
COVALENT LOGISTICS ROAD TERRESTRIAL VERTEBRATE FAUNA SURVEY

Covalent Lithium

ecoscape



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EXECUTIVE SUMMARY

Covalent Lithium engaged Ecoscape to conduct basic and targeted terrestrial fauna survey along a proposed product haul road route (Logistics Road), connecting the mine processing operations at Mt Holland to Great Eastern Highway. The proposed route is approximately 113 km, following an existing gazetted road that crosses areas of uncleared native vegetation and agricultural land. The total size of the survey area is 3142 hectares (ha).

The survey was undertaken by Ecoscape from the 28th of March to the 5th of April 2022. The purpose of the survey was to delineate fauna habitats, obtain knowledge on the likely fauna assemblage and focus on identifying the presence/absence and suitable habitat of conservation significant listed species identified during the desktop assessment. This will allow for a better understanding of the local fauna's potential sensitivity to impacts resulting from the road installation. The outcomes of the survey and other information (e.g. desktop aspects) will be used to inform the environmental assessment and approvals process.

The key outcomes from the field survey identified:

- 136 Habitat assessments were conducted identifying four broad vertebrate fauna habitat types: Eucalypt Woodland, Shrubland, Regrowth and Seasonal Marsh/Wetland. Both the Eucalypt Woodland (367.77 ha) and the Shrubland (1312.62 ha) provide habitat for most species in the area and made up the largest part of the survey area, with the Regrowth (5.76 ha) and Seasonal Marsh/Wetland (0.43 ha) being less common. These habitat types recorded during the survey are considered to be well represented outside the survey areas.
- Sixty-four vertebrate and one invertebrate fauna species were recorded during the survey, consisting of:
 - Twenty-two mammals (seven introduced)
 - Thirty-six birds
 - Six reptiles
 - One invertebrate.
- The conservation significant vertebrate fauna species recorded by the field survey were:
 - Malleefowl *Leipoa ocellata* (EPBC-VU, BC-VU), listed as a 'Threatened' fauna taxon at the conservation level of 'Vulnerable' under both Commonwealth and State legislation
 - Western Brush Wallaby *Notamacropus irma* (DBC-A-P4), classified as 'Priority 4' by the State Department of Biodiversity, Conservation and Attractions.
 - Central Long-eared Bat *Nyctophilus major tor* (DBC-A-P4), classified as 'Priority 4' by the State Department of Biodiversity, Conservation and Attractions. Ambiguous call recorded, this has been added on a precautionary basis
- The targeted Malleefowl mound searches identified two previously unrecorded Malleefowl nest mounds, one of which was active.
- In accordance with guidelines for the critically endangered Arid Bronze Azure Butterfly (*Ogyris subterrestris petrina*) (ABAB), a targeted survey was conducted to determine the presence/absence of the sugar ant species (*Camponotus* sp. nr. *terebrans*) on which its larvae parasitise. Sugar ants were detected at two single trees out of the 100 trees sampled. Densities of sugar ant colonies found during this survey are low, however, it is a requirement that the presence of the sugar ant colonies be reported to DBCA.

ACRONYMS AND ABBREVIATIONS

Table 1: Acronyms and abbreviations

Acronyms	
BC Act	Western Australian <i>Biodiversity Conservation Act 2016</i>
BoM	Bureau of Meteorology
CALM	Western Australian Department of Conservation and Land Management (1985-2006, now DBCA)
CD	Conservation Dependent (fauna; specially protected species under the Western Australian BC Act)
CR	Critically Endangered (listed under Commonwealth EPBC Act and/or Western Australian BC Act)
DAWE	Commonwealth Department of Agriculture, Water and Environment (2020-)
DBCA	Western Australian Department of Biodiversity, Conservation and Attractions
DBH	Diameter at Breast Height (1.3 m)
DEC	Western Australian Department of Environment and Conservation (2006-2013, now DBCA)
DEWHA	Commonwealth Department of the Environment, Water, Heritage and the Arts (2007-2010, now DAWE)
DPaW	Western Australian Department of Parks and Wildlife (2013-2017, now DBCA)
DPIRD	Western Australian Department of Primary Industries and Rural Development
DSEWPaC	Commonwealth Department of Sustainability, Environment, Water, Population and Communities (2010-2013, now DAWE)
DWER	Western Australian Department of Water and Environmental Regulation
EN	Endangered (listed under Commonwealth EPBC Act and/or Western Australian BC Act)
Ecoscape	Ecoscape (Australia) Pty Ltd
EP Act	Western Australian <i>Environmental Protection Act 1986</i>
EPA	Western Australian Environmental Protection Authority
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
GDA 94	Geographic Datum of Australia 1994
GIS	Geographic Information System
GPS	Global Positioning System
GWA	Government of Western Australia
ha	hectare/hectares
IBRA	Interim Biogeographic Regionalisation for Australia
IUCN	International Union for Conservation of Nature
km	kilometre/kilometres
m	metre/metres
MGA	Map Grid of Australia
MA	Marine species (fauna; protected under international agreements and EPBC Act)
MI	Migratory species (fauna; specially protected species under the Western Australian BC Act, also EPBC Act)
MNES	Matters of National Environmental Significance
OS	Other specially protected species (fauna; specially protected species under the Western Australian BC Act)
P; P1, P2, P3, P4, P5	Priority Flora and Fauna species rankings (P1-P4) or Priority Ecological Communities (P1-P5)
PMST	Protected Matters Search Tool (hosted by DAWE, used to search for MNES)
SoW	Scope of Works
sp.	Species (generally referring to an unidentified taxon or when a phrase name has been applied)
subsp.	Subspecies (infrataxon)
S1	Schedule 1 Fauna species listed under the BC Act
TSSC	Threatened Species Scientific Committee
VU	Vulnerable (listed under Commonwealth EPBC Act and/or Western Australian BC Act)
WAM	Western Australian Museum
*	Introduced fauna species

1 INTRODUCTION

1.1 BACKGROUND

Covalent Lithium is developing the Mt Holland Lithium Project which will include the construction and operation of a fully integrated mine, concentrator, and refinery in Western Australia. The Mount Holland Lithium Project (the project) is an integrated project consisting of a mine, concentrator, and refinery to produce battery quality lithium hydroxide (LiOH) for the international market. The project is centred on the Earl Grey hard-rock lithium deposit 105 km south of Southern Cross in Western Australia and approximately 500 km east of Perth. It is owned by a 50-50 joint venture (JV) between subsidiaries of Wesfarmers Pty Ltd (WES:ASX) and Sociedad Química y Minera de Chile S.A. (SQM: NYSE). Covalent is the manager for the JV and is responsible for the development and operation of the project.

Covalent Lithium has identified a potential product haul road route (Logistics Road) to connect the mine processing operations at Mt Holland to Great Eastern Highway. The proposed route is from Great Eastern Highway at Moorine Rock, crossing both agricultural areas and uncleared native vegetation following existing gazetted roads for approximately 113 km terminating close to the entrance to the Mt Holland mine site on the Marvel Loch-Forrestania Road (**Figure 1**).

The proposed route requires an Environmental Protection Authority (EPA) Basic fauna survey, which was undertaken by Ecoscape from the 28th of March to the 5th of April 2022. The purpose of the survey was to delineate fauna habitats, obtain knowledge on the likely fauna species assemblage and focus on recording habitat for conservation significant listed species to better understand their potential sensitivity to impacts resulting from the road installation.

The outcomes of the survey and other information (e.g. desktop aspects) will be used to inform the environmental assessment and approvals process.

1.2 SURVEY AREA

The Covalent Lithium project area, known as the 'survey area' in this report, is located within the Shire of Yilgarn and intersects with the Avon Wheatbelt, Coolgardie, and Mallee bioregions of Western Australia, approximately 500km east of Perth (**Figure 1**).

The survey area is approximately 130 m in width including a 50 m buffer from the edges of the existing road infrastructure for the entire length (113 km), there are also 76 proposed borrow pits of varying sizes. The total size of the survey area, including the existing cleared road, and the borrow pits is 3,142 ha. A section of the survey area was subject to a Basic fauna survey in 2020, undertaken by Ecoscape, for the construction of the water pipeline for the Mt Holland project site. The survey area intersects large contiguous expanses of native vegetation and is currently a gazetted road (**Figure 1**).

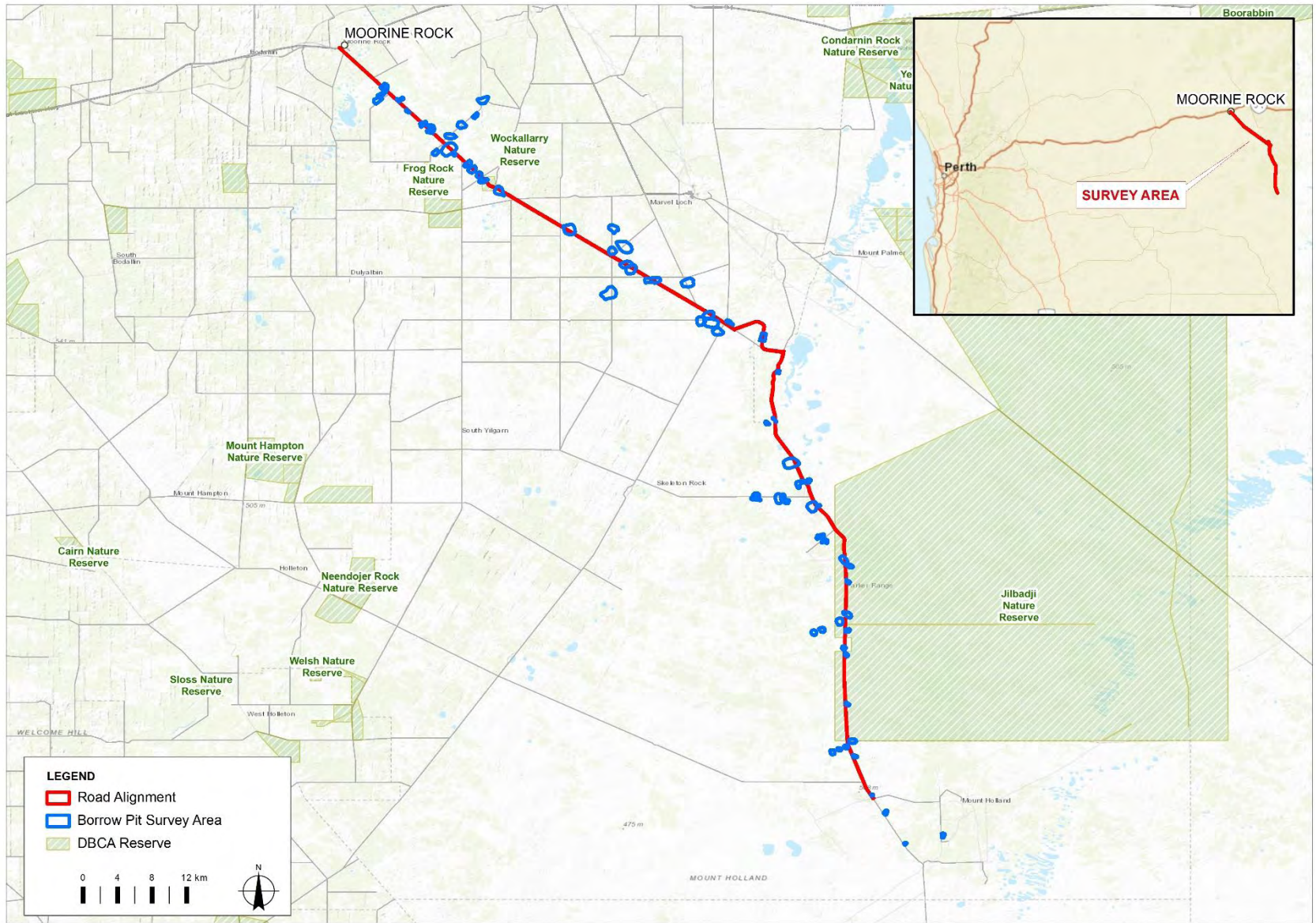


Figure 1: Survey area location

1.3 SURVEY REQUIREMENTS

Covalent Lithium required a desktop assessment, Basic fauna survey and a targeted fauna survey of the Survey Area, these were conducted in accordance with the requirements outlined in the Environmental Protection Authority's (EPA 2020) document Technical Guidance –Terrestrial vertebrate fauna surveys for environmental impact assessment. These surveys were:

- opportunistic collection and recording of fauna evidence including trail cameras; bat echolocation recorders; bird surveys
- targeted conservation significant fauna survey and habitat assessment.

In addition, a targeted fauna survey was required to determine the presence/absence of the sugar ant species (*Camponotus* sp. nr. *terebrans*) within the survey area. The sugar ant is the host species of the conservation listed species Arid Bronze Azure Butterfly (*Ogyris subterrestris petrina*) (ABAB). The ABAB is a 'Threatened Species' that is listed as 'Critically Endangered' under the national *Environment Protection and Biodiversity Conservation Act 1999* and the state *Biodiversity Conservation Act 2016*. These surveys were conducted in accordance with the Western Australian Department of Biodiversity, Conservation and Attractions (DBCA) - *Guideline for the survey of arid bronze azure butterfly (ABAB) in Western Australia (2020a)*.

The overarching objective of the surveys is to understand the environmental values with respect to fauna species within the proposed corridor for the proposed route. The survey sought to provide sufficient information on the fauna habitats and fauna species present, to accurately assess the impacts of the road construction.

1.4 COMPLIANCE

This environmental assessment was conducted in accordance with Commonwealth and State legislation and guidelines:

- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- Western Australian *Environmental Protection Act 1986* (EP Act)
- Western Australian *Biodiversity Conservation Act 2016* (BC Act)
- Western Australian *Biodiversity Conservation Regulations 2018*
- Western Australian *Animal Welfare Act 2002*
- Department of Environment, Water, Heritage and the Arts (DEWHA 2009) *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 (DSEWPaC 2011a) *Survey guidelines for Australia's threatened mammals*
- DSEWPaC (2011b) *Survey guidelines for Australia's threatened reptiles*
- DEWHA (DEWHA 2010a) *Survey guidelines for Australia's threatened bats*
- DEWHA (DEWHA 2010b) *Survey guidelines for Australia's threatened birds*
- Department of Parks and Wildlife (DPaW 2017) *Interim Guideline for Preliminary Surveys of Night Parrot (*Pezoporus occidentalis*) in Western Australia*
- Threatened Species Scientific Committee ((TSSC 2016) *Conservation Advice *Pezoporus occidentalis**
- Department of Environment and Conservation (2012). Chuditch (*Dasyurus geoffroi*) Recovery Plan
- Department for Environment and Heritage (2007). National Recovery Plan for Malleefowl
- DBCA - *Guideline for the survey of arid bronze azure butterfly (ABAB) in Western Australia (2020a)*
- DBCA - *Arid bronze azure butterfly (ABAB) survey in Western Australia additional information (2020b)*.

Summaries of the main Acts under which this assessment was conducted, and related criteria and definitions, are available in **Appendix One**.

As well as those listed above, the assessment complied with EPA requirements for environmental survey and reporting in Western Australia, as outlined in:

- EPA (2020) *Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment*, known herein as the Fauna Technical Guidance
- EPA (2016) *Environmental Factor Guideline – Terrestrial Fauna*
- EPA (2021) *Statement of environmental principles, factors, objectives and aims of EIA*.

Additional details (definitions and criteria) relevant to these works are available in **Appendix One**.

2 DESKTOP ASSESSMENT

2.1 PHYSICAL ENVIRONMENT

2.1.1 CLIMATE

The closest Bureau of Meteorology (BoM) stations with long term records are Southern Cross and Hyden stations, both have similar records. Hyden station is located approximately 75 km south west of the survey area. The mean annual rainfall is 342 mm falling between May and September. The rainfall during the six month period prior to the field survey was 72% of the long-term average for this period (BoM 2022).

January is the hottest month with a mean maximum temperature of 33.8°C and minimum of 15.6°C. July is the coldest month with a mean maximum of 16.5°C and minimum of 4.7°C (BoM 2022).

According to the Köppen-Geiger climate classification, the survey area has an arid-steppe climate with (relatively) cold summers (Class BSk) that border Mediterranean (or continental) climates in continental interiors some distance from the coast (Peel, Finlayson & McMahon 2007). This classification is considered to represent a cold semiarid climate where the average temperature is below 18°C, summer maximum temperatures are considered to be warm to hot and the coldest month maximum is above 0°C. Large diurnal temperature variations are a feature of this climate zone.

Figure 2 shows the average rainfall and temperatures of the survey area, with rainfall for the year preceding the field survey.

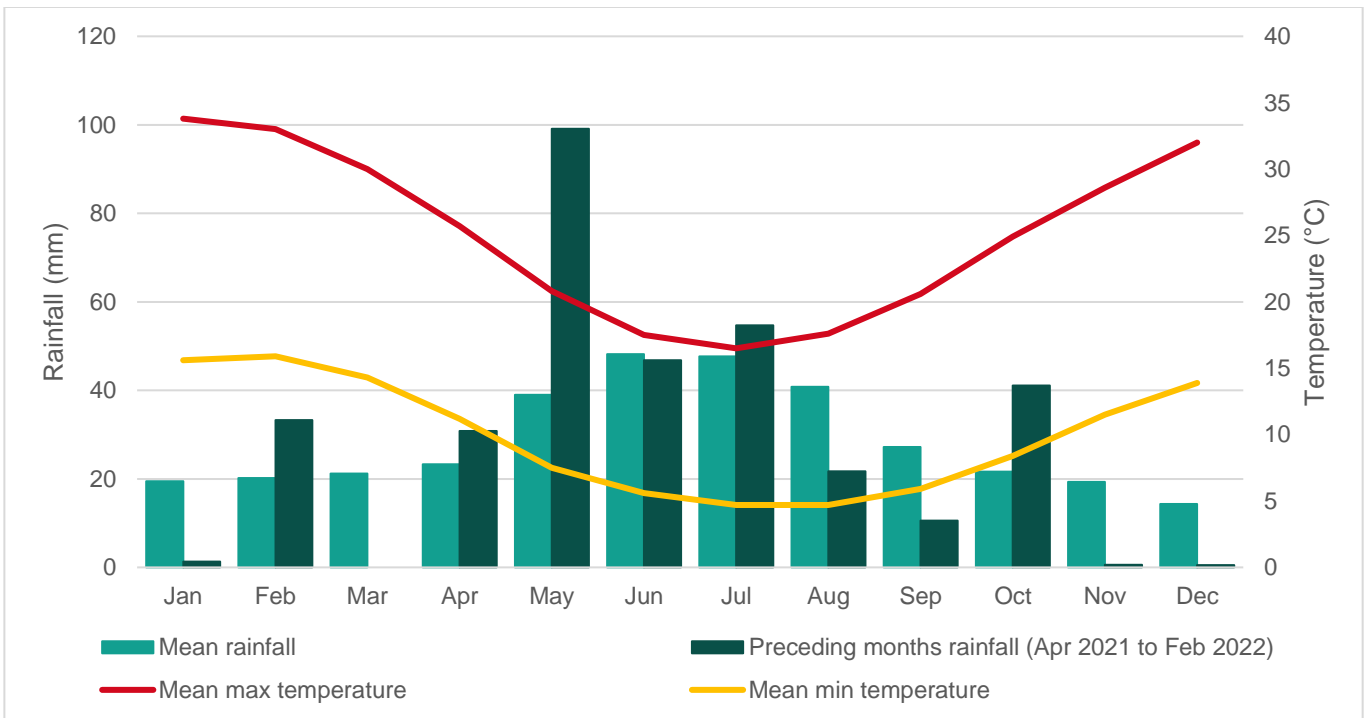


Figure 2: Rainfall and temperature data for the survey area (BoM 2022)

Western Australian rainfall deciles 1 October 2021 to 31 March 2022

Australian Gridded Climate Data

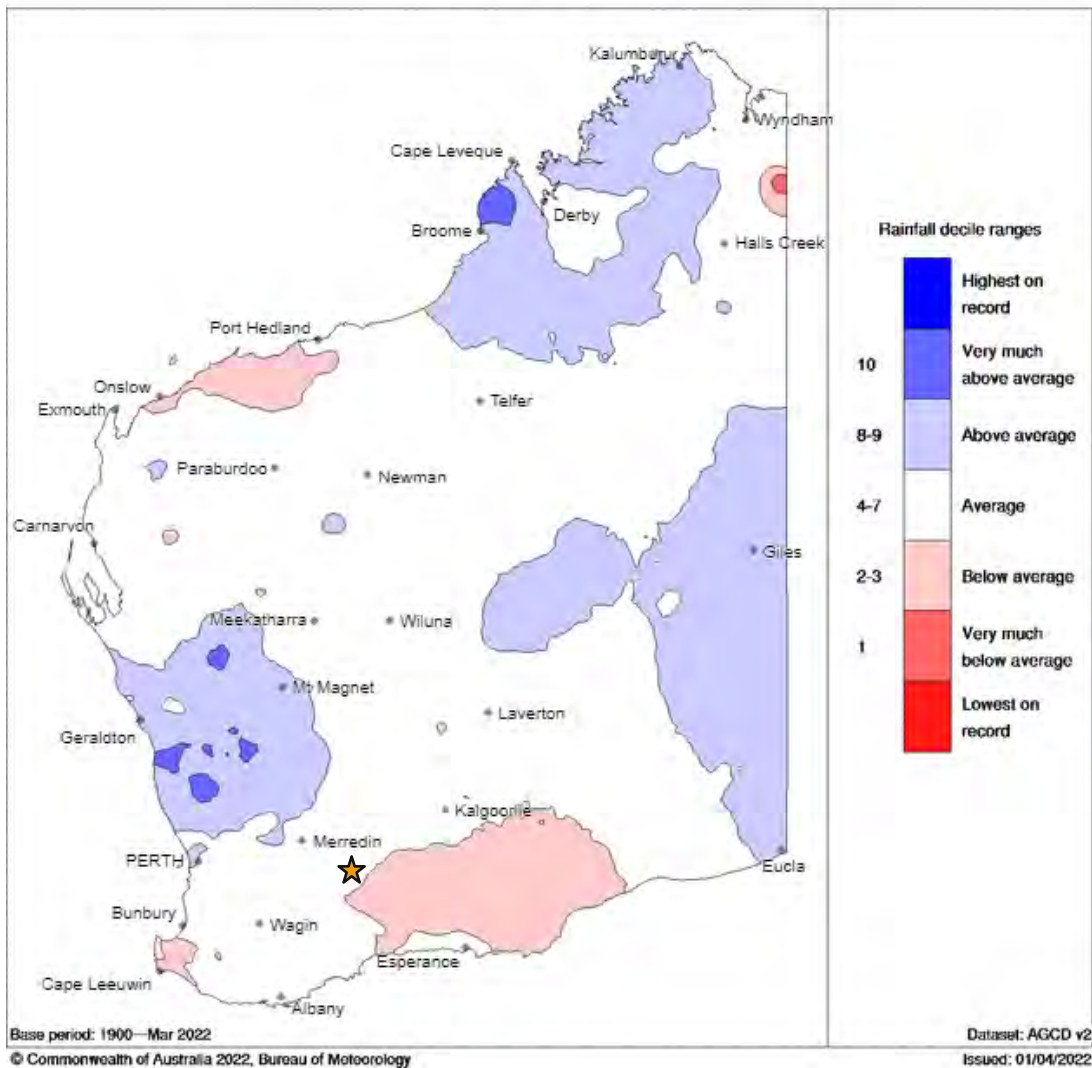


Figure 3: Rainfall deciles for the 6 months prior to the field survey. The star in Figure 3 indicates the approximate location of the field survey.

2.1.2 WETLANDS AND DRAINAGE

The survey area is located in the Swan Avon-Yilgarn catchment area (Landgate & Government of Western Australia 2022). The survey area intersects with four minor non-perennial watercourses. The closest wetland is Lake Cronin which is 33km south of the survey area.

2.1.3 ENVIRONMENTALLY SENSITIVE AREAS

The survey area intersects two mapped Environmentally Sensitive Areas (ESAs). These ESAs are associated with the Jilbadji Nature Reserve (R24049) and the Wockallary Nature Reserve (R29537) (Landgate & Government of Western Australia 2022).

Twelve of the proposed borrow pits are located within, or have a proportion located within, the Jilbadji and Wockallary Nature Reserves. The area of the proposed borrow pits that falls within the Jilbadji Nature Reserve is 201.67 ha and the area within the Wockallary Nature Reserve is 26.28 ha.

2.1.4 CONSERVATION LANDS

The proposed route intersects the Jilbadji Nature Reserve (R24049) and the Wockallarry Nature Reserve (R29537) and comes within 2.5 km of Frog Rock Reserve (R20262).

Twelve of the proposed borrow pits are located within, or have a proportion located within Jilbadji (201 ha) and Wockallarry Nature Reserves (26 ha). None of the proposed disturbance areas fall within Frog Rock Nature Reserve.

2.1.5 LAND USE HISTORY

Dominant land uses in the region include grazing native pastures (approximately 17%), UCL and Crown reserves (67%), Cultivation -Dry Land agriculture (2%) and Conservation Reserves (12%) (Cowan et al. 2001). The survey area includes evidence of disturbance from mineral exploration activity.

2.2 BIOLOGICAL ENVIRONMENT

2.2.1 BIOGEOGRAPHIC REGION

Biogeographic regions are delineated on the basis of similar climate, geology, landforms, vegetation and fauna and are defined in the Interim Biogeographical Regionalisation for Australia (IBRA) (Department of Agriculture Water and the Environment 2020). The survey area intersects two IBRA subregions of the Avon Wheatbelt and Coolgardie bioregions as described below.

AVW1, Merredin (Beecham (2001) *The Avon Wheatbelt is an area of active drainage dissecting a Tertiary plateau in Yilgarn Craton. Gently undulating landscape of low relief. Proteaceous scrubheaths, rich in endemics, on residual lateritic uplands and derived sandplains; mixed eucalypt, Allocasuarina huegeliana and Jam-York Gum woodlands on Quaternary alluvials and eluvials. Within this bioregion, AW1 is an ancient peneplain with low relief, gently undulating landscape. There is no connected drainage; salt lake chains occur as remnants of ancient drainage systems that now only function in very wet years. Lateritic uplands are dominated by yellow sandplain. Climate is Semi-arid (Dry) Warm Mediterranean.*

COO2, Southern Cross (Cowan, Graham & Mckenzie 2001); *The subregion has subdued relief, comprising gently undulating uplands dissected by broad valleys with bands of low greenstone hills. It lies on the 'Southern Cross Terrains' of the Yilgarn Craton. The granite strata of Yilgarn Craton are interrupted by parallel intrusions of Archaean Greenstone. Drainage is occluded. It has an arid to semi-arid Warm Mediterranean climate with 250-300 mm of mainly winter rainfall.*

2.2.2 THREATENED AND PRIORITY FAUNA

Combined database search results are incorporated into **Table 7** in **Appendix Two**.

Species identified by these database searches that are excluded from the field survey and further assessments (including likelihood assessments) are listed in **Table 8** along with the reason for their exclusion (e.g. marine species whose habitat does not occur within the survey area, invertebrates are not within the scope of the survey). Such excluded species are not further referenced in this document.

2.2.2.1 NatureMap

NatureMap (DBCA 2007-2021) is maintained collaboratively by the DBCA and the Western Australian Museum (WAM). These records represent a combination of vouchered museum specimens and records obtained via the Fauna Survey Returns Database which are maintained by the DBCA. The NatureMap database is currently being updated and reports are no longer obtainable via this system. However, previous database reports are valid for 5 years, therefore this report will include the NatureMap data obtained for the Detailed fauna survey conducted for Covalent Lithium in 2021 (Ecoscape 2021b).

The NatureMap search identified 12 conservation-listed vertebrate fauna species that have been recorded within a 40 km radius of 757926E 6448785S.

The list is comprised of:

- Five mammals
- Four birds
- One reptile.

The NatureMap results are incorporated into **Table 7 Appendix Two**.

2.2.2.2 EPBC-listed Threatened Fauna

The Protected Matters Search Tool (PMST) search, using a 20 km buffer, identified the following as having been recorded or having potential to occur within the search area:

- Two mammals
- Five birds

The PMST results are incorporated into **Table 7 Appendix Two**.

DBCA Database Search

A search of the DBCA databases was conducted (search reference: FAUNA#7051) using a 60 km buffer around the provided shapefiles of the survey area. Thirteen conservation-listed were identified as having previously been recorded from within the search area buffer, consisting of:

- Nine mammals
- Three birds
- One reptile.

The DBCA database results are incorporated into **Table 7 Appendix Two**

2.2.2.3 Threatened and Priority Fauna Likelihood Assessment

The likelihood of conservation-listed fauna species, as identified by the database and literature searches, occurring within the survey area was assessed using the following criteria:

- suitability of habitat types likely to be present within the survey area
- distance between previous record of conservation-listed species and the survey area
- frequency and number of records in the region
- date of record of conservation-listed species (recent or historical)
- the record is naturally occurring (not from a sanctuary or translocated population).

The following were also taken into consideration during the assessment:

- sufficiency of information
- behavioural and ecological characteristics such as cryptic behaviours, size and mobility of species
- record certainty.

The categories of likelihood of occurrence, assessed using the above criteria, are shown in **Table 2**.

Table 2: Categories for likelihood of occurrence of conservation-listed fauna

Likelihood Category	Criteria
Known to occur	Species previously recorded within the survey area within 25 years.
Likely to occur	Suitable habitat is expected to occur within the survey area and records of the species within 25 years exist within close proximity*
May occur	Suitable habitat is expected to occur within the survey area and historic records of the species exist within close proximity* OR Suitable habitat is expected to occur within the survey area and recent (<25yrs) records exist within the database search buffer but not in close proximity*
Unlikely to occur	Suitable habitat is expected to occur within the survey area however previous records are limited and/or historic and/or not in proximity** OR Suitable habitat is not expected to occur within the survey area and recent (<25yrs) records do not occur in close proximity*
Very Unlikely to occur	Suitable habitat is not expected to occur in the survey area AND/OR previous records are limited and/or historic and/or not in proximity**

* close proximity = 15 km [= ¼ of the distance of the database search buffer]

** proximity = 30 km [= ½ of the distance of the database search buffer]

The likelihood of species occurring within the survey area are indicated in **Table 7** in **Appendix Two**. Five species were assessed as having a High likelihood of occurring within the survey area:

- *Dasyurus geoffroii* (Chuditch, Western Quoll)
- *Notamacropus Irma* (Western Brush Wallaby)
- *Leipoa ocellata* (Malleefowl)
- *Platycercus icterotis xanthogenys* (Western Rosella (inland))
- *Falco peregrinus* (Peregrine Falcon)

Likelihood of occurrence does not take into consideration factors such as frequency that a species occurs (or may occur), the duration that such species occupies (or may occupy) the survey area or dependence on habitat or resources within the survey area. Highly mobile species potentially only occur within (or for birds, overflying) the survey area for very brief periods and/or on very infrequent intervals. If a previous observation included in the database search records corresponds with this event it is listed as 'known'; if such a transient visitation is possible in the future the likelihood of such species occurring is likely listed as 'likely'.

Following the field survey, when actual survey area characteristics are better understood and the level of survey effort was considered, the likelihood of occurrence was re-evaluated. The post-survey likelihood is also incorporated into **Table 7** and discussed further in **Section 5.1.3.1**, including providing an indication of dependence of species on the habitat and resources available within the survey area.

2.2.2.4 Black Cockatoos

According to DBCA mapping (DSEWPaC 2012), the survey area is outside the modelled distribution for Black Cockatoos, with the closest confirmed breeding area approximately 60km Southwest of the survey area (Landgate & Government of Western Australia 2022).

2.2.3 FAUNA HABITAT

Previous surveys conducted by Ecoscape identified the following broad habitat types occurring within the survey area or are known from nearby:

- Mallee woodland
- Salmon Gum woodland
- Shrubland

2.3 RELEVANT LITERATURE

2.3.1 PREVIOUS SURVEYS

The following documents have been identified as having relevance to current survey:

- Ecoscape Australia Pty Ltd (2019a) *Covalent Malleefowl Monitoring*. Report prepared for Covalent Lithium Pty Ltd.
- Ecoscape Australia Pty Ltd (2019b) *2019 Mt Holland Chuditch Monitoring*. Report prepared for Covalent Lithium Pty Ltd.
- Ecoscape Australia Pty Ltd (2020a) *2019 Mt Holland Malleefowl Monitoring*. Report prepared for Covalent Lithium Pty Ltd.
- Ecoscape Australia Pty Ltd (2020b) *Pipeline Fauna Survey*. Report prepared for Covalent Lithium Pty Ltd.
- Ecoscape Australia Pty Ltd (2020c) *Blue Vein and Powerline Access Roads Fauna Survey*. Report prepared for Covalent Lithium Pty Ltd.
- Ecoscape Australia Pty Ltd (2020d) *2020 Mt Holland Chuditch Monitoring*. Report prepared for Covalent Lithium Pty Ltd.
- Ecoscape Australia Pty Ltd (2021a) *2020 Malleefowl Monitoring*. Report prepared for Covalent Lithium Pty Ltd.
- Ecoscape Australia Pty Ltd (2021b) *Earl Grey Lithium Project – Detailed Terrestrial Fauna Survey*. Report prepared for Covalent Lithium Pty Ltd.

2.3.2 IBSA DATA SEARCH

The Department of Water and Environmental Regulation's (DWER's) *Index of Biodiversity Surveys for Assessments (IBSA)* Portal (DWER 2021) was searched for recent environmental surveys in the vicinity of the survey area.

The search, conducted on 21.03.2022, identified 14 environmental surveys that have been conducted within 150 km of the survey area. 11 of these listings did not have data accessible for review i.e. contained metadata only. The following documents had relevance to current survey:

- Western Wildlife (2017), Earl Grey Lithium Project: Level 2 vertebrate fauna survey with targeted Chuditch and Malleefowl surveys, 2016 – 2017. Unpublished report to Kidman Resources Limited.
- Mattiske Consulting Pty Ltd (2018). Threatened and Priority Flora Assessment, Earl Grey Lithium - Pre-Clearance Surveys.

2.3.3 OTHER LITERATURE

No other documents have been located that provide contextual information for this assessment.

3 METHODS

3.1 SURVEY AIMS

The aims of the biological survey were to:

- conduct a Basic fauna survey
- Chuditch (*Dasyurus geoffroii*) and Mallefowl (*Leipoa ocellata*) targeted surveys
- Arid Bronze Azure Butterfly (*Ogyris subterrestris petrina*, 'ABAB') targeted surveys.

Whilst these species were the targets of the surveys, any other conservation-listed fauna encountered directly or indirectly during the survey were also to be recorded.

3.2 GUIDING PRINCIPLES

The fauna and fauna habitat survey was conducted as a Basic survey according to the Fauna Technical Guidance (EPA 2020). The EPA recommends a Basic survey should:

- be conducted as a low intensity survey to gather broad fauna and habitat information
- verify the adequacy of the desktop assessment
- map, describe and photograph habitats
- record opportunistic fauna observations
- identify possible future survey site locations, access and logistics
- determine if a Detailed survey is required.

Targeted surveys were also conducted to gather information on significant fauna and habitats.

3.3 FAUNA FIELD SURVEY

The methods utilised during the field survey followed those outlined in the Fauna Technical Guidance (EPA 2020), conducted as a Basic survey.

Conservation criteria used in this assessment are included in **Table 5** and **Table 6** in **Appendix One**..

Survey method details are outlined below.

3.3.1 FAUNA SURVEY METHODS

The Basic fauna survey incorporated a number of survey techniques as per the Terrestrial Fauna Technical Guidance (EPA 2020) including habitat assessment, active searches, raking of spoil heaps and leaf litter, searches for secondary evidence such as scats and tracks, as well as opportunistic searches.

Survey techniques included:

- opportunistic bird observations while moving through the survey area
- turning of surface debris (rocks, logs, vegetation spoil heaps) that reptiles and mammals may shelter beneath
- raking of litter beds to locate fossorial reptile species
- tree hollow inspection to detect fauna
- baited motion cameras (Reconyx HC500) to capture evidence of cryptic and nocturnal fauna species not easily observed directly
- Anabat Swift recorders fitted with ultrasonic microphones to sample for bats.
- Targeted dig surveys for the ant species, *Camponotus sp. nr. terebrans*.

Fauna species were identified opportunistically based on sightings, calls, remains, diggings and other signs. Potential habitats for conservation significant species were identified and evaluated (see **Section 3.3.1.1**) and their likelihood of occurrence re-assessed.

Based on the desktop assessment, the following were considered to be “Likely to Occur” in the survey area and they, and habitat suitable to support them, were targeted during the field survey:

- *Dasyurus geoffroyi* (Chuditch, Western Quoll)
- *Notamacropus Irma* (Western Brush Wallaby)
- *Leipoa ocellata* (Malleefowl)
- *Platycercus icterotis xanthogenys* (Western Rosella (inland))
- *Falco peregrinus* (Peregrine Falcon)

3.3.1.1 Fauna Habitat Assessment

The fauna habitats present within the survey areas were identified and mapped. Fauna habitats were described as an area which is distinguishable from its surrounding area by its landform, vegetation and fauna assemblage occupying the area. In addition, its likelihood to harbour specialised fauna species which are not found in adjacent areas was taken into consideration.

The following information was used to identify and map all fauna habitats within the survey area:

- previous fauna habitat mapping
- land systems
- vegetation type and condition mapping
- aerial imagery
- landforms
- soil characteristics
- fauna assemblage information.

The composition and characteristics of each fauna habitat type was recorded, including noting suitability for various fauna suites or conservation-listed species. Habitat types were delineated in the field and digitised upon return from the field survey.

3.3.2 TARGETED SURVEY METHODS

3.3.2.1 Chuditch Survey Methods

Chuditch (*Dasyurus geoffroyi*; EPBC-, BC Act VU)

The suitability of the survey area for Chuditch, also known as Western Quoll, such as the presence of fallen hollow logs and hollow standing trees, was recorded.

The survey area was intensively searched by walked search patterns looking for evidence of presence such as tracks, scats, and dens. Baited trail cameras were located in suitable habitat to detect presence of this species.

3.3.2.2 Malleefowl Survey Methods

Malleefowl (*Leipoa ocellata*; EPBC-, BC Act VU)

Surveyors recorded the presence and locations of nest mounds of any age, as well as observations, tracks and scats. The *National Malleefowl Recovery Team Monitoring Manual* (NMRT 2019) provided guidance for Malleefowl survey methods.

3.3.2.3 Arid Bronze Azure Butterfly Survey Methods

Methods used for the survey followed the Department of Biodiversity Conservation and Attractions (DBCA) ABAB survey guidelines (DBCA 2020a). The surveys were conducted under the guidance of Ecoscape Principal Zoologist Bruce Turner.

The ABAB survey guidelines state that the host ant colonies occur at the base of mature smooth-barked eucalypts. Host ant colonies seem to occur at two extremes - either the ant colonies are very sparse and difficult to find; or else they are very widespread, with ants obvious and abundant (DBCA 2020a).

To determine if the host ant is present at a site, and in what numbers, a random sample of trees is examined and assessed for ant presence/absence. Ant presence can be determined either by nocturnal survey (visiting the trees in the evening, commencing in the first hour after sunset) or by diurnal survey (disturbing the soil around the base of the trees, to a depth of ~ 10 cm, to determine if an ant colony is present). Ecoscape used the diurnal survey method by disturbing soil at the base of trees using a square mouthed shovel to dig 10 cm deep trenches at the base of the sampled trees.

100 trees were sampled at 10 separate locations where smooth barked trees were dominant. Trees sampled included those beside roads and tracks, where sugar ants (and the ABAB) are typically more abundant (DBCA 2020a). If a large colony of the host ant is present, the ants will be clearly apparent on tree trunks in the evening, or in nests at the base of trees during the day.

4 FIELD SURVEY RESULTS

4.1 FAUNA SURVEY

The fauna survey was conducted by Bruce Turner (Principal Zoologist), Robert Hemsworth (Senior Zoologist) and Sam Ryken (Senior Zoologist) from the 28th of March until the 5th of April 2022.

The survey was conducted in accordance with the requirements for a Basic survey as outlined in the Fauna Technical Guidance (EPA 2020). The habitat assessment points were traversed on foot and all habitats were assessed for quality and capability of supporting both locally common and significant fauna species.


4.1.1 FAUNA HABITAT




Four fauna habitat types were recorded within the survey area (**Table 3**):


- Eucalypt Woodland (Open/Closed)
- Shrubland
- Regrowth
- Seasonal Marsh

The quality of each habitat type was based on the field surveyor's experience and takes into consideration the level of disturbance to habitats from weeds, the amount of native vegetation, vegetation cover (density) and the context of the habitat with the surrounding landscape.

Table 3: Fauna habitat types

Habitat type	Description	Photograph
Eucalypt woodland	<p>Open Eucalypt woodland consisting of mixed compositions of Eucalypt species. Occurring within this habitat type are Salmon Gum, Mallee, Mallet, Gimlet, Red Morrel and Wandoo. Occurring mostly over low shrubs on clay, clayey sand and sandy clay soils; minimal understory; 30-50% litter cover; high frequency of fallen logs.</p> <p>Disturbance: Low to high.</p> <p>Fire Age: >10 yrs.</p> <p>Extent: 367.77ha, 11.7%</p>	

Habitat type	Description	Photograph
<p>Shrubland</p>	<p>Closed to dense shrublands of mixed species (<i>Allocasuarina</i>, <i>Hakea</i>, <i>Acacia</i>, and/or <i>Melaleuca</i>) on clay, clayey sand, sand or sandy clay soils; gravel; 50-95% litter cover.</p> <p>Disturbance: Low to high.</p> <p>Fire Age: 5-10 yrs.</p> <p>Extent: 1312.62ha, 41.77%</p>	
<p>Regrowth</p>	<p>Vegetation regrowth in previously cleared areas such as old borrow pits. Comprising of open shrubland of mixed species (<i>Allocasuarina</i>, <i>Hakea</i>, <i>Acacia</i>, and/or <i>Melaleuca</i>) on clayey sand or sandy clay soils; gravel; 10% litter cover.</p> <p>Disturbance: Low to high.</p> <p>Fire Age: >10 yrs.</p> <p>Extent: 5.76ha, 0.18%</p>	
<p>Seasonal Marsh</p>	<p>Seasonal inundated marsh with Samphire and low <i>Melaleuca</i> shrub; clay soils; quartz; 5% litter cover.</p> <p>Disturbance: Low.</p> <p>Fire Age: >10 yrs.</p> <p>Extent: 0.43ha, 0.01%</p>	

Habitat type	Description	Photograph
Cleared or developed	<p>Not habitat, includes borrow pits and land cleared for agricultural use.</p> <p>Disturbance: High.</p> <p>Extent: 1455.42ha, 46.32%</p>	
Total Extent	3142 ha, 100%	

EUCALYPT WOODLAND

The Eucalypt woodland type (367.77ha) occurred in a variety of compositions within the survey area, with Salmon Gum woodlands over mixed shrub species (mostly *Melaleuca* sp.) on clay flats being the most frequently occurring form. This habitat type also included varying degrees of Gimlet (*E. Salubris*), Merrit (*E. flocktoniae*), Red Morrel (*E. longicornis*), Wheatbelt Wandoo (*E. capillosa*) and species of Mallet (e.g. *E. astringens*). Mallee woodland was included within the Eucalypt woodland habitat type, as it was usually interspersed with other Eucalypt species. Mallee woodland describes a structural type, and there is variability in plant species composition. Mallee woodland has a shrubland understorey ranging from minimal to dense.

Mallee woodland includes one or more of Tall Sand Mallee (*Eucalyptus eremophila*), Stiff-leaved Mallee (*E. rigidula*), Wheatbelt Wandoo (*E. capillosa*), Lerp Mallee (*E. incrassata*), Square-fruited Mallee (*E. prolixa*), Burracoppin Mallee (*E. burracoppinensis*), *E. ravida*, *E. urna*, White Mallee (*E. cylindriflora*), Yorrell (*E. gracilis*), Woodline Mallee (*E. cylindrocarpa*) and Merrit (*E. flocktoniae*) (Mattiske Consulting 2021). The understorey includes a range of shrubs, particularly *Melaleuca* spp.

Salmon Gum woodland is significant for the tall hollow-bearing trees and large fallen logs that provide shelter and nesting opportunities for a wide range of fauna species. It potentially supports conservation significant fauna including the Chuditch (*Dasyurus geoffroi*), Inland Western Rosella (*Platycercus icterotis xanthogenys*), and Central Long-eared Bat (*Nyctophilus major tor*). Where the woodland is interspersed with Mallee, Allocasuarina and Acacia species, it may also support Malleefowl (*Leipoa ocellata*). Eucalypt woodland also provides nesting habitat for small birds where the understorey is dense. In this habitat, the reptile assemblage is likely to vary depending upon the substrate type (e.g. clay, sand etc) and the litter cover.

SHRUBLAND

Shrublands (1312.62ha) are common throughout the survey area. Shrublands occur on sandy-clay flats, gravelly sands and lateritic rises and vary in composition, but are usually dominated by species of Allocasuarina, Hakea, Acacia, Banksia and/or Melaleuca. Although sparse low mallee eucalypts may be present, this habitat lacks large trees. The dense structure of the vegetation provides shelter and nesting habitat for ground-dwelling birds. When in flower, shrubland habitats are likely to attract a suite of nectar-feeding bird species.

Shrublands also occur in small, isolated patches throughout Eucalypt woodland habitat, at a scale too small to be mapped (mostly *Melaleuca* species).

Shrublands potentially support conservation significant fauna including the Malleefowl (*Leipoa ocellata*), Chuditch (*Dasyurus geoffroii*), Rainbow Bee-eater (*Merops ornatus*), Western Brush Wallaby (*Notamacropus irma*) and Lake Cronin Snake (*Paroplocephalus atriceps*).

Strips of highly disturbed habitat; shrublands interspersed with areas of Salmon Gum and Mallee woodland, can also be found along roadsides in the parts of the survey area that have been developed for agricultural use. These areas of roadside vegetation support species typical of agriculturally developed land, such as Australian Ringneck (*Barnardius zonarius*), Magpie Lark (*Grallina cyanoleuca*), Willie Wagtail (*Rhipidura leucophrys*) and Galah (*Eolophus roseicapilla*).

REGROWTH

Several areas of regrowth (5.76ha) were recorded in association with old borrow pits bordering the Shrubland habitat type. The open nature of this habitat in combination with young regrowth is potentially favoured by a suite of reptile species. Raptors will use open areas for foraging and macropod species are frequently seen in areas of regrowth as well foraging on young shrub species.

Within both the Eucalypt woodland and the Shrubland habitat there were areas with different stages of regrowth after fire or historical clearing.

SEASONAL MARSHLAND

There are two seasonal marshlands (0.43 ha) located in the survey area (**Map 2**). One wetland (insert map reference here – Map 2-13?) comprised of Samphire and low *Melaleuca* shrub on clay with quartz gravel. Whereas the second wetland (Map 2-36?) is formed by a layer of granite and clay that retains water seasonally and is surrounded by low grasses.

The wetlands potentially support conservation significant bat species such as the Central Long-eared Bat (*Nyctophilus major tor*). Migratory waterbird species may use the wetland areas; however, this is unlikely as there is a larger wetland nearby; Lake Cronin which is 33km south of the survey area.

4.1.2 FAUNA ASSEMBLAGE

Sixty-four vertebrate and one invertebrate fauna species were recorded during the survey (**Table 9** in **Appendix Three**), consisting of:

- Twenty-two mammals (seven introduced)
- Thirty-six birds
- Six reptiles
- One invertebrate.

Of these, three are conservation-listed:

- *Notamacropus irma* (Western Brush Wallaby); P4 DBCA status, recorded on a camera trap.
- *Leipoa ocellata* (Malleefowl); VU EPBC status; VU BC status, recently used mound recorded.
- *Nyctophilus major tor* (Central Long-eared Bat); P4 DBCA status, ambiguous call recorded on a bat ultrasonic recorder.

The sugar ant *Camponotus sp. nr. Terebrans* was also recorded (

Table 12, Image 3 and Image 4: Sugar ants (*Camponotus sp. nr. terebrans*), which may indicate suitable habitat for the conservation listed Arid Bronze Azure Butterfly (*Ogyris subterrestris petrina*) CR EPBC status; CR BC status.

Survey sites are shown on **Map 2** and listed in **Table 10, Table 11** and

Table 12 in **Appendix Three**.

4.1.3 SIGNIFICANT FAUNA AND ASSOCIATED HABITAT

The significant fauna species observed during the field survey are discussed below with respect to each species' habitat requirements, taking into consideration the findings of the field survey and survey effort.

4.1.3.1 Western Brush Wallaby

A Western Brush Wallaby was recorded on a camera trap and scats were found during the field survey. Suitable habitat for Western Brush Wallaby is found throughout the survey area (1680.39 ha). The Western Brush Wallaby's optimum habitat is open forest or woodland, particularly favouring open, seasonally wet flats with low grasses and open scrubby thickets. It is also found in some areas of mallee and heathland and is uncommon in karri forest (Van Dyck & Strahan 2008).

4.1.3.2 Malleefowl

Two Malleefowl (*Leipoa ocellata*) mounds were found during the survey (**Map 2, Table 11**), mound 1 (**Image 1** and **Image 2**) was found next to an old drill line and did not show any recent activity, mound 2 (**Image 1**) showed signs of very recent activity and was directly adjacent to a recently cleared track. Neither mound has previously been recorded as part of an Ecoscape fauna survey. Suitable Malleefowl habitat was found to occur in the survey area.



Image 1 and Image 2: Malleefowl mounds located within the survey area.

4.1.3.3 Arid Bronze Azure Butterfly Survey Results

One hundred smooth-barked trees, comprising of Salmon Gum and Mallet, were sampled at 10 separate locations (**Table 12, Map 2**) across the survey area. Surveys identified the presence of two active colonies of the sugar ant (*Camponotus sp. nr. terebrans*) (**Image 3 and Image 4**), at locations Sugar Ant 1 and Sugar Ant 2 (**Map 2 - 42**) immediately adjacent to the survey area.



Image 3 and Image 4: Sugar ants (*Camponotus* sp. nr. *terebrans*)

4.1.4 FAUNA SURVEY LIMITATIONS

Table 4: Fauna survey limitations

Possible limitations	Constraints (yes/no): Significant, moderate or negligible	Comment
Availability of data and information	No	DBCA guidelines were specific and detailed. No constraints in obtaining data.
Competency/experience of the survey team, including bioregion experience	No	Field survey staff were experienced (36 years) with the targeted fauna survey methods used and with the identification of fauna and fauna habitat.
Scope of survey e.g. excluded fauna groups	No	Targeted species adequately sampled, and no sampling methods were constrained due to external factors.
Timing, weather, season	No	No constraints.
Disturbances that may have affected results	No	No significant disturbances were observed that could negatively affect survey results.
Proportion of fauna identified, recorded, or collected	No	The primary focus of the field survey was the definition of targeted species and fauna habitat types.
Adequacy of survey intensity and proportion of survey achieved	No	All major fauna habitat types including those favoured by conservation significant fauna were investigated and defined.
Access	No	No access issues encountered; survey areas adequately surveyed.
Data and analysis issues including sampling biases	No	Limited data collected; no analysis required.

5 DISCUSSION

5.1 FAUNA SIGNIFICANCE

5.1.1 FAUNA HABITAT TYPES

Four broad fauna habitat types were recorded during the field survey (**Section 4.1.1**):

- Eucalypt woodland (367.77ha)
- Shrubland (1312.62ha)
- Regrowth (5.76ha)
- Seasonal Marsh (0.43ha)

Within the two main habitat types (Eucalypt woodland and Shrubland) there were also areas with different stages of regrowth after fire or historical clearing. On a landscape scale, these areas of regrowth coupled with older unburnt areas, create a mosaic environment which can support a diverse range of species. Some of these species will have specific habitat requirements that will be unique e.g. Malleefowl require shrubland or open Mallee woodland over shrub, Chuditch require Eucalypt woodland with a high percentage of fallen hollow logs.

Cleared or developed areas, such as cleared borrow pits and roads are not considered to be habitat.

A total of 227.95 ha of the area proposed to be cleared, occurs within the Jilbadji (201.67 ha) and Wockallary (26.28 ha) Nature Reserves (**Map 2**) Borrow pits 44, 46, 47.1, 47.2, 48.1, 48.2, 49.2, 50.1, 50.2, and 51 fall within the Jilbadji Nature Reserve, and borrow pits 18 and 19 fall within Wockallary Nature Reserve, these have been previously cleared and utilised as borrow pits. Clearing within these nature reserves may require additional approvals.

5.1.2 FAUNA ASSEMBLAGE

Sixty-four vertebrate fauna species and one targeted invertebrate species were recorded during the field survey (**Table 9** in **Appendix Three**). Survey techniques used included active searches, habitat assessments, trail cameras and ultrasonic recording units. All species recorded were expected to occur and were considered typical for the region and the habitat surveyed. The conservation significant vertebrate species that were recorded were Malleefowl (*Leipoa ocellata*), Western Brush Wallaby (*Notamacropus irma*) and Central Long-eared Bat (*Nyctophilus major tor*). The likelihood of occurrence of conservation significant species that were not recorded is discussed below. Each species is discussed with respect to their habitat requirements, taking into consideration the findings of the field survey and survey effort, and determining their post-survey likelihood of occurrence (**Table 7** in **Appendix Two**).

Targeted surveys for the sugar ant *Camponotus* sp. nr. *Terebrans* identified the presence of the species at two locations, Sugar Ant 1, and Sugar Ant 2 (**Map 2** - 42). The sugar ant is the host species of the conservation listed species the Arid Bronze Azure Butterfly (*Ogyris subterrestris petrina*) and is discussed below.

5.1.3 RECORDED CONSERVATION-LISTED SPECIES

Arid Bronze Azure Butterfly (*Ogyris subterrestris petrina*) – CR EPBC Act, CR BC Act

A targeted fauna survey was conducted to determine the presence/absence of the sugar ant species *Camponotus* sp. nr. *terebrans* within the survey area. The sugar ant is the host species of the conservation listed species Arid Bronze Azure Butterfly (*Ogyris subterrestris petrina*) (ABAB). The ABAB is a 'Threatened Species' that is listed as 'Critically Endangered' under the national *Environment Protection and Biodiversity Conservation Act 1999* and the state *Biodiversity Conservation Act 2016*. The surveys were conducted in accordance with the *DBCAs - Guideline for the survey of arid bronze azure butterfly (ABAB) in Western Australia* (2020).

The ABAB has an obligate association with the sugar ant, with its larvae living within the ants' nest and protected by the ants during development. It is thought that the ants are rewarded with secretion that are produced by the larvae. In order to maintain this association, the ABAB requires large colonies of the sugar ants. Despite being widespread, the sugar ant is uncommon and (as of 2020) only three large colonies and several small colonies are known to occur, with the ABAB occurring at two of the large colonies, which are over 50 km from the survey area. The habitat at these two large colonies is mature mixed Gimlet *Eucalypt Salubris* and Salmon Gum *Eucalypt Salmonophloia* woodland on red-brown loam soils, with an open understorey. The habitat where the colonies in this survey were found matches this habitat description.

According to the DBCA - *Guideline for the survey of arid bronze azure butterfly (ABAB) in Western Australia* (2020a), on-ground ABAB surveys may not be required, as the densities of sugar ant colonies found during this survey are low, ants were detected at two single trees out of the 100 trees sampled. However, it is a requirement that the presence of the sugar ant colonies be reported to DBCA.

Malleefowl (*Leipoa ocellata*) – VU EPBC Act, VU BC Act

Malleefowl are large stocky, mostly ground dwelling birds that construct large nesting mounds that contain decomposing leaf litter which they use to incubate their eggs. Malleefowl habitat consist of shrubland and Mallee woodland with sandy soils, high cover of leaf litter and that has been unburnt for a long period of time (Benshemesh 2007). Suitable Malleefowl habitat was found throughout the survey area, and it is highly likely that this species is widely distributed through this habitat.

Two Malleefowl mounds (points MF1; MF2) were recorded during the survey (**Map 2** – 43; 55), only one showed signs of recent activity, however this mound was directly adjacent to a recently cleared track. The presence of an active mound may require an exclusion zone.

Western Brush Wallaby (*Notamacropus irma*) – P4 DBCA status

The Western Brush Wallaby's optimum habitat is open forest or woodland, particularly favouring open, seasonally wet flats with low grasses and open scrubby thickets. It is also found in some areas of mallee and heathland, and is uncommon in karri forest (Van Dyck & Strahan 2008). Suitable habitat for Western Brush Wallaby is found throughout the survey area (1680.39 ha). One Western Brush Wallaby was recorded on a camera trap and multiple scats were found during the field survey. The DBCA database search returned 41 records of Western Brush Wallaby within the survey area, the majority of which have been recorded since 2016. Western Brush Wallabies have an estimated home range of 32.5 to 69.2 ha (Bamford, Inglis & Watson 2009) and the local area likely supports a resident population of an unknown number of individuals.

Central Long-eared Bat (*Nyctophilus major tor*) – P4 DBCA status

Central Long-eared Bat is widespread across the arid south of Australia, and though thought to have a population of substantially more than 10,000 individuals, the reliability of this estimate is low (Woinarski, Burbidge & Harrison 2014). Although only known from 15 localities in Western Australia, it is considered locally common in the Coolgardie Bioregion (DEWHA 2010). It occurs in eucalypt woodlands with a tall shrub understorey and around granite outcrops, roosting beneath bark, in tree crevices or in the foliage of trees (DEWHA 2010; Van Dyck & Strahan 2008). Current threats to this species are inferred and include habitat loss and fragmentation or inappropriate fire regimes leading to a loss of habitat and/or roost sites (Woinarski, Burbidge & Harrison 2014). The Central Long-eared Bat is known from Jilbadji Nature Reserve (DEWHA 2010), which the survey area intersects, and is likely to occur in the Mallee and Salmon Gum Woodland habitat, with 367.77 ha of suitable habitat occurring within the survey area.

The calls of long-eared bat species *Nyctophilus* spp. cannot be distinguished reliably, therefore either or both the Lesser Long-eared Bat *Nyctophilus geoffroyi* and/or the Central Long-eared Bat *Nyctophilus major tor* may have been present in the survey area. Given that the Central Long-eared Bat has been previously recorded in the Jilbadji Nature Reserve, it is likely that it occurs within the survey area, however trapping would be required to distinguish it from the sympatric Lesser Long-eared Bat for further confirmation.

5.1.3.1 Post-survey Likelihood Assessment

The post-survey likelihood assessment is incorporated into **Table 7** in **Appendix Two**.

Conservation-listed fauna species identified during the desktop assessment as being known to occur in the survey area that were not recorded during the field survey are discussed below with respect to each species' habitat requirements, taking into consideration the findings of the field survey and survey effort.

Western Rosella (Inland) (*Platycercus icterotis xanthogenys*) – P4 DBCA status

The Western Rosella only occurs in the south-west of Western Australia and is Western Australia's only rosella species. The subspecies, *Platycercus icterotis xanthogenys*, occurs in the drier inland areas and is known to occur in the survey area. This species feeds both in trees and on the ground and is sometimes seen eating grain along roadsides.

Suitable habitat occurs in the area and DBCA records indicate that this species has been recorded in the survey area, with 11 records from 2017 occurring within the Earl Grey Development Envelope. It is likely that, because this species is uncommon but widespread, it was just not observed during this survey. Therefore, the post-survey likelihood of the species occurring in the survey area is "Likely."

Peregrine Falcon (*Falco peregrinus*) – OS BC status/DBCA status

This bird of prey saw massive declines in the 1960s and 1970s due to the use of the pesticide DDT. Populations in Australia have recovered better than elsewhere in the world, however it is still protected by legislation, as are all Australian raptors. This species is not confined to a specific habitat, although it is usually seen perching on poles, fences, or dead trees in agricultural areas. It nests on cliffs, buildings, or the old stick nests of other species e.g. Raven.

No Peregrine Falcons were recorded during the survey. DBCA records indicate that this species does occur in the survey area, with one record from 2017 occurring within the Earl Grey Development Envelope, however this species is likely to be transient in the area. The agricultural lands occurring at the northern end of the survey area are the preferred foraging habitat for this species, however, suitable breeding habitat is limited in these areas. Given the extent of the agricultural areas within the local region, clearing in this area is likely to have minimal impact on this species. The post-survey likelihood of the species occurring in the survey area is "Likely."

Chuditch (*Dasyurus geoffroi*) – VU EPBC status; VU BC status/DBCA status

Once relatively abundant across semiarid Australia in every mainland state, the Chuditch today survives only in the south-west of Western Australia, living in Jarrah forests, drier woodlands, and Mallee shrubland in the far eastern Wheatbelt.

Chuditch require adequate numbers of suitable den and refuge sites (hollow logs or earth burrows) and sufficient prey biomass (large invertebrates, reptiles, and small mammals) to survive. They are capable of travelling long distances and have large home ranges, and even at their most abundant, Chuditch are generally present in low numbers. For this reason, they require habitats that are of a suitable size and not excessively fragmented (DBCA 2017). Chuditch are known to occur in the survey area and suitable habitat occurs throughout the area (Eucalypt Woodland 367.77 ha, and to a lesser extent Shrubland 1312.62 ha).

There are 216 records of Chuditch occurring within the survey area buffer zone, with many occurring in the Earl Grey development envelope. The majority (201) of these records are from 2016 and 2017, during surveys conducted by Western Wildlife for Covalent Lithium (Western Wildlife 2017).

Chuditch are listed as vulnerable (VU) under the Commonwealth EPBC Act 1999 and the Western Australian BC Act 2016 and are considered as Matters of National Environmental Significance (MNES). Covalent Lithium has an ongoing Chuditch monitoring program to monitor the density of the local Chuditch population prior to, during, and post construction of the mine and associated infrastructure. Therefore, the absence of Chuditch in the present survey is not an indication of their absence from the survey area, as they have been

recorded locally and suitable habitat exists within the survey area. Therefore, the post-survey likelihood of the species occurring in the survey area is "Known."

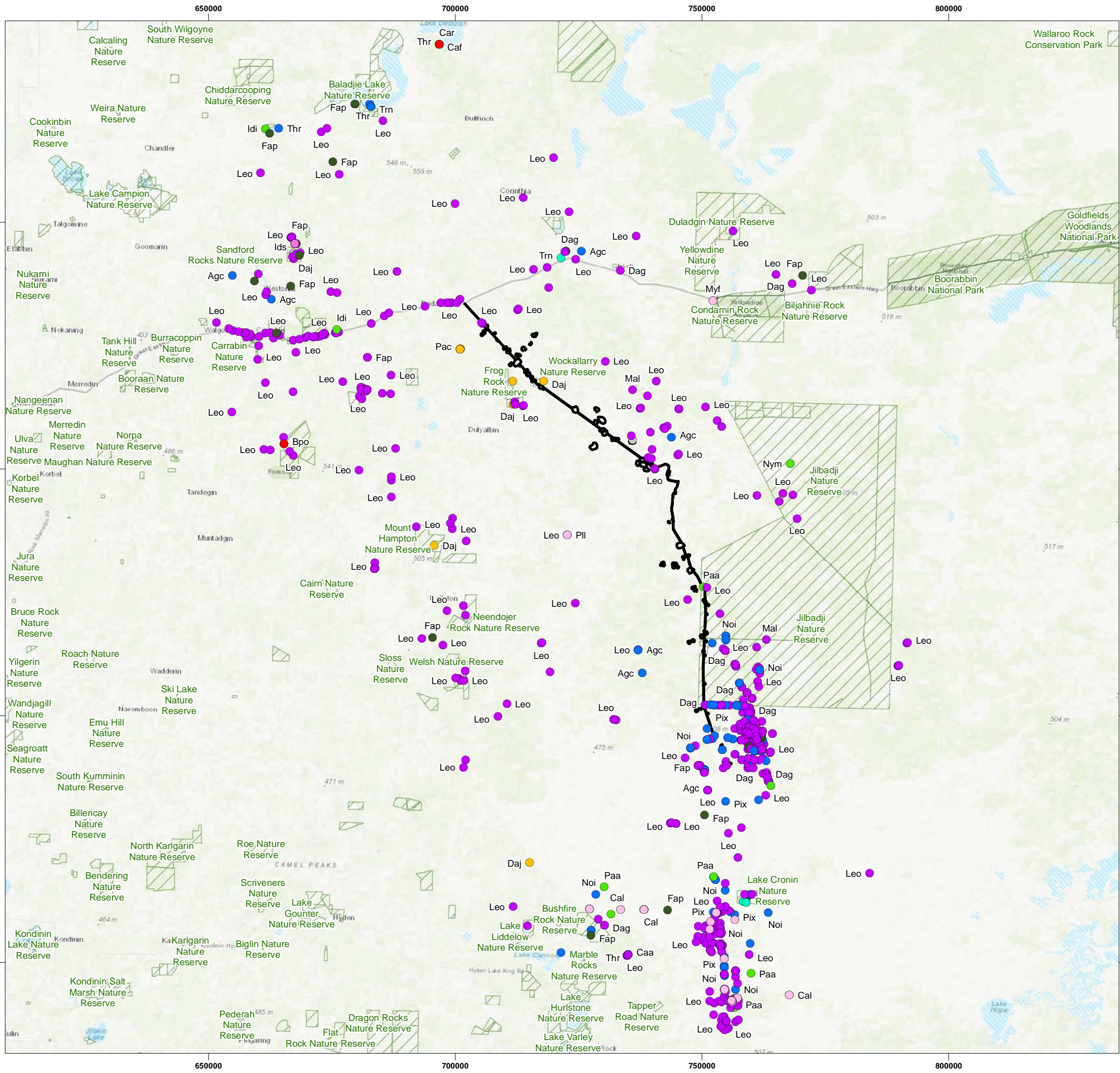
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MAPS



LEGEND

- Survey
- DBCA Nature Reserve (2011)

Conservation Significant Fauna

- Critically Endangered
- Endangered
- Endangered or Priority 3
- Vulnerable
- Conservation Dependent
- Migratory Species
- Other Specially Protected
- Priority 1
- Priority 3
- Priority 4

Taxon Name	Code	Status
<i>Aganippe castellum</i>	Agc	P4
<i>Apus pacificus</i>	App	MI
<i>Bettongia penicillata ogilbyi</i>	Bpo	CR
<i>Calidris acuminata</i>	Caa	MI
<i>Calidris ferruginea</i>	Caf	CR
<i>Calidris ruficollis</i>	Car	MI
<i>Calyptorhynchus latirostris</i>	Cal	EN
<i>Daphnia jollyi</i>	Daj	P1
<i>Dasyurus geoffroyi</i>	Dag	VU
<i>Falco peregrinus</i>	Fap	OS
<i>Idiosoma intermedium</i>	Idi	P3
<i>Idiosoma sp.</i>	Ids	EN or P3
<i>Leipoa ocellata</i>	Leo	VU
<i>Leporillus conditor</i>	Lec	CD
<i>Macrotis lagotis</i>	Mal	VU
<i>Myrmecobius fasciatus</i>	Myf	EN
<i>Notamacropus irma</i>	Noi	P4
<i>Nyctophilus major tor</i>	Nym	P3
<i>Parartemia contracta</i>	Pac	P1
<i>Paroplocephalus atriceps</i>	Paa	P3
<i>Petrogale lateralis lateralis</i>	PII	EN
<i>Phascogale calura</i>	Phc	CD
<i>Platycercus icterotis xanthogenys</i>	Pix	P4
<i>Thinornis rubricollis</i>	Thr	P4
<i>Tringa nebularia</i>	Trn	MI

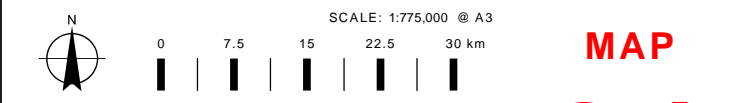
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 SERVICE LAYERS: SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY



**DBCA DATABASE
 SEARCH RESULTS - FAUNA
 BASIC TERRESTRIAL
 VERTEBRATE FAUNA SURVEY**



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



PROJECT NO: 4715-22

REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

**MAP
01**

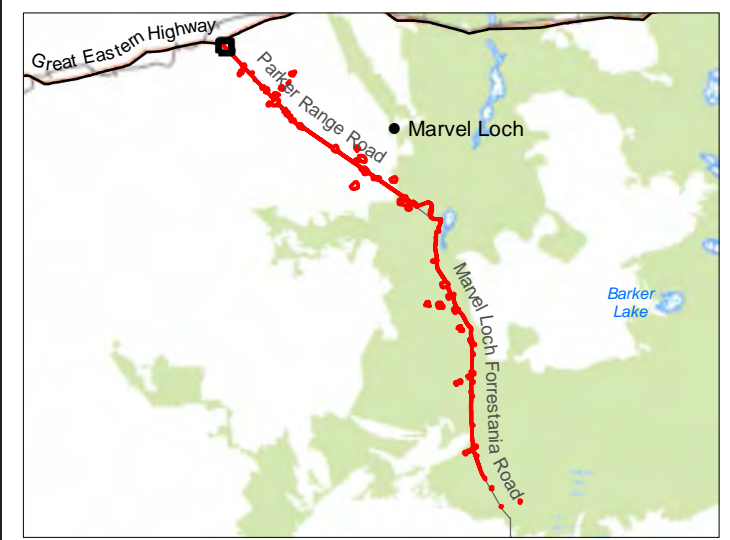


LEGEND

Survey Area

Fauna Habitat

Cleared



DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBCA 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



FAUNA HABITAT
LOGISTICS ROAD FAUNA SURVEY



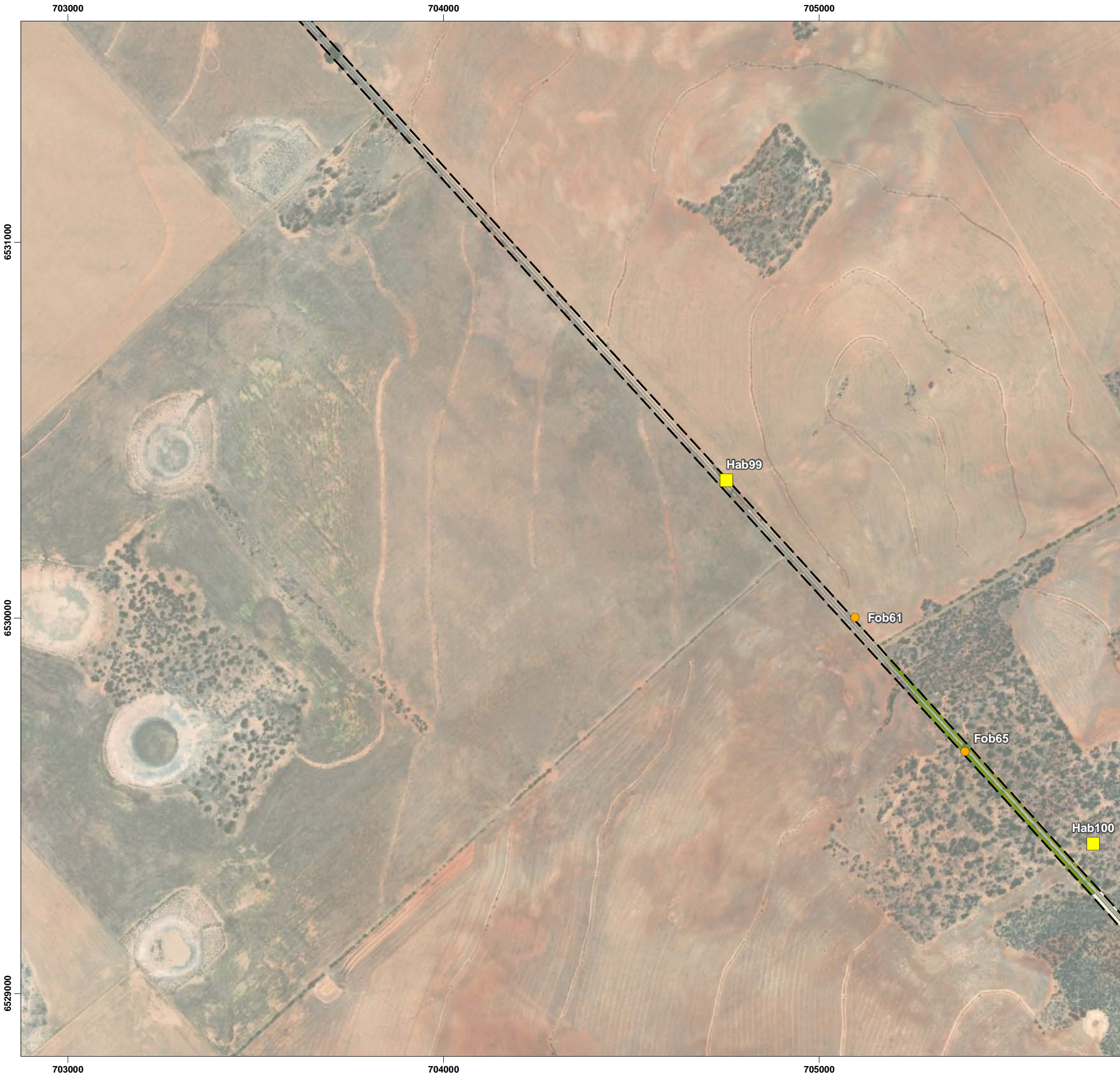
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 DATUM: GDA 1994
 UNITS: METER









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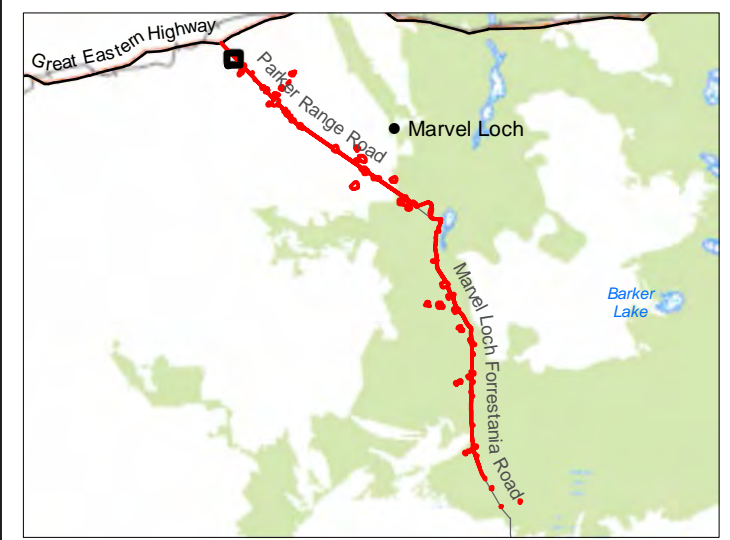
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MAP
2-1



LEGEND

-  Survey Area
-  Fauna Observation Point
-  Habitat Assessment Point
- Fauna Habitat**
-  Shrubland
-  Woodland (Open/Closed)
-  Cleared



DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBCA 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



**FAUNA HABITAT
 LOGISTICS ROAD FAUNA SURVEY**



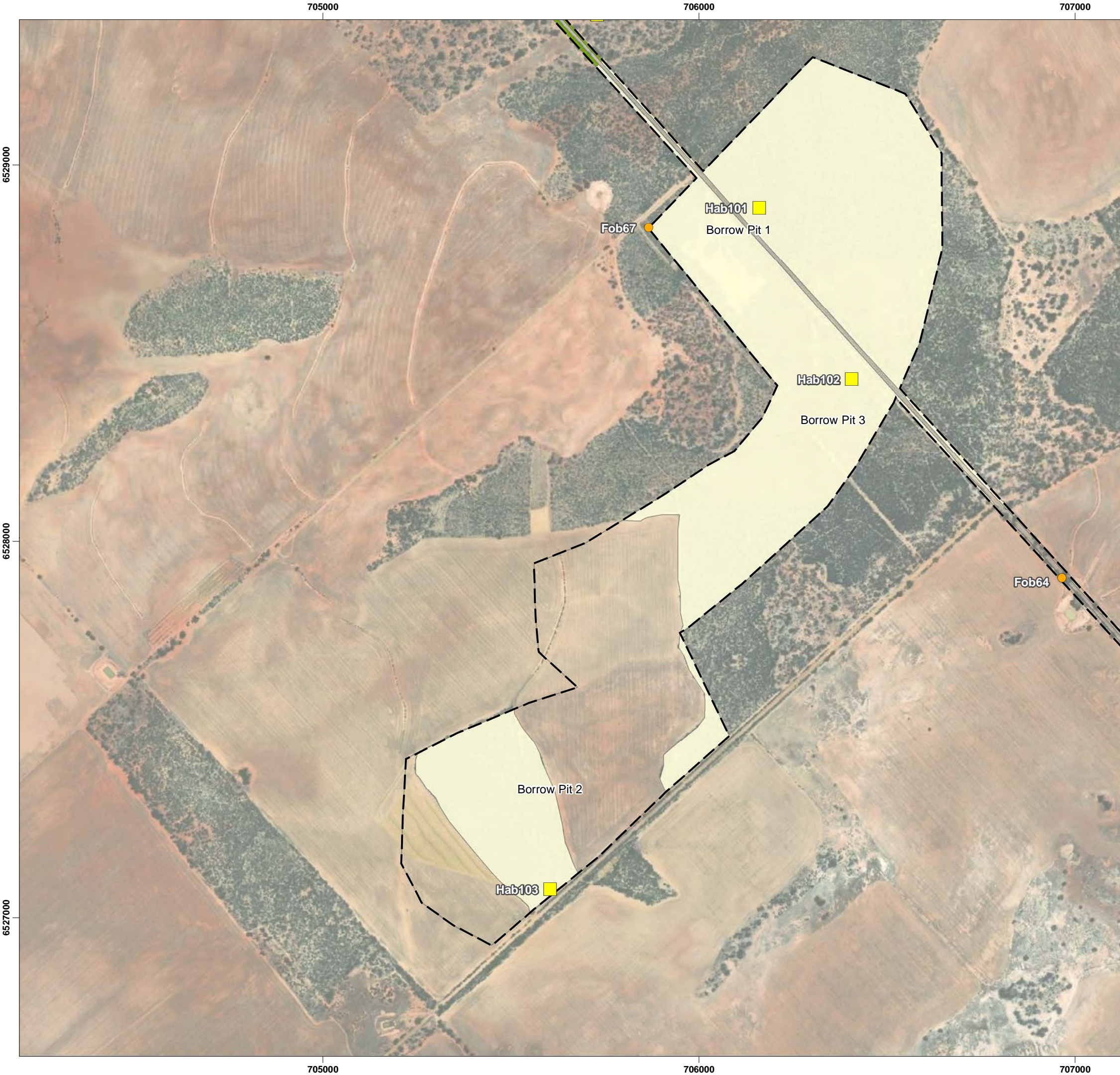
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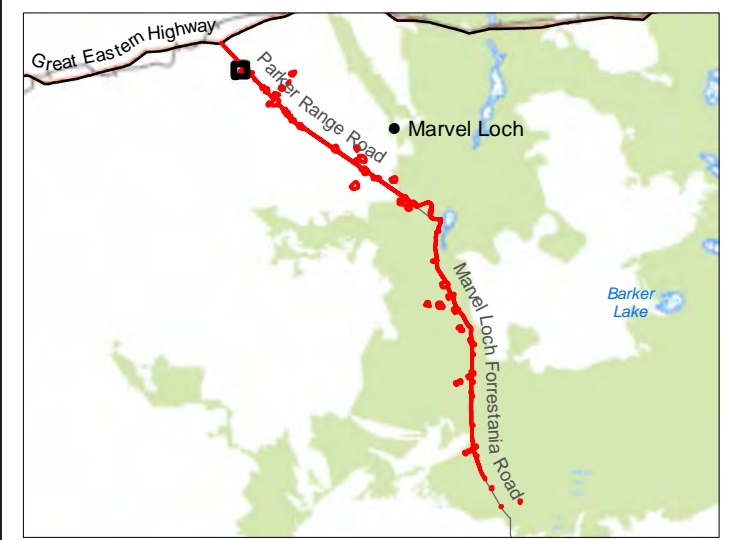
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**MAP
 2-2**



LEGEND

- Survey Area
- Fauna Observation Point
- Habitat Assessment Point
- Fauna Habitat**
- Shrubland
- Woodland (Open/Closed)
- Cleared



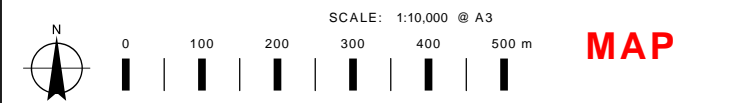
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 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



**FAUNA HABITAT
 LOGISTICS ROAD FAUNA SURVEY**



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER









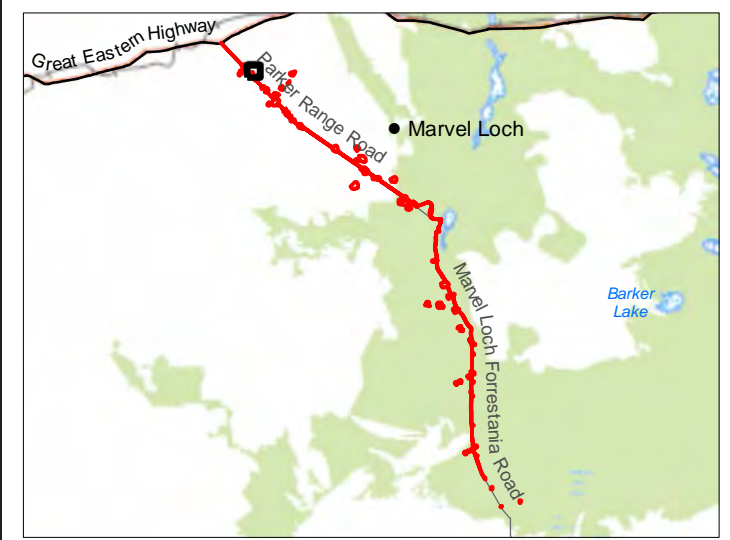
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**MAP
 2-3**



LEGEND

-  Survey Area
-  Fauna Observation Point
-  Habitat Assessment Point
- Fauna Habitat**
-  Shrubland
-  Woodland (Open/Closed)
-  Cleared



DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBCA 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



**FAUNA HABITAT
 LOGISTICS ROAD FAUNA SURVEY**



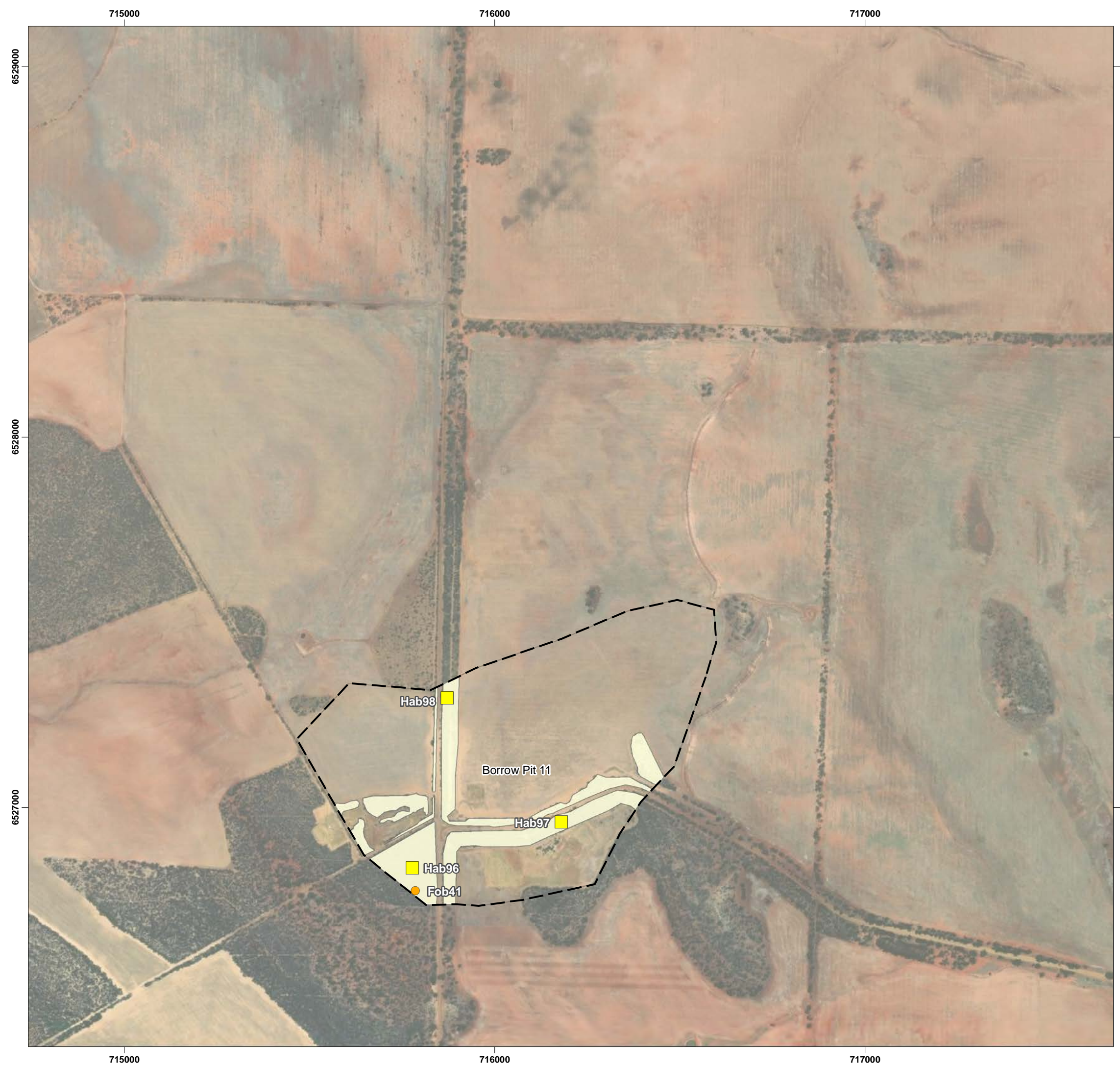
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 DATUM: GDA 1994
 UNITS: METER








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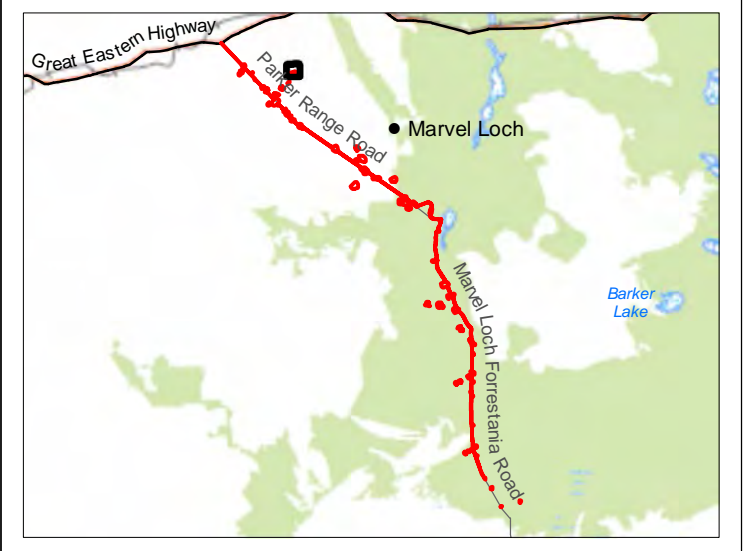
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**MAP
 2-4**



LEGEND

-  Survey Area
 -  Fauna Observation Point
 -  Habitat Assessment Point
- Fauna Habitat**
-  Shrubland
 -  Cleared



DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBCA 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



**FAUNA HABITAT
 LOGISTICS ROAD FAUNA SURVEY**



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER









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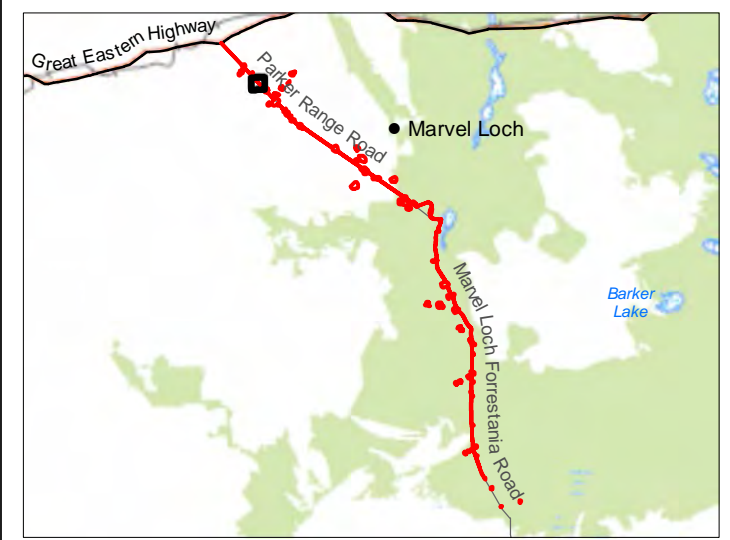
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**MAP
 2-5**



LEGEND

-  Survey Area
-  Fauna Observation Point
-  Habitat Assessment Point
- Fauna Habitat**
-  Shrubland
-  Woodland (Open/Closed)
-  Cleared



DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBCA 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



**FAUNA HABITAT
 LOGISTICS ROAD FAUNA SURVEY**



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



PROJECT NO: 4715-22

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**MAP
 2-6**

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LEGEND

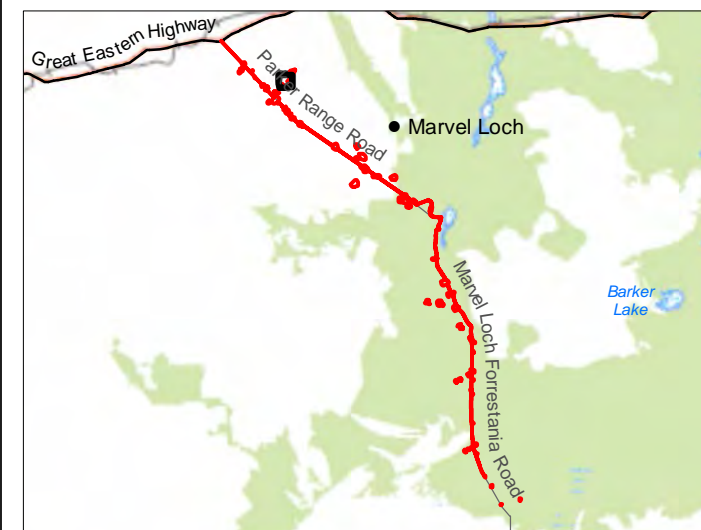
Survey Area

Habitat Assessment Point

Fauna Habitat

Shrubland

Cleared



DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBCA 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



FAUNA HABITAT
LOGISTICS ROAD FAUNA SURVEY



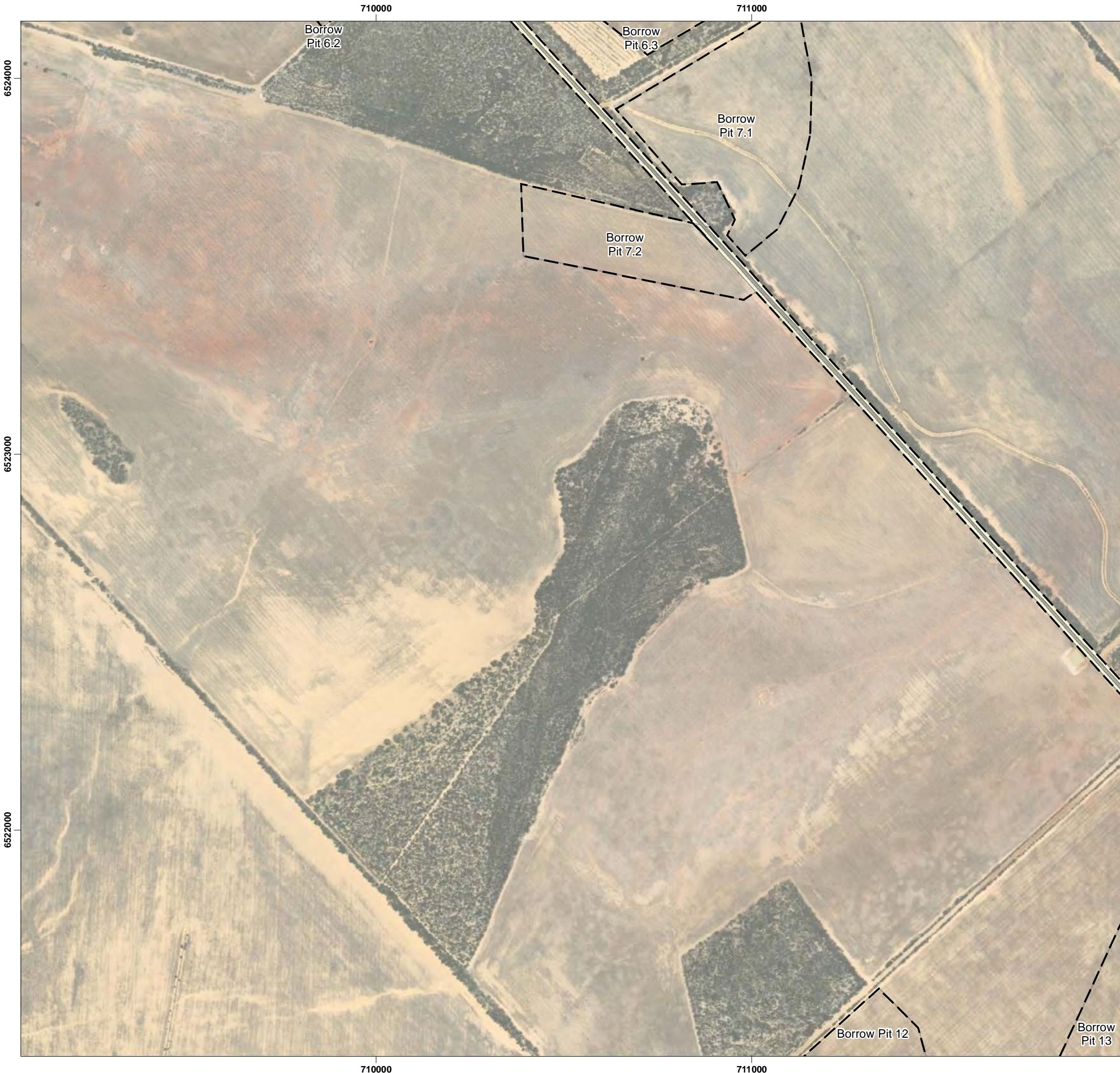
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 DATUM: GDA 1994
 UNITS: METER






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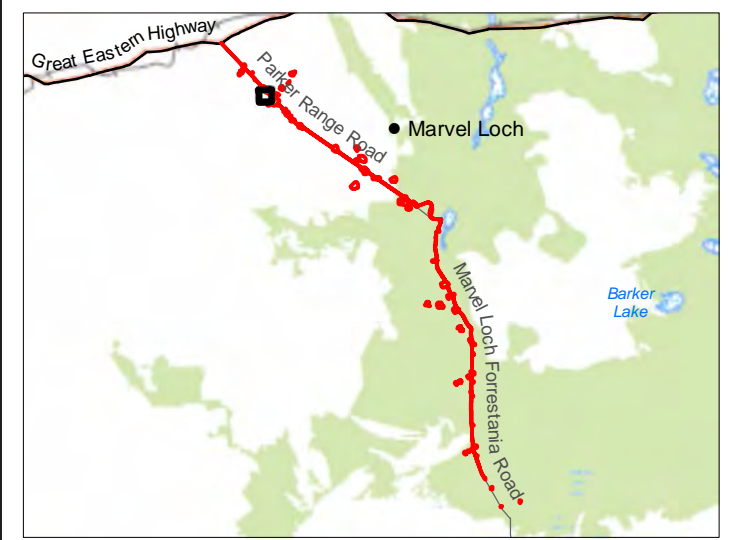
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MAP
2-7



LEGEND

-  Survey Area
- Fauna Habitat**
-  Shrubland
-  Cleared



DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBCA 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



FAUNA HABITAT
LOGISTICS ROAD FAUNA SURVEY



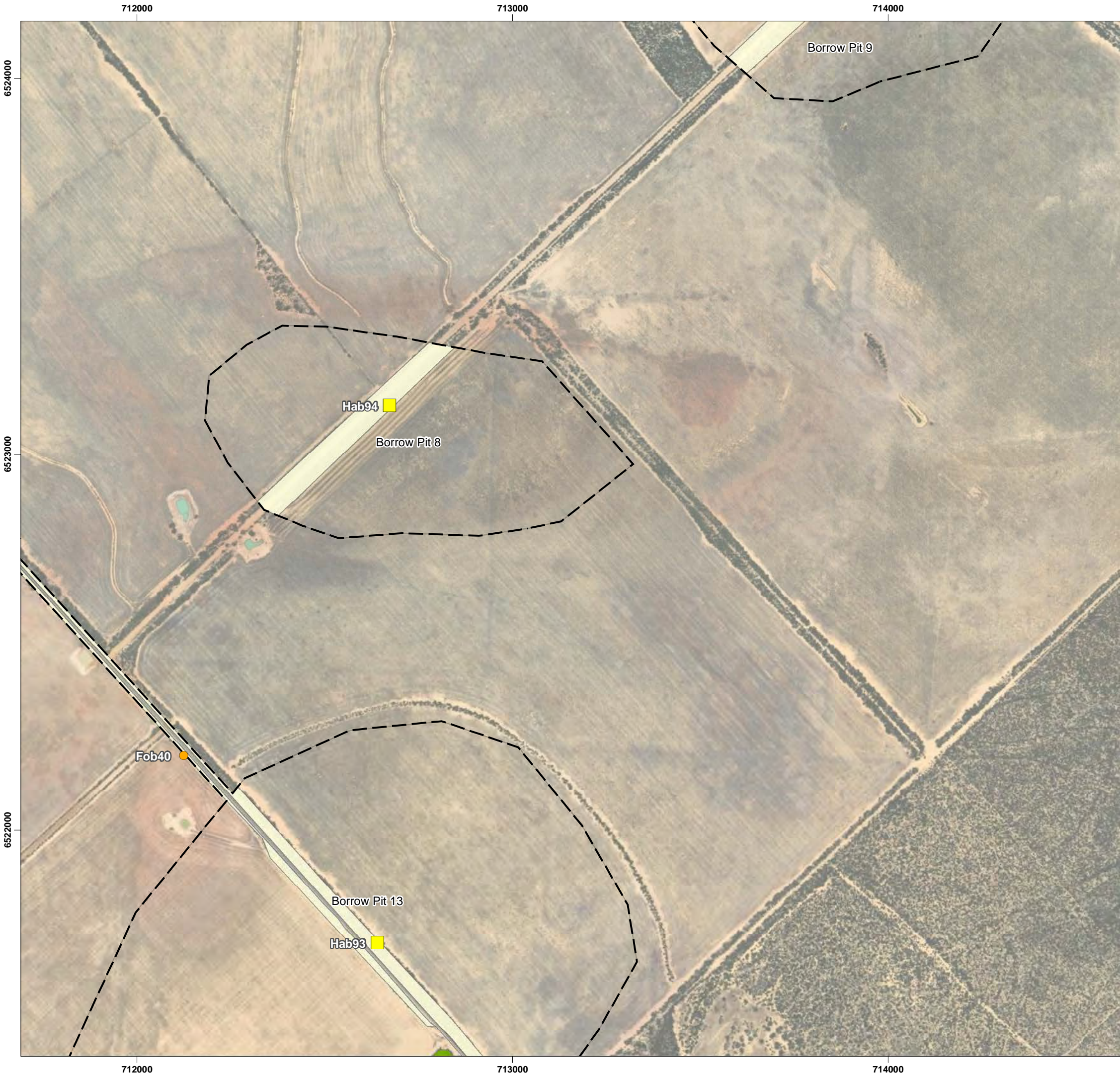
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 UNITS: METER









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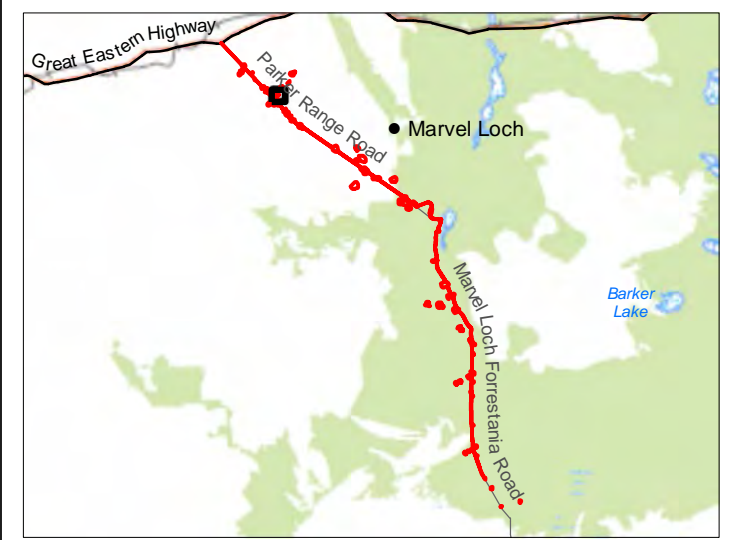
REV	AUTHOR	APPROVED	DATE
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MAP
2-8



LEGEND

-  Survey Area
-  Fauna Observation Point
-  Habitat Assessment Point
- Fauna Habitat**
-  Shrubland
-  Woodland (Open/Closed)
-  Cleared



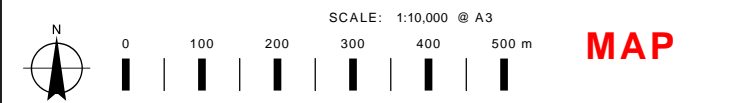
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 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



**FAUNA HABITAT
 LOGISTICS ROAD FAUNA SURVEY**



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



PROJECT NO: 4715-22

REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

**MAP
 2-9**

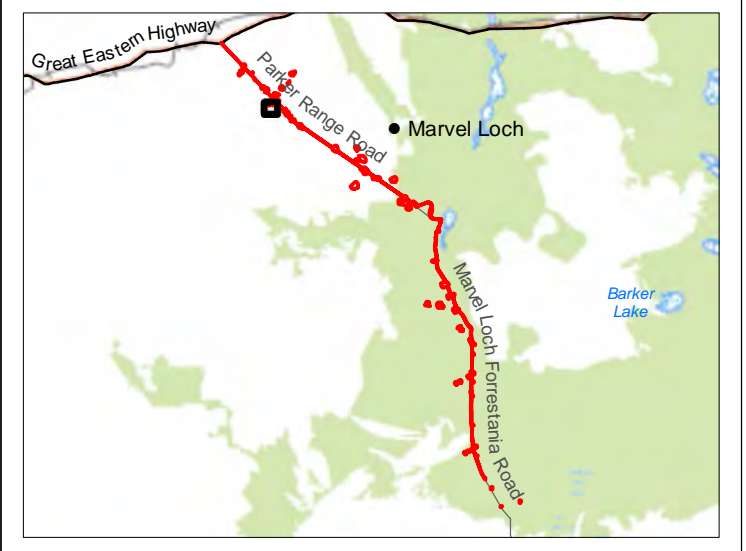


LEGEND

- Survey Area
- Habitat Assessment Point
- DBCA Nature Reserve (2011)

Fauna Habitat

- Shrubland
- Woodland (Open/Closed)
- Cleared



DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBCA 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



FAUNA HABITAT
LOGISTICS ROAD FAUNA SURVEY



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER

SCALE: 1:10,000 @ A3

PROJECT NO: 4715-22

REV	AUTHOR	APPROVED	DATE
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MAP 2-10

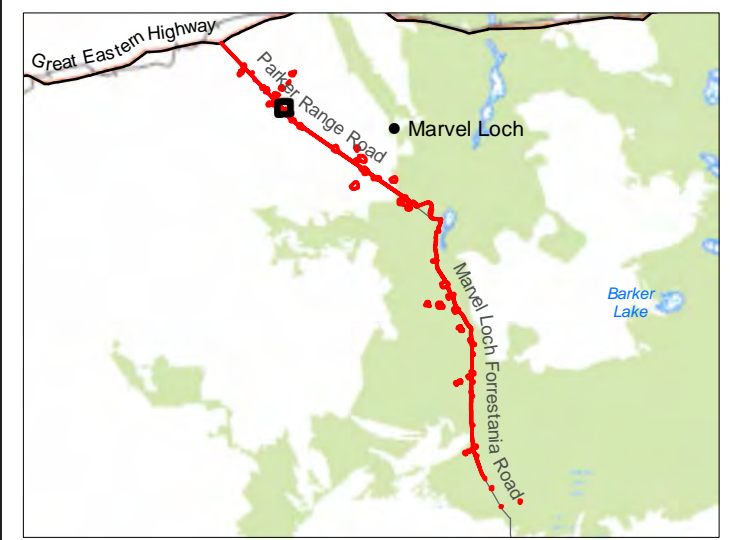


LEGEND

- Survey Area
- Habitat Assessment Point

Fauna Habitat

- Shrubland
- Woodland (Open/Closed)
- Cleared



DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBCWA 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



FAUNA HABITAT
LOGISTICS ROAD FAUNA SURVEY



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER

SCALE: 1:10,000 @ A3

MAP 2-11

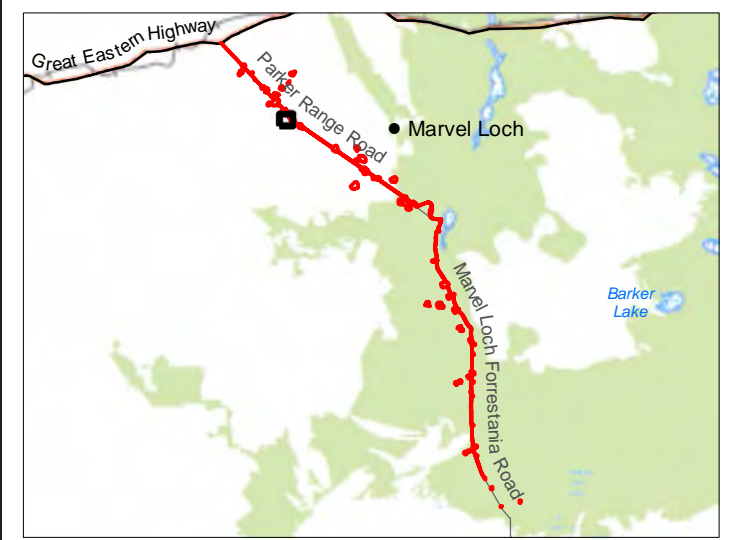
PROJECT NO: 4715-22

REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022



LEGEND

- Survey Area
- Habitat Assessment Point
- DBCA Nature Reserve (2011)
- Fauna Habitat**
- Shrubland
- Cleared



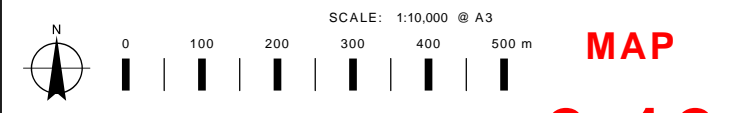
DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBCAs 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



**FAUNA HABITAT
 LOGISTICS ROAD FAUNA SURVEY**



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



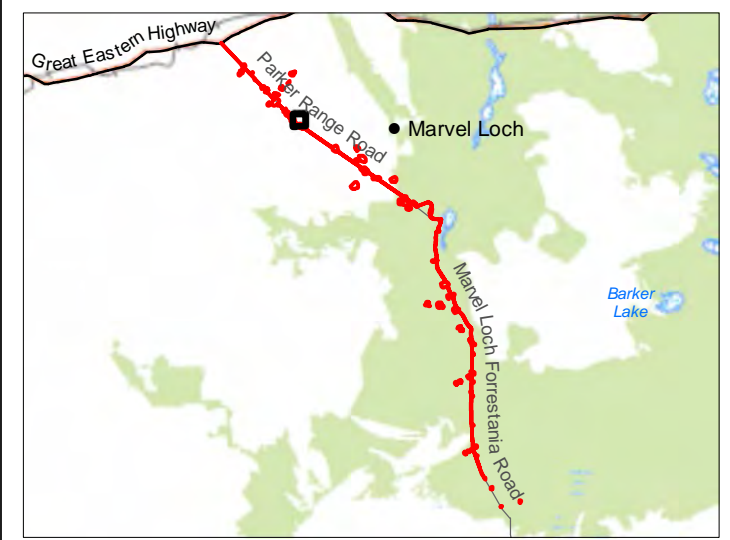
PROJECT NO: 4715-22			
REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

**MAP
 2-12**



LEGEND

- Survey Area
 - Fauna Observation Point
 - Habitat Assessment Point
 - DBCA Nature Reserve (2011)
- Fauna Habitat**
- Seasonal Marsh
 - Shrubland
 - Woodland (Open/Closed)
 - Cleared



DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBC 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



**FAUNA HABITAT
 LOGISTICS ROAD FAUNA SURVEY**



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



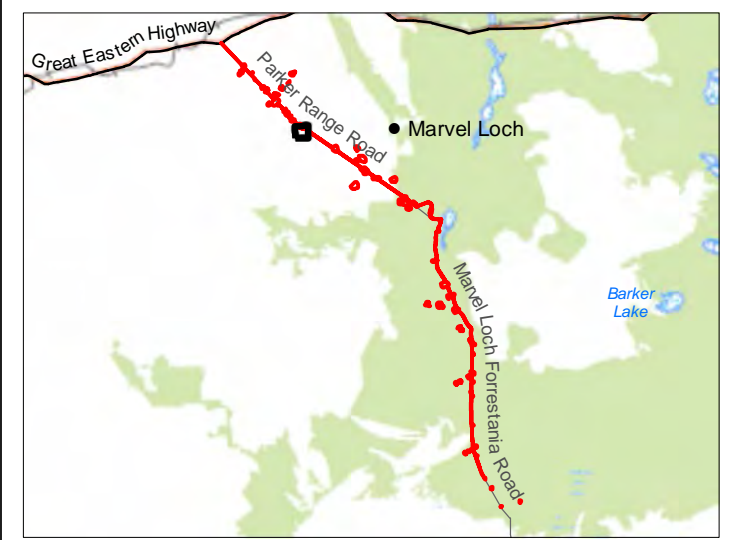
PROJECT NO: 4715-22			
REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

**MAP
 2-13**



LEGEND

- Survey Area
- Fauna Observation Point
- Habitat Assessment Point
- DBCA Nature Reserve (2011)
- Fauna Habitat**
- Shrubland
- Woodland (Open/Closed)
- Cleared



DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBC 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



**FAUNA HABITAT
 LOGISTICS ROAD FAUNA SURVEY**



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



PROJECT NO: 4715-22

REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

**MAP
 2-14**

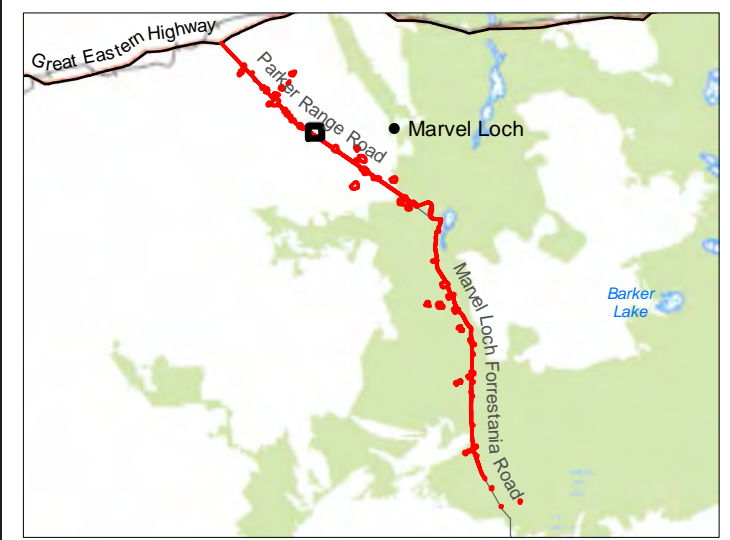


LEGEND

- Survey Area
- Fauna Observation Point
- Habitat Assessment Point

Fauna Habitat

- Woodland (Open/Closed)
- Cleared



DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBCA 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



**FAUNA HABITAT
 LOGISTICS ROAD FAUNA SURVEY**



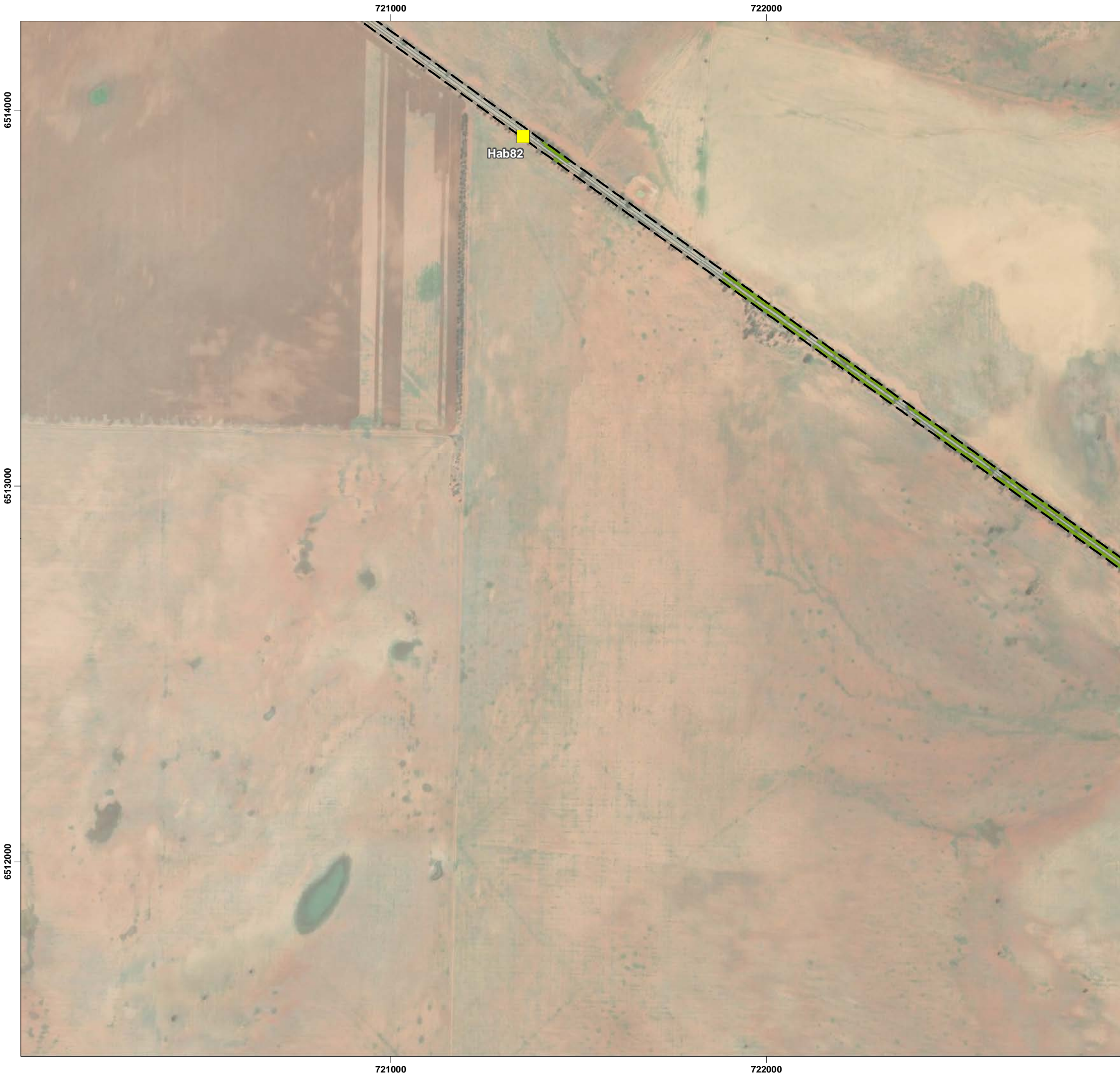
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 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER

SCALE: 1:10,000 @ A3





**MAP
2-15**

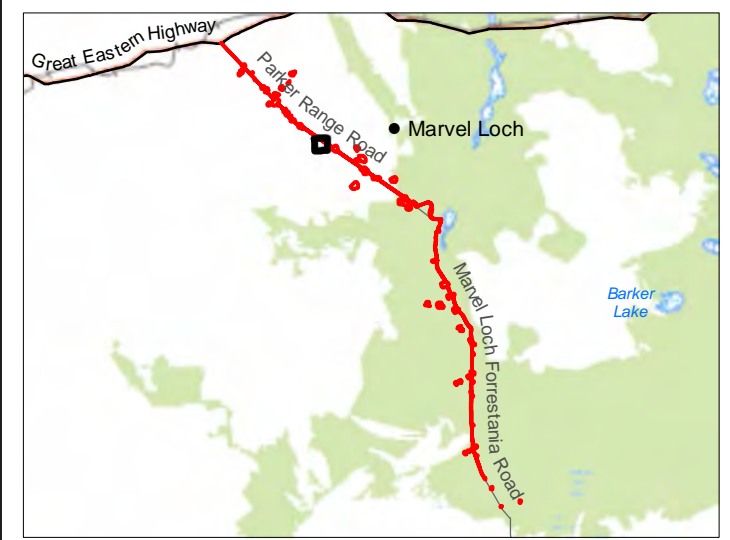
REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

PROJECT NO: 4715-22



LEGEND

-  Survey Area
-  Habitat Assessment Point
- Fauna Habitat**
-  Woodland (Open/Closed)
-  Cleared



DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBCA 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



**FAUNA HABITAT
 LOGISTICS ROAD FAUNA SURVEY**



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



PROJECT NO: 4715-22

REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

**MAP
 2-16**

723000

724000

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LEGEND

- Survey Area
- Fauna Observation Point
- Habitat Assessment Point
- Fauna Habitat**
- Shrubland
- Woodland (Open/Closed)
- Cleared



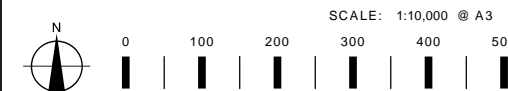
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 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



FAUNA HABITAT
LOGISTICS ROAD FAUNA SURVEY



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



MAP
2-17

PROJECT NO: 4715-22

REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

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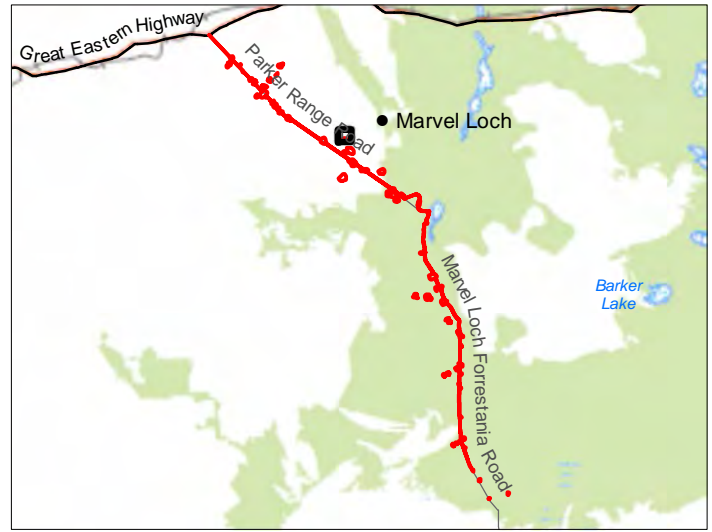
729000

730000



LEGEND

-  Survey Area
 -  Fauna Observation Point
 -  Habitat Assessment Point
- Fauna Habitat**
-  Shrubland
 -  Cleared



DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBCA 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



**FAUNA HABITAT
 LOGISTICS ROAD FAUNA SURVEY**



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



PROJECT NO: 4715-22

REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

**MAP
 2-18**

723000

724000

725000









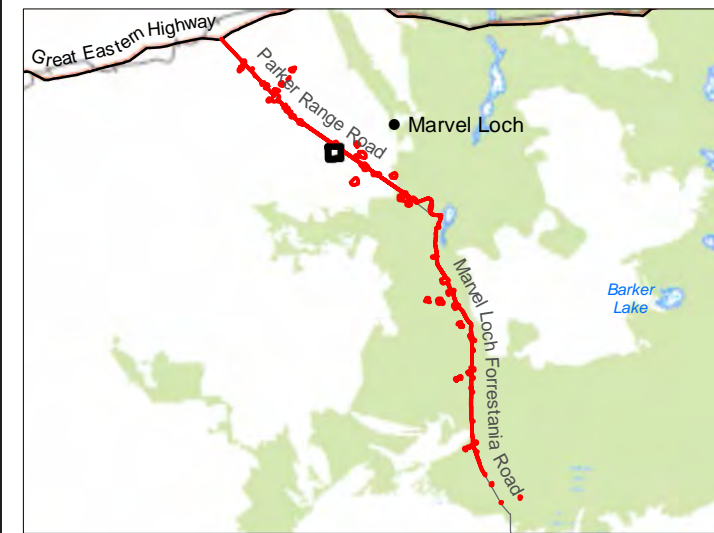
723000

724000

725000

LEGEND

-  Survey Area
-  Fauna Observation Point
-  Habitat Assessment Point
- Fauna Habitat**
-  Shrubland
-  Woodland (Open/Closed)
-  Cleared



DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBCA 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



FAUNA HABITAT
LOGISTICS ROAD FAUNA SURVEY



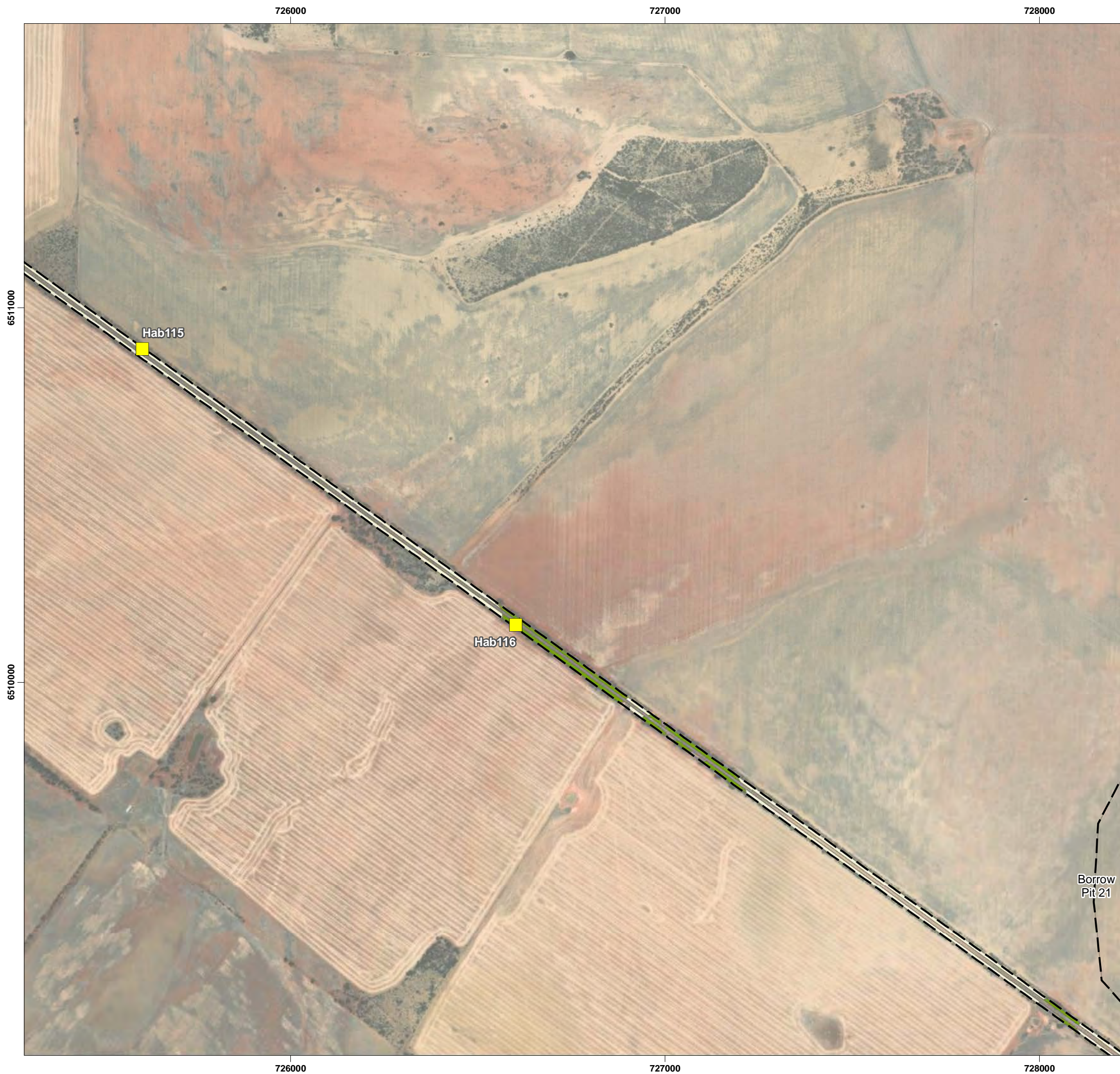
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 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER








PROJECT NO: 4715-22

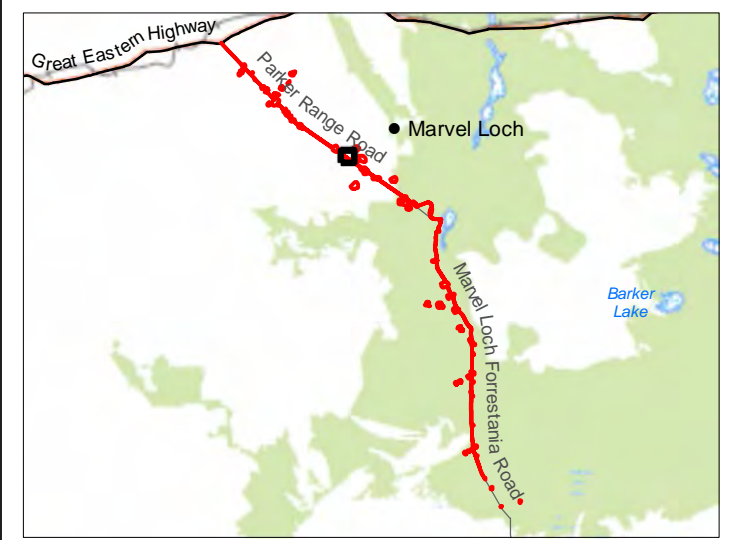
REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

MAP
2-19



LEGEND

-  Survey Area
-  Habitat Assessment Point
- Fauna Habitat**
-  Shrubland
-  Woodland (Open/Closed)
-  Cleared



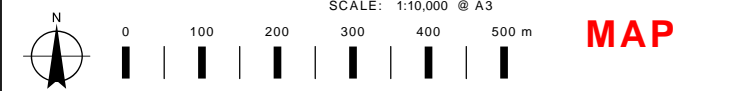
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 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



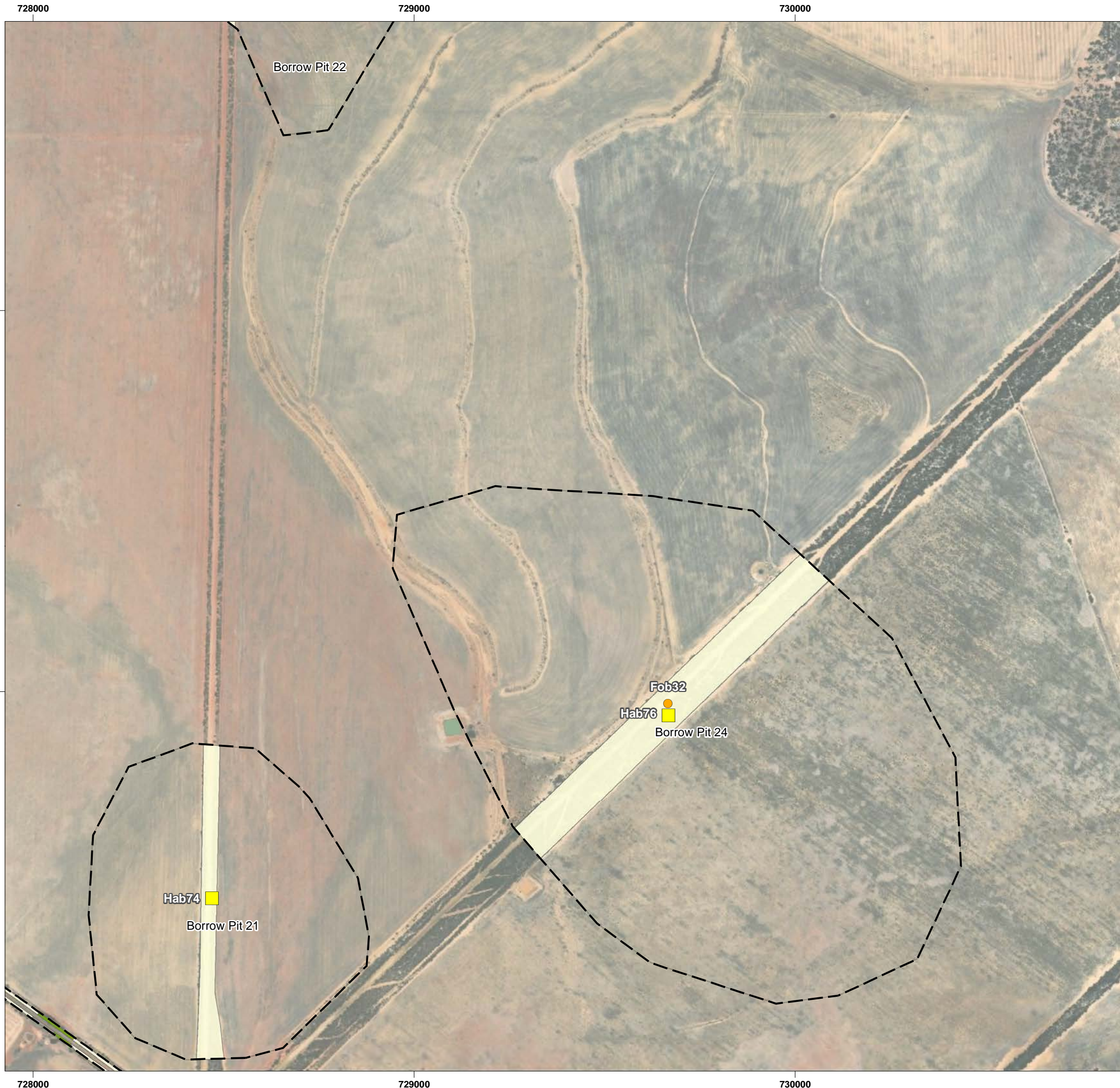
**FAUNA HABITAT
 LOGISTICS ROAD FAUNA SURVEY**



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



PROJECT NO: 4715-22				MAP 2-20
REV	AUTHOR	APPROVED	DATE	
00	NW	BT	29/07/2022	

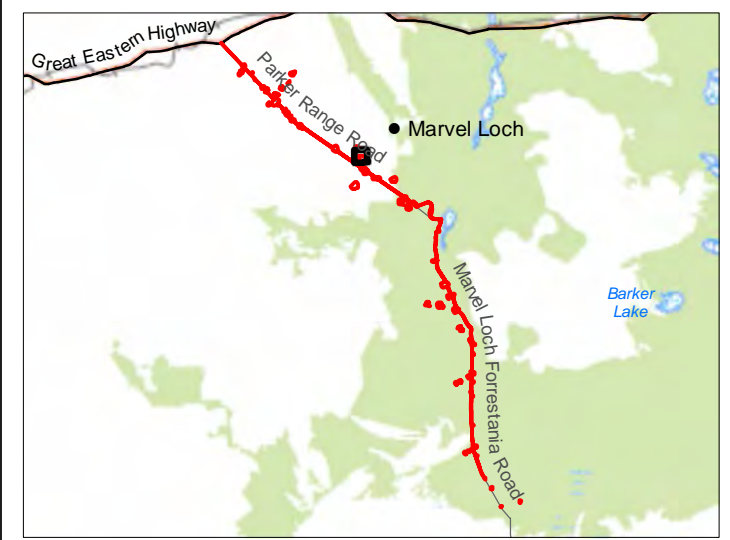


LEGEND

- Survey Area
- Fauna Observation Point
- Habitat Assessment Point

Fauna Habitat

- Shrubland
- Woodland (Open/Closed)
- Cleared



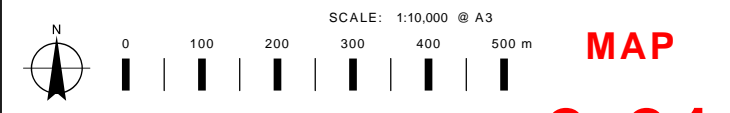
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 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBCA 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



**FAUNA HABITAT
 LOGISTICS ROAD FAUNA SURVEY**

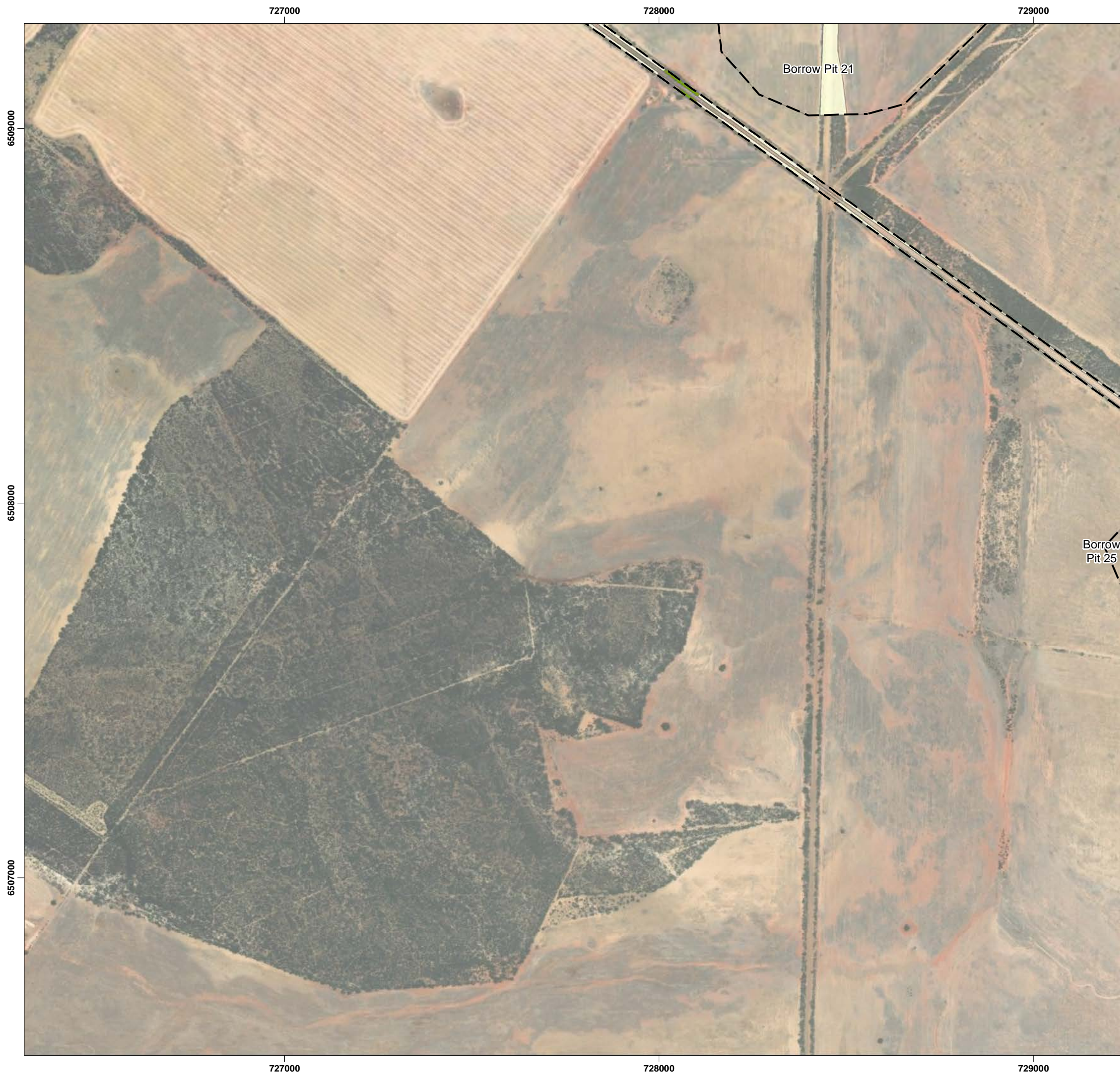


COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



PROJECT NO: 4715-22			
REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

**MAP
 2-21**

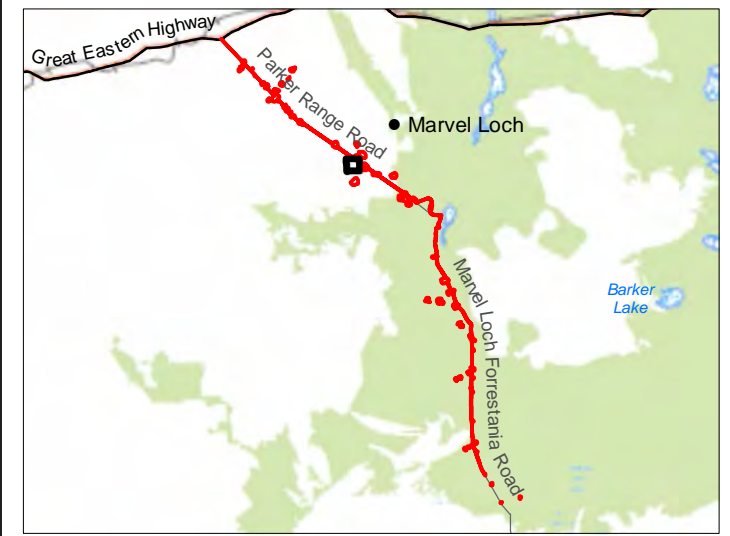


LEGEND

Survey Area

Fauna Habitat

- Shrubland
- Woodland (Open/Closed)
- Cleared



DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBCA 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



FAUNA HABITAT
LOGISTICS ROAD FAUNA SURVEY



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER








PROJECT NO: 4715-22

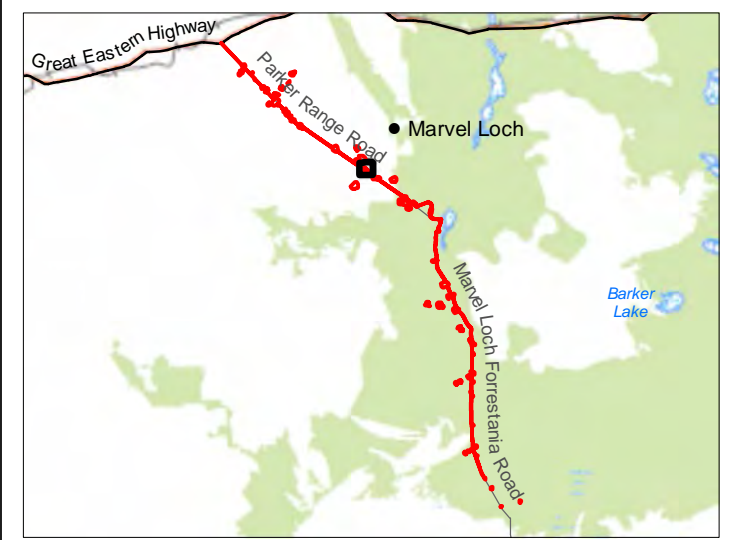
REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

MAP
2-22



LEGEND

-  Survey Area
-  Habitat Assessment Point
- Fauna Habitat**
-  Shrubland
-  Woodland (Open/Closed)
-  Cleared



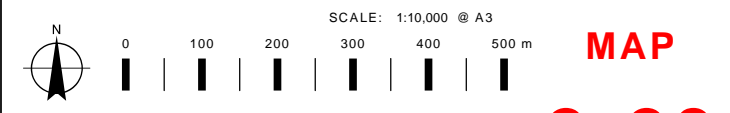
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 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



**FAUNA HABITAT
 LOGISTICS ROAD FAUNA SURVEY**



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



PROJECT NO: 4715-22			
REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

**MAP
 2-23**

727000

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LEGEND

- Survey Area
- Fauna Observation Point
- Habitat Assessment Point
- Fauna Habitat**
- Shrubland
- Woodland (Open/Closed)
- Cleared



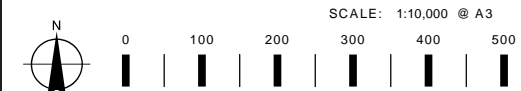
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 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBCA 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



FAUNA HABITAT LOGISTICS ROAD FAUNA SURVEY



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



SCALE: 1:10,000 @ A3

MAP

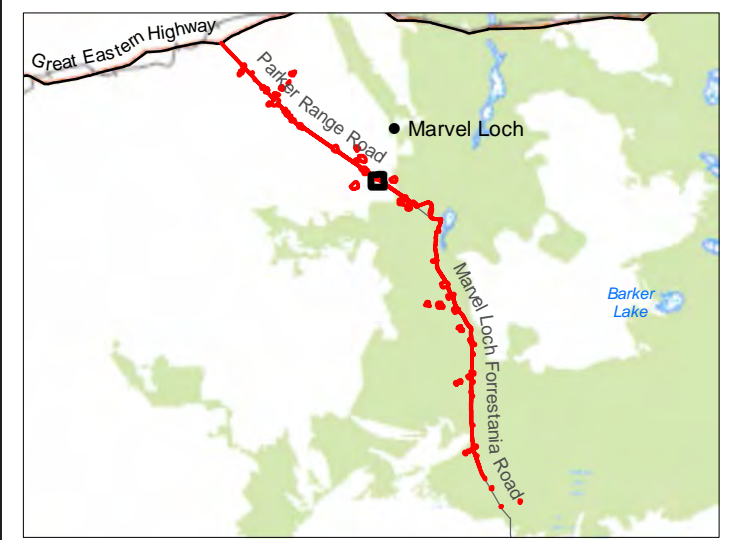
REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

2-24



LEGEND

- Survey Area
- Fauna Observation Point
- Habitat Assessment Point
- Fauna Habitat**
- Shrubland
- Woodland (Open/Closed)
- Cleared



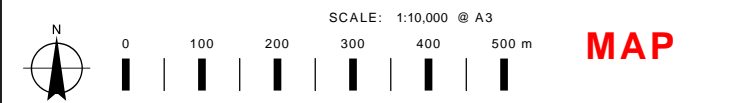
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 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



**FAUNA HABITAT
 LOGISTICS ROAD FAUNA SURVEY**

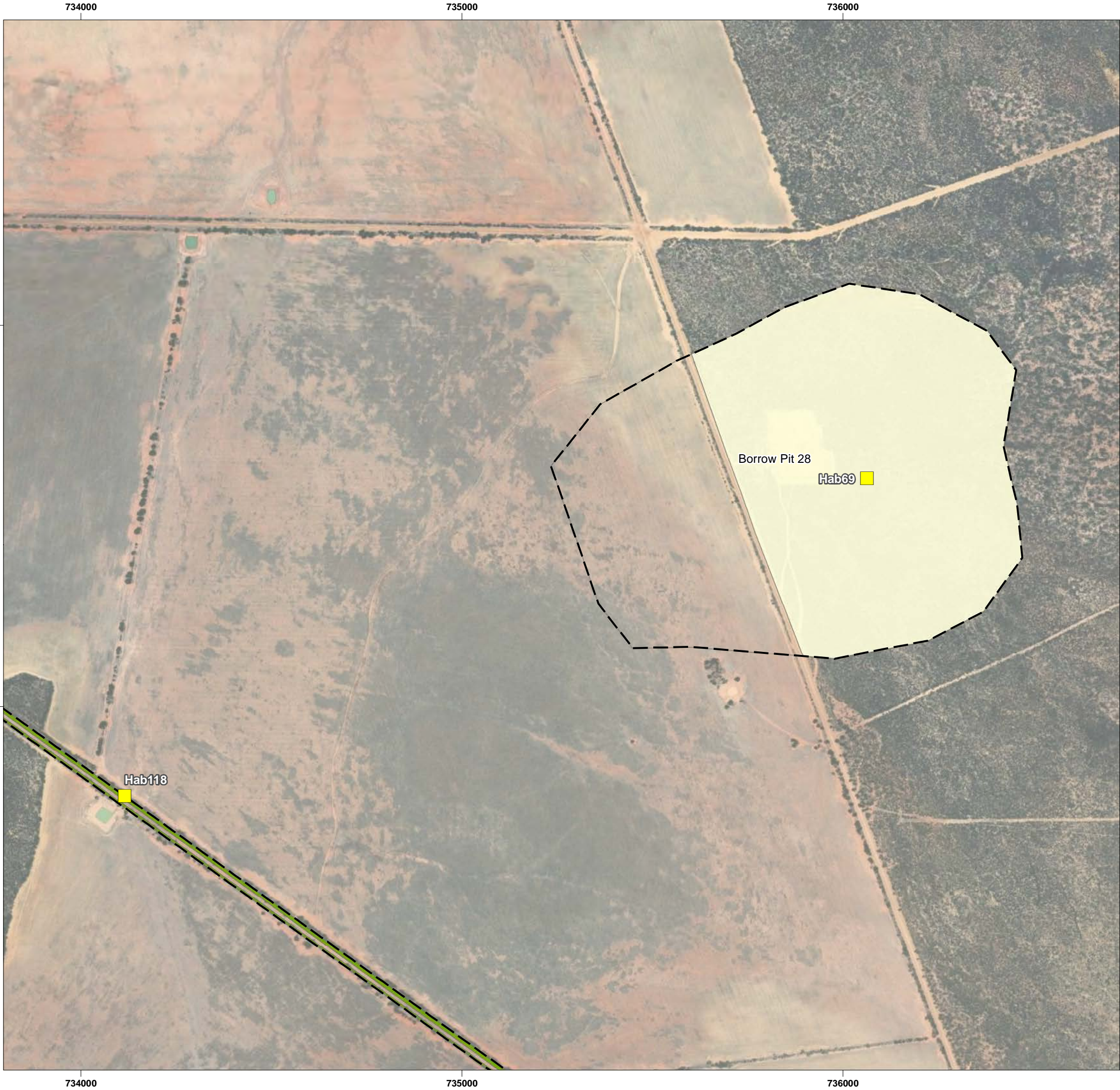


COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER








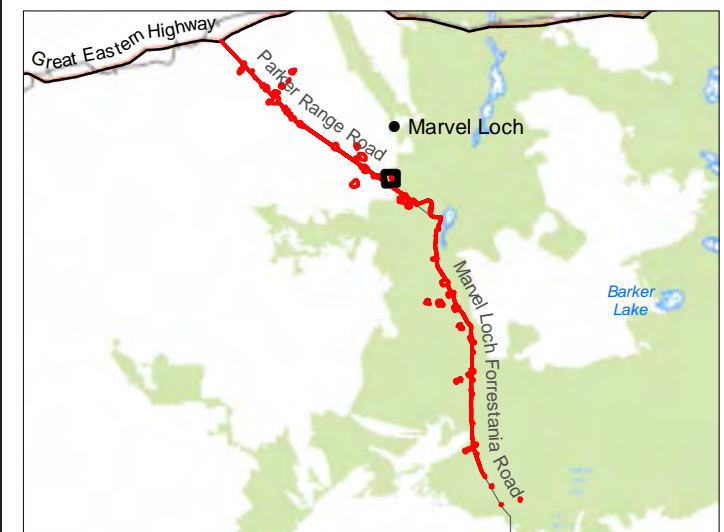
PROJECT NO: 4715-22			
REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

**MAP
 2-25**



LEGEND

-  Survey Area
-  Habitat Assessment Point
- Fauna Habitat**
-  Shrubland
-  Woodland (Open/Closed)
-  Cleared



DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBCA 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



**FAUNA HABITAT
 LOGISTICS ROAD FAUNA SURVEY**



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



PROJECT NO: 4715-22

REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

**MAP
 2-26**



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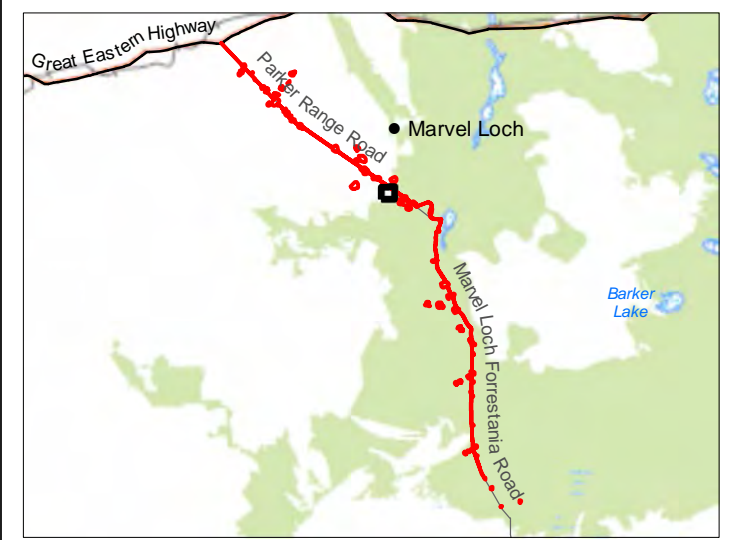
LEGEND

Survey Area

Fauna Habitat

Woodland (Open/Closed)

Cleared



DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBCA 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



FAUNA HABITAT
LOGISTICS ROAD FAUNA SURVEY



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



PROJECT NO: 4715-22

REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

MAP
2-27

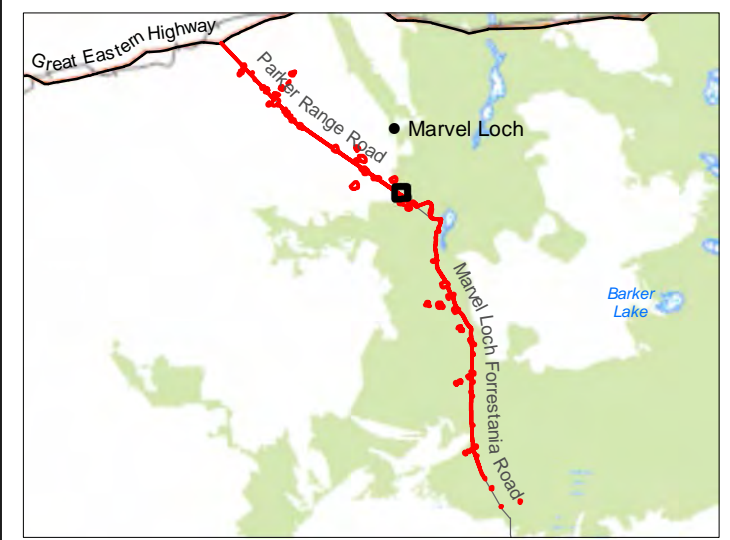


LEGEND

- Survey Area
- Habitat Assessment Point

Fauna Habitat

- Shrubland
- Woodland (Open/Closed)
- Cleared



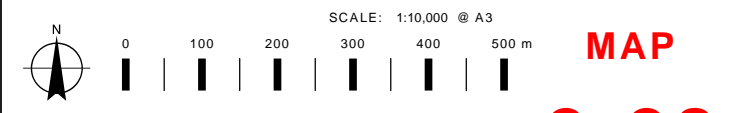
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 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



FAUNA HABITAT
LOGISTICS ROAD FAUNA SURVEY



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER








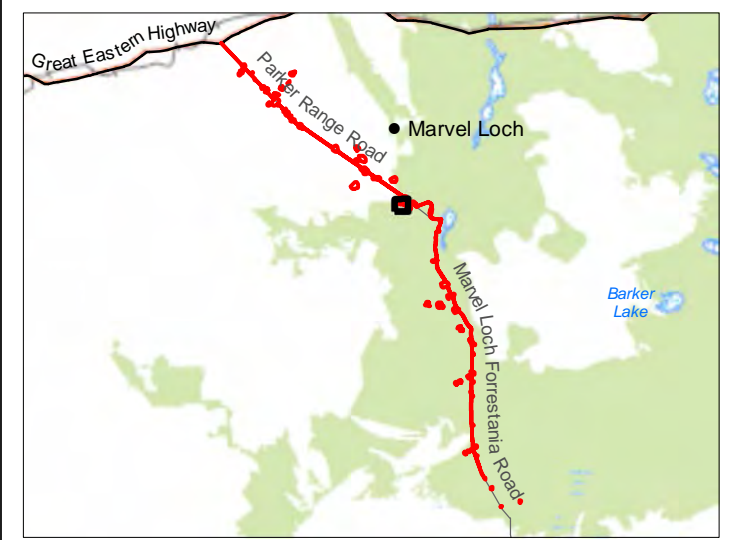
MAP 2-28

REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022



LEGEND

-  Survey Area
 -  Fauna Observation Point
 -  Habitat Assessment Point
- Fauna Habitat**
-  Shrubland
 -  Cleared



DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBCA 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



**FAUNA HABITAT
 LOGISTICS ROAD FAUNA SURVEY**



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



PROJECT NO: 4715-22			
REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

**MAP
 2-29**

739000

740000

741000

6501000






6500000

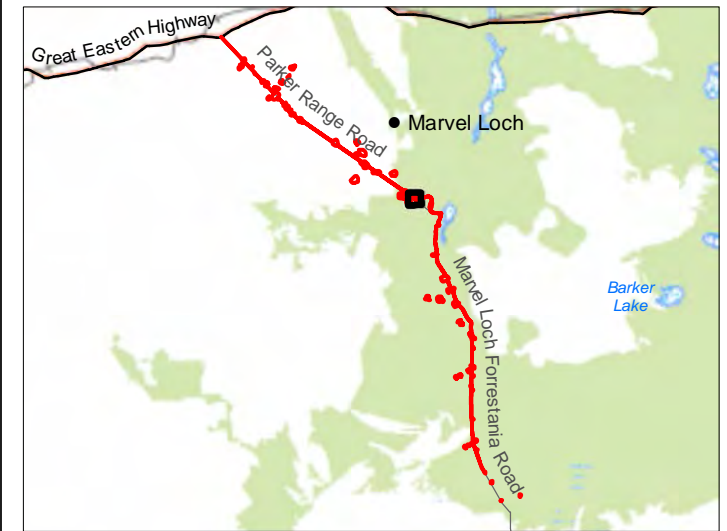
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6500000



LEGEND

-  Survey Area
-  Habitat Assessment Point
- Fauna Habitat**
-  Shrubland
-  Woodland (Open/Closed)
-  Cleared



DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBCA 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



**FAUNA HABITAT
 LOGISTICS ROAD FAUNA SURVEY**



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



**MAP
 2-30**

PROJECT NO: 4715-22

REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

739000

740000

741000

742000 743000 744000

6501000

6501000






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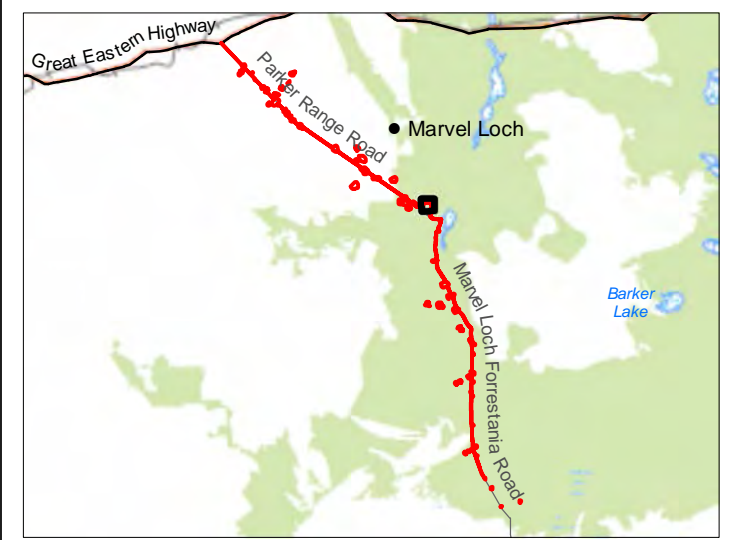
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742000 743000 744000



LEGEND

-  Survey Area
-  Habitat Assessment Point
- Fauna Habitat**
-  Shrubland
-  Woodland (Open/Closed)
-  Cleared



DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBCA 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



FAUNA HABITAT LOGISTICS ROAD FAUNA SURVEY



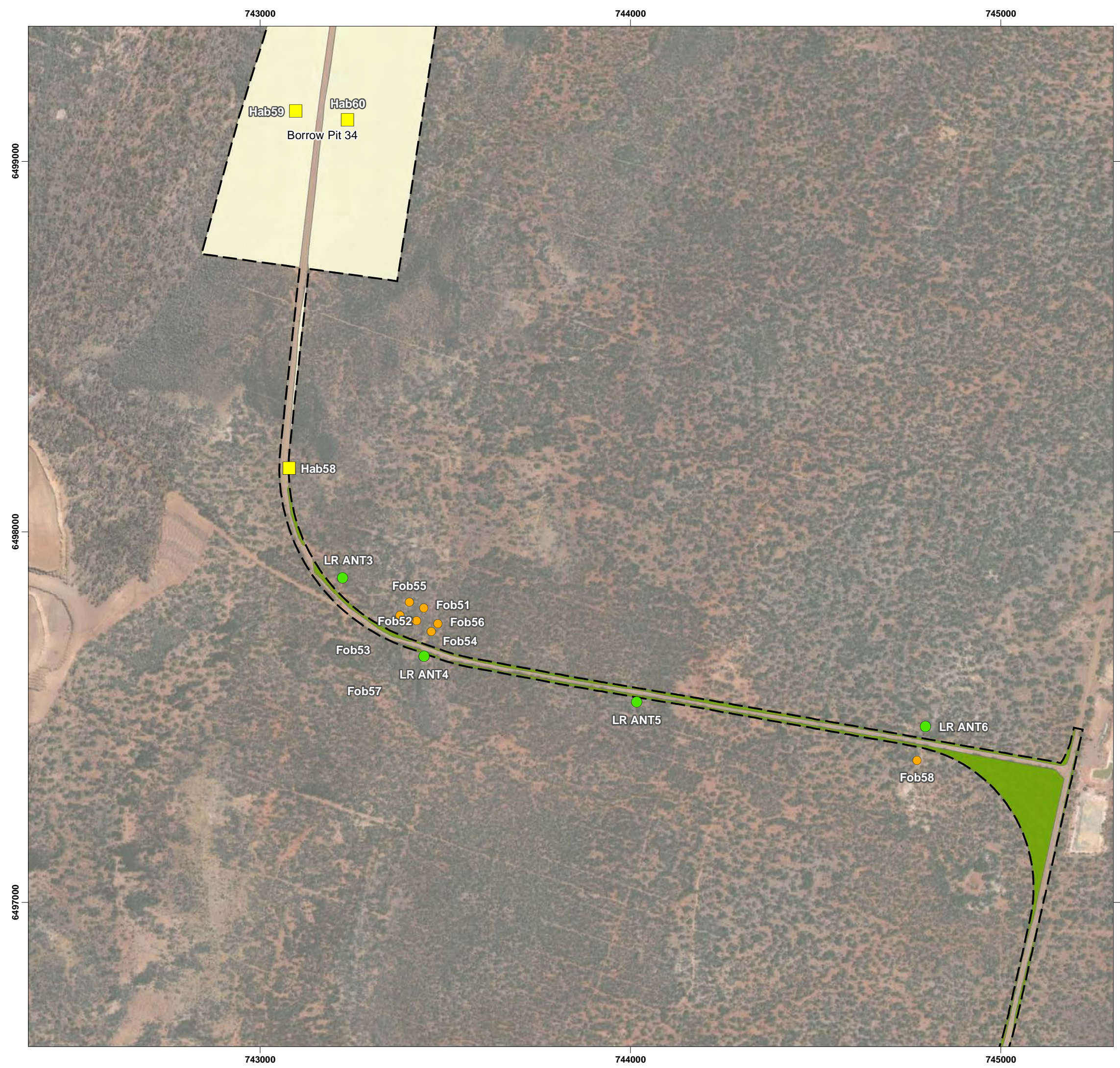
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 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



PROJECT NO: 4715-22

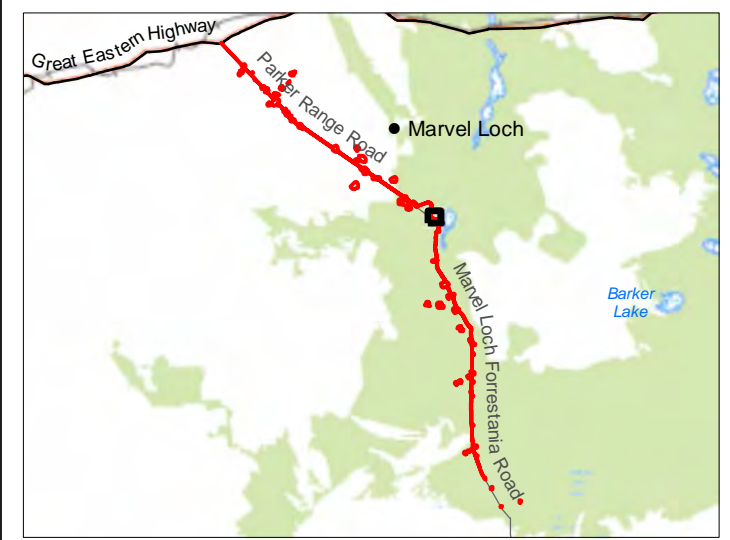
REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

**MAP
2-31**



LEGEND

- Survey Area
 - Fauna Observation Point
 - Habitat Assessment Point
 - Sugar Ant Survey Site
- Fauna Habitat**
- Shrubland
 - Woodland (Open/Closed)
 - Cleared



DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBCA 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



**FAUNA HABITAT
 LOGISTICS ROAD FAUNA SURVEY**



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



PROJECT NO: 4715-22

REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

**MAP
 2-32**

743000

744000

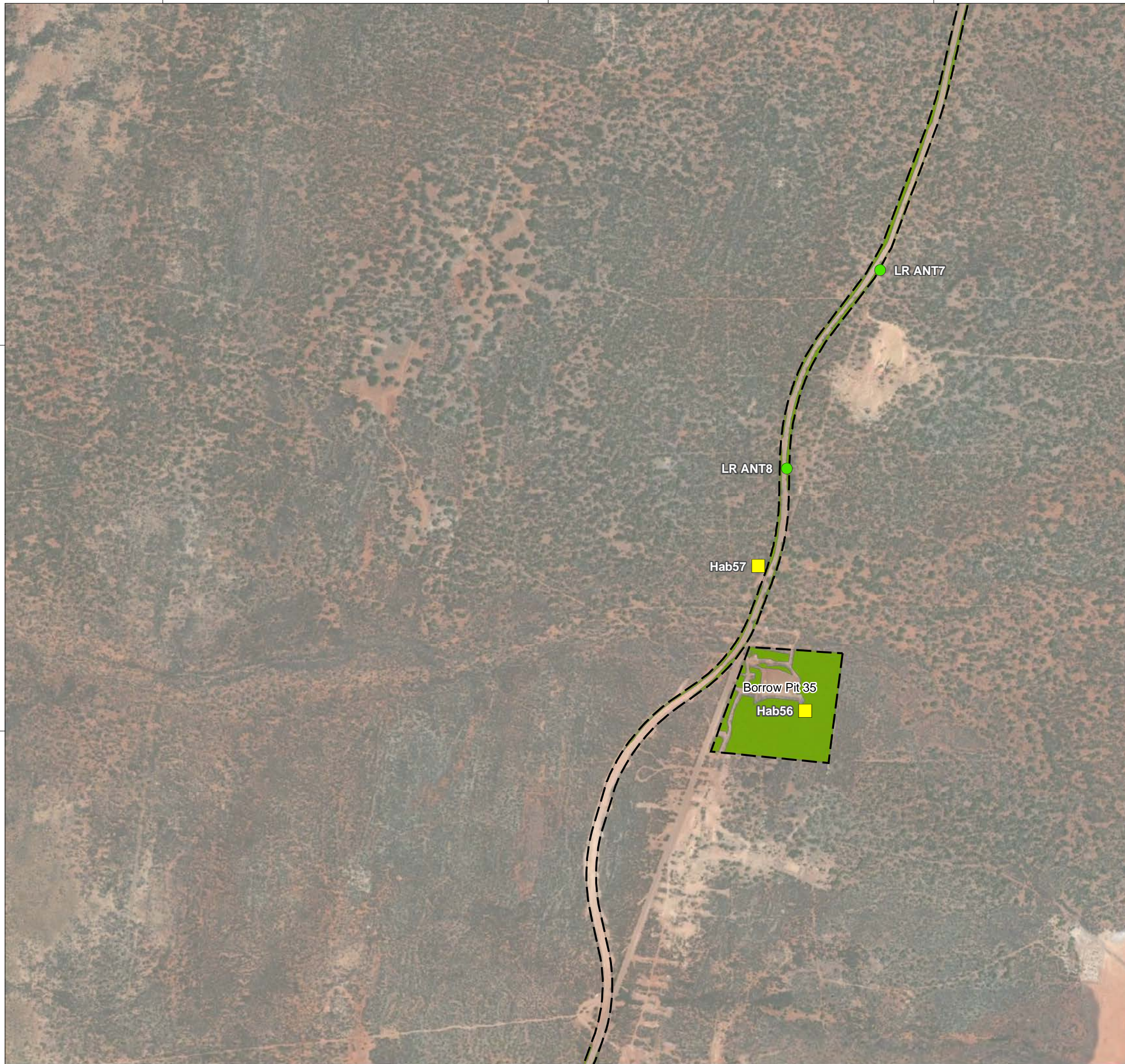
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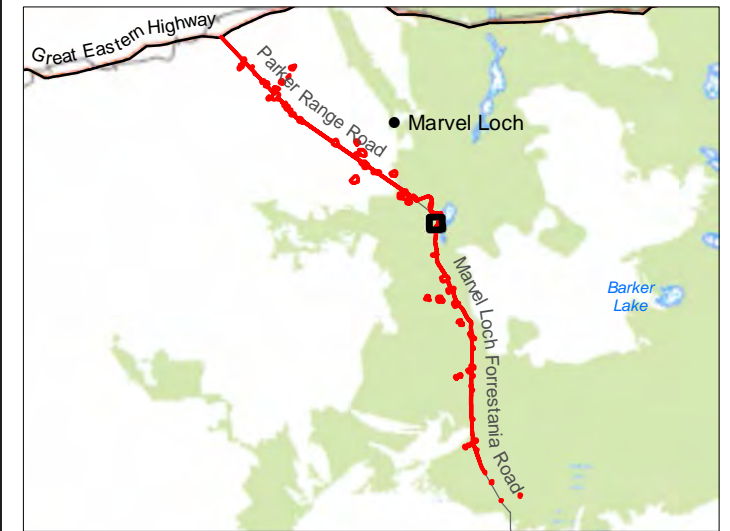
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LEGEND

-  Survey Area
-  Habitat Assessment Point
-  Sugar Ant Survey Site
- Fauna Habitat**
-  Woodland (Open/Closed)
-  Cleared



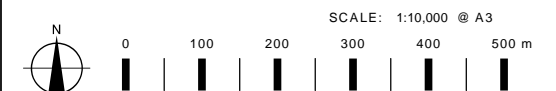
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 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBCA 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



FAUNA HABITAT LOGISTICS ROAD FAUNA SURVEY



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



PROJECT NO: 4715-22

REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

**MAP
2-33**

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745000

6494000

6494000

6493000

6493000

6492000

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



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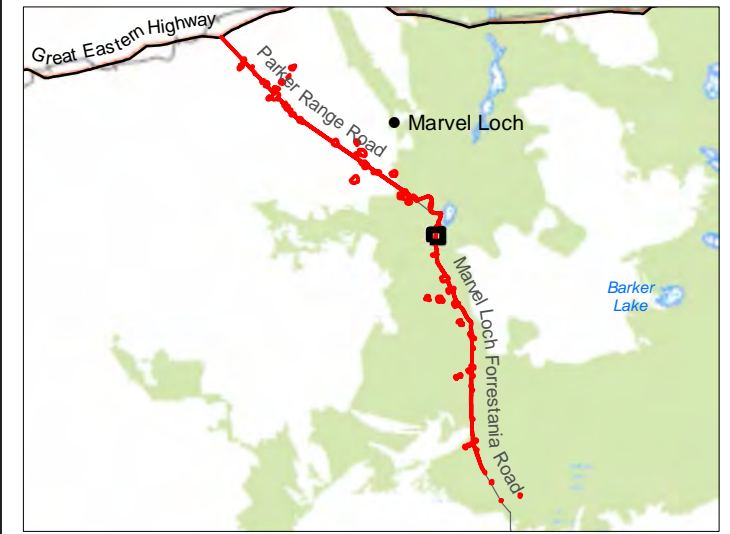
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LEGEND

-  Survey Area
-  Habitat Assessment Point
- Fauna Habitat**
-  Woodland (Open/Closed)
-  Cleared



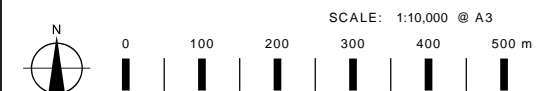
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 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBCA 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



FAUNA HABITAT
LOGISTICS ROAD FAUNA SURVEY



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



PROJECT NO: 4715-22

REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

MAP
2-34

743000

744000

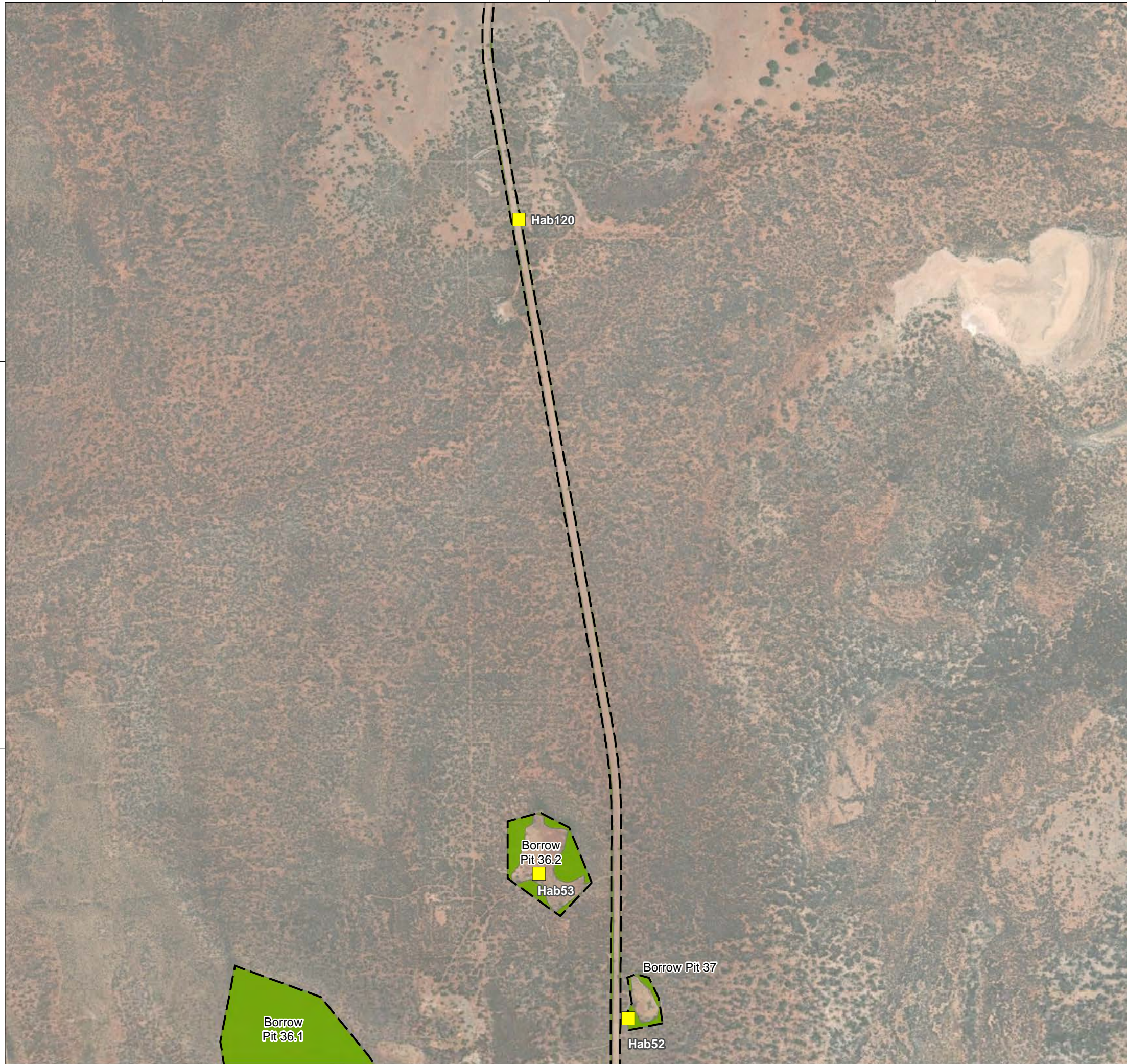
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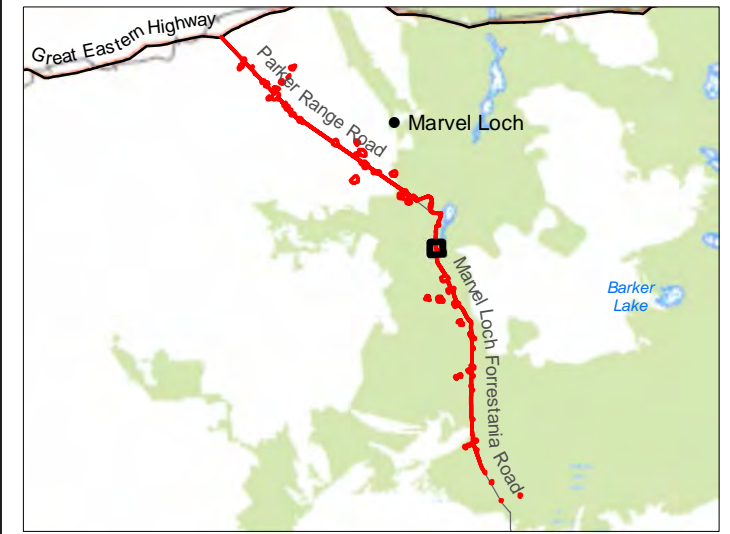
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LEGEND

- Survey Area
- Habitat Assessment Point
- Fauna Habitat**
- Woodland (Open/Closed)
- Cleared



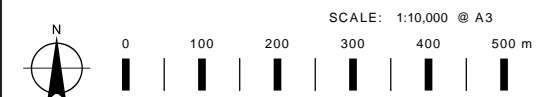
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 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



FAUNA HABITAT LOGISTICS ROAD FAUNA SURVEY



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



**MAP
2-35**

REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

PROJECT NO: 4715-22

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6489000

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6487000

743000




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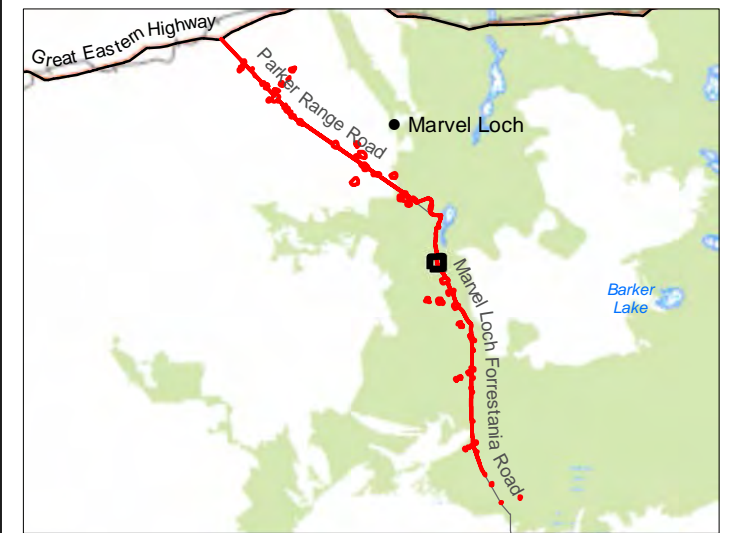
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LEGEND

-  Survey Area
-  Bat Recorder
-  Motion Camera
-  Fauna Observation Point
-  Habitat Assessment Point

Fauna Habitat

-  Seasonal Marsh
-  Woodland (Open/Closed)
-  Cleared



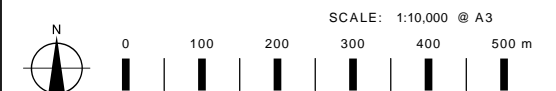
DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBCA 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



FAUNA HABITAT LOGISTICS ROAD FAUNA SURVEY



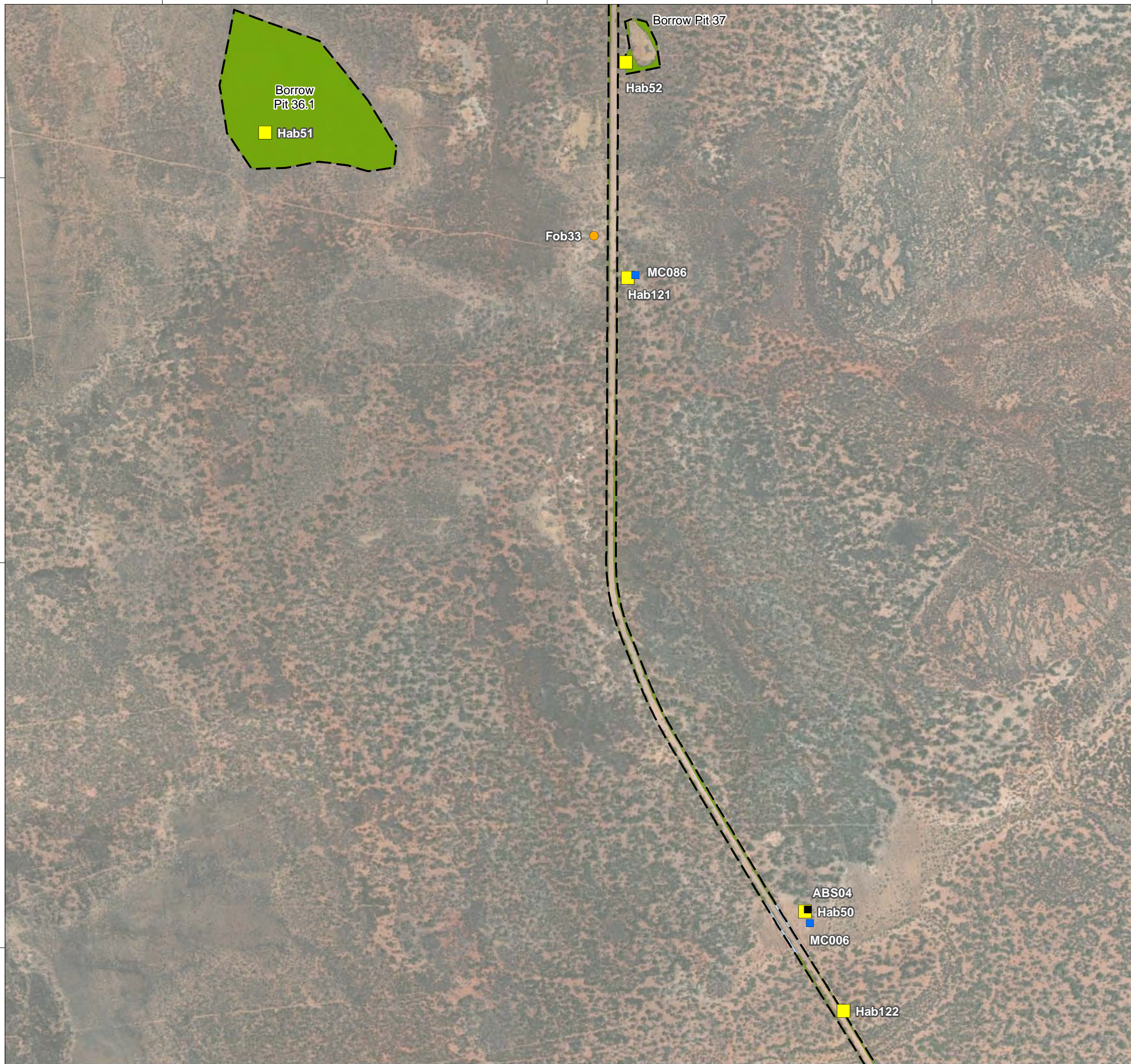
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 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER

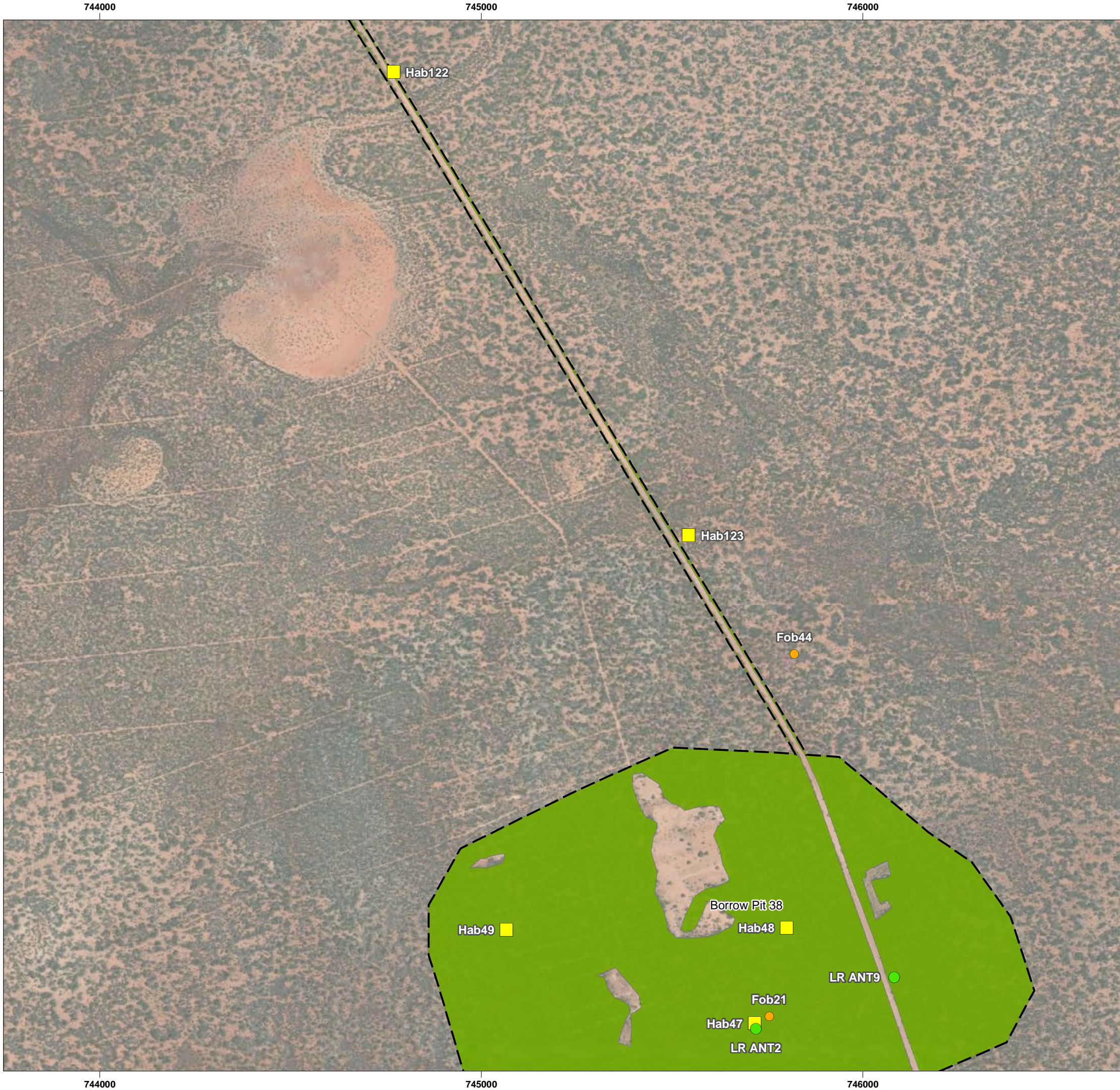


PROJECT NO: 4715-22

REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

**MAP
2-36**



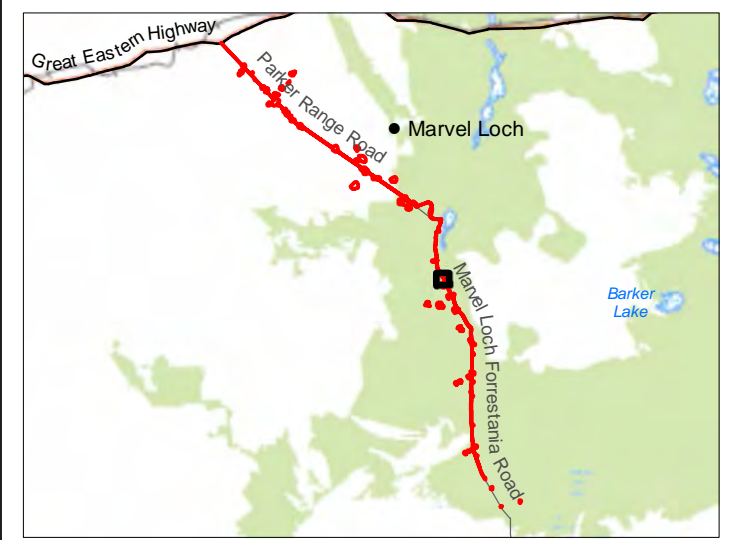


LEGEND

- Survey Area
- Fauna Observation Point
- Habitat Assessment Point
- Sugar Ant Survey Site

Fauna Habitat

- Woodland (Open/Closed)
- Cleared



DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBCA 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



FAUNA HABITAT
LOGISTICS ROAD FAUNA SURVEY



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER

SCALE: 1:10,000 @ A3

MAP
2-37

REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

PROJECT NO: 4715-22

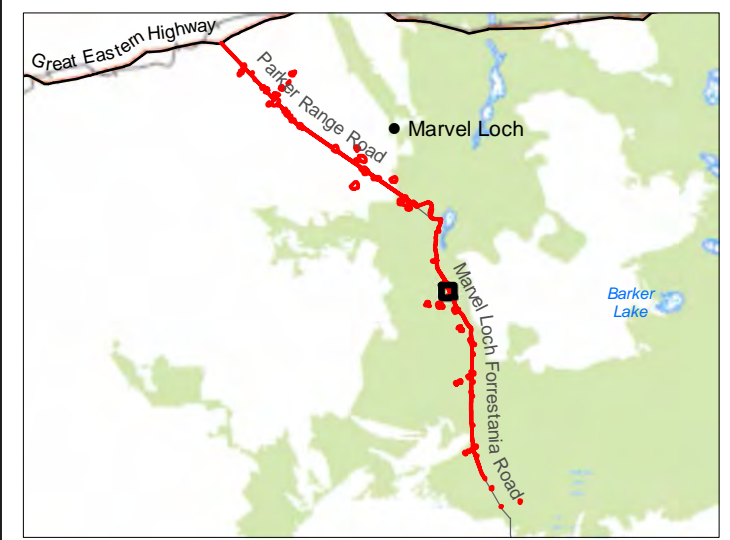


LEGEND

- Survey Area
- Motion Camera
- Fauna Observation Point
- Habitat Assessment Point
- Sugar Ant Survey Site

Fauna Habitat

- Shrubland
- Woodland (Open/Closed)
- Cleared



DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBCA 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



FAUNA HABITAT
LOGISTICS ROAD FAUNA SURVEY



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER





SCALE: 1:10,000 @ A3

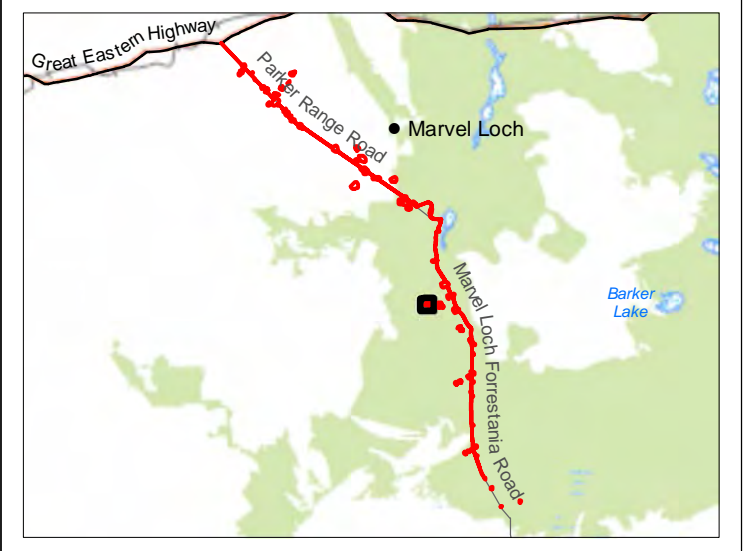
MAP
2-38

REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022



LEGEND

-  Survey Area
-  Fauna Observation Point
-  Habitat Assessment Point
- Fauna Habitat**
-  Shrubland



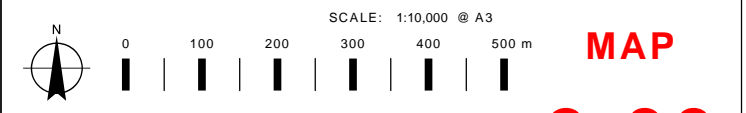
DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBCA 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



**FAUNA HABITAT
 LOGISTICS ROAD FAUNA SURVEY**



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



MAP 2-39

REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

PROJECT NO: 4715-22

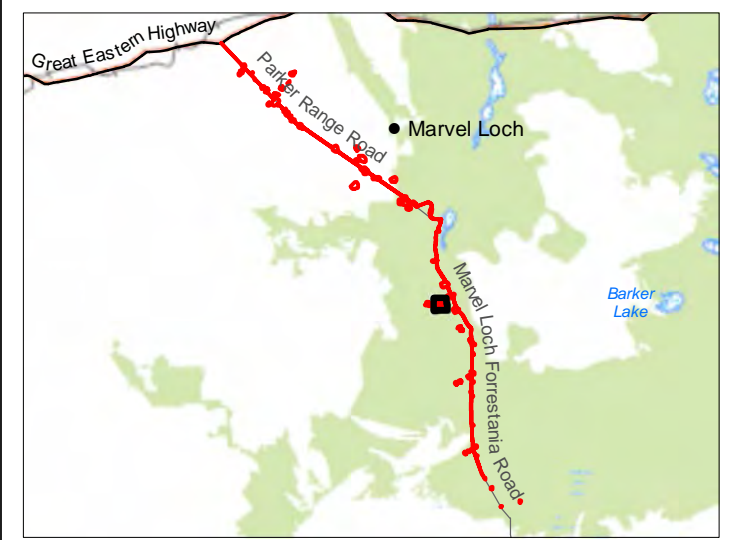


LEGEND

- Survey Area
- Fauna Observation Point
- Habitat Assessment Point

Fauna Habitat

- Shrubland
- Cleared



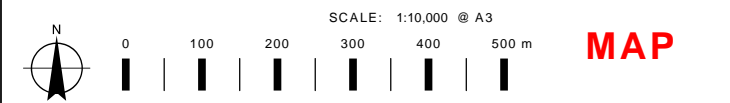
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 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBCA 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



**FAUNA HABITAT
 LOGISTICS ROAD FAUNA SURVEY**



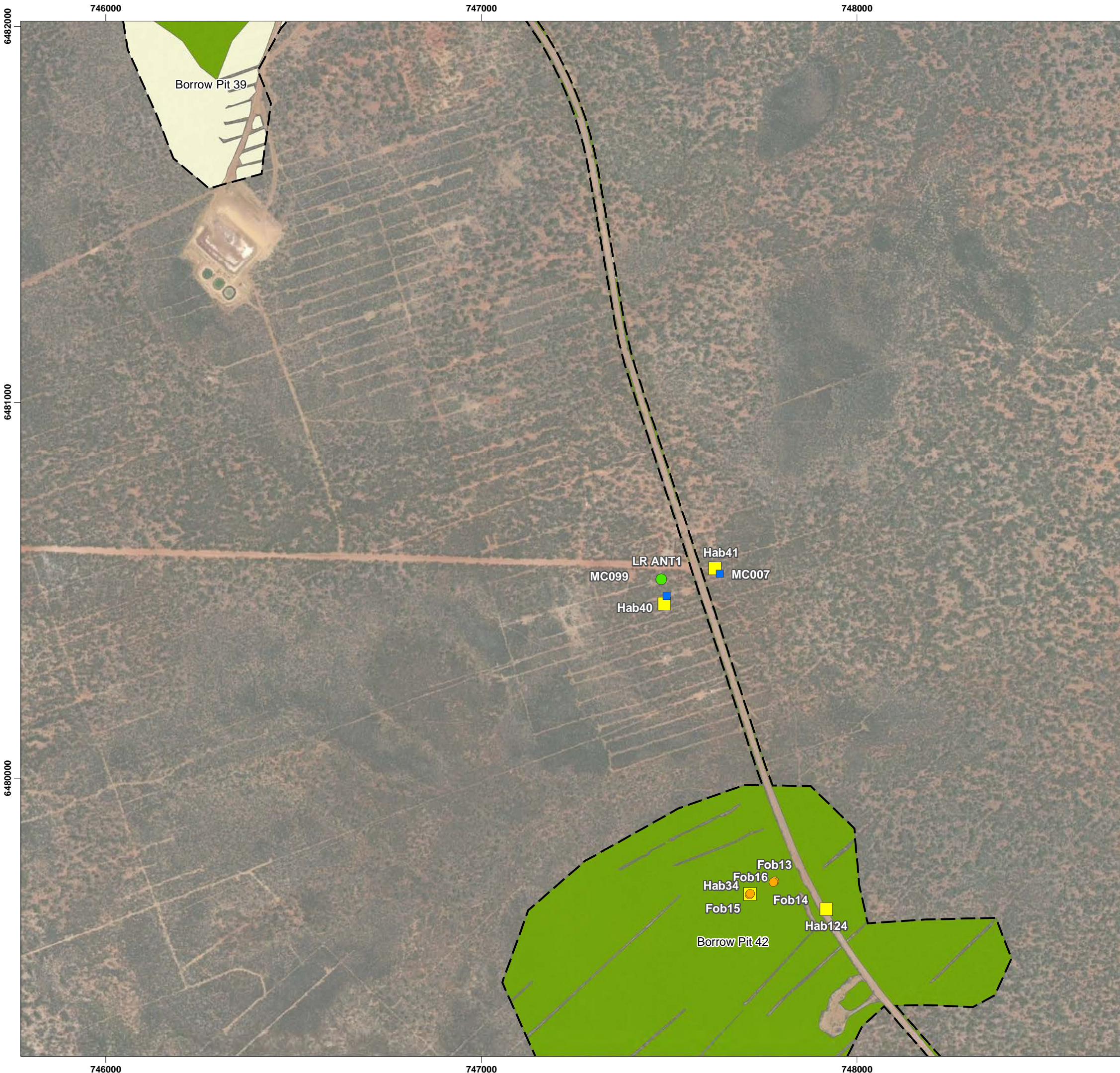
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 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



PROJECT NO: 4715-22

REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

**MAP
 2-40**

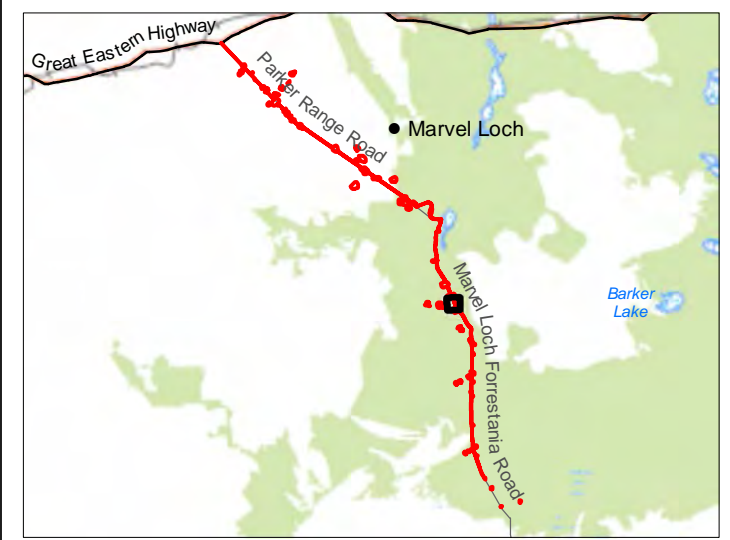


LEGEND

- Survey Area
- Motion Camera
- Fauna Observation Point
- Habitat Assessment Point
- Sugar Ant Survey Site

Fauna Habitat

- Shrubland
- Woodland (Open/Closed)
- Cleared



DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBCA 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



**FAUNA HABITAT
 LOGISTICS ROAD FAUNA SURVEY**



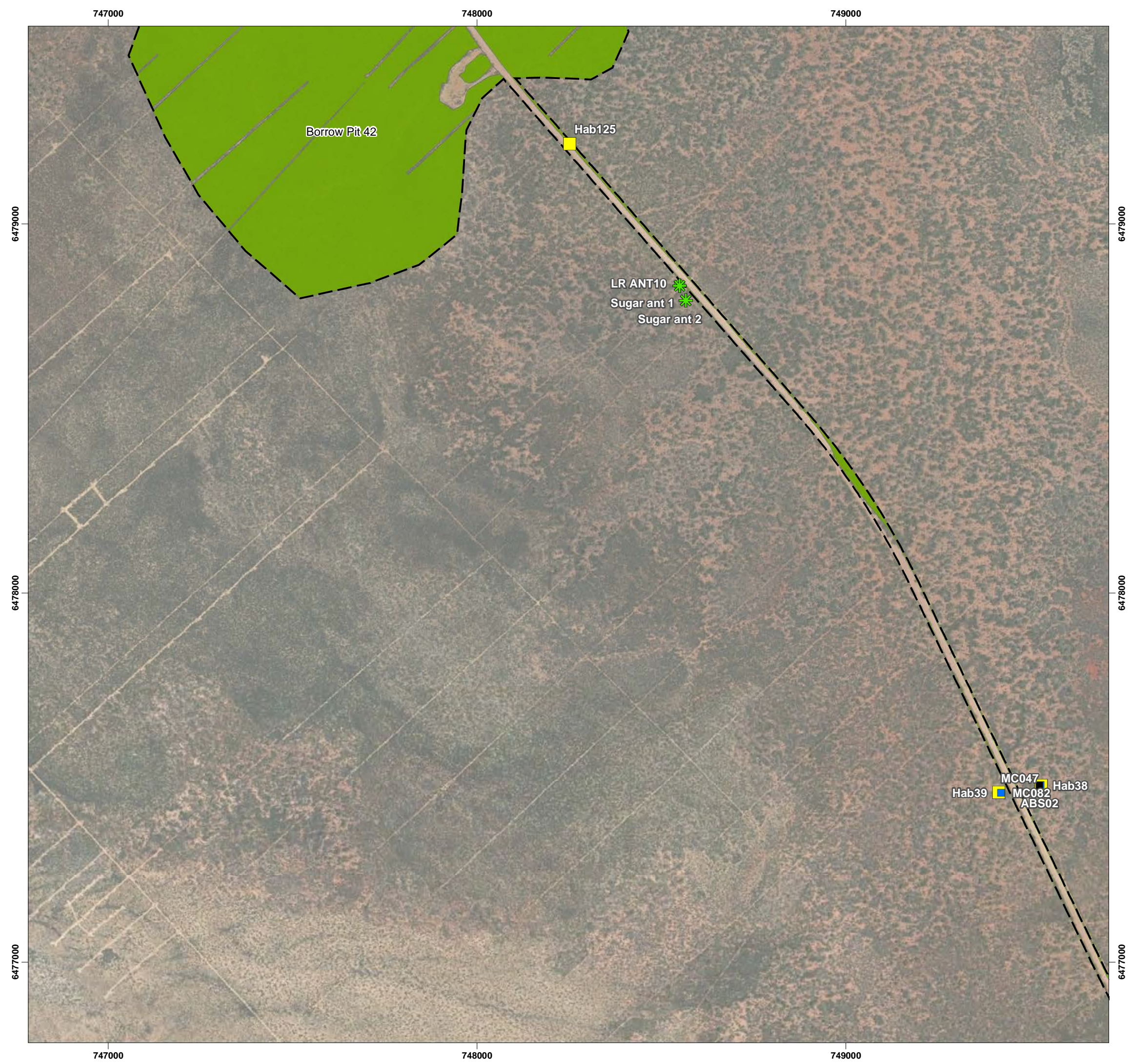
COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER

SCALE: 1:10,000 @ A3

**MAP
 2-41**

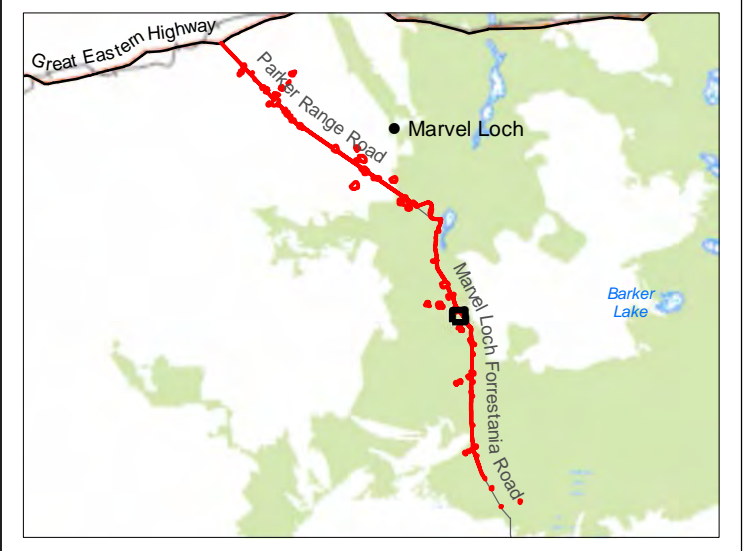
REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

PROJECT NO: 4715-22



LEGEND

- Survey Area
- Bat Recorder
- Motion Camera
- Habitat Assessment Point
- Sugar Ant Colony Recorded
- Sugar Ant Survey Site
- Fauna Habitat**
- Woodland (Open/Closed)
- Cleared



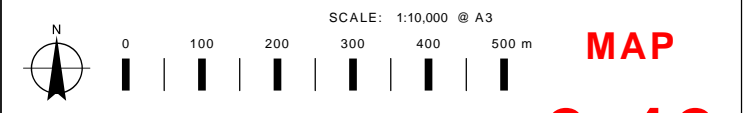
DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBCA 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



**FAUNA HABITAT
 LOGISTICS ROAD FAUNA SURVEY**



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



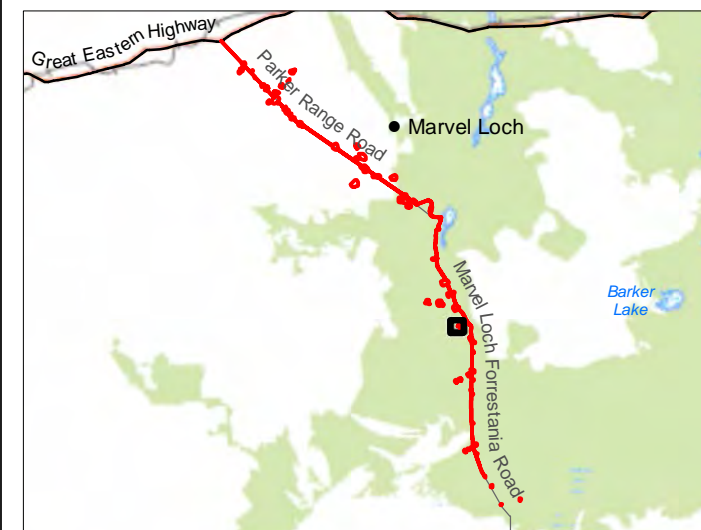
MAP 2-42

REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022



LEGEND

- Survey Area
 - Fauna Observation Point
 - Habitat Assessment Point
 - Malleefowl Mound Observation
- Fauna Habitat**
- Shrubland
 - Woodland (Open/Closed)
 - Cleared



DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBCA 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



**FAUNA HABITAT
 LOGISTICS ROAD FAUNA SURVEY**



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



**MAP
 2-43**

PROJECT NO: 4715-22

REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

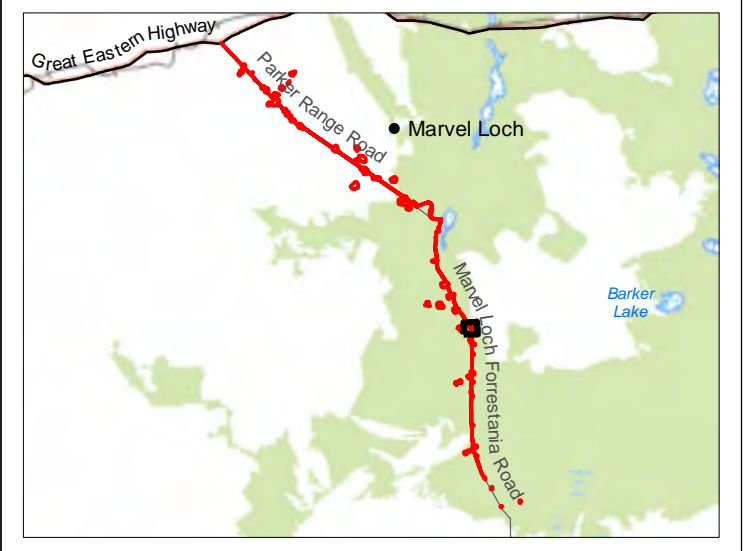


LEGEND

- Survey Area
- Motion Camera
- Habitat Assessment Point
- DBCA Nature Reserve (2011)

Fauna Habitat

- Woodland (Open/Closed)
- Cleared



DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBCAs 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



**FAUNA HABITAT
 LOGISTICS ROAD FAUNA SURVEY**



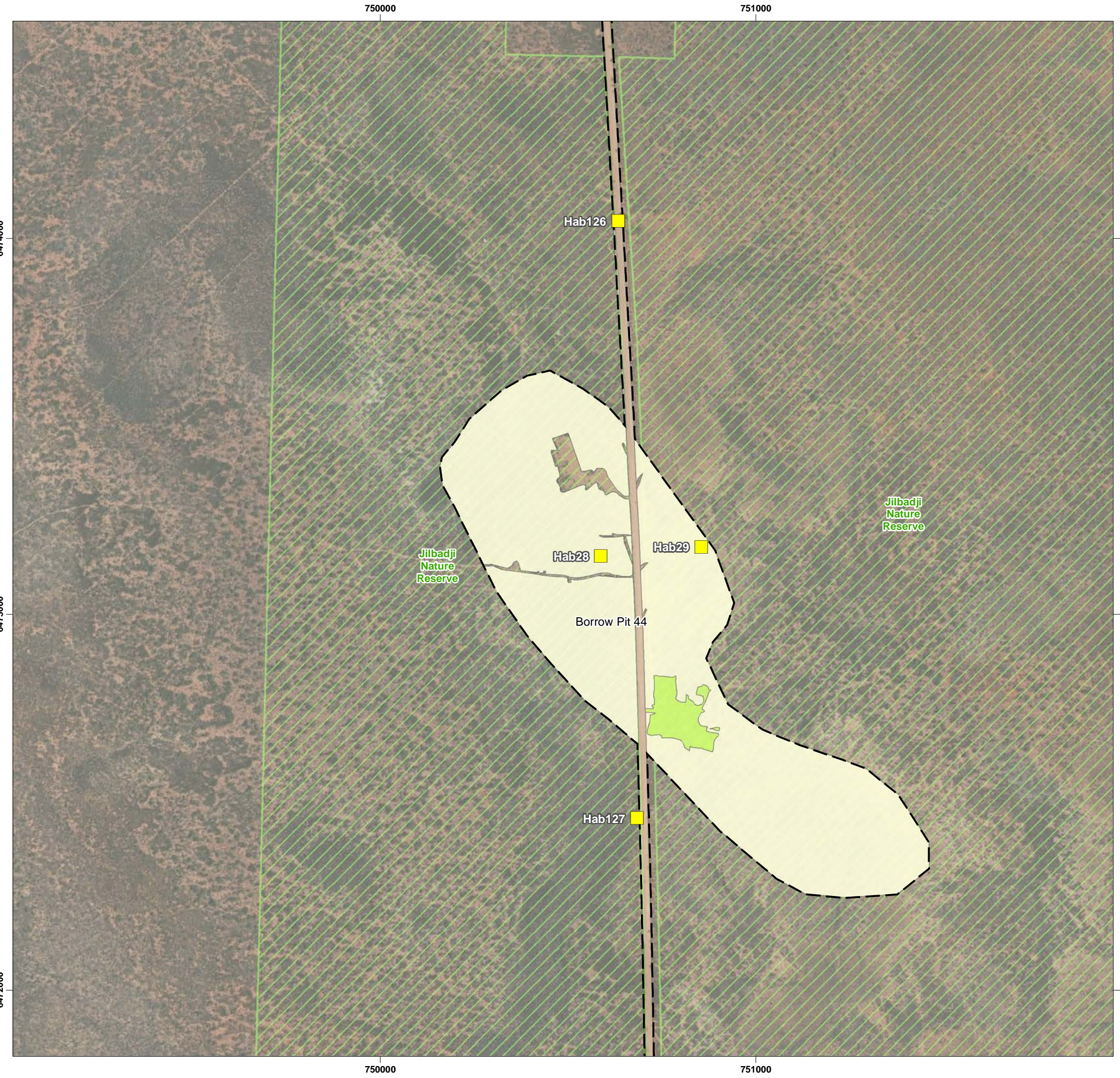
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 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER

SCALE: 1:10,000 @ A3

PROJECT NO: 4715-22

REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

**MAP
 2-44**

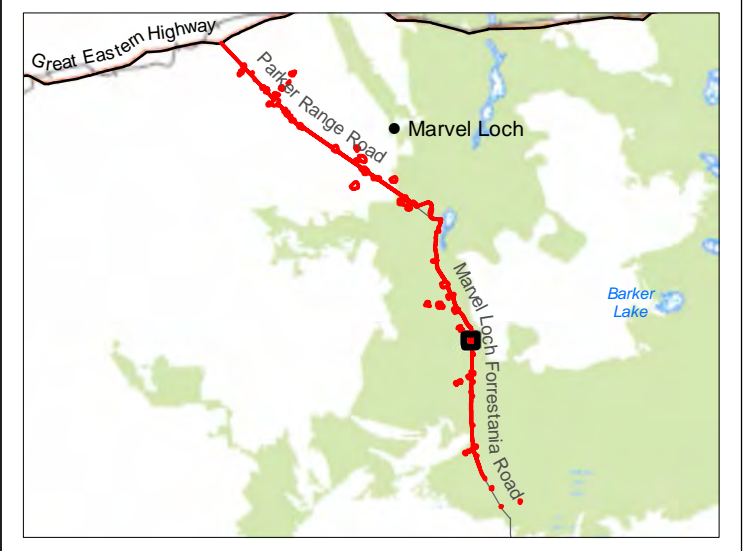


LEGEND

- Survey Area
- Habitat Assessment Point
- DBCA Nature Reserve (2011)

Fauna Habitat

- Regrowth
- Shrubland
- Woodland (Open/Closed)
- Cleared



DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBC 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



**FAUNA HABITAT
 LOGISTICS ROAD FAUNA SURVEY**



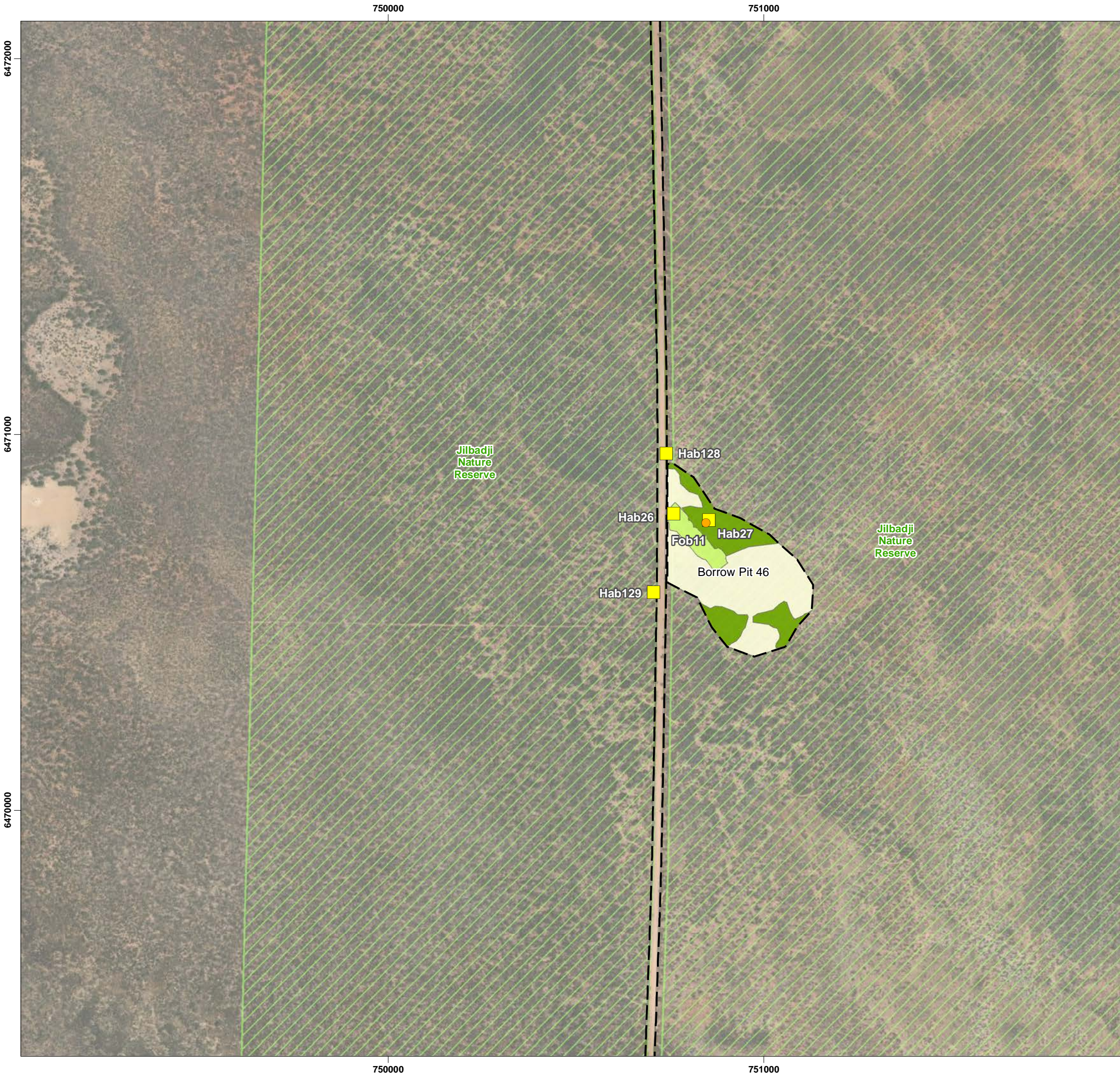
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 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER

SCALE: 1:10,000 @ A3

**MAP
 2-45**

REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

PROJECT NO: 4715-22

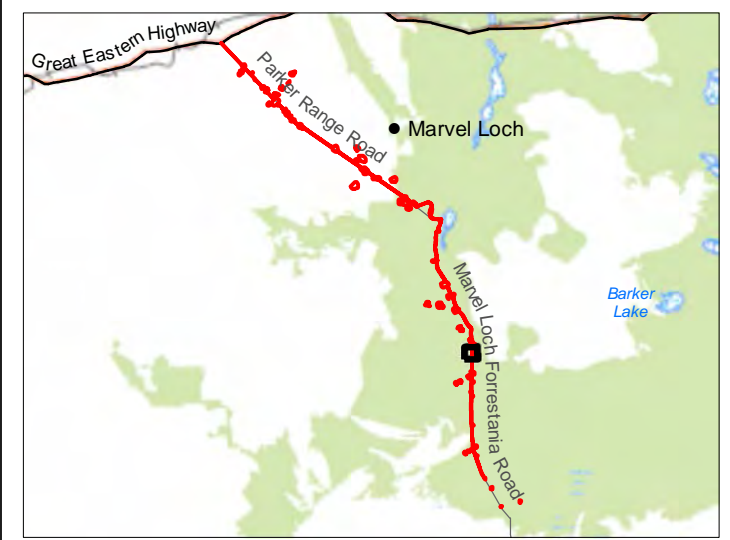


LEGEND

- Survey Area
- Fauna Observation Point
- Habitat Assessment Point
- DBCA Nature Reserve (2011)

Fauna Habitat

- Regrowth
- Shrubland
- Woodland (Open/Closed)
- Cleared



DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBC 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



**FAUNA HABITAT
 LOGISTICS ROAD FAUNA SURVEY**



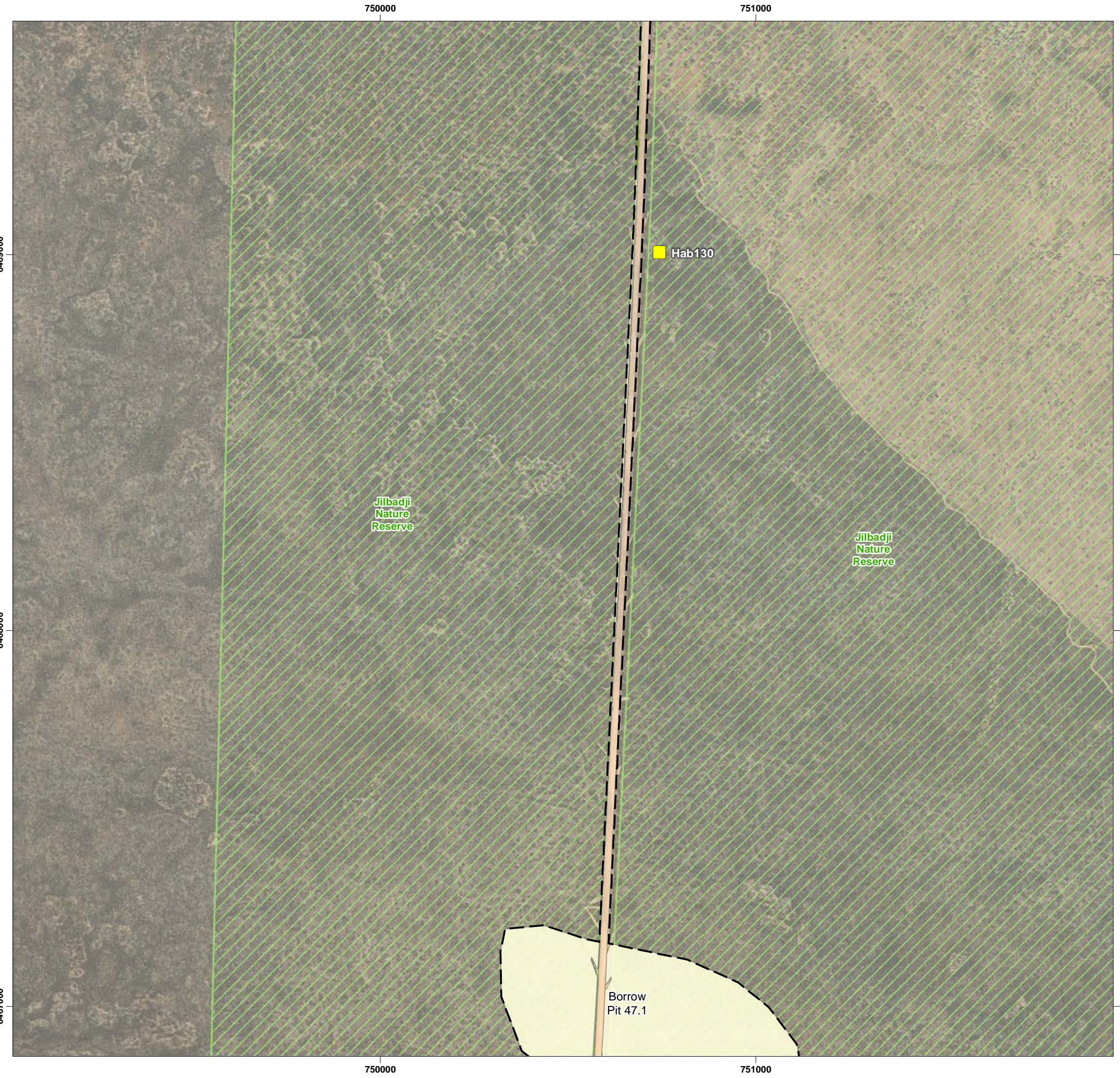
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 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER

SCALE: 1:10,000 @ A3

**MAP
 2-46**

REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

PROJECT NO: 4715-22

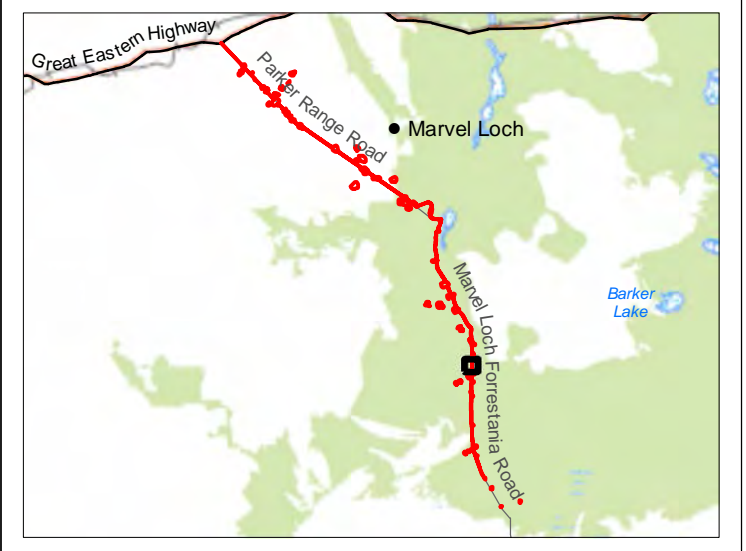


LEGEND

- Survey Area
- Habitat Assessment Point
- DBC Nature Reserve (2011)

Fauna Habitat

- Shrubland
- Woodland (Open/Closed)
- Cleared



DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBC 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



**FAUNA HABITAT
 LOGISTICS ROAD FAUNA SURVEY**



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER

SCALE: 1:10,000 @ A3

**MAP
2-47**

REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

PROJECT NO: 4715-22

747000

748000

749000

6465000

6465000

6464000

6464000







747000

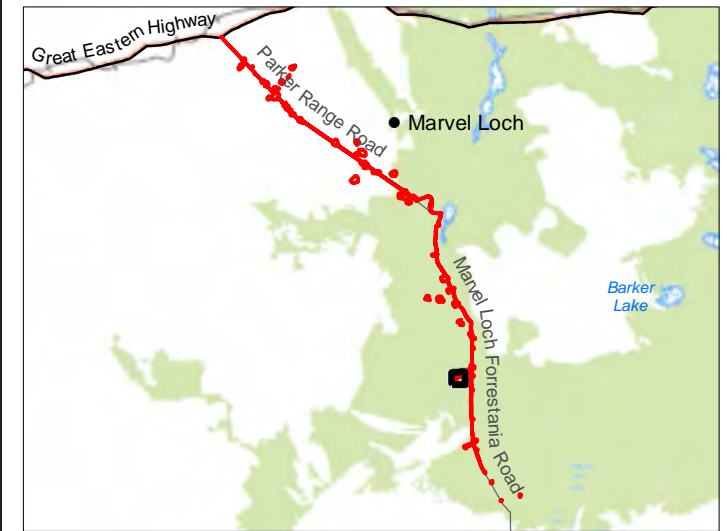
748000

749000



LEGEND

-  Survey Area
-  Fauna Observation Point
-  Habitat Assessment Point
- Fauna Habitat**
-  Shrubland
-  Woodland (Open/Closed)
-  Cleared



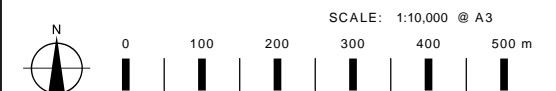
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 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBCA 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



FAUNA HABITAT LOGISTICS ROAD FAUNA SURVEY



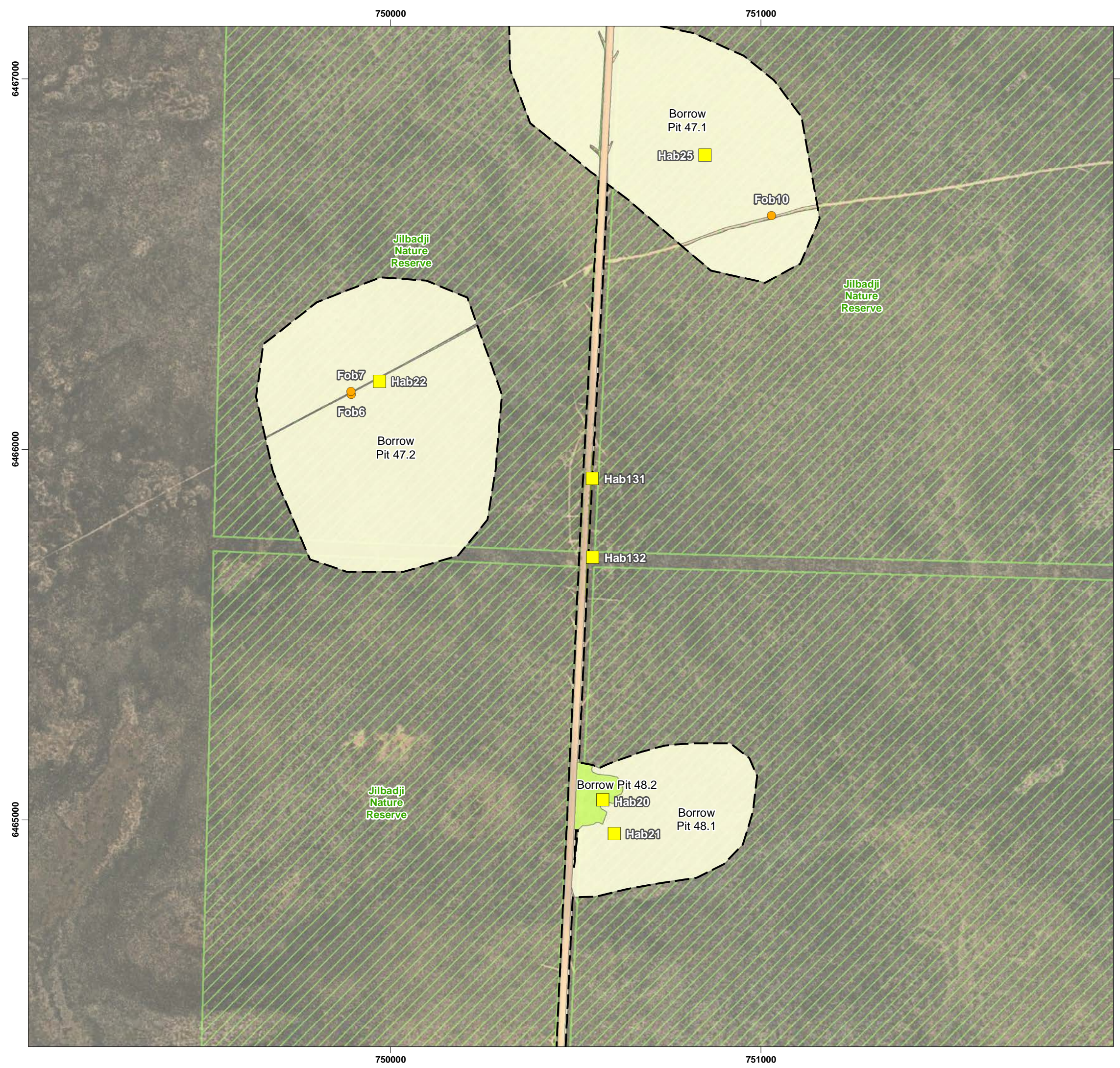
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 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



PROJECT NO: 4715-22

REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

**MAP
2-48**

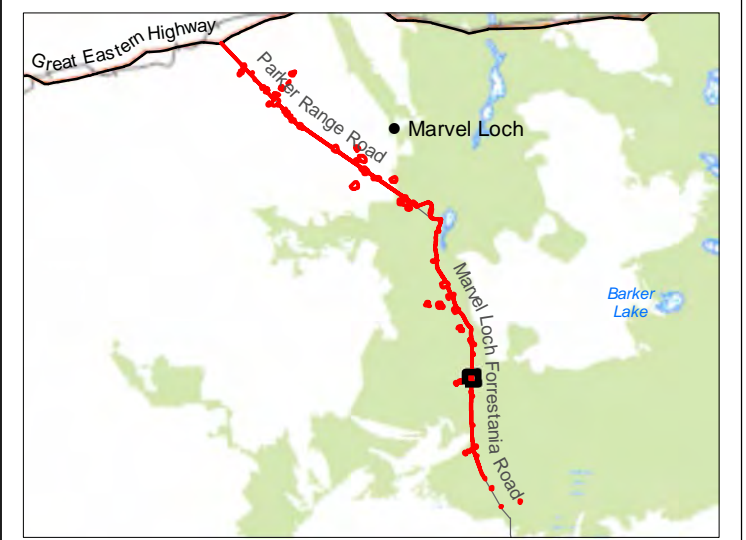


LEGEND

- Survey Area
- Fauna Observation Point
- Habitat Assessment Point
- DBCA Nature Reserve (2011)

Fauna Habitat

- Regrowth
- Shrubland
- Woodland (Open/Closed)
- Cleared



DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBCA 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



**FAUNA HABITAT
 LOGISTICS ROAD FAUNA SURVEY**

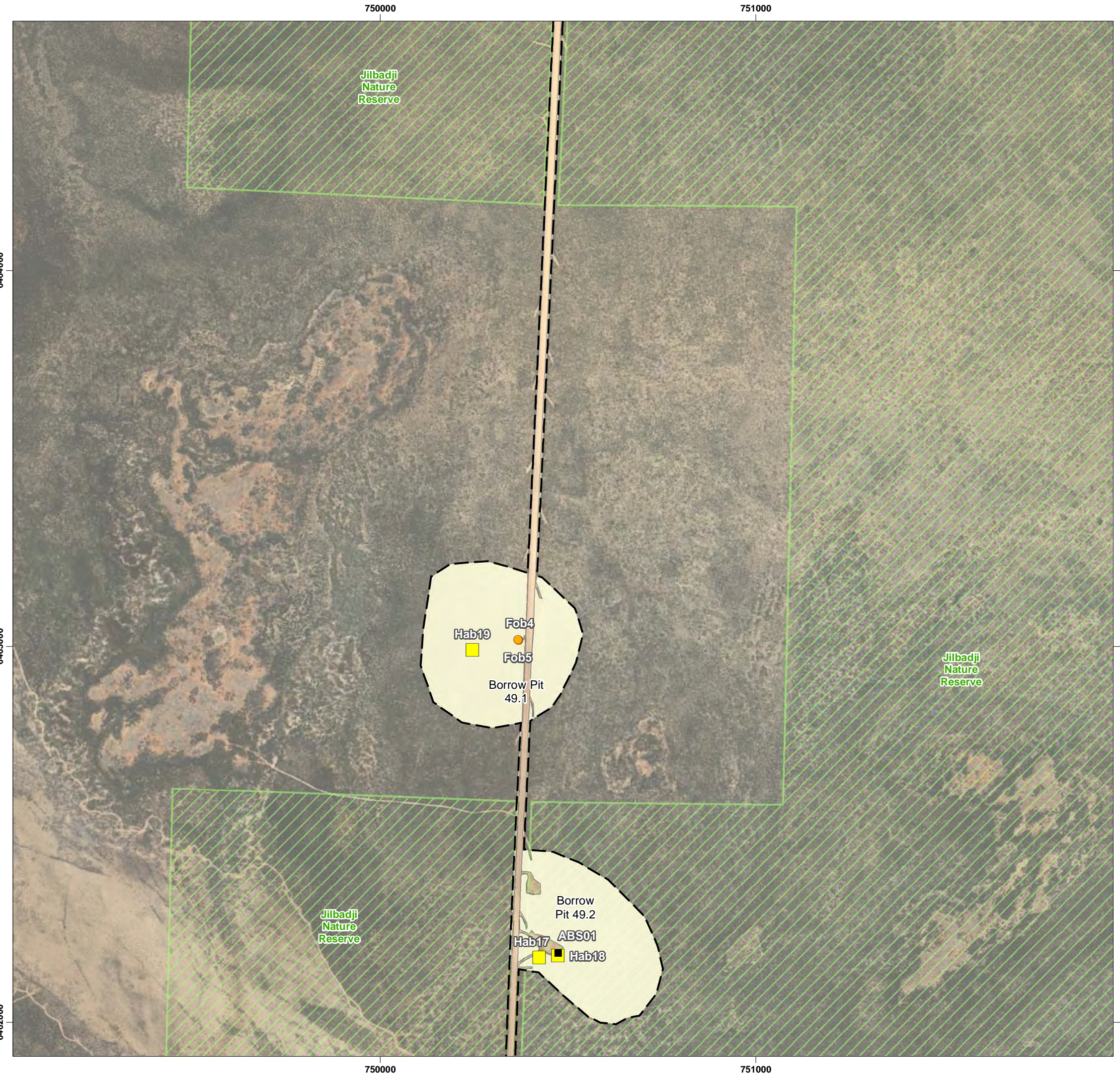


COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER

SCALE: 1:10,000 @ A3

**MAP
 2-49**

REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

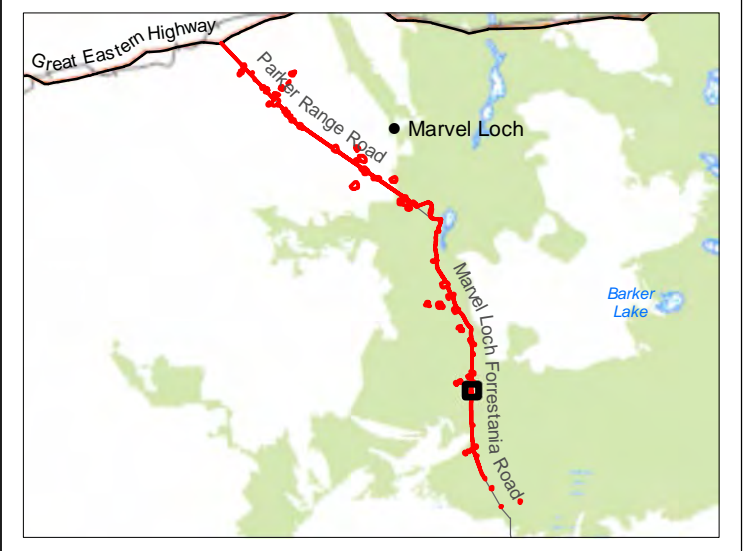


LEGEND

- Survey Area
- Bat Recorder
- Fauna Observation Point
- Habitat Assessment Point
- DBCA Nature Reserve (2011)

Fauna Habitat

- Shrubland
- Woodland (Open/Closed)
- Cleared



DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBC 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



FAUNA HABITAT
LOGISTICS ROAD FAUNA SURVEY



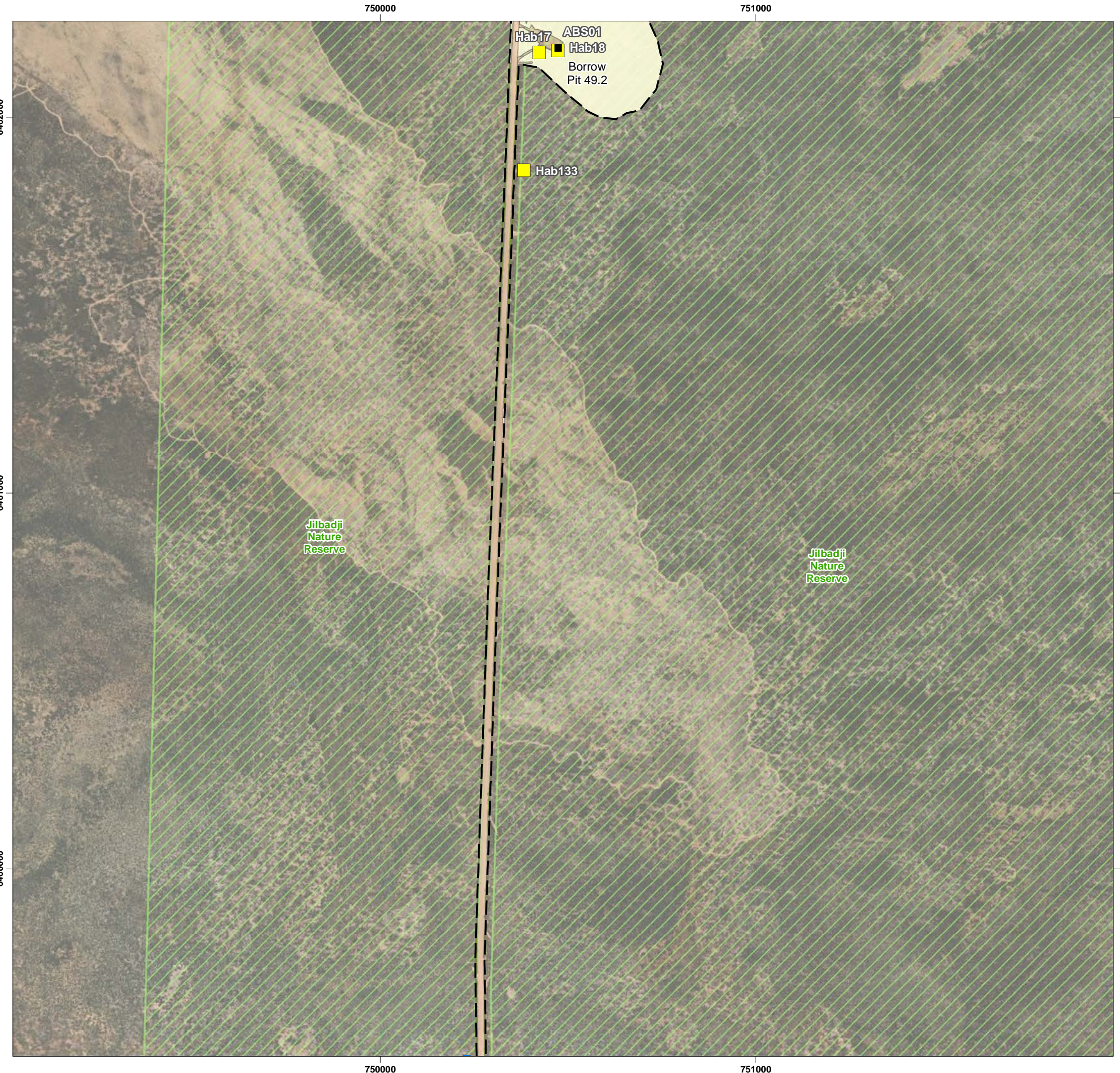
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 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER

SCALE: 1:10,000 @ A3

MAP
2-50

REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

PROJECT NO: 4715-22



LEGEND

- Survey Area
- Bat Recorder
- Motion Camera
- Habitat Assessment Point
- DBCA Nature Reserve (2011)

Fauna Habitat

- Shrubland
- Woodland (Open/Closed)
- Cleared

DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBC 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



**FAUNA HABITAT
 LOGISTICS ROAD FAUNA SURVEY**



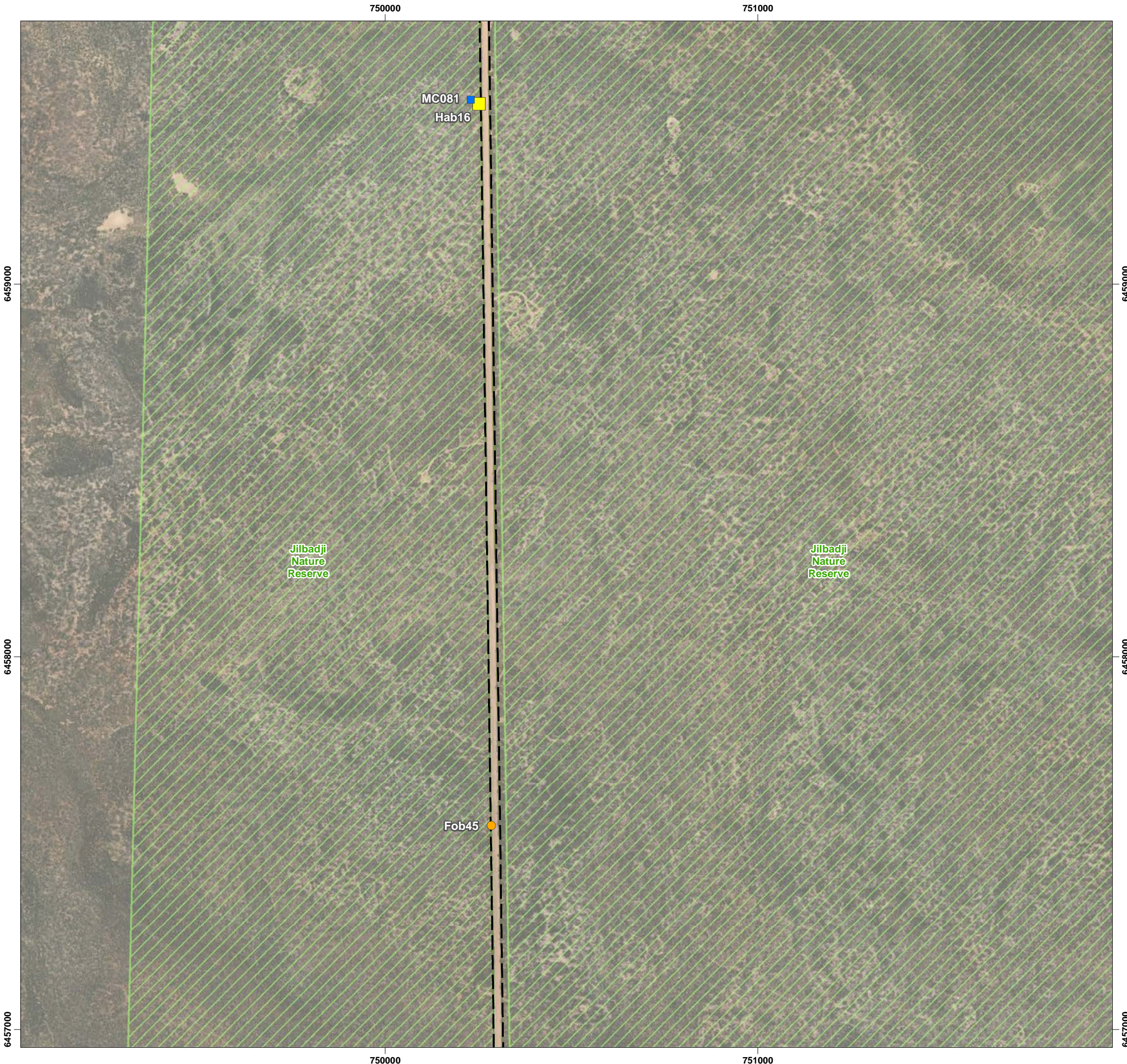
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 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER

SCALE: 1:10,000 @ A3

PROJECT NO: 4715-22

REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

**MAP
2-51**

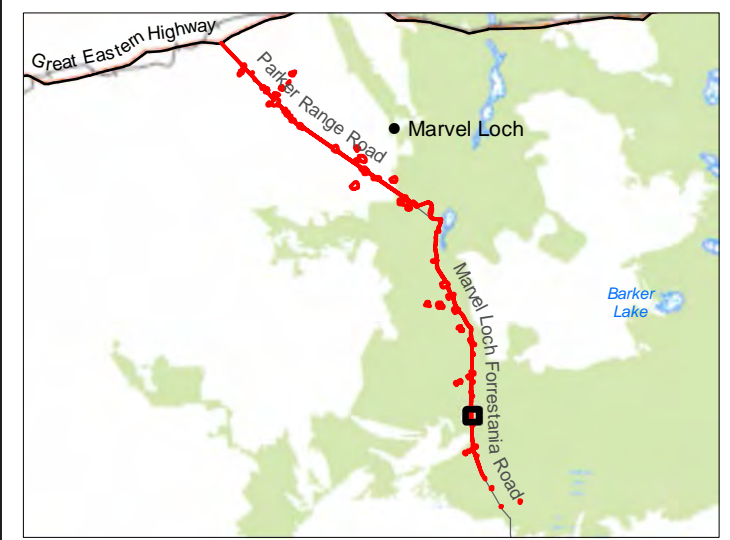


LEGEND

- Survey Area
- Motion Camera
- Fauna Observation Point
- Habitat Assessment Point
- DBCA Nature Reserve (2011)

Fauna Habitat

- Shrubland
- Woodland (Open/Closed)
- Cleared



DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBC 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



**FAUNA HABITAT
 LOGISTICS ROAD FAUNA SURVEY**



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER

SCALE: 1:10,000 @ A3

**MAP
2-52**

REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

PROJECT NO: 4715-22

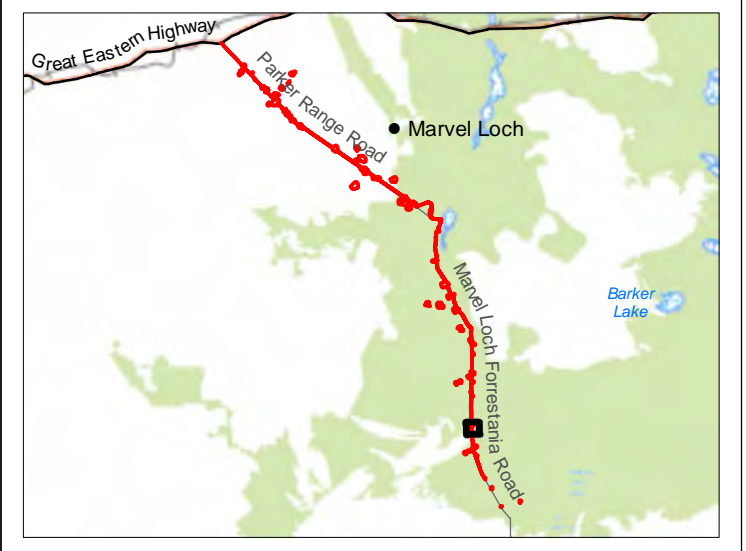


LEGEND

- Survey Area
- Fauna Observation Point
- Habitat Assessment Point
- DBCA Nature Reserve (2011)

Fauna Habitat

- Regrowth
- Shrubland
- Woodland (Open/Closed)
- Cleared



DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBCA 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



**FAUNA HABITAT
 LOGISTICS ROAD FAUNA SURVEY**



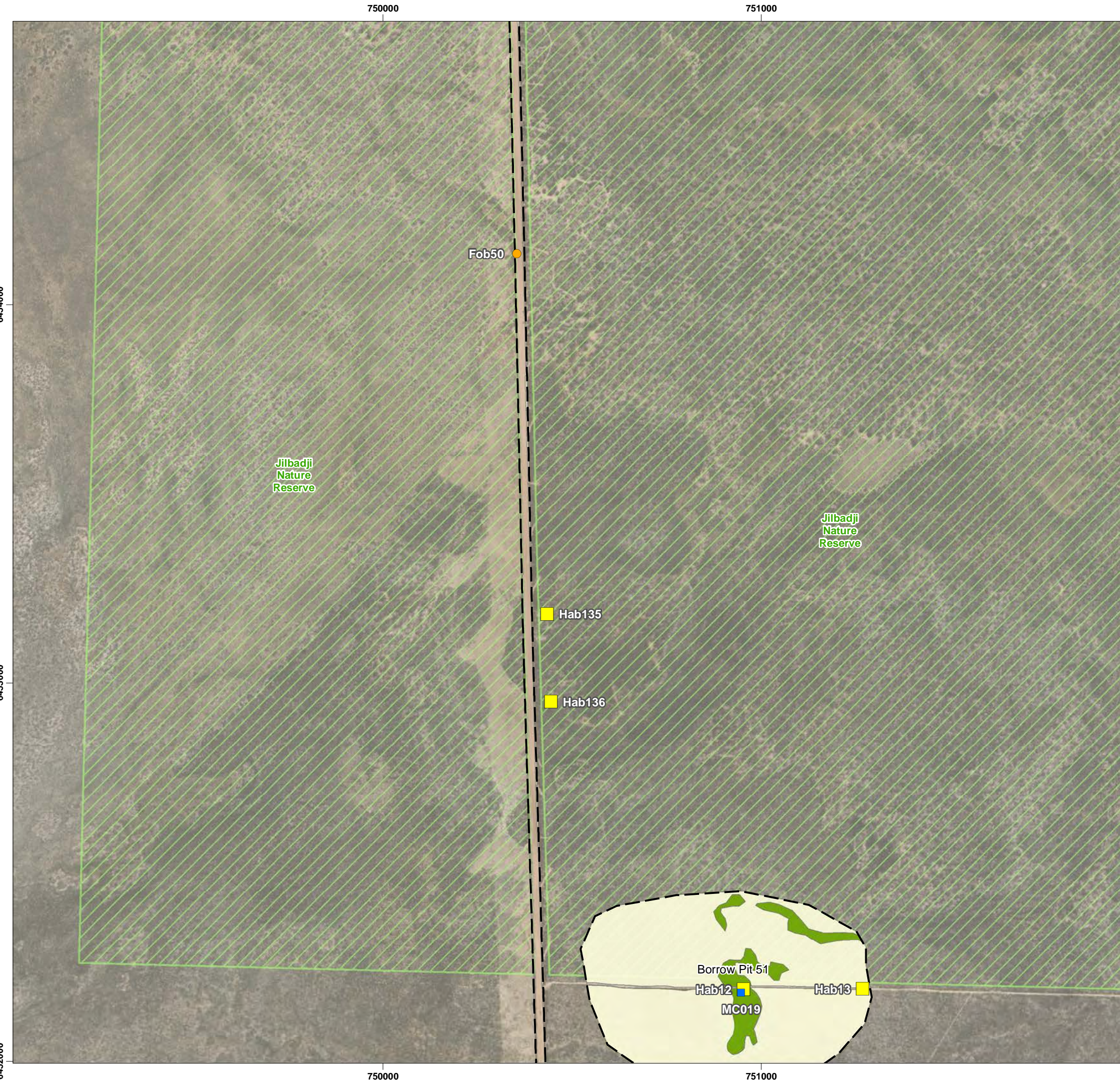
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 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER

SCALE: 1:10,000 @ A3

**MAP
 2-53**

REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

PROJECT NO: 4715-22

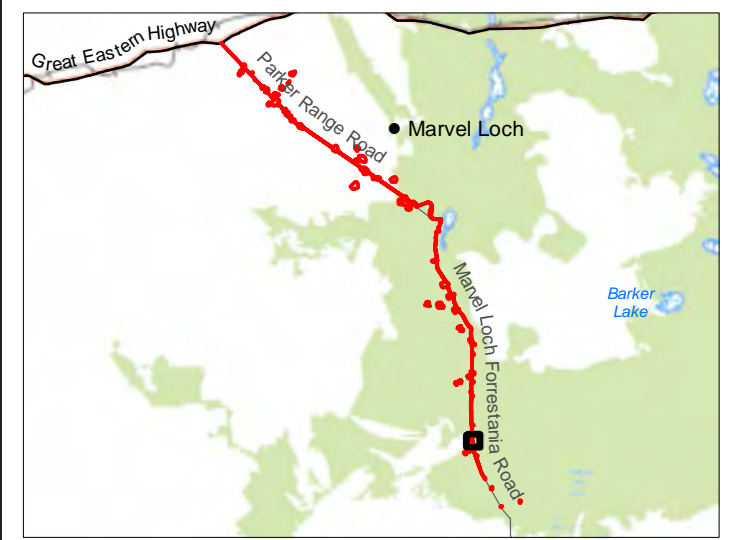


LEGEND

- Survey Area
- Motion Camera
- Fauna Observation Point
- Habitat Assessment Point
- DBCA Nature Reserve (2011)

Fauna Habitat

- Shrubland
- Woodland (Open/Closed)
- Cleared



DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBC 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



FAUNA HABITAT
LOGISTICS ROAD FAUNA SURVEY

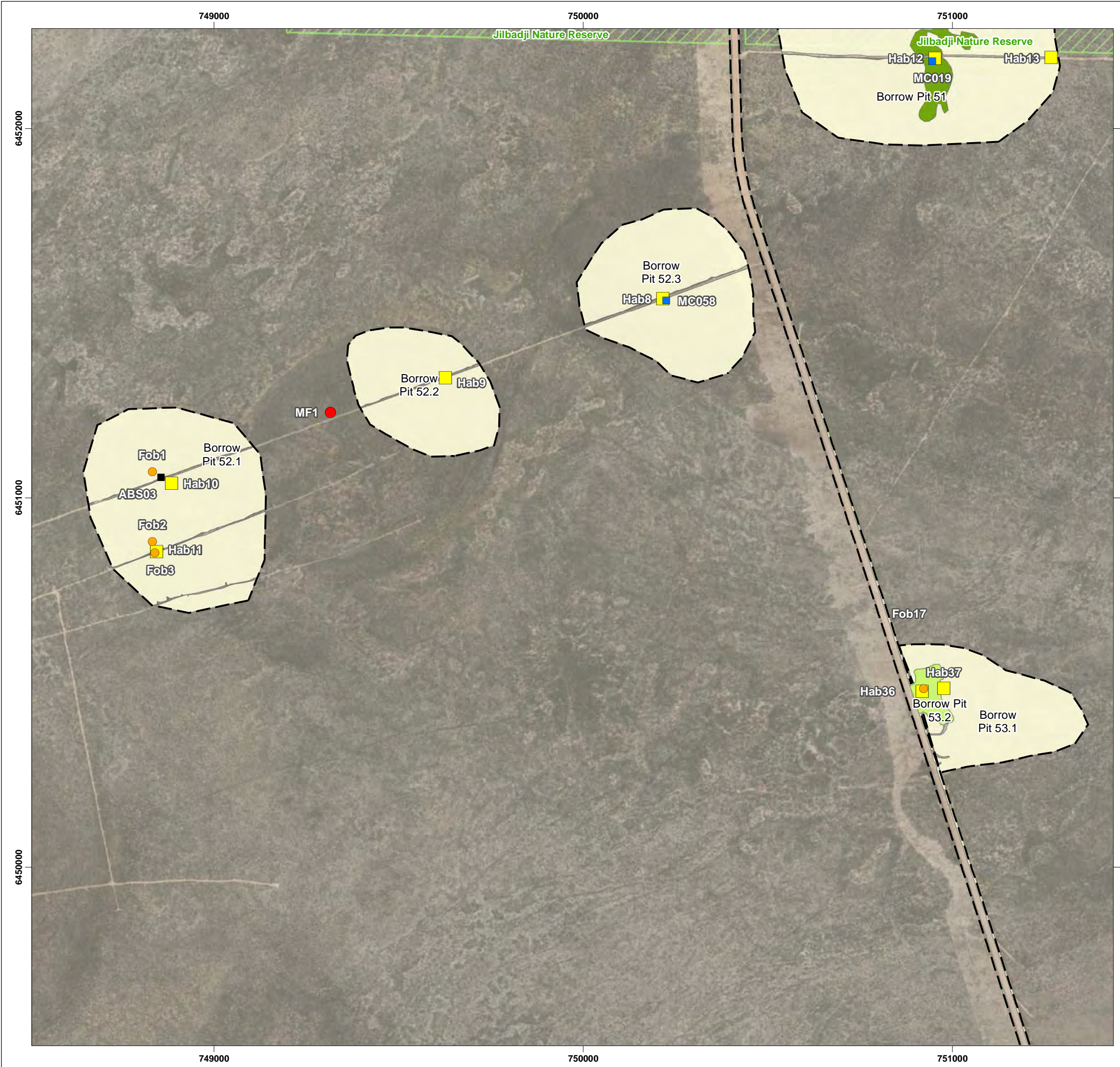


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 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER

SCALE: 1:10,000 @ A3

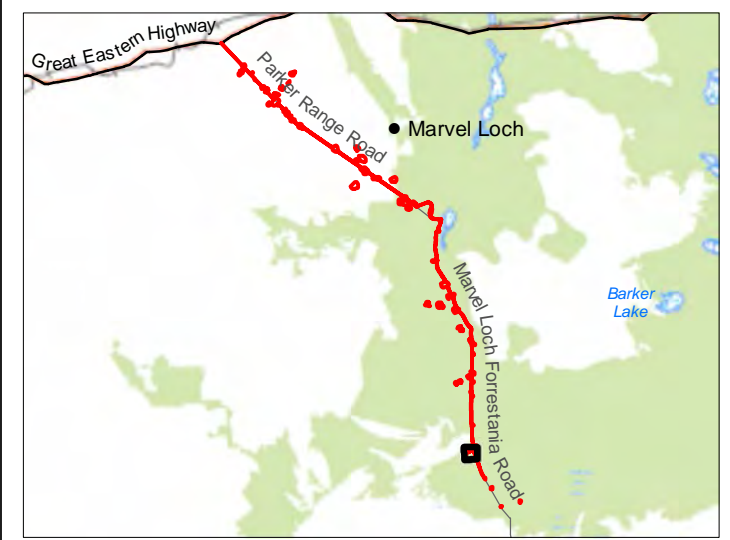
MAP
2-54

REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022



LEGEND

- Survey Area
 - Bat Recorder
 - Motion Camera
 - Fauna Observation Point
 - Habitat Assessment Point
 - Malleefowl Mound Observation
 - DBCA Nature Reserve (2011)
- Fauna Habitat**
- Regrowth
 - Shrubland
 - Woodland (Open/Closed)
 - Cleared



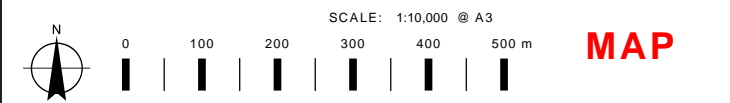
DATASOURCES:
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 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



**FAUNA HABITAT
 LOGISTICS ROAD FAUNA SURVEY**



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER






MAP 2-55



REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

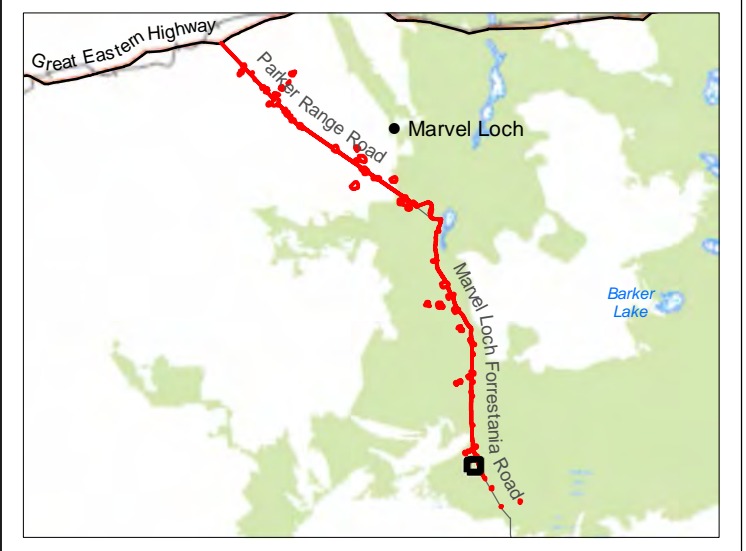


LEGEND

-  Survey Area
-  Fauna Observation Point
-  Habitat Assessment Point

Fauna Habitat

-  Shrubland
-  Cleared



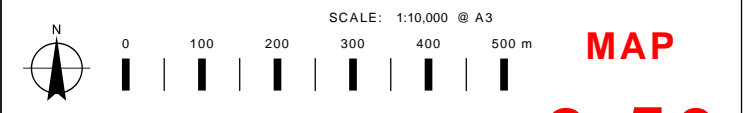
DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBCA 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



FAUNA HABITAT
LOGISTICS ROAD FAUNA SURVEY



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



PROJECT NO: 4715-22			
REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

MAP
2-56

751000

752000

753000

6447000

6447000

6446000

6446000

6445000






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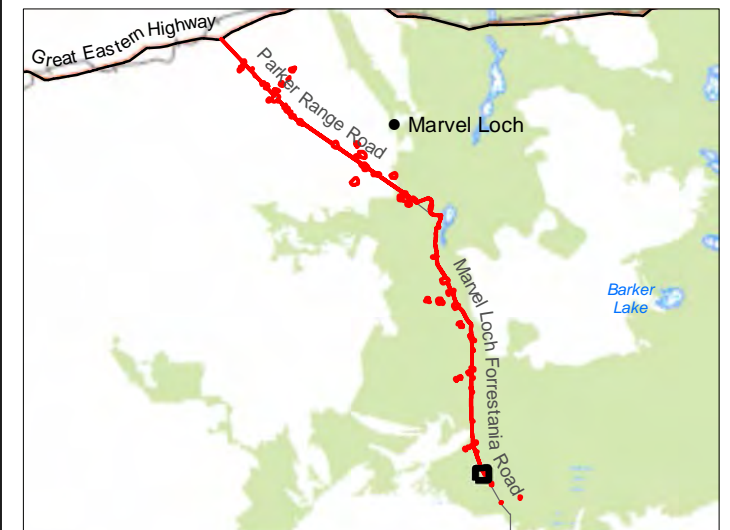
751000

752000

753000

LEGEND

-  Survey Area
 -  Motion Camera
 -  Habitat Assessment Point
- Fauna Habitat**
-  Shrubland
 -  Cleared



DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBCA 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



FAUNA HABITAT LOGISTICS ROAD FAUNA SURVEY



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



PROJECT NO: 4715-22

REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

**MAP
2-57**



752000

753000

754000

6444000

6444000

6443000






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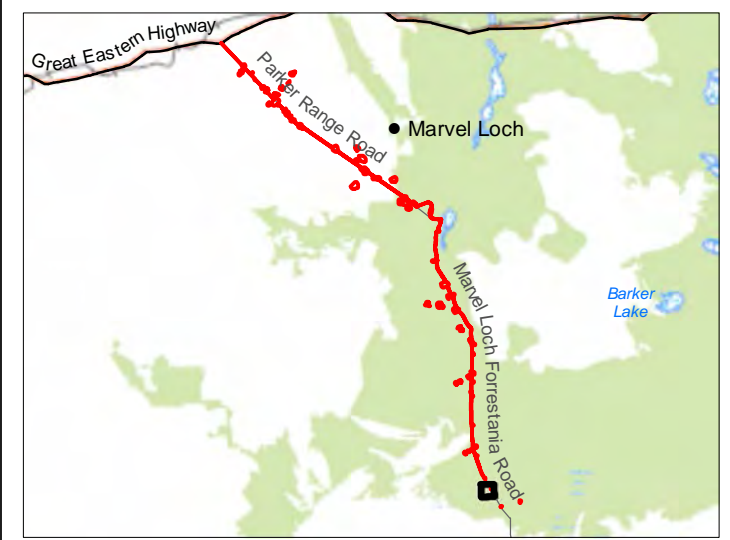
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753000

754000

LEGEND

-  Survey Area
 -  Motion Camera
 -  Fauna Observation Point
 -  Habitat Assessment Point
- Fauna Habitat**
-  Shrubland



DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBCA 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



FAUNA HABITAT LOGISTICS ROAD FAUNA SURVEY



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



PROJECT NO: 4715-22

REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

MAP
2-58



755000

756000

757000

6442000

6442000

6441000

6441000

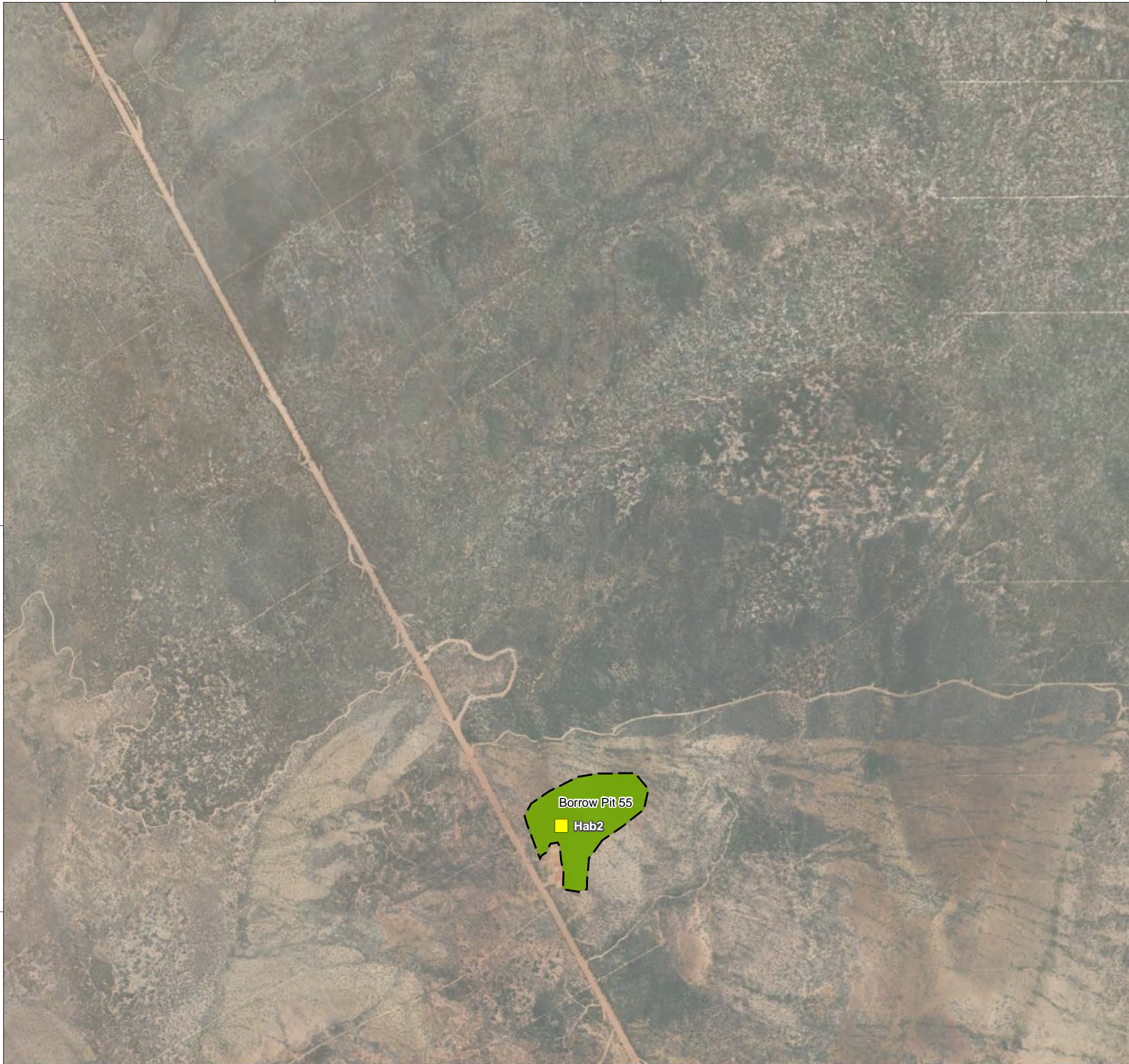
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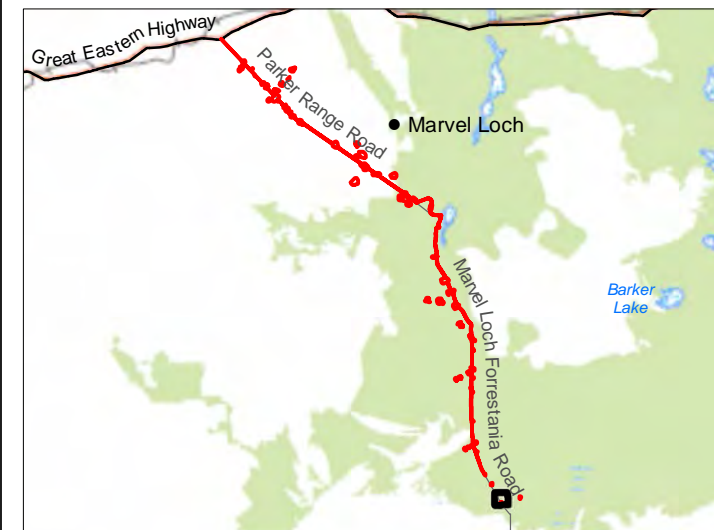
756000

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LEGEND

-  Survey Area
-  Habitat Assessment Point
- Fauna Habitat**
-  Woodland (Open/Closed)



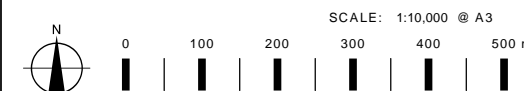
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 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBCA 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



FAUNA HABITAT
LOGISTICS ROAD FAUNA SURVEY

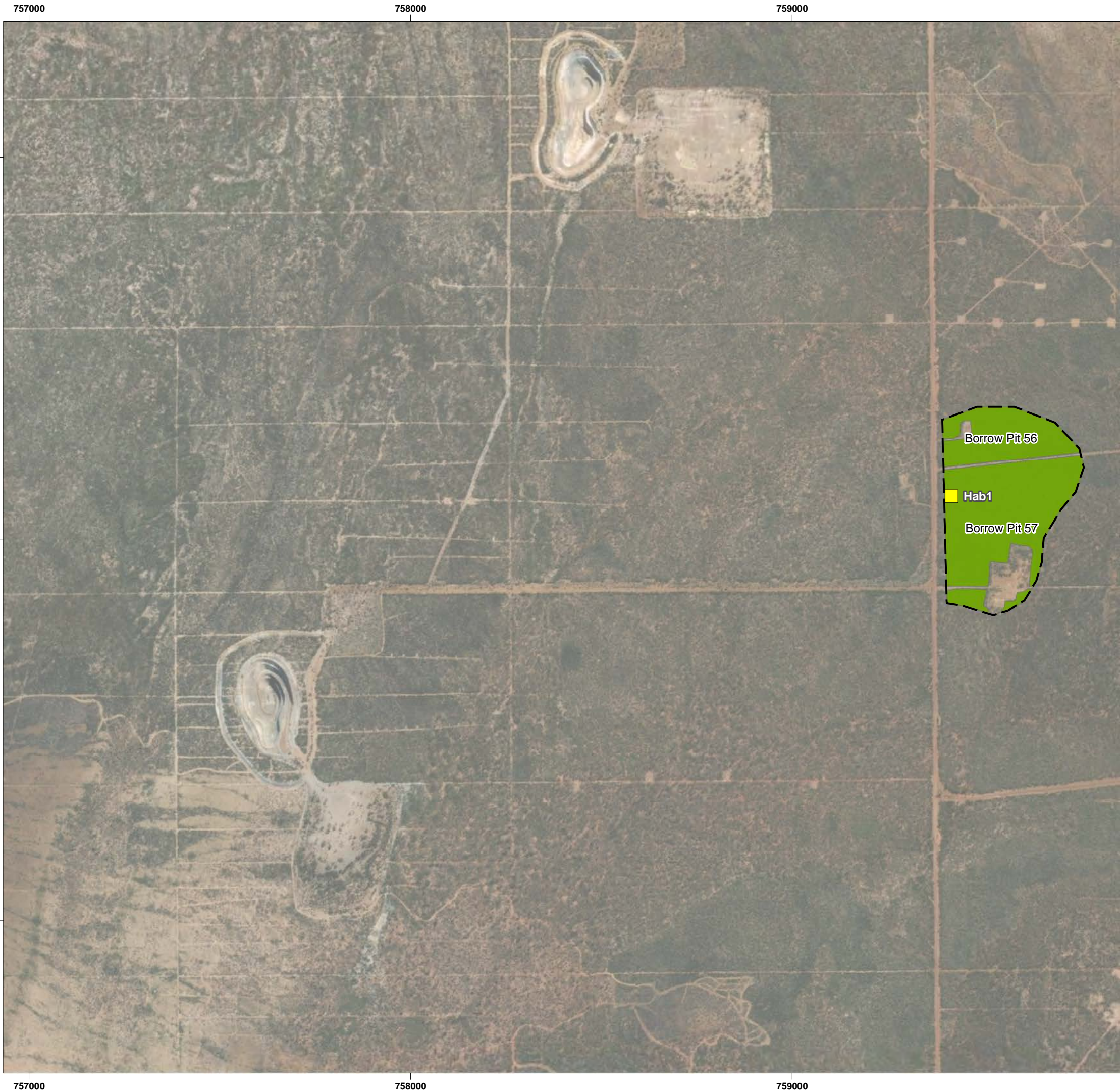


COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER







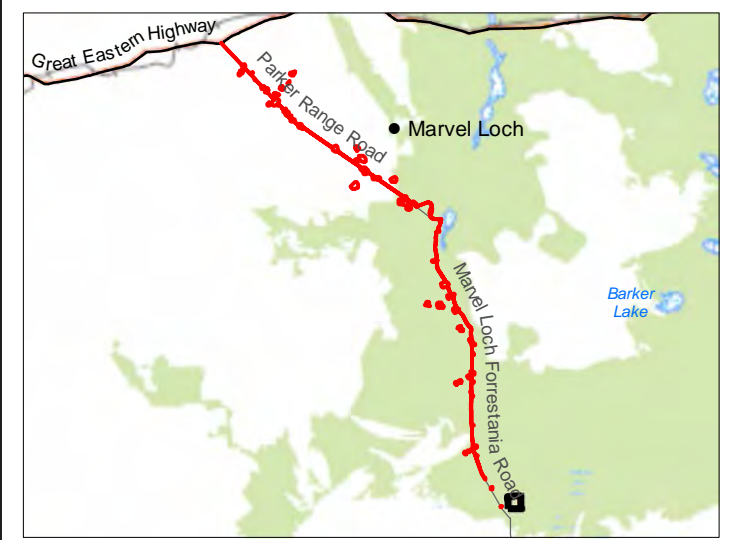
MAP
2-59

REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022



LEGEND

-  Survey Area
-  Habitat Assessment Point
- Fauna Habitat**
-  Woodland (Open/Closed)
-  Cleared



DATASOURCES:
 SOURCE DATA: FAUNA (ECOSCAPE 2022), LEGISLATED LANDS AND WATERS (DBCA 2011)
 AERIAL: ESRI (2021 AND 2022)
 BASE MAP: GEOSCIENCE AUSTRALIA TOPOGRAPHY
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



**FAUNA HABITAT
 LOGISTICS ROAD FAUNA SURVEY**



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



PROJECT NO: 4715-22

REV	AUTHOR	APPROVED	DATE
00	NW	BT	29/07/2022

**MAP
 2-60**

APPENDIX ONE LEGISLATIVE CONTEXT, DEFINITIONS AND CRITERIA

COMMONWEALTH ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

The EPBC Act is a legal framework to protect and manage matters of national environmental significance (MNES) including important flora, fauna, ecological communities, and heritage areas listed under the Act.

Threatened taxa (flora and fauna) are protected under the EPBC Act, which lists species and ecological communities that have been assessed as meeting the criteria to be listed as Critically Endangered, Endangered, Vulnerable, Conservation Dependant, Extinct, or Extinct in the Wild, as detailed in **Table 5**.

Threatened Ecological Communities protected under the EPBC Act are categorised as Critically Endangered, Endangered or Vulnerable, also detailed in this table.

Migratory species subject to international agreements are also protected under the EPBC Act. The definition of a migratory species under the Act follows that prescribed by the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) (Department of the Environment 2021):

Migratory species are the entire population or any geographically separate part of the population of any species or lower taxon of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries.

Species listed by the following international agreements are currently protected under the EPBC Act:

- Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)
- China-Australia Migratory Bird Agreement (CAMBA)
- Japan-Australia Migratory Bird Agreement (JAMBA)
- Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).

Table 5: EPBC Act categories for flora, fauna, and ecological communities

Category	Threatened species	Threatened Ecological Communities
Extinct	A native species is eligible to be included in the extinct category at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.	n/a
Extinct in the wild	A native species is eligible to be included in the extinct in the wild category at a particular time if, at that time: (a) it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or (b) it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.	n/a
Critically Endangered (CE)	A native species is eligible to be included in the <i>critically endangered</i> category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.	An ecological community is eligible to be included in the <i>critically endangered</i> category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria

Category	Threatened species	Threatened Ecological Communities
Endangered (EN)	A native species is eligible to be included in the <i>endangered</i> category at a particular time if, at that time: (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.	An ecological community is eligible to be included in the <i>endangered</i> category at a particular time if, at that time: (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable (VU)	A native species is eligible to be included in the <i>vulnerable</i> category at a particular time if, at that time: (a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.	An ecological community is eligible to be included in the <i>vulnerable</i> category at a particular time if, at that time: (a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.
Conservation Dependent	A native species is eligible to be included in the conservation dependent category at a particular time if, at that time: (a) the species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered, or critically endangered; or (b) the following subparagraphs are satisfied: (i) the species is a species of fish; (ii) the species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long-term survival in nature are maximised; (iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory; (iv) cessation of the plan of management would adversely affect the conservation status of the species.	n/a

WESTERN AUSTRALIAN ENVIRONMENTAL PROTECTION ACT 1986

The Western Australian EP Act was created to provide for an Environmental Protection Authority (the EPA) that has the responsibility for:

- prevention, control and abatement of pollution and environmental harm
- conservation, preservation, protection, enhancement, and management of the environment
- matters incidental to or connected with the above.

The EPA is responsible for providing the guidance and policy under which environmental assessments are conducted. It conducts environmental impact assessments (based on the information provided by the proponent), initiates measures to protect the environment and provides advice to the Minister responsible for environmental matters.

WESTERN AUSTRALIAN BIODIVERSITY CONSERVATION ACT 2016

The Western Australian BC Act provides for the conservation, protection and ecologically sustainable use of biodiversity and biodiversity components in Western Australia.

Threatened species (both flora and fauna) and ecological communities that meet the categories listed within the BC Act are protected under this legislation and require authorisation by the Minister to take or disturb. These are known as Threatened Flora, Threatened Fauna, and Threatened Ecological Communities. The conservation categories of Critically Endangered, Endangered and Vulnerable are detailed in **Table 6**; these categories align with those of the EPBC Act. Some State-listed threatened species and ecological communities are provided with additional protection as they are also listed under the Commonwealth EPBC Act (see **Table 5** for conservation status category descriptions).

The most recent Western Australian flora and fauna listings were published in the Government Gazette on 11 September 2018 (Government of Western Australia 2018a).

PRIORITY-LISTED FLORA AND FAUNA

Flora are listed as PF where populations are geographically restricted or threatened by local processes, or where there is insufficient information to formally assign them to TF categories. Whilst PF are not specifically listed in the BC Act, some may qualify as being of special conservation interest and thereby have a greater level of protection than unlisted species.

There are three categories covering Western Australian-listed TF and four categories covering PF species which are outlined in **Table 6**. PF for Western Australia are regularly reviewed by the DBCA whenever new information becomes available, with species status altered or removed from the list when data indicates that they no longer meet these requirements.

Conservation significant fauna species are listed by the DBCA as Priority Fauna where populations are geographically restricted or threatened by local processes, or where there is insufficient information to formally assign them to threatened fauna categories. Whilst Priority Fauna are not specifically listed in the BC Act, these have a greater level of significance than other native species. The categories covering Priority Fauna species are outlined in **Table 6**.

Flora and fauna species may be listed as being of special conservation interest if they have a naturally low population, have a restricted natural range, are subject to or recovering from a significant population decline or reduction of range or are of special interest, and the Minister considers that taking may result in depletion of the species. Migratory species and those subject to international agreement are also listed under the Act. These are known as 'specially protected species' in the BC Act.

Table 6: Conservation codes for Western Australian flora and fauna (DBCA 2019)

Conservation Codes for Western Australian Flora and Fauna	
Threatened, Extinct and Specially Protected fauna or flora ¹ are species ² which have been adequately searched for and are deemed to be, in the wild, threatened, extinct or in need of special protection, and have been gazetted as such.	
The <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i> and the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> have been transitioned under regulations 170, 171 and 172 of the <i>Biodiversity Conservation Regulations 2018</i> to be the lists of Threatened, Extinct and Specially Protected species under Part 2 of the <i>Biodiversity Conservation Act 2016</i>.	
Categories of Threatened, Extinct and Specially Protected fauna and flora are:	
T	<p>Threatened species</p> <p>Listed by order of the Minister as Threatened in the category of critically endangered, endangered, or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the <i>Biodiversity Conservation Act 2016</i> (BC Act).</p> <p>Threatened fauna is that subset of 'Specially Protected Fauna' listed under schedules 1 to 3of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i> for Threatened Fauna.</p> <p>Threatened flora is that subset of 'Rare Flora' listed under schedules 1 to 3of the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> for Threatened Flora.</p> <p>The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.</p>

Conservation Codes for Western Australian Flora and Fauna	
CR	<p>Critically endangered species</p> <p>Threatened species considered to be “<i>facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines</i>”.</p> <p>Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i> for critically endangered fauna or the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> for critically endangered flora.</p>
EN	<p>Endangered species</p> <p>Threatened species considered to be “<i>facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines</i>”.</p> <p>Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i> for endangered fauna or the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> for endangered flora.</p>
VU	<p>Vulnerable species</p> <p>Threatened species considered to be “<i>facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines</i>”.</p> <p>Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i> for vulnerable fauna or the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> for vulnerable flora.</p>
<p>Extinct species</p> <p>Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.</p>	
EX	<p>Extinct species</p> <p>Species where “<i>there is no reasonable doubt that the last member of the species has died</i>”, and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).</p> <p>Published as presumed extinct under schedule 4 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i> for extinct fauna or the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> for extinct flora.</p>
EW	<p>Extinct in the wild species</p> <p>Species that “<i>is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form</i>”, and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act).</p> <p>Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.</p>
<p>Specially protected species</p> <p>Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection.</p> <p>Species that are listed as threatened species (critically endangered, endangered, or vulnerable) or extinct species under the BC Act cannot also be listed as Specially Protected species.</p>	
MI	<p>Migratory species</p> <p>Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act).</p> <p>Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the <i>Convention on the Conservation of Migratory Species of Wild Animals</i> (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species.</p> <p>Published as migratory birds protected under an international agreement under schedule 5 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i>.</p>
CD	<p>Species of special conservation interest (conservation dependent fauna)</p> <p>Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act).</p> <p>Published as conservation dependent fauna under schedule 6 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i>.</p>
OS	<p>Other specially protected species</p> <p>Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act).</p> <p>Published as other specially protected fauna under schedule 7 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i>.</p>

Conservation Codes for Western Australian Flora and Fauna	
P	<p>Priority species</p> <p>Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened fauna or flora.</p> <p>Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.</p> <p>Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.</p>
1	<p>Priority 1: Poorly-known species</p> <p>Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.</p>
2	<p>Priority 2: Poorly-known species</p> <p>Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.</p>
3	<p>Priority 3: Poorly-known species</p> <p>Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.</p>
4	<p>Priority 4: Rare, Near Threatened and other species in need of monitoring</p> <p>(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands.</p> <p>(b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent.</p> <p>(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.</p>
<p>¹ The definition of flora includes algae, fungi, and lichens.</p> <p>² Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies or variety, or a distinct population).</p>	

ENVIRONMENTALLY SENSITIVE AREAS

There are a number of areas within Western Australia identified as being of environmental significance within which the exemptions to the Native Vegetation Clearing Regulations do not apply. These are referred to as Environmentally Sensitive Areas (ESAs), and are declared under section 51B of the EP Act and described in the *Environmental Protection (Environmentally Sensitive Areas) Notice*.

CONSERVATION ESTATE

The National Reserve System is a network of protected areas managed for conservation under international guidelines. The objective of placing areas of bushland into the Conservation Estate is to achieve and maintain a comprehensive, adequate, and representative reserve system for Western Australia. The Conservation and Parks Commission is the vesting body for conservation lands, forest and marine reserves that are managed by DBCA (Government of Western Australia 2018b).

APPENDIX TWO

DESKTOP ASSESSMENT RESULTS AND LIKELIHOOD ASSESSMENTS

Table 7: Fauna database results and likelihood assessments

Blue shading indicates high likelihood; darker blue indicates species is known (recorded) from the survey area. Species identified by database searches but not included in this assessment are listed in **Table 8**, along with the reason for their exclusion.

Species	Common name	Conservation status		Database			Likelihood of occurrence	
		EPBC Act	WA	PMST**	DBCA	NatureMap	Desktop	Post-survey
Mammals								
<i>Bettongia penicillata ogilbyi</i>	Woylie, Brush-tailed bettong	EN	CR		X		Very Unlikely	Very Unlikely
<i>Dasyurus geoffroii</i>	Chuditch, Western Quoll	VU	VU	Known	X	X	Known	Known
<i>Leporillus conditor</i>	Greater stick-nest rat, Wopilkara	VU	CD		X		Very Unlikely	Very Unlikely
<i>Macrotis lagotis</i>	Bilby, Dalgyte	VU	VU		X	X	Very Unlikely	Very Unlikely
<i>Myrmecobius fasciatus</i>	Numbat, Walpurti	EN	EN		X		Very Unlikely	Very Unlikely
<i>Notamacropus irma</i>	Western brush wallaby		P4		X	X	Known	Known
<i>Nyctophilus major tor</i> (Call was ambiguous)	Central long-eared bat		P4		X		Very Unlikely	Likely
<i>Petrogale lateralis lateralis</i>	Black-flanked rock-wallaby, Black-footed rock-wallaby, Moororong	EN	EN		X		Very Unlikely	Very Unlikely
<i>Phascogale calura</i>	Red-tailed Phascogale, Red-tailed Wambenger, Kenngoor	VU	EN	Likely	X		May Occur	Unlikely
<i>Pseudomys australis</i>	Plains rat	VU	VU			X	Unlikely	Unlikely
<i>Pseudomys chapmani</i>	Western Pebble-mound Mouse		P4			X	Unlikely	Unlikely
Birds								
<i>Calyptorhynchus latirostris</i>	Carnaby's Black Cockatoo, Short-billed Black-cockatoo	EN	EN	Likely		X	Unlikely	Unlikely
<i>Chalcites osculans</i>	Black-eared Cuckoo	MI/MA		Known			May Occur	May Occur
<i>Falco hypoleucos</i>	Grey Falcon	VU	VU	May			May Occur	May Occur
<i>Falco peregrinus</i>	Peregrine falcon		S		X	X	Known	Likely
<i>Leipoa ocellata</i>	Malleefowl	VU	VU	Known	X	X	Known	Known
<i>Merops ornatus</i>	Rainbow Bee-eater	MI/MA	IA	May		X	May Occur	May Occur
<i>Motacilla cinerea</i>	Grey Wagtail	MI/MA	IA	May			May Occur	May Occur
<i>Pezoporus occidentalis</i>	Night Parrot	EN	CR	May			Very Unlikely	Very Unlikely

DESKTOP ASSESSMENT RESULTS AND LIKELIHOOD ASSESSMENTS

Species	Common name	Conservation status		Database			Likelihood of occurrence	
		EPBC Act	WA	PMST**	DECA	NatureMap	Desktop	Post-survey
<i>Platycercus icterotis xanthogenys</i>	Western rosella (inland)		P4		X	X	Known	Likely
Reptiles								
<i>Paroplocephalus atriceps</i>	Lake Cronin snake		P3		X	X	May Occur	May Occur

Table 8: Excluded species and reason for exclusion

Species	Common name	Conservation status		Reason excluded from assessment
		EPBC Act	WA	
<i>Actitis hypoleucos</i>	Common Sandpiper	MI/MA	IA	Migratory wetland species, no suitable habitat in survey area
<i>Aganippe castellum</i>	Tree-stem trapdoor spider		P4	Invertebrate; not within the scope of the project
<i>Apus pacificus</i>	Fork-tailed Swift	MI/MA	MI/IA	Migratory wetland species, no suitable habitat in survey area
<i>Bulbucus ibis</i>	Cattle Egret	MI/MA		Migratory wetland species, no suitable habitat in survey area
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	MI/MA	MI/IA	Migratory wetland species, no suitable habitat in survey area
<i>Calidris ferruginea</i>	Curllew Sandpiper	CR/MI/MA	VU/IA	Migratory wetland species, no suitable habitat in survey area
<i>Calidris melanotos</i>	Pectoral Sandpiper	MI/MA		Migratory wetland species, no suitable habitat in survey area
<i>Calidris ruficollis</i>	Red-necked stint	MI	MI/IA	Migratory wetland species, no suitable habitat in survey area
<i>Daphnia jollyi</i>	Water flea		P1	Invertebrate; not within the scope of the project
<i>Idiosoma intermedium</i>	Coolgardie shield-backed trapdoor spider		P3	Invertebrate; not within the scope of the project
<i>Idiosoma nigrum</i>	Shield-backed Trapdoor Spider, Black Rugose Trapdoor Spider	VU		Invertebrate; not within the scope of the project
<i>Parartemia contracta</i>	Brine shrimp		P1	Invertebrate; not within the scope of the project
<i>Thinornis rubricollis</i>	Hooded Dotterel, Hooded Plover	MI/MA	P4	Migratory wetland species, no suitable habitat in survey area
<i>Tringa nebularia</i>	Common greenshank		IA	Migratory wetland species, no suitable habitat in survey area

APPENDIX THREE FIELD SURVEY RESULTS

Table 9: Recorded fauna species

Species	Common name	EPBC Act status	Western Australian status
Mammals			
<i>Canis familiaris</i>	Wild Dog*		
<i>Equus asinus</i>	Donkey*		
<i>Tachyglossus aculeatus</i>	Short-beaked Echidna		
<i>Vulpes vulpes</i>	Fox*		
<i>Notamacropus irma</i>	Western Brush Wallaby		P4
<i>Macropus fuliginosus</i>	Western Grey Kangaroo		
<i>Felis catus</i>	Feral Cat*		
<i>Oryctolagus cuniculus</i>	European Rabbit*		
<i>Notomys mitchellii</i>	Mitchell's Hopping Mouse		
<i>Sminthopsis dolichura</i>	Little Long-tailed Dunnart		
<i>Sminthopsis gilberti</i>	Gilbert's Dunnart		
<i>Rattus rattus</i>	Black Rat*		
<i>Mus musculus</i>	House Mouse*		
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat		
<i>Chalinolobus morio</i>	Chocolate Wattled Bat		
<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat		
<i>Vespadelus baverstocki</i>	Inland Forest Bat		
<i>Vespadelus regulus</i>	Southern Forest Bat		
<i>Austronomus australis</i>	White-striped Free-tailed Bat		
<i>Ozimops kitcheneri</i>	Western Free-tailed Bat		
<i>Ozimops petersi</i>	Inland Free-tailed Bat		
<i>Nyctophilus geoffroyi and/or Nyctophilus major tor</i> Note: Ambiguous identification	Lesser Long-eared Bat and/or Central Long-eared Bat		P4 (Central Long-eared Bat)
Birds			
<i>Acanthiza apicalis</i>	Inland Thornbill		
<i>Acanthiza inornata</i>	Western Thornbill		
<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill		
<i>Aquila audax</i>	Wedge-tailed eagle		
<i>Artamus cyanopterus</i>	Dusky Woodswallow		
<i>Barnardius zonarius</i>	Australian Ringneck		
<i>Climacteris rufus</i>	Rufus Treecreeper		
<i>Corvus coronoides</i>	Australian Raven		
<i>Cracticus nigrogularis</i>	Pied Butcherbird		
<i>Cracticus torquatus</i>	Grey Butcherbird		
<i>Daphoenositta chrysoptera</i>	Varied Sitella		
<i>Dromaius novaehollandiae</i>	Emu		
<i>Drymodes brunneopygia</i>	Southern Scrub Robin		
<i>Eolophus roseicapilla</i>	Galah		
<i>Eopsaltria griseogularis</i>	Western Yellow Robin		

Species	Common name	EPBC Act status	Western Australian status
<i>Gavicalis virescens</i>	Singing Honeyeater		
<i>Grallina cyanoleuca</i>	Magpie Lark		
<i>Gymnorhina tibicen</i>	Australian Magpie		
<i>Hirundo neoxena</i>	Welcome Swallow		
<i>Leipoa ocellata</i>	Malleefowl	VU	VU
<i>Lichenostomus leucotis</i>	White-eared Honeyeater		
<i>Malurus pulcherrimus</i>	Blue-breasted Fairywren		
<i>Manorina flavigula</i>	Yellow-throated Miner		
<i>Ocyphaps lophotes</i>	Crested Pigeon		
<i>Pachycephala pectoralis</i>	Golden Whistler		
<i>Petrochelidon nigricans</i>	Tree Martin		
<i>Phaps chalcoptera</i>	Common Bronzewing		
<i>Pomatostomus Superciliosus</i>	White-browed babbler		
<i>Rhipidura albiscapa</i>	Grey Fantail		
<i>Rhipidura leucophrys</i>	Willie Wagtail		
<i>Strepera versicolor</i>	Grey Currawong		
<i>Taeniopygia castanotis</i>	Zebra finch		
<i>Oreoica gutturalis</i>	Crested Bellbird		
<i>Cinclosoma clarum</i>	Western Chestnut Quail-thrush		
<i>Calamanthus cautus</i>	Shy Heathwren		
<i>Pyrholaemus brunneus</i>	Redthroat		
Reptiles			
<i>Ctenophorus cristatus</i>	Bicycle Dragon		
<i>Moloch horridus</i>	Thorny Devil		
<i>Pseudonaja affinis</i>	Dugite		
<i>Tiliqua rugosa</i>	Shingleback, Bobtail		
<i>Varanus gouldii</i>	Sand Goanna		
<i>Egernia richardi</i>	Woodland Crevice Skink		
Invertebrates			
<i>Camponotus sp. nr. terebrans</i>	Sugar Ant		

*introduced

Table 10: Habitat assessment sites (GDA94, Zone 50)

Site Name	Site Type	Description	Easting	Northing
Hab1	Habitat Assessment	Mallee woodland over dense shrubland (some Allocasuarina sp.)	759418	6441113
Hab2	Habitat Assessment	Open Mallee woodland over shrub/regrowth	755742	6440223
Hab3	Habitat Assessment	Low shrubland with some Banksia sp.	753997	6443915
Hab4	Habitat Assessment	Low shrubland, some Mallee, Allocasuarina sp	752647	6445635
Hab5	Habitat Assessment	Low to medium shrubland with Mallee, Allocasuarina sp and sparse Banksia	752646	6445930
Hab6	Habitat Assessment	Low shrubland with spread out Mallee, some Banksia	752099	6446849
Hab7	Habitat Assessment	Mostly Allocasuarina sp, some Banksia sp	751766	6447887
Hab8	Habitat Assessment	Closed medium shrubland with sparse Mallee, Allocasuarina sp	750216	6451540

Site Name	Site Type	Description	Easting	Northing
Hab9	Habitat Assessment	Closed shrubland with sparse Mallee, Allocasuarina sp.	749628	6451325
Hab10	Habitat Assessment	Low shrubland with Allocasuarina and Banksia sp.	748886	6451039
Hab11	Habitat Assessment	Closed shrubland, Allocasuarina sp.	748845	6450854
Hab12	Habitat Assessment	Open Mallee woodland over shrubs	750953	6452191
Hab13	Habitat Assessment	Low closed shrubland with Banksia sp. Allocasuarina sp.	751268	6452192
Hab14	Habitat Assessment	Shrubland, Allocasuarina sp, Hakea sp	750344	6456545
Hab15	Habitat Assessment	Shrubland, Allocasuarina sp.	750533	6456466
Hab16	Habitat Assessment	Open Mallee woodland over shrub	750252	6459484
Hab17	Habitat Assessment	Shrubland with Callitris and Mallee over Leptospermum reeds on yellow sand	750423	6462173
Hab18	Habitat Assessment	Mostly Melaleuca with sparse Mallee	750473	6462178
Hab19	Habitat Assessment	Shrubland, Allocasuarina sp	750245	6462991
Hab20	Habitat Assessment	Regrowth, some shrub, Hakea and Allocasuarina sp	750573	6465055
Hab21	Habitat Assessment	Shrubland Melaleuca	750604	6464964
Hab22	Habitat Assessment	Allocasuarina with sparse Mallee	749970	6466185
Hab23	Habitat Assessment	Open Mallee woodland over shrub (Melaleuca)	748200	6465234
Hab24	Habitat Assessment	Closed shrubland with spread out Mallee	747407	6464923
Hab25	Habitat Assessment	Closed low shrubland mostly Allocasuarina sp	750849	6466795
Hab26	Habitat Assessment	Regrowth, shrubland over pit	750760	6470790
Hab27	Habitat Assessment	Open Salmon gum woodland over shrub, old fire scar	750854	6470772
Hab28	Habitat Assessment	Closed Allocasuarina shrubland	750587	6473156
Hab29	Habitat Assessment	Open shrubland fire scar	750855	6473180
Hab30	Habitat Assessment	Open Salmon Gum with Gimlet, over shrubland	750561	6474740
Hab31	Habitat Assessment	Shrubland mostly Acacia	748723	6475401
Hab32	Habitat Assessment	Mallee woodland over Acacia shrub	748844	6475286
Hab33	Habitat Assessment	Shrubland	748269	6475915
Hab34	Habitat Assessment	Open Salmon Gum woodland over shrub	747715	6479692
Hab35	Habitat Assessment	Open Salmon Gum woodland over medium shrubland	746256	6482095
Hab36	Habitat Assessment	Regrowth, Allocasuarina sp	750919	6450477
Hab37	Habitat Assessment	Shrubland, Allocasuarina sp, Mallee	750977	6450484
Hab38	Habitat Assessment	Open Salmon Gum woodland over shrub	749530	6477479
Hab39	Habitat Assessment	Open Salmon Gum woodland over shrub	749415	6477460
Hab40	Habitat Assessment	Woodland with Mallet over Melaleuca shrub	747488	6480465
Hab41	Habitat Assessment	Woodland with Mallet over Melaleuca shrub	747622	6480559
Hab42	Habitat Assessment	Low shrubland (fire scar), Mallee woodland south-east corner	744738	6480584
Hab43	Habitat Assessment	Acacia shrubland	744209	6480603
Hab44	Habitat Assessment	Allocasuarina low shrubland	741981	6480643
Hab45	Habitat Assessment	Allocasuarina low shrubland	741957	6480771
Hab46	Habitat Assessment	Allocasuarina shrubland with sparse Mallee	746928	6482345
Hab47	Habitat Assessment	Open Salmon Gum and other eucalypt sp woodland over Melaleuca shrub	745718	6484344
Hab48	Habitat Assessment	Open woodland, Gimlet/ Morrel over shrubs	745801	6484594
Hab49	Habitat Assessment	Open Salmon Gum woodland over shrub	745066	6484589
Hab50	Habitat Assessment	Marsh wetland, samphire, melaleuca shrub	744671	6487094

Site Name	Site Type	Description	Easting	Northing
Hab51	Habitat Assessment	Open Salmon Gum woodland over shrub (regeneration)	743267	6489118
Hab52	Habitat Assessment	Borrow pit 37	744205	6489301
Hab53	Habitat Assessment	Borrow pit 36.2	743974	6489675
Hab54	Habitat Assessment	Grassland with some trees	743795	6492103
Hab55	Habitat Assessment	Salmon Gum woodland over low shrub (regeneration)	744020	6493516
Hab56	Habitat Assessment	Low open Salmon Gum woodland over shrub (regrowth)	744667	6495053
Hab57	Habitat Assessment	Open Salmon Gum woodland over melaleuca shrub	744545	6495429
Hab58	Habitat Assessment	Open Salmon Gum and Wandoo woodland over low shrub	743079	6498173
Hab59	Habitat Assessment	Allocasuarina shrubland	743097	6499137
Hab60	Habitat Assessment	Allocasuarina shrubland, some Mallee and Acacia	743236	6499114
Hab61	Habitat Assessment	Open Salmon Gum woodland over Melaleuca shrub	743280	6500038
Hab62	Habitat Assessment	Low shrubland mostly Acacia	739822	6501070
Hab63	Habitat Assessment	Shrubland with Mallee	738815	6499920
Hab64	Habitat Assessment	Low shrubland with sparse Grevillea	738100	6501107
Hab65	Habitat Assessment	Allocasuarina shrubland	738116	6501243
Hab66	Habitat Assessment	Shrubland mixed	736963	6501111
Hab67	Habitat Assessment	Allocasuarina shrubland	736989	6501273
Hab68	Habitat Assessment	Allocasuarina shrubland	737919	6501869
Hab69	Habitat Assessment	Shrubland, Acacia sp.	736063	6505599
Hab70	Habitat Assessment	Shrubland, mostly Acacia with Mallee	732424	6505897
Hab71	Habitat Assessment	Open Salmon Gum woodland over shrub	728247	6504355
Hab72	Habitat Assessment	Allocasuarina shrubland	728393	6504243
Hab73	Habitat Assessment	Shrubland Allocasuarina and Acacia	728014	6504446
Hab74	Habitat Assessment	Low mixed shrubland	728469	6509458
Hab75	Habitat Assessment	Acacia shrubland next to cleared land	728529	6512203
Hab76	Habitat Assessment	Shrubland Acacia sp. mostly with some Mallee	729667	6509937
Hab77	Habitat Assessment	Mixed shrubland with some Mallee	729867	6507860
Hab78	Habitat Assessment	Shrubland (open) some Mallee	730469	6507412
Hab79	Habitat Assessment	Open shrubland, Allocasuarina and Acacia	724567	6511549
Hab80	Habitat Assessment	Acacia shrubland	724593	6511648
Hab81	Habitat Assessment	Open Salmon Gum woodland over Melaleuca, some parts with Mallee and shrub	724392	6511769
Hab82	Habitat Assessment	Mostly cleared some shrub and unknown species of Eucalypt planted along road	721353	6513931
Hab83	Habitat Assessment	Open Salmon Gum woodland and Mallee over shrub	720002	6514890
Hab84	Habitat Assessment	Callitris open shrubland	717514	6516689
Hab85	Habitat Assessment	Acacia shrubland	717166	6516878
Hab86	Habitat Assessment	Wetland with patches of sandy clay and grass, surrounded by open shrub	716478	6517260
Hab87	Habitat Assessment	Mixed dense shrubland with Acacia, Allocasuarina and Mallee	716120	6517896
Hab88	Habitat Assessment	Shrubland with Allocasuarina and mostly Acacia	715502	6518459
Hab89	Habitat Assessment	Shrubland mostly Acacia	714814	6519191
Hab90	Habitat Assessment	Open Salmon Gum woodland	714847	6519301
Hab91	Habitat Assessment	Shrubland with Allocasuarina and Acacia	714339	6519728

Site Name	Site Type	Description	Easting	Northing
Hab92	Habitat Assessment	Closed Salmon Gum and Mallee woodland over shrub	712708	6521309
Hab93	Habitat Assessment	Shrubland with Allocasuarina and Acacia with some Mallee	712641	6521700
Hab94	Habitat Assessment	Acacia shrubland	712673	6523129
Hab95	Habitat Assessment	Shrubland with mostly Acacia with some Allocasuarina and Mallee	713833	6524295
Hab96	Habitat Assessment	Shrubland with Allocasuarina and Acacia, some sparse Eucalypt tree sp.	715778	6526838
Hab97	Habitat Assessment	Shrubland with Allocasuarina and Acacia, some sparse Eucalypt tree sp.	716180	6526961
Hab98	Habitat Assessment	Shrubland with Allocasuarina and Acacia, some sparse Eucalypt tree sp.	715872	6527297
Hab99	Habitat Assessment	Cleared or developed, occasional Salmon Gum and shrub	704753	6530367
Hab100	Habitat Assessment	Open Salmon Gum woodland with Mallee and Melaleuca	705730	6529399
Hab101	Habitat Assessment	Acacia shrubland with sparse Mallee	706161	6528886
Hab102	Habitat Assessment	Shrubland with Allocasuarina and Acacia	706406	6528431
Hab103	Habitat Assessment	Acacia shrubland with Mallee	705604	6527076
Hab104	Habitat Assessment	Open Salmon Gum woodland over Melaleuca and Acacia shrubland with sparse Mallee	707488	6527430
Hab105	Habitat Assessment	Cleared land with occasional Salmon Gum and shrub	707405	6527424
Hab106	Habitat Assessment	Acacia shrubland with sparse Mallee	707526	6527272
Hab107	Habitat Assessment	Open Salmon Gum woodland over Melaleuca	707885	6526955
Hab108	Habitat Assessment	Shrubland Allocasuarina and Acacia sp.	708187	6526579
Hab109	Habitat Assessment	Wandoo woodland with unknown eucalypt sp., some Salmon Gum over shrub	708948	6525752
Hab110	Habitat Assessment	Mixed shrubland with some Salmon Gum, Wandoo interspersed further south	709333	6525340
Hab111	Habitat Assessment	Mallee woodland over shrub	717970	6516416
Hab112	Habitat Assessment	Open Salmon Gum and Morrel woodland	718743	6515847
Hab113	Habitat Assessment	Mallee woodland with Salmon Gum over shrub	719688	6515150
Hab114	Habitat Assessment	Open Salmon Gum woodland over Melaleuca with some Mallee	724837	6511438
Hab115	Habitat Assessment	Shrubland with some Mallee	725604	6510891
Hab116	Habitat Assessment	Open woodland consisting of Morrel, Salmon Gum, and Mallee	726602	6510153
Hab117	Habitat Assessment	Eucalypt woodland over mixed shrubland	730934	6507098
Hab118	Habitat Assessment	Open Salmon Gum woodland with Mallee over shrub	734115	6504766
Hab119	Habitat Assessment	Wandoo and Salmon Gum open woodland	736397	6503064
Hab120	Habitat Assessment	Salmon Gum woodland over low shrub (regeneration)	743922	6491367
Hab121	Habitat Assessment	Open Salmon Gum woodland over Melaleuca and other shrub (some regeneration)	744210	6488742
Hab122	Habitat Assessment	Salmon Gum woodland over melaleuca with Mallee Morrel further south	744770	6486836
Hab123	Habitat Assessment	Open woodland with Morrel, Gimlet, and Salmon Gum over Melaleuca and low shrub	745544	6485622
Hab124	Habitat Assessment	Salmon Gum woodland with Mallet and Mallee (regeneration)	747919	6479652
Hab125	Habitat Assessment	Open woodland of Salmon Gum and Morrel over shrub (Melaleuca)	748252	6479217

Site Name	Site Type	Description	Easting	Northing
Hab126	Habitat Assessment	Shrubland with Acacia and sparse Mallee	750634	6474047
Hab127	Habitat Assessment	Open Salmon Gum woodland over dense shrub	750684	6472458
Hab128	Habitat Assessment	Shrubland (mostly Acacia and some Allocasuarina) with sparse Mallee	750740	6470951
Hab129	Habitat Assessment	Salmon Gum woodland with Gimlet over low shrubland	750706	6470580
Hab130	Habitat Assessment	Shrubland with Calistris, Allocasuarina and some Mallee	750744	6469006
Hab131	Habitat Assessment	Salmon Gum woodland (young) over shrub	750545	6465922
Hab132	Habitat Assessment	Closed shrubland (Allocasuarina, Calistris, and Acacia)	750546	6465709
Hab133	Habitat Assessment	Mallee woodland with some Salmon Gum over shrub	750383	6461859
Hab134	Habitat Assessment	Shrubland with Allocasuarina and Acacia, varying degrees of Mallee	750315	6456798
Hab135	Habitat Assessment	Mallee woodland with mostly shrub	750434	6453183
Hab136	Habitat Assessment	Shrubland of Allocasuarina and Acacia with sparse Mallee	750444	6452951

Table 11: Fauna observation sites (GDA94, Zone 50)

Site Name	Site Type	Description	Easting	Northing
MF1	Fauna Observation	<i>Leipoa ocellata</i>	749316	6451232
Fob1	Fauna Observation	<i>Pomatostomus superciliosus</i>	748833	6451071
Fob2	Fauna Observation	<i>Drymodes brunneopygia</i>	748833	6450882
Fob3	Fauna Observation	<i>Pomatostomus superciliosus</i>	748840	6450851
Fob4	Fauna Observation	<i>Macropus irma</i>	750368	6463017
Fob5	Fauna Observation	<i>Drymodes brunneopygia</i>	750367	6463018
Fob6	Fauna Observation	<i>Tachyglossus aculeatus</i>	749893	6466149
Fob7	Fauna Observation	<i>Macropus fuliginosus</i>	749893	6466157
Fob8	Fauna Observation	<i>Gavicalis virescens</i>	748258	6465169
Fob9	Fauna Observation	<i>Varanus gouldii</i>	748121	6465217
Fob10	Fauna Observation	<i>Dromaius novaehollandiae</i>	751029	6466631
Fob11	Fauna Observation	<i>Eopsaltria griseogularis</i>	750845	6470765
MF2	Fauna Observation	<i>Leipoa ocellata</i>	748722	6475400
Fob12	Fauna Observation	<i>Macropus fuliginosus</i>	748732	6475395
Fob13	Fauna Observation	<i>Pachycephala pectoralis</i>	747780	6479727
Fob14	Fauna Observation	<i>Macropus irma</i>	747777	6479723
Fob15	Fauna Observation	<i>Acanthiza apicalis</i>	747713	6479691
Fob16	Fauna Observation	<i>Lichenostomus leucotis</i>	747716	6479694
Fob17	Fauna Observation	<i>Macropus fuliginosus</i>	750922	6450483
Fob18	Fauna Observation	<i>Artamus cyanopterus</i>	744230	6480690
Fob19	Fauna Observation	<i>Acanthiza apicalis</i>	741946	6480659
Fob20	Fauna Observation	<i>Cracticus torquatus</i>	746990	6482343
Fob21	Fauna Observation	<i>Pomatostomus superciliosus</i>	745756	6484362
Fob22	Fauna Observation	<i>Macropus fuliginosus</i>	738105	6501214
Fob23	Fauna Observation	<i>Tachyglossus aculeatus</i>	736986	6501239
Fob24	Fauna Observation	<i>Dromaius novaehollandiae</i>	736997	6501081

Site Name	Site Type	Description	Easting	Northing
Fob25	Fauna Observation	<i>Falco berigora</i>	736988	6500662
Fob26	Fauna Observation	<i>Barnardius zonarius</i>	732406	6505931
Fob27	Fauna Observation	<i>Equus asinus</i>	732445	6505871
Fob28	Fauna Observation	<i>Aquila audax</i>	728185	6504257
Fob29	Fauna Observation	<i>Tachyglossus aculeatus</i>	728277	6504245
Fob30	Fauna Observation	<i>Eolophus roseicapilla</i>	728160	6504389
Fob31	Fauna Observation	<i>Vulpes vulpes</i>	728526	6511827
Fob32	Fauna Observation	<i>Cracticus nigrogularis</i>	729666	6509969
Fob33	Fauna Observation	<i>Canis familiaris</i>	744122	6488850
Fob34	Fauna Observation	<i>Barnardius zonarius</i>	724609	6511572
Fob35	Fauna Observation	<i>Eolophus roseicapilla</i>	724600	6511615
Fob36	Fauna Observation	<i>Rhipidura leucophrys</i>	724587	6511534
Fob37	Fauna Observation	<i>Manorina flavigula</i>	719984	6514876
Fob38	Fauna Observation	<i>Tiliqua rugosa</i>	717519	6516652
Fob39	Fauna Observation	<i>Taeniopygia castanotis</i>	717468	6516713
Fob40	Fauna Observation	<i>Hirundo neoxena</i>	712124	6522198
Fob41	Fauna Observation	<i>Petrochelidon nigricans</i>	715786	6526776
Fob42	Fauna Observation	<i>Moloch horridus</i>	732140	6506181
Fob43	Fauna Observation	<i>Ctenophorus cristatus</i>	733159	6505443
Fob44	Fauna Observation	<i>Strepera versicolor</i>	745820	6485310
Fob45	Fauna Observation	<i>Moloch horridus</i>	750285	6457548
Fob46	Fauna Observation	<i>Moloch horridus</i>	751626	6448246
Fob47	Fauna Observation	<i>Malurus pulcherrimus</i>	753989	6443881
Fob48	Fauna Observation	<i>Acanthiza inornata</i>	753933	6443889
Fob49	Fauna Observation	<i>Drymodes brunneopygia</i>	753958	6443853
Fob50	Fauna Observation	<i>Moloch horridus</i>	750353	6454136
Fob51	Fauna Observation	<i>Acanthiza uropygialis</i>	743442	6497795
Fob52	Fauna Observation	<i>Lichenostomus leucotis</i>	743422	6497761
Fob53	Fauna Observation	<i>Rhipidura leucophrys</i>	743377	6497775
Fob54	Fauna Observation	<i>Cracticus nigrogularis</i>	743463	6497732
Fob55	Fauna Observation	<i>Daphoenositta chrysoptera</i>	743403	6497810
Fob56	Fauna Observation	<i>Gavicalis virescens</i>	743480	6497753
Fob57	Fauna Observation	<i>Pachycephala pectoralis</i>	743402	6497762
Fob58	Fauna Observation	<i>Climacteris rufus</i>	744774	6497384
Sugar ant 1	Fauna Observation	<i>Camponotus sp. nr. terebrans</i>	748549	6478834
Sugar ant 2	Fauna Observation	<i>Camponotus sp. nr. terebrans</i>	748567	6478793
Fob59	Fauna Observation	<i>Ctenophorus cristatus</i>	750281	6456685
Fob60	Fauna Observation	<i>Pseudonaja affinis</i>	708019	6526762
Fob61	Fauna Observation	<i>Corvus coronoides</i>	705095	6530002
Fob62	Fauna Observation	<i>Grallina cyanoleuca</i>	709663	6524960
Fob63	Fauna Observation	<i>Gymnorhina tibicen</i>	708225	6526525
Fob64	Fauna Observation	<i>Ocyphaps lophotes</i>	706965	6527903

Site Name	Site Type	Description	Easting	Northing
Fob65	Fauna Observation	<i>Aquila audax</i>	705388	6529645
Fob66	Fauna Observation	<i>Phaps chalcoptera</i>	710386	6524195
Fob67	Fauna Observation	<i>Rhipidura albiscapa</i>	705866	6528834

Table 12: Sugar ant survey sites (GDA94, Zone 50)

Site Name	Site Type	Description	Easting	Northing
Ant 1	Targeted survey	<i>Camponotus sp. nr. terebrans</i> absent	747478	6480530
Ant 2	Targeted survey	<i>Camponotus sp. nr. terebrans</i> absent	745720	6484328
Ant 3	Targeted survey	<i>Camponotus sp. nr. terebrans</i> absent	743222	6497877
Ant 4	Targeted survey	<i>Camponotus sp. nr. terebrans</i> absent	743442	6497665
Ant 5	Targeted survey	<i>Camponotus sp. nr. terebrans</i> absent	744016	6497541
Ant 6	Targeted survey	<i>Camponotus sp. nr. terebrans</i> absent	744796	6497475
Ant 7	Targeted survey	<i>Camponotus sp. nr. terebrans</i> absent	744861	6496195
Ant 8	Targeted survey	<i>Camponotus sp. nr. terebrans</i> absent	744618	6495681
Ant 9	Targeted survey	<i>Camponotus sp. nr. terebrans</i> absent	746082	6484464
Ant 10	Targeted survey	<i>Camponotus sp. nr. terebrans</i> present	748549	6478835

APPENDIX FOUR BAT CALL ANALYSIS

Acoustic analysis and bat call identification from Mt Holland, Western Australia

Prepared for **Ecoscape Australia Pty Ltd**

Version **27 June 2022**

SZ project reference **SZ617**



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This report should be included as an appendix in any larger submission to Government, and cited as:

Specialised Zoological (2022). Acoustic analysis and bat call identification from Mt Holland, Western Australia. Unpublished report by Specialised Zoological for Ecoscape Australia Pty Ltd, 27 June 2022, project reference SZ617.

Summary

Bat identifications from acoustic recordings are provided from Mt Holland, c. 80 km south of Southern Cross, Western Australia. The identification of bat species from full spectrum WAV-format recordings of their echolocation calls was based on measurements of characteristic frequency, observation of pulse shape, and the pattern of harmonics.

At least nine species of bat were identified as being present (**Tables 1 and 2**). Representative echolocation calls for each identification are illustrated (**Figure 1**), as recommended by the Australasian Bat Society (ABS 2006). Further details are available should verification be required.

Methods

The data provided were recorded in full spectrum WAV format with Titley Scientific Anabat Swift bat detectors (sampling rate 500 kHz, set to turn on automatically at sunset and off at sunrise). WAV files were converted to Zero Crossings format in Wildlife Acoustics Kaleidoscope version 5.1.9 software, and then opened in Titley Scientific Anabat Insight version 2.0.1 software. A filtering and decision tree process was run to allocate each Zero Crossings file to a frequency band representing one or more bat species, and then the presence of species in each frequency band group was validated by inspecting examples to allocate a species-level identification. The dataset comprised four recording sites, with the sampling period extending from 29 March to 28 April 2022. Identifications are presented as a site by species matrix, rather than a matrix giving explicit identifications per recording night within each site.

Species were identified based on information in Churchill (2008), and the author's own unpublished material. Nomenclature follows Jackson and Groves (2015).

Comments on identifications

Most species were identified unambiguously, but some call types have more than one possibility for their source. For example, the calls of long-eared bat species *Nyctophilus* spp. cannot be distinguished reliably, and both candidate species might have been present. Likewise, some call sequences of Gould's Wattled Bat *Chalinolobus gouldii* can appear very similar to those produced by the Inland Free-tailed Bat *Ozimops petersi*, but *C. gouldii* was recognised based on the alternating high and low characteristic frequency in successive pulses, and *O. petersi* was identified based on pulse shapes.

Limitations

The identifications presented in this report have been made within the following context:

1. The identifications made herein were based on the ultrasonic acoustic data recorded and provided by a 'third party' (the client named on the front of this report).
2. The scope of this report extended to providing information on the identification of bat species in bulk ultrasonic recordings. Further comment on these species and the possible impacts of a planned project on bat species were not part of the scope.
3. In the case of the present report, the recording equipment was not set up and supplied by Specialised Zoological. The equipment was operated by the third party during the survey.
4. Other than the general location of the study area, Specialised Zoological has not been provided with detailed information of the survey area, has not made a visit to observe the habitats available for bats, nor have we visited the specific project areas on a previous occasion.
5. Specialised Zoological has had no input into the overall design and timing of this bat survey, recording site placement, nor the degree of recording site replication.
6. While Specialised Zoological has made identifications to the best of our ability given the available materials, and reserves the right to re-examine the data and revise any identification following a query, it is the client's and / or proponent's responsibility to provide supporting evidence for any identification, which might require follow-up trapping effort or non-invasive methods such as video recordings. Specialised Zoological bears no liability for any follow-up work that may be required to support an identification based initially on the analysis of acoustic recordings undertaken and reported on here.
7. There are a variety of factors that affect the 'detectability' of each bat species, given the frequency, power and shape characteristics of their calls. Further information on the analysis and the various factors that can impinge on the reliability of identifications can be provided upon request.
8. The analysis of ultrasonic recordings is one of several methods that can be used to survey for bats, and comprehensive surveys typically employ more than one method. If an identification in the present report is ambiguous or in question, a trapping programme would help to resolve the presence of the possibilities in the project area.

References

- ABS (2006). Recommendations of the Australasian Bat Society Inc for reporting standards for insectivorous bat surveys using bat detectors. *The Australasian Bat Society Newsletter* 27: 6–9. [ISSN 1448-5877]
- Churchill, S.K. (2008). *Australian bats*. 2nd ed. Allen and Unwin, Crows Nest, NSW.
- Jackson, S.M. and Groves, C.P. (2015). *Taxonomy of Australian mammals*. CSIRO Publishing, Victoria.

Table 1. Species identified in the present survey from all sites combined.

VESPERTILIONIDAE	
Gould's Wattled Bat	<i>Chalinolobus gouldii</i>
Chocolate Wattled Bat	<i>Chalinolobus morio</i>
Inland Broad-nosed Bat	<i>Scotorepens balstoni</i>
Inland Forest Bat	<i>Vespadelus baverstocki</i>
Southern Forest Bat	<i>Vespadelus regulus</i>
Ambiguous identifications	
Lesser Long-eared Bat / and/or Central Long-eared Bat	<i>Nyctophilus geoffroyi</i> / and/or <i>Nyctophilus major tor</i>
MOLOSSIDAE	
White-striped Free-tailed Bat	<i>Austronomus australis</i>
Western Free-tailed Bat	<i>Ozimops kitcheneri</i>
Inland Free-tailed Bat	<i>Ozimops petersi</i>

Table 2. Species identifications, with the degree of confidence indicated by a code (see Table 1 for full species names).

	ABS1	ABS2	ABS3	ABS4
<i>A. australis</i>	X	X	X	—
<i>C. gouldii</i>	X	X	X	—
<i>C. morio</i>	X	X	X	—
<i>Nyctophilus</i> sp.	NC	NC	NC	—
<i>O. kitcheneri</i>	X	X	X	—
<i>O. petersi</i>	X	X	X	—
<i>S. balstoni</i>	X	X	X	—
<i>V. baverstocki</i>	X	X	X	—
<i>V. regulus</i>	X	X	X	—

ABS1 serial 622828 31.948657 S, 119.649943 E

ABS2 serial 622905 31.811107 S, 119.635905 E

ABS3 serial 622742 31.725390 S, 119.582327 E

ABS4 serial 622898 32.048963 S, 119.635035 E

Definition of confidence level codes

— Recording issue, no identifications available.

X Unambiguous identification of the species at the site based on measured call characteristics and comparison with available reference material. Greater confidence in this ID would come only after capture and supported by morphological measurements or a DNA sequence.

NC Needs Confirmation. Either call quality was poor, or the species cannot be distinguished reliably from another that makes similar calls. Alternative identifications are indicated in the *Comments on identifications* section of this report. If this is a species of conservation significance, further survey work might be required to confirm the record.

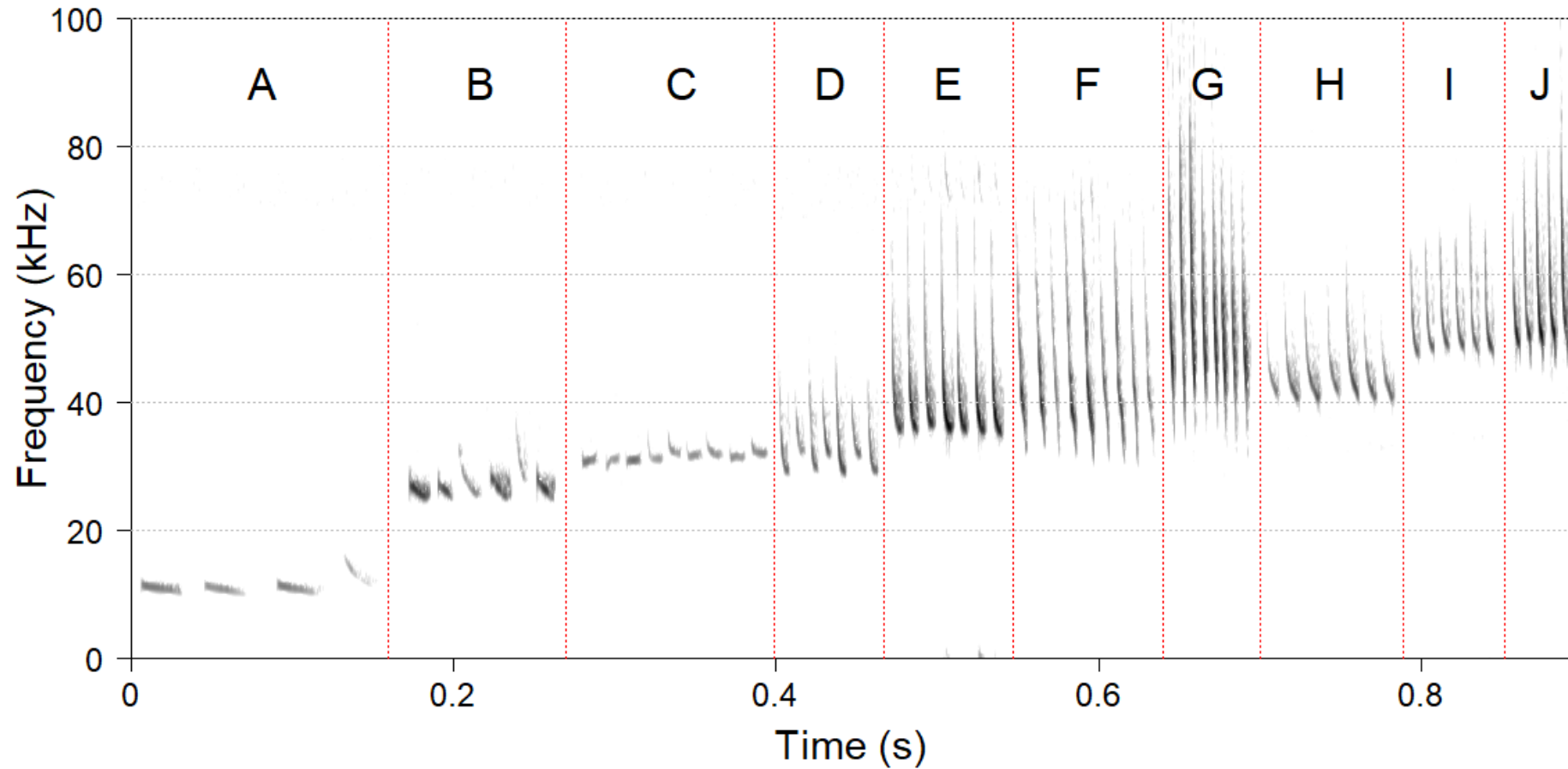


Figure 1. Representative echolocation call sequence portions of the species identified (**A:** *Austronomus australis*; **B:** *Ozimops kitcheneri*; **C:** *Ozimops petersi*; **D:** *Chalinolobus gouldii*; **E:** *Scotorepens balstoni*; **F,G:** *Nyctophilus geoffroyi* / *N. major tor*; **H:** *Vespadelus regulus*; **I:** *Vespadelus baverstocki*; **J:** *Chalinolobus morio*; time between pulses has been compressed).