

# **Dante Project**

Native Vegetation Clearing Permit Application – Supporting Document

**97992001 Pty Ltd**

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# Executive summary

97992001 Pty Ltd (“the Proponent”) holds 100% of exploration licences E 69/3401 and E 69/3552 within the Shire of Ngaanyatjarraku, Western Australia (WA). As these tenements are located within an environmentally sensitive area (ESA), Regulation 5 item 20 of Environmental Protection (Clearing of Native Vegetation) Regulations 2004 (WA) does not apply and a clearing permit is required for mineral exploration activities.

The Proponent is seeking a purpose permit for clearing up to 14 ha of native vegetation inside a proposed Permit Area of 10,432 ha. This document has been prepared to support the Native Vegetation Clearing Permit (NVCP) application.

## Ecological considerations

Flora and fauna studies undertaken to information avoidance and mitigation measures for the proposed exploration works identified the following:

- Three vegetation units, all of which are highly representative of the region. Vegetation condition was good to excellent.
- No Threatened or Priority Ecological Communities
- No Threatened flora listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or WA *Biodiversity Conservation Act 2016* (BC Act). One Priority 1 species (*Euphorbia parvicaruncula*) was recorded from several locations. Occurrences of *Euphorbia parvicaruncula* could be avoided when designing and developing access tracks and drill pads, however it should be noted that this an annual species and recognising individual dead plants would be difficult at most times of the year.
- One weed species, *Cenchrus ciliaris* (Buffel Grass), was observed and described as common to abundant. Buffel Grass is not listed as a Weed of National Significance or a Declared Plant.
- No conservation significant fauna were recorded (and are unlikely to occur as the available habitat is unsuitable)

An assessment of the ten clearing Principles is provided in Section 6 and indicates that proposed clearing of 14 ha for mineral exploration purposes is not likely to be at variance with any clearing principles.

## Tenure and social considerations

The Project is located within the Aboriginal Lands Trust estate of the Ngaanyatjarra Central Reserve (Reserve ID 17614) and within the Ngaanyatjarra Indigenous Protected Area. The Aboriginal community of Mantamaru (also known as Jameson) is located within E 69/3552, approximately 2.6 km from the proposed Permit Area.

The Proponent has a signed Native Title Agreement with the Ngaanyatjarra Land Council. Initial heritage surveys have been completed for the Project. The Proponent is bound by their heritage agreement to only undertake works in areas with heritage clearance from the Ngaanyatjarra Land Council. The Permit Area has excluded registered Aboriginal heritage sites.



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# 1 Introduction

## 1.1 Purpose and scope

97992001 Pty Ltd (“the Proponent”) proposes to undertake mineral exploration within its exploration licence tenements E 69/3401 and E 69/3552 (see Section 1.3), located approximately 600 kilometres (km) northwest of Laverton, Western Australia (WA). The tenements are approximately 100 km west of the junction between WA, South Australia and the Northern Territory (Figure 1-1).

The proposed exploration work comprises the following:

- 80 drill holes (each with a 25 metre (m) x 25 m pad)
- 50 km of access tracks (approximately 3 m wide), of which 20 km has been previously cleared.

A Native Vegetation Clearing Permit (NVCP) under the *Environmental Protection Act 1986* (EP Act) (see Section 1.2) is being sought for clearing of 14 ha within a Permit Area of 10,432 ha (Figure 1-2) to provide for the proposed exploration works. Aurecon Australasia Pty Ltd (“Aurecon”) has been engaged by the Proponent to prepare this supporting document for the NVCP application.

## 1.2 Legislative framework

Under Section 51C of the EP Act, clearing of native vegetation is an offence unless the clearing is done in accordance with a NVCP or there is an exemption. Exemptions include:

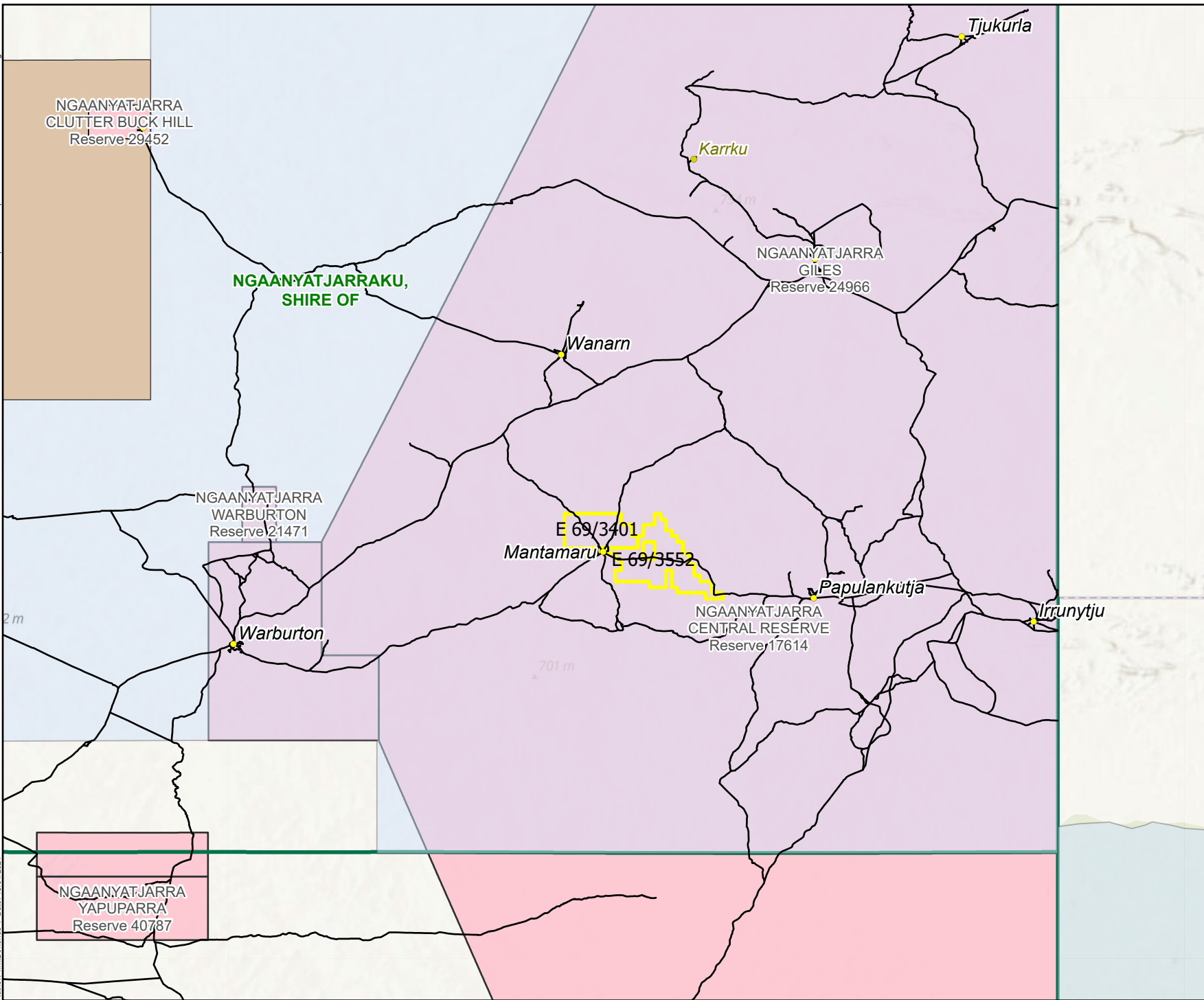
- **Schedule 6 exemptions:** exemptions provided in Schedule 6 of the EP Act. These exemptions mainly refer to clearing required (or provided for) under other laws. For example, clearing carried out in the implementation of a proposal that has been assessed by the EPA under s.38 of the EP Act. **Clearing native vegetation is not usually assessed as part of an application for a works approval or licence. This means a clearing permit is still required unless a works approval or licence is issued with specific approvals relating to clearing native vegetation** (DWER, 2019).
- **exemptions under Regulations:** exemptions for ‘prescribed clearing’ are provided under Regulation 5 of the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 (Native Vegetation Regulations). These exemptions do not apply in within an environmentally sensitive area (ESA). Clearing for low impact mineral exploration as described in Schedule 1 of the Native Vegetation Regulations is exempt under Item 20 of Regulation 5. **The exploration tenements E 69/3401 and E 69/3552 are within an ESA** (DWER, 2021) **corresponding to ALT estate Ngaanyatjarra Central Reserve (ID 17614)** (see Section 3.8) **and are therefore not exempt.**

In accordance with s.20 of the EP Act, the Department of Energy, Mines, Industry Regulation and Safety (DEMIRS) has been delegated authority for the administration, assessment and approval of NVCP applications relating to mineral activities regulated under the *Mining Act 1978*. Initial discussions with the confirmed that **a NVCP is required for the proposed mineral exploration work.**

There are two types of NVCPs that can be applied for under s.51E of the EP Act. These are the Area Permit and the Purpose Permit. Only the Purpose Permit is applicable for exploration licences (DEMIRS, n.d.). A Purpose Permit is therefore being applied for from the DEMIRS for the clearing for the proposed exploration works.

This NVCP application supporting document has been prepared with consideration of the following:

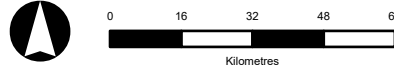
- *Information on How to Apply for a Clearing Permit* (DEMIRS, n.d.a)
- *Application for new permit or referral to clear native vegetation* (DWER, 2021)
- *A guide to the assessment of applications to clear native vegetation: Under Part V Division 2 of the Environmental Protection Act 1986* (DER, 2014)



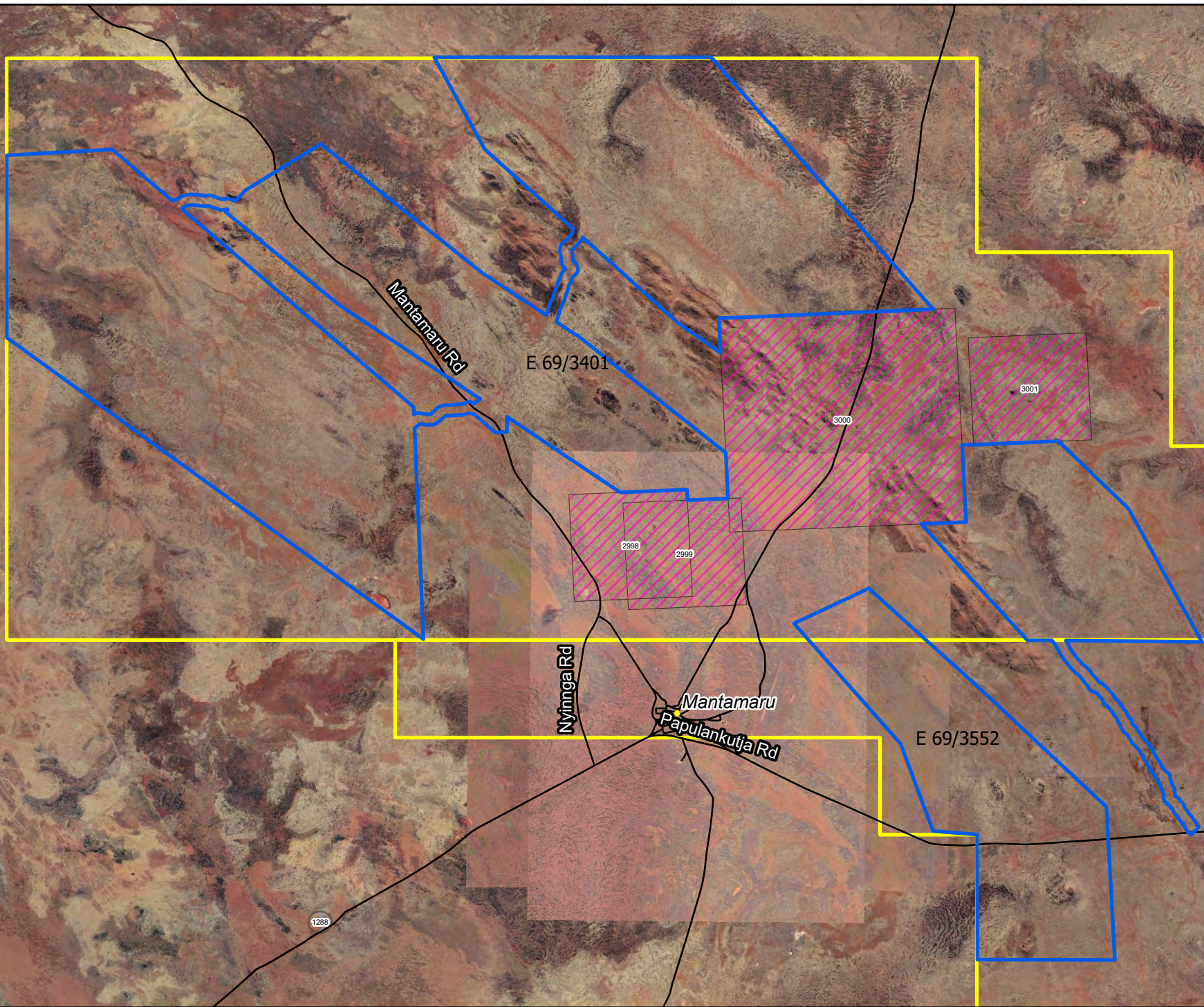
**Legend**

- Current Roads
- Aboriginal Communities and Town Reserves
  - Remote Aboriginal Community - Permanent
  - Remote Aboriginal Community - Seasonal
- ▭ LGA Boundary
- Mining Tenements
  - ▭ Live
- CAPAD
- Indigenous Protected Area
- DBCA - Legislated Lands and Waters
- Nature Reserve
- ALT Estate
- Reserve

Source: Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community.



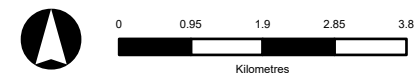




**Legend**

- Existing Roads
- Permit Area
- Aboriginal Communities and Town Reserves
  - Remote Aboriginal Community - Permanent
- Aboriginal Heritage Places
  - Registered Site
  - Other Heritage Places
- Mining Tenements
  - Live

Source: Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community.





## 1.3 Proponent and land details

Proponent and contact details for the Project are provided in Table 1-1.

Table 1-1 Proponent and contact information

Proponent	Contact
<p><b>97992001 Pty Ltd</b> ACN: 624 169 455</p> <p><i>Postal Address:</i> PO Box Z5083 Perth WA 6000</p> <p><i>Business address:</i> Level 9, 28 The Esplanade Perth WA 6000</p>	<p><b>Kylie Webster</b> Senior Environmental Consultant, Aurecon Australasia Pty Ltd <i>Telephone:</i> (08) 6145 9300 <i>Email:</i> <a href="mailto:kylie.webster@aurecongroup.com">kylie.webster@aurecongroup.com</a></p> <p><i>Business address:</i> 5/863 Hay St Perth WA 6000</p>

Exploration licences E 69/3401 and E 69/3552 are 100% held by the Proponent as detailed in Table 1-2. Proof of tenure is provided in Appendix A. The tenements are located within the local government area (LGA) of the Shire of Ngaanyatjarraku within an area subject to exclusive native title rights. The tenements are also within an Aboriginal Reserve and an Indigenous Protected Area (IPA) as detailed in Section 3.8.

Table 1-2 Project tenements

Tenement ID	Type	Holder	Grant date	End date	Area
E 69/3401	Exploration licence	97992001 Pty Ltd	11/02/2019	10/02/2024	70 BL (~216 km <sup>2</sup> )
E 69/3552	Exploration licence	97992001 Pty Ltd	28/01/2020	27/01/2025	122 BL (~376 km <sup>2</sup> )

## 1.4 Environmental Assessments

Various environmental studies were commissioned by specialist consultants to inform the design of the exploration program and preparation of the NVCP. The environmental studies included desktop assessments as well as site surveys as follows:

- *Desktop Assessment of Flora and Vegetation: Jameson Project* (Western Botanical, 2023a)
- *Targeted Flora and Vegetation Assessment, Jameson Tenements* (Western Botanical, 2023b)
- *Basic and Targeted Vertebrate Fauna Survey, West Musgrave Project Area* (Terrestrial Ecosystems, 2023)

Copies of these reports are attached as Appendices C and D.

## 2 Proposed clearing and rehabilitation

The Proponent proposes to clear up to 14 ha inside a 10,432 ha Permit Area as shown in Figure 1-2. Clearing will be undertaken progressively in a series of mineral exploration campaigns. Clearing is required for the following purposes:

- Drill pads
- Access tracks
- Supporting infrastructure including laydown areas, parking areas, bag farms and core yards.

Clearing will typically be undertaken using a small excavator, bulldozer, loader or grader. Where practicable raised blade clearing will be used. Where this is not practicable, topsoil will be stripped and temporarily stockpiled to the sides of the access tracks and drill pads (within the proposed clearing area) for use in post-exploration rehabilitation works. Sumps for water storage will be required.

Clearing will be kept to the minimum required for safe exploration. Clearing areas will be rehabilitated within six months if no longer required. Rehabilitation must comply with tenement conditions (Appendix B) and will typically consist of:

- Removal of all equipment and wastes
- Drill collars will be cut no less than 400 mm below the surface then securely capped and backfilled to form a water-shedding mound above the natural ground level
- Backfilling of excavations (including sumps)
- Stockpiled topsoil and vegetation will be respread over cleared areas
- Windrows will be back-bladed onto tracks
- Ripping of compacted areas as required.

A summary of clearing activities proposed as part of this project has been provided in Table 2-1.

**Table 2-1 Proposed clearing details**

Item	Description
Permit Application Area	10,432 ha
Area of native vegetation to be cleared	14 ha
Purpose of clearing	Mineral exploration
Method of clearing	Cutting / Mechanical
Timeframe of clearing	Start date: Upon approval of NVCP End date: Within ten (10) years after NVCP approval
Post operational land use	Same as pre-operational (i.e. remains part of Ngaanyatjarra Central Reserve (Reserve ID 17614))  <i>(note: there is no local planning strategy or local planning scheme for the Shire of Ngaanyatjarraku (DPLH, 2021))</i>



## 3 Existing environment

### 3.1 Regional setting

The Project is located within the Mann-Musgrave Block Interim Biogeographic Regionalisation of Australia (IBRA) subregion. The IBRA framework classifies Australia's landscapes into geographically distinct bioregions based on climate, geology, landform, native vegetation and species, with more localised info provided as a subregion level. The WA section of the Mann-Musgrave Block subregion is characterised by sandplains that support low open woodlands of either Desert Oak or Mulga over *Triodia basedowii* hummock grasslands (Graham & Cowan, 2001). Ranges support mixed wattle scrub or *Callitris glaucophylla* woodlands over hummock and tussock grasslands, and are often fringed by low open woodlands of Ironwood (*Acacia estrophiolata*) and Corkwoods (*Hakea* spp.) over tussock and hummock grasses. The WA section is almost entirely Aboriginal Reserve (94.33% of area) (see Section 3.8), with other dominant land uses including crown land and crown reserves (4.28%), grazing – leasehold (1.36%), and grazing – freehold (0.03%) (Graham & Cowan, 2001).

The nearest DBCA legislated land to the Project is the A-class Pila Nature Reserve (Gibson Desert) (R 34606) approximately 130 km west north-west of the Project tenements. The nearest wetland of national or international significance is the Gibson Desert Gnamma Holes, approximately 170 km north-west of the Project tenements.

A large nickel-copper mine (West Musgrave Copper and Nickel Project (WMCNP)) is in early stages of development to the south of the Project.

### 3.2 Climate

The regional climate of the Project is arid. The nearest Bureau of Meteorology (BoM) weather station is 'Giles Meteorological Office', (BoM ID 013017, located at 128.30°E, 25.03°S), approximately 90 km northwest of E 69/3552. Between 1991 and 2020 the station recorded an average annual rainfall of 326.5 mm with the majority of rain received from November to March (BoM, 2023); however, this is higher than for all years of recorded data (1956 to 2023) which had an average of 290.9 mm. Rainfall is highly variable from year to year (Terrestrial Ecosystems, 2023) and over the summer months is typically associated with tropical lows and ex-tropical cyclones moving south (Western Botanical, 2023b). The average annual temperature is a maximum of 29.8 and a minimum of 16.2, with the highest temperatures coincident with greatest rainfall (i.e. also November to March). Monthly averages for rainfall, maximum temperature, and minimum temperature are presented in Figure 3-1.

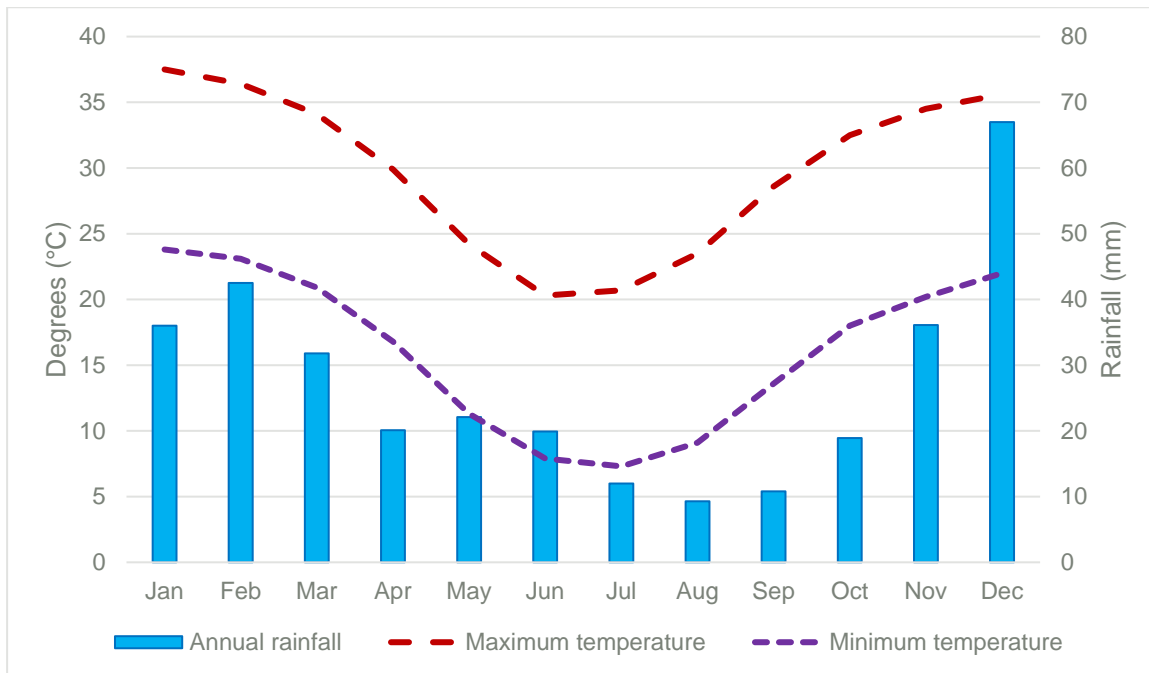


Figure 3-1 Climate monthly averages for Giles Meteorological Office (013017) from 1991 to 2020 (BoM, 2023)

### 3.3 Topography, landforms and soils

The Project vicinity is predominantly of low relief with an extensive cover of aeolian sand (Rockwater Pty Ltd, 2010, cited in Western Botanical, 2023b). Landforms include (Western Botanical, 2023b):

- Extensive gently inclined hardpan plains with red-brown silty sand to clayey sand soils and discontinuous pisolitic lag gravel mantle
- Subdued low hills with red-brown silty sand to clayey sand soils and minor banded ironstone formation (magnetite) and/or gabbro outcrops
- Ephemeral playa lake systems with red-brown clay soil.

#### 3.3.1 Geology

The Project is located within an east-west trending orogenic belt of the Mesoproterozoic Musgrave Block, which comprises a variety of high grade (amphibolite to granulite facies) basement lithologies overprinted by several major tectonic episodes (GCX Metals, 2023, cited in Western Botanical, 2023a). The tenements are dominated by the Jameson Range Intrusion of the Giles Complex, which consists of olivine-bearing gabbroic lithologies. The tenements are considered highly prospective for magmatic nickel (Ni), copper (Cu) and platinum-group elements (PGE) deposits.

Detail on surface geology is provided in Section 2.2.2 of the *Desktop Assessment of Flora and Vegetation: Jameson Project* (Western Botanical, 2023a) (Attachment 1 of Appendix C).

#### 3.3.2 Soils

Soil landscape mapping (DPIRD, 2022) indicates that the Permit Area intersects four soil landscape units as shown in Table 3-1. These soil landscapes are not restricted to the Project tenements.

Table 3-1 Soil landscapes intersecting Project tenements (DPIRD, 2022)

Soil unit	Description	Intersects Project tenements	Intersects Permit Area
BA21	Steep hills and ranges on sedimentary and some metamorphic, volcanic, and granitic rocks; bare rock outcrop is common; some gorges	Yes	Yes
Fa34	Steep hills and ranges on basic rocks; rock outcrop common; some gorges; small pediments and plains	Yes	No
My109	Outwash plains and dissected fan and terrace formations flanking ranges of sedimentary and some metamorphic, volcanic, and granitic rocks	Yes	Yes
My112	Extensive plains with numerous dunes which are often short and of irregular shape and orientation	Yes	Yes

Acid sulfate soil risk mapping shows no known occurrences of acid sulfate soils in the vicinity (DWER, 2017).

### 3.4 Hydrology

The tenements are located within the northern part of the Warburton Basin hydrographic catchment. There are no significant creeks or water bodies in the vicinity and surface water flows are intermittent and occur after large rainfall events (Western Botanical, 2023a).

### 3.5 Hydrogeology

The tenements are located within the East Murchison Groundwater Area proclaimed under the *Rights in Water and Irrigation Act 1914* (RiWI Act). Proclaimed areas provide for the use of water for commercial activity under a licence. The Proponent does not currently propose to abstract groundwater and any water brought to site for drilling will be retained in sumps. Should groundwater abstraction be required in the future, the following licences from Department of Water and Environmental Regulation (DWER) may be required:

- *take water* (s.5C groundwater or surface water licence). Licences to take water define how much and when water may be taken and specify any obligations the licence holder must meet when using the water
- *construct wells*, including bores and soaks (s.26D licence).

Groundwater resources in the area have been broadly mapped with a total dissolved solids (TDS) content of 1,000 - 3,000 milligrams per litre (mg/L) (DWER, 2018), which is considered brackish. A hydrogeological baseline survey undertaken for the WMCNP found salinity is typically less than 2,000 mg/L TDS and falls within the potable to slightly brackish range (CDM Smith, 2020a, cited in Western Botanical, 2023a). The WMCNP survey indicated groundwater is relatively shallow, ranging in depth from 3 to 8 metres below ground level (mbgl) with the occasional increase to 14 to 20 mbgl.

Water supply to the Mantamartu (Jameson) community is from two bores located approximately 3.7 km north north-east of the community. The bores within fractured rock aquifers and the supplied water is treated to remove naturally occurring nitrates (OZ Minerals, 2021, cited in Western Botanical, 2023a).

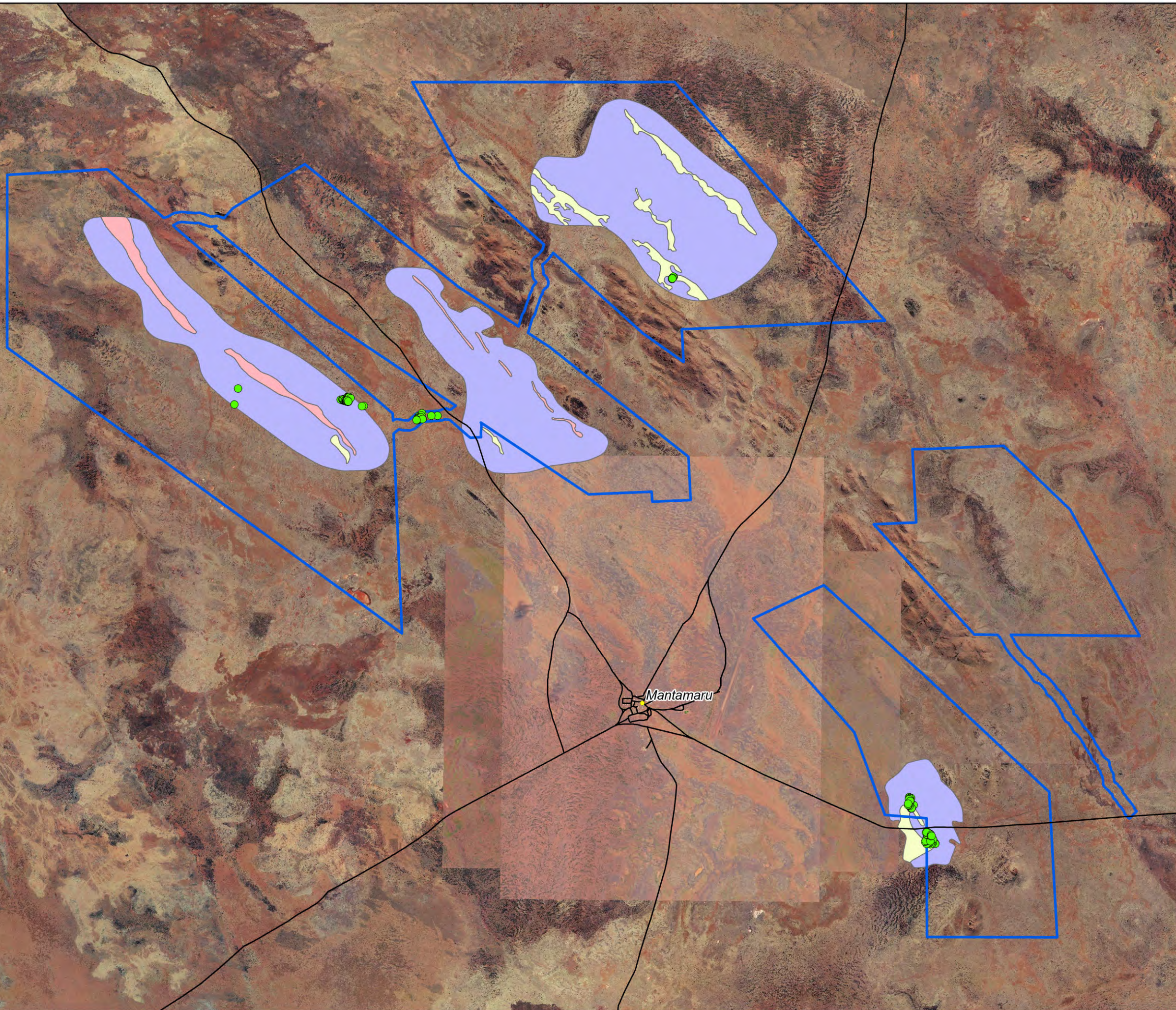
### 3.6 Flora and vegetation

This section has been informed by a desktop assessment and literature review (Western Botanical, 2023a) and a *Targeted Flora and Vegetation Assessment* (Western Botanical, 2023b) (Appendix C) for the Project (Figure 3-2). The field survey was completed across sections of exploration tenements E 69/3401 and E69/3552 in Spring 2023 and included two rounds of surveys (21 – 23 August and 15 November 2023).



### Legend

- Current Roads
- ▭ Permit Area
- Conservation Significant Flora
- *Euphorbia parvicaruncula* (P1)
- Vegetation Units
- ▭ CPNG: Claypan, Grassy
- ▭ HPMS: Hardpan Mulga Shrubland
- ▭ MHMS: Magnetite Hill Mulga Shrubland
- Aboriginal Communities and Town Reserves
- Remote Aboriginal Community - Permanent



Source: Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community.





### 3.6.1 Vegetation communities

There are five pre-European vegetation systems mapped across the Project tenements (DPIRD, 2019), two of which intersect the Permit Area as follows:

- Central Ranges\_18: Low woodland, open low woodland or sparse woodland of Mulga (*Acacia aneura*) and associated species
- Central Ranges\_39: Scrub, open scrub or sparse scrub of wattle, teatree and other species (*Acacia* spp., *Melaleuca* spp).

Both of these vegetation systems are widely represented in the surrounding area and remain intact at a bioregional level with greater than 99% of its pre-European extent remaining (Western Botanical, 2023a). The Shire of Ngaanyatjarraku is predominantly undisturbed with 99% of its pre-European vegetation extent intact (DWER, 2023c, cited in Western Botanical, 2023a).

Vegetation mapping for the proposed exploration works (Western Botanical, 2023b) described three vegetation communities (Table 3-2, Figure 3-2). All three were noted to be locally widespread in the Jameson area and the Central Ranges bioregion.

Table 3-2 Vegetation descriptions (Western Botanical, 2023b)

Vegetation unit	Vegetation description
MHMS Magnetite Hill Mulga Shrubland	Low rounded hills with (i) gabbro rock on lower slopes and plains, (ii) magnetite ridge running +/- N-S, (iii) small and isolated patches of calcrete. Vegetation is scattered Mulga ( <i>Acacia aptaneura</i> ) 1 to 4m, <i>Acacia kempeana</i> 1 to 3m, <i>Hakea lorea</i> subsp. <i>lorea</i> 1.2m, PFC 5% over scattered <i>Maireana triptera</i> 0.4m, <i>Eremophila georgei</i> 1.2m, <i>Eremophila longifolia</i> 1.5m, PFC 1% over <i>Sclerolaena ?gardneri</i> 0.15 PFC 10% and bunch grasses <i>Aristida contorta</i> 0.2m, <i>Eragrostis eriopoda</i> 0.3m, <i>Cymbopogon ambiguus</i> 1m, PFC 10% with <i>Eragrostis mucronate</i> desert form glabrous 0.3m (only on the on outcropping magnetite).
HPMS Hardpan Mulga Shrubland	Scattered <i>Acacia aptaneura</i> (Mulga) 2 to 3m, PFC 5% over bunch grasses <i>Aristida contorta</i> 0.2, <i>Salsola tragus</i> 0.4, <i>Eragrostis eriopoda</i> 0.4, <i>Digitaria brownii</i> 0.4m, PFC 25%. Soil is red-brown silty sand with abundant black pizolitic lag gravel.
CPNG Claypan, grassy	Flat claypan with cracking clay and grassland dominated by <i>Eragrostis setifolia</i> 0.4m PFC 15%, <i>Aristida inaequiglumis</i> 0.4m, <i>Aristida contorta</i> PFC 2%. Scattered <i>Cenchrus ciliaris</i> * PFC < 1%.

Vegetation condition was recorded as good to very good for most of the HMPS and MHMS vegetation units (Western Botanical, 2023b). The CPNG vegetation community had not been subject to fire due to sparse grass cover, and was considered to be in very good to excellent condition.

The vegetation assessment identified that vegetation in the Project tenements demonstrated effects of extended drought and frequent fires (Western Botanical, 2023b). The HMPS vegetation community was recorded as containing multiple dead stags of Mulga with little recruitment evidence. It was noted that causes of fire were unknown, but that fire is used to regenerate grassy forage for kangaroos which are extensively hunted by Traditional Owners in central Australia.

### 3.6.2 Groundwater dependent ecosystems

Review of the Groundwater Dependent Ecosystems (GDE) Atlas (BoM, 2024) indicates that parts of the Project tenements and Permit Area intersect areas mapped as having low and medium terrestrial GDE potential. Terrestrial GDEs rely on the subsurface presence of groundwater. The area of medium terrestrial potential is within a soil land system draining towards a salt lake/clay pan located approximately 10 km to the north-west of the Project tenements (Western Botanical, 2023a).

An assessment of potential terrestrial GDEs undertaken for the WMCNP identified seven probable facultative GDEs (ecosystem utilises groundwater when available but will persist without) and one probable obligate GDE (ecosystem is dependent on groundwater) (Western Botanical, 2023a).

### 3.6.3 Ecological communities

No known Threatened or Priority Ecological Communities have been identified within 10 km of the Project tenements (Western Botanical, 2023a).

### 3.6.4 Environmentally sensitive areas

The Project tenements are located within an ESA, as it lies within an area known as the Ranges of the Western Desert, which is listed on the Register of the National Estate as having Indigenous values of National Estate significance (Western Botanical, 2023a). The ESA boundaries align with the Ngaanyatjarra Central Reserve (Reserve ID 17614) (see Section 3.8).

### 3.6.5 Flora

The desktop search and literature review (Western Botanical, 2023a) identified records of 35 flora species of conservation significance within or near a 100 km buffer of the Project tenements, of which 27 were assessed as having the potential to occur within the Project tenements. Six of the 11 priority flora species recorded from the WMCNP surveys occur within 5 km of the southern boundary of the Project tenements.

The Project field survey (Western Botanical, 2023b) identified 34 species of flora within the Project tenements, the majority of which were noted to be well known and widespread within central Australia. A full list of identified species is provided within Appendix C. One of the identified flora species, *Euphorbia parvicaruncula*, is listed as a Priority 1 species in WA. The species is described as a low, virgate branching annual herb to 30 cm in height that is found within small to large clay-based ephemeral playa lakes in central Australia. The species was recorded within most identified CPNG vegetation units and within smaller hardpan patches within the HPMS vegetation unit. Florabase records confirmed that the species had been recorded east of the Mantamaru townsite within vegetation mapped as CPNG. An additional survey by Western Botanical identified large populations of the *Euphorbia parvicaruncula* within a large grassy claypan south of the Mantamaru townsite. Western Botanical (2023b) suggested that *Euphorbia parvicaruncula* is a claypan-specific annual species, likely present in years of suitable rainfall and temporal pattern and otherwise absent. Occurrences of *Euphorbia parvicaruncula* could be avoided when developing access tracks to the proposed drill pads, however it should be noted that recognising individual dead plants would be difficult at most times of the year.

### 3.6.6 Weeds

During the survey, *Cenchrus ciliaris* (Buffel Grass) was routinely observed within and near the Project tenements and described as common to abundant (Western Botanical, 2023b). This species was noted to be well naturalised within the Jameson area, and dominant in areas with sandier soil profiles. No other weed species were recorded during the survey. Fourteen 14 weed species were recorded across the three WMCNP projects. None were listed as Weeds of National Significance or Declared Plants (Western Botanical, 2023a).

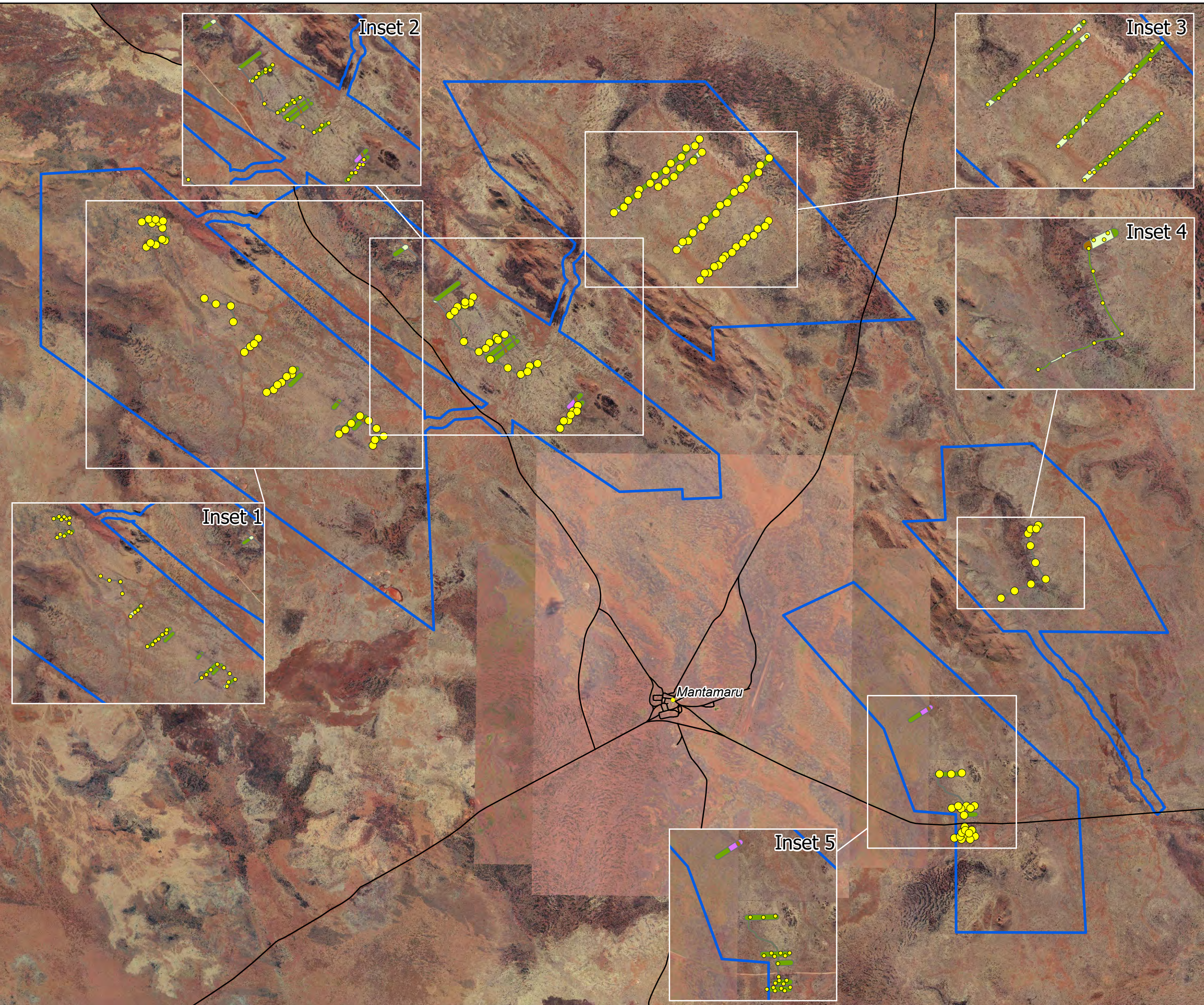
## 3.7 Fauna and habitat

This section has been informed from a Basic and Targeted Vertebrate Fauna Survey and desktop assessment for the Project completed by Terrestrial Ecosystems (2023) (Appendix D). The survey was completed broadly in line with *Technical Guidance for Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA, 2020). The field survey was undertaken from 12 – 13 October 2023. The vertebrate fauna survey targeted areas of proposed explorations works and the survey boundary comprised a 50 m buffer of nominated drill lines and a 10 m buffer of nominated access tracks (Figure 3-3).

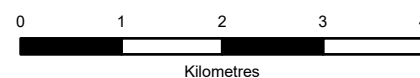


Legend

- Fauna Single Site Assessment
- Current Roads
- Permit Area
- Fauna Habitat**
- Disturbed area
- Grass Plain
- Low shrubs over grass on plains
- Low stoney ridges
- Shrubs over spinifex
- Aboriginal Communities and Town Reserves**
- Remote Aboriginal Community - Permanent



Source: Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community.





### 3.7.1 Fauna habitats

The site survey included 144 habitat assessments and identified four fauna habitats. These included grass plains, low shrubs over grass on plains, shrubs over spinifex, low stoney ridges and disturbed habitats.

Fauna habitat within the survey area was described as undisturbed, but depleted of trees, sparsely vegetated with shrubs and consisting of drying grasses, small patches of spinifex hummocks and extensive bare ground. Fauna habitat within the survey area was classified as in good condition. It did not support an ecological linkage or pathway that is not already available within the region.

### 3.7.2 Fauna species

No conservation significant vertebrate fauna species were recorded during the survey. The fauna habitats present in the survey area were considered unsuitable for conservation significant fauna that may potentially occur in the locality. As a result, no conservation significant species were considered likely to be significantly impacted by the proposed drilling program. Terrestrial Ecosystems identified that a referral under the EPBC Act was not recommended for the Project.

Evidence of four feral and pest fauna species (camels, feral cats, wild dogs and rabbits) were recorded during the site survey.

### 3.7.3 Short-range endemic species

A Level 2 short-range endemic (SRE) invertebrate survey for the WMCNP (Alacran Environmental Science, 2020) identified SRE category invertebrates from eight of the nine mapped habitats. Of the 55 potential SRE taxa identified, 50 were potential SREs owing to data deficiency and the remaining five were widespread. None of the habitats identified within the survey areas were considered distinctly unique or containing any obvious barriers to local dispersal. It was concluded that SREs found in the identified habitats would be found outside of the survey areas.

Similarly, there is a high degree of habitat connectivity across the Permit Area, which makes it unlikely any SRE species (if present) are restricted to the Project area.

### 3.7.4 Subterranean Fauna

Exploration activities are not anticipated to have a significant impact on subterranean fauna (if present). No subterranean fauna assessments have been undertaken.

## 3.8 Land use and social setting

The tenements are located within the Shire of Ngaanyatjarraku. The Shire comprises approximately 160,000 square kilometres (km<sup>2</sup>) within the traditional lands of the Ngaanyatjarra people of the Central Desert (Shire of Ngaanyatjarraku, 2024). The Shire's main township is the Aboriginal community of Warburton, approximately 100 km west south-west of the Project. The Aboriginal community of Mantamaru (also known as Jameson) is located within E 69/3552 (DPLH, 2020) (Figure 1-2). The Project is located within the Aboriginal Lands Trust estate of the Ngaanyatjarra Central Reserve (Reserve ID 17614) (DPLH, 2024) and within the Ngaanyatjarra Indigenous Protected Area (IPA) (DCCEE, 2022) (Figure 1-1). The tenement conditions for E 69/3401 and E 69/3552 (Appendix B) include "Consent to Mine on Use and Benefit of Aboriginal Inhabitants Reserve 17614 granted".

The Project is within an area subject to exclusive native title rights under the Ngaanyatjarraku Lands Determination (NNTT: WCD2005/002, Federal Court: WAD6004/2004). The Registered Native Title Body Corporate (RNTBC) is the Yarnangu Ngaanyatjarraku Parna (Aboriginal Corporation) RNTBC. There are four registered Indigenous Land Use Agreements (ILUA) currently in place over the Project as shown in Figure 1-2.

**Table 3-3 Existing ILUAs over Project area**

NNTT #	Name	Applicant party	Other parties	Subject
WI2004/005	Ngaanyatjarra Lands Indigenous Land Use Agreement (Body Corporate Agreement) No.1	WMC Resources Limited	Ngaanyatjarra Land Council (Aboriginal Corporation) Yarnangu Ngaanyatjarraku Parna (Aboriginal Corporation) State of Western Australia	Mining; exploration
WI2004/006	Telstra Ngaanyatjarra ILUA	Telstra	Ngaanyatjarra Land Council (Aboriginal Corporation) Yarnangu Ngaanyatjarraku Parna (Aboriginal Corporation)	Access; communication; infrastructure
WI2005/002	Airservices Australia - Ngaanyatjarra Indigenous Land Use Agreement	Airservices Australia	Ngaanyatjarra Land Council (Aboriginal Corporation) Yarnangu Ngaanyatjarraku Parna (Aboriginal Corporation)	Access; communication; infrastructure
WI2022/002	Ngaanyatjarraku Roads and Shire Works	Shire of Ngaanyatjarraku	Ngaanyatjarra Council (Aboriginal Corporation) (ICN 101) Ngaanyatjarra Land Council (Aboriginal Corporation) (ICN 715) Yarnangu Ngaanyatjarraku Parna (Aboriginal Corporation) RNTBC (ICN 4527)	Infrastructure

The Proponent has a signed Native Title Agreement with the Ngaanyatjarra Land Council. Ancillary Agreement for mineral exploration on Ngaanyatjarra Lands was executed in October 2016 between:

- Yarnangu Ngaanyatjarraku Parna (Aboriginal Corporation) RNTBC (Indigenous Corporation Number (ICN): 4527)
- Ngaanyatjarra Land Council (Aboriginal Corporation) (ICN: 715)
- Ngaanyatjarra Council (Aboriginal Corporation) (ICN: 101), and
- 97992001 Pty Ltd.

### 3.9 Heritage

Initial heritage surveys have been completed for the Project. The details of the heritage survey outcomes are confidential to the Ngaanyatjarra Land Council; however, the Proponent is bound by their heritage agreement to only undertake works in areas with heritage clearance from the Ngaanyatjarra Land Council. Survey details and stakeholder engagement relating to heritage considerations for the Project are outlined in Section 4.

Searches of the Aboriginal Heritage Places dataset (DPLH, 2023) and the Aboriginal Cultural Heritage Inquiry System (ACHIS) (Appendix E) on 18 January 2024 returned five Registered or Lodged Aboriginal Cultural Heritage Sites located within 10 km of the Project tenements; four of these occur within E 69/3401 (Table 3-4). The Permit Area has been designed to avoid heritage areas as shown in Figure 1-2.

**Table 3-4 Aboriginal heritage places with 10 km of the Project tenements (DPLH, 2023)**

Place ID	Name	Status	Type	Proximity
2998	Ilintji	Registered Site	Creation / Dreaming Narrative	Within E 69/3401

Place ID	Name	Status	Type	Proximity
2999	Kiri-Tjitji	Registered Site	Creation / Dreaming Narrative	Within E 69/3401
3000	Waranju	Registered Site	Creation / Dreaming Narrative	Within E 69/3401
3001	Punkula-Uku-Wani	Registered Site	Creation / Dreaming Narrative	Within E 69/3401
1288	Jameson	Lodged	Artefacts / Scatter	Approximately 3.6 km south south-west of E 69/3552

No areas or items of non-Aboriginal heritage have been identified in the Project vicinity. An inherit database on 15 January 2024 showed there are only three heritage places within the Shire of Ngaanyatjarraku: Giles Meteorological Station Group (Place No. 18645), Warakurna Multi-Function Police Facility (Warakurna) (Place No. 19003), and Warburton Multi-Function Police Facility (Place No. 19004). All three are over 90 km from the Project tenements and are not listed as State Heritage or under a local planning scheme, however it should be noted that the Shire of Ngaanyatjarraku does not have a local planning scheme (DPLH, 2021).



## 4 Stakeholder engagement

A summary of stakeholder consultation conducted in relation to the Project is provided in Table 4-1.

Table 4-1 Summary of stakeholder engagement for proposed exploration works

Stakeholder	Format and timing	Subject	Outcome
DEMIRS	Three emails between 9 - 16 May 2023  <i>Contact:</i> ██████████ ██████████	Organising preliminary meeting to discuss the regulatory approval process for exploration works (drilling).	Setting of meeting date
	Meeting on 26 May 2023  <i>DEMIRS attendees:</i>  ██████████ ██████████ ██████████ ██████████ ██████████ ██████████	Meeting with all regulators to: <ul style="list-style-type: none"> <li>Introduce the Project and team</li> <li>Meet relevant regulators</li> <li>Discuss the regulatory approval processes and responsibilities for exploration works.</li> </ul>	Requirements include: <ul style="list-style-type: none"> <li>Program of works (PoW)</li> <li>Flora and fauna surveys</li> <li>NVCP</li> </ul>
	Emails and phone calls between 20 September 2023 and 4 January 2024  <i>Contact:</i> ██████████ ██████████	Approval requirements for the PoW, including: <ul style="list-style-type: none"> <li>Flora and fauna surveys</li> <li>NVCP.</li> </ul>	Submitted a PoW with the following environmental considerations: <ul style="list-style-type: none"> <li>Amendments to pad sizes</li> <li>Adjusted a planned drill line which intersected a mapped occurrence of Priority 1-listed <i>Eurphorbia parvicaruncula</i>.</li> </ul>
	Emails between 27 November 2023 and 18 January 2024  <i>Contact:</i> ██████████ ██████████	Approval requirements for the Program of Works (PoW), including: <ul style="list-style-type: none"> <li>Flora and Fauna surveys</li> <li>NVCP.</li> </ul>	
Ngaanyatjarra Council and Traditional Custodians	Historical engagement (through previous tenement holders) over previous ten years	Extensive exploration activities across the current Project area.	Ancillary Agreement for mineral exploration on Ngaanyatjarra Lands (see Section 3.8), entered into October 2016.
	Community engagement and land survey between 26 - 31 July 2023, including: <ul style="list-style-type: none"> <li>Consultation sessions with: <ul style="list-style-type: none"> <li>Representatives from the Ngaanyatjarra Council's Land and Culture team</li> <li>Elders</li> <li>Senior Knowledge Holders</li> <li>Wider community of Traditional Custodians</li> </ul> </li> </ul>	The introductory session was followed by a detailed Project overview of proposed activities that 97992001 Pty Ltd would like to undertake across the tenement area. The sessions were two-way conversations with a high level of engagement.  Topics arising from engagement included: <ul style="list-style-type: none"> <li>Light pollution from potential future mining operations</li> </ul>	<ul style="list-style-type: none"> <li>Evident that previous engagement had been a positive experience and that many had some knowledge of the Project and the type of activities being proposed</li> <li>97992001 Pty Ltd is committed to: <ul style="list-style-type: none"> <li>Effective and ongoing engagement with Traditional Custodians</li> <li>Providing opportunities relative to the pace and scale of the activities</li> </ul> </li> </ul>

Stakeholder	Format and timing	Subject	Outcome
	<p>from the Ngaanyatjarra Lands</p> <ul style="list-style-type: none"> <li>■ Detailed helicopter survey over the proposed Project area. Participants included: <ul style="list-style-type: none"> <li>– Elders</li> <li>– Senior Knowledge Holders</li> <li>– Ngaanyatjarra Council's Anthropologist.</li> </ul> </li> <li>■ On-ground archaeological survey, with participation from: <ul style="list-style-type: none"> <li>– Elders</li> <li>– Senior Knowledge Holders</li> <li>– Ngaanyatjarra Council's Land and Culture team (including anthropologists and archaeologists)</li> </ul> </li> <li>■ Community BBQ and football game with broader community of Mantamaru (Jameson Community) and Papulankutja (Blackstone community)</li> <li>■ Dinners with senior Traditional Custodians</li> </ul>	<ul style="list-style-type: none"> <li>■ The lack of effective engagement with other mining companies working in the area (to which)</li> <li>■ Potential business engagement and employment opportunities with the Project</li> <li>■ Naming of any future discoveries made on Ngaanyatjarra Lands</li> <li>■ Opportunities to engage with other Traditional Custodians and Aboriginal business owners from the Pilbara to learn how they have navigated the business development space to find the right balance between caring for country and economic development opportunities.</li> </ul>	<p>required at each stage of the development of the Project</p> <ul style="list-style-type: none"> <li>■ Helicopter survey of Project area</li> <li>■ On-ground archaeological survey of Project priority areas and sample pegging of drill lines/ drill pads</li> <li>■ Details of heritage survey outcomes are confidential to the Ngaanyatjarra Land Council</li> <li>■ 97992001 Pty Ltd is bound by their heritage agreement to only undertake works in areas with heritage clearance from the Ngaanyatjarra Land Council.</li> </ul>
	<p>Community engagement and land survey between 5 - 8 September 2023, including:</p> <ul style="list-style-type: none"> <li>■ Reconnaissance and archaeology clearance. Attended by: <ul style="list-style-type: none"> <li>– Senior Knowledge Holders</li> <li>– Traditional Custodians survey team</li> </ul> </li> <li>■ Presentation and engagement at Jameson School with students and teachers</li> <li>■ Meeting with Ngaanyatjarra Council's archaeologist</li> <li>■ Dinners with senior Traditional Custodians</li> </ul>	<ul style="list-style-type: none"> <li>■ Project area reconnaissance and archaeology clearance survey work of key drill lines and access tracks.</li> <li>■ Discussion of Project and provision of sports equipment and art resources to the Jameson School.</li> </ul>	<p>Archaeology clearances of key drill lines and access tracks.</p>
	<p>Phone calls and emails between 7 September - 15 October with</p>	<p>Topics included:</p> <ul style="list-style-type: none"> <li>■ Fauna survey.</li> <li>■ Heritage survey report</li> </ul>	<p>Furthering of scopes, planning and logistics</p>

Stakeholder	Format and timing	Subject	Outcome
	Ngaanyatjarra Council Culture and Heritage Manager	<ul style="list-style-type: none"> <li>■ Rock chip and mapping</li> <li>■ Airborne magnetics survey</li> <li>■ Helicopter Versatile Time Domain Electromagnetic (VTEM) Survey.</li> </ul>	
	Rock chip sampling and drill line pegging from 16 – 20 October 2023, including meeting with: <ul style="list-style-type: none"> <li>■ Liaison Officer</li> <li>■ Senior Knowledge Holders</li> </ul>	<ul style="list-style-type: none"> <li>■ General Project update</li> <li>■ Schedule of works</li> <li>■ Drilling program planned for first half of 2024, including Project maps indicating the proposed work areas to confirm access approval.</li> </ul>	Confirmation of access approvals for proposed exploration works in 2024.

## 5 Environmental mitigation and management

The Project design has amended planned pad sizes and drill lines to minimise potential impacts (Table 4-1). Exploration activities will be undertaken in accordance with the mitigation measures presented in Table 5-1 and subject to the tenement conditions (Appendix B) for exploration licences 69/3552 and E 69/3401.

**Table 5-1 Environmental mitigation measures**

Aspect	Potential impact	Mitigation measure
Clearing and earth disturbance	Unnecessary or unauthorised disturbance	<ul style="list-style-type: none"> <li>■ Disturbance areas will be kept to the minimum required and existing disturbance used where possible</li> <li>■ Where practicable, recorded locations for Priority 1-listed <i>Eurphobia parvicaruncula</i> will be avoided when developing an exploration management plan for the Project</li> <li>■ All areas proposed to be cleared will be subject to pre-clearance flora survey by a suitably qualified and experienced botanist</li> <li>■ Clearing areas will be clearly demarcated prior to clearing or machines will be led by a spotter with a GPS</li> <li>■ When clearing tracks and drill lines, the path of least resistance through the vegetation will be chosen to minimise disturbance</li> <li>■ Cutting of branches will be favoured over removing entire trees</li> <li>■ Designated access routes to clearing areas will be used</li> <li>■ Raised-blade clearing will be used wherever practicable</li> <li>■ Vegetation will be cleared and stockpiled for use in rehabilitation</li> <li>■ Where raised-blade clearing is not practicable, topsoil will be removed and stockpiled for future rehabilitation</li> <li>■ A toolbox meeting will be held between the supervising geologist/field assistant and the clearing contractor to ensure that the operator is aware of the approved clearing areas, traffic management measures and any areas that need to be avoided</li> <li>■ All topsoil removed will be separately stockpiled for replacement after backfilling. Locations of stockpiles will be recorded using GPS.</li> <li>■ Service logs to be maintained. All vehicles coming to site be checked for hydrocarbon leaks</li> <li>■ As per exploration licence conditions (Appendix B), all disturbed areas will be backfilled and rehabilitated within six months after excavation to the satisfaction of the Environmental Officer at DEMIRS, unless otherwise approved in writing.</li> </ul>
Weeds, pests and pathogens	Introduction and/or spread of weeds, pests and/or pathogens	<ul style="list-style-type: none"> <li>■ All vehicles and equipment arriving on site will be free of soil, weeds, seeds, and vegetative matter</li> <li>■ Vehicles to provide weed hygiene certificates prior coming to site.</li> <li>■ Weed infestations will be treated.</li> </ul>
Fauna (general)	Altered fauna behaviour  Injury, entrapment and/or mortality of fauna	<ul style="list-style-type: none"> <li>■ Personnel will be required to adhere to speed limits and drive to road / weather conditions to minimise risks of fauna injuries or death due to traffic</li> <li>■ Care in handling and disposal of organic matter comprising declared weeds to minimize risk of seed dispersal in the area.</li> <li>■ Any death or injury of fauna will be recorded</li> <li>■ Waste management measures will be implemented</li> </ul>

Aspect	Potential impact	Mitigation measure
	Increased mortality of fauna due to construction or upgrade of roads/tracks	<ul style="list-style-type: none"> <li>■ Feeding and unnecessary handling of fauna will be banned</li> <li>■ All drill holes will be plugged immediately after completion of the hole</li> <li>■ At least one side of each sump will be ramped to allow fauna egress</li> <li>■ A suitable experienced fauna spotter / handler will be present during exploration works to relocate fauna if deemed necessary.</li> </ul>
Air quality and noise	Disturbance to surrounding receivers	<ul style="list-style-type: none"> <li>■ Disturbance areas will be kept to the minimum required and existing disturbance used where possible</li> <li>■ Clearing activities would occur progressively to minimise exposure of cleared surfaces to wind erosion</li> <li>■ Disturbed areas will be rehabilitated within six months of no longer being required</li> <li>■ Topsoil stripping and spreading activities will be restricted if dust cannot be adequately controlled during high winds</li> <li>■ Vehicles and mobile plant will be maintained as per manufacturer specifications to ensure noise and air emissions are minimised.</li> </ul>
Heritage	Harm to heritage items or places (known or unknown)	<ul style="list-style-type: none"> <li>■ All proposed mineral exploration will be carried out in accordance with the provisions of the <i>Aboriginal Heritage Act 1972</i></li> <li>■ An Unexpected Finds Protocol will be implemented on site, to ensure any newly discovered sites are reported to the Ngaanyatjarra Land Council and DPLH</li> <li>■ Site inductions will be conducted with all contractors and site personnel to ensure they are aware of chance-finds procedures and provisions for encountering archaeological sites under the <i>Aboriginal Heritage Act 1972</i></li> <li>■ The Proponent will ensure that all areas have been surveyed for heritage prior to clearing</li> <li>■ Registered Aboriginal heritage sites have been excluded from the Permit Area and the Proponent is bound by their heritage agreement to only undertake works in areas with heritage clearance from the Ngaanyatjarra Land Council</li> <li>■ If required, Aboriginal heritage monitors will be invited to be present during ground disturbance</li> </ul>



## 6 Assessment against the 10 Clearing Principles

When assessing clearing permit applications, DWER has regard to the ten clearing principles contained in Schedule 5 of the EP Act. An assessment against the ten clearing principles is presented in Table 6-1 and uses the following assessment categories:

- Not at variance – there is enough data to provide certainty
- Not likely to be at variance – there is an element of uncertainty
- May be at variance – there is insufficient data available to fully assess the impacts
- At variance – there are known impacts or significant risk of impact.

**All of the Clearing Principles were assessed as “Not at Variance” (Table 6-1).**

**Table 6-1 Assessment Against the 10 Clearing Principles**

Principle	Commentary		Assessment
	Flora (Western Botanical, 2023b)	Fauna (Terrestrial Ecosystems, 2023)	
<b>Principle (a)</b> – Native vegetation should not be cleared if it comprises a high level of biological diversity.	The habitats observed within the Study Area are highly representative of those of the region around the Mantamaru (Jameson) townsite and support a narrow range of species endemic to the region. The Study Area does not support habitats with particularly high species richness.	Clearing vegetation will not comprise a high level of biodiversity. It is improbable that any conservation significant vertebrate fauna are in the project area and will be significantly impacted by exploration activity.	Not at variance
<b>Principle (b)</b> – Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to WA.	The habitats of the Study Area are well represented in the region and not restricted to the Study Area. Further, these are not suitable for the known significant fauna of region (Great Desert Skink, Bilby).	Exploration activity in the project area will not result in the loss of significant habitat for indigenous fauna.	Not at variance
<b>Principle (c)</b> – Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.	No Threatened (Rare) flora were noted within the Study Area and none are known in close proximity to the Study Area.	N/A	Not at variance
<b>Principle (d)</b> – Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a threatened ecological community.	There are no Threatened Ecological Communities (TECs) nearby the Study Area. While the Study Area lies within an Environmentally Sensitive Area (ESA), this is so listed due to Aboriginal Heritage considerations.	The area does not contain a threatened ecological fauna community.	Not at variance
<b>Principle (e)</b> – Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.	The region inclusive of the Study Area has not been extensively cleared.	The area is not a remnant.	Not at variance
<b>Principle (f)</b> – Native vegetation should not be cleared if it is growing in, or in association with, an	Small ephemeral grassy claypans (CPNG habitat) are known within and nearby the	The area does not contain a natural wetland.	Not at variance

Principle	Commentary		Assessment
	Flora (Western Botanical, 2023b)	Fauna (Terrestrial Ecosystems, 2023)	
environment associated with a watercourse or wetland.	Study Area. While these do collect water and are likely important for fauna utilization on an occasional basis, the wetlands are small and would only serve as water sources for short periods of time following rainfall. These are not considered significant wetlands in either a local or regional sense.		
<b>Principle (g)</b> – Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	The exploration activity planned is not likely to cause any significant land degradation.	N/A	Not at variance
<b>Principle (h)</b> – Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.	There are no Conservation Areas noted in close proximity to the Study Area.	Exploration activity in the project area is unlikely to impact on conservation areas in the region.	Not at variance
<b>Principle (i)</b> – Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.	The exploration activity planned is not likely to cause any significant deterioration of surface or groundwater.	N/A	Not at variance
<b>Principle (j)</b> – Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.	The exploration activity planned is not likely to cause or exacerbate the incidence of flooding.	N/A	Not at variance

## 7 Conclusion

The clearing required for this proposal will result in the removal of up to 14 ha of native vegetation considered to be in good to excellent condition. The impacted vegetation units are considered representative of vegetation within the region and are not considered suitable habitat for known conservation significant fauna species within the region. Moreover, appropriate environmental management controls will be in place to mitigate potential environmental impacts during design, clearing, exploration, and rehabilitation. The Project has been assessed as not at variance to the ten clearing principles listed in Schedule 5 of the EP Act.

The Proponent has a signed Native Title Agreement with the Ngaanyatjarra Land Council. Initial heritage surveys have been completed for the Project. The Proponent is bound by their heritage agreement to only undertake works in areas with heritage clearance from the Ngaanyatjarra Land Council. The Permit Area has excluded registered Aboriginal heritage sites

With implementation of the proposed environmental mitigation and management measures, the Project is considered unlikely to have a significant impact on the environment.

## 8 References

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# Appendix A Proof of tenure

Redacted

# Appendix B Tenement conditions and endorsements



Exploration leases are issued with stringent environmental and rehabilitation conditions to ensure that the tenement holder conducts exploration activities in a safe and sustainable manner. Tenement conditions and endorsement for the Project tenements are outlined in the table below.

Tenement conditions and endorsements for E 69/3401 and E 69/3552

Tenement	Type	Cond No	Version	Text	Start	End
E 69/3401	Condition	1	4	<del>The prior written consent of the Minister responsible for the <i>Mining Act 1978</i> being obtained before commencing any exploration activities on Use and Benefit of Aboriginal Inhabitants Reserve 17614.</del>	11/02/2019	09/04/2019
			1	<b>Consent to Mine on Use and Benefit of Aboriginal Inhabitants Reserve 17614 granted</b>	<b>09/04/2019</b>	
		2	1	Entry on Use & Benefit of Aboriginal Inhabitants Reserve 17614 and activities undertaken on the Licence by any non-Aboriginal lessee, licensee, employee, contractor or agent being authorised by an entry permit issued under the provisions of the <i>Aboriginal Affairs Planning Authority Act 1972</i> .	09/04/2019	
		3	1	All disturbances to the surface of the land made as a result of exploration, including costeans, drill pads, grid lines and access tracks, being backfilled and rehabilitated to the satisfaction of the Environmental Officer, Department of Mines, Industry Regulation and Safety. Backfilling and rehabilitation being required no later than 6 months after excavation unless otherwise approved in writing by the Environmental Officer, Department of Mines, Industry Regulation and Safety.	09/04/2019	
		4	1	All waste materials, rubbish, plastic sample bags, abandoned equipment and temporary buildings being removed from the mining tenement prior to or at the termination of exploration program.	09/04/2019	
		5	1	Unless the written approval of the Environmental Officer, Department of Mines, Industry Regulation and Safety is first obtained, the use of drilling rigs, scrapers, graders, bulldozers, backhoes or other mechanised equipment for surface disturbance or the excavation of costeans is prohibited. Following approval, all topsoil being removed ahead of mining operations and separately stockpiled for replacement after backfilling and/or completion of operations.	09/04/2019	
	Endorsement	1	1	The Licensee's attention is drawn to the provisions of the <i>Aboriginal Heritage Act 1972</i> and any Regulations thereunder.	11/02/2019	
		2	1	The Licensee's attention is drawn to the <i>Environmental Protection Act 1986</i> and the Environmental Protection (Clearing of Native Vegetation) Regulations 2004, which provides for the protection of all native vegetation from damage unless prior permission is obtained.	11/02/2019	
			1	<b>In respect to Water Resource Management Areas (WRMA) the following endorsements apply:</b>	<b>11/02/2019</b>	
		3	1	The Licensee's attention is drawn to the provisions of the: <ul style="list-style-type: none"> <li>■ <i>Waterways Conservation Act, 1976</i></li> <li>■ <i>Rights in Water and Irrigation Act, 1914</i></li> <li>■ <i>Metropolitan Water Supply, Sewerage and Drainage Act, 1909</i></li> </ul>	11/02/2019	

Tenement	Type	Cond No	Version	Text	Start	End
				<ul style="list-style-type: none"> <li>■ Country Areas Water Supply Act, 1947</li> <li>■ Water Agencies (Powers) Act 1984</li> </ul>		
		4	1	The rights of ingress to and egress from, and to cross over and through, the mining tenement being at all reasonable times preserved to officers of Department of Water and Environmental Regulation (DWER) for inspection and investigation purposes.	11/02/2019	
		5	1	The storage and disposal of petroleum hydrocarbons, chemicals and potentially hazardous substances being in accordance with the current published version of the Department of Water and Environmental Regulation (DWER) relevant Water Quality Protection Notes and Guidelines for mining and mineral processing.	11/02/2019	
		6	1	The taking of groundwater from an artesian well and the construction, enlargement, deepening or altering of any artesian well is prohibited unless current licences for these activities have been issued by Department of Water and Environmental Regulation (DWER).	11/02/2019	
			1	<b>In respect to Proclaimed Ground Water Areas the following endorsement applies:</b>	11/02/2019	
		7	1	The taking of groundwater and the construction or altering of any well is prohibited without current licences for these activities issued by the Department of Water and Environmental Regulation (DWER), unless an exemption otherwise applies.	11/02/2019	
E 69/3552	Condition	1	1	All disturbances to the surface of the land made as a result of exploration, including costeans, drill pads, grid lines and access tracks, being backfilled and rehabilitated to the satisfaction of the Environmental Officer, Department of Mines, Industry Regulation and Safety. Backfilling and rehabilitation being required no later than 6 months after excavation unless otherwise approved in writing by the Environmental Officer, Department of Mines, Industry Regulation and Safety.	28/01/2020	
		2	1	All waste materials, rubbish, plastic sample bags, abandoned equipment and temporary buildings being removed from the mining tenement prior to or at the termination of exploration program.	28/01/2020	
		3	1	Unless the written approval of the Environmental Officer, Department of Mines, Industry Regulation and Safety is first obtained, the use of drilling rigs, scrapers, graders, bulldozers, backhoes or other mechanised equipment for surface disturbance or the excavation of costeans is prohibited. Following approval, all topsoil being removed ahead of mining operations and separately stockpiled for replacement after backfilling and/or completion of operations.	28/01/2020	
		4	1	No interference with the use of the Aerial Landing Ground and mining thereon being confined to below a depth of 15 metres from the natural surface.	28/01/2020	
			1	<b>Consent to Mine on Use and Benefit of Aboriginal Inhabitants Reserve 17614 granted</b>	<b>28/01/2020</b>	

Tenement	Type	Cond No	Version	Text	Start	End
	Endorsement	1	1	The Licensee's attention is drawn to the provisions of the <i>Aboriginal Heritage Act 1972</i> and any Regulations thereunder.	28/01/2020	
		2	1	The Licensee's attention is drawn to the <i>Environmental Protection Act 1986</i> and the Environmental Protection (Clearing of Native Vegetation) Regulations 2004, which provides for the protection of all native vegetation from damage unless prior permission is obtained.	28/01/2020	
			<b>1</b>	<b>In respect to Water Resource Management Areas (WRMA) the following endorsements apply:</b>	<b>28/01/2020</b>	
		3	1	The Licensee's attention is drawn to the provisions of the: <ul style="list-style-type: none"> <li>■ <i>Waterways Conservation Act, 1976</i></li> <li>■ <i>Rights in Water and Irrigation Act, 1914</i></li> <li>■ <i>Metropolitan Water Supply, Sewerage and Drainage Act, 1909</i></li> <li>■ <i>Country Areas Water Supply Act, 1947</i></li> </ul> <i>Water Agencies (Powers) Act 1984</i>	28/01/2020	
		4	1	The rights of ingress to and egress from, and to cross over and through, the mining tenement being at all reasonable times preserved to officers of Department of Water and Environmental Regulation (DWER) for inspection and investigation purposes.	28/01/2020	
		5	1	The storage and disposal of petroleum hydrocarbons, chemicals and potentially hazardous substances being in accordance with the current published version of the Department of Water and Environmental Regulation (DWER) relevant Water Quality Protection Notes and Guidelines for mining and mineral processing.	28/01/2020	
		6	1	The taking of groundwater from an artesian well and the construction, enlargement, deepening or altering of any artesian well is prohibited unless current licences for these activities have been issued by Department of Water and Environmental Regulation (DWER).	28/01/2020	
		7	1	Measures such as drainage controls and stormwater retention facilities are to be implemented to minimise erosion and sedimentation of adjacent areas, receiving catchments and waterways.		
		8	1	All activities to be undertaken so as to avoid or minimise damage, disturbance or contamination of waterways, including their beds and banks, and riparian and other water dependent vegetation.		
			<b>1</b>	<b>In respect to Proclaimed Ground Water Areas the following endorsement applies:</b>	<b>28/01/2020</b>	
	9	1	The taking of groundwater and the construction or altering of any well is prohibited without current licences for these activities issued by the Department of Water and Environmental Regulation (DWER), unless an exemption otherwise applies.	28/01/2020		

# Appendix C Targeted Flora and Vegetation Assessment



**Western  
Botanical**

## Targeted Flora and Vegetation Assessment, Jameson Tenements

Prepared for: Julimar Resources Pty Ltd

Report Ref: WB1022 v1.1





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1	G. Cockerton	22 <sup>nd</sup> Dec 2023	22 <sup>nd</sup> Dec 2023
1.1 update to vegetation maps and IBSA datafile including additional vegetation mapping	G. Cockerton	29 <sup>th</sup> January 2024	29 <sup>th</sup> January 2024

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*This report has been designed for double-sided printing*

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## 1. Executive Summary

Julimar Resources Pty Ltd contracted Western Botanical to undertake Reconnaissance and Targeted flora and vegetation assessments of their exploration tenements E 69/3401 and E69/3552 near the Jameson townsite (Mantamaru Aboriginal Community) in Spring 2023. Julimar plan to undertake early-stage exploration activities at several sites in the region and the botanical assessment was designed to provide sufficient information for a Clearing Permit to be provided under delegated authority by the Department of Energy, Mines, Industry Regulation and Safety (DMIRS).

The landforms of the Study Area are:

- (i) Extensive gently inclined hardpan plains with red-brown silty sand to clayey sand soils and discontinuous pizolitic lag gravel mantle;
- (ii) Subdued low hills with red-brown silty sand to clayey sand soils and minor banded ironstone formation (magnetite) and/or gabbro outcrops; and
- (iii) Ephemeral playa lake systems with red-brown clay soil.

Three vegetation associations, or habitat units, were mapped within close proximity to the proposed drill pads and access tracks:

- (i) HPMS Hardpan Mulga Shrublands  
*Acacia aptaneura*, *A. kempeana* open low woodlands with scattered *Senna* species mid shrubs over *Aristida contorta* bunch grasses and *Sclerolaena* spp. herbs.
- (ii) CPNG Claypan, grassy  
Grassland with *Aristida inaequiglumis*, *Eragrostis setifolia*, occasional *Eragrostis xerophila*.
- (iii) MHMS Magnetite (low) Hill Mulga Shrubland  
*Acacia aptaneura* open low woodlands with scattered midstorey of *Eremophila latrobei* subsp. *glabra* and patches of *Eriachne mucronata* (desert form glabrous)

Thirty four species from 23 genera and representing 34 species were recorded within the Study Area. The majority of these are well known and widespread within central Australia.

One species encountered within the grassy claypans (CPNG habitat) of the Study Area, *Euphorbia parvicaruncula*, <https://florabase.dbca.wa.gov.au/browse/profile/4637>, is listed as a Priority 1 species in Western Australia. As an annual species with ovoid smooth seeds, the species would be expected to be found within its preferred habitat but at various locations from year to year. Occurrences of *Euphorbia parvicaruncula* could be avoided in developing access tracks to the proposed drill pads within the Study Area, however, recognising the individual dead plants will be difficult at most times of the year. The practicality of implementation of, and outcomes



associated with, avoidance of point data for the species, given its biology and preferred habitat, should be considered when developing an exploration management plan for the program.

## **2. Introduction**

Julimar Resources Pty Ltd contracted Western Botanical to undertake Reconnaissance and Targeted flora and vegetation assessments of their exploration tenements E 69/3401 and E69/3552 near the Jameson townsite (Mantamaru Aboriginal Community) in Spring 2023. Julimar plan to undertake early-stage exploration activities at several sites in the region and the botanical assessment was designed to provide sufficient information for a Clearing Permit to be provided under delegated authority by the Department of Energy, Mines, Industry Regulation and Safety (DMIRS).

### **2.1. Previous surveys**

No previous botanical studies have been undertaken specifically within the Study Area. Relevant to this project, extensive flora surveys have been undertaken by Western Botanical in recent years for the BHP West Musgrave Copper and Nickel Project (WMCNP) extending in a southerly alignment from the Jameson townsite to the WMCNP mining tenements some 30 km south of Jameson. This has provided excellent local context for the Julimar Resources Study Area

### **2.2. Current Survey**

The current survey involved vegetation mapping and targeted significant species assessments over a period of five days in two events in August and November 2023 by Western Botanical staff Geoff Cockerton, Steven Cockerton and Felicity Keet.

### **2.3. Physical Environment**

A location map and description of the physical and biological environments is presented in Western Botanical 2023a, Appendix 1.

The seasonal conditions prior and during to the field surveys was dry and few ephemeral species were observed, however, perennial flora were readily recognised.

### 3. Methods

The Study Area was assessed in two periods: 21<sup>st</sup> to 23<sup>rd</sup> August and 14<sup>th</sup> – 15<sup>th</sup> November 2023 by a two-person team led by Geoff Cockerton, Principal Botanist and assisted by Steven Cockerton (Environmental Technician) or Felicity Keet (Botanist). The August surveys were undertaken with assistance from Mr Shaun Nickholds, Ngaanyatjarra (NG) Council and six Traditional Owners while the November assessment was undertaken with the assistance of Mt Nickholds and three Traditional Owners.

Transects of proposed tracks and of drill pads were conducted on-foot, in-vehicle and utilising quad bikes as terrain allowed and findings dictated. Where significant flora were recorded, detailed traverses at five to 10m intervals were conducted.

Releve sites were used to describe vegetation with representative photographs taken and species profiles compiled. Vegetation mapping was drawn on to 1:10,00 scale colour satellite imagery and digitised for presentation.

Geoff Cockerton is very familiar with the flora, any conservation-significant flora observed were individually counted and locations entered into iPads running the ARCGIS Field Maps application with an accuracy of +/- 4m.

Specimens of all flora were collected for future reference and any species not readily named in the field were verified by Dr. Margaret Collins utilising the resources at the DBCA's Reference Herbarium and Research Collection as required. Field maps were digitised, and significant species data was collated by CAD Resources Pty Ltd.

#### 3.1. Desktop Assessment

A Desktop Assessment of the significant flora, vegetation, physical and biological environments was undertaken by Belinda Jeanes, Western Botanical 2023a, and is presented in its entirety in Appendix 1.

## 4. Results and Discussion

### 4.1. Desktop Assessment

The significant level of botanical survey conducted between 2014 – 2019 across the WMCNP has located 11 Priority flora species, six of which were within 5 km of the southern boundary of the Study Area. Also of relevance is the identification of eight vegetation associations within the WMCNP that are either a probable obligate GDE (one) or probable facultative GDE (seven) (Western Botanical, 2020; CDM Smith 2020b).

The literature review identified 14 weed species as having been recorded across the three projects. None are listed as Weeds of National Significance (WoNS) or Declared Plants. Buffel Grass (*Cenchrus ciliaris*) is known to occur along roadsides within the Study Area (GHD, 2021).

### 4.2. Field Survey

#### 4.2.1. Landforms

The landforms of the Study Area are:

- (iv) Extensive gently inclined hardpan plains with red-brown silty sand to clayey sand soils and discontinuous pizolitic lag gravel mantle;
- (v) Subdued low hills with red-brown silty sand to clayey sand soils and minor banded ironstone formation (magnetite) and/or gabbro outcrops; and
- (vi) Ephemeral playa lake systems with red-brown clay soil.

#### 4.2.2. Vegetation Mapping

Three vegetation associations, or habitat units, were mapped within close proximity to the proposed drill pads and access tracks, Figure 1. These were, in order of decreasing area of occupancy:

Veg Code	Vegetation Name	Vegetation Description
HPMS	Hardpan Mulga Shrublands	<i>Acacia aptaneura</i> , <i>A. kempeana</i> open low woodlands with scattered <i>Senna</i> species mid shrubs over <i>Aristida contorta</i> bunch grasses and <i>Sclerolaena</i> spp. herbs.
CPNG	Claypan, grassy	Grassland with <i>Aristida inaequiglumis</i> , <i>Eragrostis setifolia</i> , occasional <i>Eragrostis xerophila</i> .
MHMS	Magnetite (low) Hill Mulga Shrubland	<i>Acacia aptaneura</i> open low woodlands with scattered midstorey of <i>Eremophila latrobei</i> subsp. <i>glabra</i> and patches of <i>Eriachne mucronata</i> (desert form glabrous)



**Figure 1. Vegetation of the Study Area**

Redacted

Vegetation associations, or habitat units, noted within the Study Area are locally widespread in the Jameson area and more broadly within the Central Ranges bioregion.

#### 4.2.3. Vegetation Descriptions

##### MHMS Magnetite Hill Mulga Shrubland

Low rounded hills with (i) gabbro rock on lower slopes and plains, (ii) magnetite ridge running +/- N-S, (iii) small and isolated patches of calcrete. Vegetation is scattered Mulga (*Acacia aptaneura*) 1 to 4m, *Acacia kempeana* 1 to 3m, *Hakea lorea* subsp. *lorea* 1.2m, PFC 5% over scattered *Maireana triptera* 0.4m, *Eremophila georgei* 1.2m, *Eremophila longifolia* 1.5m, PFC 1% over *Sclerolaena ?gardneri* 0.15 PFC 10% and bunch grasses *Aristida contorta* 0.2m, *Eragrostis eriopoda* 0.3m, *Cymbopogon ambiguus* 1m, PFC 10% with *Eragrostis mucronata* desert form glabrous 0.3m (only on the on outcropping magnetite).

##### Plate 1 MHMS Magnetite Hill Mulga Shrubland





## HPMS Hardpan Mulga Shrubland

Scattered *Acacia aptaneura* (Mulga) 2 to 3m, PFC 5% over bunch grasses *Aristida contorta* 0.2, *Salsola tragus* 0.4, *Eragrostis eriopoda* 0.4, *Digitaria brownii* 0.4m, PFC 25%. Soil is red-brown silty sand with abundant black pizolitic lag gravel.

### Plate 2 HPMS Hardpan Mulga Shrubland





**CPNG Claypan, grassy**

Flat claypan with cracking clay and grassland dominated by *Eragrostis setifolia* 0.4m PFC 15% , *Aristida inaequiglumis* 0.4m, *Aristida contorta* PFC 2%. Scattered *Cenchrus ciliaris*\* PFC < 1%.

**Plate 3 CPNG Claypan, grassy**

#### 4.2.4. Flora

Thirty four species from 23 genera and representing 34 species were recorded within the Study Area, Table 1. The majority of these are well known and widespread within central Australia.

**Table 1. Systematic species list**

Family	Genus	species	Cons_Status
Acanthaceae	Rostellularia	adscendens var. pogonanthera	
Asteraceae	Pterocaulon	sphacelatum	
Boraginaceae	Euploca	cunninghamii	
Boraginaceae	Halgania	sp. Indet	
Chenopodiaceae	Einadia	nutans subsp. eremaea	
Chenopodiaceae	Maireana	triptera	
Chenopodiaceae	Sclerolaena	?gardneri	
Chenopodiaceae	Sclerolaena	cornishiana	
Euphorbiaceae	Euphorbia	parvicaruncula	Priority 1
Euphorbiaceae	Euphorbia	tannensis subsp. eremophila	
Fabaceae	Acacia	aptaneura	
Fabaceae	Acacia	kempeana	
Fabaceae	Rhynchosia	sp. Indet	
Fabaceae	Senna	artemisioides subsp. oligophylla	
Fabaceae	Senna	artemisioides subsp. x sturtii	
Fabaceae	Senna	glaucifolia	
Fabaceae	Senna	sp. Billabong (J.D. Alonzo 721)	
Haloragaceae	Haloragis	gossei var. gossei	
Lamiaceae	Dicrastylis	exsuccosa	
Malvaceae	Sida	fibulifera	
Poaceae	Aristida	contorta	
Poaceae	Aristida	inaequiglumis	
Poaceae	Digitaria	brownii	
Poaceae	Enneapogon	avenaceus	
Poaceae	Eragrostis	setifolia	
Poaceae	Eragrostis	setifolia	
Poaceae	Eragrostis	xerophila	
Poaceae	Eriachne	mucronata (desert form glabrous)	
Poaceae	Poaceae	sp. Indet	
Poaceae	Themeda	triandra	
Poaceae	Triodia	sp. Indet	
Proteaceae	Hakea	lorea subsp. lorea	
Scrophulariaceae	Eremophila	georgei	
Scrophulariaceae	Eremophila	latrobei subsp. glabra	



Family	Genus	species	Cons_Status
Scrophulariaceae	Eremophila	longifolia	

### 4.3. Conservation-Significant Flora

#### *Euphorbia parvicaruncula*

Priority 1

One species encountered within the grassy claypans (CPNG habitat) of the Study Area, *Euphorbia parvicaruncula*, <https://florabase.dbca.wa.gov.au/browse/profile/4637>, is listed as a Priority 1 species in Western Australia. A representative specimen from this location has been vouchered at the WA Herbarium.

*Euphorbia parvicaruncula* is a low, virgate branching annual herb to 30cm in height that is found within small to large clay-based ephemeral playa lakes in central Australia.

#### Plate 4. *Euphorbia parvicaruncula* within the Study Area



*Euphorbia parvicaruncula* was recorded within most CPNG habitats and smaller hardpan patches within the HPMS habitat in the Study Area, Figure 2.

Plants observed near Jameson within the Study Area were either dead or at the end of their life cycle and showed evidence of successful seed set following flowering. Once recognised in the



field, plants were readily distinguished from the larger, upright, taller *Euphorbia tannensis* subsp. *eremaea* which were alive, green, supple and growing to 0.7m tall in the adjacent HPMS habitat on sandier soils and 5 to 20 cm higher in elevation than the soil surface of the claypans.

**Plate 5. Habitat supporting *Euphorbia parvicaruncula* within the Study Area**



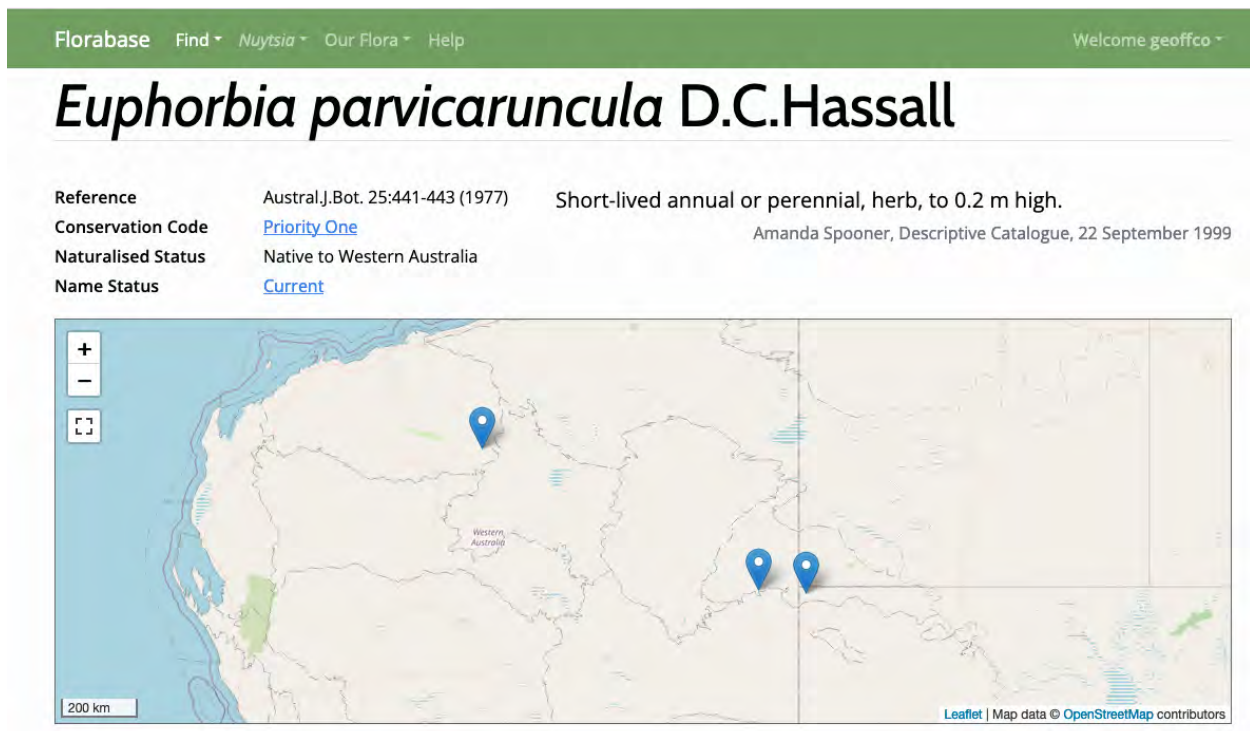
**Figure 2. Records of *Euphorbia parvicaruncula* within the Study Area**



Redacted

Florabase lists two specimens previously collected within W.A., Figure 3, and a third confirmed record has been made by Western Botanical east of the Jameson townsite within a grassy claypan (CPNG habitat) adjacent to a gabbro hill. Surveys by Western Botanical conducted at the same time as the November 2023 surveys of the Study Area also confirmed large populations (> 200 plants) of *Euphorbia parvicaruncula* within a large grassy claypan immediately south of the Jameson townsite (specimens yet to be vouchered).

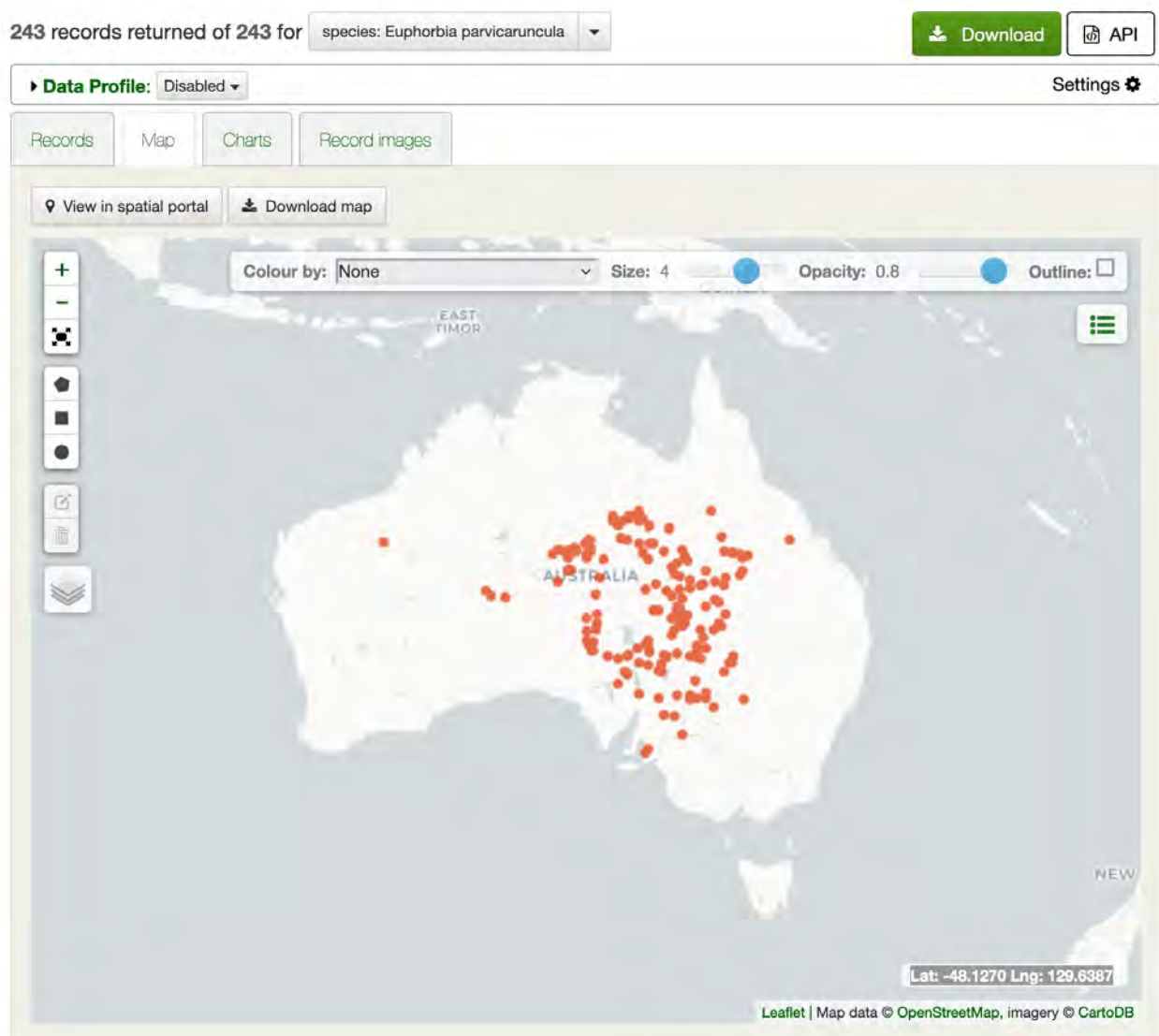
**Figure 3. Distribution of *Euphorbia parvicaruncula* within Western Australia (Florabase)**



*Euphorbia parvicaruncula* is poorly collected in Western Australia but is widely collected within the south-eastern Northern Territory, north-eastern South Australia, south-western Queensland and western New South Wales, Figure 4.

The habitat supporting *Euphorbia parvicaruncula* is not geographically restricted in Central Australia. It is considered that the paucity of records within Western Australia is likely an artefact of limited survey within the preferred habitat of *Euphorbia parvicaruncula* at appropriate times of the year and following appropriate seasonal conditions.

**Figure 4. Distribution of *Euphorbia parvicaruncula* in Australia (AVH)**



Based on these records, Western Botanical suggests that *Euphorbia parvicaruncula* is a claypan-specific annual species which likely is only present in years of suitable rainfall quantity and temporal pattern within its preferred habitat.

As an annual species with ovoid smooth seeds, the species would be expected to be found within its preferred habitat but at various locations from year to year. Occurrences of *Euphorbia parvicaruncula* could be avoided in developing access tracks to the proposed drill pads within the Study Area, however, recognising the individual dead plants will be difficult at most times of the year.

The practicality of implementation of, and outcomes associated with, avoidance of point data for the species, given its biology and preferred habitat, should be considered when developing an exploration management plan for the program.

#### ***Acacia* sp. GCFK-1271**

Note: Records of *Acacia* sp. GCFK-1271, noted in the field as a Species of Interest (SOI), were subsequently found to represent a broad phyllode form of *Acacia aptaneura*, a common and widespread Mulga species. While this is shown on the map presented in Figure 2, it does not have conservation significance and is not listed as a Priority Flora species in Western Australia, and should therefore be disregarded.

#### **4.4. Weeds**

*Cenchrus ciliaris* (Buffel Grass) was observed routinely within and nearby the Study Area and is now well naturalised in the Jameson area. *Cenchrus ciliaris* can be highly competitive with native species. *Cenchrus ciliaris* dominates many areas near the Jameson townsite, particularly those areas with sandier soil profiles, and is common to abundant within the Study Area.

#### **4.5. Vegetation Condition**

Vegetation demonstrated the effects of extended drought and frequent fires. The HPMS habitat unit showed many dead stags of Mulga with little recent recruitment evident. While it is unclear whether these fires are natural events from lightning strikes or from human activity, it is noted that fire is used to regenerate grassy forage for kangaroos which are extensively hunted by Traditional Owners in central Australia.

Vegetation Condition is therefore recorded as Good to Very Good for much of the HPMS and MHMS communities mapped within the Study Area; while that of the CPNG habitat, not subject to fire due to sparse grass cover, is regarded as Very Good to Excellent.



## 5. Assessment Against the 10 Clearing Principles

**Principle (a) – Native vegetation should not be cleared if it comprises a high level of biological diversity.**

The habitats observed within the Study Area are highly representative of those of the region around the Jameson townsite and support a narrow range of species endemic to the region. The Study Area does not support habitats with particularly high species richness.

The Project is not at variance with this principle.

**Principle (b) – Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.**

The habitats of the Study Area are well represented in the region and not restricted to the Study Area. Further, these are not suitable for the known significant fauna of region (Great Desert Skink, Bilby).

The Project is not at variance with this principle.

**Principle (c) – Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.**

No Threatened (Rare) flora were noted within the Study Area and none are known in close proximity to the Study Area.

The Project is not at variance with this principle.

**Principle (d) – Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a threatened ecological community.**

There are no Threatened Ecological Communities (TECs) nearby the Study Area. While the Study Area lies within an Environmentally Sensitive Area (ESA), this is so listed due to Aboriginal Heritage considerations.

The Project is not at variance with this principle.

**Principle (e) – Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.**

The region inclusive of the Study Area has not been extensively cleared.

The Project is not at variance with this principle.

**Principle (f) – Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.**

Small ephemeral grassy claypans (CPNG habitat) are known within and nearby the Study Area. While these do collect water and are likely important for fauna utilization on an occasional basis, the wetlands are small and would only serve as water sources for short periods of time following rainfall. These are not considered significant wetlands in either a local or regional sense.

The Project is not at variance with this principle.

**Principle (g) – Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.**

The exploration activity planned is not likely to cause any significant land degradation.

The Project is not at variance with this principle.

**Principle (h) – Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.**

There are no Conservation Areas noted in close proximity to the Study Area.

The Project is not at variance with this principle.

**Principle (i) – Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.**

The exploration activity planned is not likely to cause any significant deterioration of surface or groundwater.

The Project is not at variance with this principle.

**Principle (j) – Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.**

The exploration activity planned is not likely to cause or exacerbate the incidence of flooding.

The Project is not at variance with this principle.

## 6. Limitations

Few limitations were experienced in conducting this project. The flora of the region was well known and relatively simple. Seasonal conditions were not ideal but, nonetheless, we are confident that the flora was adequately addressed.

Limitation	Discussion
Available sources of contextual information	The author has over 15 years' experience in assessing the flora of the Central Ranges bioregion, specifically in the Jameson area for the WMCNP and the field team were cognoscente of information gathered in that project. This is not a Limitation for the proposal
The Scope of the survey	The scope and budget available were adequate for the assessment undertaken. This is not a Limitation for the proposal
Proportion of flora collected and identified	The flora of the habitats investigated is relatively simple and not overly diverse. While dry conditions prevailed during both survey events, flora present was readily identified. This is not a Limitation for the proposal
Completeness and further work which may be needed	A survey during more favourable seasonal conditions would likely add ephemerals to the species list. However, such seasonal conditions are unpredictable and no significant flora is known in the region that may have been present within the habitats of the Study Area. This is not a Limitation for the proposal
Mapping reliability	Vegetation was mapped using 1:10,000 aerial imagery which was adequate for the habitats encountered within this bioregion. This is not a Limitation for the proposal
Timing: weather, season	The field assessments were undertaken during relatively dry conditions. It is likely that ephemerals are under-represented in the species list. <b>This is a minor Limitation for the proposal</b>
Disturbances	No significant human disturbances were observed within the study area. Frequent fire is a common issue in the region. This is not a Limitation for the proposal
Intensity	The study was conducted at 10m intervals between observers, adequate for purpose. This is not a Limitation for the proposal
Resources	The field assessment was adequately resourced. This is not a Limitation for the proposal
Access	Access throughout the Study Area was excellent. This is not a Limitation for the proposal
Experience levels	The author has over 15 years' experience in assessing the flora of the Central Ranges bioregion and over 32 years' experience in flora assessment within Western Australia.

## 7. List of Participants

Participant	Field Surveys	Specimen Identification	Data Analysis	Report Preparation
Geoff Cockerton B.Sc. (Biology) Principal Botanist Flora Taking (Biological Assessment) License No. – FB62000542	1	1	1	1
Steven Cockerton (Environmental Technician)	1			
Felicity Keet B.Sc. Hons (Conservation Biology, Agriculture) Botanist Flora Taking (Biological Assessment) License No. – FB62000530	1	1	1	
Dr. Margaret Collins		1		
Belinda Jeanes B.Sc.				1
Brian White, CAD Resources Pty Ltd				1



## **8. Acknowledgements**

Mr Shaun Nickholds, Ranger Coordinator, Nganaytjarra (NG) Council is thanked for his assistance in the field during surveys and for his coordination of Traditional Owners who allowed the surveys to be undertaken on their lands.

Traditional Owners of the Jameson Community are thanked for permission to camp on site and for their assistance in field surveys.

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Western Botanical (2023a) *Desktop Assessment of Flora and Vegetation: Jameson Project*. Consultant's report prepared for Julimar Resources Pty. Ltd. Report Ref: WB1021.

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## Appendix 1. Western Botanical (2023a) Desktop Assessment



**Western  
Botanical**

Desktop Assessment of Flora and Vegetation:  
Jameson Project

Prepared for: Julimar Resources Pty. Ltd.

Report Ref: WB1021





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Citation: Western Botanical (2023) *Desktop Assessment of Flora and Vegetation: Jameson Project*. Consultant's report prepared for Julimar Resources Pty. Ltd. Report Ref: WB1021

Client Name: Julimar Resources Pty. Ltd.

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Version	Prepared By	Approved for Issue	Issue Date
	B. Jeanes G. Cockerton	6 <sup>th</sup> Dec 2023	6 <sup>th</sup> Dec 2023

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## 1. Executive Summary

Julimar Resources Pty Ltd plan to develop the Jameson Nickel – Copper – Platinum Group Elements Project, located within the West Musgraves region approximately 1,300 km north-east of Perth and 100 km west of the Surveyor General’s Corner. The Project comprises two tenements (E69/3401 and E69/3552) and is approximately 59,200 ha in size. Situated within Aboriginal Reserve 17614 the area is subject to native title rights under the Ngaanyatjarraku Lands Determination, which is managed for and on behalf of the Traditional Owners by the Ngaanyatjarra Land Council. The township of Mantamaru (Jameson) is located within tenement E69/3401.

Julimar Resources commissioned Western Botanical to conduct a desktop assessment of the flora and vegetation of the Project area (hereafter referred to as the Study Area) to provide contextual information for the subsequent botanical survey of the Study Area.

The Study Area intersects the Mann-Musgrave Block subregion (CER01) of the Central Ranges IBRA bioregion. The climate is arid with average annual rainfall of 290.8 mm, peaking from late spring to early autumn (BoM, 2023a).

The overall Study Area comprises eight mapped surface geological units and four soil landscape systems. The Jameson Range and adjacent hills comprise approximately 17 % of the Study Area with the majority (~74 %) consisting of surrounding outwash plains. Plains with numerous dunes, are restricted to the north-west and south-east corners of the Study Area (~ 8 %) (DPIRD, 2023a).

Located within the northern part of the Warburton Basin hydrographic catchment, there are no significant creeks or water bodies within the Study Area. Groundwater salinities have been broadly mapped at Total Dissolved Solids content of 1,000 - 3,000 mg/L (brackish) (DWER, 2023a). Terrestrial Groundwater Dependent Ecosystem (GDE) potential has not been ascertained within a national assessment for much of the Study Area. Exceptions include; the south-east corner of tenement E69/3552 and the Jameson Range which is mapped as having a low potential for supporting a terrestrial GDE; and a section of the north-west corner of tenement E69/3401 which is mapped as having moderate terrestrial GDE potential (BoM, 2023b).

The five pre-European vegetation system associations mapped across the Study Area remain intact at a bioregional level with greater than 99 % of their pre-European extent remaining (WALGA, 2020). The dominant associations include Mulga (*Acacia aneura*) woodland and associated species (Central Ranges\_18) (~ 78 % of the Study Area) on the outwash plains; and Wattle, teatree and other species (*Acacia* spp. *Melaleuca* spp) sparse scrub to scrub, located on ranges and hills (Central Ranges\_39) (~ 12 %).

The Study Area is located within an Environmentally Sensitive Area as it lies within an area known as the Ranges of the Western Desert, which is listed on the Register of the National Estate as having Indigenous values of National Estate significance (DWER, 2023b; DCCEE, 2023).



There are no known Threatened or Priority Ecological Communities within 100 km of the Study Area (DBCA, 2023f).

A literature review identified three projects (with associated botanical surveys) within 100 km of the Study Area; Wingellina Nickel Project (WNP) located approximately 90 km east of the Study Area; the West Musgrave Copper and Nickel Project (WMCNP) which is currently in construction and located approximately 11 km south of the Study Area; and roadworks within the Shire of Ngaanyatjarra (partially within the Study Area). Significant range extensions for flora taxa were common to all surveys and are indicative of the paucity of botanical survey within the broader region.

State and Commonwealth database searches and the literature review indicate 35 flora taxa of conservation significance have been recorded within (or near) a 100 km radius of the Study Area. This includes 13 Priority 1, three Priority 2, 18 Priority 3 and one Priority 4 species. Of these, 27 were assessed as having the potential (Possible) to occur within the Study Area.

The significant level of botanical survey conducted between 2014 – 2019 across the WMCNP has located 11 Priority flora species, six of which were within 5 km of the southern boundary of the Study Area. Also of relevance is the identification of eight vegetation associations within the WMCNP that are either a probable obligate GDE (one) or probable facultative GDE (seven) (Western Botanical, 2020; CDM Smith 2020b).

The literature review identified 14 weed species as having been recorded across the three projects. None are listed as WoNS or Declared Plants. Buffel Grass (*Cenchrus ciliaris*) is known to occur along roadsides within the Study Area (GHD, 2021).

## **2. Introduction**

### **2.1. Project Background**

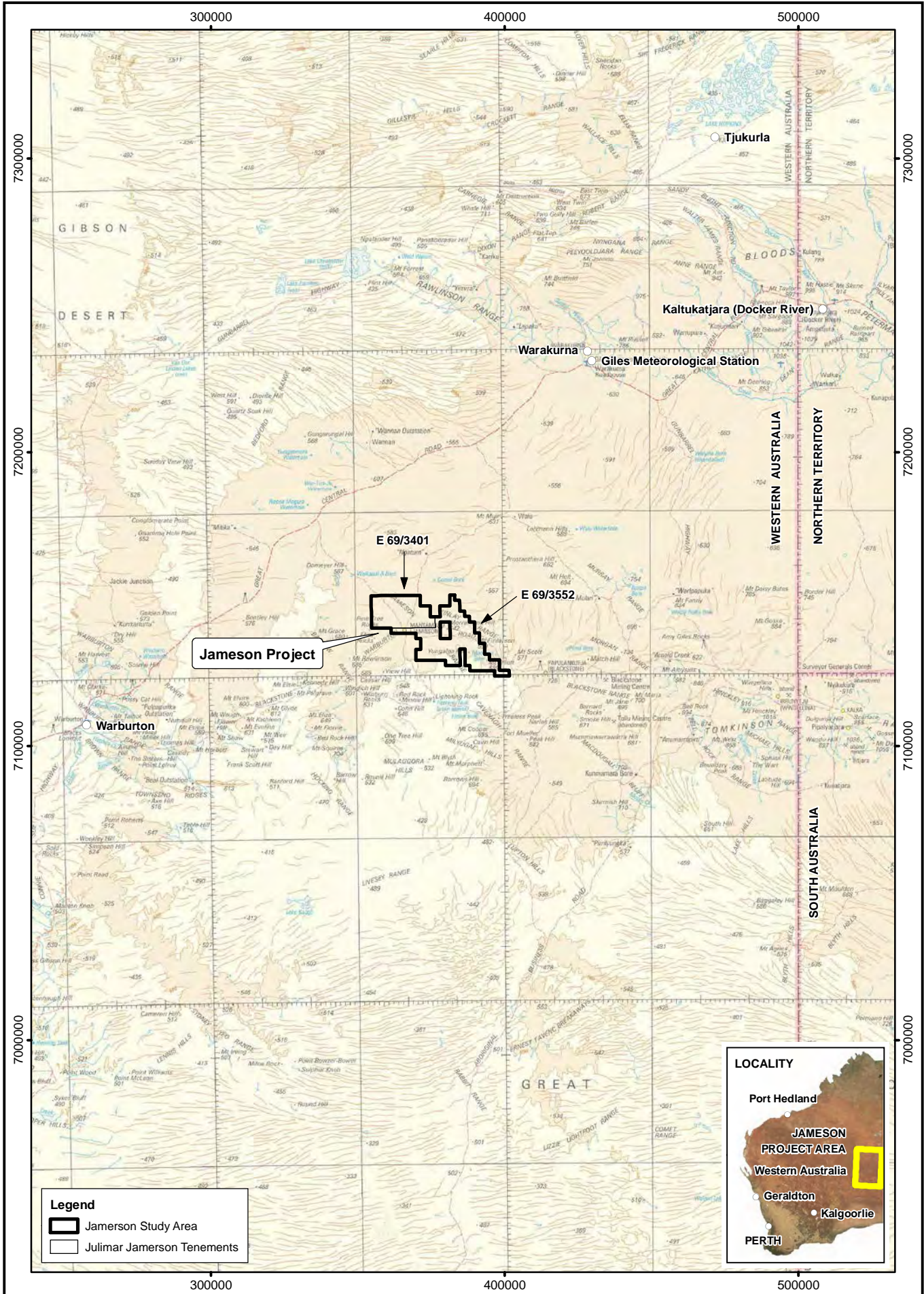
Julimar Resources Pty Ltd (Julimar Resources) plan to develop the Jameson Nickel – Copper – Platinum Group Elements Project which is in the West Musgraves region of Western Australia. The Project is located approximately 1,300 km north-east of Perth and 100 km west of the Surveyor General’s Corner (Figure 1).

Julimar Resources commissioned Western Botanical to conduct a desktop assessment of the flora and vegetation of the Project area (hereafter referred to as the Study Area) which is comprised of tenements E69/3401 and E69/3552 and is approximately 59,200 ha in size. The desktop assessment will provide contextual information for the subsequent botanical survey of the Study Area.

### **2.1. Land Use**

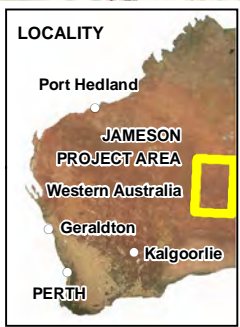
The Study Area is located entirely within the Shire of Ngaanyatjarraku (which is approximately 160,000 km<sup>2</sup> in size) and within Aboriginal Reserve 17614 (Figure 2). The Study Area occurs within an area subject to native title rights under the Ngaanyatjarraku Lands Determination, which is managed for and on behalf of the Traditional Owners by the Ngaanyatjarra Land Council. The township of Mantamaru (Jameson) is located within the Study Area. Originally established in the vicinity of a mining camp, the community became incorporated in 1976 and a member of the Ngaanyatjarra Council in 1981 (Shire of Ngaanyatjarraku, 2023). The Blackstone – Warburton Road and Jameson Wanarn Road dissect both tenements of the Study Area. The West Musgraves Nickel - Copper Project (WMNCP) is located approximately 11 km south of the Study Area.

**Figure 1. Regional location of the Study Area**



**Legend**

- Jameson Study Area
- Julimar Jameson Tenements



Imagery: Geoscience Australia

0 10 20 30 km  
 Scale: 1:1,750,000  
 MGA94 (Zone 52)

CAD Ref: a2986\_F004\_01  
 Date: November 2023

Rev: A | A4

**Western Botanical**

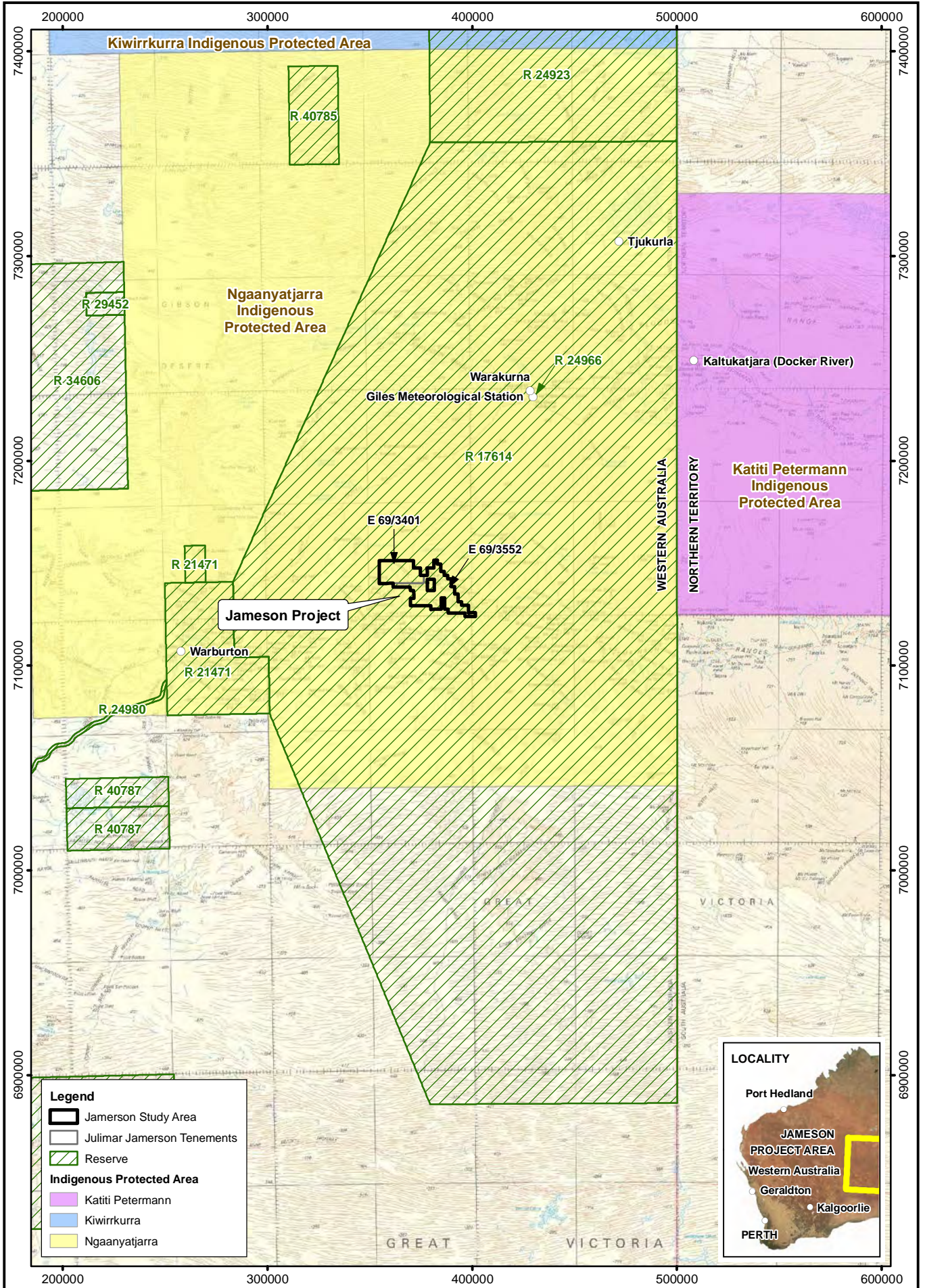
Author: B. Jeanes | WB Ref:

Drawn: CAD Resources ~ www.cadresources.com.au  
 Tel: (08) 9246 3242 ~ Fax (08) 9246 3202

**Julimar Resources**  
**Jameson Project**  
 Location



**Figure 2. Study Area with Cadastre**



Imagery: Geoscience Australia

0 20 40 km  
 Scale: 1:2,500,000  
 MGA94 (Zone 52)

CAD Ref: a2986\_F004\_07  
 Date: November 2023

Rev: A A4

**Western Botanical**

Author: B. Jeanes      WB Ref:  
 Drawn: CAD Resources ~ www.cadresources.com.au  
 Tel: (08) 9246 3242 ~ Fax (08) 9246 3202

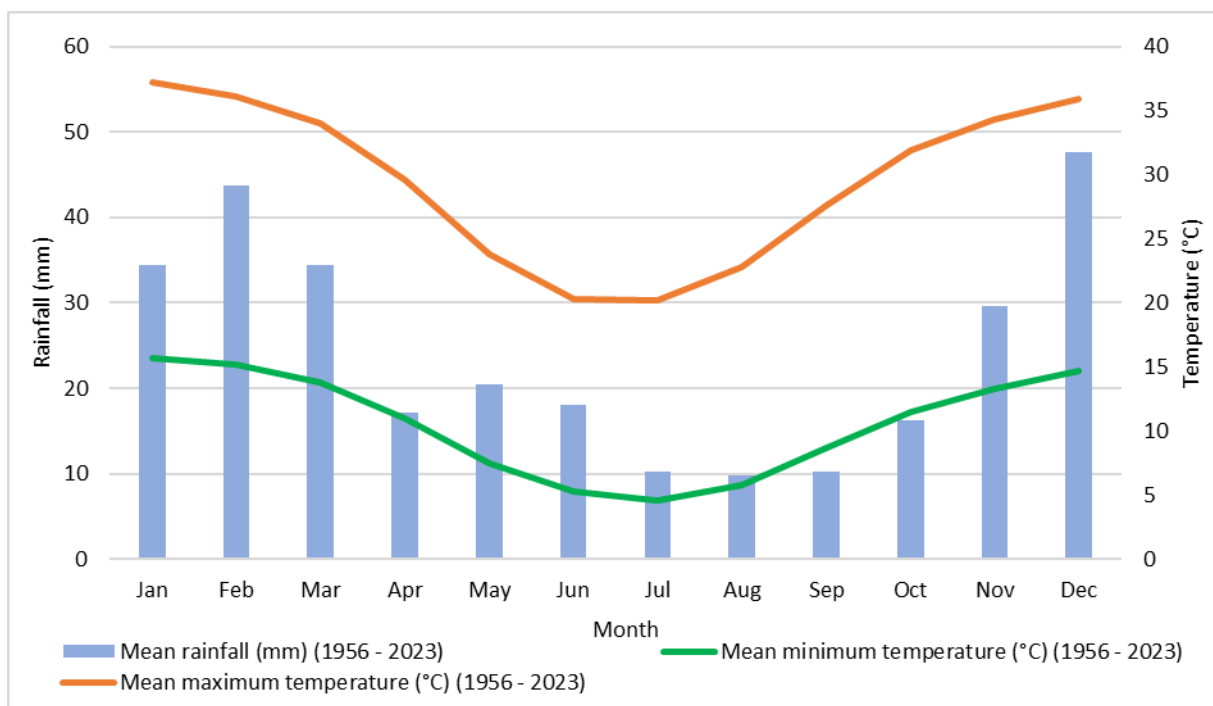
**Julimar Resources  
 Jameson Project  
 Reserves and Indigenous Protected Areas**



## 2.2. Physical Environment

### 2.2.1. Climate

The Study Area is in an arid climate with the region receiving both summer and winter rainfall patterns (Graham and Cowan, 2001). Located midway between Warburton and Giles, the nearest Bureau of Meteorology (BoM) weather station is located at Giles, approximately 93 km north-west of the Study Area (Warburton Airfield weather station is approximately 102 km south-west of the Study Area). The average annual rainfall for Giles, is 290.8 mm. Average monthly rainfall peaks from late spring to early autumn, with the highest average rainfall occurring in December (47.7 mm). Rainfall during these months is generally associated with the southward movement of tropical lows and ex-tropical cyclones. Mean maximum daily temperatures range from 20.2 °C in July to 37.2 °C in January with mean minimum temperatures ranging from 6.9 °C in July to 23.5 °C in January (Figure 3) (BoM, 2023a).



**Figure 3. Long-term average climate data for Giles (weather station number 013017) (1956 – 2023) (BoM, 2023a).**

### 2.2.2. Geology

The Study Area lies within the Mesoproterozoic Musgrave Block in central Australia. Approximately 500 km long and 140, 000 km<sup>2</sup> in size, the Musgrave Block is an east-west trending orogenic belt and comprises a variety of high grade (amphibolite to granulite facies) basement lithologies overprinted by several major tectonic episodes. (GCX Metals, 2023).



The western portion of the Musgrave Block (the West Musgrave region) hosts the economically significant Giles Complex which is one of the world's largest layered intrusions. The Mesoproterozoic Jameson Range intrusion forms part of the Giles Complex. The Study Area is dominated by the Jameson Intrusion which is predominantly mafic in composition and consists of olivine-bearing gabbroic lithologies. The Study Area contains large-scale magmatic Ni-Cu-PGE targets, including outcropping PGE-Au reefs and is considered highly prospective for magmatic Ni-Cu-PGE deposits (GCX Metals, 2023).

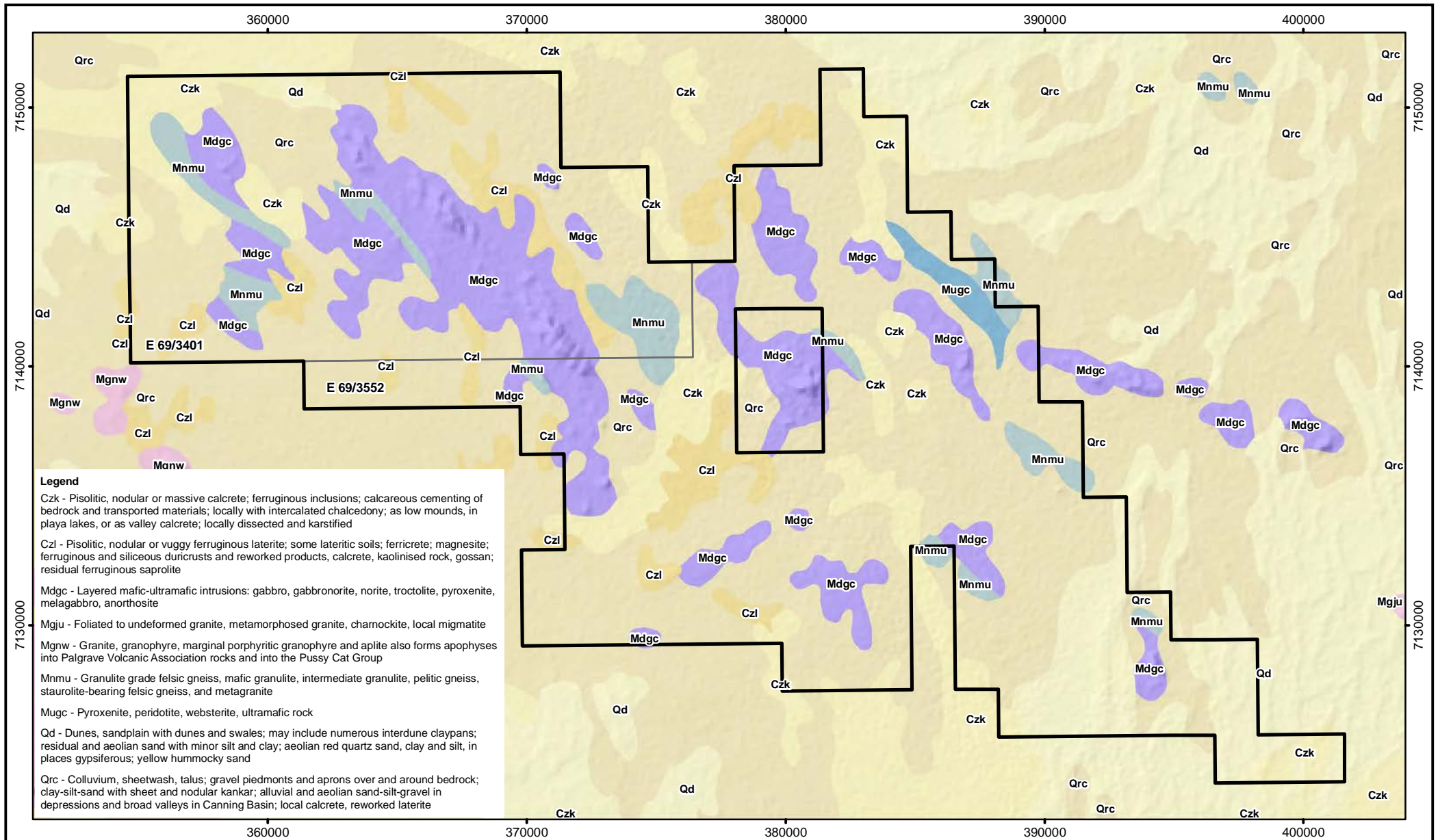
The Study Area traverses eight surface geological units (Table 1; Figure 4). Dominant units include Qrc (colluvium, sheetwash, talus) which comprised ~ 51 % of the Study Area, Mdgc (layered mafic-ultramafic intrusions) ~ 18 % and Czk (calcrete) ~ 11 %.

**Table 1. Surface geology of the Study Area (Raymond, *et al*, 2012).**

Geology Unit	Description	Area (ha)	% of Study Area
Czk	Pisolitic, nodular or massive calcrete; ferruginous inclusions; calcareous cementing of bedrock and transported materials; locally with intercalated chalcedony; as low mounds, in playa lakes, or as valley calcrete; locally dissected and karstified	6,622.97	11.2
Czl	Pisolitic, nodular or vuggy ferruginous laterite; some lateritic soils; ferricrete; magnesite; ferruginous and siliceous duricrusts and reworked products, calcrete, kaolinised rock, gossan; residual ferruginous saprolite	3,728.86	6.3
Mdgc	Layered mafic-ultramafic intrusions: gabbro, gabbronorite, norite, troctolite, pyroxenite, melagabbro, anorthosite.	10,964.88	18.5
Mgnw	Granite, granophyre, marginal porphyritic granophyre and aplite also forms apophyses into Palgrave Volcanic Association rocks and into the Pussy Cat Group.	0.08	<0.1
Mnmu	Granulite grade felsic gneiss, mafic granulite, intermediate granulite, pelitic gneiss, staurolite-bearing felsic gneiss, and metagranite.	2,808.22	4.7
Mugc	Pyroxenite, peridotite, websterite, ultramafic rock.	562.16	0.9
Qd	Dunes, sandplain with dunes and swales; may include numerous interdune claypans; residual and aeolian sand with minor silt and clay; aeolian red quartz sand, clay and silt, in places gypsiferous; yellow hummocky sand	4,125.46	7.0
Qrc	Colluvium, sheetwash, talus; gravel piedmonts and aprons over and around bedrock; clay-silt-sand with sheet and nodular kankar; alluvial and aeolian sand-silt-gravel in depressions and broad valleys in Canning Basin; local calcrete, reworked laterite.	30,387.79	51.3
	TOTAL	59,200.42	100



**Figure 4. Surface Geology of the Study Area.**



Legend	QUATERNARY	CENOZOIC	MESOPROTEROZOIC	
Jamerson Study Area	Qd	Czk	Mdgc	Mgnw
Jamerson Tenements	Qrc	Czl	Mgiu	Mnm
				Mugc

0 4km

Scale: 1:200,000  
MGA94 (Zone 52)

CAD Ref: a2986\_F004\_05  
Date: November 2023

Rev: A A4

Western Botanical

Author: B. Jeanes | WB Ref:

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**Julimar Resources**  
**Jameson Project**  
**Surface Geology of Australia, 1:1 000 000**

### 2.2.3. Soil Landscape Systems

Soil landscape mapping of WA has been completed by the Department of Primary Industries and Regional Development (DPIRD) through the compilation of various surveys at differing scales (varying from 1:20,000 to 1:3,000,000). The mapping conforms to a nested hierarchy which was established to manage the varying scales and subsequent levels of information evident across the surveys (DPIRD, 2023a).

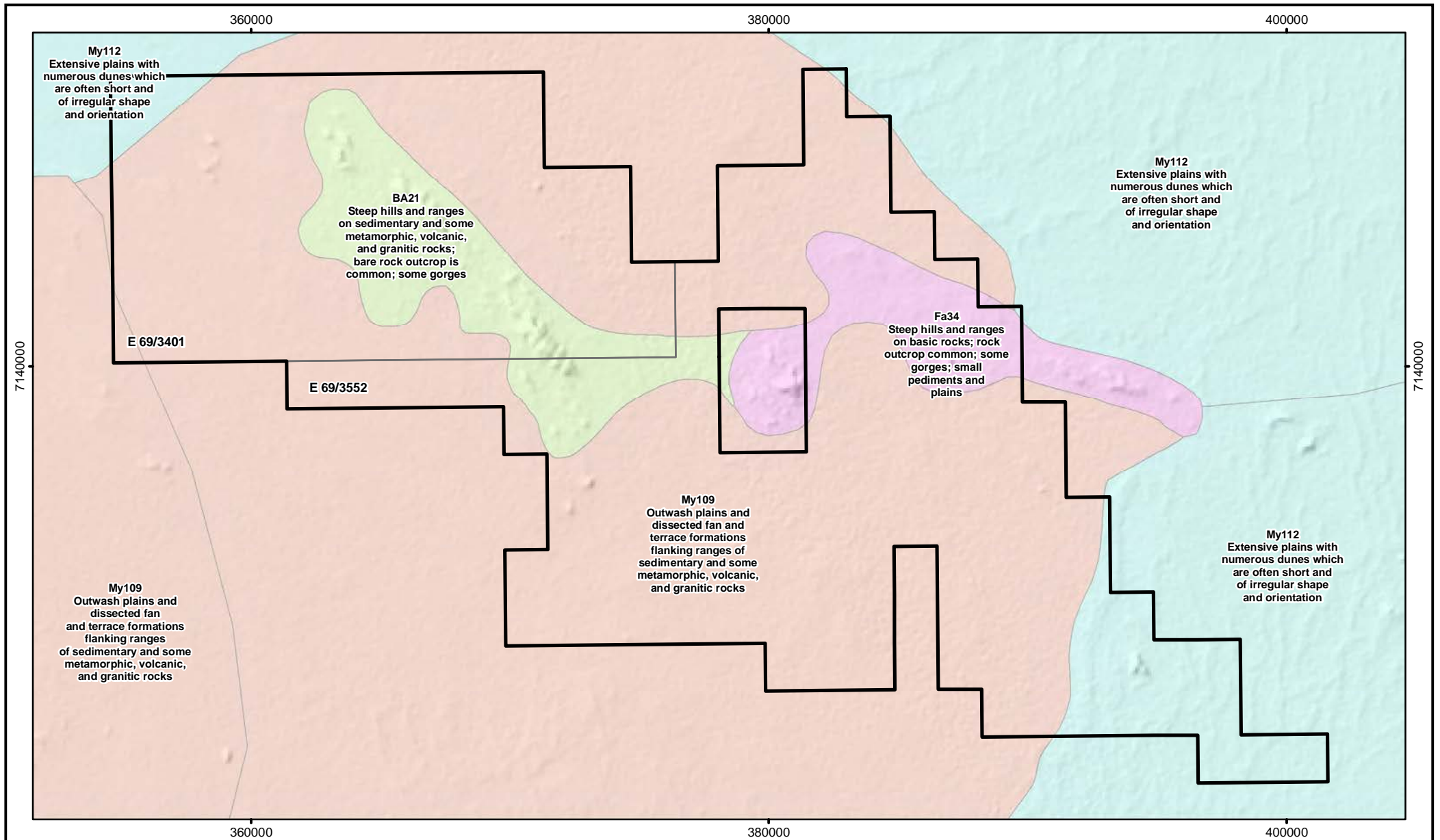
Approximately 74 % of the Study Area is located across outwash plains (My109) which flank the ranges/hills of the area. The Jameson Range lies within the BA21 atlas system, which comprises ~ 12 % of the Study Area with the hills to the east located within the Fa34 system (~ 5 %). Plains with numerous sand dunes (My112) are restricted to the north-west and south-east corners of the Study Area (~ 8 %) (Table 2, Figure 5).

**Table 2. Soil landscape systems of the Study Area (DPIRD, 2023a)**

Soil landscape system	Description	Area (ha)	% of Study Area
BA21	Steep hills and ranges on sedimentary and some metamorphic, volcanic, and granitic rocks; bare rock outcrop is common; some gorges.	7,242.72	12.2
Fa34	Steep hills and ranges on basic rocks; rock outcrop common; some gorges; small pediments and plains	3,053.17	5.2
My109	Outwash plains and dissected fan and terrace formations flanking ranges of sedimentary and some metamorphic, volcanic, and granitic rocks	44,061.87	74.4
My112	Extensive plains with numerous dunes which are often short and of irregular shape and orientation	4,842.66	8.2
	Total	59,200.42	100

**Figure 5. Soil Landscape Systems of the Study Area.**





Legend	
	Jamerson Study Area
	Julimar Jamerson Tenements
<b>Mapping Unit Name</b>	
	BA21
	Fa34
	My109
	My112

0 4km	
Scale: 1:200,000	
MGA94 (Zone 52)	
CAD Ref: a2986_F004_04	
Date: November 2023	Rev: A A4

Author: B. Jeanes	WB Ref:
Drawn: CAD Resources - www.cadresources.com.au	
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**Julimar Resources**  
**Jameson Project**  
**Soil Landscape Systems (DoAF)**

## 2.2.4. Hydrology and Hydrogeology

The Study Area is located within the northern part of the Warburton Basin hydrographic catchment. The Warburton Basin encompasses the southern Gibson Desert and northern Great Victoria Desert. Surface water flow occurs only intermittently after large rainfall events, limited by the arid environment, predominantly low relief and extensive cover of aeolian sand (Rockwater Pty Ltd, 2010). Inspection of aerial imagery indicates there are no significant creeks or water bodies within the Study Area.

The Study Area is located within the East Murchison Groundwater Area proclaimed under the *Rights in Water and Irrigation Act 1947* (DWER, 2019). Groundwater resources in the area have been broadly mapped at a total dissolved solids (TDS) content of 1,000 - 3,000 milligrams per litre (mg/L) (DWER, 2023a) which is considered brackish. The Mantamartu (Jameson) community (located within the Study Area) is supplied water from two bores located approximately 3.7 km north-north-east of the town site (DoP, 2013). Hosted within fractured rock aquifers, the bores supply water that is treated via reverse osmosis to remove naturally occurring nitrates (OZ Minerals, 2021). Approximately 11 km south of the Study Area, a hydrogeological baseline survey conducted for the WMCNP indicated groundwater is relatively shallow throughout the WMCNP area, typically ranging between depths of 3 to 8 metres below ground level (mbgl) (although elevated areas where depth to groundwater was 14 to more than 22 m were recorded). Groundwater quality for the WMCNP is typically less than 2,000 mg/L TDS and falls within the potable to slightly brackish range (CDM Smith, 2020a).

## 2.3. Biological Environment

### 2.3.1. Interim Biogeographic Regionalisation of Australia (IBRA)

The Study Area is located within the Central Ranges IBRA bioregion which surrounds the WA, NT and SA borders (46 % of bioregion in WA, 26 % in the NT and 28 % in SA) and comprises three subregions. The Study Area is situated entirely within the Mann-Musgrave Block subregion (CER01) (Figure 6).

The Mann-Musgrave Block subregion extends across WA, NT and SA, however the summary information reported here pertains to WA only:

- **Mann-Musgrave subregion (CR01)** is 4,701,519.37 ha in size and contains a high proportion of Proterozoic ranges including both volcanic and quartzites and derived soil plains, interspersed with red Quaternary sandplains with some permian exposure. Vegetation can broadly be described as;
  - low open woodlands of Desert Oak or Mulga over *Triodia basedowii* hummock grasslands on sandplains;
  - low open woodlands of Ironwood (*Acacia estrophiolata*) and Corkwoods (*Hakea* spp.) over tussock and hummock grasses fringing the ranges; and

- mixed wattle scrub or *Callitris glaucophylla* woodlands over hummock and tussock grasslands on ranges. The climate is Arid, with a mean rainfall of 200mm comprising summer and winter rain.

Dominant land uses within the bioregion include;

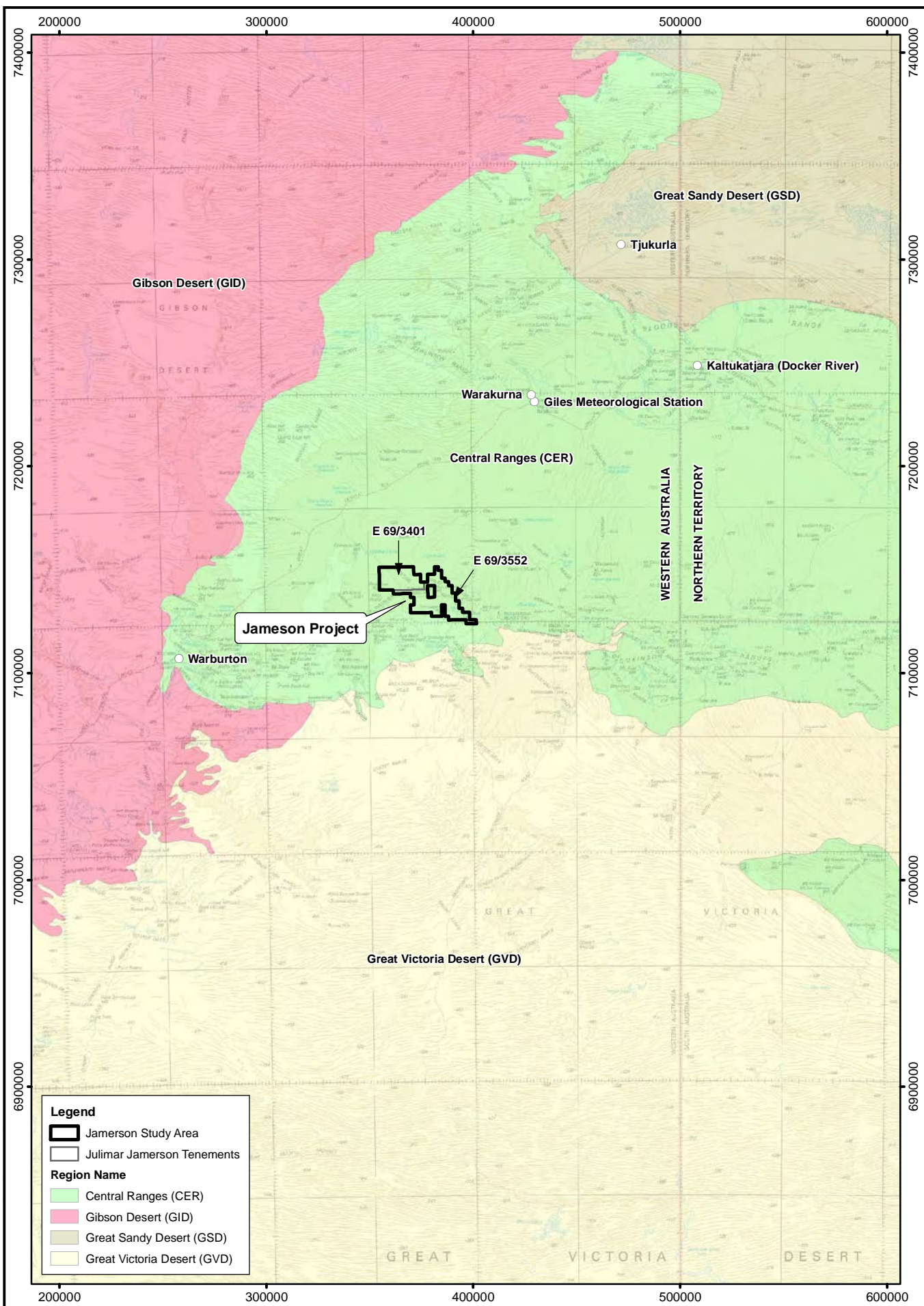
- Aboriginal Reserve (94.33% of subregion area),
- Grazing – Freehold (0.03%), Leasehold (1.36%),
- Unallocated Crown Land (UCL) and Crown Reserves (4.28%) (Graham and Cowan, 2001).

Approximately 99.97% of pre-European vegetation (see Section 2.3.2) currently remains within the Mann-Musgrave Block subregion, none of which is protected (reserved) for conservation (DBCA, 2018).

**Figure 6. Location of Study Area within IBRA**



Imagery: Geoscience Australia, Interm Biogeographic Regionalisation for Australia (IBRA), Version 7 (Subregions): Australian Government Department of the Environment



**Legend**

- Jamerson Study Area
- Julimar Jamerson Tenements

**Region Name**

- Central Ranges (CER)
- Gibson Desert (GID)
- Great Sandy Desert (GSD)
- Great Victoria Desert (GVD)

0 20 40 km

Scale: 1:2,500,000  
MGA94 (Zone 52)

CAD Ref: a2986\_F004\_02\_02  
Date: November 2023

Rev: A A4

**Western Botanical**

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**Julimar Resources**  
**Jameson Project**

**Interm Biogeographic Regionalisation for Australia (IBRA)**

### 2.3.2. Pre-European Vegetation

The pre-European vegetation mapping of WA dataset maps the original native vegetation presumed to have existed prior to European settlement. It is based predominantly on the published and unpublished mapping of J.S. Beard. The first broad-scale vegetation mapping of Western Australia was conducted by Beard in 1979 with several revisions and updates resulting in the most recent and comprehensive iteration, detailed in Beard *et al.* (2013).

J.S. Beard describes five vegetation system associations across the Study Area (Table 3, Figure 7). Statistics on the pre-European and current extent of the Beard vegetation associations of WA are used in the assessment of development applications and both conservation and land use planning. A summary of the bio-regional extent of the pre-European vegetation associations present in the Study Area, is presented in Table 3. Information has been sourced from the latest (2020) dataset (WALGA, 2020).

Approximately 78 % of the Study Area is located within the Central Ranges\_18 vegetation system association which is described as a low woodland, open low woodland or sparse woodland of Mulga (*Acacia aneura*) and associated species. The ranges and hills of the area support the Central Ranges\_39 vegetation system association which is comprised of wattle, teatree and other species (*Acacia* spp. *Melaleuca* spp) as sparse scrub to scrub (~ 12 % of Study Area). The most restricted vegetation system association is Central Ranges\_230 which has been mapped as occurring within the northern boundary (Figure 7) and is characterised by a tree steppe of Desert oak (*Allocasuarina decaisneana*) over soft spinifex (*Triodia pungens*). This association comprised < 0.5 % of the Study Area (Table 3).

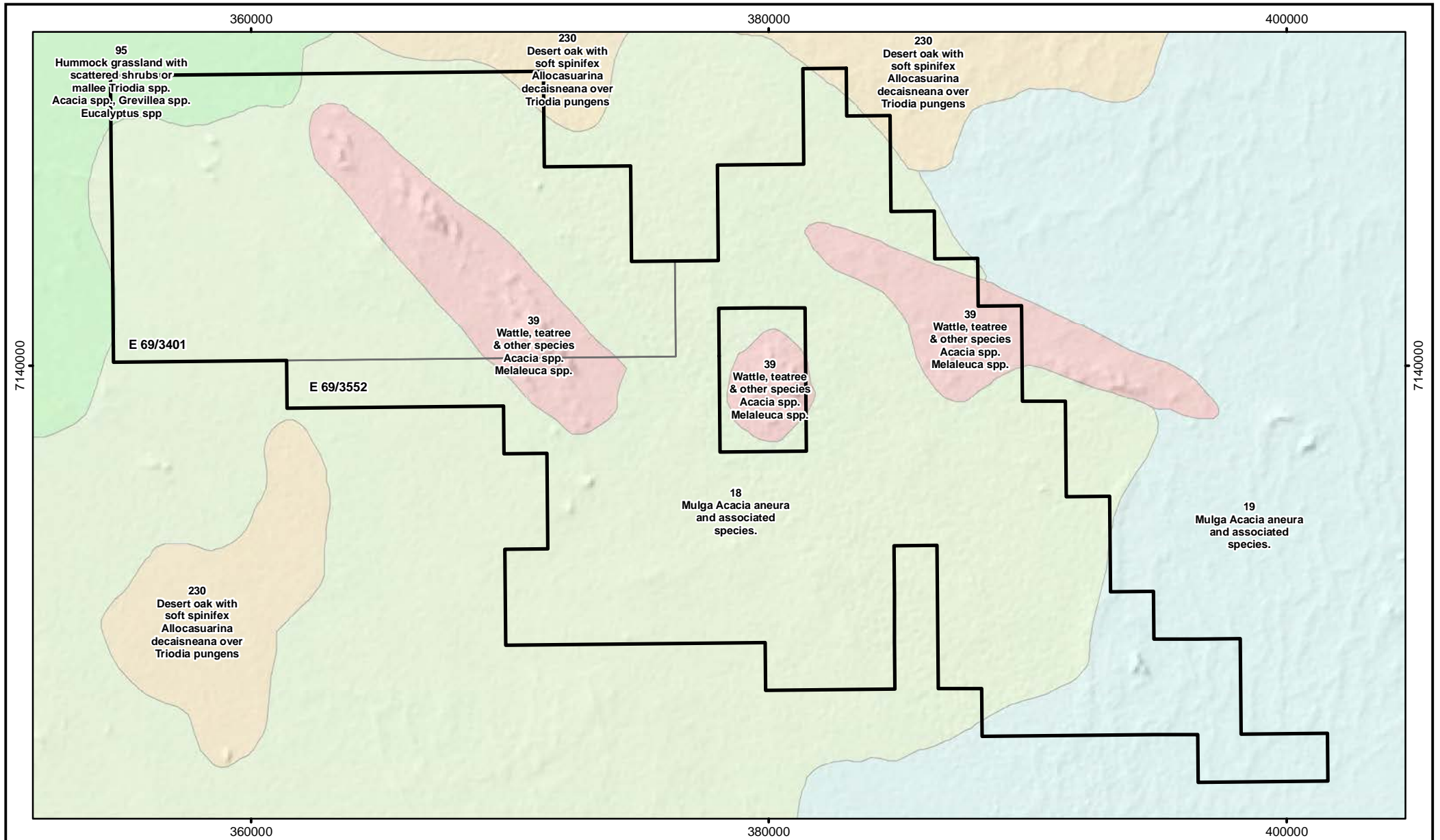
All vegetation system associations mapped across the Study Area remain intact at a bioregional level with greater than 99 % of pre-European extent remaining of each (Table 3). The Shire of Ngaanyatjarraku (in which the Study Area is located) currently has 99 % of it's pre-European vegetation extent remaining (DWER, 2023c).

**Table 3. Pre-European vegetation system associations of the Study Area (WALGA, 2020).**

Veg. System	Veg. Assoc.	SA Code	Description	Scale	Pre-European extent (ha)	Current extent (ha) and % remaining	Extent in Study Area (ha)	% within Study Area
Central Ranges	18	18	Low woodland, open low woodland or sparse woodland of Mulga ( <i>Acacia aneura</i> ) and associated species.	Central Ranges Bioregion	1,075,925.77	1,075,162.54 99.9 %	46,155.68	4.3
Central Ranges	19	19	Low woodland, open low woodland or sparse woodland of Mulga ( <i>Acacia aneura</i> ) and associated species.	Central Ranges Bioregion	902,247.67	902,171.11 100 %	4,188.62	0.5
Central Ranges	39	39	Scrub, open scrub or sparse scrub of wattle, teatree and other species ( <i>Acacia</i> spp. <i>Melaleuca</i> spp).	Central Ranges Bioregion	404,690.75	404,690.75 100 %	7,407.61	1.8
Central Ranges	95	95	Shrub-steppe. Hummock grassland with scattered shrubs or mallee <i>Triodia</i> spp. <i>Acacia</i> spp., <i>Grevillea</i> spp. <i>Eucalyptus</i> spp	Central Ranges Bioregion	47,953.38	47,953.38 100 %	1,184.92	2.5
Central Ranges	230	230	Tree steppe of Desert oak ( <i>Allocasuarina decaisneana</i> ) with soft spinifex ( <i>Triodia pungens</i> ).	Central Ranges Bioregion	1,180,953.21	1,180,953.21 100 %	263.59	<0.1
Total							59,200.42 ha	

**Figure 7. Pre-European Vegetation of the Study Area.**





Legend	
	Jamerson Study Area
	Julimar Jamerson Tenements
Vegetation Association	
	18
	19
	39
	95
	230

0 4km  
Scale: 1:200,000  
MGA94 (Zone 52)

CAD Ref: a2986\_F004\_03  
Date: November 2023

Rev: A A4

Western Botanical

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Julimar Resources  
Jameson Project  
Pre-European Vegetation (DoAF)

### 2.3.3. Groundwater Dependent Ecosystems (Terrestrial)

A Groundwater Dependent Ecosystem (GDE) is defined as an ecosystem that relies on groundwater for some or all its water requirements. The GDE Atlas is a national dataset of Australian GDEs to inform groundwater planning and management. The Atlas contains information about three types of ecosystems (aquatic, terrestrial and subterranean) (BoM, 2023b).

While much of the Study Area is located within an area in which GDE potential (of any type) has not been ascertained within a national assessment, there are sections within the Study Area mapped as having low terrestrial GDE potential. These are located within the south-east corner of tenement E69/3552 and across the Jameson Range. A section of the north-west corner of tenement E69/3401 lies within an area mapped as having moderate terrestrial GDE potential (BoM, 2023b). Located within a soil land system described as extensive plains with numerous dunes (DPIRD, 2023b), this area drains toward a salt lake/clay pan located approximately 10 km to the north-west of the Study Area boundary.

Of relevance is an assessment of potential terrestrial GDEs conducted by CDM Smith (2020b) for the WMNCP, located approximately 11 km south of the Study Area on the boundary of the Central Ranges (CER01) and Great Victoria Desert (GVD02) IBRA regions. Utilising the vegetation descriptions and mapping completed by Western Botanical (2020), one vegetation association (*Eucalyptus duttonii* Shrubland) was identified as being a probable obligate GDE (access to groundwater defines the ecosystem's presence in the landscape). In addition, seven vegetation associations were classified as being probable facultative GDEs (the ecosystem utilises groundwater when available but will persist without). These association included:

- Calcrete *Corymbia opaca* Woodland;
- Calcrete Platform Hummock Grassland *Acacia eremophila* variant;
- Calcrete Platform Hummock Grassland *Melaleuca eleuterostachya* variant;
- Complex of Low Mallee Woodland and *Melaleuca. glomerata, Acacia kempeana* Shrubland;
- Complex of *M. glomerata A. kempeana* Shrubland and Hard pan Mulga Woodland;
- Complex of Sand plains with Wattles other than Mulga over Spinifex and Calcrete Platform Hummock Grassland; and
- Complex of *A. kempeana* Shrubland and Hard pan Mulga Woodland (Western Botanical, 2020).

### 2.3.4. Significant Wetlands

There are no wetlands of international (Ramsar) significance within 100 km of the Study Area. The nearest is Lake Gregory, which is proposed for inclusion as a Ramsar wetland, and is situated approximately 610 km to the north (DBCA, 2023a). The nearest significant wetlands, as listed under the Directory of Important Wetlands in Australia (DIWA) (DBCA, 2023b) are the Gibson

Desert Gnamma Holes, located approximately 170 km west-north-west of the Study Area (northern end) and Yeo Lake-Lake Throssell situated approximately 356 km west-south-west of the southern end of the Study Area.

### 2.3.5. Environmentally Sensitive Areas

Environmentally sensitive areas (ESAs) are classes or areas of native vegetation where the exemptions for clearing vegetation under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 (Clearing Regulations) do not apply. They include the following:

- a declared World Heritage property as defined in sections 13 of the *Environment Protection and Biodiversity Conservation Act 1999* of the Commonwealth;
- an area that is included on the Register of the National Estate, because of its natural heritage value, under the *Australian Heritage Council Act 2003* of the Commonwealth;
- a defined wetland and the area within 50 m of the wetland;
- the area covered by vegetation within 50 m of rare flora, to the extent to which the vegetation is continuous with the vegetation in which the rare flora is located;
- the area covered by a threatened ecological community;
- a Bush Forever site listed in “Bush Forever” Volumes 1 and 2 (2000), published by the Western Australia Planning Commission, except to the extent to which the site is approved to be developed by the Western Australia Planning Commission, as described in subclause (3);
- the areas covered by the following policies —
  - (i) the Environmental Protection (Gnangara Mound Crown Land) Policy 1992;
  - (ii) the Environmental Protection (Western Swamp Tortoise) Policy 2002;
- the areas covered by the lakes to which the Environmental Protection (Swan Coastal Plain Lakes) Policy 1992 applies;
  - (i) protected wetlands as defined in the Environmental Protection (South West Agricultural Zone Wetlands) Policy 1998;
  - (j) areas of fringing native vegetation in the policy area as defined in the Environmental Protection (Swan and Canning Rivers) Policy 1998.

The Study Area is located within an ESA (DWER, 2023b) (Figure 8) as the region, known as the Ranges of the Western Desert, is listed on the Register of the National Estate. Registered in 1978, the area was recognised as having Indigenous values of National Estate significance and is approximately 8,016,568 ha in size (Laverton - Warburton Road, extending from 25 km east of Warburton to the Northern Territory and South Australian Borders, 8 km west of Kaltukatjara NT) (DCCEEW, 2023). Other ESAs within the region include;

- Gibson Desert Nature Reserve (now referred to as Pila Nature Reserve), located 128 km north-west of the Study Area and listed on the Register of the National Estate for being an area typical of the Gibson Desert;

- Baker Lake Area: located 145 km west of the Study Area (and 30 km south of Warburton). Registered on the National Estate for having Indigenous values of National Estate significance, contains fossils in sediments and diverse flora.
- Neale Junction Nature Reserve; located 258 km to the south-west and listed on the Register of the National Estate for being Representative of the area between Great Victoria Desert Wildlife Sanctuary and Queen Victoria Spring Reserve. Serves as an important corridor for movement of animals and plants between wetter parts of western and eastern Australia.
- Great Victoria Desert Nature Reserve; located 337 km south of the Study Area and listed on the Register of the National Estate for containing rich and extremely varied vegetation and providing a connecting corridor for the faunas of eastern and western Australia (DCCEEW, 2023).

### 2.3.6. Conservation Reserves in the Region

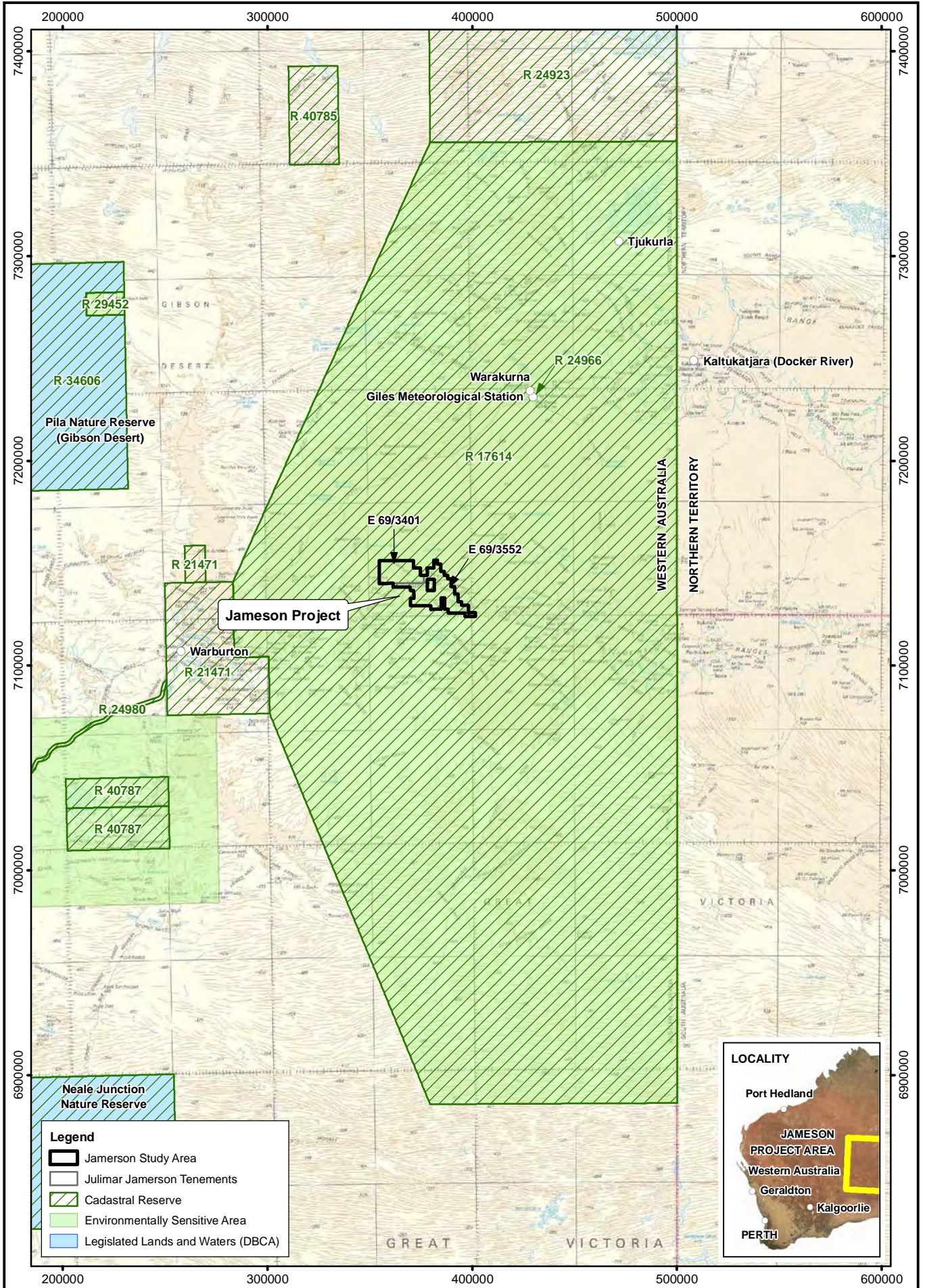
There are seven conservation reserves or parks within approximately 450 km of the Study Area (Table 4). This includes five nature reserves within WA (DBCA Legislated Lands), the nearest of which is Pila (Gibson Desert) Nature Reserve, located approximately 128 km to the north-west of the Study Area (DBCA, 2023c) (Figure 8). Within SA, the Mamungari Conservation Park is located approximately 253 km from the Study Area (DEW, 2023) while the NT Uluru-Kata Tjuta National Park is situated 273 km north-east of the Study Area (DEPWS, 2023a).

**Table 4. Conservation areas within the vicinity of the Study Area (DBCA, 2023c; DEW, 2023; DEPWS, 2023a).**

Name	ID No.	Type	~Distance from Study Area
<b>Western Australia</b>			
Pila Nature Reserve (Gibson Desert)	34606	A Class Nature Reserve	128 km NW
Neale Junction Nature Reserve	34720	A Class Nature Reserve	258 km SW
Great Victoria Desert Nature Reserve	30490	A Class Nature Reserve	337 km S
Yeo Lake Nature Reserve	36271	A Class Nature Reserve	360 km SW
Plum Lakes Nature Reserve	25801	A Class Nature Reserve	440 km SW
<b>South Australia</b>			
Mamungari Conservation Park	CP 49	Conservation Park	253 km SE
<b>Northern Territory</b>			
Uluru-Kata Tjuta National Park		National Park Commonwealth	273 km NE

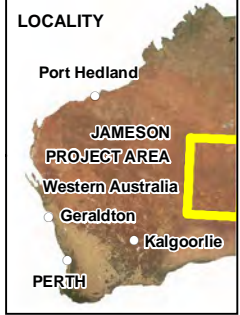


**Figure 8. Environmentally Sensitive Areas and Conservation Reserves of the Region**



**Legend**

- Jamerson Study Area
- Julimar Jamerson Tenements
- Cadastral Reserve
- Environmentally Sensitive Area
- Legislated Lands and Waters (DBCA)



Imagery: Geoscience Australia

0 20 40 km  
 Scale: 1:2,500,000  
 MGA94 (Zone 52)

Date: November 2023 Rev: A A4

Author: B. Jeanes WB Ref:  
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**Julimar Resources  
 Jameson Project  
 Reserves and Environmentally Sensitive Areas**



### 3. Methods

#### 3.1. Desktop Assessment

##### 3.1.1. Literature Review

A review of available literature relevant to the Study Area was undertaken, utilising (but not limited to) the Index of Biodiversity Surveys for Assessment search portal. Of the 16 reports reviewed, the majority (13) pertained to the Wingellina Nickel Cobalt Project (WNCP) (previously referred to as the Wingellina Nickel Project), located approximately 90 km east of the Study Area. Also included were the reported results of botanical survey work conducted between 2014 – 2019 for the West Musgrave Copper and Nickel Project (WMCNP) which is currently in construction and located approximately 11 km south of the Study Area.

##### 3.1.2. Database Searches

Database searches were conducted to identify potential Threatened and Priority Flora species, Threatened Ecological Communities (TECs), Priority Ecological Communities (PECs), or other areas of conservation significance that may be encountered during field surveys (Table 5). The DBCA Framework for Conservation Significant Flora; and the Definitions of TECs and PECs are presented in Appendix 1 and Appendix 2.

Subsequent to the database searches, a desktop assessment of the likelihood of each Threatened and Priority flora species occurring within the Study Area was performed by considering (a) the proximity of known Conservation Significant flora and communities to the Study Area; and (b) the similarities between supporting habitats for each species and those of the Study Area.

A search of DPIRD's Western Australian Organism List (WAOL) for the Shire of Ngaanyatjarraku was completed to identify plant species declared under the *Biosecurity and Agriculture Management Act 2007* (BAM Act) that are known to occur in WA, for the local government area.

**Table 5. Details of database searches conducted.**

Provider	Reference	Database	Search parameters
<b>Western Australia</b>			
Department of Biodiversity, Conservation and Attractions (DBCA)	DBCA, (2023d) (Ref: 60-1023FL)	Threatened and Priority Flora database	100 km radius of Study Area polygon.
	DBCA (2023e) (Ref: 60-1023FL)	Western Australian Herbarium Specimen database	
	DBCA (2023f)	Threatened and Priority Ecological Communities database	100 km radius of Study Area polygon.

<b>Provider</b>	<b>Reference</b>	<b>Database</b>	<b>Search parameters</b>
Department of Agriculture, Water and the Environment (DAWE)	DAWE (2023a)	Protected Matters Search Tool (PMST)	50 km radius of Study Area polygon
Department of Primary Industries and Regional Development (DPIRD)	DPIRD (2023c)	Western Australian Organism List	Shire of Ngaanyatjarraku



## 4. Results

### 4.1. Literature Review

A summary of the key findings, in relation to flora and vegetation, of the 16 reports identified from the literature review are presented in Table 6. A single report pertained to botanical survey work conducted within the Study Area; an assessment of proposed roadworks disturbance areas in the Shire of Ngaanyatjarraku. Multiple locations were surveyed across an area ~ 215 km in width, only one of which was located within the Study Area (a section of the Jameson Wanarn (Cutline) Road, ~15 km in length and 79 ha in size). No significant flora was identified at this location however two Priority *Goodenia* species were recorded in the broader survey area. A total of 178 flora taxa representing 33 families and 92 genera were identified. Included were four weed species, none of which were WoNS or Declared Plants. Nine vegetation types were described, all of which were considered well represented in adjacent areas (GHD, 2021).

Of most relevance to the Study Area is the work associated with the WMCNP due to this project's proximity and the extensive level of botanical survey conducted. At its nearest point (the northern access road corridor), the WMCNP surveyed area is located less than 1 km from the Study Area and covers 41, 519 ha in total. From survey work conducted between 2014 – 2019, a total of 390 native flora taxa from 166 genera and 50 families have been identified within the WMCNP area. The majority of species were considered widespread and well represented in the broader region. Eight weed species were recorded, none of which were WoNS or Declared Plants. Eleven Priority flora species were located (two P1 species and nine P3), as discussed further in Section 4.1.1.

The majority of vegetation assessed across the WMCNP was in Excellent to Pristine condition with a total of 29 vegetation associations delineated. The potential for some associations to be terrestrial GDE's is discussed in Section 2.3.3. Of the 29 vegetation associations, most were regionally widespread although it was recognised that no detailed regional-scale vegetation mapping is currently available to confirm this assessment (Western Botanical, 2020).

The paucity of botanical survey within the broader region is evident in the number of range extensions identified within the WMCNP. A total of 57 significant range extensions (100 km - 800 km) were recorded, although when AVH records were considered in conjunction with the DBCA's Florabase database, this was reduced to 32 species (Western Botanical, 2020). Similarly, the identification of species that require further taxonomic and conservation review is common in areas with limited botanical survey. There have been 11 species recorded within the WMCNP survey area that either appear to represent new species (two *Eragrostis* species and a *Sida* species) or are poorly known and represent new subspecies (eight species). All require taxonomic review and have the potential to acquire Priority Flora status (Western Botanical, 2020).

Between 2002 and 2018, various levels of botanical survey have been conducted across the four tenements (and road and pipeline alignments) associated with the Wingellina Nickel Cobalt Project (WNCP) (Table 6). Located approximately 90 km east of the Study Area, 13 reports

pertaining to this project were reviewed. Survey work completed up to 2011 was included in the project's Public Environmental Review (Hinckley Range Pty Ltd, 2015) and centred on tenements E69/535 (mine area) and L69/12, the site of the proposed Central Officer Basin borefield and pipeline route. Additional survey of the Lewis Calcrete tenement (E69/3065) and Cobb Depression (Embayment) borefield (L69/19) and pipeline route were undertaken in 2013 and 2018 (Table 6).

There is no available summary of the total flora, as surveyed across all areas associated with the WNCP (between 2002 – 2018). Considering changes to taxonomic and conservation status review that have occurred since the original field work was conducted across the WNCP, a total of eight Priority flora species have been recorded within the project area. Botanical survey completed up to 2013 identified 31 range extensions (>100 km) (MWH, 2015). Consolidation of the mapped vegetation communities recorded from the WNCP was undertaken by MWH in 2015 (as an addendum to the PER) to determine local and regional representation. Multivariate statistical analysis of floristic data identified 11 floristic super groups which were differentiated by landforms, soils and dominant taxa present. The extent of each floristic super group within the project area was not calculated due to limitations with the data and aerial imagery interpretation. Limitations included variable fire history, existing mapped mosaic vegetation communities, the collection of relevé data and variable disturbance from herbivorous grazers and anthropogenic causes (MWH, 2015).

Comparison of the mapped vegetation communities across the WNCP was made with the 11 floristic super groups, Beard's broad-scale vegetation mapping (pre-European vegetation) and Soil Landscape Systems to assess their regional representation. The mapped vegetation communities were considered to be widespread in the Central Ranges and Great Victoria Desert bioregions (MWH, 2015). It was noted during the consolidation of existing vegetation communities for the PER that while the majority of botanical surveys were undertaken following above average rainfall, the timing of the surveys (i.e. distributed over a period of several years) and methodologies utilised were variable; inevitably resulting in a degree of variation in the floristic data collected (MWH, 2015).

**Table 6. Summary of available reports relevant to the Study Area.**

Study details and reference	Survey type	Summary of results	Significant findings	~Distance from Study Area
Warburton Flora and Vegetation Survey.  Report prepared for Shire of Ngaanyatjaraku by GHD Pty Ltd, May 2021 (GHD, 2021)	Detailed survey of; -Warburton Road Bypass; ~15 km, 75.4 ha. -Jameson Wanarn (Cutline) Road; ~15 km, 79 ha. -Blackstone Alignment (Papulankujta Road); 1 km, 1.8 ha. -8 gravel pits (103.6 ha in total). 31 quadrats and three relevés assessed. Field survey conducted March 2021	178 flora taxa representing 33 families and 92 genera. One Threatened and two Priority flora species located in survey area. Four weed species (no WoNS or Declared Plants); * <i>Cenchrus ciliaris</i> , * <i>Bidens bipinnata</i> , * <i>Malvastrum americanum</i> and * <i>Rumex vesicarius</i> . Nine vegetation types identified. Broadly described as Mulga ( <i>Acacia</i> spp.) woodlands, <i>Triodia</i> hummock grasslands and <i>Aristida</i> tussock grasslands. Vegetation condition ranged from Good to Excellent. No TEC or PEC present.	Flora of conservation significance located within survey area: <i>o Seringia exastia</i> <sup>1</sup> (Threatened under the BC Act and Critically Endangered under the EPBC Act), was a common plant with more than 300 individuals recorded from 33 locations. <i>o Goodenia virgata</i> (P2). Previously no known records from Mann-Musgrave Block IBRA subregion. Recorded within Warburton Road bypass area and one gravel pit. <i>o Goodenia gibbosa</i> (P3). One individual located from the 'Near Tjulan' proposed gravel pit.	Within Study Area: section of Jameson Wanam (Cutline) Road; a section of Blackstone alignment (Papulankujta Road) located ~ 0.4 km N of Study Area also surveyed.
West Musgrave Project Pre-feasibility Study - Assessment of potential GDEs in the West Musgrave Project area.	Assessment of the potential for aquatic and terrestrial GDEs within the Project area. Based on various desktop assessments, literature		One vegetation association ( <i>Eucalyptus duttoni</i> Shrubland) was identified as being a probable obligate GDE and seven vegetation associations were classified as being probable facultative GDEs. These association included: Calcrete <i>Coymbia</i>	Area surveyed by Western Botanical along access road from

<sup>1</sup> It is noted in GHD (2021) that due to taxonomic review of several *Seringia* taxa by Binks et al (2020), *Seringia exastia* was likely to be delisted as a Threatened flora species (under the BC Act) as it has been concluded that *S. exastia* and *S. elliptica* are the same species. *Seringia exastia* is known to be widespread throughout the Kimberley, Pilbara and central WA regions and extends into the NT and SA. While this species is no longer listed as Threatened under the BC Act, its status as Critically Endangered currently remains unchanged under the EPBC Act however it did not appear in the PMST search conducted for this desktop assessment (Appendix 3).

Study details and reference	Survey type	Summary of results	Significant findings	~Distance from Study Area
Report prepared for Oz Minerals Exploration Pty Ltd (and included in West Musgrave Copper and Nickel Project EPA Section 38 Referral Supporting Document) by CDM Smith, March 2020. (CDM Smith, 2020b)	review and results of prior botanical survey work (conducted by Western Botanical) across the Project area.		<i>opaca</i> Woodland, Calcrete Platform Hummock Grassland <i>Acacia eremophila</i> variant, Calcrete Platform Hummock Grassland <i>Melaluca eleuterostachya</i> variant, Complex of Low Mallee Woodland and <i>Melaluca. glomerata</i> , <i>Acacia kempeana</i> Shrubland, Complex of <i>M. glomerata</i> <i>A. kempeana</i> Shrubland and Hard pan Mulga Woodland, Complex of Sand plains with Wattles other than Mulga over Spinifex and Calcrete Platform Hummock Grassland, Complex of <i>A. kempeana</i> Shrubland and Hard pan Mulga Woodland.	Blackstone-Warburton Road (near Mantamaru) to WMCNP is located immediately adjacent the Study Area.
Detailed Flora and Vegetation Survey, West Musgraves Copper and Nickel Project.  Report prepared for Oz Minerals Limited by Western Botanical, March 2020. (Western Botanical, 2020)	Report includes results of detailed survey work conducted from 2014 – 2015 and 2018 – 2019.  Total survey area was 45,519 ha consisting of ten major components. Total of 99 quadrats and 90 relevés assessed.	390 native flora species from 166 genera and 50 families.  11 Priority Flora species recorded (two P1 species and nine P3). No Threatened flora located.  Eight weed species recorded (no WoNS or Declared Plants), two species of which are highly invasive; * <i>Cenchrus ciliaris</i> and * <i>Rumex vesicarius</i>  29 vegetation associations identified. Majority of vegetation in Excellent to Pristine condition. No PEC or TEC within or near the survey area.	Priority species recorded; <i>Aenictophyton anomalum</i> P1, <i>Indigofera warburtonensis</i> P1, <i>Acacia eremophila</i> var. numerous-nerved variant (A.S. George 11924) P3, <i>Amaranthus centralis</i> P3, <i>Aristida jerichoensis</i> var. <i>subspinulifera</i> P3, <i>Chrysocephalum apiculatum</i> subsp. <i>ramosum</i> P3, <i>Eragrostis</i> sp. Erect spikelets (P.K. Latz 2122) P3, <i>Eragrostis</i> sp. Limestone (P.K. Latz 5921) P3, <i>Goodenia asteriscus</i> P3, <i>Stackhousia clementii</i> P3, <i>Tephrosia</i> sp. Central (P.K. Latz 17037) P3. 57 species recorded that represent range extensions of 100 km to 800km within W.A. and / or Australia.  11 species had taxonomic significance worthy of taxonomic and conservation	Surveyed access road from Blackstone-Warburton Road (near Mantamaru) to WMCNP is located immediately adjacent the Study Area.



Study details and reference	Survey type	Summary of results	Significant findings	~Distance from Study Area
			review; two <i>Eragrostis</i> and a <i>Sida</i> that appeared to represent new species; and eight species that were poorly known and represent new subspecies.	
<p>Wingellina Project – Lewis Calcrete Tenement: Targeted Flora and Fauna Survey.</p> <p>Report prepared for Hinckley Range Pty Ltd by Stantec, October 2018. (Stantec, 2018)</p>	<p>Targeted flora and fauna survey for species of conservation significance within an area defined by a proposed drilling grid-line access tracks, buffered by 50 metres (within E69/3065). Field survey conducted in September 2018.</p>	<p>No flora or vegetation of conservation significance was recorded within the survey area.</p>	<p>A total of 41 flora species of conservation significance were identified by the database searches and literature review as potentially occurring within the survey area (15 P1 species, six P2, 19 P3 and one P4). Post – field survey, only four of these species were assessed as having the potential to occur, all of which were herbaceous and ephemeral. Due to much of the survey area having been burnt in 2017 and the sub-optimal seasonal conditions at the time of survey, these species may not have been observable at the time if they were present.</p>	<p>79 km E</p>
<p>Wingellina Nickel Project Public Environmental Review.</p> <p>Report prepared for Hinckley Range Pty Ltd by Equinox Environmental and SNC Lavalin, September 2015. (Hinckley Range Pty Ltd, 2015)</p>	<p>Public Environmental Review (PER) that includes a summary of botanical work conducted for the project prior to document submission.</p>	<p>Flora and vegetation summarised as:</p> <p><u>Mine area (E69/535):</u> 323 flora taxa from 45 families and 130 genera. Eight introduced species, no WoNS or Declared Plants. 13 vegetation communities, condition from Good to Pristine. No TEC or PEC.</p> <p><u>Central Officer Basin borefield (L69/12)</u> Six vegetation communities, condition Excellent to Pristine. No TEC or PEC. 163 flora taxa from 32 families and 87 genera.</p>	<p><u>Mine area (E69/535):</u> Four Priority species: <i>Calotis latiuscula</i> (P3); <i>Euphorbia inappendiculata</i> (P 1/2); <i>Goodenia lunata</i> (P1); and <i>Menkea lutea</i> (P1). Range extensions for 32 taxa recorded. One locally significant vegetation community: Sparse tall shrublands of <i>Hakea lorea</i> on hill tops and ridgeline.</p> <p><u>Central Officer Basin borefield (L69/12)</u> Five Priority species recorded within the borefield area and access track survey area: <i>Neurachne lanigera</i> (P1); <i>Aristida</i></p>	<p>72 km E (nearest survey area)</p>

Study details and reference	Survey type	Summary of results	Significant findings	~Distance from Study Area
		<p><u>Central Officer Basin Pipeline:</u> Ten vegetation communities, vegetation condition Excellent to Pristine. No TEC or PEC. 180 taxa from 35 families and 102 genera.</p> <p>Four introduced species located during borefield/pipeline surveys, no WoNS or Declared Plants.</p>	<p><i>jerichoensis</i> var. <i>subspinulifera</i> (P1); <i>Calotis latiuscula</i> (P3); <i>Goodenia modesta</i> (P3); and <i>Stackhousia clementii</i> (P3).</p> <p><u>Central Officer Basin Pipeline:</u> Four Priority species recorded along the pipeline route: <i>Aristida jerichoensis</i> var. <i>subspinulifera</i> (P1); <i>Calotis latiuscula</i> (P3); <i>Goodenia modesta</i> (P3); and <i>Stackhousia clementii</i> (P3). New undescribed species recorded: <i>Goodenia</i> sp. affin. <i>quasilibera</i> (L. Ransom 868), seven populations located, confined to calcrete areas. This species has since been identified as the P3 species <i>Goodenia asteriscus</i>.</p> <p>Disjunct populations of <i>Acacia acanthoclada</i> and <i>Thryptomene longifolia</i> recorded (borefield/pipeline).</p>	
<p>Wingellina Nickel Project Flora and Vegetation Addendum.</p> <p>Report prepared for Metals X Limited by MWH, August 2015. (MWH, 2015).</p>	<p>Report prepared as an addendum to the PER to consolidate the existing vegetation communities recorded from the Project area and surrounding areas to determine local and regional representation. A critical review of the list of taxa recorded in Project</p>	<p>Of the 25 conservation significant flora taxa identified by the desktop assessment, eight are known to occur within the Project area, two are considered likely to occur and four are considered to possibly occur. The remaining taxa were considered unlikely to occur.</p> <p>The completed vegetation and flora surveys of the Project area (conducted from 2011 – 2013) identify a total of 38 taxa considered to represent a range extension of greater than 100</p>	<p>The vegetation community considered to be at most risk from Project related disturbance was Community 2a (Open Mid Mallee Woodland of <i>Eucalyptus socialis</i> and/or <i>E. gypsophila</i>) recorded from the proposed mining area. Based on land system mapping and Beard's (1974) broad-scale vegetation mapping, the community or a close variation of the community, was considered to be well represented in the immediate surrounds of the Project area. Therefore, the significance</p>	<p>72 km E (nearest survey area)</p>

Study details and reference	Survey type	Summary of results	Significant findings	~Distance from Study Area
	area surveys to identify range extensions and determine the significance of these also undertaken.	km. These taxa were reviewed and subject to a range extension significance test to determine the significance of the range extensions. Of the 38 taxa, eight are considered to be high significance, 13 are considered to be medium significance, nine are considered to be low significance, one is considered to be very low significance and seven are not considered to represent a range extension. The vegetation communities described and delineated from the proposed mining, borefield and pipeline areas were considered to be widespread in the Central Ranges and Great Victoria Desert bioregions.	of this impact was considered to be low. The impact on the remaining vegetation communities described from the Project area was considered to be low to negligible. These communities were considered to be regionally widespread.	
Wingellina Nickel Project: Calcrete Tenement E69/3065 Targeted Flora Survey.  Report prepared for Metals X Limited by Outback Ecology Services, February 2014. (OES, 2014)	Targeted flora survey of an area containing a proposed drill line track, and 90 drill pads within E69/3065. Conducted in December 2013.	No flora or vegetation of conservation significance recorded within the survey area.	Post-field survey, the majority of Priority flora species identified by the desktop assessment (OES, 2013b) were considered unlikely to occur within the survey area. However, as the survey was conducted outside the optimal survey period for the region, the two annual/ephemeral species; <i>Menkea lutea</i> (P1) and <i>Vittadinia pustulata</i> (P2), would not have been observable, if present in the area.	79 km E
Wingellina Nickel Project: Level 1 Flora and Vegetation Survey of the Cobb Depression Borefield and Pipeline Route.	Desktop study and Reconnaissance survey of area overlying L69/19 and the Giles-Mulga Park Road. 53 relevés assessed.	126 flora species (including subspecies and variants) from 30 families and 69 genera. Three introduced species recorded: <i>*Cenchrus ciliaris</i> , <i>*Citrullus colocynthis</i> , <i>*Portulaca oleracea</i> .	Three vegetation associations were considered locally significant in the context of the survey area; - AdLOW; the only Woodland unit dominated by <i>Allocasuarina decaisneana</i>	72 km E

Study details and reference	Survey type	Summary of results	Significant findings	~Distance from Study Area
Draft report prepared for Metals X Limited by Outback Ecology Services, May 2013. (OES, 2013a)	Field survey conducted March 2013 (below average rainfall – 3 month).	No Threatened flora located. One Priority species present: <i>Calotis latiuscula</i> (P3) Eight broad vegetation associations identified. Vegetation condition ranged from Very Good to Excellent.	<p>- ATOS/AhEhTG; scattered <i>Acacia</i> shrubland over Tussock Grassland appears to be restricted to the loamy outwash plains surrounding Mount Fanny.</p> <p>- TsHG; the only portion of the survey area where an almost pure <i>Triodia</i> hummock grassland occurs that is not in association with sand dunes and other shrublands</p> <p>Mulga vegetation within the survey area was considered to be regionally significant due to its role as a resource (water, nutrients) hot spot within arid landscapes.</p> <p>Level 2 (Detailed) flora and vegetation survey recommended.</p>	
Wingellina Nickel Project: Vegetation, Flora, and Fauna Desktop Assessment of Tenement E69/3065.  Report prepared for Metals X Limited by Outback Ecology Services, August 2013. (OES, 2013b)	Desktop assessment of flora and vegetation of E69/3065	33 Priority flora species were identified by the database searches and literature review, 17 were considered to have potential to occur in the tenement.  Eleven introduced flora species identified as having the potential to occur within the tenement, two of which were classified as a significant Environmental Weed; Ruby Dock ( <i>*Rumex vesicarius</i> ) and Buffel Grass ( <i>*Cenchrus ciliaris</i> ).		79 km E
Wingellina Nickel Project: Level 1 Flora and Vegetation Assessment of the Wingellina Borefield.	Desktop study of flora and vegetation and a Targeted flora survey of a proposed drill line, 11 drill pads and	One individual of <i>Stackhousia clementii</i> (P3) was located within the survey area.  <i>Neurachne lanigera</i> (P1) which was previously found along the Tjuntjuntjarra Track during the	One individual of <i>Stackhousia clementii</i> (P3) located.	77 km SSE



Study details and reference	Survey type	Summary of results	Significant findings	~Distance from Study Area
Report prepared for Metals X Limited by Outback Ecology Services, April 2012. (OES, 2012)	associated access track within the (then proposed) Wingellina borefield (within L69/12). Conducted October 2011 (above average rainfall – 12 month).	May 2011 survey was not found on or within 10m of the proposed drill pads, drill line or access road. Five vegetation communities identified (all previously described by OES (2011b)). Vegetation was weed-free and in Pristine condition.	Five populations (totalling 98 plants) of <i>Goodenia</i> sp. affin. <i>quasilibera</i> (L. Ransom 868) <sup>2</sup> (now <i>Goodenia asteriscus</i> P3) were found within 10 m of the proposed drill pad access road. This species was treated at the time as a Priority species since it was unknown outside of the Wingellina Borefield Tenement (L69/12) and had not been subject to comprehensive searches.	
Wingellina Nickel Project: Proposed Borefield Drill Line Targeted Flora Assessment.  Report prepared for Metals X Limited by Outback Ecology Services, November 2011. (OES, 2011a)	Targeted survey conducted in October 2011.		Five populations (98 plants) of <i>Goodenia</i> sp. affin. <i>quasilibera</i> (L. Ransom 868) (now <i>Goodenia asteriscus</i> , P3) were located.  <i>Neurachne lanigera</i> (P1) which was previously found along the Tjuntjuntjarra Track during the May 2011 survey was not found within the area surveyed.	77 km SSE
Wingellina Nickel Project: Level 1 Flora and Vegetation Assessment of the Wingellina Borefield. Preliminary Results	Desktop review and targeted survey of roadside flora and vegetation of the Tjuntjuntjarra Track through L69/12. Total survey area was 171 ha. Twelve quadrats assessed.	163 taxa representing 32 families and 87 genera. Two introduced species recorded: * <i>Cenchrus ciliaris</i> (Buffel Grass) and * <i>Tribulus terrestris</i> (Caltrop), both occurred at a low frequency. Six vegetation communities identified. Vegetation generally in Excellent to Pristine condition. No TEC or PEC present.	Four significant species found in the survey area: • <i>Neurachne lanigera</i> - Listed as P1 in WA and Rare in SA. Occurred as highly localised populations in the survey area • <i>Goodenia</i> sp. affin. <i>quasilibera</i> (L. Ransom 868), a new undescribed species at	77 km SSE

<sup>2</sup> This species has since undergone taxonomic review and is now known as *Goodenia asteriscus* (Lang and Davies, 2017) a Priority 3 species. Specimens from four locations within the Ngaanyatjaraku Local Government Area are held at the WA Herbarium (WAH, 2018-). This species also occurs within north-eastern SA (AVH, 2023).

Study details and reference	Survey type	Summary of results	Significant findings	~Distance from Study Area
Report prepared for Metals X Limited by Outback Ecology Services, July 2011. (OES, 2011b)	Field survey conducted in May 2011 (above average rainfall – 3 month).	Mulga communities in the Study Area were floristically diverse with species composition varying significantly over distance in response to subtle changes in soil texture. Definition of these Mulga communities was beyond the resources and requirements of the survey.	the time, now known as <i>Goodenia asteriscus</i> (P3). • <i>Acacia acanthoclada</i> (Harrow Wattle), a disjunct population 500 km from the main distribution of the species in WA and SA. • <i>Thryptomene longifolia</i> - relictual disjunct population 400 km from the main distribution of the species in SA.	
Level 2 Flora and Vegetation Assessment of the Wingellina Mine.  Report prepared for Metals X Limited by Outback Ecology Services, June 2011. (OES, 2011c)	Detailed survey of E69/535 conducted in October 2010 (after above average rainfall – 3 month) combined with results of April 2008 (below average rainfall – 3 month) survey. 33 quadrats and 44 relevés assessed.	358 taxa from 46 families and 131 genera. Eight introduced species located, none of which were Declared Plants. * <i>Cenchrus ciliaris</i> (Buffel grass) present throughout the north-eastern sections of the survey area. No Threatened flora present. Four Priority flora species located. 14 vegetation communities from 11 broad floristic formations identified. Vegetation generally in Excellent condition. No TEC or PEC present.	Four Priority taxa recorded during the October 2010 survey: <i>Menkea lutea</i> (P1), <i>Goodenia lunata</i> (P1), <i>Euphorbia inappendiculata</i> (P3) and <i>Calotis latiuscula</i> (P3). Large numbers of <i>Menkea lutea</i> recorded in the Mitchell Grass dominated southern sections of the survey area. Single individuals of <i>Euphorbia inappendiculata</i> , <i>Goodenia lunata</i> and <i>Calotis latiuscula</i> recorded.	89 km E
Wingellina Nickel Project Baseline Vegetation and Flora Assessment  Report prepared for Metals X Limited by Outback Ecology Services, April 2009. (OES, 2009)	Detailed survey of E69/535 conducted in April 2008. 30 quadrats assessed.	176 specimens collected of which 154 were identified to species level. Of the identified flora, there were 100 taxa (including subspecies and variants) from 40 genera and 24 families. No Threatened or Priority flora. One introduced species located, * <i>Cenchrus ciliaris</i> (Buffel grass). Seven vegetation units identified. Vegetation condition varied from Excellent to Degraded.	Three units described were sampled once and may be restricted, however they were to the south of the proposed mining area and were considered unlikely to be impacted. Two minor vegetation units described by HGM Maunsell (2002) were not sampled due to time and access constraints imposed by traditional cultural events occurring at the time of survey.	89 km E

Study details and reference	Survey type	Summary of results	Significant findings	~Distance from Study Area
		No TEC or PEC present.		
<p>Wingellina Nickel Project Flora and Fauna Desktop Study of Tenement L69/12.</p> <p>Report prepared for Metals X Limited by Outback Ecology Services, May 2008. (OES, 2008)</p>	Desktop assessment of flora and fauna	<p>No Threatened or Priority flora were recorded within 100 km radius of L69/12 from DEC (now DBCA) and WAH database searches. Limited botanical survey had been conducted in the region at the time. No TEC or PEC within 100 km.</p>	<p>It was noted that the lack of conservation significant flora records for the area is likely to be a reflection of the limited survey effort in the region, rather than a true reflection of species abundance and distribution.</p>	77 km SSE
<p>Wingellina Baseline Biological Survey.</p> <p>Report prepared for Acclaim Exploration NL by HGM Maunsell, December 2002. (HGM Maunsell, 2002)</p>	Reconnaissance survey conducted in April 2002 over 100km <sup>2</sup> , including the settlement and surrounds of the Wingellina Aboriginal Community.	<p>188 vascular plant taxa (including incomplete identifications) from 87 genera and 37 families.</p> <p>No Threatened or Priority flora. Six introduced plant species, none of which were Declared Plants.</p> <p>Seven vegetation communities identified.</p>	<p>Three vegetation communities assessed as being of likely regional significance with one also of local conservation significance.</p>	89 km E

## 4.1. Database Searches

### 4.1.1. Significant Flora

A total of 30 flora taxa of conservation significance were identified by the DBCA database searches as having been recorded within approximately 100 km of the Study Area (Figure 9). This included 12 Priority 1; two Priority 2; 15 Priority 3 and one Priority 4 taxa. No flora taxa listed as Threatened under the *BC Act* or *EPBC Act* were identified as occurring within 100 km of the Study Area (DBCA, 2023d, 2023e; DAWE. 2023a).

In addition to the 30 taxa identified by the DBCA database searches, five flora taxa of conservation significance were found within the literature review as having been recorded in the region (but did not appear in the database search). This included four species recorded within the WMCNP area that were located within < 1km to 48 km of the Study Area (Western Botanical, 2020): *Aenictophyton anomalum* (P1); *Acacia eremophila* var. numerous nerved variant (A.S. George 11924) (P3); *Aristida jerichoensis* var. *subspinulifera* (P3) and *Eragrostis* sp. Limestone (P.K. Latz 5921) (P3). *Goodenia virgata* (P2) has been recorded within the Warburton Road bypass area and one associated gravel pit by GHD (2021) (approximately 105 km from the Study Area).

A further nine Priority species that did appear in the database search results have also been recorded during botanical surveys in the region in closer proximity to the Study Area (than indicated in the database search results). This includes eight species recorded in association with the WMCNP: *Goodenia lunata* (P1); *Indigofera warburtonensis* (P1); *Amaranthus centralis* (P3); *Chrysocephalum apiculatum* subsp. *racemosum* (P3); *Eragrostis* sp. Erect spikelets (P.K. Latz 2122) (P3); *Goodenia asteriscus* (P3); *Stackhousia clementii* (P3) and *Tephrosia* sp. Central (P.K. Latz 17037) (P3). A single specimen of *Goodenia gibbosa* (P3) was recorded by GHD (2021) in a gravel pit along Great Central Road, to the north of the Study Area (Table 7).

A summary of the 35 taxa of conservation significance identified from all database searches and the literature review, regarding description/habitat, known distribution and nearest known location to the Study Area is presented in Table 7. Included is an assessment of likelihood of occurrence within the Study Area. Of the 35 flora taxa, 27 were assessed as having the potential (Possible) to occur due to the habitats present within the Study Area (Table 7).



**Table 7. Summary of conservation significant flora database search and literature review results for the vicinity of the Study Area (sorted by conservation rank) and their likelihood of occurrence within the Study Area (DBCA, 2023d, 2023e).**

Taxon	Conservation rank			Data Source			Description, habitat and current known distribution (local government areas) (WAH, 1998-; DBCA, 2023e)	Nearest recorded location to Study Area	Likelihood within Study Area
	DBCA	BC Act	EPBC Act	TPFL/WAH	PMST	Lit. Review			
<b>Priority 1</b>									
<i>Aenictophyton anomalum</i>	P1					*	Perennial herb or shrub. Stems to 20cm long. Flowers yellow/orange, Aug – Sept. Four specimen records for WA. Nearest (database) specimen recorded 147 km NW of Study Area. Recorded within WMCNP (Western Botanical, 2020) (specimen did not appear in database search) and was associated with the deep sands of the Sand Dune <i>Acacia - Grevillea</i> vegetation association. Ngaanyatjarraku, Wiluna LGA.	5 km S of E69/3552 (within WMCNP area)	Possible
<i>Apowollastonia stirlingii</i> subsp. <i>stirlingii</i>	P1			*			Shrub to 1 m high. Two specimen records for WA. Recorded on rocky slope with skeletal red sand and hummock grassland. Ngaanyatjarraku LGA.	56 km ESE of E69/3552	Possible
<i>Caesia chlorantha</i>	P1			*			Rhizomatous and tuberous, tufted perennial, herb, to 0.6m high. Fl. white. Black soil plains. Thirteen specimen records for WA, majority (12) from near Kununurra, one from near Wingellina. Vegetation and site description associated with the latter (and nearest specimen); cracking clay soil in drainage depression with <i>Astrebla pectinata</i> tussock grassland. Ngaanyatjarraku, Wyndham-East Kimberley LGA.	96 km E of E69/3552	Unlikely
<i>Euphorbia parvicaruncula</i>	P1			*			Short-lived annual or perennial, herb, to 0.2 m high. Two specimen records for WA; Cavanagh Range and Balfour Downs Station (growing amongst rocks) East Pilbara, Ngaanyatjarraku LGA.	11.8 km S of E69/3552	Possible

Taxon	Conservation rank			Data Source			Description, habitat and current known distribution (local government areas) (WAH, 1998-; DBCA, 2023e)	Nearest recorded location to Study Area	Likelihood within Study Area
	DBCA	BC Act	EPBC Act	TPFL/WAH	PMST	Lit. Review			
<i>Goodenia lunata</i>	P1			*		*	Slender, erect or ascending perennial, herb, to 0.25 m high. Fl. yellow, Jul. Nine specimen records for WA. Nearest database specimen (94.5 km E of E69/3552) at Wingellina community sampled from cracking clay plain with open tussock grassland of <i>Astrebla pectinata</i> . Recorded by Western Botanical in 2007 near, but outside, the current WMCNP alignment (specimen did not appear in database search). Found within a <i>Melaleuca Triodia</i> Spinifex community (Western Botanical, 2020). Halls Creek, Ngaanyatjarraku LGA.	13 km S of E69/3552 (near WMCNP)	Possible
<i>Indigofera warburtonensis</i>	P1			*		*	Shrub to 1 m. Fl. Pink, red. Six specimen records for WA. Nearest specimen sampled on stony hills. Recorded within WMCNP area (Western Botanical, 2020) at three sites; two within an <i>Acacia cuthbertsonii</i> Shrubland association and the third within Stony Mulga Shrubland. Ngaanyatjarraku LGA.	22 km SW of E69/3552 (also recorded within WMCNP within this proximity)	Possible
<i>Isotropis winneckeii</i>	P1			*			Perennial, herb. Fl. pink-purple, Jan or Jul or Oct. Skeletal soils. Sandstone ranges, rocky rises. Four specimen records for WA. Nearest specimen sampled from Rawlinson Range on a rocky rise supporting spinifex with scattered <i>Acacia</i> . Ngaanyatjarraku LGA.	89 km NNE of E69/3552	Unlikely
<i>Menkea lutea</i>	P1			*			Erect or prostrate annual, herb. Fl. yellow, Jul. Red loam. Five specimen records for WA. Nearest specimen sampled on red loam (Blackstone Mining Camp, 1963). More recently (2010) located around Wingellina on cracking clay. Ngaanyatjarraku LGA.	10 km E of E69/3552	Possible
<i>Micromyrtus helmsii</i>	P1			*			Slender shrub, 0.9-1.5 m high. Fl. Sep. Two specimen records for WA. Nearest specimen sampled in 1891. More recently (2000) collected from undulating red sand hills approximately 190 km SSE of Study Area. Associated vegetation: <i>Lomandra</i> , <i>Grevillea pterosperma</i> ,	97 km SW of E69/3552	Possible

Taxon	Conservation rank			Data Source			Description, habitat and current known distribution (local government areas) (WAH, 1998-; DBCA, 2023e)	Nearest recorded location to Study Area	Likelihood within Study Area
	DBCA	BC Act	EPBC Act	TPFL/WAH	PMST	Lit. Review			
							<i>G. juncifolia</i> subsp. <i>juncifolia</i> and <i>Eucalyptus gongylocarpa</i> .		
<i>Neurachne lanigera</i>	P1			*			Tufted perennial, grass-like or herb, 0.15-0.3 m high. Fl. other, Jul to Aug or Oct. Red sand, laterite. Rocky outcrops, plains. Seventeen specimen records for WA. Nearest specimen sampled on slopes of rocky outcrops. Associated vegetation: <i>Paraneurachne muelleri</i> , <i>Thyridolepis mitchelliana</i> and <i>Triodia</i> . Laverton, Menzies, Ngaanyatjarraku, Wiluna LGA.	32 km WNW of E69/3401	Possible
<i>Ptilotus royceanus</i>	P1			*			Perennial, herb or shrub, to 0.5 m high. Fl. pink, Apr to Oct. Rocky walls; cliffs. Fourteen specimen records for WA. Nearest specimen sampled from Rawlinson Range on a rock wall/cliff face. Ngaanyatjarraku LGA.	100 km NNW of E69/3552	Unlikely
<i>Schoenus centralis</i>	P1			*			Tufted annual, grass-like or herb (sedge), 0.05 m high. Fl. brown, Jul. Red sand. Rocky creek beds, seepage areas. One specimen record for WA (1967), sampled from Rawlinson Range in rocky creek bed. Ngaanyatjarraku LGA.	92 km NNW of E69/3552	Unlikely
<i>Thryptomene</i> sp. Warburton (M. Henson & M. Hannart 32433)	P1			*			One specimen record for WA (2011), sampled from near Mt Squires in West Musgraves. Ngaanyatjarraku LGA. Also previously recorded by Western Botanical within the Mt Squires tenements where it grows atop a large, coarse grained syenite (granite) hill (Western Botanical, 2020).	22.3 km SW of E69/3552	Possible
<b>Priority 2</b>									
<i>Euphorbia inappendiculata</i> var. <i>queenslandica</i>	P2			*			Erect to spreading herb. Sixteen specimen records for WA. Nearest specimen sampled from crab-holed plain near Wingellina. Majority of specimens sampled from the Pilbara region (Ashburton LGA). Ashburton, Halls Creek, Ngaanyatjarraku LGA.	89 km E of E69/3552	Unlikely
<i>Goodenia virgata</i>	P2					*	Ascending to erect, virgate perennial, herb, to 0.4 m high. Fl. yellow, Jul. Red sandy loam. Near salt pans. Seven	105 km WSW of E69/3401	Possible

Taxon	Conservation rank			Data Source			Description, habitat and current known distribution (local government areas) (WAH, 1998-; DBCA, 2023e)	Nearest recorded location to Study Area	Likelihood within Study Area
	DBCA	BC Act	EPBC Act	TPFL/WAH	PMST	Lit. Review			
							specimen records for WA. Nearest (database) specimen sampled from gravelly soils on edge of Lake Blair, 225 km NW of Study Area. Recorded by GHD (2021) within Warburton Road bypass area and one associated gravel pit. Specimens did not appear in WAH database search. East Pilbara, Ngaanyatjarraku, Wiluna LGA.	(near Warburton)	
<i>Teucrium grandiusculum</i> subsp. <i>grandiusculum</i>	P2			*			Perennial, herb or shrub, to 0.8 m high. Fl. white, Jun to Sep. Red sand. Rocky slopes, along watercourses. One specimen record (1989) for WA, sampled from the Bell Rock Range on a rocky slope with red sand. Ngaanyatjarraku LGA.	85 km SE of E69/3552	Possible
<b>Priority 3</b>									
<i>Acacia eremophla</i> var. <i>numerous nerved</i> variant (A.S. George 11924)	P3					*	Dense, spreading shrub, 1-2 m high. Fl. yellow, Sep. Sandy soils. Flats. Nineteen specimen records for WA. Nearest (database) specimen sampled from Neale Junction Nature Reserve in open Eucalyptus scrubland on flats (sand over clay), approximately 350 km SW of Study Area. Recorded within WMCNP (Western Botanical, 2020) (specimen did not appear in database search) exclusively on calcrete platforms. Dundas, Kalgoorlie-Boulder, Laverton, Menzies LGA.	48 km SW of E69/3552 (within WMCNP area)	Possible
<i>Amaranthus centralis</i>	P3			*		*	Annual herb. Seven specimen records for WA. Nearest database specimen (18 km E of Study Area) sampled from a granite outcrop with silty sand and <i>Acacia aneura</i> , <i>A. quadrimarginea</i> . Recorded within WMCNP area within hardpan mulga woodlands (Western Botanical, 2020) (specimen did not appear in database search). Ashburton, East Pilbara, Ngaanyatjarraku LGA.	15 km S of E69/3552 (within WMCNP area)	Possible



Taxon	Conservation rank			Data Source			Description, habitat and current known distribution (local government areas) (WAH, 1998-; DBCA, 2023e)	Nearest recorded location to Study Area	Likelihood within Study Area
	DBCA	BC Act	EPBC Act	TPFL/ WAH	PMST	Lit. Review			
<i>Aristida jerichoensis</i> var. <i>subspinulifera</i>	P3					*	Compactly tufted perennial, grass-like or herb, 0.3-0.8 m high, lemma groove muricate. Hardpan plains. Forty-five specimen records for WA. Nearest database specimen sampled from 135 km NE of Study Area. This species has been recorded SW of Wingellina (Hinckley Range Pty Ltd, 2015) (specimen did not appear in database search). Recorded within the WMCNP survey area in claypan – grassland, hardpan mulga woodland and groved mulga vegetation associations (Western Botanical, 2020) (specimen did not appear in database search). Ashburton, East Pilbara, Meekatharra, Ngaanyatjarraku, Wiluna LGA.	< 0.05 km S of E69/3552 (within WMCNP northern access road corridor)	Possible
<i>Chrysocephalum apiculatum</i> subsp. <i>racemosum</i>	P3			*		*	Perennial herb. Flowers yellow. Five specimen records for WA. Nearest database specimen (44 km SW of Study Area) sampled at Mount Florrie in Mulga woodland. Also sampled nearby on sand dunes with Mulga woodland. Associated with Palgrave volcanics. Recorded within WMCNP area on sandplains and sand dunes (Western Botanical, 2020) (specimen did not appear in database search). Ngaanyatjarraku LGA.	< 1 km S of E69/3552 (within WMCNP northern access road corridor)	Possible
<i>Eragrostis</i> sp. Erect spikelets (P.K. Latz 2122)	P3			*		*	Perennial grass. Five specimen records for WA. Nearest database specimen (97 km NNE of Study Area) sampled from gravelly semi-saline creek levee. Recorded within WMCNP area on shallow sand over outcropping and sub cropping granodiorite (Western Botanical, 2020) (specimen did not appear in database search). Ashburton, East Pilbara, Meekatharra, Ngaanyatjarraku LGA.	4 km W of E69/3552 (within WMCNP northern access road corridor)	Possible
<i>Eragrostis</i> sp. Limestone (P.K. Latz 5921)	P3					*	Perennial grass. Four specimen records for WA. Nearest database specimen (117 km NE of Study Area) sampled from calcrete outcrop. Recorded within WMCNP area on outcropping calcrete platforms in small, isolated	3 km W of E69/3552 (within WMCNP)	Possible

Taxon	Conservation rank			Data Source			Description, habitat and current known distribution (local government areas) (WAH, 1998-; DBCA, 2023e)	Nearest recorded location to Study Area	Likelihood within Study Area
	DBCA	BC Act	EPBC Act	TPFL/ WAH	PMST	Lit. Review			
							populations (Western Botanical, 2020) (specimen did not appear in database search). East Pilbara, Menzies, Ngaanyatjarraku LGA.	northern access road corridor)	
<i>Eucalyptus sparsa</i>	P3			*			(Mallee), ca 3 m high, bark rough, fibrous to flaky, smooth above. Fl. white, Jan to Feb. Red sand. Sand dunes. Three specimen records for WA. No site description provided for nearest specimen. Other specimens from area sampled from red sand dune or flat plain with deep red sandy earth. Ngaanyatjarraku LGA.	40 km ESE of E69/3552	Possible
<i>Fuirena nudiflora</i>	P3			*			Tufted annual, grass-like or herb (sedge), 0.05-0.2 m high, perianth absent; stamen 1. Fl. brown, Apr to May or Jul. Sand. Swamps, creek beds. Four specimen records for WA, three of which are from the Kimberley region. Nearest specimen sampled from a rocky creek bed in the Rawlinson Range. Broome, Ngaanyatjarraku, Wyndham-East Kimberley LGA.	91 km NNE of E69/3552	Unlikely
<i>Goodenia asteriscus</i>	P3			*		*	Fl. yellow, mainly Sept. – Jan. Grows in hard clay and loam soils and is able to colonise compacted disturbed areas (Lang and Davis, 2017). Four specimen records for WA, nearest database specimens (10 km E of Study Area) sampled from the Blackstone Range and Cavanagh Range (red loam). Recorded within WMCNP area on calcrete platform hummock grassland (Western Botanical, 2020) (specimen did not appear in database search). Ngaanyatjarraku LGA.	< 1 km E or W of E69/3552 (within WMCNP area)	Possible
<i>Goodenia gibbosa</i>	P3			*		*	Prostrate to decumbent herb, stems, often stoloniferous, to 40 cm. Fl. yellow, Jul. Sandy soils. Eight specimen records for WA. Nearest database specimen (44 km SW of Study Area) sampled from Mulga woodland at base of sand dune (Palgrave volcanics). Also recorded by GHD	38 km N of E69/3401 (GHD, 2021)	Possible

Taxon	Conservation rank			Data Source			Description, habitat and current known distribution (local government areas) (WAH, 1998-; DBCA, 2023e)	Nearest recorded location to Study Area	Likelihood within Study Area
	DBCA	BC Act	EPBC Act	TPFL/ WAH	PMST	Lit. Review			
							(2021) (one specimen) at gravel pit along Great Central Road, approximately 38 km N of Study Area. Ngaanyatjarraku LGA.		
<i>Indigofera cornuligera</i> subsp. <i>cornuligera</i>	P3			*			Perennial herb or shrub to 0.5 m. Fl. deep pink. Eight specimen records for WA. Nearest specimen sampled from Mt Aloysius, east of Blackstone Range. Ngaanyatjarraku LGA.	58 km E of E69/3552	Possible
<i>Indigofera gilesii</i>	P3			*			Shrub, to 1.5 m high. Fl. purple-pink, May or Aug. Pebbly loam. Amongst boulders and outcrops, hills. Thirty-nine specimen records for WA. Nearest specimen sampled from Mount Fanny, NE of Blackstone Range. Ashburton, East Pilbara, Halls Creek, Meekatharra, Ngaanyatjarraku, Wiluna LGA.	66 km E of E69/3552	Possible
<i>Lythrum paradoxum</i>	P3			*			Woody erect herb, 0.6-1 m high, plants glabrous, inflorescence of (1-) 2-7 flowers, stamens 8-12, exserted. Fl. pink/purple. Two specimen records for WA. Nearest specimen sampled from a rocky gully at Mount Fanny. Ngaanyatjarraku LGA.	40 km E of E69/3552	Possible
<i>Melaleuca nanophylla</i>	P3			*			Tree or shrub, to 5 m high. Fl. yellow. Ridges. Three specimen records for WA, all sampled from same area on rocky gypsum outcrops where it was an occasional but dominant plant. Associated vegetation: occasional <i>Acacia tetragonophylla</i> , <i>Scaevola</i> and <i>Zygophyllum aurantiacum</i> . Ngaanyatjarraku LGA.	100 km NW of E69/3401	Unlikely
<i>Prostanthera centralis</i>	P3			*			Erect shrub, 0.3-1 m high. Fl. blue-purple, Jul to Oct. Gravelly soils, red sand. Rocky quartzite scree slopes. Fourteen specimen records for WA. Nearest specimen sampled from rocky hill/ridge with red sand (associated with Rawlinson Range). Associated vegetation: low shrubland. <i>Triodia</i> sp., mallee eucalypts. Ngaanyatjarraku LGA.	92 km NNE of E69/3552	Unlikely

Taxon	Conservation rank			Data Source			Description, habitat and current known distribution (local government areas) (WAH, 1998-; DBCA, 2023e)	Nearest recorded location to Study Area	Likelihood within Study Area
	DBCAs	BC Act	EPBC Act	TPFL/WAH	PMST	Lit. Review			
<i>Stackhousia clementii</i>	P3			*		*	Dense broom-like perennial, herb, to 0.45 m high. Fl. green/yellow/brown. Skeletal soils. Sandstone hills. Twenty-two specimen records for WA. Nearest database specimen sampled (in 2007) from shallow skeletal red sand on calcrete platform within the now WMCNP area. Associated vegetation: Mulga Wanderrrie Bank Shrubland. Low shrubs including <i>Ptilotus obovatus</i> and grasses <i>Enneapogon caerulescens</i> and <i>Eragrostis eriopoda</i> . Recorded at a number of locations (further south than the database specimen) within the WMCNP area (Western Botanical, 2020). Ashburton, Carnarvon, East Pilbara, Karratha, Murchison, Ngaanyatjarraku, Wiluna LGA.	13.3 km S of E69/3552 (within WMCNP area)	Possible
<i>Tephrosia</i> sp. Central (P.K. Latz 17037)	P3			*		*	Perennial herb. Fl. orange. Three specimen records for WA. Nearest database specimen (75 km NW of Study Area) sampled from creek bed (by rocky outcrop) in the Bedford Range. Recorded within WMCNP area on Hardpan Mulga Woodland (Western Botanical, 2020) (specimen did not appear in database search). Ngaanyatjarraku LGA.	21 km SW of E69/3552 (within western access road corridor)	Possible
<i>Vittadinia pustulata</i>	P3			*			Low annual, herb (sometimes persisting as an under-shrub), 0.1-0.3 m high. Fl. Sep. Eleven specimen records for WA. Nearest specimen sampled from a sand flat adjacent to a sand dune with Mulga woodland on the other side. Menzies, Ngaanyatjarraku, Wiluna LGA.	44 km E of E69/3552	Possible
<b>Priority 4</b>									
<i>Comesperma viscidulum</i>	P4			*			Shrub, to ca 0.7 m high. Twenty-one specimen records for WA. Nearest specimen sampled from the Rawlinson Range.	95 km NNE of E69/3552	Possible



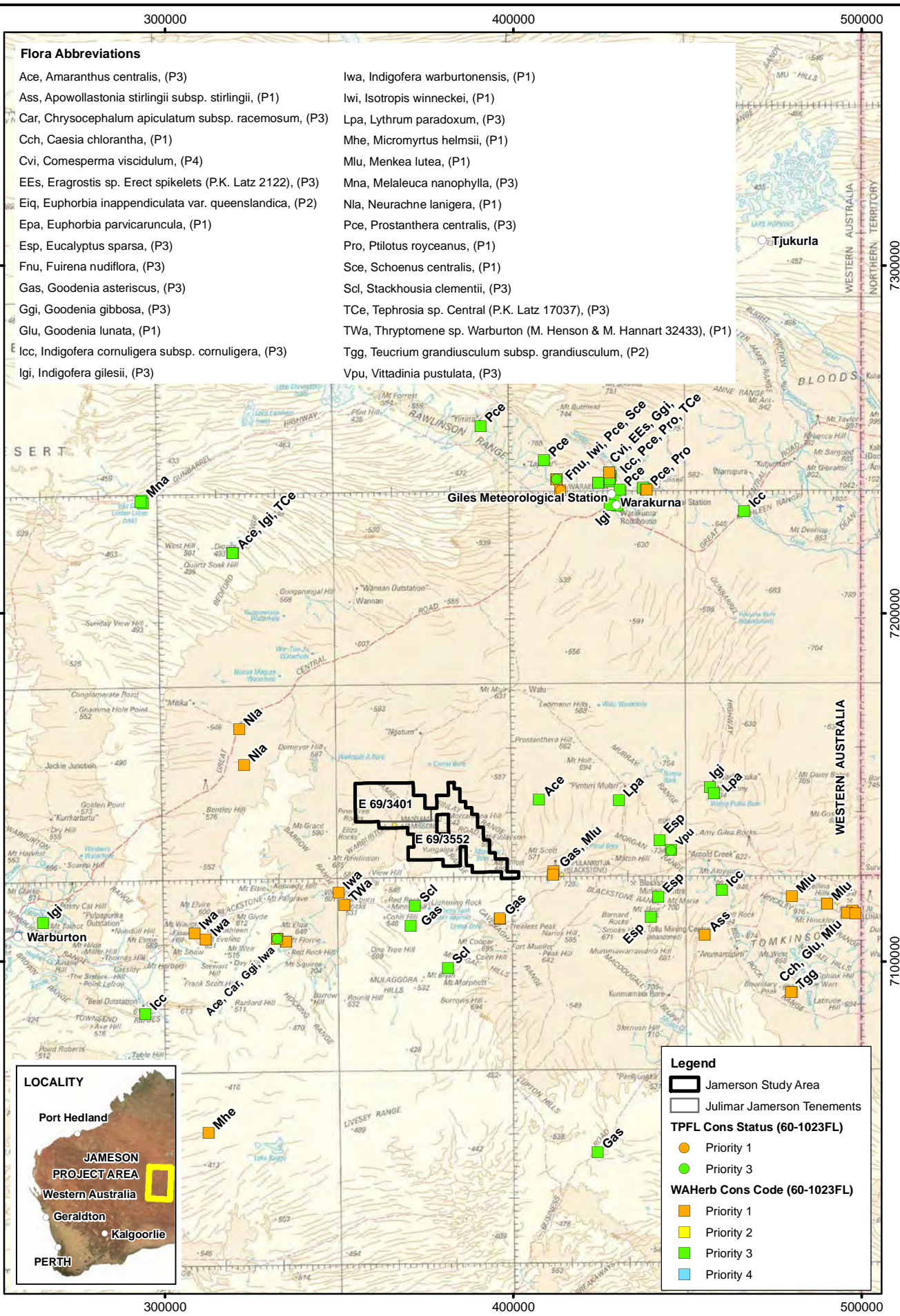
Taxon	Conservation rank			Data Source			Description, habitat and current known distribution (local government areas) (WAH, 1998-; DBCA, 2023e)	Nearest recorded location to Study Area	Likelihood within Study Area
	DBCA	BC Act	EPBC Act	TPFL/WAH	PMST	Lit. Review			
							Kalgoorlie-Boulder, Laverton, Menzies, Ngaanyatjarraku, Wiluna LGA.		

**Figure 9. Regional Flora of Conservation Significance**

**Flora Abbreviations**

- |  |  |
|--|--|
| Ace, <i>Amaranthus centralis</i> , (P3)                                | Iwa, <i>Indigofera warburtonensis</i> , (P1)                               |
| Ass, <i>Apowollastonia stirlingii</i> subsp. <i>stirlingii</i> , (P1)  | Iwi, <i>Isotropis winneckeii</i> , (P1)                                    |
| Car, <i>Chrysocephalum apiculatum</i> subsp. <i>racemosum</i> , (P3)   | Lpa, <i>Lythrum paradoxum</i> , (P3)                                       |
| Cch, <i>Caesia chlorantha</i> , (P1)                                   | Mhe, <i>Micromyrtus helmsii</i> , (P1)                                     |
| Cvi, <i>Comesperma viscidulum</i> , (P4)                               | Mlu, <i>Menkea lutea</i> , (P1)  |
| EEs, <i>Eragrostis</i> sp. Erect spikelets (P.K. Latz 2122), (P3)      | Mna, <i>Melaleuca nanophylla</i> , (P3)                                    |
| Eiq, <i>Euphorbia inappendiculata</i> var. <i>queenslandica</i> , (P2) | Nla, <i>Neurachne lanigera</i> , (P1)                                      |
| Epa, <i>Euphorbia parvicaruncula</i> , (P1)                            | Pce, <i>Prostanthera centralis</i> , (P3)                                  |
| Esp, <i>Eucalyptus sparsa</i> , (P3)                                   | Pro, <i>Ptilotus royceanus</i> , (P1)                                      |
| Fnu, <i>Fuirena nudiflora</i> , (P3)                                   | Sce, <i>Schoenus centralis</i> , (P1)                                      |
| Gas, <i>Goodenia asteriscus</i> , (P3)                                 | ScI, <i>Stackhousia clementii</i> , (P3)                                   |
| Ggi, <i>Goodenia gibbosa</i> , (P3)                                    | TCe, <i>Tephrosia</i> sp. Central (P.K. Latz 17037), (P3)                  |
| Glu, <i>Goodenia lunata</i> , (P1)                                     | TWa, <i>Thryptomene</i> sp. Warburton (M. Henson & M. Hannart 32433), (P1) |
| icc, <i>Indigofera cornuligera</i> subsp. <i>cornuligera</i> , (P3)    | Tgg, <i>Teucrium grandiusculum</i> subsp. <i>grandiusculum</i> , (P2)      |
| Igi, <i>Indigofera gilesii</i> , (P3)                                  | Vpu, <i>Vittadinia pustulata</i> , (P3)                                    |

Imagery: Geoscience Australia - Threatened and Priority Flora Database (TPFL) and the WA Herbarium database (WAHerb); Department of Biodiversity, Conservation and Attractions



**Legend**

- Jamerson Study Area
- Julimar Jamerson Tenements

**TPFL Cons Status (60-1023FL)**

- Priority 1
- Priority 3

**WAHerb Cons Code (60-1023FL)**

- Priority 1
- Priority 2
- Priority 3
- Priority 4

0 10 20 km

Scale: 1:1,500,000  
MGA94 (Zone 52)

CAD Ref: a2986\_F004\_06  
Date: November 2023

Rev: A A4

**Western Botanical**

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**Julimar Resources**  
**Jameson Project**  
Conservation Significant Flora

#### 4.1.2. Threatened and Priority Ecological Communities

There are no known Threatened Ecological Communities (TECs) or Priority Ecological Communities (PECs) occurring within a 100 km radius of the Study Area (DBCA, 2023f).

#### 4.1.3. Invasive Species

Within the Shire of Ngaanyatjarraku there are currently 49 flora taxa listed as Declared Plants under Section 22(2) of the *BAM Act* (DPIRD, 2023c). This includes 30 taxa which are listed as Weeds of National Significance (WoNS) (DAWE, 2023b) (Appendix 5).

Fourteen weed species have been recorded during botanical surveys associated with the WNP (Hinkley Range Pty Ltd, 2015), WMCNP (Western Botanical, 2020) and Shire of Ngaanyatjarraku roadworks (GHD, 2021) (as summarised in Table 6). None are listed as WoNS or Declared Plants although the invasive nature of *\*Cenchrus ciliaris* (Buffel Grass) and *\*Rumex vesicarius* is noted. Buffel Grass is known to occur along roadsides within the Study Area (GHD, 2021).

A summary of the fourteen weed species identified from the literature review regarding their ecological impact and invasiveness ratings from the Department of Parks and Wildlife (DPaW) Goldfields Region Species Prioritisation Process (2014) is presented in Table 8. Buffel Grass, Ruby Dock and Spiked Malvastrum have been recorded across all three survey areas within the region.

**Table 8. Ecological impact and invasiveness ratings of weed species recorded within the vicinity of the Study Area (DPaW, 2014).**

Scientific and common name	Present in surveyed area:			Ecological impact <sup>3</sup>	Invasiveness <sup>4</sup>
	WNP <sup>5</sup>	WMCNP <sup>6</sup>	Shire of Ngaanyatjarraku <sup>7</sup>		
<i>*Bidens bipinnata</i> Bipinnate Beggartick			*	U	U
<i>*Brassica tournefortii</i> Mediterranean Turnip		*		U	R
<i>*Capsella bursa-pastoris</i> Shepherd's Purse	*			NA	NA
<i>*Cenchrus ciliaris</i> Buffel Grass	*	*	*	H	R
<i>*Cenchrus pennisetiformis</i> <sup>8</sup>	*			NA	NA

<sup>3</sup> H = High, L = Low, M = Medium, U = Unknown, NA = Not assessed

<sup>4</sup> R = Rapid, M = Moderate, U = Unknown, NA = Not assessed

<sup>5</sup> Wingellina Nickel Project (Hinkley Range Pty Ltd, 2015)

<sup>6</sup> West Musgrave Copper and Nickel Project (Western Botanical, 2020)

<sup>7</sup> GHD (2021)

<sup>8</sup> At the time of survey in 2011 – 2012, *\*Cenchrus pennisetiformis* had not previously been recorded from WA but was known from arid parts of SA (Hinkley Range Pty Ltd, 2015). Although still excluded from the WA Herbarium

Scientific and common name	Present in surveyed area:			Ecological impact <sup>3</sup>	Invasiveness <sup>4</sup>
	WNP <sup>5</sup>	WMCNP <sup>6</sup>	Shire of Ngaanyatjarraku <sup>7</sup>		
Cloncurry Buffel Grass					
* <i>Citrullus colocynthis</i> Camel Melon, Colocynth	*	*		M	R
* <i>Citrullus lanatus</i> Pie Melon, Paddy Melon	*			M	R
* <i>Chloris virgata</i> Feather Top Rhodes Grass		*		U	U
* <i>Erodium aureum</i> Cork Screw		*		U	U
* <i>Malvastrum americanum</i> Spiked Malvastrum	*	*	*	H	R
* <i>Portulaca oleracea</i> Common Purslane	*			U	U
* <i>Rumex vesicarius</i> Ruby Dock	*	*	*	H	R
* <i>Sonchus oleraceus</i> Common Sowthistle	*			U	R
* <i>Tribulus terrestris</i> Caltrop	*	*		L	M

database as occurring in WA (WAH, 1998-), this species appears within the Atlas of Living Australia (ALA) as occurring throughout north-west WA where it is considered naturalised (ALA, 2023).



## 5. Summary

The information collated from the desktop assessment of the Study Area can be summarised as follows:

- The Study Area is located within the Mann-Musgrave Block subregion (CER01) of the Central Ranges IBRA bioregion. Average annual rainfall is 290.8 mm (as recorded at Giles) with rainfall peaking in this arid climate from late spring to early autumn (BoM, 2023a).
- Located across eight surface geological units, dominant of which are the Qrc (colluvium, sheetwash, talus) unit, (comprising ~ 51% of the Study Area), Mdgc (layered mafic-ultramafic intrusions) unit (~ 18 %) and the Czk unit (calcrete) (~ 11 %).
- Four soil landscape systems are mapped across the Study Area;
  - My109: outwash plains flanking the Jameson Range and adjacent hills, comprises the majority of the Study Area (~74 % of the Study Area);
  - BA21: steep hills and ranges (Jameson Range) on sedimentary and some metamorphic, volcanic, and granitic rocks (~ 12 %);
  - Fa34: steep hills and ranges on basic rocks, includes the hills to the east of the Jameson Range (~ 5 %).
  - My112: plains with numerous dunes, restricted to north-west and south-east corners of the Study Area (~ 8 %) (DPIRD, 2023a).
- Groundwater salinities have been broadly mapped at TDS content of 1,000 - 3,000 mg/L (brackish) across the Study Area (DWER, 2023a).
- Located within the northern part of the Warburton Basin hydrographic catchment, there are no significant creeks or water bodies within the Study Area. Surface water flow occurs intermittently after significant rainfall events.
- Five pre-European vegetation system associations are mapped across the Study Area, all of which remain individually intact at a bioregional level (> 99 % of pre-European extent remaining) (WALGA, 2020);
  - Central Ranges\_18: Mulga (*Acacia aneura*) woodland and associated species (~ 78 % of the Study Area);
  - Central Ranges\_39: Wattle, teatree and other species (*Acacia* spp. *Melaleuca* spp) sparse scrub to scrub, located on ranges and hills (~ 12 %);
  - Central Ranges\_19: Mulga (*Acacia aneura*) woodland and associated species (~ 7 %);
  - Central Ranges\_95: Shrub-steppe. Hummock grassland with scattered shrubs or mallee *Triodia* spp. *Acacia* spp., *Grevillea* spp. *Eucalyptus* spp. (~ 2%); and
  - Central Ranges\_230: tree steppe of Desert oak (*Allocasuarina decaisneana*) over soft spinifex (*Triodia pungens*) (< 0.5 %) (.

- The Study Area is located within an ESA as it lies within an area known as the Ranges of the Western Desert, which is listed on the Register of the National Estate as having Indigenous values of National Estate significance (DWER, 2023b; DCCEEW, 2023).
- Database searches and the literature review indicate 35 flora taxa of conservation significance have been recorded within (or near) a 100 km radius of the Study Area. This includes 13 Priority 1, three Priority 2, 18 Priority 3 and one Priority 4 species. Of these, 27 were assessed as having the potential (Possible) to occur within the Study Area.
- Significant botanical survey has been conducted across the West Musgrave Copper and Nickel Project (WMCNP), located to the immediate south of the Study Area. Eleven Priority flora species have been recorded (two P1 species and nine P3) across the project area, six of which were located within 5 km of the southern boundary of the Study Area.
- Terrestrial GDE potential has not been ascertained within a national assessment for much of the Study Area. Exceptions include; the south-east corner of tenement E69/3552 and the Jameson Range which is mapped as having a low potential for supporting a terrestrial GDE; and a section of the north-west corner of tenement E69/3401 which is mapped as having moderate terrestrial GDE potential (BoM, 2023b). Within the WMCNP area, one vegetation association has been identified as being a probable obligate GDE with a further seven associations classified as being probable facultative GDEs (CDM Smith (2020b).
- There are no known Threatened or Priority Ecological Communities within 100 km of the Study Area.
- There are currently 49 flora taxa listed as Declared Pests (DPIRD, 2023c), including 30 taxa which are listed as WoNS (DAWE, 2023b) within the Shire of Ngaanyatjarraku. Within the region, 14 weed species have been recorded during botanical surveys associated with the WNP (Hinkley Range Pty Ltd, 2015), WMCNP (Western Botanical, 2020) and Shire of Ngaanyatjarraku roadworks (GHD, 2021). None are listed as WoNS or Declared Plants. Buffel Grass (*Cenchrus ciliaris*) is known to occur along roadsides within the Study Area (GHD, 2021).

## 6. Bibliography

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## **Appendix 1. Framework for Conservation Significant Flora: WA (DBCA)**

## **DBCA Conservation Codes for Western Australian Flora**

Under the Wildlife Conservation Act 1950, the Minister for the Environment may declare species of flora to be protected if they are considered to be in danger of extinction, rare or otherwise in need of special protection.

Specially protected flora are species which have been adequately searched for and are deemed to be, in the wild, either rare, at risk of extinction, or otherwise in need of special protection, and have been gazetted as such.

Categories of specially protected flora are:

### **T Threatened species**

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 Biodiversity Conservation Act 2016 (BC Act).

*Threatened fauna* is that subset of ‘Specially Protected Fauna’ listed under schedules 1 to 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for Threatened Fauna.

*Threatened flora* is that subset of ‘Rare Flora’ listed under schedules 1 to 3 of the Wildlife Conservation (Rare Flora) Notice 2018 for Threatened Flora.

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.

### **CR Critically endangered species**

Threatened species considered to be “facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines”.

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 Wildlife Conservation (Specially Protected Fauna) Notice 2018 for critically endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for critically endangered flora.

**EN Endangered species**

Threatened species considered to be “facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines”.

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 Wildlife Conservation (Specially Protected Fauna) Notice 2018 for endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for endangered flora.

**VU Vulnerable species**

Threatened species considered to be “facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines”.

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 Wildlife Conservation (Specially Protected Fauna) Notice 2018 for vulnerable fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for vulnerable flora.

**Extinct species**

Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.

**EX Extinct species**

Species where “there is no reasonable doubt that the last member of the species has died”, and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).

Published as presumed extinct under schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for extinct fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for extinct flora.

**EW Extinct in the wild species**

Species that “is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form”, and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act).



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.

### **Specially protected species**

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.

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.

### **MI Migratory species**

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).

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 Convention on the Conservation of Migratory Species of Wild Animals (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.

Published as migratory birds protected under an international agreement under schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.

### **CD Species of special conservation interest (conservation dependent fauna)**

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). Published as conservation dependent fauna under schedule 6 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.

### **OS Other specially protected species**

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).

Published as other specially protected fauna under schedule 7 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.

## **P Priority species**

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.

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.

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.

### **1 Priority 1: Poorly-known species**

Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, 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.

### **2 Priority 2: Poorly-known species**

Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, 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.

### **3 Priority 3: Poorly-known species**

Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.

### **4 Priority 4: Rare, Near Threatened and other species in need of monitoring**

(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands.

(b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent.

(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

**Last updated 3 January 2019**

## **Appendix 2. DBCA Definitions of Threatened Ecological Communities (TECs) and Priority Ecological Communities (PECs)**

## DEFINITIONS, CATEGORIES AND CRITERIA FOR THREATENED AND PRIORITY ECOLOGICAL COMMUNITIES

### 1. GENERAL DEFINITIONS

#### Ecological Community

A naturally occurring biological assemblage that occurs in a particular type of habitat.

Note: The scale at which ecological communities are defined will often depend on the level of detail in the information source, therefore no particular scale is specified.

A **threatened ecological community (TEC)** is one which is found to fit into one of the following categories; “presumed totally destroyed”, “critically endangered”, “endangered” or “vulnerable”.

Possible threatened ecological communities that do not meet survey criteria are added to DEC’s Priority Ecological Community Lists under Priorities 1, 2 and 3. Ecological Communities that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

An **assemblage** is a defined group of biological entities.

**Habitat** is defined as the areas in which an organism and/or assemblage of organisms lives. It includes the abiotic factors (e.g. substrate and topography), and the biotic factors.

**Occurrence:** a discrete example of an ecological community, separated from other examples of the same community by more than 20 meters of a different ecological community, an artificial surface or a totally destroyed community.

By ensuring that every discrete occurrence is recognised and recorded future changes in status can be readily monitored.

**Adequately Surveyed** is defined as follows:

“An ecological community that has been searched for thoroughly in most likely habitats, by relevant experts.”

**Community structure** is defined as follows:

“The spatial organisation, construction and arrangement of the biological elements comprising a biological assemblage” (e.g. Eucalyptus salmonophloia woodland over scattered small shrubs over dense herbs; structure in a faunal assemblage could refer to trophic structure, e.g. dominance by feeders on detritus as distinct from feeders on live plants).

**Definitions of Modification and Destruction** of an ecological community:

**Modification:** “changes to some or all of ecological processes (including abiotic processes such as hydrology), species composition and community structure as a direct or indirect result of human activities. The level of damage involved could be ameliorated naturally or by human intervention.”



**Destruction:** “modification such that reestablishment of ecological processes, species composition and community structure within the range of variability exhibited by the original community is unlikely within the foreseeable future even with positive human intervention.”

**Note:** Modification and destruction are difficult concepts to quantify, and their application will be determined by scientific judgment. Examples of modification and total destruction are cited below:

**Modification of ecological processes:** The hydrology of Toolibin Lake has been altered by clearing of the catchment such that death of some of the original flora has occurred due to dependence on fresh water. The system may be brought back to a semblance of the original state by redirecting saline runoff and pumping waters of the rising water table away to restore the hydrological balance. Total destruction of downstream lakes has occurred due to hydrology being altered to the point that few of the original flora or fauna species are able to tolerate the level of salinity and/or water logging.

**Modification of structure:** The understorey of a plant community may be altered by weed invasion due to nutrient enrichment by addition of fertiliser. Should the additional nutrients be removed from the system the balance may be restored, and the original plant species better able to compete. Total destruction may occur if additional nutrients continue to be added to the system causing the understorey to be completely replaced by weed species, and death of overstorey species due to inability to tolerate high nutrient levels.

**Modification of species composition:** Pollution may cause alteration of the invertebrate species present in a freshwater lake. Removal of pollutants may allow the return of the original inhabitant species. Addition of residual highly toxic substances may cause permanent changes to water quality, and total destruction of the community.

**Threatening processes** are defined as follows:

“Any process or activity that threatens to destroy or significantly modify the ecological community and/or affect the continuing evolutionary processes within any ecological community.”

Examples of some of the continuing threatening processes in Western Australia include: general pollution; competition, predation and change induced in ecological communities as a result of introduced animals; competition and displacement of native plants by introduced species; hydrological changes; inappropriate fire regimes; diseases resulting from introduced microorganisms; direct human exploitation and disturbance of ecological communities.

**Restoration** is defined as returning an ecological community to its pre-disturbance or natural state in terms of abiotic conditions, community structure and species composition.

**Rehabilitation** is defined as the re-establishment of ecological attributes in a damaged ecological community although the community will remain modified.

## **2. DEFINITIONS AND CRITERIA FOR PRESUMED TOTALLY DESTROYED, CRITICALLY ENDANGERED, ENDANGERED AND VULNERABLE ECOLOGICAL COMMUNITIES**

### **Presumed Totally Destroyed (PD)**

An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future.

An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant **and either** of the following applies (A or B):

- A) Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats or
- B) All occurrences recorded within the last 50 years have since been destroyed

**Critically Endangered (CR)**

An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated.

An ecological community will be listed as **Critically Endangered** when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C):

- A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply (i or ii):
  - i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years);
  - ii) modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated.
- B) Current distribution is limited, and one or more of the following apply (i, ii or iii):
  - i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years);
  - ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes;
  - iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes.
- C) The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).

**Endangered (EN)**

An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.

An ecological community will be listed as **Endangered** when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B, or C):

- A) The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement and either or both of the following apply (i or ii):
  - i) the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years);
  - ii) modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated.
- B) Current distribution is limited, and one or more of the following apply (i, ii or iii):

i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years);

ii) there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes;

iii) there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes.

C) The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).

### **Vulnerable (VU)**

An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.

An ecological community will be listed as **Vulnerable** when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium (within approximately 50 years) to long-term future. This will be determined on the basis of the best available information by it meeting **any one or more** of the following criteria (A, B or C):

A) The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated.

B) The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations.

C) The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long-term future because of existing or impending threatening processes

### **3. DEFINITIONS AND CRITERIA FOR PRIORITY ECOLOGICAL COMMUNITIES**

Possible threatened ecological communities that do not meet survey criteria or that are not adequately defined are added to the Priority Ecological Community List under priorities 1, 2 and 3. These three categories are ranked in order of priority for survey and/or definition of the community. Ecological communities that are adequately known, and are rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

#### **Priority One:** Poorly-known ecological communities

Ecological communities that are known from very few occurrences with a very restricted distribution (generally  $\leq 5$  occurrences or a total area of  $\leq 100$ ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.

#### **Priority Two:** Poorly-known ecological communities

Communities that are known from few occurrences with a restricted distribution (generally  $\leq 10$  occurrences or a total area of  $\leq 200$ ha). At least some occurrences are not believed to be under immediate threat (within

approximately 10 years) of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.

**Priority Three:** Poorly known ecological communities

- (i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or:
- (ii) communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat (within approximately 10 years), or;
- (iii) communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, inappropriate fire regimes, clearing, hydrological change etc.

Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.

**Priority Four:** Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.

- (i) Rare. Ecological communities known from few occurrences 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 communities are usually represented on conservation lands.
- (ii) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for a higher threat category.
- (iii) Ecological communities that have been removed from the list of threatened communities during the past five years.

**Priority Five:** Conservation Dependent ecological communities

Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

(Department of Environment and Conservation January 2013)

## **Appendix 3. Protected Matters Search Tool Results**





Australian Government

Department of Climate Change, Energy,  
the Environment and Water

# EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 23-Oct-2023

[Summary](#)

[Details](#)

[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)

# Summary

## Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

<a href="#">World Heritage Properties:</a>	None
<a href="#">National Heritage Places:</a>	None
<a href="#">Wetlands of International Importance (Ramsar)</a>	None
<a href="#">Great Barrier Reef Marine Park:</a>	None
<a href="#">Commonwealth Marine Area:</a>	None
<a href="#">Listed Threatened Ecological Communities:</a>	None
<a href="#">Listed Threatened Species:</a>	11
<a href="#">Listed Migratory Species:</a>	7

## Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <https://www.dcceew.gov.au/parks-heritage/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

<a href="#">Commonwealth Lands:</a>	None
<a href="#">Commonwealth Heritage Places:</a>	None
<a href="#">Listed Marine Species:</a>	9
<a href="#">Whales and Other Cetaceans:</a>	None
<a href="#">Critical Habitats:</a>	None
<a href="#">Commonwealth Reserves Terrestrial:</a>	None
<a href="#">Australian Marine Parks:</a>	None
<a href="#">Habitat Critical to the Survival of Marine Turtles:</a>	None

## Extra Information

This part of the report provides information that may also be relevant to the area you have

<a href="#">State and Territory Reserves:</a>	1
<a href="#">Regional Forest Agreements:</a>	None
<a href="#">Nationally Important Wetlands:</a>	None
<a href="#">EPBC Act Referrals:</a>	1
<a href="#">Key Ecological Features (Marine):</a>	None
<a href="#">Biologically Important Areas:</a>	None
<a href="#">Bioregional Assessments:</a>	None
<a href="#">Geological and Bioregional Assessments:</a>	None

# Details

## Matters of National Environmental Significance

### Listed Threatened Species

[\[ Resource Information \]](#)

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.

Number is the current name ID.

Scientific Name	Threatened Category	Presence Text	Buffer Status
<b>BIRD</b>			
<a href="#">Aphelocephala leucopsis</a> Southern Whiteface [529]	Vulnerable	Species or species habitat known to occur within area	In feature area
<a href="#">Erythrotriorchis radiatus</a> Red Goshawk [942]	Endangered	Species or species habitat may occur within area	In feature area
<a href="#">Falco hypoleucos</a> Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area	In feature area
<a href="#">Leipoa ocellata</a> Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area	In feature area
<a href="#">Pezoporus occidentalis</a> Night Parrot [59350]	Endangered	Species or species habitat may occur within area	In feature area
<a href="#">Polytelis alexandrae</a> Princess Parrot, Alexandra's Parrot [758]	Vulnerable	Species or species habitat likely to occur within area	In feature area
<b>MAMMAL</b>			
<a href="#">Macroderma gigas</a> Ghost Bat [174]	Vulnerable	Species or species habitat may occur within area	In buffer area only
<a href="#">Macrotis lagotis</a> Greater Bilby [282]	Vulnerable	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
<a href="#">Petrogale lateralis centralis</a> Warru, Central Australian Rock-wallaby [90831]	Vulnerable	Species or species habitat likely to occur within area	In feature area
<a href="#">Sminthopsis psammophila</a> Sandhill Dunnart [291]	Endangered	Species or species habitat may occur within area	In buffer area only

## REPTILE

<a href="#">Liopholis kintorei</a> Great Desert Skink, Tjakura, Warrarna, Mulyamiji [83160]	Vulnerable	Species or species habitat known to occur within area	In feature area
--	------------	---	-----------------

## Listed Migratory Species

[ [Resource Information](#) ]

Scientific Name	Threatened Category	Presence Text	Buffer Status
-----------------	---------------------	---------------	---------------

### Migratory Marine Birds

<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In buffer area only
---	--	--	---------------------

### Migratory Terrestrial Species

<a href="#">Motacilla cinerea</a> Grey Wagtail [642]		Species or species habitat may occur within area	In feature area
<a href="#">Motacilla flava</a> Yellow Wagtail [644]		Species or species habitat may occur within area	In feature area

### Migratory Wetlands Species

<a href="#">Actitis hypoleucos</a> Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area
<a href="#">Calidris melanotos</a> Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
<a href="#">Charadrius veredus</a> Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area	In feature area

## Other Matters Protected by the EPBC Act

Listed Marine Species		[ Resource Information ]	
Scientific Name	Threatened Category	Presence Text	Buffer Status
<b>Bird</b>			
<a href="#">Actitis hypoleucos</a>			
Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
<a href="#">Apus pacificus</a>			
Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In buffer area only
<a href="#">Calidris acuminata</a>			
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area
<a href="#">Calidris melanotos</a>			
Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
<a href="#">Chalcites osculans as Chrysococcyx osculans</a>			
Black-eared Cuckoo [83425]		Species or species habitat likely to occur within area overfly marine area	In feature area
<a href="#">Charadrius veredus</a>			
Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area overfly marine area	In feature area
<a href="#">Merops ornatus</a>			
Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
<a href="#">Motacilla cinerea</a>			
Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area	In feature area



Scientific Name	Threatened Category	Presence Text	Buffer Status
<a href="#">Motacilla flava</a> Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area	In feature area

## Extra Information

### State and Territory Reserves [\[ Resource Information \]](#)

Protected Area Name	Reserve Type	State	Buffer Status
Ngaanyatjarra	Indigenous Protected Area	WA	In feature area

### EPBC Act Referrals [\[ Resource Information \]](#)

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action				
<a href="#">Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia</a>	2015/7522	Not Controlled Action	Completed	In feature area

# Caveat

## 1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

## 2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

## 3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

## 4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

# Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Department of Land and Resource Management, Northern Territory](#)
- [-Department of Environmental and Heritage Protection, Queensland](#)
- [-Department of Parks and Wildlife, Western Australia](#)
- [-Environment and Planning Directorate, ACT](#)
- [-Birdlife Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- Natural history museums of Australia
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-South Australian Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)
- [-Australian National Herbarium, Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence](#)
- [Forestry Corporation, NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- [-Australian Tropical Herbarium, Cairns](#)
- [-eBird Australia](#)
- [-Australian Government – Australian Antarctic Data Centre](#)
- [-Museum and Art Gallery of the Northern Territory](#)
- [-Australian Government National Environmental Science Program](#)
- [-Australian Institute of Marine Science](#)
- [-Reef Life Survey Australia](#)
- [-American Museum of Natural History](#)
- [-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [-Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact us](#) page.

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## **Appendix 4. Declared Pests -s22(2) of the Ngaanyatjarraku Local Government Area**



**Declared Pests - s22(2) of the Ngaanyatjaraku Local Government Area (DPIRD, 2023b).**

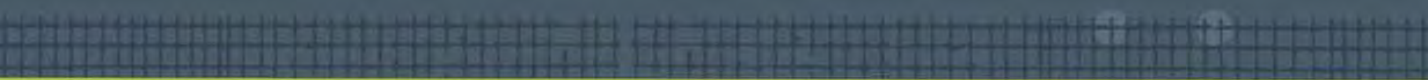
<b>Taxon</b>	<b>Control categories</b>	<b>WoNS</b>	<b>Common name</b>
* <i>Alhagi maurorum</i> Medik.	C3 Management		camelthorn
* <i>Asparagus asparagoides</i> (L.) Druce		Y	bridal creeper
* <i>Austrocylindropuntia cylindrica</i> (Juss. ex Lam.) Backeb.	C3 Management	Y	coral cactus, cane cactus
* <i>Austrocylindropuntia subulata</i> (Muehlenpf.) Backeb.	C3 Management	Y	Eve's pin, Eve's needle
* <i>Calotropis procera</i> (Aiton) W.T.Aiton			rubber bush, calotropis
* <i>Chondrilla juncea</i> L.	C3 Management		skeleton weed, rush skeleton weed, naked weed, hogbite, gum succory
* <i>Coccinea grandis</i>	C3 Management	Y	tindola,scarlet gourd,scarlet fruited gourd,roh,pepino cimarrón,pepasan,mughad,little gourd,kundree,ivy gourd,ekadala,arakis
* <i>Cryptostegia madagascariensis</i> Bojer ex Decne.			Rubbervine, Madagascar rubbervine
* <i>Cylindropuntia fulgida</i> (Engelm.) F.M.Knuth	C3 Management	Y	coral cactus, boxing glove cactus
* <i>Cylindropuntia imbricata</i> (Haw.) F.M.Knuth	C3 Management	Y	rope pear, devil's rope
* <i>Cylindropuntia kleiniae</i> (DC.) F.M.Knuth	C3 Management	Y	candle cholla, Klein's pencil cactus, Klein's cholla
* <i>Cylindropuntia pallida</i> (Rose) F.M.Knuth	C3 Management	Y	white-spined Hudson pear, Hudson pear (white-spined)
* <i>Cylindropuntia tunicata</i> (Lehm.) F.M.Knuth	C3 Management	Y	thistle cholla, brown-spined Hudson pear, Hudson pear (brown-spined)
* <i>Echium plantagineum</i> L.			salvation Jane, Paterson's curse
* <i>Hydrocotyle ranunculoides</i> L. f.	C3 Management		water pennywort, spaghetti weed, hydrocotyle, grote waternavel, floating marsh pennywort
* <i>Jatropha gossypifolia</i> L.	C3 Management	Y	cotton-leaf physic-nut, bellyache bush
* <i>Lantana camara</i> L.	C3 Management	Y	wild sage, white sage, red-flowered sage, largeleaf lantana, common lantana
* <i>Moraea flaccida</i> (Sweet) Steud.			one-leaf cape tulip
* <i>Moraea miniata</i> Andrews			two-leaf cape tulip
* <i>Onopordum acaulon</i> L.			stemless thistle
* <i>Opuntia elata</i> Salm-Dyck	C3 Management	Y	Riverina pear

Taxon	Control categories	WoNS	Common name
* <i>Opuntia elatior</i> Mill.	C3 Management	Y	red-flower prickly pear
* <i>Opuntia engelmannii</i> Salm-Dyck ex Engelm.	C3 Management	Y	Engelmann's prickly pear, Engelmann's pear
* <i>Opuntia ficus-indica</i> (L.) Mill.	C3 Management		tuna cactus, sweet pricklypear, spiny pest pear, spineless cactus, prickly pear, mission pricklypear, grootdoringturksvy, Indian fig, Boereturksvy
* <i>Opuntia microdasys</i> (Lehm.) Pfeiff.	C3 Management	Y	teddy bear cactus, golden bristle cactus, bunny ears
* <i>Opuntia monacantha</i> Haw.	C3 Management	Y	drooping tree pear
* <i>Opuntia polyacantha</i> Haw.	C3 Management	Y	plains prickly pear
* <i>Opuntia puberula</i> Hort. Vindob. ex Pfeiff.	C3 Management	Y	nopal de tortuga, nopal de culebra
* <i>Opuntia stricta</i> (Haw.) Haw.	C3 Management	Y	erect prickly pear, common prickly pear
* <i>Opuntia tomentosa</i> Salm- Dyck	C3 Management	Y	velvet tree pear, velvet pear
* <i>Parkinsonia aculeata</i> L.	C3 Management	Y	parkinsonia
* <i>Pistia stratiotes</i> L.	C2 Eradication		water lettuce
* <i>Prosopis glandulosa</i> Torr. x * <i>Prosopis velutina</i> Wooton	C2 Eradication	Y	mesquite
* <i>Rubus anglocandicans</i> A.Newton	C3 Management	Y	Blackberry
* <i>Rubus laudatus</i> A.Berger	C3 Management	Y	early blackberry
* <i>Rubus rugosus</i> Sm.	C3 Management	Y	keriberry, Himalayan blackberry
* <i>Rubus ulmifolius</i> Schott	C3 Management	Y	elmleaf blackberry, Thornfree, Loch Ness, Blacksatin
* <i>Sagittaria platyphylla</i> (Engelm.) J.G.Sm.	C3 Management	Y	sagittaria, delta arrowhead
* <i>Senna alata</i> (L.) Roxb.			seven-golden-candlesticks, ringwormshrub, ringwormbush, ringworm senna, empress-candle-plant, emperor's candlesticks, candlestick senna, candle bush, Christmas-candle
* <i>Senna obtusifolia</i> (L.) H.S.Irwin & Barneby			sicklepod senna, sicklepod, coffeeweed, Javabean, Chinese Senna
* <i>Silybum marianum</i> (L.) Gaertn.			variegated thistle, milkthistle, blessed milkthistle

Taxon	Control categories	WoNS	Common name
<i>*Solanum elaeagnifolium</i> Cav.		Y	white horsenettle, silverleaf nightshade
<i>*Solanum linnaeanum</i> Hepper & P.-M.L.Jaeger			apple of Sodom
<i>*Tamarix aphylla</i> (L.) H.Karst.		Y	tamarisk, flowering cypress, athel tree, athel tamarisk, athel pine, athel
<i>*Ulex europaeus</i> L.	C3 Management	Y	gorse, furze
<i>*Xanthium spinosum</i> L.	C3 Management		thorny burweed, spiny cocklebur, spiny clotbur, prickly burweed, piikkisappiruoho, dagger weed, dagger cocklebur, burweed, boetebos, Bathurst burr
<i>*Xanthium strumarium</i> L.	C3 Management		Sheepbur, sea burdock ,rough cocklebur, kra chap, karheasappiruoho, kankerroos ,hedgehog burweed, heartleaf cocklebur, ditchbur, common cocklebur,cocklebur,clotbur,buttonbur,burweed,abrojill o,Noogoorra burr, Bathurst burr
<i>*Zantedeschia aethiopica</i> (L.) Spreng.			calla lily,arum lily
<i>*Ziziphus mauritiana</i> Lam.	C3 Management		Saucunazi, macaniqueira, m'sau, Indian jujube, Chinese apple

### Control categories as listed under the Biosecurity and Agriculture Management Regulations 2013 (DPIRD, 2022c)

Category	Description
C1	Organisms which should be excluded from part or all of Western Australia.
C2	Organisms which should be eradicated from part or all of Western Australia.
C3	Organisms that should have some form of management applied that will alleviate the harmful impact of the organism, reduce the numbers or distribution of the organism or prevent or contain the spread of the organism.
Unassigned	Unassigned: Declared pests that are recognised as having a harmful impact under certain circumstances, where their subsequent control requirements are determined by a Plan or other legislative arrangements under the Act.



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# Appendix D Basic and Targeted Vertebrate Fauna Survey



# Basic and Targeted Vertebrate Fauna Survey

## West Musgrave Project Area

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Prepared for: Julimar Resources Pty Ltd

Version 1. December, 2023



## RECORD OF DISTRIBUTION

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### DISCLAIMER

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Appendix B. Regional Vertebrate Fauna Survey Data

Appendix C. Definitions of Significant Fauna under the WA Biodiversity Conservation Act 2016 and Priority Species

Appendix D. Fauna habitat assessment data

## EXECUTIVE SUMMARY

Julimar Resources is proposing exploration activity near the West Musgrave area about 140km west of the junction between the Western Australian, Northern Territory and South Australian borders. It has nominated the location of multiple drill pads and the drill rig access route to these drill holes. The assessed project area is approximately 8km north-west of the Jameson Community and has an area of ~212ha, although the disturbance footprint will be much smaller.

The following four broad fauna habitats are in the project area: grass plains, low shrubs over grass on plains, shrubs over spinifex and low stoney ridges. Because of the sparseness of trees and shrubs, and the extent of bare ground and lack of leaf litter, the project area is likely to have a limited vertebrate fauna assemblage.

There are no conservation significant species likely to be significantly impacted by the proposed exploration drilling program. No referral is recommended under the *EPBC Act 1999*.

## 1. INTRODUCTION

### 1.1 BACKGROUND

Julimar Resources is proposing exploration activity near the West Musgrave area about 140km west of the junction between the Western Australian, Northern Territory and South Australian borders. It has nominated the location of multiple drill pads and the drill rig access route to these drill holes. The assessed project area is approximately 8km north-west of the Jameson Community and has an area of ~212ha (Figures 1 and 2).

### 1.2 PROJECT OBJECTIVES AND SCOPE OF WORKS

Terrestrial Ecosystems was commissioned by Julimar Resources Pty Ltd to undertake a Basic and Targeted vertebrate fauna risk assessment of the project area to support an exploration program. The methodology broadly follows that described in the Environmental Protection Authority's (EPA; 2020) *Technical Guidance – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment*. A Basic fauna assessment involves undertaking a desktop review and reconnaissance site visit. The objectives of this fauna assessment were to:

- provide an indication of the vertebrate fauna assemblage (reptiles, amphibians, mammals and birds) in and near the project area, so that potential impacts on the fauna and fauna assemblage might be adequately assessed; and
- describe the major vertebrate fauna habitats present.

To achieve these objectives, Terrestrial Ecosystems:

- reviewed Terrestrial Ecosystems' database [includes Atlas of Living Australia] to identify potential vertebrate fauna within the areas;
- searched the Commonwealth Governments database of fauna of national environmental significance to identify species potentially occurring within the areas that are protected under the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* or international migratory bird agreements (JAMBA/CAMBA);
- undertook a site reconnaissance survey, assessed fauna habitats and searched the area for conservation significant fauna and their habitat;
- reviewed previous fauna surveys conducted near the project area in similar habitat types; and
- discussed the likelihood of *EPBC Act 1999* and *Biodiversity Conservation (BC) Act 2016* listed species being present in the project area.

## 2. EXISTING ENVIRONMENT

### 2.1 LOCATION OF PROJECT AREA

The project area is within the Mann-Musgrave Block Interim Biogeographic Regionalisation of Australia (IBRA) subregion. This subregion is characterised by the sandplains that support low open woodlands of either Desert Oak or Mulga over *Triodia basedowii* hummock grasslands. Low open woodlands of Ironwood (*Acacia estrophiolata*) and Corkwoods (*Hakea* spp.) over tussock and hummock grasses often fringe ranges (Graham and Cowan 2001). The ranges support mixed wattle scrub or *Callitris glaucophylla* woodlands over hummock and tussock grasslands (Graham and Cowan 2001).

### 2.2 LAND USE HISTORY

The dominant land uses in this IBRA subregion and in the Western Australian section are Aboriginal Reserve (94.33% of subregion area), grazing – freehold (0.03%), grazing – leasehold (1.36%), unallocated crown land and crown reserves (4.28%; Graham and Cowan 2001). A large BHP West Musgrave nickel-copper mine is in early stages of development to the south of the project area.

### 2.3 CLIMATE

The project area is characterised as arid. The Giles weather station, which is approximately 105km to the north, has an annual rainfall of approximately 290mm, although this varies considerably from year-to-year. The highest mean maximum and minimum temperatures in Giles are in December to February (Bureau of Meteorology 2023). The lowest mean daily maximum and minimum temperatures occur in July (Chart 1). Rainfall predominantly occurs between January and March from low pressure cells moving in from the north-west.

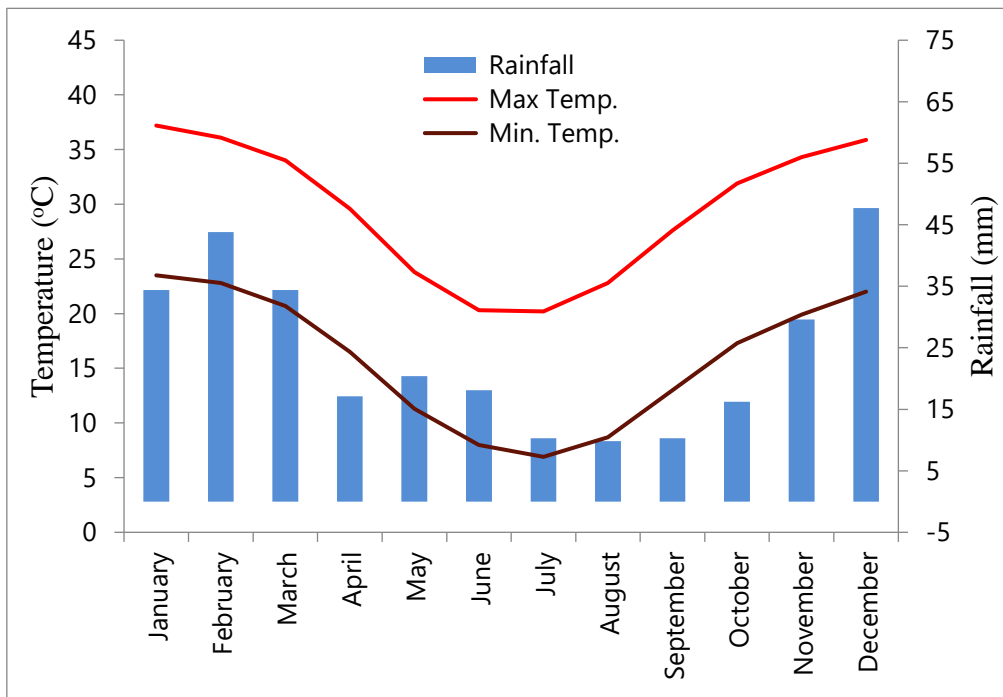


Chart 1. Climatic averages for Giles weather station

## 2.4 REGIONAL BIOLOGICAL FAUNA CONTEXT OF PROJECT AREA

The frogs, reptiles, mammals and birds in the vicinity of the project area have been surveyed for other environmental assessments and are therefore known. Fauna surveys and assessments undertaken in the vicinity of the project area that have been reviewed for this assessment include:

- Adaptive NRM (2021) *West Musgrave Copper and Nickel Project: Night Parrot Desktop Habitat Analysis*, unpublished report for OZ Minerals Ltd, Perth.
- Donato Environmental Services (2019) *Avian and microbat baseline characterisation associated with the proposed wind turbine electricity generators*, unpublished report for OZ Minerals Ltd, Perth.
- Jakkett, N.A. and Leseberg, N.P. (2021) *OZ Minerals Ltd West Musgrave Copper and Nickel Project – Peer Review of Night Parrot assessments*, unpublished report for OZ Minerals Ltd, Perth.
- Ngaanyatjarra Council Land and Culture (2019) *Regional Habitat and Targeted Survey for Great Desert Skink Liopholis kintorei and Targeted Survey for Petrogale lateralis Warru*, Unpublished Report prepared for Oz Minerals and Cassini JV, Western Australia.
- OZ Minerals Ltd (2020) *Regional Habitat and Targeted Survey for Great Desert Skink and Targeted Survey for Petrogale lateralis (Warru)*, unpublished report for OZ Minerals Ltd, Perth.
- Pearson, D. and Turner, J. (2000) Marsupial moles pop up in the Great Victoria and Gibson Deserts, *Australian Mammalogy*, 22, 115-119.
- Western Wildlife (2020) *West Musgrave Copper and Nickel Project: Level 2 Vertebrate Fauna Survey 2018/2019*, unpublished report for OZ Minerals Ltd, Perth.
- Western Wildlife (2020) *West Musgrave Copper and Nickel Project: Targeted Great Desert Skink Survey 2018/2019*, unpublished report for OZ Minerals Ltd, Perth.

The most useful survey data are in the Western Wildlife (2020), Donato Environmental Services (2019) and Ngaanyatjarra Council Land and Culture (2019) reports that were used in the assessment of what is now the proposed BHP mining operation which is immediately south of the project area.

### 2.4.1 Fauna species at risk

An outdated report by Graham and Cowan (2001) indicated that the fauna species at risk in the IBRA subregion included Peregrine Falcon (*Falco peregrinus*), Grey Falcon (*Falco hypoleucos*), Major Mitchell's Cockatoo (*Cacatua leadbeateri*), Princess Parrot (*Polytelis alexandrae*), Scarlet-chested Parrot (*Neophema splendida*), Slender-billed Thornbill (*Acanthiza iredalei iredalei*), Malleefowl (*Leipoa ocellata*), Night Parrot (*Pezoporus occidentalis*), Bilby (*Macrotis lagotis*), Southern Marsupial Mole (*Notoryctes typhlops*), Mulgara (*Dasyercus cristicauda*), Black-footed Rock Wallaby (*Petrogale lateralis*), Great Desert Skink (*Liopholis kintorei*) and Woma (*Aspidites ramsayi*). Some of these species are either no longer on the threatened species list or have changed their classification, and additional species have been added to the list.



### 3. METHODOLOGY

#### 3.1 DATABASE SEARCHES

A search of the *EPBC Act* online database of matters of national environmental significance (MNES) was undertaken to extract a list of conservation significant species that could potentially be in the project area (Appendix A). In addition, a desktop search of the Terrestrial Ecosystems' fauna survey database was used to develop an appreciation of the vertebrate fauna assemblages in relevant sections of the bioregion near the project area.

Other more general texts were also used to provide supplementary information on vertebrate fauna in the bioregion, including Tyler et al. (2000) for frogs; Storr et al. (1983, 1990, 1999, 2002) and Thompson and Thompson (2006) for reptiles; Johnstone and Storr (1998, 2004) for birds; and Van Dyck and Strahan (2008) for mammals.

Collectively these sources of information were used to create lists of species expected to utilise the project area and broader subregion. It should be noted that these lists will include species that have been recorded in the general region but are possibly vagrants and they will not generally be found in the project area due to a lack of suitable habitat (e.g. wetland and shore birds). Vagrants can be recorded almost anywhere. Many of the records are historical and some of the species are no longer present in the areas (e.g. Bilby). Many of the bird, mammal, reptile and amphibian species have specific habitat requirements that may be present in the general area but not in the project area. Also, the ecology of many of these species is often not well understood and it can sometimes be difficult to indicate those species whose specific habitat requirements are not present in the project area. Therefore, many species will be included in the lists produced from database searches but will not be present in the actual project area.

There are errors in most databases, including Atlas of Living Australia and the WA Museum collection. These errors occur because of a misidentification of individuals, taxonomic name changes and incorrect coordinates being entered into the database. Terrestrial Ecosystems was unable to verify the primary records, so it has used the information provided. Obvious errors have been removed but readers should appreciate that species lists, and fauna surveys reported in the appendices may include these errors.

#### 3.2 SITE INSPECTION AND FAUNA HABITAT ASSESSMENT

The project area was assessed on 12-13 October 2023 and the purpose of this assessment was to record fauna habitat types and condition in the project area, and to search for evidence of conservation significant vertebrate fauna in the project area. Specifically, the zoologists focused their search on the Great Desert Skink, Malleefowl, Bilby and Night Parrot habitat. The fauna habitat assessment had two foci:

- assessing fauna habitat types and their condition; and
- assessing the possible presence of and recording evidence of conservation significant fauna.

This information included a description of the habitat structure, habitat condition, landform, soils and vegetation and time since last fire. The data in Table 1 were assessed at each location as part of the habitat assessment:

**Table 1. Habitat assessment variables**

<b>Observer's Name:</b>	
<b>Coordinates of the location as UTM (GDA94):</b>	
<b>Fire history – options</b>	
<input type="checkbox"/> > 5 years	
<input type="checkbox"/> 1-5 years	
<input type="checkbox"/> < 1 year	
<b>Landform – options</b>	
<input type="checkbox"/> Beach	<input type="checkbox"/> Lower slope
<input type="checkbox"/> Clay plain	<input type="checkbox"/> Mid slope
<input type="checkbox"/> Cliff	<input type="checkbox"/> Ridge
<input type="checkbox"/> Creek line	<input type="checkbox"/> River
<input type="checkbox"/> Dam	<input type="checkbox"/> Rocky outcrop / breakaway
<input type="checkbox"/> Drainage line	<input type="checkbox"/> Salt lake
<input type="checkbox"/> Dune crest	<input type="checkbox"/> Sand dune
<input type="checkbox"/> Dune slope	<input type="checkbox"/> Sand plain
<input type="checkbox"/> Dune swale	<input type="checkbox"/> Stony plain
<input type="checkbox"/> Escarpment	<input type="checkbox"/> Swamp
<input type="checkbox"/> Flat	<input type="checkbox"/> Undulating
<input type="checkbox"/> Gorge	<input type="checkbox"/> Upper slope
<input type="checkbox"/> Gully	<input type="checkbox"/> Wetland
<input type="checkbox"/> Intertidal / mangrove	<input type="checkbox"/> Water hole
<input type="checkbox"/> Lake / lake edge	
<b>Habitat quality – options</b>	
<input type="checkbox"/> <i>High quality fauna habitat</i> – These areas closely approximate the vegetation mix and quality that would have been in the area prior to any disturbance. The habitat has connectivity with other habitats and is likely to contain the most natural vertebrate fauna assemblage.	
<input type="checkbox"/> <i>Very good fauna habitat</i> - These areas show minimal signs of disturbance (e.g. grazing, clearing, fragmentation, weeds) and generally retain many of the characteristics of the habitat if it had not been disturbed. The habitat has connectivity with other habitats and fauna assemblages in these areas are likely to be minimally effected by disturbance.	
<input type="checkbox"/> <i>Good fauna habitat</i> – These areas showed signs of disturbance (e.g. grazing, clearing, fragmentation, weeds) but generally retain many of the characteristics of the habitat if it had not been disturbed. The habitat has connectivity with other habitats and fauna assemblages in these areas are likely to be affected by disturbance.	
<input type="checkbox"/> <i>Disturbed fauna habitat</i> – These areas showed signs of significant disturbance. Many of the trees, shrubs and undergrowth are cleared. These areas may be in the early succession and regeneration stages. Areas may show signs of significant grazing, containing weeds or have been damaged by vehicle or machinery. Habitats are fragmented or have limited connectivity with other fauna habitats. Fauna assemblages in these areas are likely to differ significantly from what might be expected in the area had the disturbance not occurred.	
<input type="checkbox"/> <i>Highly degraded fauna habitat</i> – These areas often have a significant loss of vegetation, an abundance of weeds, and a large number of vehicle tracks or are completely cleared. Limited or no fauna habitat connectivity. Fauna	

<b>Observer's Name:</b>	
assemblages in these areas are likely to be significantly different to what might have been in the area pre-disturbance.	
<b>Soil colour - options</b>	
<input type="checkbox"/> Black	<input type="checkbox"/> Red
<input type="checkbox"/> Brown	<input type="checkbox"/> White
<input type="checkbox"/> Grey	<input type="checkbox"/> Yellow
<input type="checkbox"/> Orange	
<b>Surface stones – options</b>	
<input type="checkbox"/> None	<input type="checkbox"/> Boulders (>250mm)
<input type="checkbox"/> Pebbles (0-50mm)	<input type="checkbox"/> Rocks
<input type="checkbox"/> Cobbles (51-250)	

### 3.2.1 Field work and reporting staff

Dr Scott Thompson and Simon Pitt undertook the site investigation and fauna habitat assessment. This assessment was carried out using a utility all-terrain vehicle (UTV), and all sections of the project area were covered. Dr Graham Thompson drafted this report, Dr Scott Thompson reviewed this report before it was sent to the client and Simon Pitt prepared the fauna habitat maps.

Senior scientists have appropriate relevant post-graduate qualifications, extensive experience in conducting fauna assessments, have published research articles on biodiversity, fauna assemblages, conservation significant species, trapping techniques and temporal variations in trapped fauna assemblages and are therefore appropriately trained and experienced for the task of preparing this assessment.

Dr Scott Thompson is the only environmental practitioner in Western Australia who has independent specialist certification (CEnvP – Ecology Specialist) in combination with post-graduate tertiary qualifications and is a licenced pest management technician (LPMT). This unique set of skills and qualifications ensures Scott undertakes fauna surveys, assessments and control programs to the highest standard and quality assurance. The qualifications and experience of the survey personnel are shown in Table 2.

**Table 2. Project personnel and their qualifications**

Name	Qualifications	Experience	Role
<b>Dr Scott Thompson</b>	BSc. (Env. Sc.), MSc. (Env. Mngt.), PhD (Env. Sc./Mngt); Cert III (Vert Pest Mng); Cert IV (WHS); CEnvP (Ecology Specialist)	> 20 years	Survey coordinator and Principal zoologist
<b>Dr Graham Thompson</b>	Post Grad. Dip. (Zool.), PhD (Zoology); Cert III (Vert Pest Mng);	> 20 years	Principal zoologist
<b>Simon Pitt</b>	BSc (NRM); Cert III (Rural and Env Pest Mng);	>15 years	Field work, fauna habitat mapping and report preparation.

### 3.3 TAXONOMY AND NOMENCLATURE

Taxonomy and nomenclature for fauna species used in this report are generally based on the WA Museum species list. Terrestrial Ecosystems has presumed that the identifications referred to in the appendices or in reports used to provide local and regional comparative data are correct and we have only corrected obvious records where the nomenclature was known to be incorrect.

### 3.4 LIMITATIONS

This Basic vertebrate fauna risk assessment is based on information contained in the Commonwealth Government database and other published and unpublished fauna survey data for the bioregion and a site visit. It is acknowledged that multiple surveys conducted in different seasons, repeated over several years and different seasonal conditions are necessary to fully appreciate the fauna assemblage in the project area.

The EPA's (2020) *Technical Guidance - Terrestrial vertebrate fauna surveys for environmental impact assessment* suggested that fauna surveys may be limited by many variables. Limitations associated with each of these variables are assessed in Table 3.

**Table 3. Fauna survey limitations and constraints**

Possible limitations	Constraint	Comment
<b>Availability of data and information</b>	Yes, negligible	There are vertebrate fauna survey data available for similar habitats immediately to the south of the project area. These data were the basis of the EPA's assessment of potential impacts on the mine that is now in early stages of development.
<b>Competency/experience of the survey team, including experience in the bioregion surveyed</b>	No	The authors of this report have appropriate graduate and post-graduate qualifications, have undertaken multiple surveys and assessments, have published a book and multiple refereed journal articles based on fauna surveys and are familiar with the vertebrate fauna in this bioregion.
<b>Scope of the survey, e.g. where faunal groups were excluded from the survey</b>	N/A	Although no trapping surveys were undertaken during the site assessment, fauna survey data from Western Wildlife's (2020) Donato Environmental Services (2019) and Ngaanyatjarra Council Land and Culture's (2019) surveys are adequate to represent the vertebrate fauna in the project area.
<b>Timing, weather and season</b>	No	Weather was suitable for a site visit.
<b>Disturbance that may have affected results, e.g. fire, flood</b>	No	Disturbances in the project area have been factored into this assessment.
<b>The proportion of fauna identified, recorded or collected</b>	N/A	
<b>Adequacy of the survey intensity and proportion of survey achieved, e.g. the extent to which the area was surveyed</b>	No	Basic survey requirements were met.
<b>Access problems</b>	No	The site was accessible using UTV.
<b>Problems with data and analysis, including sampling biases</b>	N/A	

N/A = not applicable, Significant = major impact on outcome of the assessment, Moderate = impacted parts of the assessment, Negligible = almost no impact on the assessment.



## 4. RESULTS

### 4.1 FAUNA HABITAT

One hundred and forty-four habitat assessments were completed in the project area (Appendix D). The following four fauna habitats were identified:

- Grass plains;
- Low shrubs over grass on plains;
- Shrubs over spinifex;
- Low stoney ridges; and
- Disturbed.

Plates 1–8 provide a visual indication of the fauna habitats and disturbed areas in the project area.



**Plate 1. Grass plains**



**Plate 2. Grass plains**



**Plate 3. Low shrubs over grass on plains**



**Plate 4. Low shrubs over grass on plains**





**Plate 5. Shrubs over spinifex**



**Plate 6. Shrubs over spinifex**



**Plate 7. Low stoney ridges**



**Plate 8. Low stoney ridges**

#### **4.1.1 Feral and pest fauna**

The field survey recorded evidence of camels (Plate 9), wild dogs (Plate 10), rabbits (Plate 11) and feral cats (Plate 12) in the project area.





**Plate 9. Camel tracks**



**Plate 10. Wild dog**



**Plate 11. Rabbit scats**



**Plate 12. Cat tracks**

## 4.2 BIOREGIONAL VERTEBRATE FAUNA ASSEMBLAGE

Appendix B provides a summary of the fauna survey data that are available near the project area. There are appreciable differences in the recorded fauna assemblages within and among fauna surveys shown in Appendix B. These differences are partially due to the varying survey effort deployed by some of the surveys and they also reflect variations in soils and vegetation as well as temporal variations in the fauna assemblages.

Tables 3-6 provide a list of vertebrate species potentially found near the project area that have been compiled based on the fauna survey report results shown in Appendix B.

**Table 4. Birds potentially found near the project area**

Family	Species	Common name	Family	Species	Common name
Casuariidae	<i>Dromaius novaehollandiae</i>	Emu		<i>Purnella albifrons</i>	White-fronted Honeyeater
Columbidae	<i>Phaps chalcoptera</i>	Common Bronzewing		<i>Manorina flavigula</i>	Yellow-throated Miner
	<i>Ocyphaps lophotes</i>	Crested Pigeon		<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater
Cuculidae	<i>Cacomantis pallidus</i>	Pallid Cuckoo		<i>Gavicalis virescens</i>	Singing Honeyeater
Caprimulgidae	<i>Eurostopodus argus</i>	Spotted Nightjar		<i>Ptilotula plumula</i>	Grey-fronted Honeyeater
Burhinidae	<i>Burhinus grallarius</i>	Bush Stone-curlew		<i>Epthianura tricolor</i>	Crimson Chat
Turnicidae	<i>Turnix velox</i>	Little Buttonquail		<i>Epthianura aurifrons</i>	Orange Chat
Otididae	<i>Ardeotis australis</i>	Australian Bustard	Pardalotidae	<i>Pardalotus rubricatus</i>	Red-browed Pardalote
Accipitridae	<i>Elanus axillaris</i>	Black-shouldered Kite	Acanthizidae	<i>Pyrrholaemus brunneus</i>	Redthroat
	<i>Hamirostra melanosternon</i>	Black-breasted Buzzard		<i>Acanthiza apicalis</i>	Inland Thornbill
	<i>Aquila audax</i>	Wedge-tailed Eagle		<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill
	<i>Circus assimilis</i>	Spotted Harrier		<i>Acanthiza robustirostris</i>	Slaty-backed Thornbill
	<i>Haliastur sphenurus</i>	Whistling Kite		<i>Smicronis brevirostris</i>	Weebill
Tytonidae	<i>Tyto alba</i>	Barn Owl		<i>Aphelocephala leucopsis</i>	Southern Whiteface
Alcedinidae	<i>Todiramphus pyrrhopygius</i>	Red-backed Kingfisher		<i>Aphelocephala nigricincta</i>	Banded Whiteface
Meropidae	<i>Merops ornatus</i>	Rainbow Bee-eater	Pomatostomidae	<i>Pomatostomus superciliosus</i>	White-browed Babbler
Falconidae	<i>Falco cenchroides</i>	Nankeen Kestrel	Campephagidae	<i>Coracina maxima</i>	Ground Cuckooshrike
	<i>Falco longipennis</i>	Australian Hobby		<i>Coracina novaehollandiae</i>	Black-faced Cuckooshrike
	<i>Falco berigora</i>	Brown Falcon		<i>Lalage tricolor</i>	White-winged Triller
Cacatuidae	<i>Eolophus roseicapilla</i>	Galah	Neosittidae	<i>Daphoenositta chrysoptera</i>	Varied Sittella
	<i>Nymphicus hollandicus</i>	Cockatiel	Psophodidae	<i>Psophodes occidentalis</i>	Chiming Wedgebill
Psittaculidae	<i>Neopsephotus bourkii</i>	Bourke's Parrot	Oreoicidae	<i>Oreoica gutturalis</i>	Crested Bellbird
	<i>Barnardius zonarius</i>	Australian Ringneck	Pachycephalidae	<i>Colluricincla harmonica</i>	Grey Shrikethrush
	<i>Psephotus varius</i>	Mulga Parrot		<i>Pachycephala rufiventris</i>	Rufous Whistler
	<i>Melopsittacus undulatus</i>	Budgerigar	Artamidae	<i>Artamus cinereus</i>	Black-faced Woodswallow
Ptilonorhynchidae	<i>Chlamydera guttata</i>	Western Bowerbird		<i>Cracticus nigrogularis</i>	Pied Butcherbird
Maluridae	<i>Amytornis oweni</i>	Sandhill Grasswren		<i>Gymnorhina tibicen</i>	Australian Magpie
	<i>Stipiturus ruficeps</i>	Rufous-crowned Emuwren	Rhipiduridae	<i>Rhipidura leucophrys</i>	Willie Wagtail
	<i>Malurus assimilis</i>	Purple-backed Fairywren	Monarchidae	<i>Grallina cyanoleuca</i>	Magpie-lark
	<i>Malurus splendens</i>	Splendid Fairywren	Corvidae	<i>Corvus orru</i>	Torresian Crow
	<i>Malurus leucopterus</i>	White-winged Fairywren	Petroicidae	<i>Petroica goodenovii</i>	Red-capped Robin
Meliphagidae	<i>Certhionyx variegatus</i>	Pied Honeyeater			



Family	Species	Common name
	<i>Melanodyras cucullata</i>	Hooded Robin
Locustellidae	<i>Cincloramphus cruralis</i>	Brown Songlark
	<i>Cincloramphus mathewsi</i>	Rufous Songlark

Family	Species	Common name
Hirundinidae	<i>Cheramoeca leucosterna</i>	White-backed Swallow
Estrildidae	<i>Taeniopygia guttata</i>	Zebra Finch
Motacillidae	<i>Anthus novaeseelandiae</i>	Australasian Pipit

**Table 5. Amphibians potentially found near the project area**

Family	Species	Common name
Limnodynastidae	<i>Notaden nichollsi</i>	Desert Spadefoot

**Table 6. Mammals potentially found near the project area**

Family	Species	Common name
Bovidae	<i>Bos taurus</i>	Cow
Camelidae	<i>Camelus dromedarius</i>	Dromedary
Canidae	<i>Canis</i> sp.	Wild dog
	<i>Vulpes vulpes</i>	Red Fox
Felidae	<i>Felis catus</i>	Cat
Molossidae	<i>Austronomus australis</i>	White-striped Freetail Bat
	<i>Mormopterus petersi</i>	Inland Free-tail Bat
Vespertilionidae	<i>Chalinolobus morio</i>	Chocolate Wattled Bat
	<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat
Dasyuridae	<i>Dasyercus blythi</i>	Brush-tailed Mulgara
	<i>Ningau ridei</i>	Wongai Ningau
	<i>Pseudantechinus macdonnellensis</i>	Fat-tailed False Antechinus
	<i>Sminthopsis hirtipes</i>	Hairy-footed Dunnart

Family	Species	Common name
	<i>Sminthopsis ooldea</i>	Ooldea Dunnart
	<i>Sminthopsis youngsoni</i>	Lesser Hairy-footed Dunnart
Macropodidae	<i>Lagorchestes hirsutus</i>	Rufous Hare-wallaby
	<i>Osphranter robustus</i>	Euro
	<i>Petrogale lateralis</i>	Black-flanked Rock-wallaby
Leporidae	<i>Oryctolagus cuniculus</i>	Rabbit
	<i>Notoryctes typhlops</i>	Southern Marsupial Mole
Equidae	<i>Equus caballus</i>	Horse
Muridae	<i>Mus musculus</i>	House Mouse
	<i>Notomys alexis</i>	Spinifex Hopping Mouse
	<i>Pseudomys desertor</i>	Desert Mouse
	<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse

**Table 7. Reptiles potentially found near the project area**

Family	Species	Common name
Agamidae	<i>Ctenophorus clayi</i>	Black-collared Dragon
	<i>Ctenophorus graafi</i>	Ring-tailed Dragon
	<i>Ctenophorus isolepis</i>	Central Military Dragon
	<i>Ctenophorus nuchalis</i>	Central Netted Dragon
	<i>Ctenophorus reticulatus</i>	Western Netted Dragon
	<i>Gowidon longirostris</i>	Long-nosed Dragon
	<i>Moloch horridus</i>	Thorny Devil

Family	Species	Common name
	<i>Pogona minor</i>	Western Bearded Dragon
Carphodactylidae	<i>Nephrurus levis</i>	Three-lined Knob-tail
Diplodactylidae	<i>Diplodactylus conspicillatus</i>	Fat-tailed Gecko
	<i>Diplodactylus laevis</i>	Desert Fat-tailed Gecko
	<i>Lucasium stenodactylum</i>	Crowned Gecko
	<i>Rhynchoedura ornata</i>	Beaked Gecko
	<i>Strophurus ciliaris</i>	Spiny-tailed Gecko

Family	Species	Common name
	<i>Strophurus elderi</i>	Jewelled Gecko
	<i>Strophurus intermedius</i>	Southern Spiny-tailed Gecko
	<i>Strophurus strophurus</i>	Western Spiny-tailed Gecko
Elapidae	<i>Brachyurophis fasciolatus</i>	Narrow-banded Burrowing Snake
	<i>Demansia psammophis</i>	Yellow-faced Whipsnake
	<i>Suta monachus</i>	Hooded Snake
	<i>Pseudechis australis</i>	Mulga Snake
	<i>Pseudonaja mengdeni</i>	Western Brown Snake
	<i>Pseudonaja modesta</i>	Ringed Brown Snake
	<i>Simoselaps anomalus</i>	Desert Banded Snake
Gekkonidae	<i>Gehyra montium</i>	Centralian Dtella
	<i>Gehyra purpurascens</i>	Purplish Dtella
	<i>Gehyra variegata</i>	Variiegated Gehyra
	<i>Heteronotia binoei</i>	Bynoe's Gecko
Pygopodidae	<i>Delma butleri</i>	Unbanded Delma
	<i>Delma desmosa</i>	Banded Delma
	<i>Delma nasuta</i>	Sharp-snouted Delma
	<i>Lialis burtonis</i>	Burton's Legless Lizard
	<i>Pygopus nigriceps</i>	Western Hooded Scaly-foot
Pythonidae	<i>Antaresia stimsoni</i>	Stimson's Python
	<i>Aspidites ramsayi</i>	Woma
Scincidae	<i>Ctenotus brooksi</i>	Brooks Ctenotus
	<i>Ctenotus calurus</i>	Blue-tailed Finesnout Ctenotus
	<i>Ctenotus helenae</i>	Clay-soil Ctenotus
	<i>Ctenotus inornatus</i>	Bar-shouldered Ctenotus
	<i>Ctenotus leonhardii</i>	Leonhardi's Ctenotus
	<i>Ctenotus nasutus</i>	Nasute Finsnout Ctenotus
	<i>Ctenotus pantherinus</i>	Leopard Ctenotus
	<i>Ctenotus piankai</i>	Coarse Sands Ctenotus

Family	Species	Common name
	<i>Ctenotus quattuordecimlineatus</i>	Fourteen-lined Ctenotus
	<i>Ctenotus schomburgkii</i>	Barred Wedgesnout Ctenotus
	<i>Cyclodomorphus melanops</i>	Spinifex Slender Blue-tongue
	<i>Egernia eos</i>	Central Pygmy Spiny-tailed Skink
	<i>Eremiascincus pallidus</i>	Western Sand-swimming Skink
	<i>Eremiascincus richardsonii</i>	Broad-banded Sand-swimmer
	<i>Lerista bipes</i>	North-western Sandslider
	<i>Lerista desertorum</i>	Central Desert Robust Slider
	<i>Lerista labialis</i>	Southern Slider
	<i>Lerista taeniata</i>	Ribbon Slider
	<i>Lerista timida</i>	Timid Slider
	<i>Liopholis inornata</i>	Desert Skink
	<i>Liopholis kintorei</i>	Great Desert Skink
	<i>Liopholis striata</i>	Nocturnal Desert Skink
	<i>Menetia greyii</i>	Common Dwarf Skink
	<i>Morethia ruficauda</i>	Lined Fire-tailed Skink
	<i>Notoscincus ornatus</i>	Ornate Soil-crevice Skink
	<i>Tiliqua multifasciata</i>	Central Blue-tongue
	<i>Tiliqua occipitalis</i>	Western Blue-tongued Lizard
Typhlopidae	<i>Anilius endoterus</i>	Interior Blind Snake
	<i>Anilius grypous</i>	Long-beaked Blind Snake
Varanidae	<i>Varanus acanthurus</i>	Spiny-tailed Monitor
	<i>Varanus brevicauda</i>	Short-tailed Pygmy Monitor
	<i>Varanus eremius</i>	Pygmy Desert Monitor
	<i>Varanus giganteus</i>	Perentie
	<i>Varanus gilleni</i>	Pygmy Mulga Monitor
	<i>Varanus gouldii</i>	Gould's Goanna
	<i>Varanus tristis</i>	Black-headed Monitor



### 4.3 CONSERVATION SIGNIFICANT FAUNA

Conservation significant fauna are protected by the Commonwealth *EPBC Act 1999*, and this list includes species covered by international treaties such as the Japan-Australia Migratory Bird Agreement (JAMBA) and China-Australia Migratory Bird Agreement (CAMBA) and the Western Australia (WA) *BC Act 2016*. The *BC Act 2016* provides for the publishing of the *Wildlife Conservation (Specially Protected Fauna) Notice* that lists species under multiple categories. In addition, DBCA maintains a list of fauna that require monitoring under four priorities based on the current knowledge of their distribution, abundance and threatening processes. The *EPBC Act 1999* and *BC Act 2016* imply legislative requirements for the management of anthropogenic impacts to minimise the effects of disturbances on species and their habitats. Priority species have no statutory protection, other than the DBCA wishes to monitor potential impacts on these species. Environmental consultants and proponents of developments are encouraged to avoid and minimise impacts on these species. Definitions of the significant fauna under the *BC Act 2016* are provided in Appendix C. The fauna species that have special status in either State or Commonwealth government legislation or are on the DBCA Priority species list and are potentially present in the vicinity of the project area are listed in Table 8. Although they were recorded in the search of the MNES online database, migratory waders and shorebirds that typically would be found around the edge of salt lakes, clay pans, estuaries and marshes have been excluded from Table 8 as there is no suitable habitat nearby.

The following is an assessment of the likelihood of each of the species listed in Table 8 being found in the project area.

**Table 8. assessment of the potential presence of a conservation significant fauna species in the project area**

Species	BC Act / DBCA priority species	EPBC Act	Comment on the potential to be in the project area
Sandhill Dunnart <i>Sminthopsis psammophila</i>	Endangered	Endangered	Not present due a lack of suitable habitat
Red Goshawk <i>Erythrotriorchis radiatus</i>	Vulnerable	Endangered	Not present due a lack of suitable habitat
Night Parrot <i>Pezoporus occidentalis</i>	Endangered	Critically endangered	Not present due a lack of suitable habitat
Southern Whiteface <i>Aphelocephala leucopsis</i>		Vulnerable	Not present due a lack of suitable habitat
Ghost Bat <i>Macroderma gigas</i>	Vulnerable	Vulnerable	Not present due a lack of suitable habitat
Great Desert Skink <i>Liopholis kintorei</i>	Vulnerable	Vulnerable	Not present due a lack of suitable habitat
Grey Falcon <i>Falco hypoleucos</i>	Vulnerable	Vulnerable	Not present due a lack of suitable habitat
Malleefowl <i>Leipoa ocellata</i>	Vulnerable	Vulnerable	Not present due a lack of suitable habitat
Greater Bilby <i>Macrotis lagotis</i>	Vulnerable	Vulnerable	Not present due a lack of suitable habitat
Central Australian Rock-wallaby <i>Petrogale lateralis centralis</i>	Vulnerable	Vulnerable	Not present due a lack of suitable habitat
Princess Parrot <i>Polytelis alexandrae</i>	Vulnerable	Vulnerable	Not present due a lack of suitable habitat

Species	BC Act / DBCA priority species	EPBC Act	Comment on the potential to be in the project area
Brush-tailed Mulgara <i>Dasyercus cristicauda</i>	P4		Not present due a lack of suitable habitat
Woma <i>Aspidites ramysayi</i>	P4		Not present due a lack of suitable habitat
Marsupial Mole <i>Notoryctes typhlops</i>	P4		Not present due a lack of suitable habitat

**Sandhill Dunnart (*Sminthopsis psammophila*)** – Endangered under the *BC Act 2016* and *EPBC Act 1999*

The Sandhill Dunnart is a small (30-45g) arid adapted dasyurid that is found in the eastern part of the Western Australian section of the Great Victoria Desert, eastern Goldfields and the western and southern parts of South Australia. Recent surveys undertaken for the Great Victoria Desert Trust has increased their geographic range in the Great Victoria Desert and into the eastern Goldfields.

Riley (2020) and Riley et al. (2021) indicated that the Sandhill Dunnart typically uses Stages 4 and 5 hummocks, and occasionally Stage 3, with Stage 4 being an open hummock ring with soft, dead leaves centrally and Stage 5 is where the hummock breaks apart and continues spreading, and the larger parts remain as suitable shelter for the dunnart.

The habitat in the project area is not suitable for this dunnart and there are no records of the Sandhill Dunnart near the project area in the Atlas of Living Australia. The Sandhill dunnart is not present in the project area.

**Red Goshawk (*Erythroriorchis radiatus*)** – Endangered under the *BC Act 2016* and *EPBC Act 1999*

Johnstone and Storr (1998) and the Atlas of Living Australia indicate the Red Goshawk's geographic distribution is confined to the Kimberley area, so it is highly improbable that it would be recorded in the project area.

**Night Parrot (*Pezoporus occidentalis*)** - Critically Endangered under the *BC Act 2016* and Endangered under the *EPBC Act 1999*

The Night Parrot is a small, arid-adapted, nocturnal, ground-feeding parrot (Johnstone and Storr 1998, Threatened Species Scientific Committee 2016). Its length is 22-25cm with a body mass of approximately 104g (Threatened Species Scientific Committee 2016), although it was suggested that they were semi-nomadic, the Night Parrots in south-western Queensland appear to be sedentary (Murphy 2015).

The Night Parrot was probably originally distributed over much of semi-arid and arid Australia (Garnett et al. 1993, Threatened Species Scientific Committee 2016). Records in north-west and western Queensland in the early 1990-2000s were in a broad cross section of the habitats available (Garnett et al. 1993, Cupitt and Cupitt 2008, Boles et al. 2016). There have been recent sightings in the Pilbara in 1980, 2005 and 2017, central WA in 1979, north-eastern South Australia in 1979, western Queensland (including Pullen-Pullen-Mt Windsor-Diamantina population) in 1980, 1990, 1993, 2006 and 2013-17 (Davis and Metcalf 2008, Garnett et al. 2011, Charalambous 2016, Pickrell 2016, AG staff 2017, Palaszczuk and Miles 2017, Rykers 2017, AG staff 2018), Pilbara in 2017 (Jones 2017) and the northern Goldfields (Jackett et al. 2017). Garnett *et al.* (2011) suggested that there were between 50-250 mature individuals in less than 5% of its previous range.

Wilson's (1937) summary of observations provided information on the early records of Night Parrots' preferred habitat and breeding sites. Recent information indicates its preferred habitat appears to be in *Triodia* grasslands, chenopod shrublands, shrubby samphire and floristically diverse habitats dominated by large-seeded species (Threatened Species Scientific Committee 2016, McCarthy 2017, Murphy et al. 2017b). At Pullen Pullen Reserve it nests in large, more or less ring-shaped *Triodia*, and the nest consists of a tunnel (25-30° and 0° to the ground; 20-33cm long) through an apron of dead spinifex leaves that leads to a chamber under a live

hummock, with a shallow depression (3-4cm) excavated into the gravelly/sandy soil (Murphy et al. 2017a). In the northern Goldfields the nest was again in a spinifex hummock, it was circular, with an excavated depression (~1.5-2.0cm) in sandy substrate (Hamilton et al. 2017, Jackett et al. 2017). The entrance tunnel was 62cm long, and was downward sloping (27°) with the entrance 28cm above the ground (Hamilton et al. 2017). It has clutches of two to four sub-elliptical, white eggs with a lustrous appearance (Murphy et al. 2017a). Breeding followed significant rains in March for the observations in Pullen-Pullen Reserve and in April in the northern Goldfields (Hamilton et al. 2017, Murphy et al. 2017a), but it is thought that breeding generally occurs between April and October (Murphy et al. 2017a).

Night Parrots establish long-term stable roost sites in long unburnt *Triodia* sp. and these sites typically support a pair or small group of Night Parrots, with individual roosts spread across an area up to several hectares (Adaptive NRM 2021). These roost sites are in open landscapes (Jackett et al. 2017, Murphy et al. 2017a) with some scattered shrubs or isolated trees, although they are predominantly treeless. Night Parrot's perceived lower visual acuity may compromise its capacity to fly in treed areas, so it selects sites to reduce potential collisions when flying (Iwaniuk et al. 2020). The Department of Parks and Wildlife (2017) described localised Night Parrot habitat as 'roosting and nesting sites in clumps of dense vegetation, primarily old and large spinifex clumps (often >50 years unburnt), especially hummocks that are ring-forming. These may be in expanses or isolated patches, but sometimes associated with other vegetation types, such as dense chenopod shrubs. Spinifex hummocks that are collapsed (i.e. less than about 40-50 cm in height) are not likely to provide adequate shelter'.

Night Parrots forage on seeds in areas of higher productivity. Murphy *et al.* (2017b) placed a GPS tag on two Night Parrots and reported that the birds called at dusk from their diurnal roosts among spinifex hummocks and then flew to more floristically diverse habitats dominated by large-seeded, prolifically seeding species to feed.

Flyways are the connecting areas between where Night Parrots forage and roost and could include areas of low mixed grassland, shrubs, herbs and chenopods with bare gibber (Cupitt and Cupitt 2008, Boles et al. 2016). Murphy et al. (2017b) reported Night Parrots fly tens of kilometres when moving between foraging and perhaps drinking water, and probably traverse a variety of habitat types.

Donata Environmental Services (2019) undertook an investigation of the avian and microbat fauna in the West Musgrave mining project area, which is immediately to the south of the project area and Jackett and Leseberg (2021) peer reviewed this report. No evidence of Night Parrots were recorded by Donata Environmental Services (2019) survey, however, the Jackett and Leseberg's (2021) assessment indicated the survey and assessment was inadequate and Night Parrot habitat was present in the project area.

There are no substantive mature spinifex hummocks in the project area and numerous feral fauna. As the preferred roosting and nesting sites for Night Parrots is not present and there is a significant threatening process for the species in the area (i.e. wild dogs and feral cats), Terrestrial Ecosystems' assessment is that the Night Parrot is not present in the project area.

### **Southern Whiteface (*Aphelocephala leucopsis*) - Vulnerable under the EPBC Act 1999**

The Southern Whiteface is a recent addition to the EPBC Act listing of vulnerable species. It is a small bird found in the arid and semi-arid interior from the WA coast near Hamelin Bay through the Great Victoria Desert into the arid areas of South Australia, Victoria, NSW and Queensland (Johnstone and Storr 2004, Department of Climate Change Energy 2023).

It is found in open woodlands and shrublands with an understorey of grasses and low shrubs (Department of Climate Change Energy 2023). It forages on the ground, feeding on insects, spiders and seeds, mostly found in the leaf-litter (Johnstone and Storr 2004, Department of Climate Change Energy 2023).

There are Southern Whiteface records in the Atlas of Living Australia in multiple locations around the project area, so in suitable habitat, it could be present. This small bird is potentially found in the areas more densely vegetated with shrubs, however, the proposed exploration drilling program will not impact on this species as it will readily move.

**Ghost Bat (*Macroderma gigas*)** - Vulnerable under the *EPBC Act 1999* and *BC Act 2016*

Armstrong and Anstee (2000), in their summary of the geographic distribution of *M. gigas* in the Pilbara, reported that they had been present in the Abydos Plain, Chichester Plateau, Gascoyne Ranges, George Ranges, Hamersley Plateau and Oakover Valley. However, more recently McKenzie and Bullen (2009) reported it as being more common in the Pilbara than previously thought despite detectability constraints caused by its cryptic call. Its preferred habitat in the Hamersley Ranges was caves beneath bluffs of low rounded hills composed of Marra Mamba geology and granite rock piles in the eastern Pilbara (Armstrong and Anstee 2000). Armstrong and Anstee (2000) reported that while the Marra Mamba iron formation was a good predictor of the occurrence of *M. gigas* in the Hamersley Range, essentially any cave beneath a bluff with sufficient depth could be considered a potential roost. It is highly unusual to find this bat in a spinifex plain unless it is near a rocky area containing suitable roosting caves.

The Atlas of Living Australia has records of this bat just inside the NT and SA border in a similar latitude to the project area. This bat requires specific retreat or roosting sites, and these sites do not exist in the project area. This bat was not recorded in Donato Environmental Services (2019) or Western Wildlife (2020) surveys, so it is highly improbable that it is present in the project area.

**Great Desert Skink (*Liopholis kintorei*)** - Vulnerable under the *BC Act 2016* and *EPBC Act 1999*

The Great Desert Skink is a large burrowing skink found in the sandy and gravelly habitats of the central and western deserts, where it lives in small colonies. Its distribution is widespread yet patchy, with evidence of pronounced genetic differentiation in some subpopulations throughout its range (Dennison et al. 2015). The Great Desert Skink primarily lives in spinifex dominated sandplains adjacent to dunes (Ridley et al. 2020). Pearson et al. (2001) reported Great Desert Skinks in the Gibson Desert in undulating sandplain of deep red sands with a surface cover of fine laterite and vegetated with spinifex grass. This habitat is not present in the project area.

The Great Desert Skink lives in social colonies from which young breeding males disperse to adjacent colonies; although the distance of dispersal is not well understood (Ridley 2015). Colonies consist of up to 10 individuals living in subterranean burrow networks of up to 10m in diameter (Ridley et al. 2020). The burrow system may be a single entrance tunnel or multiple entrances. Long-used burrows are often large and complex. The local skink community will have established a latrine site(s), which for old burrow complexes, is often quite large and visible.

Habitat critical to their survival is typically hummock grass sandplains and some adjacent dunefield swales, often associated with paleodrainage channels, however, they have been recorded in open Mulga woodland in South Australia (McAlpin 2001).

Ngaanyatjarra Council Land and Culture (2019) undertook surveys in the area around the proposed West Musgrave mining operations and recorded multiple active Great Desert Skink burrows.

The Great Desert Skink is not present in the project area due to a lack of suitable habitat and no burrows were found in the site investigation.

**Grey Falcon (*Falco hypoleucos*)** - Vulnerable species under the *EPBC Act 1999* and *BC Act 2016*

The Grey Falcon is a moderately large raptor that is mostly found in the northern half of Western Australia, mostly in lightly wooded, coastal or riverine areas.

There are multiple records of the Grey Falcon in the Pilbara, but very few in the Goldfields and in the central desert areas around the project area. They are mostly recorded along the drainage lines and around the permanent or semi-permanent pools.

It is highly unlikely that the Grey Falcon is in the project area.

**Malleefowl (*Leipoa ocellata*)** - Vulnerable under the *BC Act 2016* and *EPBC Act 1999*

Malleefowl are large, ground-dwelling birds that rarely fly unless alarmed or are perching for the night. Historically, Malleefowl have been found in mallee regions of southern Australia from approximately the 26th parallel of latitude southwards. Prior to vegetation clearing for agriculture, Malleefowl were abundant in the WA Wheatbelt. Vegetation clearing for agriculture also opened adjacent bushland to predators, and in the south-west of WA, Malleefowl often only persist in isolated remnant patches of native vegetation. Sheep and other herbivores (e.g. goats, kangaroos) grazing in remnant vegetation removes or thins the undergrowth, and they also compete with Malleefowl for herbaceous foods and can cause changes to the structure and floristic diversity of foraging habitats (Benshemesh 2007).

Malleefowl and their eggs are vulnerable to predation by foxes, and newly hatched chicks are vulnerable to foxes, cats and raptors (Priddel and Wheeler 1990, Benshemesh and Burton 1999, Benshemesh 2007, Lewis and Hines 2014). Their abundance in the Goldfields is low and they are sparsely distributed, favouring those areas that are more densely vegetated. Malleefowl build distinctive nests that comprise a large mound of soil/rock covering a central core of leaf litter. These nest mounds range in diameter but can span more than five metres and may be up to one metre high. Malleefowl are generally monogamous and once breeding commences, and they typically pair for life. The presence of nest mounds provides an indication of the presence of Malleefowl in the area.

Malleefowl have been observed in the bioregion, however, there are no recent records of active breeding mounds in the vicinity of the project area. No Malleefowl, their tracks or mounds were present in the project area during the site visit, and the habitat was not suitable. So, they are not present in the project area.

**Bilby (*Macrotis lagotis*)** – Vulnerable under the *EPBC Act 1999* and *BC Act 2016*

This nocturnal, medium sized, omnivorous, burrow dwelling marsupial was once wide-spread in Australian arid and semi-arid areas. Its geographical distribution has now contracted to a few small populations in southern Northern Territory, south-eastern Queensland, the Pilbara and sandy deserts of Western Australia. Bilby distribution is now largely restricted to two broad habitat types: mulga woodlands with lateritic red earth and spinifex grasslands with high fire frequency, again with the red earth (Johnson 1989, Southgate 1990). Its distribution appears limited by access to suitable burrowing habitat and areas of high plant and food production. Southgate et al. (2007) reported that the distribution of Bilbies in the Tanami Desert was related to substrate type, which is probably also true for around the project area in the Little Sandy Desert.

There are scattered old records for Bilby in the vicinity of the project area in the Atlas of Living Australia, but it and its burrows, scats and diggings were not recorded during the site visit. So, they are not present in the project area.

**Central Australian Rock-wallaby (*Petrogale lateralis centralis*)** – Vulnerable under the *EPBC Act 1999* and the *BC Act 2016*

The black-flanked rock-wallaby is endemic to Western Australia. It shelters in shaded rocky areas such as caves, cliffs, scree and rockpiles during the day and feeds at night on grasses, forbs, shrubs and occasionally seeds and fruits.

This rock-wallaby's distribution in the central desert is centred at the Macdonnell Ranges and extends into the Central Ranges, the Murchison Ranges and Indulkana Range. The closest known population was at Pilbirrin, a



small rock outcrop north-west of the Cavanagh Range, but Ngaanyatjarra Council Land and Culture (2019) indicated that it was no longer present in this location.

Scat searches and camera traps recorded no evidence of the Rock-Wallaby in the nearby Cavanagh and Tomkinson Ranges (Ngaanyatjarra Council Land and Culture 2019). There is no suitable habitat for this wallaby in the project area, so, they are not present in the project area.

**Crest-tail Mulgara (*Dasyercus cristicauda*) and Brush-tailed Mulgara (*Dasyercus blythi*)** - Priority 4 with the DBCA

Woolley (2005) recognises two species of 'Mulgara'; *Dasyercus blythi* and *D. cristicauda*. *Dasyercus blythi* has a non-crested tail, two upper premolars and six nipples; *D. cristicauda* has a crested tail, three upper premolars and eight nipples. Both species potentially have overlapping distributions in arid Australia, but it is thought that *D. cristicauda* does not currently exist in Western Australia, although there are old records indicating its presence. Woolley (2005) suggested the common names for these two species be Brush-tailed Mulgara for *D. blythi* and Crest-tailed Mulgara for *D. cristicauda*. These two species can be sympatric in places, but probably utilise different parts of the habitat on a local scale when they are recorded in the same area. Currently, there are insufficient data to separate the spatial ecology, burrows and reproductive biology of these two species. Information that follows is based on what is known for 'Mulgara' without distinguishing between the species.

The reported distribution of Mulgara includes much of the inland spinifex covered sandy desert and spinifex vegetated areas in the Pilbara and northern goldfields. Within these areas their distribution is patchy and it is most frequently confined to mature spinifex dominated habitat (Gibson and Cole 1992, Masters 1998, Masters et al. 2003, Thompson and Thompson 2008). In some areas, their relative abundance is positively associated with rainfall in the previous 12 to 24 months (Gibson and Cole 1992, Masters 1998, Dickman et al. 2001, Letnic and Dickman 2005) and recent burning of the spinifex does not seem to be sufficient to shift Mulgara out of an area (Thompson and Thompson 2007). Mulgara are generally sedentary in contrast with some other small dasyurids and have high site fidelity and a low propensity for dispersal once a home range has been established (Masters 1998, Dickman et al. 2001).

According to Newman-Martin (2023), there were two species of Mulgara potentially present near the project area; *D. blythi* and the now extinct *D. hillieri* with *D. cristicauda* being found to the north of the project area.

The lack of substantial spinifex habitat in the project area would suggest that Mulgara are not present in the project area.

**Princess Parrot (*Polytelis alexandrae*)** - Vulnerable under the *EPBC Act 1999* and a Priority 4 species with DBCA

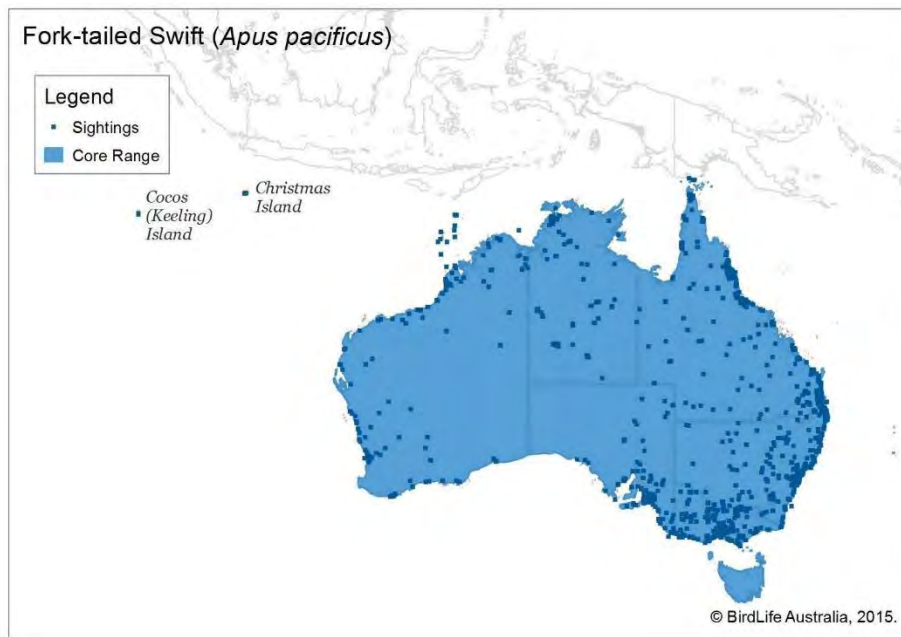
The Princess Parrot is found mostly in the inland arid areas of Australia, and in Western Australia in the Gibson, Little Sandy and Great Victoria Deserts (Johnstone and Storr 1998, Pavey et al. 2014). They are also occasionally found in lightly wooded areas adjacent to the sandy deserts (Moriarty 1972).

Very little is known about the Princess Parrot, even the exact extent of its geographical distribution is poorly understood. It is thought to be nomadic within the central desert regions of Australia, occupying arid shrub lands, particularly those dominated by Mulga, Desert Oak and spinifex. Due to the paucity of information on the species, accurate estimates of its conservation significance are difficult to make, however, this species is probably threatened by habitat loss to agricultural practices and changes in fire regimes.

There were very few trees in the project area, so the habitat is generally not suitable for this species, so it is highly unlikely to be present in the project area.

**Fork-tailed Swift (*Apus pacificus*)** - Migratory species under the *EPBC Act 1999* and *BC Act 2016*

This species breeds in the northeast and mid-east Asia and winters in Australia and southern New Guinea. It is a visitor to most parts of Western Australia, beginning to arrive in the Kimberley in late September, in the Pilbara in November and in the southwest land division in mid-December, and leaving by late April. The Fork-tailed swift is an almost exclusively an aerial species, foraging and sleeping on the wing. It rarely comes to earth, usually only for breeding. It is common in the Kimberley, uncommon to moderately common near northwest, west and southeast coasts and rare to scarce elsewhere. It is rarely seen in the Goldfields (Plate 13).



**Plate 13. Range and actual reported sightings of the Fork-tailed Swift**

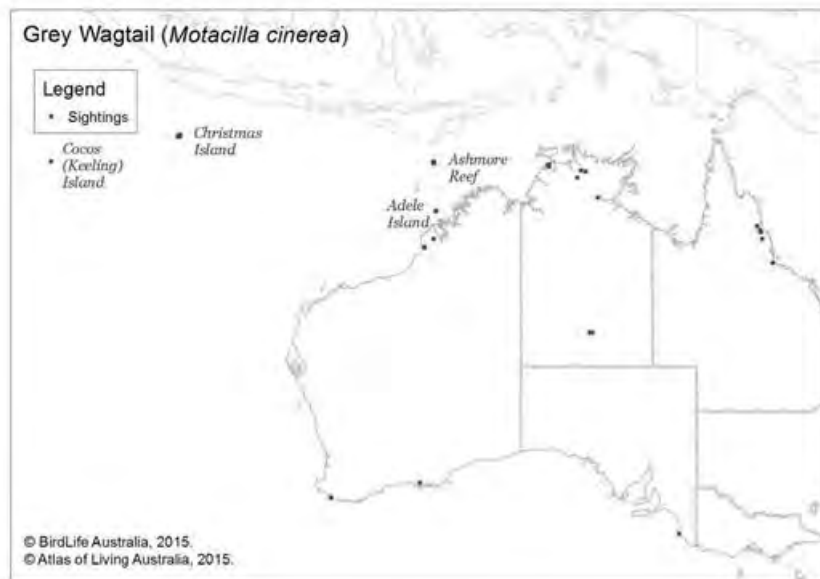
(taken from <http://www.environment.gov.au/biodiversity/threatened/publications/epbc-act-referral-guidelines-migratory-birds>)

The Fork-tailed Swift may very infrequently be seen in the region. However, any proposed exploration activity is unlikely to significantly impact on this species as it is an aerial species and will move away to other areas if it is disturbed.

**Grey Wagtail (*Motacilla cinerea*)** - Migratory under the *EPBC Act 1999* and *BC Act 2016*

The Grey Wagtail is a small yellow breasted bird with a grey back and head. Johnstone and Storr (2004) reported this migratory species as breeding in Palearctic from western Europe and north-west Africa to eastern Asia and wintering in Africa, south-east Asia, Indonesia, the Philippines, New Guinea and Australia. Its preferred habitat in Australia is banks and rocks in fast-running fresh water including rivers, streams and creeks where it feeds on insects.

The Atlas of Living Australia records two sightings on the south-coast of Western Australia and none around the project area (Plate 14). The Grey Wagtail is highly unlikely to be seen in the project area due to a lack of records and suitable habitat.

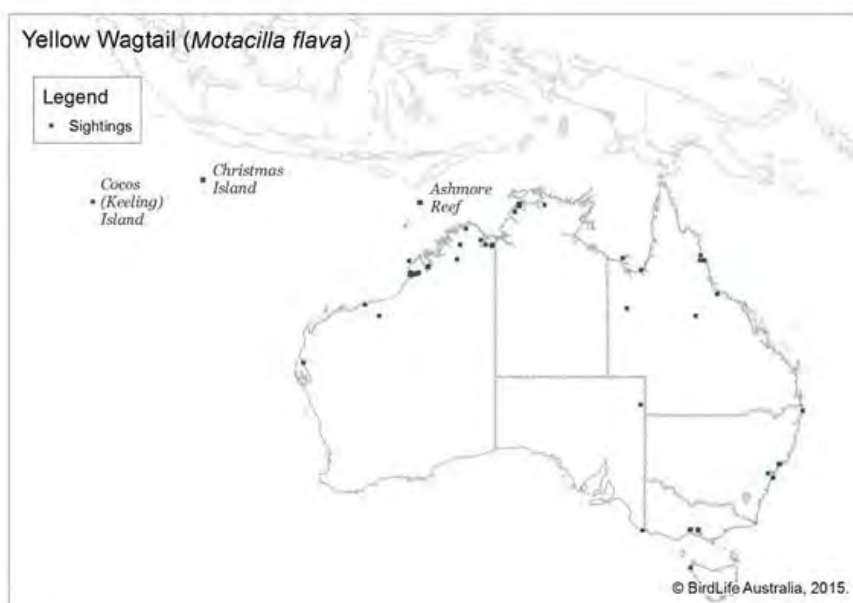


**Plate 14. Reported sightings of the Grey Wagtail**

(taken from <http://www.environment.gov.au/biodiversity/threatened/publications/epbc-act-referral-guidelines-migratory-birds>)

**Yellow Wagtail (*Motacilla flava*)** - Migratory under the *EPBC Act 1999* and *BC Act 2016*

The Yellow Wagtail is found in the millions in the northern hemisphere and the Atlas of Living Australia records multiple records of this bird in Australia in the coastal areas (Plate 15). There are no records for this species in inland Western Australia near the project area, therefore it is highly unlikely to be impacted by the proposed development.



**Plate 15. Reported sightings of the Yellow Wagtail**

(taken from <http://www.environment.gov.au/biodiversity/threatened/publications/epbc-act-referral-guidelines-migratory-birds>)

**Peregrine Falcon (*Falco peregrinus*)** – Otherwise specially protected under the *BC Act 2016*

The Peregrine Falcon is uncommon, although widespread throughout much of Australia excluding the extremely dry areas and has a wide and patchy distribution. It shows habitat preference for areas near cliffs along coastlines, rivers and ranges and within woodlands along watercourses and around lakes. Nesting sites include ledges along cliffs, granite outcrops and quarries, hollow trees near wetlands and old nests of other large bird species. There is no evidence to suggest any change in status in the last 50 years.

The Atlas of Living Australia has records of this species in the vicinity of the project area, however, it is unlikely to be seen on the sparsely vegetated plains in the project area.

**Long-tailed Dunnart (*Antechinomys longicaudatus*)** - Priority 4 species with DBCA.

Burbidge *et al.* (2008) summarised the Long-tailed Dunnart geographic distribution as widely scattered in arid zone where it inhabits rugged rocky areas. They went on to suggest that its striated footpads, long tail and behaviour in captivity indicated that it was an active and capable climber. Specimens have been recorded in several rocky ranges in the Gibson Desert, West MacDonnell National Park, Murchison, Carnarvon Basin and the Pilbara. All previous capture sites for Long-tailed Dunnarts are within rugged rocky landscapes that support a low open woodland or shrubland of Acacias (especially mulga) with an understorey of spinifex hummocks, and (occasionally) also perennial grasses and cassias.

Long-tailed Dunnarts are typically found on banded ironstone formations (BIFs), rocky hills and ridges or the adjacent areas in much lower numbers (Department of Environment and Conservation 2007, Harewood 2014). They are typically found in low abundance when trapped on rocky areas and much lower abundance in adjacent areas. The vegetation is often low open woodland or shrubland of *Acacia* sp. (especially mulga) with an understorey of spinifex hummocks, and (occasionally) perennial grasses and cassias.

There are scattered records of this dunnart in the vicinity of the project area, but it was not recorded by Western Wildlife (2020) in its survey of the West Musgrave mining area. There was no suitable habitat for this dunnart in the project area, as the rocky ridges were far too small to support a population of this dunnart, so it is highly unlikely to be present.

**Woma (*Aspidites ramsayi*)** - Priority 1 species with DBCA

The southern Woma python was once recorded in a crescent shaped geographic distribution from Shark Bay to Kitchener in WA and the central sandy desert areas. However, the southern population is now mostly only found on the two extremes of this distribution with a small population east of the wheatbelt in relatively dense shrubs on a sandy substrate.

In Western Australia it is found in arid woodland or shrubland areas, typically on sand plains. Western Wildlife record (2020) recorded an individual on the Western Access Road into the West Musgrave mining area, so they are found in the sandy areas that have some vegetation cover. It is highly improbable that they are in the project area due to a lack of suitable habitat and the presence of predators (e.g. wild dogs and cats).

**Southern Marsupial Mole (*Notoryctes typhlops*)** – Priority 4 with DBCA

The Southern Marsupial Mole is one of two marsupial moles in Australia. It is a blind, fossorial, mammal that has no external ears, heavily keratinised snout, very reduced tail and dense silky, golden-brown to pale cream fur, and a rear facing pouch in females (Threatened Species Scientific Committee 2015). Its very short and powerful front limbs with long claws are used to dig its way through sandy soil.

Its geographic range includes the Great Victoria Desert, extending east to the western half of the Simpson Desert in South Australia including and in southern Northern Territory. Western Wildlife (2020) recorded multiple burrows that they believed belonged to marsupial moles, but no moles.

The hard sandy-clay soils and lack of dunes in the project area would strongly suggest that it isn't present in the project area.

**Oriental Plover (*Charadrius veredus*)** - Migratory species under the *EPBC Act 1999* and *BC Act 2016*

A migrant species with patchy distribution in Australia, the Oriental Plover is sparsely distributed across arid and semi-arid Australia but avoids truly desert regions. Its preferred habitat is dry plains. It was not recorded in other fauna surveys undertaken near the project area. The species is under threat because of habitat reduction due to agriculture and changing fire regimes.

It was not recorded during the Western Wildlife (2020) or Donato Environmental Services (2019) surveys of the West Musgrave proposed mining area. The habitat is potentially suitable in the project area, but it is unlikely to be impacted by an exploration program, as it will readily move to adjacent areas if disturbed.



## 4.4 THE FAUNA SURVEY DATA FOR FAUNA HABITATS REPRESENTED IN THE PROJECT AREA

The EPA's (2020) *Technical Guidance – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* indicated that the level of fauna assessment should be determined considering the following criteria:

- level of existing regional knowledge;
- type and comprehensiveness of recent local surveys;
- degree of existing disturbance or fragmentation at the regional scale;
- extent, distribution and significance of habitats;
- significance of species likely to be present;
- sensitivity of the environment to the proposed activities; and
- scale and nature of impact.

Western Wildlife's (2020) report in conjunction with Donato Environmental Services (2019) avian and bat survey and Ngaanyatjarra Council Land and Culture's (2019) targeted survey for the Great Desert Skink were adequate for the West Musgrave mining operations to receive approval, and the Julimar Resources project is very much smaller, in an adjacent area, with very little terrestrial fauna and is only for the purposes of an exploration program. Any additional surveys are unlikely to provide fauna data that would affect the impact assessment

on the vertebrate fauna for the project area.

## 4.5 AMPHIBIANS

A single frog species (i.e. *Notaden nichollsi*) was recorded in the Western Wildlife (2020) survey of the West Musgrave mining project area (

Table 5). *Notaden nichollsi* lives in sandy areas, and it is able to burrow to over 2m into the soil to find a moisture layer sufficient to stop it desiccating (Thompson et al. 2005). This habitat was not present in the project area.

## 4.6 REPTILES

The regional reptile data provided in Table 7 provides an indication of the diversity of herpetofauna in this part of the inland desert. However, the sparseness of the vegetation, the lack of ground leaf litter, the hard sandy clay soils mean that there are very few reptiles in the project area. The only conservation significant reptile potentially in the project area is the Woma, however, it is highly unlikely to be present due to a lack of suitable habitat. Exploration activity is unlikely to significantly impact on the reptile assemblage.

## 4.7 BIRDS

The number of birds and bird species in the northern Goldfields and semi-arid areas fluctuates based on seasons and recent rainfall (Craig and Chapman 2003). Semi-arid and arid areas of inland Australia support a diverse range of transient and nomadic species that move through large areas in search of available resources. Heavy rain that is followed by flowering and seeding of many plant species is often sufficient to draw many of these nomadic species to the general area. These species move on to other areas once the resource is depleted or better resources are available in adjacent areas.

The project area is likely to support a very depleted avifauna assemblage due to the sparseness of the trees. There is a low possibility that the Southern Whiteface, Peregrine Falcon, Princess Parrot and Oriental Plover are occasionally visitors to the project area, but they will readily move if disturbed.

There was no evidence to indicate that Malleefowl are in the area and the habitat is unsuitable for this mostly terrestrial large-bodied bird.

Exploration activity is unlikely to have a significant impact of the avifauna in the area.

#### **4.8 NON-VOLANT MAMMALS**

All the terrestrial mammals potentially in the survey area, would be present in the many square kilometres of similar habitat in adjacent areas. The only mammal species of conservation significance potentially near the project area is the Long-tailed Dunnart, which would typically be found on the rocky ridges, outcrops and breakaways. The rocky ridges in the project area are small and isolated, so it is improbable that they would support the Long-tailed Dunnart. The habitat is not suitable for the Southern Marsupial Mole.

#### **4.9 BATS**

All the bats likely to be recorded in the project area are common throughout the semi-arid parts of Western Australia and none are of conservation significance. Western Wildlife (2020) recorded Findlayson's Cave Bat (*Vespadelus findlaysoni*) and the Lesser Long-eared Bat (*Nyctophilus geoffroyi*) in the proposed West Musgrave mining area. These are a cave and tree roosting species and given the lack of nearby caves and the scarcity of trees, it would be surprising for either species to be recorded in the project area.

Exploration activity will not significantly impact on the bat fauna when considered in a bioregional context.

#### **4.10 BIODIVERSITY VALUE**

An ecological assessment of a site should consider its biodiversity value at the genetic, species and ecosystem levels, and its ecological functional value at the ecosystem level. There are inadequate data to assess the ecological value at the genetic level.

The fauna habitat types represented in the project area are abundant and in similar condition in adjacent areas. Therefore, the fauna assemblage that is present in the project area will also be present and abundant in the adjacent areas. The site assessment indicated that project area has low biodiversity value.

##### **4.10.1 Ecological functional value at the ecosystem level**

The project area has few trees, sparsely vegetated shrubs and drying grasses with a lot of bare ground. It has very little ecological functional value.

##### **4.10.2 Maintenance of threatened ecological communities**

No threatened ecological fauna communities were identified in the project area.

##### **4.10.3 Condition of fauna habitat**

The fauna habitat in the project area is undisturbed, but depleted of trees, sparsely vegetated with shrubs, a lot of drying grasses, small patches of spinifex hummocks and a lot of bare ground. The habitat in the project area is mostly undisturbed and in good condition.

#### **4.10.4 Ecological linkages**

The project area does not support an ecological linkage or pathway that is not already available in the region.

#### **4.10.5 Size and scale of the proposed disturbance**

The project area assessed is dispersed as it consists of drill rig access routes and multiple drill pads, with a total area of approximately ~212ha. This represents a very small fraction of similar fauna habitat found in the adjacent area and bioregion. Exploration activity is unlikely to have significant impacts on the vertebrate fauna in a bioregional context.

#### **4.10.6 Abundance and distribution of similar habitat in the adjacent areas**

Fauna habitats present in the project area are abundant in adjacent areas. It is therefore likely that the fauna assemblage in the project area is like that in the many square kilometres of similar habitat in adjacent areas and the bioregion.

#### **4.10.7 Potential impacts on ecosystem function**

It is probable that a very small number of trees and shrubs will be cleared for exploration activity, because there are so few of them in the project area. The drill rig and associated vehicles and equipment will simply drive across the landscape along the designed routes from one drill pad to the next. It is improbable that there will be a significant impact on conservation significant fauna or the existing fauna assemblage in the project area.

## **5. POTENTIAL ENVIRONMENTAL IMPACTS**

Exploration activity in the project area will potentially result in the death or injury of fauna during vehicle movements for exploration, and there will be the loss of a small quantity of vegetation.

However, given the small area for exploration activity, the sparseness of the trees and shrubs, and most of the dry grass will have disappeared by the end of summer, potential impacts on the vertebrate fauna will be minimal in a bioregional context, given the availability of similar habitat in adjacent areas.

### **5.1 DIRECT IMPACTS**

#### **5.1.1 Animal deaths during the clearing process and displacement of fauna**

Clearing vegetation and activities associated with the development will result in the loss of some small fauna that retreat to burrows, such as reptiles and mammals. Nocturnal species are unlikely to be active when most of the land clearing and construction work is taking place which may result in these individuals being adversely impacted when they attempt to escape. This loss of vegetation is unlikely to have a significant impact when considered in a bioregional context. Larger terrestrial animals and avian species will most often move to adjacent areas. These species will be required to establish new activity areas and home ranges, and this could result in the temporary displacement of resident species.

Clearing linear corridors and other areas increases fauna habitat edges. Small mammals can respond both positively and negatively to edges depending on their ecological traits (Laurance 1991, 1994, Goosem and Marsh 1997, Goosem 2000). Edge and disturbance effects can lead to altered and most often higher levels of predation, restricting or increasing fauna movements and altering assemblage structure (Oxley et al. 1974, Paton 1994, Baker et al. 1998, Temple 1998, Luck et al. 1999, Goosem et al. 2001). Goldingay and Whelan (1997) and Clarke and Oldland (2007) reported that edge effects can extend up to 150-200m from the edge for some species, meaning the impact area on vertebrate fauna is likely to be larger than the cleared footprint.

Edge effects can lead to the disruption of ecological processes such as predation and dispersal, animal movements and can change assemblage structure. The consequence is that the impact area will always be much larger than the cleared area.

#### **5.1.2 Reduction or loss of activity areas and closure of burrows**

Clearing vegetation and associated development activities are likely to destroy reptile and mammal burrows or foraging habitat that are currently in use or that could be used again. Clearing vegetation that forms part of the activity area of individuals has the potential to force these animals into adjacent areas. These areas may offer fewer resources placing individuals under survival pressure. It could also cause individuals to move into the territories of other individuals increasing competition for resources. Forced relocations could increase the possibility of predation.

### **5.2 INDIRECT IMPACTS**

In addition to the obvious impact of vegetation clearing there can be an equally significant or greater impact in the adjacent areas because of 'edge effects'. Edge effects can lead to the disruption of ecological processes such as predation and dispersal, animal movements and can change assemblage structure. The consequence is that the impact area will always be much larger than the cleared area. Vehicle tracks also have the propensity to develop weed infestations which can impact on natural fauna habitats. Cleared corridors can also provide improved predator access to areas, enhance the invasion of pest species into areas and may act as inhibitors or disrupt fauna migration and movement patterns.

There are numerous potential threats associated with vegetation clearing and development that could have an impact on the vertebrate fauna in the project area. Some of these are discussed below.

### 5.2.1 Habitat fragmentation

In addition to direct impacts of vegetation clearing, infrastructure including tracks, has the potential to fragment habitat. Cleared linear tracks of land are 'unnatural' in much of the habitat. These linear structures that partition existing activity areas, isolate sections of established communities and may alter long and medium-term patterns of movement around established home ranges particularly for small mammals and reptiles. A reduction in the population because of this development would be difficult to detect given our current knowledge of the spatial ecology for most of the small mammals known to be in the area. The project area contains sparse vegetation and existing vehicle tracks. The impacts of habitat fragmentation due to additional vehicle tracks would therefore be quite low.

### 5.2.2 Introduced fauna and weeds

Increased habitat fragmentation and human activity often results in an increase in the abundance of introduced species such as the house mouse (*Mus musculus*), fox (*Vulpes vulpes*), feral cat (*Felis catus*) and wild dogs (*Canis lupus*). This increase may be due to a decline in habitat health, increased road kills, poor disposal of waste and easier access to areas via tracks.

House mice, cats and wild dogs are known to be established in the area and based on the tracks, scats and fauna observed during the field investigations there is a reasonable density of feral cats and wild dogs in the project area. In many situations they have become a 'naturalised' species in the Australian bush. Increases in wild dog or cat numbers can have a detrimental impact on native fauna because they predate on and compete with native species, severely disrupting the natural balance. The feral cat is a particularly damaging predator on native fauna and any increase in their numbers could have a detrimental effect on local native fauna (Kinneer 1993, Bamford 1995, Woinarski et al. 2017, Woinarski et al. 2018, Murphy et al. 2019); hence it is important to ensure that populations of the feral predators, such as cats are under control.

Infrastructure known to support feral species, such as rubbish disposal sites and bins, and permanent water, should be managed to minimise increases in these populations.

Introduced plant species can successfully and rapidly invade areas of cleared native vegetation or otherwise disturbed by humans. Introduced plant species may replace native species that provide shelter or foraging areas for native fauna. Major changes to the structure of vegetation will alter the fauna habitat and consequently may influence fauna species composition. Preparing and implementing a weed management plan will largely reduce their threat to native fauna species.

### 5.2.3 Road fauna deaths

An increase in road fauna deaths is likely to occur where new roads/tracks are constructed or upgraded affecting kangaroos, nocturnal birds, and ground dwelling large carnivorous predators. Species such as goannas and raptors are attracted to carrion on road verges and as a result there is an increased propensity for these species to be killed by vehicles. Given that this project area is being used to construct new roads these impacts will need to be mitigated.



#### **5.2.4 Fire**

Increased human activity is often associated with an altered fire regime which leads to a degradation of natural ecosystems. Fire has been identified as one of the threatening processes for some conservation significant species as numerous small mammal and bird species rely on long unburnt vegetation.

Large and widespread fires are unlikely to be a significant threat to native fauna species in and adjacent to the project area due to the sparseness of the vegetation.

#### **5.2.5 Anthropogenic activity**

Unnatural noises, vibrations, artificial light sources, and vehicle and human movement in an area may be sufficient to force individuals or fauna species to move from adjacent areas or alter their activity periods. This form of disturbance is likely to occur during the initial vegetation clearing and when development activity commences. The overall impact is likely to be confined to a relatively small area and is unlikely to be a significant impact.

#### **5.2.6 Dust**

Dust generated from shifting topsoil and increased vehicle traffic can potentially degrade surrounding vegetation, reducing its ability to absorb sunlight, and influencing photosynthetic rates. Degradation of these areas may potentially render habitat unsuitable for fauna. Dust suppression and management programs are an essential component of minimising impacts on fauna in areas adjacent to the mine and along access roads. An effective dust management and monitoring program is required.

## **6. VERTEBRATE FAUNA RISK ASSESSMENT**

### **6.1 RISK ASSESSMENT**

Fauna surveys to support disturbance applications are part of the environmental risk assessment undertaken to consider what potential impacts exploration activity might have on the biodiversity on a particular area and region. Potential impacts on fauna from the proposed development are identified and briefly described above. Tables 9, 10 and 11 provide a summary of the risk assessment associated with this project.

Any risk assessment is a product of the likelihood of an impact occurring and the consequences of that impact. Likelihood and consequences are categorised and described below. The assessed risk level (likelihood x consequences) is then calculated as the overall risk for the development. This is followed by an assessment of the acceptability of the risk associated with each of the impacts. Disturbances and vegetation clearing have an impact on the fauna at multiple scales – site, local, landscape and regional. Each of these is considered in the risk assessment. This assessment should be considered in the context of the summary in Table 11.

**Table 9. Fauna impact risk assessment descriptors**

Likelihood		
Level	Description	Criteria
<b>A</b>	Rare	The environmental event may occur, or one or more conservation significant species may be present in exceptional circumstances.
<b>B</b>	Unlikely	The environmental event could occur, or one or more conservation significant species could be present at some time.
<b>C</b>	Moderate	The environmental event should occur, or one or more conservation significant species should be present at some time.
<b>D</b>	Likely	The environmental event will probably occur, or one or more conservation significant species will be present in most circumstances.
<b>E</b>	Almost certain	The environmental event is expected to occur, or one or more conservation significant species is expected to be present in most circumstances.
Consequences		
Level	Description	Criteria
<b>1</b>	Insignificant	Insignificant impact on fauna of conservation significance or regional biodiversity, and the loss of individuals will be insignificant in the context of the availability of similar fauna or fauna assemblages in the area.
<b>2</b>	Minor	Impact on fauna localised and no significant impact on species of conservation significance in the project area. Loss of species at the local scale.
<b>3</b>	Moderate	An appreciable loss of fauna in a regional context or a limited impact on species of conservation significance in the project area.
<b>4</b>	Major	Significant impact on conservation significant fauna or their habitat in the project area and/or regional biodiversity and/or a significant loss in the biodiversity at the landscape scale.
<b>5</b>	Catastrophic	Loss of species at the regional scale and/or a significant loss of species categorised as 'vulnerable' or 'endangered' under the EPBC Act (1999) at a regional scale.
Acceptability of Risk		
Level of risk	Management Action Required	
Low	No action required.	
Moderate	Avoid if possible, routine management with internal audit and review of monitoring results annually.	
High	Externally approved management plan to reduce risks, monitor major risks annually with external audit and review of management plan outcomes annually. May a referral to the Commonwealth under the EPBC Act 1999.	
Extreme	Unacceptable, project should be redesigned or not proceed.	

**Table 10. Levels of acceptable risk**

		Likelihood				
		Rare or very low (A)	Unlikely or low (B)	Moderate (C)	Likely (D)	Almost certain (E)
Consequence	Insignificant (1)	Low	Low	Low	Low	Low
	Minor (2)	Low	Low	Low	Moderate	Moderate
	Moderate (3)	Low	Moderate	Moderate	High	High
	Major (4)	Moderate	Moderate	High	High	Extreme
	Catastrophic (5)	Moderate	High	High	Extreme	Extreme

**Table 11. A risk assessment of the impact of ground disturbance activity on fauna**

			Before management			With management		
Potential impacts			Inherent risk			Residual risk		
Factor			Likelihood	Consequence	Significance			
<b>Fauna survey data</b>	Inadequate vertebrate fauna survey data to adequately assess the risks	Unknown loss of fauna, fauna of conservation significance, and fauna assemblages, and an incomplete fauna assessment.	A	1	Low			
<b>Clearing vegetation</b>	Loss of fauna habitat – local scale	Loss of terrestrial fauna in the project area.	E	2	Mod.			
	Loss of fauna habitat – landscape scale	Loss of some fauna during vegetation clearing.	B	1	Low			
	Loss of fauna habitat – regional scale	Small loss of some fauna from the region.	B	1	Low			
	Loss of a threatened ecological fauna community	Loss of an undetected threatened ecological fauna community.	A	2	Low			
	Habitat fragmentation	Fauna movement restricted resulting in the death of fauna and a loss of biodiversity.	A	2	Low			
<b>Death or loss of conservation significant fauna</b>	Loss of a unique terrestrial fauna ecosystem	Loss of an ecosystem containing fauna with high species richness, high abundance and numerous top of the food chain predators.	A	2	Low			
	Oriental Plover	Death or reduced viability of this species.	A	2	Low			
	Princess Parrot	Death or reduced viability of this species.	A	2	Low			
	Southern Whiteface	Death or reduced viability of this species.	A	2	Low			
	Peregrine Falcon	Death or reduced viability of this species.	A	2	Low			
<b>Human impacts</b>	Increase or spread of weeds	Changed vegetation and a resulting loss of fauna habitat.	E	2	Mod.			
	Road kills	Animals being killed by vehicles as they cross roads	E	1	Low			

## 6.2 NATIVE VEGETATION CLEARING PRINCIPLES AS THEY PERTAIN TO VERTEBRATE FAUNA

The *Environmental Protection Act 1986* outlines 10 principles that are to be used in the assessment of native vegetation clearing permit applications which are also applicable for other assessments and approvals (Table 12). Where possible, native vegetation should not be cleared if any of the following principles are comprised.

**Table 12. Assessment of impact using the native vegetation clearing principles**

Principle	Response
It comprises a high level of biological diversity.	Clearing vegetation will not comprise a high level of biodiversity. It is improbable that any conservation significant vertebrate fauna are in the project area and will be significantly impacted by exploration activity.
It comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.	Exploration activity in the project area will not result in the loss of significant habitat for indigenous fauna.
It includes, or is necessary for the continued existence or, rare flora.	N/A
It comprises the whole or a part of, or is necessary for the maintenance of, a threatened ecological community.	The area does not contain a threatened ecological fauna community.
It is significant as a remnant of native vegetation in an area that has been extensively cleared.	The area is not a remnant.
It is growing in, or in association with, an environment associated with a watercourses or wetland.	The area does not contain a natural wetland.
The clearing of the vegetation is likely to cause appreciable land degradation.	N/A
The clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.	Exploration activity in the project area is unlikely to impact on conservation areas in the region.
The clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.	N/A
The clearing of the vegetation is likely to cause or exacerbate the incidence of flooding.	N/A

## 6.3 REFERRAL UNDER THE EPBC ACT

Exploration drilling in the project area is unlikely to significantly impact on a conservation significant vertebrate fauna species, so a referral under the *EPBC Act 1999* is not recommended.



## 7. SUMMARY

Julimar Resources is proposing exploration activity in the West Musgrave area and has nominated the location of potential drill holes and the drill rig access route to these drill holes. The project area is approximately 8km north-west of the Jameson Community and the total area assessed is ~212ha, although the disturbance footprint will be much smaller.

The following four broad fauna habitats are in the project area: grass plains, low shrubs over grass on plains, shrubs over spinifex and low stoney ridges. Because of the sparseness of trees and shrubs, and the extent of bare ground and lack of leaf litter, the project area is likely to have a limited vertebrate fauna assemblage.

There are no conservation significant species likely to be significantly impacted by the proposed exploration drilling program. No referral is recommended under the *EPBC Act 1999*.

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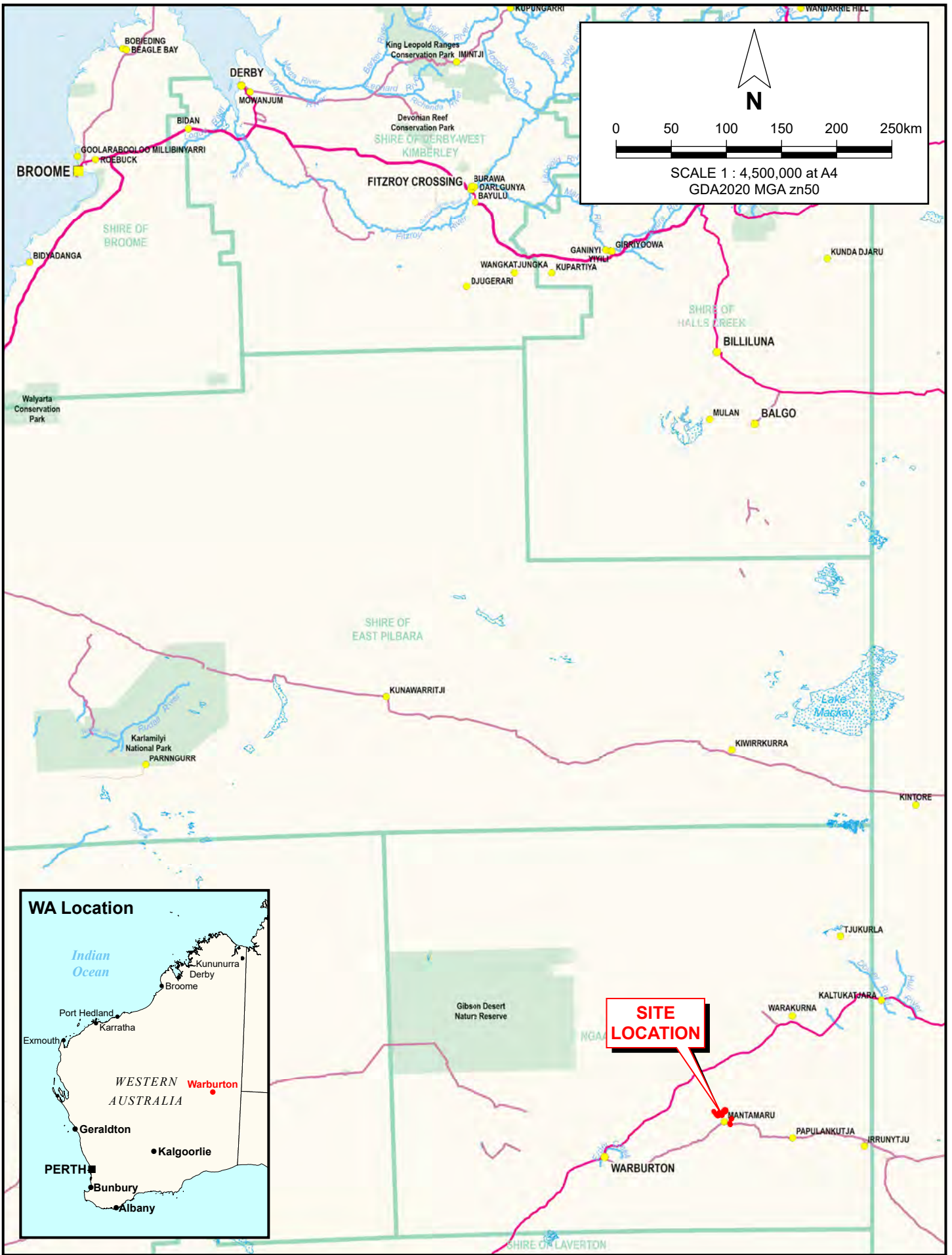


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# Figures

Basic and Targeted Vertebrate Fauna Survey  
West Musgrave Project Area





**SITE LOCATION**



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 BASIC AND TARGETED VERTEBRATE FAUNA SURVEY  
 WEST MUSGRAVES PROJECT AREA

**Figure 1**

**REGIONAL LOCATION**

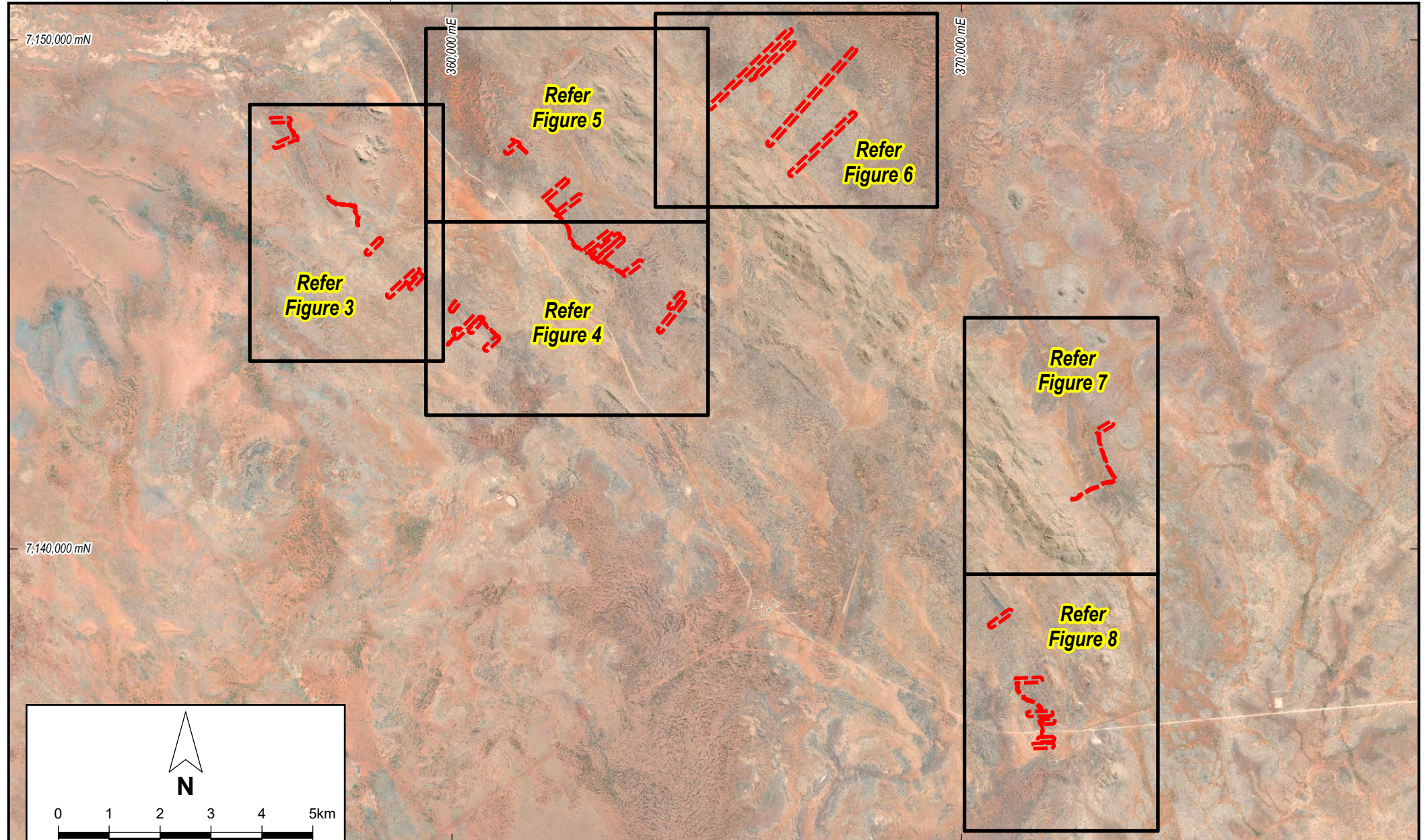


Drawn: G. Thompson      Date: 18 Dec 2023

Job: 2023-0118

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0 1 2 3 4 5km

SCALE 1 : 100,000 at A4  
GDA2020 MGA zn50

**Legend**  
[Red dashed line symbol] Site Boundary

**TERRESTRIAL ECOSYSTEMS**

Drawn: G. Thompson      Date: 18 Dec 2023

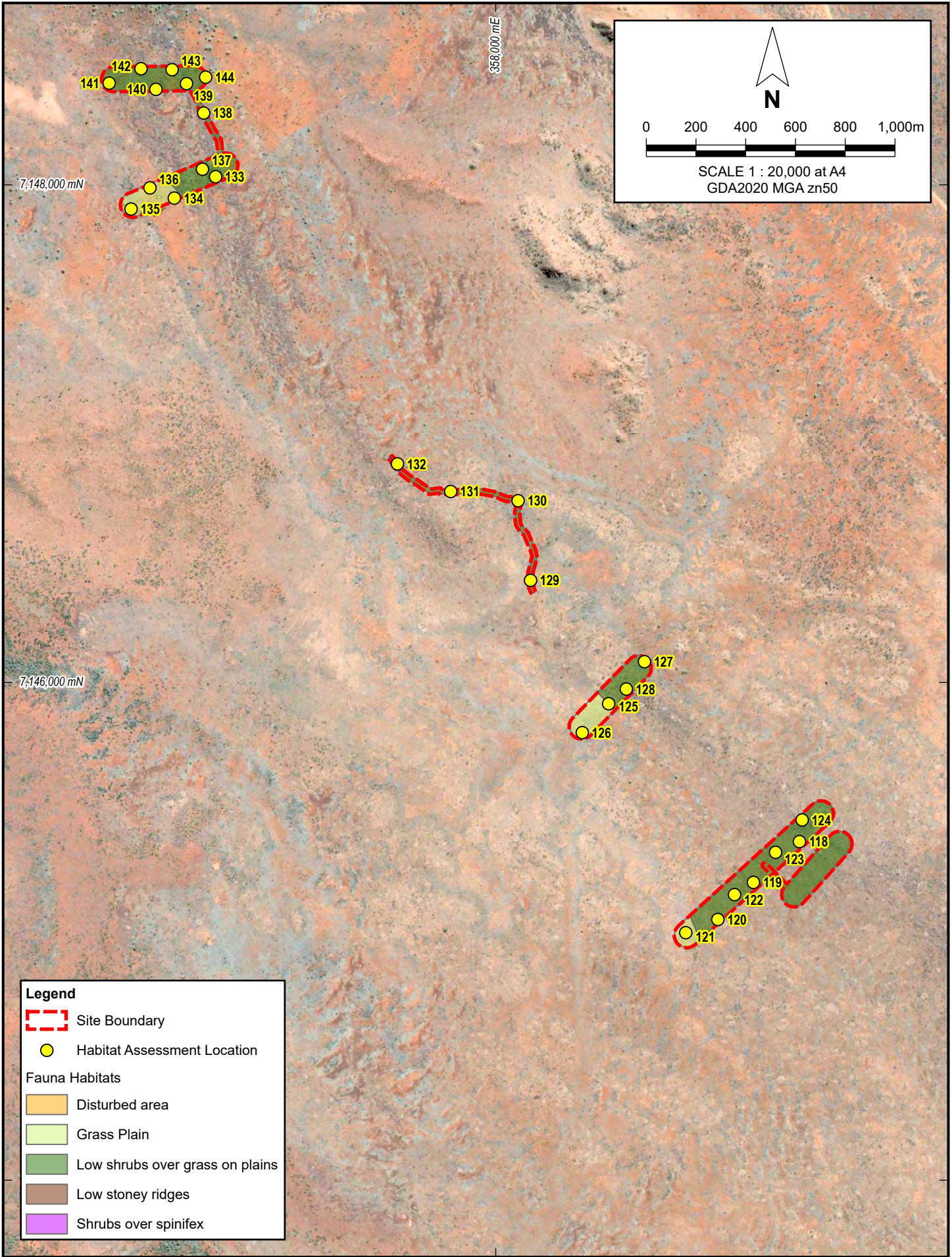
Julimar Resources Ltd  
BASIC AND TARGETED VERTEBRATE FAUNA SURVEY  
WEST MUSGRAVES PROJECT AREA

**PROJECT AREA**

**Figure 2**

Job: 2023-0118





**Legend**

- Site Boundary
- Habitat Assessment Location

**Fauna Habitats**

- Disturbed area
- Grass Plain
- Low shrubs over grass on plains
- Low stoney ridges
- Shrubs over spinifex

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**TERRESTRIAL ECOSYSTEMS**

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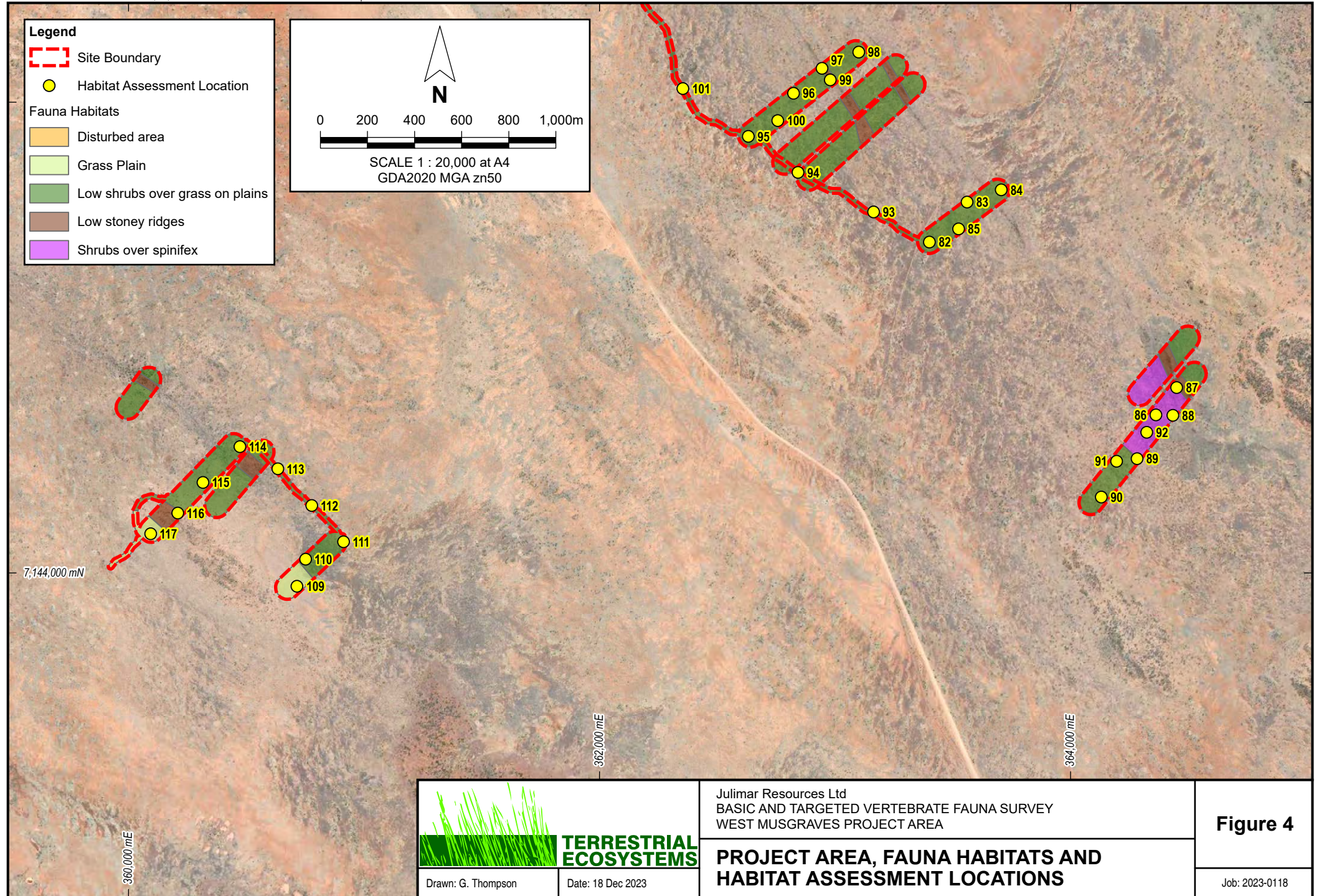
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 BASIC AND TARGETED VERTEBRATE FAUNA SURVEY  
 WEST MUSGRAVES PROJECT AREA

**PROJECT AREA, FAUNA HABITATS AND HABITAT ASSESSMENT LOCATIONS**

**Figure 3**

Job: 2023-0118







**PROJECT AREA, FAUNA HABITATS AND  
HABITAT ASSESSMENT LOCATIONS**

**Legend**

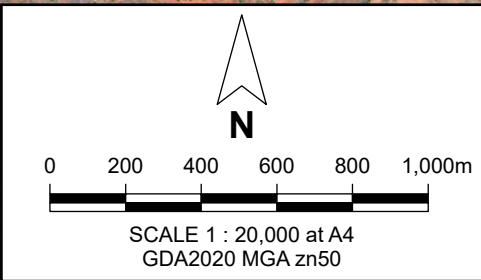
- Site Boundary
- Habitat Assessment Location

Fauna Habitats

- Disturbed area
- Grass Plain
- Low shrubs over grass on plains
- Low stoney ridges
- Shrubs over spinifex



Drawn: G. Thompson      Date: 18 Dec 2023



0 200 400 600 800 1,000m

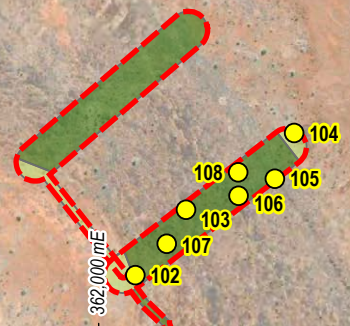
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GDA2020 MGA zn50

7,148,000 mN

360,000 mE

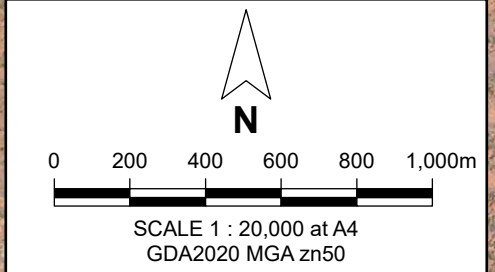
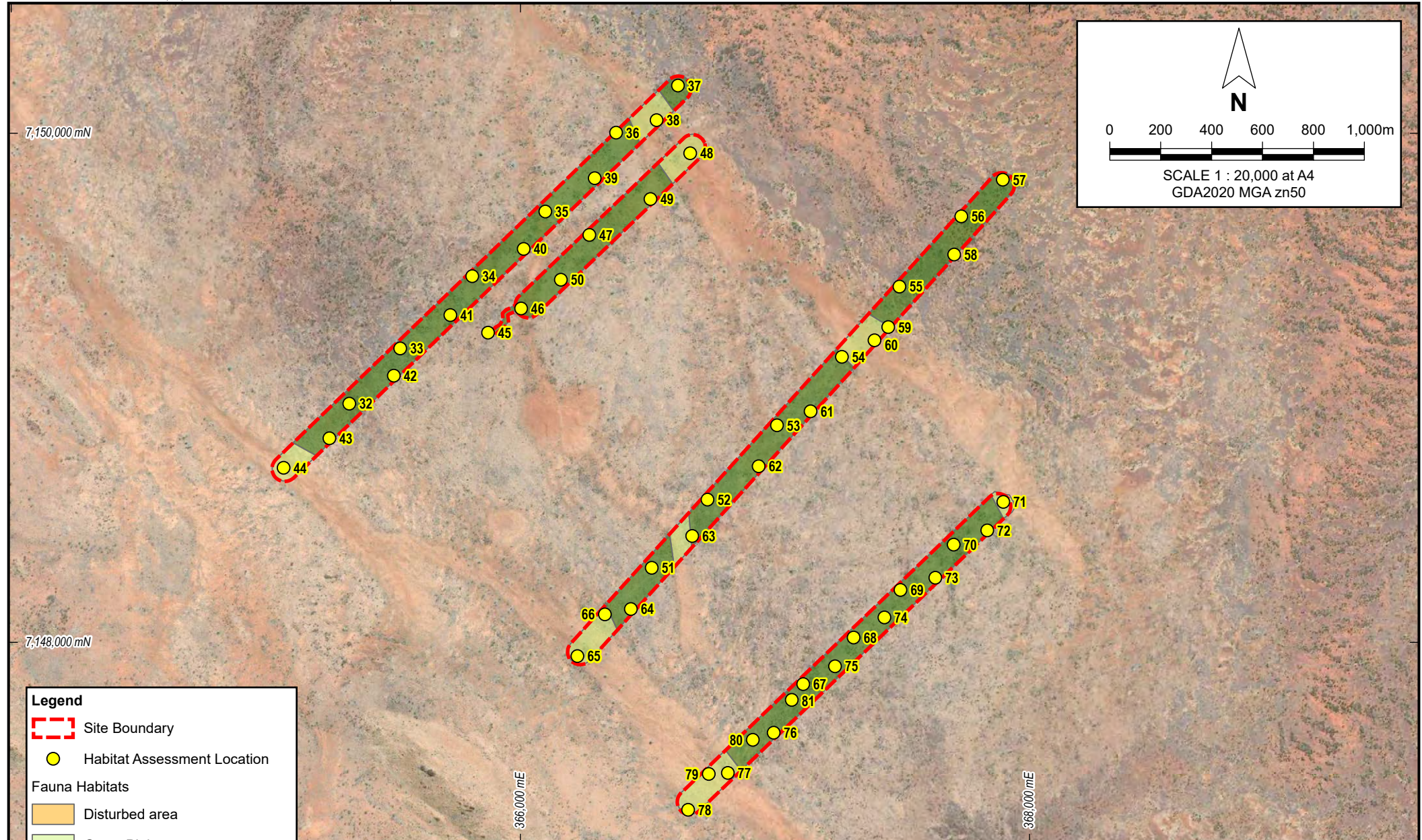
362,000 mE

364,000 mE



Map showing site boundary (red dashed line) and habitat assessment locations (yellow circles) numbered 102 through 108. The locations are clustered in the lower right quadrant of the map, within a green-shaded habitat area.





**Legend**

- Site Boundary (Red dashed line)
- Habitat Assessment Location (Yellow circle)
- Fauna Habitats**
  - Disturbed area (Orange)
  - Grass Plain (Light Green)
  - Low shrubs over grass on plains (Dark Green)
  - Low stoney ridges (Brown)
  - Shrubs over spinifex (Purple)

**TERRESTRIAL ECOSYSTEMS**

Drawn: G. Thompson      Date: 18 Dec 2023

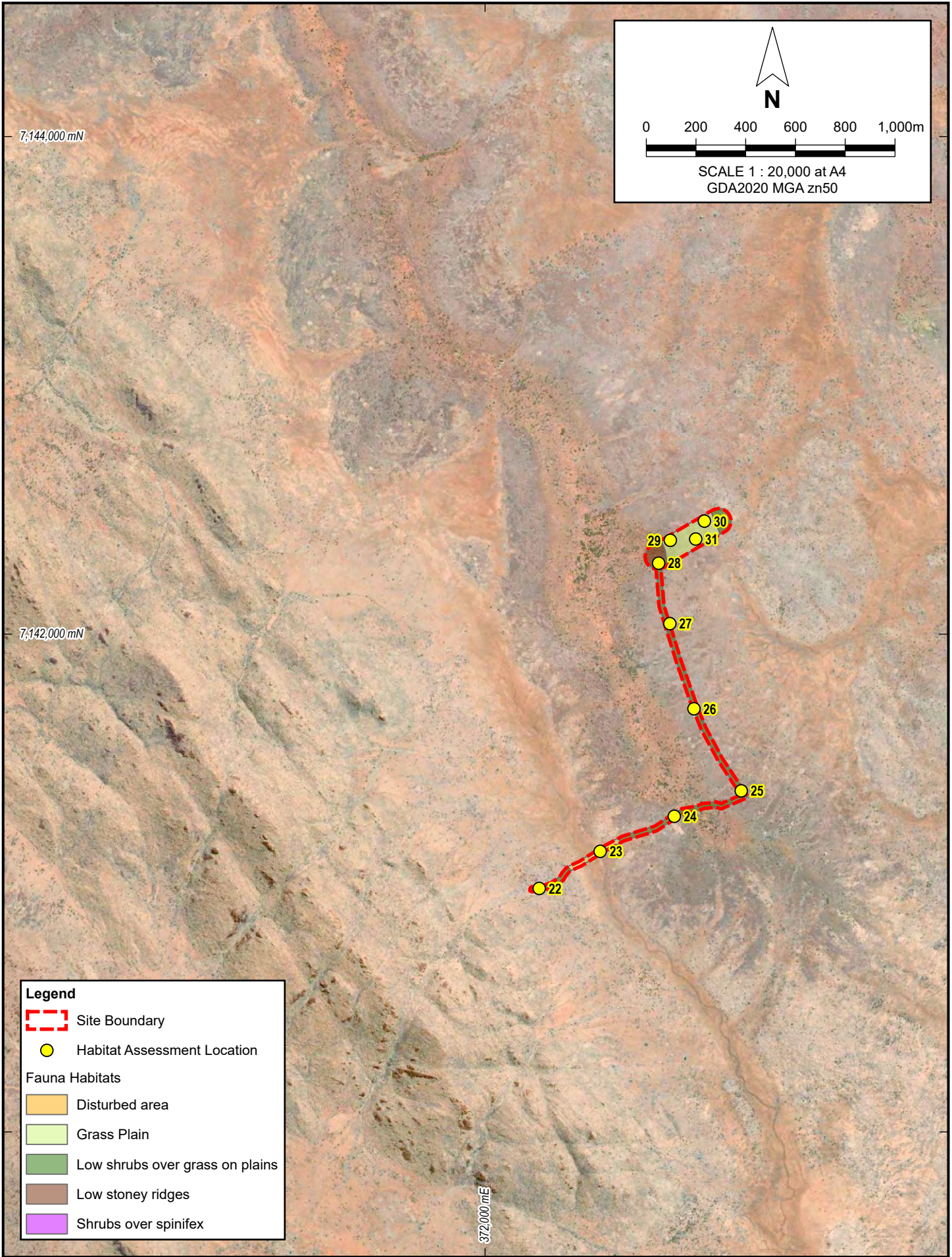
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BASIC AND TARGETED VERTEBRATE FAUNA SURVEY  
WEST MUSGRAVES PROJECT AREA

**PROJECT AREA, FAUNA HABITATS AND  
HABITAT ASSESSMENT LOCATIONS**

**Figure 6**

Job: 2023-0118





**Legend**

- Site Boundary
- Habitat Assessment Location

**Fauna Habitats**

- Disturbed area
- Grass Plain
- Low shrubs over grass on plains
- Low stoney ridges
- Shrubs over spinifex

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**TERRESTRIAL ECOSYSTEMS**

Drawn: G. Thompson      Date: 18 Dec 2023

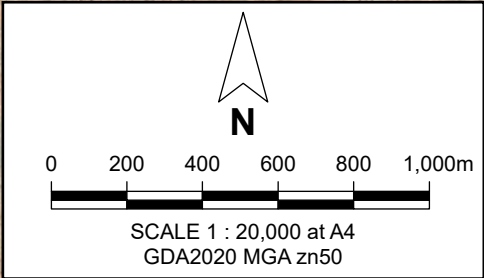
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 WEST MUSGRAVES PROJECT AREA

**PROJECT AREA, FAUNA HABITATS AND HABITAT ASSESSMENT LOCATIONS**

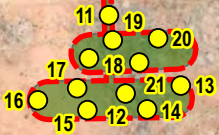
**Figure 7**

Job: 2023-0118







7,138,000 mN








7,136,000 mN

372,000 mE

**Legend**

-  Site Boundary
-  Habitat Assessment Location

**Fauna Habitats**

-  Disturbed area
-  Grass Plain
-  Low shrubs over grass on plains
-  Low stoney ridges
-  Shrubs over spinifex

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**TERRESTRIAL ECOSYSTEMS**

Drawn: G. Thompson      Date: 18 Dec 2023

Julimar Resources Ltd  
 BASIC AND TARGETED VERTEBRATE FAUNA SURVEY  
 WEST MUSGRAVES PROJECT AREA

**PROJECT AREA, FAUNA HABITATS AND  
 HABITAT ASSESSMENT LOCATIONS**

**Figure 8**

Job: 2023-0118



# Appendix A.

## EPBC search data

Basic and Targeted Vertebrate Fauna Survey  
West Musgrave Project Area





Australian Government

Department of Climate Change, Energy,  
the Environment and Water

# EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 08-Aug-2023

[Summary](#)

[Details](#)

[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)

# Summary

## Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

<a href="#">World Heritage Properties:</a>	None
<a href="#">National Heritage Places:</a>	None
<a href="#">Wetlands of International Importance (Ramsar)</a>	None
<a href="#">Great Barrier Reef Marine Park:</a>	None
<a href="#">Commonwealth Marine Area:</a>	None
<a href="#">Listed Threatened Ecological Communities:</a>	None
<a href="#">Listed Threatened Species:</a>	11
<a href="#">Listed Migratory Species:</a>	8

## Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <https://www.dcceew.gov.au/parks-heritage/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

<a href="#">Commonwealth Lands:</a>	None
<a href="#">Commonwealth Heritage Places:</a>	None
<a href="#">Listed Marine Species:</a>	10
<a href="#">Whales and Other Cetaceans:</a>	None
<a href="#">Critical Habitats:</a>	None
<a href="#">Commonwealth Reserves Terrestrial:</a>	None
<a href="#">Australian Marine Parks:</a>	None
<a href="#">Habitat Critical to the Survival of Marine Turtles:</a>	None

## Extra Information

This part of the report provides information that may also be relevant to the area you have

<a href="#">State and Territory Reserves:</a>	2
<a href="#">Regional Forest Agreements:</a>	None
<a href="#">Nationally Important Wetlands:</a>	None
<a href="#">EPBC Act Referrals:</a>	2
<a href="#">Key Ecological Features (Marine):</a>	None
<a href="#">Biologically Important Areas:</a>	None
<a href="#">Bioregional Assessments:</a>	None
<a href="#">Geological and Bioregional Assessments:</a>	None

# Details

## Matters of National Environmental Significance

### Listed Threatened Species

[\[ Resource Information \]](#)

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.  
Number is the current name ID.

Scientific Name

Threatened Category

Presence Text

#### BIRD

[Aphelocephala leucopsis](#)

Southern Whiteface [529]

Vulnerable

Species or species habitat known to occur within area

[Erythrotriorchis radiatus](#)

Red Goshawk [942]

Endangered

Species or species habitat may occur within area

[Falco hypoleucos](#)

Grey Falcon [929]

Vulnerable

Species or species habitat likely to occur within area

[Leipoa ocellata](#)

Malleefowl [934]

Vulnerable

Species or species habitat likely to occur within area

[Pezoporus occidentalis](#)

Night Parrot [59350]

Endangered

Species or species habitat may occur within area

[Polytelis alexandrae](#)

Princess Parrot, Alexandra's Parrot [758]

Vulnerable

Species or species habitat known to occur within area

#### MAMMAL

[Macroderma gigas](#)

Ghost Bat [174]

Vulnerable

Species or species habitat may occur within area

[Macrotis lagotis](#)

Greater Bilby [282]

Vulnerable

Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
<a href="#">Petrogale lateralis centralis</a> Warru, Central Australian Rock-wallaby [90831]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Sminthopsis psammophila</a> Sandhill Dunnart [291]	Endangered	Species or species habitat may occur within area
<b>REPTILE</b>		
<a href="#">Liopholis kintorei</a> Great Desert Skink, Tjakura, Warrarna, Mulyamiji [83160]	Vulnerable	Species or species habitat known to occur within area
<b>Listed Migratory Species</b> <span style="float: right;"><a href="#">[ Resource Information ]</a></span>		
Scientific Name	Threatened Category	Presence Text
<b>Migratory Marine Birds</b>		
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area
<b>Migratory Terrestrial Species</b>		
<a href="#">Motacilla cinerea</a> Grey Wagtail [642]		Species or species habitat may occur within area
<a href="#">Motacilla flava</a> Yellow Wagtail [644]		Species or species habitat may occur within area
<b>Migratory Wetlands Species</b>		
<a href="#">Actitis hypoleucos</a> Common Sandpiper [59309]		Species or species habitat may occur within area
<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
<a href="#">Calidris melanotos</a> Pectoral Sandpiper [858]		Species or species habitat may occur within area
<a href="#">Charadrius veredus</a> Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area



Scientific Name	Threatened Category	Presence Text
<a href="#">Glareola maldivarum</a> Oriental Pratincole [840]		Species or species habitat may occur within area

## Other Matters Protected by the EPBC Act

Listed Marine Species		[ <a href="#">Resource Information</a> ]
Scientific Name	Threatened Category	Presence Text
Bird		
<a href="#">Actitis hypoleucos</a> Common Sandpiper [59309]		Species or species habitat may occur within area
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area
<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
<a href="#">Calidris melanotos</a> Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area
<a href="#">Chalcites osculans as Chrysococcyx osculans</a> Black-eared Cuckoo [83425]		Species or species habitat known to occur within area overfly marine area
<a href="#">Charadrius veredus</a> Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
<a href="#">Glareola maldivarum</a> Oriental Pratincole [840]		Species or species habitat may occur within area overfly marine area
<a href="#">Merops ornatus</a> Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area
<a href="#">Motacilla cinerea</a> Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area
<a href="#">Motacilla flava</a> Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area

## Extra Information

State and Territory Reserves			[ <a href="#">Resource Information</a> ]
Protected Area Name	Reserve Type	State	
Gibson Desert	Nature Reserve	WA	
Ngaanyatjarra	Indigenous Protected Area	WA	

EPBC Act Referrals				[ <a href="#">Resource Information</a> ]
Title of referral	Reference	Referral Outcome	Assessment Status	
Not controlled action				
<a href="#">Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia</a>	2015/7522	Not Controlled Action	Completed	
<a href="#">Wingellina open pit nickel mine project, 8kms SW Surveyor Generals' Corner, WA</a>	2013/7021	Not Controlled Action	Completed	

# Caveat

## 1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

## 2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

## 3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

## 4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

# Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Department of Land and Resource Management, Northern Territory](#)
- [-Department of Environmental and Heritage Protection, Queensland](#)
- [-Department of Parks and Wildlife, Western Australia](#)
- [-Environment and Planning Directorate, ACT](#)
- [-Birdlife Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- Natural history museums of Australia
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-South Australian Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)
- [-Australian National Herbarium, Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence](#)
- [Forestry Corporation, NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- [-Australian Tropical Herbarium, Cairns](#)
- [-eBird Australia](#)
- [-Australian Government – Australian Antarctic Data Centre](#)
- [-Museum and Art Gallery of the Northern Territory](#)
- [-Australian Government National Environmental Science Program](#)
- [-Australian Institute of Marine Science](#)
- [-Reef Life Survey Australia](#)
- [-American Museum of Natural History](#)
- [-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [-Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact us](#) page.

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# Appendix B. Regional Vertebrate Fauna Survey Data

Basic and Targeted Vertebrate Fauna Survey  
West Musgrave Project Area



## B.1 REGIONAL VERTBRATE FAUNA SURVEY DATA

Taxa	Species	Common name	Surveys												Bat recorder	Camera traps	Spotlighting	Targeted	Transect	Transect	Elliotts	C
			A	WM Site 1	WM Site 2	WM Site 3	WM Site 4	WM Site 5	WM Site 6	WM Site 7	WM Site 8	WM Site 9	WM Site 10	WM Site 11								
<b>Amphibians</b>																						
Limnodynastidae	<i>Notaden nichollsi</i>	Desert Spadefoot																1				
<b>Reptiles</b>																						
Agamidae	<i>Ctenophorus clayi</i>	Black-collared Dragon	X																			
	<i>Ctenophorus graafi</i>	Ring-tailed Dragon	X																			
	<i>Ctenophorus isolepis</i>	Central Military Dragon	X						X			X	X	X				1	6	9	23	
	<i>Ctenophorus nuchalis</i>	Central Netted Dragon	X			X												1				
	<i>Ctenophorus reticulatus</i>	Western Netted Dragon	X																			
	<i>Gowidon longirostris</i>	Long-nosed Dragon																1				
	<i>Moloch horridus</i>	Thorny Devil	X																2	6		
	<i>Pogona minor</i>	Western Bearded Dragon				X							X					1				
Carphodactylidae	<i>Nephrurus levis</i>	Three-lined Knob-tail			X	X			X									1		2		
Diplodactylidae	<i>Diplodactylus conspicillatus</i>	Fat-tailed Gecko			X		X					X	X	X				2				
	<i>Diplodactylus laevis</i>	Desert Fat-tailed Gecko				X			X	X								2		1		
	<i>Lucasium stenodactylum</i>	Crowned Gecko					X			X	X							2		2		
	<i>Rhynchoedura ornata</i>	Beaked Gecko	X	X	X	X			X	X								1				
	<i>Strophurus ciliaris</i>	Spiny-tailed Gecko																4		1		
	<i>Strophurus elderi</i>	Jewelled Gecko	X		X								X					1	2	1		
	<i>Strophurus intermedius</i>	Southern Spiny-tailed Gecko	X															1				
	<i>Strophurus strophurus</i>	Western Spiny-tailed Gecko												X			1	1		2		
Elapidae	<i>Brachyuropsis fasciolatus</i>	Narrow-banded Burrowing Snake	X																			
	<i>Demansia psammophis</i>	Yellow-faced Whipsnake	X				X								X							
	<i>Suta monachus</i>	Hooded Snake																1				
	<i>Pseudechis australis</i>	Mulga Snake							X									1				
	<i>Pseudonaja mengdeni</i>	Western Brown Snake										X	X							1		
	<i>Pseudonaja modesta</i>	Ringed Brown Snake	X															1				
	<i>Simoselaps anomalus</i>	Desert Banded Snake		X			X	X				X						1				
Gekkonidae	<i>Gehyra montium</i>	Centralian Dtella	X																			
	<i>Gehyra purpurascens</i>	Purplish Dtella	X	X	X	X	X	X	X		X	X						2	5	2		
	<i>Gehyra variegata</i>	Variegated Gehyra	X	X				X										1	4	2		
	<i>Heteronotia binoei</i>	Bynoe's Gecko	X		X	X	X		X	X			X	X	X				1			
Pygopodidae	<i>Delma butleri</i>	Unbanded Delma																	1			
	<i>Delma desmosa</i>	Banded Delma					X															

Taxa	Species	Common name	Surveys A												B							C	
			WM Site 1	WM Site 2	WM Site 3	WM Site 4	WM Site 5	WM Site 6	WM Site 7	WM Site 8	WM Site 9	WM Site 10	WM Site 11	WM Site 12	Bat recorder	Camera traps	Spotlighting	Targeted	Transect	Transect	Elliots		
	<i>Delma nasuta</i>	Sharp-snouted Delma	X																				
	<i>Lialis burtonis</i>	Burton's Legless Lizard				X			X							1	6						
	<i>Pygopus nigriceps</i>	Western Hooded Scaly-foot	X	X																	1		
Pythonidae	<i>Antaresia stimsoni</i>	Stimson's Python														1							
	<i>Aspidites ramsayi</i>	Woma																			1		
Scincidae	<i>Ctenotus brooksi</i>	Brooks Ctenotus				X					X					1							
	<i>Ctenotus calurus</i>	Blue-tailed Finesnout Ctenotus																			1	3	
	<i>Ctenotus helenae</i>	Clay-soil Ctenotus		X		X					X												
	<i>Ctenotus inornatus</i>	Bar-shouldered Ctenotus								X													
	<i>Ctenotus leonhardii</i>	Leonhardi's Ctenotus	X	X		X			X	X											1		
	<i>Ctenotus nasutus</i>	Nasute Finesnout Ctenotus				X						X											
	<i>Ctenotus pantherinus</i>	Leopard Ctenotus	X	X			X		X			X	X	X						1		3	
	<i>Ctenotus piankai</i>	Coarse Sands Ctenotus							X														
	<i>Ctenotus quattuordecimlineatus</i>	Fourteen-lined Ctenotus	X	X		X					X		X								1	1	
	<i>Ctenotus schomburgkii</i>	Barred Wedgesnout Ctenotus	X																				
	<i>Cyclodomorphus melanops</i>	Spinifex Slender Blue-tongue	X								X										4		
	<i>Egernia eos</i>	Central Pygmy Spiny-tailed Skink	X																				
	<i>Eremiascincus pallidus</i>	Western Sand-swimming Skink		X		X					X										1		
	<i>Eremiascincus richardsonii</i>	Broad-banded Sand-swimmer																			1		
	<i>Lerista bipes</i>	North-western Sandslider	X	X	X	X	X	X	X	X	X	X	X	X	X							2	
	<i>Lerista desertorum</i>	Central Desert Robust Slider	X																			2	
	<i>Lerista labialis</i>	Southern Slider	X	X	X	X		X		X	X												
	<i>Lerista taeniata</i>	Ribbon Slider			X							X										1	
	<i>Lerista timida</i>	Timid Slider	X																				
	<i>Liopholis inornata</i>	Desert Skink	X		X		X	X				X	X								1	2	
	<i>Liopholis kintorei</i>	Great Desert Skink	X																		1	5	
	<i>Liopholis striata</i>	Nocturnal Desert Skink			X	X															1	5	
	<i>Menetia greyii</i>	Common Dwarf Skink	X	X		X	X	X	X	X											4		
	<i>Morethia ruficauda</i>	Lined Fire-tailed Skink		X	X		X	X				X	X								2		
	<i>Notoscincus ornatus</i>	Ornate Soil-crevice Skink							X			X											
	<i>Tiliqua multifasciata</i>	Central Blue-tongue												X		2					1	1	
	<i>Tiliqua occipitalis</i>	Western Blue-tongued Lizard													3		1						
Typhlopidae	<i>Anilius endoterus</i>	Interior Blind Snake		X	X		X	X				X											
T	<i>Anilius grypus</i>	Long-beaked Blind Snake																					
Varanidae	<i>Varanus acanthurus</i>	Spiny-tailed Monitor																					
	<i>Varanus brevicauda</i>	Short-tailed Pygmy Monitor					X						X								1		
	<i>Varanus eremius</i>	Pygmy Desert Monitor	X				X		X							2	1			1	2		

Taxa	Species	Common name	Surveys A												B							C	
			WM Site 1	WM Site 2	WM Site 3	WM Site 4	WM Site 5	WM Site 6	WM Site 7	WM Site 8	WM Site 9	WM Site 10	WM Site 11	WM Site 12	Bat recorder	Camera traps	Spotlighting	Targeted	Transect	Transect	Elliotts		
	<i>Varanus giganteus</i>	Perentie															1						
	<i>Varanus gilleni</i>	Pygmy Mulga Monitor						X									1			2			
	<i>Varanus gouldii</i>	Gould's Goanna								X	X					8	1		16	4			
	<i>Varanus tristis</i>	Black-headed Monitor															1						
<b>Birds</b>																							
Casuariidae	<i>Dromaius novaehollandiae</i>	Emu							X			X							2		2		
Columbidae	<i>Phaps chalcoptera</i>	Common Bronzewing															1						
	<i>Ocyphaps lophotes</i>	Crested Pigeon	X	X	X	X	X	X	X	X	X	X	X	X		1			2		9		
Cuculidae	<i>Cacomantis pallidus</i>	Pallid Cuckoo	X																				
Caprimulgidae	<i>Eurostopodus argus</i>	Spotted Nightjar														1					1		
Burhinidae	<i>Burhinus grallarius</i>	Bush Stone-curlew																					
Turnicidae	<i>Turnix velox</i>	Little Buttonquail				X	X		X					X		5	3	1	1	1	17		
Otididae	<i>Ardeotis australis</i>	Australian Bustard						X	X			X					1	1	6	3			
Accipitridae	<i>Elanus axillaris</i>	Black-shouldered Kite															1						
	<i>Hamirostra melanosternon</i>	Black-breasted Buzzard	X																				
	<i>Aquila audax</i>	Wedge-tailed Eagle		X					X								1				1		
	<i>Circus assimilis</i>	Spotted Harrier		X										X			1				2		
	<i>Haliastur sphenurus</i>	Whistling Kite															1						
Tytonidae	<i>Tyto alba</i>	Barn Owl															1						
Alcedinidae	<i>Todiramphus pyrrhopygius</i>	Red-backed Kingfisher					X				X												
Meropidae	<i>Merops ornatus</i>	Rainbow Bee-eater					X				X					1	1						
Falconidae	<i>Falco cenchroides</i>	Nankeen Kestrel		X				X					X				1	2			4		
	<i>Falco longipennis</i>	Australian Hobby										X					1	1			2		
	<i>Falco berigora</i>	Brown Falcon	X		X		X	X									1	2			5		
Cacatuidae	<i>Eolophus roseicapilla</i>	Galah	X			X		X				X		X		1		1			5		
	<i>Nymphicus hollandicus</i>	Cockatiel	X															1					
Psittaculidae	<i>Neopsephotus bourkii</i>	Bourke's Parrot															1	1			1		
	<i>Barnardius zonarius</i>	Australian Ringneck					X					X											
	<i>Psephotus varius</i>	Mulga Parrot																					
	<i>Melopsittacus undulatus</i>	Budgerigar	X	X	X	X	X	X	X	X	X	X	X	X		2	1	4			9		
Ptilonorhynchidae	<i>Chlamydera guttata</i>	Western Bowerbird														1					2		
Maluridae	<i>Amytornis oweni</i>	Sandhill Grasswren					X		X							3	1	1	1	1	16		
	<i>Stipiturus ruficeps</i>	Rufous-crowned Emuwren																1			7		
	<i>Malurus assimilis</i>	Purple-backed Fairywren	X	X		X			X		X		X				1	5	1		16		
	<i>Malurus splendens</i>	Splendid Fairywren															1				1		
	<i>Malurus leucopterus</i>	White-winged Fairywren	X	X		X	X		X		X	X	X			1	1				19		
Meliphagidae	<i>Certhionyx variegatus</i>	Pied Honeyeater	X										X										

Taxa	Species	Common name	Surveys A												Surveys B												C	
			WM Site 1	WM Site 2	WM Site 3	WM Site 4	WM Site 5	WM Site 6	WM Site 7	WM Site 8	WM Site 9	WM Site 10	WM Site 11	WM Site 12	Bat recorder	Camera traps	Spotlighting	Targeted	Transect	Transect	Elliotts							
	<i>Purnella albifrons</i>	White-fronted Honeyeater	X															1				11						
	<i>Manorina flavigula</i>	Yellow-throated Miner		X	X	X		X	X	X	X	X	X				1	1	4				28					
	<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater	X											X					3				6					
	<i>Gavicalis virescens</i>	Singing Honeyeater	X	X	X	X	X	X	X	X	X	X	X	X	X		1	1	12	1				39				
	<i>Ptilotula plumula</i>	Grey-fronted Honeyeater					X	X						X			1		1				8					
	<i>Epthianura tricolor</i>	Crimson Chat	X														1	1					1					
	<i>Epthianura aurifrons</i>	Orange Chat																					1					
Pardalotidae	<i>Pardalotus rubricatus</i>	Red-browed Pardalote								X	X								2				1					
Acanthizidae	<i>Pyrholaemus brunneus</i>	Redthroat					X																2					
	<i>Acanthiza apicalis</i>	Inland Thornbill					X																1					
	<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill					X	X															1					
	<i>Acanthiza robustirostris</i>	Slaty-backed Thornbill				X													3				5					
	<i>Smicrornis brevirostris</i>	Weebill																1					1					
	<i>Aphelocephala leucopsis</i>	Southern Whiteface		X		X																	3					
	<i>Aphelocephala nigricincta</i>	Banded Whiteface			X			X	X										1				1					
Pomatostomidae	<i>Pomatostomus superciliosus</i>	White-browed Babbler	X	X															1	1			3					
Campephagidae	<i>Coracina maxima</i>	Ground Cuckooshrike				X					X								1									
	<i>Coracina novaehollandiae</i>	Black-faced Cuckooshrike			X	X		X											1	2			3					
	<i>Lalage tricolor</i>	White-winged Triller																	1									
Neosittidae	<i>Daphoenositta chrysoptera</i>	Varied Sittella																					1					
Psophodidae	<i>Psophodes occidentalis</i>	Chiming Wedgebill	X																									
Oreoicidae	<i>Oreoica gutturalis</i>	Crested Bellbird	X	X		X		X	X		X	X	X					2		4			9					
Pachycephalidae	<i>Colluricincla harmonica</i>	Grey Shrike Thrush		X																								
	<i>Pachycephala rufiventris</i>	Rufous Whistler		X																			5	8				
Artamidae	<i>Artamus cinereus</i>	Black-faced Woodswallow	X	X		X		X	X	X	X	X		X	X		2	1	7				43					
	<i>Cracticus nigrogularis</i>	Pied Butcherbird	X	X	X	X	X	X	X	X	X	X	X			4	1	3					6					
	<i>Gymnorhina tibicen</i>	Australian Magpie	X	X	X	X	X	X	X	X	X	X	X	X					4	1	1		4					
Rhipiduridae	<i>Rhipidura leucophrys</i>	Willie Wagtail	X	X		X	X	X		X	X	X	X	X			7	1	5				13					
Monarchidae	<i>Grallina cyanoleuca</i>	Magpie-lark			X	X					X																	
Corvidae	<i>Corvus orru</i>	Torresian Crow		X	X	X		X	X	X	X			X				3	1	2			2					
Petroicidae	<i>Petroica goodenovii</i>	Red-capped Robin	X															1		1			3					
	<i>Melanodryas cucullata</i>	Hooded Robin	X					X											1				1					
Locustellidae	<i>Cincloramphus cruralis</i>	Brown Songlark	X			X																						
	<i>Cincloramphus mathewsi</i>	Rufous Songlark								X																		
Hirundinidae	<i>Cheramoeca leucosterna</i>	White-backed Swallow										X			X								2	3				
Estrildidae	<i>Taeniopygia guttata</i>	Zebra Finch	X	X	X	X	X	X	X	X	X	X	X	X	X			3	1	7				27				
Motacillidae	<i>Anthus novaeseelandiae</i>	Australasian Pipit	X			X	X				X								1	2			1					



Taxa	Species	Common name	Surveys A												B						C	
			WM Site 1	WM Site 2	WM Site 3	WM Site 4	WM Site 5	WM Site 6	WM Site 7	WM Site 8	WM Site 9	WM Site 10	WM Site 11	WM Site 12	Bat recorder	Camera traps	Spotlighting	Targeted	Transect	Transect	Elliotts	
<b>Mammals</b>																						
Bovidae	<i>Bos taurus</i>	Cow	X																			
Camelidae	<i>Camelus dromedarius</i>	Dromedary	X			X	X	X	X	X	X	X	X	X		9	1	16	19	59		
Canidae	<i>Canis sp.</i>	Wild dog	X	X				X	X	X	X	X	X	X		21		6	1	37		
	<i>Vulpes vulpes</i>	Red Fox													14			2	1			
Felidae	<i>Felis catus</i>	Cat	X	X		X	X	X	X	X		X	X		15	1	3	8	23			
Molossidae	<i>Austronomus australis</i>	White-striped Freetail Bat													2		2					
	<i>Mormopterus petersi</i>	Inland Free-tail Bat													1							
Vespertilionidae	<i>Chalinolobus morio</i>	Chocolate Wattled Bat													2							
	<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat															2					
Dasyuridae	<i>Dasyercus blythi</i>	Brush-tailed Mulgara				X			X		X				4	1	1	5	54			
	<i>Ningauai ridei</i>	Wongai Ningauai	X	X		X	X		X		X	X	X	X								
	<i>Pseudantechinus macdonnellensis</i>	Fat-tailed False Antechinus	X																			
	<i>Sminthopsis hirtipes</i>	Hairy-footed Dunnart				X																
	<i>Sminthopsis ooldea</i>	Ooldea Dunnart		X																		
	<i>Sminthopsis youngsoni</i>	Lesser Hairy-footed Dunnart										X										
Macropodidae	<i>Lagorchestes hirsutus</i>	Rufous Hare-wallaby	X														1					
	<i>Osphranter robustus</i>	Euro	X																			
	<i>Petrogale lateralis</i>	Black-flanked Rock-wallaby	X																			
Potoroidae	<i>Bettongia lesueur</i>	Burrowing Bettong																		2		
Leporidae	<i>Oryctolagus cuniculus</i>	Rabbit													1	2	2	1	2			
Notoryctidae	<i>Notoryctes sp.</i>	Marsupial Mole sp.																			1	
	<i>Notoryctes typhlops</i>	Southern Marsupial Mole	X														1					
Equidae	<i>Equus caballus</i>	Horse																1				
Muridae	<i>Mus musculus</i>	House Mouse	X	X	X	X		X	X	X	X	X	X	X								
	<i>Notomys alexis</i>	Spinifex Hopping Mouse	X	X		X	X		X		X	X			26	1	5		31			
	<i>Pseudomys desertor</i>	Desert Mouse			X			X		X	X											
	<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse	X		X			X		X	X	X	X	X								

A Atlas of Living Australia

B Western Wildlife (2020) *West Musgrave Copper and Nickel Project: Level 2 Vertebrate Fauna Survey 2018/2019*, unpublished report for OZ Minerals Ltd, Perth.

C Pearson, D. and Turner, J. (2000) Marsupial moles pop up in the Great Victoria and Gibson Deserts, *Australian Mammalogy*, 22, 115-119.

# **Appendix C. Definitions of Significant Fauna under the WA Biodiversity Conservation Act 2016 and Priority Species**

**Basic and Targeted Vertebrate Fauna Survey  
West Musgrave Project Area**



## ATTACHMENT C

### DEFINITIONS OF SIGNIFICANT FAUNA UNDER THE WA BIODIVERSITY CONSERVATION ACT 2016

Threatened, Extinct and Specially Protected fauna or flora<sup>1</sup> are species<sup>2</sup> 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 *Wildlife Conservation (Specially Protected Fauna) Notice 2018* and the *Wildlife Conservation (Rare Flora) Notice 2018* have been transitioned under regulations 170, 171 and 172 of the *Biodiversity Conservation Regulations 2018* to be the lists of Threatened, Extinct and Specially Protected species under Part 2 of the *Biodiversity Conservation Act 2016*. Categories of Threatened, Extinct and Specially Protected fauna and flora are:

#### **T Threatened Species**

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 *Biodiversity Conservation Act 2016* (BC Act).

**Threatened fauna** is that subset of 'Specially Protected Fauna' listed under schedules 1 to 3 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for Threatened Fauna.

**Threatened flora** is that subset of 'Rare Flora' listed under schedules 1 to 3 of the *Wildlife Conservation (Rare Flora) Notice 2018* for Threatened Flora.

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.

#### **CR Critically endangered species**

Threatened species considered to be "*facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines*".

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 *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for critically endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for critically endangered flora.

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<sup>1</sup> The definition of flora includes algae, fungi and lichens

<sup>2</sup> 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).

## EN Endangered species

Threatened species considered to be *"facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines"*.

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 *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for endangered flora.

## VU Vulnerable species

Threatened species considered to be *"facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines"*.

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 *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for vulnerable fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for vulnerable flora.

## Extinct Species

Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.

## EX Extinct species

Species where *"there is no reasonable doubt that the last member of the species has died"*, and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).

Published as presumed extinct under schedule 4 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for extinct fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for extinct flora.

## EW Extinct in the wild species

Species that *"is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form"*, and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act).

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.

## Specially Protected Species

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.

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.

## **MI Migratory birds protected under an international agreement**

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).

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 *Convention on the Conservation of Migratory Species of Wild Animals* (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.

Published as migratory birds protected under an international agreement under schedule 5 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

## **CD Species of special conservation interest (conservation dependant fauna)**

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).

Published as conservation dependent fauna under schedule 6 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

## **OS Other specially protected species**

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).

Published as other specially protected fauna under schedule 7 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

## **P Priority species**

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.

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.

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



### **P1 Priority 1: Poorly-known species**

Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, 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.

### **P2 Priority 2: Poorly-known species**

Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, 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.

### **P3 Priority 3: Poorly-known species**

Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.

### **P4 Priority 4: Rare, Near Threatened and other species in need of monitoring**

(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands.

(b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent.

(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

# Appendix D.

## Fauna habitat assessment data

Basic and Targeted Vertebrate Fauna Survey  
West Musgrave Project Area



Date: 12/10/2023      Habitat Assessment #: 1      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 371128 mE 7137418 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 12/10/2023      Habitat Assessment #: 2      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 371341 mE 7137418 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass





Date: 12/10/2023      Habitat Assessment #: 3      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 371535 mE 7137442 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 12/10/2023      Habitat Assessment #: 4      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 371626 mE 7136779 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 12/10/2023      Habitat Assessment #: 5      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 371773 mE 7136783 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 12/10/2023      Habitat Assessment #: 6      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 371701 mE 7136732 mN      Fire History: > 5yrs      Landform: Flat plain

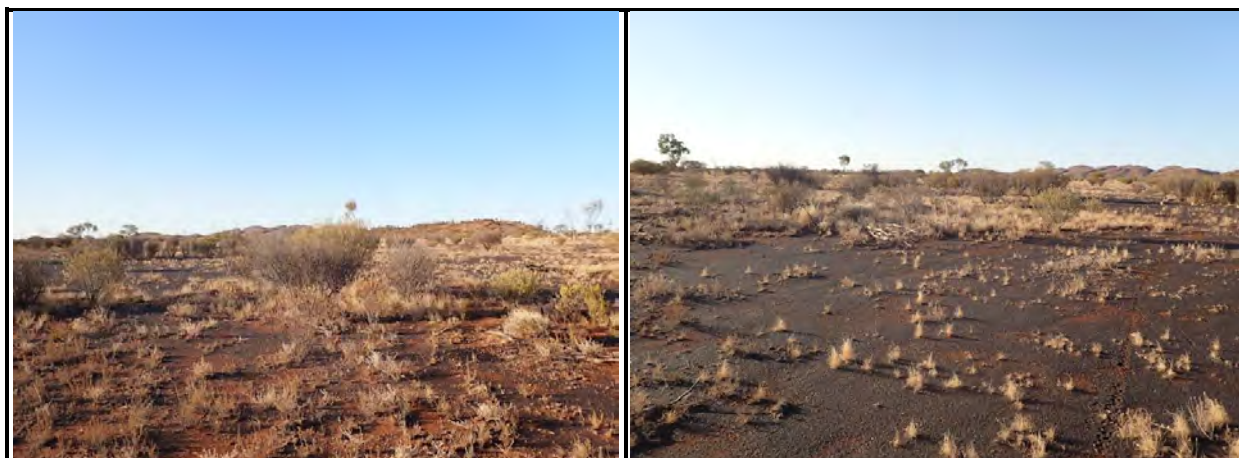
Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass





Date: 12/10/2023      Habitat Assessment #: 7      Observer: Dr Scott Thompson and Simon Pitt  
GDA94 52; 371529 mE 7136720 mN      Fire History: > 5yrs      Landform: Flat plain  
Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles  
Habitat Type: Shrubs with grass



Date: 12/10/2023      Habitat Assessment #: 8      Observer: Dr Scott Thompson and Simon Pitt  
GDA94 52; 371357 mE 7136730 mN      Fire History: > 5yrs      Landform: Flat plain  
Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles  
Habitat Type: Shrubs with grass



Date: 12/10/2023      Habitat Assessment #: 9      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 371476 mE 7136777 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 12/10/2023      Habitat Assessment #: 10      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 371585 mE 7136590 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass





Date: 12/10/2023      Habitat Assessment #: 11      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 371599 mE 7136353 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 12/10/2023      Habitat Assessment #: 12      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 371643 mE 7136146 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 12/10/2023      Habitat Assessment #: 13      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 371789 mE 7136167 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 12/10/2023      Habitat Assessment #: 14      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 371700 mE 7136104 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass





Date: 12/10/2023      Habitat Assessment #: 15      Observer: Dr Scott Thompson and Simon Pitt  
GDA94 52; 371542 mE 7136102 mN      Fire History: > 5yrs      Landform: Flat plain  
Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles  
Habitat Type: Shrubs with grass



Date: 12/10/2023      Habitat Assessment #: 16      Observer: Dr Scott Thompson and Simon Pitt  
GDA94 52; 371411 mE 7136128 mN      Fire History: > 5yrs      Landform: Flat plain  
Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles  
Habitat Type: Shrubs with grass





Date: 12/10/2023      Habitat Assessment #: 17      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 371515 mE 7136160 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 12/10/2023      Habitat Assessment #: 18      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 371546 mE 7136239 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 12/10/2023      Habitat Assessment #: 19      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 371609 mE 7136287 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 12/10/2023      Habitat Assessment #: 20      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 371729 mE 7136292 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass





Date: 12/10/2023      Habitat Assessment #: 21      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 371679 mE 7136228 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 22      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 372217 mE 7140977 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 23      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 372462 mE 7141126 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 24      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 372760 mE 7141267 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass





Date: 13/10/2023      Habitat Assessment #: 25      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 373029 mE 7141369 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 26      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 372839 mE 7141699 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 27      Observer: Dr Scott Thompson and Simon Pitt  
GDA94 52; 372742 mE 7142041 mN      Fire History: > 5yrs      Landform: Flat plain  
Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles  
Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 28      Observer: Dr Scott Thompson and Simon Pitt  
GDA94 52; 372697 mE 7142284 mN      Fire History: > 5yrs      Landform: Flat plain  
Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles  
Habitat Type: Shrubs with grass



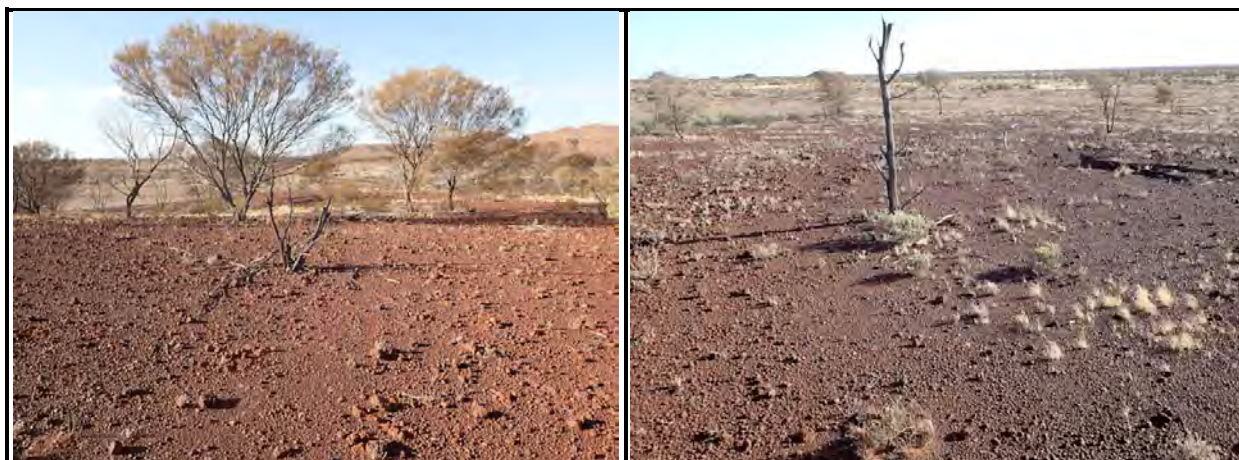


Date: 13/10/2023      Habitat Assessment #: 29      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 372744 mE 7142376 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Grass plain



Date: 13/10/2023      Habitat Assessment #: 30      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 372881 mE 7142453 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Grass plain



Date: 13/10/2023      Habitat Assessment #: 31      Observer: Dr Scott Thompson and Simon Pitt  
GDA94 52; 372846 mE 7142381 mN      Fire History: > 5yrs      Landform: Flat plain  
Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles  
Habitat Type: Grass plain



Date: 13/10/2023      Habitat Assessment #: 32      Observer: Dr Scott Thompson and Simon Pitt  
GDA94 52; 365327 mE 7148936 mN      Fire History: > 5yrs      Landform: Flat plain  
Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles  
Habitat Type: Shrubs with grass





Date: 13/10/2023      Habitat Assessment #: 33      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 365527 mE 7149153 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 34      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 365810 mE 7149437 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 35      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 366097 mE 7149691 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 36      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 366375 mE 7150001 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass





Date: 13/10/2023      Habitat Assessment #: 37      Observer: Dr Scott Thompson and Simon Pitt  
GDA94 52; 366618 mE 7150186 mN      Fire History: > 5yrs      Landform: Flat plain  
Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles  
Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 38      Observer: Dr Scott Thompson and Simon Pitt  
GDA94 52; 366534 mE 7150050 mN      Fire History: > 5yrs      Landform: Flat plain  
Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles  
Habitat Type: Grass plain

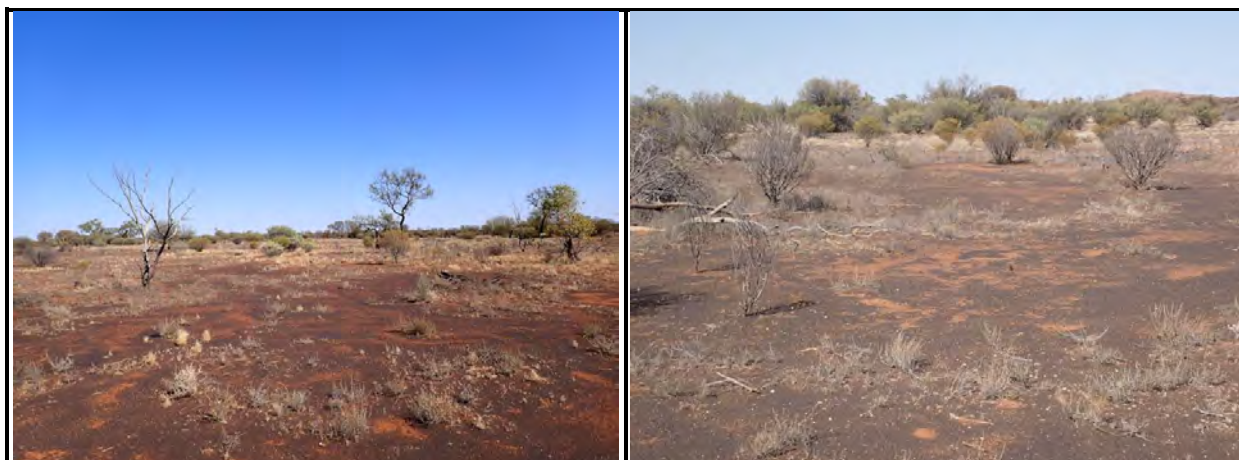


Date: 13/10/2023      Habitat Assessment #: 39      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 366291 mE 7149822 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 40      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 366012 mE 7149544 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass





Date: 13/10/2023      Habitat Assessment #: 41      Observer: Dr Scott Thompson and Simon Pitt  
GDA94 52; 365724 mE 7149284 mN      Fire History: > 5yrs      Landform: Flat plain  
Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles  
Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 42      Observer: Dr Scott Thompson and Simon Pitt  
GDA94 52; 365502 mE 7149046 mN      Fire History: > 5yrs      Landform: Flat plain  
Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles  
Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 43      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 365249 mE 7148800 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 44      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 365069 mE 7148684 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Grass plain





Date: 13/10/2023      Habitat Assessment #: 45      Observer: Dr Scott Thompson and Simon Pitt  
GDA94 52; 365872 mE 7149215 mN      Fire History: > 5yrs      Landform: Flat plain  
Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles  
Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 46      Observer: Dr Scott Thompson and Simon Pitt  
GDA94 52; 366002 mE 7149310 mN      Fire History: > 5yrs      Landform: Flat plain  
Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles  
Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 47      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 366270 mE 7149599 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 48      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 366666 mE 7149920 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Grass plain





Date: 13/10/2023      Habitat Assessment #: 49      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 366510 mE 7149740 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 50      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 366158 mE 7149423 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 51      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 366515 mE 7148291 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 52      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 366734 mE 7148559 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass





Date: 13/10/2023      Habitat Assessment #: 53      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 367007 mE 7148851 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 54      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 367262 mE 7149120 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 55      Observer: Dr Scott Thompson and Simon Pitt  
GDA94 52; 367488 mE 7149396 mN      Fire History: > 5yrs      Landform: Flat plain  
Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles  
Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 56      Observer: Dr Scott Thompson and Simon Pitt  
GDA94 52; 367731 mE 7149672 mN      Fire History: > 5yrs      Landform: Flat plain  
Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles  
Habitat Type: Shrubs with grass



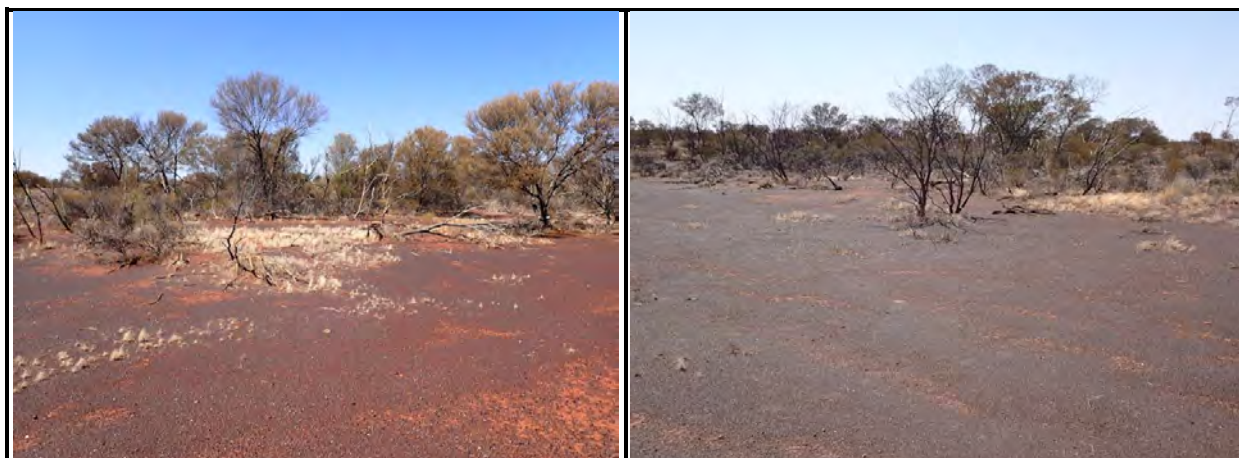


Date: 13/10/2023      Habitat Assessment #: 57      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 367894 mE 7149816 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 58      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 367703 mE 7149522 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 59      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 367444 mE 7149237 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Grass plain



Date: 13/10/2023      Habitat Assessment #: 60      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 367390 mE 7149185 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Grass plain





Date: 13/10/2023      Habitat Assessment #: 61      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 367139 mE 7148906 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 62      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 366935 mE 7148690 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass

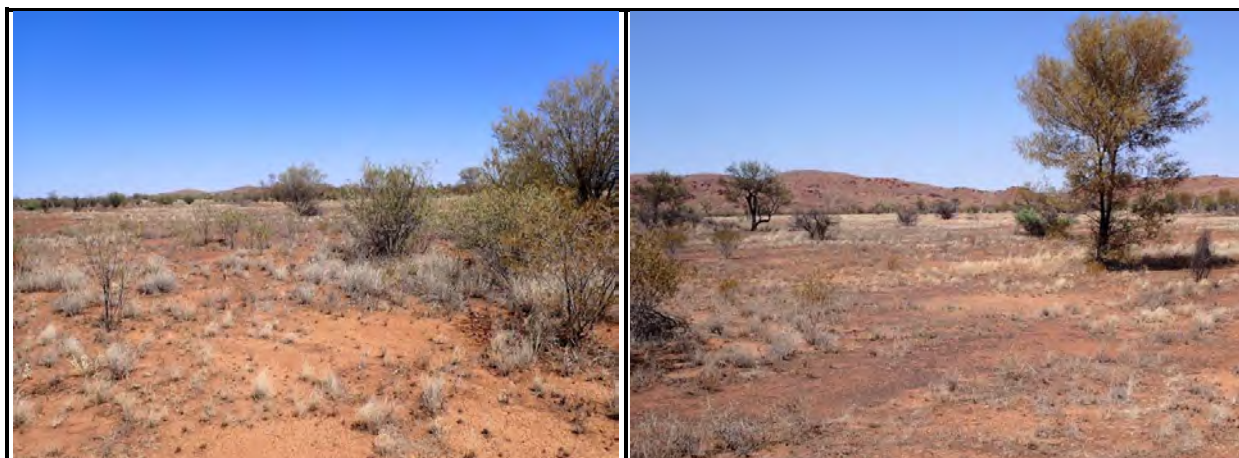


Date: 13/10/2023      Habitat Assessment #: 63      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 366674 mE 7148416 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 64      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 366433 mE 7148129 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass





Date: 13/10/2023      Habitat Assessment #: 65      Observer: Dr Scott Thompson and Simon Pitt  
GDA94 52; 366223 mE 7147944 mN      Fire History: > 5yrs      Landform: Flat plain  
Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles  
Habitat Type: Grass plain



Date: 13/10/2023      Habitat Assessment #: 66      Observer: Dr Scott Thompson and Simon Pitt  
GDA94 52; 366331 mE 7148108 mN      Fire History: > 5yrs      Landform: Flat plain  
Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles  
Habitat Type: Grass plain

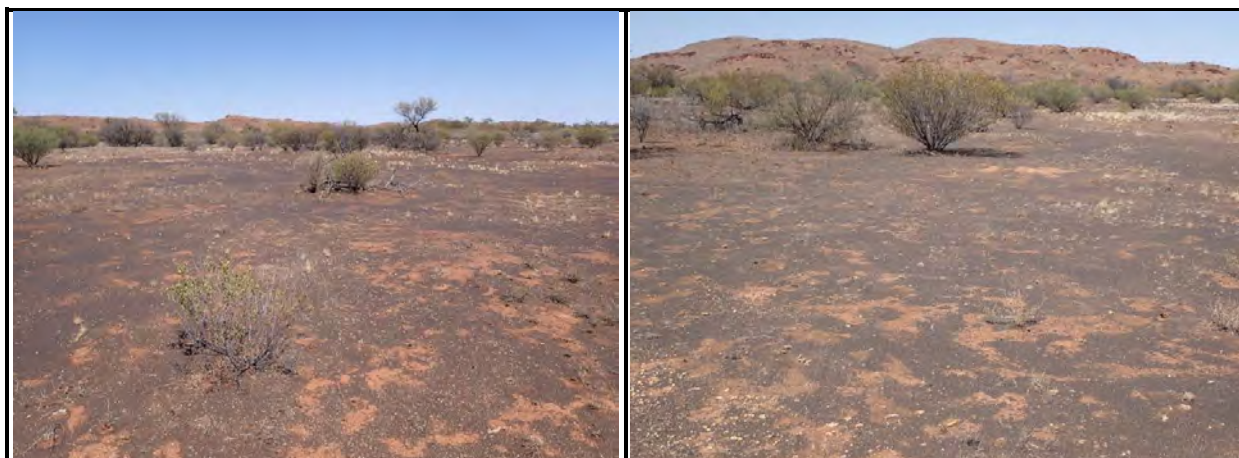


Date: 13/10/2023      Habitat Assessment #: 67      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 367110 mE 7147834 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 68      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 367308 mE 7148017 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass





Date: 13/10/2023      Habitat Assessment #: 69      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 367492 mE 7148204 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 70      Observer: Dr Scott Thompson and Simon Pitt

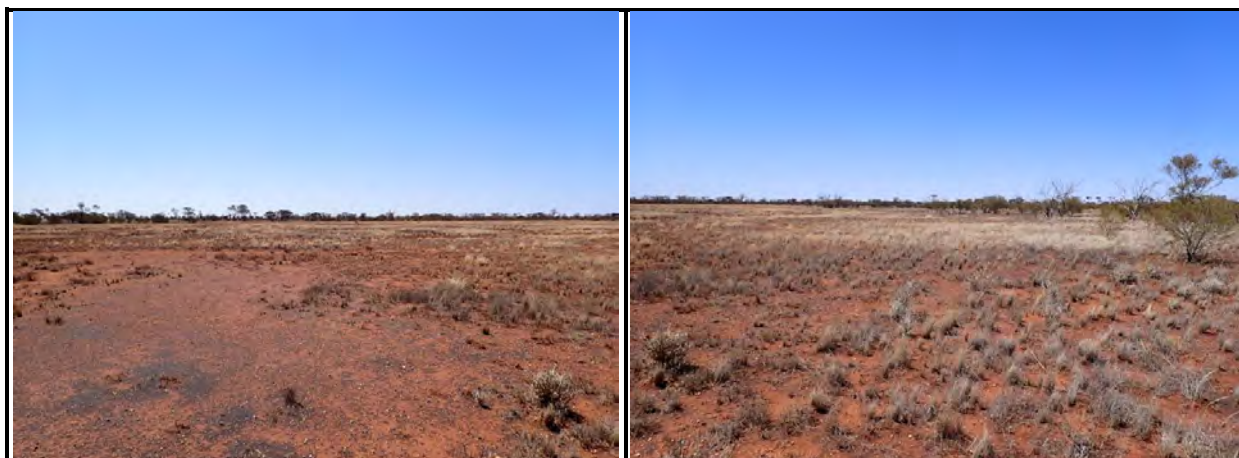
GDA94 52; 367701 mE 7148382 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 71      Observer: Dr Scott Thompson and Simon Pitt  
GDA94 52; 367896 mE 7148550 mN      Fire History: > 5yrs      Landform: Flat plain  
Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles  
Habitat Type: Grass plain



Date: 13/10/2023      Habitat Assessment #: 72      Observer: Dr Scott Thompson and Simon Pitt  
GDA94 52; 367833 mE 7148438 mN      Fire History: > 5yrs      Landform: Flat plain  
Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles  
Habitat Type: Shrubs with grass





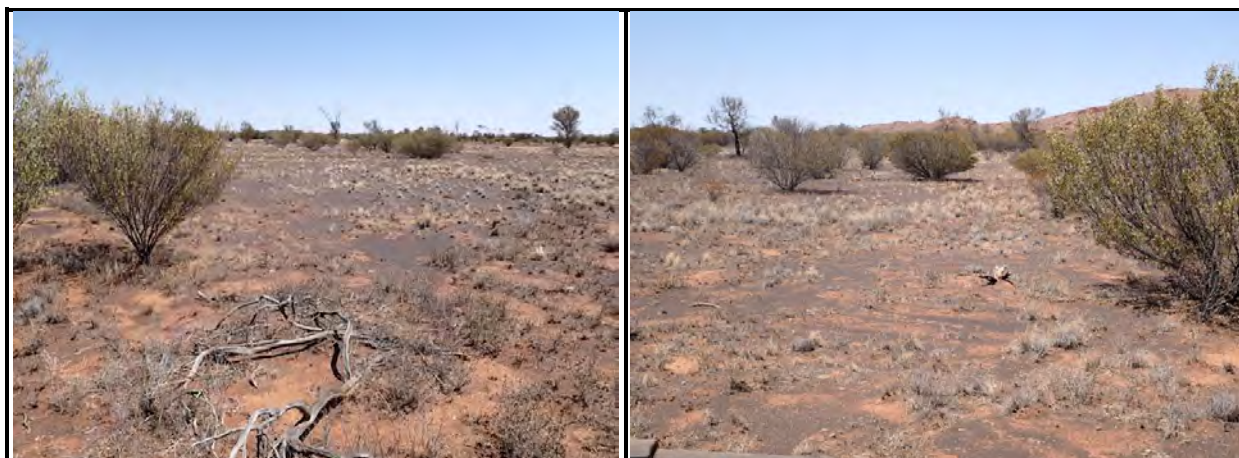
Date: 13/10/2023      Habitat Assessment #: 73      Observer: Dr Scott Thompson and Simon Pitt  
GDA94 52; 367629 mE 7148252 mN      Fire History: > 5yrs      Landform: Flat plain  
Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles  
Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 74      Observer: Dr Scott Thompson and Simon Pitt  
GDA94 52; 367429 mE 7148096 mN      Fire History: > 5yrs      Landform: Flat plain  
Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles  
Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 75      Observer: Dr Scott Thompson and Simon Pitt  
GDA94 52; 367235 mE 7147904 mN      Fire History: > 5yrs      Landform: Flat plain  
Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles  
Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 76      Observer: Dr Scott Thompson and Simon Pitt  
GDA94 52; 366994 mE 7147643 mN      Fire History: > 5yrs      Landform: Flat plain  
Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles  
Habitat Type: Shrubs with grass

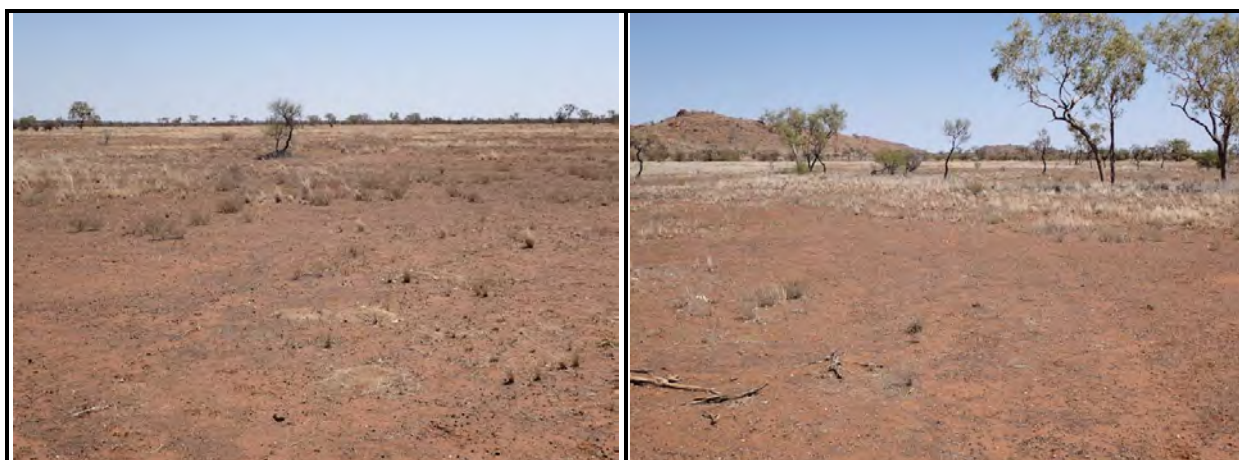




Date: 13/10/2023      Habitat Assessment #: 77      Observer: Dr Scott Thompson and Simon Pitt  
GDA94 52; 366814 mE 7147485 mN      Fire History: > 5yrs      Landform: Flat plain  
Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles  
Habitat Type: Grass plain



Date: 13/10/2023      Habitat Assessment #: 78      Observer: Dr Scott Thompson and Simon Pitt  
GDA94 52; 366658 mE 7147340 mN      Fire History: > 5yrs      Landform: Flat plain  
Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles  
Habitat Type: Grass plain



Date: 13/10/2023      Habitat Assessment #: 79      Observer: Dr Scott Thompson and Simon Pitt  
GDA94 52; 366739 mE 7147481 mN      Fire History: > 5yrs      Landform: Flat plain  
Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles  
Habitat Type: Grass plain



Date: 13/10/2023      Habitat Assessment #: 80      Observer: Dr Scott Thompson and Simon Pitt  
GDA94 52; 366912 mE 7147615 mN      Fire History: > 5yrs      Landform: Flat plain  
Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles  
Habitat Type: Shrubs with grass



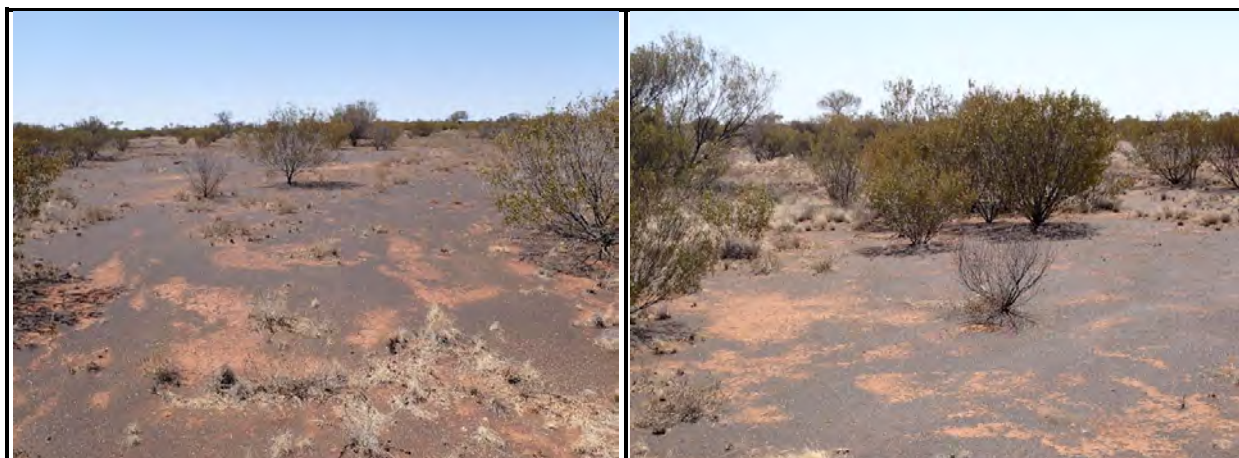


Date: 13/10/2023      Habitat Assessment #: 81      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 367065 mE 7147772 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 82      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 363400 mE 7145404 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 83      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 363560 mE 7145574 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 84      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 363705 mE 7145626 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass





Date: 13/10/2023      Habitat Assessment #: 85      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 363524 mE 7145460 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 86      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 364362 mE 7144670 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs over spinifex



Date: 13/10/2023      Habitat Assessment #: 87      Observer: Dr Scott Thompson and Simon Pitt  
GDA94 52; 364450 mE 7144786 mN      Fire History: > 5yrs      Landform: Rocky ridge  
Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles  
Habitat Type: Low rocky ridge



Date: 13/10/2023      Habitat Assessment #: 88      Observer: Dr Scott Thompson and Simon Pitt  
GDA94 52; 364434 mE 7144668 mN      Fire History: > 5yrs      Landform: Flat plain  
Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles  
Habitat Type: Shrubs over spinifex



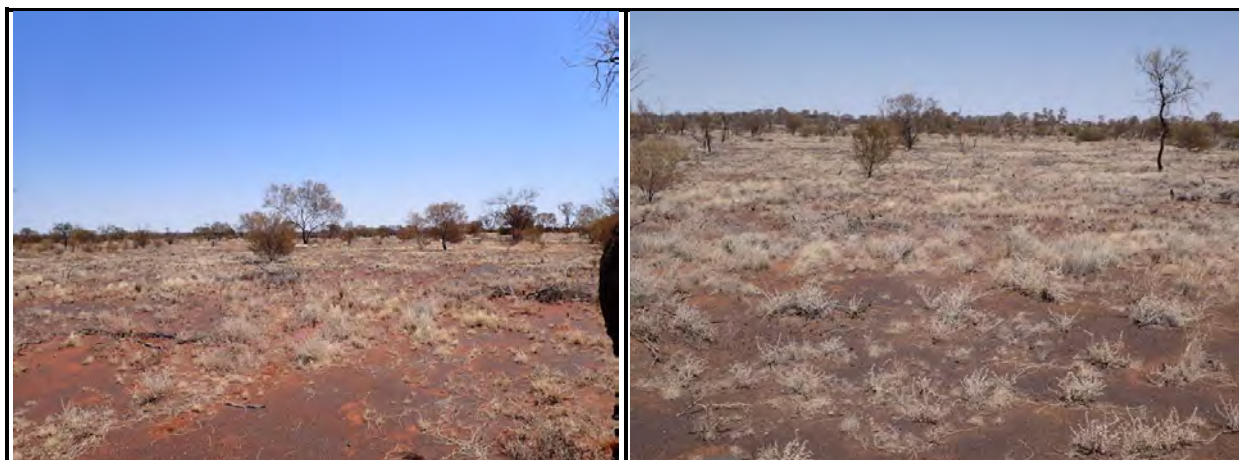


Date: 13/10/2023      Habitat Assessment #: 89      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 364282 mE 7144484 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 90      Observer: Dr Scott Thompson and Simon Pitt

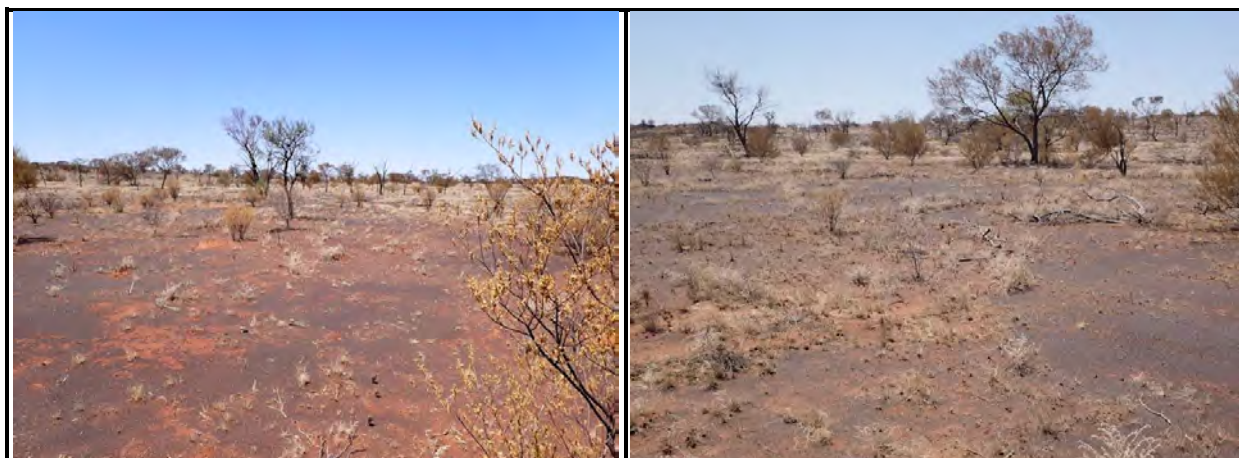
GDA94 52; 364130 mE 7144321 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 91      Observer: Dr Scott Thompson and Simon Pitt  
GDA94 52; 364195 mE 7144473 mN      Fire History: > 5yrs      Landform: Flat plain  
Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles  
Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 92      Observer: Dr Scott Thompson and Simon Pitt  
GDA94 52; 364323 mE 7144596 mN      Fire History: > 5yrs      Landform: Flat plain  
Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles and stones  
Habitat Type: Shrubs over spinifex



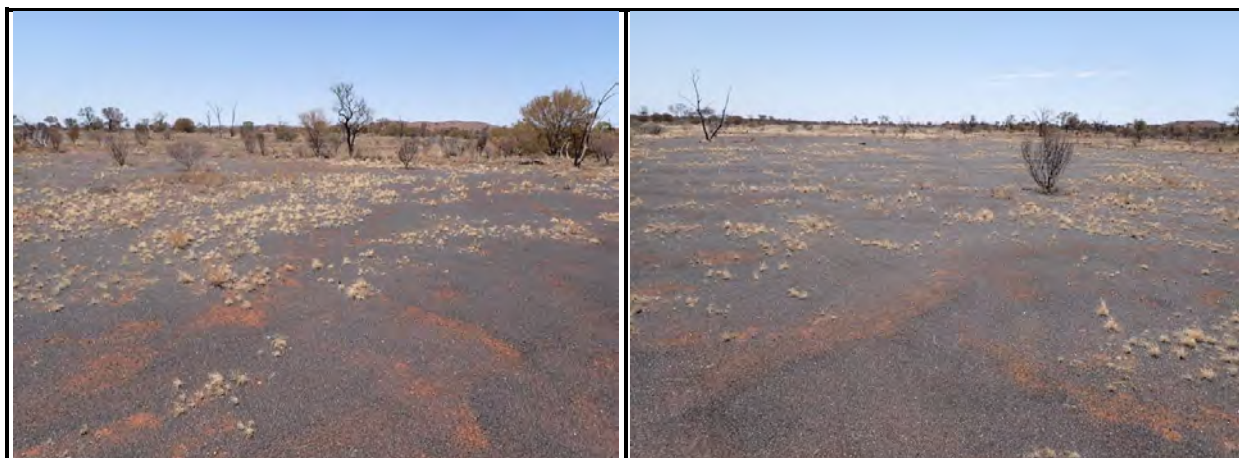


Date: 13/10/2023      Habitat Assessment #: 93      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 363163 mE 7145532 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 94      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 362842 mE 7145700 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 95      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 362631 mE 7145853 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 96      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 362823 mE 7146036 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass





Date: 13/10/2023      Habitat Assessment #: 97      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 362944 mE 7146142 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Stoney ridge

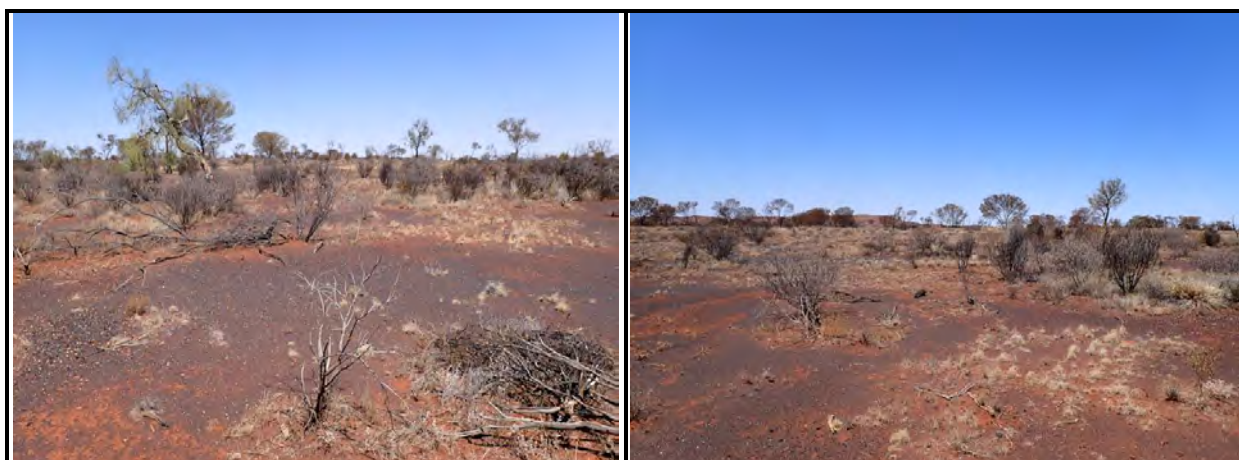


Date: 13/10/2023      Habitat Assessment #: 98      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 363100 mE 7146211 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 99      Observer: Dr Scott Thompson and Simon Pitt  
GDA94 52; 362979 mE 7146093 mN      Fire History: > 5yrs      Landform: Flat plain  
Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles and stones  
Habitat Type: Stoney ridge



Date: 13/10/2023      Habitat Assessment #: 100      Observer: Dr Scott Thompson and Simon Pitt  
GDA94 52; 362756 mE 7145920 mN      Fire History: > 5yrs      Landform: Flat plain  
Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles  
Habitat Type: Shrubs with grass





Date: 13/10/2023      Habitat Assessment #: 101      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 362353 mE 7146056 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 102      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 362096 mE 7146582 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Grass plain

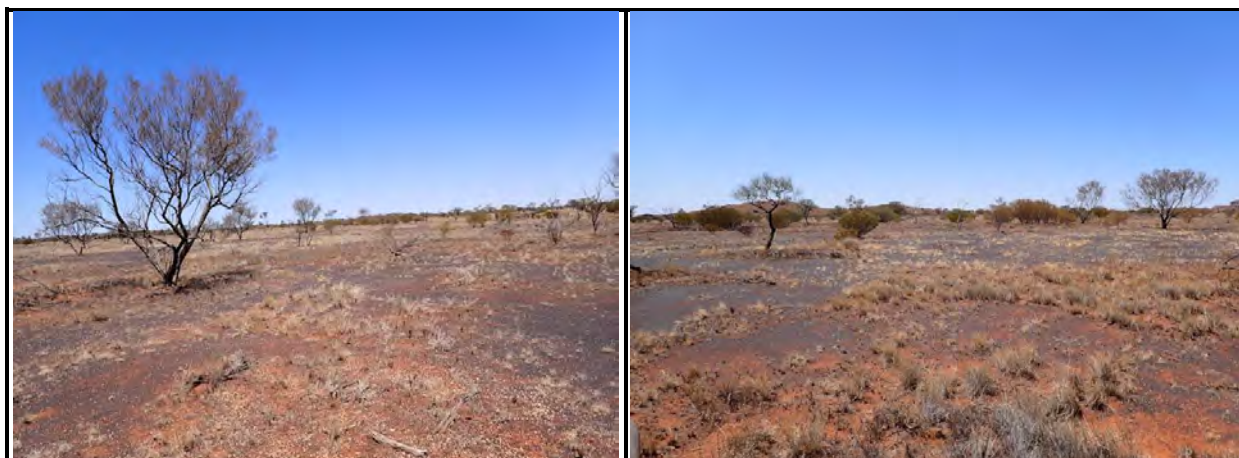


Date: 13/10/2023      Habitat Assessment #: 103      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 362230 mE 7146755 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 104      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 362516 mE 7146958 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Grass plain





Date: 13/10/2023      Habitat Assessment #: 105      Observer: Dr Scott Thompson and Simon Pitt  
GDA94 52; 362465 mE 7146837 mN      Fire History: > 5yrs      Landform: Flat plain  
Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles and stones  
Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 106      Observer: Dr Scott Thompson and Simon Pitt  
GDA94 52; 362369 mE 7146792 mN      Fire History: > 5yrs      Landform: Flat plain  
Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles  
Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 107      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 362179 mE 7146665 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 108      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 362368 mE 7146854 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass





Date: 13/10/2023      Habitat Assessment #: 109      Observer: Dr Scott Thompson and Simon Pitt  
GDA94 52; 360714 mE 7143942 mN      Fire History: > 5yrs      Landform: Flat plain  
Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles  
Habitat Type: Grass plain



Date: 13/10/2023      Habitat Assessment #: 110      Observer: Dr Scott Thompson and Simon Pitt  
GDA94 52; 360751 mE 7144057 mN      Fire History: > 5yrs      Landform: Flat plain  
Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles  
Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 111      Observer: Dr Scott Thompson and Simon Pitt  
GDA94 52; 360912 mE 7144131 mN      Fire History: > 5yrs      Landform: Flat plain  
Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles  
Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 112      Observer: Dr Scott Thompson and Simon Pitt  
GDA94 52; 360777 mE 7144285 mN      Fire History: > 5yrs      Landform: Flat plain  
Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles  
Habitat Type: Shrubs with grass





Date: 13/10/2023      Habitat Assessment #: 113      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 360633 mE 7144441 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 114      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 360472 mE 7144535 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 115      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 360315 mE 7144383 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with rocks

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 116      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 360208 mE 7144253 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Stoney Ridge





Date: 13/10/2023      Habitat Assessment #: 117      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 360093 mE 7144165 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Grass plain



Date: 13/10/2023      Habitat Assessment #: 118      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 359220 mE 7145359 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 119      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 359035 mE 7145195 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 120      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 358892 mE 7145046 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass





Date: 13/10/2023      Habitat Assessment #: 121      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 358763 mE 7144993 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Grass plain



Date: 13/10/2023      Habitat Assessment #: 122      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 358959 mE 7145146 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 123      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 359124 mE 7145316 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 124      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 359231 mE 7145446 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass





Date: 13/10/2023      Habitat Assessment #: 125      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 358453 mE 7145913 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 126      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 358347 mE 7145797 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Grass plain



Date: 13/10/2023      Habitat Assessment #: 127      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 358597 mE 7146082 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 128      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 358524 mE 7145972 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass





Date: 13/10/2023      Habitat Assessment #: 129      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 358139 mE 7146409 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 130      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 358089 mE 7146729 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 131      Observer: Dr Scott Thompson and Simon Pitt  
GDA94 52; 357818 mE 7146766 mN      Fire History: > 5yrs      Landform: Flat plain  
Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles and stones  
Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 132      Observer: Dr Scott Thompson and Simon Pitt  
GDA94 52; 357604 mE 7146877 mN      Fire History: > 5yrs      Landform: Flat plain  
Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles  
Habitat Type: Shrubs with grass





Date: 13/10/2023      Habitat Assessment #: 133      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 356873 mE 7148031 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 134      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 356707 mE 7147945 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Grass plain



Date: 13/10/2023      Habitat Assessment #: 135      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 356533 mE 7147901 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Grass plain



Date: 13/10/2023      Habitat Assessment #: 136      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 356609 mE 7147986 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Grass plain





Date: 13/10/2023      Habitat Assessment #: 137      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 356820 mE 7148061 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with rocks

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 138      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 356825 mE 7148287 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 139      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 356756 mE 7148405 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 140      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 356633 mE 7148382 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass





Date: 13/10/2023      Habitat Assessment #: 141      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 356445 mE 7148407 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 142      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 356573 mE 7148465 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass

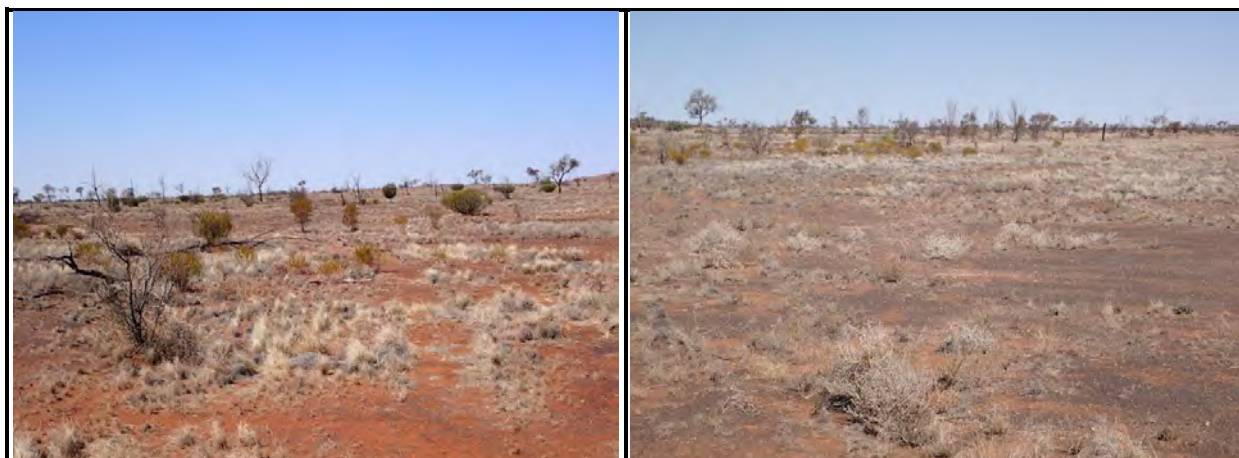


Date: 13/10/2023      Habitat Assessment #: 143      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 356698 mE 7148461 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass



Date: 13/10/2023      Habitat Assessment #: 144      Observer: Dr Scott Thompson and Simon Pitt

GDA94 52; 356833 mE 7148431 mN      Fire History: > 5yrs      Landform: Flat plain

Soil Type: Sandy clay      Habitat Quality: Good      Surface: Sand with pebbles

Habitat Type: Shrubs with grass







# Appendix E Aboriginal Cultural Heritage Inquiry System Report

### Search Criteria

4 Aboriginal Cultural Heritage (ACH) Register in Shapefile - Dante\_Tenements2023

### Disclaimer

Aboriginal heritage holds significant value to Aboriginal people for their social, spiritual, historical, scientific, or aesthetic importance within Aboriginal traditions, and provides an essential link for Aboriginal people to their past, present and future. In Western Australia Aboriginal heritage is protected under the Aboriginal Heritage Act 1972.

All Aboriginal cultural heritage in Western Australia is protected, whether or not the ACH has been reported or exists on the Register.

The information provided is made available in good faith and is predominately based on the information provided to the Department of Planning, Lands and Heritage by third parties. The information is provided solely on the basis that readers will be responsible for making their own assessment as to the accuracy of the information. If you find any errors or omissions in our records, including our maps, it would be appreciated if you provide the details to the Department via <https://achknowledge.dplh.wa.gov.au/ach-enquiry-form> and we will make every effort to rectify it as soon as possible.

### Copyright

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Location information data licensed from Western Australian Land Information Authority (WALIA) trading as Landgate. Copyright in the location information data remains with WALIA. WALIA does not warrant the accuracy or completeness of the location information data or its suitability for any particular purpose.

### Terminology

ID: ACH on the Register is assigned a unique ID by the Department of Planning, Lands and Heritage using the format: ACH-00000001. For ACH on the former Register the ID numbers remain unchanged and use the new format. For example the ACH ID of the place Swan River was previously '3536' and is now 'ACH-00003536'.

#### Access and Restrictions:

- Boundary Reliable (Yes/No): Indicates whether to the best knowledge of the Department, the location and extent of the ACH boundary is considered reliable.
- Boundary Restricted = No: Represents the actual location of the ACH as understood by the Department.
- Boundary Restricted = Yes: To preserve confidentiality the exact location and extent of the place is not displayed on the map. However, the shaded region (generally with an area of at least 4km<sup>2</sup>) provides a general indication of where the ACH is located. If you are a landowner and wish to find out more about the exact location of the place, please contact the Department of Planning, Lands and Heritage.
- Culturally Sensitive = No: Availability of information that the Department of Planning, Lands and Heritage holds in relation to the ACH is not restricted in any way.
- Culturally Sensitive = Yes: Some of the information that the Department of Planning, Lands and Heritage holds in relation to the ACH is restricted if it is considered culturally sensitive information. This information will only be made available if the Department of Planning, Lands and Heritage receives written approval from the people who provided the information. To request access please contact via <https://achknowledge.dplh.wa.gov.au/ach-enquiry-form>.
- Culturally Sensitive Nature:
  - No Gender / Initiation Restrictions: Anyone can view the information.
  - Men only: Only males can view restricted information.
  - Women only: Only females can view restricted information.

#### Status:

- Register: Aboriginal cultural heritage places that are assessed as meeting Section 5 of the Aboriginal Heritage Act 1972.
- Lodged: Information which has been received in relation to an Aboriginal cultural heritage place, but is yet to be assessed under Section 5 of the Aboriginal Heritage Act 1972.
- Historic: Aboriginal heritage places assessed as not meeting the criteria of Section 5 of the Aboriginal Heritage Act 1972. Includes places that no longer exist as a result of land use activities with existing approvals.

Place Type: The type of Aboriginal cultural heritage place. For example an artefact scatter place or engravings place.

Legacy ID: This is the former unique number that the former Department of Aboriginal Sites assigned to the place.

#### Coordinates

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# Aboriginal Cultural Heritage Inquiry System

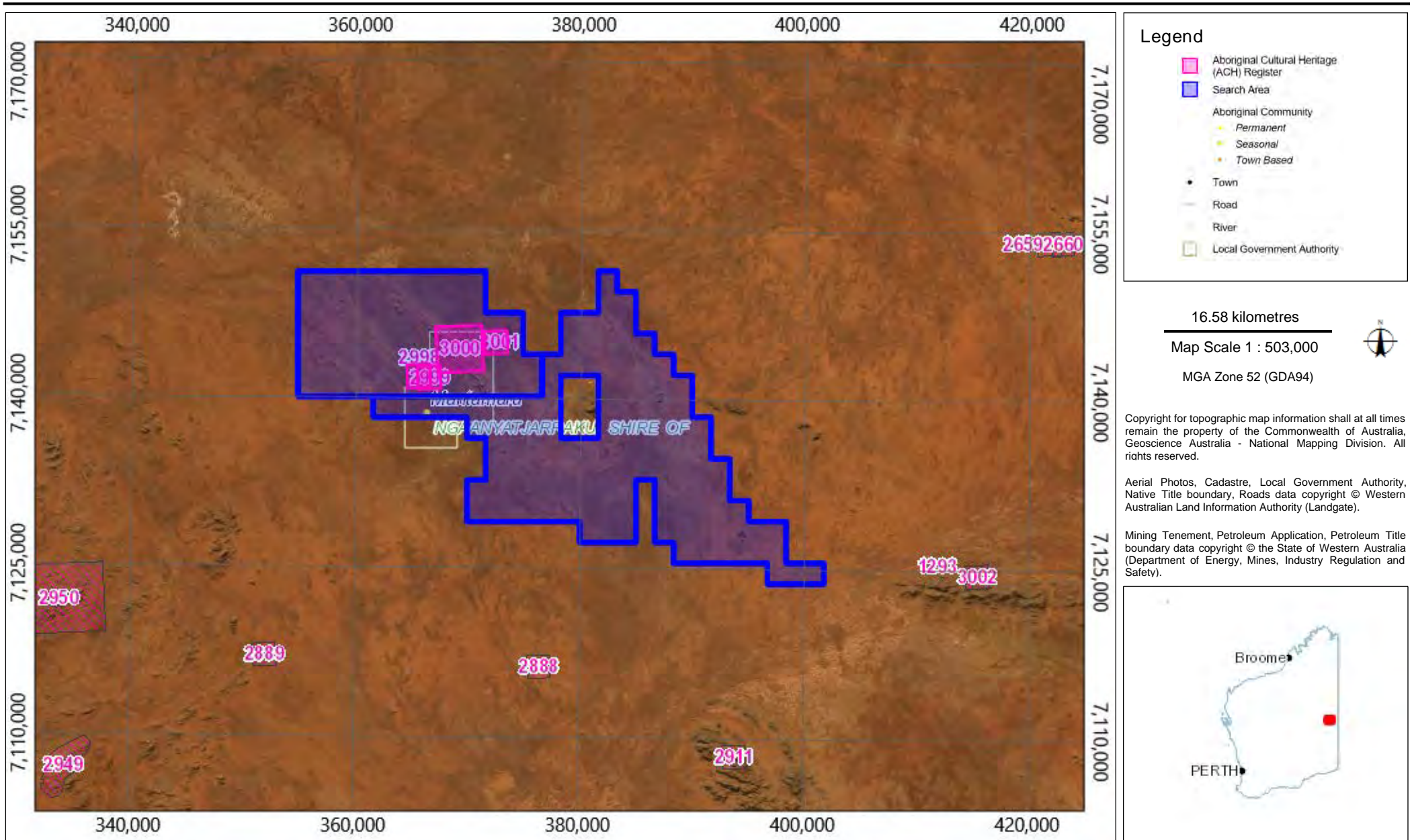
## List of Aboriginal Cultural Heritage (ACH) Register

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	Place Type	Knowledge Holders	Legacy ID
2998	ILINTJI	Yes	No	Yes	No Gender / Initiation Restrictions	Register	Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	W00226
2999	KIRI-TJITJI	Yes	No	Yes	No Gender / Initiation Restrictions	Register	Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	W00227
3000	WARANJU	Yes	No	Yes	No Gender / Initiation Restrictions	Register	Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	W00228
3001	PUNKULA-UKU-WANI	Yes	No	Yes	No Gender / Initiation Restrictions	Register	Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	W00229

# Aboriginal Cultural Heritage Inquiry System

## Map of Aboriginal Cultural Heritage (ACH) Register

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### Search Criteria

No Aboriginal Cultural Heritage (ACH) Lodged in Shapefile - Dante\_Tenements2023

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# Aboriginal Cultural Heritage Inquiry System

## List of Aboriginal Cultural Heritage (ACH) Lodged

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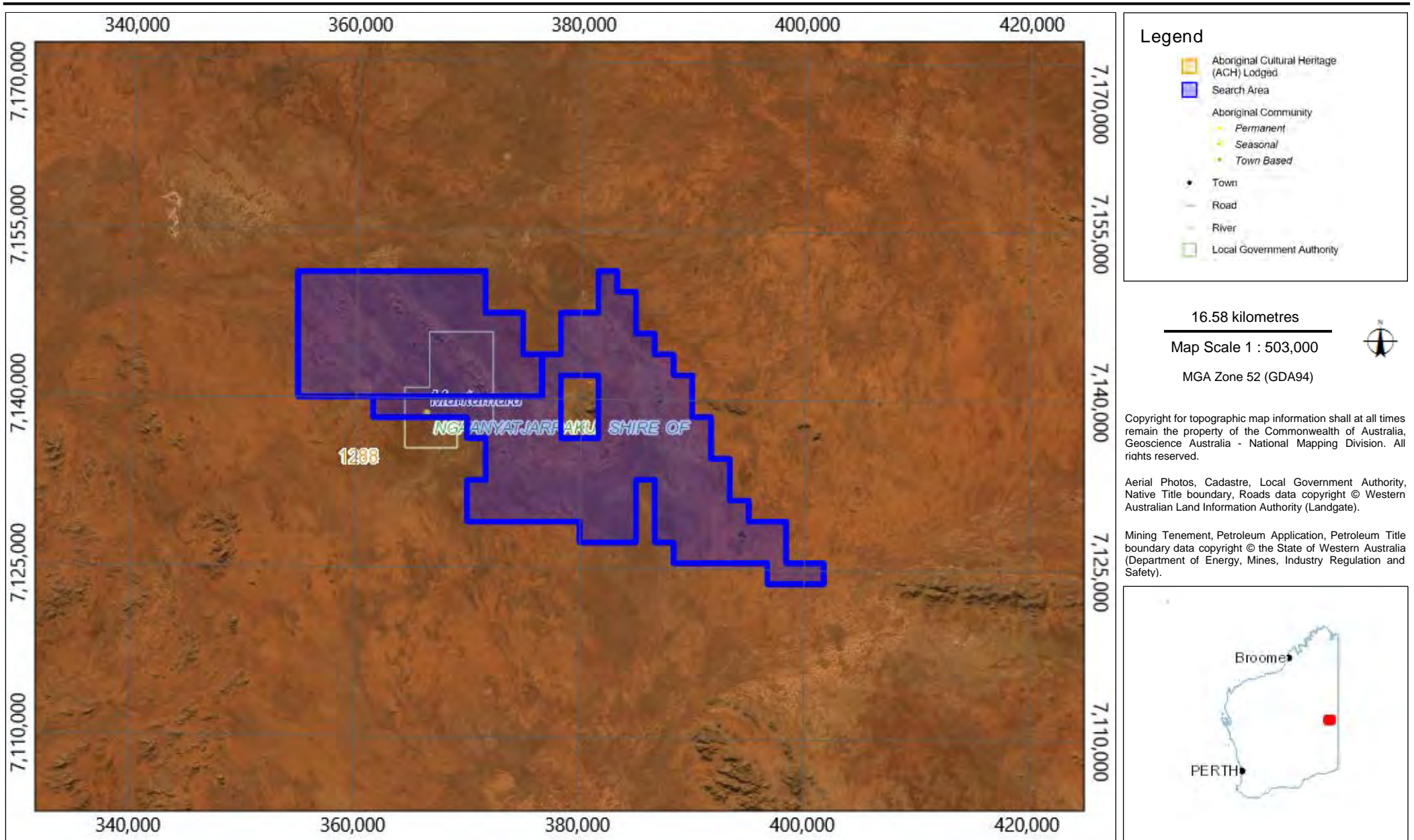
Topographic basemap sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community.



# Aboriginal Cultural Heritage Inquiry System

## Map of Aboriginal Cultural Heritage (ACH) Lodged

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## List of Aboriginal Cultural Heritage (ACH) Historic

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### Search Criteria

No Aboriginal Cultural Heritage (ACH) Historic in Shapefile - Dante\_Tenements2023

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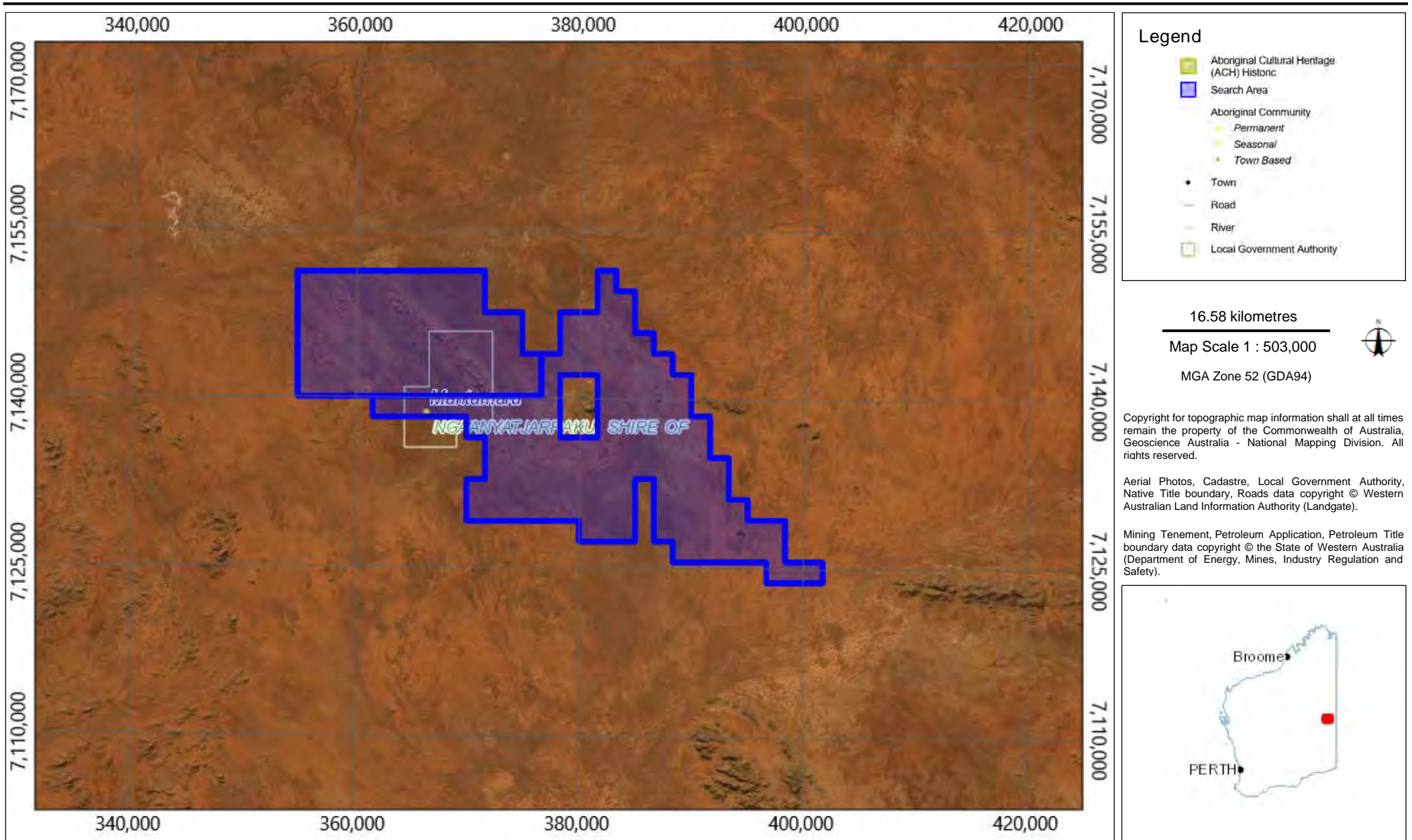
Topographic basemap sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community.



# Aboriginal Cultural Heritage Inquiry System

## Map of Aboriginal Cultural Heritage (ACH) Historic

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