

Purpose Permit Supporting Document

Jonah Bore Project

M36/657

Prepared by



Comprehensive Mine Site Services

Version: 1.0

Date of Submission: 6 July 2023

Environmental Group Site Name: Jonah Bore Project

Environmental Group Site Code: S0223414

Company Name: MLG Oz Limited

Phone: (08) 9022 7746

Address: PO Box 1484, Kalgoorlie, WA, 6433

Email: murray@mlgoz.com.au

EXECUTIVE SUMMARY

The Jonah Bore Project (“Jonah Bore” the “Project”) is located 25 km west of Leinster in Western Australia on Mining Lease M36/657, which covers 149.6 ha. It is accessed via Agnew-Sandstone Road, and a public track, and a private site access road on miscellaneous licence L 36/187.

This document has been prepared to support a Native Vegetation Clearing Permit – Purpose Permit to clear vegetation for the purposes of extending existing mine operations to support recommencing mining of the Jonah Bore Project. No mining or processing currently occurs on the site.

The total project footprint is 54.3 ha, of which 37.5 ha of vegetation is proposed to be cleared. Studies identified:

- A total of 17.9 ha of existing disturbed area including areas of rehabilitation.
- Two vegetation communities were recorded in the clearing area; none are considered restricted.
 - Spinifex – Eucalypt Sandplain habitat type covers an area of 51.45 ha and consists of consolidated sands providing habitat for burrowing mammals and reptiles.
 - Sand Dune habitat covers 2.63 ha and consists of loose sands providing habitat for fossorial reptiles.
- No Threatened Ecological Communities (TECs) listed under the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth) (EPBC Act) or *Biodiversity Conservation Act 2016* (WA) (BC Act).
- No Department of Biodiversity, Conservation and Attractions (DBCA) listed Priority Ecological Community (PEC) were found to occur.
- No species listed as Declared Rare Flora, Endangered, or Vulnerable were found in the search area.
- No plant taxa recorded from the study area were gazetted as Threatened Flora pursuant to the Biodiversity Conservation Act or listed under the EPBC Act were found to occur.
- The Study area is absent of any restricted habitat types that occur in the subregion.
- Twelve vertebrate species of conservation significance may occur in the survey area. The majority of significant species recorded from the desktop assessment are unlikely to be present in the project area and the vegetation is unlikely to be of importance to any threatened species with the potential to occur.
- The vegetation is likely to provide habitat for two Priority 4 species: Brush-tailed Mulgara and Striated Grasswren.
- Western Wildlife concluded that the vegetation habitats of the study area are common and widespread in the semiarid regions of Western Australia and are unlikely to provide ecological linkages or refugia.
- Therefore, no significant impacts to terrestrial fauna are expected.

An assessment against the ten clearing Principles is provided in Section 4. The assessment of the ten clearing principles concludes that the clearing of 37.5 ha of native vegetation within a purpose permit area of 70.9 ha is not likely to be at variance with any clearing principles.

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1. INTRODUCTION

1.1 Background

The *Environmental Protection Act 1986* (WA) (EP Act) and *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* (WA) require that all land clearing related to mining and mineral exploration activities are approved by the Department of Water and Environmental Regulation (DWER). In accordance with Section 20 of the EP Act, applications relating to mineral and petroleum activities are delegated to the Department of Mine, Industry, Regulation and Safety (DMIRS) for assessment.

This report supports a native vegetation clearing permit (Purpose Permit) for proposed mining activities as defined in Section 3. Information is provided to enable assessment of the impacts of the proposed clearing on each of the ten 'Land Clearing Principles' described within Schedule 5 of the EP Act. This document provides the necessary ecological information and environmental impact management measures for the proposed clearing.

1.2 Proponent

The Jonah Bore Project ("Jonah Bore", "the Project") is owned solely by MLG Oz Limited ("MLG"). MLG is listed on the Australian Stock Exchange as ASX: MLG.

All compliance and regulatory requirements regarding this assessment document should be forwarded by email, post, or courier to the following address:

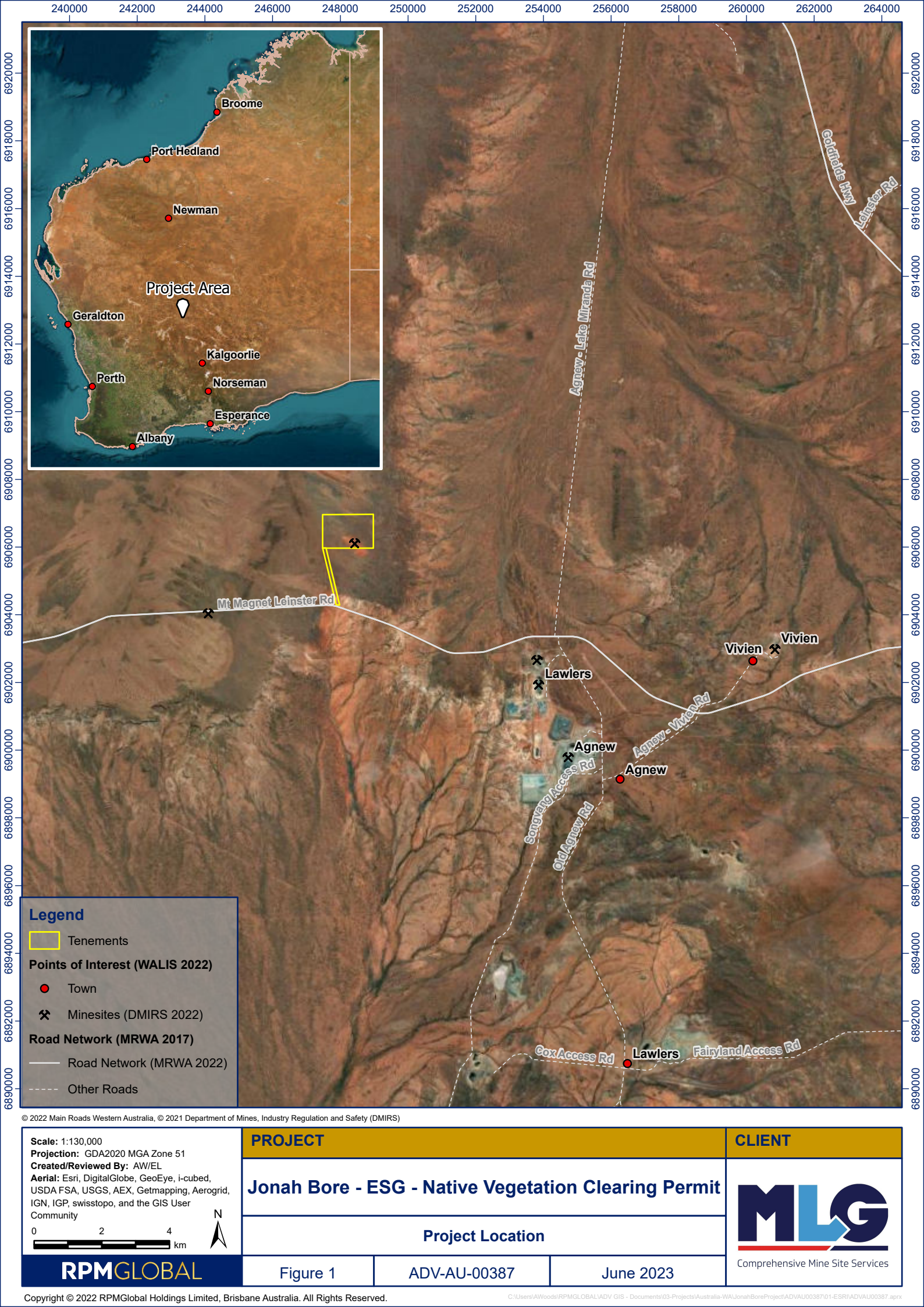
Proponent:MLG Oz Limited
Address:PO Box 1484
Kalgoorlie WA 6433

Contact:Murray Leahy
Position:Managing Director
Telephone:(08) 9022 7746
Email: murray@mlgoz.com.au

1.3 Location, Access and Tenure

The Project is located 25 km west of Leinster in Western Australia in the Lawlers District, and East Murchison Mineral Field. The Project is situated on Mining Lease M36/657, which covers 149.6 ha. It is accessed via Agnew-Sandstone Road, and a public track and a private site access road on miscellaneous licence L 36/187.

M36/657 was granted in July 2006, with MLG being the applicant and only holder of the mining lease from the date of grant to present day. The applicable tenement associated with this Purpose Permit application is M36/657 as shown in Figure 1.



Legend

- Tenements
- Points of Interest (WALIS 2022)**
 - Town
 - Minesites (DMIRS 2022)
- Road Network (MRWA 2017)**
 - Road Network (MRWA 2022)
 - Other Roads

Scale: 1:130,000
 Projection: GDA2020 MGA Zone 51
 Created/Reviewed By: AW/EL
 Aerial: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

PROJECT

Jonah Bore - ESG - Native Vegetation Clearing Permit

CLIENT

Comprehensive Mine Site Services

Project Location

Figure 1 ADV-AU-00387 June 2023

2. ENVIRONMENTAL SETTING

Baseline environmental data for Jonah Bore is presented in this section. The baseline data used for this Purpose Permit supporting document is based on available historical survey information and the most recent surveys that have been undertaken.

2.1 Regional Setting

The Project area is located within the northeastern Goldfields within the Murchison Interim Biographic Regionalisation for Australia (IBRA) region and Eastern Murchison (MUR01) sub-region (DCCEEW, 2020; DoEE, 2020) It is also located within the Austin Botanical District (ANBG, 2020). The dominant land-uses in this bioregion are grazing-native pastures (85.5%), Unallocated Crown Land and Crown Reserves (11.3%), mining of gold and nickel (1.8%), and conservation (1.4%) (Cowan et al., 2001).

Vegetation of the sub-region is dominated by Mulga Woodlands often rich in ephemerals; hummock grasslands, saltbush shrublands and Halosarcia shrublands (Cowan et al., 2001). Its internal drainage characterises it and extensive areas of elevated red desert sandplains with minimal dune development (Cowan et al., 2001). Salt lake systems are associated with the occluded paleodrainage system and broad plains of red-brown soils and breakaway complexes and red sandplains, are widespread (DEC, 2002).

2.2 Geology

The Project is located within the Murchison Province. Tille (2006) describes the geology of this Province as:

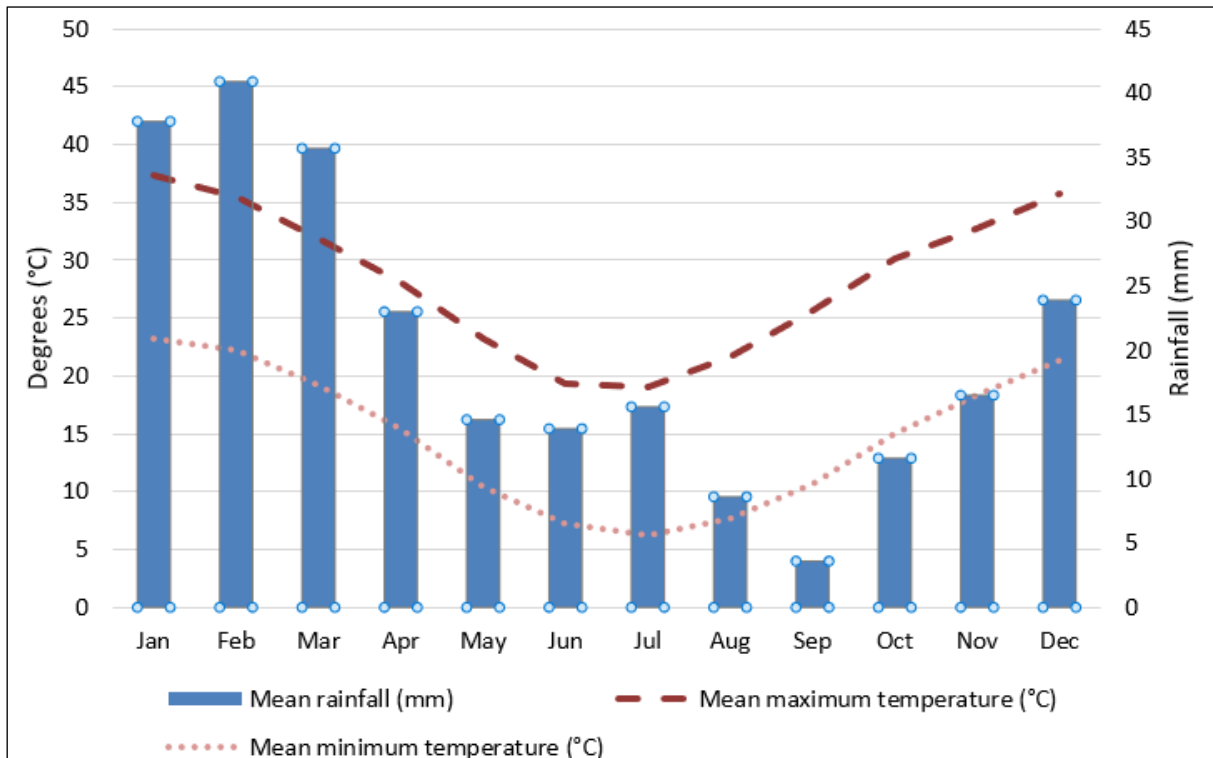
“The underlying rocks are predominantly Archaean even-grained porphyritic granitic rocks. These are intruded by quartz veins and dolerite dykes. Throughout the Craton are areas of Archaean migmatite and gneiss. These rocks are especially common along the western margin and in the north-west where the Narryer Terrane and Yarlalweelor Gneiss Complex are located. The latter consists of migmatite, gneiss, schist and quartzite. Areas of gneiss are associated with Archaean greenstone belts which are prominent. These belts have a north-west trend and become more common to the east. They contain a mixture of metamorphosed mafic to ultra-mafic volcanic rocks (including basalt, amphibolite, dolerite and gabbro), felsic volcanic rocks, and metasedimentary rocks (including cherts and banded iron formations). This Archaean bedrock has been extensively weathered and laterised”.

2.3 Climate

The nearest meteorological station to the Project is Leinster Aero (site number 012314), located approximately 25 km northeast of the Project site. Site 012314 readings commenced in 1994, with the latest available data from 18 August 2022 (Chart 1).

The annual average rainfall reported at the site is 251.6 mm (BOM, 2022). The highest rainfall typically occurs in February (40.9 mm) and the lowest rainfall occurs in September (3.6 mm). The annual average number of days of rain is 30.8. Temperatures range from a mean maximum of 37.3°C in January to 19°C in July. The project site temperatures range from minimum mean temperatures of 23.2°C in January to 6.2°C in July. On average, there are 83.2 days per annum with temperatures above 35°C. The highest mean number of days per month is January, with 22.3 days above 35°C.

Chart 1: Leinster Aero Climate Data



2.4 Soils and Landforms

The Murchison Province consists of an extensive plateau of low relief. Laterite or silcrete mesas are usually found at the top of the landscape in areas of granitic basement (Tille, 2006). These mesas have lateritic breakaways, kaolinised footslopes (often saline) and are surrounded by gently sloping plains (Tille, 2006). There are also some low hills, domes and tor fields of granite, gneiss and quartz found in upper parts of the landscape (Tille, 2006).

The Project occupies the Salinaland Plains Zone which is comprised (Tille, 2006):

“Sandplains (with hardpan wash plains and some mesas, stony plains and salt lakes) on granitic rocks (and some greenstone) of the Yilgarn Craton. Red sandy earths, Red deep sands, Red shallow loams and Red loamy earths with some Red-brown hardpan shallow loams, Salt lake soils and Red shallow sandy duplexes. Mulga shrublands with spinifex grasslands (and some halophytic shrublands and eucalypt woodlands). Located in the northern Goldfields from Lakes Barlee and Ballard to Wiluna and Laverton”.

A desktop assessment of the Department of Water and Environmental Regulation (DWER) contaminated sites database for known contaminated sites in and around the Project area was undertaken. The closest known contaminated site is 60 km southeast of M36/657 (Parcel ID 17928, Date Classified 23 October 2019) (DWER, 2021).

MLG commissioned RPM Advisory Services Pty Ltd (RPM) to conduct a Soil Assessment of MLG’s three proposed deposits sites including Comet Vale (E297/42), Mt Keith (E53/1480), and Jonah Bore (M36/657). The report is provided in Appendix 1.

Overall, the soil properties are described as stable, geochemically benign aeolian sands with limited nutritional value for plant growth. Given that local native plant species are adapted to these conditions, revegetating disturbed surfaces is expected to occur over time. This is supported by the positive performance of areas that MLG has already rehabilitated, demonstrated in the rehabilitation performance monitoring reports (Blueprint, 2021a, 2021b) and general site observations.

2.5 Hydrology

The landform terrain in the proposed pit environs consists of gently undulating sand plains with open hummock grasslands with emergent trees and shrubs. The occasional low sand dune less than 15 m high also exists in the surrounding sand sheets. Surface drainage is not well developed; there are no established creek lines located on the tenement. Review of aerial photography indicates that there are no surface water features in the tenement. The tenement spans a surface elevation range of 383 (west) - 406 (east) m RL AHD.

With relatively low rainfall (259.3 mm per annum) and high annual evaporation (2,800 mm), runoff events are infrequent. The sand areas have infiltration rates higher than maximum rainfall intensity, although the clay-rich interdune areas and the nearby historic borrow pits mined to the clay base have reduced permeability allowing water to pond.

2.6 Hydrogeology

The tenements are located within the Goldfields Groundwater Area where the bulk of the water resource is saline with a total dissolved solids (TDS) content of > 14,000 mg/L and is dominated by sodium and chloride ions (Water Authority of Western Australia, 1993). Rainfall infiltration is the region's main source of aquifer recharge, usually associated with major infrequent storms.

The regional hydrogeology comprises paleochannel deposits and widespread alluvium and lake deposits overlying weathered and fractured Archean bedrock. The regional water table depth ranges from less than 1 m in playa lake environments to more than 40 m in elevated areas. The regional water table may be absent when the fractured zone is unsaturated or fractures are poorly developed (Kern, 1995).

Groundwater flow is highly dependent on topography and is predominantly towards playa lakes and major paleo drainages. Recharge tends to occur during heavy rainfall events, with additional recharge from surface runoff and flooding generated during these events (Kern, 1995). Groundwater is mainly saline to hypersaline, with potable water not known to occur regionally. Bore yields are heavily dependent on rock type (Kern, 1995).

2.7 Flora and Vegetation

Several flora and vegetation surveys have been completed for the Jonah Bore Project comprising:

- Flora and Vegetation Survey of the Jonah Bore Project (Goldfields Landcare Services (GLS, 2006)) Appendix 2.
- Desktop Flora and Vegetation Survey. Jonah Bore Project (Onshore Environmental, 2020) Appendix 3.
- Flora and Vegetation Survey of the Jonah Bore Project (GLS, 2021) Appendix 4.

The study area for the 2021 Flora and Vegetation Survey (GLS, 2021) with the recorded vegetation communities is described in Figure 3.

The information presented here is a comprehensive overview of flora and vegetation based on the findings of each survey completed for the Jonah Bore Project.

2.7.1 Vegetation Communities

An early survey by GLS (2006) described the vegetation as primarily a mixture of small patches of low open woodland in which the tallest stratum is dominated by *Eucalyptus gongolycarpa* and Tall Open Shrubland where Mulga is predominant over a matrix of Low Open Shrubland (*Eremophila* sp. et al) and Tussock Grassland (Spinifex) (GLS, 2006). A recent detailed field flora and vegetation survey was completed by GLS (November 2021), surveying approximately 64 ha of the Mining lease M36/657. The survey indicated that the area had been burnt during 2006 and the tallest regrowth was seen in the *Acacia* sp. that reached up to two metres. The fire appears to have impacted the landscape in the survey area unevenly, leaving some areas almost treeless, while mature Marble Gums (*Eucalyptus gongylocarpa*), grow in other areas.

The survey area lies entirely within the Bullimore Land System, which is described as extensive sandplains supporting spinifex hummock grasslands. The survey classified the vegetation associations to Sandplain Spinifex Hummock Grassland (SASP) and one vegetation sub-type that being Sand Dune Shrubland (SDSH) (Table 1 and Figure 2). The conditions of the vegetation were classified as 'Good' based on the Vegetation Condition Scale adapted from Keighery (1994) and Trudgen (1988) (GLS, 2021). None of the vegetation associations were aligned with any federal or state-listed TECs or state-listed PECs documented from the Murchison bioregion.



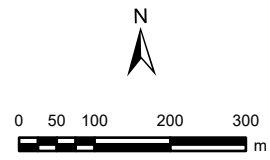
Legend

- Purpose Permit Application Area
- Tenements
- Proposed New Disturbance

Vegetation Community (Goldfields 2023)

- Disturbed
- SASP, Sandplain Spinifex Hummock Grasslands
- SDSH, Sand Dune Shrubland

Scale: 1:10,000
 Projection: GDA2020 MGA Zone 51
 Created/Reviewed By: AW/EL
 Aerial: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community






PROJECT		CLIENT
July 2023	Jonah Bore - ESG - Native Vegetation Clearing Permit	 Comprehensive Mine Site Services
Figure 2		
ADV-AU-00387	Vegetation Communities	

Table 1:Vegetation Associations of the Study area (GLS, 2023)

Broad Floristic Formation	Vegetation Description	Area (ha)	% of Study Area	Photo
Sandplain spinifex hummock grassland	Open Low Scrub of <i>Acacia effusifolia</i> , <i>A. jamesiana</i> , <i>Grevillea juncifolia</i> , <i>Eremophila platythamnos</i> subsp. <i>platythamnos</i> , <i>E. forrestii</i> subsp. <i>forrestii</i> and <i>Duboisia hopwoodii</i> over Open Dwarf Scrub of <i>Enekbatus eremaeus</i> , <i>Seringia velutina</i> , <i>Bonamia erecta</i> , <i>Dampiera roycei</i> , over Open Hummock Grassland of <i>Triodia basedowii</i> and scattered grass of <i>Amphipogon caricinus</i> on orange silty sand on a sand plain.	51.45	71.5	
Sand Dune Shrubland	Open Low Woodland of <i>Eucalyptus gongylocarpa</i> over Scattered Low Trees of <i>Eucalyptus oldfieldii</i> and <i>Gyrostemon ramulosus</i> over Mixed Open Dwarf Scrub of <i>Senna artemisioides</i> subsp. <i>filifolia</i> , <i>Acacia ligulata</i> , <i>Grevillea juncifolia</i> , <i>Eremophila platythamnos</i> subsp. <i>platythamnos</i> , <i>Dianella revoluta</i> , <i>Ptilotus obovatus</i> , <i>Goodenia peacockiana</i> , <i>Leptosema chambersii</i> , and <i>Eucalyptus gongylocarpa</i> over Very Open Hummock Grass of <i>Triodia basedowii</i> with scattered grasses of <i>Rytidosperma caespitosum</i> and <i>Amphipogon caricinus</i> , and the annual <i>Leucochrysum stipitatum</i> on orange sand on a sand dune.	2.63	3.7	
Disturbed Areas	N/A	17.86	24.8	
	Total	71.94	100	

2.7.2 Conservation Significant Flora

A desktop assessment of the Project area was undertaken in July 2020 by searching NatureMap (DBCA, 2020) and the EPBC Act Protected Matters Database (DCCEEW, 2020). The searches were completed for the tenement from a point coordinate 120° 26' 55" E, 27° 56' 51" S with a 40 km buffer.

A total of 358 plant taxa (including varieties and subspecies) from 49 families and 151 genera were identified within a 40 km radius search of the study area. None of the plant taxa recorded from the database search were gazetted as threatened flora pursuant to the BC Act or listed under the EPBC Act.

A list of conservation significant flora species occurring within a 40 km radius of the study area was compiled. This report identified seven additional species of conservation significance with the potential to occur in the area. Those species are provided in Table 2.

Table 2: Conservation Significant Flora

Species	Conservation Code
<i>Calytrix warburtonensis</i>	P2
<i>Eremophila arachnoides</i> subsp. <i>arachnoides</i>	P3
<i>Eremophila pungens</i>	P4
<i>Goodenia modesta</i>	P3
<i>Grevillea inconspicua</i>	P4
<i>Hemigenia exilis</i>	P4
<i>Homalocalyx echinulatus</i>	P2

The recent field survey (GLS, 2021) provided the following findings on Conservation Significant Flora:

- A total of 76 species from 25 families and 53 genera have been recorded in the survey area. The most prevalent families recorded were *Fabaceae* and *Scrophulariaceae*.
- No species listed as Declared Rare Flora, Endangered or Vulnerable were found in the search area.
- No plant taxa recorded from the study area were gazetted as Threatened Flora pursuant to the Biodiversity Conservation Act or listed under the EPBC Act.
- No PECs listed by the DBCA were encountered during the survey.

2.7.3 Weeds

Recent field survey (GLS, 2021) provided the following findings on weeds and introduced species:

- No introduced weed species or plants listed as a WoNS under the EPBC Act were recorded in the survey area.
- No introduced species or Declared Pests listed under the BAM Act were recorded from the study area.

2.7.4 Dieback

Dieback (*Phytophthora* sp.) is a soil-borne water mould that spreads by root-to-root growth amongst host plants and through zoospores, which are motile in water and moist soil. The fungus also has two resting structures, chlamydospores, and oospores, that are resistant to desiccation and can survive in dry conditions before developing into active zoospores when wet conditions return. Soil movement by vehicles, human activity and terrestrial mammals is also a significant means of dieback spread.

The “vulnerable zone” to dieback is considered to be the area of south-west Australia, west and south of the 400 mm rainfall isohyet. However, several incidents have been recorded in wet conditions to the east of the isohyet, including the Forrestania area (DBCA, 2020). GLS did not identify any areas of vegetation suspected of being affected by dieback.

2.7.5 Wildfire

Fires may arise in the Project area from:

- Uncontrolled wildfires.
- Operating vehicles and equipment.

Fire in the Project area will be managed by:

- All personnel being trained in the use of available firefighting equipment e.g. fire extinguishers, water truck and advised on the plan of action in case of a fire.
- All hot work (such as welding/cutting/grinding) activities will be undertaken away from the Project area at MLG Oz's Kalgoorlie Depot.
- No deliberate burning of any vegetation.

2.8 Fauna and Habitat

Western Wildlife completed a vertebrate fauna survey in 2021 at Jonah Bore that included targeted searches for the *Ogyris subterrestris petrina* (Arid Bronze Azure Butterfly) and *Leipoa ocellata* (Malleefowl) (Western Wildlife, 2021). The survey was undertaken in accordance with:

- Environmental factor guideline – terrestrial fauna (EPA, 2016a).
- EPA Technical Guidance: Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA, 2020).

A summary of the findings from the desktop assessment and field survey is provided in this section. The report is included as Appendix 5.

The field assessment and review of available vegetation mapping identified two vegetation habitat types in the survey area (Figure 3):

- The Spinifex – Eucalypt Sandplain habitat type covers an area of 50.7 ha and consists of consolidated sands providing habitat for burrowing mammals and reptiles.
- The Sand Dune habitat covers 3.3 ha that consists of loose sands providing habitat for fossorial reptiles.

Eucalypts were scattered across both habitat types providing crevices and small hollows for the native fauna species of the area. The survey identified 16.8 ha of disturbed area.

The faunal assemblage of the study area is likely to be largely intact, as the study area is situated within a larger tract of native vegetation. Many of the species that occur are widely distributed through semi-arid Australia. The predicted faunal assemblage included nine frogs, 80 reptiles, 116 birds, 30 native mammals and nine introduced mammals.

The assessment identified 12 species of conservation significance that may potentially occur at the Project site as described in Table 3 and represented in Figure 3. Of the 12 conservation significant species, seven threatened species have the potential to occur in the area:

- Night Parrot – *Pezoporus occidentalis*.
- Malleefowl – *Leipoa ocellata*.
- Grey Falcon – *Falco hypoleucos*.
- Chuditch – *Dasyurus geoffroii*.
- Great Desert Skink – *Liopholis kintorei*.
- Princess Parrot – *Polytelis alexandrae*.
- Southern Whiteface - *Aphelocephala leucopsis*.

The vegetation is unlikely to be of importance to any threatened species with the potential to occur. The vegetation is likely to provide habitat for two Priority 4 species being *Dasyercus blythi* (Brush-tailed Mulgara) and *Amytornis striatus striatus* (Striated Grasswren), (Western Wildlife, 2021). There was one recorded sighting during the survey of the Priority 4 species, *Amytornis striatus striatus* (Striated Grasswren) at the boundary of the northwest development envelope (Figure 3).

Western Wildlife concluded that the vegetation habitats of the study area are common and widespread in the semiarid regions of Western Australia and are unlikely to provide ecological linkages or refugia. The study area also lacks restricted habitat types that occur in the subregion, such as granite exposures, salt lakes or freshwater wetland.

Table 3: Conservation Significant Vertebrate Fauna

Species	Status			Habitat Preference	Likelihood of Occurrence	Notes
	EPBC Act	BC Act	DBCA Priority			
<i>Pezoporus occidentalis</i> (Night Parrot)	En	Cr		Large spinifex clumps for roosting and breeding, chenopod shrublands, and spinifex for foraging.	Unlikely	This species is known from very few records. Records in WA have been in association with salt lakes. The study area lacks large spinifex.
<i>Leipoa ocellata</i> (Malleefowl)	Vu	Vu		Acacia thickets, mallee woodlands, and shrublands with leaf litter. Also forages in adjacent habitats.	Potential	No mounds were found, and it is considered unlikely that this species breeds in the study area, but they may forage.
<i>Falco hypoleucos</i> (Grey Falcon)	Vu	Vu		Forages over lightly timbered plains, rivers.	Unlikely	The study area is outside the core range of this species, there are no records within 100 km, and the breeding habitat is absent.
<i>Dasyurus geoffroii</i> (Chuditch)	Vu	Vu		Forests, woodlands & shrublands, denning in hollow logs, babbler nests, burrows, or rock crevices.	Unlikely	There are no recent records in the region, and it is likely that this species is very uncommon or locally extinct.
<i>Liopholis kintorei</i> (Great Desert Skink)	Vu	Vu		Sandplains	Possible	This species is represented by a single record from 1964, however, the habitat of the study area is potentially suitable.
<i>Polytelis alexandrae</i> (Princess Parrot)	Vu		P4	Sandplains, breeds in Marble Gums	Possible	Although outside the core range of this species, the habitats present are potentially suitable for foraging and breeding.
<i>Aphelocephala leucopsis</i> (Southern Whiteface)	Vu			Eucalypt or Mulga woodlands and <i>Acacia</i> shrublands with a shrubby or grassy understory.	Potential	The study area is within the range of this species, and it has been recorded nearby, but the habitats present are not those most favoured by this species.
<i>Apus pacificus</i> (Fork-tailed Swift)	Mi	Mi		Overfly any habitat	Potential	This species is largely aerial in Australia, and although it may overfly the area, the study area is not likely to be important for this species.
<i>Falco peregrinus</i> (Peregrine Falcon)		O S		Variety of habitats, nests in tall trees, cliffs, open pits.	Potential	Although likely to occur in the region, the study area is unlikely to be of particular significance to this species.
<i>Dasyercus blythi</i> (Brush-tailed Mulgara)			P4	Spinifex sandplains	Likely	Although not recorded, this species is known from nearby records and the habitat in the study area appears suitable.
<i>Sminthopsis longicaudata</i> (Long-tailed Dunnart)			P4	Breakaways, rocky habitats, scree slopes.	Unlikely	Although known from nearby records, there is no suitable habitat in the study area.

Species	Status			Habitat Preference	Likelihood of Occurrence	Notes
	EPBC Act	BC Act	DBCA Priority			
<i>Nyctophilus major tor</i> (Central Long-eared Bat)			P4	Woodlands	Possible	The study area is within the range of this species and the eucalypts may provide habitat; however, this species is likely to favour more wooded habitats.
<i>Amytornis striatus striatus</i> (Striated Grasswren)			P4	Spinifex grasslands	Known to occur	This species was recorded during the August 2021 field survey.



Legend

- Tenements
- Proposed New Disturbance
- Purpose Permit Application Area

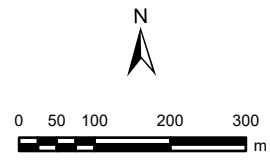
Conservation Significant Fauna (Western Wildlife 2023)

- *Amytornis striatus striatus* - Straited grasswren (Priority 4)

Fauna Habitat (Western Wildlife 2023)

- Disturbed
- Sand Dune
- Spinifex - Eucalypt Sandplain

Scale: 1:10,000
 Projection: GDA2020 MGA Zone 51
 Created/Reviewed By: AW/EL
 Aerial: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



PROJECT		CLIENT
July 2023	Jonah Bore - ESG - Native Vegetation Clearing Permit	 Comprehensive Mine Site Services
Figure 3		
ADV-AU-00387	Fauna Habitat and Conservation Significant Fauna	

2.8.1 Short Range Endemics (SRE)

Invertebrate Solution Pty Ltd (2022) was contracted to complete a Short Range Endemic (SRE) desktop assessment of MLG's four proposed deposits sites, including Comet Vale (E297/42), Mt Keith (E53/1480), 16 Mile Well (E36/1003) and Jonah Bore (M36/657) (Appendix 6). This survey was undertaken according to the 'Technical Guidance – Sampling of short-range endemic invertebrate fauna' (EPA, 2016b).

The Project areas has one potential SRE habitat, associated with a single sand dune in the central section of the Project area. The desktop assessment identified:

- Ten possible SRE species with a low likelihood of occurrence of:
 - barychelid trapdoor spider (*Synothele* 'MYG312').
 - idiopid trapdoor spider (*Idiosoma* 'MYG014', *Idiosoma* 'MYG015', *Idiosoma* 'MYG017', *Idiosoma* 'MYG019', *Idiosoma* 'MYG020', *Idiosoma* 'MYG061').
 - pseudoscorpions (*Beierolpium* 'sp. 8/2').
 - scorpions (*Urodacus* sp.'cf gibson 5', *Urodacus* sp.'gibson 1').

There is a potential for SRE habitat associated with the single sand dune that is present in the central portion of the Project area. These provide a moderate likelihood of containing potential SRE species due to their isolated nature, however, the local abundance and homogeneous nature of this habitat would suggest that taxa would be present throughout the entire sand dune habitat and not restricted to the Project area.

2.8.2 Subterranean Fauna

Subterranean fauna does not require investigating as the mining operations do not intersect groundwater and the low-impact activities on the tenement.

2.9 Heritage and Social Setting

2.9.1 Land Use and Community

The Project is located 23 km west of Leinster in the Shire of Leonora. The Shire of Leonora is sparsely populated, with a total population of 1,411 (ABS, 2022). Of this, 202 (14.3%) are Indigenous Peoples (ABS, 2022). The nearest population centre to the Project is the town of Leinster with a population of approximately 405 (ABS, 2022). The Project is wholly on the Leinster Downs Station pastoral lease that currently operates as a sheep station.

Gold and nickel mining, prospecting, pastoralism and tourism are the principal economic activities in the area. Population centres that attract tourists include Sandstone (located 115 km west of the Project) and Leinster (25 km east of the Project). Various mines are located in the area, such as Gold Fields Limited Agnew Gold Mine (6 km southeast of the Project) and BHP's Nickel West Leinster Mine (30 km northeast of the Project). Wanjarri Nature Reserve is located 75 km northeast of the Project.

2.9.2 Aboriginal Heritage

A search of the Department of Planning, Lands and Heritage (DPLH, 2022) Aboriginal Heritage Inquiry System (AHIS) (Heritage Council & State Heritage Office, 2022) on 14 November 2022 identified two registered site and two lodged site in M36/657 and L36/187 as detailed in Table 4 and shown in Figure 4. The report is provided in Appendix 7.

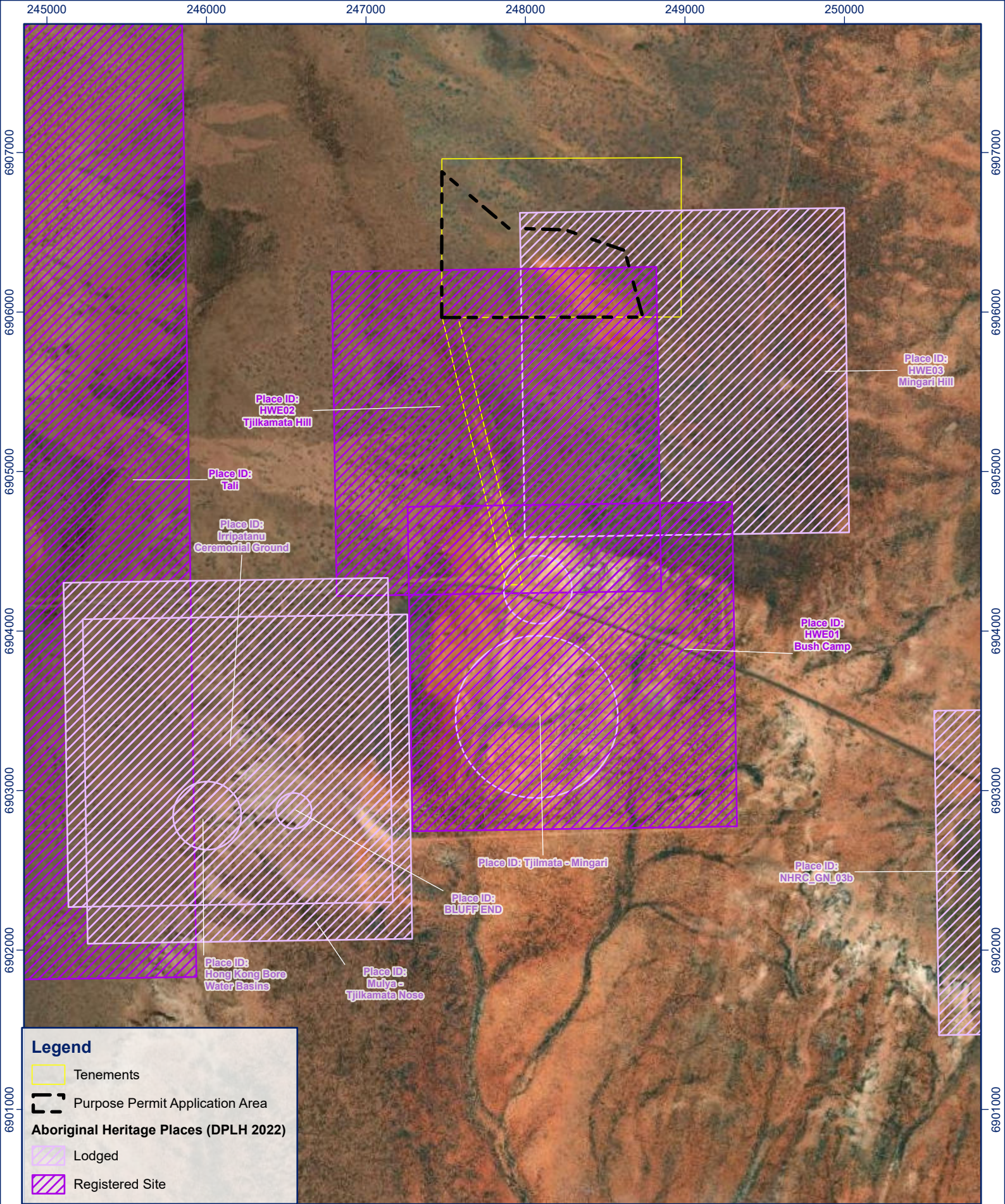
Table 4: Aboriginal Heritage Sites

Tenement	Site ID	Site Name	Status	Type	Restrictions
M36/657	18980	HWE03 Mingari Hill	Lodged	Mythological, Natural Feature	No gender restrictions
M36/657 & L36/187	18983	HWE02 Tjilkamata Hill	Registered	Mythological, Named Place, Natural Feature	No gender restrictions
L36/187	18979	HWE01 Bush Camp	Registered	Man-Made Structure, Camp	No gender restrictions
	19858	Tjilmata- Mingari	Lodged	Mythological, Other: A complex of natural features	No gender restrictions

MLG and Tjiwarl Aboriginal Corporation (TAC) have finalised a Heritage Protection Agreement (HPA). An Ethnographic Tjiwarl Cultural Heritage Survey was conducted over M36/657 and L36/187 by Human Terrains Anthropological Consultancy (HTAC), with representatives of the Tjiwal Native Title Holding Group on 25-26 April 2023 (Appendix 10). The preliminary advice provided confirmed that there were no identified Aboriginal sites and that all the Tjiwal Representatives who participated in the ethnographic consultation recommended that MLG could continue to use the Jonah Bore sand quarry, as per the plans provided by MLG (HTAC, 2023).

2.9.3 Non-Aboriginal Heritage


The Heritage Council State Heritage Office inHerit database was searched on 14 November 2022 (Heritage Council & State Heritage Office, 2022). No places of heritage value were found to be recorded on the M36/657 or L36/187 tenements. The nearest heritage site is 122 km southeast of the Project area.



Scale: 1:30,000
Projection: GDA2020 MGA Zone 51
Created/Reviewed By: AW/EL
Aerial: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 250 500 1,000 m

RPMGLOBAL

PROJECT		CLIENT
Jonah Bore - ESG - Native Vegetation Clearing Permit		 Comprehensive Mine Site Services
Aboriginal Heritage Sites		
Figure 4	ADV-AU-00387	July 2023

3. PROPOSED LAND CLEARING

3.1 Overview of Operations

The Project is a small-scale sand and gravel mining operation consisting of shallow sand and gravel excavating to use in the construction industry. The mining operation will be carried out in a basic strip-mining style, comprising:

- Pre-stripping of vegetation and soil, which is stockpiled in low windrows perpendicular to the active mining area for later use in rehabilitation.
- Excavating sand and gravel to a typical depth of 1.5 m (maximum of 5 m) that is subsequently screened into different product sizes and loaded into road trains for transport offsite.
- Progressively rehabilitating mined areas.

Approximately 150,000 tonnes of sand and gravel materials will be excavated, and up to 50,000 tonnes per annum will be screened (works approval: W6655/2022/1) from the Project area. The operation currently has a remaining life of mine of approximately five years (2027).

The operation is typically carried out by:

- One Komatsu 155 bulldozer (pre-strip and rehabilitation activities).
- One Caterpillar 966H front-end loader (road train loading of the material).
- Two Kenworth road trains (transport of the mined sand and gravel to the end customer).
- One Kenworth water truck (dust suppression).
- One Caterpillar 140H grader for road maintenance.
- One Mobile screening plant.

Explosives will not be required for the strip-mining activities. Sand and gravel will be picked up by a front-end loader and loaded into the mobile screening plant. The plant will be situated within already disturbed areas and will move across the active working area as required. The screened product will be stockpiled and loaded into road trains when required by a front-end loader.

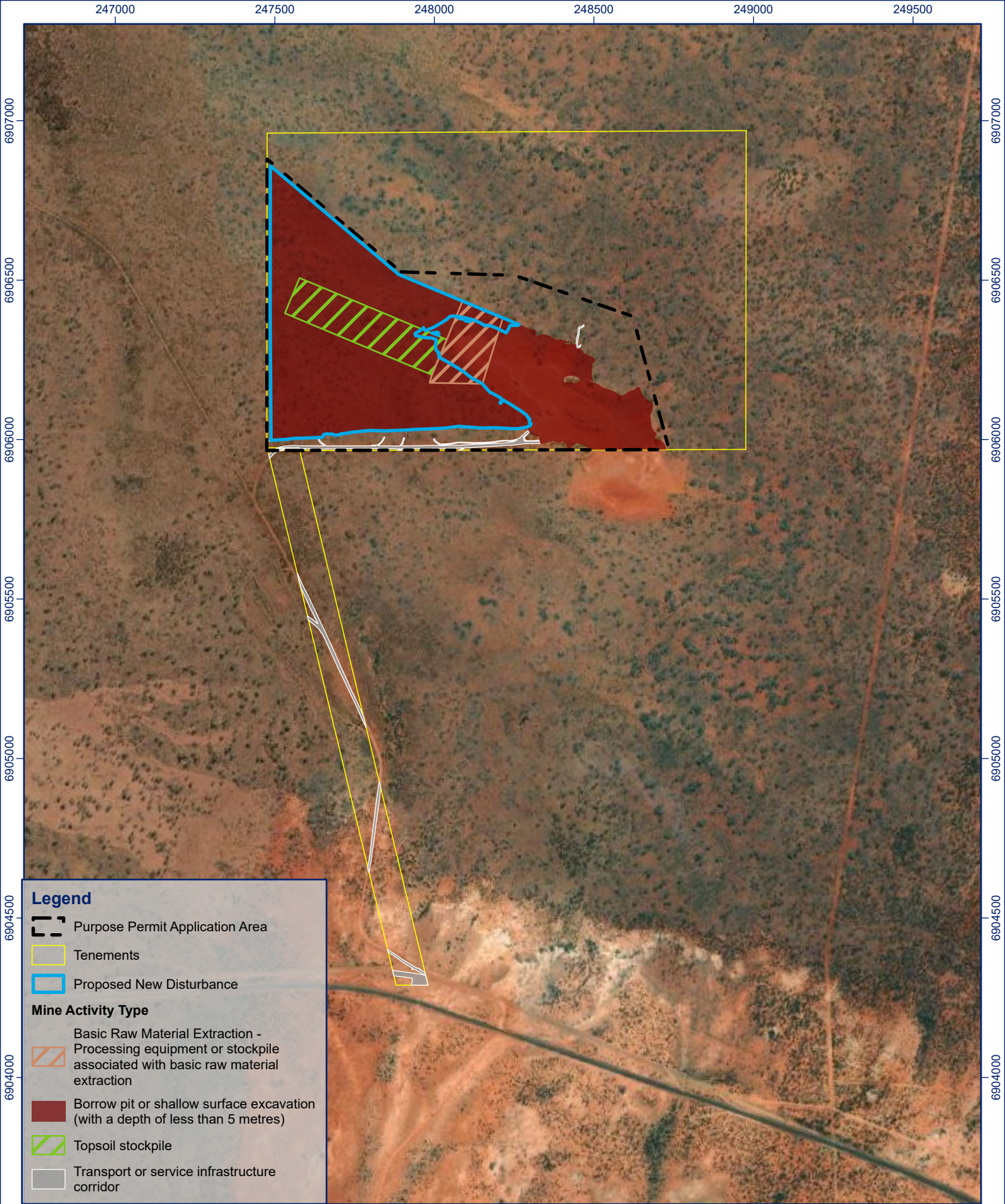
Only 10 ha of active mining area will be open anytime. Once an active mining area is completed, it will be progressively rehabilitated. The operations produce no waste rock.

3.2 Areas of Disturbance

The total clearing of native vegetation proposed under this Purpose Permit application is 37.5 ha within a Purpose Permit boundary of 70.9 ha. The NVCP supports recommencing mining at Jonah Bore Project. The mine activity areas and associated footprint are outlined in Table 5 and illustrated in Figure 5.

Table 5: Disturbance Elements

Element	Size (Ha)
Transport or service infrastructure corridors.	
Borrow pit or shallow surface excavation (with a depth of less than 5 metres).	
Topsoil Stockpile	
Basic Raw Material Extraction – Processing equipment or stockpile associated with basic raw material extraction	
Total	37.5



Scale: 1:15,000
 Projection: GDA2020 MGA Zone 51
 Created/Reviewed By: AW/EL
 Aerial: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

PROJECT		CLIENT
Jonah Bore - ESG - Native Vegetation Clearing Permit		 Comprehensive Mine Site Services
Development Layout		

4. ASSESSMENT OF CLEARING PRINCIPLES

Clearing applications are assessed against 10 principles as outlined in Schedule 5 of the EP Act (Table 6). These principles aim to ensure that all potential impacts resulting from the removal of native vegetation can be assessed in an integrated way and applied to all lands in Western Australia. The principles address the four main environmental areas of biodiversity significance, land degradation, conservation estate and ground and surface water quality.

Information regarding the potential impact of clearing for mining activities on each of these principles for the Project area is provided in Table 6.

Table 6: Native Vegetation Clearing Principles

Clearing Principle	Assessment	Assessed Outcome
Biodiversity Significance		
a) Native vegetation should not be cleared if it comprises a high level of biological diversity.	<ul style="list-style-type: none"> The vegetation to be cleared is not considered to support a high level of biological diversity. Vegetation communities and fauna habitats of the Project are considered common and widespread in the subregion and unlikely to function as refugia. Flora and vegetation surveys did not record any Threatened Ecological Communities (TECs) or Priority Ecological Communities (PECs). No restricted Vegetation Substrate Association were recorded in the area. 	The proposed clearing is unlikely to significantly impact biodiversity at a local or regional level. Therefore, the proposed clearing is not likely to be at variance with this clearing principle.
b) Native vegetation should not be cleared if it comprises the whole or part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.	<ul style="list-style-type: none"> Two fauna habitats were identified in the survey area. These were considered to be common and widespread in the local area and extend well beyond the clearing boundary. There are no restricted vegetation units that have been identified in the Project area that are considered significant for the maintenance of native fauna. Conservation significant fauna – 12 fauna species of conservation significance listed under legislation or as Priority species by DBCA have the potential to occur in the survey area, with only one being known to occur: <ul style="list-style-type: none"> Night Parrot - no favoured habitat in the area. Malleefowl – no breeding habitat present, foraging may occur. Pre-clearance surveys for Malleefowl will be undertaken. Any identified active Malleefowl mounds will be avoided and an exclusion zone of 50 m around the active mound will be maintained. Grey Falcon - at extent of range and no nearby records. Breeding habitats absent. Chuditch - species is very uncommon or locally extinct. Great Desert Skink - no recent nearby records. Potential suitable habitat is present. Princess Parrot - at extent of range and no nearby records. Potential suitable habitat is present. Fork-tailed Swift- Aerial species unlikely to be impacted. 	The proposed clearing is unlikely to significantly impact the habitat of fauna at a local or regional level. Therefore, the proposed clearing is not likely to be at variance with this clearing principle.

Clearing Principle	Assessment	Assessed Outcome
	<ul style="list-style-type: none"> – Peregrine Falcon- no favoured habitat in the area. – Brush-tailed Mulgara – Favoured habitat present. Habitat deemed common and widespread in the area. – Long-tailed Dunnart - no favoured habitat in the area. – Central Long-eared Bat - no favoured habitat in the area. – Striated Grasswren – Favoured habitat present. Habitat deemed common and widespread in the area. • Ten SRE's species that either had a conservation status or a likely SRE status were identified to have a low likelihood of occurrence within the survey area. Due to the homogenous nature of the habitat in which these species are found, it is unlikely that they are restricted to the project area. 	
c) Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.	<ul style="list-style-type: none"> • No threatened plant taxa protected under state or federal legislation were recorded during flora surveys. • No Priority flora species were recorded in the clearing area. • Should populations of Priority flora be identified they will be avoided where possible, otherwise liaison with DMIRS will be undertaken and an impact assessment report will be provided prior to clearing occurring. 	The proposed clearing is unlikely to significantly impact conservation significant flora at a local or regional level. Therefore, the proposed clearing is not likely to be at variance with this clearing 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 TEC.	<ul style="list-style-type: none"> • No TECs or PECs were recorded in the Project area. 	The proposed clearing will not impact TECs, therefore, the proposed clearing is not likely to be at variance with this clearing 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.	<ul style="list-style-type: none"> • Vegetation of the area is not considered to be remnant, with limited clearing in a vastly uncleared environment. 	The proposed clearing is unlikely to significantly impact remnant vegetation at a local or regional level. Therefore, the proposed clearing is not likely to be at variance with this clearing 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.	<ul style="list-style-type: none"> • There are no wetlands or permanent surface water features in the Project area. • All drainage lines in the immediate vicinity of the Project are ephemeral and remain dry for most of the year. • No vegetation groups were classed as riparian in the clearing area. 	The proposed clearing is unlikely to significantly impact watercourses or wetlands at a local or regional level. Therefore, the proposed clearing is not likely to be at variance with this clearing principle.
Land Degradation		
g) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	<ul style="list-style-type: none"> • The proposed vegetation clearing and mining operations will not cause any appreciable land degradation. • The area of active mining open at any one time will be limited to 10 ha. • MLG has had implemented successful rehabilitation programs that has been applied across all MLG projects. All disturbed areas will 	The proposed clearing is unlikely to significantly impact land degradation at a local or regional level. Therefore, the proposed clearing is not likely to be at variance with this clearing principle.

Clearing Principle	Assessment	Assessed Outcome
	be rehabilitated at the completion of operations, or progressively throughout operation where it is practical to do so. MLG has had implemented successful rehabilitation programs that has been applied across all MLG projects.	
Conservation Estate		
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.	<ul style="list-style-type: none"> There are no conservation estates in the vicinity of the Project. 	The proposed clearing will not impact the environmental values of any adjacent or nearby conservation area. Therefore, the proposed clearing is not likely to be at variance with this clearing principle.
Ground and Surface Water Quality		
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.	Surface water: <ul style="list-style-type: none"> There are no notable drainage lines or watercourses in the vicinity of the Project. Due to the nature of the sandy soils and the proposed stormwater management controls (v-drains, bunds and berms will be constructed as necessary to direct rainfall away from open excavations), stormwater ponding is expected to be limited. Groundwater: <ul style="list-style-type: none"> Clearing of vegetation is unlikely to have an impact on the quality of groundwater. Groundwater will not be intersected or impacted by the mining of sand and gravel. There are no groundwater dependant vegetation units within the Project area. The disturbance area is not within a Public Drinking Water Source Area. 	The proposed clearing is unlikely to significantly impact the quality of surface or underground water on a local or regional level. Therefore, the proposed clearing is not likely to be at variance with this clearing principle.
j) Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.	<ul style="list-style-type: none"> The Project is in an area of uncoordinated ephemeral drainages which are dry for most of the year, with low rainfall and areas of sand with high infiltration. However, minor flows will occur periodically during high rainfall events. Some localised increase in surface runoff may occur where vegetation is cleared. However, the impact is unlikely to be detectable in the context of the range of the natural variability of runoff and implementation of proposed stormwater management controls. Any minor effects will be short term as most of the area cleared will be revegetated on completion of operations or progressively where practicable. 	The proposed clearing is unlikely to cause, or exacerbate, the incidence of flooding. Therefore, the proposed clearing is not likely to be at variance with this clearing principle.

In summary, the assessment of the proposed clearing of 37.5 ha of vegetation in the project area against the ten clearing principles demonstrates that there is unlikely to be a significant impact on any of the environmental factors in the clearing principles. Therefore, the proposed clearing is in accordance with the ten-clearing principles.

5. ENVIRONMENTAL MANAGEMENT MEASURES

The following commitments listed in Table 7 are made to ensure impacts to native vegetation, fauna and habitat are minimised. These are consistent with the commitments made in the Mining Proposal submitted to DMIRS.

Table 7: Management Commitments

Environment Aspect	Commitment No.	Commitment
Clearing and Topsoil Disturbance	Commitment 1	Activities undertaken in a manner that minimizes vegetation clearing and ground disturbance.
	Commitment 2	All clearing will be undertaken in accordance with a Native Vegetation Clearing Permit and the Clearing Procedure.
	Commitment 3	The area of active mining open at any one time will be limited to 10 ha.
	Commitment 4	Clearing areas will be clearing pegged and/or flagged to delineate in the field.
	Commitment 5	The clearing request form will require sign off by the Project Manager prior to clearing occurring.
	Commitment 6	The Clearing Procedure will be incorporated into the site induction.
	Commitment 7	Disturbed areas will be rehabilitated progressively and in accordance with the Mine Closure Plan.
Surface Water	Commitment 8	Surface mobile equipment will be maintained throughout the life of the Project to minimise the risk of spillage and/or seepage to the environment.
	Commitment 9	Stormwater management controls, including v-drains, bunds and berms will be constructed as necessary to direct rainfall away from open excavations.
Flora and Fauna	Commitment 10	All vehicles and equipment arriving on site will be in a clean condition, free of soil, weeds, seeds and vegetative matter.
	Commitment 11	Adherence to Weed management and monitoring programs.
	Commitment 12	Pre-clearance surveys for conservation significant flora and fauna will be undertaken one month prior to clearing.
	Commitment 13	Should additional populations of priority flora or fauna be identified, MLG Oz will apply the following procedure: <ul style="list-style-type: none"> – Where possible, priority species will be avoided. Where priority species cannot be avoided, MLG Oz will liaise with DMIRS and provide a supplementary report on impacts to species prior to any clearing occurring.
	Commitment 14	Any identified active Mallee fowl mound will be avoided and an exclusion zone of 50 m around the active mound will be maintained.
	Commitment 15	Should additional populations of priority flora or fauna be identified, MLG Oz will apply the following procedure: <ul style="list-style-type: none"> – Where possible, priority species will be avoided. Where priority species cannot be avoided, MLG Oz will liaise with DMIRS and provide a supplementary report on impacts to species prior to any clearing occurring
	Commitment 16	An understanding of % impacts to Priority species will be maintained.
	Commitment 17	Records will be maintained and made available for internal and external reporting, auditing and improvement.
	Commitment 18	An assessment of the disturbance footprint will be undertaken post clearing activities and as new aerial imagery, or survey data become available.
	Commitment 19	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.
Air Quality and Noise	Commitment 20	Unsealed surfaces will be watered as required to minimise the generation of dust.
	Commitment 21	During high winds, topsoil stripping and spreading activities will be restricted if dust cannot be adequately controlled.
	Commitment 22	Vehicles and plant will be maintained as per manufacturer specifications to ensure noise and air emissions are minimised.

Environment Aspect	Commitment No.	Commitment
	Commitment 23	All proposed operations will be carried out in accordance with the provisions of the <i>Aboriginal Heritage Act 1972</i> .
	Commitment 24	To protect the general public from inadvertently entering the Project area, appropriate signage will be erected and access to any abrupt changes in elevation will be restricted with an appropriate safety bund.
Workforce and Training	Commitment 25	An environmental and heritage induction and training program will be developed for the Project.

MLG Oz has developed an internal land clearing procedure, which is outlined in Table 8. All clearing will be undertaken in accordance with the Native Vegetation Clearing Permit and the Clearing Procedure, which has been translated into a clearing request form (Appendix 8). The Clearing Request Form will require sign off by the Project Manager prior to clearing occurring and this will be incorporated into the site induction.

Table 8:MLG Oz Clearing Procedure

No.	Description	Responsibility
1	Identify area of land requiring clearing. Produce a map that clearly shows the location and size of the area to be cleared.	Project Manager
2	Verify that all the necessary approvals exist for the proposed clearing and that associated conditions have been met, including necessary flora and fauna surveys. All areas delineated for clearing will require pre-clearance searches for Mallee fowl mounds by a suitably qualified person, prior to clearing occurring.	Project Manager / Environmental Consultant
3	Check that the area is within the boundaries approved by DMIRS for clearing.	Project Manager
4	Check that clearing will not result in exceedance of allowed areas to be open at any one time.	Project Manager
5	Peg the area to be cleared with survey pegs and flagging tape such that the area to be cleared is clearly marked.	Project Manager
6	Inspect any earthworks equipment that has arrived at site or may have been used in an area where weed species are recorded. Ensure the underside of the machinery and implements are free of weed seeds, pieces of vegetation and caked mud or earth. Any machinery that is not free of weed seeds, vegetation or caked earth must not be allowed to operate until it is thoroughly cleaned.	Project Manager
7	Hold a pre-start meeting with the earthworks operators and supervisor to ensure they are advised of the following: <ul style="list-style-type: none"> The exact requirements of the earthworks (e.g. where the clearing pegs are located). Any clearing conditions specified in the permit (including flora and fauna survey requirements). The location where vegetation and topsoil are to be stockpiled or re-spread. The location of any environmental or rehabilitated areas that are to be avoided. 	Project Manager
8	Once vegetation has been removed, commence the removal of topsoil to the depth specified by the Project Manager and in accordance with the Mining Proposal. Push the topsoil to the area where it is to be stored. If the topsoil is to be stockpiled elsewhere, push the topsoil into an area where it can be easily loaded and removed.	Earthworks Operator
9	Ensure the topsoil stockpile is less than two metres high and is not located in an area where it can be inundated by water, driven over or disturbed.	Earthworks Operator
10	During earthworks, regularly inspect the activities and ensure the conditions of this procedure and associated approval documents are complied with.	Project Manager
11	Should any non-compliance with the permit conditions or this procedure, or the potential disturbance of an environmental or rehabilitated area be noticed or suspected, immediately stop the earthworks until the issues are solved.	Project Manager
12	Undertake a post-clearing inspection, recording the final area of disturbance, location of the vegetation and topsoil stockpiles, volume and date.	Project Manager

No.	Description	Responsibility
13	Ensure all clearing is reported in the Annual Environmental Report submission.	Project Manager

MLG Oz has developed a Weed Management Procedure that is outlined in Table 9. The Weed Management Procure includes a monitoring program to ensure early weed detection. The procedure in (Appendix 9).

Table 9: Weed Management Procedure

No.	Description	Responsibility
1	Define the area of extent for a weed inventory and management program on an annual basis, and in line with any changes to lease holdings.	Project Coordinator
2	All personnel will record locations of weed infestations if identified during day-to-day duties on site, including site inspections and monitoring. At a minimum, the physical location coordinates and species name needs to be recorded and sent to the Project Coordinator for mapping and recording in the weed data base.	All personnel Project Coordinator Compliance Manager
3	Seek advice on the best method of removal from the Department of Primary Industries and Regional Development, WA, or other appropriate advisors, and direct onsite personnel to carry out the selected removal option.	Compliance Manager
4	The weed management program must be planned and implemented on an annual basis. Implementation may vary depending on rainfall events and specific site conditions.	Project Manager
5	Prior to commencing the program, a pre-start meeting will be held with weed management contractors to prioritise and plan the requirements of the program.	Project Manager
6	Choose a method of treatment for each identified weed species in consultation with the weed management contractor and government departments as required. Weed treatment methods that may be used include, but are not limited to: <ul style="list-style-type: none"> • Herbicide/chemical mix application; and • Manual techniques such as digging & hand-pulling. 	Weed Coordinator
7	Weed spraying contractors will be engaged each year to undertake management programs as required by the respective Project Managers if significant weed outbreaks have been identified. Works undertaken during the program will be recorded to evaluate the effectiveness of current treatments in subsequent programs using the Weed Management Form.	Project Manager
8	Follow-up mapping will need to take place at a similar time the following year to allow valid comparisons. When revisiting identified weed infestations from previous management programs, the effectiveness of selected management techniques will be assessed and recorded in the weed database. This will allow for improvements to be incorporated into subsequent weed management programs.	Project Manager Compliance Manager

6. REHABILITATION

Rehabilitation is the return of disturbed land to a safe, stable, productive, non-polluting, and self-sustaining condition enabling beneficial land uses to be considered.

MLG Oz undertakes progressive rehabilitation whenever practicable. Rehabilitation includes the following steps:

- Battering the shallow pit walls to <12 degrees.
- Respreading topsoil on the pit floor to a typical depth of 300 mm.
- Respreading stockpiled vegetation to provide habitat and nutrients.
- Ripping pit surfaces to assist in capturing windblown seed, water infiltration, and reducing erosion potential.

Rehabilitation, closure monitoring and maintenance programs will be initiated to ensure the success of rehabilitation works, demonstrate achievement of completion criteria, and identify the need for maintenance works as described in the Mine Closure Plan.

MLG Oz has rehabilitated several disturbed areas that are no longer required by the mining operations. Of the disturbance that has occurred, approximately 60% has been progressively rehabilitated (as of June 2022).

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APPENDICES

APPENDIX 1:SOILS ASSESSMENT (RPM 2022)

Reference: P-116573

RPM Advisory Services Pty Ltd

RPM Ref: ADV-AU-00235

Level 2, 131 St Georges Terrace
Perth WA 6000
Australia

3 March 2022

Phone: +61 8 9482 0700
Fax: +61 8 9482 0799

Murray Leahy
Managing Director
MLG Oz Limited
10 Yindi Way
Kalgoorlie WA 6430

Dear Murray,

Re: Soil Assessment – Comet Vale, Jonah Bore and Mt Keith Deposits

Blueprint Environmental Strategies Pty Ltd (“Blueprint”) (prior to its acquisition by RPMGlobal Holdings Limited, acting under its wholly-owned subsidiary, RPM Advisory Services Pty Ltd, together “RPM”) was commissioned by MLG Oz Limited (“MLG” or the “Client”) to complete a soil assessment for the Comet Vale, Jonah Bore and Mt Keith Deposits.

The following Memorandum is a deliverable as defined as part of the scope of work agreed on in P-116573.

Yours Sincerely,



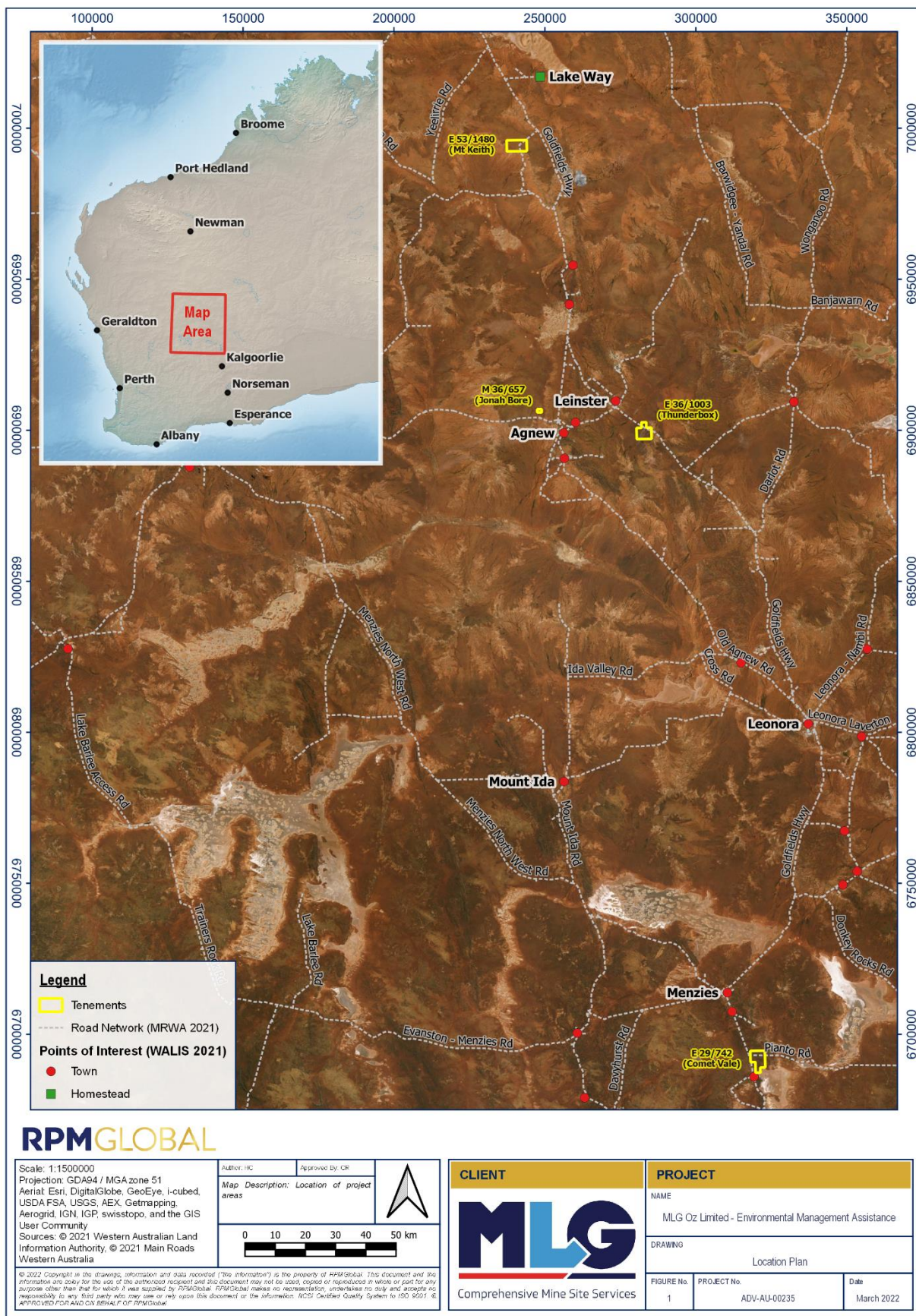
Siobhan Pelliccia
Manager – ESG West
RPM Advisory Services Pty Ltd

1. Introduction

MLG Oz Limited (“MLG”) was established in 2002 and currently operates 29 sites throughout Western Australia. MLG offers a range of value added services from bulk haulage, crushing and screening, aggregate and sand supplies. Its client base includes some of Australia’s largest resource companies in the gold, iron ore and nickel sectors.

MLG is seeking approval for developing sand supply operations at its Comet Value, Jonah Bore and Mt Keith deposits in the northeast Goldfields region of WA (**Figure 1**). This Memorandum provides an assessment of key physical and chemical properties of soil samples collected from each deposit, with a focus on the suitability of these materials for rehabilitation of the sites following mine closure.

Figure 1: Location Plan



This Memorandum has been prepared for MLG Oz Limited only for the purpose set out in and subject to the terms and conditions of its engagement with Blueprint Environmental Strategies Pty Ltd. This Memorandum must be read in its entirety and is subject to all limitations, assumptions and conditions as set out in its engagement and the body of the Memorandum. RPM does not authorise reliance on this Memorandum by any third party except for relevant government agencies, RPM and will not be liable for any loss or damage suffered by a third party relying on this Memorandum.

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2. Methodology

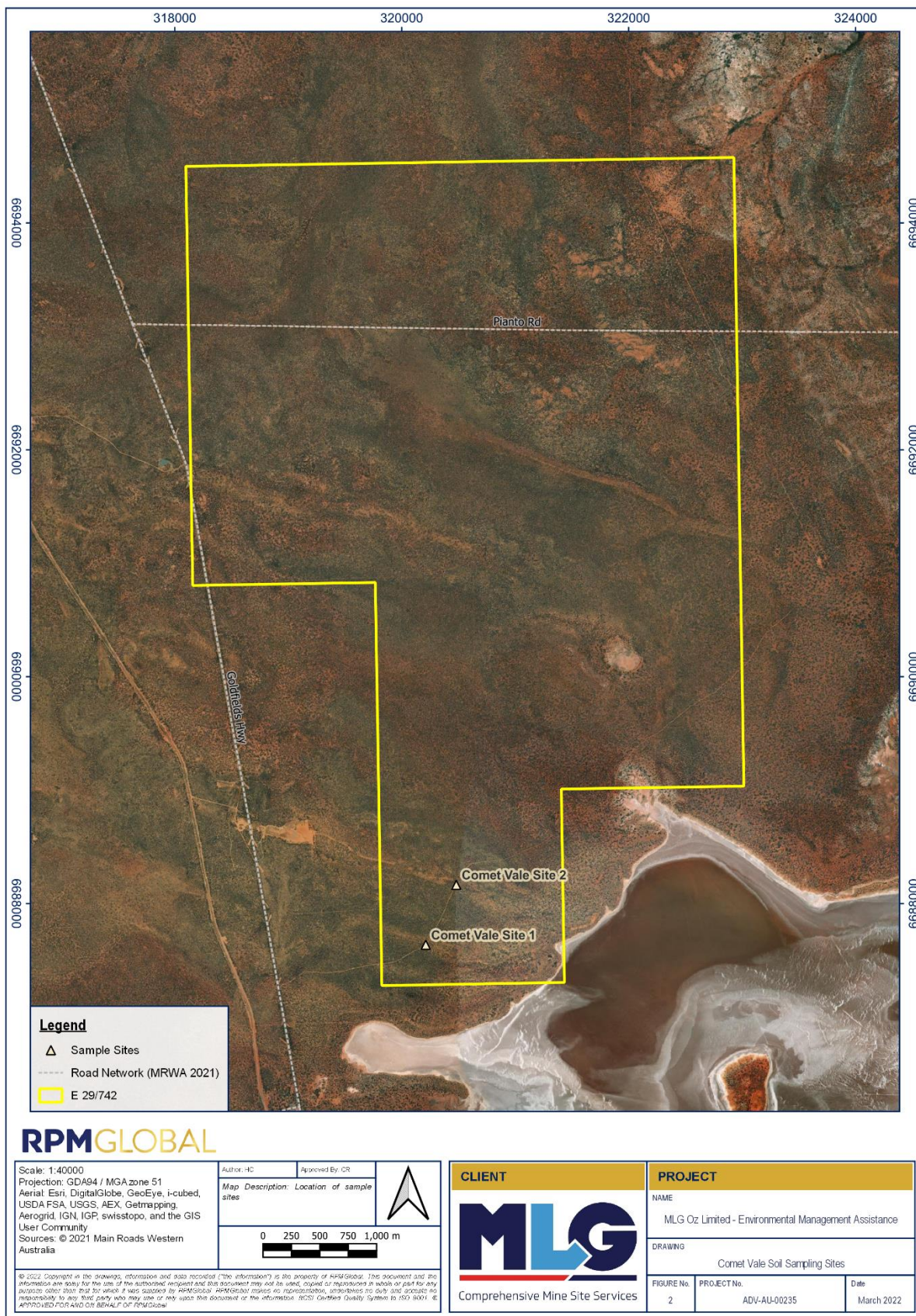
Representative samples of surface soil (0-20 cm) and subsoil (20-40 cm) were collected by MLG staff from the following locations:

- Two locations (Site 1 and Site 2) from Comet Vale (**Figure 2**);
- Two locations (Site 1 and Site 2) from Jonah Bore (**Figure 3**); and
- Two locations (Site 1 and Site 2) from Mt Keith (**Figure 4**).

The samples were submitted to Envirolab Services (WA) Pty Ltd (MPL Envirolabs), located in Myaree, WA, for analysis of the following parameters:

- pH of a 1:5 soil:water extract.
- Electrical conductivity (EC) of a 1:5 soil:water extract.
- Extractable sulfur by extraction with 0.25 M KCl solution at 40°C (KCL 40 test).
- Exchangeable cations (Ca, Mg, Na and K) by extraction with 1 M ammonium chloride, pH 7 solution.
- Extractable aluminium by extraction with 1 M KCl solution.
- Total nitrogen.
- Total phosphorus.
- Ammonium and nitrate nitrogen (by extraction with 1 M KCl).
- Extractable phosphorus (water extract).
- Phosphorus Buffer Index (PBI).
- Particle size distribution (PSD) by dry sieving through a stacked series of 150, 100, 75, 37.5, 19, 9.5, 4.75, 2.36, 1.18, 0.60, 0.425, 0.30, 0.15 and 0.075 mm sieves.
- Emerson Class Number using AS 1289.3.8.1 – 2017 (contracted to Western Geotechnical & Laboratory Services, Welshpool).
- Acid digestible metals and metalloids (As, B, Ba, Be, Cd, Co, Cr, Cu, Hg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Zn).

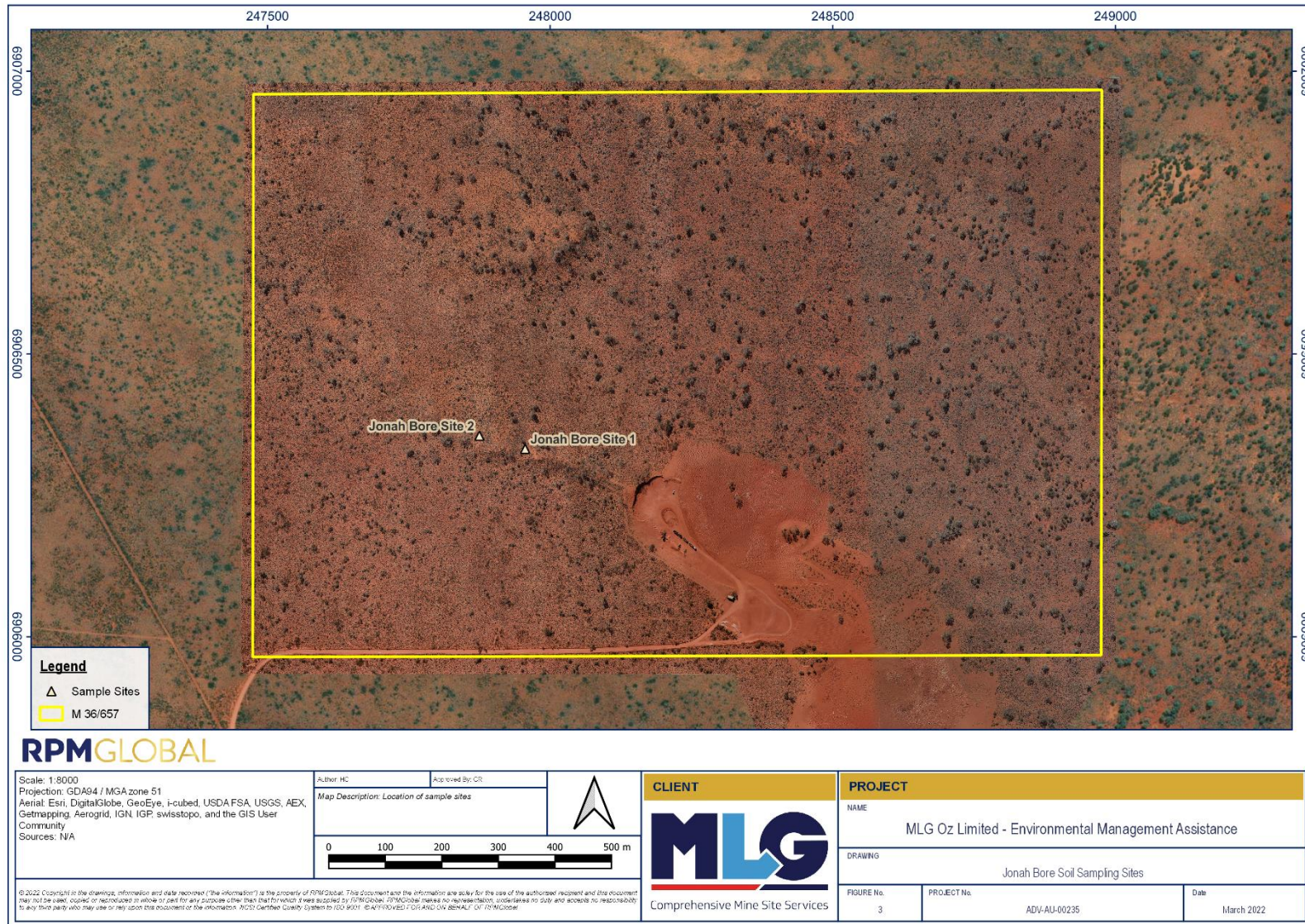
Figure 2: Comet Vale Soil Sampling Sites



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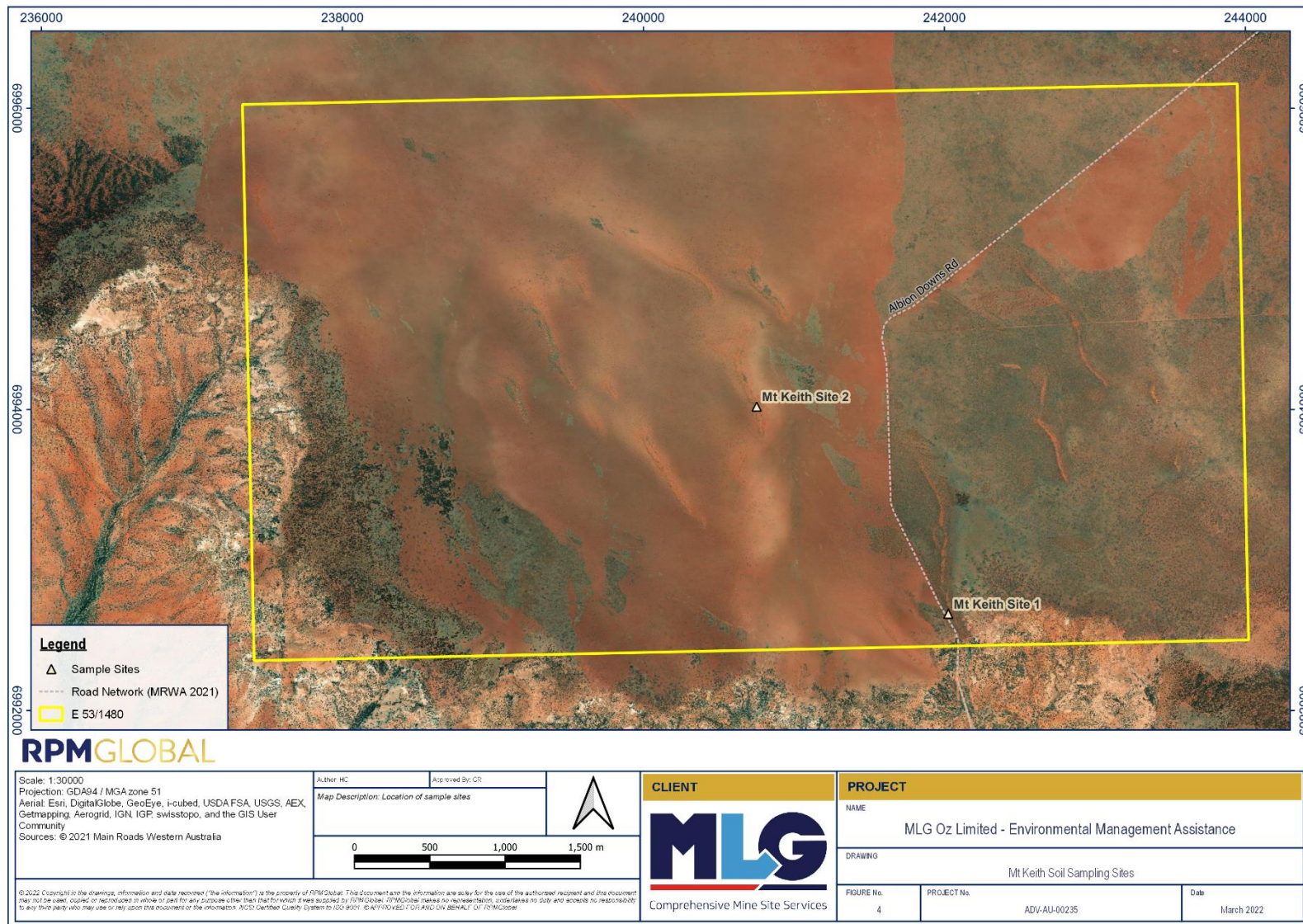
Figure 3: Jonah Bore Soil Sampling Sites



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Figure 4: Mt Keith Soil Sampling Sites



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3. Results and Discussion

3.1 Comet Vale Samples

Site information and results from laboratory analyses used to inform this assessment are presented in the following locations:

- **Plate 1** shows characteristics of the soil profile such as colour, texture and consistency.
- **Figure 5** presents particle size distribution data for four samples from Comet Vale.
- **Table 1** presents results for pH, EC and Emerson Class Number.
- **Table 2** presents results for plant nutrients and PBI.
- **Table 3** presents results for exchangeable cations (Ca, Mg, Na, K and Al) and calculated values for Cation Exchange Capacity (CEC) and Exchangeable Sodium Percentage (ESP).
- **Table 4** presents results for acid-digestible metals and metalloids. Results have been compared with concentration threshold values for clean fill under the DWER Landfill Waste and Classification Definitions 1996 (as amended 2019), where available. These threshold values are:
 - Arsenic 14 mg/kg
 - Barium 5%
 - Boron 5%
 - Beryllium 2 mg/kg
 - Cadmium 0.4 mg/kg
 - Cobalt 5%
 - Copper 5%
 - Manganese 5%
 - Mercury 0.2 mg/kg
 - Molybdenum 10 mg/kg
 - Lead 2 mg/kg
 - Nickel 4 mg/kg
 - Selenium 2 mg/kg

On the basis of this information, key findings relating to the characteristics of sand from Comet Vale are as follows:

- **Plate 1** shows that this soil is typical of pale reddish-brown sands from aeolian dune systems in the arid regions of Western Australia. The soil is uniform in colour and texture throughout the excavated profile, and apart from minor plant roots, is devoid of leaf litter and humus in the surface horizon.
- The particle size distributions of four samples tested (**Figure 5**) indicate very well sorted sand with a median particle diameter of approximately 0.3 mm. The fine fraction contents, which includes very fine sand (0.02 to 0.075 mm), silt (0.002 to 0.02 mm) and clay (<0.002 mm), are very low ($\leq 2\%$). The lack of fine material means that there is a low risk of dust generation, but also means the soil profile will be very well drained and have a low plant-available water holding capacity (PAWC).
- The samples are moderately acidic, as indicated by pH values between 5.4 and 5.6 (**Table 1**). These values are typical of leached siliceous sands, which are naturally acidic and have very little pH buffering capacity.
- The soil is non-saline, as indicated by low EC values ranging from 6.1 to 6.3 $\mu\text{S}\cdot\text{cm}$ (**Table 1**).
- Emerson Class Numbers of 5 indicate that the fine fraction materials have a low potential for dispersion. Spontaneous dispersion and hard-setting behaviours are not expected for this soil type.

- Nutrient contents of these samples are very low, as indicated by low concentrations of total N, total P, NH₄-N, NO₃-N, extractable S and extractable P presented in **Table 2**. PBI values, ranging from 27 to 29, are rated as very low, indicating the soil has very little capacity to retain nutrients supplied as soluble fertilisers or by mineralisation of organic matter.
- Exchangeable cation concentrations (**Table 3**) are very low, with all values except for calcium being below the laboratory reporting limits. These values indicate very low concentrations of calcium, magnesium and potassium (all essential plant nutrients) and confirm the limited capacity of the soil to retain other essential plant nutrients.
- The soils are classified as non-sodic, noting that soil sodicity is largely irrelevant to sandy sands.
- Concentrations of metals and metalloids (**Table 4**), with only nickel levels (4.3 to 4.9 mg/kg) exceeding the WA concentration threshold for clean fill (4 mg/kg). These values do not represent a risk to human health or the environment and remain well below the average global concentration of nickel in the Earth's crust (80 mg/kg, Smith and Huyck 1999).



Plate 1: Soil Profile at Comet Vale

Figure 5: Particle Size Distribution – Comet Vale Samples

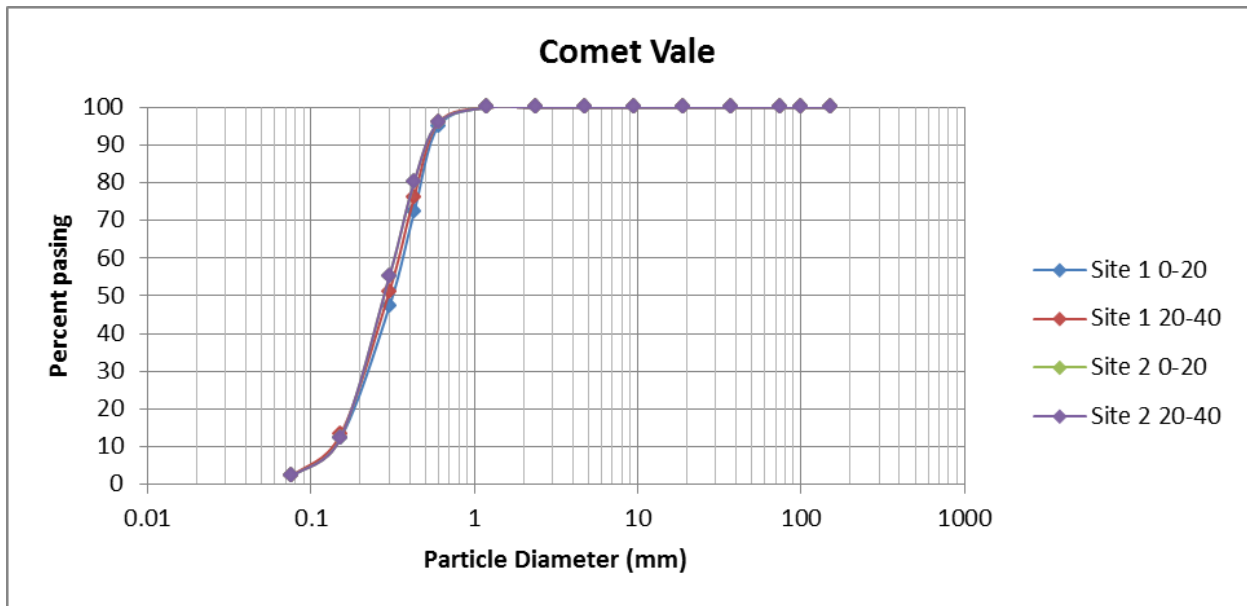


Table 1: pH, EC and Emerson Class – Comet Vale Samples

Sample	Units	Sample 1	Sample 2	Sample 3	Sample 4
Location	-	Site 1	Site 1	Site 2	Site 2
Depth	cm	0 - 20	20 - 40	0 - 20	20 - 40
pH	pH units	5.5	5.4	5.6	5.6
EC	µS/cm	6.1	6.3	6.3	6.1
Emerson Class	-	5	5	5	5

Table 2: Nutrients – Comet Vale Samples

Sample	Units	Sample 1	Sample 2	Sample 3	Sample 4
Location	-	Site 1	Site 1	Site 2	Site 2
Depth	cm	0 - 20	20 - 40	0 - 20	20 - 40
Total N	mg/kg	79	87	45	57
Total P	mg/kg	14	14	15	14
Ammonium-N	mg/kg	5.0	6.2	4.4	5.1
Nitrate-N	mg/kg	0.36	0.34	0.26	0.32
Extractable S	mg/kg	3	3	3	3
Extractable P	mg/kg	<0.5	<0.5	<0.5	<0.5
PBI	-	28	29	28	27

Table 3: Exchangeable Cations – Comet Vale Samples

Sample	Units	Sample 1	Sample 2	Sample 3	Sample 4
Location	-	Site 1	Site 1	Site 2	Site 2
Depth	cm	0 - 20	20 - 40	0 - 20	20 - 40
Calcium	cmol(+)/kg	0.3	0.3	0.3	0.4
Magnesium	cmol(+)/kg	<0.41	<0.41	<0.41	<0.41
Sodium	cmol(+)/kg	<0.22	<0.22	<0.22	<0.22
Potassium	cmol(+)/kg	<0.13	<0.13	<0.13	<0.13
Aluminium	cmol(+)/kg	<0.07	<0.07	<0.07	<0.07
CEC	cmol(+)/kg	<1	<1	<1	<1
ESP	%	<1	<1	<1	<1

Table 4: Metals and Metalloids – Comet Vale Samples

Sample	Units	Sample 1	Sample 2	Sample 3	Sample 4
Location	-	Site 1	Site 1	Site 2	Site 2
Depth	cm	0 - 20	20 - 40	0 - 20	20 - 40
Arsenic	mg/kg	1.3	1.5	1.7	1.7
Boron	mg/kg	<1	<1	<1	<1
Barium	mg/kg	2.8	3.1	2.6	2.7
Beryllium	mg/kg	<0.5	<0.5	<0.5	<0.5
Cadmium	mg/kg	<0.1	<0.1	<0.1	<0.1
Cobalt	mg/kg	1.0	1.2	1.3	1.2
Chromium	mg/kg	75	82	97	100
Copper	mg/kg	1.7	2.0	2.3	2.2
Mercury	mg/kg	<0.01	<0.01	<0.01	<0.01
Manganese	mg/kg	12	11	20	16
Molybdenum	mg/kg	<0.5	<0.5	<0.5	<0.5
Nickel	mg/kg	4.3	4.7	4.9	4.8
Lead	mg/kg	1.3	1.4	1.6	1.7
Antimony	mg/kg	<0.5	<0.5	<0.5	<0.5
Selenium	mg/kg	0.1	0.1	0.2	0.2
Tin	mg/kg	<0.5	<0.5	<0.5	<0.5
Zinc	mg/kg	1.5	1.3	1.2	1.2

3.2 Jonah Bore Samples

Site information and results from laboratory analyses used to inform this assessment are presented in the following locations:

- **Plate 2** show characteristics of the soil profile such as colour, texture and consistency.
- **Figure 6** presents particle size distribution data for four samples from Comet Vale.
- **Table 5** presents results for pH, EC and Emerson Class Number.
- **Table 6** presents results for plant nutrients and PBI.
- **Table 7** presents results for exchangeable cations (Ca, Mg, Na, K and Al) and calculated values for Cation Exchange Capacity (CEC) and Exchangeable Sodium Percentage (ESP).
- **Table 8** presents results for acid-digestible metals and metalloids. Results have been compared with concentration threshold values for clean fill under the DWER Landfill Waste and Classification Definitions 1996 (as amended 2019), where available. These threshold values are:
 - Arsenic 14 mg/kg
 - Barium 5%
 - Boron 5%
 - Beryllium 2 mg/kg
 - Cadmium 0.4 mg/kg
 - Cobalt 5%
 - Copper 5%
 - Manganese 5%
 - Mercury 0.2 mg/kg
 - Molybdenum 10 mg/kg
 - Lead 2 mg/kg
 - Nickel 4 mg/kg
 - Selenium 2 mg/kg

On the basis of this information, key findings relating to the characteristics of sand from Jonah Bore are as follows:

- **Plate 2** shows that this soil is typical of pale reddish-brown sands from aeolian dune systems in the arid regions of Western Australia. The soil is uniform in colour and texture throughout the excavated profile, and apart from minor plant roots, is devoid of leaf litter and humus in the surface horizon.
- The particle size distributions of four samples tested (**Figure 6**) indicates very well sorted sand with a median particle diameter of approximately 0.25 mm. The fine fraction contents, which includes very fine sand (0.02 to 0.075 mm), silt (0.002 to 0.02 mm) and clay (<0.002 mm), are very low ($\leq 2\%$). The lack of fine material means that there is a low risk of dust generation, but also means the soil profile will be very well drained and have a low plant-available water holding capacity (PAWC).
- The samples are moderately acidic, as indicated by pH values of 5.3 (**Table 5**). These values are typical of leached siliceous sands, which are naturally acidic and have very little pH buffering capacity.
- The soil is non-saline, as indicated by low EC values ranging from 7.0 to 8.0 $\mu\text{S}\cdot\text{cm}$ (**Table 5**).
- Emerson Class Numbers of 5 indicate that the fine fraction materials have a low potential for dispersion. Spontaneous dispersion and hard-setting behaviours are not expected for this soil type.
- Nutrients contents of these samples are very low, as indicated by low concentrations of total N, total P, $\text{NH}_4\text{-N}$, $\text{NO}_3\text{-N}$, extractable S and extractable P presented in Table 6. PBI values, ranging from 17 to 29, are rated as very low, indicating the soil has very little capacity to retain nutrients supplied as soluble fertilisers or by mineralisation of organic matter.
- Exchangeable cation concentrations (**Table 7**) are very low, with all values except for calcium being below the laboratory reporting limits. These values indicate very low concentrations of calcium, magnesium and potassium (all essential plant nutrients) and confirm the limited capacity of the soil to retain other essential plant nutrients.
- The soils are classified as non-sodic, noting that soil sodicity is largely irrelevant to sandy sands.
- Concentrations of metals and metalloids (**Table 8**) were all below the WA concentration thresholds for clean fill. Chromium values were slightly elevated (16 – 190 mg/kg), but are considered to be of no environmental consequence as chromium is expected in to present in very stable minerals (such as chromite, FeCr_2O_4) in which it occurs as the almost insoluble trivalent form (Cr^{3+}).



Plate 2: Soil Profile at Jonah Bore

Figure 6: Particle Size Distribution – Jonah Bore Samples

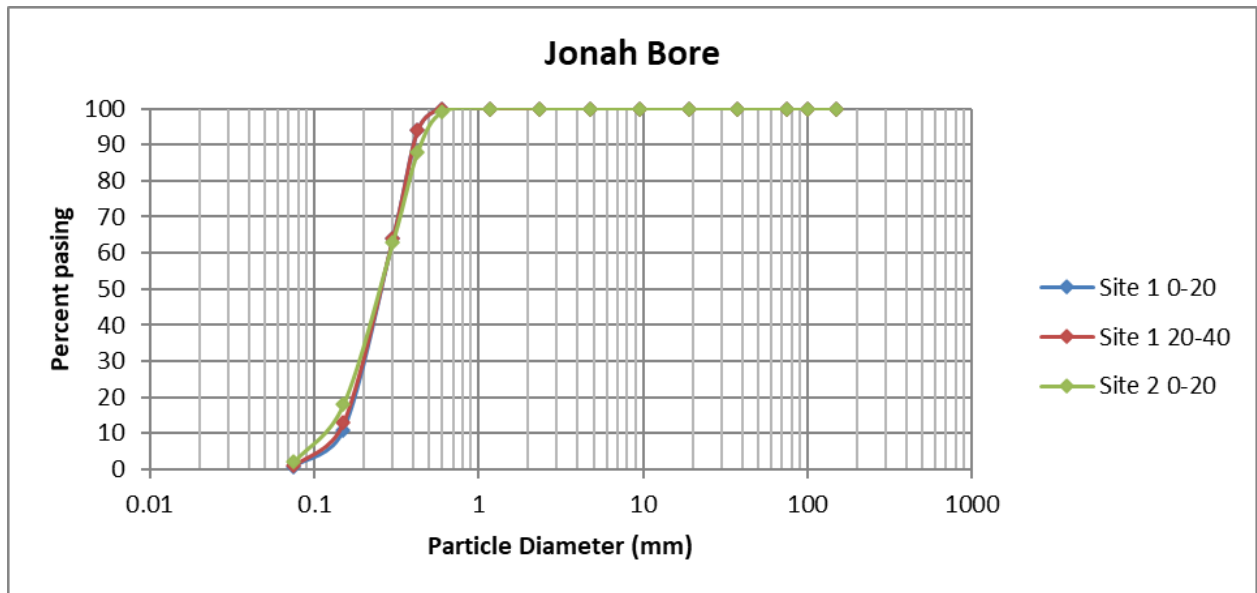


Table 5: pH, EC and Emerson Class – Jonah Bore Samples

Sample	Units	Sample 1	Sample 2	Sample 3
Location	-	Site 1	Site 1	Site 2
Depth	cm	0 - 20	20 - 40	0 - 20
pH	pH units	5.3	5.3	5.3
EC	µS/cm	7.0	8.0	7.1
Emerson Class	-	5	5	5

Table 6: Nutrients – Jonah Bore Samples

Sample	Units	Sample 1	Sample 2	Sample 3
Location	-	Site 1	Site 1	Site 2
Depth	cm	0 - 20	20 - 40	0 - 20
Total N	mg/kg	54	46	65
Total P	mg/kg	31	28	34
Ammonium-N	mg/kg	6.5	6.1	4.7
Nitrate-N	mg/kg	0.19	0.21	0.32
Extractable S	mg/kg	3	4	3
Extractable P	mg/kg	<0.5	<0.5	<0.5
PBI	-	26	29	17

Table 7: Exchangeable Cations – Jonah Bore Samples

Sample	Units	Sample 1	Sample 2	Sample 3
Location	-	Site 1	Site 1	Site 2
Depth	cm	0 - 20	20 - 40	0 - 20
Calcium	cmol(+)/kg	<0.25	<0.25	0.4
Magnesium	cmol(+)/kg	<0.41	<0.41	<0.41
Sodium	cmol(+)/kg	<0.22	<0.22	<0.22
Potassium	cmol(+)/kg	<0.13	<0.13	<0.13
Aluminium	cmol(+)/kg	<0.07	<0.07	<0.07
CEC	cmol(+)/kg	<1	<1	<1
ESP	%	<1	<1	<1

Table 8: Metals and Metalloids – Jonah Bore Samples

Sample	Units	Sample 1	Sample 2	Sample 3
Location	-	Site 1	Site 1	Site 2
Depth	cm	0 - 20	20 - 40	0 - 20
Arsenic	mg/kg	1.8	1.9	
Boron	mg/kg	<1	<1	<1
Barium	mg/kg	1.8	1.9	2.0
Beryllium	mg/kg	<0.5	<0.5	<0.5
Cadmium	mg/kg	<0.1	<0.1	<0.1
Cobalt	mg/kg	0.9	0.7	0.9
Chromium	mg/kg	190	160	160
Copper	mg/kg	2.7	2.4	3.1
Mercury	mg/kg	<0.01	<0.01	<0.01
Manganese	mg/kg	17	15	20
Molybdenum	mg/kg	<0.5	<0.5	<0.5
Nickel	mg/kg	3.9	3.2	3.8
Lead	mg/kg	2.8	2.5	2.8
Antimony	mg/kg	<0.5	<0.5	<0.5
Selenium	mg/kg	0.3	0.3	0.3
Tin	mg/kg	<0.5	<0.5	<0.5
Zinc	mg/kg	2.4	2.0	4.4

3.3 Mt Keith Samples

Site information and results from laboratory analyses used to inform this assessment are presented in the following locations:

- **Plate 3** show characteristics of the soil profile such as colour, texture and consistency.
- **Figure 7** presents particle size distribution data for four samples from Comet Vale.
- **Table 9** presents results for pH, EC and Emerson Class Number.
- **Table 10** presents results for plant nutrients and PBI.
- **Table 11** presents results for exchangeable cations (Ca, Mg, Na, K and Al) and calculated values for Cation Exchange Capacity (CEC) and Exchangeable Sodium Percentage (ESP).
- **Table 12** presents results for acid-digestible metals and metalloids. Results have been compared with concentration threshold values for clean fill under the DWER Landfill Waste and Classification Definitions 1996 (as amended 2019), where available. These threshold values are:
 - Arsenic 14 mg/kg
 - Barium 5%
 - Boron 5%
 - Beryllium 2 mg/kg
 - Cadmium 0.4 mg/kg
 - Cobalt 5%
 - Copper 5%
 - Manganese 5%
 - Mercury 0.2 mg/kg
 - Molybdenum 10 mg/kg
 - Lead 2 mg/kg
 - Nickel 4 mg/kg
 - Selenium 2 mg/kg

On the basis of this information, key findings relating to the characteristics of sand from Jonah Bore are as follows:

- **Plate 3** shows that this soil is typical of pale reddish-brown sands from aeolian dune systems in the arid regions of Western Australia. The soil is uniform in colour and texture throughout the excavated profile, and apart from minor plant roots, is devoid of leave litter and humus in the surface horizon.
- The particle size distributions of four samples tested (**Figure 7**) indicates very well sorted sand with a median particle diameter of approximately 0.3 mm. The fine fraction contents, which includes very fine sand (0.02 to 0.075 mm), silt (0.002 to 0.02 mm) and clay (<0.002 mm), are very low ($\leq 2\%$). The lack of fine material means that there is a low risk of dust generation, but also means the soil profile will be very well drained and have a low plant –available water holding capacity (PAWC).
- The samples are moderately acidic, as indicated by pH values of 5.3 to 5.6 (**Table 9**). These values are typical of leached siliceous sands, which are naturally acidic and have very little pH buffering capacity.
- The soil is non-saline, as indicated by low EC values ranging from 4.6 to 7.0 $\mu\text{S}\cdot\text{cm}$ (**Table 9**).
- Emerson Class Numbers of 5 indicate that the fine fraction materials have a low potential for dispersion. Spontaneous dispersion and hard-setting behaviours are not expected for this soil type.
- Nutrients contents of these samples are very low, as indicated by low concentrations of total N, total P, $\text{NH}_4\text{-N}$, $\text{NO}_3\text{-N}$, extractable S and extractable P presented in Table 10. PBI values, ranging from 13 to 23, are rated as very low, indicating the soil has very little capacity to retain nutrients supplied as soluble fertilisers or by mineralisation of organic matter.
- Exchangeable cation concentrations (**Table 11**) are very low, with all values being below the laboratory reporting limits. These values indicate very low concentrations of calcium, magnesium and potassium (all essential plant nutrients) and confirm the limited capacity of the soil to retain other essential plant nutrients.
- The soils are classified as non-sodic, noting that soil sodicity is largely irrelevant to sandy sands.
- Concentrations of metals and metalloids (**Table 8**) were all below the WA concentration thresholds for clean fill.



Plate 3: Soil Profile at Mt Keith

Figure 7: Particle Size Distribution – Mt Keith Samples

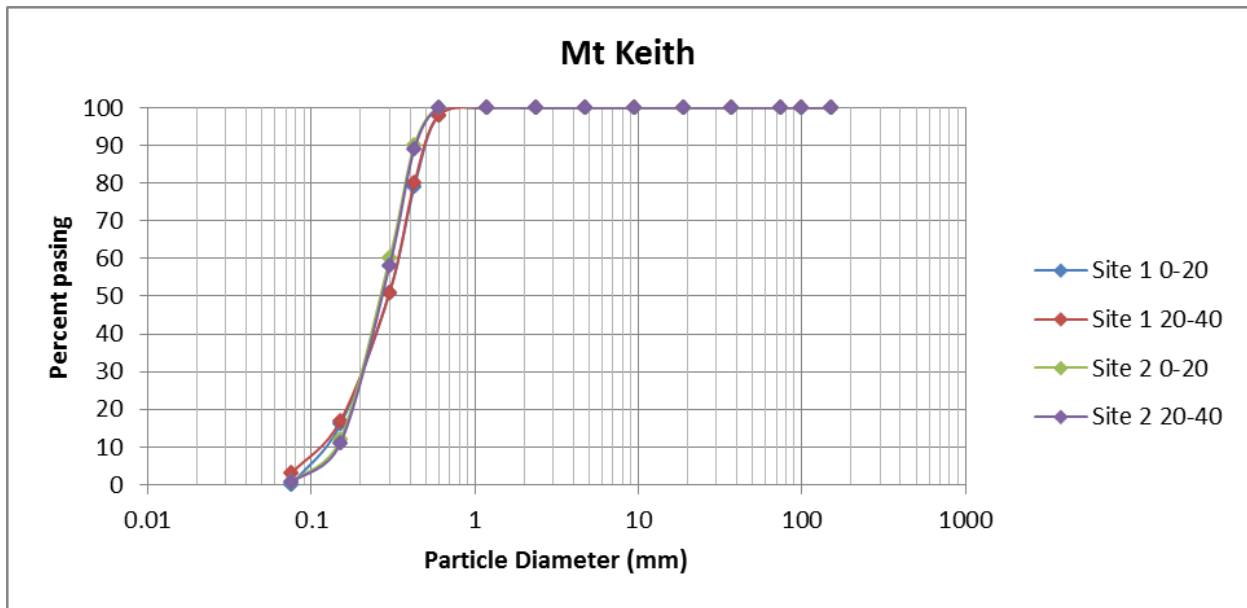


Table 9: pH, EC and Emerson Class – Mt Keith Samples

Sample	Units	Sample 1	Sample 2	Sample 3	Sample 4
Location	-	Site 1	Site 1	Site 2	Site 2
Depth	cm	0 - 20	20 - 40	0 - 20	20 - 40
pH	pH units	5.5	5.6	5.3	5.3
EC	µS/cm	4.6	4.9	7.0	6.7
Emerson Class	-	5	5	5	5

Table 10: Nutrients – Mt Keith Samples

Sample	Units	Sample 1	Sample 2	Sample 3	Sample 4
Location	-	Site 1	Site 1	Site 2	Site 2
Depth	cm	0 - 20	20 - 40	0 - 20	20 - 40
Total N	mg/kg	70	59	19	19
Total P	mg/kg	30	34	21	19
Ammonium-N	mg/kg	3.9	5.1	6.1	6.1
Nitrate-N	mg/kg	0.23	0.31	0.11	0.12
Extractable S	mg/kg	<2	<2	5	4
Extractable P	mg/kg	<0.5	<0.5	<0.5	<0.5
PBI	-	23	22	13	22

Table 11: Exchangeable Cations – Mt Keith Samples

Sample	Units	Sample 1	Sample 2	Sample 3	Sample 4
Location	-	Site 1	Site 1	Site 2	Site 2
Depth	cm	0 - 20	20 - 40	0 - 20	20 - 40
Calcium	cmol(+)/kg	<0.25	<0.25	<0.25	<0.25
Magnesium	cmol(+)/kg	<0.41	<0.41	<0.41	<0.41
Sodium	cmol(+)/kg	<0.22	<0.22	<0.22	<0.22
Potassium	cmol(+)/kg	<0.13	<0.13	<0.13	<0.13
Aluminium	cmol(+)/kg	<0.07	<0.07	<0.07	<0.07
CEC	cmol(+)/kg	<1	<1	<1	<1
ESP	%	<1	<1	<1	<1

Table 12: Metals and Metalloids – Mt Keith Samples

Sample	Units	Sample 1	Sample 2	Sample 3	Sample 4
Location	-	Site 1	Site 1	Site 2	Site 2
Depth	cm	0 - 20	20 - 40	0 - 20	20 - 40
Arsenic	mg/kg	1.8	1.9	1.3	1.3
Boron	mg/kg	<1	<1	<1	<1
Barium	mg/kg	2.5	2.7	3.0	3.0
Beryllium	mg/kg	<0.5	<0.5	<0.5	<0.5
Cadmium	mg/kg	<0.1	<0.1	<0.1	<0.1
Cobalt	mg/kg	0.7	0.7	<0.5	<0.5
Chromium	mg/kg	75	77	64	59
Copper	mg/kg	2.4	2.6	1.5	1.6
Mercury	mg/kg	<0.01	<0.01	<0.01	<0.01
Manganese	mg/kg	18	22	13	12
Molybdenum	mg/kg	<0.5	<0.5	<0.5	<0.5
Nickel	mg/kg	2.1	2.6	1.3	1.4
Lead	mg/kg	2.2	2.2	1.4	1.3
Antimony	mg/kg	<0.5	<0.5	<0.5	<0.5
Selenium	mg/kg	0.2	0.2	0.2	0.2
Tin	mg/kg	<0.5	<0.5	<0.5	<0.5
Zinc	mg/kg	2.1	2.2	1.5	1.2

4. Conclusions

The physical and chemical properties of sands from Comet Vale (Section 3.1), Jonah Bore (Section 3.2) and Mt Keith (Section 3.3) are sufficiently similar for the same rehabilitation strategies to be applied at each deposit. Characteristics that need to be considered when implementing site rehabilitation include:

- The materials are loose, pale red-brown aeolian sands with very low plant available water capacity.
- Although the sands have a low risk of generating significant amounts of dust, they contain substantial amounts of fine to medium sand-sized particles that are easily mobilised by moderate to strong wind gusts. The growth of emerging seedlings may be impacted by the associated sand blasting if the area is not thoroughly ripped.
- The sands are moderately acidic, with pH values ranging from 5.3 to 5.6. As the soils are comprised mainly of silica particles with very low concentrations of exchangeable aluminium, the acidity levels are unlikely to be a problem for common sand dune species (notably *Spinifex triodia*) in the arid regions of WA.
- The sands are non-saline and non-sodic.
- Nutrients contents and soil organic matter contents are extremely low. Low PBI and CEC values indicate they have very little capacity to retain soluble nutrients applied as soluble fertilisers or mineralised organic materials. The very low nutrient status is unlikely to support high densities of plant species, and application of slow-release, balanced fertilisers may be beneficial for revegetation of each site.
- Heavy metal and metalloid concentrations are exceptionally low and, with the exception of slightly elevated nickel (when compared to DWER contamination threshold values) in the Comet Vale sample, comply with “clean fill” criteria in WA (DWER 2019).

In summary, the soils from all sites have comparable properties, comprising stable, geochemically benign aeolian sands with limited nutritional value for plant growth. Given that local, native plant species are adapted to these conditions, revegetation of disturbed surfaces is expected to occur over time. This is reinforced by the positive performance of areas that have already been rehabilitated by MLG, as demonstrated by rehabilitation performance monitoring reports (Blueprint 2021a, Blueprint 2021b) and general site observations.

5. References

Blueprint Environmental Strategies Pty Ltd (Blueprint) (2021a). *Eight Mile Rock Hole Project, Rehabilitation Performance Assessment*. An unpublished report prepared for MLG Oz Limited.

Blueprint Environmental Strategies Pty Ltd (Blueprint) (2021b). *Jonah Bore Project, Rehabilitation Performance Assessment*. An unpublished report prepared for MLG Oz Limited.

DWER (2019). *Landfill Waste and Classification Definitions 1996 (as amended 2019)*. Department of Water and Environmental Regulation (DWER). December 2019.

Smith, KS and Huyck, HO (1999). *An Overview of the Abundance, Relative Mobility, Bioavailability, and Human Toxicity of Metals*. *Reviews in Economic Geology*. Volume 6, Chapter 2.

**APPENDIX 2: FLORA AND VEGETATION SURVEY (GLS
2006)**



Department of Conservation
and Land Management



Your reference:
Our reference: 2006F000108V01
Enquiries: Kelly Poultney

Phone: 9334 0123
Fax: 9334 0278
Email: kellyp@calm.wa.gov.au

Leahy Haulage
PO Box 1484
KALGOORLIE WA 6433

Attention: Murray Leahy

Dear Mr Leahy

REQUEST FOR RARE FLORA INFORMATION

I refer to your request of 16 February 2006 for information on rare flora in the following areas.

1. Cangrass swamp: The search co-ordinates used were $29^{\circ} 57' - 30^{\circ} 27' S$ and $120^{\circ} 50' - 121^{\circ} 20' E$.
2. Agnew: The search co-ordinates used were $27^{\circ} 41' - 28^{\circ} 11' S$ and $120^{\circ} 11' - 121^{\circ} 41' E$.

A search was undertaken for this area of (1) the Department's *Threatened (Declared Rare) Flora* database (for results, *if any*, see "Threatened Flora Data" – coordinates are GDA94 – there were no records retrieved on this database for 'Cangrass swamp'), (2) the *Western Australian Herbarium Specimen* database for priority species opportunistically collected in the area of interest (for results, *if any*, see "WAHERB" – coordinates are GDA94 – see condition number 9 in the attached 'Conditions in Respect of Supply') and (3), the Department's *Declared Rare and Priority Flora List* [this list, which may also be used as a species target list, contains species that are declared rare (Conservation Code R or X for those presumed to be extinct), poorly known (Conservation Codes 1, 2 or 3), or require monitoring (Conservation Code 4) – for results, *if any*, see "Declared Rare and Priority Flora List"]. The results are attached electronically to this email.

Attached also are the conditions under which this information has been supplied. Your attention is specifically drawn to the seventh point, which refers to the requirement to undertake field investigations for the accurate determination of rare flora occurrence at a site. *The information supplied should be regarded as an indication only of the rare flora that may be present and may be used as a target list in any surveys undertaken.*

An invoice for \$250 (plus GST) to supply this information will be forwarded.

It would be appreciated if any populations of rare flora encountered by you in the area could be reported to this Department to ensure their ongoing management.

If you require any further details, or wish to discuss rare flora management, please contact my Principal Botanist, Dr Ken Atkins, on (08) 9334 0425.

Yours faithfully

K Poultney

.....
for Keiran McNamara
EXECUTIVE DIRECTOR
** February, 2006

Please note: Co-ordinates supplied for all data search requests must be provided in latitude/longitude format, 'eastings and northings' are no longer suitable. Thank you.

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

RARE FLORA INFORMATION

CONDITIONS IN RESPECT OF SUPPLY OF INFORMATION

1. All requests for data to be made in writing to the Executive Director, Department of Conservation and Land Management, Attention: Threatened Flora Database Officer, Species and Communities Branch.
2. The data supplied may not be supplied to other organisations, nor be used for any purpose other than for the project for which they have been provided, without the prior written consent of the Executive Director, Department of Conservation and Land Management.
3. Specific locality information for Declared Rare Flora is regarded as confidential, and should be treated as such by receiving organisations. Specific locality information for DRF may not be used in public reports without the written permission of the Executive Director, Department of Conservation and Land Management. Publicly available reports may only show generalised locations or, where necessary, show specific locations without identifying species. The Department is to be contacted for guidance on the presentation of rare flora information.
4. Note that the Department of Conservation and Land Management respects the privacy of private landowners who may have rare flora on their property. Rare flora locations identified in the data as being on private property should be treated in confidence, and contact with property owners made through the Department of Conservation and Land Management.
5. Receiving organisations should note that while every effort has been made to prevent errors and omissions in the data provided, they may be present. The Department of Conservation and Land Management accepts no responsibility for this.
6. Receiving organisations must also recognise that the database is subject to continual updating and amendment, and such considerations should be taken into account by the user.
7. **It should be noted that the supplied data do not necessarily represent a comprehensive listing of the rare flora of the area in question. Its comprehensiveness is dependant on the amount of survey carried out within the specified area. The receiving organisation should employ a botanist, if required, to undertake a survey of the area under consideration.**
8. Acknowledgment of the Department of Conservation and Land Management as source of the data is to be made in any published material. Copies of all such publications are to be forwarded to the Department of Conservation and Land Management, Attention: Principal Botanist, Species and Communities Branch.
9. The development of the PERTH Herbarium database was not originally intended for electronic mapping (eg. GIS ArcView). The latitude and longitude coordinates for each entry are not verified prior to being databased. It is only in recent times that collections have been submitted to PERTH with GPS recorded in latitude and longitude coordinates. Therefore, be aware when using this data in ArcView that some records may not plot to the locality description given with each collection.

THE DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

DECLARED RARE AND PRIORITY FLORA LIST

for Western Australia

CONSERVATION CODES

R: Declared Rare Flora - Extant Taxa

Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such.

X: Declared Rare Flora - Presumed Extinct Taxa

Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently, and have been gazetted as such.

1: Priority One - Poorly known Taxa

Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat, e.g. road verges, urban areas, farmland, active mineral leases, etc., or the plants are under threat, e.g. from disease, grazing by feral animals, etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.

2: Priority Two - Poorly Known Taxa

Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.

3: Priority Three - Poorly Known Taxa

Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but are in need of further survey.

4: Priority Four - Rare Taxa

Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.

ABBREVIATIONS USED IN THREATENED FLORA DATABASE PRINTOUTS

VESTING

AGR Chief Exec Dept of Agriculture
 ALT Aboriginal Land Trust
 BAP Baptist Union of WA Inc
 BSA Boy Scouts Association
 CC Conservation Commission - NPNCA - LFC
 CGT Crown Grant in Trust
 COM Commonwealth of Australia
 CRO Crown Freehold-Govt Ownership
 DOL Dept of Land Administration
 DPU Ministry for Planning
 EXD Exec Direc CALM
 FRE Freehold
 HOW Homeswest
 ILD Industrial Lands Develop. Auth
 JOI Joint Vesting-NPNCA & Shire
 LAC LandCorp
 LFC Lands and Forests Commission
 MAG Minister for Agriculture
 MED Ministry of Education
 MHE Minister for Health
 MIN Minister for Mines
 MPL Ministry for Planning
 MPR Minister for Prisons
 MRD Main Roads WA
 MTR Minister for Transport
 MWA Minister for Water Resources
 MWO Minister for Works
 NAT Natural Trust of Australia WA
 NON Not Vested
 NPN NPNCA
 OTH Other
 PRI Private
 RAI Westrail
 SEC Western Power
 SHI Shire
 SPC State Planning Commission
 TEL Telstra
 TGR Timber Govt Requirement
 TOW TOWN
 UNK Unknown
 WAT Water Corporation
 WEL Minister Community Welfare
 WRC Water & Rivers Commission
 XPL Ex-Pastoral Lease

PURPOSES

ABR Aboriginal Reserve
 AER Aerodrome
 CAM Camping
 CAR Caravan park
 CEM Cemetery
 CFA Conservation of Fauna
 CFF Conservation Of Flora & Fauna
 CFL Conservation of Flora
 CHU Church
 CPK Car Park
 COM Common
 CON Conservation Park
 DEF Defence
 DRA Drain
 EDE Educational Endowment
 EDU Educational purposes UWA
 ENE Enjoyment of Natural Environ.
 EXC Excepted from sale

EXL Exploration Lease
 EXP Experimental Farm
 FIR Firing Range
 FOR State Forest
 GHA Grain Handling
 GOL Golf
 GRA Gravel Pit
 GRE Green Belt
 GVT Government Requirements
 HAR Harbour Purposes
 HEP Heritage Purposes
 HER Heritage trail
 HOS Hospital
 KEN Kennels
 MIN Mining lease
 MUN Municipal Purposes
 NPK National Park
 NRE Nature Reserve
 OTH Other
 PAC Public access
 PAR Parkland (& Recreation)
 PAS Pastoral lease
 PFL Protection of Flora
 PIC Picnic ground
 PLA Plantation
 POS Public Open Space
 PPA Public parkland
 PRS Prison site
 PUT Public Utility
 QUA Quarry
 RAD Radio Station
 RAC Racecourse
 REC Recreation
 REH Rehabilitation
 RNP Re-establish Native Plants
 RRE Railway Reserve
 RUB Rubbish
 SAN Sand
 SCH School-site
 SET Settlers requirements
 SHI Shire Requirements
 SHO Showgrounds
 SNN Sanitary
 STO Stopping place
 TIM Timber
 TOU Tourism
 TOW Town-site
 TRA Training Ground
 TRI Trig station
 TVT Television transmitting
 UNK Unknown
 UTI Utilities
 VCL Vacant Crown Land
 VER Road Verge
 VPF Vermin Proof Fence
 WAT Water
 WCO Water & Conservation of F & F
 WOO Firewood

* Please note that LFC now comes under the Conservation Commission.

GOLDFIELDS LANDCARE SERVICES

PO Box 485, Kalgoorlie 6433
Fax: 90213334 Mobile: 0413134955
Email: xerophil@optusnet.com.au
ABN 32 669 560 047

RARE FLORA SEARCH AND VEGETATION SURVEY FOR LEAHY HAULAGE P.L. AT AGNEW

Goldfields Landcare Services conducted a vegetation survey for Leahy Haulage P.L. on adjoining leases M36/657 and L36/187 located 12k NW of Agnew on 25 and 26 July 2006. The survey and identification work was carried out by Phil Stanley and Paula Pavlovic.

Lease No M36/657 has been pegged for the purpose of sand mining and covers an area of 1000m x 1500m over sand plain and sand dunes supporting vegetation associations typical of that land type while lease No M36/657 is a miscellaneous lease pegged to provide access to the former lease and is 100m wide x 1720m long, most of which is on sand plain country with the southern portion extending into lateritic gravel adjacent to breakaway country.

The vegetation consists primarily of a mixture of small patches of:

Low Open Woodland in which the tallest stratum is dominated by *Eucalyptus gongolycarpa*; and Tall Open Shrubland where Mulga is predominant over a matrix of Low Open Shrubland (*Eremophila sp et al*) and Tussock Grassland (*Spinifex*)

The area had been burnt approximately 18 months previously and was in an early phase of regeneration. It had received very little rain prior to this survey. These facts combined with the timing of the survey; during a period when very few of the plants were in bud or flower, made a positive identification of a number of the specimens collected very difficult.

A series of traverses were conducted around the perimeter of the leases and along the diagonals of the mining lease with frequent departures from the traverse lines to inspect plant species not immediately recognisable. Due to the open nature of the vegetation, visibility was very good.

Specimen material of those plant species not immediately recognised was collected, pressed and dried before being returned to Kalgoorlie where identification was carried out using appropriate reference books, plant keys, Florabase and comparison with specimens contained in Goldfields Landcare Services collection of plant samples and those at the Goldfields Herbarium. Additionally, numerous photographs were taken and used as an aid in identification.

Documents obtained from CALM showed that there are six priority species in the area, namely:

Baeckia sp Sandstone (Conservation status P1)

Eremophila pungens ms (P4)

Acacia balsamea (P4)

Eucalyptus striatocalyx subsp. *delicata* (P1)

Grevillea inconspicua (P4)

Hemigenia exilis (P4)

One specimen in particular proved to be too difficult to confidently eliminate from the list of priority species with the information and material available at the time as it bore similarities to some *Baeckia* species. A more complete description of *Baeckia* sp. Sandstone was obtained from the Dept of Environment and Conservation in Kalgoorlie and compared to additional photographs and plant material collected from the site by Murray Leahy on 31.08.06 which included flowers. We were then able to determine that our specimen was not *Baeckia* sp. Sandstone.

One additional specimen has still not been identified but as it bears no resemblance to any of the priority species listed above we are able to conclude that none of those priority species occurred on either of the leases surveyed.

A total of 81 species was identified to at least genus level a list of which is attached.

Phil Stanley
Director
03.09.06

Leahy Haulage P.L. Agnew Sandmining Lease Vegetation Survey

#37 unknown

Abutilon	otocarpum
Acacia	aneura var. macrocarpa
Acacia	coolgardiensis
Acacia	kempeana
Acacia	ligulata
Acacia	minyura
Acacia	steadmanii
Acacia	aneura var. aneura
Aluta	masonneuvei
Alyogyne	pinoniana
Anthobolus	leptomerioides
Bonomia	erecta
Brachychiton	gregorii
Brunonia	austalis
Calandrinia	pumila
Calitrix	desolata
Canthium	latifolium
Conocarpus	cotinifolius
Dampiera	scaevolina?
Dianella	revoluta
Dicrastylis	brunnea var brunnea
Dicrastylis	brunnea
Dicrastylis	flexuosa
Dodonaea	viscosa
Duboisia	hopwoodii
Eragrostis	lanipes
Eremophila	clarkeii
Eremophila	flabulata
Eremophila	forrestii
Eremophila	fraseri
Eremophila	granitica
Eremophila	longifolia
Eriachne	helmsii
Erodium	cygnorum
Eucalyptus	celastroides
Eucalyptus	gongylocarpa
Eucalyptus	kingsmillii
Eucalyptus	leptopoda
Eucalyptus	oldfieldii
Eucalyptus	oleosa
Exocarpus	sparteus
Goodenia	wilunensis
Goodenia sp 25	
Grevillea	berryana
Grevillea	juncifolia
Grevillea	stenobotrya
Hakea	superea
Helichrysum	cassinianum
Heliotropium	europaeum
Homalocalyx	thryptomenoides

Indigofera	boviparda
Kennedia	prorepens
Keraudrinia	integrifolia
Lachnystachys	coolgardiensis
Lechenaultia	striata
Leptosema	chambersii
Myoporum	montanum
Phyllota	humilis
Pimelea	microcephala
Prostanthera	althoferi ssp. althoferi
Pterocaulon	serrulatam
Ptilotus	exaltatus
Ptilotus	gaudichaudii var. gaudichaudii
Ptilotus	obovatus
Ptilotus	polystachyus
Ptilotus	schwarzii
Ptilotus	sessilifolius
Scaevola	parvifolia
Sida	catyxhymenia
Sida	excedentifolia
Sida	intricata
Sida	phaeticha
Solanum	centrale
Solanum	coactiliferum
Solanum	faciophyllum
Solanum	plicatile
Thryptomene	denticulata
Trachymene	glaucifolia
Triodia	basedowii
Velleia	discophora
Velleia	hisbida

WAHERB SPECIMEN DATABASE
GENERAL ENQUIRY

Acacia balsamea

R.S.Cowan & Maslin (Mimosaceae)

CONSERVATION STATUS:P4

Coll.: B.R. Maslin 5402 Date: 20 09 1983 (PERTH 00153222)

LOCALITY Leinster Downs Station, 3 km N of Perversence Well (which is at Agnew Mine Camp No. 1 site) WA

LAT 27 Deg 49 Min 22.000 Sec S LONG 120 Deg 35 Min 59.000 Sec E

Rounded or infundibular shrubs to 2.5 m tall, phyllodes concentrated towards ends of branches. Bark medium to dark grey, fibrous, finely longitudinally fissured towards base of main trunks, smooth on branches. Phyllodes erect, not particularly rigid, shallowly curved to shallowly serpentinous, medium green, with fine resin ribs which are just visible to the unaided eye, smelling of *

On top of highly weathered, granite breakaway. Growing with *Acacia aneura*.

Abundance: common.

Previous det.: *Acacia balsamea* R.S.Cowan & Maslin

Frequency:common.

Baeckea sp. Sandstone (C.A. Gardner s.n. 26 Oct. 1963)

PN (Myrtaceae)

CONSERVATION STATUS:P1

Coll.: R. Schuh & G. Cassis 96-19 Date: 26 10 1996 (PERTH 05095190)

LOCALITY 31.7 km W of Agnew towards Sandstone, WA

LAT 27 Deg 57 Min 44.000 Sec S LONG 120 Deg 25 Min 39.000 Sec E

Host No. 72

Previous det.: *Thryptomene aspera* subsp. *glabra*

Eucalyptus striaticalyx

subsp. *delicata* Nicolle & P.J.Lang (Myrtaceae)

CONSERVATION STATUS:P1

Coll.: S.G.M. Carr 513 Date: 22 03 1963 (PERTH 01290908)

LOCALITY 614 mile peg on Wiluna - Leonora road [20 km N of Agnew on the Wiluna - Leonora road] WA

LAT 27 Deg 50 Min 0.000 Sec S LONG 120 Deg 31 Min 0.000 Sec E

15 ft half barked.

Previous det.: *Eucalyptus striaticalyx* W.Fitzg.

**DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT
DECLARED RARE AND PRIORITY FLORA LIST
22 February 2005**

SPECIES / TAXON	CONS CODE	CALM REGION	DISTRIBUTION	FLOWER PERIOD
Baeckea sp. Sandstone (CA Gardner s.n.)	1	GLD,MW	Wiluna, Sandstone, Agnew	Oct
Eremophila pungens ms	4	GLD,MW	Eareheedy, Meekatharra, Lake Way, Barwidgee, Wanjarri, Wiluna, Wonganoo, Granite Peak, Lorna Glen Hmsfd, Agnew, Leinster	Jun-Oct

Total No. of Records = 5

Species Name	Cons.	Pop ID	No. Plants	Latitude	Longitude	Purpose	Vest
Grevillea inconspicua	4	14		27^54'29.3"	120^37'03.1"	Pastoral lease	NON
	4	15		27^56'19.3"	120^36'58.1"	Pastoral lease	NON
	4	16		27^57'04.3"	120^36'54.1"	Pastoral lease	NON
	4	17		27^57'45.3"	120^36'58.1"	Pastoral lease	NON
Hemigenia exilis	4	7	200	28^09'37.3"	120^40'40.1"	Pastoral lease	NON

Leahy Haulage P.L. Agnew Sandmining Lease Vegetation Survey

#37 unknown

Abutilon	otocarpum
Acacia	aneura var. macrocarpa
Acacia	coolgardiensis
Acacia	kempeana
Acacia	ligulata
Acacia	minyura
Acacia	steadmanii
Acacia	aneura var. aneura
Aluta	masonneuvei
Alyogyne	pinoniana
Anthobolus	leptomerioides
Bonomia	erecta
Brachychiton	gregorii
Brunonia	austalis
Calandrinia	pumila
Calitrix	desolata
Canthium	latifolium
Conocarpus	cotinifolius
Dampiera	scaevolina?
Dianella	revoluta
Dicrastylis	brunnea var brunnea
Dicrastylis	brunnea
Dicrastylis	flexuosa
Dodonaea	viscosa
Duboisia	hopwoodii
Eragrostis	lanipes
Eremophila	clarkei
Eremophila	flabulata
Eremophila	forrestii
Eremophila	fraseri
Eremophila	granitica
Eremophila	longifolia
Eriachne	helmsii
Erodium	cygnorum
Eucalyptus	celastroides
Eucalyptus	gongylocarpa
Eucalyptus	kingsmillii
Eucalyptus	leptopoda
Eucalyptus	oldfieldii
Eucalyptus	oleosa
Exocarpus	sparteus
Goodenia	wilunensis
Goodenia sp 25	
Grevillea	berryana
Grevillea	juncifolia
Grevillea	stenobotrya
Hakea	superea
Helichrysum	cassinianum
Heliotropium	europaeum
Homalocalyx	thryptomenoides

Indigofera	boviparda
Kennedia	prorepens
Keraudrinia	integrifolia
Lachnystachys	coolgardiensis
Lechenaultia	striata
Leptosema	chambersii
Myoporum	montanum
Phyllota	humilis
Pimelea	microcephala
Prostanthera	althoferi ssp. althoferi
Pterocaulon	serrulatum
Ptilotus	exaltatus
Ptilotus	gaudichaudii var. gaudichaudii
Ptilotus	obovatus
Ptilotus	polystachyus
Ptilotus	schwarzii
Ptilotus	sessilifolius
Scaevola	parvifolia
Sida	calyxhymeria
Sida	excedentifolia
Sida	intricata
Sida	phaeticha
Solanum	centrale
Solanum	coactiliferum
Solanum	laciophyllum
Solanum	plicatile
Thryptomene	denticulata
Trachymene	glaucifolia
Triodia	basedowii
Velleia	discophora
Velleia	hisbida

**APPENDIX 3:DESKTOP FLORA AND VEGETATION
SURVEY (ONSHORE ENVIRONMENTAL 2020)**



Desktop Flora and Vegetation Survey Jonah Bore Project

Prepared for MLG Oz Pty Ltd
24th July 2020



Document Status						
Rev No.	Authors	Reviewer/s	Date	Approved for Issue		
				Name	Distributed To	Date
1	J.Waters	D. Brearley	09/07/2020	D.Brearley	N.Garbin	23/07/2020
2	D.Brearley	N.Garbin	23/07/2020	D.Brearley	N.Garbin	24/07/2020



ACN 095 837 120
PO Box 227
YALLINGUP WA 6282
Telephone 0427339842
E-mail: info@onshoreenvironmental.com.au

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EXECUTIVE SUMMARY

MLG Oz Pty Ltd (MLG) owns and operates sand mining operations at four project areas in the Goldfields region of Western Australia. As part of these mining proposals MLG has commissioned Onshore Environmental Consultants (Onshore Environmental) to undertake a desktop study of the Jonah Bore Project Area. The Jonah Bore Project Area (herein referred to as the study area) is located approximately 600km northeast of Perth and 25 km west of Leinster in the Northern Goldfields region.

The desktop survey included an assessment of the potential for conservation significant species and ecological communities to occur within or surrounding the study area, as well as a comprehensive literature review of surveys previously completed within the general area.

A total number of 358 plant taxa (including varieties and subspecies) from 49 families and 151 genera were identified within a 40 km radius search of the study area. Species representation was greatest amongst the Fabaceae, Asteraceae, Chenopodiaceae, Scrophulariaceae, Poaceae and Myrtaceae families. The most speciose genera were *Eremophila* (34 taxa), *Acacia* (25 taxa), *Eucalyptus* (13 taxa), *Ptilotus* (10 taxa) and *Maireana* (10 taxa).

None of the plant taxa recorded from the database search were gazetted as Threatened Flora pursuant to the *Biodiversity Conservation Act 2016* (BC Act) or listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

A list of conservation significant flora species occurring within a 50 km radius of the study area was compiled during the literature review and database searches. The likelihood of each taxon occurring within the study area was assessed using a set of criteria that are based on presence of suitable landform and distance to known records. A total of 14 Priority flora taxa, as listed by the Department of Biodiversity Conservation and Attractions (DBCAs), were identified as potentially occurring within the study area. Of these species, one species was identified as *likely* to occur within the study area based on known distribution and habitat preference; *Baeckeke* sp. Sandstone (C.A. Gardner s.n. 26 Oct. 1963) (Priority 3). The remaining 13 Priority flora taxa identified were considered *unlikely* to occur within the study area.

No introduced species or Declared Pests listed under the *Biosecurity and Agriculture Management Act 2007* (BAM Act 2007) were recorded from the database searches. A total of eleven introduced flora species were identified as potentially occurring within the study area.

A list of Threatened Ecological Communities (TECs) and Priority Ecological Communities (PECs) occurring within a 100 km radius of the study area was compiled during the literature review and database searches. No TECs or PECs as listed by the Department of Energy and Environment (DoEE) or the DBCAs were identified as being likely to occur within the study area.

Vegetation within the study area was determined to be well represented at all levels (statewide, bioregional [IBRA region and IBRA sub-region] and local), with greater than 99% of the pre-European extent remaining for the sole Beard (1976) vegetation association represented within the study area. The proportion of the same vegetation association occurring within secure (Class I-IV) reserves is less than 2% at the state level, which is under the 15% minimum standard. However, given that the pre-European extent of the Beard vegetation association will not be significantly reduced (i.e. it will remain well above the 30% threshold within the bioregion), the reservation status is determined to be of least concern for biodiversity conservation.

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1.0 INTRODUCTION

1.1 Preamble

MLG is a privately owned company currently operating out of approximately 20 sites in Western Australia and the Northern Territory. MLG holds four mining tenements in the Goldfields region of Western Australia (WA) including:

- M15/1466 - Eight Mile Rock Hole Project;
- M15/125 - Mt Burges Project;
- M24/905 - Canegrass Project; and
- M36/657 - Jonah Bore Project.

Onshore Environmental was commissioned to undertake a desktop assessment of the Jonah Bore Project. This report details findings from this assessment.

1.2 Location and Land Use

The Jonah Bore Project Area (herein referred to as the study area) is located within the Shire of Leonora in central southern Western Australia (Figure 1). The nearest regional towns are Leinster (25 km east) and Sandstone (112 km west). The study area is serviced by an unsealed road that connects with the nearest sealed road, the Agnew-Sandstone Road, approximately 2 km to the south.

The dominant land uses in the region are pastoral grazing (cattle), crown reserves and mining (operations and exploration). The study area is located on the Leinster Downs Pastoral Lease and the closest active mine site is the Agnew Gold Mine, approximately 8 km to the southeast. Nickel and gold are the dominant mining resources in the region.

1.3 Biogeographic Regions

The latest version of the Interim Biogeographic Regionalisation for Australia (IBRA7) divides Australia into 89 bioregions based on climate, geology, landform, native vegetation and species information, and includes 419 sub-regions (Department of Environment 2013, Thackway and Cresswell 1995). The bioregions and sub-regions are the reporting unit for assessing the status of native ecosystems and their level of protection in the National Reserve System.

The study area is located within the Murchison bioregion, specifically within the Eastern Murchison sub-region (MUR01) which covers approximately 7.85 million hectares (Cowan 2001). The Eastern Murchison sub-region comprises northern parts of the Southern Cross and Eastern Goldfields Terrains of the Yilgarn Craton. It is characterised by extensive areas of elevated red desert sandplains with occasional dune systems and scattered breakaway complexes, as well as internal drainage systems comprising extensive salt lake systems associated with occluded paleo-drainage channels. The vegetation is dominated by Mulga Woodlands often rich in ephemerals, hummock grasslands, saltbush shrublands and *Tecticornia* shrublands (Cowan 2001).



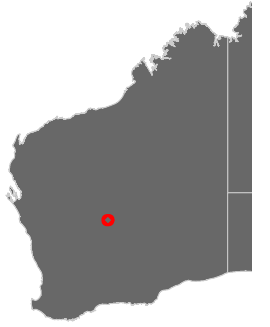
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Jonah Bore

FIGURE 1
Study Area Location

Legend

- Jonah Bore Study Area



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Projection: MGA Zone 51

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Status:	Final
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Requested by:	DB

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



1.4 Climate

The Murchison region has an arid to semi-arid climate. The closest weather station to the study area is the Leinster Aero weather station, approximately 25 km east of the study area. Average annual rainfall is 266.1 mm with a bimodal rainfall pattern peaking in February and July (Figure 2). Summer rainfall originates from deteriorating tropical cyclones that cross the coast of northern Western Australia and dissipate to the south east. Winter rainfall results from cold fronts crossing the southern coastline and moving inland. Mean maximum summer temperatures peak at 37.3 degrees in January with mean maximum winter temperatures down to 18.9 degrees in July. Mean minimum temperatures range from 23.3 degrees in January to 6.1 degrees in July.

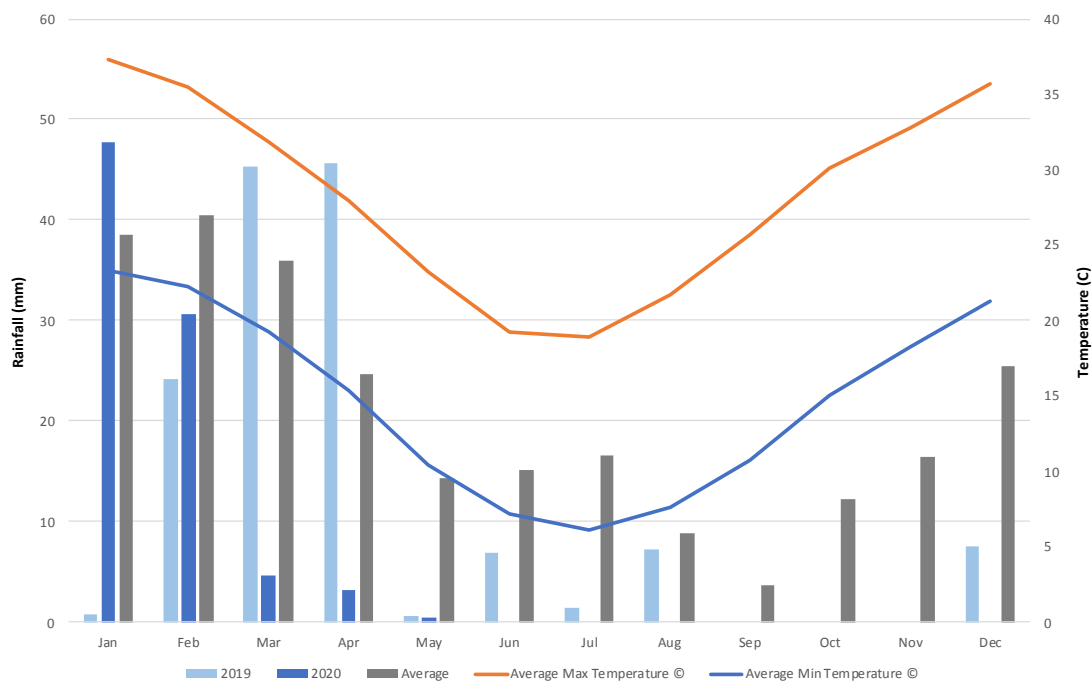


Figure 2 Rainfall and climatic data recorded at the Leinster Airport station for 2019 and January to May 2020, with the long term average (Bureau of Meteorology 2020).

1.5 Soils and Landforms

Tille (2006) classified the most recent and detailed mapping of Western Australia's rangelands and arid interior into a hierarchy of soil-landscape mapping units. The study area is located within the Murchison Province of the Goldfields Region. The Murchison Province occupies about 304,875 km² (12.1% of Western Australia), covering the eastern Mid-West and Northern Goldfields region of central Western Australia. The Murchison Province consists of an extensive plateau of low relief. High points in the landscape are often laterite or silcrete mesas in areas of granitic basement rock. These mesas are described as having lateritic breakaways, kaolinised footslopes (often saline) and are surrounded by gently sloping plains. Areas of low hills, domes and tor fields of granite, gneiss and quartz also occur in the upper parts of the landscape.

The majority of the landscape consists of gently undulating wash plains and sandplains. Plains in the area are typically red-brown hardpan plains with sandy banks and groves, occasionally with gravelly mantles. There are also some areas of narrow saline drainage

tracts. Low rises with outcrops of granite, gneiss and schists also occur in combination with quartz stony and gravelly plains.

Another dominant feature of the landscape of this province is extensive areas of gently undulating sandplains with occasional sand dunes. These areas are most common to the east of the province becoming dominant towards the eastern margin. Sandplains also occur in the north-west and the south-west sectors of the province.

The soils for the Murchison Province are described as red loamy earths and red-brown hardpan shallow loams, with some red shallow loams on wash plains. Red sandy earths and red deep sands are found on sandy banks.

The Murchison Province is divided into seven soil-landscape zones, with the study area occurring within the Salinaland Plains Zone. The Salinaland Plains Zone is located in the Northern Goldfields between Lake Barlee and Lake Ballard and extending to Wiluna and Laverton. The zone is approximately 132,450 km² in area. Major landform units consist of sandplains (with hardpan wash plains and some mesas, stony plains and salt lakes) on granitic rocks (and some greenstone) belonging to the Yilgarn Craton. Soils are predominantly red sandy earths, red deep sands, red shallow loams and red loamy earths with some red-brown hardpan shallow loams, salt lake soils and red shallow sandy duplexes. The vegetation is summarised by Tille (2006) as Mulga shrublands with spinifex grasslands (and some halophytic shrublands and eucalypt woodlands).

1.6 Land Systems

Land system mapping has been completed across the north-eastern goldfields at a scale of 1:250,000 by Pringle *et al.* (1994). A single land system occurs within the study area; the Bullimore Land System (Figure 3). The Bullimore Land System is characterised by broadly undulating red sandplains with occasional occurrences of near parallel sand dunes. Vegetation is generally dominated by spinifex hummock grasslands.

There are five land units that have been defined for the Bullimore Land System (Table 1). The sand sheet unit is the most dominant land unit accounting for approximately 85% of the total land system. The other land units cover a smaller proportion of the land system, with loamy plains occupying approximately 10%, followed by narrow drainage zones and dissected tracts (2% each), and dunes (1%).

Table 1 Land units occurring within the Bullimore land system.

Land Unit	Definition	Soil	% of Area
Sand sheet	Extensive level to gently undulating plains, occasionally more than 10 km wide.	Deep earthy red sand	85%
Sand dune	Generally linear, occasionally reticulate, aeolian deposits to 5 km long and generally < 10 m high.	Deep siliceous red sand	1%
Loamy plains	Generally level tracts to 2 km wide subject to sheet run-on from adjacent outcrops of granite.	Deep sandy-surfaced red earth	10%
Narrow drainage zones	Narrow (< 100 m) tracts subject to concentrated sheet flow and sump areas near granite outcrops.	Deep sandy-surfaced red earth	2%
Dissected tracts	Variably stripped weathered granite surfaces, including incipient breakaways	Lithosols	2%

1.7 Flora and Vegetation

The study area is located within the Austin Botanical District, within the Murchison IBRA region of the Eremaean Province (Beard 1990). Beard (1976) described and mapped vegetation of the area at a scale of 1:1,000,000. The original vegetation mapping undertaken by Beard was refined by Shepherd *et al.* (2002) at a scale of 1:250,000. One vegetation association was defined covering the entire study area, 107 Hummock Grassland, described as shrub steppe, mulga and *Eucalyptus kingsmillii* over hard spinifex (Figure 4). The Pre-European extent currently remaining for the vegetation association within the study area is 100% (Table 2).

Table 2 Pre-European extent of the vegetation association occurring within the study area (Shepherd *et al.* 2002).

Vegetation Association	System	Description	Pre-European Extent (ha)	% Remaining	% Current Extent in Class I-IV Reserves
107	Wiluna	Hummock Grassland, shrub steppe, mulga and <i>Eucalyptus kingsmillii</i> over hard spinifex	3,348,249	100.0	3.1

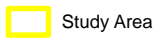


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Jonah Bore


FIGURE 3
Land systems occurring
within the study area
(descriptions from
Pringle *et al.* 1994)


Legend

 Study Area

Land Systems

 RGEARA, Ararak Land System

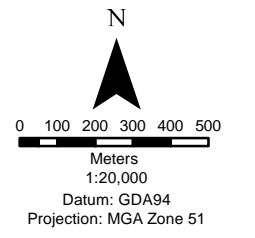
 RGEBLM, Bullimore Land System

 RGESHE, Sherwood Land System



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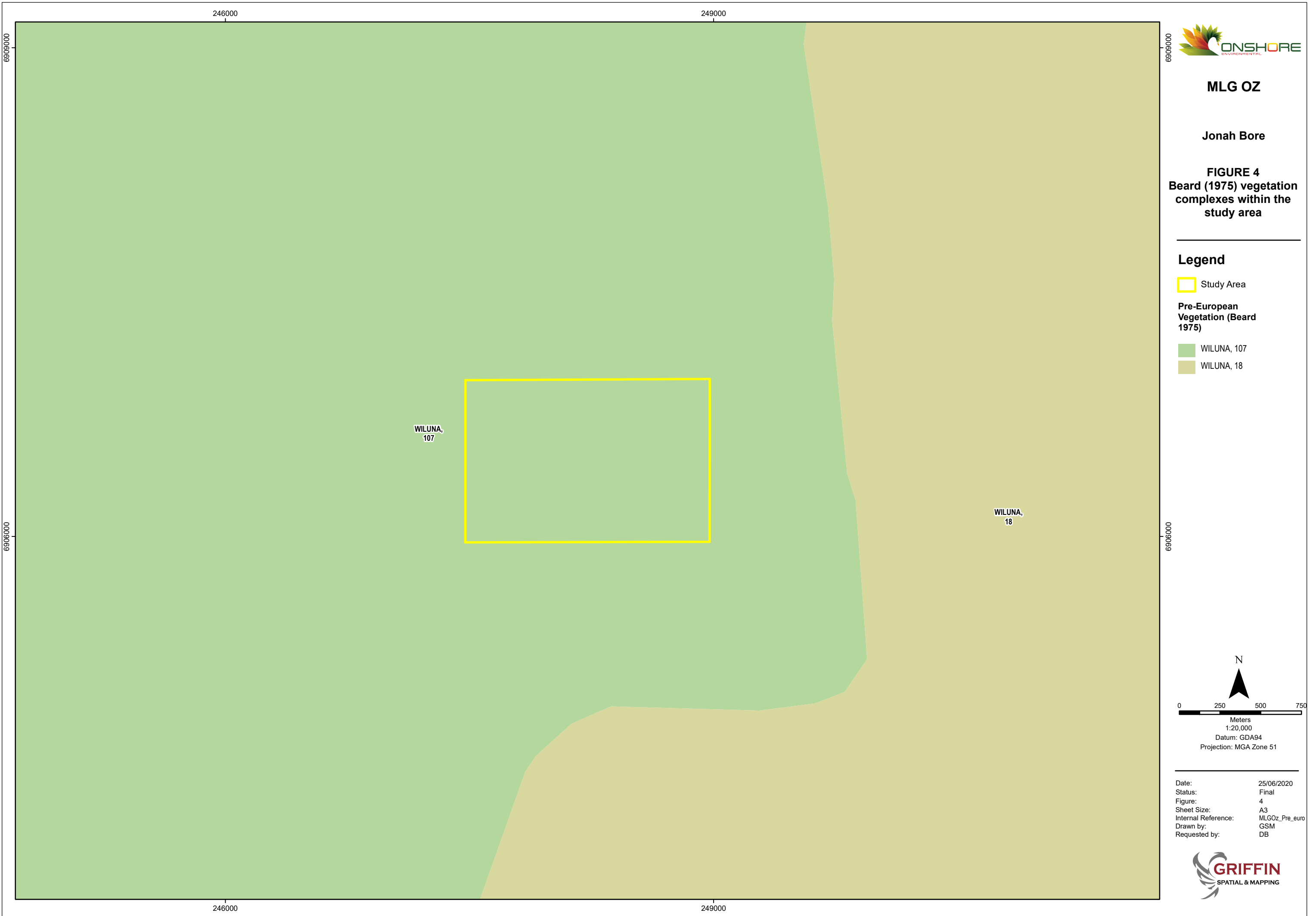
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MLG OZ

Jonah Bore

FIGURE 4
Beard (1975) vegetation
complexes within the
study area

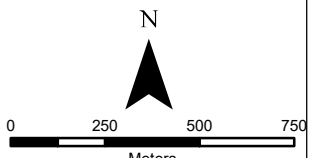
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-  Study Area
- Pre-European Vegetation (Beard 1975)**
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-  WILUNA, 18

WILUNA,
107

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2.0 METHODOLOGY

2.1 Guidance Statements

The desktop assessment was carried out in a manner that was compliant with Environmental Protection Authority (EPA) requirements for the environmental surveying and reporting in Western Australia:

- Technical Guidance Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016a);
- Environmental Factor Guideline: Flora and Vegetation (EPA 2016b); and
- Statement of Environmental Principles, Factors and Objectives (EPA 2020).

2.2 Desktop Assessment

2.2.1 Literature Review

Two regional scale reports relevant to the study area locality were reviewed:

- A summary of bioregional data (Cowan 2001); and
- Vegetation description and mapping by Beard (1976).

There was one historical flora and vegetation survey completed in July 2006 on mining leases M36/657 and M36/187 that included the current study area (Goldfields Landcare Services 2006). Two recent surveys undertaken on behalf of MLG on similar landforms (i.e. sand dunes and sand plains) were also reviewed:

- Onshore Environmental (2020a) Detailed Flora and Vegetation survey Canegrass Project area; and
- Onshore Environmental (2020b) Detailed Flora and Vegetation survey Eight Mile and Mt Burges Project areas.

A number of additional surveys completed on various landforms within the surrounding area were also reviewed as part of the desktop assessment:

- Blackwell and Cala (1977) Yeelirrie Mining Project Vegetation Surveys including revegetation potential;
- EPA (2001) Mt Margaret Nickel-Cobalt Project, Anaconda Nickel Limited, Report and recommendations of the Environmental Protection Authority;
- Onshore Environmental (2003) Field survey: Flora and Vegetation Leinster - Wiluna Optic Fibre Cable Route;
- Onshore Environmental (2003) Field Survey: Flora and Vegetation Meekatharra - Wiluna Optic Fibre Cable Route;
- Onshore Environmental (2004) Honeymoon Well Nickel Project Flora and Vegetation Survey Wedgetail Deposit;
- Woodman Environmental Consulting (2006) Vivien Project Flora and Vegetation Assessment;
- Onshore Environmental (2008) Agnew Gold Mining Company Emu - Vivien Pipeline, Vivien, Vivien Gem, Turret North & Cinderella Project Flora & Vegetation Survey; and
- Onshore Environmental (2008) Agnew Gold Mining Company Crusader, 450 South, Zone 2 and New Woman Projects Flora & Vegetation Survey.

2.2.2 Database Searches

Desktop searches included databases relating to conservation significant flora, TECs and PECs previously collected or described within, or in close proximity to, the study area.

For this report the search was extended beyond the study area to place flora values into a local and regional context. The following databases were searched:

- NatureMap: This database represents the most comprehensive source of information on the distribution of Western Australia's flora, comprising records from the Department of Biodiversity, Conservation and Attractions (DBCA) database and the Western Australian (WA) Herbarium Specimen Database (40 km radial search; accessed 27 May 2020) (DBCA 2020a);
- DBCA's Threatened and Priority flora database was searched to confirm the NatureMap results (50 km radial search; May 2020) (DBCA 2020b);
- DBCA's TEC, PEC and Environmentally Sensitive Areas (ESAs) database was searched to identify significant communities (100 km radial search; May 2020) (DBCA 2020c);
- Environmental Protection and Biodiversity Conservation (EPBC) Act Protected Matters Database (50 km radial search; accessed 27 May 2020) (DoEE 2020); and
- International Union for Conservation of Nature (IUCN) database (accessed 27 May 2020) (IUCN 2020).

A list of flora species that have the potential to occur within the study area was collated from the above database searches.

2.2.3 Land Unit Mapping

Pringle *et al* (1994) completed land system mapping across the Northern Goldfields region, which included the study area. This extensive and comprehensive mapping was developed to provide baseline information about Western Australian rangelands for use in management and conservation. These assessments have defined, characterised and mapped the Western Australian landscape into broadly defined land systems which are then further classified into land units based on landform, soil and vegetation interactions.

The landforms of the study area were inferred from land system mapping and land unit descriptions made for the region by Pringle *et al.* (1994) and Mabbutt (1963), in combination with high resolution aerial imagery of the study area.

2.2.4 Assessment of Conservation Significance

The conservation significance of flora and ecological communities are classified at a Commonwealth, State and Local level on the basis of various Acts and Agreements, including:

International Level:

- IUCN: The IUCN 'Red List' lists species at risk under nine categories (status codes) (Appendix 1).

Commonwealth Level:

- EPBC Act: The Department of Energy and Environment (DoEE) lists threatened flora and ecological communities, which are determined by the Threatened Species Scientific Committee according to criteria set out in the Act. The Act lists flora that are considered to be of conservation significance under one of six categories (Appendix 1).

State Level:

- Biodiversity Conservation Act (BC Act): At a State level, native flora species are protected under the BC Act - Wildlife Conservation Notice. A number of species are assigned an additional level of conservation significance based on a limited number of known populations and the perceived threats to these locations (Appendix 1); and

- DBCA Priority list: DBCA produces a list of Priority species and ecological communities that have not been assigned statutory protection under the BC Act. Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added under Priorities 1, 2 or 3. Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been removed from the threatened species list for other taxonomic reasons, are placed in Priority 4. These species require regular monitoring (see Appendix 1). The list of PECs identifies those that need further investigation before nomination for TEC status at a State level (Appendix 1).

Local Level:

- Species may be considered of local conservation significance because of their patterns of distribution and abundance. Although not formally protected by legislation, such species are acknowledged to be in decline as a result of threatening processes, primarily habitat loss through land clearing. These species may be considered for listing under the DBCA's Priority list if threatening processes are not addressed and populations decline to such an extent that they meet the criteria for conservation listing.

2.2.5 Assessment of Likelihood of Occurrence in the Study Area

A list of conservation significant flora species occurring within a 50 km radius of the study area was compiled during the literature review and database searches. The likelihood of each taxon occurring within the study area was assessed using a set of rankings and criteria (as described in Table 3). The criteria are based on the presence of suitable landforms and distance to known records. The presence of suitable habitat was assessed based on land unit mapping of the study area and knowledge of the geology, landforms, soils and vegetation of adjacent areas.

Table 3 Ranking system used to assign the likelihood that a flora species would occur in the study area.

Rank	Criteria
Recorded	The species has previously been recorded in the study area.
Likely	The species has previously been recorded from a landform/habitat which is present within the study area, and there are previous records within a 20 km radius of the study area.
Possible	The species has previously been recorded from a landform/habitat which is present within the study area, and there are previous records within a 50 km radius of the study area.
Unlikely	The landform/habitat from which the species has previously been recorded is absent within the study area, and/or there are no previous records within a 50 km radius of the study area.

3.0 RESULTS

3.1 Desktop Review

3.1.1 Previous Baseline Flora Surveys

The study area is situated within the Wiluna Sub-region of the Austin Botanical District in the Eremaean Botanical Province (Beard 1976). Historically, regional vegetation was described broadly as mulga bush (Gardner 1942), mulga scrub (Christian *et al.* 1960) or arid scrub (Department of National Development 1955). More detailed studies by CSIRO Division of Land Research were undertaken in 1958 covering the area between Wiluna and Meekatharra (Mabbutt *et al.* 1963). Vegetation was described as a heterogeneous mix of woodland, shrubland and hummock grassland. In total 75 vegetation communities were recognised across the area surveyed. Due to the widespread dominance of the mulga tree layer, many of the communities were defined by characteristic species present in one or more of the understorey strata.

More recently vegetation of the eastern Murchison sub-region was described by Cowan (2001) as dominated by mulga woodlands often rich in ephemerals, along with hummock grasslands, saltbush shrublands and *Halosarcia* shrublands.

There has been one historical flora and vegetation survey undertaken at the study area in July 2006 (Goldfields Landcare Services 2006), with a number of more recent surveys completed in the wider region. Results from these surveys are described in Table 4.

Table 4 Previous surveys completed within and in close proximity to the study area.

Name	Company	Dates	Floristics	Conservation Significant
Previous surveys completed within the study area				
Rare Flora Search and Vegetation Survey for Leahy Haulage PL at Agnew	Goldfields Landcare Services (2006)	25 - 26 July 2006	81 plant taxa	None
Previous surveys completed on behalf of MLG				
Detailed Flora and Vegetation Survey Canegrass Project Area	Onshore Environmental (2020a)	19 - 21 May 2020	76 plant taxa from 18 families and 45 genera	<i>Homalocalyx grandiflorus</i> (P3), <i>Newcastelia insignis</i> (P2)
Detailed Flora and Vegetation survey Eight Mile and Mt Burges Project areas	Onshore Environmental (2020b)	25 - 29 February 2020	188 plant taxa from 37 families and 102 genera	<i>Acacia cylindrica</i> (P3), <i>Caesia viscida</i> (P2, range extension), <i>Chamelaucium</i> sp. Parker Range (B.H. Smith 1255) (P1, range extension), <i>Hakea rigida</i> (P2), <i>Homalocalyx grandiflorus</i> (P3), <i>Lepidosperma lyonsii</i> (P1), <i>Melichrus</i> sp. Coolgardie (K.R. Newbey 8698) (P1), <i>Newcastelia insignis</i> (P2), <i>Phebalium</i> cf. <i>drummondii</i> (P3), <i>Verticordia mitodes</i> (P3)
Previous surveys completed in close proximity to the study area				
Yeelirrie Mining Project Vegetation Surveys including revegetation potential	Blackwell and Cala (1977)	9-10 June 1976, 5 September 1976, 23 March- 2 April 1977	Not recorded	A number of undescribed species
Mt Margaret Nickel-Cobalt Project, Anaconda Nickel Limited, Report and recommendations of the Environmental Protection Authority	EPA (2001)	A summary of surveys completed by Dames & Moore (2000), Landcare Services (1997) and Mattiske Consulting Pty Ltd. (2000).	Not recorded	<i>Stenanthemum patens</i> (P1) ¹ , <i>Eremophila pungens</i> (P4), <i>Hemigenia exilis</i> (P4), <i>Grevillea inconspicua</i> (P4), <i>Baeckea</i> sp. Melita Station ² Two undescribed flora species: <i>Phyllanthus</i> sp. nov. ³ . (LCS 2987) and <i>Acacia</i> aff. <i>resinimarginea</i> ⁴

¹ Previously known as *Stenanthemum* sp. Mt Clifford.

² *Baeckea* sp. Melita Station was recorded as a Priority 1 species at the time of the survey. This species is now known as *Hysterobaeckea occlusa* and is no longer listed as conservation significant.

³ Likely *Phyllanthus baeckeoides* (P3) which occurs in the area.

⁴ There are 11 priority *Acacia* species occurring within the Eastern Murchison subregion.

Name	Company	Dates	Floristics	Conservation Significant
Field survey: Flora and Vegetation Leinster – Wiluna Optic Fibre Cable Route	Onshore Environmental (2003)	15-19 September 2003	188 plant taxa from 33 families and 73 genera	<i>Eremophila pungens</i> (P4), <i>Grevillea inconspicua</i> (P4), <i>Hemigenia exilis</i> (P4), <i>Hysterobaeckea occlusa</i> ⁵ , <i>Calytrix erosipetala</i> ⁶ , <i>Calytrix uncinata</i> ⁷ , <i>Acacia balsamea</i> ⁸
Field Survey: Flora and Vegetation Meekatharra – Wiluna Optic Fibre Cable Route	Onshore Environmental (2003)	8-10 February 2003	Not recorded	<i>Micromyrtus mucronulata</i> (P1) ⁹
Honeymoon Well Nickel Project Flora and Vegetation Survey Wedgetail Deposit	Onshore Environmental (2004)	27-30 March 2004	192 taxa 41 families, 87 genera	None recorded
Vivien Project Flora and Vegetation Assessment	Woodman Environmental Consulting (2006)	July 2006	137 taxa from 35 families	<i>Hysterobaeckea occlusa</i> ¹⁰ , <i>Calytrix erosipetala</i> ¹¹ , <i>Grevillea inconspicua</i> (P4)
Agnew Gold Mining Company Crusader, 450 South, Zone 2 & New Woman Projects Flora & Vegetation Survey	Onshore Environmental (2008)	27 March - 3 April 2008	138 taxa, 37 families and 59 genera	<i>Hybanthus floribundus</i> subsp. <i>chloroxanthus</i> (P3), <i>Eremophila pungens</i> (P4)
Agnew Gold Mining Company Emu – Vivien Pipeline, Vivien, Vivien Gem, Turret North & Cinderella Project Flora & Vegetation Survey	Onshore Environmental (2008)	29 January - 5 February 2008	136 taxa from 31 families and 65 genera	<i>Thryptomene</i> sp. Leinster (B.J. Lepschi & L.A. Craven 4362) (P3), <i>Hysterobaeckea occlusa</i> ¹² , <i>Calytrix erosipetala</i> ¹³ , <i>Hybanthus floribundus</i> subsp. <i>chloroxanthus</i> (P3), <i>Eremophila pungens</i> (P4), <i>Grevillea inconspicua</i> (P4)

⁵ *Baeckea* sp. Melita Station was recorded as a Priority 1 species at the time of the survey. This species is now known as *Hysterobaeckea occlusa* and is no longer listed as conservation significant.

⁶ This species was a Priority 3 species at the time of survey but is no longer listed as conservation significant.

⁷ This species was a Priority 3 species at the time of survey but is no longer listed as conservation significant.

⁸ This species was a Priority 4 species at the time of survey but is no longer listed as conservation significant.

⁹ This species was known as *Micromyrtus racemosa* var. *mucronata* at the time of survey.

¹⁰ *Baeckea* sp. Melita Station was recorded as a Priority 1 species at the time of the survey. This species is now known as *Hysterobaeckea occlusa* and is no longer listed as conservation significant.

¹¹ This species was a Priority 3 species at the time of survey but is no longer listed as conservation significant.

¹² *Baeckea* sp. Melita Station was recorded as a Priority 1 species at the time of the survey. This species is now known as *Hysterobaeckea occlusa* and is no longer listed as conservation significant.

¹³ This species was a Priority 3 species at the time of survey but is no longer listed as conservation significant.

3.1.2 Land Systems and Land Units - Rangeland Mapping

The study area lies within the Bullimore Land System as mapped by Pringle *et al* (1994), which is characterised by broadly undulating red sandplains with occasional occurrences of near parallel sand dunes, generally supporting vegetation dominated by spinifex hummock grasslands.

Interpretation of aerial imagery for the study area identified two land units as occurring within the study area; the 'sand sheet' and the 'sand dune' land units. The study area is predominantly covered by a sandplain with a number of near parallel, aeolian sand dunes (Figure 5, Table 5). Vegetation of these land units is described as being variable but generally dominated by hard spinifex.

Table 5 Characteristics of land units relevant to the Bullimore Land System (derived from Pringle *et al* 1994).

Land Unit	Definition	Vegetation
Sand sheet	Extensive level to gently undulating plains, occasionally more than 10km wide	Hard spinifex hummock grasslands with generally very variable scattered tall shrubs and trees (<i>Acacia</i> spp. Proteaceous species and <i>Eucalyptus</i> spp.), often with heath low shrubs
Sand dune	Generally linear, occasionally reticulate, aeolian deposits to 5 km long and generally < 10 m high	Very variable; dominated alternatively by spinifex, low myrtaceous heath or tall proteaceous shrubs, rarely by trees; heath component invariably prominent

MLG OZ

Jonah Bore

FIGURE 5
Vegetation Types
(inferred land units from
land system mapping)

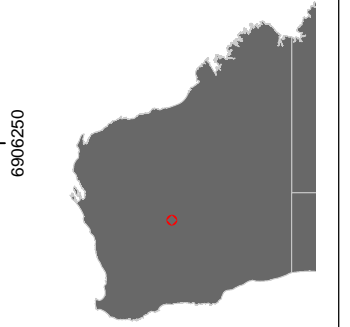


Legend

Jonah Bore Study Area

Vegetation Types

	Disturbed	Existing disturbed mine area
	Sand Dune	Very variable; dominated alternatively by spinifex, low myrtaceous heath or tall proteaceous shrubs, rarely by trees; heath component invariably prominent
	Sand Sheet	Hard spinifex hummock grasslands with generally very variable scattered tall shrubs and trees (Acacia spp. Proteaceous species and Eucalyptus spp.), often with heath low shrubs



N

0 50 100 150

Meters
1:5,000
Datum: GDA94
Projection: MGA Zone 51

Date: 07/07/2020
Status: Final
Figure: 5
Sheet Size: A3
Internal Reference: MLG_Oz_JB_VT
Drawn by: GSM
Requested by: DB

3.2 Flora Species

A total number of 358 plant taxa (including varieties and subspecies) from 49 families and 151 genera have the potential to occur within the study area based on the desktop assessment (Table 6, Appendix 2). The total species list includes those species recorded from the 40 km radial search from Nature Map (DBCA 2020a), a 50 km radial search for conservation significant flora (DBCA 2020b), and the 50 km Protected Matters Database search (DoEE 2020). It is noted that the actual number of taxa occurring within the study area boundary is likely to be lower than the above estimate due to the specific landforms represented (i.e. sand plains and sand dunes).

Species representation within the region was greatest amongst the Fabaceae, Asteraceae, Chenopodiaceae, Scrophulariaceae, Poaceae and Myrtaceae families (Table 5). The most speciose genera were *Eremophila* (34 taxa), *Acacia* (25 taxa), *Eucalyptus* (13 taxa), *Ptilotus* (10 taxa) and *Maireana* (10 taxa).

Table 6 Statistics for flora potentially occurring within the study area.

Overview	No. Taxa
Families	49
Genera	151
Taxa (species, subspecies, varieties)	358
Native Taxa	346
Introduced Taxa	11
Threatened Flora	0
Priority Flora	14
Speciose Families	No. Taxa
Fabaceae	47
Asteraceae	44
Chenopodiaceae	41
Scrophulariaceae	34
Poaceae	29
Myrtaceae	29
Goodeniaceae	12
Amaranthaceae	10
Malvaceae	10
Speciose Genera	No. Taxa
<i>Eremophila</i>	34
<i>Acacia</i>	25
<i>Eucalyptus</i>	13
<i>Ptilotus</i>	10
<i>Maireana</i>	10
<i>Swainsona</i>	9
<i>Sclerolaena</i>	8
<i>Dodonaea</i>	7
<i>Atriplex</i>	7
<i>Rhodanthe</i>	7

3.3 Significant Flora

Database searches were undertaken around the study area (as detailed in Section 2.2) to identify conservation significant flora previously collected or identified within, or in the vicinity of, the study area.

3.3.1 Threatened Flora listed under the EPBC Act

A search of the EPBC Act Protected Matters database was undertaken for a 50 km radius around the study area (DoEE 2020). No Threatened Flora (T) as listed under the EPBC Act were recorded as occurring or having suitable habitat within the 50 km search radius.

3.3.2 Threatened Flora listed under the IUCN Red List

A search of the International Union for Conservation of Nature (IUCN) database (IUCN 2020) determined that no Threatened Flora taxa were likely to occur within the study area.

3.3.3 Threatened Flora listed under the BC Act

No Threatened Flora taxa were identified from the DBCA rare flora database search (DBCA 2020b) as occurring within a 50 km radius of the study area.

3.3.4 Priority Flora recognised by the DBCA

The DBCA rare flora database and NatureMap searches identified fourteen (14) Priority flora taxa as potentially occurring within a 50 km radius of the study area (Table 7). There was one Priority 1 taxon, one Priority 2 taxon, ten Priority 3 taxa and two Priority 4 taxa recorded. The likelihood of these taxa occurring within the study area is presented in Table 7.

Based on the known distribution and habitat preferences of the 14 Priority flora taxa recorded from the database searches, the Priority 3 flora taxon *Baeckea* sp. Sandstone (C.A. Gardner s.n. 26 Oct. 1963) was the only species determine to be *likely* to occur within the study area (Table 7). This taxon has been recorded on red sand plains approximately 2 km southwest of the study area.

The remaining 13 Priority flora taxa were considered *unlikely* to occur within the study area due to the absence of suitable habitat (Table 7).

Table 7 Significant flora previously recorded from a 50 km search radius of the study area (DBCA 2020b).

Taxon	Cons Code	Life Form	Habitat Preference	Likelihood in study area
<i>Baeckea</i> sp. Sandstone (C.A. Gardner s.n. 26 Oct. 1963)	P3	Perennial	Red sand.	Likely
<i>Calytrix warburtonensis</i>	P2	Perennial	Rocky hills, breakaways.	Unlikely
<i>Eremophila arachnoides</i> subsp. <i>arachnoides</i>	P3	Perennial	Calcrete soils. Shallow loam over limestone.	Unlikely
<i>Eremophila pungens</i>	P4	Perennial	Red soils with ironstone gravels. Stony plains.	Unlikely
<i>Goodenia modesta</i>	P3	Annual	Playa formation in paleodrainage channel. Salt lakes. Grey clay.	Unlikely

Taxon	Cons Code	Life Form	Habitat Preference	Likelihood in study area
<i>Grevillea inconspicua</i>	P4	Perennial	Greenstone outcrops, adjacent to drainage lines. Ironstone ridge and stony plains.	Unlikely
<i>Hemigenia exilis</i>	P4	Perennial	Flat ground and low rises above creek. Quartz-feldspar gravel conglomerate overlying a weathered granite/felsic gneiss bedrock. Red loam and red sandy clay.	Unlikely
<i>Homalocalyx echinulatus</i>	P2	Perennial	Lower hillslopes with mantle of banded ironstone, quartz and metasediments. Skeletal red brown sandy clay loam soils.	Unlikely
<i>Korthalsella leucothrix</i>	P1	Aerial parasite; Perennial	Red sandy clay. On <i>Acacia acuminata</i> and <i>A. craspedocarpa</i> .	Unlikely
<i>Mirbelia ferricola</i>	P3	Perennial	Banded ironstone hill crests. Skeletal soils.	Unlikely
<i>Phyllanthus baeckeoides</i>	P3	Perennial	Gentle slopes, gravelly ironstone soils.	Unlikely
<i>Thryptomene nealensis</i>	P3	Perennial	Growing on top of an irregular broken duricrust breakaway, skeletal soils.	Unlikely
<i>Thryptomene</i> sp. Leinster (B.J. Lepschi & L.A. Craven 4362)	P3	Perennial	Rocky weathered granite, sandstone outcrops and duricrust breakaways. Brown sandy clay loam, sandy clay in depressions on weathered granite.	Unlikely
<i>Verticordia jamiesonii</i>	P3	Perennial	Plateau of duricrust breakaway. Rocky weathered granite with pockets of small sandy clay in depressions.	Unlikely

3.1.5 Locally Significant Flora

Significant flora populations are generally restricted to certain habitat types and substrates. Due to the prevalence of sand dune habitats across arid Australia, these habitats are not generally known to harbour rare flora unless areas of sand dunes are regionally isolated or have been under investigated floristically. Due to the regional isolation and scattered occurrence of some of the sand dune belts across the Bullimore Land System (and Eastern Murchison bioregion in general) some of the flora occurring on sand dunes may be locally restricted.

3.4 Introduced Flora

A total of eleven introduced species were assessed as potentially occurring within the study area from the database searches:

- **Asphodelus fistulosus* (Onion Weed);
- **Citrullus colocynthis* (Bitter Apple);
- **Erodium aureum*;
- **Mentha pulegium* (Pennyroyal);
- **Digitaria ciliaris* (Summer Grass);
- **Setaria verticillata* (Whorled Pigeon Grass);
- **Rumex hypogaeus* (Doublegee);
- **Solanum nigrum* (Black Berry Nightshade);
- **Tribulus terrestris* (Caltrop);

- **Carrichtera annua* (Ward's Weed); and
- **Cenchrus ciliaris* (Buffel Grass).

None of the above species are listed as Declared Pests under the *Biosecurity and Agriculture Management Act 2007* (BAM Act 2007).

3.5 Representation & Reservation of Vegetation

Regional mapping completed by Beard (1976) was utilised to assess the representation of vegetation within the study area. One Beard vegetation association was represented within the study area (Table 8). In terms of representation, the Western Australian Government is committed to the National Objectives Targets for Biodiversity Conservation which includes a target that prevents clearance of ecological communities with an extent below 30% of that present at pre-European settlement (Department of Natural Resources and Environment 2002, EPA 2000).

When considering representation at the State level, the Beard association represented within the study area currently has 99.95% of the pre-European extent remaining (Government of Western Australia 2018). The study area is located within the Murchison bioregion, specifically within the Eastern Murchison subregion (as discussed in Section 1.4). When considering the representation of vegetation at the IBRA regional level and IBRA system level, approximately 99% of the pre-European extent remains for the vegetation association represented (Table 8). The study area falls entirely within the Shire of Leonora. At this local level approximately 99% of the pre-European extent remains for the vegetation association represented at a local level (Table 8). Vegetation within the study area is therefore determined to be well represented at all levels (statewide, bioregional [IBRA region and IBRA sub-region] and local).

In terms of reservation, there is a benchmark for a minimum of 15% of each Beard vegetation association to be protected in Class I-IV reserves (Commonwealth of Australia 1997). The proportion of the vegetation association occurring within secure reserves ranges between 1% and 5% at all levels (Table 8). However, given that the pre-European extent of the Beard vegetation association represented within the study area will not be significantly reduced (i.e. will remain well above the 30% threshold within the bioregion), the reservation status is determined to be of least concern for biodiversity conservation.

Table 8 Pre-European extent of vegetation represented on the basis of identified datasets (Government of Western Australia 2018).

Vegetation System / Association	Pre-European Extent (ha)	Current Extent (ha)	% European Extent Remaining	Pre-Current Extent in Class I-IV Reserves (ha)	% Extent in Class Reserves	Current Extent in Class I-IV DBCA Managed Lands (ha)	% Current Extent DBCA Managed Lands
Statewide							
	2,815,387.35	2,813,995.93	99.95	324942.557	1.65	324942.557	11.55
Beard Vegetation System – Wiluna							
	2,732,464.57	2,731,073.14	99.95	46,560.91	1.70	323,018.79	11.83
IBRA Region – Murchison							
	2,792,383.45	2,790,992.03	99.95	46,521.94	1.67	324,017.26	11.61
IBRA Sub-Region – East Murchison							
	2,785,303.02	2,783,911.60	99.95	46,521.94	1.67	322,406.58	11.58
Local Government – Shire of Leonora							
	229,689.82	229,387.36	99.87	11,707.76	5.10	11,707.76	5.10

3.6 Significant Ecological Communities

3.6.1 TECs listed under Federal Legislation

A search of the EPBC Act Protected Matters database (DoEE 2020) confirmed there were no federally listed TECs within a 100 km radius of the study area (Table 9).

3.6.2 TECs listed under State Legislation

A search of the DBCA ecological community database (DBCA 2019b) confirmed there was one state listed TEC record within 100 km radius of the study area; The Depot Springs Stygofauna Community (Table 9). This is listed as Vulnerable (criterion B) under WA criteria (Appendix 1). This ecological community occurs 30 km to the west of the study area and is considered very unlikely to occur due to the absence of drainage features within the study area.

3.6.3 PECs recognised by DBCA

A search of DBCA's ecological community database (DBCA 2019) confirmed that seven PECs were known to occur within a 100 km radius of the study area. These communities are all listed as Priority 1 by the DBCA. There are two types of PECs that were identified from the searches and predominately occur within the Murchison Region. The first group includes unique calcrete groundwater stygofauna assemblages associated with paleodrainage systems. These PECs are significant due to the invertebrate fauna and are not generally noted for their flora assemblages. The second group of PECs are characterised by rocky ranges composed of banded ironstone formation (BIF) with unique flora assemblages. Neither of these landforms occur within or immediately surrounding the study area, hence none of these PECs are likely to occur within the study area.

Landforms within the study area are comprised of sandplains and sand dunes. These landforms are not currently listed within any descriptions of TECs or PECs within the Murchison bioregion. Based on inferred landforms of the study area and known habitat types of currently documented TECs and PECs, it is unlikely that there will be undocumented significant ecological communities within the study area.

Table 9 List of TECs and PECs occurring within 100km of the study area.

Community Name	Characteristics	Threats	Category	Location
Threatened Ecological Communities				
Depot Springs stygofauna community	Unique assemblages of invertebrates have been identified in the groundwater calcretes.	Mining	VU B)	30 km W
Priority Ecological Communities				
Booylgoo Range vegetation complexes (banded ironstone formation)	Banded ironstone formation	Mining	Priority 1	43 km W
Kaluwiri calcrete groundwater assemblage type on Raeside palaeodrainage on Kaluwiri Station	Unique assemblages of invertebrates have been identified in the groundwater calcretes.	Mining	Priority 1	35 km NW
Lake Miranda east calcrete groundwater assemblage types on Carey palaeodrainage on Yakabindie Station	Unique assemblages of invertebrates have been identified in the groundwater calcretes.	Mining	Priority 1	17 km N

Community Name	Characteristics	Threats	Category	Location
Threatened Ecological Communities				
Pinnacles calcrete groundwater assemblage type on Raeside palaeodrainage on Pinnacles Station	Unique assemblages of invertebrates have been identified in the groundwater calcretes.	Mining	Priority 1	35 km SW
Violet Range (Perseverance Greenstone Belt) vegetation complexes (banded ironstone formation)	Banded ironstone formation	Mining	Priority 1	34 km NNW
Yakabindie calcrete groundwater assemblage type on Carey palaeodrainage on Yakabindie Station	Unique assemblages of invertebrates have been identified in the groundwater calcretes.	Mining	Priority 1	30 km N
Yandal calcrete groundwater assemblage type on Carey palaeodrainage on Yandal Station	Unique assemblages of invertebrates have been identified in the groundwater calcretes.	Mining	Priority 1	50 km NE

4.0 SUMMARY

A total number of 358 plant taxa (including varieties and subspecies) from 49 families and 151 genera were recorded from database searches within a 40 km radius search of the study area. Species representation was greatest among the Fabaceae, Asteraceae, Chenopodiaceae, Scrophulariaceae, Poaceae and Myrtaceae families. The most speciose genera were *Eremophila* (34 taxa), *Acacia* (25 taxa), *Eucalyptus* (13 taxa), *Ptilotus* (10 taxa) and *Maireana* (10 taxa).

None of the plant taxa recorded from the database search were gazetted as Threatened Flora pursuant to the BC Act or listed under the EPBC Act.

A total of 14 Priority flora taxa, as listed by the DBCA, were identified from the database searches. One Priority flora taxon was identified as *likely* to occur within the study area based on the known distribution and habitat preference of the taxon; *Baeckea* sp. Sandstone (C.A. Gardner s.n. 26 Oct. 1963) (Priority 3). The remaining 13 Priority flora were considered *unlikely* to occur within the study area.

No Declared Pests listed under the BAM Act were recorded from the 40 km radial database search. A total of eleven introduced species were assessed as potentially occurring within the study area.

Vegetation within the study area was determined to be well represented at all levels (statewide, bioregional [IBRA region and IBRA sub-region] and local), with greater than 99% of the pre-European extent remaining for the sole Beard (1976) vegetation association represented within the study area. The proportion of the same vegetation association occurring within secure (Class I-IV) reserves is 1 percent at the state level, which is under the 15% minimum standard. However, given that the pre-European extent of the Beard vegetation association will not be significantly reduced (i.e. it will remain well above the 30% threshold within the bioregion), the reservation status is determined to be of least concern for biodiversity conservation.

It was determined to be unlikely that vegetation within the study area was aligned with any federal or state listed TECs or state listed PECs.

5.0 STUDY TEAM

The desktop flora and vegetation survey was planned, co-ordinated and executed by the following personnel:

Onshore Environmental Consultants P/L
ABN 41 095 837 120
PO Box 227
YALLINGUP WA 6282
M 0427 339 842
Email info@onshoreenvironmental.com.au

Project Staff

Dr Darren Brearley	PhD	Project Manager and Principal Botanist
Ms Jessica Waters	BSc	Senior Ecologist
Mr Todd Griffin		GIS Specialist

6.0 REFERENCES

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APPENDIX 1

Conservation Codes

Conservation codes for Western Australian Flora and Fauna



Department of Biodiversity,
Conservation and Attractions

CONSERVATION CODES

For Western Australian Flora and Fauna

Threatened, Extinct and Specially Protected fauna or flora¹ are species² 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.

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.

¹The definition of flora includes algae, fungi and lichens

²Species 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).

Conservation categories for flora described under the EPBC Act

Category	Description
Extinct (EX)	A species is extinct if there is no reasonable doubt that the last member of the species has died.
Extinct in the Wild (EW)	A species is categorised as extinct in the wild if it is only known to survive in cultivations, in captivity, or as a naturalised population well outside its past range; or if it has not been recorded in its known/expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically Endangered (CE)	The species is facing an extremely high risk of extinction in the wild and in the immediate future.
Endangered (EN)	The species is likely to become extinct unless the circumstances and factors threatening its abundance, survival, or evolutionary development cease to operate; or its numbers have been reduced to such a critical level, or its habitats have been so drastically reduced, that it is in immediate danger of extinction.
Vulnerable (VU)	Within the next 25 years, the species is likely to become endangered unless the circumstances and factors threatening its abundance, survival or evolutionary development cease to operate.
Conservation Dependent (CD)	The species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.

Conservation categories for species described under the IUCN

Category	Description
Extinct (EX)	A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
Extinct in the Wild (EW)	A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past range. A taxon is presumed Extinct in the Wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
Critically Endangered (CE)	A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered, and it is therefore considered to be facing an extremely high risk of extinction in the wild.
Endangered (EN)	A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered, and it is therefore considered to be facing a very high risk of extinction in the wild.
Vulnerable (VU)	A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable, and it is therefore considered to be facing a high risk of extinction in the wild.
Near Threatened (NT)	A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.
Data Deficient (DD)	A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases great care should be exercised in choosing between DD and a threatened status. If the range of a taxon is suspected to be relatively circumscribed, and a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified.

DEFINITIONS AND CRITERIA FOR THREATENED 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).

<p>Vulnerable (VU)</p> <p>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.</p> <p>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):</p> <p>A) The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated.</p> <p>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.</p> <p>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.</p>
<p>DEFINITIONS AND CRITERIA FOR PRIORITY ECOLOGICAL COMMUNITIES</p>
<p>Priority One: Poorly-known ecological communities:</p> <p>Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤ 5 occurrences or a total area of ≤ 100ha). 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.</p>
<p>Priority Two: Poorly-known ecological communities</p> <p>Communities that are known from few occurrences with a restricted distribution (generally ≤ 10 occurrences or a total area of ≤ 200ha). At least some occurrences are not believed to be under immediate threat 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.</p>
<p>Priority Three: Poorly known ecological communities</p> <p>(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:</p> <p>(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, or;</p> <p>(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, and inappropriate fire regimes.</p> <p>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.</p>
<p>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.</p> <p>(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.</p> <p>(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 Vulnerable.</p> <p>(iii) Ecological communities that have been removed from the list of threatened communities during the past five years.</p>
<p>Priority Five: Conservation Dependent ecological communities</p> <p>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.</p>

APPENDIX 2

Total flora list from the study area

Family	Genus	Species	Infra Rank	Infra Name	Cons. Code
Aizoaceae	<i>Gunnioopsis</i>	<i>propinqua</i>			
Aizoaceae	<i>Gunnioopsis</i>	<i>rodwayi</i>			
Aizoaceae	<i>Tetragonia</i>	<i>eremaea</i>			
Amaranthaceae	<i>Ptilotus</i>	<i>aeroides</i>			
Amaranthaceae	<i>Ptilotus</i>	<i>chamaecladus</i>			
Amaranthaceae	<i>Ptilotus</i>	<i>exaltatus</i>			
Amaranthaceae	<i>Ptilotus</i>	<i>gaudichaudii</i>			
Amaranthaceae	<i>Ptilotus</i>	<i>helipteroides</i>			
Amaranthaceae	<i>Ptilotus</i>	<i>obovatus</i>	var.	<i>obovatus</i>	
Amaranthaceae	<i>Ptilotus</i>	<i>polystachyus</i>			
Amaranthaceae	<i>Ptilotus</i>	<i>roei</i>			
Amaranthaceae	<i>Ptilotus</i>	<i>rotundifolius</i>			
Amaranthaceae	<i>Ptilotus</i>	<i>schwartzii</i>			
Araliaceae	<i>Trachymene</i>	<i>cyanopetala</i>			
Araliaceae	<i>Trachymene</i>	<i>ornata</i>			
Asparagaceae	<i>Thysanotus</i>		sp.	Eremaean (S. van Leeuwen 1067)	
Asphodelaceae	* <i>Asphodelus</i>	<i>fistulosus</i>			
Asteraceae	<i>Actinobole</i>	<i>oldfieldianum</i>			
Asteraceae	<i>Brachyscome</i>	<i>ciliaris</i>			
Asteraceae	<i>Calocephalus</i>	<i>multiflorus</i>			
Asteraceae	<i>Calotis</i>	<i>hispidula</i>			
Asteraceae	<i>Calotis</i>	<i>multicaulis</i>			
Asteraceae	<i>Cephalipterum</i>	<i>drummondii</i>			
Asteraceae	<i>Chrysocephalum</i>	<i>eremaeum</i>			
Asteraceae	<i>Chthonocephalus</i>	<i>pseudevax</i>			
Asteraceae	<i>Chthonocephalus</i>	<i>viscosus</i>			
Asteraceae	<i>Cratystylis</i>	<i>subspinescens</i>			
Asteraceae	<i>Erodiophyllum</i>	<i>acanthocephalum</i>			
Asteraceae	<i>Erymophyllum</i>	<i>ramosum</i>	subsp.	<i>ramosum</i>	
Asteraceae	<i>Helipterum</i>	<i>craspedioides</i>			
Asteraceae	<i>Isoetopsis</i>	<i>graminifolia</i>			
Asteraceae	<i>Leiocarpa</i>	<i>semicalva</i>	subsp.	<i>semicalva</i>	
Asteraceae	<i>Lemooria</i>	<i>burkittii</i>			
Asteraceae	<i>Leucochrysum</i>	<i>stipitatum</i>			
Asteraceae	<i>Minuria</i>	<i>cunninghamii</i>			
Asteraceae	<i>Minuria</i>	<i>gardneri</i>			
Asteraceae	<i>Minuria</i>	<i>integerrima</i>			
Asteraceae	<i>Minuria</i>	<i>leptophylla</i>			
Asteraceae	<i>Myriocephalus</i>	<i>querinae</i>			
Asteraceae	<i>Olearia</i>	<i>humilis</i>			
Asteraceae	<i>Olearia</i>	<i>stuartii</i>			

Family	Genus	Species	Infra Rank	Infra Name	Cons. Code
Asteraceae	<i>Pluchea</i>	<i>dentex</i>			
Asteraceae	<i>Podolepis</i>	<i>aristata</i>	subsp.	<i>affinis</i>	
Asteraceae	<i>Podolepis</i>	<i>capillaris</i>			
Asteraceae	<i>Podolepis</i>	<i>kendallii</i>			
Asteraceae	<i>Podotheca</i>	<i>gnaphalioides</i>			
Asteraceae	<i>Pogonolepis</i>	<i>stricta</i>			
Asteraceae	<i>Quinqueremulus</i>	<i>linearis</i>			
Asteraceae	<i>Rhodanthe</i>	<i>chlorocephala</i>	subsp.	<i>splendida</i>	
Asteraceae	<i>Rhodanthe</i>	<i>citrina</i>			
Asteraceae	<i>Rhodanthe</i>	<i>floribunda</i>			
Asteraceae	<i>Rhodanthe</i>	<i>humboldtiana</i>			
Asteraceae	<i>Rhodanthe</i>	<i>maryonii</i>			
Asteraceae	<i>Rhodanthe</i>	<i>polakii</i>			
Asteraceae	<i>Rhodanthe</i>	<i>sterilescens</i>			
Asteraceae	<i>Schoenia</i>	<i>ayersii</i>			
Asteraceae	<i>Senecio</i>	<i>glossanthus</i>			
Asteraceae	<i>Senecio</i>	<i>gregorii</i>			
Asteraceae	<i>Senecio</i>	<i>magnificus</i>			
Asteraceae	<i>Trichanthodium</i>	<i>skirrophorum</i>			
Asteraceae	<i>Waitzia</i>	<i>acuminata</i>			
Aytoniaceae	<i>Asterella</i>	<i>drummondii</i>			
Boraginaceae	<i>Halgania</i>	<i>cyanea</i>			
Boraginaceae	<i>Heliotropium</i>	<i>inexplicitum</i>			
Boraginaceae	<i>Trichodesma</i>	<i>zeylanicum</i>			
Brassicaceae	<i>Carrichtera</i>	<i>annua</i>			
Brassicaceae	<i>Lepidium</i>	<i>oxytrichum</i>			
Brassicaceae	<i>Lepidium</i>	<i>phleobopetalum</i>			
Brassicaceae	<i>Menkea</i>	<i>australis</i>			
Brassicaceae	<i>Menkea</i>	<i>sphaerocarpa</i>			
Brassicaceae	<i>Stenopetalum</i>	<i>filifolium</i>			
Casuarinaceae	<i>Casuarina</i>	<i>obesa</i>			
Casuarinaceae	<i>Casuarina</i>	<i>pauper</i>			
Celastraceae	<i>Stackhousia</i>	<i>megaloptera</i>			
Celastraceae	<i>Stackhousia</i>	<i>muricata</i>	subsp.	annual (W.R. Barker 2172)	
Chenopodiaceae	<i>Atriplex</i>	<i>acutibractea</i>	subsp.	<i>acutibractea</i>	
Chenopodiaceae	<i>Atriplex</i>	<i>bunburyana</i>			
Chenopodiaceae	<i>Atriplex</i>	<i>codonocarpa</i>			
Chenopodiaceae	<i>Atriplex</i>	<i>holocarpa</i>			
Chenopodiaceae	<i>Atriplex</i>	<i>spongiosa</i>			
Chenopodiaceae	<i>Atriplex</i>	<i>stipitata</i>			
Chenopodiaceae	<i>Atriplex</i>	<i>vesicaria</i>			

Family	Genus	Species	Infra Rank	Infra Name	Cons. Code
Chenopodiaceae	<i>Dissocarpus</i>	<i>paradoxus</i>			
Chenopodiaceae	<i>Dysphania</i>	<i>cristata</i>			
Chenopodiaceae	<i>Dysphania</i>	<i>kalpari</i>			
Chenopodiaceae	<i>Dysphania</i>	<i>melanocarpa</i>	forma.	<i>melanocarpa</i>	
Chenopodiaceae	<i>Dysphania</i>	<i>melanocarpa</i>			
Chenopodiaceae	<i>Dysphania</i>	<i>saxatilis</i>			
Chenopodiaceae	<i>Enchylaena</i>	<i>tomentosa</i>	var.	<i>tomentosa</i>	
Chenopodiaceae	<i>Eremophea</i>	<i>spinosa</i>			
Chenopodiaceae	<i>Eriochiton</i>	<i>sclerolaenoides</i>			
Chenopodiaceae	<i>Maireana</i>	<i>amoena</i>			
Chenopodiaceae	<i>Maireana</i>	<i>carnosa</i>			
Chenopodiaceae	<i>Maireana</i>	<i>convexa</i>			
Chenopodiaceae	<i>Maireana</i>	<i>georgei</i>			
Chenopodiaceae	<i>Maireana</i>	<i>glomerifolia</i>			
Chenopodiaceae	<i>Maireana</i>	<i>pentatropis</i>			
Chenopodiaceae	<i>Maireana</i>	<i>pyramidata</i>			
Chenopodiaceae	<i>Maireana</i>	<i>thesioides</i>			
Chenopodiaceae	<i>Maireana</i>	<i>trichoptera</i>			
Chenopodiaceae	<i>Maireana</i>	<i>triptera</i>			
Chenopodiaceae	<i>Rhagodia</i>	<i>drummondii</i>			
Chenopodiaceae	<i>Rhagodia</i>	<i>preissii</i>			
Chenopodiaceae	<i>Salsola</i>	<i>australis</i>			
Chenopodiaceae	<i>Sclerolaena</i>	<i>cuneata</i>			
Chenopodiaceae	<i>Sclerolaena</i>	<i>densiflora</i>			
Chenopodiaceae	<i>Sclerolaena</i>	<i>deserticola</i>			
Chenopodiaceae	<i>Sclerolaena</i>	<i>diacantha</i>			
Chenopodiaceae	<i>Sclerolaena</i>	<i>eriacantha</i>			
Chenopodiaceae	<i>Sclerolaena</i>	<i>eurotioides</i>			
Chenopodiaceae	<i>Sclerolaena</i>	<i>fimbriolata</i>			
Chenopodiaceae	<i>Sclerolaena</i>	<i>obliquicuspis</i>			
Chenopodiaceae	<i>Tecticornia</i>	<i>indica</i>	subsp.	<i>bidens</i>	
Chenopodiaceae	<i>Tecticornia</i>	<i>laevigata</i>			
Chenopodiaceae	<i>Tecticornia</i>	<i>undulata</i>			
Chenopodiaceae	<i>Tecticornia</i>		sp.	Dennys Crossing (K.A. Shepherd & J. English KS 552)	
Colchicaceae	<i>Wurmbea</i>	<i>deserticola</i>			
Convolvulaceae	<i>Convolvulus</i>	<i>clementii</i>			
Convolvulaceae	<i>Duperreya</i>	<i>commixta</i>			
Crassulaceae	<i>Crassula</i>	<i>colorata</i>	var.	<i>acuminata</i>	
Cucurbitaceae	* <i>Citrullus</i>	<i>colocynthis</i>			
Cupressaceae	<i>Callitris</i>	<i>columellaris</i>			

Family	Genus	Species	Infra Rank	Infra Name	Cons. Code
Cyperaceae	<i>Cyperus</i>	<i>gymnocaulos</i>			
Cyperaceae	<i>Fimbristylis</i>	<i>dichotoma</i>			
Euphorbiaceae	<i>Bertya</i>	<i>dimerostigma</i>			
Euphorbiaceae	<i>Euphorbia</i>	<i>drummondii</i>			
Euphorbiaceae	<i>Euphorbia</i>	<i>porcata</i>			
Fabaceae	<i>Acacia</i>	<i>aneura</i>			
Fabaceae	<i>Acacia</i>	<i>aptaneura</i>			
Fabaceae	<i>Acacia</i>	<i>balsamea</i>			
Fabaceae	<i>Acacia</i>	<i>burkittii</i>			
Fabaceae	<i>Acacia</i>	<i>caesaneura</i>			
Fabaceae	<i>Acacia</i>	<i>craspedocarpa</i>			
Fabaceae	<i>Acacia</i>	<i>doreta</i>			
Fabaceae	<i>Acacia</i>	<i>effusifolia</i>			
Fabaceae	<i>Acacia</i>	<i>grasbyi</i>			
Fabaceae	<i>Acacia</i>	<i>heteroneura</i>	var.	<i>prolixa</i>	
Fabaceae	<i>Acacia</i>	<i>incurvaneura</i>			
Fabaceae	<i>Acacia</i>	<i>jamesiana</i>			
Fabaceae	<i>Acacia</i>	<i>kempeana</i>			
Fabaceae	<i>Acacia</i>	<i>mulganeura</i>			
Fabaceae	<i>Acacia</i>	<i>murrayana</i>			
Fabaceae	<i>Acacia</i>	<i>nyssophylla</i>			
Fabaceae	<i>Acacia</i>	<i>oswaldii</i>			
Fabaceae	<i>Acacia</i>	<i>pteraneura</i>			
Fabaceae	<i>Acacia</i>	<i>quadrimarginea</i>			
Fabaceae	<i>Acacia</i>	<i>ramulosa</i>	var.	<i>linophylla</i>	
Fabaceae	<i>Acacia</i>	<i>ramulosa</i>			
Fabaceae	<i>Acacia</i>	<i>sibina</i>			
Fabaceae	<i>Acacia</i>	<i>tetragonophylla</i>			
Fabaceae	<i>Acacia</i>	<i>thoma</i>			
Fabaceae	<i>Acacia</i>	<i>victoriae</i>			
Fabaceae	<i>Glycine</i>	<i>canescens</i>			
Fabaceae	<i>Indigofera</i>	<i>georgei</i>			
Fabaceae	<i>Kennedia</i>	<i>prorepens</i>			
Fabaceae	<i>Leptosema</i>	<i>chambersii</i>			
Fabaceae	<i>Mirbelia</i>	<i>ferricola</i>			P3
Fabaceae	<i>Mirbelia</i>	<i>rhagodioides</i>			
Fabaceae	<i>Senna</i>	<i>artemisioides</i>	subsp.	x <i>artemisioides</i>	
Fabaceae	<i>Senna</i>	<i>artemisioides</i>	subsp.	x <i>sturtii</i>	
Fabaceae	<i>Senna</i>	<i>artemisioides</i>			
Fabaceae	<i>Senna</i>	<i>charlesiana</i>			
Fabaceae	<i>Senna</i>	<i>glutinosa</i>	subsp.	<i>chatelainiana</i>	

Family	Genus	Species	Infra Rank	Infra Name	Cons. Code
Fabaceae	<i>Senna</i>	<i>manicula</i>			
Fabaceae	<i>Swainsona</i>	<i>beasleyana</i>			
Fabaceae	<i>Swainsona</i>	<i>halophila</i>			
Fabaceae	<i>Swainsona</i>	<i>incei</i>			
Fabaceae	<i>Swainsona</i>	<i>kingii</i>			
Fabaceae	<i>Swainsona</i>	<i>leeana</i>			
Fabaceae	<i>Swainsona</i>	<i>oroboides</i>			
Fabaceae	<i>Swainsona</i>	<i>paradoxa</i>			
Fabaceae	<i>Swainsona</i>	<i>purpurea</i>			
Fabaceae	<i>Swainsona</i>	<i>tenuis</i>			
Fabaceae	<i>Trigonella</i>	<i>suavissima</i>			
Geraniaceae	* <i>Erodium</i>	<i>aureum</i>			
Geraniaceae	<i>Erodium</i>	<i>crinitum</i>			
Geraniaceae	<i>Erodium</i>	<i>cygnorum</i>			
Goodeniaceae	<i>Dampiera</i>	<i>dentata</i>			
Goodeniaceae	<i>Goodenia</i>	<i>maideniana</i>			
Goodeniaceae	<i>Goodenia</i>	<i>mimuloides</i>			
Goodeniaceae	<i>Goodenia</i>	<i>modesta</i>			P3
Goodeniaceae	<i>Goodenia</i>	<i>mueckeana</i>			
Goodeniaceae	<i>Goodenia</i>	<i>peacockiana</i>			
Goodeniaceae	<i>Goodenia</i>	<i>xanthosperma</i>			
Goodeniaceae	<i>Scaevola</i>	<i>parvifolia</i>	subsp.	<i>acuminata</i>	
Goodeniaceae	<i>Scaevola</i>	<i>spinescens</i>			
Goodeniaceae	<i>Velleia</i>	<i>cycnopotamica</i>			
Goodeniaceae	<i>Velleia</i>	<i>glabrata</i>			
Goodeniaceae	<i>Velleia</i>	<i>rosea</i>			
Haloragaceae	<i>Glischrocaryon</i>	<i>aureum</i>			
Haloragaceae	<i>Haloragis</i>	<i>odontocarpa</i>	forma	<i>pterocarpa</i>	
Haloragaceae	<i>Haloragis</i>	<i>trigonocarpa</i>			
Juncaceae	<i>Juncus</i>	<i>aridicola</i>			
Lamiaceae	<i>Dicrastylis</i>	<i>brunnea</i>			
Lamiaceae	<i>Dicrastylis</i>	<i>flexuosa</i>			
Lamiaceae	<i>Dicrastylis</i>	<i>sessilifolia</i>			
Lamiaceae	<i>Hemigenia</i>	<i>exilis</i>			P3
Lamiaceae	* <i>Mentha</i>	<i>pulegium</i>			
Lamiaceae	<i>Newcastelia</i>	<i>hexarrhena</i>			
Lamiaceae	<i>Prostanthera</i>	<i>albiflora</i>			
Lamiaceae	<i>Prostanthera</i>	<i>althoferi</i>	subsp.	<i>althoferi</i>	
Lamiaceae	<i>Teucrium</i>	<i>teucriiflorum</i>			
Loranthaceae	<i>Amyema</i>	<i>microphylla</i>			
Loranthaceae	<i>Lysiana</i>	<i>murrayi</i>			

Family	Genus	Species	Infra Rank	Infra Name	Cons. Code
Malvaceae	<i>Alyogyne</i>	<i>pinoniana</i>			
Malvaceae	<i>Androcalva</i>	<i>loxophylla</i>			
Malvaceae	<i>Androcalva</i>	<i>luteiflora</i>			
Malvaceae	<i>Hannafordia</i>	<i>bissillii</i>	subsp.	<i>bissillii</i>	
Malvaceae	<i>Lawrencia</i>	<i>densiflora</i>			
Malvaceae	<i>Lawrencia</i>	<i>helmsii</i>			
Malvaceae	<i>Seringia</i>	<i>elliptica</i>			
Malvaceae	<i>Seringia</i>	<i>velutina</i>			
Malvaceae	<i>Sida</i>	<i>ectogama</i>			
Malvaceae	<i>Sida</i>		sp.	Excedentifolia (J.L. Egan 1925)	
Montiaceae	<i>Calandrinia</i>	<i>eremaea</i>			
Montiaceae	<i>Calandrinia</i>	<i>papillata</i>			
Montiaceae	<i>Calandrinia</i>	<i>polyandra</i>			
Myrtaceae	<i>Baeckea</i>		sp.	Sandstone (C.A. Gardner s.n. 26 Oct. 1963)	P3
Myrtaceae	<i>Calytrix</i>	<i>carinata</i>			
Myrtaceae	<i>Calytrix</i>	<i>desolata</i>			
Myrtaceae	<i>Calytrix</i>	<i>erosipetala</i>			
Myrtaceae	<i>Calytrix</i>	<i>uncinata</i>			
Myrtaceae	<i>Calytrix</i>	<i>warburtonensis</i>			P2
Myrtaceae	<i>Enekbatus</i>	<i>eremaeus</i>			
Myrtaceae	<i>Eucalyptus</i>	<i>camaldulensis</i>	subsp.	<i>obtusa</i>	
Myrtaceae	<i>Eucalyptus</i>	<i>carnei</i>			
Myrtaceae	<i>Eucalyptus</i>	<i>clelandiorum</i>			
Myrtaceae	<i>Eucalyptus</i>	<i>eremicola</i>	subsp.	<i>peeneri</i>	
Myrtaceae	<i>Eucalyptus</i>	<i>eremicola</i>			
Myrtaceae	<i>Eucalyptus</i>	<i>gongylocarpa</i>			
Myrtaceae	<i>Eucalyptus</i>	<i>gypsophila</i>			
Myrtaceae	<i>Eucalyptus</i>	<i>kingsmillii</i>			
Myrtaceae	<i>Eucalyptus</i>	<i>longicornis</i>			
Myrtaceae	<i>Eucalyptus</i>	<i>lucasii</i>			
Myrtaceae	<i>Eucalyptus</i>	<i>oldfieldii</i>			
Myrtaceae	<i>Eucalyptus</i>	<i>striaticalyx</i>			
Myrtaceae	<i>Eucalyptus</i>	<i>trivalva</i>			
Myrtaceae	<i>Homalocalyx</i>	<i>echinulatus</i>			P3
Myrtaceae	<i>Homalocalyx</i>	<i>thryptomenoides</i>			
Myrtaceae	<i>Hysterobaeckea</i>	<i>occlusa</i>			
Myrtaceae	<i>Melaleuca</i>	<i>interioris</i>			
Myrtaceae	<i>Melaleuca</i>	<i>xerophila</i>			
Myrtaceae	<i>Micromyrtus</i>	<i>flaviflora</i>			
Myrtaceae	<i>Thryptomene</i>	<i>nealensis</i>			P3
Myrtaceae	<i>Thryptomene</i>		sp.	Leinster (B.J. Lepschi & L.A. Craven 4362)	P3

Family	Genus	Species	Infra Rank	Infra Name	Cons. Code
Myrtaceae	<i>Verticordia</i>	<i>jamesonii</i>			P3
Nyctaginaceae	<i>Boerhavia</i>	<i>repleta</i>			
Oleaceae	<i>Jasminum</i>	<i>calcareum</i>			
Ophioglossaceae	<i>Ophioglossum</i>	<i>lusitanicum</i>			
Phyllanthaceae	<i>Phyllanthus</i>	<i>baeckeoides</i>			P3
Phyllanthaceae	<i>Poranthera</i>	<i>leiosperma</i>			
Pittosporaceae	<i>Pittosporum</i>	<i>angustifolium</i>			
Poaceae	<i>Aristida</i>	<i>contorta</i>			
Poaceae	<i>Aristida</i>	<i>obscura</i>			
Poaceae	<i>Austrostipa</i>	<i>eremophila</i>			
Poaceae	<i>Austrostipa</i>	<i>nitida</i>			
Poaceae	<i>Austrostipa</i>	<i>trichophylla</i>			
Poaceae	<i>Cenchrus</i>	<i>ciliaris</i>			
Poaceae	<i>Dactyloctenium</i>	<i>radulans</i>			
Poaceae	* <i>Digitaria</i>	<i>ciliaris</i>			
Poaceae	<i>Enneapogon</i>	<i>caerulescens</i>			
Poaceae	<i>Enneapogon</i>	<i>polyphyllus</i>			
Poaceae	<i>Eragrostis</i>	<i>dielsii</i>			
Poaceae	<i>Eragrostis</i>	<i>eriopoda</i>			
Poaceae	<i>Eragrostis</i>	<i>parviflora</i>			
Poaceae	<i>Eragrostis</i>	<i>pergracilis</i>			
Poaceae	<i>Eragrostis</i>		sp.	Yeelirrie Calcrete (S. Regan LCH 26770)	
Poaceae	<i>Eriachne</i>	<i>flaccida</i>			
Poaceae	<i>Eriachne</i>	<i>helmsii</i>			
Poaceae	<i>Monachather</i>	<i>paradoxus</i>			
Poaceae	<i>Panicum</i>	<i>decompositum</i>			
Poaceae	<i>Panicum</i>	<i>effusum</i>			
Poaceae	<i>Paractaenum</i>	<i>novae-hollandiae</i>			
Poaceae	<i>Paspalidium</i>	<i>basicladum</i>			
Poaceae	<i>Paspalidium</i>	<i>clementii</i>			
Poaceae	<i>Paspalidium</i>	<i>constrictum</i>			
Poaceae	<i>Perotis</i>	<i>rara</i>			
Poaceae	* <i>Setaria</i>	<i>verticillata</i>			
Poaceae	<i>Themeda</i>	<i>triandra</i>			
Poaceae	<i>Tragus</i>	<i>australianus</i>			
Poaceae	<i>Tripogonella</i>	<i>loliiformis</i>			
Polygalaceae	<i>Polygala</i>	<i>isingii</i>			
Polygonaceae	* <i>Rumex</i>	<i>hypogaeus</i>			
Portulacaceae	<i>Portulaca</i>	<i>oleracea</i>			
Proteaceae	<i>Grevillea</i>	<i>deflexa</i>			
Proteaceae	<i>Grevillea</i>	<i>inconspicua</i>			P4

Family	Genus	Species	Infra Rank	Infra Name	Cons. Code
Proteaceae	<i>Grevillea</i>	<i>sarissa</i>	subsp.	<i>bicolor</i>	
Proteaceae	<i>Grevillea</i>	<i>sarissa</i>	subsp.	<i>sarissa</i>	
Proteaceae	<i>Hakea</i>	<i>leucoptera</i>	subsp.	<i>sericipes</i>	
Proteaceae	<i>Hakea</i>	<i>minyma</i>			
Proteaceae	<i>Hakea</i>	<i>recurva</i>	subsp.	<i>recurva</i>	
Pteridaceae	<i>Cheilanthes</i>	<i>lasiophylla</i>			
Rubiaceae	<i>Psyrax</i>	<i>rigidula</i>			
Rutaceae	<i>Philotheca</i>	<i>brucei</i>	subsp.	<i>brucei</i>	
Rutaceae	<i>Philotheca</i>	<i>tomentella</i>			
Santalaceae	<i>Exocarpos</i>	<i>aphyllus</i>			
Santalaceae	<i>Korthalsella</i>	<i>leucothrix</i>			P1
Santalaceae	<i>Santalum</i>	<i>lanceolatum</i>			
Santalaceae	<i>Santalum</i>	<i>spicatum</i>			
Sapindaceae	<i>Dodonaea</i>	<i>adenophora</i>			
Sapindaceae	<i>Dodonaea</i>	<i>microzyga</i>	var.	<i>acrolobata</i>	
Sapindaceae	<i>Dodonaea</i>	<i>petiolaris</i>			
Sapindaceae	<i>Dodonaea</i>	<i>rigida</i>			
Sapindaceae	<i>Dodonaea</i>	<i>viscosa</i>	subsp.	<i>angustissima</i>	
Sapindaceae	<i>Dodonaea</i>	<i>viscosa</i>	subsp.	<i>mucronata</i>	
Sapindaceae	<i>Dodonaea</i>	<i>viscosa</i>	subsp.	<i>spatulata</i>	
Scrophulariaceae	<i>Eremophila</i>	<i>alternifolia</i>			
Scrophulariaceae	<i>Eremophila</i>	<i>arachnoides</i>	subsp.	<i>arachnoides</i>	P3
Scrophulariaceae	<i>Eremophila</i>	<i>clarkei</i>			
Scrophulariaceae	<i>Eremophila</i>	<i>conglomerata</i>			
Scrophulariaceae	<i>Eremophila</i>	<i>exilifolia</i>			
Scrophulariaceae	<i>Eremophila</i>	<i>falcata</i>			
Scrophulariaceae	<i>Eremophila</i>	<i>foliosissima</i>			
Scrophulariaceae	<i>Eremophila</i>	<i>forrestii</i>	subsp.	<i>forrestii</i>	
Scrophulariaceae	<i>Eremophila</i>	<i>galeata</i>			
Scrophulariaceae	<i>Eremophila</i>	<i>georgei</i>			
Scrophulariaceae	<i>Eremophila</i>	<i>gilesii</i>	subsp.	<i>variabilis</i>	
Scrophulariaceae	<i>Eremophila</i>	<i>granitica</i>			
Scrophulariaceae	<i>Eremophila</i>	<i>homoplastica</i>			
Scrophulariaceae	<i>Eremophila</i>	<i>hygrophana</i>			
Scrophulariaceae	<i>Eremophila</i>	<i>latrobei</i>	subsp.	<i>glabra</i>	
Scrophulariaceae	<i>Eremophila</i>	<i>longifolia</i>			
Scrophulariaceae	<i>Eremophila</i>	<i>maculata</i>	subsp.	<i>brevifolia</i>	
Scrophulariaceae	<i>Eremophila</i>	<i>malacoides</i>			
Scrophulariaceae	<i>Eremophila</i>	<i>margarethae</i>			
Scrophulariaceae	<i>Eremophila</i>	<i>metallicorum</i>			
Scrophulariaceae	<i>Eremophila</i>	<i>oldfieldii</i>	subsp.	<i>angustifolia</i>	

Family	Genus	Species	Infra Rank	Infra Name	Cons. Code
Scrophulariaceae	<i>Eremophila</i>	<i>oppositifolia</i>	subsp.	<i>angustifolia</i>	
Scrophulariaceae	<i>Eremophila</i>	<i>pantonii</i>			
Scrophulariaceae	<i>Eremophila</i>	<i>platycalyx</i>	subsp.	Granites (D.J. Eddinger & G. Marsh DJE 4782)	
Scrophulariaceae	<i>Eremophila</i>	<i>platycalyx</i>	subsp.	Leonora (J. Morrisey 252)	
Scrophulariaceae	<i>Eremophila</i>	<i>platythamnos</i>	subsp.	<i>platythamnos</i>	
Scrophulariaceae	<i>Eremophila</i>	<i>pungens</i>			P4
Scrophulariaceae	<i>Eremophila</i>	<i>ramiflora</i>			
Scrophulariaceae	<i>Eremophila</i>	<i>serrulata</i>			
Scrophulariaceae	<i>Eremophila</i>	<i>shonae</i>	subsp.	<i>shonae</i>	
Scrophulariaceae	<i>Eremophila</i>	<i>sp.</i>			
Scrophulariaceae	<i>Eremophila</i>	<i>spectabilis</i>	subsp.	<i>brevis</i>	
Scrophulariaceae	<i>Eremophila</i>	<i>spuria</i>			
Scrophulariaceae	<i>Eremophila</i>	<i>subfloccosa</i>	subsp.	<i>lanata</i>	
Solanaceae	<i>Duboisia</i>	<i>hopwoodii</i>			
Solanaceae	<i>Lycium</i>	<i>australe</i>			
Solanaceae	<i>Nicotiana</i>	<i>rosulata</i>	subsp.	<i>rosulata</i>	
Solanaceae	<i>Solanum</i>	<i>chrysotrichum</i>			
Solanaceae	<i>Solanum</i>	<i>cleistogamum</i>			
Solanaceae	<i>Solanum</i>	<i>lasiophyllum</i>			
Solanaceae	* <i>Solanum</i>	<i>nigrum</i>			
Solanaceae	<i>Solanum</i>	<i>nummularium</i>			
Solanaceae	<i>Solanum</i>	<i>plicatile</i>			
Stylidiaceae	<i>Stylidium</i>	<i>induratum</i>			
Thymelaeaceae	<i>Pimelea</i>	<i>microcephala</i>	subsp.	<i>microcephala</i>	
Thymelaeaceae	<i>Pimelea</i>	<i>microcephala</i>			
Thymelaeaceae	<i>Pimelea</i>	<i>subvillifera</i>			
Thymelaeaceae	<i>Pimelea</i>	<i>trichostachya</i>			
Zygophyllaceae	<i>Roepera</i>	<i>aurantiaca</i>			
Zygophyllaceae	<i>Tribulus</i>	<i>astrocarpus</i>			
Zygophyllaceae	<i>Tribulus</i>	<i>occidentalis</i>			
Zygophyllaceae	* <i>Tribulus</i>	<i>terrestris</i>			

**APPENDIX 4:FLORA AND VEGETATION SURVEY (GLS
2021)**

FLORA AND VEGETATION SURVEY

Jonah Bore Project



Prepared by

Goldfields Landcare Services

for

MLG Oz Limited

November 2021

Version 2

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APPENDICES

- A: Species of Conservation Significance Database Search Results
- B: Quadrat Sampling Site Descriptions
- C: Plant Species List by Vegetation Type
- D: Conservation Code Definitions
- E: Vegetation Classification System

1. SUMMARY

Goldfields Landcare Services (GLS) was contracted by MLG Oz Limited in July to conduct a detailed flora and vegetation survey over an area covering 71.9 Hectares at their Jonah Bore Project located approximately 25 kilometres west of Leinster to comply with requirements in seeking approvals for near surface sand mining operations.

This was the second survey conducted by GLS on this project, a reconnaissance survey having been carried out in September 2006.

Two Botanists carried out the fieldwork on 04.09.21 and 05.09.21. It consisted of quadrat surveys, traverses, and opportunistic sampling conducted within and around the survey area.

Four quadrat surveys were conducted to characterise the vegetation of the survey area and that of the surrounding region.

Two vegetation types were recorded and described within the survey area.

Seventy-six vascular plant species have been recorded from within the survey area. The most prevalent families recorded were Fabaceae and Scrophulariaceae.

No plant species gazetted as “Threatened” pursuant to Part 2 of the *Biodiversity Conservation Act 2016 Western Australia* (W A) and no plant species listed as “Critically Endangered” under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act, Commonwealth) were recorded within the surveyed areas.

No plant species of conservation significance listed under State or Commonwealth acts have been recorded within the survey area.

No Threatened Ecological Communities (TECs) listed under *the Biodiversity Conservation Act* or *EPBC Act* or Priority Ecological Communities (PECs) listed by the Department of Biodiversity Conservation and Attractions (DBCA) were encountered during the survey.

No weed species listed as Declared under *the Biosecurity and Agriculture Management Act (2007)* were recorded within the survey area.

No plant listed as a Weed of National Significance (WoNS) under the *EPBC Act* was encountered in the survey area.

No non-native introduced species were recorded within the survey areas.

The condition of the vegetation was classified as “Good” based on the Vegetation Condition Scale adapted from Keighery 1994 and Trudgen 1988. (Environmental Protection Authority 2016, p.10)

2. INTRODUCTION

2.1 Location

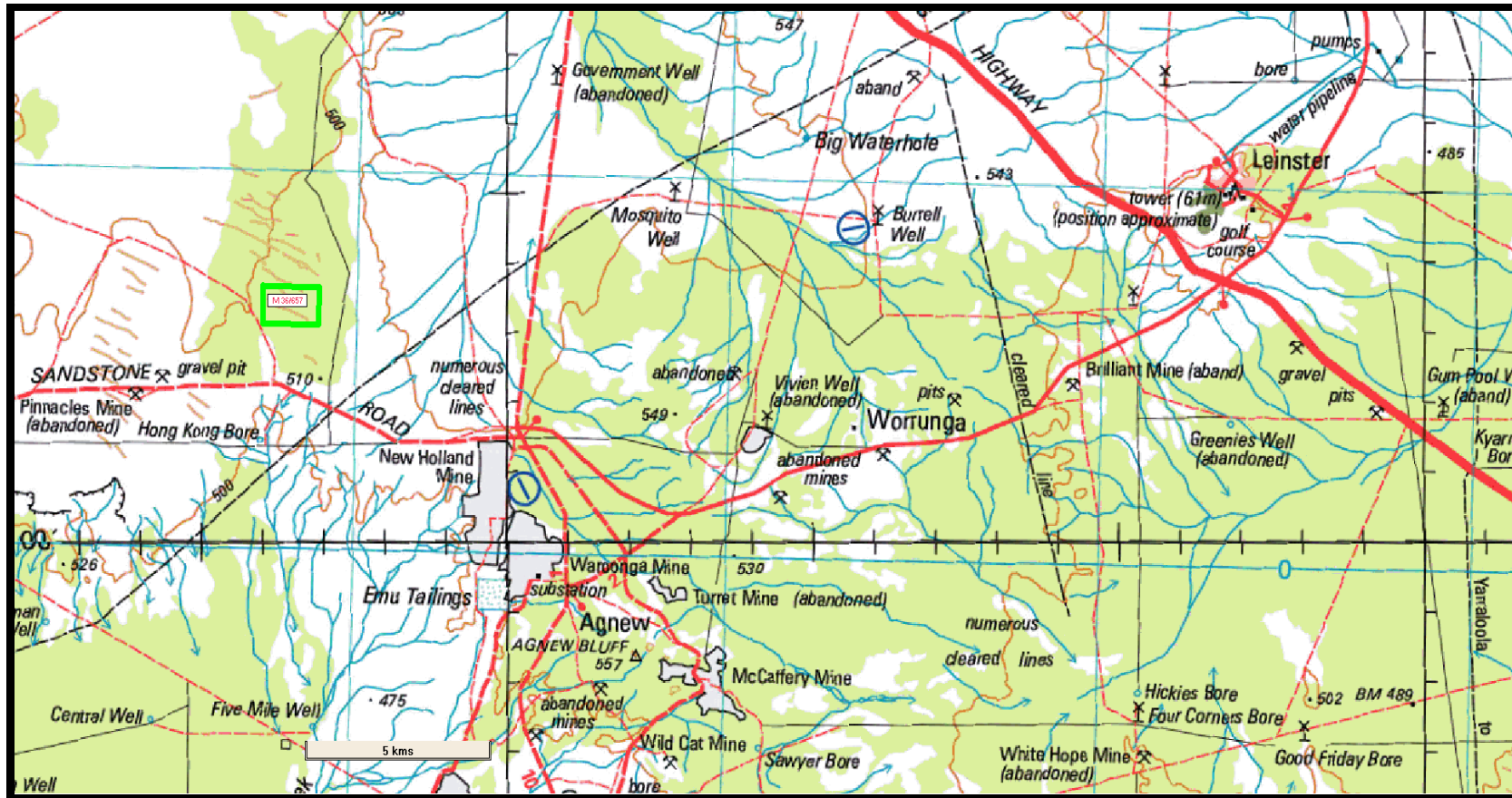
Situated on the land of the traditional owners, the Tjiwarl people, the mining town of Leinster is located in the North-eastern Goldfields of Western Australia approximately 326 kilometres north-north-west of Kalgoorlie and 650 kilometres north-east of Perth.

The area over which this survey was conducted is on Leinster Downs Pastoral Station and is situated 1.7 kilometres north of the Sandstone-Agnew Road, 25 kilometres west of Leinster. Access to the survey area can be gained from the main road via an existing haul road. (Map 1 below). The survey area covered approximately 48% of the Mining Lease M 36/657.

The region has a long history of mining dating back to 1897 and continuing today with mines currently opening and expanding in the area. Pastoral development began on Leinster Downs in 1909.

The pre-European vegetation mapped by Beard et al (2013) shows the vegetation type, within which most of this survey area lies, to have been Shrub Steppe hummock grassland which is the second most extensive vegetation type in the State covering a total area of 25.3 million hectares with 3.2 million of that in the Murchison Bioregion. (Beard 2013, p.14)

Map 1: Location Map



Key: Survey area

2.2 Objective

Goldfields Landcare Services was contracted by MLG Oz Limited to conduct a Detailed Flora and Vegetation Survey over 71.9 Hectares on their Mining Lease M 36/657, to comply with requirements in seeking approvals to expand an existing sand mining operation.

The objective of this survey was to assess potential impacts to flora and vegetation in accordance with the Environmental Protection Authority (EPA) *Technical Guidance, Flora and Vegetation Surveys for Environmental Impact Assessment*, December 2016.

This Spring survey was planned to capture any ephemeral plant species not previously recorded, and to conduct quadrat surveys to confirm vegetation type classifications and to refine vegetation type boundaries.

2.3 Survey Categories

Reconnaissance Survey

“A reconnaissance survey is undertaken to verify the information obtained from the desktop study, characterise the flora and delineate the vegetation units present. In some instances, a reconnaissance survey is necessary to determine the type of survey required. A reconnaissance survey generally involves a site visit by an experienced botanist to undertake low intensity sampling of the flora and vegetation, to describe the general vegetation characteristics and condition at an appropriate scale. The reconnaissance survey should clarify whether the area may support any significant flora or vegetation. If significant flora or vegetation is located or considered likely to be present during a reconnaissance survey, a targeted or detailed survey may be required.” (EPA 2016, p. 5)

Targeted Survey

“A targeted survey is used to gather information on significant flora and/or vegetation. A targeted survey aims to determine the size and extent of all significant flora populations or vegetation in the survey area and to place any impacts into context” (EPA 2016, p. 5)

Detailed Survey

“A detailed survey is necessary for significant proposals to adequately address the EPA’s objective for Flora and Vegetation, as a preliminary or key environmental factor of assessment.” (EPA 2016, p.5)

2.4 Background Research

The purpose is to gather background information on the target area (usually at the locality scale). This involves a search of available sources of literature, data, and map-based information.

In the WA Department of Agriculture's *Technical Bulletin, No 87 An inventory and condition survey of the north-eastern Goldfields, Western Australia*, authors H. Pringle *et.al.* 1994 describe land systems according to their topography, soils and vegetation, reference to which, has provided the basis for the identification of the vegetation types described in this survey.

Other relevant survey reports reviewed were:

- The Western Australian Museum's (1992) *Biological Survey of The Eastern Goldfields of Western Australia & Supplements* covering the Sandstone-Sir Samuel and Laverton-Leonora study areas.
- Goldfields Landcare Services (2006) *Rare Flora Search and Vegetation Survey for Leahy Haulage P.L. at Agnew.*

Stantec.(2018) "*Flora and Fauna Survey: Agnew Gold Mine Camp, Power Plant, Airport, Wind Farm and Pipeline.*" Prepared for Goldfields Australia Pty Ltd, 21 June 2018.

2.4.1 Rare and Priority Flora Searches

In WA, under the *Biodiversity Conservation Act 2016* WA, all plants are protected. Some, which are under threat of extinction, are classified as Threatened Species. Others which are either under consideration to be declared as Threatened Species or still require monitoring are classified as Priority Flora species. The definitions of the five different classifications of Priority Species and that of Threatened Species and Presumed Extinct Species are shown in Appendix D.

A database search for Rare and Priority Flora potentially occurring within 50 kilometres of the centre of the survey area was carried out by the WA Department of Biodiversity Conservation and Attractions (DBCA) on 29.09.21, (Ref. No. 12-0921FL).

The search results were cross-checked against the results of a search of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) list of Threatened Flora.

One species listed as Critically Endangered, and one species listed as Endangered on the EPBC list also occurred on the DBCA list.

A Protected Matters Report was generated from the Department of Environment and Energy's online search facility on 01.11.2021. The report provides general guidance on matters of national environmental significance and other matters protected by the Environment Protection and Biodiversity Conservation Act. The search area was located approximately at the centre of the survey area with a 50-kilometre buffer. No plant species was listed as Threatened within the search area.

There are 16 species classified as Threatened or Priority species were recorded from the DBCA searches.

The W.A. Department of Parks and Wildlife Threatened and Priority Flora Database (TPFL) contained six species, the West Australia Herbarium Database (WAHerb) contained 15, however, some species occurred in both searches.

A DPaW NatureMap Species Report was created 26.08.21 covering an area with a 40-km radius from the survey area which revealed 11 priority plant species occurring within it

The results indicate a total of 16 species of conservation significance from four searches, potentially occurring in the area.

- One species were listed as Threatened (Rare)
- Two plant species were listed as Priority 1
- One plant species was listed as Priority 2
- Nine plant species were listed as Priority 3
- Three plant species were listed as Priority 4 (See Appendix A)

2.4.2 Threatened and Priority Ecological Communities Searches

Listed threatened species and ecological communities are recognized as a matter of national environmental significance. Consequently, any action that is likely to have a significant impact on listed threatened species and ecological communities under the EPBC Act must be referred to the Minister. The different categories of threatened species and threatened ecological communities and their respective definitions are shown in Appendices D2 and D3.

The Australian Government Department of Environment and Energy’s List of Threatened Ecological Communities (TEC) viewed online, shows that the TEC nearest the survey area is at Toolibin Lake, east of Narrogin and is over 600 kilometres south-west of the survey area.

A database search was conducted by the DBCA of Threatened Ecological Communities (TEC’s) and Priority Ecological Communities (PEC’s) endorsed by the minister for the environment on 09.09 21 (Ref: 49-0821EC)

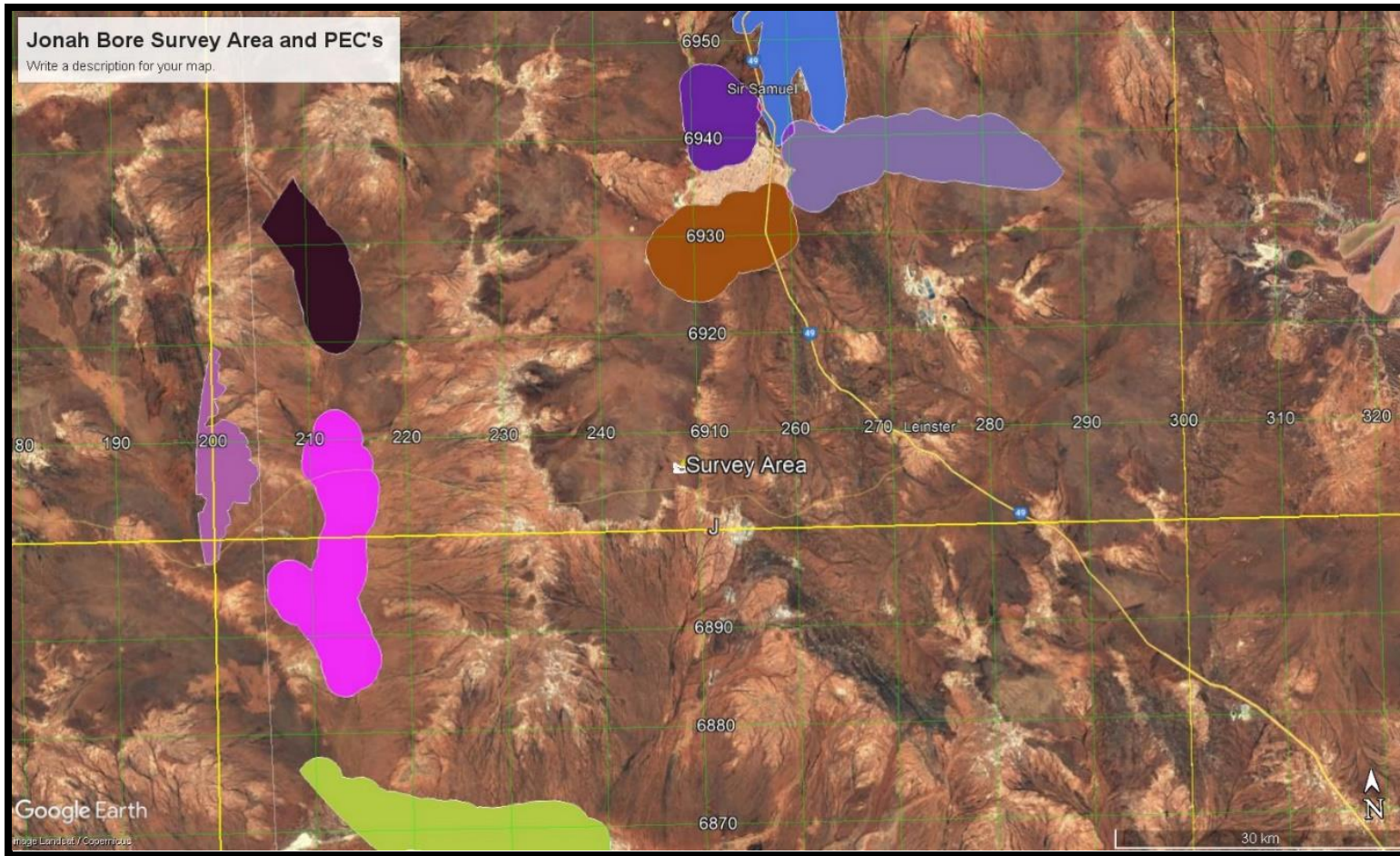
This search revealed that the nearest TEC to this survey area is the Depot Springs stygofauna complex which is located approximately 30.5 kilometres west of the survey area.

The nearest PEC to this survey area is the Lake Miranda west calcrete groundwater assemblage type on Carey paleodrainage on Yakabindie Station located approximately 16.6 kilometres north of the survey area.

Table 1. TEC and PECs nearest the survey area

Ecological Community	Status
Depot Springs stygofauna community (TEC)	Vulnerable (B)
Lake Miranda west groundwater assemblage on Carey paleodrainage. (PEC)	P1

Map 2: TEC PEC Search Results



Key:

-  Pinnacles Calcrete Groundwater Assemblage
-  Depot Springs Stygofauna Community
-  Booylgoo Range Vegetation Complexes
-  Kaluwiri Calcrete Groundwater Assemblage
-  Lake Miranda West Calcrete Groundwater Assemblage
-  Yakabindie Calcrete Groundwater Assemblage
-  Violet Range BIF Vegetation Complexes
-  Lake Miranda East Calcrete Groundwater Assemblage

2.4.3 Climate

Beard described the climate of the Murchison Region (Austin Botanical District) in *Plant Life of Western Australia*, within which the survey area lies as: “Arid with summer and winter rain; annual precipitation 200 mm”. (Beard 1990, p. 186)

The nearest Bureau of Meteorology weather station for which temperature data is available is located at Leinster Aero (No. 12314), approximately 25 kilometres north-east of the survey area.

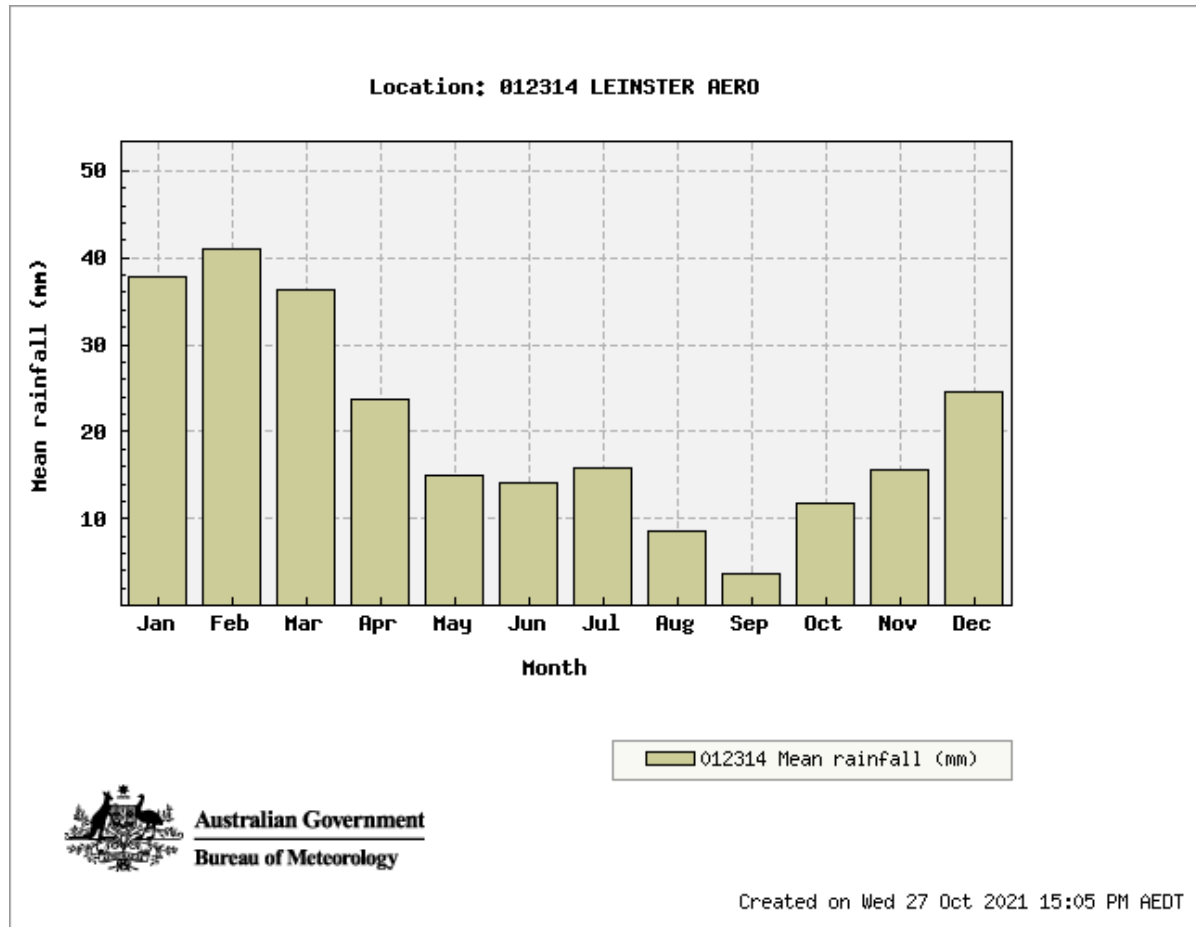
Records from that station for the 27 years from 1994 to 2021 show that the mean annual maximum temperature was 28.3° C, and the mean annual minimum temperature was 14.8° C.

Rainfall readings from 1926 to 2015 (89 years) from The BOM site at Pinnacles, (No 12067), located 28 kilometres south of the survey area, show that the mean annual rainfall is 235.5 mm with approximately 68% of that normally falling from January to June.

The rainfall readings from Leinster Aero for the past 25 years, however, show that the mean annual figure is 253 mm and that 64 % of that falls between December and April as show on the graph below. (Bureau of Meteorology 2021).

Rainfall recorded for the six months (March-August) preceding the survey totalled 87.2 mm which was 77% of the mean of the last 27 years rainfall for the same period, which was 113.4 mm.

Figure 1: Leinster Aero Mean Rainfall Graph



2.4.4 Land Systems

The surveyed areas lie within the Eastern Murchison (MUR 01) sub-region of the Murchison (MUR) region as classified under the Interim Biogeographic Regionalisation of Australia (IBRA) Version 7 which states:

“Under the Convention of Biological Diversity, Australia has worked towards a target of 17 per cent of our continent to be protected as part of the National Reserve System. In building the National Reserve System, priority is given to under-represented bioregions that have less than 10 per cent of their remaining area protected in reserves.” (Department of Environment and Energy (DEE) 2021).

The Murchison Bioregion is classed as Underrepresented with less than 1% protected in reserves. It is described as:

“Mulga low woodlands, often rich in ephemerals, on outcrop and fine-textured Quaternary alluvial and eluvial surfaces mantling granitic and greenstone strata of the northern part of the Yilgarn Craton. Surfaces associated with the occluded drainage occur throughout with hummock grasslands on Quaternary sandplains, saltbush shrublands on calcareous soils and Halosarcia low shrublands on saline alluvia. Areas of red sandplains with mallee-mulga parkland over hummock grasslands occur in the east.” (Thackway and Cresswell 1995, p. 68)

In *Plant Life of Western Australia*, Dr. John Beard described and mapped the vegetation in the Austin Botanical District, now recognised as The Murchison Region which covers 316,239 square kilometres. He characterised the vegetation as “Predominantly mulga low woodland (*Acacia aneura*) on plains, reduced to scrub on hills. Tree steppe of *Eucalyptus* spp. and *Triodia basedowii* on sand plains.” Referring to the Eastern half of the region he wrote that it has “catenas comprising sandplains on the higher ground, loam soils on the slopes and plains, and salt lakes in the valley bottoms. In some case there are “low level sandplains” in the valleys formed of sand transported from the upper parts of the landscape.” (Beard 1990, p. 187)

The Western Australian Museum’s (WAM) Biological Survey of The Eastern Goldfields of Western Australia Supplements covering the Sandstone-Sir Samuel and Laverton-Leonora study areas describes the various Landforms in the region. This survey lies within the Sandstone-Sir Samuel study area. Only one of these Landforms can be identified from satellite imagery interpretation within this current survey area, Dunefields, which are described below:

“**Dunefields** are associated with two landforms within both Study Areas: Sandplains and Salt Lake Features. Dunefields associated with Sandplains

shared few structural or vegetational links to salt lake dunes. Vegetation on sandplain dunefields varied with the height and structure of the dune system. Broad, low dunes had a cover of tall *Eucalyptus gongylocarpa* over *Triodia basedowii* while narrow, abrupt dunes had a lower vegetation, sometimes with discernible zonation from crest to swale. Low Woodlands of *Eucalyptus gongylocarpa* dominated the-surrounding sandplains, the dune slopes supported mallees of *Eucalyptus kingsmillii* and *E. youngiana* while the dune crests and upper slopes were characterised by tall shrublands of *Grevillea* spp. The hummock grass *Triodia basedowii*, prominent on the slopes and swales, was replaced by *Plectrachne schinzii* on the dune crests and upper slopes. The ephemeral flora was essentially the same on dunes and surrounding sandplain areas.” (WAM, pp. 27-28)

In the WA Department of Agriculture’s *Technical Bulletin, No. 87 An inventory and condition survey of the north-eastern Goldfields, Western Australia*, authors H. Pringle *et.al.*(Technical Bulletin No. 87) describe land systems according to their topography, soils and vegetation. The 1: 250 000 scale map of the land systems accompanying the report shows the areas surveyed for this project lie entirely within the **Bullimore Land System** which is described as: “Extensive sandplains supporting spinifex hummock grasslands.” (Pringle *et al.* p. 180)

2.4.5 Vegetation

Technical Bulletin No. 87 identifies five different landform units which may exist within the Bullimore Land System:

“**Sand sheet** – extensive level to gently undulating plains, occasionally more than 10 km wide.

Sand dunes – generally linear, occasionally reticulate, aeolian deposits to 5 km long and generally < 10 m high.

Loamy plains – generally level tracts to 2 km wide subject to sheet run-on from adjacent outcrops of granite.

Narrow drainage zones – narrow (<100 m) tracts subject to concentrated sheet flow and sump areas near granite outcrops.

Dissected tracts – variably stripped weathered granite surfaces, including incipient breakaways.” (H. Pringle *et al.*, p.18)

Each landform unit may host a number of different vegetation types.

3. METHODS

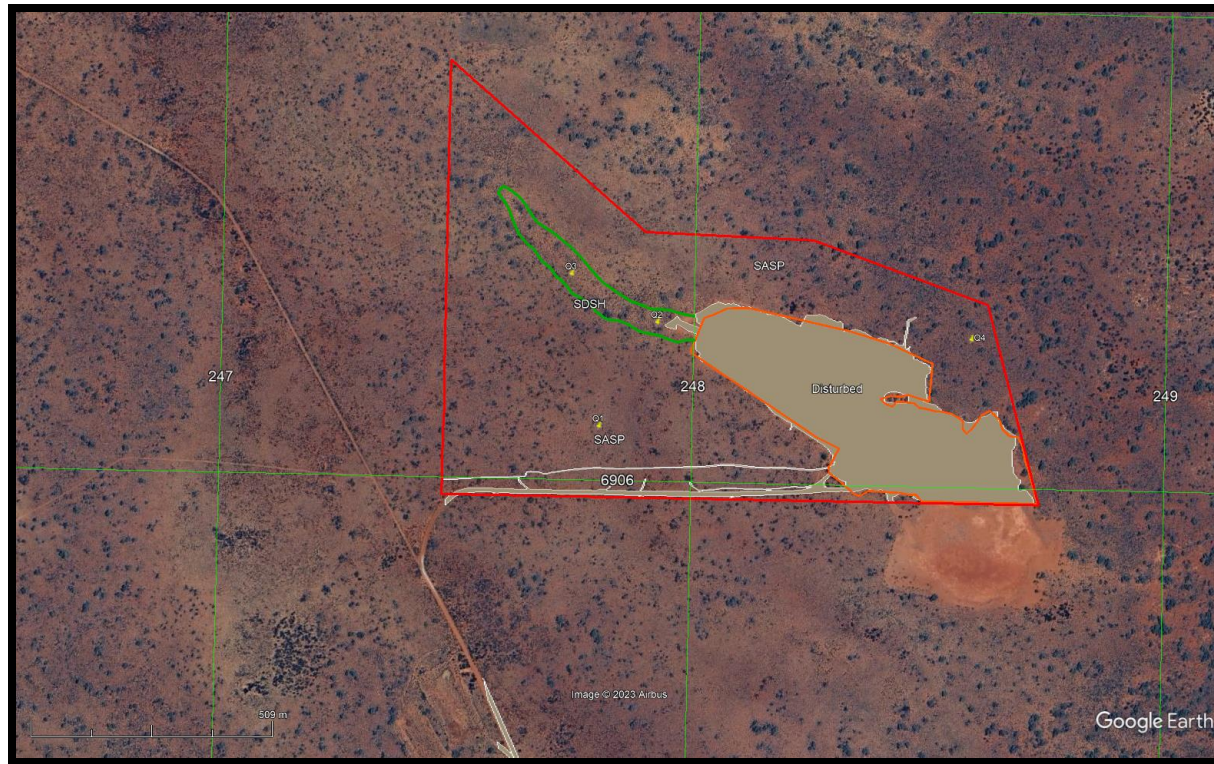
The field survey was designed to provide data to facilitate the characterisation of the vegetation types present and produce a map depicting those units. Also, to search for Threatened and Priority plants species likely to occur in the area.

The fieldwork was undertaken on the 04.09.21 and 05.09.21 to confirm the validity of the imagery interpretations made from satellite data of the area, to record and collect plant samples from traverses, and quadrat surveys, to determine the presence or otherwise of potential PEC's and flora of conservation significance and to record the condition of the vegetation.






Land Systems and associated Landform units were identified from the WA Department of Agriculture's *Technical Bulletin, No. 87 An inventory and condition survey of the north-eastern Goldfields, Western Australia.* Vegetation Types were interpreted from quadrat surveys and vegetation type boundaries defined using satellite imagery.

Vehicle access to the survey area was made via an existing haul road running from the Agnew-Sandstone Road. Traverses were conducted by foot to selected points as shown in the image below.

Map 3: Jonah Bore GPS tracks



Key:

-  Tracks
-  Survey Area Boundary
-  Sand Dune Shrubland (SDSH)
-  Disturbed Area
-  Sandplain Spinifex Hummock Grassland (SASP)

Four quadrat surveys were conducted.

Each 20m x 20m quadrat survey recorded descriptions of landscape, surface, rock type, soils, overall vegetation type, fire age, condition/disturbances, vegetation stratum height, total percentage cover and dominant species from which a vegetation description was deduced using the Vegetation Classification System shown at Appendix E. A list of species together with their height and percentage foliar cover was also recorded.

Plant species were recorded or sampled, and locations were recorded using a Garmin GPSmap76csx device with +/- 3m accuracy and a Garmin g66i device. Photographs were taken from the north – west corner of each quadrat. Opportunistic samples, notes, photographs, and GPS coordinates were also taken to aid the mapping and reporting.

Specimens collected in the field were subsequently identified using appropriate text references, plant keys and web sites.

3.1 Definitions of Survey Limitations

According to the EPA Guidance Statement December 2016 for Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia, flora and vegetation surveys may be limited by the following:

- sources of information and availability of contextual information (i.e. pre-existing background versus new material);
- the scope (i.e. what life forms, etc., were sampled);
- Proportion of flora collected and identified (based on sampling, timing and intensity);
- completeness and further work which might be needed (e.g. was the relevant area fully surveyed);
- mapping reliability;
- timing, weather, season, cycle;
- disturbances (fire, flood, accidental human intervention etc.);
- intensity (in retrospect, was the intensity adequate);
- resources;
- access problems; and
- experience levels (e.g. degree of expertise in plant identification to taxon level). (EPA, pp.13-15)

An assessment of these aspects is detailed in the table below:

3.2 Survey Limitations

TABLE 2: Survey Limitations

ASPECT	CONSTRAINT	COMMENT
Sources and availability of contextual information	No	The WA Department of Agriculture's <i>Technical Bulletin, No. 87 An inventory and condition survey of the north-eastern Goldfields, Western Australia</i> , and accompanying 1: 250 000 Sir Samuel sheet provides extensive reference material for the region and the survey area.
Scope	No	The survey covered all aspects of flora and vegetation assessment required for a detailed survey and preparation of IBSA compliant data.
Proportion of flora collected and identified	No	Traverses covered the two vegetation types encountered within the land system and four quadrat surveys were conducted. 76 taxa were recorded and all were identified.
Completeness	No	Given the relatively small size of the survey area and the uniformity of its vegetation, the survey is effort considered adequate to characterise flora and vegetation in and around the survey area.
Mapping reliability	No	Detail considered adequate for this survey in this region.
Timing	No	The recommended time for primary surveys in this region is 6-8 weeks post the wet season which is regarded as March – June. This survey was carried out on 4 th and 5 th September.
Disturbances	No	No impediments encountered.
Intensity	No	Data collected considered adequate for this survey in this region.
Resources	No	Resources were adequate with four-person days devoted to botanical survey work.
Access Problems	No	Survey areas accessible by foot and four-wheel drive vehicle.
Experience Levels	No	Personnel have combined over 32 years field surveying experience in the Eastern and North-Eastern Goldfields and Murchison Region.

4. RESULTS

4.1 Flora

Four quadrats, each 20m x 20m were surveyed.

A total of 43 separate plant specimens were collected from within the survey area.

Seventy-six different species, including sub-species and varieties have been identified from 25 families and 53 genera.

The most abundant genera were *Acacia* with eight species and *Eremophila* with five.

A complete list of species recorded is shown in the attached Appendix C.

No non-native introduced species were recorded within the survey area.

No plant species gazetted as Declared Rare Flora pursuant to Part 2 of the *Biodiversity Conservation Act 2016* (W. A.) and no species listed as Threatened pursuant to the List of Threatened Flora of the EPBC Act (Department of Sustainability, Water, Population and Communities) has been recorded from within the survey area.

No priority species listed in the DPaW's Threatened and Priority Flora List or the Nature Map Species Report have been identified.

A search conducted by the DBCA of the Threatened and Priority Ecological Communities database revealed that there are no known occurrences of TEC's recorded within 50 km of the survey area with the closest being Depot Springs, located 30.5 km to the west.

No TEC's were identified during the survey.

The nearest PEC to this survey area is the Lake Miranda west calcrete groundwater assemblage type on Carey paleodrainage on Yakabindie Station located approximately 16.6 kilometres north of the survey area.

No PEC's were identified within the survey area.

4.2 Vegetation Classification

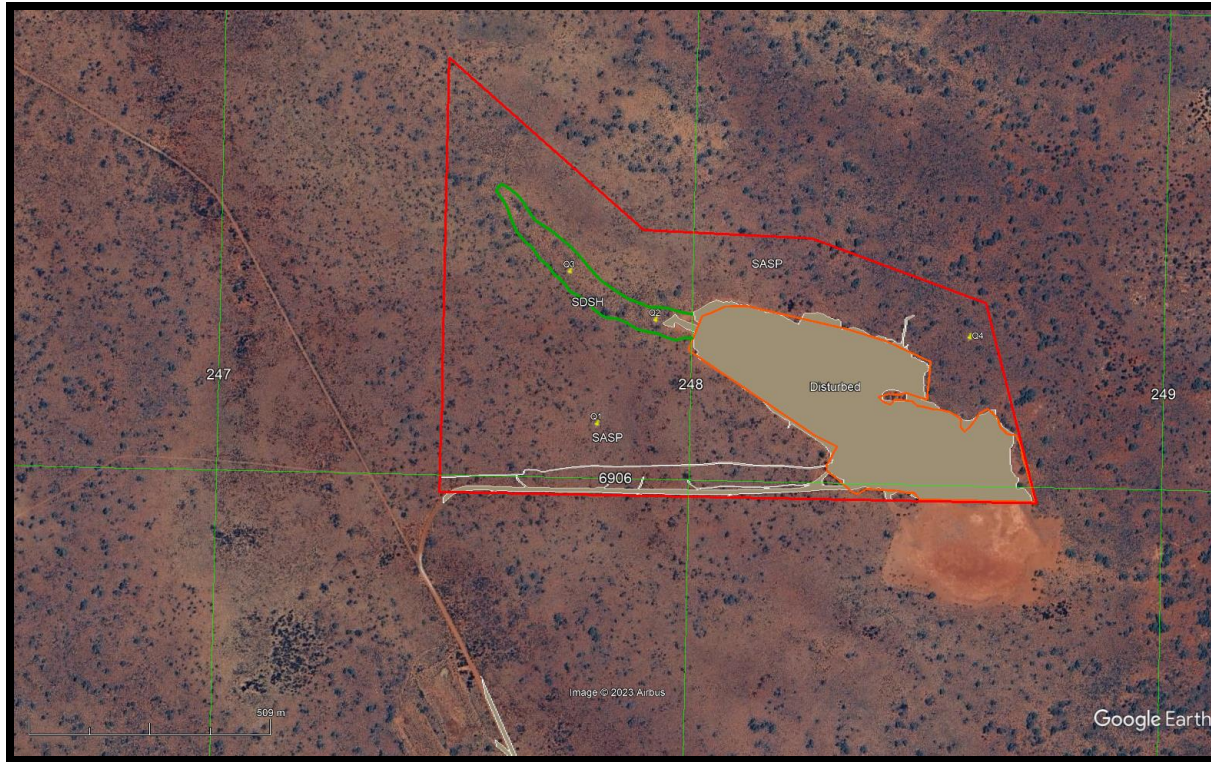
The survey area lies entirely within the Bullimore Land System which is described as “Extensive sandplains supporting spinifex hummock grasslands”. (Pringle, *et al.* pp 180, 262)

Within the 71.2 Ha survey area, two separate vegetation units and the disturbed areas were identified and mapped:

- Sandplain spinifex hummock grassland 51.5 Ha Or 71.5% of the area
- Disturbed areas 17.9 Ha or 24.8% and
- Sand Dune Shrubland 2.6 Ha or 3.7%

Vegetation type descriptions for the four quadrats surveyed are shown in Appendix B.

MAP 4: Jonah Bore Vegetation and Quadrat locations.




Key:

 Survey Area Boundary

 Sand Dune Shrubland (SDSH)

 Disturbed Area

 Sandplain Spinifex Hummock Grassland (SASP)

4.4 Condition of the Plant Communities

The region has been subjected to long-term, pastoral, and mining activities.

Mining began in 1897 with the discovery of gold in the region. Leinster Downs Station, on which the survey area is located, was established in 1909 and has been used to run horses, cattle and sheep and is currently lightly stocked with cattle.

No introduced weed species were encountered in the survey.

The area had been burnt in 2006. The tallest regrowth was seen in the *Acacia* sp. which reached up to two metres. The fire appears to have impacted the landscape within the survey area unevenly, leaving some areas almost treeless while mature Marble Gums, *Eucalyptus gongylocarpa*, grow in other areas. The size of the Spinifex rings also varies. However, most of them are considered to fall within the Class 4 category of 16-20 years of age (Burrows *et al.* 2014), consistent with the timing of the previous known fire event and taking into account variable factors affecting intensity such as fuel load and wind speed.

The condition of the vegetation overall was considered to be “Good” based on the Vegetation Condition Scale adapted from Keighery (1994) and Trudgen (1988) shown below.

Table 5: Vegetation Condition Scale for Eremaean and Northern Botanical Provinces (Keighery 1994, Trudgen 1988) taken from EPA (2016)

Excellent	Pristine or nearly so, no obvious signs of damage caused by human activities since European settlement.
Very Good	Some relatively slight signs of damage caused by human activities since European settlement. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds, or occasional vehicle tracks.
Good	More obvious signs of damage caused by human activity since European settlement, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or slightly aggressive weeds.
Poor	Still retains basic vegetation structure or ability to regenerate it after very obvious impacts of human activities since European settlement, such as grazing, partial clearing, frequent fires or aggressive weeds.
Degraded	Severely impacted by grazing, very frequent fires, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species present including very aggressive species.
Completely Degraded	Areas that are completely or almost completely without native species in the structure of their vegetation; i.e. areas that are cleared or ‘parkland cleared’ with their flora comprising weed or crop species with isolated native trees or shrubs.

The Agriculture WA publication entitled *Pastoral resources and their management in the north-eastern Goldfields, Western Australia* (Pringle, 1994) provides an interpretation of the findings from the rangeland survey of that area.

The report covered an area of about 100,600 square kilometres and includes individual station reports on all or part of 51 stations within it including that prepared for Leinster Downs Station.

In assessing the pastoral resource condition for the stations, the survey employed a vegetation condition rating scale developed to describe the grazing potential of the various land systems encountered on the individual properties.

Although this scale uses different criteria to that used in the field assessments for this report, it is included here for the purpose of comparison.

The vegetation condition rating of **Good** was described as: Perennials present include all or most of the species expected; some less palatable or unpalatable species may have increased, but total perennial cover is not very different from the optimal.

The report prepared for Leinster Downs shows that all of the Bullimore land system which occupies 27986 Ha or 19.6% of the property, was assessed as being in Good condition. This concurs with the assessment made in this survey, although based upon different assessment criteria.

5. DISCUSSION

The WA Department of Agriculture's Technical Bulletin, No. 87 covers a survey area of 100 570 square kilometres. Within that area the Bullimore Land System occupies 24 013 square kilometres or 24%. Given the nature of the proposed activity, i.e., shallow strip mining of sand, any physical disturbance created would be confined to the extensive Sandplain Spinifex Hummock Grassland within the Bullimore Land System.

The area surveyed covered just 71.9 hectares and was confined to just one of the vegetation types described in Technical Bulletin 87, Sandplain Spinifex Hummock Grassland (SASP) and one vegetation sub-type, that being Sand Dune Shrubland (SDSH) which was encountered on the remaining portion of the dune currently being mined.

It is considered that the small size of the area surveyed, the uniformity of the vegetation within it and the varying effect that fire has had on it, combine to reduce the value of any statistical analysis of the data collected, hence, that has not been performed.

No potential Priority Ecological Communities were identified, with the nearest known one located 16.6 kilometres north of the survey area.

The nearest Threatened Ecological Community is located 30.5 kilometres west of the survey area.

An Index of Biodiversity Surveys for Assessment (I.B.S.A.) data package will be prepared in accordance with the requirements of *the Environmental Protection Act of 1986*.

6. CONCLUSION AND RECOMMENDATIONS

A total of 76 species (including sub-species and varieties) from 25 families and 53 genera have been recorded in the survey area. The most prevalent families recorded were *Fabaceae* and *Scrophulariaceae* (Appendix C).

- No plant species gazetted as Threatened or Declared Rare Flora pursuant to subsection (2) of section 23F of the *Biodiversity Conservation Act 2016* (W. A.) were recorded.
- No plant species listed as Threatened pursuant to Schedule 1 of the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth) (Department of Sustainability, Water, Population and Community) were recorded.
- No species listed as Declared by the Department of Agriculture and Food Western Australia under the *Biosecurity and Agricultural Management Act 2007* were recorded.
- No plant species listed as a Weed of National Significance (WoNS) under the *EPBC Act 1999* were encountered in the survey area. Weeds of National

Significance are considered by the States and Territories to pose a significant threat to biodiversity.

- No species identified as Priority species, listed by DBCA (2019) have yet been recorded.
- No Threatened Ecological Communities listed by the DBCA (2019) were recorded.
- No Threatened Ecological Communities listed by the Australian Government Department of Environment and Energy were identified.
- No Priority Ecological Communities listed by the DBCA (2019) were recorded.

The following recommendations are made to protect and enhance the conservation and botanical values in the Jonah Bore project area:

Apart from the actual mining and the threat of wildfires, the greatest threat posed to the vegetation of the area would most likely be from the dust generated by the mining and haulage of the sand, however there was no evidence that this had had a negative impact on the vegetation at the time of the survey nor prior to that time. It has been ascertained that a water truck is deployed for dust suppression at the site, this appears to be having the desired effect as it was found that plants growing on the edge of disturbed areas did not appear to be adversely affected, as can be seen in the photo below.



Older rehabilitated areas were found to have a good cover of shrubs, predominantly *Acacias*, while recently disturbed areas that had not yet had any rehabilitation work done on them were surprisingly well covered with the grass *Rytidosperma caespitosum* as show below.



- Ground disturbance and clearing of vegetation should be limited to that which is essential for the development of the project.
- Apply weed prevention measures.
- Maintain rehabilitation techniques previously employed.

7. PARTICIPANTS

Mr Phil Stanley Dip Cart, Dip Hort and Ms Paula Pavlovic BA, MA of Goldfields Landcare Services carried out the field work, plant identification, mapping, report and IBSA data preparation for this project. Flora Taking (Biological Assessment) Licence numbers: FB2000231 and FB62000232.

GIS mapping by Mr Andrew Waters, BSc, GradCertGIS, AdvCertHort. of Woodgis.

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Appendix A: Species of Conservation Significance Database Search Results

Appendix A: Species of Conservation Significance recorded from DBCA data searches and DAWE Protected Matters Search. (See Key at bottom)

Taxon	Cons_Code	WAHERB	TPFL	NatureMap	EPBCA
<i>Baeckea</i> sp. Sandstone (C.A. Gardner s.n. 26 Oct. 1963)	3	X	X	x	
<i>Calytrix warburtonensis</i>	2		X		
<i>Eremophila arachnoides</i> subsp. <i>arachnoides</i>	3	X		X	
<i>Eremophila pungens</i>	4	X		X	
<i>Goodenia modesta</i>	3	X		X	
<i>Grevillea inconspicua</i>	4	X	X	X	
<i>Hemigenia exilis</i>	4	X	X	X	
<i>Homalocalyx echinulatus</i>	3	X			
<i>Korthalsella leucothrix</i>	1	X			
<i>Mirbelia ferricola</i>	3	X		X	
<i>Phyllanthus baeckeoides</i>	3	X	X	X	
<i>Seringia exastia</i>	T	X			CE
<i>Swainsona katjarra</i>	1	X			
<i>Thryptomene nealensis</i>	3	X		X	
<i>Thryptomene</i> sp. Leinster (B.J. Lepschi & L.A. Craven 4362)	3	X	X	X	
<i>Verticordia jamiesonii</i>	3	X		X	

Key:

T: Threatened

CE: Critically Endangered

TPFL: Threatened and Priority Flora

EPBCA: Environment Protection and Biodiversity Conservation Act

Appendix B: Quadrat Sampling Site Descriptions



Plate 1: Quadrat 1 Sandplain Spinifex Hummock Grassland (SASP)

At quadrat number one (51 J 247801 m E ; 6906106 m S) the vegetation was described as Open Low Scrub of *Acacia effusifolia*, *A. jamesiana*, *Grevillea juncifolia*, *Eremophila platythamnos* subsp. *platythamnos*, *E. forrestii* subsp. *forrestii* and *Duboisia hopwoodii* (PFC 2-10%, 1-2 m) over Open Dwarf Scrub of *Enekbatus eremaeus*, *Seringia velutina*, *Bonamia erecta*, *Dampiera roycei*, (PFC 2-10%, <1 m) over Open Hummock Grass of *Triodia basedowii* (PFC 10-30%, 0.4 m) and Scattered Grass of *Amphipogon caricinus* (PFC <1%, 0.3 m) on orange silty sand on a sand plain.



Plate 2: Quadrat 2 Sand Dune Shrubland (SASP sub-type SDSH)

At quadrat number two (51 J 247920 m E ; 6906327 m S) the vegetation was described as Open Low woodland A of *Eucalyptus gongylocarpa* (PFC 2-10%, 6 m) over Scattered Low Trees of *Eucalyptus oldfieldii* and *Gyrostemon ramulosus* (PFC <2%; <5 m) over Mixed Open Dwarf Scrub of *Senna artemisioides* subsp. *filifolia*, *Acacia ligulata*, *Grevillea juncifolia*, *Eremophila platythamnos* subsp. *platythamnos*, *Dianella revoluta*, *Ptilotus obovatus*, *Goodenia peacockiana*, *Leptosema chambersii*, and *Eucalyptus gongylocarpa* (PFC 2-10%, < 1m) over Very Open Hummock Grass of *Triodia basedowii* (PFC 2-10%; 0.3 m) with Scattered Grasses of *Rytidosperma caespitosum* and *Amphipogon caricinus*, and the annual *Leucochrysum stipitatum* (PFC <2%; 0.5 m) on orange sand on a sand dune.



Plate 3: Quadrat 3 Sand Dune Shrubland (SASP sub-type SDSH)

At quadrat number three (51 J 247737 m E; 6906425 m S) the vegetation was described as Scattered Low Trees B of *Eucalyptus gongylocarpa* and *Gyrostemon ramulosus* (PFC <2%, <5 m) over Open Dwarf Scrub of *Acacia jamesiana*, *Grevillea juncifolia*, *Eremophila forrestii* subsp. *forrestii*, *Enekbatus eremaeus*, *Homocalyx thryptomenoides*, *Calytrix desolata*, *Chrysocephalum puteale*, *Eremophila platythamnus* subsp. *platythamnus*, *Leptosema chambersii*, and *Grevillea juncifolia* (PFC 2-10%, <1 m) over Open Hummock Grass of *Triodia basedowii* (PFC 10-30%, 0.4 m) and Scattered Grass of *Rytidosperma caespitosum* on orange silty sand on a sand dune.



Plate 4: Quadrat 4 Sandplain Spinifex Hummock Grassland (SASP)

At quadrat number four (51 J 248585 m E; 6906304 m S) the vegetation was described as Open Low woodland A of *Eucalyptus gongylocarpa*, (PFC 2-10%, 7 m) over Scattered Low Trees B of *E. gongylocarpa* (PFC <1%, 2-3 m) over Open Low Scrub of *Acacia ligulata*, *A. murrayana*, *Dodonaea viscosa* subsp. *mucronata*, *E. gongylocarpa*, *E. leptopoda*, *Grevillea juncifolia*, *Rhagodia drummondii*, *Marianthus bicolour* and *Hakea minyma* (PFC 2-10%, 1-2 m) over Scattered Low shrubs of *Maireana thesioides*, *Ptilotus obovatus*, *Euphorbia tannensis* subsp. *eremophila* and *Ptilotus polystachyus* (PFC <2%, <1 m) over Open Hummock Grass of *Triodia basedowii* (PFC 10-30%, 0.4 m) on orange silty sand on a sand plain.

Appendix C: Species List by Vegetation Type

Appendix C: Plant Species List by Vegetation Type. (See key at end of list.)

Family	Genus and Species	SASP	SDSH	Rehab
Amaranthaceae	<i>Ptilotus obovatus</i>	X	X	
Amaranthaceae	<i>Ptilotus polystachya</i>	X		
Araliaceae	<i>Trachymene glaucifolia</i>	X		
Asparagaceae	<i>Thysanotus exiliflorus</i>		X	
Asparagaceae	<i>Thysanotus manglesianus</i>	X		
Asteraceae	<i>Chrysocephalum puteale</i>		X	
Asteraceae	<i>Lemooria burkittii</i>	X		
Asteraceae	<i>Leucochrysum stipitatum</i>	X	X	
Asteraceae	<i>Olearia subspicata</i>		X	
Asteraceae	<i>Siemssenia capillaris</i>	X		
Chenopodiaceae	<i>Dysphania rhadinostachya</i> subsp. <i>inflata</i>	X		
Chenopodiaceae	<i>Maireana thesioides</i>	X		
Chenopodiaceae	<i>Rhagodia drummondii</i>	X		
Chenopodiaceae	<i>Salsola australis</i>			X
Convolvulaceae	<i>Bonamia erecta</i>	X		
Convolvulaceae	<i>Convolvulus remotus</i>	X		
Cyperaceae	<i>Schoenus subaphyllus</i>	X		
Euphorbiaceae	<i>Euphorbia tannensis</i> subsp. <i>eremophila</i>	X		
Euphorbiaceae	<i>Monotaxis luteiflora</i>	X		
Fabaceae	<i>Acacia caesaneura</i>	X		
Fabaceae	<i>Acacia effusifolia</i>	X		
Fabaceae	<i>Acacia jamesiana</i>	X	X	
Fabaceae	<i>Acacia ligulata</i>	X	X	
Fabaceae	<i>Acacia longispinea</i>	X		
Fabaceae	<i>Acacia minyura</i>	X		
Fabaceae	<i>Acacia murrayana</i>	X		
Fabaceae	<i>Acacia tetragonophylla</i>	X		
Fabaceae	<i>Daviesia grahamii</i>	X		
Fabaceae	<i>Leptosema chambersii</i>	X	X	
Fabaceae	<i>Senna artemisioides</i>	X		
Fabaceae	<i>Senna artemisioides</i> subsp. <i>filifolia</i>		X	
Fabaceae	<i>Senna glutinosa</i> subsp. <i>xluerssenii</i>	X	X	
Fabaceae	<i>Senna pleurocarpa</i> subsp. <i>pleurocarpa</i>	X		
Goodeniaceae	<i>Brunonia australis</i>	X		
Goodeniaceae	<i>Dampiera roycei</i>	X		

Appendix C: Plant Species List by Vegetation Type. *continued*

Family	Genus and Species	SASP	SDSH	Rehab
Goodeniaceae	<i>Goodenia peacockiana</i>	X	X	
Goodeniaceae	<i>Scaevola parvifolia</i>		X	
Goodeniaceae	<i>Scaevola spinescens</i>	X		
Gyrostemonaceae	<i>Gyrostemon ramulosus</i>		X	
Homerocallidaceae	<i>Dianella revoluta</i>	X	X	
Lamiaceae	<i>Prostanthera althoferi</i>	X		
Malvaceae	<i>Alyogyne pinoniana</i>	X		
Malvaceae	<i>Androcalva loxophylla</i>	X		
Malvaceae	<i>Brachychiton gregorii</i>	X		
Malvaceae	<i>Seringia velutina</i>	X		
Montiaceae	<i>Calandrinia polyandra</i>	X		
Myrtaceae	<i>Calytrix desolata</i>		X	
Myrtaceae	<i>Enekbatus eremaeus</i>	X	X	
Myrtaceae	<i>Eucalyptus gongylocarpa</i>	X	X	
Myrtaceae	<i>Eucalyptus kingsmillii</i>	X		
Myrtaceae	<i>Eucalyptus leptopoda</i>	X	X	
Myrtaceae	<i>Eucalyptus oldfieldii</i>	X		
Myrtaceae	<i>Homalocalyx thryptomenoides</i>	X	X	
Myrtaceae	<i>Micromyrtus flaviflora</i>	X		
Pittosporaceae	<i>Marianthus bicolor</i>	X	X	
Pittosporaceae	<i>Pittosporum angustifolium</i>	X		
Poaceae	<i>Amphipogon caricinus</i>	X	X	
Poaceae	<i>Rytidosperma caespitosum</i>	X	X	X
Poaceae	<i>Triodia basedowii</i>	X	X	
Proteaceae	<i>Grevillea didymobotrya</i> subsp. <i>didymobotrya</i>	X		
Proteaceae	<i>Grevillea juncifolia</i>	X	X	
Proteaceae	<i>Hakea minyma</i>	X		
Rubiaceae	<i>Psydrax rigidula</i>	X		
Rubiaceae	<i>Psydrax suaveolens</i>	X		
Santalaceae	<i>Exocarpos sparteus</i>	X		
Sapindaceae	<i>Dodonaea microzyga</i> var. <i>acrolobata</i>		X	
Sapindaceae	<i>Dodonaea viscosa</i> subsp. <i>mucronata</i>	X	X	
Scrophulariaceae	<i>Eremophila decipiens</i>	X		
Scrophulariaceae	<i>Eremophila forrestii</i> subsp. <i>forrestii</i>	X	X	
Scrophulariaceae	<i>Eremophila granitica</i>	X	X	
Scrophulariaceae	<i>Eremophila longifolia</i>	X		
Scrophulariaceae	<i>Eremophila platythamnos</i> subsp. <i>platythamnos</i>	X	X	

Appendix C: Plant Species List by Vegetation Type. *continued*

Family	Genus and Species	SASP	SDSH	Rehab
Solanaceae	<i>Duboisia hopwoodii</i>	X		
Solanaceae	<i>Solanum centrale</i>	X		
Solanaceae	<i>Solanum lasiophyllum</i>	X		
Thymelaeaceae	<i>Pimelea microcephala</i>	X		

Key:

SASP: (Undifferentiated) Sandplain Spinifex Hummock Grasslands.

SAHS: Sandplain Heath Stratum

Appendix D: Conservation Code Definitions

Appendix D1: Conservation Codes for Western Australian Flora and Fauna (Department of Biodiversity, Conservation and Attractions, 2016) Retrieved Feb. 2019

Specially protected fauna and flora Code	Description
T	<p><u>Threatened species</u></p> <p>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.</p>
CR	<p>Critically endangered species</p> <p>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.</p>
EN	<p>Endangered species</p> <p>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.</p>
VU	<p>Vulnerable species</p> <p>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.</p>
EX	<p>Extinct species</p> <p>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.</p>
EW	<p>Extinct in the wild species</p> <p>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.</p>

Appendix D2: Conservation Codes for Western Australian Flora and Fauna (Department of Biodiversity, Conservation and Attractions, 2016) Retrieved Feb. 2019 *continued*

Specially protected species	Description
<p style="text-align: center;">MI</p>	<p>Migratory species</p> <p>Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act). 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.</p>
<p style="text-align: center;">CD</p>	<p>Species of special conservation interest (conservation dependent fauna)</p> <p>Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act). Published as conservation dependent fauna under schedule 6 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018..</p>
<p style="text-align: center;">OS</p>	<p>Other specially protected species</p> <p>Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act). Published as other specially protected fauna under schedule 7 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.</p>

Appendix D3: Conservation Codes for Western Australian Flora and Fauna (Department of Biodiversity, Conservation and Attractions, 2016) Retrieved Feb. 2019 *continued*

Priority Species Codes	Description
<p>P1</p>	<p>Priority 1: Poorly-known species</p> <p>Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.</p>
<p>P2</p>	<p>Priority 2: Poorly-known species</p> <p>Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.</p>
<p>P3</p>	<p>Priority 3: Poorly-known species</p> <p>Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.</p>
<p>P4</p>	<p>Priority 4: Rare, Near Threatened and other species in need of monitoring</p> <p>(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands.</p> <p>(b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for Vulnerable but are not listed as Conservation Dependent.</p> <p>(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.</p>

Appendix D4: Definition of Threatened Flora Species (Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth))

Category Code	Category
Ex	<p>Extinct</p> <p>Species which at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.</p>
ExW	<p>Extinct in the Wild</p> <p>Species which is known only to survive in cultivation, in captivity or as a naturalized population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.</p>
CE	<p>Critically Endangered</p> <p>Species which at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.</p>
E	<p>Endangered</p> <p>Species which is not critically endangered and it is facing a very high risk of extinction in the wild in the immediate or near future, as determined in accordance with the prescribed criteria.</p>
V	<p>Vulnerable</p> <p>Species which is not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.</p>
CD	<p>Conservation Dependent</p> <p>Species which at a particular time if, at that time: a) the species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or b) the following subparagraphs are satisfied: (i) the species is a species of fish; (ii) the species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximized; (iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory; (iv) cessation of the plan of management would adversely affect the conservation status of the species.</p>

Appendix D5: Definitions and Criteria of Threatened Ecological Communities (Department of Environment and Conservation 2013)

Category Code	Category
<p style="text-align: center;">PD</p>	<p>Presumed Totally Destroyed</p> <p>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:</p> <p>(i) Records within the last 50 years have not been confirmed despite thorough searches or known likely habitats or;</p> <p>(ii) All occurrences recorded within the last 50 years have since been destroyed.</p>
<p style="text-align: center;">CE</p>	<p>Critically Endangered</p> <p>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.</p> <p>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.</p> <p>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).</p>
<p style="text-align: center;">EN</p>	<p>Endangered</p> <p>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):</p> <p>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):</p> <p>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);</p> <p>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.</p> <p>B) Current distribution is limited, and one or more of the following apply (i, ii or iii):</p> <p>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);</p> <p>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;</p> <p>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.</p> <p>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).</p>
<p style="text-align: center;">VU</p>	<p>Vulnerable</p> <p>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 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):</p> <p>A) The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated.</p> <p>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.</p> <p>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.</p>

Appendix D6: Definitions and Criteria for Priority Ecological Communities (Department of Environment and Conservation 2013)

Category Code	Category
<p>P1</p>	<p>Poorly-known ecological communities:</p> <p>Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤ 5 occurrences or a total area of ≤ 100ha). 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.</p>
<p>P2</p>	<p>Poorly-known ecological communities:</p> <p>Communities that are known from few occurrences with a restricted distribution (generally ≤ 10 occurrences or a total area of ≤ 200ha). At least some occurrences are not believed to be under immediate threat 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.</p>
<p>P3</p>	<p>Poorly known ecological communities:</p> <p>(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:</p> <p>(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, or;</p> <p>(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, and inappropriate fire regimes.</p> <p>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.</p>
<p>P4</p>	<p>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.</p> <p>6. 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.</p> <p>(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 Vulnerable.</p> <p>(iii) Ecological communities that have been removed from the list of threatened communities during the past five years.</p>
<p>P5</p>	<p>Conservation Dependent ecological communities</p> <p>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.</p>

Appendix E: Vegetation Classification System

Appendix E: Vegetation Classification System (Modified Muir 1977)

Form/Height	Canopy Cover				
	Dense 70-100%	Mid-Dense 30-70%	Sparse 10-30%	Very Sparse 2-10%	Scattered <2%
Trees >30m	Dense Tall Forest	Tall Forest	Tall Woodland	Open Tall Woodland	Scattered Tall Trees
Trees 15-30m	Dense Forest	Forest	Woodland	Open woodland	Scattered Trees
Trees 5-15m	Dense Low Forest A	Low Forest A	Low Woodland A	Open Low Woodland A	Scattered Low Trees A
Trees <5m	Dense Low Forest B	Low Forest B	Low Woodland B	Open Low Woodland B	Scattered Low Trees B
Mallee tree form	Dense Tree Mallee	Tree Mallee	Open Tree Mallee	Very Open Tree Mallee	Scattered Tree Mallees
Mallee shrub form	Dense Shrub Mallee	Shrub Mallee	Open Shrub Mallee	Very Open Shrub Mallee	Scattered Shrub Mallees
Shrubs >2m	Dense Thicket	Thicket	Scrub	Open Scrub	Scattered Tall Shrubs
Shrubs 1-2m	Dense Heath	Heath	Low Scrub	Open Low Scrub	Scattered Shrubs
Shrubs <1m	Dense Low Heath	Low Heath	Dwarf Scrub	Open Dwarf Scrub	Scattered Low Shrubs
Mat plants, Bunch	Dense Mat Plants/	Mat Plants/Grass/	Open Mat Plants/	Very Open Mat Plants/	Scattered Mat Plants/
Grass, Hummock	Grass/Hummock	Hummock Grass/	Grass/Hummock	Grass/Hummock Grass/	Grasses/Hummock
Grass, Sedges, Herbs	Grass/Sedges/Herbs	Sedges/Herbs	Grass/Sedges/Herbs	Sedges/Herbs	Grasses/Sedges/Herbs

**APPENDIX 5: BASIC VETEBRATE FAUNA SURVEY AND
TARGETED ARID BRONZE BUTERFLY SURVEY
(WESTERN WILDLIFE 2022)**

Jonah Bore Project:

Basic Vertebrate Fauna Survey and Targeted Arid Bronze Azure Butterfly Survey 2021



Prepared for: MLG Oz Limited

Prepared by: Western Wildlife
570 Clare Rd
Hovea WA 6071
Ph 0427 510 934



June 2023

Executive Summary

Introduction

MLG Oz Limited (MLG) operate a sand quarry at the Jonah Bore Project, 25km west of Leinster in the Goldfields region of Western Australia. Western Wildlife was commissioned to carry out a basic vertebrate fauna survey and targeted Arid Bronze Azure Butterfly (*Ogyris subterrestris petrina*) host ant and Malleefowl (*Leipoa ocellata*) survey.

The aims of the fauna survey were to:

- Identify the fauna habitats present in the study area.
- Conduct a targeted Malleefowl survey.
- Conduct a targeted survey for the host ant of the Arid Bronze Azure Butterfly.
- List the vertebrate fauna that were recorded in the study area and/or have the potential to occur in the study area.
- Identify species of conservation significance, or habitats of particular importance for fauna, that potentially occur in the study area.

Methods

The fauna survey was undertaken in accordance with *Technical guidance: terrestrial vertebrate fauna surveys for environmental impact assessment* (EPA 2020) and relevant State and Federal Guidelines on surveying conservation significant fauna.

The field study was undertaken by two zoologists on the 26th August 2021 and included:

- Identification of fauna habitats
- Targeted searches for evidence of the Malleefowl.
- Targeted searches for the attendant ant of the Arid Bronze Azure Butterfly.
- Opportunistic record keeping of all vertebrate fauna observed

Species of conservation significance were classified as: **Threatened** if listed as Extinct in the Wild, Critically Endangered, Endangered or Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and/or *Biodiversity Conservation Act 2016* (BC Act); **Migratory** if listed as Migratory under the EPBC Act and/or BC Act, excluding those species also listed as threatened; **Specially Protected** if listed as Other Specially Protected Species or Conservation Dependent Fauna under the BC Act; **Priority** if listed as Priority by DBCA and **Locally Significant** if considered by the author to potentially be of local significance.

Fauna Habitats

Two fauna habitats were identified across the study area:

- Spinifex - Eucalypt sandplain
- Sand dune

Habitats that are less common in the Bioregion, such as granite outcrops, salt lakes or freshwater wetlands, were absent from the study area.

Faunal Assemblage

The faunal assemblage of the study area is likely to be largely intact, as the study area is situated within a larger tract of native vegetation. Many of the species that occur are widely distributed through semi-arid Australia. The predicted faunal assemblage includes up to nine frogs, 80 reptiles, 116 birds, 30 native mammals and nine introduced mammals.

Conservation Significant Fauna

Sixteen conservation significant species may occur in the study area, 13 vertebrates and three invertebrates.

The eight Threatened species that may occur are:

- **Arid Bronze Azure Butterfly** (*Ogyris subterrestris petrina*) - EPBC Act (Critically Endangered), BC Act (Critically Endangered)
- **Night Parrot** (*Pezoporus occidentalis*) - EPBC Act (Endangered), BC Act (Critically Endangered)
- **Malleefowl** (*Leipoa ocellata*) - EPBC Act (Vulnerable), BC Act (Vulnerable)
- **Grey Falcon** (*Falco hypoleucos*) - EPBC Act (Vulnerable), BC Act (Vulnerable)
- **Great Desert Skink** (*Liopholis kintorei*) - EPBC Act (Vulnerable), BC Act (Vulnerable)
- **Chuditch** (*Dasyurus geoffroii*) - EPBC Act (Vulnerable), BC Act (Vulnerable)
- **Princess Parrot** (*Polytelis alexandrae*) - EPBC Act (Vulnerable), Priority 4
- **Southern Whiteface** (*Aphelocephala leucopsis*) – EPBC Act (Vulnerable).

A targeted survey for the host ant of the Arid Bronze Azure Butterfly failed to find any ants, thus it is unlikely that this species occurs in the study area. The Spinifex in the study area is unlikely to be large enough to support breeding or roosting by the Night Parrot, so this species is also unlikely to occur. The Malleefowl potentially occurs as a foraging visitor, but the study area does not contain breeding habitat. The Princess Parrot possibly occurs and the study area included potential breeding and foraging habitat, however, the core range of this irruptive species is further east. The Great Desert Skink possibly occurs, but it is uncertain whether the current range of the species extends as far southwest as the study area, and it generally favours treeless sandplains. The Grey Falcon is unlikely to occur as the study area is outside the core range for the species, and breeding habitat is absent. The Chuditch is likely to be locally extinct. The Southern Whiteface potentially occurs, however, this species prefers habitats such as Mulga woodlands and Acacia shrublands that are absent from the study area.

The one Migratory species that may occur is:

- **Fork-tailed Swift** (*Apus pacificus*) – EPBC Act (Migratory), BC Act (Migratory)

The Fork-tailed Swift is thought to be almost entirely aerial when visiting Australia. Although this species is likely to overfly the study area on occasion, the study area is not likely to provide important habitat. Several Migratory shorebirds occur in the region but there is no shorebird habitat in or within 20km of the study area.

The one Specially Protected species that may occur is:

- **Peregrine Falcon** (*Falco peregrinus*) – BC Act (Other Specially Protected Fauna)

No breeding habitat is present, but the study area may represent a small part of the foraging range for a pair of Peregrine Falcons.

The six Priority species that may occur are the:

- **Brush-tailed Mulgara** (*Dasyercus blythi*) – Priority 4
- **Long-tailed Dunnart** (*Sminthopsis longicaudata*) – Priority 4
- **Central Long-eared Bat** (*Nyctophilus major tor*) - Priority 3
- **Striated Grasswren** (*Amytornis striatus striatus*) – Priority 4
- **Moriarty's Trapdoor Spider** (*Kwonkan moriartii*) – Priority 2
- **Northern Shield-backed Trapdoor Spider** (*Idiosoma clypeatum*) - Priority 3

Of these, the Striated Grasswren was recorded during the fauna survey. The Brush-tailed Mulgara is likely to occur in the Spinifex – Eucalypt sandplain, although none were detected during the fauna survey. The Central Long-eared Bat possibly occurs, roosting in tree hollows if present, although it is likely to favour more wooded habitats. The Long-tailed Dunnart is unlikely to occur due to lack of suitable rocky habitats. The two species of Priority spider are also unlikely to occur, due to lack of suitable substrates for burrows.

Important Habitats

The habitats in the Study Area are common and widespread in the subregion and are unlikely to function as ecological linkages or refugia. Of the habitats present in the study area, the Spinifex – Eucalypt sandplain shrubland habitat potentially provides habitat for Priority 4 species the Brush-tailed Mulgara (*Dasyercus blythi*) and the Striated Grasswren (*Amytornis striatus striatus*), but the habitats present are unlikely to be important for Threatened species.

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1. Introduction

MLG Oz Pty Limited (MLG) operate a sand quarry at the Jonah Bore Project, 25km west of Leinster in the Goldfields region of Western Australia. As MLG propose to extend their quarry footprint, they commissioned Western Wildlife to carry out a basic vertebrate fauna survey of the development footprint. As the Arid Bronze Azure Butterfly (*Ogyris subterrestris petrina*) and Malleefowl (*Leipoa ocellata*) potentially occur in the region, the survey also included a component to target these species.

The aims of the fauna survey were to:

- Identify the fauna habitats present in the study area.
- Conduct a targeted Malleefowl survey.
- Conduct a targeted survey for the host ant of the Arid Bronze Azure Butterfly.
- List the vertebrate fauna that were recorded in the study area and/or have the potential to occur in the study area.
- Identify species of conservation significance, or habitats of particular importance for fauna, that potentially occur in the study area.

This report details the findings of the basic and targeted fauna survey conducted in August 2021 and a desktop study of a small additional area in June 2023.

1.1 The Study Area

The Jonah Bore Project is located in the Shire of Leonora in the Goldfields region of Western Australia, about 25km west of Leinster and 324km north of Kalgoorlie (Figure 1). The study area is located to the west of the existing sand quarry and totals 70.8ha, comprised of the 2021 63.6ha study area and the 2023 7.2ha desktop-only study area (Figure 2).

1.2 Regional Context

1.2.1 IBRA Bioregion

The Interim Biogeographic Regionalisation for Australia (IBRA) classifies the land surface of Australia into 89 Bioregions and 419 subregions, each defined by a set of environmental influences that impact the occurrence of flora and fauna and their interaction with the physical environment (DoEE 2018).

The study area lies in the East Murchison Subregion (MUR1) of the Murchison Bioregion of the Interim Biogeographic Regionalism for Australia (IBRA) classification system (DoEE 2017). The subregion includes hummock grasslands on red desert sandplains with minimal dune development, broad plains supporting mulga woodlands and large salt lake systems with saltbush and samphire shrublands (Cowan 2001).

Important features of the subregion include calcrete aquifers, which support stygofauna (subterranean aquatic invertebrates). Although the vertebrate fauna is considered diverse, they are generally wide-ranging and occur in one or more neighbouring subregions (Cowan 2001). Lake Barlee, about 126km southwest of the study area, is considered regionally significant as it is an important breeding site for Banded Stilts (*Cladorhynchus leucocephalus*).

1.2.2 Botanical Province

The Botanical Provinces are determined by vegetation mapping (Beard 1980) and broadly correspond to climactic regions; the Southwest (Bassian) Province experiencing warm dry summers and cool wet winters, the Northern Province experiencing warm wet summers and cool dry winters and the Eremaean Province experiencing low, irregular rainfall. The study area is in Eremaean Province, therefore, the faunal assemblage of the area is likely to be dominated by widespread arid-adapted species.

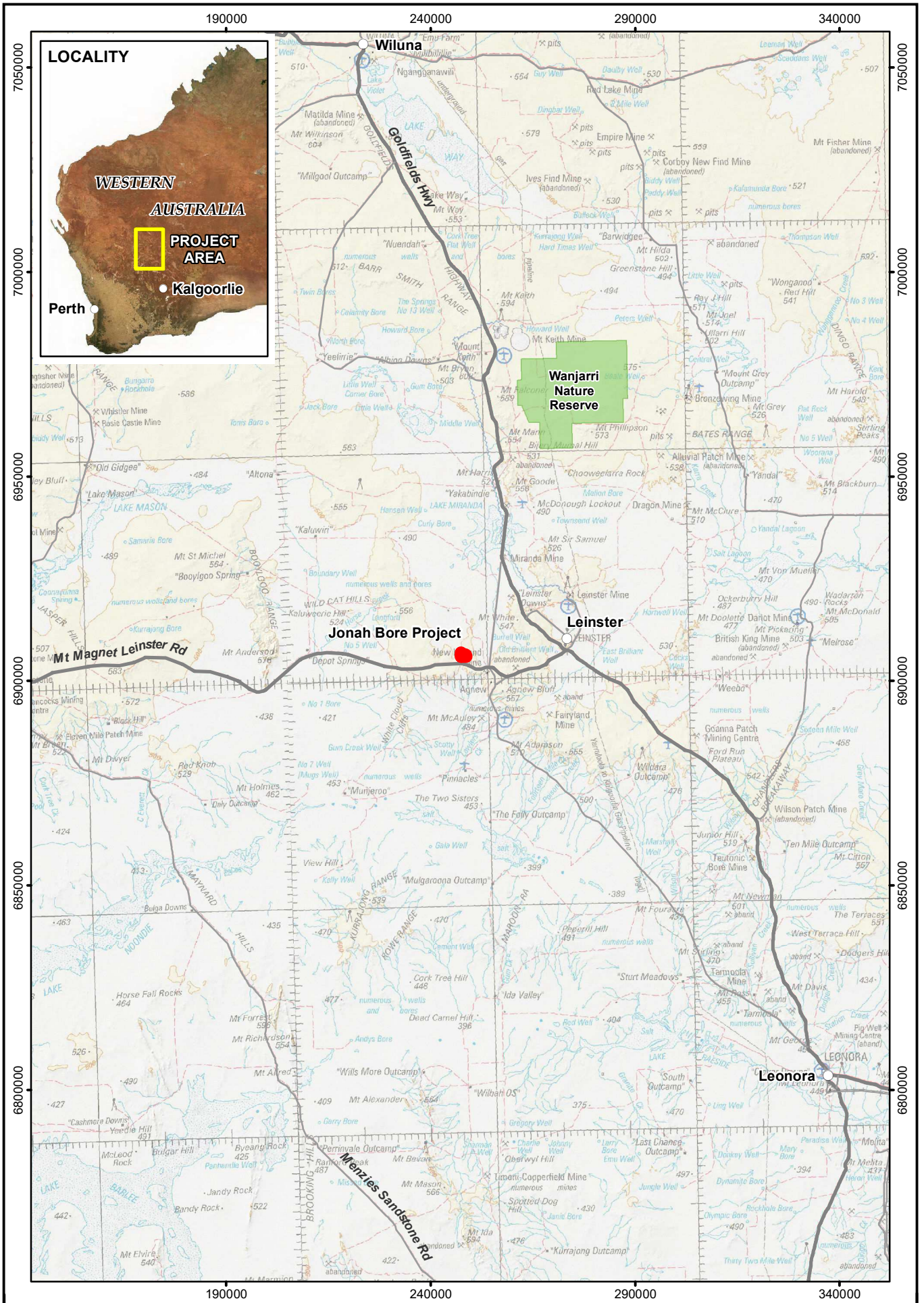
1.2.3 Parks and Reserves

The study area does not overlap with any parks or reserves. The nearest is Wanjarri Nature Reserve (Figure 1).

1.2.4 Land Systems

Land systems are broad descriptions of landform, geology and soils. The study area intersects with a single land system, characterised as follows:

- **Bullimore System** – gently undulating sandplain with occasional linear dunes and stripped surfaces supporting spinifex grasslands with mallees and acacia shrubs.



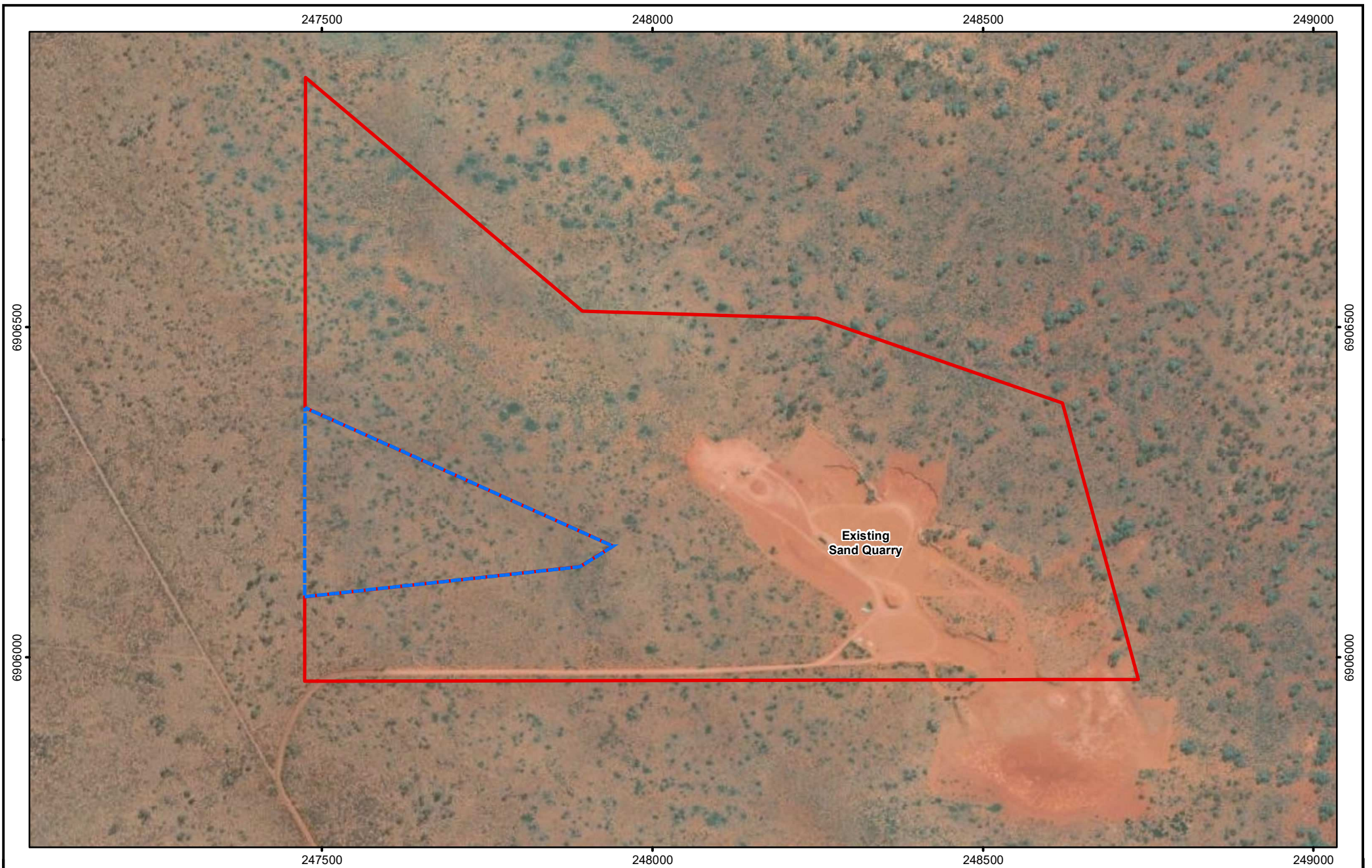
Drawn: CAD Resources
 www.cadresources.com.au
 Tel: (08) 9246 3242
 CAD Ref: a2840Fa009_01 | A4
 Date: June 2023 | Rev: A



N
 0 9 18 km
 Scale: 1:1,250,000
 MGA94 (Zone 51)
 Author: J. Wilcox



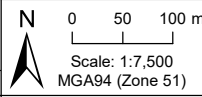
Jonah Bore Project
Regional Location

Figure: **1**



Legend
 2023 desktop study area
 2021 basic study area

Drawn: CAD Resources
 www.cadresources.com.au
 Tel: (08) 9246 3242
 CAD Ref: a2840Fa009_02 | A4
 Date: June 2023 | Rev: A | Author: J. Wilcox



**Jonah Bore Project
 Study Area**

1.3 Climate and Weather

The climate statistics for Leinster Aero (Site 012314) are presented in Figure 3. November to February are the hottest months and June to August the coolest. The variable rainfall recorded at Leinster is indicative of the Eremaean region. This weather station has a mean annual rainfall of 253mm. The annual rainfall recorded for 2020 was below average at 102.6mm. Weather during the fauna survey was warm (26°C) and dry.

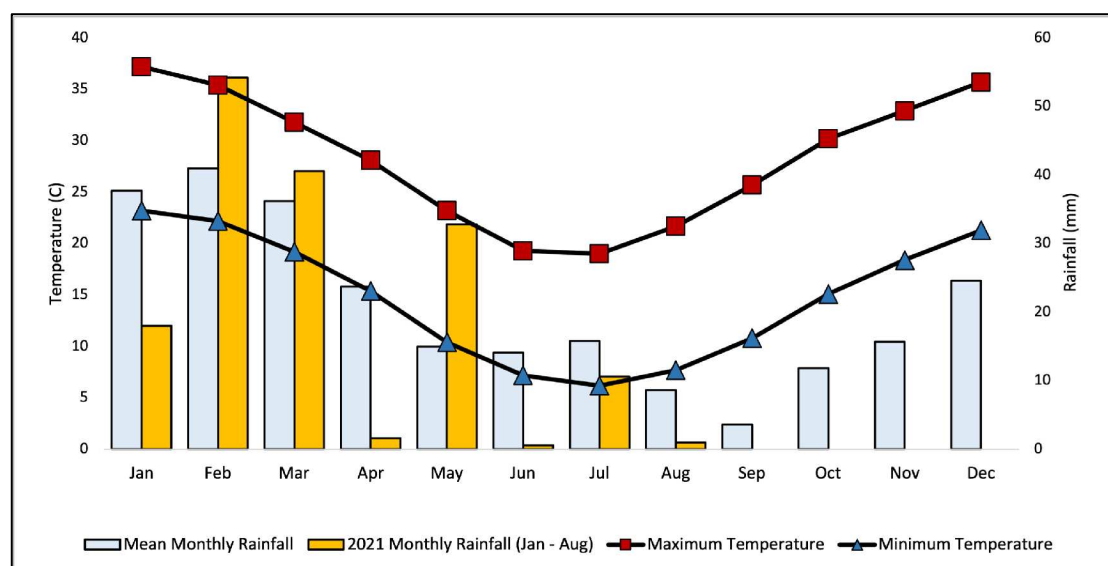


Figure 3. Mean monthly temperature and rainfall at Leinster (data from Bureau of Meteorology 2021).

2. Methods

2.1 Level of Survey

A basic vertebrate fauna survey and targeted survey for the host ant of the Arid Bronze Azure Butterfly (*Ogyris subterrestris petrina*) were conducted. The fauna survey was conducted with reference to the following documents:

- Environmental factor guideline – terrestrial fauna (EPA 2016)
- Technical guidance: terrestrial vertebrate fauna surveys for environmental impact assessment (EPA 2020)
- Guideline for the survey of arid bronze azure butterfly (ABAB) in Western Australia (DFCA 2020)

The fauna survey included a search of available literature and databases (a desk-top study), and a short site visit. The data collected in the field serve to put the desk-top study into context, as well as allowing for the identification of fauna habitats and likely faunal assemblages of the site. In 2023, a 7.2ha area was added to the study area. As the vegetation was the same as much of the original study area, this area was subject to a desk-top survey only.

2.2 Personnel

Two zoologists from Western Wildlife carried out the fauna survey (Table 1).

Table 1. Personnel involved in the fauna survey.

Name	Role	Qualification	Experience
Jenny Wilcox	Supervising Zoologist (plan and lead fieldwork, prepare report)	BSc.Biol./Env.Sci., Hons.Biol.	21 years
Tim Gamblin	Conduct fieldwork	BSc.	10 years

2.3 Taxonomy and Nomenclature

Taxonomy and nomenclature for fauna species used in this report follow the Western Australian Museum checklists.

2.4 Literature Review

Lists of fauna expected to occur in the study area were produced using information from a number of sources. These included publications that provide information on general patterns of distribution of frogs (Tyler *et al.* 2000), reptiles (Storr *et al.* 1983, 1990, 1999 and 2002, Wilson and Swan 2017), birds (Barrett *et al.* 2003; Johnstone and Storr 1998; Johnstone and Storr 2004) and mammals (Churchill 2007, Menkhorst and Knight 2011; Van Dyck and Strahan 2008).

The databases in Table 2 were searched for fauna records in and around the study area. Some species may occur on database results that are not likely to be present in the study area, usually due either to lack of suitable habitat or the study area being outside the known range of the species (i.e., erroneous records or records of vagrants). Where possible, these species are not included in lists of expected fauna.

Table 2. Databases used in the preparation of this report.

Database	Type of records held on database	Area searched
Western Australian Museum Specimen Database (DBCA 2007-)	Records of specimens held in the WA Museum. Includes historical data.	20km surrounding 27.9452°S, 120.4401°E.
Fauna Survey Returns Database (DBCA 2007-)	Records of fauna captured, observed or inferred from secondary evidence during fauna surveys.	40km surrounding 27.9452°S, 120.4401°E.
Birds Australia Atlas Database (DBCA 2007-)	Records of bird observations in Australia, 1998-2009.	40km surrounding 27.9452°S, 120.4401°E.
Birdata (DBCA 2007-)	Records of bird observations in Australia, 2010-current.	20km surrounding 27.9452°S, 120.4401°E.
Mark Cowan Surveys (DBCA 2007-)	Vertebrate captures from various biological surveys undertaken by Mark Cowan and colleagues from 2001 - 2017.	20km surrounding 27.9452°S, 120.4401°E.
DBCA's Threatened and Priority Fauna Database	Records of Threatened and Priority species in Western Australia, also drawing from the databases above.	100km surrounding 485610 E, 6638560 N (Zone 51)
EPBC Act Protected Matters Search Tool	Records on matters protected under the EPBC Act, including threatened species.	10km surrounding 27.9452°S, 120.4401°E.
Index of Biodiversity Surveys for Assessments (IBSA) Database.	Biodiversity reports and spatial data that support assessments and compliance.	Murchison Biogeographic Region (within 100km of study area).

In addition, the results of the following fauna surveys within 100km of the study area were used to compile the fauna lists:

- *The Biological Survey of the Eastern Goldfields of Western Australia Part 10: Sandstone-Sir Samuel and Leonora-Laverton Study Area* (Hall *et al.* 1994). The Sandstone – Sir Samuel study area was located at Wanjarri, about 70km north-east of the study area and the Leonora-Laverton study area was located at Eristoun, about 180km south-east of the study area. These sites were sampled 1979 – 1981.
- *Vertebrate Fauna Assessment, Yeelirrie Project: Baseline Report* (Bamford Consulting Ecologists 2011). The Yeelirrie Project is located about 79km north of the study area. This survey was undertaken in 2009 and 2010 and included a site reconnaissance survey, a two-phase detailed trapping survey and two targeted survey for conservation significant species. A total of four frog, 49 reptile, 82 bird, 21 native mammal and four introduced mammals were recorded. Conservation significant species recorded were the Brush-tailed Mulgara (*Dasyercus blythi*), Malleefowl (*Leipoa ocellata*), Peregrine Falcon (*Falco peregrinus*), Black-flanked Rock-wallaby (*Petrogale lateralis lateralis*) and Central Long-eared Bat (*Nyctophilus major tor*).

- *Mt Keith Satellite Proposal: Vertebrate Fauna Review* (Biota Environmental Sciences 2017). This review includes data from previous surveys at the Mt Keith Project in 2004 by ATA (2005) and 2004, 2005 and 2006 by Biota Environmental Sciences (2006a, 2006b). The Mt Keith Project is located about 79km north of the study area. A total of three frog, 38 reptile, 77 bird, 16 native mammal and one introduced mammal were recorded across all surveys reviewed. No species currently listed as conservation significant were recorded but the Brush-tailed Mulgara (*Dasymercus blythi*) was recorded nearby.
- *Bellevue Gold Limited Level 2 Fauna Assessment: Bellevue Gold Project* (Bamford Consulting Ecologists 2019). The Bellevue Gold Project is located about 50km northeast of the study area. This survey was undertaken in 2018 and involved a single-phase detailed survey and targeted surveys for conservation significant fauna. A total of one frog, 29 reptile, 58 bird, eight native mammal and four introduced mammals were recorded. No species currently listed as conservation significant were recorded.
- *Flora and Fauna Survey: Agnew Gold Mine Camp, Power Plant, Airport, Wind Farm and Pipeline* (Stantec 2018). The Agnew Gold Project is located about 8km south of the study area. The basic fauna survey was conducted in 2018 and one reptile, five birds, two native mammals and four introduced mammals were recorded. No species currently listed as conservation significant were recorded. This report also summarises the results of a single-phase detailed survey of the Agnew Gold Mine by ENV Australia (2008) in which 62 species but no conservation significant fauna were recorded, and three basic fauna surveys undertaken by Astron (2012), Minesite Rehabilitation Services (2003) and Rapallo Environmental (2017).

2.5 Field Studies

2.5.1 Licensing

The fauna survey was completed under Fauna Taking (Biological Assessment) Licence 27000507 and Authorisation to Take or Disturb Threatened Species TFA 2021-0105.

2.5.2 Arid Bronze Azure Butterfly Host Ant Survey

The Arid Bronze Azure Butterfly Host Ant Survey was undertaken in a manner consistent with the survey guidelines for this species (DBCA 2020). The survey guidelines recommend that the number of sample sites is calculated using the following:

$$\text{number of sample trees} = 10 \times \sqrt{(\text{site area in hectares})}$$

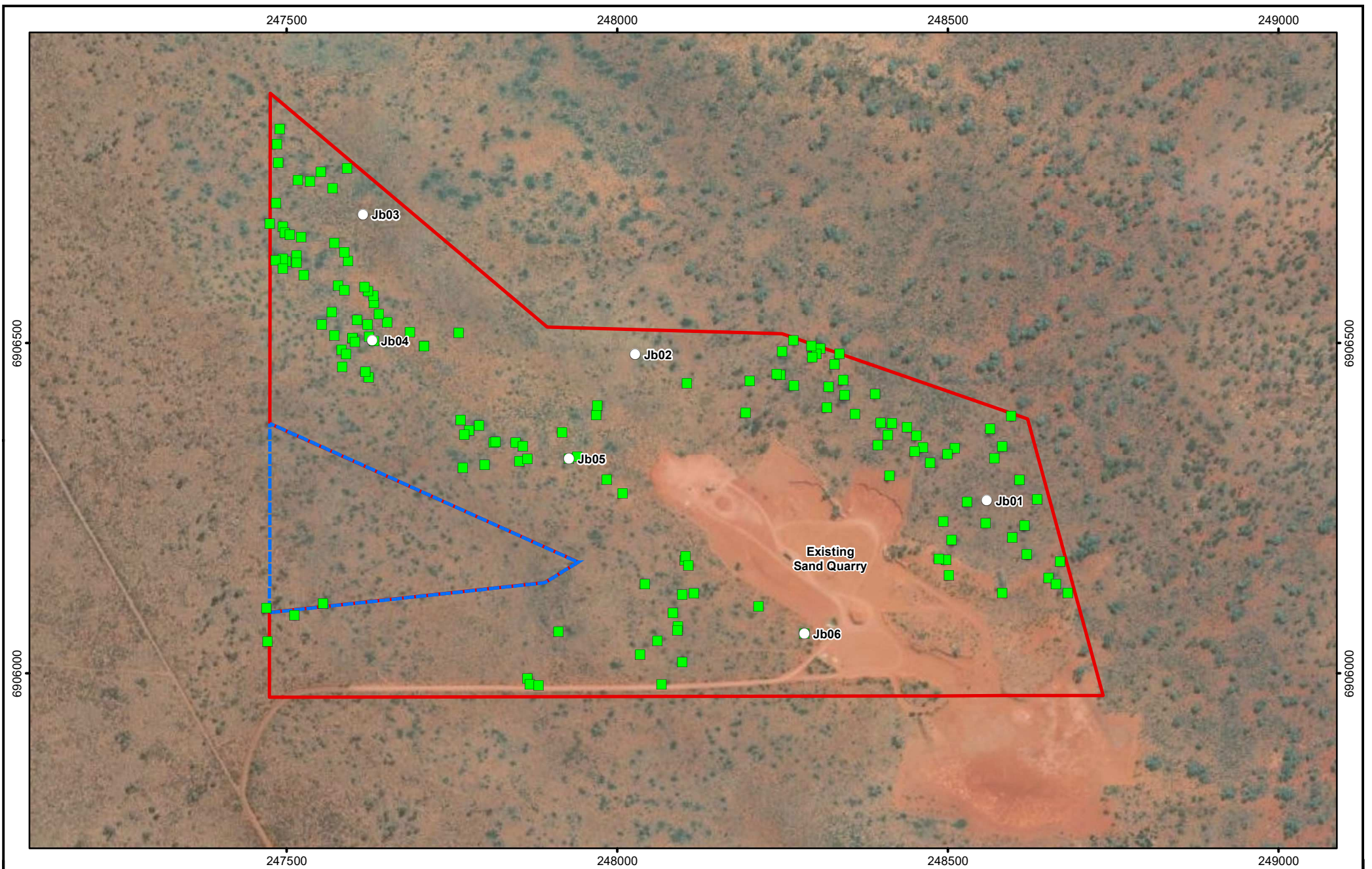
Therefore, for the 63.6ha study area, the minimum number of sample trees is 80. As the study area was small, the survey exceeded this with almost all trees present sampled, totaling 146 trees (Figure 4). The diameter at breast height (DBH) of each tree was measured, and the soil surface around the base of the tree disturbed to sample for the ant. If the host ant *Camponotus sp. nr. terebrans* was present, a specimen would be collected for confirmation of identification.

2.5.3 Opportunistic Records

All vertebrate fauna observed in the study area were recorded. Fauna were observed directly, or inferred from secondary signs such as burrows, diggings, feathers, tracks, scats or skulls. Particular attention was paid to searching for signs of conservation significant species, including the Malleefowl (*Leipoa ocellata*) and Brush-tailed Mulgara (*Dasymercus blythi*). All Malleefowl mounds were recorded with a GPS location, photograph and indication of activity.

2.6 Habitat Mapping

Habitat mapping was undertaken using observations made by fauna personnel in the field (Figure 4, Appendix 5), interpretation of aerial photography and vegetation mapping in Onshore Environment (2020) and Goldfields Landcare Services (2021). CAD Resources produced the maps from shapefiles and information provided by Western Wildlife. Elements of each habitat likely to be important for fauna were identified. Habitat elements may include, but are not limited to, rocky crevices, caves, tree hollows, tree crevices, leaf litter or sands suitable for burrowing.



Legend

- 2021 basic study area
- 2023 desktop study area
- Arid Bronze Azure Butterfly Host Ant Sample Tree
- Habitat Assessment

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

CAD Ref: a2840Fa009_04 | A4

Date: June 2023 | Rev: A | Author: J. Wilcox

N

0 50 100 m

Scale: 1:7,500
MGA94 (Zone 51)

Western Wildlife

Jonah Bore Project Survey Effort

2.7 Likelihood of Occurrence

Fauna of conservation significance were assessed and ranked for their likelihood of occurrence in the study area, according to the criteria in Table 3.

Table 3. Criteria for assessing likelihood of occurrence.

Likelihood	Criteria
Unlikely	<ul style="list-style-type: none"> • The study area is outside the current known distribution of the species as presented in the literature. • No suitable habitat was identified as being present during the field survey. • For some species, individuals may occur occasionally as vagrants, especially if suitable habitat is located nearby, but the study area itself would not support the species. • May include species generally accepted as being locally extinct.
Possible	<ul style="list-style-type: none"> • The study area is within or just outside the current known distribution of the species, as presented in the literature. • Any habitat present is either limited in extent or of marginal quality at best. • No recent or nearby records of the species on databases. • The species is generally known to be less common in the vicinity of the study area (e.g., for inland sites, where the species usually occurs on the coast).
Potential	<ul style="list-style-type: none"> • The study area is within the current known distribution of the species, as presented in the literature. • Habitat of reasonable quality was identified as being present during the field survey. • There are some recent and/or nearby records of the species of databases.
Likely	<ul style="list-style-type: none"> • The study area is well within the current known distribution of the species, as presented in the literature. • Habitat of good quality was identified as being present during the field survey. • Many recent and nearby records of the species on databases.
Known to occur	<ul style="list-style-type: none"> • The species was positively identified in the study area during this field survey or recorded as occurring in the study area on previous recent field surveys. • Note that for a species 'known to occur', the habitat may still be marginal and therefore the population may be small, or the species may visit the site irregularly.

2.8 Assessing Conservation Significance of Fauna

2.8.1 Legislative Protection for Fauna

The Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) is the Commonwealth Government's primary piece of environmental legislation. Listed under Part 3 of the EPBC Act are 'Matters of National Environmental Significance' (MNES); these include threatened species, threatened ecological communities and migratory species. Threatened fauna species are assessed against categories based on International Union for Conservation of Nature (IUCN) criteria.

The migratory species listed under the EPBC Act are those recognised under international agreements. These agreements are the China-Australia Migratory Bird Agreement (CAMBA), the Japan-Australia Migratory Bird Agreement (JAMBA), the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA), or species listed under the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) for which Australia is a range state.

Matters of National Environmental Significance (MNES) include the following categories:

- **Extinct in the wild (EW):** Taxa known to survive only in captivity.
- **Critically Endangered (Cr):** Taxa facing an extremely high risk of extinction in the wild in the immediate future.
- **Endangered (En):** Taxa facing a very high risk of extinction in the wild in the near future.
- **Vulnerable (Vu):** Taxa facing a very high risk of extinction in the wild in the medium-term future.
- **Migratory (Mi):** Taxa listed under international agreements to which Australia is a party.

Reports on the conservation status of most vertebrate fauna species have been produced by the federal Department of Agriculture, Water and the Environment (DAWE) in the form of Action Plans. An Action Plan is a review of the conservation status of a taxonomic group against IUCN categories. Action Plans have been prepared for amphibians (Tyler 1998), reptiles (Cogger *et al.* 1993), birds (Garnett *et al.* 2011) and mammals (Woinarski *et al.* 2014). These publications also use categories similar to those used by the EPBC Act. The information presented in some of the earlier Action Plans may be out of date due to changes since publication.

The *Biodiversity Conservation Act 2016* (BC Act) is State legislation that aims to conserve and protect biodiversity and biodiversity components in Western Australia, including threatened fauna. It is administered by the Department of Biodiversity, Conservation and Attractions (DBCA). In addition to threatened fauna, the BC Act has scope to protect threatened ecological communities and important habitats.

Fauna species are listed under the BC Act as threatened species using IUCN categories, or as specially protected species, as described below.

Threatened Species:

- **Extinct in the wild (EW):** Taxa known to survive only in captivity.
- **Critically Endangered (Cr):** Taxa facing an extremely high risk of extinction in the wild in the immediate future.
- **Endangered (En):** Taxa facing a very high risk of extinction in the wild in the near future.
- **Vulnerable (Vu):** Taxa facing a very high risk of extinction in the wild in the medium-term future.

Specially Protected Species:

- **Migratory (Mi):** A subset of the migratory fauna that are known to visit Western Australia that are protected under the international agreements or treaties, excluding species that are listed as Threatened species.
- **Conservation dependent fauna (CD):** Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened
- **Other specially protected species (OS):** fauna in need of special protection to ensure their conservation.

The BC Act supersedes the *Western Australian Wildlife Conservation Act 1950* (WC Act).

Priority species are not listed under State or Commonwealth Acts. In Western Australia, DBCA maintains a list of Priority Fauna made up of species that are possibly Threatened but do not meet adequacy of survey requirements or are otherwise data deficient. There are four levels of Priority as defined by DBCA, as listed below.

- **Priority 1:** Poorly known species (on threatened lands)
- **Priority 2:** Poorly known species in few locations (some on conservation lands)
- **Priority 3:** Poorly known species in several locations (some on conservation lands)
- **Priority 4:** Rare, near threatened and other species in need of monitoring

2.8.2 Levels of Conservation Significance in this report

Five levels of conservation significance are used within this report to indicate the level of significance of fauna species, according to the following criteria:

- **Threatened (T):** Taxa listed as Extinct in the Wild, Critically Endangered, Endangered or Vulnerable under the EPBC Act and/or BC Act. These species are grouped as they are all species considered to be at risk of extinction, are often rare and are likely to be subject to on-going threatening processes.
- **Migratory (Mi):** Taxa listed as Migratory under the EPBC Act and/or BC Act, excluding those species also listed as threatened. These species are grouped as they are not necessarily rare but may be dependent on specific habitats for a portion of their life-cycle. For these species, loss of important foraging, breeding or stop-over sites may have a disproportionately large impact on populations.
- **Specially Protected (SP):** Taxa listed as Other Specially Protected Species or Conservation Dependent Fauna under the BC Act. These species are not necessarily rare but may be dependent on on-going conservation to ensure their protection.
- **Priority (P):** Taxa listed as Priority by DBCA. These species are grouped as they are either conservation dependent or data deficient and in need of further survey.
- **Locally Significant (LS):** Locally significant taxa are not listed under State or Commonwealth Acts or in publications on threatened fauna or as Priority species by DBCA, but are considered by the author to potentially be of local significance because they are at the limit of their distribution in the area, they have a very restricted range or they occur in breeding colonies (e.g. some waterbirds). This level of significance has no legislative recognition and is based on interpretation of information on the species patterns of distribution. For example, the Government of Western Australia (2000) used this sort of interpretation to identify significant bird species in the Perth metropolitan area as part of Bush Forever. Recognition of such species is consistent with the aim of preserving regional biodiversity.

2.9 Survey Limitations

Various factors can limit the effectiveness of a fauna survey. Pursuant to EPA Technical Guidance (EPA 2016c), these factors have been identified and their potential to impact on the effectiveness of the surveys has been assessed in Table 4 below. All fauna surveys have limitations, and not all fauna species present on the site are likely to be sampled during a survey. Fauna may not be recorded because they are rare, they are difficult to trap or observe, or because they are only present on the site for part of the year.

Table 4. Fauna survey limitations.

Potential Limitation	Extent of limitation for the fauna survey	
Competency /experience of the team carrying out the survey	Not limiting	Supervising zoologist has 21 years' experience with fauna surveys in Western Australia and is experienced with targeted Malleefowl surveys. Assisting zoologist has experience with targeted surveys for the host ant of the Arid Bronze Azure Butterfly.
Proportion of fauna identified, recorded and/or collected.	Not limiting	Although only a small proportion of the fauna were recorded, a complete inventory is not the purpose of a basic fauna survey.
Sources of information e.g. previously available information (whether historic or recent) as distinct from new data	Minor limitation	Few studies have been undertaken in the region, leading to a paucity of nearby recent records of fauna, making it difficult to place records in the study area into a regional context. This is somewhat ameliorated for many species as arid zone fauna typically have wide distributions.
Timing/weather/season/cycle	Not limiting	The weather was warm and dry, and conducive to recording fauna.
Disturbances (e.g. fire, flood, accidental human intervention etc.), which affected results of survey	Not limiting	No disturbances noted.
Intensity (in retrospect, was the intensity adequate)	Not limiting	Sufficient time was allowed to survey all habitats.
Completeness (e.g. was relevant area fully surveyed)	Not limiting	A representative proportion of all habitats were able to be accessed and surveyed.
Resources (e.g. degree of expertise available in animal identification to taxon level)	Not limiting	No taxonomic issues were encountered.
Remoteness and/or access problems	Not limiting	Entire study area accessible by vehicle or on foot.
Availability of contextual (e.g. biogeographic) information on the region	Minor limitation	There is little contextual information available for this region, however, much of the fauna that occur have widespread distributions across the arid zone.

3. Fauna Habitats

Two broad fauna habitats were identified in study area, plus the disturbed areas around the existing sand quarry (Table 5, Figure 5). The habitats are described in the sections below.

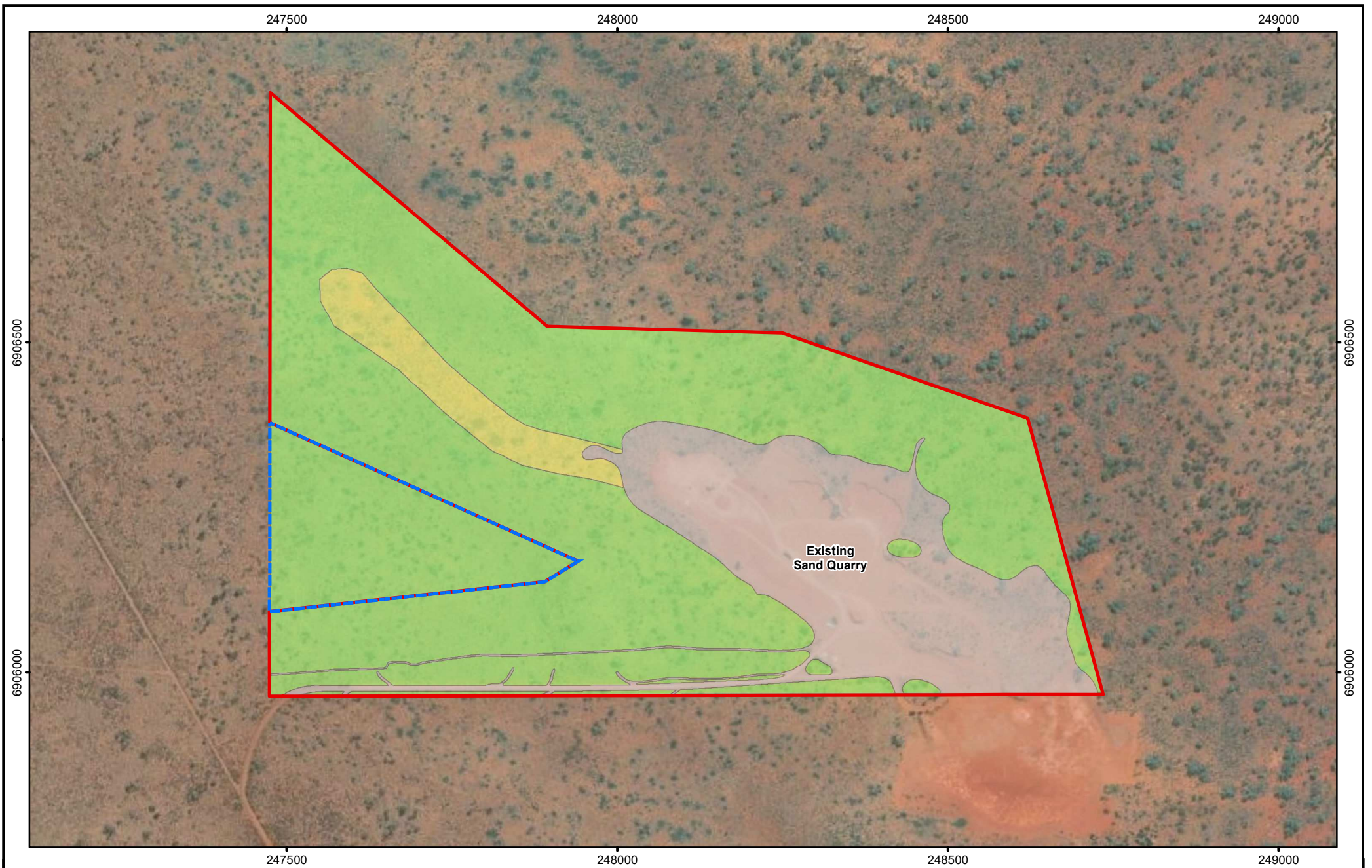
Table 5. Fauna habitats in the study area.

Fauna Habitat	Key Habitat Elements	Total Area (ha)
Spinifex – Eucalypt Sandplain	<ul style="list-style-type: none"> Consolidated sands provide habitat for burrowing mammal and reptiles. Scattered eucalypts provide crevices and hollows. 	50.7
Sand Dune	<ul style="list-style-type: none"> Loose sands provide habitat for fossorial reptiles. Scattered eucalypts provide crevices and small hollows. 	3.3
Disturbed	<ul style="list-style-type: none"> Nil 	16.8
		70.8

The fauna habitats of the study area are relatively common in the subregion and typical of the Bullimore Land System. Restricted habitat types that occur in the subregion, such as granite exposures, salt lakes or freshwater wetlands, are absent from the study area. The nearest salt lakes are about 22km north and 41km south.



Plate 1. Disturbed area around the existing sand quarry.



Legend	
	2023 desktop study area
	2021 basic study area
	Sand Dune
	Spinifex - Eucalypt Sandplain
	Disturbed

Drawn: CAD Resources www.cadresources.com.au Tel: (08) 9246 3242		 Scale: 1:7,500 MGA94 (Zone 51)
CAD Ref: a2840Fa009_05 A4	Date: June 2023	
Rev: A	Author: J. Wilcox	



Jonah Bore Project Fauna Habitats

3.1 Spinifex – Eucalypt Sandplain

Red sandplain supports a very open Marble Gum (*Eucalyptus gongylocarpa*) woodland over an open *Acacia* and *Eremophila* shrubland over spinifex hummock grassland. Conservation significant fauna that may use this habitat include the Brush-tailed Mulgara (*Dasyercus blythi* – Priority 4) and Striated Grasswren (*Amytornis striatus striatus* – Priority 4).



Plate 2. Spinifex – Eucalypt sandplain.



Plate 3. Spinifex – Eucalypt sandplain.



Plate 4. Spinifex – Eucalypt sandplain with larger hollow-bearing eucalypt.

3.2 Sand Dune

A low orange sand dune supported an open spinifex grassland with scattered Marble Gums over patches of open mixed shrubs such as *Grevillea* and *Acacia sp.* (Plates 5 and 6). The loose sands of this habitat support fossorial reptiles, some of which are sand dune specialists. Conservation significant fauna that may use this habitat include the Striated Grasswren (*Amytornis striatus striatus* – Priority 4).



Plate 5. Sand dune.



Plate 6. Sand dune.



Plate 7. Footslopes of sand dune.

4. Vertebrate Fauna of the Study Area

The results of the desktop survey and the field survey were combined to form lists of the vertebrate fauna potentially occurring in the study area. The lists of frogs, reptiles, birds and mammals that potentially occur in the study area are presented in Appendices 1 – 4 and are summarised below in Table 6. There are seven conservation significant fauna that potentially occur, and these are summarised in Table 7.

Table 6. Summary of vertebrate fauna potentially occurring in the study area.

Taxon	Total species	Introduced species	Recorded on this survey	Conservation significant species				
				Threatened	Migratory	Specially Protected	Priority	Locally Significant
Amphibians	9	-	-	-	-	-	-	-
Reptiles	80	-	-	1	-	-	-	-
Birds	116	-	20	5	1	1	1	-
Mammals	39	9	3	1	-	-	3	-
Totals:	244	9	23	7	1	1	4	0

As it is situated in a larger tract of native vegetation, the study area is likely to support a relatively intact faunal assemblage, with only regionally extinct species likely to be missing from the area. The faunal assemblage is likely to be primarily Eremaean, dominated by species occurring in arid areas with irregular rainfall. As the study area is relatively small and contains to habitats, it is unlikely that all of the species listed in Appendices 1 – 4 occur, however, these are all species known to occur in the region.

The predicted faunal assemblages and fauna of conservation significance are discussed in the sections below. The results of the EPBC Act Protected Matters search are given in Appendix 5. The results of the DBCA Threatened and Priority Fauna Database search and conservation significant fauna recorded on the survey are shown in Figures 6 - 8.

4.1 Amphibians

There are nine frog species potentially occurring in the study area (Appendix 1). Most of the species expected to occur are burrowing frogs that use seasonal or ephemeral wetlands for breeding. These species also breed opportunistically in man-made depressions. The study area lacks natural wetlands, but temporary pools in man-made depressions may occur in the current quarry areas. During the non-breeding season burrowing frogs may forage in the terrestrial habitats in the study area.

4.2 Reptiles

There are up to 80 species of reptile that potentially occur in the study area (Appendix 2). One species was observed opportunistically during the site visit. Given its setting in a large, continuous tract of native vegetation, the study area is likely to support an intact reptile assemblage in each habitat. Although the expected reptile assemblage is species rich, the overall small size of the study area makes it likely that the species present are a subset of those listed in Appendix 2.

Species that rely on rocky habitats or mulga woodlands are likely to be absent from the study area due to lack of suitable habitat. The study area is likely to support a suite of sandplain and sand-dune dwelling species, and a suite of more generalist species, such as the Dwarf Skink (*Menetia greyii*) and Mulga Snake (*Pseudechis australis*) that have large distributions and occur in a range of vegetation and soil types. Semi-arboreal species may occur in association with the larger eucalypts, where they can shelter in hollows and crevices.

4.3 Birds

There are 116 species of bird that potentially occur in the study area, of which 20 were observed during the fauna survey (Appendix 3). As the study area is in the arid (Eremaean) region, and thus the bird assemblage is likely to be dominated by species that are widespread, occurring across the inland arid areas of Australia. A small suite of species are Bassian in their distribution, (occurring in the south-west), and are on the north-eastern limit of their range in the study area, including the Spotted Pardalote (*Pardalotus punctatus*) and White-eared Honeyeater (*Nesioptilotis leucotis*).

While many bird species occur across all habitats, others are more dependent on a single habitat or habitat characteristic. Species that favour woodland habitats, such as the White-browed Treecreeper (*Climacteris affinis*) and Yellow-plumed Honeyeater (*Ptilotula ornata*) are likely to be uncommon in the shrubland-dominated study area, although they may still occur as mallee eucalypts are present. The scattered mallee trees may have small hollows suitable for nesting birds.

Honeyeaters and the Purple-crowned Lorikeet (*Parvipsitta porphyrocephala*) feed on nectar and move to take advantage of seasonal flowering resources. These species are likely to fluctuate in abundance, both seasonally and between years, and are likely to be abundant in the study area when the shrublands or eucalypt canopy is flowering.

A dense cover of shrubs is favoured by the Shy Heathwren (*Hylacola cauta*), Blue-breasted Fairy-wren (*Malurus pulcherrimus*), Southern Scrub-robin (*Drymodes brunneopygia*) and Copperback Quail-thrush (*Cinclosoma clarum*). These and other species nest in dense vegetation in the sandplain shrubland habitat or the edges of the sand dune habitat, some, such as the Southern Scrub-Robin, on the ground and many, such as the Inland Thornbill (*Acanthiza apicalis*), within a metre of the ground. These nests can be vulnerable to feral predators, (foxes and cats), when dense habitats are fragmented.

4.4 Mammals

There are 39 mammals with the potential to occur in the study area, of which 30 are native and nine are introduced (Appendix 4). Only three mammals were observed opportunistically during the site visit; the Euro (*Osphranter robustus*), Cat (*Felis catus*) and Dog (*Canis lupus*). The mammal assemblage also demonstrates both Bassian and Eremaean influences. Species such as the Ooldea Dunnart (*Sminthopsis ooldea*) have an arid distribution, contrasted to species such as the Western Pygmy Possum (*Cercartetus concinnus*), with a distribution that extend into the south-west.

The mammal assemblage is likely to be relatively intact, missing only those species extinct in the bioregion. Many of the critical weight range mammals, including species such as the Common Brushtail Possum (*Trichosurus vulpecula*), were noted to be lost from the semi-arid and arid regions in the vicinity of the study area by 1906 (Short 2004).

5. Fauna of Conservation Significance

5.1 Vertebrate Fauna

There are twelve fauna of conservation significance that are known to occur in the region: six Threatened, one Migratory, one Specially Protected and three Priority species. Each species is summarised in Table 7 and discussed in the sections below. No locally significant vertebrate fauna were identified. The majority of species likely to occur are wide-ranging in the arid region.

The following species are represented by records on DBCA's Threatened and Priority Fauna Database or possible occurrence on the EPBC Act Protected Matters Search Tool (Figure 6, Appendix 6), however, these are species that are reliant on wetlands, a habitat that is absent from the study area:

- Common Sandpiper (*Actitis hypoleucos*) – Migratory
- Curlew Sandpiper (*Calidris ferruginea*) – Critically Endangered
- Gull-billed Tern (*Geochelidon nilotica*) – Migratory
- Common Greenshank (*Tringa nebularia*) – Migratory
- Sharp-tailed Sandpiper (*Calidris acuminata*) – Migratory
- Pectoral Sandpiper (*Calidris melanotos*) – Migratory
- Yellow Wagtail (*Motacilla flava*) – Migratory
- Grey Wagtail (*Motacilla cinerea*) – Migratory

These species have been omitted from the faunal assemblage lists in Appendices 1 – 4 and the potentially occurring conservation significant species listed in Table 7 and are not discussed further.

Table 7. Summary of conservation significant vertebrate fauna.

Key: Mig = Migratory, En = Endangered, Vu = Vulnerable, OS = Other Specially Protected Fauna, P = Priority, LS = locally significant.

Species	Status				Habitat preferences	Likelihood of occurrence	Notes
	EPBC Act	BC Act	DBCA Priority	Locally Significant			
Threatened							
<i>Pezoporus occidentalis</i> Night Parrot	En	Cr			Large spinifex clumps for roosting and breeding, chenopod shrublands and spinifex for foraging.	Unlikely	This species is known from very few records. Records in WA have been in association with salt lakes. The study area lacks large spinifex.
<i>Leipoa ocellata</i> Malleefowl	Vu	Vu			Acacia thickets, mallee woodlands and shrublands with leaf litter. Also forages in adjacent habitats.	Potential	No mounds were found, and it is considered unlikely that this species breeds in the study area, but they may forage.
<i>Falco hypoleucos</i> Grey Falcon	Vu	Vu			Forages over lightly timbered plains, rivers.	Unlikely	The study area is outside the core range of this species, there are no records within 100km and breeding habitat is absent.
<i>Dasyurus geoffroii</i> Chuditch	Vu	Vu			Forests, woodlands & shrublands, denning in hollow logs, babbler nests, burrows or rock crevices.	Unlikely	There are no recent records in the region and it is likely that this species is very uncommon or locally extinct.
<i>Liopholis kintorei</i> Great Desert Skink	Vu	Vu			Sandplains.	Possible	This species is represented by a single record from 1964, however, the habitat of the study area is potentially suitable.
<i>Polytelis alexandrae</i> Princess Parrot	Vu		P4		Sandplains, breeds in Marble Gums.	Possible	Although outside the core range of this species, the habitats present are potentially suitable for foraging and breeding.
<i>Aphelocephala leucopsis</i> Southern Whiteface	Vu				Eucalypt or Mulga woodlands and Acacia shrublands with a shrubby or grassy understory.	Potential	The study area is within the range of this species and it has been recorded nearby, but the habitats present are not those most favoured by this species.
Migratory							
<i>Apus pacificus</i> Fork-tailed Swift	Mi	Mi			Overfly any habitat.	Potential	This species is largely aerial in Australia, and although it may overfly the area, the study area is not likely to be important for this species.

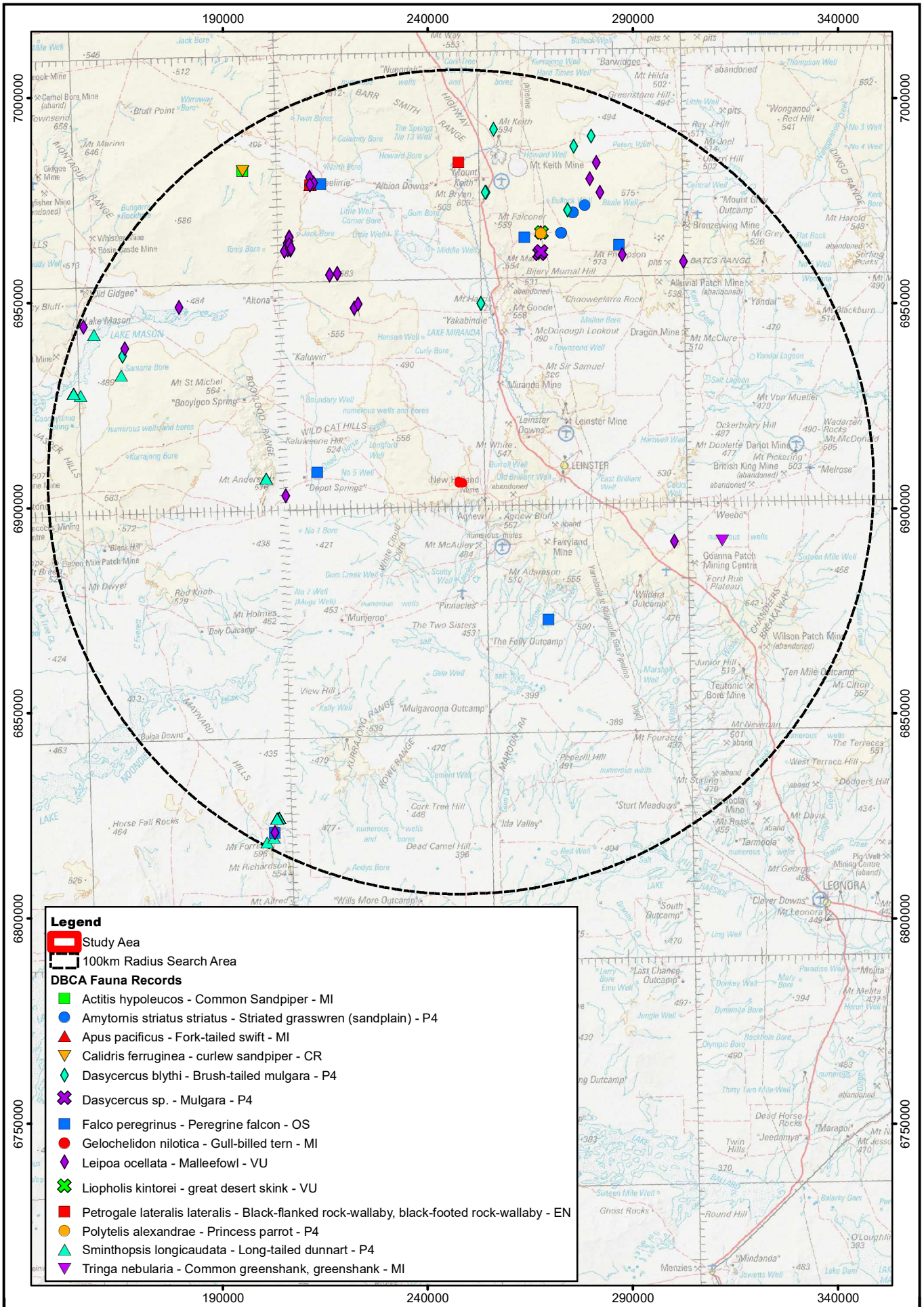
Table 7. (cont.)

Species	Status				Habitat preferences	Likelihood of occurrence	Notes
	EPBC Act	BC Act	DBCA Priority	Locally Significant			
Specially Protected							
<i>Falco peregrinus</i> Peregrine Falcon		OS			Variety of habitats, nests in tall trees, cliffs, open pits.	Potential	Although likely to occur in the region, the study area is unlikely to be of particular significance to this species.
Priority Fauna							
<i>Dasyercus blythi</i> Brush-tailed Mulgara			P4		Spinifex sandplains.	Likely	Although not recorded, this species is known from nearby records and the habitat in the study area appears suitable.
<i>Sminthopsis longicaudata</i> Long-tailed Dunnart			P4		Breakaways, rocky habitats, scree slopes.	Unlikely	Although known from nearby records, there is no suitable habitat in the study area.
<i>Nyctophilus major tor</i> Central Long-eared Bat			P3		Woodlands.	Possible	The study area is within the range of this species and the eucalypts may provide habitat, however, this species is likely to favour more wooded habitats.
<i>Amytornis striatus striatus</i> Striated Grasswren			P4		Spinifex grasslands.	Known to occur	This species was recorded during the August 2021 field survey.

5.1.1 Threatened Fauna

There are seven Threatened vertebrates that potentially occur in the study area (Table 7).

Threatened species are those that are considered in danger of extinction as their populations have declined and/or are still declining, and their total population size is small and/or fragmented or geographically restricted. Sites that support these species may be important for their long-term conservation, particularly if the site supports a resident or breeding population.



Legend

- Study Area
- 100km Radius Search Area

DBCFA Fauna Records

- Actitis hypoleucos* - Common Sandpiper - MI
- Amytornis striatus striatus* - Striated grasswren (sandplain) - P4
- Apus pacificus* - Fork-tailed swift - MI
- Calidris ferruginea* - curlew sandpiper - CR
- Dasyercus blythi* - Brush-tailed mulgara - P4
- Dasyercus sp.* - Mulgara - P4
- Falco peregrinus* - Peregrine falcon - OS
- Gelochelidon nilotica* - Gull-billed tern - MI
- Leipoa ocellata* - Malleefowl - VU
- Liopholis kintorei* - great desert skink - VU
- Petrogale lateralis lateralis* - Black-flanked rock-wallaby, black-footed rock-wallaby - EN
- Polytelis alexandrae* - Princess parrot - P4
- Smythopsis longicaudata* - Long-tailed dunnart - P4
- Tringa nebularia* - Common greenshank, greenshank - MI

Night Parrot – *Pezoporus occidentalis*

The Night Parrot is listed as Endangered under the EPBC Act and Critically Endangered under the BC Act.

Historically, the Night Parrot was recorded across a large range in the arid and semi-arid interior of Australia (Garnett *et al.* 2011). In recent times however, there are very few verified records of the species. Reliable records in recent times are from two main areas, one in western Queensland and one Western Australia (TSSC 2016b). Western Australia records are from Lake Gregory in the southern Kimberley, a site near Wiluna and near the Fortescue Marsh in the Pilbara (NPRT 2021, Davis and Metcalf 2008).

The key habitats for the Night Parrot are thought to be chenopod shrublands and Spinifex grasslands, with the chenopod shrublands a refuge during dry conditions (Garnett *et al.* 2011). Nesting sites are in mature Spinifex, often large ring-forming clumps (DPAW 2017). Foraging habitats are likely to vary across Australia, but include herbs, grasses, grass-like plants, *Sclerolaena spp.* and other chenopods (DPAW 2017). With the reasons for its decline unknown, potential threats to the species remain unconfirmed (TSSC 2016b). Possible threats include predation by feral cats or foxes, human-induced fire and degradation of soil around watering points (TSSC 2016b).

Knowledge about the current distribution and habitat requirements of the Night Parrot in Western Australia is based on very few records. Therefore, there is considerable uncertainty when assessing the likelihood of occurrence of this species. The spinifex observed was short and unlikely to be suitable for roosting or nesting according to current knowledge.

Malleefowl – *Leipoa ocellata*

The Malleefowl is listed as Vulnerable under the BC Act and EPBC Act.

The Malleefowl is a bird of dense shrublands, mulga woodlands and mallee woodlands. It used to be common in the southern arid and semi-arid areas of Western Australia (Johnstone and Storr 1998). In order to construct their nest mounds, the Malleefowl needs leaf litter on sandy substrates (Garnett and Crowley 2010). The mounds are usually constructed intermittently by a pair of birds between autumn and spring. Between early spring and mid to late summer, 15 - 25 eggs are laid in the mound by the female, while the male continues to tend the mound. The chicks emerge between November and January (sometimes as late as March), and as they receive no parental care, chick mortality can be high (Benshemesh 2007).

As Malleefowl nest on the ground, the eggs and flightless chicks are vulnerable to predation by feral predators. However, the main threat to Malleefowl is habitat loss and the fragmentation and degradation of remaining habitat, as well as the death of adults on roads (Benshemesh 2007, Garnett *et al.* 2011). Fire can have a significant impact on populations, by killing adult birds, causing local extinctions in fragmented habitats and causing a cessation in breeding activity for many years after a fire (Benshemesh 2007).

There are many records of Malleefowl within the 100km of the study area on DBCA's Threatened and Priority Fauna Database, many of them recent (Figure 6). Malleefowl are likely to occur throughout the woodlands and shrublands of the region. Malleefowl will often breed in the same general area year after year, and new mounds may be constructed, or old mounds re-used. The adult birds have been found to range over one to many square kilometres, and these home ranges overlap (Benshemesh 2007). It is likely that all vegetation in the study area is foraging habitat for Malleefowl. Potential breeding habitat appears to be absent in the study area, as litter-forming shrublands are absent.

Grey Falcon – *Falco hypoleucos*

The Grey Falcon is listed as Vulnerable under the BC Act and EPBC Act.

The Grey Falcon may number fewer than 1000 individuals, though it occurs across a large portion of arid and semi-arid Australia with its distribution centred on inland drainages (Garnett *et al.* 2011). It forages over timbered plains, including *Acacia* shrublands, also ranging out onto treeless plains. The Grey Falcon nests in tall trees on watercourses (Garnett *et al.* 2011) and occasionally on man-made structures such as transmission line towers (pers. obs.). Threats to this species are unknown but may include habitat degradation due to overgrazing or clearing and provision of water in arid areas favouring the closely related Peregrine Falcon (Garnett *et al.* 2011).

The study area lacks suitable breeding habitat for this species. The Grey Falcon may forage during the non-breeding season, but the species is at the southern limit of its range in the vicinity of the Study area and there are no records within 100km on DBCA's Threatened and Priority Fauna Database (Figure 6).

Chuditch – *Dasyurus geoffroii*

The Chuditch is listed as Vulnerable under the BC Act and EPBC Act.

The Chuditch used to occur across much of the continent but is now restricted to the southwest of Western Australia. Although they used to occupy a range of habitats, the majority of Chuditch now occur in the Jarrah forest with some wheatbelt/goldfields populations in drier woodlands, heath and mallee shrublands (Van Dyck and Strahan 2008; Orrell and Morris 1994). Up until recently, there were only occasional records of the Chuditch from the wheatbelt and goldfields, with this population estimated at 2,000 mature individuals (Woinarski *et al.* 2014, DoEE 2016). In recent years a substantial population has been recorded at Forrestiana (pers. obs, Raynor *et al.* 2011).

Chuditch are highly mobile, and typically have large home-ranges (Woinarski *et al.* 2014). In the study at Forrestiana, the average distance travelled between consecutive refuge sites was 500 m for females and 3.3km for males, with the maximum distance travelled 1.5 km for females and 4.5 - 12 km for males (Rayner *et al.* 2011). Males were found to occur across large core home ranges averaging 2,125 ha which overlapped with other males and females. Females inhabited a smaller core home range of 189 ha (Rayner *et al.* 2011). The core home range describes the area contained by den locations, and the actual area over which individuals can range is much higher (DEC 2012). As Chuditch use up to 180 different dens sites within their core home range (Woinarski *et al.* 2014), no particular den site is likely to be significant.

The current major threats to Chuditch are land clearing (including fragmentation of continuous habitat), predation by and competition with feral predators (foxes and cats) and deliberate and accidental mortality from poisoning, trapping, illegal shooting or road kills (DEC 2012). There are no records of Chuditch within 100km of the study area on DBCA's Threatened and Priority Fauna Database (Figure 6). It is considered unlikely that the Chuditch would occur in the study area, and it is likely to be locally extinct in this part of its range.

Great Desert Skink – *Liopholis kintorei*

The Great Desert Skink is listed as Vulnerable under the BC Act and EPBC Act.

The Great Desert Skink is a large burrowing lizard that occurs patchily across the western deserts region of central Australia (McAplin 2001). Formerly widespread, it has disappeared from much of its range in Western Australia (TSSC 2016a). This species usually occurs on spinifex sandplains and may also inhabit adjacent dune swales. In the Tanami and parts of the Great Sandy Desert it also occurs in the lateritic soils of paleodrainage lines (McAplin 2001). The Great Desert Skink lives in burrow systems that can be 1m deep and over 10m in diameter. The burrow systems can have multiple entrances and are characterised by the presence of a scat latrine. Up to three generations live in the burrow system. Burrows may remain active for several years, and males move between burrow systems, mating with females across several burrows. Great Desert Skinks hibernate in the cooler months, usually between May/June and September/October.

Threats to the Great Desert Skink include predation after loss of vegetation cover from fire and possibly habitat degradation from feral Camels and Rabbits (TSSC 2016a). With the cessation of traditional land management practices across much of the western deserts region, frequent patch-burning has been replaced by extensive hot fires (McAplin 2001). Fire management to protect the species should focus on prevention of frequent, widespread hot fires, though the needs of other fauna should also be considered (Cadenhead *et al.* 2016). Great Desert Skinks prefer a mosaic of fire ages, favouring areas that have been burnt in the past three to 15 years (McAplin 2001). Both Cats and Foxes are known to prey on the Great Desert Skink.

There is a single record of this species on DBCA's Threatened and Priority Fauna Database, from Wanjarri Nature Reserve in 1964 (Figure 6, DBCA 2021). Although the Great Desert Skink possibly occurs on the Spinifex -Eucalypt sandplains, it favours treeless sandplains and it is uncertain whether this species is still extant in the region.

Princess Parrot – *Polytelis alexandrae*

The Princess Parrot is listed as Vulnerable under the EPBC Act and Priority 4 by DBCA.

The Princess Parrot occurs across inland arid Australia where it inhabits shrublands and open woodlands over Spinifex in the swales between dunes (Garnett *et al.* 2011). There is limited information on population trends, as this species generally occurs in unpopulated areas and can be irruptive (TSSC 2018). The Princess Parrot can congregate in large flocks to breed in response to rainfall events (TSSC 2018). It nests in hollows and has been recorded nesting in River Red Gum (*Eucalyptus camaldulensis*), Marble Gum (*Eucalyptus gongylocarpa*) and Desert Oak (*Allocasuarina decaisneana*) (Garnett *et al.* 2011). Though no threats are confirmed for the species, it may be adversely affected by altered fire regimes and competition with introduced grazing herbivores (Garnett *et al.* 2011). The conservation priority for the species is to undertake active fire management to protect breeding habitat (TSSC 2018).

This species possibly occurs as a foraging or breeding visitor to the study area, although its core range is generally further inland. The lack of records in the region make it difficult to determine its local status. There is a single record within 100km on DBCA's Threatened and Priority Fauna Database, from Wanjarri Nature Reserve in 1964 (Figure 6, DBCA 2021). Potential breeding habitat is present in the stands of Marble Gum in the Spinifex - Eucalypt sandplain habitat.

Southern Whiteface – *Aphelocephala leucopsis*

The Southern Whiteface is listed as Vulnerable under the EPBC Act.

Despite occurring across much of the southern interior of Australia, the Southern Whiteface was recently listed as Vulnerable due to steep population declines over the past two decades (Garnett and Baker 2021).

This species inhabits a range of open Eucalypt or Acacia woodlands and shrublands, usually with an understory of grasses or shrubs (Garnett and Baker 2021). The Southern Whiteface mainly forages on the ground, eating both seeds and invertebrates. It usually constructs its nest in a tree crevice or hollow. Threats to the species are considered to be habitat loss, habitat degradation by livestock grazing and the impacts of climate change, including increased incidence of drought and extreme events such as heatwaves and wildfire (DCCEEW 2023).

This species potentially occurs as a foraging or breeding species in the vicinity of the study area, however, the habitats in the study area lack the generally grassy or shrubby understory that this species prefers. In this region it is more likely to favour Mulga woodlands and Acacia shrublands.

5.1.2 Migratory Fauna

There is one Migratory species that potentially occurs in the study area (Table 7). Other Migratory species are known from the region but require wetland habitats.

Migratory species are not always present at a site, but a particular site may have significance as a seasonal or ephemeral foraging, breeding or shelter area. Impacts to these sites may then impact the population both within the site and further afield. For Migratory shorebirds, a site is deemed internationally important if it regularly supports more than 1% of the flyway population of a species, or a total abundance of at least 20,000 shorebirds, and nationally important if it regularly supports more than 0.1% of the flyway population of a species, at least 2,000 shorebirds or at least 15 shorebird species (Hansen *et al.* 2016, Commonwealth of Australia 2017).

Fork-tailed Swift – *Apus pacificus*

The Fork-tailed Swift is listed as Migratory under the BC Act and EPBC Act.

The Fork-tailed Swift is a non-breeding visitor to Australia between September and April (Boehm 1962). While it can be common further north, in southwest Australia this species is generally scarce (Johnstone and Storr 1998). The bird is primarily observed foraging for insects in proximity to cyclonic weather (Boehm 1962). Although a migratory species, the Fork-tailed Swift has a large range and a large population that appears to be stable (Birdlife International 2020).

There is a single record in the region on DBCA's Threatened and Priority Fauna Database, about 41km west of the study area (Figure 6). Although it is likely to occur periodically, in Western Australia the Fork-tailed Swift is largely an aerial species and the study area is not likely to be of particular importance to the species.

5.1.3 Specially Protected Fauna

There is one specially protected species that potentially occurs in the study area (Table 7).

The populations of Specially Protected species are large enough that they are not considered to be Threatened. However, they require on-going conservation intervention (i.e., Conservation Dependent) or be specially protected in order to prevent them from becoming Threatened.

Peregrine Falcon – *Falco peregrinus*

The Peregrine Falcon is listed as Other Specially Protected Fauna under the BC Act.

The Peregrine Falcon is a widespread bird of prey that globally has a very large range and a very large population that appears to be secure (BirdLife International 2020). In Western Australia the population is secure, though this species may experience reductions at a local level due to human disturbance at nesting sites (Debus 1998). The Peregrine Falcon nests mainly on ledges on cliffs or rocky outcrops, and it may also use tall trees (Johnstone and Storr 1998). This species often takes advantage of man-made structures such as abandoned open pits or quarries. The Peregrine Falcon was recorded in the region on DBCA's Threatened and Priority Fauna Database (Figure 6), with the nearest record about 35km west. The study area lacks breeding habitat for this species. If a pair nests nearby, they may forage over the sandplain shrublands and other more open habitats, with the study area representing only a small part of a much larger foraging territory.

5.1.4 Priority Fauna

There are four Priority fauna species that potentially occur in the study area (Table 7).

Priority 1, 2 or 3 species need further survey effort, as insufficient data exist to adequately determine their status. Many Priority 1, 2 and 3 species are known from only a few records in a limited number of locations, thus determining their status in the study area may be problematic. Priority 4 species are considered to require regular monitoring, as although they are adequately known, they are either rare, near threatened or recently removed from the threatened list.

Brush-tailed Mulgara – *Dasyercus blythi*

The Brush-tailed Mulgara is listed as Priority 4 by DBCA.

This species is widely distributed across arid Australia, and though its population has declined in the past, it is currently thought to be stable or declining only slowly (Woinarski *et al.* 2014). It is thought that its ability to use a variety of food resources, tolerate severe declines in bodyweight, enter torpor and dig deep burrows has buffered the species from the impacts of feral predators and a variable climate and resource availability (Masters and Dickman 2012). It is therefore listed as of 'Least Concern' in the Action Plan for Australian Mammals 2012 (Woinarski *et al.* 2014). The Brush-tailed Mulgara occurs mostly on Spinifex grasslands, sheltering during the day in burrows.

There are records of this species within 100km on DBCA's Threatened and Priority Fauna Database, in the vicinity of Mt Keith and Wanjarri Nature Reserve (Figure 6, DBCA 2021). Although not recorded in the study area, the Brush-tailed Mulgara is likely to occur on the Eucalypt - Spinifex Sandplains. The population of this species is likely to fluctuate from year to year depending on prevailing environmental conditions.

Long-tailed Dunnart – *Sminthopsis longicaudata*

The Long-tailed Dunnart is listed as Priority 4 by DBCA.

This species is associated with breakaways and scree slopes, but also occurs on gravel or stony plains (Van Dyck and Strahan 2008). There are records of this species within 100km on DBCA's Threatened and Priority Fauna Database (Figure 6). Although the study area is within the known range of the Long-tailed Dunnart, potentially suitable breakaway habitat is absent and this species is considered unlikely to occur.

Central Long-eared Bat – *Nyctophilus major tor*

The Central Long-eared Bat is listed as Priority 3 by DBCA.

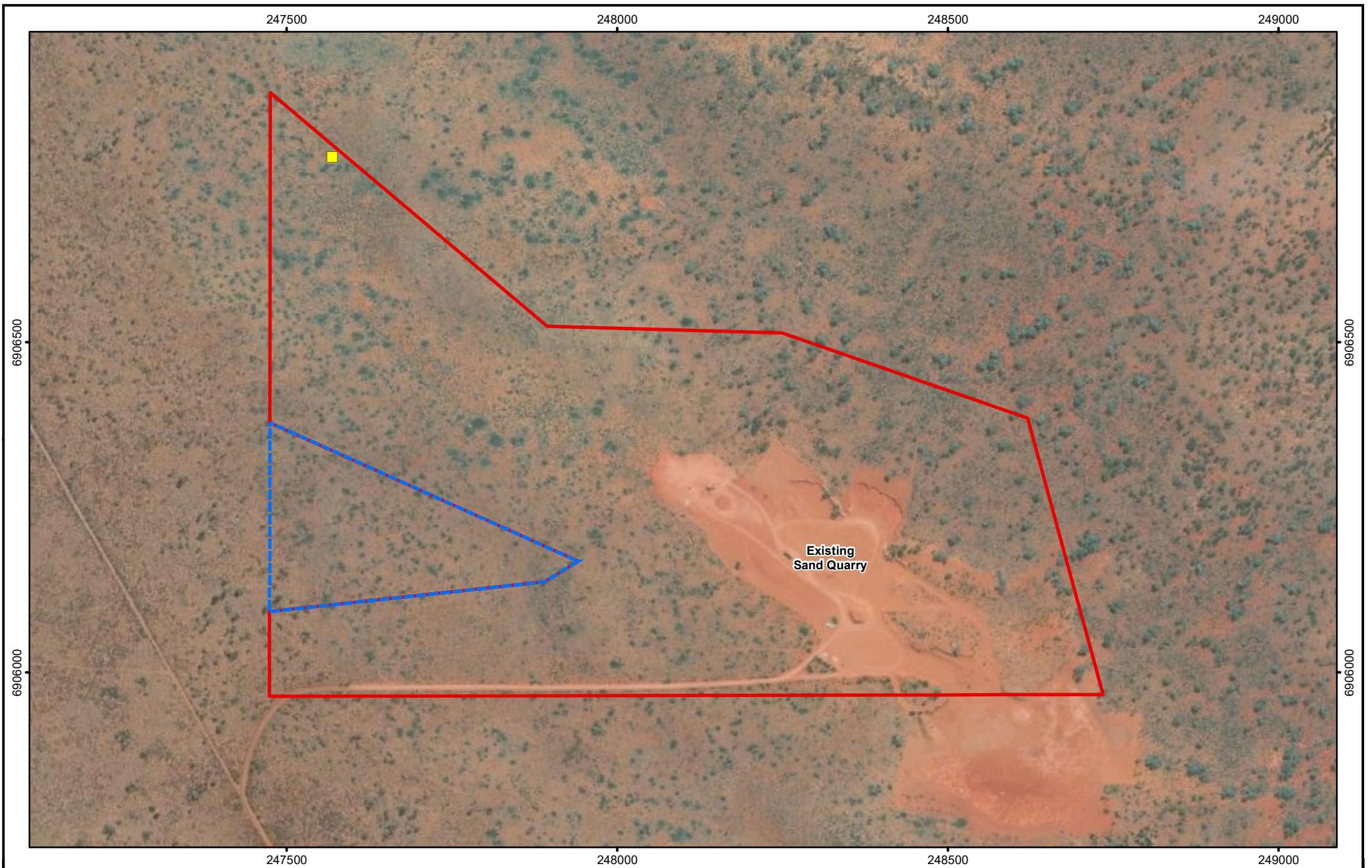
The Central Long-eared Bat occurs across southern central Australia, inhabiting woodlands, mallee and thickets (Woinarski *et al.* 2014). Although there are no estimates of population size, it is not thought to be declining and there is no evidence that its range has contracted (Woinarski *et al.* 2014). Although there are no records within 100km on DBCA's Threatened and Priority Fauna Database (Figure 6), this species has been recorded at Yeeleerie (Bamford Consulting Ecologists 2011). The Central Long-eared Bat potentially occurs in the Mulga woodlands in the region, but the study area is unlikely to provide important habitat for this species.

Striated Grasswren – *Amytornis striatus striatus*

The sandplain subspecies of the Striated Grasswren is listed as Priority 4 by DBCA.

The species occurs across much of arid Australia, inhabiting Spinifex sandplains, usually with an overstorey of shrubs or mallee eucalypts (Garnett *et al.* 2011, Johnstone and Storr 2004). It is listed as 'Near Threatened' in the Action Plan for Australian Birds due to its decline in the central and south-eastern parts of its range (Garnett *et al.* 2011). The key threat to the Striated Grasswren is extensive fires that burn mature Spinifex grasslands.

The Striated Grasswren was recorded in the study area (Figure 7). There is a 2016 record and some older records (1979, 1987) from the Wanjarri Nature Reserve on DBCA's Threatened and Priority Fauna Database (Figure 6), about 65km north of the study area. This species is likely to inhabit both habitats in the study area, favouring areas with patches of shrubs. It is likely that the Striated Grasswren is patchily distributed across sandplains in the region, and their abundance is likely to fluctuate in response to fire.



- Legend**
- Straited Grasswren Record
 - - - 2023 desktop study area
 - 2021 basic study area

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 Date: June 2023 | Rev: A | Author: J. Wilcox

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Jonah Bore Project
Straited Grasswren Record

5.2 Invertebrate Fauna

This report is primarily concerned with vertebrate fauna and no comprehensive literature review was undertaken for this group. The invertebrate fauna of the study area are more species rich and abundant than the vertebrate fauna, but cataloguing their occurrence was outside the scope of this survey. However, three invertebrates of conservation significance were recorded within 100km of the study area on DBCA's Threatened and Priority Fauna Database (Figure 6, DBCA 2021) or are known to occur in the region (Table 8).

Table 8. Summary of conservation significant invertebrate fauna.

Key: Mig = Migratory, En = Endangered, Vu = Vulnerable, OS = Other Specially Protected Fauna, P = Priority, LS = locally significant.

Species	Status				Habitat preferences	Likelihood of occurrence	Notes
	EPBC Act	BC Act	DBCA Priority	Locally Significant			
Threatened							
<i>Ogyris subterrestris petrina</i> Arid Bronze Azure Butterfly	Cr	Cr			Smooth-barked eucalypt woodland hosting large colonies of the larval attendant ant, <i>Camponotus sp. nr. terebrans</i> .	Unlikely	Although smooth-barked eucalypts were present, no colonies of the attendant ant were recorded despite a survey exceeding the DBCA (2020) guidelines.
Priority							
<i>Kwonkan moriartii</i> Moriarty's Trapdoor Spider			P2		Poorly known.	Unlikely	Sandplain and sand dune habitat is unlikely to be suitable for burrow construction.
<i>Idiosoma clypeatum</i> Northern Shield-backed Trapdoor Spider			P3		Acacia shrublands on clay-loam or loamy soils.	Unlikely	Sandplain and sand dune habitat is unlikely to be suitable for burrow construction.

5.2.1 Threatened Invertebrates

Arid Bronze Azure Butterfly - *Ogyris subterrestris petrina*

This butterfly is listed as Critically Endangered under both the EPBC Act and BC Act.

The Arid Bronze Azure Butterfly is only known from two sub-populations, both near Barbalin in the eastern Wheatbelt. A third subpopulation at Lake Douglas, near Kalgoorlie, appears to be extinct. This species is reliant on an attendant ant, the sugar ant *Camponotus sp. nr. terebrans*, as the butterfly larvae live in the nest and the ants protect the larvae. The ant colonies occur at the base of smooth-barked eucalypts, and only large colonies of the host ant are able to support the butterfly.

There are no records of this species within 100km of the study area (Figure 8), however, the study area is within the predicted range of the attendant ant species (DBCA 2020). As a thorough search for the attendant ant failed to find any colonies, it is considered unlikely that the Arid Bronze Azure Butterfly occurs in the study area.

5.2.2 Priority Invertebrates

Moriarty's Trapdoor Spider - *Kwonkan moriartii*

This spider is listed as Priority 2 by DBCA.

A mygalomorph spider, this species is likely to be relatively long-lived. The females construct a silk-lined burrow in which they reside for their entire life. The males will disperse in search of females when they reach sexual maturity, dying after mating.

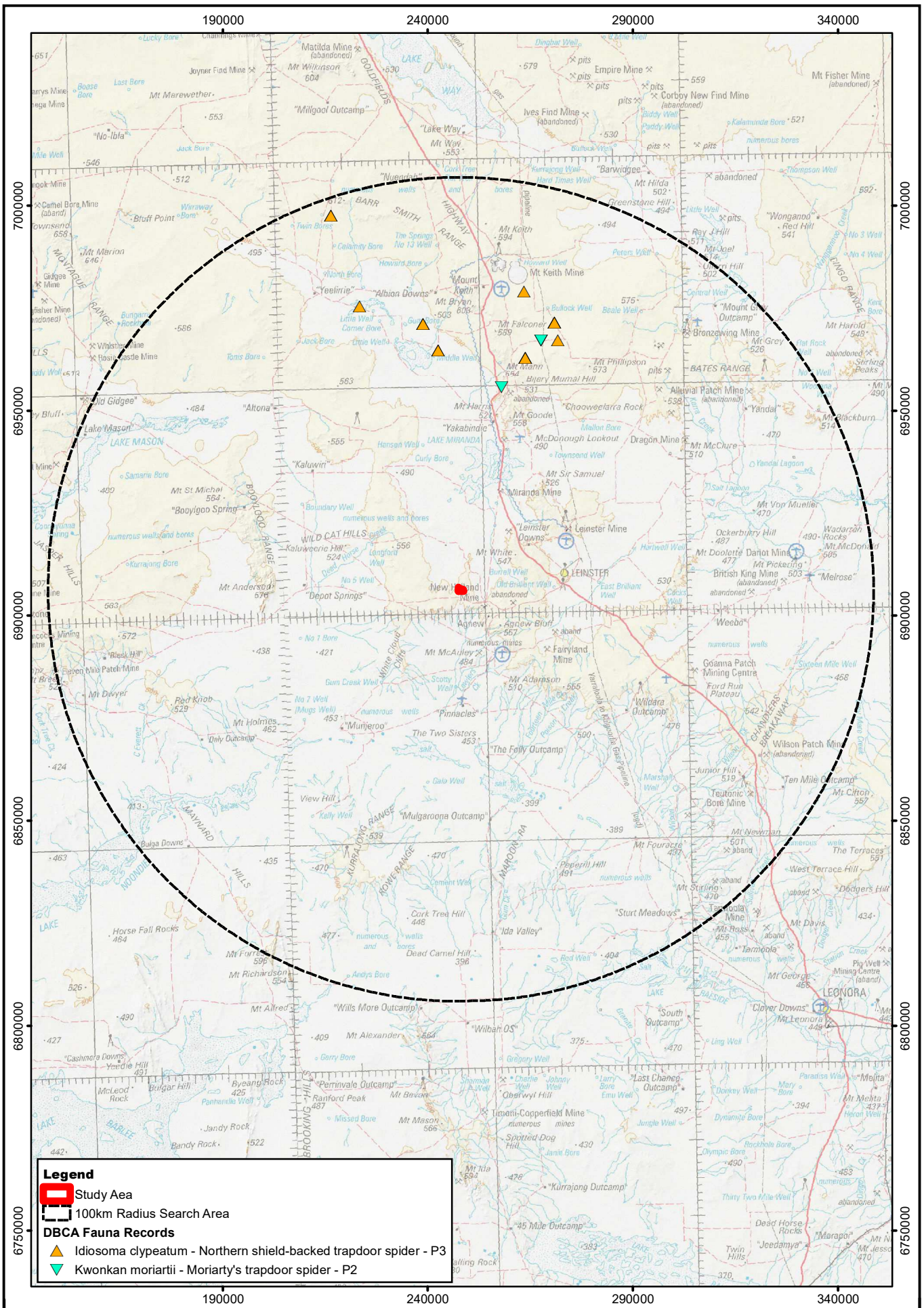
There are three records of this species within 100km of the study area on DBCA's Threatened and Priority Fauna Database, although it is probable that this is the same record in triplicate from different sources. The records are from 1962 and the nearest is about 50km north (Figure 8). This spider is poorly known and represented by very few records, hence it is difficult to determine its pattern of distribution in the region. It may be present in the local area but it is unlikely that sandplain habitat would be suitable for burrow construction, and the loose flowing soils of the sand dune would not be habitat.

Northern Shield-backed Trapdoor Spider - *Idiosoma clypeatum*

This spider is listed as Priority 3 by DBCA.

This species was formerly known as the Shield-backed Trapdoor Spider (*Idiosoma nigrum*) before a review determined that *Idiosoma nigrum* was comprised of several species (Rix *et al.* 2018). The Northern Shield-backed Trapdoor Spider has a wide distribution through the Murchison and Yalgoo Bioregions and is the most arid-adapted of the genus. Studies have generally found burrows of this species in association with *Acacia* shrublands on clay-loam or loam soils on lower slopes and flats (Biologic 2012, Ecologia 2013).

There are several records of this species within 100km on DBCA's Threatened and Priority Fauna Database (Figure 8), the closest being about 58km north. Although known to occur in the region, this species is unlikely to occur in the study area due to lack of suitable burrowing habitat.



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Jonah Bore Project
DBCA records of conservation significant invertebrates

Figure: **8**

6. Conclusions

6.1 Faunal Assemblage

The faunal assemblage of the study area is likely to be largely intact, as the study area is situated within a larger tract of native vegetation. The assemblage is likely to be mostly Eremaean, made up of species with a primarily inland distribution, with a few Bassian species, with a primarily south-western distribution. Many of the species that occur are widely distributed through semi-arid Australia. The predicted faunal assemblage includes up to nine frogs, 80 reptiles, 116 birds, 30 native mammals and nine introduced mammals. The observed assemblage thus far includes no frogs or reptiles, 20 birds, one native mammal and two introduced mammals.

6.2 Conservation Significant Fauna

Thirteen conservation significant vertebrates and three conservation significant invertebrates potentially occur in the study area, as summarised in Tables 7 and 8.

One conservation significant species is **known to occur**: the Striated Grasswren (*Amytornis striatus striatus*; Priority 4). This species was recorded during the survey and is likely to be resident, although its population may fluctuate in response to fire. The small size of the study area is only likely to support a few individuals.

One conservation significant species is **likely to occur**: the Brush-tailed Mulgara (*Dasycercus blythi*; Priority 4). This species is known from recent records in the region and occurs on sandplains.

Four conservation significant species may **potentially occur**: the Malleefowl (*Leipoa ocellata*; Vulnerable), Southern Whiteface (*Aphelopcephala leucopsis*; Vulnerable), Fork-tailed Swift (*Apus pacificus*; Migratory) and Peregrine Falcon (*Falco peregrinus*; Specially Protected Fauna). Of these, the study area is unlikely to provide important habitat to the Fork-tailed Swift, as this species is almost entirely aerial when visiting Australia. The Peregrine Falcon may occur as a non-breeding visitor, but the study area would comprise a small part of a much larger home-range for a pair of birds. The Malleefowl may forage in the study area, as it is known to occur in the region, but potential breeding habitat is absent. The Southern Whiteface may forage or breed in the study area, however, this species prefers habitats such as Mulga woodlands and Acacia shrublands that are absent from the study area.

Three conservation significant species **possibly occur**: the Princess Parrot (*Polytelis alexandrae*; Vulnerable), Great Desert Skink (*Liopholis kintorei*; Vulnerable) and Central Long-eared Bat (*Nyctophilus major tor*; Priority 3). The Princess Parrot is an irruptive species that may occur on occasion, but its core range is further east. The sandplain habitat may support the Great Desert Skink, but it is uncertain whether the distribution of the species extends as far southwest as the study area, and this species usually prefers treeless sandplains. The Central Long-eared Bat is known from the region and may use the eucalypts on the sandplain, but is likely to prefer more wooded habitats.

The remaining seven species (three invertebrates and four vertebrates) are considered **unlikely to occur**. These are the Night Parrot (*Pezoporus occidentalis*; Critically Endangered), Grey Falcon (*Falco hypoleucos*; Vulnerable), Chuditch (*Dasyurus geoffroii*; Vulnerable), Long-tailed Dunnart (*Sminthopsis longicaudata*; Priority 4), Arid Bronze Azure Butterfly (*Ogyris subterrestris petrina*; Critically Endangered), Moriarty's Trapdoor Spider (*Kwonkan moriartii*; Priority 2) and the Northern Shield-backed Trapdoor Spider (*Idiosoma clypeatum*; Priority 3). The study area lacks suitably large spinifex to support roosting or breeding by the Night Parrot. The study area is outside the core range of the Grey Falcon, and lacks breeding habitat for this species. The Chuditch is not represented by any records in the region and may be locally extinct. The study area lacks the breakaways that support the Long-tailed Dunnart. A survey for the host ant of the Arid Bronze Azure Butterfly failed to record this species, therefore no suitable habitat is present. The sandy soils of the study area are unlikely to provide burrowing habitat for Moriarty's Trapdoor Spider or the Northern Shield-backed Trapdoor Spider.

6.3 Important Habitats

All habitats have some importance in that they support native fauna, however, habitats may be of particular importance if they:

- support very diverse or unique faunal assemblages
- are restricted or rare in the region (and thus the associated faunal assemblages are restricted or rare)
- are refugia (e.g. from drought or fire)
- provide ecological linkage
- support conservation significant fauna

The habitats in the study area are common and widespread in the subregion and are unlikely to function as ecological linkages or refugia. Of the habitats present in the study area, the Spinifex – Eucalypt sandplain shrubland habitat potentially provides habitat for Priority 4 species the Brush-tailed Mulgara (*Dasyercus blythi*) and the Striated Grasswren (*Amytornis striatus striatus*), but the habitats present are unlikely to be important for Threatened species.

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Appendices

Appendix 1. Frog Species Recorded or Potentially Occurring in the Study Area

Key to records:

This survey = species recorded in the survey area August 2021.

Yeelirrie Project = species recorded at the Yeelirrie Project, 79km north of the study area, by Bamford Consulting Ecologists (2011).

Bellevue Gold = species recorded at the Bellevue Gold Project, 50km north of the study area, by Bamford Consulting Ecologists (2019).

Mt Keith Project = species recorded at the Mt Keith Project, 79km north of the study area, by Biota (2017, 2006a, 2006b) and/or ATA (2005).

Agnew Gold = species recorded at the Agnew Gold Mine, 8km south of the study area, by Stantec (2018), ENV (2008), Astron (2012), Minesite Rehabilitation Services (2003) and/or Rapallo Environmental (2017).

WAM Goldfields = species recorded in the Sir Samuel-Sandstone and Leonore-Laverton study areas by the WA Museum (Hall *et al.* 1994).

WA Museum = species records from the Western Australian Museum Database (see Table 2).

FSDB = species records from the Fauna Survey Database (see Table 2).

DBCA = species records from the DBCA Threatened and Priority Species Database (see Table 2).

EPBC = species & species habitat from the EPBC Protected Matters Search Tool (see Table 2).

Species	Conservation status	Records								
		This survey	Yeelirrie Project	Bellevue Gold	Mt Keith Project	Agnew Gold	WAM Goldfields	WA Museum	FSDB	DBCA
Pelodyadidae (tree frogs and water-holding frogs)										
Main's Frog <i>Cyclorana mainii</i>			+		+		+			
Western Water-holding Frog <i>Cyclorana occidentalis</i>			+		+		+			
Desert Tree Frog <i>Litoria rubella</i>			+	+		+				
Limnodynastidae (burrowing frogs)										
Northern Burrowing Frog <i>Neobatrachus aquilonius</i>								+		
Kunapalari Frog <i>Neobatrachus kunapalari</i>							+	+		
Shoemaker Frog <i>Neobatrachus sutor</i>								+		
Plonking Frog <i>Neobatrachus wilsmorei</i>								+		
Centralian Burrowing Frog <i>Platyplectrum spenceri</i>					+			+		
Myobatrachidae (ground frogs)										
Western Toadlet <i>Pseudophryne occidentalis</i>			+					+		
Number of frog species predicted:		9								

Appendix 2. Reptile Species Recorded or Potentially Occurring in the Study Area

Key to records:

This survey = species recorded in the survey area August 2021.

Yeelirrie Project = species recorded at the Yeelirrie Project, 79km north of the study area, by Bamford Consulting Ecologists (2011).

Bellevue Gold = species recorded at the Bellevue Gold Project, 50km north of the study area, by Bamford Consulting Ecologists (2019).

Mt Keith Project = species recorded at the Mt Keith Project, 79km north of the study area, by Biota (2017, 2006a, 2006b) and/or ATA (2005).

Agnew Gold = species recorded at the Agnew Gold Mine, 8km south of the study area, by Stantec (2018), ENV (2008), Astron (2012), Minesite Rehabilitation Services (2003) and/or Rapallo Environmental (2017).

WAM Goldfields = species recorded in the Sir Samuel-Sandstone and Leonore-Laverton study areas by the WA Museum (Hall *et al.* 1994).

WA Museum = species records from the Western Australian Museum Database (see Table 2).

FSDB = species records from the Fauna Survey Database (see Table 2).

DBCA = species records from the DBCA Threatened and Priority Species Database (see Table 2).

EPBC = species & species habitat from the EPBC Protected Matters Search Tool (see Table 2).

Species	Conservation status	Records								
		This survey	Yeelirrie Project	Bellevue Gold	Mt Keith Project	Agnew Gold	WAM Goldfields	WA Museum	FSDB	DBCA
Carphodactylidae (knob-tailed geckoes)										
	<i>Nephurus laevis</i>									
Mid-line Knob-tail	<i>Nephurus vertebralis</i>		+	+					+	
Southern Barking Gecko	<i>Underwoodisaurus milii</i>			+		+			+	
Diplodactylidae (ground geckos)										
	<i>Diplodactylus conspicillatus</i>		+	+	+			+		
Wheatbelt Ground Gecko	<i>Diplodactylus granariensis</i>		+	+		+		+		
	<i>Diplodactylus pulcher</i>		+	+	+	+		+		
Southern Sandplain Gecko	<i>Lucasium bungabinnia</i>							+		
Mottled Ground Gecko	<i>Lucasium squarrosus</i>			+	+			+	+	
Western Beaked Gecko	<i>Rhynchoedura ornata</i>		+	+	+	+				
Goldfield's Spiny-tailed Gecko	<i>Strophurus assimilis</i>								+	
Jewelled Gecko	<i>Strophurus elderi</i>		+		+			+		
Western Ring-tailed gecko	<i>Strophurus strophurus</i>		+	+	+			+		
	<i>Strophurus wellingtonae</i>		+		+	+		+		
Gekkonidae (geckoes)										
Purplish Dtella	<i>Gehyra purpurascens</i>							+		
Tree Dtella	<i>Gehyra variegata</i>		+	+	+	+		+		
Bynoe's Gecko	<i>Heteronotia binoei</i>		+	+	+	+		+		
Pygopodidae (legless-lizards)										
Sandplain Worm-lizard	<i>Aprasia repens</i>			+						
	<i>Delma butleri</i>		+					+	+	
	<i>Delma nasuta</i>		+					+		
Burton's Legless-Lizard	<i>Lialis burtonis</i>		+	+	+			+	+	
Western Hooded Scaly-foot	<i>Pygopus nigriceps</i>		+	+	+			+		

Appendix 2. (cont.)

Species	Conservation status	Records								
		This survey	Yeellirrie Project	Bellevue Gold	Mt Keith Project	Agnew Gold	WAM Goldfields	WA Museum	FSDB	DBCA
Agamidae (dragon lizards)										
Ring-tailed Dragon	<i>Ctenophorus caudicinctus</i>		+	+		+	+			
Mallee Sand Dragon	<i>Ctenophorus fordi</i>						+			
Military Dragon	<i>Ctenophorus isolepis</i>	+	+		+	+	+			
Central Netted Dragon	<i>Ctenophorus nuchalis</i>		+	+		+				
Western Netted Dragon	<i>Ctenophorus reticulatus</i>						+			
Salt Pan Dragon	<i>Ctenophorus salinarum</i>			+			+	+		
Lozenge-marked Dragon	<i>Ctenophorus scutulatus</i>		+				+			
Mulga Dragon	<i>Diporiphora amphiboluroides</i>					+	+			
Thorny Devil	<i>Moloch horridus</i>		+				+	+		
Bearded Dragon	<i>Pogona minor</i>		+				+			
Pebble-mimic Dragon	<i>Tympanocryptis pseudopsephos</i>				+	+		+		
Scincidae (skink lizards)										
Fence Skink	<i>Cryptoblepharus buchananii</i>		+							
	<i>Cryptoblepharus plagioccephalus</i>		+				+			
	<i>Ctenotus ariadnae</i>		+		+		+			
	<i>Ctenotus calurus</i>				+		+			
	<i>Ctenotus grandis</i>		+				+	+		
	<i>Ctenotus hanloni</i>		+							
	<i>Ctenotus helenae</i>		+		+		+	+		
Common Desert Ctenotus	<i>Ctenotus leonhardii</i>		+	+	+		+			
Leopard Ctenotus	<i>Ctenotus pantherinus</i>		+		+		+			
	<i>Ctenotus quattuordecimlineatus</i>				+		+			
	<i>Ctenotus schomburgkii</i>		+							
	<i>Ctenotus uber</i>				+					
Southern Pygmy Spiny-tailed Skink	<i>Egernia depressa</i>		+		+		+			
	<i>Egernia formosa</i>				+		+			
Broad-banded Sand Swimmer	<i>Eremiascincus richardsonii</i>		+	+	+		+			
	<i>Lerista bipes</i>				+		+			
	<i>Lerista desertorum</i>		+	+	+	+	+	+		
	<i>Lerista timida</i>			+	+	?	?	+		
Desert Skink	<i>Liopholis inornata</i>		+		+			+		
Great Desert Skink	<i>Liopholis kintorei</i>	T							+	
Night Skink	<i>Liopholis striata</i>		+		+					
Dwarf Skink	<i>Menetia greyii</i>		+	+	+		+	+		
	<i>Morethia butleri</i>		+		+	+	+			
Western Blue-tongue	<i>Tiliqua occipitalis</i>		+				+			
Centralian Blue-tongue	<i>Tiliqua multifasciata</i>		+		+		+			

Appendix 2. (cont.)

Species	Conservation status	Records								
		This survey	Yeellirrie Project	Bellevue Gold	Mt Keith Project	Agnew Gold	WAM Goldfields	WA Museum	FSDB	DBCA
Varanidae (goannas)										
Short-tailed Pygmy Monitor	<i>Varanus breviceauda</i>						+			
Stripe-tailed Monitor	<i>Varanus caudolineatus</i>		+		+		+	+		
Desert Pygmy Monitor	<i>Varanus eremius</i>		+					+		
Perentie	<i>Varanus giganteus</i>		+		+					
Sand Goanna	<i>Varanus gouldii</i>		+	+		+	+			
Yellow-spotted Monitor	<i>Varanus panoptes</i>		+	+	+	+	+	+	+	
Black-tailed Tree Monitor	<i>Varanus tristis</i>									
Pythonidae (Australian pythons)										
Stimson's Python	<i>Antaresia stimsoni</i>			+						
Typhlopidae (blind-snakes)										
Dark-spined Blind Snake	<i>Anilius bicolor</i>		+					+		
Prong-snouted Blind Snake	<i>Anilius bituberculatus</i>									
	<i>Anilius hamatus</i>		+	+			+			
Southern Beaked Blind Snake	<i>Anilius waitii</i>			+						
Elapidae (front-fanged snakes)										
Narrow-banded Shovel-nosed Snake	<i>Brachyuropis fasciolatus</i>									
Southern Shovel-nosed Snake	<i>Brachyuropis semifasciatus</i>									
Yellow-faced Whipsnake	<i>Demansia psammophis</i>									
Moon Snake	<i>Furina ornata</i>						+	+		
Black-naped Snake	<i>Neelaps bimaculatus</i>									
Monk Snake	<i>Parasuta monarchus</i>				+			+		
Mulga Snake	<i>Pseudechis australis</i>					+				
Ringed Brown Snake	<i>Pseudonaja modesta</i>		+	+	+	+				
Gwardar / Western Brown Snake	<i>Pseudonaja mengdeni</i>		+	+	+		+			
Jan's Banded Snake	<i>Simoselaps bertholdi</i>		+				+	+		
Rosen's Snake	<i>Suta fasciata</i>			+				+		
Number of reptile species predicted:		80								

Appendix 3. Bird Species Recorded or Potentially Occurring in the Study Area

Key to records:

This survey = species recorded in the survey area August 2021.

Yeelirrie Project = species recorded at the Yeelirrie Project, 79km north of the study area, by Bamford Consulting Ecologists (2011).

Bellevue Gold = species recorded at the Bellevue Gold Project, 50km north of the study area, by Bamford Consulting Ecologists (2019).

Mt Keith Project = species recorded at the Mt Keith Project, 79km north of the study area, by Biota (2017, 2006a, 2006b) and/or ATA (2005).

Agnew Gold = species recorded at the Agnew Gold Mine, 8km south of the study area, by Stantec (2018), ENV (2008), Astron (2012), Minesite Rehabilitation Services (2003) and/or Rapallo Environmental (2017).

WA Museum = species records from the Western Australian Museum Database (see Table 2).

Birdata = species records from the Birdata Database (see Table 2).

Birds Aust. = species records from the Birds Australia Atlas Database (see Table 2).

WAM = species records from the Western Australian Museum Database (see Table 2).

FSDB = species records from the Fauna Survey Database (see Table 2).

DBCA = species records from the DBCA Threatened and Priority Species Database (see Table 2).

EPBC = species & species habitat from the EPBC Protected Matters Search Tool (see Table 2).

Species	Conservation status	Records												
		This survey	Yeelirrie Project	Bellevue Gold	Mt Keith Project	Agnew Gold	Birdata	Birds Aust.	WA Museum	FSDB	DBCA	EPBC		
Dromaiidae (emus)														
Emu <i>Dromaius novaehollandiae</i>		+	+	+	+	+	+	+						
Megapodiidae (mound-builders)														
Malleefowl <i>Leipoa ocellata</i>	T		+									+	+	
Phasianidae (pheasants and quails)														
Stubble Quail <i>Coturnix pectoralis</i>														
Accipitridae (kites, hawks and eagles)														
Black-shouldered Kite <i>Elanus caeruleus</i>														
Square-tailed Kite <i>Hamiostra isura</i>														
Black-breasted Buzzard <i>Hamiostra melanosternon</i>				+						+				
Whistling Kite <i>Haliastur sphenurus</i>			+	+	+	+	+	+						
Black Kite <i>Milvus migrans</i>														
Spotted Harrier <i>Circus assimilis</i>			+											
Brown Goshawk <i>Accipiter fasciatus</i>					+	+								
Collared Sparrowhawk <i>Accipiter cirrocephalus</i>			+		+									
Wedge-tailed Eagle <i>Aquila audax</i>			+	+	+	+	+	+	+					
Little Eagle <i>Hieraaetus morphnoides</i>			+		+									
Otidae (bustards)														
Australian Bustard <i>Ardeotis australis</i>			+											
Turnicidae (button-quails)														
Little Button-quail <i>Turnix velox</i>														
Burhinidae (stone-curlews)														
Bush Stone-curlew <i>Burhinus grallarius</i>			+	+										

Appendix 3. (cont.)

Species	Conservation status	Records												
		This survey	Yeelirrie Project	Bellevue Gold	Mt Keith Project	Agnew Gold	Birdata	Birds Aust.	WA Museum	FSDB	DBCA	EPBC		
Charadriidae (lapwings and plovers)														
Banded Lapwing <i>Vanellus tricolor</i>			+			+		+						
Columbidae (pigeons and doves)														
Common Bronzewing <i>Phaps chalcoptera</i>			+		+	+		+						
Crested Pigeon <i>Ocyphaps lophotes</i>			+	+	+	+	+	+						
Diamond Dove <i>Geopelia cuneatus</i>				+		+								
Cuculidae (cuckoos)														
Pallid Cuckoo <i>Cacomantis pallidus</i>			+		+		+	+		+				
Fan-tailed Cuckoo <i>Cacomantis flabelliformis</i>											+			
Black-eared Cuckoo <i>Chrysococcyx osculans</i>														
Horsfield's Bronze-Cuckoo <i>Chrysococcyx basalus</i>			+		+									
Tytonidae (barn owls)														
Eastern Barn Owl <i>Tyto javanica</i>														
Strigidae (hawk-owls)														
Southern Boobook Owl <i>Ninox boobook</i>			+						+	+				
Podargidae (frogmouths)														
Tawny Frogmouth <i>Podargus strigoides</i>			+		+		+							
Caprimulgidae (nightjars)														
Spotted Nightjar <i>Eurostopodus argus</i>			+							+				
Aegothelidae (owlet-nightjars)														
Australian Owlet-Nightjar <i>Aegotheles cristatus</i>			+		+					+	+			
Apodidae (swifts)														
Fork-tailed Swift <i>Apus pacificus</i>	Mi												+	
Alcedinidae (forest kingfishers)														
Red-backed Kingfisher <i>Todiramphus pyrrhopygius</i>			+	+	+	+					+			
Sacred Kingfisher <i>Todiramphus sanctus</i>			+			+								
Meropidae (bee-eaters)														
Rainbow Bee-eater <i>Merops ornatus</i>			+	+	+	+								
Falconidae (falcons)														
Grey Falcon <i>Falco hypoleucos</i>	T													+
Peregrine Falcon <i>Falco peregrinus</i>	OS		+						+				+	
Australian Hobby <i>Falco longipennis</i>			+	+		+			+					
Brown Falcon <i>Falco berigora</i>			+	+	+	+			+	+				
Australian Kestrel <i>Falco cenchroides</i>			+	+	+	+	+		+	+	+			
Cacatuidae (cockatoos)														
Galah <i>Cacatua roseicapilla</i>			+		+	+			+	+				
Cockatiel <i>Nymphicus hollandicus</i>			+		+	+	+		+					

Appendix 3. (cont.)

Species	Conservation status	Records														
		This survey	Yeelirrie Project	Bellevue Gold	Mt Keith Project	Agnew Gold	Birdata	Birds Aust.	WA Museum	FSDB	DBCA	EPBC				
Psittacidae (lorikeets & parrots)																
Night Parrot	<i>Pezoporus occidentalis</i>	T														+
Budgerigah	<i>Melopsittacus undulatus</i>		+		+					+					+	
Bourke's Parrot	<i>Neophema bourkii</i>													+		
Elegant Parrot	<i>Neophema elegans</i>		+													
Scarlet-chested Parrot	<i>Neophema splendida</i>															
Princess Parrot	<i>Polytelis alexandrae</i>	T													+	+
Australian Ringneck	<i>Platycercus zonarius</i>		+	+	+	+				+						
Mulga Parrot	<i>Platycercus varius</i>		+	+	+	+										
Ptilonorhynchidae (bowerbirds)																
Western Bowerbird	<i>Ptilonorhynchus maculatus guttatus</i>		+	+	+	+				+						
Climacteridae (treecreepers)																
White-browed Treecreeper	<i>Climacteris affinis</i>					+				+	+					
Maluridae (fairy-wrens)																
Striated Grasswren	<i>Amytornis striatus striatus</i>	P	+													+
Splendid Fairy-wren	<i>Malurus splendens</i>			+	+	+	+									
Variegated Fairy-wren	<i>Malurus lamberti</i>			+	+	+	+									
White-winged Fairy-wren	<i>Malurus leucopterus</i>			+	+	+				+	+					
Meliphagidae (honeyeaters)																
Black Honeyeater	<i>Sugomel niger</i>					+										
Red Wattlebird	<i>Anthochaera carunculata</i>									+						
Spiny-cheeked Honeyeater	<i>Acanthagenys rufogularis</i>		+	+	+	+	+	+	+	+	+				+	
Yellow-throated Miner	<i>Manorina flavigula</i>		+	+	+	+	+	+	+	+	+					
Singing Honeyeater	<i>Gavicalis virescens</i>			+	+	+			+	+	+				+	
White-eared Honeyeater	<i>Lichenostomus leucotis</i>															
White-plumed Honeyeater	<i>Ptilotula penicillata</i>			+	+	+			+	+						
Grey-fronted Honeyeater	<i>Ptilotula plumula</i>		+			+										
Yellow-plumed Honeyeater	<i>Ptilotula ornata</i>									+						
Brown-headed Honeyeater	<i>Melithreptus brevirostris</i>															
Brown Honeyeater	<i>Lichmera indistincta</i>			+	+		+	+	+							
White-fronted Honeyeater	<i>Purnella albifrons</i>			+		+	+								+	
Pied Honeyeater	<i>Certhionyx variegatus</i>					+	+									
Grey Honeyeater	<i>Conopophila whitei</i>					+										
Crimson Chat	<i>Epthianura tricolor</i>			+	+		+			+					+	
Orange Chat	<i>Epthianura aurifrons</i>									+						
Pardalotidae (pardalotes)																
Red-browed Pardalote	<i>Pardalotus rubricatus</i>														+	
Striated Pardalote	<i>Pardalotus striatus</i>		+	+		+	+			+						

Appendix 3. (cont.)

Species	Conservation status	Records																		
		This survey	Yeelirrie Project	Bellevue Gold	Mt Keith Project	Agnew Gold	Birdata	Birds Aust.	WA Museum	FSDB	DBCA	EPBC								
Acanthizidae (thornbills, gerygones & allies)																				
Shy Heathwren	<i>Calamanthus cautus</i>																			
Rufous Fieldwren	<i>Calamanthus campestris</i>																			
Redthroat	<i>Pyrrholaemus brunneus</i>			+	+					+										
Weebill	<i>Smicrornis brevirostris</i>			+		+	+	+	+	+										
Western Gerygone	<i>Gerygone fusca</i>			+			+			+										
Inland Thornbill	<i>Acanthiza apicalis</i>			+	+	+	+	+	+	+										
Slender-billed Thornbill	<i>Acanthiza iredalei</i>																			
Chestnut-rumped Thornbill	<i>Acanthiza uropygialis</i>			+	+	+	+			+										
Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>			+	+	+	+			+										
Slaty-backed Thornbill	<i>Acanthiza robustirostris</i>			+		+				+	+									
Southern Whiteface	<i>Aphelocephala leucopsis</i>	T		+	+	+	+													+
Pomatostomidae (Australian babblers)																				
White-browed Babbler	<i>Pomatostomus superciliosus</i>			+	+	+	+	+	+	+										
Grey-crowned Babbler	<i>Pomatostomus temporalis</i>			+	+	+	+													
Psophodidae (whipbirds, wedgebills and quail-thrush)																				
Western Quail-thrush	<i>Cinclosoma marginatum</i>			+	+					+										
Chestnut (Copper-back) Quail-Thrush	<i>Cinclosoma clarum</i>																			
Western Wedgebill	<i>Psophodes occidentalis</i>																			
Artamidae (woodswallows)																				
Masked Woodswallow	<i>Artamus personatus</i>			+		+	+													
Black-faced Woodswallow	<i>Artamus cinereus</i>			+	+	+	+	+	+	+										
Little Woodswallow	<i>Artamus minor</i>					+	+	+												
Cracticidae (butcherbirds, currawongs & magpie)																				
Grey Butcherbird	<i>Cracticus torquatus</i>			+	+	+	+	+	+	+										
Pied Butcherbird	<i>Cracticus nigrogularis</i>			+	+	+	+	+	+	+										
Australian Magpie	<i>Cracticus tibicen</i>			+	+	+	+	+	+	+	+									
Grey Currawong	<i>Strepera versicolor</i>			+		+	+			+										
Campephagidae (cuckoo-shrikes and trillers)																				
Ground Cuckoo-shrike	<i>Coracina maxima</i>			+	+	+				+										
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>			+	+	+	+	+	+	+										
White-winged Triller	<i>Lalage tricolor</i>			+		+														
Neosittidae (sittellas)																				
Varied Sittella	<i>Daphoenositta chrysoptera</i>			+																
Oreoicidae (bellbird)																				
Crested Bellbird	<i>Oreoica gutturalis</i>			+	+	+	+	+	+	+										
Pachycephalidae (whistlers)																				
Rufous Whistler	<i>Pachycephala rufiventris</i>			+	+	+	+													
Grey Shrike-thrush	<i>Colluricincla harmonica</i>			+	+	+	+													

Appendix 3. (cont.)

Species	Conservation status	Records												
		This survey	Yeelirrie Project	Bellevue Gold	Mt Keith Project	Agnew Gold	Birdata	Birds Aust.	WA Museum	FSDB	DBCA	EPBC		
Rhipiduridae (wagtails and fantails)														
Grey Fantail <i>Rhipidura albiscapa</i>			+					+						
Willie Wagtail <i>Rhipidura leucophrys</i>			+	+	+	+	+	+		+				
Monarchidae (monarchs and flycatchers)														
Magpie-lark <i>Grallina cyanoleuca</i>			+	+	+	+		+						
Corvidae (ravens and crows)														
Australian Raven <i>Corvus coronoides</i>						+	+			+				
Little Crow <i>Corvus bennetti</i>		+	+	+	+	+	+	+		+				
Torresian Crow <i>Corvus orru</i>			+	+	+	+	+	+						
Petroicidae (Australian robins)														
Jacky Winter <i>Microeca fascians</i>			+											
Hooded Robin <i>Melanodryas cucullata</i>			+	+	+	+		+		+				
Red-capped Robin <i>Petroica goodenovii</i>			+	+	+	+	+	+		+				
Hirundinidae (swallows)														
White-backed Swallow <i>Cheramoeca leucosterna</i>		+	+	+		+	+	+						
Fairy Martin <i>Hirundo ariel</i>			+	+	+									
Welcome Swallow <i>Hirundo neoxena</i>			+	+	+	+	+	+						
Tree Martin <i>Petrochelidon nigricans</i>			+		+	+	+	+						
Locustellidae (Old World warblers, songlarks & grassbirds)														
Brown Songlark <i>Cincloramphus cruralis</i>										+				
Rufous Songlark <i>Cincloramphus mathewsi</i>						+		+			+			
Dicaeidae (flower-peckers)														
Mistletoebird <i>Dicaeum hirundinaceum</i>			+		+	+		+						
Estrildidae (finches)														
Zebra Finch <i>Taeniopygia gutatta</i>			+	+	+	+	+	+		+				
Motacillidae (pipits and true wagtails)														
Australian Pipit <i>Anthus australis</i>			+	+	+	+								
Number of bird species predicted:		116												

Appendix 4. Mammal Species Recorded or Potentially Occurring in the Study Area

Key to records:

This survey = species recorded in the survey area August 2021.

Yeelirrie Project = species recorded at the Yeelirrie Project, 79km north of the study area, by Bamford Consulting Ecologists (2011).

Bellevue Gold = species recorded at the Bellevue Gold Project, 50km north of the study area, by Bamford Consulting Ecologists (2019).

Mt Keith Project = species recorded at the Mt Keith Project, 79km north of the study area, by Biota (2017, 2006a, 2006b) and/or ATA (2005).

Agnew Gold = species recorded at the Agnew Gold Mine, 8km south of the study area, by Stantec (2018), ENV (2008), Astron (2012), Minesite Rehabilitation Services (2003) and/or Rapallo Environmental (2017).

WAM Goldfields = species recorded in the Sir Samuel-Sandstone and Leonore-Laverton study areas by the WA Museum (Hall *et al.* 1994).

WA Museum = species records from the Western Australian Museum Database (see Table 2).

FSDB = species records from the Fauna Survey Database (see Table 2).

DBCA = species records from the DBCA Threatened and Priority Species Database (see Table 2).


EPBC = species & species habitat from the EPBC Protected Matters Search Tool (see Table 2).




Species	Conservation status	Records									
		This survey	Yeelirrie Project	Bellevue Gold	Mt Keith Project	Agnew Gold	WAM Goldfields	WA Museum	FSDB	DBCA	EPBC
Tachyglossidae (echidnas)											
Echidna <i>Tachyglossus aculeatus</i>		+	+	+	+	+	+				
Dasyuridae (carnivorous marsupials)											
Kultarr <i>Antechinomys laniger</i>							+				
Brush-tailed Mulgara <i>Dasyercus blythi</i>	P		+		+			+		+	
Chuditch <i>Dasyurus geoffroii</i>	T										+
Wongai Ningai <i>Ningai ridei</i>			+		+		+	+			
Woolley's False Antechinus <i>Pseudantechinus woolleyae</i>			+					+			
Fat-tailed Dunnart <i>Sminthopsis crassicaudata</i>					+		+				
Little Long-tailed Dunnart <i>Sminthopsis dolichura</i>					+	+					
Hairy-footed Dunnart <i>Sminthopsis hirtipes</i>			+				+				
Long-tailed Dunnart <i>Sminthopsis longicaudata</i>	P									+	
Stripe-faced Dunnart <i>Sminthopsis macroura</i>			+		+	+	+	+			
Ooldea Dunnart <i>Sminthopsis ooldea</i>			+				+				
Macropodidae (kangaroos and wallabies)											
Euro <i>Osphranter robustus</i>			+	+	+	+	+				
Red Kangaroo <i>Osphranter rufus</i>			+	+		+	+				
Western Grey Kangaroo <i>Macropus fuliginosus</i>						+					
Muridae (rodents)											
House Mouse <i>Mus musculus</i>	Int.		+		+		+	+			
Spinifex Hopping Mouse <i>Notomys alexis</i>			+			+	+				
Bolam's Mouse <i>Pseudomys bolami</i>					+						
Desert Mouse <i>Pseudomys desertor</i>					+						
Sandy Inland Mouse <i>Pseudomys hermannsburgensis</i>					+		+	+			
Emballonuriidae (sheathtail bats)											
Yellow-bellied Sheathtail Bat <i>Saccolaimus flaviventris</i>			+								
Hill's Sheathtail Bat <i>Taphozous hilli</i>						+					

Appendix 4. (cont.)

Species	Conservation status	Records								
		This survey	Yeelirrie Project	Bellevue Gold	Mt Keith Project	Agnew Gold	WAM Goldfields	WA Museum	FSDB	DBCA
Molossidae (free-tailed bats)										
White-striped Free-tailed Bat	<i>Austronomus australis</i>		+	+		+	+			
Inland Free-tailed Bat	<i>Ozimops petersi</i>		+	+		+	+			
Vespertilionidae (evening bats)										
Gould's Wattleed Bat	<i>Chalinolobus gouldii</i>		+	+		+	+			
Chocolate Wattleed Bat	<i>Chalinolobus morio</i>					+				
Lesser Long-eared Bat	<i>Nyctophilus geoffroyi</i>		+	+		+	+			
Central Long-eared Bat	<i>Nyctophilus major tor</i>	P	+							
Inland Broad-nosed Bat	<i>Scotorepens balstoni</i>		+		+	+	+			
Inland Forest Bat	<i>Vespadelus baverstocki</i>		+							
Findlayson's Cave Bat	<i>Vespadelus findlaysoni</i>		+	+		+	+			
Canidae (dogs & foxes)										
Dingo/Dog	<i>Canis familiaris dingo/familiaris</i>	Int.	+	+		+				
Fox	<i>Vulpes vulpes</i>	Int.	+				+			
Felidae (cats)										
Feral Cat	<i>Felis catus</i>	Int.	+	+	+	+	+			
Camelidae (camels)										
Dromedary Camel	<i>Camelus dromedarius</i>	Int.		+			+			
Bovidae (goats & cows)										
Cow	<i>Bos taurus</i>	Int.			+	+	+			
Sheep	<i>Ovis aries</i>	Int.					+			
Goat	<i>Capra hircus</i>	Int.				+				
Leporidae (rabbits)										
European Rabbit	<i>Oryctolagus cuniculus</i>	Int.	+	+		+	+			
Number of mammal species predicted:		30 native, 9 introduced								

Appendix 5. Habitat Assessment Sites

Appendix 5 – Habitat Assessment Sites.	
<p>Jb01</p> <p>Habitat: Spinifex – Eucalypt Sandplain</p> <p>Landform: plain</p> <p>Vegetation: Open eucalypt woodland over open Acacia and Grevillea shrubland over spinifex hummock grassland.</p> <p>Fire age: no evidence of recent fire.</p> <p>Disturbance: none noted</p> <p>Soil: red sand</p> <p>Rock: none</p> <p>Important elements: tree hollows, leaf litter, woody debris, sands for burrowing.</p> <p>Wetlands: none</p>	
<p>Jb02</p> <p>Habitat: Spinifex – Eucalypt Sandplain</p> <p>Landform: plain</p> <p>Vegetation: Patchy open shrubland of Acacia and Grevillea over spinifex hummock grassland and herbs.</p> <p>Fire age: no evidence of recent fire.</p> <p>Disturbance: none noted</p> <p>Soil: red sand</p> <p>Rock: none</p> <p>Important elements: sands for burrowing.</p> <p>Wetlands: none</p>	
<p>Jb03</p> <p>Habitat: Sand dune</p> <p>Landform: lower slope</p> <p>Vegetation: Open shrubland of Grevillea and Acacia with scattered mallee eucalypts over spinifex hummock grassland.</p> <p>Fire age: no evidence of recent fire.</p> <p>Disturbance: none noted</p> <p>Soil: red sand</p> <p>Rock: none</p> <p>Important elements: tree hollows, leaf litter, woody debris, sands for burrowing.</p> <p>Wetlands: none</p>	

Appendix 5 – Habitat Assessment Sites.	
<p>Jb04</p> <p>Habitat: Sand dune</p> <p>Landform: dune crest</p> <p>Vegetation: Open eucalypt woodland over open shrubland of Grevillea and Acacia over open spinifex hummock grassland.</p> <p>Fire age: no evidence of recent fire.</p> <p>Disturbance: none noted</p> <p>Soil: red sand</p> <p>Rock: none</p> <p>Important elements: tree hollows, leaf litter, woody debris, sands for burrowing.</p> <p>Wetlands: none</p>	
<p>Jb05</p> <p>Habitat: Sand dune</p> <p>Landform: dune</p> <p>Vegetation: Open eucalypt woodland over medium to low shrubs and spinifex hummock grassland.</p> <p>Fire age: no evidence of recent fire.</p> <p>Disturbance: none noted</p> <p>Soil: red sand</p> <p>Rock: none</p> <p>Important elements: tree hollows, leaf litter, woody debris, sands for burrowing.</p> <p>Wetlands: none</p>	
<p>Jb06</p> <p>Habitat: Spinifex – Eucalypt Sandplain</p> <p>Landform: gentle slope and flat</p> <p>Vegetation: Open low mallee eucalypts and occasional kurrajong over low shrubs and spinifex hummock grassland.</p> <p>Fire age: no evidence of recent fire.</p> <p>Disturbance: none noted</p> <p>Soil: red sand</p> <p>Rock: none</p> <p>Important elements: tree hollows, leaf litter, woody debris, sands for burrowing.</p> <p>Wetlands: none</p>	

Appendix 6. EPBC Act Protected Matters Search Tool Results

Fauna species listed for the area within a 10km radius of -27.9452°S, 120.4401 °E, excluding marine species.

Species	EPBC Act Status	Type of Presence
Night Parrot <i>Pezoporus occidentalis</i>	Endangered	Species or species habitat MAY occur within area
Malleefowl <i>Leipoa ocellata</i>	Vulnerable	Species or species habitat LIKELY to occur within area
Grey Falcon <i>Falco hypoleucos</i>	Vulnerable	Species or species habitat MAY occur within area
Princess Parrot <i>Polytelis alexandrae</i>	Vulnerable	Species or species habitat MAY occur within area
Chuditch <i>Dasyurus geoffroii</i>	Vulnerable	Species or species habitat MAY occur within area
Grey Wagtail <i>Motacilla cinerea</i>	Migratory (terrestrial)	Species or species habitat MAY occur within area
Yellow Wagtail <i>Motacilla flava</i>	Migratory (terrestrial)	Species or species habitat MAY occur within area
Common Sandpiper <i>Actitis hypoleucos</i>	Migratory (wetland)	Species or species habitat MAY occur within area
Sharp-tailed Sandpiper <i>Calidris acuminata</i>	Migratory (wetland)	Species or species habitat MAY occur within area
Pectoral Sandpiper <i>Calidris melanotos</i>	Migratory (wetland)	Species or species habitat MAY occur within area

**APPENDIX 6: SRE DESKTOP ASSESSMENT
(INVERTEBRATE SOLUTIONS 2022)**

Desktop assessment for Short Range Endemic Fauna for Sand and Gravel Pits – Comet Vale, Mt Keith, Thunderbox and Jonah Bore, Northern Goldfields, Western Australia.



Report by *Invertebrate Solutions Pty Ltd*
for MLG OZ Ltd

May 2022

Dr Timothy Moulds
Director and Principal Ecologist
Invertebrate Solutions Pty Ltd
PO Box 14
Victoria Park, WA 6979
Australia
tim@invertebratesolutions.com
www.invertebratesolutions.com

Invertebrate Solutions. (2022). Desktop assessment for Short Range Endemic Fauna for Sand and Gravel Pits – Comet Vale, Mt Keith, Thunderbox and Jonah Bore, Northern Goldfields, Western Australia. Unpublished report to MLG OZ Ltd, May 2022.

Report Number 2021ISJ13_F01_20220505

Prepared for: MLG OZ Ltd

Frontispiece: The widespread mygalomorph spider *Gaius austini* from the Goldfields area

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Executive Summary

MLG Oz Ltd (MLG) is proposing to develop a series of four separate sand and gravel pits (the Project) located in the northern Goldfields region of Western Australia. MLG proposes to extract sand and gravel from the four deposits for industrial use. The four projects to be assessed for SRE invertebrates are:

- Comet Vale E297/42 – 21km SW of Menzies
- Mt Keith E53/1480 – 62 km SE of Wiluna
- Thunderbox E36/1003 – 12 km SE of Leinster
- Jonah Bore M36/657 – 25 km W of Leinster

Invertebrate Solutions has been requested by MLG to undertake a desktop assessment for Short Range Endemic (SRE) invertebrates for the Sand and Gravel Pit Project. The assessment is required to support environmental approvals under Commonwealth and State legislation. Due to the disparate nature of the four Project areas throughout the Northern Goldfields region, two separate Desktop Study areas (Northern and Southern) were searched for potential SRE species to determine the potential likelihood of SRE species being present within each individual Project area.

The Project areas within the Northern Desktop Study Area contain no known Confirmed SRE species, six Likely SRE species and 55 Possible SRE species. The Likely species are summarised below:

- Two slaters (*Acanthodillo sp.'7'* and *Buddelundia sp.'45'*) – Likely SRE species
- Two Idiopid trapdoor spiders (*Kwonkan goongarriensis* and *K. moriartii*) – Likely SRE species
- Two millipedes (*Antichiropus 'DIP002'* and *Antichiropus 'DIP003'*) – Likely SRE species

The Southern Desktop Study Area contains no known Confirmed SRE species, one Likely SRE species and four Possible SRE species:

- One anamid trapdoor spider (*Kwonkan goongarriensis*) – Likely SRE species

The remaining species identified from desktop resources were found to be widespread. Species that are considered to be Possible SREs is related to incomplete taxonomy or distributional data where survey data is inadequate to provide meaningful further comment on the species.

An additional conservation significant invertebrate (widespread, non-SRE species), was identified in the desktop assessment as having a Moderate likelihood of occurrence in the Thunderbox and Comet Vale Project areas:

- A mygalomorph spider – *Idiosoma clypeatum* - DBCA Priority 3

Whilst some Likely and Possible SRE species occur near the four Project areas, it should, however, be noted that all SRE habitat identified within the Project areas is not restricted in nature and occurs in adjoining land. No SRE or conservation significant terrestrial invertebrates are anticipated to be restricted to any of the four Project areas, due to the homogenous habitat present in the region and the very small extent of the Project areas themselves.

No survey work is required in order to meet the requirements for EPA technical guidance Sampling of short range endemic invertebrate fauna (EPA) 2016.

1. Introduction

MLG Oz Ltd (MLG) is proposing to develop a series of four separate sand and gravel pits (the Project) located in the northern Goldfields region of Western Australia. MLG proposes to extract sand and gravel from the four deposits for industrial use. Invertebrate Solutions Pty Ltd (Invertebrate Solutions) has been requested by MLG to undertake a desktop assessment for Short Range Endemic (SRE) invertebrates for the four Sand and Gravel Pit locations. The assessment is required to support environmental approvals under Commonwealth and State legislation.

The four projects to be assessed for SRE invertebrates are:

- Comet Vale E297/42 – 21km SW of Menzies
- Mt Keith E53/1480 – 62 km SE of Wiluna
- Thunderbox E36/1003 – 12 km SE of Leinster
- Jonah Bore M36/657 – 25 km W of Leinster

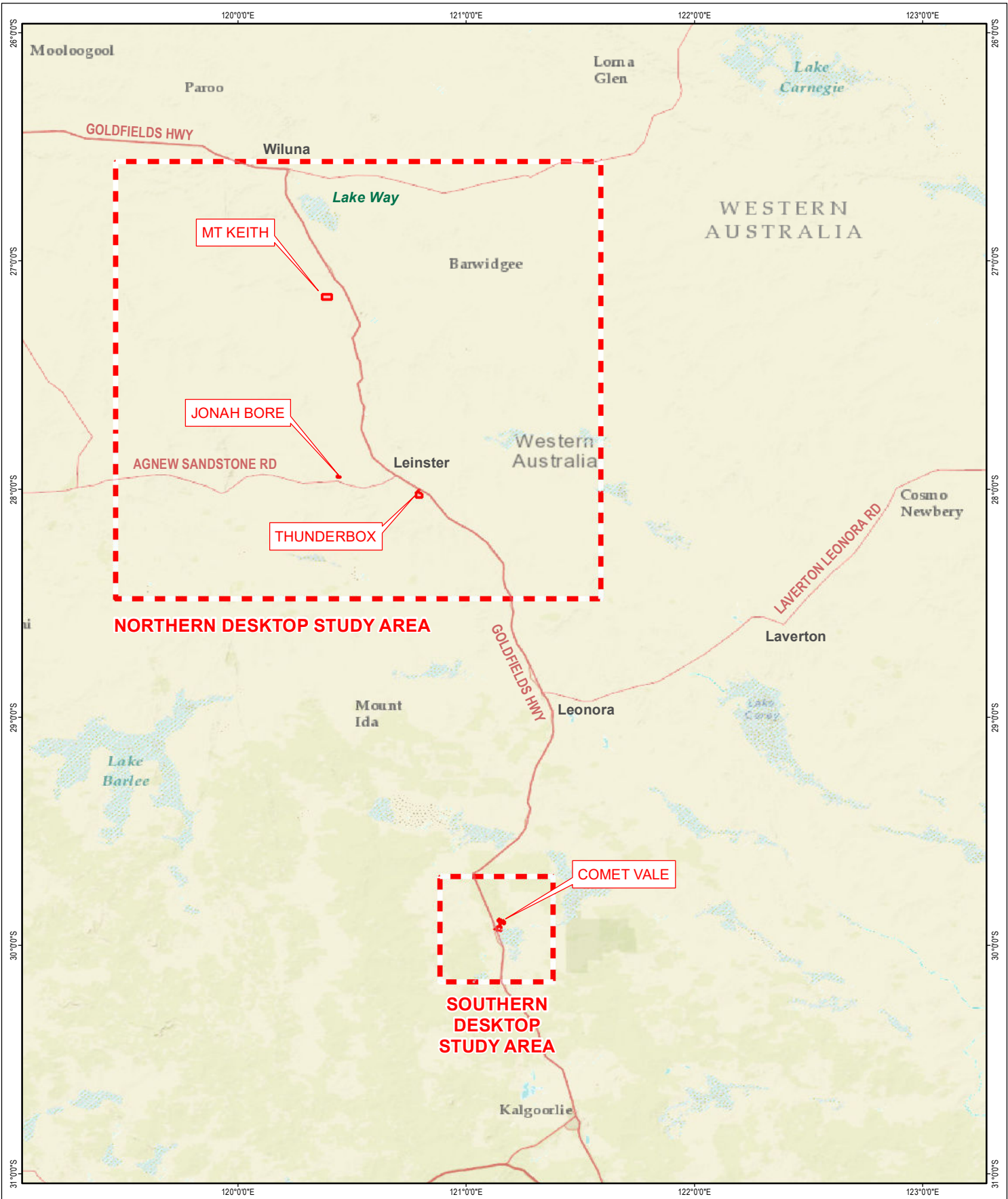
SRE invertebrates occur within terrestrial habitats and possess naturally restricted ranges and poor dispersal capabilities. The high degrees of local endemism and lack of habitat connectivity makes SRE fauna susceptible to high level impacts from localised projects, with species' extinction a real possibility if they are not adequately considered during project planning phases.

1.1 Purpose of this report



Invertebrate Solutions has been requested by Blueprint Environmental Strategies on behalf of MLG to undertake the following scope of works within the four MLG project areas, Western Australia:

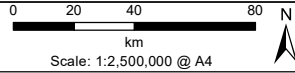
- Undertake a desktop assessment for short range endemic (SRE) invertebrates to determine known SRE fauna in the area, as well as habitats in which they likely occur.
- A summary of the invertebrate fauna (SRE and conservation significant) of the four desktop assessment areas and the likelihood of occurrence of such fauna and their conservation values in the context of the proposed sand and gravel mines for each of the four areas individually;
- Provide recommendations and any suggested requirements for further work to comply with relevant legislation.
- Provide a written report containing the above items.

The desktop assessment will be undertaken with regard to Technical Guidance Sampling of short range endemic invertebrate fauna (EPA 2016).



Legend

-  Desktop Study Area
-  Project Area



-NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS

LOCALITY MAP



Invertebrate Solutions
 m +61 (0) 429 792 834
 s +61 (0) 405 561 978
 e tim@invertebratesolutions.com
 w www.invertebratesolutions.com

PROJECT ID SRE Assessment of Sand & Gravel Pits		DATE 29/03/2022	
HORIZONTAL DATUM AND PROJECTION GCS GDA 1994			
CREATED ENVIRONMAPS	CHECKED TM	APPROVED TM	REVISION 0

Figure 1
 Desktop Study Areas and
 Project Areas for SRE Assessment

1.2 Project Area and Desktop Study Area

The four Project areas are located throughout the Northern Goldfields region of Western Australia and are shown in Figure 1. Due to the disparate nature of the four sites, two separate Desktop Study areas (Northern and Southern) were searched for potential SRE species to determine the potential likelihood of SRE species being present within each individual site. The Desktop Study areas are centred on the project areas and were used for the purposes of database searches and relevant literature (Figure 1).

The Northern Desktop Study area (~4.3 million Ha), is bounded by the north west corner (26.565274°S, 119.464898°E) and the south east corner (28.480838°S, 121.591088°E) and encompasses the Mt Keith, Thunderbox and Jonah Bore sites.

The Southern Desktop Study area (~250,000 Ha), is bounded by the north west corner (29.696918°S, 120.883626°E) and the south east corner (30.159383°S, 121.379448°E) and encompasses the Comet Vale site.

1.3 Introduction to SRE fauna

Short range endemic (SRE) invertebrates are species with restricted distributions. The isolation of invertebrates in specific habitats or bioregions leads to endemism at various spatial scales. The vast majority of invertebrates are capable of dispersing substantial distances at some phase of their life cycle. Some groups, however, are susceptible to short-range endemism which describes endemic species with restricted ranges, arbitrarily defined in Western Australia as less than 10,000 km² (100 km x 100 km) (Harvey, 2002). Taxa that have been more commonly found to contain SRE representatives include:

- Onychophorans (velvet worms);
- Crustaceans (Isopoda);
- Arachnids (mygalomorph spiders, pseudoscorpions, opiliones, scorpions, schizomids);
- Myriapods (millipedes and centipedes);
- Molluscs (land snails); and
- Insects (hemipterans, grasshoppers, butterflies).

SRE invertebrate fauna taxa are generally found in sheltered, relatively mesic environments such as isolated habitats (e.g. boulder piles, isolated hills, dense patches of vegetation, gullies) and can include microhabitats within these environments such as deep leaf litter accumulation, large logs, under bark, cave areas, springs and permanent water bodies.

Many processes contribute to taxa being susceptible to short range endemism. Generally, these factors are related to the isolation of a species which can include the ability and opportunity to disperse, life history, physiology, habitat requirements, and habitat availability. Taxa that exhibit short range endemism generally exhibit poor dispersal, low growth rates, low fecundity and reliance on habitat types that are discontinuous (Harvey, 2002). Taxa that reside within easily isolated habitats surrounded by physical barriers such as islands, mountains, aquifers, lakes and caves are also more susceptible to becoming SRE species often including additional taxa not otherwise generally forming SREs.

Taxa that exhibit short range endemism are particularly vulnerable to disturbance, either natural or anthropogenic, as they are reliant upon specialised and often restricted habitats (often moist) (Framenau, *et al.*, 2008). Short range endemic taxa are unable to disperse to *refugia* when their habitats are threatened or destroyed, thus making them a priority for conservation efforts.

The allocation of short range endemism status can be difficult due to the often incomplete taxonomic framework of many invertebrate groups and the often frequent need for substantial revision to enable accurate identification. Short Range Endemic status is assigned using the categories described in Table 1, based upon the available information from the Western Australian Museum (WAM) database and discussion with appropriate taxonomic authorities for various invertebrate groups. Insufficient information exists for many invertebrate species due to specimens being juvenile, the wrong sex to allow identification, damaged, or inadequate taxonomic frameworks, precluding the assignment of SRE status.

Table 1 Short Range Endemic Status of Species

SRE Status	Definition
Confirmed	A confirmed SRE species. A known distribution of < 10,000 km ² (after Harvey 2002). Taxonomy of the group is well known. The group is well represented in collections, or via comprehensive sampling.
Likely	Likely to be a SRE species based upon knowledge of the family/genus, where other closely related species show evidence of short range endemism. Where habitats containing the specimens show discontinuity within the landscape.
Possible	Based upon existing knowledge of the genus / family there is a possibility that the species may have a restricted range. Where habitats containing the specimens may show discontinuity within the landscape. Possible SRE species may be assigned one of the sub categories below: <ul style="list-style-type: none"> A. Data deficient i.e. new species, lack of distribution, taxonomic or collecting knowledge, juvenile specimens, wrong sex for identification B. Habitat indicators C. Morphology indicators D. Molecular evidence E. Research and expertise of WAM staff/taxonomic specialists
Widespread	Not a SRE, a wide ranging distribution of > 10,000 km ²

1.4 Conservation Legislation and Guidance Statements

Terrestrial SRE species are protected under state legislation via the newly enacted *Biodiversity Conservation Act 2016* (BC Act) which came into force on 1st January 2019, replacing the outdated *Wildlife Conservation Act 1950*. The new BC Act is aligned with the federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The assessment of SRE fauna for environmental impact assessment (EIA) is undertaken in Western Australia with regard to Technical Guidance – Sampling of short range endemic invertebrate fauna (EPA 2016).

At the State level, the BC Act provides a list of species that have special protection as species listed under Part 2 of BC Act. This notice is updated periodically by the Department of Biodiversity,

Conservation and Attractions (DBCA) (formerly the Department of Parks and Wildlife (DPaW)) and the current list (November 2019) includes numerous SRE species from the Wheatbelt, South Coast, Murchison and Pilbara regions. Included in the list are crustaceans, arachnids and myriapods that are considered to be “rare or likely to become extinct, as critically endangered fauna, or are declared to be fauna that is in need of special protection” (DPaW 2019). In addition to the specially protected fauna, DBCA also maintains a list of Priority fauna that are considered to be of conservation significance but do not meet the criteria for formal listing under the BC Act. The Priority fauna list is irregularly updated by DBCA and is now part of the BC Act.

The BC Act now provides the ability for the state government of Western Australia to formally list Threatened Ecological Communities (TECs), along with threatening processes.

The federal EPBC Act protects both species and ecological communities. The most relevant Western Australian listing for SRE fauna is the mygalomorph spider *Idiosoma nigrum* that only occurs in the northern Wheatbelt region and is listed as Vulnerable.

1.5 Report Limitations and Exclusions

This study was limited to the written scope provided to the client by Invertebrate Solutions (5th August 2021) and in Section 1.1. This study was limited to the extent of information made available to Invertebrate Solutions at the time of undertaking the work. Information not made available to this study, or which subsequently becomes available may alter the conclusions made herein. Assessment of potential impacts to SRE fauna was based on proposed development plans provided by the client.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. Invertebrate Solutions has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by Invertebrate Solutions described in this report (this section and throughout this report). Invertebrate Solutions disclaims liability arising from any of the assumptions being incorrect.

Invertebrate Solutions has prepared this report on the basis of information provided by MLG Oz Ltd and others (including Government authorities), which Invertebrate Solutions has not independently verified or checked beyond the agreed scope of work. Invertebrate Solutions does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

Site conditions may change after the date of this report. Invertebrate Solutions does not accept responsibility arising from, or in connection with, any change to the site conditions. Invertebrate Solutions is also not responsible for updating this report if the site conditions change.

Short Range Endemic status was assigned using the available information from the WAM database and discussion with appropriate taxonomic authorities for various invertebrate groups. Insufficient information exists for many invertebrate species due to specimens being juvenile, the wrong sex to allow identification, damaged, or inadequate taxonomic frameworks, precluding the assignment of SRE status.

2. Methods

Invertebrate Solutions undertook the following tasks for the desktop SRE assessment survey of the Project area:

- SRE desktop assessment based upon Western Australian Museum Records and previous survey reports.

The desktop assessment was undertaken with regard to the Technical Guidance – Sampling of short range endemic invertebrate fauna (EPA 2016).

2.1 SRE Desktop Methodology

The likelihood of SRE invertebrate species occurring in the Desktop Study Area was assessed using a combination of regional and local botanical and landform information and database searches including:

- Analysis of published and unpublished reports concerning SRE invertebrate from the region.
- Botanical and vegetation mapping and other information available for the Study Area.
- A field survey of the Project area informed the initial Desktop Likelihood of occurrence.
- Results of a Protected Matters Search from the Federal Government’s Department of Agriculture, Water and the Environment (DAWE) website.
- Records of fauna held by the WAM.

When considering the likelihood of SRE invertebrates at the local scale the Project area was specifically investigated whilst assessments at the regional scale included the entire Northern Goldfields. Based on the analysis of all available information the Desktop Study Area was assigned a level of likelihood to support SRE invertebrates of either ‘Very Low’, ‘Low’, ‘Moderate’, ‘High’, or ‘Definite’ (Table 2).

The likelihood that a particular vegetation unit or habitat type potentially contains or supports SRE species is defined in Table 3.

2.2 Short Range Endemic Status

Taxonomic groups known to contain SRE representatives were examined in more detail to determine if the specimens collected in this study are potentially restricted forms. SRE status will be assigned after comparison with the morphology of other close relatives in the group and current knowledge on their distribution and ecology, where known.

Table 2 SRE species likelihood of occurrence definitions

SRE Species Likelihood of occurrence	Definition
Definite	The species is confirmed to occur within the Project area.
High	Habitat for the species is known to occur within the Project area and known records of the species are within 20 km.
Moderate	Habitat for the species is known to occur within the Project area and known records of the species are within 50 km.
Low	The species has been recorded from within 50 km, however, no habitat is present for the species within the Project area.
Very low	No habitat exists for the species within the Project area and no records of the species are within 50 km or the distribution of the species is known well enough to exclude its presence within the Project area.

Table 3 SRE habitat suitability definitions

SRE habitat Likelihood of occurrence	Definition
High	The habitat has a High likelihood of containing SRE species as it has at least three microhabitat factors that support the presence of SRE species such as: SE facing slopes, moisture, rocky areas, habitat isolates, deep leaf litter, mountainous areas, deep gullies or gorges, riparian vegetation, or habitats known to contain SRE species.
Moderate	The habitat has a Moderate likelihood of containing SRE species as it has at least two microhabitat factors that support the presence of SRE species such as: SE facing slopes, moisture, rocky areas, habitat isolates, deep leaf litter, mountainous areas, deep gullies or gorges, riparian vegetation or habitats known to contain SRE species.
Low	The habitat has a Low likelihood of containing SRE species as it has only a single microhabitat factor that support the presence of SRE species such as: SE facing slopes, moisture, rocky areas, habitat isolates, deep leaf litter, mountainous areas, deep gullies or gorges, riparian vegetation or habitats known to contain SRE species.
Nil	No potential habitat exists for SRE species within the vegetation type / condition area. This includes areas that are totally cleared, completely degraded or urbanised. This also includes areas that are dominated by weeds or exotic vegetation species.

3. Results

3.1 SRE Invertebrates of the Goldfields region

Whilst there are limited systematic surveys for SRE species close to the Project Areas there are several studies from the region for various resources projects. One of the closest projects to be completed recently is at the Mt Keith satellite mine expansion project (MWH 2016) south of Leinster. This comprised of multiple survey seasons and included the Mt Keith disturbance footprint as well the adjacent Wanjarri Nature Reserve. The surveys recorded over 1,500 specimens representing 49 taxa, however, only two species were considered by experts as Confirmed SRE species, four as Likely SRE species and 23 as Potential SRE species.

A SRE assessment was undertaken at Lake Wells in 2018 that lies to the east of the Northern Desktop Study area (Bennelongia 2018). This survey identified seven different habitats that were investigated for potential SRE species, however, most were considered to have a Low likelihood of containing SRE species. The field survey identified 38 taxa with potential to be SRE species from groups including mygalomorph spiders, pseudoscorpions, millipedes, scorpions, isopods and land snails. The most prospective habitat for SRE species were the gypsum dunes with some taxa only recorded in this habitat, however, the extent of this habitat is large and no taxa were anticipated to be restricted to the Project area (Bennelongia 2018).

A comprehensive SRE survey was undertaken for the Tropicana Gold Project (Ecologia 2009) located approximately 330 km to the north east of Kalgoorlie between 2006 and 2008 using pitfall traps and active searching. The surveys recorded 46 potential SRE species from within the Tropicana Project area, with three confirmed SRE mygalomorph spiders being recorded only from within proposed impact areas (Ecologia 2009). The habitat for these species was found to be more widespread than the proposed impacts although a monitoring program was initiated to ensure these species were not significantly impacted (EPA 2010).

A baseline survey for SRE invertebrates in the Northern goldfields was undertaken on Cashmere Downs station for Cashmere Iron in 2010. This survey used a wide variety of different trapping techniques to record several likely SRE species including *Antichiropus* millipedes and mygalomorph trapdoor spiders (GHD 2010). No species were found to be restricted to proposed impact areas.

More widely within the greater Goldfields and Yilgarn areas comprehensive SRE surveys have been undertaken at the Gruyere Gold Project located approximately 100 km to the north east of Laverton. The survey recorded 20 taxa with the potential to contain SRE species, of which eight were determined to be Potential SRE species and the other 12 were found to be widespread (Harewood 2016, Framenau 2015, Volschenk 2015). The Potential SRE species included two species of scorpion, four species of spider, one species of isopod and one species of centipede (Harewood 2016).

Habitats within the wider Goldfields and Yilgarn area that are considered prospective for SRE invertebrates include creek and drainage lines, Banded Iron Formation (BIF) ridges, mesas, stony hills and breakaways. The majority of reported SRE species in the Goldfields and Yilgarn comprise of Camaenid land snails, Mygalomorph spiders, *Urodacus* scorpions, and *Antichiropus* and *Atelomastix*

millipedes (Bamford 2006; Bamford and Bancroft 2006; Bennelongia 2012, Biota 2009; Biota 2011; Car et al. 2013; GHD 2012; Harewood 2016, Ninox 2009, Volschenck 2015).

3.2 SRE Habitat in Project Areas

All assessments for likelihood of occurrence of conservation significant and SRE invertebrate species were undertaken with regard to the Technical Guidance – Sampling of short range endemic invertebrate fauna (EPA 2016).

Mt Keith SRE Habitat

The potential SRE habitat at the Mt Keith Project area is associated with the sand dunes that are present throughout the area (Figure 2). These provide a Moderate likelihood of containing potential SRE species due to their isolated nature, however, the local abundance and homogeneous nature of this habitat would suggest that taxa would be present throughout the entire sand dune habitat and not restricted to the Project area.

Jonah Bore SRE Habitat

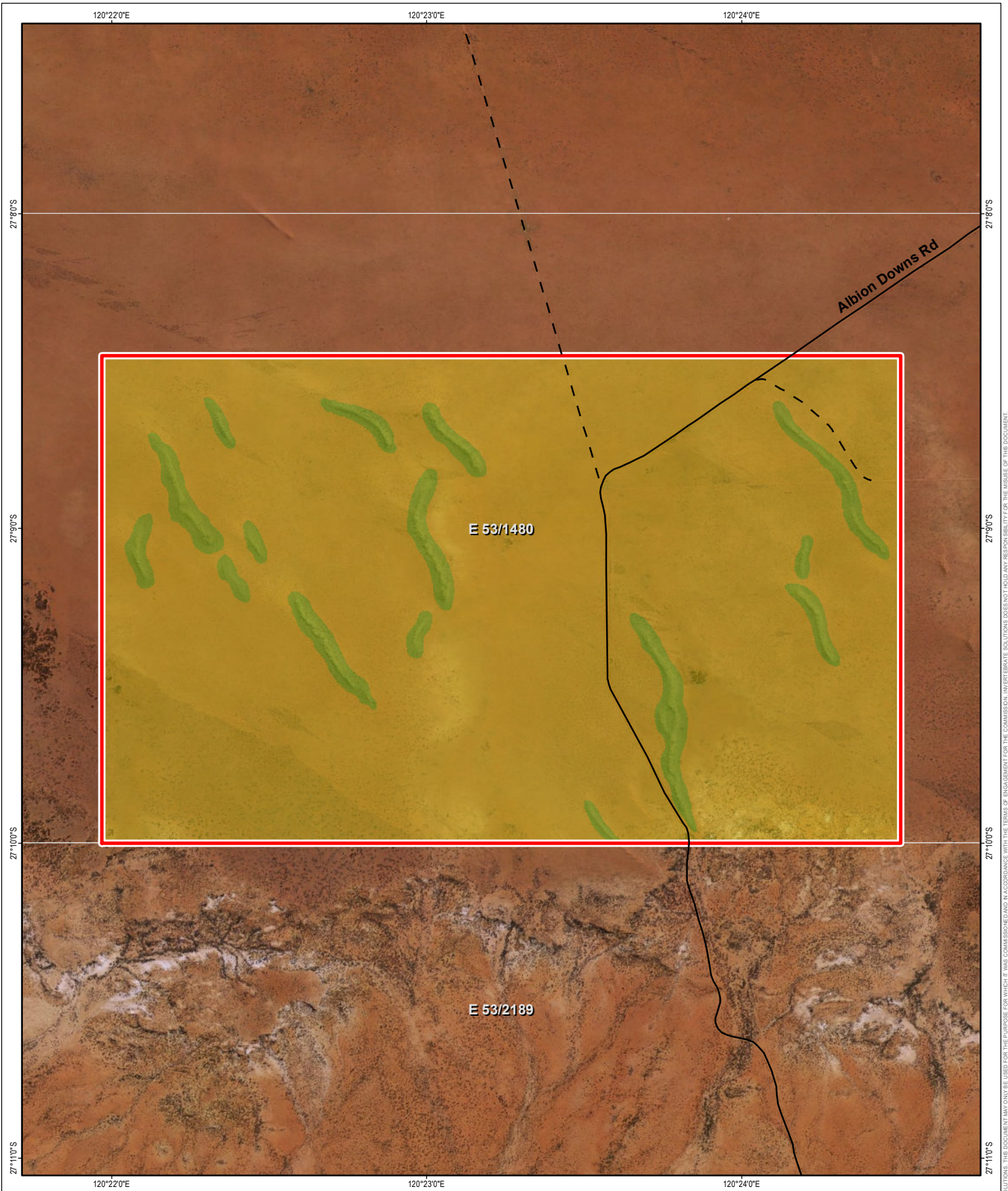
The potential SRE habitat at the Jonah Bore Project area is associated with the single sand dune that is present in the central portion of the Project area (Figure 3). These provide a Moderate likelihood of containing potential SRE species due to their isolated nature, however, the local abundance and homogeneous nature of this habitat would suggest that taxa would be present throughout the entire sand dune habitat and not restricted to the Project area.

Thunderbox SRE Habitat

The potential SRE habitat at the Thunderbox Project area is associated with the drainage lines and more dense vegetated areas that are present in the eastern and south western portions of the Project area (Figure 4). These provide a Moderate likelihood of containing potential SRE species due to their increased leaf litter accumulations and higher moisture content providing potential refugia for SRE taxa. These habitat do, however, extend beyond the Thunderbox Project area and are continuous in the regional landscape that would suggest that any potential SRE taxa would be not be restricted to the small amount of habitat present within the Project area.

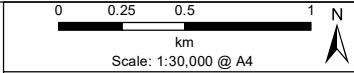
Comet Vale SRE Habitat

The potential SRE habitat at the Comet Vale Project area is associated with the drainage lines, sand dunes and more dense vegetated areas that are present in the north eastern and south western portions of the Project area (Figure 5). These provide a Moderate likelihood of containing potential SRE species due to their increased leaf litter accumulations and higher moisture content providing potential refugia for SRE taxa. These habitat do, however, extend beyond the Comet Vale Project area and are continuous in the regional landscape that would suggest that any potential SRE taxa would be not be restricted to the small amount of habitat present within the Project area.



Legend

- Project Area
- Tenement
- Road
- Track
- SRE Habitat Suitability**
- Moderate Likelihood SRE Habitat
- Low Likelihood SRE Habitat



- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS

LOCALITY MAP



Invertebrate Solutions
 m +61 (0) 429 792 834
 s +61 (0) 405 561 978
 e tim@invertebratesolutions.com
 w www.invertebratesolutions.com

PROJECT ID		DATE	
SRE Assessment of Sand & Gravel Pits		11/04/2022	
HORIZONTAL DATUM AND PROJECTION			
GCS GDA 1994			
CREATED	CHECKED	APPROVED	REVISION
ENVIRONMAPS	TM	TM	0

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Figure 2
Mt Keith Desktop
SRE Habitat Mapping

- TENEMENTS SOURCED DMIRS 2022

120°26'0"E

120°26'30"E

27°53'0"S

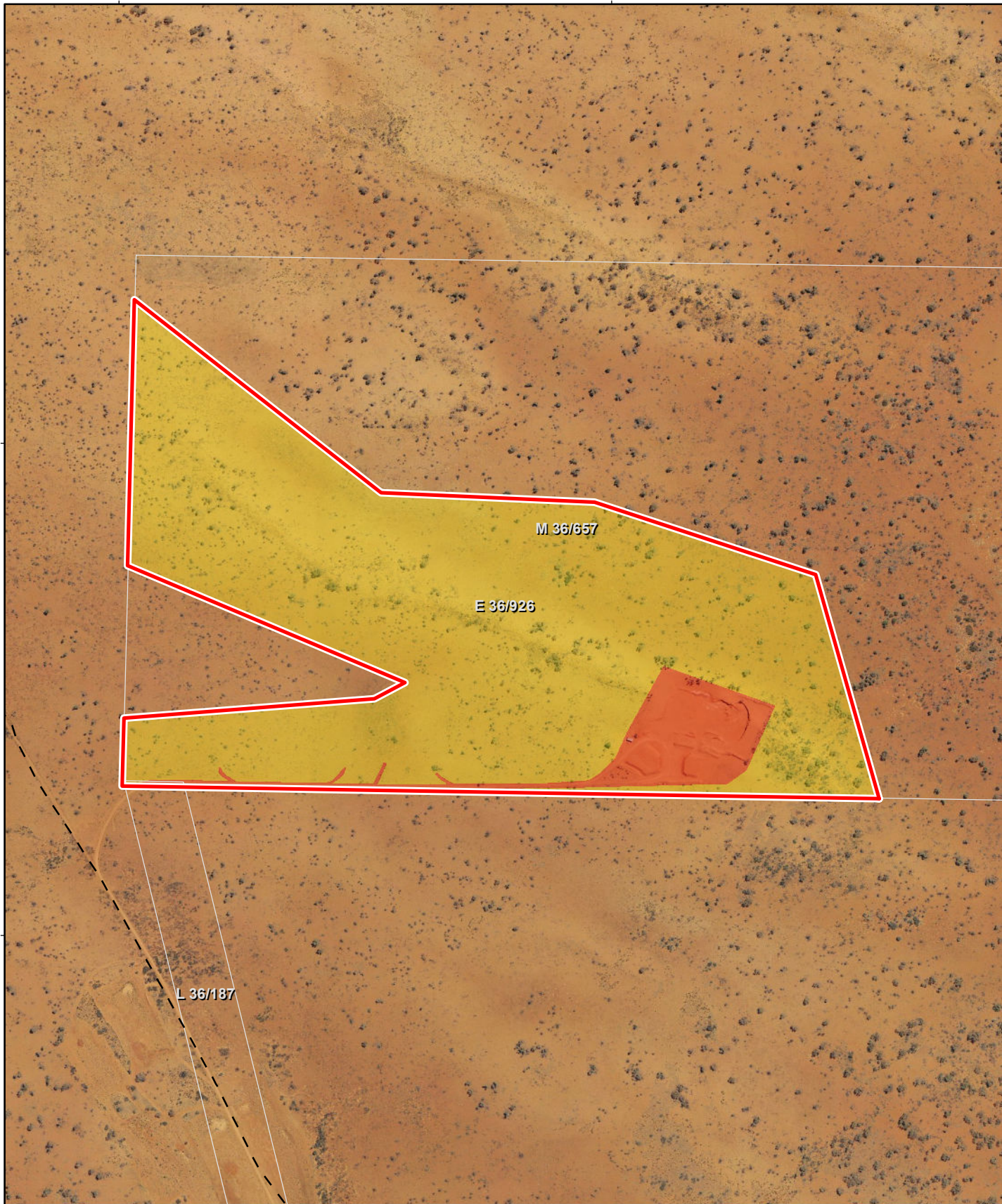
27°53'0"S

27°57'0"S

27°57'0"S

120°26'0"E

120°26'30"E



Legend

Project Area

Tenement

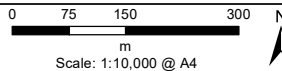
Road

Track

SRE Habitat Suitability

Low Likelihood SRE Habitat

Nil



Invertebrate Solutions
 m +61 (0) 429 792 834
 s +61 (0) 405 561 978
 e tim@invertebratesolutions.com
 www.invertebratesolutions.com

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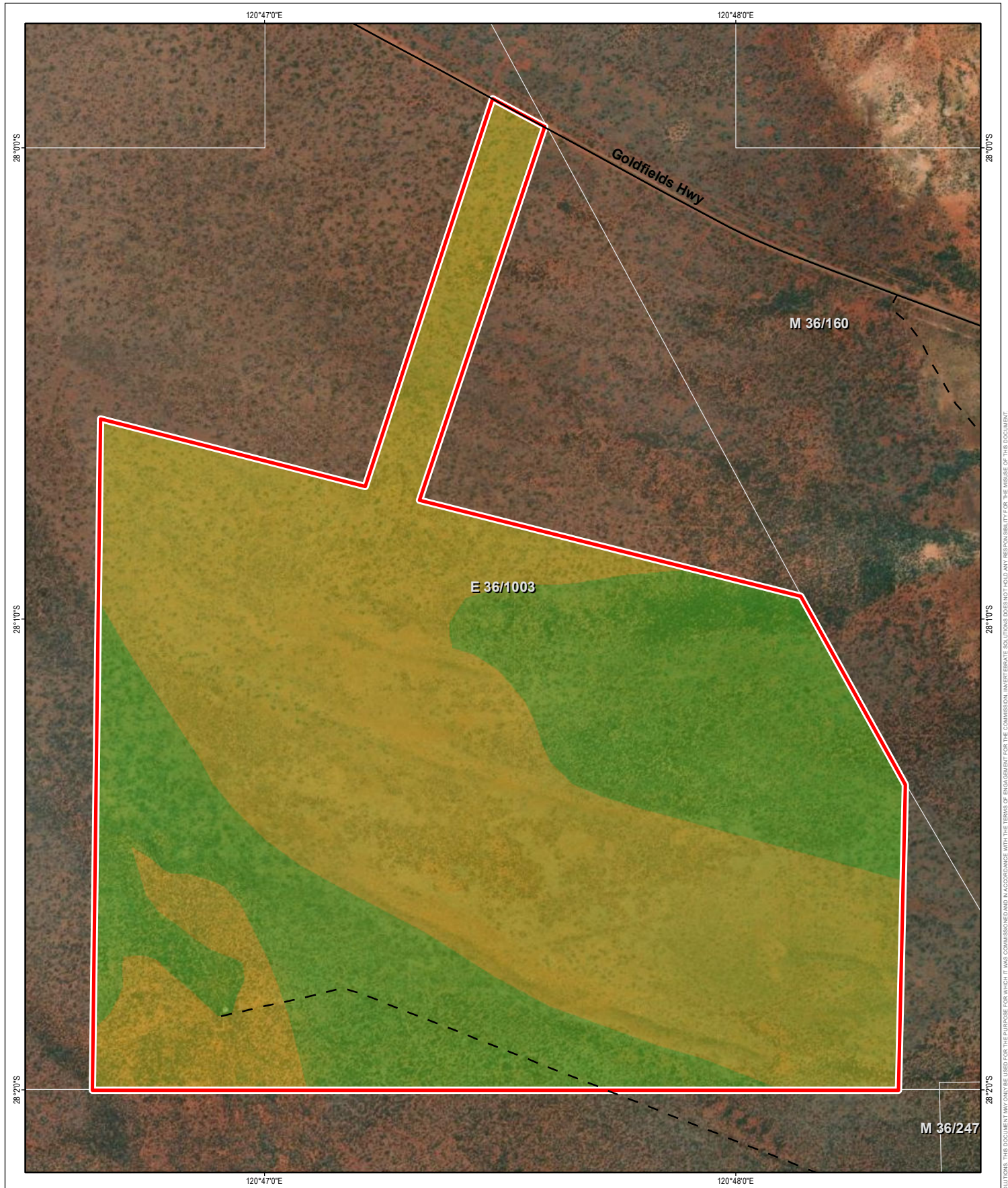
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ENVIRONMAPS	TM	TM	0

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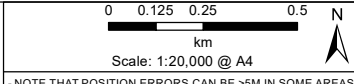
Figure 3
Jonah Bore Desktop
SRE Habitat Mapping

- TENEMENTS SOURCED DMIRS 2022



Legend

- Project Area
- Tenement
- Road
- Track
- SRE Habitat Suitability**
- Moderate Likelihood SRE Habitat
- Low Likelihood SRE Habitat



- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS

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m +61 (0) 429 792 834
s +61 (0) 405 561 978
e tim@invertebratesolutions.com
w www.invertebratesolutions.com

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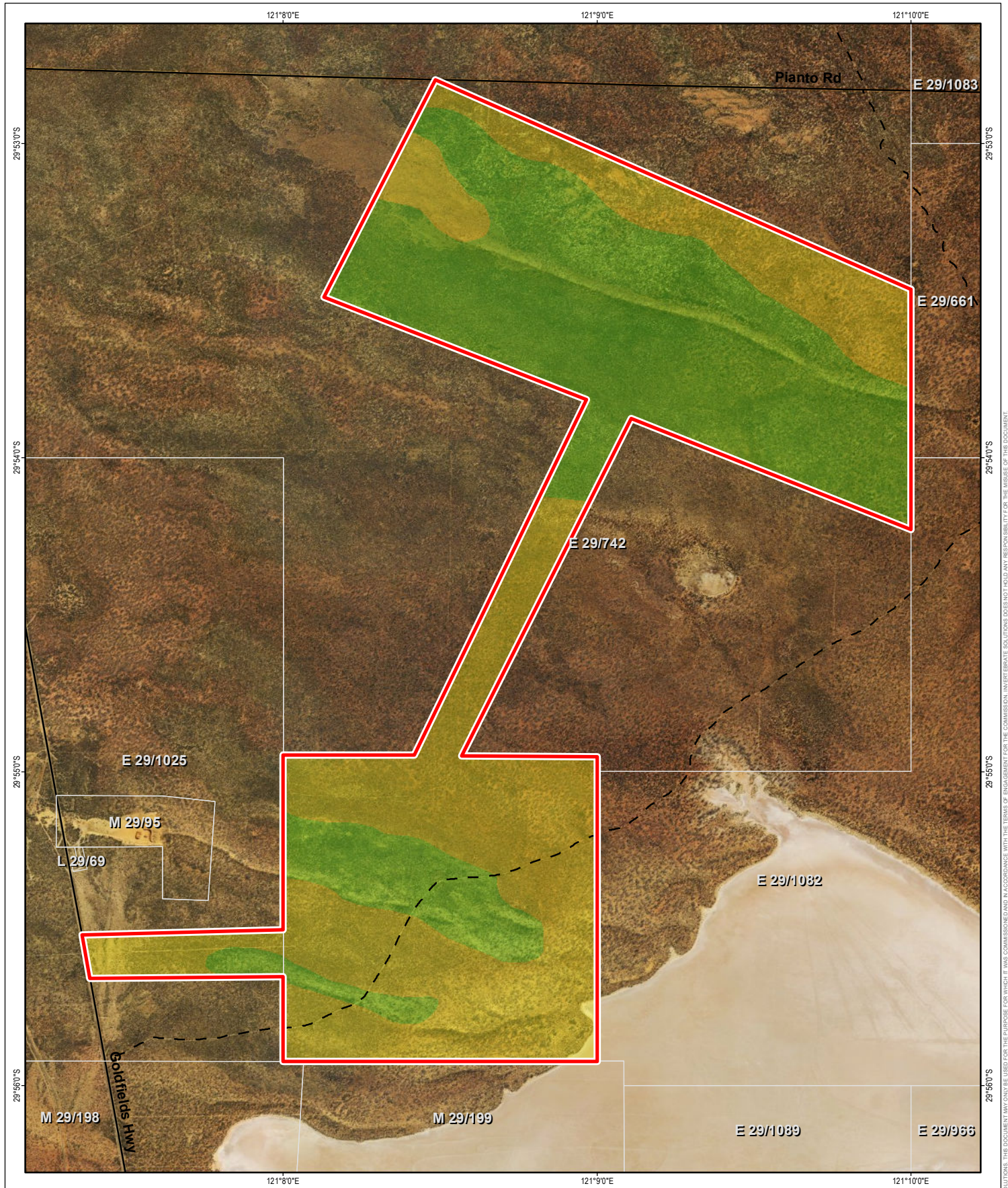
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ENVIRONMAPS	TM	TM	0

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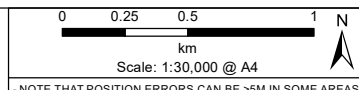
Figure 4
Thunderbox Desktop
SRE Habitat Mapping

- TENEMENTS SOURCED DMIRS 2022



Legend

- Project Area
- Tenement
- Road
- Track
- SRE Habitat Suitability**
- Moderate Likelihood SRE Habitat
- Low Likelihood SRE Habitat



-NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS

LOCALITY MAP





Invertebrate Solutions

m +61 (0) 429 792 834
s +61 (0) 405 561 978
e tim@invertebratesolutions.com
w www.invertebratesolutions.com

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CREATED	CHECKED	APPROVED	REVISION
ENVIRONMAPS	TM	TM	0

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Figure 5
Comet Vale Desktop
SRE Habitat Mapping

3.3 Conservation Significant and SRE Fauna in the Desktop Study Areas

A list of conservation significant fauna for the Northern and Southern Desktop Study Areas was compiled from the DBCA Specially Protected Fauna Notice 2019 (DBCA 2019) and the DAWE's Protected Matters Search Tool (PMST). SRE species that are listed under the BC Act and/or the EPBC Act and are likely to occur or have known habitat within the Desktop Study Area are shown in Table 4 along with their conservation code. The PMST results listed no known SRE or conservation significant invertebrate fauna within 50 km of the four Project areas. A full description of the BC and DBCA conservation codes are shown in Appendix 1. The full list of species obtained from the PMST searches are shown in Appendix 2.

A search of the WAM databases for potential SRE taxa occurring in the Northern and Southern Desktop Study Areas centred on the Project areas was undertaken (WAM 2021a, b, c). The results of these were filtered for SRE species as shown in Table 4. Definitions for SRE status are found in Table 1.

The records held by the WAM are not exhaustive and represent only specimens within the WAM collections that have been databased. The Entomology, Mollusc and Crustacean collections remain largely un-databased. Specimens identified to genus level only have been excluded from the analysis as it is impossible to determine if they represent a SRE taxa.

The Northern Desktop Study Area contains no known Confirmed SRE species, six Likely SRE species and 55 Possible SRE species (Table 4). The Likely species are summarised below:

- Two slaters (*Acanthodillo sp.'7'* and *Buddelundia sp.'45'*) – Likely SRE species
- Two Idiopid trapdoor spiders (*Kwonkan goongarriensis* and *Kwonkan moriartii*) – Likely SRE species
- Two millipedes (*Antichiropus 'DIP002'* and *Antichiropus 'DIP003'*) – Likely SRE species

The Possible SRE species include 27 mygalomorph spiders, 11 scorpions, six armadillid slaters, three pseudoscorpions, and two centipedes that have habitat present within the three Project areas. All these species are considered Possible SREs due to data deficiencies and absence of taxonomic frameworks that prohibit a conclusive assignment of SRE status. The remaining species identified from desktop resources were found to be widespread.

The Southern Desktop Study Area contains no known Confirmed SRE species, one Likely SRE species and four Possible SRE species (Table 4). The species are summarised below:

- One anamid trapdoor spider (*Kwonkan goongarriensis*) – Likely SRE species
- One anamid trapdoor spider (*Aname 'MYG347 -DNA'*) – Possible SRE species
- Three pseudoscorpions (*Sundochernes 'PSE020'*, *Synsphyronus 'PSE023'*, *Beierolpium 'sp. 8/2'*) – Possible SRE species

All these species from the southern Desktop Study area are considered Possible SREs due to data deficiencies and absence of taxonomic frameworks that prohibit a conclusive assignment of SRE status. The remaining species identified from desktop resources were found to be widespread.

An additional four conservation significant invertebrates (widespread, non-SRE species) were identified in the desktop assessment:

- A fairy shrimp - *Branchinella simplex* – DBCA Priority 1
- A fairy shrimp - *Branchinella denticulata*– DBCA Priority 3
- A mygalomorph spider – *Idiosoma clypeatum* – DBCA Priority 3
- A butterfly – The Inland Hairstreak (*Jalmenus aridus*) – DBCA Priority 1
- A butterfly – The Arid Bronze Azure Butterfly (*Ogyris subterrestris petrina*) – BC Act Critically Endangered / EPBC Act Critically Endangered

Only one of these conservation significant species is considered as having potential habitat within the Project areas, the Priority 3 mygalomorph spider *Idiosoma clypeatum* that is associated with Acacia woodlands on a variety of soil types including sandy, clay and gravel, outside of drainage channels. The Arid Bronze Azure Butterfly (*Ogyris subterrestris petrina*) was not identified as occurring, or having potential habitat within 50 km of the Projects area using the PMST.

Table 4 SRE Invertebrates in WAM databases and Conservation Significant invertebrates recorded from or with potential habitat within each Project area.

Higher Classification	Genus and Species	SRE status	DBCA / BC Act Conservation Status	EPBC Conservation Status	Likely habitat present in each Project area				Desktop likelihood of species within each Project Area			
					Southern Area		Northern Area		Southern Area		Northern Area	
					Comet Vale	Mt Keith	Thunderbox	Jonah Bore	Comet Vale	Mt Keith	Thunderbox	Jonah Bore
Crustacea:												
Thamnocephalidae	<i>Branchinella denticulata</i>	Widespread	Priority 3	-	Not present	Not present	Not present	Not present	Very Low	Very Low	Very Low	Very Low
	<i>Branchinella simplex</i>	Widespread	Priority 1	-	Not Present	Not Present	Not Present	Not Present	Very Low	Very Low	Very Low	Very Low
Armadillidae	<i>Acanthodillo sp.'7'</i>	Likely	-	-	Not Present	Not Present	Present	Not Present	Very Low	Very Low	Low	Very Low
	<i>Acanthodillo sp.'yakabindie a'</i>	Possible (A)	-	-	Not Present	Not Present	Present	Not Present	Very Low	Very Low	Low	Very Low
	<i>Buddelundia sp.'25'</i>	Possible (A)	-	-	Not Present	Present	Not Present	Not Present	Very Low	Moderate	Very Low	Very Low
	<i>Buddelundia sp.'45'</i>	Likely	-	-	Not Present	Present	Not Present	Not Present	Very Low	Moderate	Very Low	Very Low
	<i>Buddelundia sp.'96'</i>	Possible (A)	-	-	Not Present	Present	Not Present	Not Present	Very Low	Moderate	Very Low	Very Low
	<i>Cubaris sp.'wiluna'</i>	Possible (A)	-	-	Not Present	Present	Not Present	Not Present	Very Low	Moderate	Very Low	Very Low
	<i>Cubaris sp.'yeelirrie 1'</i>	Possible (A)	-	-	Not Present	Present	Not Present	Not Present	Very Low	Moderate	Very Low	Very Low
<i>Cubaris sp.'yeelirrie 2'</i>	Possible (A)	-	-	Not Present	Present	Not Present	Not Present	Very Low	Moderate	Very Low	Very Low	
Arachnida:												
Araneae: Mygalomorphae												
Barychelidae	<i>Mandjelia sp.'wanjarri'</i>	Possible (A)	-	-	Not Present	Present	Present	Not Present	Very Low	Moderate	Low	Very Low
	<i>Synothele 'MYG312'</i>	Possible (A)	-	-	Not Present	Not Present	Present	Present	Very Low	Very Low	Moderate	Moderate
Idiopidae	<i>Idiosoma' MYG014'</i>	Possible (A)	-	-	Not Present	Present	Not Present	Present	Very Low	Moderate	Very Low	Low
	<i>Idiosoma' MYG015'</i>	Possible (A)	-	-	Not Present	Present	Not Present	Present	Very Low	Moderate	Very Low	Low
	<i>Idiosoma' MYG017'</i>	Possible (A)	-	-	Not Present	Present	Not Present	Present	Very Low	Moderate	Very Low	Low
	<i>Idiosoma' MYG019'</i>	Possible (A)	-	-	Not Present	Present	Not Present	Present	Very Low	Moderate	Very Low	Low
	<i>Idiosoma' MYG020'</i>	Possible (A)	-	-	Not Present	Present	Not Present	Present	Very Low	Moderate	Very Low	Low
	<i>Idiosoma 'MYG061'</i>	Possible (A)	-	-	Not Present	Present	Not Present	Present	Very Low	Moderate	Very Low	Low
	<i>Idiosoma clypeatum</i>	Widespread	Priority 3	-	Present	Not Present	Present	Not Present	Moderate	Low	Moderate	Very Low
	<i>Eucyrtops 'MYG029'</i>	Possible (A)	-	-	Not Present	Present	Present	Not Present	Very Low	Moderate	Low	Very Low
<i>Eucyrtops 'MYG032'</i>	Possible (A)	-	-	Not Present	Present	Present	Not Present	Very Low	Moderate	Low	Very Low	
Anamidae	<i>Aname 'MYG030'</i>	Possible (A)	-	-	Not Present	Not Present	Present	Not Present	Very Low	Very Low	Low	Very Low
	<i>Aname 'MYG031'</i>	Possible (A)	-	-	Not Present	Not Present	Present	Not Present	Very Low	Very Low	Low	Very Low
	<i>Aname 'MYG170'</i>	Possible (A)	-	-	Not Present	Not Present	Present	Not Present	Very Low	Very Low	Low	Very Low
	<i>Aname 'MYG173'</i>	Possible (A)	-	-	Not Present	Not Present	Present	Not Present	Very Low	Very Low	Low	Very Low
	<i>Aname 'MYG176'</i>	Possible (A)	-	-	Not Present	Not Present	Present	Not Present	Very Low	Very Low	Low	Very Low
	<i>Aname 'MYG177'</i>	Possible (A)	-	-	Not Present	Not Present	Present	Not Present	Very Low	Very Low	Low	Very Low
	<i>Aname 'MYG212'</i>	Possible (A)	-	-	Not Present	Not Present	Present	Not Present	Very Low	Very Low	Low	Very Low
	<i>Aname 'MYG216'</i>	Possible (A)	-	-	Not Present	Not Present	Present	Not Present	Very Low	Very Low	Low	Very Low
	<i>Aname 'MYG227'</i>	Possible (A)	-	-	Not Present	Not Present	Present	Not Present	Very Low	Very Low	Low	Very Low
	<i>Aname 'MYG235'</i>	Possible (A)	-	-	Not Present	Not Present	Present	Not Present	Very Low	Very Low	Low	Very Low
	<i>Aname 'MYG347 -DNA'</i>	Possible (A)	-	-	Present	Not Present	Not Present	Not Present	Moderate	Very Low	Very Low	Very Low
	<i>Kwonkan 'MYG171'</i>	Possible (A)	-	-	Not Present	Present	Not Present	Not Present	Very Low	Low	Very Low	Very Low
	<i>Kwonkan 'MYG172'</i>	Possible (A)	-	-	Not Present	Present	Not Present	Not Present	Very Low	Low	Very Low	Very Low
	<i>Kwonkan 'MYG175'</i>	Possible (A)	-	-	Not Present	Not Present	Not Present	Not Present	Very Low	Low	Low	Low
	<i>Kwonkan 'MYG194'</i>	Possible (A)	-	-	Not Present	Present	Not Present	Not Present	Very Low	Low	Very Low	Very Low
<i>Kwonkan 'MYG210'</i>	Possible (A)	-	-	Not Present	Not Present	Not Present	Not Present	Very Low	Very Low	Very Low	Very Low	
<i>Kwonkan 'MYG211'</i>	Possible (A)	-	-	Not Present	Not Present	Not Present	Not Present	Very Low	Very Low	Very Low	Very Low	
<i>Kwonkan 'MYG352 -DNA'</i>	Possible (A)	-	-	Not Present	Not Present	Not Present	Not Present	Very Low	Very Low	Very Low	Very Low	
<i>Kwonkan 'MYG447'</i>	Possible (A)	-	-	Not Present	Not Present	Present	Not Present	Very Low	Very Low	Low	Very Low	
<i>Kwonkan goongarriensis</i>	Likely	-	-	Present	Not Present	Present	Not Present	High	Very Low	Low	Very Low	
<i>Kwonkan moriartii</i>	Likely	-	-	Not Present	Not Present	Present	Not Present	Very Low	Very Low	Low	Very Low	
<i>Teyl 'MYG025'</i>	Possible (A)	-	-	Not Present	Present	Not Present	Not Present	Very Low	Low	Moderate	Very Low	

Higher Classification	Genus and Species	SRE status	DBCA / BC Act Conservation Status	EPBC Conservation Status	Likely habitat present in each Project area				Desktop likelihood of species within each Project Area			
					Southern Area	Northern Area			Southern Area	Northern Area		
					Comet Vale	Mt Keith	Thunderbox	Jonah Bore	Comet Vale	Mt Keith	Thunderbox	Jonah Bore
	<i>Teyl 'MYG053'</i>	Possible (A)	-	-	Not Present	Present	Not Present	Not Present	Very Low	Low	Moderate	Very Low
	<i>Teyl 'MYG124'</i>	Possible (A)	-	-	Not Present	Present	Not Present	Not Present	Very Low	Low	Moderate	Very Low
Pseudoscorpiones												
Chernetidae	<i>Sundochernes 'PSE020'</i>	Possible (A)	-	-	Present	Present	Present	Not Present	Very Low	Low	Low	Very Low
Garypidae	<i>Synsphyronus 'PSE023'</i>	Possible (A)	-	-	Present	Present	Present	Not Present	Very Low	Low	Low	Very Low
Olpidae	<i>Beierolpium 'sp. 8/2'</i>	Possible (A)	-	-	Present	Present	Present	Present	Low	Low	Low	Low
Scorpiones												
Urodacidae	<i>Urodacus sp. 'cf gibson 5'</i>	Possible (A)	-	-	Not Present	Present	Not Present	Present	Very Low	Low	Very Low	Low
	<i>Urodacus sp. 'gibson 1'</i>	Possible (A)	-	-	Not Present	Present	Not Present	Present	Very Low	Low	Very Low	Low
	<i>Urodacus sp. 'gibson 3'</i>	Possible (A)	-	-	Not Present	Not Present	Present	Not Present	Very Low	Very Low	Low	Very Low
	<i>Urodacus sp. 'gibson 5'</i>	Possible (A)	-	-	Not Present	Not Present	Present	Not Present	Very Low	Very Low	Low	Very Low
	<i>Urodacus sp. 'lakeway 1'</i>	Possible (A)	-	-	Not Present	Not Present	Not Present	Not Present	Very Low	Very Low	Very Low	Very Low
	<i>Urodacus sp. 'lakeway2'</i>	Possible (A)	-	-	Not Present	Not Present	Not Present	Not Present	Very Low	Very Low	Very Low	Very Low
	<i>Urodacus sp. 'laverton 2'</i>	Possible (A)	-	-	Not Present	Not Present	Present	Not Present	Very Low	Very Low	Low	Very Low
	<i>Urodacus sp. 'laverton 5'</i>	Possible (A)	-	-	Not Present	Not Present	Present	Not Present	Very Low	Very Low	Low	Very Low
	<i>Urodacus 'SCO009 Biota 2'</i>	Possible (A)	-	-	Not Present	Present	Present	Not Present	Very Low	Moderate	Low	Very Low
	<i>Urodacus 'SCO018'</i>	Possible (A)	-	-	Not Present	Not Present	Present	Not Present	Very Low	Low	Low	Very Low
	<i>Urodacus 'species A Biota'</i>	Possible (A)	-	-	Not Present	Not Present	Present	Not Present	Very Low	Low	Low	Very Low
	<i>Urodacus 'species B Biota'</i>	Possible (A)	-	-	Not Present	Not Present	Present	Not Present	Very Low	Low	Low	Very Low
	<i>Urodacus 'yeelirrie'</i>	Possible (A)	-	-	Not Present	Present	Not Present	Not Present	Very Low	Moderate	Very Low	Very Low
Myriapoda												
Chilopoda												
Chilenophilidae	<i>'CHI001'</i>	Possible (A)	-	-	Not Present	Not Present	Present	Not Present	Very Low	Low	Low	Very Low
Mecistocephalidae	<i>Mecistocephalus 'CHI002'</i>	Possible (A)	-	-	Not Present	Not Present	Present	Not Present	Very Low	Low	Low	Very Low
Diplopoda												
Paradoxosomatidae	<i>Antichiropus 'DIP002'</i>	Likely	-	-	Not Present	Not Present	Present	Not Present	Very Low	Low	Low	Very Low
	<i>Antichiropus 'DIP003'</i>	Likely	-	-	Not Present	Not Present	Present	Not Present	Very Low	Low	Low	Very Low
Insecta												
Lepidoptera	<i>Jalmenus aridus</i>	Widespread	Priority 1	-	Not present	Not present	Not present	Not present	Very Low	Very Low	Very Low	Very Low
	<i>Ogyris subterrestris petrina</i>	Widespread	Critically Endangered	Critically Endangered	Not present	Not present	Not present	Not present	Very Low	Very Low	Very Low	Very Low

4. Discussion

4.1 SRE Invertebrate Assessment

The Project areas within the Northern Desktop Study Area contain no known Confirmed SRE species, six Likely SRE species and 55 Possible SRE species. The Likely species are summarised below and in Table 5:

- Two slaters (*Acanthodillo sp.'7'* and *Buddelundia sp.'45'*) – Likely SRE species
- Two Idiopid trapdoor spiders (*Kwonkan goongarriensis* and *Kwonkan moriartii*) – Likely SRE species
- Two millipedes (*Antichiropus 'DIP002'* and *Antichiropus 'DIP003'*) – Likely SRE species

The Southern Desktop Study Area contains no known Confirmed SRE species, one Likely SRE species and four Possible SRE species (Table 4) with the Likely SRE species shown below:

- One anamid trapdoor spider (*Kwonkan goongarriensis*) – Likely SRE species

All the Possible SRE species are classified as such due to data deficiencies and absence of taxonomic frameworks that prohibit a conclusive assignment of SRE status. The remaining species identified from desktop resources were found to be widespread.

An additional conservation significant invertebrate (widespread, non-SRE species), was identified in the desktop assessment as potentially occurring in both the Northern and Southern Desktop Study areas and is shown below and in Table 5:

- A mygalomorph spider – *Idiosoma clypeatum* - DBCA Priority 3

All Likely SRE, and conservation significant species with habitat within the four Project areas, are considered in depth in Section 4.1.1 – 4.1.3 respectively. Species that are considered to be Possible SREs is related to incomplete taxonomy or distributional data where survey data is inadequate to provide meaningful further comment on the species.

Table 5 Likelihood of occurrence summary for Likely SRE and conservation significant invertebrates

Taxa	SRE Status / Conservation Status	Project Area where taxa may occur	Likelihood of occurrence in individual Project area	Explanation
Crustacea: Armadillidae				
<i>Buddelundia sp.'45'</i>	Likely	Mt Keith	Moderate	Records within 20 km but differing habitat
<i>Acanthodillo sp.'7'</i>	Likely	Thunderbox	Low	Records over 50 km but similar habitat
Arachnida: Mygalomorphae				
<i>Idiosoma clypeatum</i>	DBCA Priority 3	Thunderbox	Moderate	Records within 20 km and similar habitat
	DBCA Priority 3	Comet Vale	Moderate	Records within 20 km and similar habitat
<i>Kwonkan goongarriensis</i>	Likely	Thunderbox	Moderate	Records over 50 km but similar habitat
	Likely	Comet Vale	High	Records within 20 km and similar habitat
<i>Kwonkan moriartii</i>	Likely	Thunderbox	Low	Records over 50 km but similar habitat
Diplopoda: Paradoxosomatidae				
<i>Antichiropus DIP002</i>	Likely	Thunderbox	Low	Records over 50 km but similar habitat
<i>Antichiropus DIP003</i>	Likely	Thunderbox	Low	Records over 50 km but similar habitat

4.1.1 Crustacea: Armadillidae

The taxonomic framework of slaters in Australia is extremely poorly making assessment of SRE status for this fauna difficult. The armadillid isopods from the Australian genus *Buddelundia* are extremely diverse in arid Australia with over 150 putative species identified in collections, primarily from Western Australia, but requires taxonomic revision at a family level making the proper identification of species difficult (Dalens 1992; Judd and Perina 2013).

Buddelundia sp.'45' is only known from four locations north of Leinster and is considered to be a Likely SRE based on knowledge of the genus and the distribution of other *Buddelundia* taxa in the region (Dr Simon Judd, pers comm. April 2022). The species is considered to have a Moderate likelihood of occurrence within the Mt Keith Project area due to the proximity to the known records although the habitat is not similar due to the sand dune dominated Mt Keith Project area.

All species within the armadillid genus *Acanthodillo* are morphologically very similar and reliable morphological characters for determining species are not yet available thus it is currently impossible to identify the taxa beyond generic level (Invertebrate Solutions 2020, Judd 2019). The genus is cryptic and much less frequently collected than *Buddelundia* and all *Acanthodillo* are considered Likely SRE species (Invertebrate Solutions 2020, Judd 2019). The taxa *Acanthodillo* sp.'7' has been recorded from Woodland and calcrete plain habitats near Lake Maitland and although some habitat similarities exist with the Thunderbox Project area the distance results in a Low likelihood of occurrence for this species.

4.1.2 Arachnida: Mygalomorphae

***Idiosoma clypeatum* – Priority 3 (DBCA)**

Idiosoma clypeatum was previously known by the WAM identification code 'MYG018' and prior to the taxonomic revision of Rix et al. 2018 was often incorporated into *Idiosoma nigrum* that is now known to only occur in the northern Wheatbelt region of Western Australia (Rix et al. 2018).

Idiosoma clypeatum has a widespread distribution in the Yalgoo and Murchison bioregions of Western Australia's inland arid zone, strongly correlated with annual rainfall of less than 250 mm (Plate 1). Like many *Idiosoma* species from the *I. nigrum* complex the burrows are adorned with a moustache like arrangement of twigs (Plate 2). Males have been collected wandering in search of females in late autumn, winter and spring, with a peak of activity in winter (Invertebrate Solutions 2017, Rix et al. 2018).

In 2017, *Idiosoma clypeatum* was formally assessed as Priority 3 fauna by DBCA; this assessment incorporated the latest taxonomic, geographic, and genetic data summarised by Rix et al. 2018. The species has a known extent of occurrence of over 120,000 km², and thus is not considered to be a short range endemic species by the definition of Harvey 2002, however, it does largely occur within areas prospective for mining and mineral resource development.

Idiosoma clypeatum (Plate 3) is known to occur in the northern Goldfields and is considered a Moderate Likelihood of occurring within the Thunderbox and Comet Vale Project areas due to their *Acacia* dominated vegetation that provides habitat for this species. Although widespread the species is patchy in distribution and can be highly localised in favourable habitat with maternal clusters occurring near the base of shrubs within accumulated leaf litter.

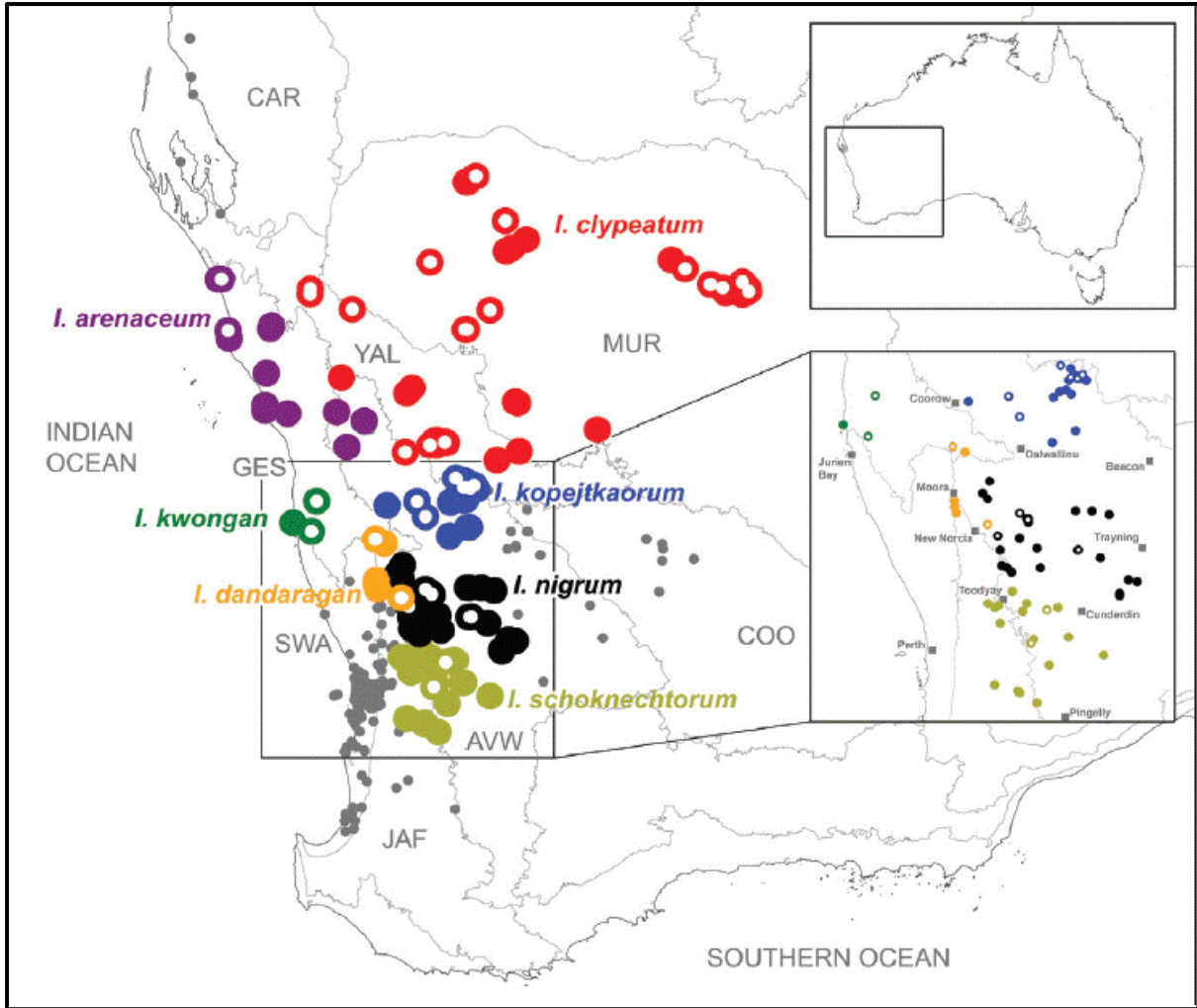


Plate 1 Distribution of *Idiosoma clypeatum* (red circles) in the Murchison and Yalgoo bioregions (after Rix et al. 2018, Figure 374).



Plate 2 Burrow of *Idiosoma clypeatum* from the Murchison bioregion marked with red arrow, showing characteristic moustache arrangement of leaves (Photo T Moulds).



Plate 3 Adult female of *Idiosoma clypeatum* from the Murchison bioregions (Photo T Moulds).

***Kwonkan goongarriensis* – Likely SRE**

The mygalomorph spider *Kwonkan goongarriensis* was described in 1983 (Main 1983) from material collected from leaf litter of heathland and Casuarina woodland in the Menzies and Leonora areas, with the type locality of Goongarrie Station. The spider makes a shallow silk lined tube that is only visible by scraping leaf litter to reveal the openings (Main 1983). It is considered to be a Likely SRE species based upon the known distribution and knowledge of the genus. The species is considered to have potential habitat in the Comet Vale and Thunderbox Project areas due to proximity to Menzies and the similar vegetation that occurs in these locations. The likelihood of occurrence is considered to be High for Comet Vale due to the close proximity to the type locality Goongarrie, whilst the Thunderbox Project area is considered to have a Low likelihood of occurrence due to the 200 km distance from Goongarrie.

***Kwonkan moriartii* – Likely SRE**

This species is known from a single male specimen collected at Kathleen Valley Station (Main 1983). Nothing is known of its habitat or ecology, however, it is considered to be a Likely SRE species. The species is considered to have potential habitat in the Thunderbox Project area due to proximity to Kathleen Valley, however the likelihood of occurrence is considered to be Low.

4.1.3 Diplopoda: Paradoxosomatidae

***Antichiropus* ‘DIP002 and DIP003’ – Likely SRE species**

Millipedes from the genus *Antichiropus* all have limited powers of dispersal and conservative ecological requirements (Car et al. 2013). In addition, the above-ground activity of most *Antichiropus* species are limited to a very small window of opportunity when there is sufficient moisture for them to forage and mate during wetter winter months (Car et al. 2013). *Antichiropus* species are, consequently, short-range endemics with very small distributions *sensu* Harvey 2002.

The two species of *Antichiropus* millipedes (DIP002 and DIP003) are both known from approximately 50 km north of Leinster where all specimens were collected in wet pitfall traps in a variety of habitats including drainage/creek lines, mulga woodland on sandy plains and rocky slopes. Although potential habitat is present at the Thunderbox Project area, the distance of over 50 km between the localities would make the likelihood of occurrence Low.

5. Conclusions and Recommendations

The Project areas within the Northern Desktop Study Area contain no known Confirmed SRE species, six Likely SRE species and 55 Possible SRE species. The Likely species are summarised below:

- Two slaters (*Acanthodillo sp.'7'* and *Buddelundia sp.'45'*) – Likely SRE species
- Two Idiopid trapdoor spiders (*Kwonkan goongarriensis* and *Kwonkan moriartii*) – Likely SRE species
- Two millipedes (*Antichiropus 'DIP002'* and *Antichiropus 'DIP003'*) – Likely SRE species

The Southern Desktop Study Area contains no known Confirmed SRE species, one Likely SRE species and four Possible SRE species (Table 4):

- One anamid trapdoor spider (*Kwonkan goongarriensis*) – Likely SRE species

The remaining species identified from desktop resources were found to be widespread. Species that are considered to be Possible SREs is related to incomplete taxonomy or distributional data where survey data is inadequate to provide meaningful further comment on the species.

An additional conservation significant invertebrate (widespread, non-SRE species), was identified in the desktop assessment as having a Moderate likelihood of occurrence in the Thunderbox and Comet Vale Project areas:

- A mygalomorph spider – *Idiosoma clypeatum* - DBCA Priority 3

Whilst some Likely and Possible SRE species occur near the four Project areas, it should, however, be noted that all SRE habitat identified within the Project areas is not restricted in nature and occurs in adjoining land. No SRE or conservation significant terrestrial invertebrates are anticipated to be restricted to any of the four Project areas, due to the homogenous habitat present in the region and the very small extent of the Project areas themselves.

No survey work is required in order to meet the requirements for EPA technical guidance Sampling of short range endemic invertebrate fauna (EPA) 2016.

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Appendix 1

Conservation Codes from Department of Biodiversity, Conservation and Attractions



CONSERVATION CODES

For Western Australian Flora and Fauna

Threatened, Extinct and Specially Protected fauna or flora¹ are species² 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.

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.

¹ The definition of flora includes algae, fungi and lichens

² Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies or variety, or a distinct population).

Appendix 2

Protected Matters Search Tool Results



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-Mar-2022

[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](#).

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar)	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	8
Listed Migratory Species:	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

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 <http://www.environment.gov.au/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.

Commonwealth Lands:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	11
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

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

State and Territory Reserves:	2
Regional Forest Agreements:	None
Nationally Important Wetlands:	2
EPBC Act Referrals:	2
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	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
BIRD			
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In buffer area only
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area	In feature area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat known to occur within area	In feature area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area	In feature area
Polytelis alexandrae Princess Parrot, Alexandra's Parrot [758]	Vulnerable	Species or species habitat may occur within area	In feature area
MAMMAL			
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area	In feature area
PLANT			
Eleocharis papillosa Dwarf Desert Spike-rush [2519]	Vulnerable	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Ricinocarpos brevis [82879]	Endangered	Species or species habitat may occur within area	In feature area

Listed Migratory Species [\[Resource Information \]](#)

Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area

Migratory Terrestrial Species

Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area	In feature area
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Migratory Wetlands Species

Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In buffer area only
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat may occur within area	In buffer area only

Other Matters Protected by the EPBC Act

Commonwealth Lands [\[Resource Information \]](#)

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Commonwealth Land Name	State	Buffer Status
Unknown		

Commonwealth Land Name	State	Buffer Status
Commonwealth Land - [51750]	WA	In buffer area only

Listed Marine Species	[Resource Information]		
Scientific Name	Threatened Category	Presence Text	Buffer Status

Bird			
------	--	--	--

Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In buffer area only
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In buffer area only
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat known to occur within area overfly marine area	In feature area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area	In feature area
Thinornis cucullatus as Thinornis rubricollis Hooded Dotterel, Hooded Plover [87735]		Species or species habitat likely to occur within area overfly marine area	In feature area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat may occur within area overfly marine area	In buffer area only

Extra Information

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

Protected Area Name	Reserve Type	State	Buffer Status
Credo	NRS Addition - Gazettal in Progress	WA	In buffer area only
Goongarrie	National Park	WA	In buffer area only

Nationally Important Wetlands [\[Resource Information \]](#)

Wetland Name	State	Buffer Status
Lake Ballard	WA	In buffer area only
Lake Marmion	WA	In buffer area only

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

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action				
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area
Ularring Hematite Project, WA	2012/6426	Not Controlled Action	Completed	In buffer area only

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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Department of Agriculture Water and the Environment

GPO Box 858

Canberra City ACT 2601 Australia

+61 2 6274 1111



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-Mar-2022

[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](#).

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar)	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	7
Listed Migratory Species:	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

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 <http://www.environment.gov.au/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.

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	10
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

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

State and Territory Reserves:	2
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	6
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	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
BIRD			
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat known to occur within area	In feature area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat likely to occur within area	In feature area
Polytelis alexandrae Princess Parrot, Alexandra's Parrot [758]	Vulnerable	Species or species habitat may occur within area	In feature area
MAMMAL			
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat may occur within area	In feature area
Sminthopsis psammophila Sandhill Dunnart [291]	Endangered	Species or species habitat may occur within area	In buffer area only
PLANT			
Atriplex yeelirrie [88538]	Endangered	Species or species habitat known to occur within area	In buffer area only

Listed Migratory Species [\[Resource Information \]](#)

Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			

Scientific Name	Threatened Category	Presence Text	Buffer Status
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In buffer area only
Migratory Terrestrial Species			
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area	In feature area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area	In feature area
Migratory Wetlands Species			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
Charadrius veredus 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
Bird			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area
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Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area	In feature area
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Thinornis cucullatus as Thinornis rubricollis Hooded Dotterel, Hooded Plover [87735]		Species or species habitat may occur within area overfly marine area	In buffer area only

Extra Information

State and Territory Reserves			[Resource Information]
Protected Area Name	Reserve Type	State	Buffer Status
Kaluwiri	NRS Addition - Gazettal in Progress	WA	In buffer area only
Wanjarri	Nature Reserve	WA	In buffer area only

EPBC Act Referrals

[[Resource Information](#)]

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Controlled action				
Extension to Wiluna Uranium Mine (Millipede & Lake Maitland), Wiluna, WA	2014/7138	Controlled Action	Post-Approval	In buffer area only
Wiluna Uranium Project	2009/5174	Controlled Action	Post-Approval	In buffer area only
Yeelirrie Uranium Mine	2009/4906	Controlled Action	Post-Approval	In buffer area only
Not controlled action				
Clearing for Mt Keith Satellite Project, WA	2017/8001	Not Controlled Action	Completed	In buffer area only
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area
Referral decision				
Northern Goldfields Interconnect Pipeline	2021/8900	Referral Decision	Referral Publication	In buffer area only

Caveat

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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

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Threatened, migratory and marine species

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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.

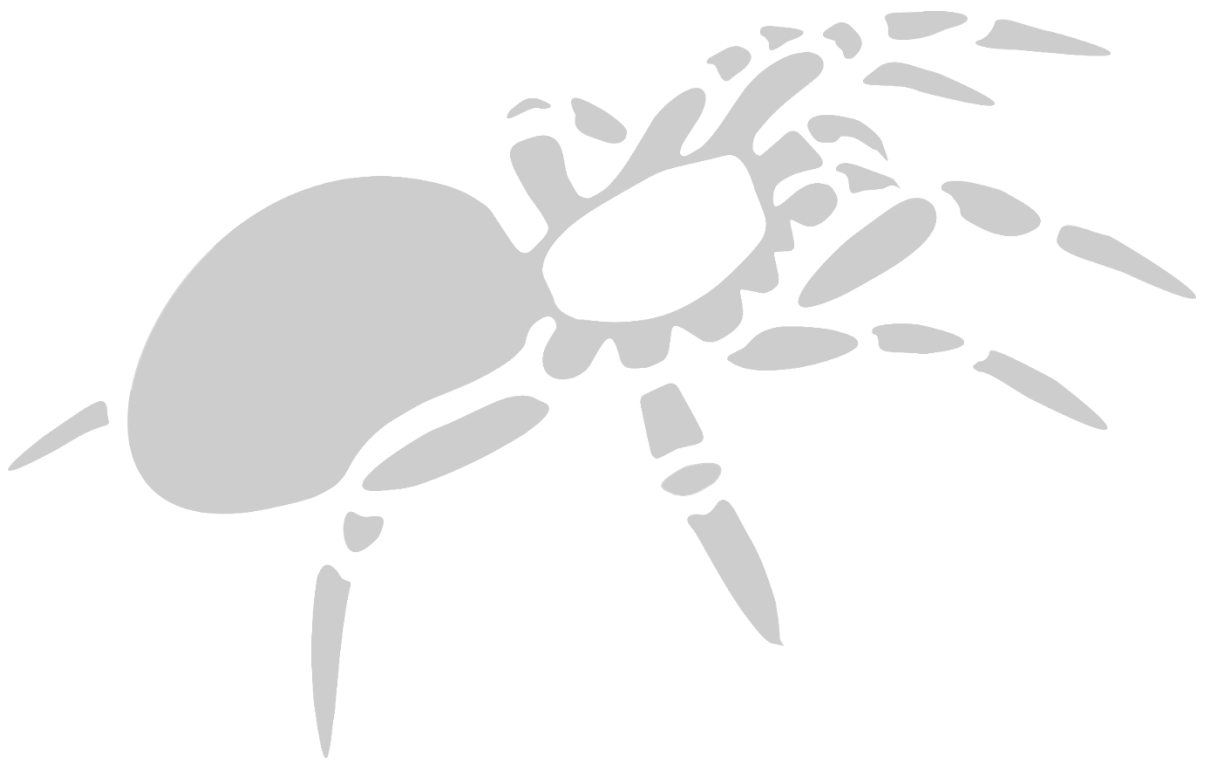
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Department of Agriculture Water and the Environment

GPO Box 858

Canberra City ACT 2601 Australia

+61 2 6274 1111



www.invertebratesolutions.com

APPENDIX 7:AHIS REPORT (DPLH 2021)

List of Registered Aboriginal Sites

Search Criteria

1 Registered Aboriginal Sites in Mining Tenement - M 36/657

Disclaimer

The *Aboriginal Heritage Act 1972* preserves all Aboriginal sites in Western Australia whether or not they are registered. Aboriginal sites exist that are not recorded on the Register of Aboriginal Sites, and some registered sites may no longer exist.

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 email the details to the Department at AboriginalHeritage@dplh.wa.gov.au and we will make every effort to rectify it as soon as possible.

Copyright

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Coordinate Accuracy

Coordinates (Easting/Northing metres) are based on the GDA 94 Datum. Accuracy is shown as a code in brackets following the coordinates.

Terminology (NB that some terminology has varied over the life of the legislation)

Place ID/Site ID: This a unique ID assigned by the Department of Planning, Lands and Heritage to the place.

Status:

- **Registered Site:** The place has been assessed as meeting Section 5 of the *Aboriginal Heritage Act 1972*.
- **Other Heritage Place which includes:**
 - **Stored Data / Not a Site:** The place has been assessed as not meeting Section 5 of the *Aboriginal Heritage Act 1972*.
 - **Lodged:** Information has been received in relation to the place, but an assessment has not been completed at this *stage* to determine if it meets Section 5 of the *Aboriginal Heritage Act 1972*.

Access and Restrictions:

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- **Restrictions:**
 - **No Restrictions:** *Anyone* can view the information.
 - **Male Access Only:** Only *males* can view restricted information.
 - **Female Access Only:** Only *females* can view restricted information.

Legacy ID: This is the former unique number that the former Department of Aboriginal Sites assigned to the place. This has been replaced by the Place ID / Site ID.



Aboriginal Heritage Inquiry System

List of Registered Aboriginal Sites

ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
18983	HWE02 Tjilkamata Hill	Yes	Yes	No Gender Restrictions	Registered Site	Mythological, Named Place, Natural Feature	*Registered Knowledge Holder names available from DPL	Not available when location is restricted	

List of Other Heritage Places

Search Criteria

1 Other Heritage Places in Mining Tenement - M 36/657

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 - Female Access Only: Only females can view restricted information.

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Aboriginal Heritage Inquiry System

List of Other Heritage Places

ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
18980	HWE03 Mingari Hill	Yes	Yes	No Gender Restrictions	Lodged	Mythological, Natural Feature	*Registered Knowledge Holder names available from DPL	Not available when location is restricted	

List of Registered Aboriginal Sites

Search Criteria

2 Registered Aboriginal Sites in Mining Tenement - L 36/187

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Aboriginal Heritage Inquiry System

List of Registered Aboriginal Sites

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18979	HWE01 Bush Camp	Yes	Yes	No Gender Restrictions	Registered Site	Man-Made Structure, Camp	*Registered Knowledge Holder names available from DPL	Not available when location is restricted	
18983	HWE02 Tjilkamata Hill	Yes	Yes	No Gender Restrictions	Registered Site	Mythological, Named Place, Natural Feature	*Registered Knowledge Holder names available from DPL	Not available when location is restricted	

List of Other Heritage Places

Search Criteria

1 Other Heritage Places in Mining Tenement - L 36/187

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Aboriginal Heritage Inquiry System

List of Other Heritage Places

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19858	Tjilmata - Mingari	No	No	No Gender Restrictions	Lodged	Mythological, Other: A complex of natural features, see site file	*Registered Knowledge Holder names available from DPL	248065mE 6903711mN Zone 51 [Reliable]	

APPENDIX 8:LAND CLEARING REQUEST FORM



Jonah Bore – Land Clearing Request Form

Request Form # Land Clearing Form.docx
Revision No: 1-
Issue Date: November 2022

Under no circumstances shall any clearing of vegetation take place without consent from Regulatory Authorities and without approval by this fully completed and signed Land Clearing Request Form (LCRF). **This form is to be completed by the applicant and forwarded to the Environmental Supervisor at least 7 working days prior to any proposed land clearing.**

ONLY WORK SPECIFIED ON THIS PERMIT IS APPROVED TO BE PERFORMED. Permit No: _____

Step 1: Proposed Activities (Applicant)			
Applicant Name:		Application Date:	
Work Group:		Tenement:	
Site:		Proposed Area (ha)	
Location (GPS):			
Clearing Plan attached	A detailed plan showing coordinates and boundary of proposed clearing, boundaries of clearing approved by DMIRS, locations of any areas of significance to be avoided (conservation significant species, drainage lines, heritage) and locations of vegetation and topsoil stockpiles must be attached.		<input type="checkbox"/> Yes
Proposed Commencement Date:		Proposed Completion Date:	
Description of Proposed Ground Disturbance			

Step 2: Site Assessment (Compliance Manager / Environmental Supervisor)							
					Yes	No	NA
1	DMIRS has granted approval for (circle one)	Approval Type	Approval ID #				
	Transport corridor/ Hardstand Area / Buildings	PoW / Mining Proposal		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2	Total Area Approved for Activity Type in Mining Proposal/PoW (ha)						
3	Area previously cleared or approved for Activity Type in Mining Proposal/PoW (ha)						
4	Area available for Activity Type (Area in Check 2 – Area in Check 3)						
5	Is sufficient area available to be cleared for the Activity Type in the Mining Proposal?			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
6	With the addition of this permit is the total open area less than 10 Ha? (Include all approved Clearing Request Forms and current open areas).			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
7	Has a pre-clearance survey for conservation significant flora and vegetation communities been undertaken by a suitably qualified and experienced person?		Survey reference:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
8	Have populations of priority flora been identified and clearly marked with a buffer zone?			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
9	If clearing of any identified populations of priority flora is unavoidable, have these been reported to DMIRS including impacts on the species?			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
10	Have observed Malleefowl mounds (active or inactive) been recorded in the Malleefowl Register?			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
11	Have active Malleefowl mounds been flagged with a 50 m buffer so that the area is clearly marked?			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
12	Have inactive Malleefowl mounds unable to be avoided, been reported to DMIRS and DBCA?			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
13	Have drainage lines been identified with clearly marked buffer zones?			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
14	Have requirements for stormwater management been included in Step 4 – Conditions?			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
15	Has a physical area inspection been undertaken? (Attach photos)			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
16	Has the Land Clearing Register and spatial data layers been reviewed and updated?			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Step 3: Acknowledgement and Acceptance

Standard Conditions	All vehicles and plant equipment must be properly maintained to avoid spills and minimise air and noise pollution.	
	Prior to works commencing all vehicles must be quarantine inspected to ensure they are clean of soil, weeds, and seeds.	
	Signage must be erected to prevent public accessing the area.	
	A pre-start meeting must be held immediately prior to the clearing works being conducted to ensure that all permit conditions have been met.	
	Vegetation and topsoil (to a depth of at least 0.3m) must be removed and placed in designated stockpiles.	
	Topsoil stockpiles must be located within the permitted area, no higher than 2m and are clearly signed.	
	Clearing must be supervised by a qualified experienced person.	
Additional Conditions and Comments	(Example: drainage, vehicle access, erosion control)	
Acknowledgment	A map referenced with the corresponding permit number has been attached to this LCRF.	<input type="checkbox"/> Yes
	The proposed area is clearly marked by a surveyor with survey pegs and flagging tape.	<input type="checkbox"/> Yes
	All conditions imposed under this permit are understood by all parties.	<input type="checkbox"/> Yes

I understand and accept all conditions stated in this approval and any associated permits and procedures. I will ensure that all conditions are strictly adhered to by myself and colleagues. The person/s carrying out this work will retain an approved copy of this permit in the work area and in all machinery at all times. Handover of this LCRF will be undertaken at shift each change.

Managing Director	LCRF Conditions Accepted?	<input type="checkbox"/> Yes	<input type="checkbox"/> No (Permit Retracted)
	<i>(name):</i>	<i>Date:</i>	<i>Signature:</i>
Compliance Manager	LCRF Conditions Accepted?	<input type="checkbox"/> Yes	<input type="checkbox"/> No (Permit Retracted)
	<i>(name):</i>	<i>Date:</i>	<i>Signature:</i>
Operator / Person Conducting Disturbance	LCRF Conditions Accepted?	<input type="checkbox"/> Yes	<input type="checkbox"/> No (Permit Retracted)
	<i>(name):</i>	<i>Date:</i>	<i>Signature:</i>

Step 4: Post Disturbance Confirmation (Compliance Manager)

Date activity was completed		
Date the final disturbance area was surveyed		
Name of surveyor		
A post clearing inspection has been conducted.	<input type="checkbox"/> Yes	
Actual Clearing Area for Activity Type (e.g. Transport and service infrastructure, mining void).	Activity Type	Area (ha)
The Land Clearance Register has been updated?	<input type="checkbox"/> Yes	
Additional Comments		

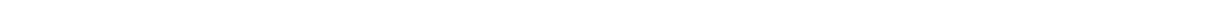
The Compliance Manager must retain copies of the signed clearing permit, the survey pick-up of the final cleared area, malleefowl survey records, photos and the updated land clearing register.

APPENDIX 9:WEED MANAGEMENT PROCEDURE



MLG Operations

Weed Management Procedure



		Address: 10 Yindi Way, Kalgoorlie WA 6430 Postal: Address: as above Ph: 08 9022 7746 Email: murray@mlgoz.com.au	
Document Title:	MLG Weed Management Procedure		
Proponent:	MLG Oz Limited		
ABN:	53 102 642 366		
ACN:	102 642 366		
Version:	Version 1		
Version date:	February 2022		
Reviewed by:	Brett Stevens	Date:	18/2/2022
Final approval:		Date:	

Disclaimer:

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Rev	Description of Revisions	Date	Prepared By	Approved By
A	Issued for Internal Review			
1	Initial Issue			



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5.	Prevention	2
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Appendices

- Appendix 1: Environmental Management Plan
- Appendix 2: Vehicle, Plant and Equipment Hygiene Certificate
- Appendix 3: Weed Management Form

1. Purpose

This Weed Management Procedure has been developed in accordance with the principles and strategies documented within the MLG Oz Limited (“MLG”) overarching Environmental Management Plan (EMP) provided as [Appendix 1](#). The EMP provides a management framework which directs and guides the development and implementation of all environmental management plans for MLG Operations. This procedure is to be used in accordance with the EMP: Flora and Fauna Management Plan [Appendix 1: Environmental Management Plan](#) and the specific sites Rehabilitation Monitoring Program.

The Project occurs within an area that from current surveys has no introduced or Declared Pest species weeds. However, there is risk that the development and operation of the Project may introduce and enable the incursion of weeds into the area. This Weed Management Procedure was developed to formalise the response to the discovery of any weed infestations through the Rehabilitation Monitoring Program or general observation of onsite personnel.

The objective of this Weed Management Procedure is to:

- Identify weed species requiring control within the Project area.
- Prevent the spread of weeds within and outside the Project site, including (any key environmental significant areas).
- Identify, map, and maintain an inventory of weed infestation locations.
- Implement a weed management program.
- Document and record weed management activities.
- Identify accountabilities for weed management at The Project site.
- Communicate this information to staff, contractors, and other interested parties.

2. Accountabilities

Accountabilities for weed management activities and support at MLG operations, are outlined in [Table 1](#).

Table 1: Weed Management Accountability

Task	Accountability
Coordination of weed management activities as outlined in this document, including being the Company Representative for Contractor Management	Project Manager
Provide resources and support as required to meet the requirements of this document	Compliance Manager

3. Background on Noxious Weeds in WA

Environmental weeds are defined as plants that establish themselves in natural ecosystems (marine, aquatic and terrestrial) and proceed to modify natural processes, usually adversely, resulting in the decline of the communities they invade.

Declared or Noxious Weeds fall into the following categories under the *Agricultural and Related Resources Protection Act 1976 (WA)* (ARRP Act):

- P1- Prevention of trade, sale, or movement of plants into the state.
- P2- Plants to be eradicated from the state.
- P3- Plant numbers and/or distribution to be reduced from the state.
- P4- Plants that should be prevented from spreading from that one area of the State.
- P5- Plants to be controlled on public land or land under the control of a local government.

4. Awareness

- All staff and contractors will attend the MLG Corporate induction. This induction includes an environmental component that contains information relating to weed identification and reporting of weed locations to Site Project Coordinator/Compliance Manager.
- Posters and other educational material relating to weed identification and control will be made available and displayed in the workplace.
- Weed Management will be included as part of environmental training.

5. Prevention

The most effective means of weed control is through the prevention of their introduction to a site or location. This will be primarily achieved through the implementation of the following practices:

- **Weed Hygiene:** All vehicles and mobile equipment shall be inspected and if required cleaned of vegetation, mud and soils prior to entry and exit of site to prevent the introduction and spread of weed seeds in accordance with the Vehicle Plant & Equipment Hygiene Certificate ([Appendix 2](#)).
- **Rehabilitation:** Undertake progressive rehabilitation to limit opportunities for weeds to invade or reinvade after treatment.
- **Minimize site disturbance:** site disturbance (particularly soil disturbance) must be minimized to reduce the opportunities for weeds to establish.

6. Weed Management Procedure

The procedure to develop a Weed Management Plan for the management and control of weeds at MLG operations is outlined in Table 2.

Table 2: Weed Management Procedure

Step/Process	Requirement	Accountability
Define	Define the area of extent for a weed inventory and management program on an annual basis, and in line with any changes to lease holdings.	Project Coordinator
Recording and Mapping	All personnel will record locations of weed infestations if identified during day-to-day duties on site, including site inspections and monitoring. At a minimum, the physical location coordinates and species name needs to be recorded and sent to the Project Coordinator for mapping and recording in the weed data base.	All personnel Project Coordinator Compliance Manager
Consultation	Seek advice on the best method of removal from the Department of Primary Industries and Regional Development, WA, or other appropriate advisors, and direct onsite personnel to carry out the selected removal option.	Compliance Manager
Planning the management Program	The weed management program must be planned and implemented on an annual basis. Implementation may vary depending on rainfall events and specific site conditions.	Project Manager
Pre-Start Meeting	Prior to commencing the program, a pre-start meeting will be held with weed management contractors to prioritise and plan the requirements of the program. Factors and questions outlined in Table 3 will be considered when planning the program.	Project Manager
Treatment Methods	<ul style="list-style-type: none"> Choose a method of treatment for each identified weed species in consultation with the weed management contractor and government departments as required. Weed treatment methods that may be used include, but are not limited to: <ul style="list-style-type: none"> Herbicide/chemical mix application; and Manual techniques such as digging & hand-pulling. 	Weed Coordinator
Implementing the management Program	<ul style="list-style-type: none"> Weed spraying contractors will be engaged each year, if significant weed outbreaks have been identified, to undertake management programs as directed by the respective Project Managers. Works undertaken during the program will be recorded to evaluate the effectiveness of current treatments in subsequent programs using the Weed Management Form (Appendix 3). 	Project Manager

Step/Process	Requirement	Accountability
Monitoring Performance	<ul style="list-style-type: none"> Follow-up mapping will need to take place at a similar time the following year to allow valid comparisons. When revisiting identified weed infestations from previous management programs, the effectiveness of selected management techniques will be assessed and recorded in the weed database. This will allow for improvements to be incorporated into subsequent weed management programs. 	Project Manager Compliance Manager

Factors and questions that will be considered when planning the Weed Management Program is outlined in Table 3.

Table 3: Planning a Weed Management Program

Method/Option	Explanation
Containment	<ul style="list-style-type: none"> Containment of weed species to prevent and control new infestations is likely to be a more realistic management approach if you are dealing with widespread, well-established species. Containment is a worthwhile exercise as it protects areas of good native vegetation, reduces new weed infestations, and reduces the need for future control by limiting the extent and intensity of infestations. Containing core infestations in an area may be an option where removing the plant from the infested area is damaging, impractical or beyond the resources and technology available. It is essential that the expansion of any weed population be contained. The key to a containment program is to focus on treating <i>isolated satellite</i> infestations, rather than core infestations (i.e. working from the outside in). Containment involves concentrating on small outlying populations and individuals while attempting to restrain further expansion of the population.
Control	<ul style="list-style-type: none"> The aim of control is to reduce the impact of a species or a number of species in a particular area. The most common method used for weed control at MLG sites is herbicide application. Weeds are also removed by manual (hand) methods.
Eradication	<ul style="list-style-type: none"> The aim of eradication is to eliminate a species or number of species from an area. It may be possible to eradicate localised populations of weeds early in the invasion process.

Method/Option	Explanation
Start at the top	<ul style="list-style-type: none"> • Many weed seeds and other plant parts move down into and along catchments through seed roll (gravity) and by being carried by water (down slopes and along watercourses). • It may be better to start treatment at the top of the watercourse or catchment so that weeds higher up in the catchment do not keep re-infesting treated areas below.
Other Factors to Consider	<p>Other factors to consider:</p> <ul style="list-style-type: none"> • Which environmental weeds have the highest priority? • How invasive is the weed? • What is the capacity of the weed infestation to spread quickly from the infested area (i.e. creek lines and riverbeds may be given a higher priority)? • What is the likely impact? Will the population infect sensitive areas or national parks? • Tackle weed species one at a time or tackle all the weeds in a small area then tackle another small area? • Accessibility and safety? • Flowering weeds identified during surveys should be given a high priority. • The most effective eradication will occur when weeds are small (i.e. 4-5 leaf stage).

7. References

Department of Primary Industries and Regional Development (DPIRD). (2020). *Western Australian Organism List*. URL: <https://www.agric.wa.gov.au/pests-weeds-diseases/weeds/declared-plants>



APPENDIX 1: ENVIRONMENTAL MANAGEMENT PLAN



ENVIRONMENTAL MANAGEMENT PLAN (EMP)

ENV.GEN.PLN.002

Created: 11/09/2015

Reviewed: 11/09/2015

Next Review: 11/09/2020

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1. DOCUMENT OVERVIEW

Control and Review Details

Document Name	Environmental Management Plan (EMP)
Created	11 / 09 / 2015
Document Number	ENV.GEN.PLN.002.0
VERSION	0
Version Date	11 / 09 / 2015
Review Schedule/Period	5 yearly or when there is change in legislation or Processes
Next Review Date	11 / 09 / 2020
Author	HSE Manager Phone: (08) 9022 7746 safety@mlgoz.com.au

2. BACKGROUND

MLG Oz PTY LTD referred to as MLG Oz is a privately owned family company which was established in 2000 as a small contractor providing silica mining and haulage services for BHP Billiton.

Through mutually constructive relationships with our client base, MLG Oz has gone from strength to strength, growing substantially each year. Current operations consists of minesite services and three (3) established business divisions of Bulk Haulage, Crushing and Screening and Sand and Stone through MLG Oz tenement owned quarries.

MLG Oz Mining Leases for Quarries are located at the following sites;

- Jonah Bore Gravel Pit: Tenement M36/657
- Jonah Bore Sand Pit: Tenement M36/657
- Tarmoola Aggregate: Tenement access agreement with mine owner: M37/90 & M37/201
- Cane Grass Sand: Tenement M24/905
- 8 Mile Rock: Tenement M15/1466

MLG Oz main office is located in Kalgoorlie Western Australia with business operations now located throughout the Goldfields and other locations of Western Australia at [Figure 1](#)

- Christmas Creek Iron Ore Mine;
- BHP Kalgoorlie Nickel Smelter;
- St Barbara King of the Hills Gold Mine;
- Goldfields Agnew Gold Mine; and
- Ramelius Resources Mt Magnet Gold Mine

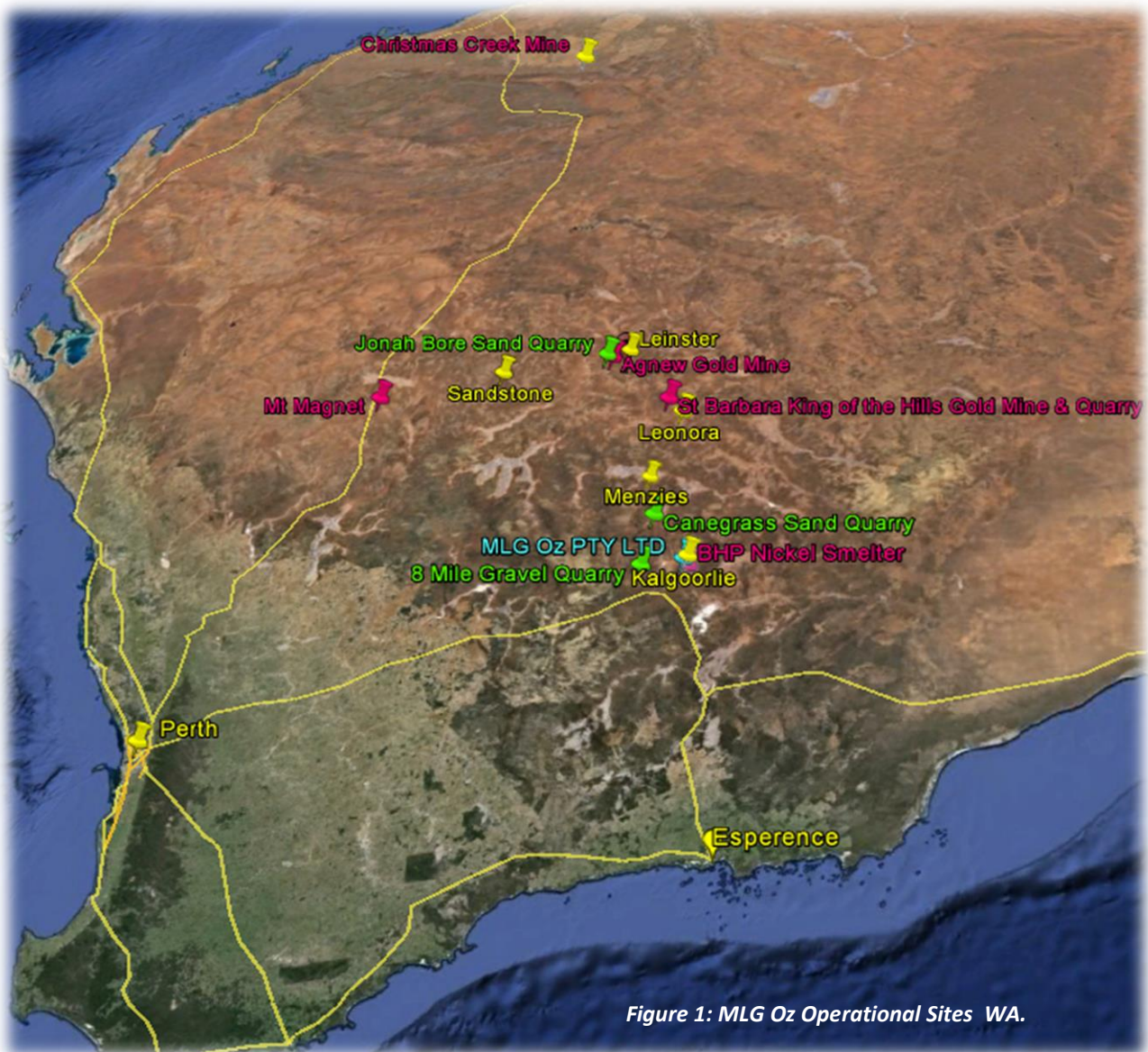


Figure 1: MLG Oz Operational Sites WA.

3. DOCUMENT OVERVIEW

3.1 PURPOSE

This Environmental Management Plan (EMP) describes the methods that MLG Oz will use to fulfil their contractual obligations to their clients in a environmentally safe and effective manner.

This EMP is to assist MLG Oz and its contractors to implement the appropriate management measures required to carry out our business operations. Where there is any conflict between the provisions of this EMP and a contractor's obligation, including various statutory requirements (i.e., licences, permits, consent conditions and relevant laws), the contract and statutory requirements are to take precedence.

3.2 OBJECTIVE

The objectives of the EMP for MLG Oz is to;

1. Provide environmental management and operational guidelines for all MLG Oz site;
2. Provide a documented emergency response procedure (ERP) for applicable sites;
3. Provide relevant and applicable management plans for the sites;
4. Formalise operating procedures to ensure conformance with the Integrated Environmental Management System (IEMS).

The function of the EMP is to:

- assist in the everyday management and operation of the site;
- minimise the potential risk of contaminants being released to the environment; *and*
- Provide a guide in the event of an environmental incident.

3.3 RELATIONSHIP TO LEGISLATION, STANDARDS AND PROCEDURES

This plan is not intended as a environmental manual and so does not contain detailed descriptions of information already contained in applicable legislation, Australian Standards, Codes of Practice and company procedures.

Although there are no detailed descriptions, we have referenced this material in the plan and regard it as our responsibility to obtain and comply with these documents.

3.4 CLIENT POLICIES AND PROCEDURES

We recognise that all Site Managers and Department Supervisors are required to be familiar with all relevant client site/operational policies and procedures. We shall follow these requirements as per the agreed contractual arrangements.

If at any point we consider a clients site/operations occupation health and safety (OHS) practices and/or environmental practices are inadequate or unclear, we will seek professional advice. If we need to make changes as a result of this advice, we will obtain our clients approval before doing so.

3.5 APPLICABLE WORK AREAS

MLG Oz will generally operate and control it's own business operations on a client site in conjunction with the client's operations. In these situations MLG Oz personnel will be under the control of our Site Manager or Department Supervisor and therefore MLG Oz assumes responsibility for the operation ensuring

1. Safe operation and up to date scheduled maintenance of all plant and equipment; and
2. Best Environmental Practice (BEP) control measures and strategies

Outside of this, where MLG Oz personnel are operating a client's plant and equipment, they will be managed by the relevant department manager/supervisor with responsibility for the safe operation of that plant and equipment assumed by the client.

3.6 MINESITE ACCOUNTABILITY

We recognise that our client's Mine Manager or Senior Site Executive will hold our Site Manager/Department Supervisor accountable for the actions of MLG Oz personnel and for providing:

- Work operations to minimise the potential for environmental impacts during operations
- All operations and activities associated with the site are being managed in an environmentally responsible manner
- A framework to confirm compliance with their policies and requirements Safe places of work;
- Safe and well maintained equipment;
- Environmentally Safe work practices;
- Adequate supervision; and,
- Suitable awareness training of our personnel where applicable.

3.7 DOCUMENT CONTROL AND REVIEW

This Environmental Management Plan is reviewed regularly as part of our document control and continuous improvement process and/or where there is a legislative or client change identified or required.

This document and associated documents produced by MLG Oz will be reviewed and reissued for the following reasons:

- as per findings from the annual review process;
- changes to site/deparment operations;
- changes to government policy or legislation;
- review of the strategic direction of the company;
- new initiatives within or across the company; and/or
- need for consistency across all sites and areas of service delivery.

Reference:

- [OPP.GEN.POL.002 Quality Policy](#)
- [ADM.GEN.PRO.001 Document Control Management](#)

4. REFERENCE DOCUMENTS

4.1 LEGISLATION AND STATUTORY DOCUMENTS

4.1.1 COMMONWELATH LEGISLATION

- N/A;

4.1.2 STATE LEGISLATION

- WA Mine Safety and Inspection Act 1994
- WA Mine Safety and Inspection Regulations 1995
- WA Environmental Protection Act 1986
- WA Environmental Protection Regulation 1987
- WA Environmental Protection Authority
- Aboriginal Heritage Act 1972 (AHA),
- Ozone Protection and Synthetic Greenhouse Gas Management Regulations 1995.

4.1.3 AUSTRALIAN STANDARDS AND CODES OF PRACTICE

- AS/NZS 4801 Occupational Health and Safety Management System -Specification with guidance for use;
- AS/NZS ISO 14001:2004 Environmental management system
- AS/NZS ISO 31000 Risk Management - Principles and guidelines

4.2 ASSOCIATED DOCUMENTS

- ENV.GEN.POL.001 Environmental Policy
- ENV.CRU.PRO.003 Mobile Crushing and Screening Environmental Management Procedure
- ENV.CRU.PLN.004.0 Dust Management and Minimisation
- ENV.CRU.PRO.005.0 Stockpile Management
- OHS.GEN.POL.001 - Safety and Health Policy
- OHS.GEN.STD.003.0 Environmental Standards 1: Biodiversity;
- OHS.GEN.STD.003.0 Environmental Standards 2: Emissions;
- OHS.GEN.STD.003.0 Environmental Standards 3: Waste Management
- OHS.GEN.STD.003.0 Environmental Standards 4: Spill Management
- OHS.GEN.STD.003.0 Environmental Standards 5: Amenity

5. ENVIRONMENTAL MANAGEMENT FRAMEWORK

5.1 OVERVIEW

The environmental management framework for MLG Oz will be developed from an Integrated Management System (IMS). The IMS will encompass environmental, health and safety management systems needed for achieving MLG Oz objectives and for delivering a high standard of management for all aspects of the MLG Oz business operations.

The structure of the environmental component of the IMS follows the principles of ISO 14001, and it contains the key elements as follows:

- **Commitment and policy** – the corporate Environmental Policy and Safety and Health Policy defines MLG Oz commitment to conduct business in all operations in an environmentally and socially responsible manner and with full legal compliance ([Section 5.2](#)).
- **Planning** – provides clearly stated objectives consistent with the policy ([Section 5.3](#)).
- **Implementation** – lists practical procedures to fulfil personnel responsibilities for environmental management, which clearly are defined, documented and communicated through inductions and training ([Section 5.4](#)).
- **Checks and corrective action** – regulates by regular inspection and auditing to assess compliance with environmental management objectives and commitments, and upholds a system for dealing with non-compliance, incidents and complaints, data recording and reporting ([Section 5.5](#)).
- **Management review** – requires an annual internal review of the IMS with the aim of continual improvement ([Section 5.6](#)).

Implementation of these IMS elements is outlined in the following sections.

5.2 COMMITMENT TO POLICY

MLG Oz is committed to managing its activities in an environmentally and socially responsible manner, as reflected in MLG Oz's Environmental Policy below. The Environmental Policy is the overarching document within the IMS, against which environmental performance is ultimately measured and reported.

5.2.1 ENVIRONMENT POLICY

MLG Oz acknowledges a responsibility to the environment, and we as a business express our commitment towards implementing practices which will promote environmental sustainability. The following policy governs the management of the environmental aspects of our company with specific focus on our environmental risks and actively reducing our waste.

This policy relates to all operations in our company and as a business we will be continually reviewing and improving our performance, so that we are able to integrate environmental and social considerations into our everyday practices.

The company will consistently encourage participation by employees in environmental matters.

MLG Oz as a company is committed to the following Principles:

- Comply with any laws governing the environment, and actively look for ways to improve on these guidelines.
- Work towards the conservation of energy, water and resources in all our operations.
- Strive to better understand both the direct and indirect impacts that our practices may have on the environment.
- Promote & communicate environmental awareness throughout all operations of the company.

- Dispose of waste thoughtfully, and develop an attitude of "reducing, recycling and reusing."
- Lessen our environmental impact by incorporating environmental considerations into our business decision-making processes & where practical & economically viable purchase environmentally-friendly products.
- Work with our entire supply chain in order to gain mutual benefits of incorporating environmentally sustainable goals into everyday business.
- Committed to actively considering the use of alternative energy sources, and low emissions technology, as they become economically viable

It is the responsibility of all employees and contractors to adhere to and comply with this policy and it's everyone's responsibility to implement within their line of authority.



MURRAY LEAHY
Managing Director
02nd January 2015

Reference:

- [ENV.GEN.POL.001 Environmental Policy](#)
- [OHS.GEN.STD.003.0 Environmental Standard 1: Biodiversity;](#)
- [OHS.GEN.STD.003.0 Environmental Standard 2: Emissions;](#)
- [OHS.GEN.STD.003.0 Environmental Standard 3: Waste Management](#)
- [OHS.GEN.STD.003.0 Environmental Standard 4: Spill Management](#)
- [OHS.GEN.STD.003.0 Environmental Standard 5: Amenity](#)

5.3 PLANNING

5.3.1 LEGAL AND OTHER OBLIGATIONS

MLG Oz recognises that developing an understanding of its own and its contractor's legal and other obligations is the first step towards achieving compliance with the relevant legal requirements.

At operational level, the identification and review of relevant legislation, regulations, policies, industry standards and protocols, and the determination of their implications for environmental management, will continue through out the business operations as part of continuous improvement.

[Section 4.1](#) identifies key legislation applicable to the MLZ Oz environmental compliance to track compliance with legislation, commitments and procedural requirements.

5.3.2 OBJECTIVE AND TARGETS

Objectives and targets where applicable will be set under this IMS document. MLG Oz measurable environmental objectives and targets will be outlined in this document and the environmental management commitments [Section 5.2](#)

5.4 IMPLEMENTATION

5.4.1 MANAGEMENT ACTIONS

The management actions to be implemented to ensure effective environmental management by MLG Oz are set provided in [appendices 3](#)

5.4.2 RESPONSIBILITIES

It is the responsibility of each and every MLG Oz Employee and contractor to practice responsible environmental management by implementing the requirements of this Environmental Management Plan and/or any relevant subordinate systems developed for their area of responsibility. The appropriate Business division and site management team holds the responsibility of implementing, managing and maintaining the requirements of this document. [Appendices 2](#)

Reference:

- [OHS.GEN.PRO.019 Safety Environmental Responsibilities](#)

5.4.3 INDUCTIONS AND AWARENESS TRAINING

MLG Oz will ensure that personnel have the appropriate knowledge and skills to meet the company's Environmental Policy, and the objectives and targets outlined in the IMS.

Environmental awareness will be included in all inductions for employees and contractors to inform them of environmental issues and responsibilities, including:

- Obligations under MLG Oz Environmental Policy, the relevant sections of MLG Oz's IMS;
- All accidents and incidents resulting in any spills or leaks are to be reported immediately;
- All spills to be controlled and cleaned up immediately;
- **NO DUMPING** of any waste or rubbish on any part of the MLG Oz property or client site;
- **NO BURNING** of rubbish on any part of the MLG Oz property or client site;
- Re-fuelling (if applicable) only in the designated hard stand area and/or where mobile fuelling occurs this is to be carried out with appropriate spill control measures
- Be aware and understand the location of emergency spill equipment and emergency response procedures
- All personnel will be required to undertake and pass a knowledge questionnaire based on the induction presentation, and records will be retained of all persons being inducted.
- Regular 'tool box' meetings will identify environmental where applicable when issues that may arise during operations.
- Additional specific environmental training will be provided to personnel involved in:
 - Storing and handling hydrocarbons and using spill kits.
 - Responding to environmental incidents (e.g., fuel spills).
- All personnel upon request will have access to hard copies of the EMP and overarching IMS, which will be located onsite in MYOSH for MLG Oz sites.

Reference:

- [Applicable Site Inductions](#)

5.5 CHECKS AND CORRECTIVE ACTIONS

5.5.1 SUPERVISION AND INSPECTIONS

The Operations Manager (or delegate) will undertake regular supervision and inspections of activities to ensure that environmental management procedures are being implemented satisfactorily. The frequency of inspection will depend on the magnitude of risk associated with the particular hazard. Inspection results will be maintained by the Operations Manager and reported to MLG Oz.

Reference:

- [OHS.GEN.PRO.140 Audits and Planned Inspections](#)

5.5.2 COMPLIANCE AUDITS AND REVIEWS

Audits and reviews will be undertaken by an appropriately qualified person on a regular basis to assess compliance with the environmental management procedures, any client site conditions and commitments documented. Auditing will be conducted to ensure there is operational compliance.

Corrective action will be implemented where required following an audit with any corrective actions being logged in MYOSH System Database for all non-conformances identified during the audit. Subsequent audits will review CAR's to ensure they are adequately addressed.

Reference:

- [OHS.GEN.PRO.140 Audits and Planned Inspections](#)

5.5.3 INCIDENTS / ACCIDENTS

Environmental incidents that occur either as a result of an emergency, accident or equipment malfunction and which cause or threaten serious environmental harm or material environmental harm, will be reported to the Site manager Manager (or delegate) and also to relevant regulatory authorities (as relevant) within 24 hours of the event.

The incident will be registered in an MYOSH System Database, investigated, and where required a written up investigation report.

In addition to statutory reporting requirements, the incident report will detail any deficiencies in the IMS or its elements (e.g., EMP and standard operating procedures). Any such deficiencies will result in the revision of the relevant IMS elements, other documents and appropriate additional training, as required.

The MYOSH System Database will be used for all operational records in relation to occupational health and safety (OH&S) and environmental incidents, near misses and hazards.

Reference:

- [OHS.GEN.PRO.005 Incident Management & Investigation](#)
- [OHS.GEN.PRO.144 Hazard Management](#)
- [section 72 of the Environmental Protection Act 1986](#)
- [verbal reporting 1300 784 782](#)
- http://www.der.wa.gov.au/images/documents/your-environment/pollution/spill-reporting_guide-s72.pdf

5.5.4 RECORDING

MLG Oz will maintain a database In MYOSH System Database for storage and retrieval of environmental data, records and other relevant information, including:

- MLG Oz documents, along with any management review of these documents.
- Regulatory documents (e.g., legislation, government policies, Compliance Register, permits and licences).
- Safe Work Procedures (SWP) and Standard Operating Procedures (SOP).
- Induction and training records.
- Environmental audit schedules and reports (including CARs) (MYOSH).
- Environmental monitoring programs where directed by regulator.
- Incident Register (MYOSH).
- Complaints received and actions taken (i.e., complaints reporting system) (MYOSH).

The above IMS documentation will be:

- Easily located in electronic copy form (MYOSH), including date of issue or revision.
- Available for all MLG Oz employees, contractors and where applicable consultants.
- Periodically reviewed and revised as necessary (and clearly dated) by authorised personnel.
- Updated by removing or replacing obsolete sections from all points of issue as required.

Reference:

- [*ADM.GEN.PRO.002 Records Management*](#)
- [*OHS.GEN.PRO.140 Audits and Planned Inspections*](#)
- [*OHS.GEN.PRO.005 Incident Management & Investigation*](#)
- [*OHS.GEN.PRO.144 Hazard Management*](#)
- [*OPP.GEN.POL.002 Quality Policy*](#)

5.5.5 REPORTING

MLG Oz will employ the following environmental reporting systems:

- Environmental Incident Reports will be entered into MYOSH System Database.
- Report on any non compliances as a result of any physical inspection or audit;
- Reporting requirements that are specific to performance indicators and targets stipulated by the client onsite are provided

5.6 MANAGEMENT REVIEWS

Internal review of the IMS by the HSE Manager will help ensure continual improvement in levels of compliance and consistency across the business. For MLG Oz, this will include:

- A review of performance against any applicable client objectives and targets;
- A summary of inspection, audits, complaints and incidents;
- Actions taken to correct or remedy non-conformances;
- Any revision or update to the IMS or EMP;
- Any revision of MLG Oz's Environmental Policy;
- Any revision as a consequence of a change in occurring to operations either at a MLG Oz or Client site;
- Reviews will be conducted annually; and
- All personnel will be encouraged to participate in the process through the reporting and close-out procedures of incidents, audits and monitoring.

6. MLG OZ BUSINESS OPERATIONS

6.1 BUSINESS DIVISIONS

6.1.1 BULK TRANSPORT

Leahy Haulage is the bulk transport division of MLG Oz. With our fleet of modern Kenworth prime movers, Leahy Haulage is the bulk transport division of MLG Oz. With both side-tipping and end-tipping trailers and their various configuration options, we have the flexibility to tailor our trucks to best suit the needs of each individual job.

Providing a wide range of services including on-road and off-road mine site ore haulage, construction material haulage, road maintenance services and any run-of-mine ore handling requirements, Leahy Haulage strives to provide timely and cost-effective service to all our customers.



6.1.2 CRUSHING AND SCREENING

The Crushing & Screening division of MLG Oz provides our client base with mobile crushing services that include run-of-mine (ROM) ore crushing, concrete aggregate production, road base production and general screening.

With our growing fleet of track mounted crushing equipment, we are able to provide our customers with cost effective crushing and screening solutions on short-lead times, allowing MLG Oz to ensure our customers are provided with timely solutions to any of their crushing requirements.



6.1.3 SAND AND STONE

As one of the preferred bulk suppliers of sand and aggregate in the Goldfields and Mid-West, the Sand & Stone division of MLG Oz provides the highest quality product to our client base in a timely and cost effective manner.

With our various quarry operations strategically located throughout the region, we offer a wide range of bulk materials, including:

- Granite Concrete Aggregate (Australian Standard)
- Granite Sealing Aggregate (Australian Standard)
- Concrete Sand (Course and Fine)
- MRWA Specification Gravel and Road Base
- Filling Sand

7. DESCRIPTION OF ENVIRONMENTS (BRIEF)

7.1 KALGOORLIE

Kalgoorlie, now known as Kalgoorlie–Boulder after Kalgoorlie and Boulder joined, is a city in the Goldfields-Esperance region of Western Australia, Australia, and is located 595 kilometres (370 mi) east-northeast of Perth at the end of the Great Eastern Highway. The town was founded in 1893 during the Yilgarn-Goldfields gold rush, and is located close to the so-called "Golden Mile". Elevation above sea level is 468 m 1,535 ft.

Approximate population is 31,107, making it the largest urban centre in the Goldfields-Esperance region and the fifth-largest in Western Australia.

The name Kalgoorlie is derived from the Wangai word *Karlkurla*, meaning "place of the silky pears".



7.1.1 TOPOGRAPHY AND DRAINAGE

Kalgoorlie is in the Eastern goldfields of Western Australia and is a semi-desert, with only 300 mm annual rainfall and 2500 mm annual evaporation. The rocks consist mainly of granite with linear greenstone belts of metamorphosed basaltic and sedimentary rocks of Archaean age ranging from 2.8-2.5 billion years old.

The area is relatively flat and the wide valleys are mostly blocked by sand dunes and occupied by internally draining salt lakes, which are dry for most of the year. Water only flows between some of the lakes after cyclonic rains, and this only happens at intervals of several decades. Given the low rainfall, poorly permeable rocks, and salt lakes, it is not surprising that there is very little groundwater, and most of this is highly saline.

7.1.2 SITE GEOGRAPHICAL LOCATION MAPS

Kalgoorlie - Boulder, Western Australia, Australia, its located on the following geographical coordinates being 30° 45' 0" South, 121° 28' 0" East

Reference:

- [appendices 8](#)

7.1.3 WEATHER AND CLIMATE

AVERAGE YEARLY RAINFALLS.

Kalgoorlie has a semi-arid climate with hot summers and mild winters. The average annual rainfall is 264.8 mm on an average of 68 days and, while the average rainfall is fairly evenly distributed throughout the year, there is considerable variation from year to year.

AVERAGE YEARLY TEMPERATURES.

The relative humidity typically ranges from 18% (dry) to 88% (very humid) over the course of the year, rarely dropping below 8% (very dry) and reaching as high as 100% (very humid).

Over the course of a year, the temperature typically varies from 6°C to 33°C and is rarely below 2°C or above 39°C

January is the hottest month with an average maximum temperature of 33.6 °C, but temperatures above 40.0 °C occur nearly once a week when hot, dry, north to northeasterly winds arrive. Such high temperatures are usually followed by a cool change from the south and occasionally with a thunderstorm.

The median cloud cover ranges from 42% (partly cloudy) to 68% (partly cloudy). The sky is cloudiest on June 20 and clearest on December 2. The clearer part of the year begins around September 18. The cloudier part of the year begins around March 5.

By contrast winters are cool with July average maximum and minimum temperatures being 16.5 °C and 4.8 °C respectively. Cold wet days with a maximum below 12.0 °C occur about once every winter. Overnight temperatures fall below freezing about 4 times in a typical winter. Such events occur on clear nights following a day of cold southerly winds.

7.1.4 FLORA AND FAUNA

FLORA.

The Goldfields region boasts 12 existing and proposed nature reserves, with a combined area of 8 million hectares.

The tranquil forests comprising more than a hundred species of eucalyptus including marble-coloured salmon gums, bronze-barked gimlets, and a variety of blackbutts provide a unique and fascinating vista contrasting against the rich, red earth and the blue skies. Nowhere else are there so many different tall trees in such an arid environment.

In contrast, low lying acacia woodlands, river gums, mallees, grasses and spinifex dominate the regions north and Nullarbor Plain breakaway country. Good winter rains see the forests and shrubs burst into colour in spring when you can enjoy striking arrays of native flowers, bright orange grevillea, Sturts desert pea, purple mulla mulla, yellow cassia, flowering eucalypts and mallees and breathtaking displays of wildflowers including pink, yellow and white everlastings, and dainty paper daisies.

The region is also one of few in Western Australia where you can find the distinctive aromatic sandalwood tree. Kalgoorlie are covered with eucalypt woodland, but vegetation becomes sparser to the north. The Goldfields Wildflower Season runs from July to October (the middle of Winter through to the middle of Spring).

FAUNA.

There is an incredibly high number of bird species flourish here, as well as the threatened Bilby (or Rabbit-eared Bandicoot), Cuditch, Mallee Fowl, Scarlet Chested Parrot, Sandhill Dunnart and Mulgara. The inhabitants of the area include ornate lizards, Emu, Echidna, Carpet Pythons, Honey-eaters, Yellow Throated Miners, Rainbow Bee-eaters and wild Budgerigars.

7.2 8 MILE ROCK QUARRY

TENEMENT M15/1466:

Eight (8) Mile Rock Quarry is located 43.6 km East as the crow flies of Kalgoorlie. The climatic conditions and environment is the same as for Kalgoorlie – Boulder area. Elevation above sea level is 468 m 1,535 ft.

7.2.1 SITE GEOGRAPHICAL LOCATION MAPS

8 Mile Rock Quarry, Western Australia, Australia, its located on the following geographical coordinates being 30°48'96.26"S 120°58'37.65"E

Reference:

- [appendices 4](#)

7.2.2 WEATHER AND CLIMATE

Due to the close proximity to Kalgoorlie the conditions are similar and without significant changes warranting further description

Reference:

- [appendices 4](#)

7.3 CANE GRASS SAND QUARRY

TENEMENT M24/905:

Cane Grass Sand Quarry is located 81.7 km North by road of Kalgoorlie on the Goldfields Highway. The climatic conditions and environment is the same as for Kalgoorlie – Boulder. Elevation above sea level is 468 m 1,535 ft.

7.3.1 SITE GEOGRAPHICAL LOCATION MAPS

Cane Grass Sand Quarry, Western Australia, Australia, its located on the following geographical coordinates being 30°12'16.62"S 121°06'05.44"E

7.3.2 WEATHER AND CLIMATE

Due to the close proximity to Kalgoorlie the conditions are similar and without significant changes warranting further description

Reference:

- [appendices 5](#)

7.4 TARMOOLA AGGRIGATE QUARRY

TENEMENT M37/90 & M37/201:

Tarmoola Aggrigate Quarry is located 29.5 km by road on the Goldfields Highway North West of Leonora, and 268.5 km North by road of Kalgoorlie on the Goldfields Highway Western Australia. Elevation above sea level is 376 m 1,234 ft.

The nearest township is Leonora a town in the Goldfields-Esperance region of Western Australia, located 237 kilometres north of the city of Kalgoorlie.

Approximate population is 779, of which 24% are of Aboriginal descent.

Leonora is primarily a mining town. There are a number of major gold mines in the Shire, as well as the Murrin Murin laterite nickel project. The area supports a significant pastoral industry.

The first European explorer was John Forrest, who visited the area in 1869. On 21 June 1869 Forrest's party made camp near a conspicuous hill, which Forrest named Mount Leonora, after his six-year-old niece Fanny Leonora Hardey. In 1894, gold was discovered in the area by a prospector named



Morrisey, and in the following two years a number of rich finds resulted in rapid development of the area. The Sons of Gwalia gold mine brought Leonora to the attention of the world. By 1897 a residential and business area had been established, and the town was gazetted as Leonora in 1898.

7.4.1 SITE GEOGRAPHICAL LOCATION MAPS

Tarmoola Aggregate Quarry, Western Australia, is located on the following geographical coordinates being 28°40'05.57"S 121°09'32.12"E

Reference:

- [appendices 7](#)

7.4.2 WEATHER AND CLIMATE

AVERAGE YEARLY RAINFALLS.

The area has a semi-arid climate and rainfall is scarce with the average being around 250mm per year.

The area has a semi-arid climate, with a mean annual rainfall of 233 millimetres (9 in).

AVERAGE YEARLY TEMPERATURES.

Mean daily maximum temperatures range from 18 °C (64 °F) for July to 37 °C (99 °F) for January.

Leonora experiences day time temperatures of around 15° celsius in winter to 38° in summer.

7.4.3 FLORA AND FAUNA

FLORA.

An abundance of wildflowers can be witnessed in the months July to September.

FAUNA.

The surrounding country side is the home to an abundance of wildlife with kangaroos and emus being the most prolific. Wedge tailed eagles are also in large numbers throughout the area. All can be seen in the wild any time of the year. There is an abundance amount of wild goats in the area

7.5 JONAH BORE SAND AND GRAVEL QUARRY

TENEMENT M36/657:

Jonah Bore Sand and Gravel Quarry is located 23.8 km by road on the Agnew Sandstone Road West of Lenister, and 387.8 km North by road of Kalgoorlie on the Goldfields Highway Western Australia.

The nearest township is Lenister is a town in the northern goldfields area of Western Australia. It is 4 km east of the Goldfields Highway, in the Shire of Leonora local government area, 968 kilometres (601 mi) northeast of the state capital, Perth. Approximate population at Lenister is 732.

The town was established in 1976 by Agnew Mining as a dormitory town for workers at its nickel mine and was named for the nearby Lenister Downs station. Facilities at Lenister include a supermarket, post office, service station, primary school and tavern. Sporting facilities include an indoor sports centre and 18 hole golf course.

Apart from the nickel operations, gold was also mined 41 km south-east



of Leinster. Elevation above sea level is 497 m (1,631 ft)

7.5.1 SITE GEOGRAPHICAL LOCATION MAPS

Jonah Bore Quarry is located on the following geographical coordinates being 27°56'57.44"S 120°26'41.62"E

Reference:

- [appendices 6](#)

7.5.2 WEATHER AND CLIMATE

AVERAGE YEARLY RAINFALLS.

Leinster and surrounding areas experiences far below average wind speed, rainfall and humidity levels. Indeed, with only 292.5 mm of rain annually, Leinster is a town in the desert.

AVERAGE YEARLY TEMPERATURES.

Summer in Leinster and surrounding areas is between December and February and maximum daily temperatures average between 34.8 and 36°C with overnight minimums averaging between 19.7 and 21.5°C. Summer days are sweltering, averaging around 36 °C in the hottest months.

Winter is between June and August and maximum daily temperatures average between 17.6 and 19.7°C with overnight minimums averaging between 4.3 and 5.8°C.

7.5.3 FLORA AND FAUNA

FLORA.

An abundance of wildflowers can be witnessed in the months July to September.

FAUNA.

Often referred to as 'the home of the wedge-tailed eagle', the countryside around Leinster is also inhabited by kangaroos and emus and dotted with many interesting rock formations to the east. The surrounding countryside is the home to an abundance of wildlife with kangaroos and emus being the most prolific. Wedge tailed eagles are also in large numbers throughout the area. All can be seen in the wild any time of the year.

8. ENVIRONMENTAL MANAGEMENT PLANS

8.1 OVERVIEW

MLG Oz will adopt a series of management plans to cover key aspects of the company's business operations.

Those that have been developed as part of the Environmental Management Plan (EMP) (and are therefore part of the Integrated Management System (IMS)) are the following:

- Water Management Plan (SWMP);
- Waste Management Plan (WMP) for the site;
- Noise Management Plan;
- Greenhouse Gas Emissions Management Plan
- Pollution Control Management Plan
- Flora and Fauna Management Plan
- Storm and Surface Water Management Plan

- Spill Management Plan
- Hazardous Materials and Substances Management Plan; and
- Fires and Burn-Off

Where required, either through an internal environmental review process or regulatory requirements, additional management plans will be developed and incorporated into this EMP.

8.2 WATER MANAGEMENT PLAN

Saving water is the responsibility of all employees and contractors at the workplace and should use the water efficiently and effectively.

MLG Oz where possible and practicable will adopting water-efficient practices that not only helps to conserve a vital natural resource, but will also benefit your business.

Through carefully managing your water MLG Oz can:

- cut costs
- develop an eco-friendly image
- attract environmentally conscious customers
- access government support programs.

The following monitoring requirements and initiatives explains how as a business we can manage our water use.

8.2.1 TAPS

- When replacing old tapware install water-efficient taps with an aerator or flow restrictor to use less water.
- When replacing old tapware install lever or mixer taps, these save water by quickly reaching a desired temperature.
- Ongoing maintenance to fix leaking taps and replace washers - even a slowly dripping tap can waste 10,000 litres of water over a year.
- Avoid washing up in amenities under running taps.

8.2.2 TOILETS

- When replacing old cisterns replace single-flush toilets with dual-flush toilets.
- Regularly check for leaks and fix immediately.
- Installed water-efficient urinals with smart controls to reduce unnecessary flushing.

8.2.3 SHOWERS

- When replacing old shower heads install water-efficient shower heads, which can use up to 40% less water.
- Fix leaking showers.

8.3 WASTE MANAGEMENT PLAN

Waste will be managed in accordance with either of the the following;

- Client Sites the Client Waste Management Plans will be adopted;
- MLG Oz owned sites MLG Oz Waste Management Plans will be followed

All waste generated during construction, operation or closure of mobile crushing and screening facilities MCSFs is to be disposed of at a licensed landfill.

Chemical and hydrocarbon contaminated materials generated during construction/installation, operation or closure of the any of our services for clients will be disposed of in accordance with the clients Policy and Procedures and where required the Environmental Protection (Controlled Waste) Regulations 2004.

Reference:

- [Environmental Protection \(Controlled Waste\) Regulations 2004.](#)
- [Applicable Client Environmental Management Procedures](#)
- [ENV.CRU.PRO.003 Mobile Crushing and Screening Environmental Management Procedure](#)

The following management practices will be implemented as a minimum:

- Littering is to be avoided at all times, use bins;
- Work and office sites are to be kept clean and tidy;
- All solid and non-hazardous wastes are to be deposited in an appropriate land fill;
- Plastic, perishables and general rubbish is to be removed from sites and appropriately disposed of;
- Recyclables such as left over materials are to be recycled if possible utilizing the Client's system if one is in existence;
- Other left over materials are to be sold as scrap to a scrap merchant where possible;
- Rubbish containers are to be carried in all vehicles and provided at all work sites;
- Waste bins are to be covered with lids to keep out animals; and
- Pollution of water courses, ground water and soils by substances such as fuel, chemicals, rubbish or detergents is to be avoided.

8.3.1 WASTE STREAMS

The following are the waste streams that will be used to segregate all generated waste onsite;

- Hydrocarbons and Hazardous Substances (including batteries) (*Controlled and Trackable Waste*)
- Metals (ferrous and non ferrous metals)
- Mixed Plastic and glass recycling (films, bottles, containers etc) (where possible)
- Mixed Paper and cardboard recycling (boxes, packaging, office waste etc) (where possible)
- Timber waste i.e. timber pallets
- Rubber i.e. tyres conveyor belts etc
- Non Recyclable rubbish (food, general, etc)

Disposal of dangerous or hazardous waste shall be in accordance with the Clients Mine Environmental policy and shall be under the direction of the Environmental Superintendent.

Reference:

- [ENV.GEN.POL.001 Environmental Policy](#)
- [OHS.GEN.STD.003.0 Environmental Standard 2: Emissions](#)
- [OHS.GEN.STD.003.0 Environmental Standard 3: Waste Management](#)

8.3.2 CONTROLLED WASTE GUIDELINES**MineSites:**

Disposal of dangerous or hazardous waste shall be in accordance with the Clients Mine Environmental Policy and Procedures and shall be under the direction of the Environmental Superintendent or other authorised person.

MLG Oz Sites:

A controlled waste is defined in this document and the latest list of controlled waste is available from the Government of Western Australia Department of Environment Regulation. Controlled Waste category list arranges the controlled wastes listed in Schedule 1 of the Environmental Protection (Controlled Waste) Regulations 2004 into 15 broad waste groups.

Reference:

- <http://www.der.wa.gov.au/images/documents/our-work/controlled-waste/cw-category-list-15April15.pdf>
- [Environmental Protection \(Controlled Waste\) Regulations 2004 Schedule 1](#)
- [OHS.GEN.PRO.109 Dangerous Goods & Hazardous Substances Procedure](#)

8.3.3 TRANSPORT OF CONTROLLED WASTE MLG OZ SITES

The Government of Western Australia Department of Environment regulates the transportation of controlled wastes. The Regulations provide for the licensing of carriers, drivers, and vehicles involved in the transportation of controlled waste on roads in Western Australia (WA).

Before any controlled waste is removed off-site the manager responsible for the waste must verify the following;

- Company must be a registered controlled waste carrier
- Driver must be a registered and licenced as a controlled waste carrier driver
- Vehicle and container must be registered; and
- Taken to a registered waste facility

8.3.4 CONTROLLED WASTE REMOVAL TRACKING RECORDS MLG OZ SITES

A regulated waste and controlled substance register containing a list and quantity of all regulated waste produced on site or transported off site is required to be kept. Under the Environmental Protection (Controlled Waste) Regulations 2004 (the Regulations) all loads of bulk controlled waste, and all loads of packaged controlled waste equal to or greater than 200 kilograms or litres, are to be accompanied by a controlled waste tracking form (CWTF) from the point of generation to unloading at an approved waste facility.

The tracking of controlled waste:

- ensures the safe transport of waste to an approved location;
- minimises the risk of unauthorised discharge into the environment;

- collects information regarding controlled waste to assist in identifying priority waste management issues in Western Australia; and
- Provides an even and competitive system for companies in the waste management industry.

Controlled waste transported on roads is tracked through the completion of CWTFs by waste holders, carriers and waste facilities. CWTFs are issued by the Department to licensed carriers either electronically via the Controlled Waste Tracking System (CWTS) or in a booklet of paper forms.

Both the licensed carrier who transports a controlled waste and the waste facility receiving that controlled waste are required to send a copy of the CWTF to the Department.

Packaged waste may include waste transported in drums, skip bins, intermediate bulk containers (IBCs) or solid wastes such as tyres, oil and fuel filters and contaminated soils.

Reference:

- [Environmental Protection \(Controlled Waste\) Regulations 2004](#)
- [OHS.GEN.PRO.109 Dangerous Goods & Hazardous Substances Procedure](#)

8.3.5 INFORMATION RECORDED ON CONTROLLED WASTE TRACKING FORM (CWTF)

Information that must be recorded on a CWTF by the carrier is detailed in Schedule 2, Division 3 of the Regulations, and is listed below:

- waste holder's name or identification
- number;
- waste holder's address;
- name and address of waste facility;
- type of controlled waste;
- date loaded onto or into the vehicle or
- tank;
- amount of controlled waste;

Reference:

- [Environmental Protection \(Controlled Waste\) Regulations 2004; Schedule2; Division](#)
- [OHS.GEN.PRO.109 Dangerous Goods & Hazardous Substances Procedure](#)

8.3.6 INFORMATION RECORDED ON CONTROLLED WASTE TRACKING REGISTER FOR REMOVAL OF CONTROLLED WASTE

Information that must be recorded on the register in the workplace are as follows:

- Waste Location
- Waste holder's address;
- CWTF docket number;
- Name and address of waste facility;
- Description and Type of controlled waste;
- Quantity of waste in kilograms and/or litres

- Date loaded onto or into the vehicle or tank;

Reference:

- [OHS.GEN.PRO.109.F1 Waste Tracking Records Form](#)
- [OHS.GEN.PRO.109 Dangerous Goods & Hazardous Substances Procedure](#)
- [ENV.GEN.POL.001 Environmental Policy](#)
- [OHS.GEN.PRO.109 Dangerous Goods & Hazardous Substances Procedure](#)
- [OHS.GEN.STD.003.0 Environmental Standard 3: Waste Management](#)

8.3.7 STORAGE OF TYRES MLG OZ SITES

The maximum allowable tyre storage requirements on MLG Oz sites are;

- 500 used tyres at a tyre fitting business
- 100 used tyres at any other place.

Do not store used tyres on licensed premises other than in accordance with the specific licence conditions.

8.4 NOISE MANAGEMENT PLAN

8.4.1 NOISE EMISSIONS

MLG Oz Head Office and Workshops

MLG Oz operates in an industrial gazetted estate. Operational hours vary due to business operations as follows:

- Prime Movers and trailers entering and leaving the site 7 days a week normally from around 0400 hours to 2000 hours but on occasions this maybe outside these hours conclusively
- Workshop and offices operate between the hours of 0600 hours to 1800 hours 6 days a week but on occasions work maybe performed on Sunday and outside these hours conclusively

Minesite, Crushing and Screening Operations

Noise minimisation and emissions in and around all operations and stockpile areas will vary upon the project (contracted works) and the client and the mobile crushing and screening facilities (MCSFs) and associated mobile plant. For this reason, should the client have a procedure for noise emissions management in and around the operational areas and ROM/Stockpile then that procedure shall take precedence.

The construction/installation and operation of the mobile crushing and screening facilities MCSFs may result in noise emissions. Noise emissions during operation are managed in accordance with the Environmental Protection (Noise) Regulations 1997.

Noise emissions will be mitigated by implementing the following management measures:

- Ensure that operation of the mobile crushing and screening facilities MCSFs is managed in accordance with any client Operations Noise and Vibration management plans;
- Minimise noise with the use of protective shields around the motors, and rubber lines and protective barriers, as required.
- Inspection and maintenance of exhaust and silencing systems on machinery, equipment and vehicles will be conducted and the use of low noise equipment, where practicable.
- Maintenance schedules established in PRONTO Maintenance Management System

8.4.2 VEHICLE MAINTENANCE

Maintenance is carried out in accordance with manufacturer's recommended servicing schedules. MLG Oz record and manage all maintenance through the PRONTO Maintenance Management System. MLG Oz through our maintenance management system will ensure that all vehicles, and associated plant, and equipment are regularly serviced and checked to ensure they are safe at all times. Silencers are a typical part of the maintenance regime and the maintenance regime and system also meets the requirements of the Western Australia Heavy Vehicle Accreditation (WAHVA).

This Maintenance Management System provides the requirements to;

- Ensure vehicles are maintained and meet all relevant safety standards;
- Have available a record of the maintenance and servicing work done to each vehicle is maintained to prove the vehicles are safe at all times;
- Ensure all accredited vehicles comply with the Road Transport (Vehicle Registration) Regulations 1999 and the relevant Australian Design Rules (ADRs);
- Prove MLG Oz Maintenance Management works and our vehicles are well maintained.
- The Maintenance Management System must comply with the following standards;
 - Road Transport (Vehicle Registration) Regulations 1999;
 - Relevant Australian Design Rules (ADRs); and
 - Main Roads Western Australia Heavy Vehicle Accreditation;

Reference:

- [*OPP.GEN.PRO.003 MLG Oz Maintenance Management System*](#)

8.5 GREENHOUSE GAS EMISSIONS MANAGEMENT PLAN

Many chemical compounds found in the Earth's atmosphere act as "greenhouse gases." These gases allow sunlight to enter the atmosphere freely. When sunlight strikes the Earth's surface, some of it is reflected back towards space as infrared radiation (heat). Greenhouse gases absorb this infrared radiation and trap the heat in the atmosphere.

Many gases exhibit these "greenhouse" properties. Some of them occur in nature (water vapour, carbon dioxide, methane, and nitrous oxide), while others are exclusively human-made (aerosols, vehicle emissions,). Site Managers are responsible for minimising energy and fuel consumption for all areas under their responsibility and work with the MLG Oz implementing new policies and environmental initiatives

This Greenhouse Gas Management Plan outlines the process for the minimisation of energy and fuel consumption thus reducing greenhouse gas emissions and providing cost savings for MLG Oz

8.5.1 OPERATIONAL REQUIREMENTS

- Purchase only energy efficient new office equipment;
- Implement energy minimisation measures – (enable Energy Star if installed, encourage employees to turn off unused lights and equipment);
- Maintenance regime and inspections current on all vehicles, plant and equipment

8.5.2 VEHICLE EMISSIONS STRATEGIES

- Plant and equipment will be maintained in accordance with the manufacturer's instructions and MLG Oz standards as per the *MLG Oz Inspection and Testing schedule PRONTO*;
- Ensure appropriate air emission minimisation measures that are included in contracts are implemented;
- Provide a means of detecting vehicles that have deteriorated to a point where excessive emissions can be visually observed;
- Where practical, vehicles will be fitted with catalytic exhaust silencers to reduce emission levels of air pollutants;
- Any vehicles emitting excessive smoke are to be repaired and contractors of MLG Oz are required to regularly tune and maintain their vehicle to reduce smoke; and
- Review the use of ozone depleting substances.

8.5.3 PARTICULATE MATTER (DUST) POLLUTANTS

MLG Oz Head Office and Workshops

- Site management shall conduct dust monitoring through site visual inspections to assess potential nuisance dust generated from site activities or unsealed areas;
- All open areas, that have dust generating potential, will be paved or grasses and/or vegetated.
- Regular maintenance/clearing of paved areas will occur to prevent potholes or build-up of particulate matter on surfaces;
- Records will be kept of all complaints received regarding dust and any causes of noticeable potential nuisance dust from the site. Documentation shall include complaint and rectification measures taken. A copy of all records shall be available for inspection by regulatory authorities as required;
- Ensure work places containing fuels, paints and solvents, building and cleaning products are well ventilated;

Minesite, Crushing and Screening Operations

Dust minimisation and emissions in and around all operations and stockpile areas will vary upon weather conditions and dependent upon the project (contracted works) and the client. For this reason, should the client have a procedure for dust emissions management in and around the operational areas and ROM/Stockpile then that procedure shall take precedence.

The construction/installation and operation of the mobile crushing and screening facilities (MCSFs) and associated mobile plant may result in dust emissions. Dust emissions will be mitigated by implementing the following management measures:

- Ensure that operation of the mobile crushing and screening facilities MCSFs is managed in accordance with any client Dust Management Plans.
- Minimise dust emissions from crushed product stockpiles and feed stockpiles using water sprays and/or water trucks.
- Fit screens, transfer points and crushing units with dust suppression controls as required.
- Ensure that dust emissions meet appropriate criteria of the client and regulatory authorities and do not cause environmental problems; and
- Enforce speed limits in MCSF work areas to reduce dust generation.

Reference:

- [ENV.CRU.PLN.004.0 Dust Management and Minimisation](#)
- [ENV.CRU.PRO.005.0 Stockpile Management](#)

8.5.3 OZONE PROTECTION FROM RELEASES

Fluorocarbon refrigerant contained in airconditioners and refrigerators can be extremely harmful to the environment. For example, 1kg of refrigerant emissions (R410a) has the same greenhouse impact as two tonnes of carbon dioxide, which is the equivalent of running your car for six months. That's why Australia has specific laws, to help protect the environment and minimise any further damage to the atmosphere.

National regulations are in place which affect people who acquire, possess, dispose of or handle ozone depleting substances (ODSs) or synthetic greenhouse gases (SGGs) in the refrigeration and airconditioning (RAC) industry.

Refrigerant Trading Authorisation

A Refrigerant Trading Authorisation must be held by any individual or business acquiring, possessing or disposing of fluorocarbon refrigerant.

Maintenance Employees

A Refrigerant Handling Licence is held by MLG Oz maintenance employees who carry out any work in relation to RAC equipment. Carrying out work in relation to RAC equipment means to do anything with a fluorocarbon refrigerant, or a component of RAC equipment, that carries the risk of refrigerant being emitted, including: decanting the refrigerant or manufacturing, installing, commissioning, servicing or maintaining RAC equipment or decommissioning RAC equipment.

MLG Oz mechanical employees hold the Refrigerant Handling Licence and have the training and skills to minimise the emission of these refrigerants to the atmosphere.

Recycled refrigerant gases are returned to the supplier.

8.6 POLLUTION CONTROL MANAGEMENT PLAN

Pollution control standards and procedures must be followed intensely. MLG Oz will cooperate with the clients hygiene programs when requested. The environment in which we operate relies on all employees to ensure that any impact they have in regards to contamination is zero to minimal.

The following requirements shall apply:

- MLG Oz shall comply with the legislative requirements and/or client Environmental Management Plan;
- Pollutants (e.g. smoke, gas, fumes, dust, sludge, waste oils, sewerage, oils, and grease) shall not be released into the atmosphere or onto the ground unless a licence is held under the Environmental Protection Act 1986;
- Such emission of pollutants shall be reported to the client representative immediately or to the regulator where applicable;
- Small spills in workshops, on roads etc. shall be cleaned up immediately [section 8.9](#);
- Under no circumstances shall pollutants be discharged or dumped into septic or drainage systems;
- MLG Oz shall ensure that the following types of waste are not held on site for periods exceeding 50 days [section 8.3.1](#):

- All waste (chemical, batteries, hydrocarbon and effluent) removal from site shall be undertaken by licensed waste disposal organisations [section 8.3](#);
- Rubber compound products;
- Tyres;
- Rubber mats and conveyors;
- Conveyor belting;
- Vinyls;
- Hydro carbon waste [section 8.11.1](#):
 - Oils;
 - Greases; and/or
 - Contaminated rags/ material.

Reference:

- [OHS.GEN.STD.003.0 Health Standard 5: Emergency Preparedness & Response](#)
- [ENV.GEN.POL.001 Environmental Policy](#)
- [OHS.GEN.STD.003.0 Environmental Standard 1: Biodiversity](#)
- [OHS.GEN.STD.003.0 Environmental Standard 2: Emissions](#)
- [OHS.GEN.STD.003.0 Environmental Standard 3: Waste Management](#)
- [OHS.GEN.STD.003.0 Environmental Standard 4: Spill Management](#)
- [OHS.GEN.STD.003.0 Environmental Standard 5: Amenity](#)

8.6.1 MANAGEMENT OF SURFACE WATER CLIENT SITES

The MLG Oz mine site services and mobile crushing and screening facilities MCSFs will be constructed and operated in accordance with client Surface and Stormwater Water Management Procedures where requested or stipulated in contractual arrangements.

Surface and storm water management measures relevant to mobile crushing and screening facilities MCSFs include:

- Position mobile crushing and screening facilities away from major watercourses.
- Use windrows to direct stormwater away from mobile crushing and screening facilities MCSF work areas.
- Grade the site as required to ensure that any stormwater, wash-down and spillage water runoff from mobile crushing and screening facilities MCSF work areas is contained and directed to a collection and settling sump from where it can be appropriately treated prior to reuse or disposal.
- Install additional drainage management structures around stockpiles, if required, to prevent clean stormwater from mixing with sediment within MCSF work areas.

8.6.1 KALGOORLIE WORKSHOP WASHDOWN AREA

All vehicles shall be washed on hard stand areas. Hydrocarbons that may be washed from vehicles and/or spilt in the workshop area shall be collected and processed through the Underground 3 stage Oil Trap Sump.

When cleaning out is carried out of the sump and collected hydrocarbons this waste will be treated as a controlled waste

Reference:

- [Section 8.3](#)
- [OHS.GEN.PRO.109 Dangerous Goods & Hazardous Substances Procedure](#)

8.7 FLORA AND FAUNA MANAGEMENT PLAN

8.7.1 MLG OZ SITES

Most wild animals are harmless but, occasionally, a few species can cause problems. MLG Oz acknowledges that animals are only following their instincts and taking advantage of the opportunities available to them, just as we all do. Therefore MLG Oz will to the best of their ability preserve and protect all wildlife at our sites. Native animals are also legally protected.

MLG Oz will utilise existing roadways to prevent any further loss or damage to flora and fauna than required under agreements and licences. MLG Oz will maintain all operations within the tenement and open cut mining operations.

8.7.2 BURNING OFF AND FIRES

There will be no burning off at any MLG Oz site at all and is prohibited. There will also be no burning off of any rubbish [section 8.12](#).

8.7.3 WILDLIFE HELP LINE

Should an incident arise MLG Oz will contact the Wildcare Helpline which provides a service for the public who find sick, injured or orphaned native wildlife and are seeking advice on where to find care for the animal.

Wildcare Helpline is a 24 hour-a-day, seven-day-a-week telephone referral service.

8.7.4 GROUND DISTURBANCE

All ground disturbance will be confined to the below MLG Oz quarry tenement sites being;

- 8 Mile Rock Quarry Tenement M15/1466 ([Appendices 4](#))
- Cane Grass Sand Quarry Tenement M24/905 ([Appendices 5](#))
- Jonah Bore Quarry Tenement M36/657 ([Appendices 6](#))
- Tarmoola Quarry Tenement M37/90 & M37/201 ([Appendices 7](#))

MLG Oz will comply with all the requirements of the approved tenements [section 9](#)

8.7.5 CONTROL AND SPREAD OF WEEDS AND OTHER PESTS

During all phases of mobilisation and demobilisation and operations MLG Oz will ensure all vehicles, plant and equipment, including trailered equipment, are clean, inspected and where required certified and approved by the client prior to entry into Client's Operations Area in accordance with all client mobilised plant, equipment and vehicle Hygiene Procedures

During construction stages and plant set up, whether activities are undertaken by an external service provider or internal client personnel, the MLG Oz site manager will be accountable for ensuring the requirements of weed and pest spread and control are met.

Reference:

- *Applicable Client Environmental Management Procedures*
- *ENV.GEN.PLN.002: Environmental Management Plan*
- *ENV.CRU.PRO.003.F1: Vehicle Plant & Equipment Hygiene Certificate*

8.7.6 CLIENT SITES

When working on client sites MLG Oz will obey and work to all client environmental requirements, policies and procedures. Where contractual arrangements stipulate certain requirements MLG Oz will work with and towards full compliance with those requirements.

There will be no ground disturbance occurring on any part of the client site without client approval process and in accordance with Client Procedures.

8.8 STORM AND SURFACE WATER MANAGEMENT PLAN

MLG Oz operations on MLG Oz sites and on client sites will be constructed and operated in accordance with this Environmental Management plan and/or the client Surface and Stormwater Water Management Procedures.

Surface and storm water management measures relevant to mining operations at MLG Oz sites and/or mobile crushing and screening facilities MCSFs include:

- Position mobile crushing and screening facilities away from major watercourses.
- Use windrows to direct stormwater away from operational areas and mobile crushing and screening facilities MCSF work areas.

Where applicable and achievable grade the site as required to ensure that any stormwater, wash-down and spillage water runoff from operational activities and work areas is contained and directed to a collection and settling sump from where it can be appropriately treated prior to reuse or disposal.

Install additional drainage management structures around stockpiles, if required, to prevent clean stormwater from mixing with sediment within operational work areas.

8.9 SPILL MANAGEMENT PLAN

8.9.1 HYDROCARBON SPILLS

Response to hydrocarbon spills is to be approached following the 3 C's (Control, Contain and Clean-Up) principle.

Control the spill by isolating the source, switching the pump off, closing the valve etc.

Contain the spill to prevent it from entering drain ways, waterways or vegetation by using absorbent products (i.e. peat moss or absorbent matting) or creating a temporary earth bund.

Clean-up the spill and dispose of hydrocarbon contaminated material in accordance with this [section 8.3](#).

All hydrocarbon spills are to be cleaned up immediately and reported as follows:

- MLG Oz sites a full Incident Report Form to be used over 19 litres [OHS.GEN.PRO.005.F1](#)
- Client Sites as per their reporting requirements

Diesel and other hydrocarbons will be used during construction/installation and operation of the mobile crushing and screening facilities MCSFs and site services. Site services and mobile crushing and screening facilities MCSFs will be operated in accordance with hydrocarbon management conditions within the client's licences and the Chemical and Hydrocarbon Management Procedures or on MLG Oz sites as per company procedures.

Hydrocarbon management measures relevant to site services and mobile crushing and screening facilities MCSFs include:

- Store hydrocarbons, lubricants and greases in bunding in accordance with AS 1940- 2004 (The storage and handling of flammable and combustible liquids).
- Utilise spill trays and other containment mechanisms to prevent spills from maintenance being discharged.
- If diesel genset's are utilised for power generation, these are to be self-bunded and drip trays are to be utilised whilst refuelling.
- Limit the storage of lubricants at the work area, with bulk quantities to be stored at the workshops or other suitable sites.

8.9.2 PRODUCT SPILLAGE

- In the event of product spillage during transport where a road train has come to rest on its side the first priority is to secure the scene and make it safe for other road users;
- When the scene is safe and managed the product must be contained from spreading. This will depend on what the product is being contained. If in doubt the scene will be controlled by Emergency Services who will take initial control of the site;
- Back up road train with trailers will be driven to the site along with the appropriate resources i.e. mobile plant, people and spill containment equipment to clean up the product and return the site back to pre-incident condition.
- Depending on the spill the EPA may need to be notified along with line management and the client whom the product belongs too.

Reference:

- [Applicable Client Environmental Management Procedures](#)
- [ENV.CRU.PRO.003 Mobile Crushing and Screening Environmental Management Procedure](#)
- [OHS.GEN.STD.003.0 Health Standard 5: Emergency Preparedness & Response](#)
- [OHS.GEN.STD.003.0 Environmental Standard 4: Spill Management](#)
- [OHS.GEN.PRO.005 Hazard & Incident Reporting Recording & Investigation](#)
- [OHS.GEN.STD.003.0 Environmental Standard 5: Amenity](#)
- [Site Specific Evacuation Plans](#)

- [Site Specific Emergency Response Equipment Site Plan](#)

8.10 MOBILE CRUSHING AND DEMOBILISATION PLAN

Commissioning of the crushing plant refers to the process that begins with the schematic design and fabrication of the associated plant and equipment concluding with the wet running of the crushing circuit under full production load.

The primary objective of this Commissioning Plan is to:

- Identify and control any hazards (safety and environmental) not previously documented on the Critical Risk Assessment;
- Eliminate or where that is not reasonably practicable the minimisation of HSE risks;
- Ensure the availability of relevant information in regards to the crushing plant commissioning activities; and
- Ensure that the commissioning process is completed within the established timeframes and to the contracted specification with safety and environmental issues a major focus.

In support of the company's commitment to the provision of an environmentally safe workplace, no plant or equipment that is to be utilised in connection with the crushing plant shall be placed in to full production and handed over to the Site Manager.

Its MLG Oz commitment and environmental responsibility to ensure that all wastes and materials are removed from site and disposed of in accordance with any relevant legislation, management plan and procedure;

Reference:

- [Applicable Client Environmental Management Procedures](#)
- [ENV.CRU.PRO.003 Mobile Crushing and Screening Environmental Management Procedure](#)

8.11 HAZARDOUS MATERIALS SUBSTANCES MANAGEMENT PLAN

To minimise the risks associated with hazardous chemicals and substances, we will seek and use the safest practicable chemicals and substances in our operations at the mine site.

In reference to operations on client sites all hazardous materials will be approved by the clients prior to bringing them onto Site according to clients operations mine site requirements.

Procedures for storage, handling and transport of hazardous material will be followed explicitly.

Reference:

- [OHS.GEN.PRO.109 Dangerous Goods & Hazardous Substances Procedure](#)
- [OHS.GEN.STD.003.0 Health Standard 13: Dangerous Goods & Hazardous Chemicals](#)
- [Site Specific Evacuation Plans](#)
- [Site Specific Emergency Response Equipment Site Plan](#)

8.11.1 EXISTING HAZARDOUS MATERIALS

Existing chemicals and hazardous substances will be listed in a register and records maintained of the accompanying Safety Data Sheet (SDS) and site approvals

8.11.2 INTRODUCTION OF HAZARDOUS MATERIALS

MLG Oz will obtain an SDS for each chemical or substance and complete the approval application for the clients approval prior to transporting to site. All employees expected to use the chemical or substance will review the SDS prior to use.

8.11.3 TRANSPORTATION, STORAGE AND HANDLING

All hazardous materials will be transported, stored and handled according to the legislated and mine site requirements. Areas where hazardous goods are stored will be prominently marked.

Reference:

- [OHS.GEN.PRO.109 Dangerous Goods & Hazardous Substances Procedure](#)

8.11.4 WASTE DISPOSAL

Reference:

- [Section 8.3](#)
- [OHS.GEN.PRO.109 Dangerous Goods & Hazardous Substances Procedure](#)

8.11.5 HAZARDOUS SUBSTANCES RISK ASSESSMENTS

MLG Oz at all sites where hazardous substances are used will keep and maintain an up to date hazardous substances register that is readily available to employees. Risk assessments must also be performed on hazardous substances to minimise exposure and protect the health and well being of employees.

Reference:

- [OHS.GEN.PRO.109 Dangerous Goods & Hazardous Substances Procedure](#)
- [Hazardous Substances Risk Assessment](#)
- [Hazardous Substances Register](#)
- [Material Safety Data Sheets \(SDS\) Register](#)
- [OHS.GEN.PRO.109 Dangerous Goods & Hazardous Substances Procedure](#)

8.11.6 MANAGEMENT OF HYDROCARBONS

Diesel and other hydrocarbons will be used during construction/installation and operation of the mobile crushing and screening facilities MCSFs. The mobile crushing and screening facilities MCSFs will be operated in accordance with hydrocarbon management conditions within the client's licences and the Chemical and Hydrocarbon Management Procedures or on MLG Oz sites as per company procedures.

Hydrocarbon management measures relevant to mobile crushing and screening facilities MCSFs include:

- Store hydrocarbons, lubricants and greases in bunding in accordance with AS 1940- 2004 (The storage and handling of flammable and combustible liquids).
- Utilise spill trays and other containment mechanisms to prevent spills from maintenance being discharged.
- Have available and strategically located mobile spill control bins in case of an emergency

- If diesel genset's are utilised for power generation, these are to be self-bunded and drip trays are to be utilised whilst refuelling.
- Limit the storage of lubricants at the mobile crushing and screening facilities MCSF work area, with bulk quantities to be stored at the workshops or other suitable sites.

Reference:

- [OHS.GEN.PRO.109 Dangerous Goods & Hazardous Substances Procedure](#)
- [AS 1940- 2004 \(The storage and handling of flammable and combustible liquids\)](#)
- [Applicable Client Environmental Management Procedures](#)
- [ENV.GEN.PLN.002 Environmental Management Plan](#)

8.12 FIRES AND BURN OFF

- Open fires on site are prohibited;
- Any fire must be reported immediately to Emergency Services;
- Any activity involving a source of ignition must be undertaken under the authority of a permit [section 8.7.2](#).

9. CULTURAL HERITAGE

9.1 MLG OZ SITES

MLG OZ have the following quarry tenements for which none identified as Aboriginal cultural heritage sites. These sites being;

- 8 Mile Rock Quarry Tenement M15/1466 ([Appendices 4](#))
- Cane Grass Sand Quarry Tenement M24/905 ([Appendices 5](#))
- Jonah Bore Quarry Tenement M36/657 ([Appendices 6](#))
- Tarmoola Quarry Tenement M37/90 & M37/201 ([Appendices 7](#))

9.2 CLIENT SITES

MLG Oz where applicable will comply with its clients obligations under Land Access Agreements (LAAs) and the Aboriginal Heritage Act 1972 (AHA) including all ministerial conditions imposed. MLG Oz understands heritage relevance and value to ensure that heritage sites are protected wherever possible and to comply with statutory obligations under the Aboriginal Heritage Act 1972 (AHA), as well as obligations to our Native Title partners.

In the event that MLG Oz operates on a client site where there is identification and management of Aboriginal cultural heritage sites the company will commit to client guidelines and procedures to protect and promote Aboriginal history and culture.

Where MLG Oz is operating on a client site shall utilise two key principles in order to minimise inadvertent impact into Aboriginal heritage sites which are:

- Always drive on existing roads and tracks;
- Always work within the confines of the Ground Disturbance Permit Statutory Obligations

Under Section 17 of the Aboriginal Heritage Act 1972 (AHA), it is an offence to:

- Alter an indigenous site in any way, including collecting artefacts;
- Conceal a Site of artefact or,
- Excavate, destroy or damage in any way an indigenous site or artefact,

Without the authorisation of the Registrar of Aboriginal Sites under section 16, or the Minister of Indigenous Affairs under Section 18 of the AHA.

10. SECURING OF LOADS

10.1 SECURING OF LOADS ONTO VEHICLES AND TRAILERS

Do not drive a vehicle carrying a load unless the load is so secured or covered that the load or any part of it cannot escape from the vehicle onto the road

Reference:

- [OHS.GEN.PRO.109 Dangerous Goods & Hazardous Substances Procedure](#)
- [OHS.GEN.SWP.059 Securing Loads](#)

11. NON-COMPLIANCE MANAGEMENT

Any events which identify non-compliances that require corrective and/or preventative action shall be identified and reported at MLG Oz using the Incident Reporting Recording & Investigation and/or Non-Compliance Management procedure.

Triggers for a non-compliance requiring corrective and or preventative action include:

- Incident Management System, which captures non-compliance and or non-compliance through:
 - HSE incident reports;
 - HSE Incident Investigations;
 - Internal and external complaints; and
 - Licence breaches;
- Regulator Improvement notice;
- Client raise issues or a breach;
- Complaints;
- Planned Inspections;
- Identified workplace hazards;
- Monitoring Processes, which capture non-compliances and non-conformances through;
 - Variations noted in HSE monitoring,
 - Failure to conduct monitoring as scheduled.
- Management Reviews, which captures non-compliance through;
 - Failure to meet target dates as required.
- Other triggers for corrective and/or preventative action include, but not limited to;
 - HSE Meeting;

- HSE Communication;
- Hazard reviews;
- Emergency/Disaster response;
- Improvement idea;
- Safety Interaction and observations;
- Compliance Audits;
 - 3rd Party;
 - Clients; and
 - Internal;
- Audits, that identify the need for corrective and/or preventative action through;
 - workplace inspections;
 - findings from environmental site inspections and Aspects and Impacts reviews;
 - identified training deficiencies;
 - required emergency response improvements;
 - regulatory non-compliances;
 - failure to comply with HSEC requirements in a System Procedure;
 - Failure to meet existing voluntary commitments.

Any of these triggers may be utilised by employees across all our site to capture events that require initiation of corrective and/or preventative actions, however the most well established method of reporting is the Incident Management System.

Reference:

- [*OHS.GEN.PRO.020 Non Compliance & Corrective Actions Management*](#)
- [*OHS.GEN.STD.003.0 Standard 15: Incident Investigation and Management*](#)
- [*OHS.GEN.PRO.005 Incident Reporting Recording & Investigation*](#)

12. ENVIRONMENTAL MONITORING AND REVIEW

Where required and/or requested MLG Oz will undertake environmental monitoring to comply with legislation, Environmental Protection Authority WA (EPA) licence requirements on Tennaments licences and/or client requirements

13. APPENDICES

- **Appendices 1:** Definitions
- **Appendices 2:** MLG Oz Structure
- **Appendices 3:** Responsibilities
- **Appendices 4:** 8 Mile Rock Quarry Tenement M15/1466
- **Appendices 5:** Cane Grass Sand Quarry Tenement M24/905
- **Appendices 6:** Jonah Bore Quarry Tenement M36/657
- **Appendices 7:** Tarmoola Quarry Tenement M37/90 & M37/201
- **Appendices 8:** MLG Oz Kalgoorlie Site and Head Office & Workshop

APPENDICES

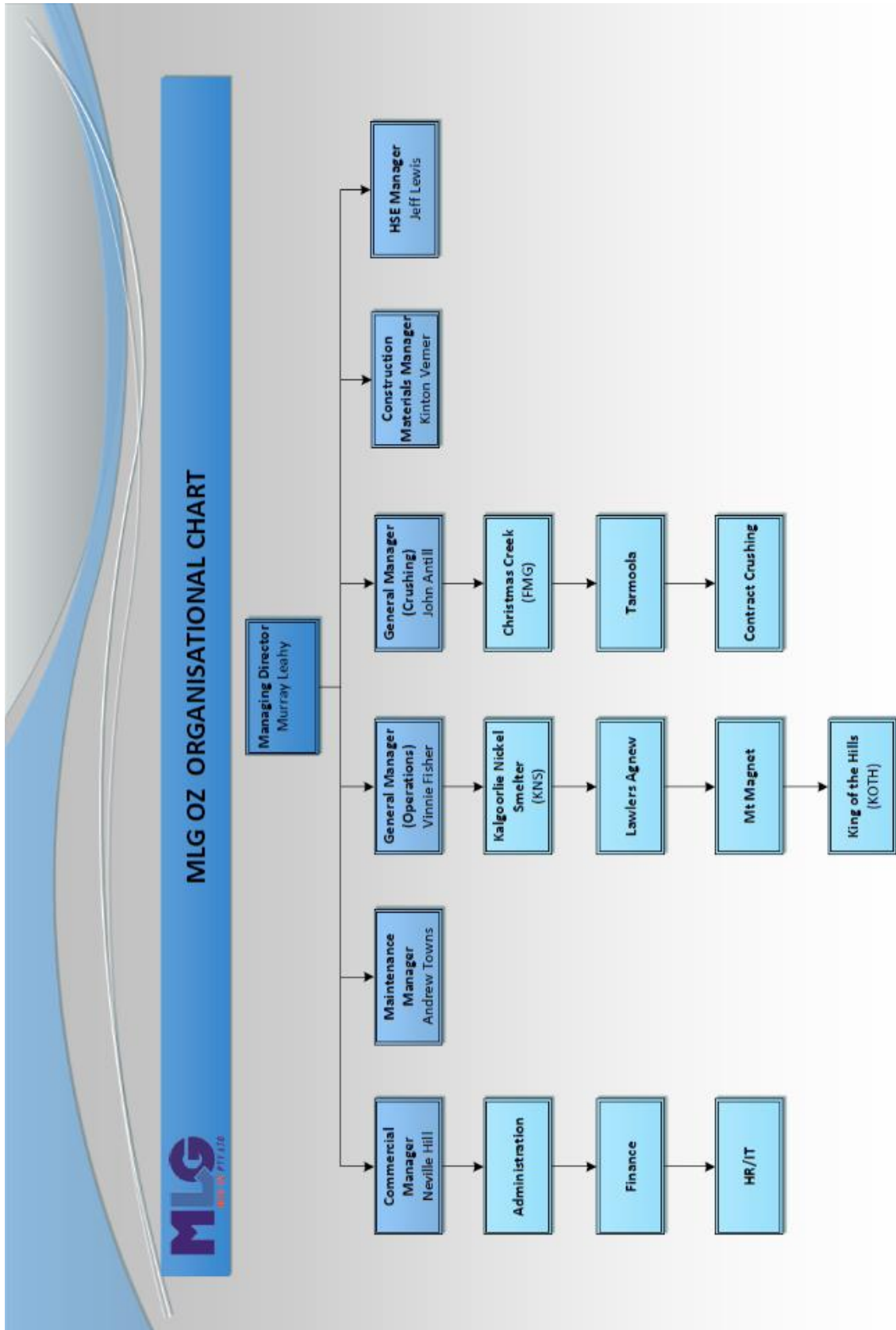
APPENDICES 1: DEFINITIONS

Term	Definition
Best Environmental Practice (BEP)	<p>The term best environmental practice (BEP) means the application of the most appropriate combination of environmental control measures and strategies. In making a selection for individual cases, at least the following graduated range of measures should be considered:</p> <ol style="list-style-type: none"> 1. the provision of information and education to the public and to users about the environmental consequences of choice of particular activities and choice of products, their use and ultimate disposal; 2. the development and application of codes of good environmental practice which covers all aspect of the activity in the product's life; 3. the mandatory application of labels informing users of environmental risks related to a product, its use and ultimate disposal; 4. saving resources, including energy; 5. making collection and disposal systems available to the public; 6. avoiding the use of hazardous substances or products and the generation of hazardous waste; 7. recycling, recovery and re-use; 8. the application of economic instruments to activities, products or groups of products; 9. establishing a system of licensing, involving a range of restrictions or a ban.
Company	Company - refers to MLG OZ PTY LTD and its subsidiaries
Competent Person	A person who has acquired, through training, qualification or experience or a combination of these, the knowledge and skills including HSE knowledge and skills, qualifying that person to perform a specified task.
Contractor	An individual, company or other legal entity contracted to carry out work for, and on behalf of MLG Oz, including self-employed persons and sub-contractors.
Discharge	'discharge' – in relation to waste or other matter, includes deposit it or allow it to escape, or cause or permit it to be, or fail to prevent it from being, discharged, deposited or allowed to escape. <i>Ref: Department of Environment and Conservation WA</i>
EPA	Environmental Protection Authority WA
ERP	Emergency Response Plan (ERP)
HSE	Health Safety and Environment
HSE Manager	Position carries the primary responsibility for safety advice at the

Term	Definition
	site. They ensure that each person at site performs their functions safely, follows relevant procedures and other measures, necessary for the safety of the site and the person.
IMS	Intergrated Management System
Intergrated Management System	An integrated management system (IMS) combines all related components of a business being Quality, Environmental, and Safety management into one system for easier management and operations.
Material environmental harm	<p>‘material environmental harm’ – means environmental harm that</p> <p>(a) is neither trivial nor negligible; or</p> <p>(b) results in actual or potential loss, property damage or damage costs of an amount, or amounts in aggregate, exceeding the threshold amount (Part.1. S3A(3)).</p> <p><i>Ref: Department of Environment and Conservation WA</i></p>
MYOSH	Safety Management System Database
Pollution	<p>‘pollution’ – means direct or indirect alteration of the environment –</p> <p>(a) to its detriment or degradation;</p> <p>(b) to the detriment of an environmental value; or</p> <p>(c) of a prescribed kind,</p> <p>that involves an emission.</p> <p><i>Ref: Department of Environment and Conservation WA</i></p>
Premises	<p>‘premises’ – means residential, industrial or other premises of any kind whatsoever and includes land, water and equipment.</p> <p><i>Ref: Department of Environment and Conservation WA</i></p>
PRONTO	Maintenance Management System Database
Risk	Risk is the possibility that harm (death, injury or illness) might occur when exposed to a hazard.
Risk Assessment	A risk assessment is the process of ensuring that the risks associated with hazards identified within work areas are adequately assessed to determine priorities for action. The magnitude of the risk is determined by considering the likelihood or probability of the hazard causing damage/injury and the likely severity of the consequences should the damage/injury occur. Risk assessments are calculated in accordance with the MLG Oz Risk Matrix.
Risk Control	Risk control means taking action to eliminate health and safety risks so far as is reasonably practicable, and if that is not possible, minimising the risks so far as is reasonably practicable. Eliminating a hazard will also eliminate any risks associated with that hazard.
Risk Register	A list of hazards, associated risks (pre- and post-control) and controls, sorted in order of the highest to lowest risk.
Serious environmental harm	<p>‘serious environmental harm’ – means environmental harm that –</p> <p>(a) is irreversible, of a high impact or on a wide scale;</p> <p>(b) is significant or in an area of high conservation value or special significance; or</p> <p>(c) results in actual or potential loss, property damage or damage costs of an amount, or amounts in aggregate, exceeding 5 times the threshold amount.</p> <p><i>Ref: Department of Environment and Conservation WA</i></p>
Waste	<p>‘waste’ – includes matter –</p> <p>(a) whether liquid, solid, gaseous or radioactive and whether useful or useless, which is discharged into the environment;</p> <p>or</p>

Term	Definition
	(b) prescribed to be waste. <i>Ref: Department of Environment and Conservation WA</i>
Workplace	Workplace – Its normal place of work but also extends to company organised social functions or where the company has sanctioned attendance of employees to social functions organised by other external parties

APPENDICES 2: MLG OZ STRUCTURE





APPENDICES 3: RESPONSIBILITIES

Position	Environmental Responsibility
Managing Director	<ul style="list-style-type: none"> • Overall responsibility for the environmental management system • Liaises with stakeholders.
General Managers	<ul style="list-style-type: none"> • Overall responsibility for site-specific implementation of environmental policy, systems and management measures.
Operations and Site Managers	<ul style="list-style-type: none"> • Ensures IMS is prepared, implemented uniformly, revised and maintained. • Ensures implementation and regular review of relevant environmental management measures. • Liases with applicable employees as required.
Contractors	<ul style="list-style-type: none"> • Fulfil contractual obligations and abide by MLG Oz's IMS. • Ensures that contractors fulfil their contractual obligations in regards to environment, health and safety (EHS) requirements.
HSE Manager & HSE Advisors	<ul style="list-style-type: none"> • Ensures IMS is prepared, implemented uniformly, revised and maintained. • Assesses the suitability and effectiveness of the IMS. • Implements induction procedures and appropriate awareness sessions training. • Ensures compliance with legislation and company policy via the establishment and maintenance of appropriate reporting systems and MYOSH databases. • Participates with personnel to improve work practices on site. • Undertakes internal site environmental audits. • Liaises with stakeholders. • Ensures implementation and regular review of environmental management measures.


8 MILE ROCK QUARRY
Goldfields, Western Australia

8 Mile Rock - Tenement M15/1466
30°48'96.26"S 120°58'37.65"E
Elevation: 2.20 km





8 MILE



BUSINESS TYPE
MLG Oz Mining and Bulk Haulage Operations


OPERATION
MLG Oz Tenement M15/1466 Quarry

STAFF NUMBERS
Onsite: Staffing as required

FLEET ALLOCATION
Prime Movers: As Required
Trailers: As Required

AVERAGE YEARLY TEMPERATURES
11.6 – 25.2 °C

AVERAGE YEARLY RAIN FALL
264.8 mm



Imagery © 2015 Google, Landsat

Satellite Aerial Imagery obtained from Google Image Maps © MLG Oz 2015

APPENDICES 4 (CONT): 8 MILE ROCK QUARRY TENEMENT M15/1466

8 MILE ROCK QUARRY
Goldfields, Western Australia

8 Mile Rock - Tenement M15/1466
Western Area







BUSINESS TYPE
MLG Oz Mining and Bulk Haulage Operations

OPERATION
MLG Oz Tenement M15/1466 Quarry

STAFF NUMBERS
Onsite: Staffing as required

FLEET ALLOCATION
Prime Movers: As Required
Trailers: As Required

AVERAGE YEARLY TEMPERATURES
11.6 – 25.2 °C

AVERAGE YEARLY RAIN FALL
264.8 mm



APPENDICES 4 (CONT): 8 MILE ROCK QUARRY TENEMENT M15/1466

8 MILE ROCK QUARRY
Goldfields, Western Australia

8 Mile Rock - Tenement M15/1466
Eastern Area







BUSINESS TYPE
MLG Oz Mining and Bulk Haulage Operations

OPERATION
MLG Oz Tenement M15/1466 Quarry

STAFF NUMBERS
Onsite: Staffing as required

FLEET ALLOCATION
Prime Movers: As Required
Trailers: As Required

AVERAGE YEARLY TEMPERATURES
11.6 – 25.2 °C


AVERAGE YEARLY RAIN FALL
264.8 mm



APPENDICES 5: CANE GRASS SAND QUARRY TENEMENT M24/905

CANE GRASS SAND QUARRY
Goldfields, Western Australia

Cane Grass: Tenement M24/905
30°12'16.62"S 121°06'05.44"E
Elevation: 1.93 km



BUSINESS TYPE
MLG Oz Mining and Bulk Haulage Operations


OPERATION
MLG Oz Tenement M24/905 Quarry

STAFF NUMBERS
Onsite: Staffing as required


FLEET ALLOCATION
Prime Movers: As Required
Trailers: As Required


AVERAGE YEARLY TEMPERATURES
11.6 – 25.2 °C

AVERAGE YEARLY RAIN FALL
264.8 mm



CANE GRASS





To Goldfields Highway

Cane Grass Sand Quarry

©2015 Google
Image ©2015 CNES/Airbus


Satellite Aerial Imagery obtained from Google Image Maps © MLG Oz 2015

APPENDICES 5 (CONT): CANE GRASS SAND QUARRY TENEMENT M24/905

CANE GRASS SAND QUARRY
Goldfields, Western Australia

Cane Grass: Tenement M24/905

Western Area



BUSINESS TYPE
MLG Oz Mining and Bulk Haulage Operations


OPERATION
MLG Oz Tenement M24/905 Quarry

STAFF NUMBERS
Onsite: Staffing as required


FLEET ALLOCATION
Prime Movers: As Required
Trailers: As Required


AVERAGE YEARLY TEMPERATURES
11.6 – 25.2 °C

AVERAGE YEARLY RAIN FALL
264.8 mm

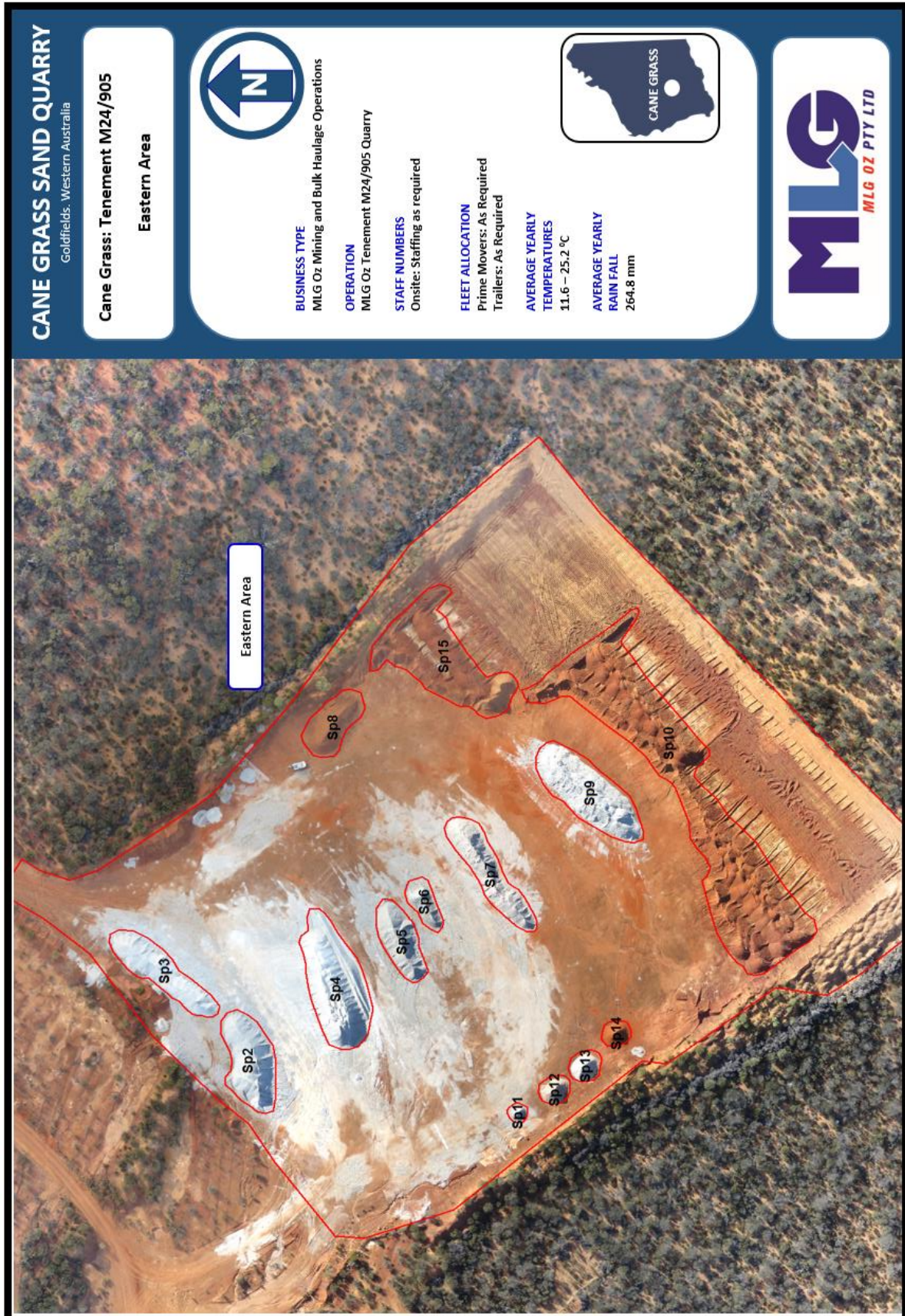


CANE GRASS






APPENDICES 5 (CONT): CANE GRASS SAND QUARRY TENEMENT M24/905





APPENDICES 6: JONAH BORE QUARRY TENEMENT M36/657

JONAH BORE QUARRY
Goldfields, Western Australia

Jonah Bore: Tenement M36/657
27°56'57.44"S 120°26'41.62"E
Elevation: 2.53 km







BUSINESS TYPE
MLG Oz Mining and Bulk Haulage Operations

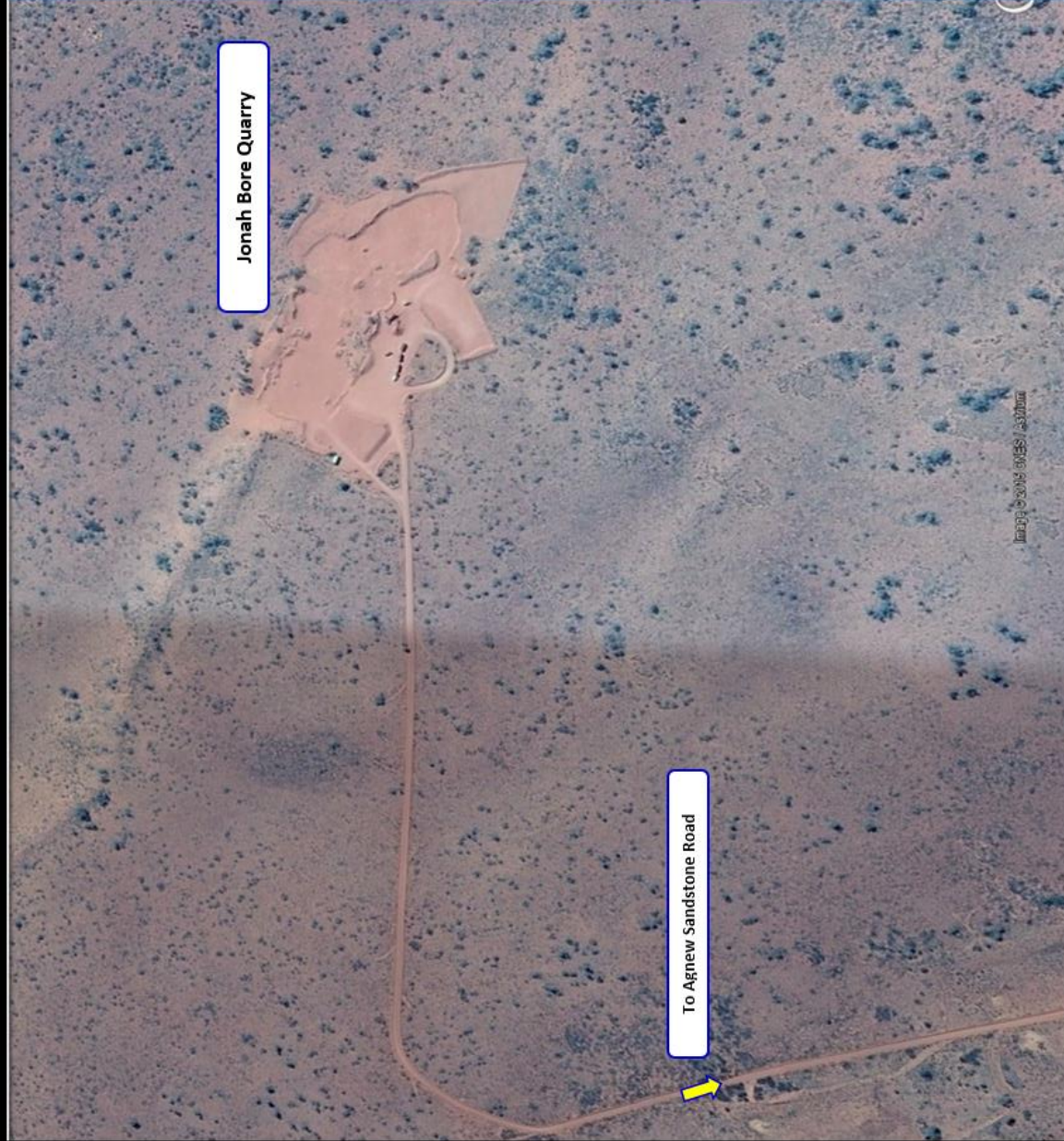
OPERATION
MLG Oz Tenement M36/657 Quarry

STAFF NUMBERS
Onsite: Staffing as required

FLEET ALLOCATION
Prime Movers: As Required
Trailers: As Required

AVERAGE YEARLY TEMPERATURES
14.7 – 28.2 °C

AVERAGE YEARLY RAIN FALL
240.6 mm



Jonah Bore Quarry


To Agnew Sandstone Road

Satellite Aerial Imagery obtained from Google Image Maps © MLG Oz 2015

APPENDICES 6 (CONT): JONAH BORE QUARRY TENEMENT M36/657

JONAH BORE QUARRY
Goldfields, Western Australia

Jonah Bore: Tenement M36/657
27°56'57.44"S 120°26'41.62"E
Elevation: 994 m



BUSINESS TYPE
MLG Oz Mining and Bulk Haulage Operations


OPERATION
MLG Oz Tenement M36/657 Quarry


STAFF NUMBERS
Onsite: Staffing as required


FLEET ALLOCATION
Prime Movers: As Required
Trailers: As Required

AVERAGE YEARLY TEMPERATURES
14.7 – 28.2 °C

AVERAGE YEARLY RAIN FALL
240.6 mm







Jonah Bore Quarry

APPENDICES 7: TARMOOLA QUARRY TENEMENT M37/90 AND M37/201

TARMOOLA QUARRY
Goldfields, Western Australia

Tarmoola: Tenement M37/90 & M37/201
28°40'05.57"S 121°09'32.12"E
Elevation: 6.43 km



BUSINESS TYPE
MLG Oz Mining and Bulk Haulage Operations

OPERATION
MLG Oz Tenement M37/90 & M37/201 Quarry

STAFF NUMBERS
Onsite: Staffing as required

FLEET ALLOCATION
Prime Movers: As Required
Trailers: As Required

AVERAGE YEARLY TEMPERATURES
14.0 – 27.9 °C

AVERAGE YEARLY RAIN FALL
237.8 mm








© 2015 Google
Image © 2015 CNES/Airbus


Satellite Aerial Imagery obtained from Google Image Maps © MLG Oz 2015


APPENDICES 7 (CONT): TARMOOLA QUARRY TENEMENT M37/90 AND M37/201

TARMOOLA QUARRY
Goldfields, Western Australia

Tarmoola: Tenement M37/90 & M37/201
28°40'05.57"S 121°09'32.12"E







BUSINESS TYPE
MLG Oz Mining and Bulk Haulage Operations


OPERATION
MLG Oz Tenement M37/90 & M37/201 Quarry

STAFF NUMBERS
Onsite: Staffing as required

FLEET ALLOCATION
Prime Movers: As Required
Trailers: As Required

AVERAGE YEARLY TEMPERATURES
14.0 – 27.9 °C


AVERAGE YEARLY RAIN FALL
237.8 mm



APPENDICES 7 (CONT): TARMOOLA QUARRY TENEMENT M37/90 AND M37/201

TARMOOLA QUARRY
Goldfields, Western Australia

Tarmoola: Tenement M37/90 & M37/201
28°40'05.57"S 121°09'32.12"E



BUSINESS TYPE
MLG Oz Mining and Bulk Haulage Operations


OPERATION
MLG Oz Tenement M37/90 & M37/201 Quarry

STAFF NUMBERS
Onsite: Staffing as required


FLEET ALLOCATION
Prime Movers: As Required
Trailers: As Required

AVERAGE YEARLY TEMPERATURES
14.0 – 27.9 °C

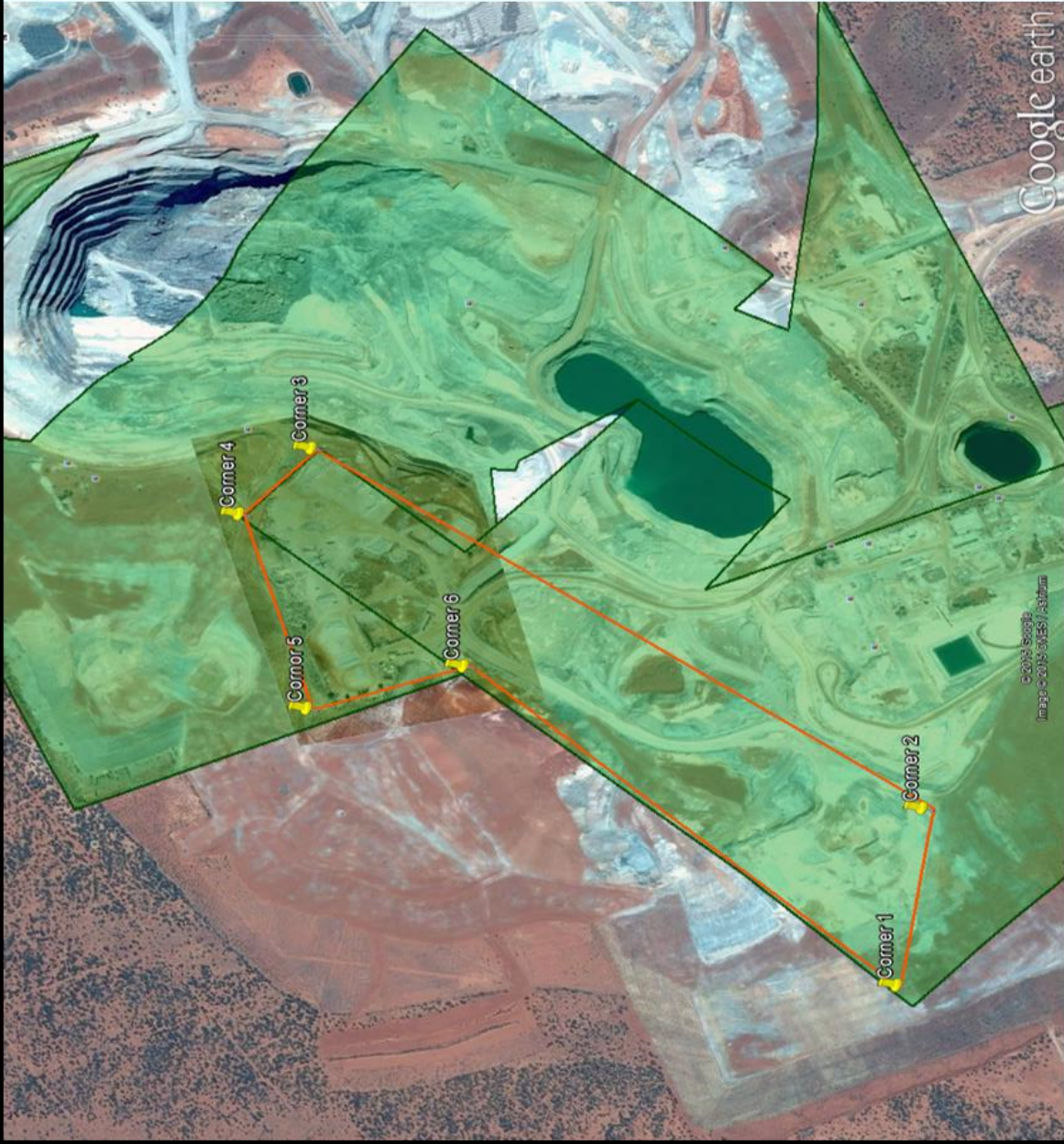
AVERAGE YEARLY RAIN FALL
237.8 mm



TARMOOLA



MLG
MLG OZ PTY LTD



APPENDICES 8: MLG OZ KALGOORLIE SITE HEAD OFFICE AND WORKSHOP

KALGOORLIE
Goldfields, Western Australia

Kalgoorlie Head Office & Workshop
30°46'39.34"S 121°27'07.41"E
Elevation: 3.42 km

BUSINESS TYPE
MLG Oz Mining and Bulk Haulage Operations

OPERATION
Current operations consists of mine site services and three (3) established business divisions of Bulk Haulage, Crushing and Screening and Sand and Stone through MLG Oz tenement owned quarries

STAFF NUMBERS
Onsite: 40 staff


FLEET ALLOCATION
Prime Movers: 26
Trailers: 60

AVERAGE YEARLY TEMPERATURES
11.6 – 25.2 °C


AVERAGE YEARLY RAIN FALL
264.8 mm



KALGOORLIE



MLG
MLG OZ PTY LTD



Satellite Aerial Imagery obtained from Google Image Maps © MLG Oz 2015
Imagery Date: 1/28/2015



APPENDIX 2: VEHICLE, PLANT AND EQUIPMENT HYGIENE CERTIFICATE



VEHICLE, PLANT AND EQUIPMENT HYGIENE CERTIFICATE

PART A: DECLARATION CERTIFICATE.

As per the Hygiene Certificate conditions **PART B REPORT**, partial or full dismantling may be required to facilitate the cleaning and inspection process. **Please note checklist areas in bold have been identified as MANDATORY.**

This declaration is valid for transport of the below **Vehicle / Plant / Equipment** stating that the cleaning has been *Please Circle* carried out in the detail stipulated in this report and declares that this item is Hygienic and safe to transport.

COMPANY: DATE:

LOCATION OF INSPECTION:

MANAGER COMPLETING INSPECTION: SIGNATURE:

MODEL: MAKE: OWNER:

REGISTRATION / SERIAL NO: ODOMETER READING:

INSPECTION AND WASHDOWN CONDUCTED AT:

METHOD OF CLEANING:

.....

CLEANERS NAME: SIGNATURE:

I Declare that I have thoroughly inspected
Name Please (Print) *Vehicle, Plant & Equipment ID (Print)*
 Against the criteria on this Hygiene Certificate and state that it is free
 Of any contaminants, soil, vegetation and seeds and is safe to travel to new location.
 DATE DECLARED: SIGNATURE:

- This Hygiene Certificate remains valid under the following conditions (1 – 4) below;**
1. The vehicle, plant and equipment does not travel off formed roads
 2. The vehicle, plant and equipment does not come into contact with declared weeds
 3. The driver operator does not operate the vehicle, plant and equipment after coming into direct contact with declared weeds or contaminated soil
 4. The vehicle, plant and equipment if operated off road, stays within the designated work area and does not cross a property boundary or other designated boundary

VEHICLE, PLANT AND EQUIPMENT HYGIENE CERTIFICATE		
PART B: CLEANING GUIDELINES REPORT		
Point	Area Cleaned	
	Standard	Standard Met (Yes / No / N/A)
1. CABIN		
1.1	Remove any rubber floor mats and clean floor surface.	
1.2	Remove and clean all door rubbers, internal door panelling and clean all windowsills.	
1.3	Remove and clean under the seat, including the rubber seat shroud.	
1.4	Remove any non-affixed floor panel if applicable and clean underneath.	
1.5	Remove rubber pedal covers and clean.	
1.6	Remove and clean behind all cabin wall lining/panelling.	
1.7	All air-conditioning vents must be internally cleaned. Access will be required for inspection.	
1.8	Clean inside all joystick controls. Access will be required for inspection.	
1.9	Check cleanliness of cabin roof, both inside and out.	
1.10	Clean ladder to cabin (may have hollow frame) and under each footstep.	
1.11	Internally clean all light covers. Access will be required for inspection.	
1.12	Check for false floor under cabin and remove for cleaning, if applicable.	
1.13	Check if the vertical cabin housing can be flushed via drainage holes.	
1.14	Clean around roll over protection support structure.	
2. ENGINE BAYS		
2.1	Remove air-filter pre-cleaner cover and clean.	
2.2	Remove air-filter and clean with air.	
2.3	Clean inside fan-belt flywheels (harmonic balancer).	
2.4	Check all surfaces of engine block including between tappet covers.	
2.5	Remove belly plates if applicable and clean.	
2.6	Remove all non-affixed engine covers to allow access for cleaning and inspection.	
2.7	Remove all engine cover rubbers for cleaning and inspection.	
2.8	Check engine housing for open-ended or spot-welded hollow support framework - flush to verify cleanliness.	
2.9	Chassis rails either side of engine are hollow and maybe flushed via drainage holes on underside of the rail (Access maybe available once belly plate bolts have been removed).	
2.10	Flush radiator and oil cooler from both sides to verify fin/core cleanliness.	
2.11	Loosen radiator shroud to let any loose debris fall through after flushing.	
2.12	Check battery boxes for cleanliness. Loosen batteries and clean under.	
2.13	Check either side of radiator for vertical hollow support structures. Flush to verify internal cleanliness if present.	
2.14	Check all wiring harnesses for internal cleanliness.	
2.15	Check under all hydraulic looming for cleanliness.	
2.16	Ensure all engine mounts are clean.	

VEHICLE, PLANT AND EQUIPMENT HYGIENE CERTIFICATE		
PART B: CLEANING GUIDELINES REPORT		
Point	Area Cleaned	
	Standard	Standard Met (Yes / No / N/A)
2.17	Ensure that all surfaces of sump and engine block are clean.	
2.18	Remove all contaminated grease from universal joints.	
2.19	Internally clean all light covers. Access will be required for inspection.	
2.20	Removing zip-ties and electrical tape that hold electric and hydraulic hoses together can facilitate the cleaning and inspection process.	
2.21	Check above the sway bar – for cleanliness.	
2.23	Flush under all checker-plate (non-slip footings) to ensure clean.	
3. TRACKS / ROLLERS / TRACK FRAMES		
3.1	Stone / Rock guards (if present) must be removed to allow cleaning and inspection access to inside track frames.	
3.2	Remove all other non-affixed panels to allow cleaning and inspection.	
3.3	Once rock guards have been removed, check where bolts attach to frame as it may be a hollow cavity, which requires flushing.	
3.4	Remove bearing covers where applicable.	
3.5	Rollers – each countersunk bolthole must be individually cleaned.	
3.6	Remove Track guides (below rollers), if present and clean.	
3.7	Roll tracks – one revolution required to check cleanliness of each track pad & countersunk bolts on rollers and idler wheels.	
3.8	Clean the track spring adjuster inside track frame.	
3.9	Clean all internal ledges and hollow cavities inside track frames.	
3.10	Carrier rollers above tracks – can have hollow vertical support structure, which requires cleaning.	
4. RIPPER CRADLE		
4.1	Ripper cradles are hollow – check for drainage hole or cracks & flush.	
4.2	Remove cutting teeth from ripper blades.	
4.3	Loosen any wear plates from ripper blades.	
5. OTHER AREAS REQUIRING CLEANING AND VERIFICATION		
5.1	Check battery box – loosen batteries and clean under.	
5.2	Check all surfaces of oil tank to ensure clean.	
5.3	Check all surfaces of fuel cell to ensure clean.	
5.4	Fuel cells from Komatsu & models must be removed to allow access under for cleaning and inspection.	
5.5	Flush under all checker-plate (non-slip footings) to ensure clean.	
5.6	Check the internal of all light covers & cavities behind.	
6. FRONT END AND RADIATORS		
6.1	Remove radiator grill (both outside and inside). Access will be required for inspection.	
6.2	Loosen radiator shroud to let loose debris fall through.	
6.3	Check either side of radiator for vertical hollow support structures. Flush to verify clean if present.	

VEHICLE, PLANT AND EQUIPMENT HYGIENE CERTIFICATE

PART B: CLEANING GUIDELINES REPORT

Point	Area Cleaned	
	Standard	Standard Met (Yes / No / N/A)
6.4	Clean inside all light covers. Access will be required to verify.	
6.5	Check front drawbar for drainage holes and flush if present.	
6.6	Check vertical channels either side of radiator for drainage holes and flush.	
6.7	Check cleanliness of air filter (pressurised air may be required).	
6.8	Remove any non-affixed panels from front of the cabin – access to air-con.	

7. TYRES AND RIMS

7.1	Ensure that all cracks and splits in tyres are free of contamination.	
7.2	Inside wheel rims may require non-affixed plates to be removed to allow access to the brake drums and inner rim.	
7.3	Dual tyres must be removed.	

8. DUMP TRUCK TRAYS

8.1	Check all surfaces of the tray for any cracks, splits or evidence of repair. If any are detected these will need to be investigated for internal contamination (if double skinned).	
8.2	Check all rubber mounts on the underside of the tray.	
8.3	If parts are shipped in the tray, all must be removed to enable inspection access.	

9. TELESCOPIC BOOMS AND BUCKETS

9.1	Check front and backside of bucket for any cracks, splits or evidence of repair.	
9.2	If any detected, the inside will need to be verified clean.	
9.3	Remove all non-affixed wear plates.	
9.4	Flush spot-welded wear plates on back of bucket.	
9.5	All cutting teeth to be removed from bucket (Boots).	
9.6	Boom arm (maybe hollow and necessitate removal of external non-affixed plates).	
9.7	All knuckles must be cleaned (remove all contaminated grease).	
9.8	Remove cutting teeth from blade.	
9.9	All telescopic booms must be fully extended and flushed through to ensure no internal contamination.	

10. GOOSE NECKS AND CIRCLE

10.1	Remove all non-affixed panels from along the Gooseneck and check all hydraulic hoses.	
10.2	All cutting teeth on the blade to be loosened and flushed behind.	
10.3	Remove all non-affixed wear plates from the blade.	
10.4	Check front and backside of blade for any cracks, splits or evidence of repair. If any detected, the inside will need to be verified clean.	
10.5	Check light mounts at the front of the Gooseneck – if applicable; these areas are generally hollow and require cleaning.	
10.6	All pivot points must be cleaned (remove all contaminated grease).	

VEHICLE, PLANT AND EQUIPMENT HYGIENE CERTIFICATE		
PART B: CLEANING GUIDELINES REPORT		
Point	Area Cleaned	
	Standard	Standard Met (Yes / No / N/A)
10.7	The Gooseneck is hollow and may have drainage holes on the underside either at the front or rear – if present flush to verify internal cleanliness.	
10.8	Flush spot-welded wear plates on back of bucket.	
Source: Australian Government – Department of Agriculture		



APPENDIX 3: WEED MANAGEMENT FORM

**APPENDIX 10:PRELIMINARY ADVICE FOR TJIWARL
ABORIGINAL CORPORATION (RNTBC) OF AN
ETHNOGRAPHIC TJIWARL CULTURAL HERITAGE
SURVEY**