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OAKAJEE PORT AND RAIL PTY LTD

EGERNIA STOKESII BADIA SUMMARY OF RESULTS

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OAKAJEE PORT AND RAIL PTY LTD

Egernia stokesii badia
Summary of Results

14 May 2010

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GLOSSARY OF TERMS

Approved Port The deepwater port located at Oakajee. The Port was approved by the state government in 1998 by Ministerial Statement 469 and more recently updated by an approved 45C process.

Conservation Significant This term is applied to species which are protected under the *Environment Protection and Biodiversity Conservation Act 1999*, the *Wildlife Conservation Act 1950*, or are listed by the Department of Environment and Conservation as priority fauna.

Freehold Land Area land that is permanently owned by a person or persons and is not the subject of a lease arrangement. Within the Project area this extends from Oakajee to the western boundary of Wandina Pastoral Station (approximately 145 km from the coast).

Oakajee Port and Rail Development The larger OPR project comprising the marine port, terrestrial port and rail components, each the subject of a separate approvals process.

Pastoral Land Area land that is the subject of a lease arrangement with the State Government of Western Australia, and the holder of the lease and is used for grazing livestock on native vegetation. The Pastoral land area extends from the western boundary of Wandina Pastoral lease (chainage 145 km) to Jack Hills (chainage 560km).

Priority Ecological Community (PEC) Possible threatened ecological communities that do not meet survey criteria are added to DEC's Priority Ecological Community 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

Project Area The area described in the Railway (Oakajee Bill 2010 (Special Act Corridor), being a 4 km corridor within pastoral land area and a 3.2 km corridor within freehold land area.

Proposed alignment The rail construction and operational footprint, being a much smaller area, completely located within the Project area.

Threatened ecological community (TEC) is one which is found to fit into one of the following categories; "presumed totally destroyed", "critically endangered", "endangered" or "vulnerable".

The Project The rail Project consisting of 560 km of rail from Oakajee to the Jack Hills mine and including a rail spur to join the existing WestNet (Mullewa) line and another spur to Weld Range.

Study Area A 10 km wide corridor encompassing the Project Area (above), in which all vertebrate fauna surveying was contained.

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EXECUTIVE SUMMARY

Oakajee Port and Rail Pty Ltd (OPR) propose the Oakajee Rail Development (the Project), a component of the larger Oakajee Port and Rail Development which also consists of the Oakajee Port (Approved Port) and the Oakajee Port Terrestrial Development which is the subject of a separate environmental impact assessment.

The Project comprises the development of approximately 570 km of rail formation within a rail transport corridor from mines in the northern mid-west to an export port at Oakajee located approximately 24 km north of Geraldton. The mainline (of approximately 530 km) extends from the western boundary of Reserve 16200 near the North West Coastal Highway to Jack Hills mine in the north-east. In addition, the Project includes a 10-15 km spur to Weld Range and another 21 km spur to connect to the existing WestNet (Mullewa) line to potentially connect the mines south of Mullewa to the Oakajee Port.

OPR commissioned *ecologia* Environment (*ecologia*) to conduct fauna surveys over proposed alignments in the mid-west from 2006 to 2009. During these investigations the black form of *Egernia stokesii badia* (listed as 'Endangered' under the *Environmental Protection and Biodiversity Conservation Act*) was discovered. As a result of extensive targeted surveys for the species conducted during the baseline fauna surveys, more than 50 previously unknown locations were discovered in Murchison region.

As a result of these findings, OPR commissioned *ecologia* to undertake further targeted fauna surveys for *E. stokesii badia* within the project ares.

- a helicopter survey was conducted in March 2009. All suitable habitat within the project area was identified and intensive on-ground searches were conducted by two zoologists experienced in recognising *E. stokesii badia* (black form) habitats, scats and individuals. Two proposed borrow areas were identified as highly likely to have skink populations – these sites were ground-truthed during September and November 2009 surveys; and
- targeted surveys focussing on determining the presence of skinks or suitable habitat in proposed geotechnical feasibility areas were conducted, as required by respective clearing permits. Fourty four feasibility survey areas (38 geotechnical areas, 2 proposed ballast quarries and 4 hydrogeological areas) were surveyed for this purpose in November 2009. Two zoologists searched intensively for suitable habitat and signs of the species presence.

The helicopter survey of the rail corridor identified all suitable habitat within the Project Area, consisting of seventeen locations that contained suitable habitat and were subsequently surveyed. Of these, 12 contained either individuals or scats of *E. stokesii badia*. For each of the survey locations, photographs and the approximate extent of suitable granite habitat were recorded.

Within the rail corridor, two large areas likely to contain numerous populations were identified. The first encompassed Sites 9, 10 and 11 (Area 1) and the second encompassed Sites 13 and 14 (Area 2). The proposed alignment does come relatively close (50-60 m) to some habitat where individuals were found, but no direct impacts are expected and the granite habitat is also dispersed more widely in these areas. The alignment bisects Area 1 and Area 2, potentially preventing movement of individuals, as it is unknown whether the skinks are capable of crossing over or under the rail lines.

As most suitable granite outcrops are situated well away from the rail line, this should not affect the long-term survival of this sub-species.

During the helicopter surveys (March 2009), subsequent freehold surveys (September 2009) and feasibility area surveys (November 2009) several proposed ballast / borrow areas have been

identified as either hosting the species, or having highly favourable habitat. These sites are referred to as Borrow Search Area (BSA) 16, BSA97, BSA130, Rock Borrow (RB) 1 (or BSA137) and RB2 (or BSA138).

Recommendations for alleviating or preventing impacts to *Egernia stokesii badia* are summarised below:

- maintaining a distance of 200 m between impact areas (proposed alignment and rock borrow areas) and any known E. *stokesii badia* colonies or individuals where possible,
- provision of fauna passages below the rail lines to allow movement of individuals within the populations that occur in Area 1 and Area 2,
- translocation of individuals to habitats away from the development prior to construction, if required,
- Rehabilitate quarries to form suitable *E. stokesii badia* habitat.
- annual monitoring of any *E. stokesii badia* populations situated within 300 m of rail and infrastructure sites, and
- educate and train staff so that they can recognise the species/subspecies, it's habitat and how to notify environmental staff if the subspecies is encountered during construction activities..

1 INTRODUCTION

1.1 PROJECT OVERVIEW

Oakajee Port and Rail Pty Ltd (OPR) propose the Oakajee Rail Development (the Project), a component of the larger Oakajee Port and Rail Development which also consists of the Oakajee Port (Approved Port) and the Oakajee Port Terrestrial Development which is the subject of a separate environmental impact assessment.

The Project comprises the development of approximately 570 km of rail formation within a rail transport corridor from mines in the northern mid-west to an export port at Oakajee located approximately 24 km north of Geraldton (Figure 1.1). The mainline (of approximately 530 km) extends from the western boundary of Reserve 16200 near the North West Coastal Highway to Jack Hills mine in the north-east. In addition, the Project includes a 10-15 km spur to Weld Range and another 21 km spur to connect to the existing WestNet (Mullewa) line to potentially connect the mines south of Mullewa to the Oakajee Port.

A Special Act of Parliament will authorise the construction of the railway within a defined corridor (Special Act Corridor, hereafter referred to as the Project area). This corridor will generally be 4 km wide in pastoral land areas and 3.2 km wide within the freehold land area. The proposed alignment will be located within the Project area, with a footprint of up to 200 m wide for construction purposes, plus additional areas for supporting infrastructure, including camps, laydown areas and maintenance yards. The permanent rail operation corridor will be up to 100 m wide.

1.2 BACKGROUND

ecologia was commissioned by OPR to conduct a vertebrate fauna assessment of the proposed rail infrastructure between 2006 and 2009. As part of this assessment *ecologia* conducted single and dual phase comprehensive Level 2 trapping surveys at 57 regional sites and at 49 sites located within the rail corridor. *ecologia* also conducted opportunistic active searches at 103 sites within the project area, totalling over 200 survey locations across the Murchison region (Figure 1.1).

The black form of the Western Spiny-tailed Skink, *Egernia stokesii badia* (listed as Endangered under the *Environmental Protection and Biodiversity Conservation Act*) was first recorded during comprehensive baseline fauna surveys undertaken along the rail corridor in 2006. As a result of the discovery of numerous previously unknown populations, OPR commissioned a further two targeted fauna surveys for *E. stokesii badia*. The first, referred to as the 'Helicopter Survey' hereafter, was designed to map the occurrence of *E. stokesii* within the project area. The second, referred to as the 'Feasibility Areas Survey' hereafter, was designed to search for *E. stokesii badia* within geotechnical feasibility study locations including proposed future quarry/borrow areas.

A regional survey was recently conducted to determine the distribution of the black form of *E. stokesii badia* in the Murchison region. Some information from this survey is included in this report although a more detailed report will be developed in the near future.

It is the black form of *E. stokesii badia* that is referred to throughout the text, unless otherwise stated.

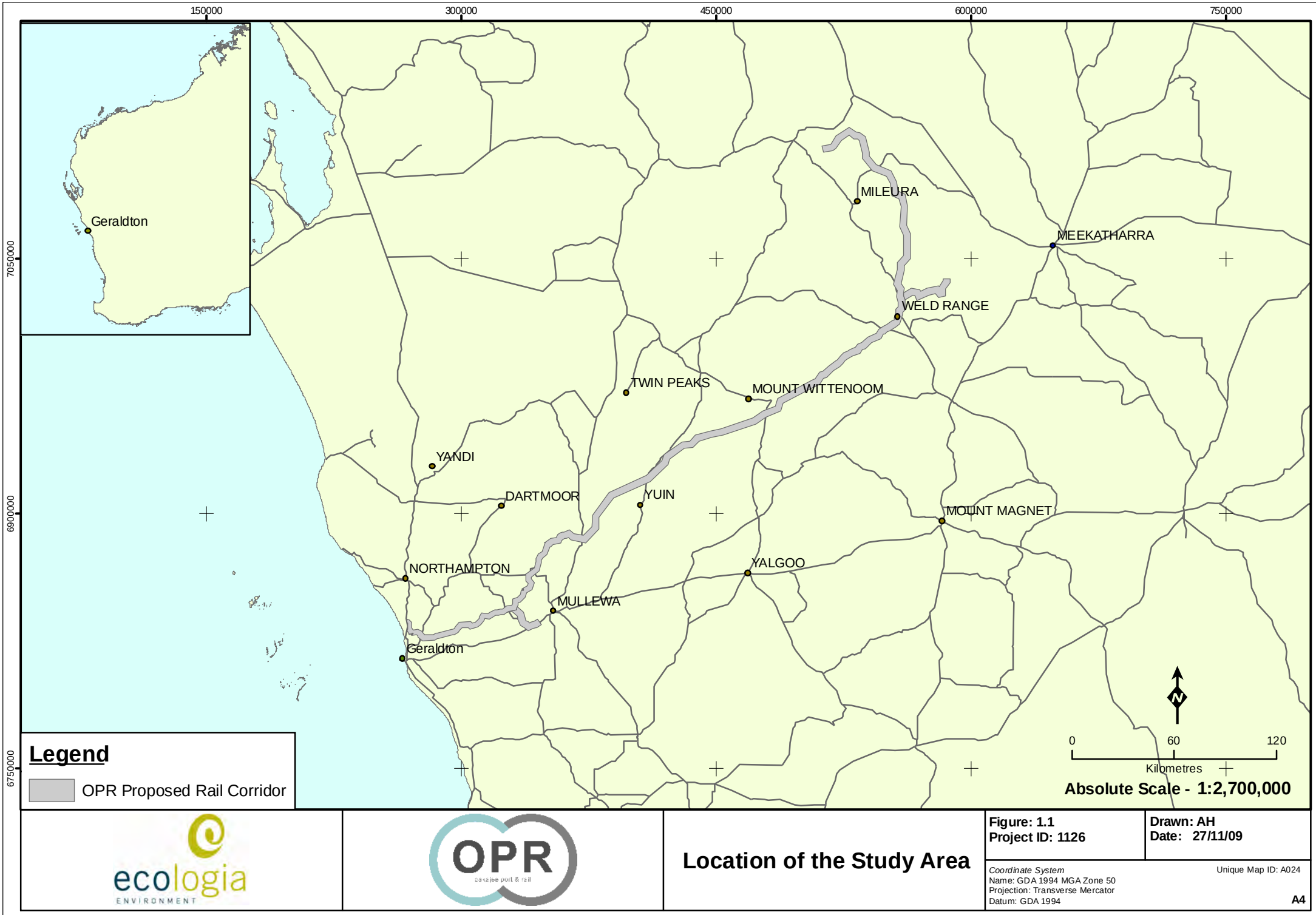
1.3 OBJECTIVES

All surveys were undertaken in recognition of the Environmental Protection Agency's (EPA) objectives with regard to fauna management:

- to maintain the abundance, species diversity and geographical distribution of terrestrial fauna; and,
- to protect Specially Protected (Threatened) fauna, consistent with the provisions of the Western Australian *Wildlife Conservation Act 1950* (WC Act).

This document provides:

- a review of background information (including literature and database searches);
- life history of *E. stokesii badia*;
- a description of fauna habitats occupied by *E. stokesii badia*;
- locations of *E. stokesii badia* recorded during ecologia's EIA and regional fauna surveys;
- information on the presence of *E. stokesii badia* in proposed borrow areas, and
- a discussion of potential impacts to the species



ecologia ENVIRONMENT

OPR oakajee port & rail

Location of the Study Area

Figure: 1.1
Project ID: 1126

Drawn: AH
Date: 27/11/09

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: A024

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2 SPECIES INFORMATION

2.1 SPECIES DESCRIPTION

Egernia stokesii badia belongs to the *cunninghami* group; a group of moderately large (SVL 170 mm), diurnal, saxicolous (rock dwelling) lizards that have sharply keeled scales (Chapple 2003). Diet is typically herbivorous with some insect material taken when available (Duffield and Bull 1998).

Egernia stokesii badia are unevenly distributed throughout the dry to semiarid habitats of Western Australia (Storr *et al.* 1999), occurring in York Gum (*Eucalyptus loxophleba*) woodland, Gimlet (*Eucalyptus salubris*) and Salmon Gum (*Eucalyptus salmonophloia*) woodland (How *et al.* 2003). At present two colour forms are known, the typically reddish brown form occurring across the northern and central wheatbelt and a black form recorded from the Murchison region (Figure 2.1).

Figure 2.1 *Egernia stokesii badia* from Rail Survey

2.2 HABITAT

The black form of Western Spiny-tailed Skink was formerly known from only a handful of locations at Woolgerong Rock and 4 km east of Yalgoo (How *et al.* 2003). According to the limited literature relating to the black form, all individuals have been found sheltering in deep horizontal rocky crevices or under boulders in stony hills (How *et al.* 2003; DEC 2007; Wilson and Swan 2008).

All individuals recorded during the fauna assessment surveys were of the black form of *E. stokesii badia*. The black form differs from the nominate form of the sub-species by their black colouration, lack of patterning in adults and differing head and scale morphology. The habitat preferences of the black form further distinguish this population from the nominate form of *Egernia stokesii badia*, which inhabits fragmented woodlands of the wheatbelt, occurring in tree hollows rather than rock crevices.

Surveys by *ecologia* of the project area and surrounds have substantially increased the known population of the species with more than 50 new locations discovered during fauna surveys

(*ecologia* 2009), and 20 new locations during the recent regional survey. All records are from emergent granite formations ranging in size from hills to low rises. The size of the granite area is not usually a factor, although areas of more extensive habitat tend to have concomitantly larger numbers of individuals and/or family groups. Flat granite domes with no boulders or crevices do not contain *E. stokesii badia* as they lack the necessary habitat for these animals.

2.3 LIFE HISTORY

Members of the Australian skink genus *Egernia* are unusual among lizards as they display sociality and post-hatching parental care (Chapple 2003). *E. stokesii* have also been found to display these behaviours. Stable social aggregations probably evolved in association with prolonged parental care and delayed juvenile dispersal. In *Egernia stokesii* groups of 2-17 individuals including 2-8 adults are known to live together in social groups (Duffield and Bull 2002b; DEC 2007). Individuals of the same social group share common crevice refuges within the group's home range, with each social group utilising between 2-11 crevices, of which 1-7 are core crevices (Duffield and Bull 2002a).

The home range overlap between social groups is relatively small (14.1%) and dispersal in and out of *E. stokesii* populations is generally low. Individuals are expected to live for several decades (How *et al.* 2003) with juveniles taking over 5 years to reach mature size. Most juveniles and sub-adults remain in the social group of their parents for that 5 year period and longer (Duffield and Bull 1996; Duffield and Bull 2002b). Family groups also tend to use communal faecal middens located near inhabited crevices (How *et al.* 2003), which are generally obvious and are used as an indicator of *E. stokesii badia* presence (Duffield and Bull 1998).

2.4 CONSERVATION STATUS

Egernia stokesii badia is listed under the EPBC Act as Endangered and as Schedule 1 (fauna that is rare or likely to become extinct) under the WC Act.

Threatening processes that are thought to be the cause of the decline of this species have been identified as a combination of overgrazing by stock and clearance of woodland habitat for agriculture (Cogger *et al.* 1993). Clearance of woodland habitat is less of a threat to the black form as they use rock crevice habitats rather than tree hollows (which are preferred by the red form), but overgrazing of plant material by livestock is likely to be the most significant risk to the species, as it reduces food availability, assuming that the black form forages on plant material in a similar manner to that shown more widely for *Egernia stokesii* (Duffield and Bull 1998). It is unknown whether *E. stokesii badia* is predated by introduced predators.

3 SURVEY METHODS

3.1 COMPREHENSIVE BASELINE SURVEY

Comprehensive baseline fauna surveys were undertaken to record as many fauna species as possible, and conformed to a Level 2 survey as described in Guidance Statement 56 (EPA 2004). 106 trapping sites in the Murchison region were surveyed using a variety of sampling techniques, both systematic and opportunistic . Trapping for terrestrial mammals and herpetofauna was undertaken using a standardised trapping format comprising a combination of pit-fall traps, Elliott box traps, funnel traps and cage traps (Figure 3.1).

Each trapping site consisted of the following:

- Pit-trap and drift fence: Five PVC pipe (16 cm diameter, minimum 50 cm deep) and five 20 L plastic buckets (30 cm diameter, 40 cm deep) were established at each site. A six metre flywire drift fence (30 cm high) bisected the pits, directing fauna into the traps.
- Elliott box traps: Twenty medium sized Elliott box traps (9 x 9 x 32 cm) were placed at each site, and baited with Universal Bait (a mixture of peanut butter, rolled oats and sardines). One trap was placed in association with the pit trap and one trap was placed in between pit traps
- Funnel traps: Funnel traps (Ecosystematica Type III) were placed in association with drift fences. Twenty funnel traps were used per site, with a trap being placed at each end of the drift fence.
- Cage traps: Two traps were used per site with one trap placed at each end of the trap line.

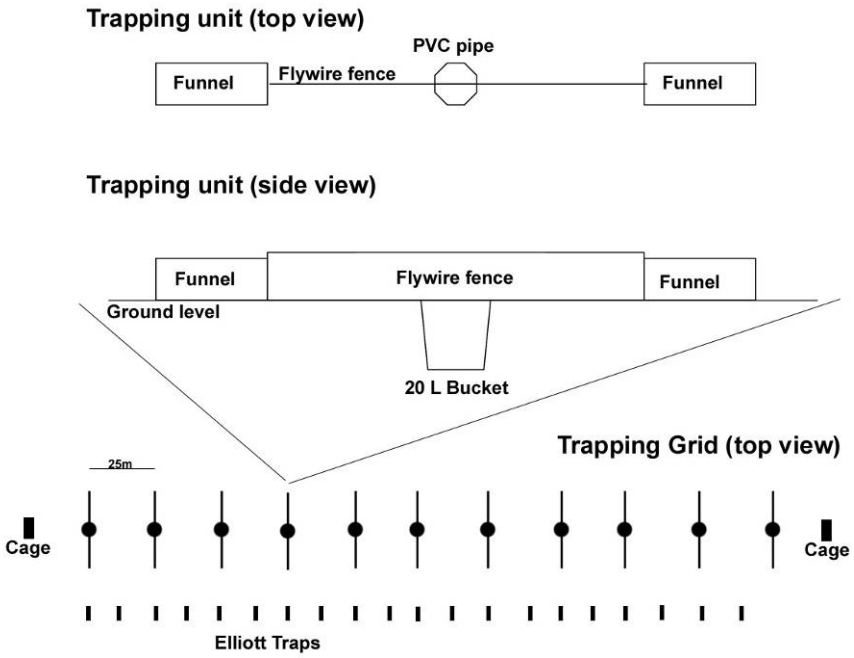


Figure 3.1 Site Setup for Baseline Trapping Survey

Trapping and opportunistic sites were searched by hand for cryptic species, which comprised searching beneath the bark of dead trees, breaking open old logs, stumps and dead free-standing trees, investigating burrows and over-turning logs and stones. Sites were selected on the basis of fauna habitat (targeting uncommon habitats or habitats poorly-represented by trapping sites) and the possibility of harbouring conservation significant fauna. Greater than 50 hrs were spent searching granite outcrops to determine the presence of *E. stokesii badia*. Observations or secondary evidence of their presence (e.g. scats) were recorded when encountered.

Relevant survey effort expended within the project area was as follows:

- trapping grids were open for 778 nights for a total of 43,368 trap nights,
- greater than 50 hours were spent searching for Western Spiny-tailed Skink,
- 350 hours were spent on opportunistic diurnal searching, , and
- 210 hours were spent on opportunistic nocturnal searching

3.2 HELICOPTER SURVEY

ecologia personnel travelled along the entire proposed rail corridor by helicopter between 3rd – 6th March 2009 identifying suitable granite outcrop habitat and surveying potential infrastructure areas. A helicopter was used to access likely habitat locations inaccessible by road.

Where potential habitat suitable for *E. stokesii badia* was observed, the helicopter landed and two zoologists experienced in recognising *E. stokesii badia* habitats, scats and individuals, searched intensively for signs of the species. Seventeen areas of likely habitat were observed. At each site, GPS recordings, photographs and site descriptions were taken (Figure 3.3).

3.3 FEASIBILITY AREA SURVEY

To comply with directives outlined in vegetation clearing permit numbers CPS3196, CPS3255 and CPS3311, *ecologia* personnel visited 44 feasibility survey areas (38 geotechnical sites, 2 ballast quarries and 4 hydro-geological sites) between 6th – 13th November 2009 to assess the likelihood of *E. stokesii badia* presence (Figure 3.3). Where potentially suitable habitat was observed, two zoologists experienced in recognising *E. stokesii badia* habitats, scats and individuals, searched intensively for signs of the species. At each site, GPS recordings, photographs and site descriptions were taken.

3.4 SURVEY TEAMS

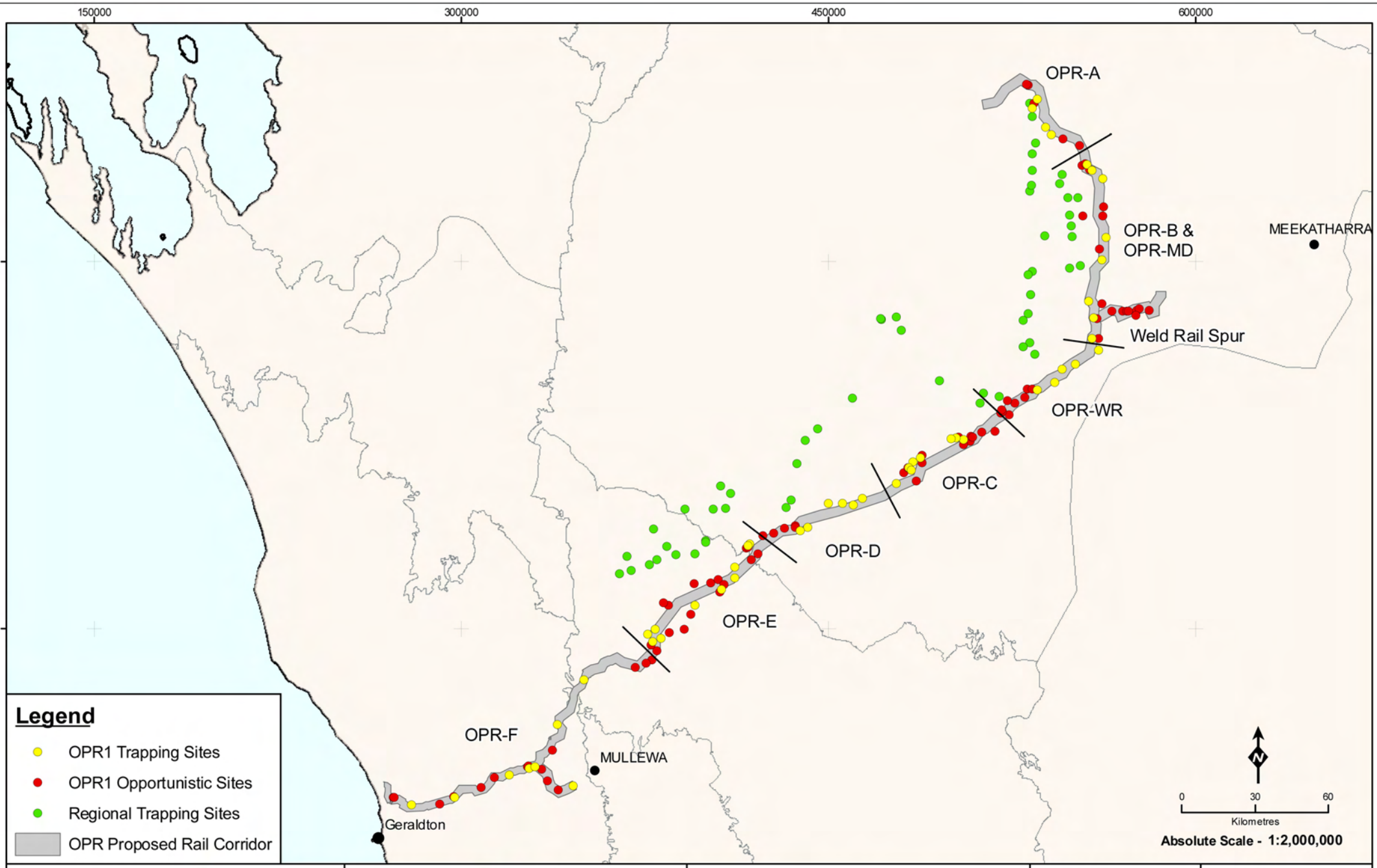
Survey staff for each survey is listed in Table 3.1

Table 3.1 Field Survey Personnel

Key Survey Members	Specialty	Level 2 Survey	Helicopter Survey	Infrastructure survey
S. Ford	Ornithology/Herpetology	•		
E. Fox	Ornithology	•		•
V. Cartledge	Herpetology	•		
D. Cancilla	Mammalogy	•	•	
J. Turpin	Ornithology	•		
T. Rasmussen	Herpetology	•	•	•
B. Barnett	Herpetology/Ornithology	•		
OTHER SURVEY STAFF				
B. Stewart	Herpetology	•		

Key Survey Members	Specialty	Level 2 Survey	Helicopter Survey	Infrastructure survey
A. Heidrich	Herpetology	•		
S. Pynt	Herpetology	•		
J. Nolthenius	Herpetology	•		
M. Wood	Ornithology	•		
G. Swann	Ornithology	•		
M. Weerheim	Ornithology	•		
B. Greatwich		•		
D. Bradshaw	Herpetology	•		
D. Algaba	Herpetology	•		
M. White		•		
R. Armistead	Mammalogy	•		
M. Landers		•		
T. Rose		•		
P. Kernan		•		

The survey was conducted under DEC Licence SF006776.



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OPR

Location of Trapping Survey Sites

Figure: 3.2
Project ID: 1126

Drawn: AH
Date: 26/10/09

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: A025

A4

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OPR

Locations of Targeted Survey Sites

Figure: 3.3
Project ID: 1130

Drawn: EF
Date: 09/12/09

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: xxxx

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4 RESULTS

Evidence of *Egernia stokesii badia* was recorded by *ecologia* from 96 locations (Figure 4.3, Table 4.1) across the Murchison region. All individuals were recorded from granite outcrops containing suitably sized crevices.

4.1 COMPREHENSIVE BASELINE SURVEY

Egernia stokesii badia was recorded from both systematic trapping sites and opportunistically during the OPR rail fauna assessments. Twenty seven individuals were recorded from two trapping sites (OPR C4 and OPR E3) and opportunistically in the OPR D, OPR E and OPR WR surveys. A further 97 individuals were recorded during the regional fauna assessment from nine trapping sites and opportunistically during the regional surveys. *E. stokesii badia* were recorded from 54 locations as shown in Figure 4.3.

4.2 HELICOPTER SURVEY

Seventeen sites and potential infrastructure areas were surveyed along the length of the rail corridor with evidence of *Egernia stokesii badia* recorded at 12 sites. No evidence of *E. stokesii badia* was found at sites 5, 7, 15, 16 or 17. Each site is discussed below with comments regarding how each area may be affected by the proposed rail corridor. Detailed site photos and habitat extents are given in Appendix A. Two large areas, referred to as Area 1 (which includes Sites 9, 10 and 11) and Area 2 (which includes Sites 13 and 14), represent large areas of conglomerated, but patchy, *E. stokesii badia* habitat which are bisected by the Project.

Survey results are summarised in Table 4.1; where the proposed alignment comes within 200 m of skink habitat, the closest point of habitat has been noted. Points where the proposed alignment comes within 200 m of skink habitat (Area 1 and Area 2) have also been marked on the plates of the sites with green dots (Appendix A). The GPS positions of these points are also provided in Table 4.1.

4.2.1 Helicopter Survey Site Records

Sites 1 and 2

Site 1 and Site 2 were located on a small ridge of granite that runs 4.2 km from west to east. *E. stokesii badia* were recorded at both sites with two individuals recorded at Site 1 and five individuals recorded at Site 2.

Located approximately 1.8 km to the north of the proposed alignment, this habitat is not expected to be impacted and is therefore not considered further.

Site 3

Site 3 was located in a discrete area of low granite boulders lying approximately 900 m north-west of the proposed alignment. *E. stokesii badia* were recorded at this site with one individual and a faecal midden observed (Figure 4.1).

The area is unlikely to be impacted based on the proposed alignment.

Figure 4.1 Figure showing *Egernia stokesii badia* Scats

Site 4

Site 4 was an open area of scattered granite boulders in open mulga woodland located approximately 650 m north of the proposed alignment. *E. stokesii badia* were recorded at this site with one individual observed. The area is not expected to be impacted directly.

Site 5

Site 5 was located at a large, low granite outcrop approximately 650 m north of the proposed alignment. No *E. stokesii badia* were recorded at this site and it was noted that little suitable microhabitat, notably deep cracks in the granite, occurred in this area.

Site 6

Site 6 was located at a large, discrete granite outcrop approximately 900 m south-east of the proposed alignment. *E. stokesii badia* were recorded at this site, with two individuals and numerous faecal middens observed (Figure 4.2).

This area is not expected to be impacted by the proposed alignment.

Figure 4.2 *Egernia stokesii badia* Individual and Scats Observed at Site 6

0 200000 400000 600000

7400000 7200000 7000000 6800000 6600000 6400000

Cape Range
Hamersley
Ashburton
Augustus
Wooramel
Edel
Western Murchison
Meekatharra
Eastern Murchison
Geraldton Hills
Mullewa
Geraldton
Tallering
Leseur Sandplain
Southern Cross
Avon Wheatbelt P1
Dandarragan Plateau
Perth
Perth
Avon Wheatbelt P2
Western Mallee
Northern Jarrah Forest

Legend

- *Egernia stokesii badia* - black form (ecologia OPR records)
- *Egernia stokesii badia* - black form (ecologia regional survey)
- *Egernia stokesii badia* - brown form (WAM records)
- *Egernia stokesii badia* - black form (University of WA)

N

0 60 120

Kilometres

Absolute Scale - 1:2,800,000

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OPR oakajee port & rail

Egernia stokesii badia Locations in the Murchison Region

Figure: 4.3
Project ID: 1130

Drawn: AH
Date: 25/01/10

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: A119

A3

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Sites 7 and 8

Site 7 and Site 8 were located approximately 1.2-1.5 km north-west of the proposed alignment. Several *E. stokesii badia* scats were found at Site 8, which indicated that they were present in the area.

The area consists of a moderately large grouping of granite boulders and outcrops. This area is not expected to be impacted by the proposed rail alignment.

Sites 9, 10 and 11 (Area 1)

Sites 9, 10 and 11 were located in a large area (approximately 30 km^2) of flat granite domes and scattered granite boulder piles. *E. stokesii badia* were recorded at Sites 9 and 10 with scats also recorded at all three sites. Five individuals were recorded at Site 9 and one was recorded at Site 10 (Figure 4.4). This wider area of suitable habitat will be referred to as Area 1 throughout.

The proposed alignment bisects Area 1, and while no granite is directly impacted, the alignment comes within 50-60 m of some suitable habitat. However, suitable habitat is available more widely at this location and it is expected that the alignment will fragment this large cluster of *E. stokesii badia* habitats potentially reducing movement of individuals between the two halves.

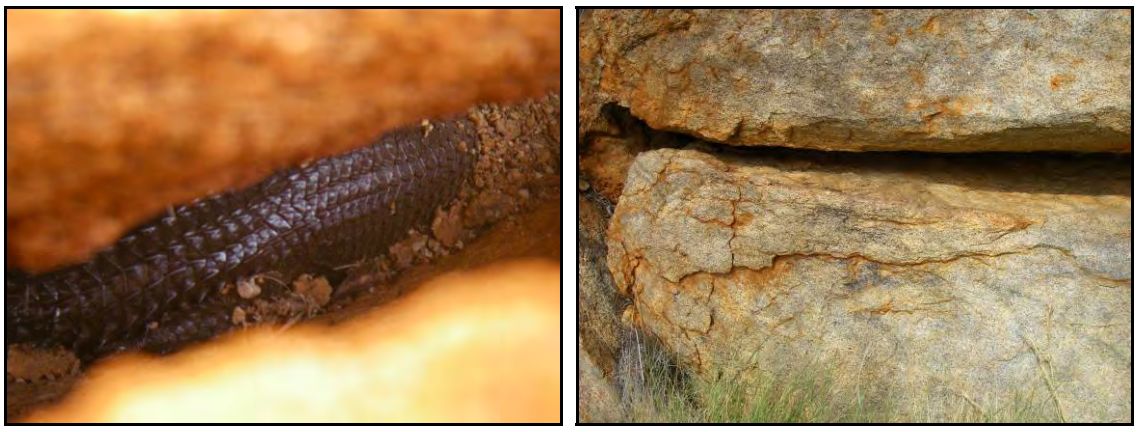

Figure 4.4 ***Egernia stokesii badia*** **Recorded in a Cracked Boulder at Site 9**

Site 12

Site 12 was located at a discrete granite outcrop located approximately 1.67 km south-east of the proposed alignment. *E. stokesii badia* scats was recorded at this site indicating that they occur in this outcrop.

The proposed alignment is not expected to impact this area.

Sites 13 and 14 (Area 2)

Site 13 was located at a set of three granite outcrops approximately 200 m south-east of the proposed alignment. Site 14 is located in a very large area (approximately 75 km^2) of scattered granite piles, granite domes and granite outcrops. The proposed alignment crosses through this area (referred to as Area 2 throughout) and most of the habitat is not impacted. Similar to Area 1 in which Sites 9, 10 and 11 were located, there is potential for the rail lines to separate populations in this area by potentially forming a barrier to their movement.

E. stokesii badia were recorded at Site 13 and 14 with one individual and several faecal middens observed at each site (e.g. Figure 4.5).

Figure 4.5 Scats and Crevice at Site 14

Sites 15, 16 and 17

Sites 15, 16 and 17 are located between Weld Range and Jack hills. No evidence of *E. stokesii badia* was observed at these sites.

All three sites incorporate discrete granite outcrops that are not expected to be impacted by the current rail deviation.

Aerial photography and habitat photographs are available for each site in Appendix A.

BSA16

This potential infrastructure area is a large granite outcrop located in farmland near Geraldton (Figure 4.6). *ecologia* searched this area in September 2009 during general Level 2 fauna surveys of the freehold portion of the project area (*ecologia* 2009) and found suitable habitat. No individuals or scats were recorded but accounts from the land owner confirm that "large black skinks occur in the boulder piles and they are generally only seen in summer" (Ian Grant *pers. comm.*). Further searches of this area will be conducted during the second phase of the freehold properties survey planned for autumn 2010.

Figure 4.6 Aerial View of BSA16

BSA97

Located less than 1 km north of Site 3, this area contains scattered granite boulders forming habitat that is highly likely to support *E. stokesii badia*.

Figure 4.7 Aerial View of BSA97

Table 4.1 summarises the results above and indicates the areas or points at which the proposed alignment crosses within 200m of potential or known *E. stokesii badia* habitat.

4.3 FEASIBILITY AREA SURVEY

The survey observed *E. stokesii badia* individuals and scats in three areas: RB1, RB2 (also referred to as BSA137 and BSA138), and BSA130 (located next to Site 9) (Table 4.1). Marginal to good habitat for *E. stokesii badia* was recorded from an additional two geotechnical clearance sites (CLBH08 access route and CLTP36) (Table 4.1). No suitable habitat was recorded from any of the other 44 survey locations. Details of each clearance area are described below.

RB1

Five *E. stokesii badia* individuals and several scat piles were observed in granite outcrops in this area (Figure 4.8),.

All four proposed drill locations within RB1 contained mostly marginal habitat for *E. stokesii badia*, however larger granite outcrops were observed within each area that may provide suitable *E. stokesii badia* habitat (Appendix B).

Figure 4.8 *Egernia stokesii badia* Habitat in which an Individual was Recorded

RB2

A single individual *E. stokesii badia* was observed in a granite outcrop in RB2BH03 and numerous scats were observed within and surrounding RB2BH03 and RB2BH04 (Appendix B), suggesting that a local population is present. RB2BH01 and RB2BH02 both contain granite habitat suitable for *E. stokesii badia* (Appendix B), but no evidence of individuals were found.

BSA130

This area is associated with the large granite field encompassing Sites 9, 10 and 11 and should be considered likely to support *E. stokesii badia* as individuals were recorded at Site 9, less than 250 m to the north-east.

Figure 4.9 Aerial view of BSA130

CLBH08 Access Route

Half way along the access route between CLTP37 and CLBH08 (447505e 6946513n) a small granite outcrop provides suitable habitat for *E. stokesii badia* although no individuals or scats were observed.

Figure 4.10 View of small outcrop along access route

Table 4.1 Summary of Survey Results

Site	Easting	Northing	Distance from Rail (closest habitat distance) (km)	*Egernia stokesii badia* recorded	Comments	Points where rail is < 200 m from habitat (shown in Appendices as green dots)
Level 2 Surveys						
ST01	379989	6928361	19.5	5 x individuals	Central Survey E pre Nov. 06	
ST02	379592	6928026	19.5	5 x individuals	Central Survey E pre Nov. 06	
ST03	379891	6928332	19.5	3 x individuals	Central Survey E pre Nov. 06	
ST04	379932	6928383	19.5	1 x individuals	Central Survey E pre Nov. 06, Vouchered with WAM, ecologia ref CENT003	
ST05	380708	6938015	27.9	2 x individuals	Central Survey E pre Nov. 06	
ST06	380720	6938031	27.9	scats	Central Survey E pre Nov. 06	
ST07	380744	6938064	27.9	scats	Central Survey E pre Nov. 06	
ST08	380754	6938140	27.9	2 x individuals	Central Survey E pre Nov. 06	
ST09	379699	6928032	19.5		C Site Spring 2006	
ST10	379699	6928032	19.5		C Site Spring 2006	
ST11	417010	6933371	3.9	scats	Central Rail Survey -2nd phase Jun 07	
ST12	417000	6933336	3.9	scats	Central Rail Survey -2nd phase Jun 07	
ST13	417144	6933512	3.9	scats	Central Rail Survey -2nd phase Jun 07	
ST14	433824	6952648	9.7	1 x individuals	Central Rail Survey -2nd phase Jun 07	
ST15	416964	6933295	3.9	2 x individuals, scats	Central Rail Survey -2nd phase Jun 07	
ST16	378974	6940881	31.5	1 x individuals	Central Rail Survey -2nd phase Jun 07	
ST17	417013	6933362	3.9	1 x individuals	Central Rail Survey -2nd phase Jun 07	
ST18	416941	6933330	3.9	1 x individuals	Central Rail Survey -2nd phase Jun 07	
ST19	416494	6932819	4.6	1 x individuals	Central Rail Survey -2nd phase Jun 07	
ST20	437100	6967339	22.8	12 x individuals	M Site Spring 2006	
ST21	440286	6994826	48.5	8 x individuals	M Site Spring 2006	
ST22	459848	6994431	41.0	1 x individuals	M Site Spring 2006	
ST23	407923	6949061	21.3	1 x individuals	M Site Spring 2006	
ST24	407923	6949061	21.3	1 x individuals	M Site Spring 2006	
ST25	533205	6998028	1.3	1 x individuals	W Sites Spring 06	
ST26	507584	7005601	22.4	1 x individuals	W Sites Spring 06	

Site	Easting	Northing	Distance from Rail (closest habitat distance) (km)	*Egernia stokesii badia* recorded	Comments	Points where rail is < 200 m from habitat (shown in Appendices as green dots)
ST27	531284	6997826	2.4	1 x individuals	W Sites Spring 06	
ST28	379699	6928032	19.5	3 x individuals	MML Autumn 2007	
ST29	416973	6933490	4.0	4 x individuals	MML Autumn 2007	
ST30	433700	6952507	9.7	6 x individuals	MML Autumn 2007	
ST31	433700	6952507	9.7	3 x individuals	MML Autumn 2007	
ST32	433700	6952507	9.7	3 x individuals	MML Autumn 2007	
ST33	433700	6952507	9.7	scats	MML Autumn 2007	
ST34	416980	6933897	4.2	1 x individuals	MML Autumn 2007	
ST35	416973	6933490	4.0	9 x individuals	MML Autumn 2007	
ST36	416973	6933490	4.0	2 x individuals	MML Autumn 2007	
ST37	416973	6933490	4.0	3 x individuals	MML Autumn 2007	
ST38	416973	6933490	4.0	1 x individuals	MML Autumn 2007	
ST39	416973	6933490	4.0	scats	MML Autumn 2007	
ST40	529428	7026221	26.2	1 x individuals	Jack Hills -south, spring 07	
ST41	531462	7028763	26.6	1 x individuals	Jack Hills -south, spring 07	
ST42	533205	6998028	1.3	1 x individuals	Jack Hills -south, spring 07	
ST43	416943	6933332	3.9	1 x individuals	Jack Hills -south, spring 07	
ST44	433572	6952538	9.7	1 x individuals	Jack Hills -south, spring 07	
ST45	531340	7028489	26.6	1 x individuals	Jack Hills -south, spring 07	
ST46	382471	6910388	4.5	4 x individuals	OPRE - Spring 08	
ST47	382471	6910388	4.5	8 x individuals	OPRE - Spring 08	
ST48	416912	6933293	3.9	5 x individuals	OPRD - Spring 08	
ST49	436379	6942068	0.3	1 x individuals	OPRD - Spring 08	
ST50	436526	6941235	0.3	1 x individuals	OPRD - Spring 08	
ST51	379661	6928035	19.5	3 x individuals	Central Survey C Nov 06	
ST52	379937	6928386	19.5	1 x individuals	Central Survey C Nov 06	
ST53	379661	6928035	19.5	9 x individuals	Central Survey C Nov 06	
ST54	437098	6967540	22.8	1 x individuals	Central Survey C Nov 06	

Site		Easting	Northing	Distance from Rail (closest habitat distance) (km)	*Egernia stokesii badia* recorded	Comments	Points where rail is < 200 m from habitat (shown in Appendices as green dots)
Helicopter Survey							
1		401659	6918799	1.9	2 x individuals	Discrete granite outcrop continues to Site 2.	
2		404880	6920053	1.8	5 x individuals, scats	Continuation of granite field from Site 1.	
3		427709	6939072	0.9	1 x individual, scats	Area of granite extends approx 250 m east and west.	
4		431955	6941152	0.65	1 x individual, scats	Discrete area of scattered granite.	
6		485917	6960475	0.9	2 x individuals, scats	Large discrete granite outcrop.	
8		488234	6967891	1.47	Oldish scats	Boulder field, Lots of cracks but appear to be too large to form suitable habitat.	
Area 1	9	506093	6976553	0.62 (0.06)	5 x individuals, scats	Sites 9, 10 and 11 are part of a large granite complex (Area 1) with suitable boulder piles throughout the area. Green dots on site aerial photograph indicate where rail alignment comes within 200 m of habitat.	Between points: 508084 E, 6976846 N 507203 E, 6976439 N and 509752 E, 6978620 N 509290 E, 6977946 N
	10	508004	6976613	0.18 (0.18)	1 x individual, scats		
	11	508349	6978723	1.2 (0.47)	Scats		
12		523678	6987432	1.67	Scats	Discrete outcrop	
Area 2	13	526298	6992389	0.2 (0.08)	1 x individual, scats	Very large area of scattered granite (Area 2). Extends up to 5 km north, east and south of waypoints. Rail may divide populations. Green dots on site aerial photograph indicate where rail alignment comes within 200 m of habitat.	At points: 526174E, 6992559 N 527053 E, 6993022 N 530033 E, 6994784 N
	14	530186	6994666	0.16 (0.02)	1 x individuals, many fresh scats		
15		555667	7089701	0.43	No individuals or signs	Discrete granite outcrop	
16		562344	7072650	1.9	No individuals or signs	Discrete granite outcrop	
17		558623	7045360	0.16	No individuals or signs	Discrete granite outcrop	

Site	Easting	Northing	Distance from Rail (closest habitat distance) (km)	*Egernia stokesii badia* recorded	Comments	Points where rail is < 200 m from habitat (shown in Appendices as green dots)
Feasibility Area Survey						
RB1	528784	6999754	5.2	5x individual, scats	Suitable habitat appears to extend along the northern edge of outcrops	
RB2	522714	6997705	6.0	1 x individual, scats		
CLBH08 access route	447505	6946513	0.09	No individuals or signs	Discrete granite outcrop, avoid if possible	
BSA16	290895	6828006	0.02	No individuals or signs	Discrete area of scattered granite. Suitable habitat and sightings of *E. stokesii badia* by land owner	Entire outcrop is located within 200m from the rail centre line
BSA97	427664	6939796	1.5	No individuals or signs	Scattered granite outcrops and boulders. Suitable habitat, avoid if possible	
BSA130	505916	6976366	0.4	Individuals, scats	Part of a large granite complex with suitable boulder piles	

Datum: WGS84, Zone: 50J. Sites where individuals or secondary evidence was found are shaded green.

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5 MANAGEMENT CONSIDERATIONS

5.1 POTENTIAL IMPACTS OF RAIL INFRASTRUCTURE

Impacts to *E. stokesii badia* are expected to be restricted to five areas along the proposed rail corridor: Area 1 and Area 2, both consisting of widely dispersed and patchy habitat that covers approx 30 km^2 and 75 km^2 respectively and three potential rock borrow areas (BSA16, RB1 and RB2).

Although little work has been done in Australia, the impact of road and rail infrastructure on wildlife has been extensively studied in Europe, Asia and North America (Forman and Alexander 1998; Jackson 2000; Cachon 2003; Clevenger and Kociolek 2006; U.S. Department of Agriculture 2006). As long linear features in a landscape, roads and railways have unique impacts on wildlife and wildlife habitats (Jackson 2000). The main impacts roads and railways can have are (Forman and Alexander 1998; Mollov 2005):

- to act as barriers to animal movements and dispersal;
- to result in habitat fragmentation or direct loss of habitat;
- to result in an ongoing source of noise, vibration and pollution; and,
- to cause direct fauna mortality.

Acting as a barrier to dispersal, habitat fragmentation and loss of habitat are likely to be the biggest potential impacts to *E. stokesii badia* as a result of the rail construction, and are discussed below.

Direct mortality of *E. stokesii badia* caused by trains is considered to be highly unlikely. Although the animals have been observed to leap short distances between boulders (*ecologia* unpublished observations), their ability to climb onto a rail line is unknown. Furthermore, the likelihood that an individual would remain on top of a rail line for any length of time is very low, as the species is generally shy and prefers to remain cryptic when a potential threat is near (*ecologia* unpublished observations).

5.1.1 Barriers to movement and dispersal

A variety of techniques have been used to mitigate the impacts of transportation systems on wildlife movements with mixed success (Jackson 2000). Wildlife passes such as tunnels or culverts help the preservation of local animal populations due to their capacity to connect habitats (Cachon 2003). Use of drainage culverts for crossing by mice and other small mammals has been observed on several occasions and the act of maintaining movement through highway corridors sustains many important ecological functions (Singleton and Lehmkuhl 1999).

Based on genetic analysis and recapture studies, dispersal rates in *E. stokesii* are thought to be low. Genetic analysis has revealed that there is a high degree of relatedness between members of a local population, demonstrating a low level of dispersal between populations (Gardner *et al.* 2001; Gardner *et al.* 2007). Studies in *E. cunninghami*, a species closely related to *E. stokesii* and showing a similar life history strategy, found that 92% of individuals had moved less than 11 m when recaptured (Stow and Sunnucks 2004).

Although females have been found to preferentially mate with males that are less related to themselves (Gardner *et al.* 2001), a study on populations of *E. stokesii* at Camel Hill (South Australia) found low levels of dispersal (approximately 5-10% recruitment/dispersal of individuals) over a six year period (Duffield and Bull 2002b).

A low dispersal rate may be expected based on the patchy nature of the black *E. stokesii badia's* preferred habitat; rocky outcrops often separated from each other by large expanses of flat, often sparsely vegetated land. Consequently, most dispersal occurs at a local level, between adjacent groups, with the rate of dispersal decreasing as a function of distance (Gardner *et al.* 2001).

Low dispersal rates over long distances may be enough to affect genetic structure, and based on genetic evidence, dispersal of up to 500 m or more may be possible (Gardner *et al.* 2001). Similar results have also been found in *E. cunninghami* with dispersal up to 477 m recorded (based on genetic analysis) (Stow *et al.* 2001), and there is a single record of an individual male *E. stokesii* travelling 350 m from its original location, and after being returned to this outcrop again moving at least 300 m away (Duffield and Bull 2002a).

Considering the comparatively large region over which the species has been recorded (Figure 4.3), these levels of dispersal, even over 500m, could be considered highly limited if these figures hold true for the black form of *Egernia stokesii badia.*

5.1.2 Habitat fragmentation and direct loss of habitat

Area 1 and Area 2 consist of large areas of patchy *E. stokesii badia* habitat. Within these two areas, two individuals were recorded within 200 m of the proposed alignment. If potentially suitable habitat cannot be avoided during construction, a search should be conducted to confirm that no individuals are present prior to clearing/destruction of the granite habitat at these locations. If individuals are discovered, translocation of said individuals to habitats away from the development may be necessary but will not pose a problem, as individuals accidentally translocated to different family groups have been known to fully integrate (Gardner *et al.* 2001).

BSA16, RB1 and RB2 consist of discrete granite outcroppings containing moderate to good habitat. Clearing in these areas will result in the loss of potential *E. stokesii badia* habitat and should be avoided if possible. If these areas cannot be avoided, a search should be conducted to determine the occurrence of individuals and if found subsequent translocation to other areas. After the completion of construction activities quarries can be rehabilitated to provide additional areas of *E. stokesii badia* habitat to offset habitat destroyed during clearing. Individuals from cleared areas can be either translocated or taken into captivity during the construction period and returned to the rehabilitated areas after construction is complete.

5.1.3 Source of noise and vibration

Noise and vibration impacts on wildlife by roads and rail networks have been widely studied (Forman and Alexander 1998; Jackson 2000; Osiris Wildlife Consulting 2004; Mollov 2005; Clevenger and Kociolek 2006). Mammal and bird species have been observed avoiding road corridors, and reductions in population densities of various species have also been observed (Forman and Alexander 1998; Jackson 2000). However, the impacts of noise and vibration on reptiles are not well documented and it is not possible to determine potential impacts of the rail line on *E. stokesii badia* populations. The low traffic frequency of 8 to 10 train movements per day (with an upper limit of 18 train movements per day in the first 88 km section, i.e. Mullewa spur line to Oakajee) is less likely to affect fauna than roads, for example, which typically have higher traffic frequencies. As most populations are situated away from the rail line, this will not affect the long-term survival of the species in the region.

Clearing and mining of rock borrow areas and infrastructure sites may result in some localised impacts, such as disturbance and possibly direct mortality, to nearby populations due to noise and vibration from blasting and use of heavy machinery. The extent of these impacts is not currently known and monitoring of *E. stokesii badia* populations should be considered before, during and after clearing and mining activities occur.

5.2 MANAGEMENT STRATEGIES

The greatest potential impact is the formation of a barrier to dispersal. However, as discussed above, the black form of *Egernia stokesii badia* is expected to share a low dispersal rate and long life span with its South Australian conspecifics, and because most of the population lives away from the proposed alignment and potential rock borrow areas it is anticipated that the species as a

whole will be unaffected by the proposal. Possible impacts due to restricted dispersal are expected to be localised to two areas discussed previously (Area 1 and Area 2).

Drainage culverts are currently proposed to be used as an engineering solution to water drainage issues along the rail infrastructure and it is possible that dispersing *E. stokesii* would use these to cross the rail infrastructure. Utilising a number of drainage culverts in the two areas of concern is recommended to increase potential access across the rail infrastructure.

Translocation of individuals away from areas of disturbance can be used to reduce impacts to regional populations. In areas were populations cannot be avoided due to engineering constraints, individuals can either be translocated to nearby habitat or held in captivity and released into rehabilitated habitat post construction.

In summary, management strategies that may be used by OPR to mitigate impacts to *Egernia stokesii badia* include:

- maintaining a distance of 200 m between impact areas (proposed alignment and rock borrow areas) and any known E. *stokesii badia* colonies or individuals where possible,
- provision of fauna passages below the rail lines to allow movement of individuals within the populations that occur in Area 1 and Area 2,
- translocation of individuals to habitats away from the development prior to construction, if required,
- Rehabilitate quarries to form suitable *E. stokesii badia* habitat.
- annual monitoring of any *E. stokesii badia* populations situated within 300 m of rail and infrastructure sites. A suitable monitoring schedule should include monitoring during the construction phase and annual monitoring during years 1, 2 and 3, and every 5 years there after for the life of the operation of the rail.
- educate and train staff so that they can recognise the species/subspecies, it's habitat and how to notify environmental staff if the subspecies is encountered during construction activities..

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6 CONCLUSION

Egernia stokesii badia individuals and scats were found at 96 locations within and surrounding the proposed OPR1 rail corridor (Table 4.1) and a further 20 locations have been located in regional surveys. The locations range from small, isolated stands of granite containing suitable habitat to larger, more extensive clusters, two of which (Area 1 and Area 2) are bisected by the current alignment.

No locations found to harbour *E. stokesii badia* will be affected by the currently proposed alignment. The proposed alignment does come relatively close (50-60 m) to some habitat where individuals were found but, within these areas, the granite habitat is also dispersed more widely away from the proposed alignment.

ecologia recommends that OPR maintain a buffer of 200m where possible between the proposed alignment, infrastructure areas and *E. stokesii badia* habitat identified in this report so that direct impacts to *E. stokesii badia* are avoided.

If possible, engineering solutions to facilitate dispersal across the rail line should be introduced at the two areas where more extensive habitat clusters are bisected. These solutions may include additional culverts below the rail line.

Alternatives to borrow locations where *E. stokesii badia* occur should be considered and it should be emphasised that *E. stokesii badia* are likely to inhabit areas where granite formations are present.

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APPENDIX A SEARCH LOCATIONS, AERIAL AND HABITAT PHOTOGRAPHY AND HABITAT BOUNDARIES FROM THE HELICOPTER SURVEY

Appendix A provides aerial photographs of the sites surveyed and more detailed photographs of the habitats at ground level. Where evidence of *E. stokesii badia* was found, a red polygon is shown on the aerial photograph representing the wider area of potentially contiguous skink habitat. In cases where the proposed alignment comes within 200 m of skink habitat, a blue polygon has also been drawn which more clearly delineates the location and size of the discrete granite outcrops in the vicinity of the rail.

A green marker (●) has been used to identify those locations where the proposed alignment comes within 200 m of likely skink habitat (coordinates of these locations are provided in Table 4.1) . This occurs in Area 1 and Area 2:

- Appendix A8 shows Area 1 which includes four green markers. In this instance, the rail alignment passes within 200 m of likely skink habitat in the section between the two green markers.
- Appendix A10 shows Area 2, where there are three green markers representing three discrete locations where the rail alignment comes within 200 m of skink habitat.

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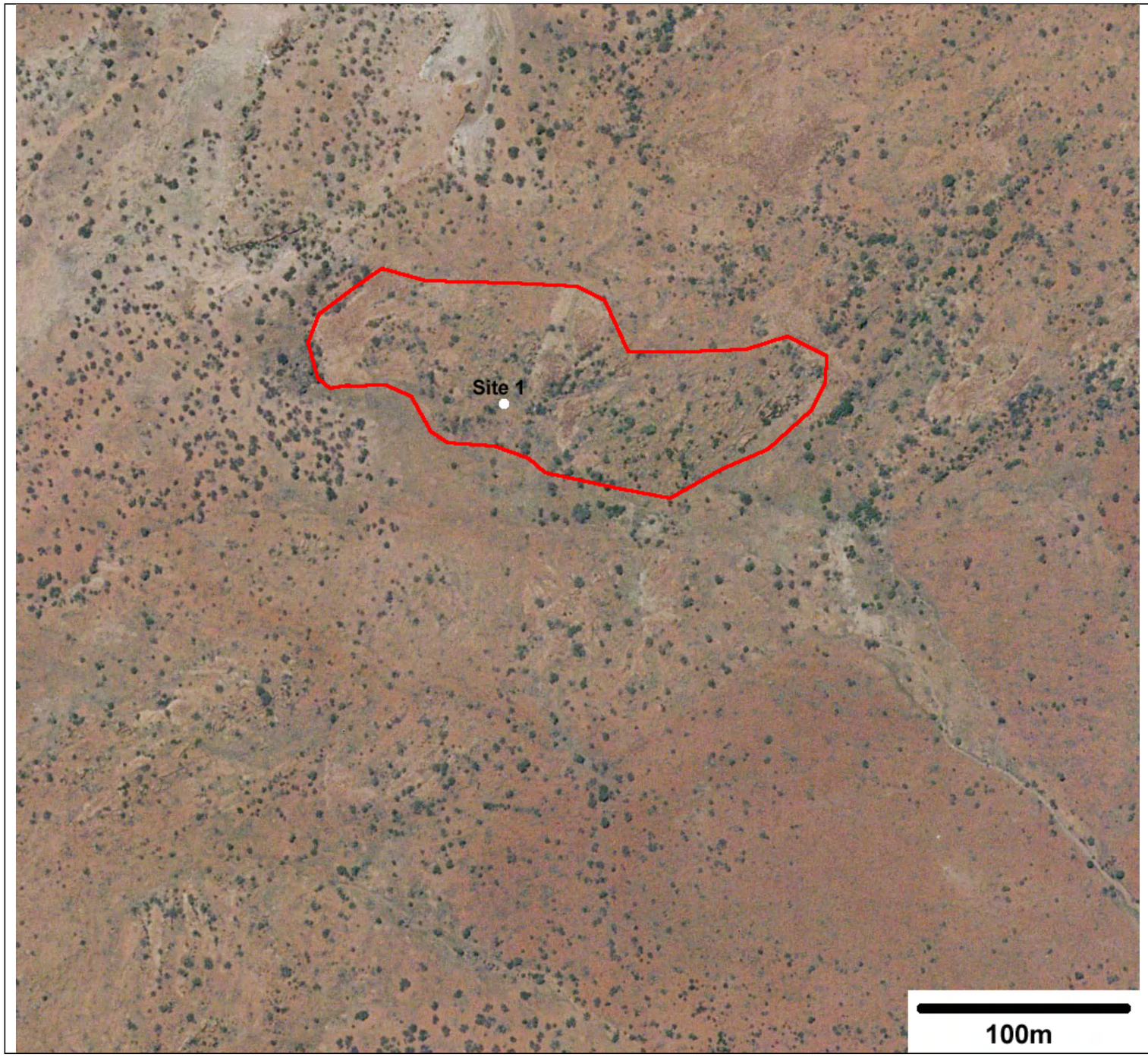
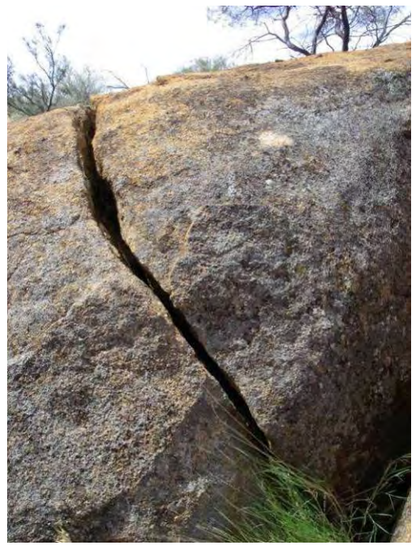
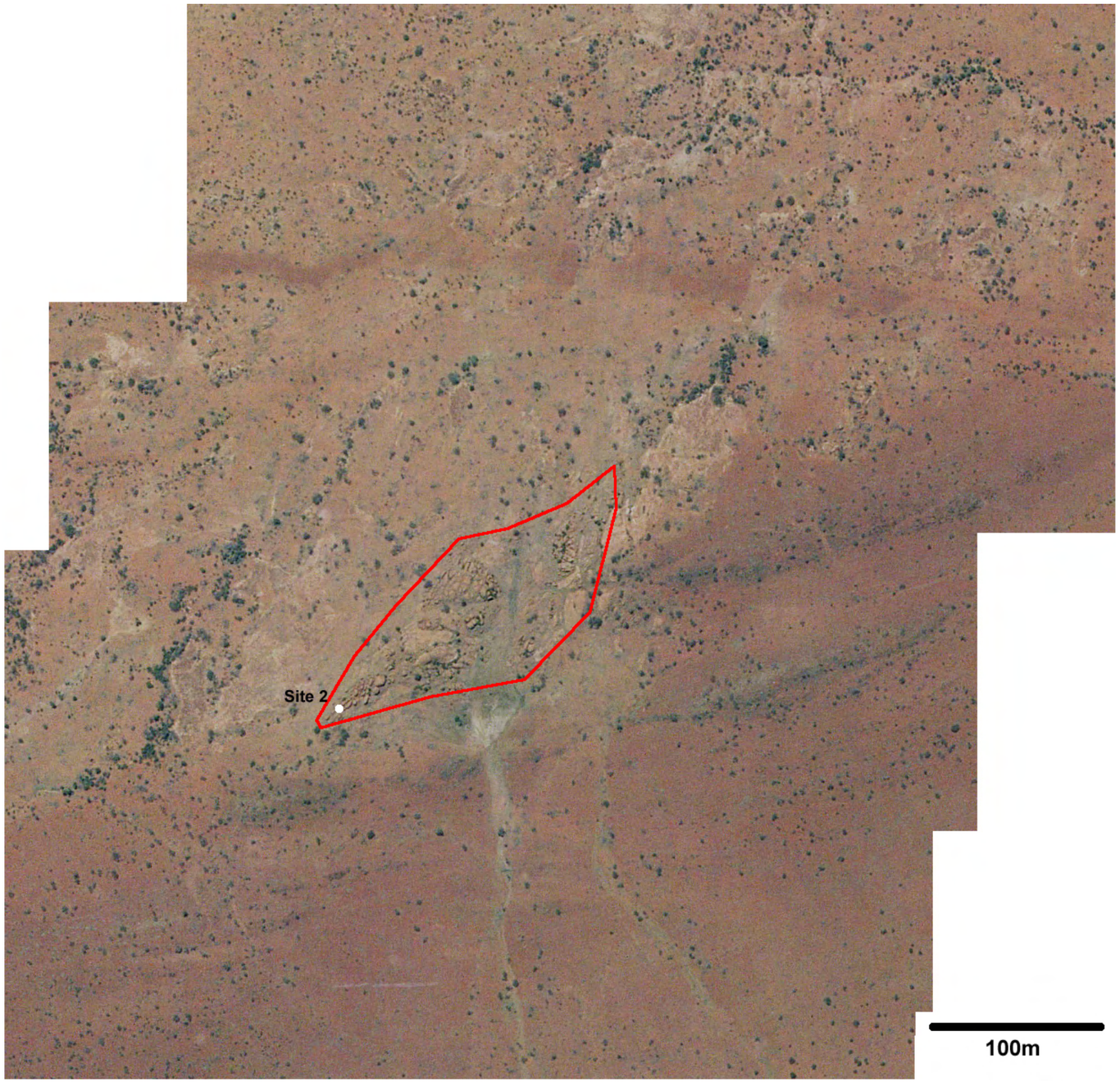
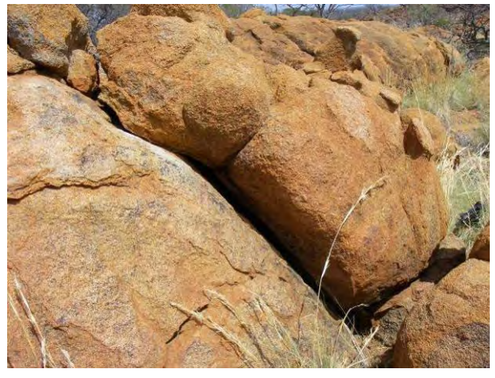
Appendix A1: Site 1



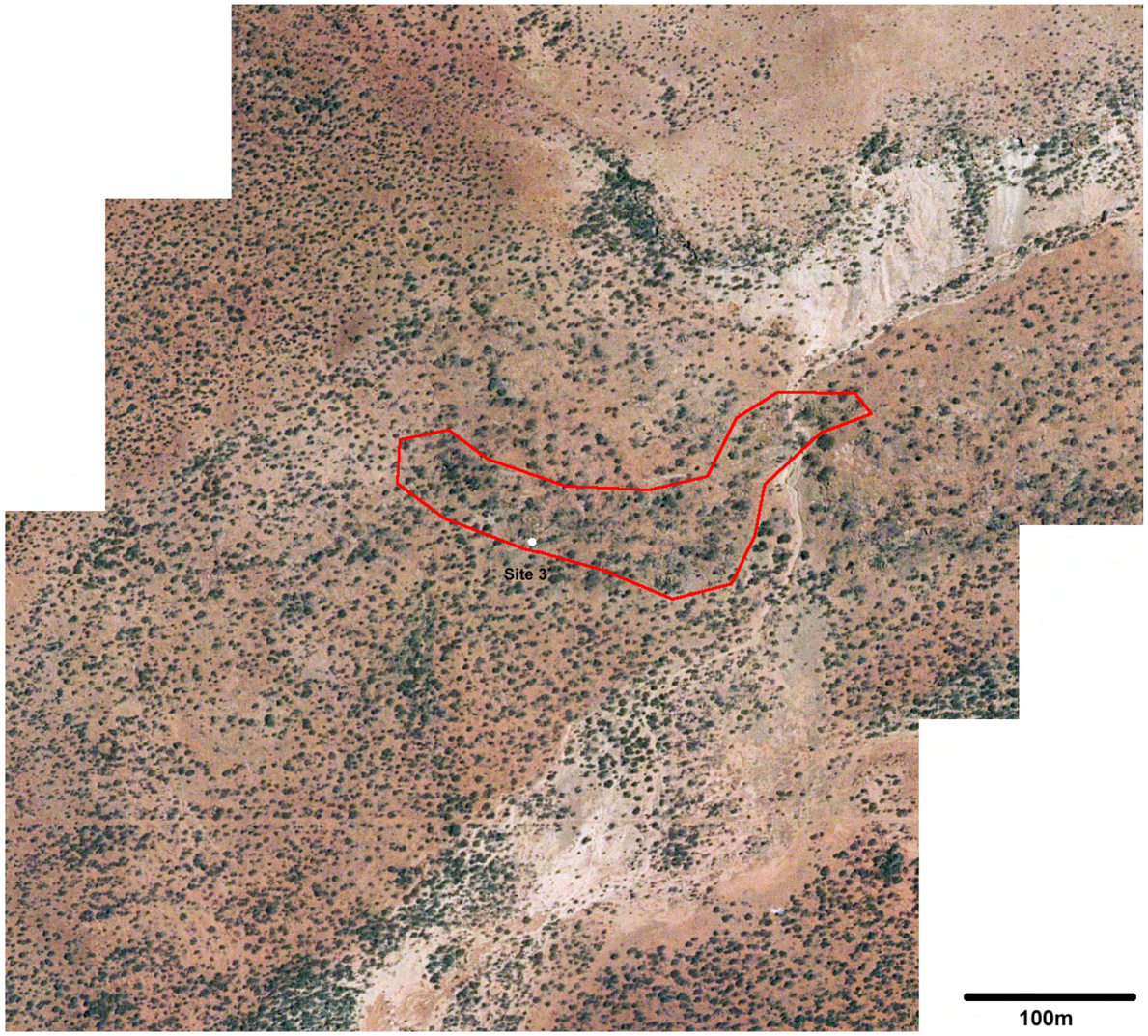


Appendix A2: Site 2





Appendix A3: Site 3



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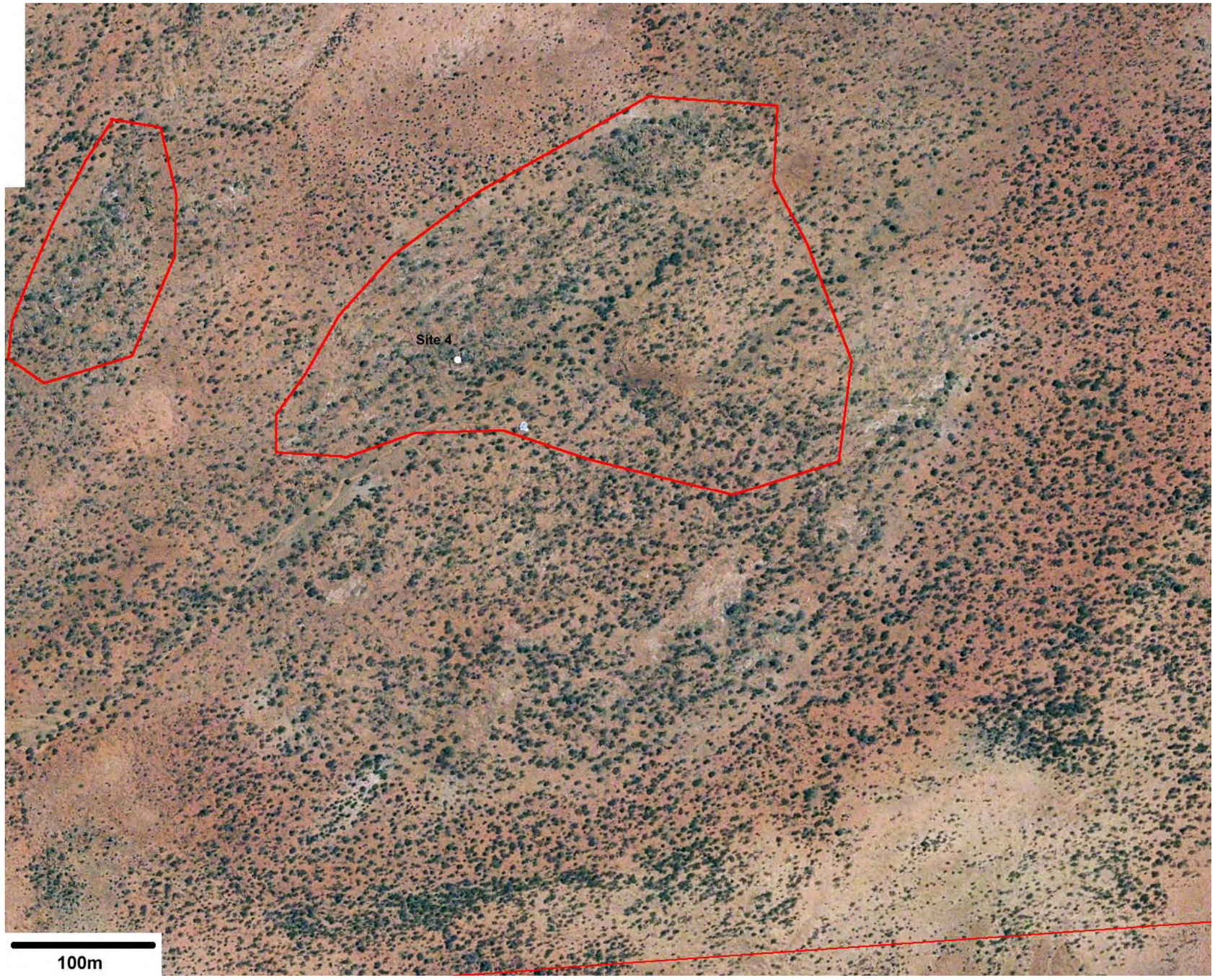
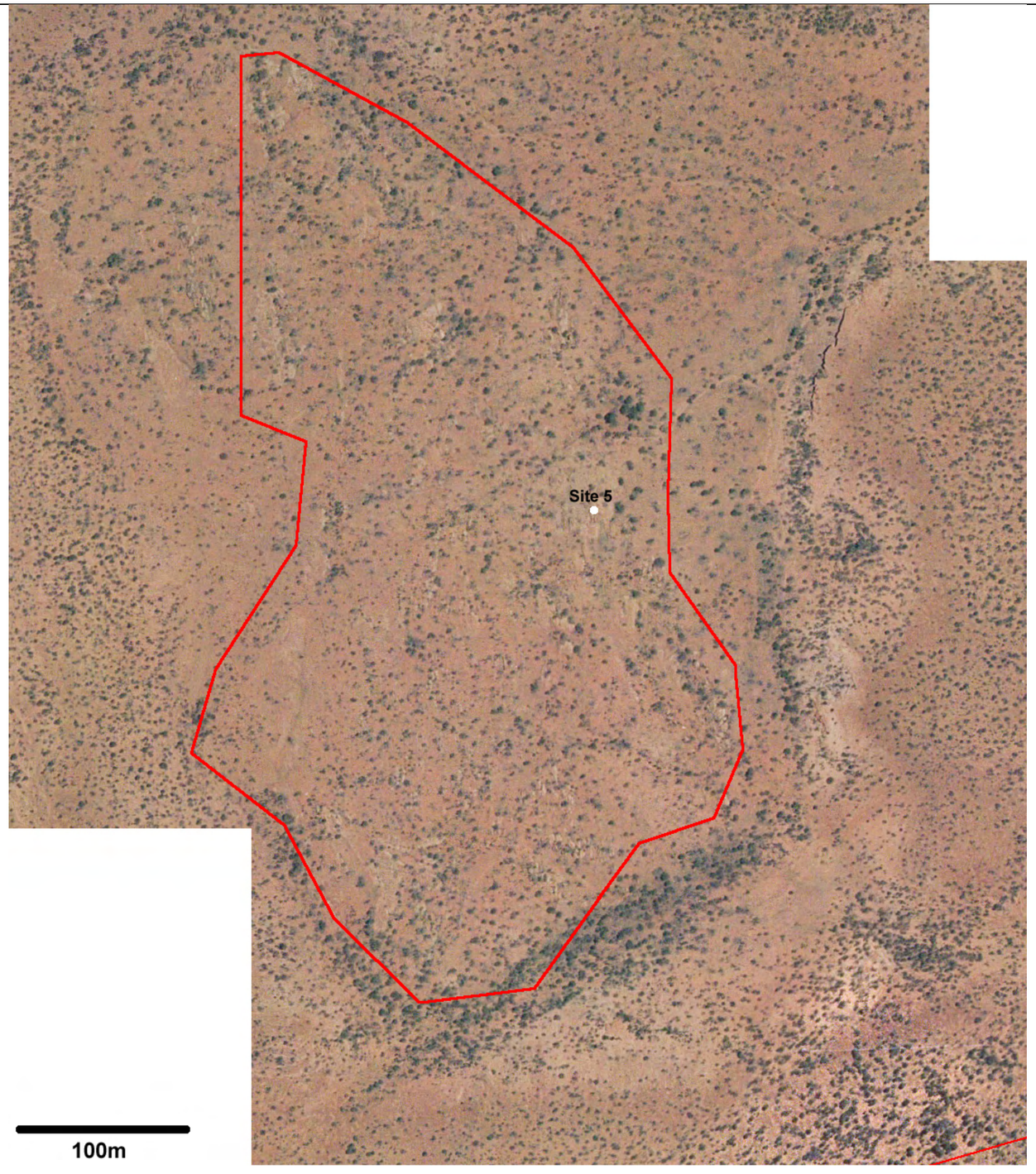
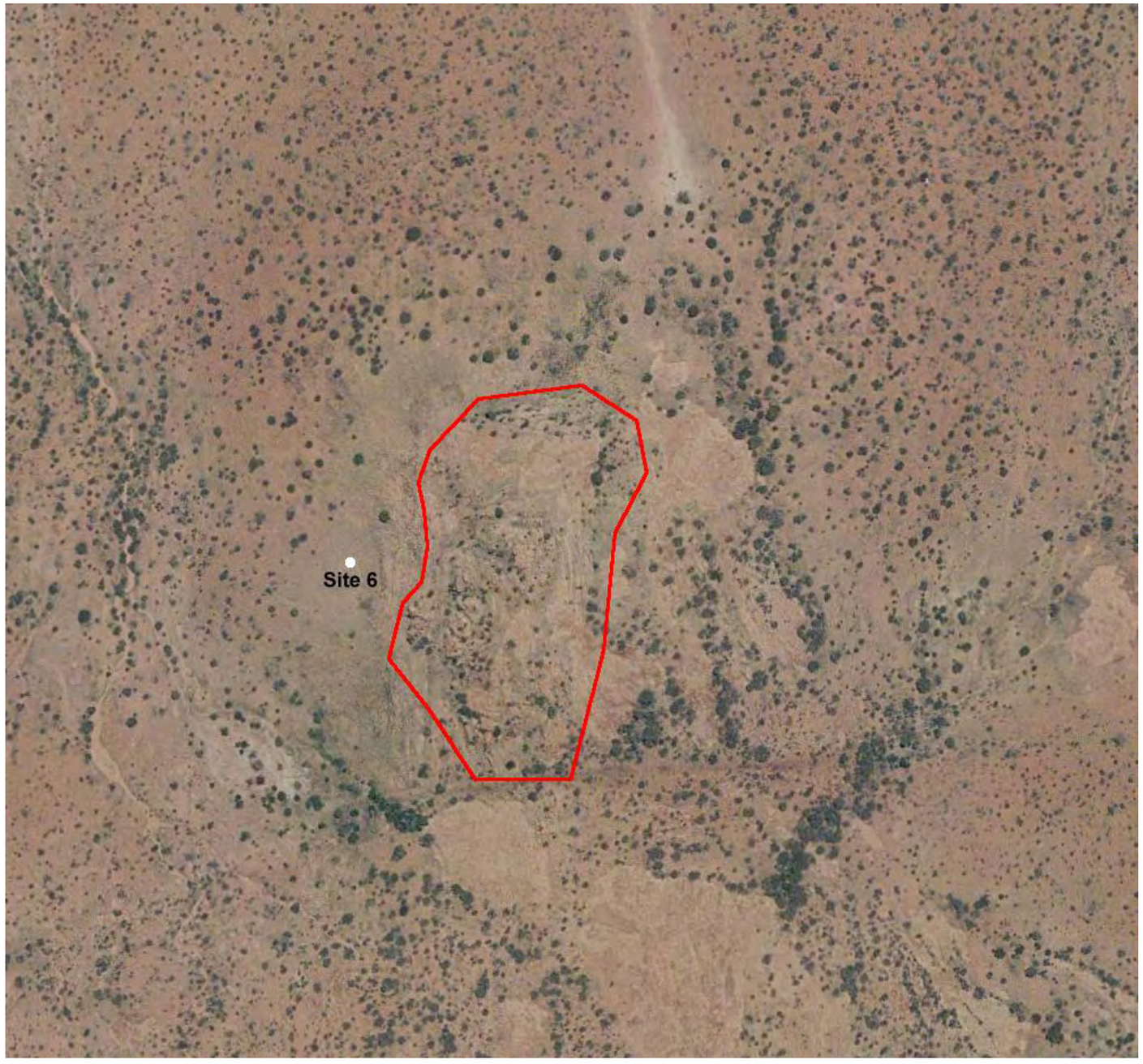


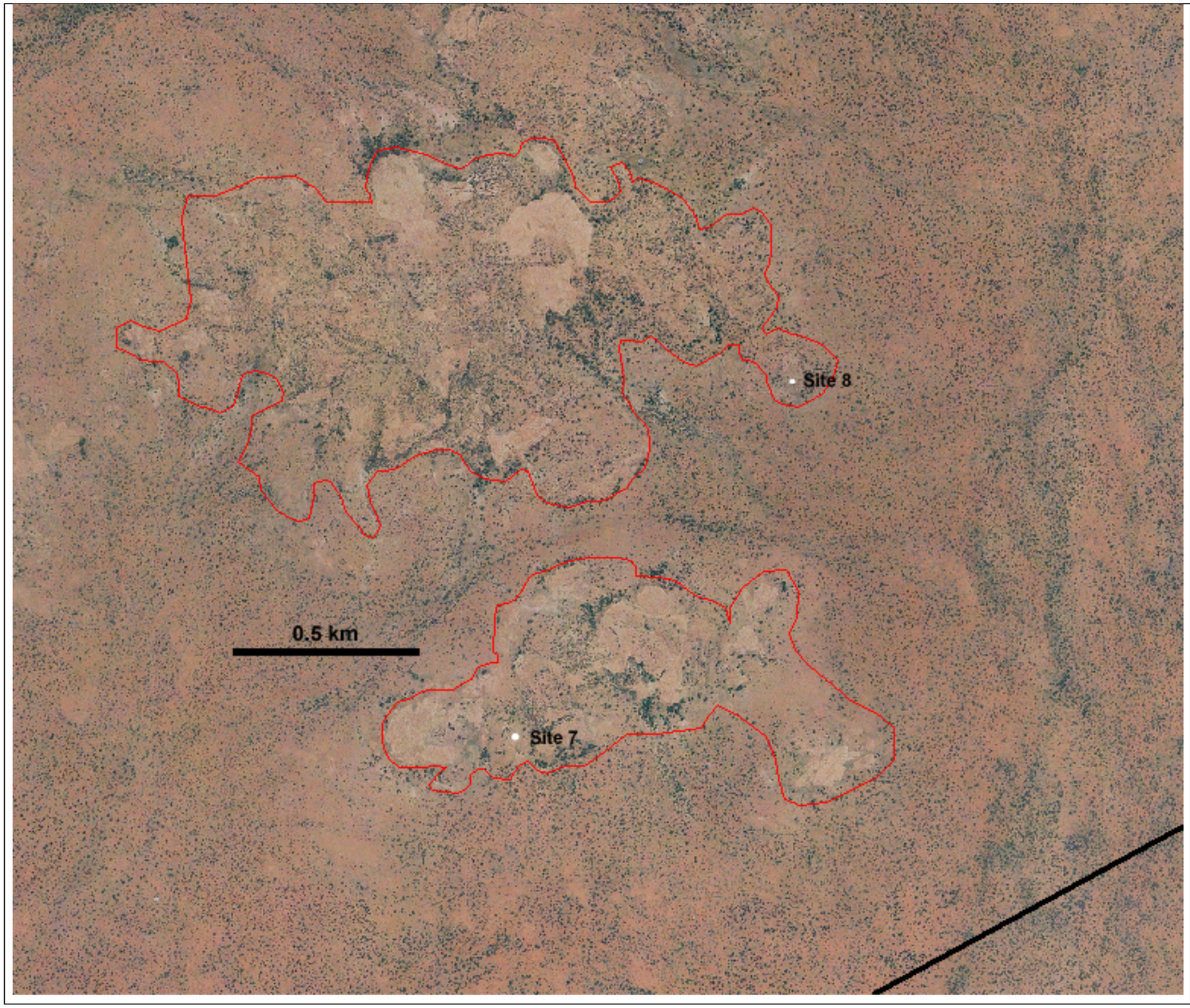
Appendix A5: Site 5



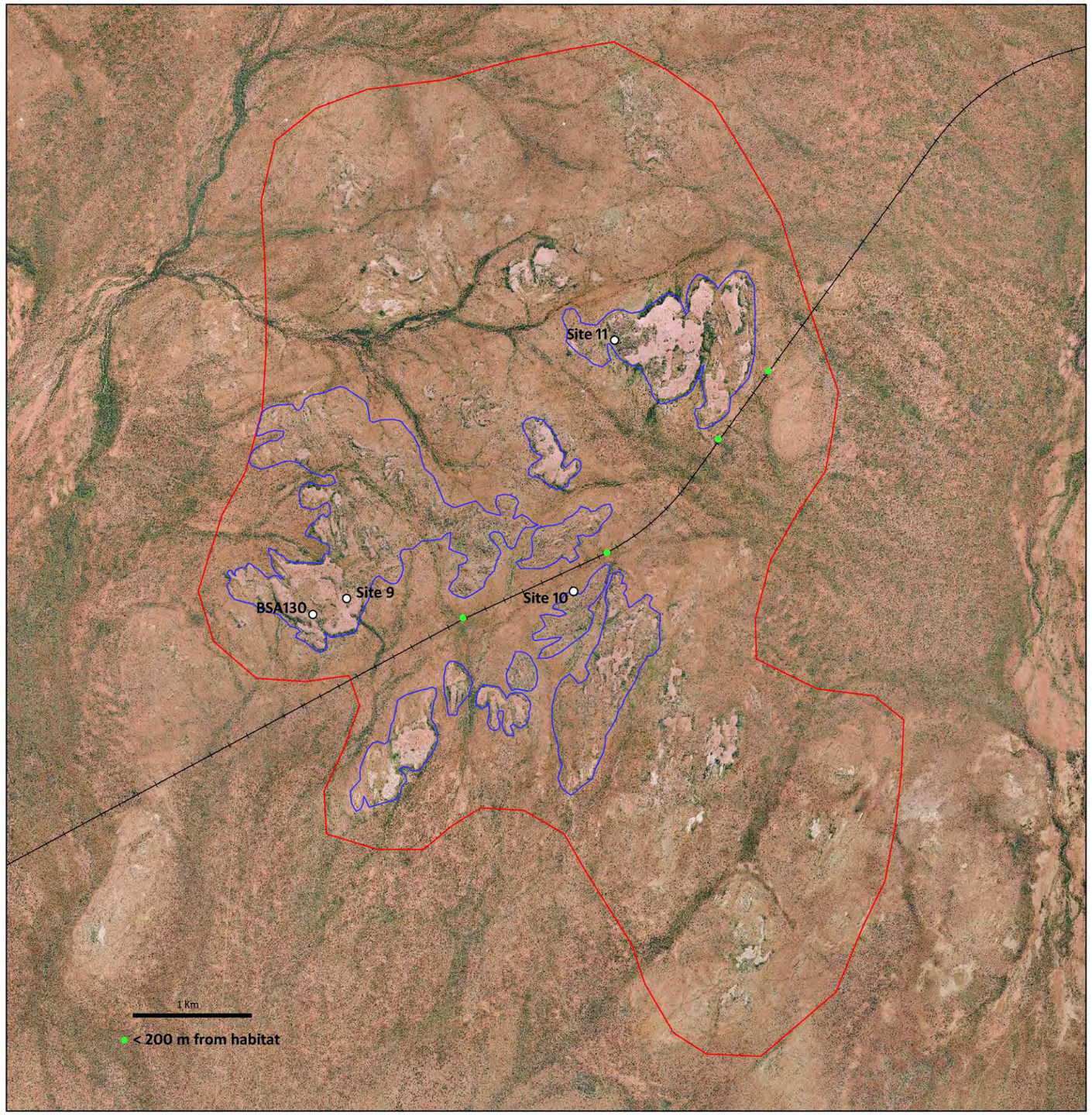
Appendix A6: Site 6



Appendix A7: Sites 7 and 8

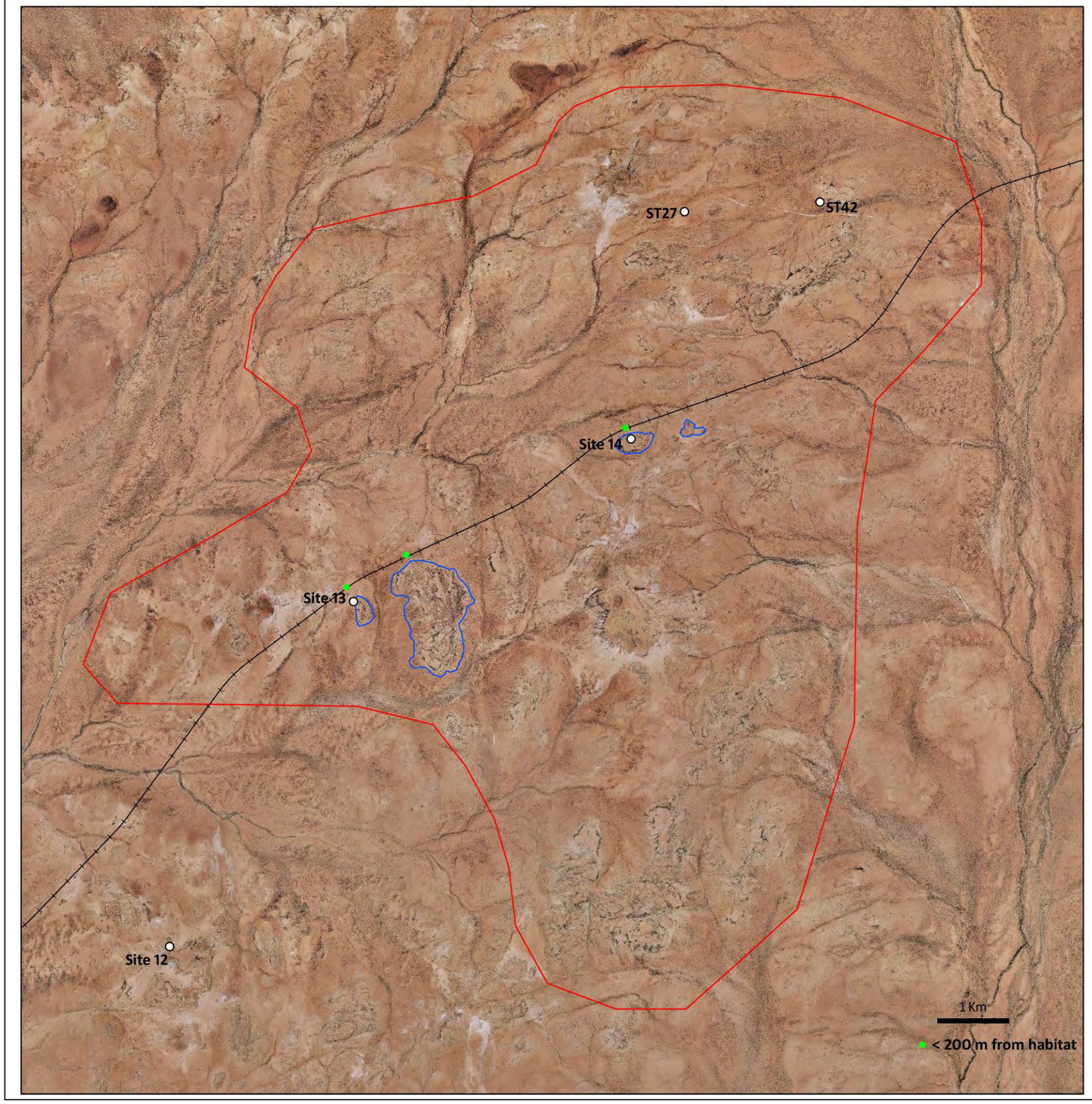


Appendix A8: Area 1 (Sites 9, 10 and 11). Red line bounds area of wider habitat; blue lines bound areas of detailed habitat.

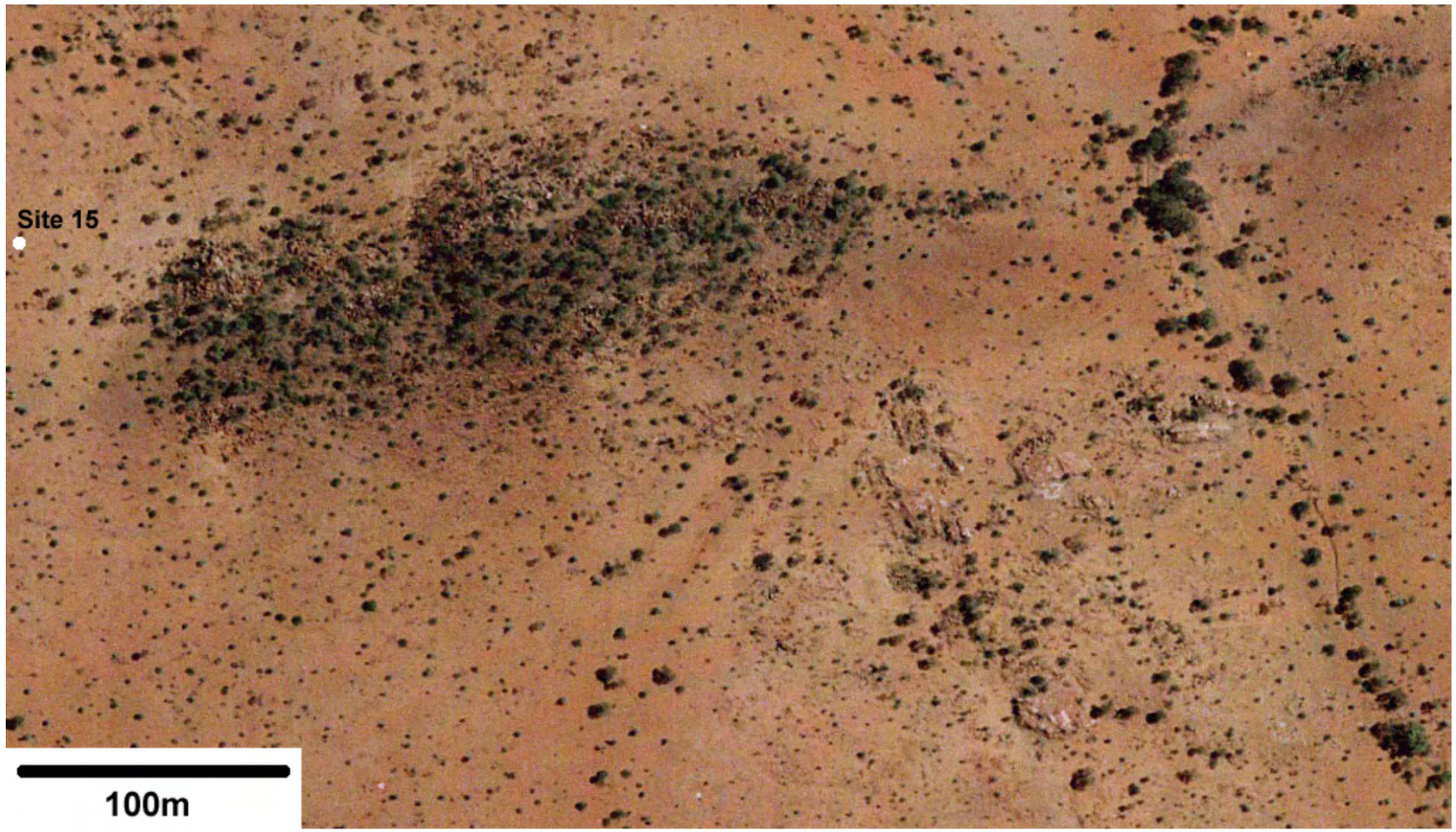


Appendix A9: Site 12

Appendix A10: Area 2 (Sites 13 and 14). Red line bounds area of wider habitat; blue lines bound areas of detailed habitat.

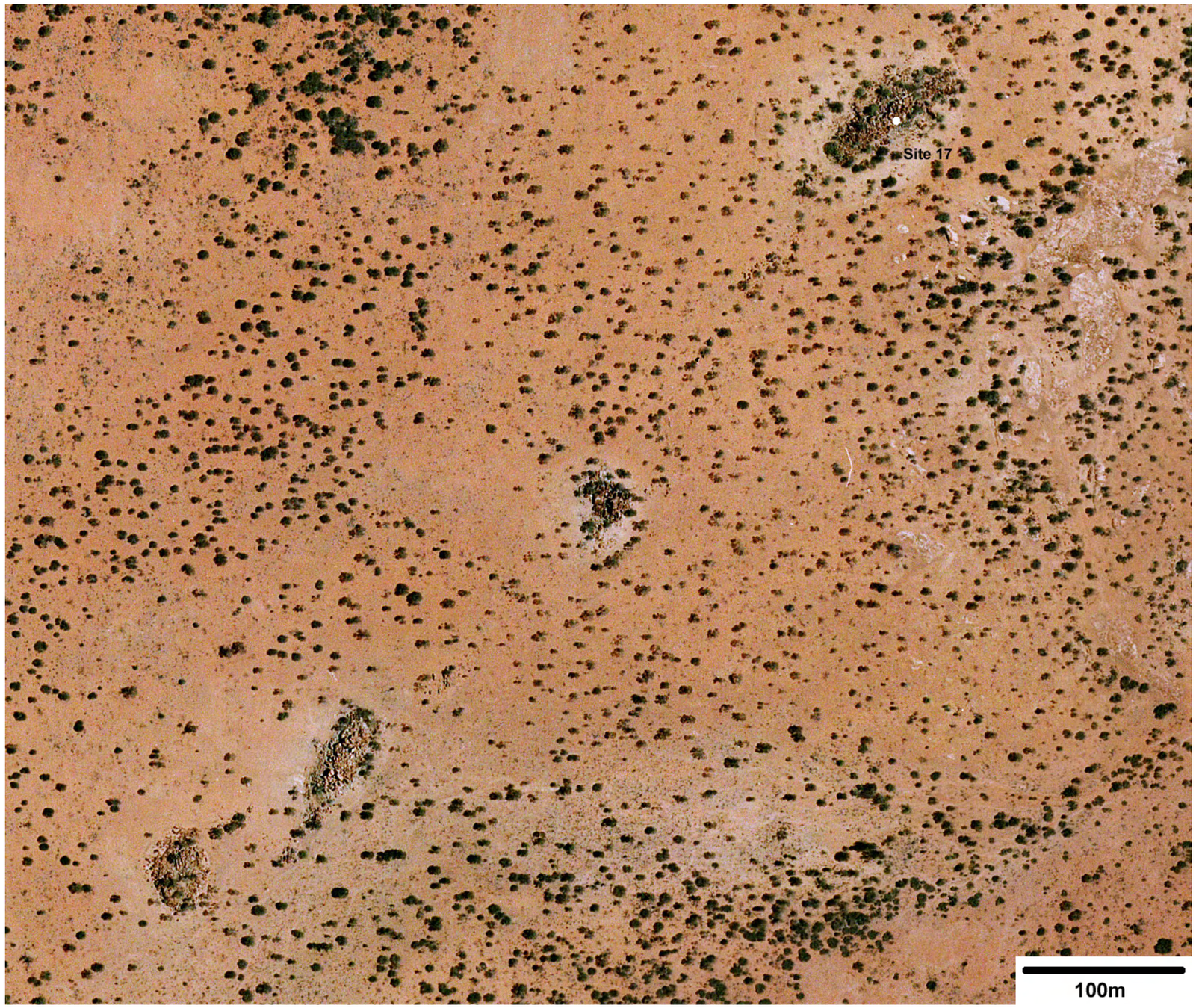


Appendix A11: Site 15



Appendix A12: Site 16

Appendix A13: Site 17



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APPENDIX B SEARCH LOCATIONS, AERIAL AND HABITAT PHOTOGRAPHY AND HABITAT BOUNDARIES FROM THE CLEARANCE AREAS SURVEY

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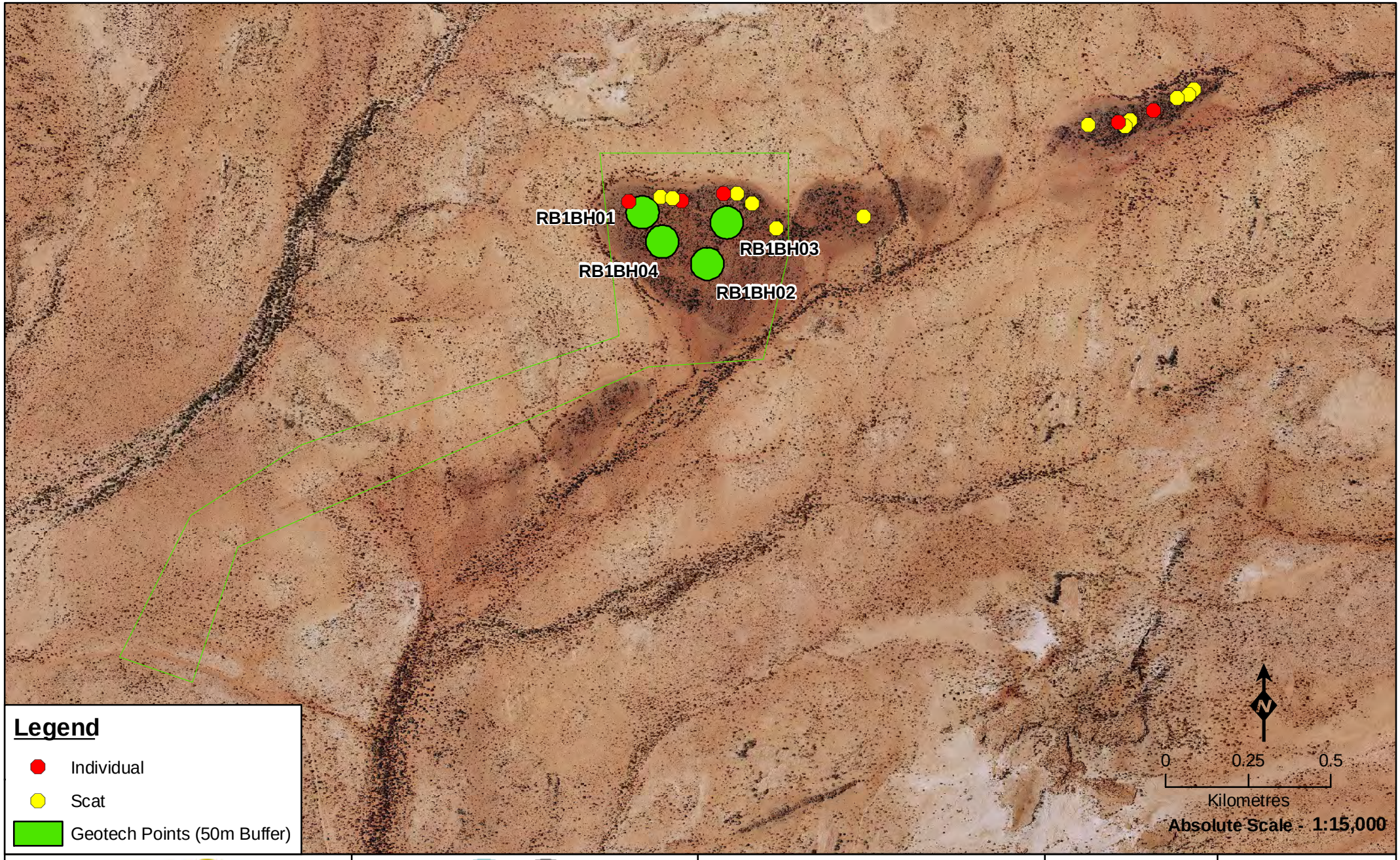


ecologia ENVIRONMENT

OPR oakajee port & rail

Egernia stokesii locations within RB1

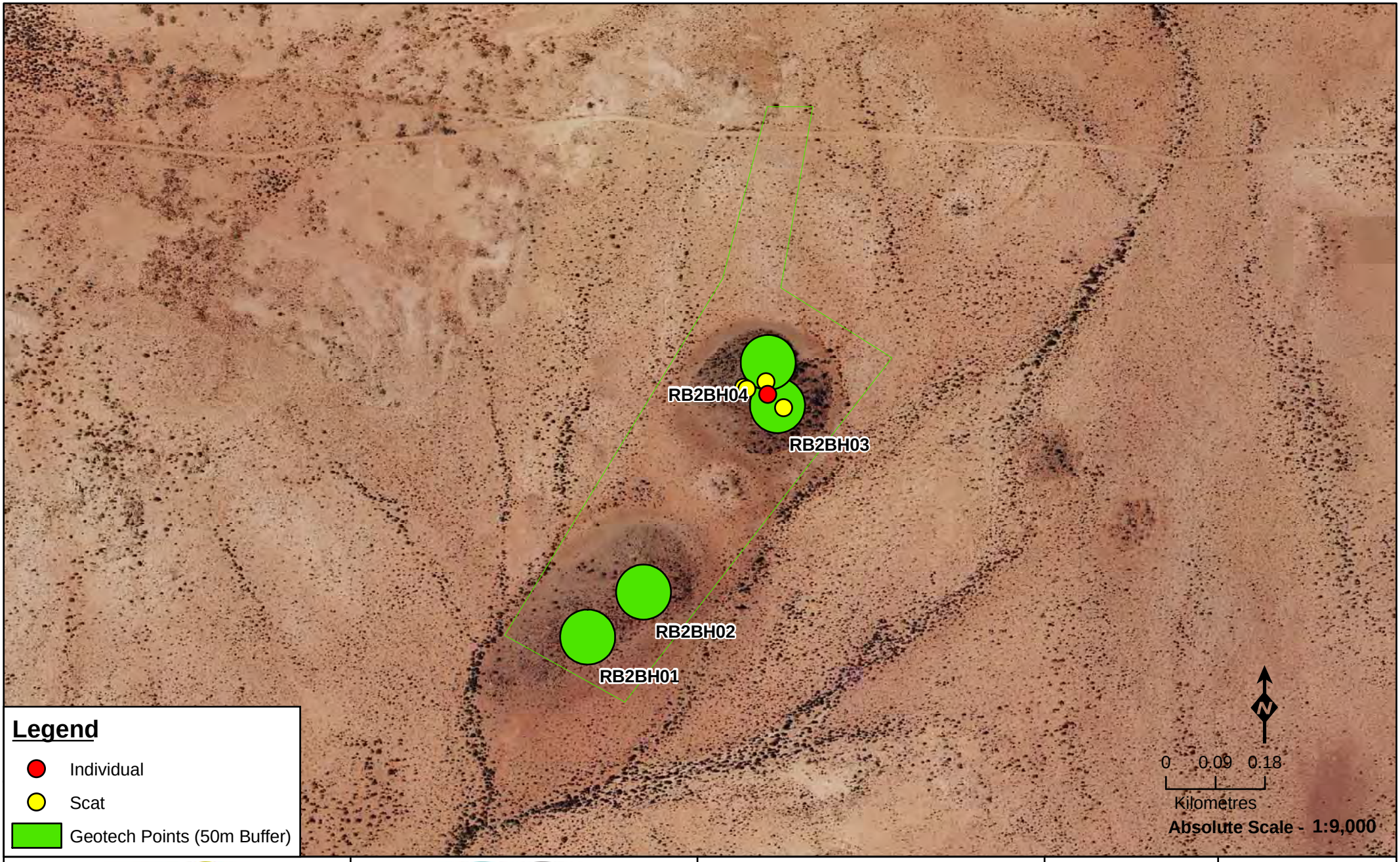
Figure: 10
Project ID: 1196

Drawn: EF
Date: 17/11/09

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: MXXX

A4



ecologia ENVIRONMENT

OPR oakajee port & rail

Egernia stokesii locations within RB2

Figure: 3.8
Project ID: 1130

Drawn: EF
Date: 17/11/09

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: MXXX

A4

Appendix B3: Site RB1

RB1BH01

RB1BH02

RB1BH03

RB1BH04

Appendix B4: RB2

RB2BH01

RB2BH02

RB2BH03

RB2BH04