water-dependent birds were found to out-compete some less common, water-independent species. Similarly, Read *et al.* (2015) found a decline in some bird species but an increase in others in the vicinity of active mines and concluded this was due to the mine attracting

large and aggressive species that displaced other species. Over-abundant native herbivores, such as kangaroos, can also adversely affect less abundant native species through competition and displacement.

Hydroecology

Interruptions of hydroecological processes can have major effects because they underpin primary production in ecosystems and there are specific, generally rare habitats that are hydrology-dependent. Fauna may be impacted by potential changes to groundwater level and chemistry and altered flow regime. These changes may alter vegetation across large areas and may lead to habitat degradation or loss. Impacts upon fauna can be widespread and major.

Changes to flow regime across the landscape may alter vegetation and may lead to habitat degradation or loss, affecting fauna. For example, Mulga has a shallow root system and relies on surface sheet flow during flood events. If surface sheet flow is impeded, Mulga can die (Kofoed 1998), which may impact on a range of fauna associated with this vegetation type.

Fire

The role of fire in the Australian environment and its importance to vertebrate fauna has been widely acknowledged (Gill *et al.* 1981; Fox 1982; Letnic *et al.* 2004). It is also one of the factors that has contributed to the decline and local extinction of some mammal and bird species (Burbidge and McKenzie 1989). Fire is a natural feature of the environment but frequent, extensive fires may adversely impact some fauna, particularly mammals and short-range endemic species. Changes in fire regime, whether to more frequent or less frequent fires, may be significant to some fauna. Impacts of severe fire may be devastating to species already occurring at low densities or to species requiring long unburnt habitats to survive. In terms of conservation management, it is not fire *per se* but the fire regime that is important, with evidence that infrequent, extensive and intense fires adversely affect biodiversity, whereas frequent fires that cover small areas and are variable in both season and intensity can enhance biodiversity. Fire management may be considered the responsibility of managers of large tracts of land, including managers of mining tenements.

Dust, light, noise and vibration

Impacts of dust, light, noise and vibration upon fauna are difficult to predict. Some studies have demonstrated the impact of artificial night lighting on fauna, with lighting affecting fauna behaviour more than noise (Rich and Longcore 2006). Effects can include impacts on predator-prey interactions, changes to mating and nesting behaviour, and increased competition and predation within and between invertebrates, frogs, birds and mammals.

The death of very large numbers of insects has been observed around some remote mine sites and attracts other fauna, notably native and introduced predators (M. Bamford pers. obs). The abundance

of some insects can decline due to mortality around lights, although this has previously been recorded in fragmented landscapes where populations are already under stress (Rich and Longcore 2006). Artificial night lighting may also lead to disorientation of migratory birds. Aquatic habitats and open habitats such as grasslands and dunes may be vulnerable to light spill.

Appendix 4. Ecological and threatening processes identified under legislation and in the literature.

Ecological processes are processes that maintain ecosystems and biodiversity. They are important for the assessment of impacts of development proposals, because ecological processes make ecosystems sensitive to change. The issue of ecological processes, impacts and conservation of biodiversity has an extensive literature. Following are examples of the sorts of ecological processes that need to be considered.

Ecological processes relevant to the conservation of biodiversity in Australia (Soule *et al.* 2004):

- Critical species interactions (highly interactive species);
- Long distance biological movement;
- Disturbance at local and regional scales;
- Global climate change;
- Hydroecology;
- Coastal zone fluxes;
- Spatially-dependent evolutionary processes (range expansion and gene flow); and
- Geographic and temporal variation of plant productivity across Australia.

Threatening processes (EPBC Act)

Under the EPBC Act, a key threatening process is an ecological interaction that threatens or may threaten the survival, abundance or evolutionary development of a threatened species or ecological community. There are currently 20 key threatening processes listed by the federal Department of the Environment (DotE 2014b):

- Competition and land degradation by rabbits.
- Competition and land degradation by unmanaged goats.
- Dieback caused by the root-rot fungus (*Phytophthora cinnamomi*).
- Incidental catch (bycatch) of Sea Turtle during coastal otter-trawling operations within Australian waters north of 28 degrees South.
- Incidental catch (or bycatch) of seabirds during oceanic longline fishing operations.
- Infection of amphibians with chytrid fungus resulting in chytridiomycosis.
- Injury and fatality to vertebrate marine life caused by ingestion of, or entanglement in, harmful marine debris.
- Invasion of northern Australia by Gamba Grass and other introduced grasses.
- Land clearance.
- Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants.
- Loss of biodiversity and ecosystem integrity following invasion by the Yellow Crazy Ant (*Anoplolepis gracilipes*) on Christmas Island, Indian Ocean.

- Loss of climatic habitat caused by anthropogenic emissions of greenhouse gases.
- Novel biota and their impact on biodiversity.
- Predation by European red fox.
- Predation by exotic rats on Australian offshore islands of less than 1000 km^2 (100,000 ha).
- Predation by feral cats.
- Predation, Habitat Degradation, Competition and Disease Transmission by Feral Pigs.
- Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species.
- The biological effects, including lethal toxic ingestion, caused by Cane Toads (*Bufo marinus*).
- The reduction in the biodiversity of Australian native fauna and flora due to the red imported fire ant, *Solenopsis invicta* (fire ant).

General processes that threaten biodiversity across Australia (The National Land and Water Resources Audit):

- Vegetation clearing;
- Increasing fragmentation, loss of remnants and lack of recruitment;
- Firewood collection;
- Grazing pressure;
- Feral animals;
- Exotic weeds;
- Changed fire regimes;
- Pathogens;
- Changed hydrology—dryland salinity and salt water intrusion;
- Changed hydrology— such as altered flow regimes affecting riparian vegetation; and
- Pollution.

In addition to the above processes, the federal Department of Agriculture, Water and the Environment (DAWE) produced Significant Impact Guidelines that provide criteria for the assessment of the significance of impacts. These criteria provide a framework for the assessment of significant impacts. The criteria are listed below.

- Will the proposed action lead to a long-term decrease in the size of a population?
- Will the proposed action reduce the area of occupancy of the species?
- Will the proposed action fragment an existing population?
- Will the proposed action adversely affect habitat critical to the survival of a species?

- Will the proposed action disrupt the breeding cycle of a population?
- Will the proposed action modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?
- Will the proposed action result in introducing invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat?
- Will the proposed action introduce disease that may cause the species to decline?
- Will the proposed action interfere with the recovery of the species?

Appendix 5. Invertebrate fauna expected to occur in the project area.

Status codes:

CS1, CS2, CS3 = (summary) levels of conservation significance. See Appendix 1 for full explanation.

EPBC Act listings: E = Endangered, V = Vulnerable, M = Migratory, Mar = Marine (See Appendix 2).

Biodiversity Conservation Act 2016 listings: S1 to S7 = Schedules 1 to 7 (See Appendix 2).

DBCA Priority species: P1 to P4 = Priority 1 to 4 (See Appendix 2).

LS = considered to be of local significance by Bamford Consulting Ecologists (see Appendix 1).

Int = introduced species.

Expected Occurrence categories: See Section 2.3.3 for explanation of expected occurrence categories.

Data sources: 1 = Atlas of Living Australia database search; 2 = NatureMap database search; 3 = DBCA Threatened Species search; 4 = general literature (e.g. field guides and handbooks); 5 = species recorded by Biota (2005).

Species	Common Name	Status	Expected Occurrence	Source
Syarinidae				
Ideoblothrus linnaei	Linnaeus' pseudoscorpion (Mesa A)	CS2 (P1)	Resident	1, 2, 3, 4
Chthoniidae				
Lagynochthonius asema	Mesa A Lagynochthonius pseudoscorpion	CS2 (P1)	Resident	1, 2, 3, 4
Hadziidae				
Nedsia hurlberti	a freshwater amphipod	CS1 (V, S3)	Resident	3, 4
Nedsia sculptilis	a freshwater amphipod	CS1 (V, S3)	Resident	3, 4
Protoneuridae				
Nososticta pilbara	Pilbara threadtail	CS2 (P2)	Resident	3, 4

Species	Common Name	Status	Expected Occurrence	Source
Hubbardiidae				
Paradraculoides anachoretus	Mesa A paradraculoides	CS1 (V, S3)	Resident	1, 2, 3, 4
Paradraculoides bythius	Mesa B/C paradraculoides	CS1 (V, S3)	Resident	1, 2, 3, 4
Paradraculoides gnophicola	Mesa G paradraculoides	CS1 (V, S3)	Resident	1, 2, 3, 4
Paradraculoides kryptus	Mesa K paradraculoides	CS1 (V, S3)	Resident	1, 3, 4
Draculoides mesozeirus	Middle Robe draculoides	CS1 (V, S3)	Resident	3, 4

Appendix 6. Vertebrate fauna expected to occur in the project area.

[1] Status codes: CS1, CS2, CS3 = (summary) levels of conservation significance. See Appendix 1 for full explanation.
EPBC Act listings: E = Endangered, V = Vulnerable, M = Migratory, Mar = Marine (See Appendix 2).
Biodiversity Conservation Act 2016 listings: S1 to S7 = Schedules 1 to 7 (See Appendix 2).
DBCA Priority species: P1 to P4 = Priority 1 to 4 (See Appendix 2).
LS = considered to be of local significance by Bamford Consulting Ecologists (see Appendix 1).
Int = introduced species.
[2]Expected Occurrence categories: See Section 2.3.3 for explanation of expected occurrence categories.
Text in **bold** indicates the species was confirmed during field investigations (A = May 2021, B = Oct/Nov 2021, C = July 2022, D = Sept 2022).
[3]Data sources: 1 = Atlas of Living Australia database search; 2 = NatureMap database search; 3 = DBCA Threatened Species search; 4 = general literature (e.g. field guides and handbooks); 5 = species recorded by Biota (2005). 6 = general literature.

Species	Common Name	Status[1]	Expected Occurrence[2]	Source[3]
Melanotaeniidae				
Melanotaenia australis	Western Rainbowfish		**Resident (A, B, D)**	1, 4
Eleotridae				
Hypseleotris compressa	Empire Gudgeon		Resident	1, 2, 4
Plotosidae				
Neosilurus hyrtlii	Hyrtl's Catfish		**Resident (A)**	1, 4
Tetraodontidae				
Leiopotherapon aheneus	Fortescue Grunter	CS2 (P4)	**Resident (A, B)**	2, 3, 4
Leiopotherapon unicolor	Spangled Perch		Resident	2, 4
Synbranchidae				
Ophisternon candidum	Blind Cave Eel	CS1 (V, S3)	Resident	2, 3
Pelodryadidae (Tree frogs)				
Cyclorana maini	Main's Frog		Resident	1, 2, 4
Litoria rubella	Little Red Tree Frog		**Resident (A, C, D)**	1, 2, 4
Limnodynastidae (Burrowing frogs)				

Species	Common Name	Status[1]	Expected Occurrence[2]	Source[3]
Neobatrachus aquilonius	Northern Burrowing Frog		Resident	4
Notaden nichollsi	Desert Spadefoot		**Resident (A)**	4
Platyplectrum spenceri	Centralian Burrowing Frog		Resident	1, 2, 4
Myobatrachidae (Ground frogs)				
Pseudophryne douglasi	Gorge Toadlet		Resident	4
Uperoleia saxatilis	Pilbara Toadlet		Resident	2, 4
Testundines				
Chelodina steindachneri	Flat-shelled Tortoise		Resident	4
Carphodactylidae (Carphodactylid geckos)				
Nephrurus levis			Resident	1, 2, 4, 5
Nephrurus cinctus			**Resident (C, D)**	1, 2, 4
Diplodactylidae (Diplodactylid geckos)				
Crenadactylus ocellatus	South-Western Clawless Gecko		Resident	1, 2, 4
Diplodactylus bilybara	Fat-tailed Gecko		**Resident (C, D)**	1, 2, 4, 5
Diplodactylus galaxias	Northern Pilbara Beak-faced Gecko		Resident	1, 2, 4
Diplodactylus mitchelli	Pilbara Stone Gecko		Resident	4
Diplodactylus savagei	Southern Pilbara Beak-faced Gecko		Resident	2, 4
Lucasium stenodactylum	Crowned Gecko		**Resident (C, D)**	1, 2, 4, 5
Oedura fimbria	Marbled Velvet Gecko		**Resident (A, D)**	2, 4, 5
Rhynchoedura ornata	Western Beaked Gecko		**Resident (D)**	1, 2, 4, 5
Strophurus elderi	Jewelled Gecko		**Resident (D)**	1, 2, 4
Strophurus jeanae	Southern Phasmid Gecko		Resident	4
Strophurus strophurus	Western spiny-tailed Gecko		Resident	4

Species	Common Name	Status[1]	Expected Occurrence[2]	Source[3]
Gekkonidae (Gekkonid geckos)				
Gehyra pilbara	Pilbara Dtella		Resident	1, 2, 4
Gehyra punctata	Spotted Dtella		**Resident (A, C, D)**	1, 2, 4
Gehyra variegata	Variegated Dtella		**Resident (A, C, D)**	2, 4
Gehyra crypta	Western Cryptic Gehyra		**Resident (D)**	4
Hemidactylus frenatus	Asian House Gecko		Resident	4
Heteronotia binoei	Bynoe's Gecko		**Resident (A, C, D)**	1, 2, 4, 5
Heteronotia spelea	Pilbara Cave Gecko		Resident	2
Pygopodidae (Legless lizards)				
Delma butleri	Spinifex Delma		Resident	2, 4
Delma elegans	Pilbara Delma		Resident	1, 2, 4
Delma haroldi	Neck-barred Delma		Resident	4
Delma nasuta	Sharp-snouted Delma		Resident	1, 2, 4, 5
Delma pax	Peace Delma		**Resident (C)**	1, 2, 4
Delma tincta	Excitable Delma		Resident	1, 2, 4
Lialis burtonis	Burton's Snake-lizard		Resident	2, 4, 5
Pygopus nigriceps	Western Hooded Scaly-foot		Resident	2, 4, 5
Agamidae (Dragons)				
Ctenophorus caudicinctus	Ring-tailed Dragon		**Resident (A, B, C, D)**	1, 2, 4, 5
Ctenophorus isolepis	Central Military Dragon		**Resident (A, C, D)**	1, 2, 4, 5
Ctenophorus nuchalis	Central Netted Dragon		**Resident (C, D)**	1, 2, 4, 5
Ctenophorus reticulatus	Western Netted Dragon		Resident	2, 4
Gowidon longirostris	Long-nosed Dragon		**Resident (A, B, C, D)**	2, 4, 5

Species	Common Name	Status[1]	Expected Occurrence[2]	Source[3]
Pogona minor	Dwarf Bearded Dragon		**Resident (C, D)**	2, 4
Tympanocryptis cephalus	Pebble Dragon		Resident	4
Scincidae (Skinks)				
Carlia munda	Shaded-litter Rainbow-Skink		**Resident (D)**	1, 2, 4, 5
Cryptoblepharus buchananii			Resident	2, 4
Cryptoblepharus ustulatus			Resident	2, 4
Ctenotus duricola	Pilbara Ctenotus		Resident	1, 2, 4, 5
Ctenotus grandis			**Resident (C)**	2, 4, 5
Ctenotus hanloni	Nimble Ctenotus		Resident	1, 2, 4, 5
Ctenotus helenae	Clay-soil Ctenotus		**Resident (C, D)**	1, 2, 4, 5
Ctenotus inornatus	Bar-shouldered Ctenotus		Resident	1
Ctenotus pantherinus	Leopard Ctenotus		**Resident (C, D)**	1, 2, 4, 5
Ctenotus rubicundus	Ruddy Ctenotus		Resident	1, 2, 4
Ctenotus saxatilis	Rock Ctenotus		**Resident (A, B, C, D)**	2, 4, 5
Ctenotus serventyi			Resident	2, 4
Cyclodomorphus melanops	Northern Slender Blue-Tongue		**Resident (A)**	1, 2, 4
Egernia cygnitos	Western Pilbara Spiny-tailed Skink		Resident	4
Egernia formosa	Goldfields Crevice-Skink		Resident	1, 2, 4
Egernia pilbarensis	Pilbara Skink		Resident	2, 4
Eremiascincus isolepis			**Resident (A, C, D)**	2
Eremiascincus pallidus	Western Narrow-Banded Skink		Resident	1, 2, 4
Eremiascincus richardsonii			Resident	5
Lerista bipes	North-Western Sandslider		Resident	1, 2, 4, 5

Species	Common Name	Status[1]	Expected Occurrence[2]	Source[3]
Lerista clara	Sharp-Blazed Three-Toed Slider		**Resident (D)**	1, 2, 4
Lerista flammicauda			Resident	2, 4
Lerista jacksoni	Jackson's Three-toed Slider		Resident	4
Lerista muelleri			**Resident (A, D)**	4, 5
Lerista verhmens			Resident	4
Menetia greyii	Common Dwarf Skink		**Resident (C, D)**	1, 2, 4, 5
Menetia surda			Resident	1, 2, 4
Morethia ruficauda			**Resident (A, C)**	1, 2, 4, 5
Notoscincus butleri	Lined Soil-Crevice Skink	CS2 (P4)	Resident	1, 2, 3
Notoscincus ornatus			Resident	1, 2, 4
Proablepharus reginae	Spinifex Snake-eyed Skink		Resident	4
Tiliqua multifasciata	Central Blue-tongue		Resident	2, 4
Varanidae (Monitors and goannas)				
Varanus acanthurus	Spiny-tailed Monitor		**Resident (D)**	2, 4
Varanus brevicauda	Short-tailed Pygmy Monitor		**Resident (D)**	4
Varanus bushi	Pilbara Mulga Monitor		**Resident (A, D)**	2
Varanus eremius	Pygmy Desert Monitor		**Resident (C, D)**	1, 2, 4, 5
Varanus giganteus	Perentie		**Resident (A)**	2, 4
Varanus gouldii	Gould's Sand Monitor		Resident	2, 4
Varanus panoptes	Yellow-spotted Monitor		**Resident (A, B, D)**	2, 4
Varanus pilbarensis	Pilbara Rock Monitor		Resident	1, 2
Varanus tristis	Racehorse Monitor		**Resident (C)**	2, 4
Typhlopidae (Blind snakes)				

Species	Common Name	Status[1]	Expected Occurrence[2]	Source[3]
Anilios ammodytes			Resident	4
Anilios ganei	Gane's blind snake (Pilbara)	CS2 (P1)	**Resident (C)**	3
Anilios grypus	Beaked Blind Snake		Resident	1, 2, 4
Anilios hamatus			**Resident (D)**	4
Anilios pilbarensis	Pilbara Blind Snake		**Resident (D)**	1
Pythonidae (Pythons)				
Antaresia perthensis	Pygmy Python		Resident	1, 4
Antaresia childreni	Children's Python		**Resident (A)**	2, 4
Aspidites melanocephalus	Black-Headed Python		**Resident (D)**	1, 2, 4, 5
Liasis olivaceus subsp. barroni	Pilbara Olive Python	CS1 (V, S3)	Resident	2, 3, 4
Elapidae (Venomous land snakes)				
Acanthophis wellsei	Pilbara Death Adder		**Resident (D)**	1, 2, 4, 5
Brachyurophis approximans	North-western Shovel-nosed Snake		Resident	4
Demansia psammophis	Yellow-faced Whipsnake		**Resident (D)**	1, 2, 4, 5
Demansia rufescens	Rufous Whipsnake		Resident	1, 2, 4
Furina ornata	Moon Snake		Resident	1, 2, 4, 5
Parasuta monachus	Monk Snake		Resident	1, 2, 4
Pseudechis australis	Mulga Snake		**Resident (D)**	1, 2, 4
Pseudonaja mengdeni	Western Brown Snake		**Resident (D)**	1, 2, 4
Pseudonaja modesta	Ringed Brown Snake		Resident	1, 2, 4
Suta fasciata	Rosen's Snake		Resident	4
Suta punctata	Spotted Snake		Resident	1, 2, 4, 5
Casuariidae (Emus and Cassowaries)				

Species	Common Name	Status[1]	Expected Occurrence[2]	Source[3]
Dromaius novaehollandiae	Emu		Resident	1, 2, 4, 5
Anatidae (Ducks, Swans and Geese)				
Dendrocygna arcuata	Wandering Whistling Duck		Irregular Visitor	2, 4
Dendrocygna eytoni	Plumed Whistling-Duck		Irregular Visitor	1, 4
Cygnus atratus	Black Swan		Irregular Visitor	1, 2, 4
Tadorna tadornoides	Australian Shelduck		Irregular Visitor	1, 4
Malacorhynchus membranaceus	Pink-eared Duck		Irregular Visitor	4
Chenonetta jubata	Australian Wood Duck		Regular Visitor	1, 4
Anas superciliosa	Pacific Black Duck		Regular Visitor	1, 2, 4
Anas gracilis	Grey Teal		**Regular Visitor (D)**	1, 2, 4
Aythya australis	Hardhead		Irregular Visitor	1, 2, 4
Phasianidae (Pheasants and Quail)				
Coturnix pectoralis	Stubble Quail		Irregular Visitor	4
Coturnix ypsilophora	Brown Quail		**Resident (C, D)**	2, 4
Podicipedidae (Grebes)				
Tachybaptus novaehollandiae	Australasian Grebe		Regular Visitor	1, 2, 4
Poliocephalus poliocephalus	Hoary-headed Grebe		Irregular Visitor	1, 2, 4
Podiceps cristatus	Great Crested Grebe		Irregular Visitor	1, 4
Threskiornithidae (Ibis and Spoonbills)				
Threskiornis moluccus	Australian White Ibis		Regular Visitor	4
Threskiornis spinicollis	Straw-necked Ibis		Regular Visitor	1, 2, 4
Platalea regia	Royal Spoonbill		Vagrant	4
Platalea flavipes	Yellow-billed Spoonbill		Irregular Visitor	1

Species	Common Name	Status[1]	Expected Occurrence[2]	Source[3]
Ardeidae (Herons, Bitterns and Egrets)				
Nycticorax caledonicus	Nankeen Night Heron		**Regular Visitor (A)**	2, 4
Ardea pacifica	White-necked Heron		**Regular Visitor (C)**	1, 2, 4
Ardea modesta	Eastern Great Egret	CS1 (M, S5)	Regular Visitor	1, 2, 4
Ardea intermedia	Intermediate Egret		Irregular Visitor	1, 2, 4
Ardea novaehollandiae	White-faced Heron		**Regular Visitor (A, D)**	1, 2, 4, 5
Ardea garzetta	Little Egret		Irregular Visitor	1, 2, 4
Pelecanidae (Pelican)				
Pelecanus conspicillatus	Australian Pelican		**Regular Visitor (A, C)**	4
Phalacrocoracidae (Cormorants)				
Phalacrocorax melanoleucos	Little Pied Cormorant		Regular Visitor	1, 4
Anhingidae (Darter)				
Anhinga novaehollandiae	Australasian Darter		**Regular Visitor (A)**	4
Accipitridae (Kites, Eagles, Goshawks)				
Elanus caeruleus	Black-shouldered Kite		Resident	1, 2, 4
Elanus scriptus	Letter-winged Kite	CS2 (P4)	Vagrant	3
Hamirostra isura	Square-tailed Kite		Irregular visitor	1, 4
Hamirostra melanosternon	Black-breasted Buzzard		Resident	4
Hieraaetus morphnoides	Little Eagle		**Resident (A)**	1, 2, 4, 5
Aquila audax	Wedge-tailed Eagle		**Resident (A, B, C)**	1, 2, 4
Erythrotriorchis radiatus	Red Goshawk	CS1 (V, S3)	**Vagrant**	3
Accipiter fasciatus	Brown Goshawk		**Resident (A)**	2, 4, 5
Accipiter cirrocephalus	Collared Sparrowhawk		**Resident (A)**	1, 2, 4

Species	Common Name	Status[1]	Expected Occurrence[2]	Source[3]
Circus assimilis	Spotted Harrier		**Resident (A, C)**	1, 2, 4
Milvus migrans	Black Kite		**Resident (A, B)**	1, 2, 4
Haliastur sphenurus	Whistling Kite		**Resident (A, B, C)**	1, 2, 4
Otididae (Bustards)				
Ardeotis australis	Australian Bustard		**Resident (C, D)**	1, 2, 4
Rallidae (Rails, Crakes, Coots)				
Gallirallus philippensis	Buff-banded Rail		Irregular Visitor	4
Porzana pusilla	Baillon's Crake		Irregular Visitor	1, 2
Porzana tabuensis	Spotless Crake		Irregular Visitor	2
Tribonyx ventralis	Black-tailed Native-hen		Irregular Visitor	1, 4
Fulica atra	Eurasian Coot		Irregular Visitor	1, 2, 4
Scolopacidae (Snipe, Sandpipers, Godwits, Curlew, Stints and Phalaropes)				
Tringa nebularia	Common Greenshank		Irregular Visitor	4
Tringa glareola	Wood Sandpiper	CS1 (M, S5)	Irregular Visitor	3
Actitis hypoleucos	Common Sandpiper	CS1 (M, S5)	Irregular Visitor	3
Calidris acuminata	Sharp-tailed Sandpiper	CS1 (M, S5)	Irregular Visitor	3
Turnicidae (Button-quails)				
Turnix velox	Little Button-quail		**Regular visitor (C, D)**	1, 2, 4
Glareolidae (Pratincoles)				
Glareola maldivarum	Oriental Pratincole	CS1 (M, S5)	Irregular Visitor	3
Burhinidae (Stone-curlews)				
Burhinus grallarius	Bush Stone-curlew	CS3	**Resident (A, C, D)**	2, 4
Recurvirostridae (Stilts)				

Species	Common Name	Status[1]	Expected Occurrence[2]	Source[3]
Himantopus himantopus	Black-winged Stilt		Irregular Visitor	1, 4
Charadriidae (Dotterals)				
Erythrogonys cinctus	Red-kneed Dotterel		Regular Visitor	1, 2, 4
Elseyornis melanops	Black-fronted Dotterel		**Resident (A, D)**	1, 2, 4, 5
Columbidae (Pigeons and Doves)				
Columba livia	Rock Dove	Int	Vagrant	4
Phaps chalcoptera	Common Bronzewing		**Resident (A, B, C, D)**	1, 4, 5
Phaps histrionica	Flock Bronzewing		Regular Visitor	4
Ocyphaps lophotes	Crested Pigeon		**Resident (A, B, C, D)**	1, 2, 4
Geophaps plumifera	Spinifex Pigeon		**Resident (A, B, C, D)**	1, 2, 4, 5
Geopelia cuneata	Diamond Dove		**Resident (A, B, C, D)**	1, 2, 4, 5
Geopelia striata	Peaceful Dove		**Resident (A, B, C, D)**	1, 2, 4, 5
Cuculidae (Cuckoos)				
Centropus phasianinus	Pheasant Coucal		**Resident (B, D)**	4
Chrysococcyx basalis	Horsfield's Bronze-Cuckoo		**Regular Visitor (A, C, D)**	1, 4, 5
Chrysococcyx osculans	Black-eared Cuckoo		**Regular Visitor (C)**	4
Cacomantis pallidus	Pallid Cuckoo		**Regular Visitor (A, C, D)**	1, 2, 4, 5
Tytonidae (Barn Owls)				
Tyto javanica	Barn Owl		Resident	2, 4
Strigidae (Hawk Owls)				
Ninox connivens	Barking Owl		**Resident (A, D)**	1, 2, 4
Ninox boobook	Southern Boobook		**Resident (A, C)**	4
Caprimulgidae (Nightjars)				

Species	Common Name	Status[1]	Expected Occurrence[2]	Source[3]
Eurostopodus argus	Spotted Nightjar		**Resident (A, C, D)**	1, 2, 4
Podargidae (Frogmouths)				
Podargus strigoides	Tawny Frogmouth		Resident	4
Aegothelidae (Owlet-nightjars)				
Aegotheles cristatus	Australian Owlet-nightjar		**Resident (A, B, C, D)**	2, 4
Apodidae (Swifts)				
Apus pacificus	Fork-tailed Swift	CS1 (M, S5)	Irregular Visitor	4
Alcedinidae (Kingfishers)				
Dacelo leachii	Blue-winged Kookaburra		**Resident (A, B, C, D)**	1, 2, 4, 5
Todiramphus sanctus	Sacred Kingfisher		**Regular Visitor (A, B, C, D)**	1, 2, 4
Todiramphus pyrrhopygius	Red-backed Kingfisher		**Regular Visitor (C)**	1, 2, 4, 5
Meropidae (Bee-eaters)				
Merops ornatus	Rainbow Bee-eater		**Regular Visitor (A, B, C, D)**	1, 2, 4, 5
Falconidae (Falcons)				
Falco cenchroides	Nankeen Kestrel		**Resident (A, C)**	1, 2, 4, 5
Falco longipennis	Australian Hobby		Resident	1, 2, 4
Falco berigora	Brown Falcon		**Resident (A, C, D)**	1, 2, 4, 5
Falco peregrinus	Peregrine Falcon	CS1 (OS, S7)	Resident	3, 4
Falco hypoleucos	Grey Falcon	CS1 (V, S3)	Regular Visitor	4
Cacatuidae (Cockatoos)				
Cacatua roseicapilla	Galah		**Resident (A, B, C, D)**	1, 2, 4, 5
Cacatua sanguinea	Little Corella		**Resident (A, C, D)**	1, 2, 4, 5
Nymphicus hollandicus	Cockatiel		**Regular Visitor (A, B, C, D)**	1, 2, 4, 5

Species	Common Name	Status[1]	Expected Occurrence[2]	Source[3]
Psittacidae (Parrots)				
Platycercus zonarius	Australian Ringneck		**Resident (A, C, D)**	1, 2, 4, 5
Melopsittacus undulatus	Budgerigar		**Regular Visitor (A, B, C, D)**	1, 2, 4, 5
Pezoporus occidentalis	Night Parrot	CS1 (E, S1)	Vagrant	3
Ptilonorhynchidae (Bowerbirds)				
Ptilonorhynchus maculatus	Western Bowerbird		Resident	1, 2, 4
Climacteridae (Tree-creepers)				
Climacteris melanurus	Black-tailed Treecreeper		Resident	4
Maluridae (Fairy-wrens, Emu-wrens and Grasswrens)				
Malurus assimilis	Purple-backed Fairy-wren		**Resident (A, B, C, D)**	1, 2, 4, 5
Malurus leucopterus	White-winged Fairy-wren		**Resident (A, C, D)**	2, 4
Stipiturus ruficeps	Rufous-crowned Emu-wren	CS3	**Resident (A, C, D)**	1, 2, 4, 5
Amytornis striatus	Striated Grasswren	CS3	**Resident (A, B)**	1, 2, 4, 5
Meliphagidae (Honeyeaters and Chats)				
Sugomel niger	Black Honeyeater		Regular Visitor	4, 5
Certhionyx variegatus	Pied Honeyeater		Regular Visitor	4
Lichmera indistincta	Brown Honeyeater		**Resident (A, B, C, D)**	1, 2, 4, 5
Melithreptus gularis	Black-chinned Honeyeater		**Irregular Visitor (C, D)**	1
Epthianura tricolor	Crimson Chat		**Regular Visitor (D)**	1, 2, 4
Epthianura aurifrons	Orange Chat		Irregular Visitor	1, 4
Acanthagenys rufogularis	Spiny-cheeked Honeyeater		Resident	2, 4
Manorina flavigula	Yellow-throated Miner		**Resident (A, B, C, D)**	1, 2, 4
Gavicalis virescens	Singing Honeyeater		**Resident (B, C, D)**	1, 2, 4, 5

Species	Common Name	Status[1]	Expected Occurrence[2]	Source[3]
Ptilotula keartlandi	Grey-headed Honeyeater		**Resident (A, B, C)**	1, 2, 4, 5
Ptilotula penicillata	White-plumed Honeyeater		**Resident (A, B, C, D)**	1, 4, 5
Pardalotidae (Pardalotes)				
Pardalotus rubricatus	Red-browed Pardalote		**Resident (A, C, D)**	1, 2, 4, 5
Pardalotus striatus	Striated Pardalote		**Resident (A)**	2, 4, 5
Acanthizidae (Thornills and Gerygones)				
Smicrornis brevirostris	Weebill		**Resident (A, B, C, D)**	1, 2, 4, 5
Gerygone fusca	Western Gerygone		Resident	4, 5
Pomatostomidae (Australian Babblers)				
Pomatostomus temporalis	Grey-crowned Babbler		**Resident (A, B, C, D)**	1, 2, 4, 5
Psophodidae (Quail-thrushes, Whipbirds and Wedgebills)				
Psophodes occidentalis	Chiming Wedgebill		Irregular Visitor	4
Artamidae (Woodswallows)				
Artamus leucorynchus	White-breasted Woodswallow		**Irregular Visitor (A)**	1, 2
Artamus personatus	Masked Woodswallow		**Resident (C, D)**	4
Artamus cinereus	Black-faced Woodswallow		**Resident (A, B, C, D)**	1, 2, 4, 5
Artamus minor	Little Woodswallow		**Resident (A, B, C)**	1, 2, 4, 5
Cracticidae (Butcherbirds and Magpie)				
Cracticus torquatus	Grey Butcherbird		Resident	4
Cracticus nigrogularis	Pied Butcherbird		**Resident (A, B, C, D)**	1, 2, 4, 5
Cracticus tibicen	Australian Magpie		**Resident (D)**	1, 2, 4
Campephagidae (Cuckoo-shrikes and Trillers)				
Coracina novaehollandiae	Black-faced Cuckoo-shrike		**Resident (A, B, C, D)**	1, 2, 4, 5

Species	Common Name	Status[1]	Expected Occurrence[2]	Source[3]
Lalage tricolor	White-winged Triller		**Resident (C, D)**	1, 2, 4, 5
Oreoididae (Bellbirds)				
Oreoica gutturalis	Crested Bellbird		**Resident (A, C, D)**	1, 2, 4, 5
Pachycephalidae (Whistlers)				
Pachycephala rufiventris	Rufous Whistler		**Resident (A, B, C, D)**	1, 2, 4, 5
Colluricincla harmonica	Grey Shrike-thrush		**Resident (A, B, C, D)**	1, 2, 4
Rhipiduridae (Fantails)				
Rhipidura leucophrys	Willie Wagtail		**Resident (A, B, C, D)**	1, 2, 4, 5
Rhipidura albiscapa	Grey Fantail		Resident	1, 4, 5
Monarchidae (Monarchs)				
Grallina cyanoleuca	Magpie-Lark		**Resident (A, B, C, D)**	1, 2, 4
Corvidae (Crows and Ravens)				
Corvus orru	Torresian Crow		**Resident (A, B, C, D)**	1, 2, 4, 5
Corvus bennetti	Little Crow		Resident	1, 2, 4
Petroicidae (Australian Robins)				
Melanodryas cucullata	Hooded Robin		**Resident (A, C, D)**	4
Petroica goodenovii	Red-capped Robin		Resident	4
Hirundinidae (Swallows and Martins)				
Cheramoeca leucosterna	White-backed Swallow		Regular Visitor	4
Hirundo neoxena	Welcome Swallow		Resident	1, 2, 4
Petrochelidon ariel	Fairy Martin		Regular Visitor	1, 2, 4, 5
Petrochelidon nigricans	Tree Martin		**Regular Visitor (A, C, D)**	1, 2, 4
Acrocephalidae (Reed-warblers)				

Species	Common Name	Status[1]	Expected Occurrence[2]	Source[3]
Acrocephalus australis	Australian Reed-Warbler		**Regular Visitor (A)**	1, 2, 4
Locustellidae (Songlarks and Grassbirds)				
Poodytes carteri	Spinifexbird		**Resident (A, B, C, D)**	1, 2, 4, 5
Cincloramphus cruralis	Brown Songlark		Regular visitor	4
Cincloramphus mathewsi	Rufous Songlark		**Regular Visitor (C, D)**	1, 4, 5
Dicaeidae (Flowerpeckers)				
Dicaeum hirundinaceum	Mistletoebird		Regular Visitor	2, 4, 5
Estrildidae (Finches and Mannikins)				
Emblema pictum	Painted Finch		**Resident (A, B, C)**	1, 2, 4, 5
Neochmia ruficauda	Star Finch	CS3	**Resident (A, B)**	1, 2, 4
Taeniopygia guttata	Zebra Finch		**Resident (A, B, C, D)**	1, 2, 4, 5
Motacillidae (Pipits)				
Anthus australis	Australian Pipit		**Resident (B)**	1, 4
Tachyglossidae (Echidna)				
Tachyglossus aculeatus	Short-beaked Echidna		**Resident (A*)**	2, 4, 5
Dasyuridae (Carnivorous Marsupials)				
Dasykaluta rosamondae	Kaluta		**Resident (D)**	2, 4
Dasyurus hallucatus	Northern Quoll	CS1 (E, S2)	**Resident (A, B, C, D)**	1, 2, 3, 4, 5
Ningaui timealeyi	Pilbara Ningaui		**Resident (C, D)**	2, 4, 5
Planigale Mt Tom Price'	Mt Tom Price Planigale		Resident	4
Planigale species 1'	Pilbara Planigale		Resident	4
Pseudantechinus woolleyae	Woolley's Pseudantechinus		**Resident (C)**	1, 2, 4
Sminthopsis longicaudata	Long-tailed Dunnart	CS2 (P4)	Resident	3

Species	Common Name	Status[1]	Expected Occurrence[2]	Source[3]
Sminthopsis macroura	Stripe-faced Dunnart		**Resident (C, D)**	2, 4
Sminthopsis youngsoni	Lesser Hairy-footed Dunnart		Resident	1, 2, 4
Phalangeridae (Possums)				
Trichosurus vulpecula	Brushtail Possum	CS3	**Resident (C)**	4
Macropodidae (Kangaroos and Wallabies)				
Osphranter robustus	Euro		**Resident (A, B, C, D)**	1, 2, 4, 5
Osphranter rufus	Red Kangaroo		**Resident (C)**	1, 2, 4
Petrogale lateralis	Black-footed Rock-Wallaby	CS1 (E, S2)	Vagrant	4
Petrogale rothschildi	Rothschild's Rock-Wallaby	CS3	**Resident (A, B)**	4
Muridae (Rats and Mice)				
Leggadina lakedownensis	Short-tailed Mouse	CS2, (P4)	Resident	3, 4
Mus musculus	House Mouse		Resident	4
Notomys alexis	Spinifex Hopping-Mouse		Irregular visitor	1, 2, 4
Pseudomys chapmani	Ngadji or Western Pebble-mound Mouse	CS2 (P4)	**Resident (C*)**	2, 3
Pseudomys delicatulus	Delicate Mouse		Resident	1, 2, 4, 5
Pseudomys desertor	Desert Mouse		**Resident (C)**	1, 2
Pseudomys hermannsburgensis	Sandy Inland Mouse		**Resident (C, D)**	1, 2, 4
Zyzomys argurus	Common Rock-Rat		**Resident (A, B)**	1, 2, 4, 5
Pteropodidae (Fruit Bats)				
Pteropus scapulatus	Little Red Flying-fox		Irregular Visitor	4
Rhinonycteridae (Leaf-nosed Bats)				
Rhinonicteris aurantia	Pilbara Leaf-nosed Bat	CS1 (V, S3)	**Resident (A, D)**	2, 3, 4
Megadermatidae (Ghost Bat)				

Species	Common Name	Status[1]	Expected Occurrence[2]	Source[3]
Macroderma gigas	Ghost Bat	CS1 (V, S3)	**Resident (A, B)**	2, 4
Emballonuridae (Shreath-tail Bats)				
Saccolaimus flaviventris	Yellow-bellied Sheath-tail Bat		**Resident (D)**	2, 4
Taphozous georgianus	Common Sheath-tail Bat		**Resident (A, B, D)**	1, 2, 4
Molossidae (Free-tail Bats)				
Austronomus australis	White-striped Free-tail Bat		Regular Visitor	4
Chaerephon jobensis	Greater Northern Free-tail Bat		**Resident (D)**	2, 4
Ozimops lumsdenae	Northern Free-tail Bat		**Resident (D)**	4
Vespertilionidae (Vespertilionid Bats)				
Chalinolobus gouldii	Gould's Wattled Bat		**Resident (D)**	2, 4
Nyctophilus daedalus	Pallid Long-Eared Bat		Resident	1, 2, 4
Nyctophilus geoffroyi	Lesser Long-eared Bat		Resident	4
Scotorepens greyii	Little Broad-nosed Bat		**Resident (D)**	2, 4
Vespadelus finlaysoni	Finlayson's Cave Bat		**Resident (A, B, D)**	1, 2, 4
Canidae (Dogs and Foxes)				
Vulpes vulpes	Red Fox	Int	Resident	4
Canis lupus	Dingo/dog	Int	**Resident (A*, B*, C)**	4, 5
Felidae (Cats)				
Felis catus	Cat	Int	**Resident (C*, D)**	2, 4
Equidae (Horses)				
Equus caballus	Horse	Int	Resident	4
Bovidae (Horned ruminants)				
Bos taurus	European Cattle	Int	**Resident**	2

Appendix 7. Species returned from the database and literature review that have been omitted from the expected species list because of habitat or range limitations, or because they are now considered locally extinct.

Note that some birds could still occur as extremely rare vagrants.

Species	Common Name
Liza subviridis	Greenback Mullet
Mugil cephalus	Sea Mullet
Caranx papuensis	Brassy Trevally
Selenotoca multifasciata	Striped Scat
Sillago ingenuua	Bay Whiting
Scorpaena sumptuosa	Western Red Scorpionfish
Chelonodon patoca	Milkspot Toadfish
Uperoleia russelli	Northwest Toadlet
Natator depressus	Flatback Turtle
Egernia depressa	Southern Pygmy Spiny-tailed Skink
Pseudonaja nuchalis	Gwardar, Northern Brown Snake
Simoselaps anomalus	Desert Banded Snake
Phalacrocorax sulcirostris	Little Black Cormorant
Phalacrocorax varius	Pied Cormorant
Phalacrocorax carbo	Great Cormorant
Pandion haliaetus	Eastern Osprey
Charadrius veredus	Oriental Plover
Acanthiza apicalis	Inland Thornbill
Acanthiza uropygialis	Chestnut-rumped Thornbill
Based on the literature, the following mammals would have been present historically and are now considered locally extinct:	
Macrotis lagotis	Greater Bilby
Isoodon auratus	Golden Bandicoot
Lagorchestes conspicillatus	Spectacled Hare-Wallaby
Pseudomys nanus	Western Chestnut Mouse
Rattus tunneyi	Pale Field-Rat
Leporillus conditor	Greater Stick-nest Rat (old nests found)

Appendix 8. Species recorded across all field investigations.

Slaters. One collected near Robe Pool and several around camp (May). Also some collected in July. Caught regularly in pits even in Sept.

Mygalomorph. Sept -one collected T1.02 (23/09).

Western Rainbowfish (May). Also seen in October (Robe Pool). Present in upper reaches of drainage system near T5 in Sept.

Fortescue Grunter. All grunters in Robe Pool appeared to be this and not Spangled Grunter (May and October).

Tandanus hyrtli. Seen in Robe Pool May 2021.

1. *Litoria rubella*. Several around pools near Robe Pool (May). Also at Yalleen Station homestead. July – in showers at new camp. Tadpoles in Yarambee Ck. Sept – in showers at camp; also several active along creek at night near T5 (22/09).

2. *Notaden nicholsii*. Calling around camp (May).

3. *Diplodactylus bilybara*. July. Several caught T2 and T4. Sept – several caught.

4. *Lucasium stenodactylum*. July. One caught T2. Sept – caught T1 and hand-capture near T5. Juvenile on T4 fund outside pit when it was removed; unusual colour with no vertebral line and small scattered pale spots.

5. *Oedura fimbria*. Sloughs in several small caves on CZR mesa (May). Sept – adult and juvenile seen while head-torching on CZR mesa (24/09).

6. *Gehyra punctata*. Several seen in caves (May). July - A juvenile (hatchling) caught near T2. Sept – many seen when head-torching around Fig Tree Hill (23/09).

7. *Gehyra variegata*. Several in camp and in dead wood elsewhere. Clear white dots linked to erratic black lines (May). July – several found head-torching along main river and in snakewood. Sept – several caught T3 and T4. Also hand-captures amongst shrubs throughout.

8. *Gehyra crypta*. Sept – seems to be the common, largish and rather pale Gehyra on River Gums and Cajeput along the creekline near T5. Notable for only two pairs of chin shields and very large toe pads (compared with G. variegata with three pir of chin shields and slightly slimmer toe pads).

9. *Heteronotia binoei*. One under drum at stock bore and several around camp (May). July – one found under dead spinifex near T3 and one under dead spinifex near camp. Sept – several caught.

10. *Nephrurus cinctus*. July - One under a dead spinifex along T3. Sept – one caught T3.

11. *Rhynchoedura ornata*. Sept – one found while spotlighting near CZR mesa (24/09).

12. *Strophurus elderi.* Sept – several caught T3.

13. *Delma pax*. July – one killed while installing pitfalls at CZ209 (2/07).

14. *Ctenophorus caudicinctus*. Seen regularly in rocky areas particular on top of mesa. Hatchlings present (May). In October, seen regularly in rocky areas with males very brightly-coloured. July - seen

regularly in rocky areas on flats, including hatchlings. Sept – seen regularly; almost all seemed to be small adults but perhaps the hatchlings grow rapidly?

15. *Ctenophorus isolepis*. Several seen in sandy sections of flats (May). July – several caught in sandy and even slightly gravelly rises. Many hatchlings. Sept – seen in slightly sandy areas and few caught. All seen and caught were adult.

16. *Ctenophorus nuchalis*. July - One active round camp (8/07). Sept – one active around camp but a smaller animal than that seen in July.

17. *Gowidon (Lophognathus) longirostris*. One in western valley of mesa (May). One along Robe River (Oct). Also seen at Yalleen Station. July. Seen and caught regularly close to watercourses, including along southern access route. Sept – seen along creeks.

18. *Pogona minor (mitchelli*). July. Adult female with oviducal eggs run over on track near Transect 1. Several others caught including gravid females. Sept – gravid females caught and one two year old.

19. *Varanus acanthurus*. Sept- One found under a pitfall along T4 when traps being remove (25/09).

20. *Varanus brevicauda*. Sept – one caught T1 (26/09).

21. *Varanus bushi*. One in dead bush sheltering in crevice near camp (May). Sept – three caught T4.

22. *Varanus eremius*. July - One under log near T1. Sept – one caught T1.

23. *Varanus giganteus*. Juvenile on west side of mesa (May).

24. *Varaus panoptes*. Distinctive foraging holes around camp (May). Also seen at Yalleen Station (October). Sept – several on cameras.

25. *Varanus tristis*. July – one in dead tree along main river near T5.

26. *Carlia munda*. Sept – one caught T3.

27. *Ctenotus grandis*. July – one caught on T2 near drainage line in dense vegetation and on deep loam soil.

28. *Ctenotus helenae*. July – hatchling caught in 3.18 in eucalypts over Buffel grass on red alluvial clayey loam, and one caught in similar soil at eastern end of T4.

29. *Ctenotus pantherinus*. July – several trapped; many are very young. Sept – several trapped; most adults.

30. *Cyclodomorphus melanops*. Several found under spoil (May and Sept).

31. *Eremiascincus isolepis*. Common under debris along big drainage line (May). July – adults and juveniles caught by searching in flood debris and dense litter along big drainage line. Sept – several pitfalled at T5 long drainage line, and seen active at night; even climbing rough trunks of Cajeput!

32. *Ctenotus saxatilis*. Seen in rocky areas on edge of mesa (May). A freshly-dead animal, probably year 2, found in Oct. July – one found and-searching at Fig Tree Hill.

33. *Lerista muelleri*. Found under spoil (May). Sept – several pitfalled. One confirmed, after very close examination, as L. muelleri.

34. *Lerista clara*. Sept – caught T3 and T4. Several caught and one had a clear mid to lower lateral black line as well as dark upper lateral zone.

35. *Menetia greyii*. July – one trapped T1. Sept – few trapped.

36. *Morethia ruficauda*. One seen along edge of mesa (May). July – one seen on mesa along northern access route.

37. *Anilios ganei*. July – one in very dense litter at base of eucalypt in flood zone of big drainage line near proposed crossing.

38. *Anilios pilbarensis*. Sept – one caught T3 and one found when head-torching on Fig Tree Hill.

39. *Anilios hamatus*. Sept – identified on basis of weakly but distinctly tri-lobed snout; angular in profile but tip rounded and not pointed, hooked or beaked. Nasal cleft connects to second upper labial. Clear transition between dark lateral and pale ventral surface. Slightly heavier in build than A. pilbarensis. Distinctive pale lines of dots formed by pale centres to scales.

40. *Antaresia childreni*. Recent sloughed skin of 70cm animal on edge of mesa (May).

41. *Aspidites melanocephalus*. One seen along access road August 2022 (SL).

42. *Acanthophis wellsi*. Sept – one active at night in shrubland on loam soil near T5 (22/09).

43. *Demansia reticulata*. Sept – one seen along T2 (25/09) and one seen along west track near Ghost Bat Gulch (26/09).

44. *Pseudechis australis*. One seen along access road August 2022 (SL).

45. *Pseudonaja mengdeni*. Sept - One seen along T3.

1. Grey Teal. Sept – two on overflow pool at stock trough east of camp (21/09).

2. Brown Quail. July – heard and seen along T3. Adult with about four chicks along T2 (7/07). Sept – recorded along T2 and T3; group of four at T2 possibly the young from July!

3. Crested Pigeon. Few near water sources along western access track south of mesa (May and October). July - On drive in (1/07) and few along T2 (2/07). Sept – few pairs and small groups seen especially near stock water points.

4. Common Bronzewing. Seen occasionally in mesa area; usually single birds but sometimes two (May and October). July - One on drainage line of T2 (2/07) and one along drainage line east of camp (9/07, 10/07). Sept – single birds occasionally.

5. Spinifex Pigeon. Small parties common on mesa in both May and October. Just-fledged bird seen on 1/11/21 and 3/11/21. July - Few along T2 and around camp (2/07). About 20 around dry mill at eastern end of T4. Sept – small numbers throughout; more near well in east (now with water). Courtship observed and nest found.

6. Diamond Dove. Groups of 2-10 birds seen regularly throughout including on mesa in May and October. Many calling along Robe River. July - Small groups throughout. Sept – small groups throughout.

7. Peaceful Dove. Not seen on mesa but in both May and October abundant along Robe River. July- mixed with Diamond Doves on flats, especially near drainage lines. Sept – few calling along watercourse at site 5.

8. Australian Pelican. One on Robe Pool (May). July – one flew past camp and one flying over Robe Pool &/07).

9. Australian Darter. Several on Robe Pool (May).

10. Nankeen Night-Heron. About 20 on Robe pool; many are juvenile (May).

11. White-faced Heron. Two at Robe Pool (28/05). Sept – one flew over northern end of T3 (25/09).

12. White-necked Heron. July – two flying near Robe Pool (7/07), ad one flying near camp (9/07).

13. Australian Bustard. July - Tracks in several places and one seen on 4/07. Sept – very fresh tracks near camp (21/09) and one seen near camp (22/09).

14. Little Button-quail. July – several seen. Quite abundant and chicks observed. Sept – several seen, including some very small young.

15. Bush Stone-curlew. One along road in south and heard around camp (May). July – track at Warramboo Ck and at mill just east of camp. Sept – one heard south of camp (22/09).

16. Black-fronted Dotterel. One beside pool on creek along south track (May). Sept – one on overflow po at stock well east of camp (24/09).

17. Galah. Pairs and small groups seen occasionally near drainage line to east of camp in May. Pair seen along Robe River in October. July - Small flocks seen most days. Sept – few pairs and occasional larger groups seen.

18. Little Corella. Few pairs round camp (28/05). Also at Yalleen and Pannawonica in October. July - Flock of about 400 roosting east of camp and smaller groups seen occasionally throughout. Sept – few pairs seen; no roost near camp.

19. Cocketiel. A few sightings of single birds and pairs in May and October along track to south and over mesa (May only over mesa). July – few small flocks seen. Sept – few small flocks.

20. Australian Ringneck. Pair seen long creek near camp (27/05). July – occasional pairs seen near drainage lines. Sept – occasional pairs along drainage lines.

21. Budgerigar. Flocks up to about 50 birds seen regularly (May); including over mesa. In October, flocks of similar size seen along southern access track but not over mesa. July - occasionally birds up to 12 at once. Sept – only small (<10 birds) flocks seen occasionally. Some breeding noted.

22. Brown Goshawk. Pair near Ghost Bat maternity roost (May).

23. Collared Sparrowhawk. One near camp (27/05).

24. Nankeen Kestrel. One along breakaway (27/05). In October, one along Pannawonica road. July - One along access road (1/07) and one near camp several times.

25. Brown Falcon. Single birds seen occasionally over camp and mesa (May). July - One along access road (1/07) and single birds occasionally on site. Sept – single birds seen occasionally.

26. Black Kite. Single birds seen occasionally over camp and mesa (May). One seen along highway daily in October.

27. Whistling Kite. One seen along south track (26/05) and one over project area (29/05). Also one along Robe River in October. July- one over Robe Pool (7/07).

28. Spotted Harrier. One near Ghost Bat maternity roost (May). July – one seen along T2 (4/07).

29. Wedge-tailed Eagle. Pair over mesa (27/05) and pr sheltering in cave on north-flank of mesa (30/10). Single bird seen in same area on 31/10. July – pair over access road near highway (9/07).

30. Little Eagle. One over Robe Pool (28/05).

31. Pallid Cuckoo. Seen and heard near camp and along south track (May). July – heard and seen regularly sometimes in twos and threes. Sept – heard and seen regularly. One along T2 being fed by White-plumed Honeyeater.

32. Horsfield's Bronze-Cuckoo. Few heard on flats (May). July – single birds heard and seen occasionally. Groups of up to three seen. Sept – few seen and heard.

33. Black-eared Cuckoo. July – one calling near T5 (8/07).

34. Pheasant Coucal. One heard in evening along Robe River (October). Sept – one heard near Ghost Bat Gulch (24/09).

35. Blue-winged Kookaburra. Heard along creek near camp (May) and along Robe Pool (October). July – heard near Robe Pool. Sept – heard along creek near T5.

36. Sacred Kingfisher. One on Robe Pool (May) and one heard along Robe River north of the mesa in October. July – seen several times. Sept – heard along creek near T5.

37. Red-backed Kingfisher. July- seen several times.

38. Rainbow Bee-eater. Two near Robe Pool (May). Small groups seen regularly in October and appeared to include juveniles. July – few pairs seen occasionally. Sept - few seen and heard.

39. Barking Owl. Several calling along creek near camp in early evening (May). September 2022 – up to three calling along creekline near T5 (22/09). Were not heard in July 2022.

40. Southern Boobook. Several calling along creek near camp later in evening and through night (May). July – one heard when head-torching along T2 (8/07).

41. Spotted Nightjar. Several calling around camp each evening (May). One seen at Yalleen in October. July – heard around camp and two flushed in Red Hill area. Sept – heard around camp.

42. Owlet-nightjar. Few heard around camp and seen occasionally along breakaway sheltering in caves (May). One flushed from a cave in the east of the mesa (south side) in October (31/10). July –

one heard near T2 (8/07). Sept – seen and herd in mesa valley (21/09) and heard at night near T5 (22/09).

43. Rufous-crowned Emu-wren. Two parties on top of mesa (27/05). July- Party on northern end of T3 on foothills of mesa. Sept – party end T3 again!

44. Striated Grasswren. Party just below mesa in west (27/05). In October several parties seen with birds noisy and conspicuous. All were in dense spinifex and shrubs on lower slopes of mesa both west and east. Detected on cameras on mesa edge on October.

45. White-winged Fairy-wren. Several parties near camp on flats (May); coloured male present. July- few parties seen and coloured males present. Sept – few parties seen; regularly along T4.

46. Variegated (Purple-backed) Fairy-wren. Party with coloured male on mesa (27/05) and parties also on flats. Party with coloured male on mesa in October and several parties seen. Generally in dense thickets of acacia on mesa top, but also one party in thicket along Robe River. July – party along T2. Coloured males present. Sept – party along T3 including two coloured males.

47. Weebill. Few in eucalypts near Ghost Bat maternity roost (May). Seen in eucalypts on mesa and along Robe River in October. July – in eucalypts along Robe River. Sept – in eucalypts along drainage lines.

48. Striated Pardalote. Calling from eucalypts along mesa edge (May).

49. Red-browed Pardalote. Calling from eucalypts near Robe Pool (May). Calling from eucalypts near Robe Pool. July- calling from eucalypts along watercourses. Sept – heard infrequently from eucalypts.

50. Hooded Robin. Male along south track near stock well (27/05). July – Several males seen on flats. Sept – two uncoloured birds along track near T2 (24/09).

51. Grey-crowned Babbler. Party on track near Ghost Bat maternity roost (27/05) and one near camp in May. Heard around Robe Pool (October). July – heard along T1, T2 and T3. Sept – parties near T2, T4 and T5.

52. Yellow-throated Miner. Party along creek near camp (May). Party along western access road in October. July- few parties on flats and along drainage line east of camp. Sept – few parties throughout.

53. White-plumed Honeyeater. Few groups amongst eucalypts along drainage lines (May) and occasionally in eucalypts on mesa (October). Also abundant in trees along Robe River in October. July – in eucalypts along drainage lines. Sept – in eucalypts along drainage lines.

54. Grey-headed Honeyeater. The common honeyeater of scattered eucalypts on flats (May). Few also seen in October. July – few on lower slopes of mesa on T3.

55. Singing Honeyeater. Two on mesa in October (30/10). July- the common honeyeater on the flats. Sept- the common honeyeater on the flats; singles and up to 3 birds seen regularly.

56. Black-chinned Honeyeater. July – party round T3 late in day (4/07). Sept – heard near T3.

57. Brown Honeyeater. Several calling in area of Ghost Bat maternity roost; also heard and seen wherever there were flowering acacia (May). Seen and heard along Robe River in October. July- common in flowering bloodwood on flats. Sept – few mostly along drainage lines.

58. Crimson Chat. Sept - Abundant along access road from highway (19/09) and group of about 10 near site 1 (20/09).

59. Grey Shrike-thrush. Few calling in valleys along breakaway and several along main drainage line to east of camp (May). Seen in eucalypts along mesa edge in October. July – one calling near Robe River near crossing. Sept – heard along T4 and on mesa edge east of mesa valley.

60. Rufous Whistler. One calling near camp (May) and one calling along Robe River in October. July - Scattered birds calling across the flats. One bird along T2 doing a very good imitation of a Black Honeyeater. Sept – few calling throughout.

61. Crested Bellbird. One calling near camp (28/05) and one heard near stock bore in south (27/05). July – heard regularly across flats. Sept – heard regularly across flats.

62. Black-faced Cuckoo-shrike. Single birds and pairs seen occasionally in both May and October. July - Small groups seen regularly. Sept – few singles and pairs seen.

63. White-winged Triller. July – male seen near T2 and near T3. Sept – heard and seen throughout; noticeably abundant and coloured males present.

64. Spinifexbird. Seen and heard regularly on flats and slopes (May). Nest with three eggs in spinifex clump on western slope of mesa (May). Few heard in October. July - seen and heard regularly across flats. Sept – Seen and heard regularly; seem to be particularly vocal and conspicuous.

65. Rufous Songlark. One calling along T2 and near T3 (July). Sept – heard at same location along T2.

66. Magpie-lark. Group of about four along creek near Ghost Bat maternity roost and several around Robe Pool (May). Pair along Robe River in October. July – few seen on flats. Sept – few seen on flats.

67. Willie Wagtail. Single birds seen regularly (May). Single bird along Robe River (October). July – single birds and pairs seen regularly. Sept – single birds and pairs seen occasionally.

68. Australian Reed-Warbler. Several in Typha of Robe Pool (May).

69. Zebra Finch. Few small groups throughout (May). Seen along western access track in October. July – small numbers throughout. Sept – small numbers throughout; flocks occasionally >20 birds.

70. Painted Finch. Pairs and small parties throughout. Nest found in top of spinifex clump on mesa (May). Also in pairs and small groups in October; occasionally up to c. 10 birds. July – seen along southern access route at Warramboo Ck.

71. Star Finch. Two seen beside Robe Pool (28/05). Several groups of about 5 along Robe River in October; included juveniles.

72. Tree Martin. Two seen near Ghost Bat maternity roost (May). July – Small flock along T2 (2/07) and small groups seen occasionally elsewhere. Sept – few seen around site 3 (20/09) and along west track regularly.

73. Black-faced Woodswallow. Small groups seen regularly throughout (May). Few seen along western access track in October. July – small numbers regularly across flats. Sept – small numbers regularly across flats.

74. White-breasted Woodswallow. One at Robe Pool (May).

75. Little Woodswallow. Few seen along breakaway (May). Also along mesa edge in October but appeared more abundant. July- seen near mesa in small numbers.

76. Masked Woodswallow. July – group of about 5 around Yamberoo Ck. Sept – single birds and small groups throughout; occasionally foraging and perching close to ground. Numbers seemed to increase during the week and flocks of 50-100 by 25/09.

77. Pied Butcherbird. One calling near camp (May). Around Yalleen in October. July – heard along watercourse. Sept – heard along watercourse east of camp.

78. Australian Magpie. September heard near stock well to east of camp (23/09).

79. Torresian Crow. One or two birds seen and heard near camp (May). Heard in distance in October. July – pair near T3 (3/07). Sept – appeared to be only single birds seen and heard occasionally.

80. Australasian Pipit. Few along southern access road in October.

Echidna. Scats in small caves (May).

Euro. Tracks and scats throughout with a lot of use of caves in May and October. Few seen. All trips.

Red Kangaroo. July - One (female) seen near T1.

Rothschild's Rock-Wallaby. Scats in caves along breakaway. Abundant. Also tracks and scats at least 10m out onto flats found in May. One flushed from a small rock hollow in October and seen fairly clearly so identification confirmed. Also on cameras.

Dasykaluta rosamondae. Sept - One caught on T2 (22/09) and one on T3 (25/09). One seen about 09:00 crossing track near T1 (23/09) and another close to this location on morning of 24/09.

Ningaui timealyi. July -two caught on T3. Female possibly with py. Sept – female with large but unfurred py on T4. Also caught T3 and T5; both males and females; females without obvious py.

Pseudantechinus woolleyi. Scats along breakaways including hills near eastern end of T2 (July 22).

Sminthopsis macroura. July – one caught T4. Sept – one caught T4.

Northern Quoll. Tracks on flat below breakaway; abundant scats along breakaway (May). Scats seemed less abundant in October. Also reported around Yalleen Homestead. July – track in sandy gravel along creek along T2, and along creek east of camp. Lots of scats on rocky hills near eastern end of T2, but no scats on hills along the two access roads…but tracks around Warramboo Creek at south access crossing. Sept – track along sandy bed of creek east of camp.

Brushtail Possum. July - One on camera near T2 and scats found nearby.

Saccolaimus flaviventris – detected on ARU September 2022.

Chaerephon jobensis – detected on ARU September 2022.

Ozimops lumsdenae – detected on ARU September 2022.

Chalinolobus gouldii – detected on ARU September 2022.

Scotorepens greyii – detected on ARU September 2022.

Taphozous georgianus. Flushed from caves along breakaway regularly in both May and October. Detected on ARU September 2022.

Vespadelus finlaysoni. Flushed from caves along breakaway regularly in both May and October. Detected on ARU September 2022.

Ghost Bat. One or two flushed from caves in valley on west of mesa (May 2021). About 8 flew out of valley with known Ghost Bat maternity roost in evening (27/05/21). Also several flew from caves in evening watch along east side of mesa (May 21). In October 2021, one flushed from north-western mesa edge (C12) and two emerged at sunset watch from this location (2/11/21). Not detected in July or September 2022 surveys.

Pilbara-Leaf-nosed Bat. Detected over camp and at several mesa caves, including one where at least some were roosting (May 2021). Detected on ARU September 2022, at several locations. The earliest records at a stock well near the camp were 39 minutes after sunset and 17 minutes after last light, suggesting a roost within a few kilometres. Given the time of year, this may be a maternity roost. The stock well is alongside a tree-lined creek and possibly the bats are following this line of veegtation.

Pseudomys chapmani. July – two active mounds along south access route and several old mounds. One old mound in east of mine area and two very old mounds (unconfirmed; extremely old and weathered) found on gravelly flats near camp.

Psuedomys desertor. July – one caught on T4.

Pseudomys hermansbergensis. July - Several caught; most in area of Buffel Grass along T3. High mortality. Sept – several caught.

Dingo. Old scats near camp (May). Tracks along southern access track in October. July – track along drainage line along T2. Track of large animal near T3 and a large animal seen on 4/07.

Feral Cat. July – faeces partly buried along T1 (2/07). Sept – one seen along access track evening of 21/09. One seen in late afternoon crossing track near T1 (22/09). Also detected on cameras.

Appendix 9. Locations of BCE observations of conservation significant fauna. Coordinates are for UTM Zone 50K.

Latin name	Species Name	Easting	Northing	location ID	evidence type	Notes
May 21						
Stipiturus ruficeps	Rufous-crowned Emu-wren	397433.5	7592860.7	Mesa top	observation	3 individuals
Neochmia ruficauda	Star Finch	399478	7594548	Robe Pool	observation	2 individuals seen beside Robe Pool
Amytornis striatus	Striated Grasswren				observation	below mesa in west 27/05
Leporillus conditor	Greater Stick-nest Rat	397499	7593396		Old nest	Locally extinct
Leporillus conditor	Greater Stick-nest Rat	398209	7590781		Old nest	Locally extinct
Dasyurus hallucatus	Northern Quoll	399274	7592996		Tracks	c. 150m ESE of camp.
Dasyurus hallucatus	Northern Quoll	397289	7593375		Scats	
Dasyurus hallucatus	Northern Quoll	397539	7593589		Scats	
Dasyurus hallucatus	Northern Quoll	397589	7593524		Scats	
Dasyurus hallucatus	Northern Quoll	398032	7593540		Scats	
Dasyurus hallucatus	Northern Quoll	397582	7593775		Scats	
Dasyurus hallucatus	Northern Quoll	397536	7593618		Scats	
Dasyurus hallucatus	Northern Quoll	397687	7593846		Scats	
Dasyurus hallucatus	Northern Quoll	398001	7592661		Scats	
Dasyurus hallucatus	Northern Quoll	397323	7593030		Scats	
Dasyurus hallucatus	Northern Quoll	397617	7593795		Scats	
Dasyurus hallucatus	Northern Quoll	397754	7593938		Scats	
Dasyurus hallucatus	Northern Quoll	398499	7593789		Scats	
Dasyurus hallucatus	Northern Quoll	397474	7593428		Scats	
Dasyurus hallucatus	Northern Quoll	398209	7590781		Scats	
Dasyurus hallucatus	Northern Quoll	398005	7592619		Scats	
Dasyurus hallucatus	Northern Quoll	397296	7593275		Scats	
Dasyurus hallucatus	Northern Quoll	398200	7591057		Scats	
Dasyurus hallucatus	Northern Quoll	398030	7593406		Scats	
Dasyurus hallucatus	Northern Quoll	398034	7593419		Scats	
Dasyurus hallucatus	Northern Quoll	398044	7593443		Scats	
Dasyurus hallucatus	Northern Quoll	397499	7593703		Scats	

Latin name	Species Name	Easting	Northing	location ID	evidence type	Notes
Dasyurus hallucatus	Northern Quoll	397530	7593739		Scats	
Dasyurus hallucatus	Northern Quoll	397608	7593798		Scats	
Dasyurus hallucatus	Northern Quoll	397626	7593815		Scats	
Dasyurus hallucatus	Northern Quoll	398001	7592662		Scats	
Dasyurus hallucatus	Northern Quoll	397499	7593396		Scats	
Dasyurus hallucatus	Northern Quoll	398088	7592930		Tracks	Base scree slope
Dasyurus hallucatus	Northern Quoll	398099	7592934		Tracks	Base scree slope
Dasyurus hallucatus	Northern Quoll	397781	7592918		Tracks	On mesa top
Dasyurus hallucatus	Northern Quoll	397653	7593333	BCE11	camera	
Dasyurus hallucatus	Northern Quoll	398499	7593789	BCE16	camera	
Dasyurus hallucatus	Northern Quoll	398499	7593789	BCE16	camera	
Dasyurus hallucatus	Northern Quoll	398499	7593789	BCE16	camera	
Dasyurus hallucatus	Northern Quoll	398021	7592693	BCE20	camera	
Dasyurus hallucatus	Northern Quoll	398021	7592693	BCE20	camera	
Petrogale rothschildi	Rothschild's Rock-Wallaby	397302	7593196		Scats	
Petrogale rothschildi	Rothschild's Rock-Wallaby	397323	7593030		Scats	
Petrogale rothschildi	Rothschild's Rock-Wallaby	398197	7593594		Scats	
Petrogale rothschildi	Rothschild's Rock-Wallaby	398301	7593691		Scats	
Petrogale rothschildi	Rothschild's Rock-Wallaby	398126	7593526		Scats	
Petrogale rothschildi	Rothschild's Rock-Wallaby	397474	7593428		Scats	
Petrogale rothschildi	Rothschild's Rock-Wallaby	398020	7593382		Scats	
Petrogale rothschildi	Rothschild's Rock-Wallaby	397298	7593101		Scats	
Petrogale rothschildi	Rothschild's Rock-Wallaby	397602	7593138		Scats	
Petrogale rothschildi	Rothschild's Rock-Wallaby	397574	7593736		Scats	
Petrogale rothschildi	Rothschild's Rock-Wallaby	398209	7590781		Scats	
Petrogale rothschildi	Rothschild's Rock-Wallaby	398005	7592619		Scats	
Petrogale rothschildi	Rothschild's Rock-Wallaby	398200	7591057		Scats	
Petrogale rothschildi	Rothschild's Rock-Wallaby	397957	7593003		Scats	
Petrogale rothschildi	Rothschild's Rock-Wallaby	398030	7593406		Scats	

Latin name	Species Name	Easting	Northing	location ID	evidence type	Notes
Petrogale rothschildi	Rothschild's Rock-Wallaby	398034	7593419		Scats	
Petrogale rothschildi	Rothschild's Rock-Wallaby	398044	7593443		Scats	
Petrogale rothschildi	Rothschild's Rock-Wallaby	397608	7593798		Scats	
Petrogale rothschildi	Rothschild's Rock-Wallaby	397626	7593815		Scats	
Macroderma gigas	Ghost Bat	399101	7592988		Observation	1 Ghost Bat
Macroderma gigas	Ghost Bat	398006	7592610		Scats	
Macroderma gigas	Ghost Bat	397539	7593589		Scats	
Macroderma gigas	Ghost Bat	397589	7593524		Scats	
Macroderma gigas	Ghost Bat	397754	7593938		Scats + feeding debris	
Macroderma gigas	Ghost Bat	397494	7593582		observation	3, Flying south into gully
Macroderma gigas	Ghost Bat	397605	7593459		observation	1, Flying overhead in easterly direction
Macroderma gigas	Ghost Bat	398242	7590765	Mat. Roost	observation	2, Flying along mesa edge
Macroderma gigas	Ghost Bat	398242	7590765	Mat. Roost	observation	1, Flying along mesa edge
Macroderma gigas	Ghost Bat	398233	7590584	Mat. Roost	observation	4, Flying eastward out of gorge c. 6:11pm
Macroderma gigas	Ghost Bat	398044	7593443		observation	1, Flying along mesa edge
Macroderma gigas	Ghost Bat	398008	7592996		observation	3, Heard and seen foraging overhead
Macroderma gigas	Ghost Bat	397528	7593384		Feeding debris	
Macroderma gigas	Ghost Bat	398200	7591057		Scats	(at entrance)
Rhinonicteris aurantia	Pilbara Leaf-nosed Bat	399452	7593033	SM4 - 01240	bat detector	River flats, east of Camp
Rhinonicteris aurantia	Pilbara Leaf-nosed Bat	397539	7593589	SM4 - 01247	bat detector	Cave at West of area
Rhinonicteris aurantia	Pilbara Leaf-nosed Bat	397935	7592985	SM4 - 01247	bat detector	East Cliff A
Rhinonicteris aurantia	Pilbara Leaf-nosed Bat	398008	7593323	Swift - MoE	bat detector	East Cliff B
Rhinonicteris aurantia	Pilbara Leaf-nosed Bat	398197	7591050	SM4 - 01240	bat detector	Ghost Bat Maternity Roost
Leiopotherapon aheneus	Fortescue Grunter	399478	7594548	Robe Pool	observation	
Oct 21						
Neochmia ruficauda	Star Finch			Robe River north of mine area	observation	several groups of 5 seen along Robe River
Amytornis striatus	Striated Grasswren	398334	7594208	C12	observation	
Amytornis striatus	Striated Grasswren	398334	7594208	3886	observation	Party of Striated Grasswrens.

Latin name	Species Name	Easting	Northing	location ID	evidence type	Notes
Amytornis striatus	Striated Grasswren	398576	7594206	3391	observation	party on upper slope in dense spinifex.
Amytornis striatus	Striated Grasswren	399505	7594317	3394	observation	Party of Striated Grasswrens on mid-slope.
Amytornis striatus	Striated Grasswren	398396	7593799	BCE30	camera	
Amytornis striatus	Striated Grasswren	398124	7594051	BCE32	camera	
Amytornis striatus	Striated Grasswren	398705.1	7593900		observation	
Amytornis striatus	Striated Grasswren	398576.2	7594206		observation	
Amytornis striatus	Striated Grasswren	399505.4	7594317		observation	
Amytornis striatus	Striated Grasswren	398219	7594163		observation	
Amytornis striatus	Striated Grasswren	398124	7594051		observation	
Amytornis striatus	Striated Grasswren	398396	7593799		observation	
Dasyurus hallucatus	Northern Quoll	398310	7594198	1224	Scat	
Dasyurus hallucatus	Northern Quoll	398392	7594238	1225	Scat	
Dasyurus hallucatus	Northern Quoll	398849	7594429	1226	Scat	
Dasyurus hallucatus	Northern Quoll	398608	7594290	1229	Scat	
Dasyurus hallucatus	Northern Quoll	405737	7606461	1231	RoadKill	
Dasyurus hallucatus	Northern Quoll	398469	7594149	1233	Scat	
Dasyurus hallucatus	Northern Quoll	398475	7594369	1234	Scats	
Dasyurus hallucatus	Northern Quoll	399281	7594303	1235	Scats	
Dasyurus hallucatus	Northern Quoll	398892	7594228	1236	Scats	
Dasyurus hallucatus	Northern Quoll	398602	7594274	3389	Scats	
Dasyurus hallucatus	Northern Quoll	398521	7594258	3390	Scats	
Dasyurus hallucatus	Northern Quoll	398334	7594208	BCE02	camera	
Dasyurus hallucatus	Northern Quoll	398720	7593903	BCE06	camera	
Dasyurus hallucatus	Northern Quoll	398894	7593925	BCE10	camera	
Dasyurus hallucatus	Northern Quoll	398494	7593834	BCE13	camera	
Dasyurus hallucatus	Northern Quoll	398219	7594163	BCE16	camera	
Dasyurus hallucatus	Northern Quoll	398665	7593871	BCE20	camera	
Dasyurus hallucatus	Northern Quoll	398881	7594222	BCE23	camera	
Dasyurus hallucatus	Northern Quoll	398396	7593799	BCE30	camera	

Latin name	Species Name	Easting	Northing	location ID	evidence type	Notes
Dasyurus hallucatus	Northern Quoll	398124	7594051	BCE32	camera	
Dasyurus hallucatus	Northern Quoll	398954	7594201	BCE33	camera	
Petrogale rothschildi	Rothschild's Rock-Wallaby	398372	7594225	ROWALL	observation	
Petrogale rothschildi	Rothschild's Rock-Wallaby	398219	7594163	C11	Scats	
Petrogale rothschildi	Rothschild's Rock-Wallaby	398894	7593925	BCE10	camera	
Petrogale rothschildi	Rothschild's Rock-Wallaby	398219	7594163	BCE16	camera	
Petrogale rothschildi	Rothschild's Rock-Wallaby	398396	7593799	BCE30	camera	
Petrogale rothschildi	Rothschild's Rock-Wallaby	398124	7594051	BCE32	camera	
Petrogale rothschildi	Rothschild's Rock-Wallaby	398954	7594201	BCE33	camera	
Macroderma gigas	Ghost Bat			main western gorge on mesa	observation	flushed from cave on the north slope.
Macroderma gigas	Ghost Bat	398219	7594163	C12	observation	2 individuals seen
Macroderma gigas	Ghost Bat	398334	7594208	C13	observation	
Macroderma gigas	Ghost Bat	398954.2	7594200.9	C15	observation	2 individuals seen
Macroderma gigas	Ghost Bat	398219	7594163		evening bat watch	1, Flying along mesa edge
Macroderma gigas	Ghost Bat	398334	7594208		evening bat watch	2, Flying along mesa edge
Leiopotherapon aheneus	Fortescue Grunter	399478	7594548	Bat3	observation	Robe Pool
July 22						
Anilios ganei	Gane's Blind Snake	399834.3	7593427.8	BLINDSNAKE	active searching	Large old River Gum
Stipiturus ruficeps	Rufous-crowned Emu-wren	399473.1	7593583.9	3.06	bird census	
Trichosurus velpecula	Brush-tailed Possum	400591.5	7590078	BCE 40	camera	
Trichosurus velpecula	Brush-tailed Possum	400442.1	7590431.9	Possum scat	scat	
Dasyurus hallucatus	Northern Quoll	400564.5	7590537	AUD 9	camera	
Dasyurus hallucatus	Northern Quoll	400762.4	7590421	BCE 02	camera	
Dasyurus hallucatus	Northern Quoll	399760	7592673	BCE 13	camera	
Dasyurus hallucatus	Northern Quoll	400591.5	7590078	BCE 40	camera	
Dasyurus hallucatus	Northern Quoll	399850.5	7593757.6	NQTRACK2	observation	Northern Quoll track in drift sand

Latin name	Species Name	Easting	Northing	location ID	evidence type	Notes
Pseudomys chapmani	Western Pebble-mound Mouse	400085.6	7593995.1	PMMM1	observation	Old mound
Pseudomys chapmani	Western Pebble-mound Mouse	374551.3	7590904		observation	active mound
Pseudomys chapmani	Western Pebble-mound Mouse	374029.7	7591187		observation	old mound
Pseudomys chapmani	Western Pebble-mound Mouse	378090.1	7589037		observation	old mound
Pseudomys chapmani	Western Pebble-mound Mouse	378094.6	7589130		observation	old mound
Pseudomys chapmani	Western Pebble-mound Mouse	377954.6	7589031		observation	active mound
Pseudomys chapmani	Western Pebble-mound Mouse	378275.1	7589174		observation	old mound
Pseudomys chapmani	Western Pebble-mound Mouse	379484.6	7588842		observation	old mound
Pseudomys chapmani	Western Pebble-mound Mouse	409757.5	7591022		observation	old mound
Sept 22						
Stipiturus ruficeps	Rufous-crowned Emu-wren	399309.7	7593693.4	3.01	bird census	
Dasyurus hallucatus	Northern Quoll	399784.2	7592666	BCE03	camera	seen on camera 3 occasions
Dasyurus hallucatus	Northern Quoll	400944.9	7587460	BCE14	camera	
Dasyurus hallucatus	Northern Quoll	400766	7590434	BCE18	camera	seen on camera 3 occasions
Dasyurus hallucatus	Northern Quoll	400607.9	7590059	BCE04	camera	
Rhinonicteris aurantia	Pilbara Leaf-nosed Bat	397692	7593379	SM4_1147 (21/9/22)	bat detector	early evening records - roost nearby
Rhinonicteris aurantia	Pilbara Leaf-nosed Bat	397692	7593379	SM4_1147 (22/9/22)	bat detector	early evening records - roost nearby
Rhinonicteris aurantia	Pilbara Leaf-nosed Bat	397692	7593379	SM4_1147 (23/9/22)	bat detector	
Rhinonicteris aurantia	Pilbara Leaf-nosed Bat	397692	7593379	SM4_1147 (24/9/22)	bat detector	
Rhinonicteris aurantia	Pilbara Leaf-nosed Bat	399782	7592695	SM4_1240 (23/9/22)	bat detector	
Rhinonicteris aurantia	Pilbara Leaf-nosed Bat	400334	7587324	SM4_01247 (24/9/22)	bat detector	
Rhinonicteris aurantia	Pilbara Leaf-nosed Bat	400334	7587324	SM4_01247 (25/9/22)	bat detector	

Appendix 10. Locations of transect sampling points (for trapping and bird census). Coordinates are for UTM Zone 50K.

Transect 1			Transect 2			Transect 3			Transect 4			Transect 5		
Label	**Easting**	**Northing**	**Label**	**Easting**	**Northing**	**Label**	**Easting**	**Northing**	**Label**	**Easting**	**Northing**	**Label**	**Easting**	**Northing**
1.01	399800.4	7591475	2.01	400221.8	7590057	3.01	399309.7	7593693	4.01	400224.3	7587468	5.01	399784.2	7592666
1.02	399846.4	7591530	2.02	400280	7590070	3.02	399353	7593659	4.02	400276.6	7587486	5.02	399785.8	7592675
1.03	399909.8	7591534	2.03	400344.5	7590074	3.03	399387.8	7593648	4.03	400322.3	7587483	5.03	399771.9	7592676
1.04	399954.6	7591541	2.04	400395.4	7590078	3.04	399424.1	7593622	4.04	400376.1	7587487	5.04	399755.7	7592693
1.05	400010.6	7591550	2.05	400448.8	7590078	3.05	399452.4	7593603	4.05	400418.5	7587498	5.05	399746.2	7592684
1.06	400075.5	7591554	2.06	400489	7590074	3.06	399473.1	7593584	4.06	400465	7587500			
1.07	400136.1	7591537	2.07	400521	7590095	3.07	399505.4	7593547	4.07	400502.6	7587503			
1.08	400190.2	7591538	2.08	400555.8	7590103	3.08	399528.8	7593531	4.08	400548.7	7587518			
1.09	400227.9	7591545	2.09	400597.2	7590108	3.09	399536.2	7593500	4.09	400595.9	7587530			
1.10	400268	7591557	2.10	400646.8	7590118	3.10	399529.9	7593470	4.10	400645.9	7587518			
1.11	400337.3	7591599	2.11	400690.7	7590126	3.11	399529.6	7593446	4.11	400702.6	7587527			
1.12	400387.7	7591598	2.12	400741.2	7590133	3.12	399518.4	7593399	4.12	400739.2	7587524			
1.13	400426.8	7591621	2.13	400799.8	7590129	3.13	399526.9	7593367	4.13	400784.9	7587528			
1.14	400499.9	7591616	2.14	400839.6	7590117	3.14	399530.3	7593334	4.14	400822.1	7587525			
1.15	400562.3	7591631	2.15	400882.5	7590116	3.15	399550.7	7593302	4.15	400876.6	7587521			
1.16	400601.1	7591640	2.16	400931.8	7590122	3.16	399551.2	7593274	4.16	400919.7	7587528			
1.17	400654	7591654	2.17	400978.5	7590120	3.17	399571.8	7593247	4.17	400973	7587517			
1.18	400707.8	7591678	2.18	401033.1	7590121	3.18	399599.2	7593227	4.18	401045	7587505			
1.19	400794	7591700	2.19	401073.6	7590113	3.19	399621.1	7593186	4.19	401113.7	7587497			
1.20	400845	7591721	2.20	401121.5	7590102	3.20	399610.1	7593161	4.20	401165.7	7587488			

Appendix 11. Raw data from May and Oct 2021

The results of the May 2021 field investigations are presented in the following tables. Species detected through motion sensitive cameras (Table 30), evening bat-watch (Table 31), bat detectors (Table 32) and additional targeted and incidental CS species observations (Table 33) are outlined below.

Table 30. Results of the motion sensitive cameras; May 2021. Locations for cameras are in Table 9.

Camera	Date	Time	Species	Event #	N Photos	FileNum	Notes
BCE03	2021-05-28	22:32	Euro	1	2	1	
BCE11	2021-05-28	22:52	Northern Quoll	1	1	1	
BCE13	2021-05-28	8:15	Spinifex Pigeon	1	9	1	2 individuals
BCE13	2021-05-28	8:42	Spinifex Pigeon	2	147	10	3 individuals
BCE13	2021-05-28	11:19	Spinifex Pigeon	3	6	166	
BCE13	2021-05-28	14:09	Spinifex Pigeon	4	9	178	
BCE13	2021-05-28	8:43	Painted Finch	1	11	13	2 individuals
BCE13	2021-05-28	11:19	Painted Finch	2	12	166	3 individuals
BCE13	2021-05-28	11:22	Diamond Dove	1	2	175	
BCE13	2021-05-28	10:20	Perentie	1	9	157	
BCE16	2021-05-29	0:41	Northern Quoll	1	21	1	
BCE16	2021-05-29	3:11	Northern Quoll	2	48	22	
BCE16	2021-05-29	8:16	Northern Quoll	3	2	70	
BCE20	2021-05-27	21:56	Northern Quoll	1	4	1	
BCE20	2021-05-27	22:25	Northern Quoll	2	20	7	

Table 31. Results of the evening bat-watches, May 2021

Date	Pers.	Coordinates	Species	Time	Count	Direction travelling	Comments
26/05/2021	BM	50 K 397494 7593582	Ghost Bat	18:10	3	south	Flying south into gully
26/05/2021	AM	50 K 397605 7593459	Ghost Bat	18:15	1	east	Flying overhead in

							easterly direction
27/05/2021	TG	50 K 398242 7590765 (Maternity roost)	Ghost Bat	18:11	2	north	Flying along mesa edge
27/05/2021	TG	50 K 398242 7590765 (Maternity roost)	Ghost Bat	18:14	1	north	Flying along mesa edge
27/05/2021	BM	50 K 398233 7590584 (Maternity roost)	Ghost Bat	18:11	4	east	Flying eastward out of the gorge at about 6:11pm
28/05/2021	TG	50 K 398043 7593685	Common Sheath-tailed Bat	18:05	5	east	Flying straight out over lowlands
28/05/2021	TG	50 K 398043 7593685	Finlayson's Cave Bat	18:07	3	east	Flying straight out over lowlands
28/05/2021	TG	50 K 398044 7593443	Ghost Bat	18:06	1	north	Flying along mesa edge
28/05/2021	BM	50 K 398008 7592996	Ghost Bat	18:12	3	?	Heard and seen foraging overhead

Table 32. Results of the bat detectors, showing Pilbara Leaf-nosed Bat records; May 2021.

Location	Waypoint	Date	Detector	PLNB records	PLNB Time
Camp	50 K 399101 7592988	26/05/2021	Swift - MoE	no	no
River flats, east of Camp	50 K 399452 7593033	26/05/2021	SM4 - 01240	yes	28/05/21 (00:48am high)
Cave at West of area	50 K 397539 7593589	27/05/2021	SM4 - 01247	yes	27/05/21 (19:31pm average, 20:19pm high) 28/5/21 (6:33am high)
Gully at eastern end of Western gorge	50 K 397744 7593432	27/05/2021	Swift - MoE	no	nil
Camp	50 K 399101 7592988	27/05/2021	SM4 - 01240	no	nil
Ghost Bat Roost (Suspected)	50 K 398059 7590698	27/05/2021	SM4 - MoE	no	nil

East Cliff A	50 K 397935 7592985	28/05/2021	SM4 - 01247	yes	28/05/21 (21:54pm moderate)
East Cliff B	50 K 398008 7593323	28/05/2021	Swift - MoE	yes	28/5/21 (22:42pm moderate)
East Cliff C	50 K 398025 7593532	28/05/2021	SM4 - MoE	no	nil
Ghost Bat Maternity Roost	50 K 398197 7591050	28/05/2021	SM4 - 01240	yes	28/5/21(21:39pm high): 29/5/21 (3:53am high)

Table 33. Targeted and incidental observations of conservation significant fauna recorded throughout the survey (Note: camera, bat detector and evening bat-watch results are not included in this table); May 2021.

Common name	Field survey	Scientific name	Observation type	Evidence Type	Coordinates (UTM)	Comments
Ghost Bat	May 2021	*Macroderma gigas*	Primary	Observation	50 K 399101 7592988	1 Ghost Bat
Ghost Bat	May 2021	*Macroderma gigas*	Secondary	Scats	50 K 398006 7592610	
Ghost Bat	May 2021	*Macroderma gigas*	Secondary	Scats	50 K 397539 7593589	
Ghost Bat	May 2021	*Macroderma gigas*	Secondary	Scats	50 K 397589 7593524	
Ghost Bat	May 2021	*Macroderma gigas*	Secondary	Scats and feeding debris	50 K 397754 7593938	
Ghost Bat	May 2021	*Macroderma gigas*	Secondary	Feeding debris	50 K 397528 7593384	
Ghost Bat	May 2021	*Macroderma gigas*	Secondary	Scats	50 K 398200 7591057	(at entrance)
Northern Quoll	May 2021	*Dasyurus hallucatus*	Secondary	Tracks	50 K 399274 7592996	c. 150m ESE of camp.
Northern Quoll	May 2021	*Dasyurus hallucatus*	Secondary	Scats	50 K 397289 7593375	
Northern Quoll	May 2021	*Dasyurus hallucatus*	Secondary	Scats	50 K 397539 7593589	
Northern Quoll	May 2021	*Dasyurus hallucatus*	Secondary	Scats	50 K 397589 7593524	

Northern Quoll	May 2021	*Dasyurus hallucatus*	Secondary	Scats	50 K 398032 7593540	
Northern Quoll	May 2021	*Dasyurus hallucatus*	Secondary	Scats	50 K 397582 7593775	
Northern Quoll	May 2021	*Dasyurus hallucatus*	Secondary	Scats	50 K 397536 7593618	
Northern Quoll	May 2021	*Dasyurus hallucatus*	Secondary	Scats	50 K 397687 7593846	
Northern Quoll	May 2021	*Dasyurus hallucatus*	Secondary	Scats	50 K 398001 7592661	
Northern Quoll	May 2021	*Dasyurus hallucatus*	Secondary	Scats	50 K 397323 7593030	
Northern Quoll	May 2021	*Dasyurus hallucatus*	Secondary	Scats	50 K 397617 7593795	
Northern Quoll	May 2021	*Dasyurus hallucatus*	Secondary	Scats	50 K 397754 7593938	
Northern Quoll	May 2021	*Dasyurus hallucatus*	Secondary	Scats	50 K 398499 7593789	
Northern Quoll	May 2021	*Dasyurus hallucatus*	Secondary	Scats	50 K 397474 7593428	
Northern Quoll	May 2021	*Dasyurus hallucatus*	Secondary	Scats	50 K 398209 7590781	
Northern Quoll	May 2021	*Dasyurus hallucatus*	Secondary	Scats	50 K 398005 7592619	
Northern Quoll	May 2021	*Dasyurus hallucatus*	Secondary	Scats	50 K 397296 7593275	
Northern Quoll	May 2021	*Dasyurus hallucatus*	Secondary	Scats	50 K 398200 7591057	
Northern Quoll	May 2021	*Dasyurus hallucatus*	Secondary	Scats	50 K 398030 7593406	
Northern Quoll	May 2021	*Dasyurus hallucatus*	Secondary	Scats	50 K 398034 7593419	
Northern Quoll	May 2021	*Dasyurus hallucatus*	Secondary	Scats	50 K 398044 7593443	
Northern Quoll	May 2021	*Dasyurus hallucatus*	Secondary	Scats	50 K 397499 7593703	

Northern Quoll	May 2021	*Dasyurus hallucatus*	Secondary	Scats	50 K 397530 7593739	
Northern Quoll	May 2021	*Dasyurus hallucatus*	Secondary	Scats	50 K 397608 7593798	
Northern Quoll	May 2021	*Dasyurus hallucatus*	Secondary	Scats	50 K 397626 7593815	
Northern Quoll	May 2021	*Dasyurus hallucatus*	Secondary	Scats	50 K 398001 7592662	
Northern Quoll	May 2021	*Dasyurus hallucatus*	Secondary	Scats	50 K 397499 7593396	
Northern Quoll	May 2021	*Dasyurus hallucatus*	Secondary	Tracks	50 K 398088 7592930	Base scree slope
Northern Quoll	May 2021	*Dasyurus hallucatus*	Secondary	Tracks	50 K 398099 7592934	Base scree slope
Northern Quoll	May 2021	*Dasyurus hallucatus*	Secondary	Tracks	50 K 397781 7592918	On mesa top
Rothschild's Rock-Wallaby	May 2021	*Petrogale rothschildi*	Secondary	Scats	50 K 397302 7593196	
Rothschild's Rock-Wallaby	May 2021	*Petrogale rothschildi*	Secondary	Scats	50 K 397323 7593030	
Rothschild's Rock-Wallaby	May 2021	*Petrogale rothschildi*	Secondary	Scats	50 K 398197 7593594	
Rothschild's Rock-Wallaby	May 2021	*Petrogale rothschildi*	Secondary	Scats	50 K 398301 7593691	
Rothschild's Rock-Wallaby	May 2021	*Petrogale rothschildi*	Secondary	Scats	50 K 398126 7593526	
Rothschild's Rock-Wallaby	May 2021	*Petrogale rothschildi*	Secondary	Scats	50 K 397474 7593428	
Rothschild's Rock-Wallaby	May 2021	*Petrogale rothschildi*	Secondary	Scats	50 K 398020 7593382	
Rothschild's Rock-Wallaby	May 2021	*Petrogale rothschildi*	Secondary	Scats	50 K 397298 7593101	
Rothschild's Rock-Wallaby	May 2021	*Petrogale rothschildi*	Secondary	Scats	50 K 397602 7593138	
Rothschild's Rock-Wallaby	May 2021	*Petrogale rothschildi*	Secondary	Scats	50 K 397574 7593736	

Rothschild's Rock-Wallaby	May 2021	*Petrogale rothschildi*	Secondary	Scats	50 K 398209 7590781	
Rothschild's Rock-Wallaby	May 2021	*Petrogale rothschildi*	Secondary	Scats	50 K 398005 7592619	
Rothschild's Rock-Wallaby	May 2021	*Petrogale rothschildi*	Secondary	Scats	50 K 398200 7591057	
Rothschild's Rock-Wallaby	May 2021	*Petrogale rothschildi*	Secondary	Scats	50 K 397957 7593003	
Rothschild's Rock-Wallaby	May 2021	*Petrogale rothschildi*	Secondary	Scats	50 K 398030 7593406	
Rothschild's Rock-Wallaby	May 2021	*Petrogale rothschildi*	Secondary	Scats	50 K 398034 7593419	
Rothschild's Rock-Wallaby	May 2021	*Petrogale rothschildi*	Secondary	Scats	50 K 398044 7593443	
Rothschild's Rock-Wallaby	May 2021	*Petrogale rothschildi*	Secondary	Scats	50 K 397608 7593798	
Rothschild's Rock-Wallaby	May 2021	*Petrogale rothschildi*	Secondary	Scats	50 K 397626 7593815	
Greater Stick-nest Rat	May 2021	*Leporillus conditor*	Secondary	Old nest	50 K 398209 7590781	Locally extinct
Greater Stick-nest Rat	May 2021	*Leporillus conditor*	Secondary	Old nest	50 K 397499 7593396	Locally extinct

Table 34. Results of the motion sensitive cameras; October 2021. Locations for cameras are in Table 12.

Camera	Species	Event #
BCE02	Northern Quoll	10
BCE06	Skink *Ctenotus ?*	1
BCE06	Northern Quoll	8
BCE06	Common Rock-Rat	1
BCE10	Northern Quoll	11
BCE10	Rothschild's Rock-Wallaby	1
BCE10	Common Rock-Rat	7
BCE13	Northern Quoll	12
BCE16	Northern Quoll	2
BCE16	Rothschild's Rock-Wallaby	1
BCE20	Northern Quoll	4
BCE23	Northern Quoll	13
BCE30	Skink *Ctenotus ?*	1
BCE30	Common Bronzewing	2
BCE30	Striated Grasswren	2
BCE30	Northern Quoll	16
BCE30	Rothschild's Rock-Wallaby	2
BCE32	Striated Grasswren	22
BCE32	Northern Quoll	1
BCE32	Woolley's Pseudantechinus	1
BCE32	Rothschild's Rock-Wallaby	3
BCE33	Northern Quoll	26
BCE33	Rothschild's Rock-Wallaby	1

Table 35. Results of the evening bat-watch, October/November 2021

Date	Pers.	Coordinates	Species	Time	Count	Comments
2/11/2021	MB	50 K 398219 7594163	Ghost Bat	20 minutes after sunset	1	Flying along mesa edge
2/11/2021	JW	50 K 398334 7594208	Ghost Bat	20 minutes after sunset	2	Flying along mesa edge

Table 36. Locations of Striated Grasswren records from May and October 2021.

trip	location ID	Easting	Northing	evidence type	Notes
May 21		NA	NA	observation	below mesa in west 27/05
Oct 21	C12	398334	7594208	observation?	
Oct 21	3886	398334	7594208	observation?	Party of Striated Grasswrens.
Oct 21	3391	398576	7594206	observation?	Striated Grasswren party on upper slope in dense spinifex.
Oct 21	3394	399505	7594317	observation?	Party of Striated Grasswrens on mid-slope.
Oct 21	BCE30	398396	7593799	camera	
Oct 21	BCE32	398124	7594051	camera	
Oct 21		398705.1	7593900	observation	
Oct 21		398219	7594163	observation	

Appendix 12. Raw data from July and September 2022.

The results of the July and September 2022 field investigations are presented in the following tables. Species detected through bat detectors (Table 37), motion sensitive cameras (Table 38, Table 39), pit-fall trapping (Table 40, Table 41) and bird censussing (Table 42, Table 43). Note that no significant bats were observed during evening bat observations during September 2022.

Table 37. Bat detector results (number of records), September 2022. Locations for bat detectors are in Table 18.

Detector	dates	***Rhinonicteris aurantius***	*Saccolaimus flaviventris*	*Chaerephon jobensis*	*Taphozous georgianus*	*Ozimops lumsdenae*	*Chalinolobus gouldii*	*Scotorepens greyii*	*Vespadelus finlaysoni*
SM4 Barry	21/09/2022			3	232	2	66	8	39
SM4 Barry	22/09/2022			8	187	3	118	10	39
SM4 Barry	23/09/2022						39	11	9
SM4 Barry	24/09/2022				33		1		1
SM4_1147	21/09/2022	**8***		1	1		214	55	437
SM4_1147	22/09/2022	**15***		4	12	2	187	32	151
SM4_1147	23/09/2022	**29**		1	1		113	15	175
SM4_1147	24/09/2022	**40**		7	6		52	5	138
SM4_1240	22/09/2022		5	7	1		6	4	3
SM4_1240	23/09/2022	**1**	1	5	2		7	15	32
SM4_1240	24/09/2022						2	15	8
SM4_01247	21/09/2022		1		42		7	13	4
SM4_01247	22/09/2022			3	32		46	12	10
SM4_01247	23/09/2022				11		38	10	2
SM4_01247	24/09/2022	**2**		20	63		206	17	5
SM4_01247	25/09/2022	**8**		103	200		102	3	

Table 38. Motion sensitive camera results, July 2022. Locations for cameras in Table 15.

CAMERA	DATE	TIME (24hr)	SPECIES Scientific name	SPECIES Common name	PHOTOS	FILE NUM
AUD 8	5/07/2022				0	
AUD 9	7/07/2022	4:03	*Dasyurus hallucatus*	Northern Quoll	3	4
BCE 02	6/07/2022	3:07	*Dasyurus hallucatus*	Northern Quoll	18	10
	6/07/2022	3:46	*Pseudantechinus wooleyae*	Fat-tailed False Antechinus	2	28
	6/07/2022	4:48	*Dasyurus hallucatus*	Northern Quoll	41	31
	6/07/2022	18:03	*Dasyurus hallucatus*	Northern Quoll	12	79
	6/07/2022	18:46	*Dasyurus hallucatus*	Northern Quoll	12	91
	6/07/2022	22:09	*Dasyurus hallucatus*	Northern Quoll	9	103
	7/07/2022	1:40	*Dasyurus hallucatus*	Northern Quoll	6	112
	7/07/2022	18:13	*Dasyurus hallucatus*	Northern Quoll	111	118
	7/07/2022	23:39	*Dasyurus hallucatus*	Northern Quoll	15	232
	7/07/2022	23:48	*Dasyurus hallucatus*	Northern Quoll	9	247
	7/07/2022	23:59	*Dasyurus hallucatus*	Northern Quoll	9	256
	8/07/2022	2:23	*Dasyurus hallucatus*	Northern Quoll	14	268
	8/07/2022	2:51	*Dasyurus hallucatus*	Northern Quoll	26	289
	8/07/2022	6:40	*Pseudantechinus woolleyae*	Fat-tailed False Antechinus	2	319
	8/07/2022	18:07	*Dasyurus hallucatus*	Northern Quoll	3	322
	8/07/2022	18:15	*Dasyurus hallucatus*	Northern Quoll	5	325
	8/07/2022	18:31	*Dasyurus hallucatus*	Northern Quoll	4	331
	8/07/2022	19:40	*Dasyurus hallucatus*	Northern Quoll	1	337
BCE 13	5/07/2022	19:21	*Dasyurus hallucatus*	Northern Quoll	3	1
	8/07/2022	2:48	*Dasyurus hallucatus*	Northern Quoll	6	4
	8/07/2022	18:30	*Dasyurus hallucatus*	Northern Quoll	6	10
	8/07/2022	18:48	*Dasyurus hallucatus*	Northern Quoll	5	16
	8/07/2022	19:22	*Dasyurus hallucatus*	Northern Quoll	2	22
BCE 30					0	
BCE 41	5/07/2022	18:48	*Felis catus*	Feral Cat	1	804

CAMERA	DATE	TIME (24hr)	SPECIES Scientific name	SPECIES Common name	PHOTOS	FILE NUM
	5/07/2022	23:11	*Trichosurus vulpecula*	Brush-tailed Possum	2	805
	6/07/2022	2:47	*Trichosurus vulpecula*	Brush-tailed Possum	3	807
	6/07/2022	10:01	*Coturnix ypsilophora*	Brown Quail	1	810
	6/07/2022	10:27	*Grallina cyanoleuca*	Magpie-lark	1	811
	6/07/2022	10:40	*Grallina cyanoleuca*	Magpie-lark	3	812
	7/07/2022	21:02	*Dasyurus hallucatus*	Northern Quoll	8	816
	7/07/2022	21:29	*Dasyurus hallucatus*	Northern Quoll	5	824
	8/07/2022	2:08	*Dasyurus hallucatus*	Northern Quoll	12	830
	8/07/2022	2:43	*Dasyurus hallucatus*	Northern Quoll	7	842
	8/07/2022	4:20	*Dasyurus hallucatus*	Northern Quoll	14	849

Table 39. Motion sensitive camera results, September 2022. Locations for cameras are in Table 16.

CAMERA	DATE	TIME (24hr)	SPECIES Scientific name	SPECIES Common name	PHOTOS	FILE NUM	NOTES
BCE06	23/09/22	21:21	*Felis catus*	Cat	6	76	Tabby
BCE 11	22/09/22	10:13	*Varanus panoptes*	Yellow-spotted Monitor	3	16	
BCE 03	23/09/22	0:40	*Dasyurus hallucatus*	Northern Quoll	6	1	
	23/09/22	4:31	*Dasyurus hallucatus*	Northern Quoll	3	10	
	25/09/22	1:46	*Dasyurus hallucatus*	Northern Quoll	2	25	
BCE 13			*Nil*				
BCE 05			*Nil*				
BCE 41	22/09/22	10:43	*Varanus panoptes*	Yellow-spotted Monitor	2	1	
	24/09/22	14:06		Quail	6	559	
BCE 42	24/09/22	9:32		Small Reptile	1	1663	
BCE 43			*Nil*		0		
AUD 9			*Nil*		0		
AUD 8			*Nil*		0		
BCE 14	25/09/22	11:21	*Corvus orru*	Torresian Crow	8	10	2 individuals

CAMERA	DATE	TIME (24hr)	SPECIES Scientific name	SPECIES Common name	PHOTOS	FILE NUM	NOTES
	25/09/22	20:43		Bush Stone-curlew	1	52	
	26/09/22	0:03	*Dasyurus hallucatus*	Northern Quoll	1	55	
	26/09/22	9:39		Singing Honeyeater	1	61	
	26/09/22	9:41		Yellow-throated Miner	1	64	
	26/09/22	13:30	*Corvus orru*	Torresian Crow	1	76	
	26/09/22	13:56	*Bos taurus*	Cow	6	84	
BCE 18	22/09/22	2:28	*Dasyurus hallucatus*	Northern Quoll	51	40	Gap over 5 mins but same individual based on spots and scarring, Ficus Hill
	22/09/22	8:27	*Varanus panoptes*	Yellow-spotted Monitor	24	103	Ficus Hill
	22/09/22	22:26	*Dasyurus hallucatus*	Northern Quoll	14	97	Same individual as event 1, Ficus Hill
	22/09/22	23:30	*Dasyurus hallucatus*	Northern Quoll	2	148	Unsure is same individual, only tail visible, Ficus Hill
BCE 04	22/09/22		*Dasyurus hallucatus*	Northern Quoll	36	1	
	23/09/22			Magpie-lark	3	40	
	24/09/22		*Dasyurus hallucatus*	Northern Quoll	33	76	
BCE 20			*Nil*		0		
AUD 1			*Nil*		0		

Table 40. Trapping data July 2022. Locations for sampling points are in Appendix 10.

Transect	Date	Trap code	Trap Type	Common name	Species	SVL (mm)	Total	Sex	Repro stat	Crown (mm)	pes	Age	Comments
1	3/07/2022	1.08	Pit	Sandy Inland Mouse	*Pseudomys hermansbergensis*			F	VC	24	17		ear length c. 14. tail hair bicolor
1	3/07/2022	1.05	Pit	Sandy Inland Mouse	*Pseudomys hermansbergensis*			M	Sc testes	24.5	17		ear length c. 13. tail hair bicolor
1	3/07/2022	1.02	Pit	Common Dwarf Skink	*Menetia greyii*	32	50						checked head scales
2	3/07/2022	2.11	Pit	Fat-tailed Gecko	*Diplodactylus bilybara*	38						2+	tail lost to ants
2	3/07/2022	2.15	Pit	Central Military Dragon	*Ctenophorus isolepis*	33	108					1	
1	3/07/2022	1.15	Pit	Central Military Dragon	*Ctenophorus isolepis*							1	
1	3/07/2022	1.11	Pit	Leopard Ctenotus	*Ctenotus pantherinus*							2	
2	4/07/2022	2.12	funnel	Central Military Dragon	*Ctenophorus isolepis*	37	125						
2	4/07/2022	2.05	pit	Ring-tailed Dragon	*Ctenophorus caudicinctus*	33	94						
2	4/07/2022	2.08	pit	Long-nosed Dragon	*Gowidon longirostris*	59	226						
3	4/07/2022	3.04	pit	Central Military Dragon	*Ctenophorus isolepis*	42	130						
1	4/07/2022	1.10	funnel	Leopard Ctenotus	*Ctenotus pantherinus*	49	127						dead. Crushed by predator from outside
4	5/07/2022	4.03	pit	Stripe-faced Dunnart	*Sminthopsis macroura*			M		27			
4	5/07/2022	4.04	pit	Fat-tailed Gecko	*Diplodactylus bilybara*	30	40	F	Grav				
2	5/07/2022	2.05	pit		*Lucasium stenodactylum*	43	68						
2	5/07/2022	2.08	pit	Dwarf Bearded Dragon	*Pogona minor*	128	350						
2	5/07/2022	2.12	pit	Central Military Dragon	*Ctenophorus isolepis*	39	126					1	
2	5/07/2022	2.12	pit	Fat-tailed Gecko	*Diplodactylus bilybara*	26	38						
2	5/07/2022	2.17	pit	Dwarf Bearded Dragon	*Pogona minor*	125	362	F	gravid				
3	5/07/2022	3.15	pit	Sandy Inland Mouse	*Pseudomys hermansbergensis*			F	VC	22.3			dead. Cold

3	5/07/2022	3.07	pit	Long-nosed Dragon	*Gowidon longirostris*	113	463						
3	5/07/2022	3.04	pit	Central Military Dragon	*Ctenophorus isolepis*	43	133						
1	5/07/2022	1.11	pit	Leopard Ctenotus	*Ctenotus pantherinus*								
1	5/07/2022	1.06	pit	Sandy Inland Mouse	*Pseudomys hermansbergensis*			M	ns	22.1			dead. Cold
4	6/07/2022	4.02	pit	Dwarf Bearded Dragon	*Pogona minor*	120	350						
4	6/07/2022	4.02	pit	Sandy Inland Mouse	*Pseudomys hermansbergensis*			F	VP	22.8			
4	6/07/2022	4.07	pit	Leopard Ctenotus	*Ctenotus pantherinus*	43	109						
4	6/07/2022	4.07	pit	Sandy Inland Mouse	*Pseudomys hermansbergensis*								
4	6/07/2022	4.16	pit	Central Military Dragon	*Ctenophorus isolepis*	37	110					1	
4	6/07/2022	4.16	pit	Leopard Ctenotus	*Ctenotus pantherinus*	32	87						
3	6/07/2022	3.15	pit	Sandy Inland Mouse	*Pseudomys hermansbergensis*					23.1			
3	6/07/2022	3.14	pit	Long-nosed Dragon	*Gowidon longirostris*	48	184					1	
3	6/07/2022	3.07	pit	Dwarf Bearded Dragon	*Pogona minor*	122	352	M					
3	6/07/2022	3.04	pit	Pilbara Ningaui	*Ningaui timealeyi*			M		23.2			
3	6/07/2022	3.02	pit	Pilbara Ningaui	*Ningaui timealeyi*			F		22.4			possible py
2	6/07/2022	2.07	pit	Long-nosed Dragon	*Gowidon longirostris*	58	246					1	
2	6/07/2022	2.15	pit	Dwarf Bearded Dragon	*Pogona minor*	127	377	M					
2	6/07/2022	2.19	pit	Fat-tailed Gecko	*Diplodactylus bilybara*	28	41						
2	6/07/2022	2.09	pit	Leopard Ctenotus	*Ctenotus pantherinus*	73	182						
4	7/07/2022	4.07	pit	Dwarf Bearded Dragon	*Pogona minor*	122	335	F	gravid				
3	7/07/2022	3.04	pit	Ring-tailed Dragon	*Ctenophorus caudicinctus*	36	115					1	
3	7/07/2022	3.07	pit	Common Dwarf Skink	*Menetia greyii*	23	25						
3	7/07/2022	3.08	pit	Sandy Inland Mouse	*Pseudomys hermansbergensis*					21.5			Dead cold.
1	7/07/2022	1.11	pit	Dwarf Bearded Dragon	*Pogona minor*	122	336						

1	7/07/2022	1.18	pit	Sandy Inland Mouse	*Pseudomys hermansbergensis*			M		20			dead. Cold
3	7/07/2022	3.02	funnel	Leopard Ctenotus	*Ctenotus pantherinus*	86	112						
4	7/07/2022	4.07	pit	Leopard Ctenotus	*Ctenotus pantherinus*	44	121					1	
4	7/07/2022	4.06	pit	Central Military Dragon	*Ctenophorus isolepis*	31	85					1	
4	7/07/2022	4.05	pit	Dwarf Bearded Dragon	*Pogona minor*	110	325	F	gravid				
4	7/07/2022	4.04	pit	Leopard Ctenotus	*Ctenotus pantherinus*	42	111					1	
4	7/07/2022	4.03	pit	Dwarf Bearded Dragon	*Pogona minor*	122	340	F	gravid				
2	7/07/2022	2.05	pit	Long-nosed Dragon	*Gowidon longirostris*	43	162					1	
2	7/07/2022	2.07	pit		*Ctenotus grandis*	85	260						
2	7/07/2022	2.12	funnel	Leopard Ctenotus	*Ctenotus pantherinus*	94	210						
2	7/07/2022	2.13	Pit	Fat-tailed Gecko	*Diplodactylus bilybara*	31							
2	7/07/2022	2.17	Pit	Central Military Dragon	*Ctenophorus isolepis*	41	130					1	
1	8/07/2022	1.04	Pit	Sandy Inland Mouse	*Pseudomys hermansbergensis*			F	VP	23.2			Dead. Cold
1	8/07/2022	1.06	Pit	Central Military Dragon	*Ctenophorus isolepis*	45	145						
4	8/07/2022	4.08	Pit	Common Dwarf Skink	*Menetia greyii*	20	26						
4	8/07/2022	4.06	Pit	Ring-tailed Dragon	*Ctenophorus caudicinctus*	44	135						
4	8/07/2022	4.03	Pit	Dwarf Bearded Dragon	*Pogona minor*	120	343	F	gravid				
3	8/07/2022	3.15	Pit	Leopard Ctenotus	*Ctenotus pantherinus*	44	122					1	
4	8/07/2022	4.17	Pit	Dwarf Bearded Dragon	*Pogona minor*	126	340	F	gravid				
4	8/07/2022	4.14	Pit	Ring-tailed Dragon	*Ctenophorus caudicinctus*	46	130						
2	8/07/2022	2.01	Pit	Central Military Dragon	*Ctenophorus isolepis*	42	127						
2	8/07/2022	2.05	Pit	Central Military Dragon	*Ctenophorus isolepis*	46	153						
2	8/07/2022	2.07	Pit	Leopard Ctenotus	*Ctenotus pantherinus*	81	215						
2	8/07/2022	2.09	Pit	Ring-tailed Dragon	*Ctenophorus caudicinctus*	40	120						
4	9/07/2022	4.20	funnel	Leopard Ctenotus	*Ctenotus pantherinus*	44	133						
4	9/07/2022	4.04	Pit	Dwarf Bearded Dragon	*Pogona minor*	120	340	F	gravid				

3	9/07/2022	3.03	Pit	Rock Ctenotus	*Ctenotus saxatilis*	40	139					1	
3	9/07/2022	3.18	Pit	Clay-soil Ctenotus	*Ctenotus helenae*	54	143						
4	9/07/2022	4.07	Pit	Desert Mouse	*Pseudomys desertor*			F	VC			Juv	
4	10/07/2022	4.16	Pit	Central Military Dragon	*Ctenophorus isolepis*								Dead. Killed by Pseudomys
4	10/07/2022	4.16	Pit	Sandy Inland Mouse	*Pseudomys hermansbergensis*			M	ScT	23.6			
4	10/07/2022	4.19	Pit	Clay-soil Ctenotus	*Ctenotus helenae*	67	190						

Table 41. Trapping data September 2022. Locations for sampling points are in Appendix 10.

Transect	Date	Trap code	Trap Type	Common name	*Species*	SVL (mm)	Total (mm)	Sex	Repro stat	Crown (mm)	Pes (mm)	Age	Comments
4	20/09/2022	4.02	pit	Pilbara Ningaui	*Ningaui timealeyi*			F	4 py. large pink	21.2			
4	20/09/2022	4.15	pit	Leopard Ctenotus	*Ctenotus pantherinus*	55	104						
4	20/09/2022	4.10	pit	Sandy Inland Mouse	*Pseudomys hermansbergensis*			M	sct	24.1			
4	21/09/2022	4.03	pit	Pilbara Mulga Monitor	*Varanus bushi*	133	312						tail damaged as if bitten
4	21/09/2022	4.11	pit	Variegated Dtella	*Gehyra variegata*	43	82						
4	21/09/2022	4.12	pit	Leopard Ctenotus	*Ctenotus pantherinus*	87	240	M					
4	21/09/2022	4.18	pit	Dwarf Bearded Dragon	*Pogona minor*	127	343	F	gravid				
2	21/09/2022	2.10	pit	Bynoe's Gecko	*Heteronotia binoei*	35	86						
2	21/09/2022	2.14	pit	Dwarf Bearded Dragon	*Pogona minor*	85	237					year 2	
5	21/09/2022	5.01	pit		*Eremiascincus isolepis*	59	154						
5	21/09/2022	5.03	pit		*Eremiascincus isolepis*	54	126						

Transect	Date	Trap code	Trap Type	Common name	*Species*	SVL (mm)	Total (mm)	Sex	Repro stat	Crown (mm)	Pes (mm)	Age	Comments
5	21/09/2022	5.04	pit	Sandy Inland Mouse	*Pseudomys hermansbergensis*			M		20.5			
3	21/09/2022	3.14	pit		*Lerista muelleri*	32	56						Died
3	21/09/2022	3.12	pit	Fat-tailed Gecko	*Diplodactylus bilybara*	41	52						
3	21/09/2022	3.04	pit	Pilbara Ningaui	*Ningaui timealeyi*			F	npy	20.8			
3	21/09/2022	3.03	pit	Pilbara Ningaui	*Ningaui timealeyi*			M		23			
3	21/09/2022	3.02	pit	Sandy Inland Mouse	*Pseudomys hermansbergensis*			m		20.9			
1	21/09/2022	1.08	pit	Variegated Dtella	*Gehyra variegata*	42	64	F	gravid				
1	21/09/2022	1.05	pit	Sandy Inland Mouse	*Pseudomys hermansbergensis*								relesed ithout measurements
4	22/09/2022	4.01	pit	Dwarf Bearded Dragon	*Pogona minor*	123	328	F	gravid				
4	22/09/2022	4.10	pit	Common Dwarf Skink	*Menetia greyii*								
4	22/09/2022	4.12	pit	Variegated Dtella	*Gehyra variegata*	43	79	F	gravid				
4	22/09/2022	4.17	pit	Central Military Dragon	*Ctenophorus isolepis*	67	250	M	breeding colour				
4	22/09/2022	4.17	pit	Dwarf Bearded Dragon	*Pogona minor*	132	360	F	gravid				
4	22/09/2022	4.18	pit		*Lerista muelleri*	34	71						
4	22/09/2022	4.19	pit	Dwarf Bearded Dragon	*Pogona minor*	141	359	F	gravid				
4	22/09/2022	4.20	pit	Sandy Inland Mouse	*Pseudomys hermansbergensis*			M		21			dead in trap. Cause unknown
2	22/09/2022	2.03	pit	Central Military Dragon	*Ctenophorus isolepis*	72	231						

Transect	Date	Trap code	Trap Type	Common name	*Species*	SVL (mm)	Total (mm)	Sex	Repro stat	Crown (mm)	Pes (mm)	Age	Comments
2	22/09/2022	2.06	pit	Sandy Inland Mouse	*Pseudomys hermansbergensis*			F		22.5			
2	22/09/2022	2.11	pit	Central Military Dragon	*Ctenophorus isolepis*	59	198						
1	22/09/2022	1.12	funnel	Fat-tailed Gecko	*Diplodactylus bilybara*	48	67						
1	22/09/2022	1.14	funnel	Kaluta	*Dasykaluta rosamondae*			M		33.4			
1	22/09/2022	1.20	pit	Sandy Inland Mouse	*Pseudomys hermansbergensis*			M		21.2			
5	22/09/2022	5.03	pit		*Eremiascincus isolepis*	55	108						
5	22/09/2022	5.04	pit	Long-nosed Dragon	*Gowidon longirostris*	87	372					year 2	
5	22/09/2022	5.05	pit	Sandy Inland Mouse	*Pseudomys hermansbergensis*			M	ns	21.3			
3	22/09/2022	3.10	pit	Dwarf Bearded Dragon	*Pogona minor*	125	345		gravid				
3	22/09/2022	3.08	pit	Pilbara Ningaui	*Ningaui timealeyi*			M		21.2			
1	22/09/2022	1.10	pit	Sandy Inland Mouse	*Pseudomys hermansbergensis*								ESC
1	22/09/2022	1.04	funnel	Bynoe's Gecko	*Heteronotia binoei*	42	91		gravid 2 eggs				
1	22/09/2022	1.02	pit	Sandy Inland Mouse	*Pseudomys hermansbergensis*			F	VC	21			
5	23/09/2022	5.02	pit		*Eremiascincus isolepis*	60	153						
5	23/09/2022	5.03	pit		*Eremiascincus isolepis*	57	148						
5	23/09/2022	5.03	pit		*Eremiascincus isolepis*	53	127						

Transect	Date	Trap code	Trap Type	Common name	*Species*	SVL (mm)	Total (mm)	Sex	Repro stat	Crown (mm)	Pes (mm)	Age	Comments
5	23/09/2022	5.04	pit	Sandy Inland Mouse	*Pseudomys hermansbergensis*			F		22			
5	23/09/2022	5.04	pit	Sandy Inland Mouse	*Pseudomys hermansbergensis*			M		21			
3	23/09/2022	3.18	pit	Pilbara Blind Snake	*Anilios pilbarensis*	265	278						
3	23/09/2022	3.14	funnel	Leopard Ctenotus	*Ctenotus pantherinus*	68	200						
3	23/09/2022	3.10	funnel	Jewelled Gecko	*Strophurus elderi*	45	63						
3	23/09/2022	3.08	pit	Pilbara Ningaui	*Ningaui timealeyi*			M		22.9			
3	23/09/2022	3.08	pit	Pilbara Ningaui	*Ningaui timealeyi*			F	npy	19.2			
3	23/09/2022	3.02	pit	Pilbara Ningaui	*Ningaui timealeyi*			M		21.1			
3	23/09/2022	3.02	pit		*Nephrurus cinctus*	62	87						
3	23/09/2022	1.11	pit	Central Military Dragon	*Ctenophorus isolepis*	69	211						
3	23/09/2022	1.15	pit	Variegated Dtella	*Gehyra variegata*								dead. Ants
3	23/09/2022	1.18	pit	Central Military Dragon	*Ctenophorus isolepis*	54	175						
4	23/09/2022	4.04	pit	Common Dwarf Skink	*Menetia greyii*	25	66						
4	23/09/2022	4.10	pit	Pilbara Mulga Monitor	*Varanus bushi*	128	306						
4	23/09/2022	4.17	pit	Dwarf Bearded Dragon	*Pogona minor*	125	346	F	gravid				
4	23/09/2022	4.20	pit		*Lucasium stenodactylum*	35	57						
2	23/09/2022	2.16	pit	Ring-tailed Dragon	*Ctenophorus caudicinctus*	69	220					yr 1?	
1	23/09/2022	1.10	funnel	Bynoe's Gecko	*Heteronotia binoei*	42	97						

Transect	Date	Trap code	Trap Type	Common name	*Species*	SVL (mm)	Total (mm)	Sex	Repro stat	Crown (mm)	Pes (mm)	Age	Comments
1	23/09/2022	1.09	pit	Sandy Inland Mouse	*Pseudomys hermansbergensis*								ant stressed so released quickly
1	23/09/2022	1.07	pit	Fat-tailed Gecko	*Diplodactylus bilybara*	55	65	M					
1	23/09/2022	1.06	pit	Central Military Dragon	*Ctenophorus isolepis*	53	170					yr 1?	
1	23/09/2022	1.06	pit	Leopard Ctenotus	*Ctenotus pantherinus*	87	189						
1	23/09/2022	1.06	funnel	Leopard Ctenotus	*Ctenotus pantherinus*	57	150						
4	24/09/2022	4.20	funnel	Pilbara Mulga Monitor	*Varanus bushi*	126	284						
4	24/09/2022	4.18	pit	Dwarf Bearded Dragon	*Pogona minor*	128	368		gravid female				
4	24/09/2022	4.15	pit	Central Military Dragon	*Ctenophorus isolepis*	51	201						
4	24/09/2022	4.15	pit	Variegated Dtella	*Gehyra variegata*	40	87						
4	24/09/2022	4.13	pit	Variegated Dtella	*Gehyra variegata*	40	81						
4	24/09/2022	4.10	pit	Variegated Dtella	*Gehyra variegata*	32	90						
4	24/09/2022	4.04	funnel	Fat-tailed Gecko	*Diplodactylus bilybara*	46	61						
4	24/09/2022	4.06	funnel	Rock Ctenotus	*Ctenotus saxatilis*	60	147						dead; no obvious reason
4	24/09/2022	4.08	funnel	Leopard Ctenotus	*Ctenotus pantherinus*	48	141						
4	24/09/2022	4.09	pit	Central Military Dragon	*Ctenophorus isolepis*	42	129					yr 1	
4	24/09/2022	4.09	pit		*Lerista clara*	44	85						
2	24/09/2022	2.07	pit	Little Button-quail	*Turnix velox*								very young chick

Transect	Date	Trap code	Trap Type	Common name	*Species*	SVL (mm)	Total (mm)	Sex	Repro stat	Crown (mm)	Pes (mm)	Age	Comments
2	24/09/2022	2.08	pit	Sandy Inland Mouse	*Pseudomys hermansbergensis*			M		21.9			
2	24/09/2022	2.09	pit	Pilbara Ningaui	*Ningaui timealeyi*			M		23.4			
1	24/09/2022	1.06	pit	Central Military Dragon	*Ctenophorus isolepis*	65	215	M					
1	24/09/2022	1.01	pit	Pygmy Desert Monitor	*Varanus eremius*	115	326						
3	24/09/2022	3.20	pit	Pilbara Ningaui	*Ningaui timealeyi*			F	small py	20.6			
3	24/09/2022	3.19	pit	Leopard Ctenotus	*Ctenotus pantherinus*	86	132						
3	24/09/2022	3.18	pit	Common Dwarf Skink	*Menetia greyii*								
3	24/09/2022	3.13	pit	Fat-tailed Gecko	*Diplodactylus bilybara*	34	49						
3	24/09/2022	3.12	pit	Pilbara Ningaui	*Ningaui timealeyi*			F	npy	21.7			
3	24/09/2022	3.12	funnel	Fat-tailed Gecko	*Diplodactylus bilybara*	45	65						
3	24/09/2022	3.12	pit		*Lerista clara*								
3	24/09/2022	3.10	pit	Jewelled Gecko	*Strophurus elderi*	44	65	F					
3	24/09/2022	3.09	pit	Pilbara Ningaui	*Ningaui timealeyi*			M		22.6			dead; no apparnet reason
3	24/09/2022	3.09	pit	Pilbara Ningaui	*Ningaui timealeyi*			F	npy	22			
3	24/09/2022	3.08	pit	Pilbara Ningaui	*Ningaui timealeyi*			M		20.3			
3	24/09/2022	3.07	pit	Pilbara Ningaui	*Ningaui timealeyi*			M		25.9			
3	24/09/2022	3.04	funnel	Shaded-litter Rainbow-Skink	*Carlia munda*								
1	24/09/2022	1.11	pit	Dwarf Bearded Dragon	*Pogona minor*	80	220					yr 1 ?	
1	24/09/2022	1.12	funnel	Leopard Ctenotus	*Ctenotus pantherinus*	67	165						

Transect	Date	Trap code	Trap Type	Common name	*Species*	SVL (mm)	Total (mm)	Sex	Repro stat	Crown (mm)	Pes (mm)	Age	Comments
1	24/09/2022	1.12	pit	Leopard Ctenotus	*Ctenotus pantherinus*	61	147						
1	24/09/2022	1.18	pit	Sandy Inland Mouse	*Pseudomys hermansbergensis*			F	VC	21.7			
5	25/09/2022	5.05	pit	Sandy Inland Mouse	*Pseudomys hermansbergensis*			M		23.1			
3	25/09/2022	3.19	pit	Kaluta	*Dasykaluta rosamondae*			M		30.8			
3	25/09/2022	3.12	pit	Jewelled Gecko	*Strophurus elderi*	46	70						
3	25/09/2022	3.08	pit	Pilbara Ningaui	*Ningaui timealeyi*			F	used pouch	20.9			
4	25/09/2022	4.17	pit	Fat-tailed Gecko	*Diplodactylus bilybara*	45	69						
4	25/09/2022	4.16	pit	Central Military Dragon	*Ctenophorus isolepis*	67	233	M	breeding colour				
4	25/09/2022	4.16	pit	Stripe-faced Dunnart	*Sminthopsis macroura*			M		29.8			
4	25/09/2022	4.15	pit	Fat-tailed Gecko	*Diplodactylus bilybara*	43	67						
1	25/09/2022	1.08	pit	Variegated Dtella	*Gehyra variegata*	38	64						
1	25/09/2022	1.08	pit	Sandy Inland Mouse	*Pseudomys hermansbergensis*			M	ns				
1	25/09/2022	1.06	pit	Sandy Inland Mouse	*Pseudomys hermansbergensis*			M	ns	20.5			
1	25/09/2022	1.02	pit	Sandy Inland Mouse	*Pseudomys hermansbergensis*			M	ns	19.7			
1	25/09/2022	1.18	funnel	Leopard Ctenotus	*Ctenotus pantherinus*	92	204						

Transect	Date	Trap code	Trap Type	Common name	*Species*	SVL (mm)	Total (mm)	Sex	Repro stat	Crown (mm)	Pes (mm)	Age	Comments
1	25/09/2022	1.19	pit		*Anilios hamatus*	200						imma ture	obvious white lines of dots on dorsum
2	25/09/2022	2.06	pit	Sandy Inland Mouse	*Pseudomys hermansbergensis*			M	ns	23			
2	25/09/2022	2.10	funnel	Bynoe's Gecko	*Heteronotia binoei*	41	102						
2	25/09/2022	2.12	pit	Pilbara Ningaui	*Ningaui timealeyi*			M		21.3			
2	25/09/2022	2.16	funnel	Leopard Ctenotus	*Ctenotus pantherinus*	85	164						
4	25/09/2022	4.03	hand capture	Spiny-tailed Monitor	*Varanus acanthurus*	170	420						found under pit when this was removed
4	25/09/2022	4.03	hand capture		*Lucasium stenodactylum*								found under pit when this was removed
4	25/09/2022	4.05	pit	Leopard Ctenotus	*Ctenotus pantherinus*	59	160						
4	25/09/2022	4.06	pit	Leopard Ctenotus	*Ctenotus pantherinus*	58	147						dead heat
3	26/09/2022	3.04	pit	Pilbara Ningaui	*Ningaui timealeyi*			M		22.6			
3	26/09/2022	3.04	pit	Bynoe's Gecko	*Heteronotia binoei*	34	69						
3	26/09/2022	3.02	funnel	Rock Ctenotus	*Ctenotus saxatilis*	59	182						
3	26/09/2022	3.02	funnel	Shaded-litter Rainbow-Skink	*Carlia munda*	35							dead. Heat
3	26/09/2022	3.15	pit		*Lerista clara*	37	75						
2	26/09/2022	2.04	pit	Sandy Inland Mouse	*Pseudomys hermansbergensis*			M	scrotal testes				

Transect	Date	Trap code	Trap Type	Common name	*Species*	SVL (mm)	Total (mm)	Sex	Repro stat	Crown (mm)	Pes (mm)	Age	Comments
2	26/09/2022	2.14	funnel	Clay-soil Ctenotus	*Ctenotus helenae*	86	110						tail very recently lost
2	26/09/2022	2.20	pit	Variegated Dtella	*Gehyra variegata*	37	76						
5	26/09/2022	5.01	pit		*Eremiascincus isolepis*	60	135						
1	26/09/2022	1.10	pit	Short-tailed Pygmy Monitor	*Varanus brevicauda*	98	185						
1	26/09/2022	1.02	pit	Pilbara Mulga Monitor	*Varanus bushi*	110	256						

Table 42. Bird census results, July 2022. Coordinates are for UTM Zone 50K.

Transect	Date	Location code	Easting	Northing	Species	N <25m	Notes
1	3/07/2022	1.09	400227.876	7591544.597	Singing Honeyeater	1	
1	3/07/2022	1.05	400010.608	7591549.88	Horsfield's Bronze-Cuckoo	1	
1	3/07/2022	1.01	399800.359	7591474.504	Purple-backed Fairy-wren	3	Coloured male present
1	3/07/2022	1.01	399800.359	7591474.504	Brown Honeyeater	1	
1	3/07/2022	1.02	399846.436	7591529.921	Crested Pigeon	1	
2	3/07/2022	2.07	400521.047	7590094.612	White-plumed Honeyeater	1	
2	3/07/2022	2.08	400555.838	7590102.8	White-plumed Honeyeater	2	
2	3/07/2022	2.08	400555.838	7590102.8	Brown Honeyeater	5	
2	3/07/2022	2.08	400555.838	7590102.8	Sacred Kingfisher	1	
2	3/07/2022	2.09	400597.162	7590107.596	Singing Honeyeater	4	
2	3/07/2022	2.09	400597.162	7590107.596	Black-faced Cuckoo-shrike	2	
2	3/07/2022	2.10	400646.83	7590117.536	Galah	7	
2	3/07/2022	2.10	400646.83	7590117.536	Spinifex Pigeon	2	
2	3/07/2022	2.15	400882.46	7590115.57	Peaceful Dove	1	
2	3/07/2022	2.15	400882.46	7590115.57	Yellow-throated Miner	3	
2	3/07/2022	2.17	400978.481	7590119.598	Singing Honeyeater	5	
2	3/07/2022	2.20	401121.472	7590101.887	Singing Honeyeater	1	
1	3/07/2022	1.11	400337.346	7591598.638	Little Corella	23	
1	3/07/2022	1.12	400387.707	7591597.513	Little Corella	29	
1	3/07/2022	1.12	400387.707	7591597.513	Singing Honeyeater	1	
1	3/07/2022	1.13	400426.75	7591620.56	Purple-backed Fairy-wren	3	Coloured male present
1	3/07/2022	1.14	400499.879	7591616.256	Singing Honeyeater	2	
1	3/07/2022	1.14	400499.879	7591616.256	Crested Bellbird	1	
1	3/07/2022	1.16	400601.057	7591640.355	Singing Honeyeater	1	
1	3/07/2022	1.16	400601.057	7591640.355	Spinifexbird	1	
1	3/07/2022	1.16	400601.057	7591640.355	Crested Bellbird	1	
1	3/07/2022	1.17	400654.013	7591654.3	Zebra Finch	3	

Transect	Date	Location code	Easting	Northing	Species	N <25m	Notes
1	3/07/2022	1.17	400654.013	7591654.3	Little Corella	4	
1	3/07/2022	1.18	400707.84	7591677.771	Little Button-quail	1	
1	3/07/2022	1.19	400794.038	7591700.114	Spinifexbird	2	
1	3/07/2022	1.20	400844.987	7591720.91	Singing Honeyeater	1	
1	3/07/2022	1.20	400844.987	7591720.91	Little Corella	2	
1	3/07/2022	1.20	400844.987	7591720.91	Galah	4	
1	3/07/2022	1.20	400844.987	7591720.91	Spinifexbird	1	
2	4/07/2022	2.01	400221.773	7590056.766	Budgerigar	2	
2	4/07/2022	2.01	400221.773	7590056.766	Diamond Dove	1	
2	4/07/2022	2.07	400521.047	7590094.612	White-plumed Honeyeater	1	
2	4/07/2022	2.10	400646.83	7590117.536	Purple-backed Fairy-wren	3	
2	4/07/2022	2.10	400646.83	7590117.536	Horsfield's Bronze-Cuckoo	1	
2	4/07/2022	2.10	400646.83	7590117.536	White-plumed Honeyeater	1	
2	4/07/2022	2.16	400931.841	7590121.744	Rufous Whistler	1	
2	4/07/2022	2.16	400931.841	7590121.744	Budgerigar	10	
2	4/07/2022	2.18	401033.061	7590120.933	Singing Honeyeater	1	
1	4/07/2022	1.14	400499.879	7591616.256	Singing Honeyeater	1	
3	4/07/2022	3.06	399473.07	7593583.917	Rufous-crowned Emu-wren	3	
3	4/07/2022	3.19	399621.065	7593186.443	Singing Honeyeater	1	
3	4/07/2022	3.19	399621.065	7593186.443	Brown Honeyeater	1	
3	4/07/2022	3.15	399550.744	7593302.234	White-plumed Honeyeater	2	
3	4/07/2022	3.15	399550.744	7593302.234	Cockatiel	2	
3	4/07/2022	3.09	399536.162	7593499.74	Brown Honeyeater	3	
3	4/07/2022	3.07	399505.359	7593547.147	Brown Honeyeater	2	
3	4/07/2022	3.03	399387.765	7593648.36	Zebra Finch	3	
5	5/07/2022	5.05	399746.241	7592683.549	White-plumed Honeyeater	2	
1	5/07/2022	1.02	399846.436	7591529.921	Spinifex Pigeon	9	
1	5/07/2022	1.01	399800.359	7591474.504	Brown Honeyeater	1	

Transect	Date	Location code	Easting	Northing	Species	N <25m	Notes
4	5/07/2022	4.05	400418.476	7587497.637	Little Button-quail	1	
4	5/07/2022	4.05	400418.476	7587497.637	Willie Wagtail	1	
4	5/07/2022	4.18	401044.952	7587505.414	Yellow-throated Miner	1	
4	5/07/2022	4.19	401113.746	7587496.874	Yellow-throated Miner	3	
4	5/07/2022	4.20	401165.692	7587488.119	Tree Martin	3	
2	5/07/2022	2.04	400395.434	7590077.777	Singing Honeyeater	2	
2	5/07/2022	2.05	400448.781	7590077.889	Spinifex Pigeon	3	
2	5/07/2022	2.05	400448.781	7590077.889	Diamond Dove	2	
2	5/07/2022	2.05	400448.781	7590077.889	White-plumed Honeyeater	1	
2	5/07/2022	2.05	400448.781	7590077.889	Little Button-quail	1	
2	5/07/2022	2.07	400521.047	7590094.612	White-plumed Honeyeater	1	
2	5/07/2022	2.12	400741.23	7590132.846	Tree Martin	1	
2	5/07/2022	2.13	400799.772	7590128.783	Little Woodswallow	2	
2	5/07/2022	2.20	401121.472	7590101.887	Singing Honeyeater	1	
2	5/07/2022	2.20	401121.472	7590101.887	Tree Martin	1	
3	5/07/2022	3.16	399551.231	7593274.12	Yellow-throated Miner	1	
3	5/07/2022	3.15	399550.744	7593302.234	Yellow-throated Miner	2	
3	5/07/2022	3.10	399529.938	7593470.034	Brown Honeyeater	3	
3	5/07/2022	3.10	399529.938	7593470.034	White-plumed Honeyeater	1	
3	5/07/2022	3.05	399452.374	7593602.716	Brown Honeyeater	1	
1	5/07/2022	1.18	400707.84	7591677.771	Zebra Finch	1	
1	5/07/2022	1.18	400707.84	7591677.771	Spinifexbird	1	
1	5/07/2022	1.18	400707.84	7591677.771	Little Button-quail	1	
1	5/07/2022	1.19	400794.038	7591700.114	Spinifex Pigeon	7	
1	5/07/2022	1.20	400844.987	7591720.91	Spinifex Pigeon	1	
4	6/07/2022	4.20	401165.692	7587488.119	Spinifex Pigeon	4	
4	6/07/2022	4.18	401044.952	7587505.414	Yellow-throated Miner	3	
4	6/07/2022	4.08	400548.698	7587518.155	Yellow-throated Miner	1	

Transect	Date	Location code	Easting	Northing	Species	N <25m	Notes
4	6/07/2022	4.07	400502.587	7587502.812	Little Button-quail	2	
4	6/07/2022	4.02	400276.62	7587486.344	Singing Honeyeater	1	
3	6/07/2022	3.20	399610.054	7593161.355	Brown Honeyeater	1	
3	6/07/2022	3.17	399571.77	7593247.349	Little Button-quail	1	
3	6/07/2022	3.17	399571.77	7593247.349	Yellow-throated Miner	3	
3	6/07/2022	3.12	399518.388	7593399.114	Yellow-throated Miner	1	
3	6/07/2022	3.12	399518.388	7593399.114	Brown Honeyeater	2	
3	6/07/2022	3.12	399518.388	7593399.114	Cockatiel	1	
3	6/07/2022	3.05	399452.374	7593602.716	Brown Honeyeater	1	
3	6/07/2022	3.03	399387.765	7593648.36	Brown Honeyeater	1	
3	6/07/2022	3.02	399352.952	7593659.1	Singing Honeyeater	1	
1	6/07/2022	1.10	400268	7591557	Galah	2	
1	6/07/2022	1.04	399954.623	7591540.895	Horsfield's Bronze-Cuckoo	1	
1	6/07/2022	1.01	399800.359	7591474.504	Brown Honeyeater	1	
2	6/07/2022	2.03	400344.488	7590074.027	Spinifex Pigeon	6	
2	6/07/2022	2.03	400344.488	7590074.027	Diamond Dove	3	
2	6/07/2022	2.05	400448.781	7590077.889	Spinifex Pigeon	15	
2	6/07/2022	2.05	400448.781	7590077.889	Spinifexbird	1	
2	6/07/2022	2.05	400448.781	7590077.889	Budgerigar	8	
2	6/07/2022	2.07	400521.047	7590094.612	Crested Pigeon	1	
2	6/07/2022	2.07	400521.047	7590094.612	Singing Honeyeater	3	
2	6/07/2022	2.07	400521.047	7590094.612	Spinifex Pigeon	1	
2	6/07/2022	2.08	400555.838	7590102.8	White-plumed Honeyeater	1	
2	6/07/2022	2.08	400555.838	7590102.8	Tree Martin	1	
2	6/07/2022	2.11	400690.719	7590125.558	Singing Honeyeater	1	
2	6/07/2022	2.11	400690.719	7590125.558	White-plumed Honeyeater	3	
2	6/07/2022	2.12	400741.23	7590132.846	Singing Honeyeater	3	
2	6/07/2022	2.12	400741.23	7590132.846	Tree Martin	2	

Transect	Date	Location code	Easting	Northing	Species	N <25m	Notes
2	6/07/2022	2.13	400799.772	7590128.783	Crested Bellbird	1	
2	6/07/2022	2.17	400978.481	7590119.598	Diamond Dove	1	
2	6/07/2022	2.20	401121.472	7590101.887	Horsfield's Bronze-Cuckoo	2	
2	6/07/2022	2.20	401121.472	7590101.887	Willie Wagtail	1	
2	6/07/2022	2.20	401121.472	7590101.887	Crested Bellbird	1	
1	6/07/2022	1.12	400387.707	7591597.513	White-winged Fairy-wren	4	
1	6/07/2022	1.16	400601.057	7591640.355	Tree Martin	2	
2	7/07/2022	2.04	400395.434	7590077.777	Singing Honeyeater	1	
2	7/07/2022	2.04	400395.434	7590077.777	Diamond Dove	1	
2	7/07/2022	2.04	400395.434	7590077.777	Little Corella	2	
2	7/07/2022	2.05	400448.781	7590077.889	Galah	2	
2	7/07/2022	2.05	400448.781	7590077.889	Pallid Cuckoo	1	
2	7/07/2022	2.06	400489.02	7590074.487	Horsfield's Bronze-Cuckoo	1	
2	7/07/2022	2.10	400646.83	7590117.536	Cockatiel	2	
2	7/07/2022	2.10	400646.83	7590117.536	Little Woodswallow	2	
2	7/07/2022	2.11	400690.719	7590125.558	Spinifexbird	1	
2	7/07/2022	2.13	400799.772	7590128.783	Crested Bellbird	1	
2	7/07/2022	2.16	400931.841	7590121.744	Red-backed Kingfisher	1	
2	7/07/2022	2.16	400931.841	7590121.744	Singing Honeyeater	1	
2	7/07/2022	2.17	400978.481	7590119.598	Rufous Whistler	1	
2	7/07/2022	2.20	401121.472	7590101.887	White-winged Triller	1	
3	7/07/2022	3.20	399610.054	7593161.355	Purple-backed Fairy-wren	3	
3	7/07/2022	3.20	399610.054	7593161.355	Torresian Crow	2	
4	7/07/2022	4.20	401165.692	7587488.119	Spinifex Pigeon	5	
4	7/07/2022	4.20	401165.692	7587488.119	Yellow-throated Miner	1	
4	7/07/2022	4.19	401113.746	7587496.874	Yellow-throated Miner	6	
4	7/07/2022	4.13	400784.938	7587528.262	Cockatiel	15	
4	7/07/2022	4.13	400784.938	7587528.262	Magpie-lark	2	

Transect	Date	Location code	Easting	Northing	Species	N <25m	Notes
1	7/07/2022	1.08	400190.177	7591538.162	Spinifexbird	1	
1	7/07/2022	1.01	399800.359	7591474.504	Little Corella	1	
3	7/07/2022	3.16	399551.231	7593274.12	Yellow-throated Miner	1	
3	7/07/2022	3.16	399551.231	7593274.12	Magpie-lark	1	
1	8/07/2022	1.01	399800.359	7591474.504	Yellow-throated Miner	4	
1	8/07/2022	1.01	399800.359	7591474.504	Brown Honeyeater	2	
1	8/07/2022	1.01	399800.359	7591474.504	Horsfield's Bronze-Cuckoo	1	
1	8/07/2022	1.07	400136.106	7591537.381	Australian Ringneck	1	
1	8/07/2022	1.07	400136.106	7591537.381	Singing Honeyeater	5	
4	8/07/2022	4.20	401165.692	7587488.119	Spinifex Pigeon	5	
4	8/07/2022	4.18	401044.952	7587505.414	Yellow-throated Miner	2	
4	8/07/2022	4.16	400919.735	7587527.883	Spinifex Pigeon	4	
4	8/07/2022	4.12	400739.171	7587524.213	Zebra Finch	2	
1	8/07/2022	1.18	400707.84	7591677.771	Spinifexbird	1	
1	8/07/2022	1.18	400707.84	7591677.771	Brown Quail	1	
1	8/07/2022	1.18	400707.84	7591677.771	Zebra Finch	4	
1	8/07/2022	1.15	400562.339	7591631.479	Crested Bellbird	1	
1	8/07/2022	1.13	400426.75	7591620.56	Little Button-quail	1	
1	8/07/2022	1.13	400426.75	7591620.56	Budgerigar	20	
2	8/07/2022	2.06	400489.02	7590074.487	White-plumed Honeyeater	2	
2	8/07/2022	2.07	400521.047	7590094.612	White-plumed Honeyeater	1	
2	8/07/2022	2.07	400521.047	7590094.612	Brown Quail	4	1 ad; 3 small chicks
2	8/07/2022	2.08	400555.838	7590102.8	Little Corella	35	
2	8/07/2022	2.08	400555.838	7590102.8	White-plumed Honeyeater	1	
2	8/07/2022	2.11	400690.719	7590125.558	Spinifexbird	1	
2	8/07/2022	2.16	400931.841	7590121.744	Diamond Dove	1	
2	8/07/2022	2.20	401121.472	7590101.887	Singing Honeyeater	1	
4	8/07/2022	4.07	400502.587	7587502.812	Galah	2	

Transect	Date	Location code	Easting	Northing	Species	N <25m	Notes
4	8/07/2022	4.06	400465	7587500	Crested Pigeon	1	
4	8/07/2022	4.05	400418.476	7587497.637	Yellow-throated Miner	7	
4	8/07/2022	4.05	400418.476	7587497.637	Singing Honeyeater	1	
4	8/07/2022	4.03	400322.328	7587483.42	Crested Pigeon	1	
4	8/07/2022	4.03	400322.328	7587483.42	White-winged Fairy-wren	1	
4	8/07/2022	4.02	400276.62	7587486.344	Willie Wagtail	1	
3	8/07/2022	3.03	399387.765	7593648.36	Crested Pigeon	3	
3	8/07/2022	3.09	399536.162	7593499.74	Black-faced Cuckoo-shrike	1	
3	8/07/2022	3.10	399529.938	7593470.034	Yellow-throated Miner	1	nest in eucalypt
3	8/07/2022	3.12	399518.388	7593399.114	Spinifex Pigeon	8	
3	8/07/2022	3.15	399550.744	7593302.234	Yellow-throated Miner	2	
3	8/07/2022	3.15	399550.744	7593302.234	Australian Ringneck	2	
5	8/07/2022	5.04	399755.694	7592693.129	Weebill	1	
3	9/07/2022	3.13	399526.866	7593366.511	Australian Ringneck	2	
3	9/07/2022	3.11	399529.575	7593445.567	Crested Pigeon	2	
4	9/07/2022	4.01	400224.329	7587467.641	Singing Honeyeater	1	
4	9/07/2022	4.02	400276.62	7587486.344	Horsfield's Bronze-Cuckoo	3	
4	9/07/2022	4.03	400322.328	7587483.42	White-winged Fairy-wren	3	
4	9/07/2022	4.04	400376.059	7587486.856	Zebra Finch	4	
4	9/07/2022	4.09	400595.867	7587529.519	Yellow-throated Miner	3	
4	9/07/2022	4.13	400784.938	7587528.262	Galah	4	
4	9/07/2022	4.14	400822.07	7587524.729	Galah	5	
4	9/07/2022	4.19	401113.746	7587496.874	Yellow-throated Miner	2	
4	10/07/2022	4.08	400548.698	7587518.155	Diamond Dove	3	
4	10/07/2022	4.15	400876.568	7587521.194	Budgerigar	4	
4	10/07/2022	4.18	401044.952	7587505.414	Yellow-throated Miner	2	
4	10/07/2022	4.19	401113.746	7587496.874	Yellow-throated Miner	4	
4	10/07/2022	4.19	401113.746	7587496.874	Budgerigar	10	

Table 43. Bird census results, September 2022. Coordinates are for UTM Zone 50K.

Transect	Date	Location code	Easting	Northing	Species	N <25m	Notes
4	20/09/2022	4.02	400276.62	7587486.344	Willie Wagtail	1	
4	20/09/2022	4.02	400276.62	7587486.344	Pallid Cuckoo	2	
4	20/09/2022	4.02	400276.62	7587486.344	Galah	3	
4	20/09/2022	4.02	400276.62	7587486.344	Horsfield's Bronze-Cuckoo	2	
4	20/09/2022	4.02	400276.62	7587486.344	Crested Pigeon	1	
4	20/09/2022	4.03	400322.328	7587483.42	Yellow-throated Miner	1	
4	20/09/2022	4.04	400376.059	7587486.856	Little Corella	1	
4	20/09/2022	4.04	400376.059	7587486.856	White-winged Fairy-wren	1	
4	20/09/2022	4.05	400418.476	7587497.637	Singing Honeyeater	1	
4	20/09/2022	4.06	400465	7587500	Little Corella	4	
4	20/09/2022	4.08	400548.698	7587518.155	Budgerigar	3	
4	20/09/2022	4.12	400739.171	7587524.213	Singing Honeyeater	3	
4	20/09/2022	4.14	400822.07	7587524.729	Spinifex Pigeon	1	
4	20/09/2022	4.18	401044.952	7587505.414	Yellow-throated Miner	1	
4	20/09/2022	4.20	401165.692	7587488.119	Crested Pigeon	2	
4	20/09/2022	4.20	401165.692	7587488.119	Spinifex Pigeon	2	
4	21/09/2022	4.01	400224.329	7587467.641	Yellow-throated Miner	1	
4	21/09/2022	4.02	400276.62	7587486.344	Yellow-throated Miner	1	
4	21/09/2022	4.02	400276.62	7587486.344	White-winged Fairy-wren	2	
4	21/09/2022	4.03	400322.328	7587483.42	Black-faced Cuckoo-shrike	1	
4	21/09/2022	4.08	400548.698	7587518.155	Masked Woodswallow	1	
4	21/09/2022	4.09	400595.867	7587529.519	Spinifex Pigeon	1	
4	21/09/2022	4.09	400595.867	7587529.519	Zebra Finch	4	
4	21/09/2022	4.14	400822.07	7587524.729	Diamond Dove	3	
4	21/09/2022	4.16	400919.735	7587527.883	Diamond Dove	1	

Transect	Date	Location code	Easting	Northing	Species	N <25m	Notes
4	21/09/2022	4.17	400973.039	7587516.923	Crested Pigeon	1	
4	21/09/2022	4.17	400973.039	7587516.923	Black-faced Cuckoo-shrike	2	
4	21/09/2022	4.17	400973.039	7587516.923	Yellow-throated Miner	3	
4	21/09/2022	4.18	401044.952	7587505.414	Yellow-throated Miner	2	
2	21/09/2022	2.01	400221.773	7590056.766	Budgerigar	4	
2	21/09/2022	2.02	400280.001	7590069.75	Singing Honeyeater	2	
2	21/09/2022	2.04	400395.434	7590077.777	Pallid Cuckoo	1	
2	21/09/2022	2.04	400395.434	7590077.777	White-plumed Honeyeater	2	
2	21/09/2022	2.07	400521.047	7590094.612	White-plumed Honeyeater	2	
2	21/09/2022	2.07	400521.047	7590094.612	Rufous Songlark	1	
2	21/09/2022	2.08	400555.838	7590102.8	Brown Quail	4	
2	21/09/2022	2.10	400646.83	7590117.536	White-winged Triller	2	
2	21/09/2022	2.20	401121.472	7590101.887	Diamond Dove	1	
1	21/09/2022	1.15	400562.339	7591631.479	Masked Woodswallow	2	
1	21/09/2022	1.18	400707.84	7591677.771	Crested Bellbird	1	
5	21/09/2022	5.01	399784.197	7592665.965	Magpie-lark	1	
5	21/09/2022	5.02	399785.795	7592674.942	Black-faced Cuckoo-shrike	2	
5	21/09/2022	5.02	399785.795	7592674.942	White-plumed Honeyeater	1	
5	21/09/2022	5.04	399755.694	7592693.129	Brown Honeyeater	4	
5	21/09/2022	5.04	399755.694	7592693.129	Cockatiel	2	
5	21/09/2022	5.04	399755.694	7592693.129	White-plumed Honeyeater	1	
5	21/09/2022	5.05	399746.241	7592683.549	Yellow-throated Miner	1	
5	21/09/2022	5.05	399746.241	7592683.549	White-plumed Honeyeater	1	
5	21/09/2022	5.05	399746.241	7592683.549	Brown Honeyeater	1	
3	21/09/2022	3.19	399621.065	7593186.443	Yellow-throated Miner	1	
3	21/09/2022	3.18	399599.196	7593227.264	Purple-backed Fairy-wren	4	2 coloured males
3	21/09/2022	3.18	399599.196	7593227.264	Zebra Finch	2	
3	21/09/2022	3.16	399551.231	7593274.12	Yellow-throated Miner	2	

Transect	Date	Location code	Easting	Northing	Species	N <25m	Notes
3	21/09/2022	3.16	399551.231	7593274.12	Australian Ringneck	1	
3	21/09/2022	3.16	399551.231	7593274.12	Galah	4	
3	21/09/2022	3.13	399526.866	7593366.511	Diamond Dove	1	
3	21/09/2022	3.11	399529.575	7593445.567	Black-faced Cuckoo-shrike	2	
3	21/09/2022	3.10	399529.938	7593470.034	Brown Quail	1	
3	21/09/2022	3.10	399529.938	7593470.034	Crested Pigeon	1	
3	21/09/2022	3.09	399536.162	7593499.74	Spinifex Pigeon	1	
3	21/09/2022	3.09	399536.162	7593499.74	Spinifexbird	1	
1	21/09/2022	1.09	400227.876	7591544.597	Zebra Finch	17	
1	21/09/2022	1.09	400227.876	7591544.597	Budgerigar	6	
1	21/09/2022	1.08	400190.177	7591538.162	Zebra Finch	20	
1	21/09/2022	1.08	400190.177	7591538.162	Budgerigar	2	
1	21/09/2022	1.08	400190.177	7591538.162	White-winged Triller	1	
1	21/09/2022	1.07	400136.106	7591537.381	Budgerigar	12	
1	21/09/2022	1.07	400136.106	7591537.381	Zebra Finch	2	
1	21/09/2022	1.06	400075.517	7591553.607	Budgerigar	26	
1	21/09/2022	1.02	399846.436	7591529.921	White-winged Triller	1	
1	21/09/2022	1.01	399800.359	7591474.504	Brown Honeyeater	1	
4	22/09/2022	4.03	400322.328	7587483.42	Yellow-throated Miner	2	
4	22/09/2022	4.07	400502.587	7587502.812	Common Bronzewing	1	
4	22/09/2022	4.08	400548.698	7587518.155	Yellow-throated Miner	1	
4	22/09/2022	4.12	400739.171	7587524.213	Yellow-throated Miner	6	
4	22/09/2022	4.12	400739.171	7587524.213	Singing Honeyeater	3	
4	22/09/2022	4.13	400784.938	7587528.262	Yellow-throated Miner	2	
4	22/09/2022	4.14	400822.07	7587524.729	Singing Honeyeater	4	
4	22/09/2022	4.14	400822.07	7587524.729	White-plumed Honeyeater	1	
4	22/09/2022	4.14	400822.07	7587524.729	Crested Pigeon	2	
4	22/09/2022	4.14	400822.07	7587524.729	Yellow-throated Miner	2	

Transect	Date	Location code	Easting	Northing	Species	N <25m	Notes
4	22/09/2022	4.16	400919.735	7587527.883	Crested Pigeon	4	
4	22/09/2022	4.16	400919.735	7587527.883	Spinifex Pigeon	2	
4	22/09/2022	4.16	400919.735	7587527.883	Zebra Finch	6	
4	22/09/2022	4.16	400919.735	7587527.883	Singing Honeyeater	2	
4	22/09/2022	4.16	400919.735	7587527.883	White-plumed Honeyeater	1	
4	22/09/2022	4.16	400919.735	7587527.883	Crested Bellbird	1	
4	22/09/2022	4.17	400973.039	7587516.923	Crested Pigeon	3	
4	22/09/2022	4.17	400973.039	7587516.923	Galah	3	
4	22/09/2022	4.17	400973.039	7587516.923	Spinifex Pigeon	4	
4	22/09/2022	4.17	400973.039	7587516.923	Diamond Dove	13	
4	22/09/2022	4.17	400973.039	7587516.923	Yellow-throated Miner	9	
4	22/09/2022	4.17	400973.039	7587516.923	Common Bronzewing	1	
4	22/09/2022	4.18	401044.952	7587505.414	Galah	5	
4	22/09/2022	4.18	401044.952	7587505.414	Crested Pigeon	2	
4	22/09/2022	4.18	401044.952	7587505.414	Yellow-throated Miner	3	
4	22/09/2022	4.18	401044.952	7587505.414	Spinifex Pigeon	2	
4	22/09/2022	4.18	401044.952	7587505.414	Diamond Dove	10	
4	22/09/2022	4.19	401113.746	7587496.874	Diamond Dove	6	
4	22/09/2022	4.19	401113.746	7587496.874	Spinifex Pigeon	1	
4	22/09/2022	4.20	401165.692	7587488.119	Crested Pigeon	5	
4	22/09/2022	4.20	401165.692	7587488.119	Diamond Dove	1	
4	22/09/2022	4.20	401165.692	7587488.119	Spinifex Pigeon	1	
2	22/09/2022	2.01	400221.773	7590056.766	Singing Honeyeater	1	
2	22/09/2022	2.02	400280.001	7590069.75	Singing Honeyeater	1	
2	22/09/2022	2.02	400280.001	7590069.75	Budgerigar	1	
2	22/09/2022	2.03	400344.488	7590074.027	Singing Honeyeater	1	
2	22/09/2022	2.04	400395.434	7590077.777	Galah	1	
2	22/09/2022	2.04	400395.434	7590077.777	Budgerigar	4	

Transect	Date	Location code	Easting	Northing	Species	N <25m	Notes
2	22/09/2022	2.04	400395.434	7590077.777	Willie Wagtail	1	
2	22/09/2022	2.04	400395.434	7590077.777	White-plumed Honeyeater	2	feeding Pallid Cuckoo chick
2	22/09/2022	2.04	400395.434	7590077.777	Pallid Cuckoo	1	
2	22/09/2022	2.09	400597.162	7590107.596	Singing Honeyeater	1	
2	22/09/2022	2.09	400597.162	7590107.596	White-plumed Honeyeater	1	
2	22/09/2022	2.12	400741.23	7590132.846	Spinifexbird	1	
2	22/09/2022	2.12	400741.23	7590132.846	Budgerigar	5	one in hollow being fed
2	22/09/2022	2.12	400741.23	7590132.846	Singing Honeyeater	2	
2	22/09/2022	2.13	400799.772	7590128.783	White-winged Triller	1	
2	22/09/2022	2.13	400799.772	7590128.783	Singing Honeyeater	3	
2	22/09/2022	2.14	400839.647	7590117.296	Singing Honeyeater	1	
2	22/09/2022	2.15	400882.46	7590115.57	Black-faced Woodswallow	1	
2	22/09/2022	2.16	400931.841	7590121.744	Diamond Dove	1	
2	22/09/2022	2.16	400931.841	7590121.744	Budgerigar	2	
1	22/09/2022	1.16	400601.057	7591640.355	Black-faced Woodswallow	2	
1	22/09/2022	1.16	400601.057	7591640.355	Singing Honeyeater	1	
1	22/09/2022	1.18	400707.84	7591677.771	Zebra Finch	2	
1	22/09/2022	1.19	400794.038	7591700.114	Masked Woodswallow	3	
1	22/09/2022	1.19	400794.038	7591700.114	Singing Honeyeater	1	
1	22/09/2022	1.19	400794.038	7591700.114	Spinifex Pigeon	2	
1	22/09/2022	1.19	400794.038	7591700.114	Zebra Finch	2	
1	22/09/2022	1.20	400844.987	7591720.91	White-winged Triller	2	
1	22/09/2022	1.20	400844.987	7591720.91	Masked Woodswallow	3	
1	22/09/2022	1.20	400844.987	7591720.91	Spinifex Pigeon	1	
5	22/09/2022	5.02	399785.795	7592674.942	White-plumed Honeyeater	1	
5	22/09/2022	5.04	399755.694	7592693.129	Brown Honeyeater	2	
5	22/09/2022	5.05	399746.241	7592683.549	Peaceful Dove	2	
3	22/09/2022	3.19	399621.065	7593186.443	Yellow-throated Miner	1	

Transect	Date	Location code	Easting	Northing	Species	N <25m	Notes
3	22/09/2022	3.02	399352.952	7593659.1	Brown Honeyeater	1	
3	22/09/2022	3.09	399536.162	7593499.74	Spinifexbird	1	
5	23/09/2022	5.01	399784.197	7592665.965	Magpie-lark	3	
5	23/09/2022	5.01	399784.197	7592665.965	White-plumed Honeyeater	1	
5	23/09/2022	5.02	399785.795	7592674.942	White-plumed Honeyeater	4	
5	23/09/2022	5.02	399785.795	7592674.942	Yellow-throated Miner	1	
5	23/09/2022	5.03	399771.935	7592675.629	White-plumed Honeyeater	1	
5	23/09/2022	5.04	399755.694	7592693.129	Black-faced Cuckoo-shrike	2	
5	23/09/2022	5.04	399755.694	7592693.129	Yellow-throated Miner	1	
5	23/09/2022	5.04	399755.694	7592693.129	White-plumed Honeyeater	2	
5	23/09/2022	5.04	399755.694	7592693.129	Budgerigar	1	
3	23/09/2022	3.20	399610.054	7593161.355	Brown Falcon	1	
3	23/09/2022	3.18	399599.196	7593227.264	Yellow-throated Miner	2	
3	23/09/2022	3.14	399530.275	7593334.098	Galah	2	
3	23/09/2022	3.12	399518.388	7593399.114	Diamond Dove	2	
3	23/09/2022	3.08	399528.833	7593530.69	Spinifex Pigeon	1	
3	23/09/2022	3.02	399352.952	7593659.1	Brown Honeyeater	3	
1	23/09/2022	1.12	400387.707	7591597.513	Budgerigar	2	
1	23/09/2022	1.14	400499.879	7591616.256	Diamond Dove	1	
1	23/09/2022	1.14	400499.879	7591616.256	Masked Woodswallow	2	
1	23/09/2022	1.17	400654.013	7591654.3	Masked Woodswallow	40	
1	23/09/2022	1.18	400707.84	7591677.771	Diamond Dove	1	
1	23/09/2022	1.19	400794.038	7591700.114	Masked Woodswallow	50	
1	23/09/2022	1.19	400794.038	7591700.114	Budgerigar	1	
1	23/09/2022	1.19	400794.038	7591700.114	Crested Bellbird	1	
1	23/09/2022	1.19	400794.038	7591700.114	Diamond Dove	3	
1	23/09/2022	1.19	400794.038	7591700.114	Singing Honeyeater	1	
1	23/09/2022	1.10	400268	7591557	Black-faced Woodswallow	1	

Transect	Date	Location code	Easting	Northing	Species	N <25m	Notes
1	23/09/2022	1.09	400227.876	7591544.597	Budgerigar	5	
1	23/09/2022	1.07	400136.106	7591537.381	Brown Falcon	1	
1	23/09/2022	1.01	399800.359	7591474.504	White-winged Triller	1	
2	23/09/2022	2.05	400448.781	7590077.889	Pallid Cuckoo	1	
2	23/09/2022	2.05	400448.781	7590077.889	White-plumed Honeyeater	2	
2	23/09/2022	2.10	400646.83	7590117.536	Diamond Dove	1	
2	23/09/2022	2.12	400741.23	7590132.846	Budgerigar	1	
2	23/09/2022	2.12	400741.23	7590132.846	Brown Honeyeater	1	
2	23/09/2022	2.12	400741.23	7590132.846	White-plumed Honeyeater	1	
4	23/09/2022	4.01	400224.329	7587467.641	Black-faced Woodswallow	2	
4	23/09/2022	4.01	400224.329	7587467.641	Singing Honeyeater	2	
4	23/09/2022	4.01	400224.329	7587467.641	White-winged Triller	1	
4	23/09/2022	4.02	400276.62	7587486.344	White-winged Fairy-wren	3	
4	23/09/2022	4.03	400322.328	7587483.42	Spinifex Pigeon	5	
4	23/09/2022	4.05	400418.476	7587497.637	White-winged Fairy-wren	3	
4	23/09/2022	4.06	400465	7587500	Spinifex Pigeon	2	
4	23/09/2022	4.09	400595.867	7587529.519	Spinifex Pigeon	2	
4	23/09/2022	4.13	400784.938	7587528.262	Galah	2	
4	23/09/2022	4.13	400784.938	7587528.262	Singing Honeyeater	1	
4	23/09/2022	4.14	400822.07	7587524.729	White-winged Triller	1	
4	23/09/2022	4.14	400822.07	7587524.729	Singing Honeyeater	1	
4	23/09/2022	4.14	400822.07	7587524.729	White-plumed Honeyeater	3	
4	23/09/2022	4.16	400919.735	7587527.883	Magpie-lark	2	
4	23/09/2022	4.16	400919.735	7587527.883	Crested Pigeon	2	
4	23/09/2022	4.16	400919.735	7587527.883	Singing Honeyeater	1	
4	23/09/2022	4.16	400919.735	7587527.883	Spinifex Pigeon	1	
4	23/09/2022	4.16	400919.735	7587527.883	Diamond Dove	1	
4	23/09/2022	4.17	400973.039	7587516.923	Yellow-throated Miner	1	

Transect	Date	Location code	Easting	Northing	Species	N <25m	Notes
4	23/09/2022	4.17	400973.039	7587516.923	Diamond Dove	4	
4	23/09/2022	4.17	400973.039	7587516.923	Spinifex Pigeon	1	
4	23/09/2022	4.18	401044.952	7587505.414	Spinifex Pigeon	2	
4	23/09/2022	4.19	401113.746	7587496.874	Spinifex Pigeon	1	
4	23/09/2022	4.20	401165.692	7587488.119	Spinifex Pigeon	1	
4	24/09/2022	4.01	400224.329	7587467.641	Singing Honeyeater	1	
4	24/09/2022	4.01	400224.329	7587467.641	Pallid Cuckoo	1	
4	24/09/2022	4.01	400224.329	7587467.641	Yellow-throated Miner	3	
4	24/09/2022	4.01	400224.329	7587467.641	Diamond Dove	2	
4	24/09/2022	4.02	400276.62	7587486.344	Horsfield's Bronze-Cuckoo	2	
4	24/09/2022	4.02	400276.62	7587486.344	Budgerigar	11	
4	24/09/2022	4.02	400276.62	7587486.344	Yellow-throated Miner	3	
4	24/09/2022	4.03	400322.328	7587483.42	Diamond Dove	3	
4	24/09/2022	4.03	400322.328	7587483.42	Spinifexbird	2	
4	24/09/2022	4.03	400322.328	7587483.42	White-winged Fairy-wren	4	
4	24/09/2022	4.03	400322.328	7587483.42	White-winged Triller	1	
4	24/09/2022	4.07	400502.587	7587502.812	Singing Honeyeater	2	
4	24/09/2022	4.08	400548.698	7587518.155	Yellow-throated Miner	4	
4	24/09/2022	4.08	400548.698	7587518.155	Spinifex Pigeon	1	
4	24/09/2022	4.09	400595.867	7587529.519	Singing Honeyeater	1	
4	24/09/2022	4.11	400702.558	7587527.306	Yellow-throated Miner	1	
4	24/09/2022	4.11	400702.558	7587527.306	Spinifexbird	1	
4	24/09/2022	4.10	400645.864	7587518.429	Spinifex Pigeon	1	
4	24/09/2022	4.12	400739.171	7587524.213	Yellow-throated Miner	11	
4	24/09/2022	4.12	400739.171	7587524.213	Singing Honeyeater	1	
4	24/09/2022	4.12	400739.171	7587524.213	Zebra Finch	1	
4	24/09/2022	4.13	400784.938	7587528.262	Yellow-throated Miner	1	
4	24/09/2022	4.13	400784.938	7587528.262	Zebra Finch	2	

Transect	Date	Location code	Easting	Northing	Species	N <25m	Notes
4	24/09/2022	4.14	400822.07	7587524.729	White-winged Triller	1	
4	24/09/2022	4.14	400822.07	7587524.729	Singing Honeyeater	1	
4	24/09/2022	4.14	400822.07	7587524.729	Yellow-throated Miner	2	
4	24/09/2022	4.15	400876.568	7587521.194	Common Bronzewing	1	
4	24/09/2022	4.15	400876.568	7587521.194	Singing Honeyeater	2	
4	24/09/2022	4.15	400876.568	7587521.194	White-plumed Honeyeater	2	
4	24/09/2022	4.15	400876.568	7587521.194	Galah	8	
4	24/09/2022	4.15	400876.568	7587521.194	Spinifex Pigeon	2	
4	24/09/2022	4.15	400876.568	7587521.194	Budgerigar	16	
4	24/09/2022	4.16	400919.735	7587527.883	Yellow-throated Miner	2	
4	24/09/2022	4.17	400973.039	7587516.923	Crested Pigeon	6	
4	24/09/2022	4.20	401165.692	7587488.119	Galah	2	
4	24/09/2022	4.20	401165.692	7587488.119	Crested Pigeon	1	
2	24/09/2022	2.02	400280.001	7590069.75	Singing Honeyeater	1	
2	24/09/2022	2.03	400344.488	7590074.027	Singing Honeyeater	1	
2	24/09/2022	2.03	400344.488	7590074.027	Budgerigar	7	
2	24/09/2022	2.05	400448.781	7590077.889	Zebra Finch	3	
2	24/09/2022	2.05	400448.781	7590077.889	Diamond Dove	1	
2	24/09/2022	2.08	400555.838	7590102.8	Magpie-lark	1	
2	24/09/2022	2.08	400555.838	7590102.8	White-winged Triller	3	
2	24/09/2022	2.09	400597.162	7590107.596	Budgerigar	1	
2	24/09/2022	2.09	400597.162	7590107.596	White-plumed Honeyeater	4	
2	24/09/2022	2.11	400690.719	7590125.558	Spinifex Pigeon	1	
2	24/09/2022	2.12	400741.23	7590132.846	Budgerigar	2	
2	24/09/2022	2.12	400741.23	7590132.846	Diamond Dove	1	
2	24/09/2022	2.13	400799.772	7590128.783	Singing Honeyeater	1	
2	24/09/2022	2.16	400931.841	7590121.744	Singing Honeyeater	1	
2	24/09/2022	2.17	400978.481	7590119.598	Spinifex Pigeon	1	

Transect	Date	Location code	Easting	Northing	Species	N <25m	Notes
2	24/09/2022	2.18	401033.061	7590120.933	White-winged Triller	1	
1	24/09/2022	1.10	400268	7591557	Masked Woodswallow	3	
1	24/09/2022	1.10	400268	7591557	Black-faced Woodswallow	1	
1	24/09/2022	1.09	400227.876	7591544.597	Budgerigar	1	
1	24/09/2022	1.07	400136.106	7591537.381	Budgerigar	1	
1	24/09/2022	1.06	400075.517	7591553.607	Australian Bustard	1	
1	24/09/2022	1.06	400075.517	7591553.607	Budgerigar	2	
1	24/09/2022	1.05	400010.608	7591549.88	Zebra Finch	2	
1	24/09/2022	1.05	400010.608	7591549.88	Masked Woodswallow	6	
1	24/09/2022	1.01	399800.359	7591474.504	Brown Honeyeater	3	
1	24/09/2022	1.01	399800.359	7591474.504	Budgerigar	1	
1	24/09/2022	1.01	399800.359	7591474.504	Weebill	1	
1	24/09/2022	1.01	399800.359	7591474.504	White-plumed Honeyeater	2	
5	24/09/2022	5.04	399755.694	7592693.129	Sacred Kingfisher	1	
5	24/09/2022	5.04	399755.694	7592693.129	Brown Honeyeater	2	
5	24/09/2022	5.04	399755.694	7592693.129	White-plumed Honeyeater	2	
3	24/09/2022	3.20	399610.054	7593161.355	Purple-backed Fairy-wren	3	
3	24/09/2022	3.19	399621.065	7593186.443	Purple-backed Fairy-wren	3	
3	24/09/2022	3.13	399526.866	7593366.511	Cockatiel	2	
3	24/09/2022	3.13	399526.866	7593366.511	Budgerigar	2	
3	24/09/2022	3.12	399518.388	7593399.114	Purple-backed Fairy-wren	3	
3	24/09/2022	3.12	399518.388	7593399.114	Black-faced Cuckoo-shrike	1	
3	24/09/2022	3.05	399452.374	7593602.716	Spinifexbird	1	
3	24/09/2022	3.02	399352.952	7593659.1	Brown Honeyeater	1	
1	24/09/2022	1.13	400426.75	7591620.56	Masked Woodswallow	4	
5	25/09/2022	5.02	399785.795	7592674.942	Budgerigar	8	
5	25/09/2022	5.02	399785.795	7592674.942	Zebra Finch	3	
5	25/09/2022	5.02	399785.795	7592674.942	White-plumed Honeyeater	2	

Transect	Date	Location code	Easting	Northing	Species	N <25m	Notes
5	25/09/2022	5.03	399771.935	7592675.629	Brown Honeyeater	2	
5	25/09/2022	5.05	399746.241	7592683.549	Brown Honeyeater	1	
5	25/09/2022	5.05	399746.241	7592683.549	Sacred Kingfisher	1	possibly feeding young
3	25/09/2022	3.17	399571.77	7593247.349	Yellow-throated Miner	1	
3	25/09/2022	3.16	399551.231	7593274.12	Yellow-throated Miner	6	
3	25/09/2022	3.13	399526.866	7593366.511	Horsfield's Bronze-Cuckoo	1	
3	25/09/2022	3.12	399518.388	7593399.114	Pallid Cuckoo	1	
3	25/09/2022	3.11	399529.575	7593445.567	Crested Pigeon	1	
3	25/09/2022	3.10	399529.938	7593470.034	Black-faced Cuckoo-shrike	1	
3	25/09/2022	3.08	399528.833	7593530.69	Brown Honeyeater	2	
3	25/09/2022	3.08	399528.833	7593530.69	Spinifexbird	1	
3	25/09/2022	3.06	399473.07	7593583.917	Budgerigar	6	
3	25/09/2022	3.05	399452.374	7593602.716	Galah	1	
3	25/09/2022	3.01	399309.717	7593693.366	White-faced Heron	1	
4	25/09/2022	4.18	401044.952	7587505.414	Common Bronzewing	1	
4	25/09/2022	4.18	401044.952	7587505.414	Yellow-throated Miner	1	
4	25/09/2022	4.19	401113.746	7587496.874	Spinifex Pigeon	1	
4	25/09/2022	4.17	400973.039	7587516.923	Cockatiel	1	
4	25/09/2022	4.17	400973.039	7587516.923	Galah	2	
4	25/09/2022	4.17	400973.039	7587516.923	Masked Woodswallow	3	
4	25/09/2022	4.17	400973.039	7587516.923	Yellow-throated Miner	5	
4	25/09/2022	4.17	400973.039	7587516.923	Spinifex Pigeon	2	
4	25/09/2022	4.17	400973.039	7587516.923	Zebra Finch	2	
4	25/09/2022	4.16	400919.735	7587527.883	Singing Honeyeater	2	
4	25/09/2022	4.16	400919.735	7587527.883	Diamond Dove	1	
4	25/09/2022	4.16	400919.735	7587527.883	White-plumed Honeyeater	2	
4	25/09/2022	4.16	400919.735	7587527.883	Brown Falcon	1	
4	25/09/2022	4.16	400919.735	7587527.883	Yellow-throated Miner	1	

Transect	Date	Location code	Easting	Northing	Species	N <25m	Notes
4	25/09/2022	4.16	400919.735	7587527.883	Spinifex Pigeon	1	
4	25/09/2022	4.15	400876.568	7587521.194	Singing Honeyeater	1	
4	25/09/2022	4.15	400876.568	7587521.194	Masked Woodswallow	9	
4	25/09/2022	4.14	400822.07	7587524.729	Diamond Dove	3	
4	25/09/2022	4.14	400822.07	7587524.729	Spinifex Pigeon	2	
4	25/09/2022	4.14	400822.07	7587524.729	White-plumed Honeyeater	3	
4	25/09/2022	4.13	400784.938	7587528.262	Masked Woodswallow	6	
4	25/09/2022	4.13	400784.938	7587528.262	Singing Honeyeater	2	
4	25/09/2022	4.12	400739.171	7587524.213	Singing Honeyeater	3	
4	25/09/2022	4.12	400739.171	7587524.213	Yellow-throated Miner	1	
4	25/09/2022	4.10	400645.864	7587518.429	Masked Woodswallow	9	
4	25/09/2022	4.10	400645.864	7587518.429	Singing Honeyeater	2	
4	25/09/2022	4.10	400645.864	7587518.429	Brown Honeyeater	1	
4	25/09/2022	4.09	400595.867	7587529.519	Black-faced Woodswallow	3	
4	25/09/2022	4.09	400595.867	7587529.519	White-winged Triller	1	
1	25/09/2022	1.09	400227.876	7591544.597	Spinifexbird	1	
1	25/09/2022	1.08	400190.177	7591538.162	Spinifex Pigeon	1	
1	25/09/2022	1.04	399954.623	7591540.895	Zebra Finch	12	
1	25/09/2022	1.02	399846.436	7591529.921	Singing Honeyeater	3	
1	25/09/2022	1.02	399846.436	7591529.921	Spinifex Pigeon	2	
1	25/09/2022	1.02	399846.436	7591529.921	Brown Honeyeater	1	
1	25/09/2022	1.01	399800.359	7591474.504	Brown Honeyeater	1	
1	25/09/2022	1.14	400499.879	7591616.256	Masked Woodswallow	1	
1	25/09/2022	1.16	400601.057	7591640.355	Crested Pigeon	1	
1	25/09/2022	1.16	400601.057	7591640.355	White-winged Triller	1	
1	25/09/2022	1.16	400601.057	7591640.355	Singing Honeyeater	1	
1	25/09/2022	1.18	400707.84	7591677.771	Masked Woodswallow	4	
1	25/09/2022	1.20	400844.987	7591720.91	Masked Woodswallow	3	

Transect	Date	Location code	Easting	Northing	Species	N <25m	Notes
2	25/09/2022	2.06	400489.02	7590074.487	Pallid Cuckoo	1	
2	25/09/2022	2.06	400489.02	7590074.487	White-plumed Honeyeater	2	
2	25/09/2022	2.06	400489.02	7590074.487	Galah	2	
2	25/09/2022	2.07	400521.047	7590094.612	Rufous Songlark	1	
2	25/09/2022	2.07	400521.047	7590094.612	White-plumed Honeyeater	2	
2	25/09/2022	2.12	400741.23	7590132.846	Budgerigar	1	
2	25/09/2022	2.20	401121.472	7590101.887	Masked Woodswallow	1	
4	25/09/2022	4.01	400224.329	7587467.641	Spinifex Pigeon	2	
4	25/09/2022	4.06	400465	7587500	Singing Honeyeater	1	
4	25/09/2022	4.06	400465	7587500	Masked Woodswallow	2	
4	25/09/2022	4.09	400595.867	7587529.519	Diamond Dove	2	
4	25/09/2022	4.09	400595.867	7587529.519	Masked Woodswallow	2	
3	26/09/2022	3.02	399352.952	7593659.1	Brown Honeyeater	1	
3	26/09/2022	3.01	399309.717	7593693.366	Rufous-crowned Emu-wren	3	
3	26/09/2022	3.14	399530.275	7593334.098	White-winged Triller	1	
3	26/09/2022	3.16	399551.231	7593274.12	Yellow-throated Miner	1	
3	26/09/2022	3.15	399550.744	7593302.234	Brown Falcon	1	
3	26/09/2022	3.15	399550.744	7593302.234	Purple-backed Fairy-wren	3	
3	26/09/2022	3.15	399550.744	7593302.234	Yellow-throated Miner	2	
5	26/09/2022	5.02	399785.795	7592674.942	Brown Honeyeater	3	
5	26/09/2022	5.02	399785.795	7592674.942	Willie Wagtail	2	
5	26/09/2022	5.01	399784.197	7592665.965	Masked Woodswallow	5	
5	26/09/2022	5.01	399784.197	7592665.965	Budgerigar	2	
5	26/09/2022	5.04	399755.694	7592693.129	Black-faced Cuckoo-shrike	2	
5	26/09/2022	5.04	399755.694	7592693.129	White-plumed Honeyeater	1	
1	26/09/2022	1.11	400337.346	7591598.638	Masked Woodswallow	1	
1	26/09/2022	1.14	400499.879	7591616.256	Masked Woodswallow	15	
1	26/09/2022	1.14	400499.879	7591616.256	Singing Honeyeater	1	

Transect	Date	Location code	Easting	Northing	Species	N <25m	Notes
1	26/09/2022	1.16	400601.057	7591640.355	Singing Honeyeater	2	
1	26/09/2022	1.17	400654.013	7591654.3	Masked Woodswallow	1	
1	26/09/2022	1.18	400707.84	7591677.771	Masked Woodswallow	2	
1	26/09/2022	1.20	400844.987	7591720.91	Diamond Dove	1	
1	26/09/2022	1.10	400268	7591557	Budgerigar	2	
1	26/09/2022	1.08	400190.177	7591538.162	Black-faced Woodswallow	1	
1	26/09/2022	1.08	400190.177	7591538.162	White-winged Triller	2	
1	26/09/2022	1.07	400136.106	7591537.381	Budgerigar	1	
1	26/09/2022	1.07	400136.106	7591537.381	Zebra Finch	3	
1	26/09/2022	1.07	400136.106	7591537.381	Black-faced Woodswallow	1	
1	26/09/2022	1.06	400075.517	7591553.607	Budgerigar	37	
1	26/09/2022	1.06	400075.517	7591553.607	Galah	2	
1	26/09/2022	1.06	400075.517	7591553.607	Zebra Finch	18	
1	26/09/2022	1.06	400075.517	7591553.607	Brown Honeyeater	3	
1	26/09/2022	1.05	400010.608	7591549.88	Zebra Finch	12	
1	26/09/2022	1.04	399954.623	7591540.895	Zebra Finch	1	
1	26/09/2022	1.03	399909.791	7591534.304	White-plumed Honeyeater	2	
1	26/09/2022	1.03	399909.791	7591534.304	Budgerigar	4	
1	26/09/2022	1.03	399909.791	7591534.304	Torresian Crow	1	
1	26/09/2022	1.02	399846.436	7591529.921	White-winged Triller	1	
1	26/09/2022	1.02	399846.436	7591529.921	Torresian Crow	1	
1	26/09/2022	1.02	399846.436	7591529.921	Budgerigar	1	
1	26/09/2022	1.02	399846.436	7591529.921	Singing Honeyeater	2	
1	26/09/2022	1.02	399846.436	7591529.921	Zebra Finch	1	
1	26/09/2022	1.01	399800.359	7591474.504	Galah	2	
1	26/09/2022	1.01	399800.359	7591474.504	Brown Honeyeater	3	
1	26/09/2022	1.01	399800.359	7591474.504	White-plumed Honeyeater	2	
1	26/09/2022	1.01	399800.359	7591474.504	Masked Woodswallow	12	

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