Native Vegetation Clearing Permit (Purpose): Supporting Documentation

Crawford Gold Project

Prepared for Cavalier Resources Limited

21 August 2024

Project Number: TE24064

DOCUMENT CONTROL

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Approval for Release

Name	Position	File Reference
Ami Jamieson	Senior Environmental Consultant	TE24064_NVCP_Supporting Documentation_1.0
Signature	Ami Jamieson Digitally signed by Ami Jamieson Date: 2024-08-21 15:31:10	

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1 Introduction

1.1 Background

Talis Consultants have been commissioned by Cavalier Resources Limited (Cavalier) to prepare a Native Vegetation Clearing Permit (NVCP) application for clearing associated with the Crawford Gold Project (the Project).

The Project is located approximately 25 kilometres (km) east of Leonora in the Goldfields region of Western Australia (see Figure 1-1). The operations are proposed to consist of an open pit, crushing infrastructure, leach pad, waste rock landform and other mine support infrastructure. Mining will be undertaken by standard truck and excavator operation with drill and blast not expected to be required at this stage. Ore will be crushed and screened on site, with heap leaching used as the processing method.

Cavalier is the registered tenement holder for the Project tenement. The details of the relevant tenement for this NVCP application, held by Cavalier, is included in Table 1-1 and Figure 1-2.

Table 1-1: Project Tenements Held by Cavalier Resources Limited

Tenement	Tenement Area (ha)	Date Granted	Expiry Date	Status
M 37/1202	890.55	04/02/2008	03/02/2029	Live

Under Section 51C of the *Environmental Protection Act 1986* (EP Act), the clearing of any native vegetation requires an approved clearing permit, unless an exemption applies. Exemptions for mining generally apply to areas of low impact mining and exploration, or for proposals that have already been assessed by the Environmental Protection Authority (EPA), Department of Water, Environment and Regulation (DWER) or Department of Energy, Mines, Industry Regulation and Safety (DEMIRS) through a separate process. This project does not have an applicable exemption and a clearing permit is therefore required.

This NVCP application is to clear up to up to 49.5 hectares (ha) of native vegetation within the Development Envelope of approximately 198.36 ha (Figure 1-3).

The purpose of this NVCP supporting document is to present the results of an assessment of the clearing required for this project against the ten clearing principles as outlined in the clearing permit guidelines - *A guide to the assessment of applications to clear native vegetation* (2014) under Part V Division 2 of the EP Act. This report identifies the potential environmental impacts associated with the proposal based on the best available data. This report and accompanying NVCP Purpose Permit application form will be submitted to DEMIRS for assessment.

1.2 Proposed Timeframe

Clearing is proposed to commence in Q4 2024/Q1 2025 with mining likely to be completed by Q4 2026.

1.3 Responsible Applicant

Cavalier Resources Limited are responsible for the implementation of the clearing described within this report. Correspondence relating to this NVCP application should be addressed to:

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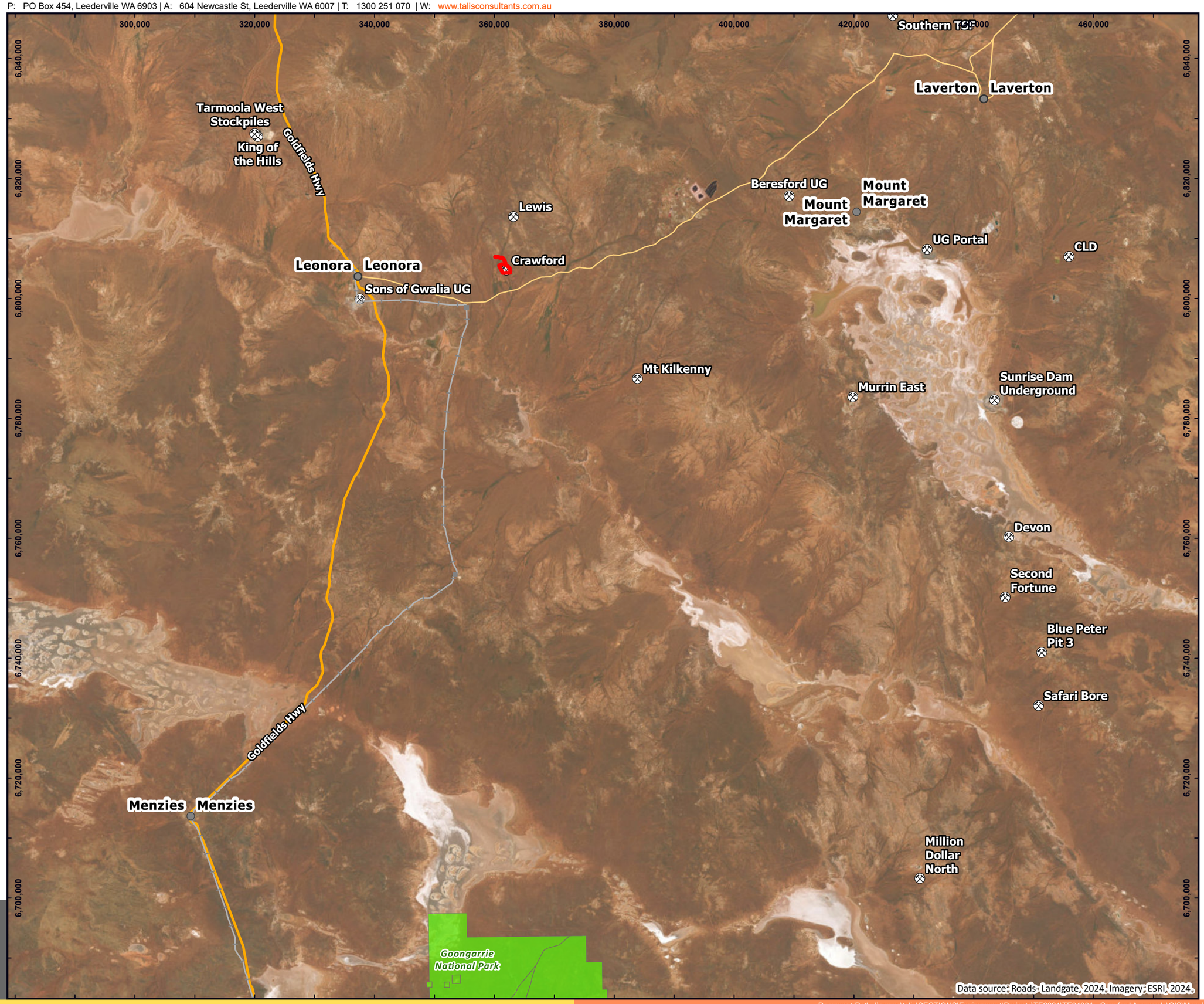


LEGEND

- Major Mining Projects
- Development Envelope
- National Park

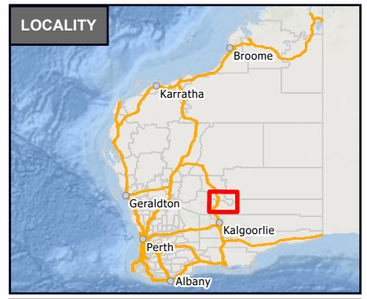
Rail Network

- Railway Stations
- Railway Lines

Western Australian Roads

- Freeway / Highway
- Main Road

LOCALITY



0 500 1,000 1,500 2,000 2,500 km

PROPOSAL LOCALITY

Crawford Gold Project Approvals

Cavalier Resources

N

0 5 10 15 20 km

Coordinate System: GDA2020 MGA Zone 51
Scale @ A3: 1:600,000

Prepared:	E Jackson	Date:	16/07/2024
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Project:	TE24064		

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Figure 1-1

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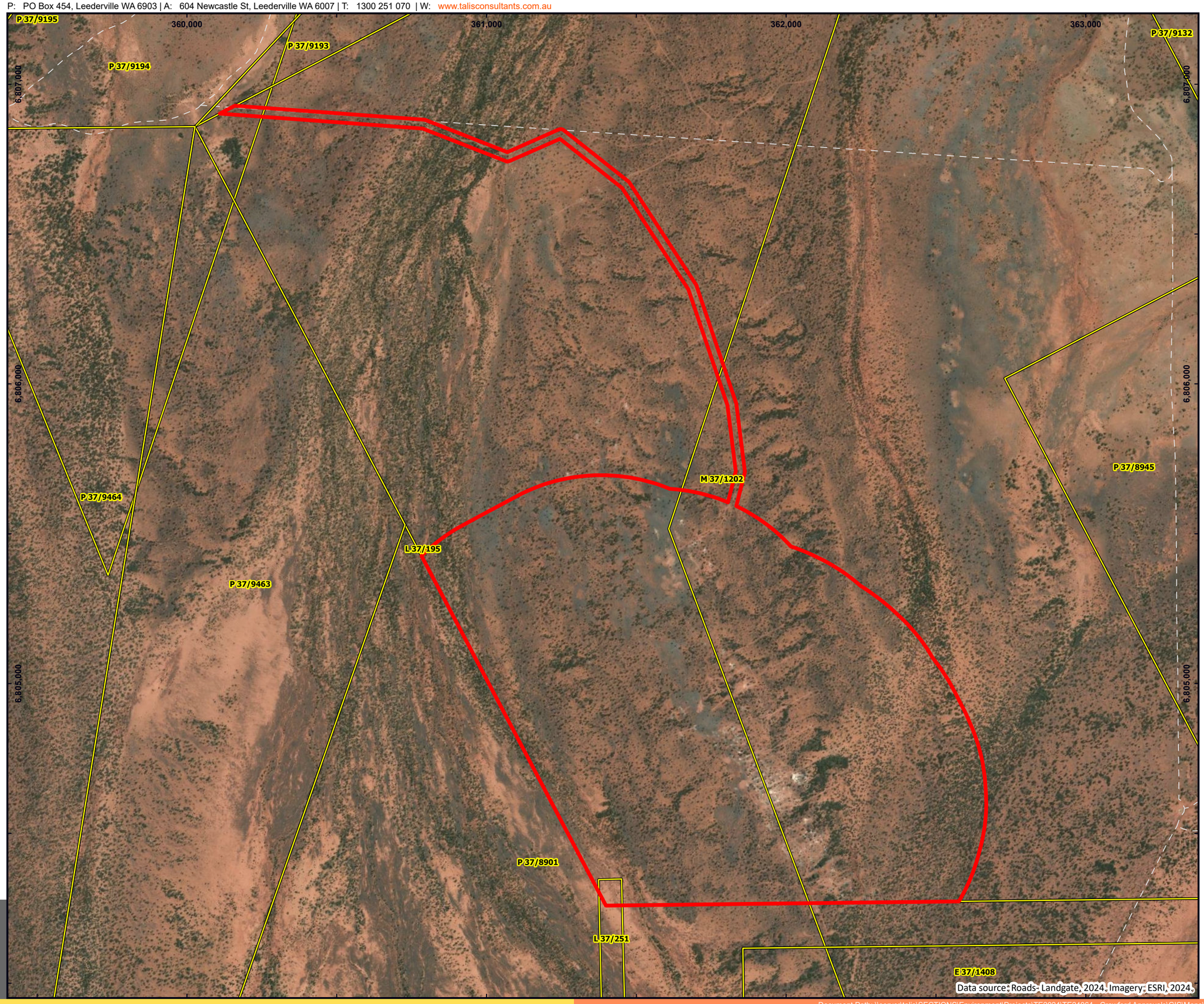

LEGEND

- Development Envelope
- Mining Tenements

Western Australian Roads

- Other

PROPOSAL TENEMENTS

Crawford Gold Project Approvals

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0 100 200 300 400 500 m

Coordinate System: GDA2020 MGA Zone 51
Scale @ A3: 1:12,000

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Figure 1-2

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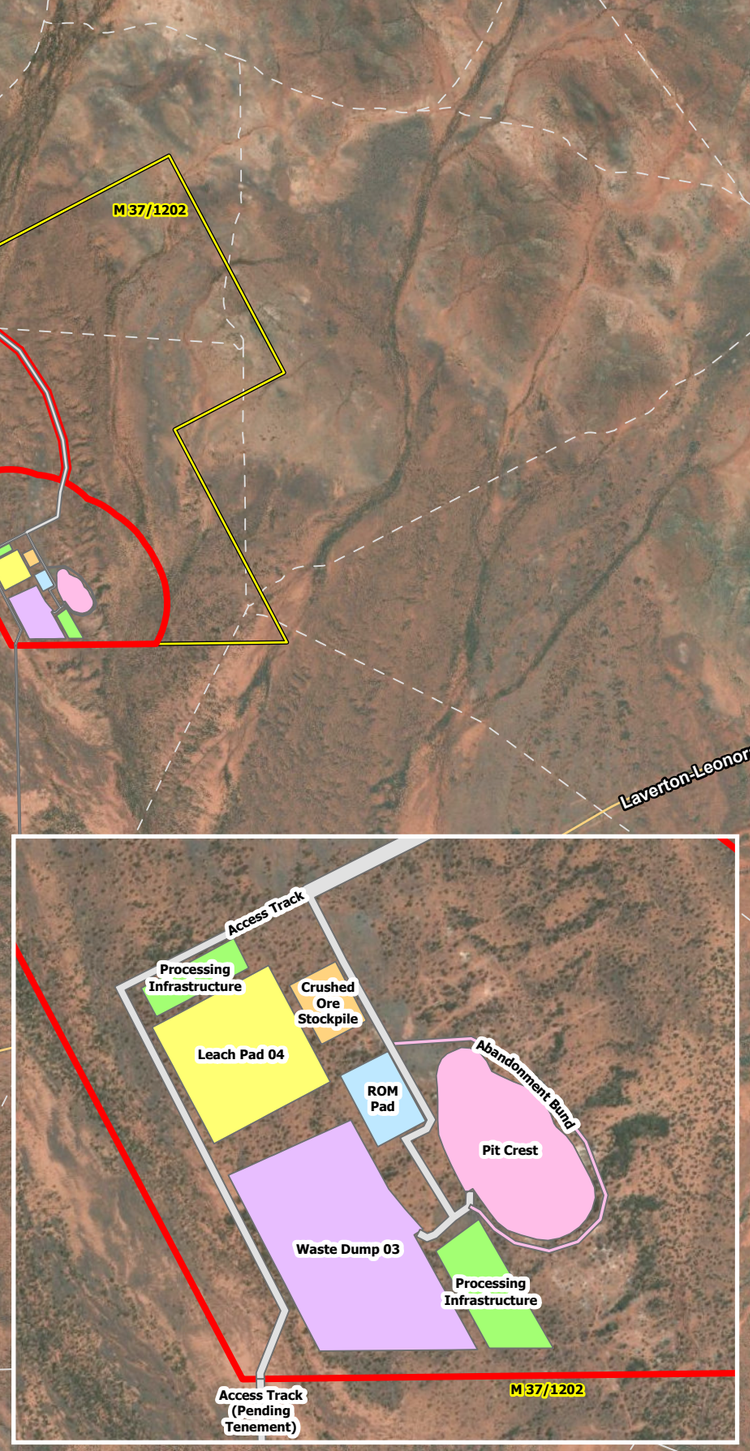
938,000 940,000 942,000 944,000 946,000 948,000 950,000 952,000

6,802,000 6,800,000 6,798,000 6,796,000 6,794,000 6,792,000 6,790,000

M 37/1202

Laverton-Leonora Rd

Laverton-Leonora Rd



Data source: Roads- Landgate, 2024. Mining Tenements - DEMIRS, 2024. Imagery: ESRI, 2024.

LEGEND

- Development Envelope
- Mining Tenement

Crawford Site Layout

Key Mining Activities

- Heap or vat leach facility
- Low grade ore stockpile (Class 1)
- Mining Void (with a depth of at least 5 metres) - above ground water level
- Plant site
- Run-of-Mine Pad
- Waste dump or overburden stockpile (Class1)

Other Mining Activities

- Transport or service infrastructure corridor
- Crawford Access Road (Outside Tenement)

Western Australian Roads

- Main Road
- Minor Road
- Other

LOCALITY

SITE LAYOUT

Crawford Gold Project Approvals

Cavalier Resources

N 0 500 1,000 1,500 2,000 m

Coordinate System: GDA2020 MGA Zone 51
Scale @ A3: 1:50,000

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Figure 1-3

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2 Site Overview

2.1 Climate

The Project is located in the Goldfields-Esperance region of Western Australia, approximately 25 km east of the town of Leonora. The local climate is classified as semi-arid, and is characterised by hot, dry summers and mild to warm winters with low and irregular rainfall. The region experiences significant temperature variations between day and night, and rainfall is usually sparse and unpredictable, often concentrated in short periods.

The monthly mean maximum temperatures range from 18.4°C in July to 37.0°C in January, while the mean minimum temperatures range from 6.1°C in July to 21.8°C in January (Figure 2-1). The annual mean minimum temperature is 14°C and the annual mean maximum temperature 27.9°C (BoM, 2024).

The mean rainfall at Leonora is lowest during September at 8.9mm and at highest during February at 30.9mm. Prevailing winds at the Project are easterly in the mornings (0900hrs) with an average speed of 9.8km/h (BoM, 2024). In the afternoons, direction varies by season, and varies between easterly and westerly.

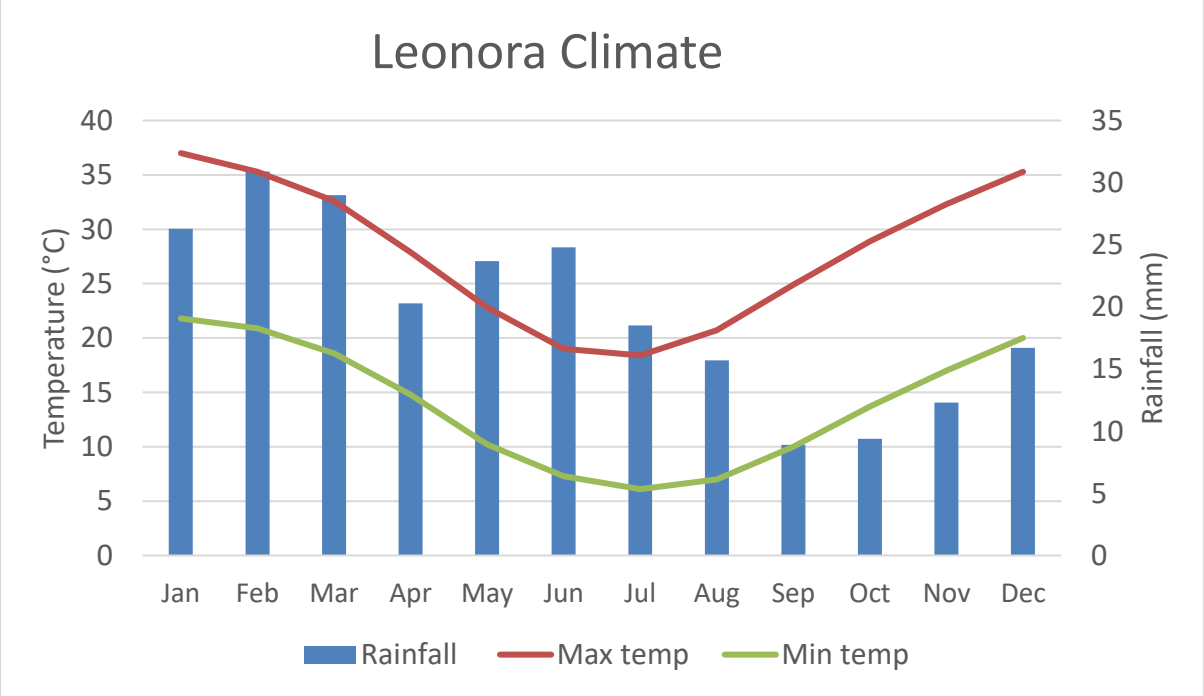

Figure 2-1: Leonora Climate

2.2 Topography

The elevation of the Project area varies moderately, featuring undulating terrain typical of the Eastern Goldfields. The relief is characterised by low hills and ridges interspersed with flat plains and shallow valleys. Elevation of the proposed site is generally between 380m and 390m above sea level (Figure 2-2). Small hills and ridges are prominent in the northern and eastern parts of the tenement, formed by weathered bedrock and ancient geological processes. Flat to gently undulating plains dominate the southern and central areas, composed of colluvial and alluvial deposits.

2.3 Interim Biogeographic Regionalisation of Australia (IBRA)

The Interim Biogeographic Regionalisation of Australia (IBRA) divides Australia into 89 bioregions based on major biological, geographical, and geological attributes. These bioregions are subdivided into 419 subregions as part of a refinement of the IBRA framework (Department of Climate Change, Energy, the Environment and Water, 2021).

The Project is located within IBRA Bioregion of Murchison (sub-region of Eastern Murchison) which is generally characterised by arid climate, with mainly winter rainfall. Landscapes comprise of low hills and mesas separated by flat colluvium and alluvial plains. Salt Lake systems are associated with the occluded paleodrainage system. Broad plains of red-brown soils and breakaway complexes as well as red sandplains are widespread. Vegetation is dominated by mulga woodlands and is often rich in ephemerals, hummock grasslands, saltbush shrublands (on calcareous soils) and Halosarcia shrublands. The Murchison region is one of the main pastoral areas in WA (ACRIS, 2008).

2.4 Soil Landscape Systems

Regional soil and land system information indicates the development envelope is situated within the Jundee and Mindura land systems. The Jundee land system is characterised by hardstone plains with ironstone gravel mantles typically supporting mulga shrublands, with a generally flat to slightly inclined relief. The Mindura land system is described as areas of low hills, ridges and granite outcrops with quartz-strewn interfluves and lower plains with wide drainage floors. The proposed disurbance footprint is located entirely within the Jundee land system.

2.4.1 Soil Characterisation

The surface soils from within the proposed disturbance areas typically have a sandy loam to clay loam texture, are ‘non-saline’, are ‘non-sodic’, have a relatively low propensity for clay dispersion, are generally free draining (‘moderate’ to ‘rapid’ hydraulic conductivity), and are typically low in organic carbon and plant-available nutrients (Mine Earth, 2024). All of the soils above the hardpan layer within the proposed disturbance areas are considered suitable for use as a rehabilitation resource.

The erodibility of the soils available within the proposed disturbance areas is likely to be relatively low, unless subject to concentrated surface water flow. Where the salvaged soils are utilised as a surface rehabilitation medium on the sloped batters of waste rock landforms, the soils will require ripping into underlying competent waste rock, to armour the surface and minimise erosion as far as practicable.

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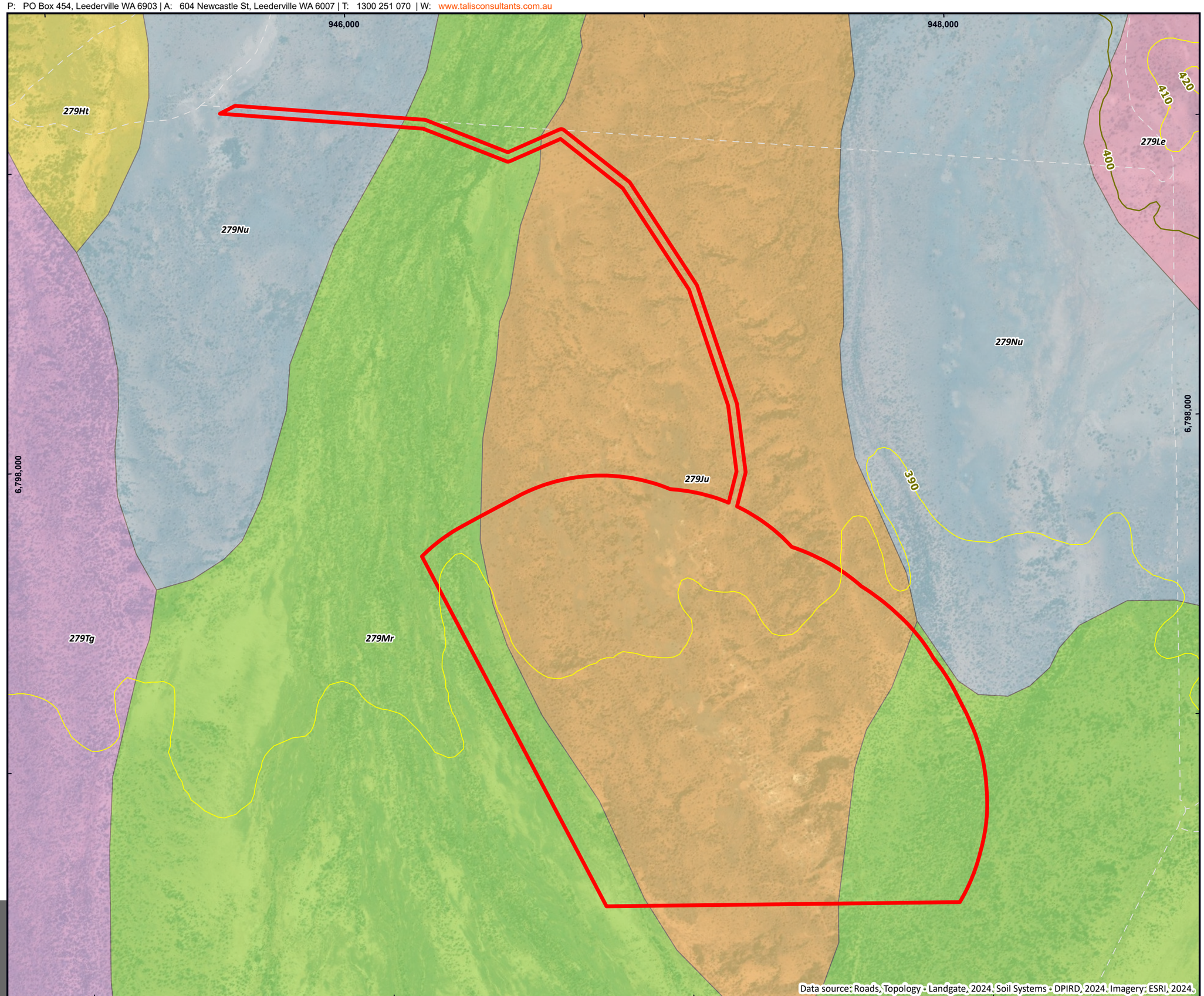


LEGEND

Development Envelope

Ground Surface Topography

Major Contour

Minor Contour

Soil Landscape Mapping - Systems

Hootanui System (279Ht): Breakaways, hills and ridges with saline gravelly and stony lower plains supporting scattered halophytic low shrublands.

Jundee System (279Ju): Hardpan plains with variable gravelly mantles and minor sandy banks supporting weakly groved mulga shrublands.

Leonora System (279Le): Low greenstone hills and stony plains supporting mixed chenopod shrublands.

Monitor System (279Mr): Distributary alluvial fans and wash plains supporting mulga - chenopod shrublands.

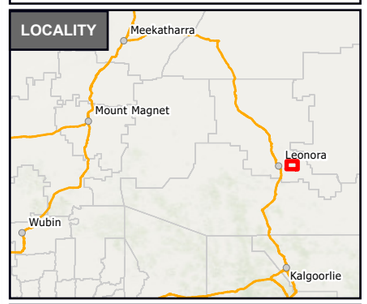
Nubev System (279Nu): Gently undulating stony plains, minor limonitic low rises and drainage floors supporting mulga and halophytic shrublands.

Tiger System (279Tg): Gravelly hardpan plains and sandy banks with mulga shrublands and wanderrie grasses.

Western Australian Roads

Other

LOCALITY



0 100 200 300 400 km

Data source: Roads, Topology - Landgate, 2024. Soil Systems - DPIRD, 2024. Imagery: ESRI, 2024.

LAND SYSTEMS & TOPOGRAPHY

Crawford Gold Project Approvals

Cavalier Resources

N

0 100 200 300 400 500 m

Coordinate System: GDA2020 MGA Zone 51
Scale @ A3: 1:12,000

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Figure 2-2

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2.5 Hydrology

2.5.1 Surface Water

The Project lies across an ephemeral creek which drains a catchment of approximately 120 km^2 north of the Project area and forms part of the Raeside-Ponton surface water catchment. The site is located near the middle of the catchment, 25-30km from the regional catchment divide to the north and 17-20km upstream from the Lake Raeside internal drainage system (Geowater, 2021). The elevation of the catchment is approximately 450 mAHD at the northern limit of the catchment and 390 mAHD at the Project site (JDA, 2024).

There is also a smaller ephemeral creek that passes through the Project site with a catchment of approximately 5 km^2 which joins the larger creek south of the site (JDA, 2024).

With limited data available on surface water flows, estimations have been created using hydrological models. It is assumed that flows through the Project area are broad and shallow with no well-defined creek lines (JDA, 2024).

The proposed mine layout includes development of a flood protection bund along the western edge of the facilities, to divert flows in high rainfall events, however as the mine life is only 1-2 years, risk of flood occurrence during the operation is reduced. A smaller bund may also be required to divert flows from the smaller ephemeral creek. Only low velocity is predicted, and scour protection is unlikely to be required (JDA, 2024).

Given the ephemeral nature of the creeks, no water quality data is available, however flows are likely to consist mainly of rainwater and is considered likely to be fresh rather than brackish or saline (JDA, 2024).

The surface water assessment undertaken by JDA in 2024 is included as Appendix A of this document.

2.5.2 Groundwater

Groundwater at the Crawford site occurs within saprolite and most of the proposed open-pit excavation will be restricted to the saprolite profile, with only the basal sections of the pit exposing a relatively thin saprock zone and the upper sections of fresh bedrock. The saprolite zone at Crawford would act more like an aquitard than an aquifer, with very low permeability and storage within the saturated zones.

The saprock zone of many Goldfields rock types can display low to moderate permeabilities with low storativity, that often act as a weak aquifer zone, which may be possible at Crawfords based on visual inspection of drill core photos from two diamond drill holes at the deposit.

Groundwater levels range from 12.4 – 13.2 m below ground. When adjusted to topography these levels correspond to 371.7 – 372.2 mAHD, and highlight a relatively uniform water table surface. No regional groundwater level data is available, but it is expected that groundwater levels decrease gradually to the south, creating a regional southerly flow direction towards the Lake Raeside drainage system.

The proposed pit will only intersect a limited amount of fresh bedrock and it is unlikely that this material will contribute any significant inflows to the pit.

Groundwater samples were collected in May 2021 by using a plastic bailer to collect water samples from close to the water table surface. Electrical conductivity (EC) values ranged from 3,640 – 8,220 uS/cm, which equate approximately to salinity levels of 2,200 – 4,900 mg/L. Groundwater salinity at Crawfords is brackish but has only been measured at shallow depths and it is possible that the salinity near the base of the pit may be higher, but it is interpreted to still be brackish. The groundwater is near-neutral with pH levels of 7.1 – 7.6 recorded.

2.6 Conservation Features

No significant conservation features are located within the proposed Project area. No Environmentally Sensitive Areas (ESA's), Threatened or Priority ecological communities are located within proximity to the Project.

3 Flora and Vegetation Assessment

A reconnaissance flora and vegetation survey was completed by Native Vegetation Solutions (NVS) for the Project in November 2020, with the report finalised in March 2021 (Appendix B). The survey covered the Mining Tenement M 37/1202 and the Prospecting Licence P 37/8901, which provided a total are for the survey of approximately 1,090 hectares (ha). The survey was carried out in accordance with the Environmental Factor Guideline – Flora and Vegetation (EPA, 2016) and the Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2016a). The reconnaissance survey had two components – a desktop literature review and a reconnaissance survey of the survey areas to:

- Verify the desktop survey;
- Define vegetation units present in the area;
- Search for species of conservation significance; and
- Determine potential sensitivity of flora and vegetation to impact.

The following section of this report summarises the findings of the flora and vegetation survey, and the results are then incorporated into the assessment against the 10 clearing principles In Section 6.

3.1 Desktop Assessment

A desktop assessment was undertaken by NVS prior to the field survey to identify relevant environmental information pertaining to the survey area and potential flora species expected to occur within the survey area. Searches of online databases, including the Department of Climate Change, Energy, the Environment and Water (DCCEEW) Protected Matters Search Tool, the Department of Biodiversity, Conservation and Attractions (DBCA) Threatened and Priority Flora Database, and the DWER Clearing Permit System (map viewer), were collated with data from previous flora and vegetation reports for the area.

3.1.1 Vegetation Assessment

3.1.1.1 *Broad Vegetation Types*

Mapping of pre-European broad vegetation within Western Australia was completed on a broad scale (1:1,000,000) by Beard (1976). These vegetation types were later re-assessed by Shepherd et. al (2002) with some larger vegetation units divided into smaller units. Together, this pre-European database contains a total of 819 vegetation types within Western Australia.

Two of Beard's pre-European vegetation associations are mapped within the survey area (Figure 3-1):

- 18 Low woodland; mulga (*Acacia aneura*)
- 39 Shrublands; mulga scrub

As shown in Table 3-1, the current extent of both vegetation associations 18 and 39 are above 30% of their pre-European extent at the State, IBRA subregion and Local Government Authority (LGA) levels. The national objectives and targets for biodiversity conservation recognise that the retention of 30% or more of the pre-clearing extent of a vegetation association is necessary if Australia's biological diversity is to be protected (NVS, 2021).

Table 3-1: Extents of vegetation associations mapped within the survey area

Vegetation Association	Scale	Pre- European extent (ha)	Current extent (ha)	Remaining (%)
18	State: WA	19,892,306	19,843,148	99.75
	IBRA Sub-region: Murchison (MUR01)	10,269,896	10,234,838	99.66
	LGA: Shire of Leonora	2,101,057	2,002,508	99.62
39	State: WA	6,613,567	6,602,578	99.83
	IBRA Sub-region: Murchison (MUR01)	711,328	701,934	98.68
	LGA: Shire of Leonora	252,141	245,994	97.56

Source: DBCA, 2024

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946,000

948,000

6,798,000

M 37/1202

Data source: Roads- Landgate, 2024. Imagery: ESRI, 2024.

LEGEND

Development Envelope

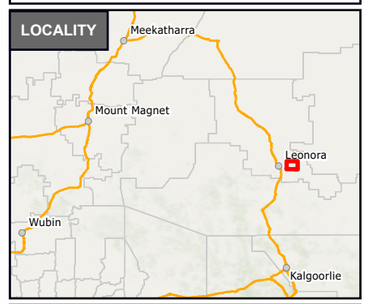
Vegetation Types

- Acacia aneura and Acacia burkittii shrubland on undulating hills
- Hakea preissi over Eremphila pantonii shrubland
- Mulga Shrubland- Drainage
- Open Mulga Shrubland

Western Australian Roads

- Other

LOCALITY



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VEGETATION TYPES

Crawford Gold Project Approvals

Cavalier Resources

N

0 100 200 300 400 500 m

Coordinate System: GDA2020 MGA Zone 51
Scale @ A3: 1:12,000

Prepared:	E Jackson	Date:	16/07/2024
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Figure 3-1

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3.1.2 Flora Assessment

3.1.2.1 *EPBC Act Protected Matters Search*

The EPBC Protected Matters Search tool did not return any records for threatened flora or suitable habitat for threatened flora within a 3 km buffer of the survey area.

There were no records for Environmentally Sensitive areas within 3 km of the survey area.

3.1.2.2 *Threatened Flora and Communities*

The DBCA database revealed no habitat for threatened flora species occurs in the survey area. Six priority flora species have the potential to occur within a 20km radius of the survey area, with the closest location 4.3 km north of the survey area. Table 3-2 summarises the priority flora species and the likelihood they could occur within the survey area.

Table 3-2: Potential for Priority Flora to occur in the survey area

Taxon	Status	Likelihood of occurring in the survey area
Acacia sp. Marshall Pool	P3	Possible – suitable habitat
Hemigenia exilis	P4	Possible – suitable habitat
Angianthus prostratus	P3	Unlikely – lack of suitable habitat
Cratystylis centralis	P3	Unlikely – lack of suitable habitat
Hybanthus floribundus subsp. *Chloroxanthus*	P3	Unlikely – lack of suitable habitat
Triglochin protuberans	P3	Unlikely – lack of suitable habitat

The DBCA database search did not have any records for Priority Ecological Communities (PEC), Threatened Ecological Communities (TEC) or Environmentally Sensitive Areas (ESA) within the survey area.

3.1.2.3 *Wetlands and Dieback*

There are no wetlands in the DWER Clearing Permit System in the survey area.

There is no record of Phytophthora cinnamomic establishing in areas receiving less than 400 mm rainfall per year (Dieback Working Group, 2000). The average rainfall in Leonora is 236.5 mm and therefore Dieback is not considered an issue in the area. However, weed hygiene practices are important in ensuring Dieback and other weed species do not establish in the area.

3.2 Field Survey Assessment

The NVS field survey was conducted on 9 November 2020 with survey methodology in accordance with the *Environmental Protection Authority (EPA) Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment*.

3.2.1 Vegetation Condition

The condition of the vegetation within the survey area was predominately recorded as Very Good. A section of vegetation in the north eastern corner of the survey area was recorded as Good, while a small area to the south of the survey area was recorded as degraded. The degradation is attributed to previous exploration activity (NVS, 2021) and it located within the Project site.

3.2.2 Vegetation Types

The field survey recorded a total of 15 Families, 26 Genera and 64 Species in the survey area. All vegetation identified is common and well represented in the Eastern Murchison subregion. Table 3-3 provides a summary of the four major vegetation groups that were found in the survey area.

Table 3-3: Vegetation Group Summary

Vegetation Group	Families	Genera	Species	Area (ha)	% of survey area
Hakea preissii over *Eremophila pantonii* shrubland	7	16	23	86.76	7.96
Acacia aneura and *Acacia burkittii* shrubland on undulating hills	11	13	24	25.67	2.35
Mulga shrubland – drainage	8	9	21	300.25	27.54
Open Mulga shrubland	12	17	30	677.39	62.14
Total	**15***	**26***	**64***	**1,090**	**100**

Source: NVS, 2021.
**Within total survey area (not sum of column)*

3.2.3 Vegetation and Flora of Conservation Significance

Based on results of the desktop assessment, and the dominant species and landform features observed in the field, no vegetation communities identified in the survey area were determined to be consistent with any TECs or PECs.

No Threatened flora species under either the Biodiversity Conservation Act 2016 or the EPBC Act were located within the survey area. No Priority Flora were located in the survey area.

3.2.4 Weeds

The desktop search using the EPBC Protected Matters search tool indicated the survey area may have suitable habitat for Ward's Weed (*Carrichtera annua*) and Buffel-grass (*Cenchrus ciliaris*).

Weed prevalence was recorded as low, and no non-native species were recorded during the field survey.

4 Fauna Assessment

A basic vertebrate fauna survey was undertaken by Terrestrial Ecosystems on tenements M 37/1202 and P 37/9801 in 2020/21 (an area of approximately 1,000 ha). The survey assessed the fauna habitat types present, identified the fauna species within the survey area during the field portion of the survey, and the potential for conservation significant fauna to occur within the survey area. It also included a risk assessment and discussed the potential environmental impacts of clearing vegetation. The following summary is based on the report provided by Terrestrial Ecosystems in 2021.

4.1 Desktop Assessment

A desktop assessment was undertaken prior to the field survey to identify relevant environmental information pertaining to the survey area and potential fauna species expected to occur within the survey area. Searches of online databases, such as *NatureMap* and EPBC Protected Matters Search Tool, were collated with data from previous fauna studies for the area. Terrestrial Ecosystems and other ecological consultancies have carried out an extensive number of surveys in the Leonora area and they were able to make use of this information in the desktop assessment. Terrestrial Ecosystems stated in their report for the Crawford Project that the available information provides a near complete list of the vertebrate species likely to be found in and around the Project area.

4.1.1 Vertebrate Fauna

Due to the number of surveys completed near the Project site, the list of birds, amphibians and mammals that could potentially be found in or near the Project area is extensive. For example, there have been 1,147 individual birds from 66 different species recorded in surveys around the Leonora area (Terrestrial Ecosystems, 2021). Appendix B of the Terrestrial Ecosystems fauna report contains the full list of vertebrate fauna recorded in the area (Appendix C of this report).

However, within the Leonora area and the Eastern Murchison IBRA sub-region, there are differences in vegetation type and therefore in fauna habitat types. The type of vegetation in the Project area combined with its lack of permanent water means a large proportion of the fauna that have been recorded in other surveys will not be present within the Project area.

4.2 Field Survey Assessment

A field assessment was carried out by Terrestrial Ecosystems on 9 November 2020 to assess fauna habitat types and condition in the Project area. The habitat structure, habitat condition, landform, soils, vegetation and time since last fire were all assessed on site. The site work also focussed on assessing the possibility that conservation significant fauna could be present in the Project area.

4.2.1 Habitat Types

There broad habitat types were recorded during the survey:

- Mulga woodland;
- Open Mulga woodland; and
- Shrubland.

There is also a small rocky ridge located on the eastern side of M 37/1202, which is approximately 1 km from the Project site.

The site assessment of the available fauna habitat indicated that there would be limited terrestrial vertebrate fauna in the Project site, as vegetation tended to be sparse and patchy with limited cover.

4.2.2 Conservation Significant Species

Based on both the desktop assessment and the site survey, it was determined that no threatened or priority species of fauna potentially occur in the Project site.

Table 4-1 contains the conservation significant fauna that were identified in the desktop assessment as potentially being present in the Project area and explains why there are unlikely to occur within the Project site.

Table 4-1: Assessment of potential presence of conservation significant fauna species

Species	DBCA Schedule/ Priority	EPBC Act Status	Comment on the potential presence
Night Parrot (*Pezoporus occidentalis*)	Critically Endangered	Endangered	Highly unlikely to be in the project area, due to a lack of suitable habitat. No mature spinifex hummocks (preferred nesting and roosting).
Malleefowl (*Leipoa ocellata*)	Vulnerable	Vulnerable	Highly unlikely to be in the project area, due to a lack of suitable habitat. Sparse vegetation not typical habitat for Malleefowl.
Grey Falcon *Falco hypoleucos*	Vulnerable	Vulnerable	Unlikely to occur in the project area as it is seldom seen in this area. Lack of substantive trees for habitat.
Chuditch *Dasyurus geoffroii*	Vulnerable	Vulnerable	Highly unlikely to be in the project area, due to a lack of suitable habitat. Project site is further north than typical distribution.
Princess Parrot *Polytelis alexandrae*	Priority 4	Vulnerable	Unlikely to occur in the project area as it is seldom seen in this area. Project site outside normal geographical distribution.
Mulgara *Dasycercus blythi*	Priority 4	-	Highly unlikely to be in the project area, due to a lack of suitable habitat.

Species	DBCA Schedule/ Priority	EPBC Act Status	Comment on the potential presence
Oriental Plover *Charadrius veredus*	Migratory	Migratory	Highly unlikely to be in the project area, due to a lack of suitable habitat. Not recorded in the area in other surveys.
Fork-tailed Swift *Apus pacificus*	Migratory	Migratory	May very infrequently be seen in the region, however, clearing vegetation is unlikely to impact on this aerial species. Rarely seen in the Goldfields.
Grey Wagtail *Motacilla cinereal*	Migratory	Migratory	Highly unlikely to be in the project area, due to a lack of suitable habitat. Preferred habitat contains freshwater.
Yellow Wagtail *Motacilla flava*	Migratory	Migratory	Highly unlikely to be in the project area, due to a lack of suitable habitat. No records of species in inland WA.
Peregrine Falcon *Falco peregrinus*	OS	-	May very infrequently be seen in the region, however, clearing vegetation is unlikely to impact on this aerial species.
Branchinella apophysata	Priority 1	-	Highly unlikely to be in the project area, due to a lack of suitable habitat. No salt lakes within Project site.
Long-tailed Dunnart *Sminthopsis longicaudata*	Priority 4	-	Improbable in the project area, but if present would be in the rocky outcrop on the eastern boundary. Outcrop is small and isolated, making it difficult for Long-tailed Dunnart to access.

Source: Terrestrial Ecosystems (2021)

4.2.3 Biodiversity Value

The fauna habitat types found within the survey area are abundant and in similar condition to adjacent areas (Terrestrial Ecosystems, 2021). As adjacent areas are more vegetated than the survey areas, the species represented at the Project site are likely to be a smaller representation of the surrounding areas. With the potentially small populations of fauna within the survey area and the sparse vegetation and lack of variance in habitat types, the Project is not expected to impact on biodiversity value or impact in a bioregional context. There are no expected impacts on fauna movement corridors or threatened ecological fauna communities or ecosystems.

4.2.4 Impacts from the Proposed Mining Activities

It is assumed there will be direct and indirect impacts (introduced fauna and weeds, dust, noise, vibration, light) from the proposed mining activities to the fauna communities that do reside within the Project area, however they are not expected to be significant in their scale. Environmental management measures to minimise Project impacts have been outlined in Section 5.

4.3 Subterranean Fauna Assessment

Given that mine pit excavation and groundwater drawdown may affect habitats of subterranean species such as troglofauna and stygofauna, Bennelongia Environmental Consultants was commissioned to complete a desktop review of the subterranean fauna occurrence in the Project area (Appendix D).

Bennelongia (2024) reviewed available information on potential subterranean habitats and previous records of subterranean species to appraise the likelihood of subterranean fauna occurring within or in the vicinity of the Project.

At least 43 different species were recorded from a 100 x 100 km search area, with 25 of these species having only been recorded from the search area. Copepods were the most diverse and unique group, with 11 species being restricted to the search area. Amphipods were the next most unique group, with 4 species restricted to the search area. The Raeside Palaeovalley contains highly prospective habitat for subterranean fauna.

While the Project is primarily in granitic geology, the ubiquity of surrounding stygofauna records suggests the Project may support stygofauna species. The impact area of the Project is small, and it is unlikely that stygofauna or troglofauna species would have a range encompassed by the Project impact area.

5 Environmental Management Measures

5.1 Avoid

The Project design minimises the clearing required within the development envelope and will utilise existing cleared areas where possible. Clearing activities will only be undertaken where it is absolutely necessary for the operations and/or progression of the Project.

5.2 Mitigation

The Proponent will develop an Environmental Management Plan which outline measures that minimise impacts of clearing while still allowing for safe and productive operations on site.

Details on key management measures committed to by the Proponent are outlined below:

- All clearing activities proposed will be undertaken in accordance with the site clearing permitting processes and in compliance with NVCP conditions;
- Areas to be cleared will be pegged and demarcated, then inspected to ensure the clearing boundary is within approved areas;
- All personnel working on site will be inducted on the need to minimise clearing of native vegetation where possible;
- Directional clearing will be implemented to ensure any fauna have an opportunity to relocate;
- No clearing will be conducted during windy conditions to reduce dust deposition on adjacent native vegetation; and
- Induction will address that there is no driving on unauthorised areas and off pre-cleared tracks.

5.3 Rehabilitation

Rehabilitation will be undertaken following closure of operations, in accordance with a Mine Closure Plan approved by DEMIRS.

An overview of general management measures that will be implemented to reduce the risk of poor or failed rehabilitation are listed below:

- Removal of approximately top 200-300 mm of soil as growth medium (topsoil) material to be stockpiled for use in rehabilitation;
- Topsoil stockpiles will not exceed 2 m in height;
- Where applicable, vegetation will be retained for reuse;
- Light ripping to break any surface crusting; and
- All hardstand areas of compacted soils will be deep ripped.

As the proposed Project life is only 1-2 years, no progressive rehabilitation is proposed.

6 Assessment Against the Ten Clearing Principles

Principle	Assessment	Outcome
Principle (a) – Native vegetation should not be cleared if it comprises a high level of biological diversity.	**Assessed Outcome:** Within the clearing area there are no threatened flora or threatened ecological communities. The flora and vegetation and vertebrate fauna surveys that were carried out for this project both show a relative lack of biological diversity within the surveyed area. The vegetation is comprised of four main types, all of which can be found in abundance outside the project area. There are no threatened or priority flora in the Project area and aside from the small rocky outcrop to the east (well outside the Project area) there are few habitat options for threatened or priority fauna species. Both the flora and fauna surveys state that the clearing associated with the Project will have very low impacts to the biodiversity value of the area. Therefore, the proposed clearing of 49.5 ha aligns with the requirements of this Principle.	**Not likely to be at variance with this principle**
Principle (b) – Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a significant habitat for fauna indigenous to Western Australia.	**Assessed Outcome:** Based on the gathered information (Section 4), none of the identified species in the proposed clearing area are considered solely dependent on any of the terrestrial habitat types identified. Disturbance within the proposed clearing area is unlikely to significantly impact any of the species listed due to the presence of similar habitat within the vicinity of the area. The Project area is not considered necessary for the maintenance of a significant habitat for fauna indigenous to Western Australia and therefore the proposed clearing of up to 49.5 ha aligns with the requirements of this Principle.	**Not likely to be at variance with this principle**

Principle	Assessment	Outcome
Principle (c) – Native vegetation should not be cleared if it includes, or is necessary for the continued existence of rare flora.	**Assessed Outcome:** No Threatened or Priority Flora were identified during the reconnaissance flora and vegetation survey. As such, the proposed clearing aligns with the requirements of this principle.	**Not likely to be at variance with this principle**
Principle (d) – Native vegetation should not be cleared if it comprises the whole or a part of or is necessary for the maintenance of a Threatened Ecological Community (TEC).	**Assessed Outcome:** No Threatened or Priority Ecological Communities were identified by NVS (2021) during the reconnaissance flora and vegetation survey. Given that there are no TECs or PECs present within the proposed clearing footprint, the clearing of up to 49.5 ha aligns with the requirements of this principle.	**Not likely to be at variance with this principle**

Principle	Assessment	Outcome
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.	**Assessed Outcome:** The development envelope falls within vegetation associations 18 and 39, as mapped by Beard and Burns (1976), both of which are dominated by Mulga (Acacia aneura). The EPA's Guidance Statement No. 33 has identified a minimum threshold of retention of 30% of pre-European extent of each community (Environmental Protection Authority, 2008). Vegetation Association 18 is well above this threshold, representation of this association within the Eastern Murchison sub-region and Shire of Leonora is 99.66 % and 99.62 %, respectively. Vegetation Association 39 is also well above the threshold at 98.68% for the Eastern Murchison sub-region and 97.56% for the Shire of Leonora. It is therefore unlikely that the proposed clearing will have any substantial impacts on the remaining extents of pre-European vegetation as Mulga shrubland is the predominant vegetation type in the area and while there is some pastoral and exploration disturbance, the remaining extent is significantly higher than the minimum threshold of 30%. The proposed clearing aligns with the requirements of this principle.	**Not likely to be at variance with this principle**
Principle (f) – Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.	**Assessed Outcome:** The Project is not located within any proclaimed Surface Water Areas (DWER, 2020) and there are no major fresh waterways or tributaries within the tenement. The DE lies across a larger ephemeral creek to the west and a smaller ephemeral creek to the east. The larger ephemeral creek drains a catchment of approximately 120 km^2 to the north of the DE, southwards towards Lake Raeside. The smaller creek has a catchment of approximately 5 km^2 which joins the larger creek south of the DE. Given the ephemeral nature of the local surface water features, and lack of major rivers and tributaries within the DE, the proposed clearing aligns with the requirements of this Principle.	**Not likely to be at variance with this principle**

Principle	Assessment	Outcome
Principle (g) – Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	**Assessed Outcome**: The (then) DER has defined land degradation as including the following (Department of Environment Regulation, 2014): • The clearing of vegetation; • Decline in vegetation condition; • Soil erosion and soil acidity (caused by wind and water erosion due to vegetation clearing); • Salinity; or • Waterlogging/flooding. The land use surrounding the Project is mostly undisturbed, except for existing roads, mining landforms and access tracks. While clearing of vegetation for mine site development will directly impact native vegetation, development plans for the Project have included measures to minimise and mitigate impacts to surface water and risk of sedimentation downstream. The works associated with the clearing are unlikely to cause appreciable land degradation that is different or more significant than what has already occurred within the Project tenements and the surrounding area to date. Therefore, the proposed clearing is unlikely to be at variance with this principle.	**Not likely to be at variance with this principle**
Principle (h) – Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.	**Assessed Outcome:** The Project is not located within or adjacent to any Environmentally Sensitive Areas (ESA). There are no reserves within or adjacent to the DE - the closest reserve being Goongarrie National Park, located approximately 110 km south of the tenement boundary. Due to the distance of the Project from significant conservation areas, the proposed clearing is not likely to be considered at variance with this Principle.	**Not likely to be at variance with this principle**

Principle	Assessment	Outcome
Principle (i) – Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.	**Assessed Outcome:** The DE has no major fresh waterways or tributaries within its boundary. Surface water channels are ephemeral and do not feature year-round baseflow. Drainage lines in the region are dry for most of the year, only flowing briefly immediately following significant rainfall. Groundwater sits at 12.4 – 13.2 m below ground level (Geowater, 2021) and there are no Public Drinking Water Source Areas within or in close proximity to the DE (the nearest is in the town of Leonora). The proposed clearing is unlikely to result in a deterioration in the quality of underground water. The lack of surface water features within the tenement and DE suggests there is little to no pathway for impacts to result from the proposed clearing, significantly reducing the likelihood of impacts to surface water quality.	**Not likely to be at variance with this principle**
Principle (j) – Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.	**Assessed Outcome:** The climate of the Project area is semi-arid with low and irregular rainfall. Although comprehensive flood modelling for the Project has not been completed, diversion channels are proposed to be installed to divert surface water flows away from mine infrastructure. Given the short life of the proposed mine, the relatively small footprint, and the arid climate, the incidence of flooding within the Project area is not considered likely to increase as a result of Project implementation. As such, the Project is not likely to be at variance with this principle.	**Not likely to be at variance with this principle**

7 Summary of Assessment

This assessment report covers approximately 49.5 ha of proposed native vegetation clearing for development of the Project and takes into account the proposed management measures outlined in Section 6.

Project implementation will not cause any disturbance to conservation significant flora or fauna species or their habitat, or any other significant conservation areas. There are no significant surface water features within the DE, which indicates that there will be minimal impact to surface water quality or flow. Significant impacts to groundwater resulting from Project implementation are also not anticipated.

As such, assessment of the proposed clearing in regard to the 10 clearing principles determined that the Project is unlikely to be at variance with any of the principles.

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APPENDIX A
Surface Water Assessment

Cavalier Resources Limited

Crawford Gold Project Leonora

Surface Water Management

June 2024

JDA Consultant Hydrologists

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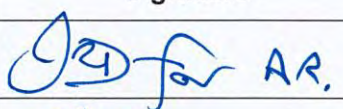
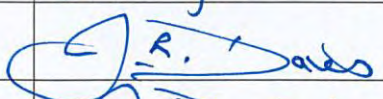
Author	Ajin Reji		7 June 2024
Checked by	Jim Davies		7 June 2024
Approved by	Jim Davies		7 June 2024

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1. INTRODUCTION

JDA was appointed by Cavalier Resources Ltd to prepare a surface water assessment for the proposed Crawford Gold Project located approximately 23 km east of the town of Leonora (Figure 1), consistent with DMIRS (2020a&b).

JDA staff have not visited the Study Area and this report is based on data provided by the Client or publicly available data.

A groundwater assessment has been prepared separately (Geowater Consulting, 2021).

2. CLIMATE

Leonora is located within the arid interior of Western Australia, and the climate is described as being semi-arid to arid. This is characterised as having low annual rainfall, high pan evaporation rates, and a large range in temperatures.

The nearest Bureau of Meteorology (BoM) weather stations with available rainfall data are Leonora (no. 12046) and Leonora Aero (no. 12241), both approximately 25 km distance from the Project. Rainfall data 1898 to 2013 at the Leonora station indicates an average annual rainfall of 236 mm with a similar average recorded at Leonora Aero 2008 to 2023. The minimum and maximum annual rainfalls recorded are 57.8 mm (1936) and 552.2 mm (1975), see Figure 2.

For individual storm events Figures 3 & 4 present Rainfall Intensity Frequency Duration (IFD) data for Leonora (BoM, 2024) for design storm durations between 1 minute and 168 hours up to 100yr ARI. The rainfall pattern is assumed to be spatially uniform across the catchment.

Ball et al (2019) recommend correction to IFDs depending on the design life of a project to allow for the impact of climate change. Given a projected mine life of 1 - 2 years no correction would be required, but would be required for mine closure.

3. CATCHMENT

The Project lies across an ephemeral creek which drains a catchment of approximately 120 km^2 north of the Project Area southwards towards Lake Raeside.

Based on available 10 m contours, the elevation of natural surface falls from approximately 450 mAHD at the northern limit of the catchment to 390 mAHD at the Project Area over a mainstream length of approximately 22 km giving an average gradient of 0.003, see Figures 5 & 6. A smaller ephemeral creek also passes through the Project Area with catchment of approximately 5 km^2 which joins the larger creek to the south of the mine site. The confluence of these two creeks is due south of the Project Area (Figure 6). The catchment vegetation appears to consist of sparse low bush and grasses (based on aerial photography).

The following sections estimate peak flow rates for the larger creek together with estimates of flow depths and velocities and advice on potential diversion of creek flows around the Project.

4. PEAK FLOW ESTIMATION

Guidance on peak flow estimation is provided in Australian Rainfall & Runoff, ARR 1987 (EA 1987) as revised in ARR&R 2019 (Ball et al, 2019). For this report ARR 1987 methods have been applied. JDA understands that ARR&R 2019 methods are under review by Engineers Australia for the remote areas of WA due to concerns about their reliability.

The Rational Method uses regionalisation techniques for estimating peak flows in ungauged catchments. Equations adopted for validation of the catchment for this method are from relationships derived from gauged catchments in the arid interior region of Western Australia (IEAust, 1987).

The Rational Method (IEAust 1987) formula can be described as:

$$Q_y = 0.278 . C_{10} (C_y / C_{10}). I_{Tc} . A$$

Where, Q_y is peak flow for an Average Recurrence Interval (ARI) of y years (m^3/s)

C_{10} is runoff coefficient for the 10 year ARI event

C_y is runoff coefficient for an ARI of y years from tabulated data in AR&R

I_{Tc} is rainfall intensity for duration Tc (mm/hr)

Tc is time to concentration (hours)

A is catchment area (km^2).

Time to concentration, Tc (hrs), is estimated from the following formula:

$$Tc = 0.76 . A^{0.38}$$

with A = 120 km^2, Tc is estimated as 4.7 hrs.

The 10 year runoff coefficient, C_{10}, is estimated from the following formula:

$C_{10} = 0.346 \, . \, L^{-0.42}$

where L is the mainstream length of the catchment.

For L = 22 km, $C_{10} = 0.094$

The peak flows for events 2, 5, 10, 20, 50 and 100 year ARI are estimated as shown in Table 1.

TABLE 1: PEAK FLOW ESTIMATION USING RATIONAL METHOD

ARI (Years)	Rainfall Intensity at Tc (mm/hr)	C_y / C_{10}	Peak Flow Estimate, Q_y (m^3/s)
2	4.81	0.34	5
5	7.51	0.70	17
10	11.99	1.00	31
20	14.76	1.28	49
50	18.51	1.62	80
100	21.57	1.91[1]	112

Note: 1. 100 year C_y / C_{10} coefficient extrapolated from 2 to 50 year data

5. HYDRAULIC FLOW ESTIMATION

Based on the 100 year ARI peak flow estimate of 112 m^3/s, Manning's flow equation has been used to approximate flow velocity and depth. It is assumed that the flow is broad, shallow sheet flow through the Project Area, with no well-defined, incised creek lines.

$Q = A.V$

where Q = flow rate (m^3/s), A is cross section of flow (m^2) and V = velocity (m/s).

Using Mannings equation:

$$\frac{V = R^{2/3} . S^{0.5}}{n}$$

where R = hydraulic radius (m), S = channel slope (m/m) and n = Mannings roughness coefficient.

Assuming flow width of 700 m, JDA calculates from the above equations for the 1% AEP flow of 112 m^3/s, assuming n = 0.05 and creek bed slope = 0.003:

Flow depth = 0.32 m

Average flow velocity = 0.5 m/s.

Local flow velocities may be twice the average flow velocity.

10 m contours on Figure 6 do not allow for the extent of the 100 yr ARI flood to be drawn.

6. PIT PROTECTION

6.1 Flood Protection Bund During Mine Operation

JDA understands the mine life is likely to be only 1 – 2 years, which reduces the risk of occurrence of flood events compared with a longer mine life.

The mine pit and associated facilities (crushed ore stockpile, Rom pad, waste dump, leach pad and processing infrastructure) may be affected by the floodplain of the large ephemeral creek in the southwest corner of the Project Site (Figure 7).

A flood protection bund may be required along the western edge of the facilities as indicated on Figure 7. A separate bund may be required on the eastern side of the pit associated with the smaller ephemeral creek (Figure 7). A freeboard of at least 0.5 m above the 100 yr flood level would be required for the bund.

More detailed survey of natural surface is required to assess flood protection bund locations and heights.

Due to the low catchment slope and associated flow velocity, it is unlikely that scour protection would be required for these flood protection bunds.

Bund compaction requirements should be assessed by a geotechnical engineer.

6.2 Abandonment Bund after Mine Closure

DoIR (1997) recommends safety bund to have a minimum height of 2 m, which exceeds the likely flood protection bund height. A flood protection bund could be constructed as part of the ultimate abandoned bund.

7. WATER QUALITY

There is no data on surface water salinity, but it is considered likely to be fresh rather than brackish or saline.

8. SUMMARY

In summary, the Project Area may be affected by inundation from the larger ephemeral creek to the west of the infrastructure and possibly the smaller ephemeral creek to the east, both of which may require flood protection bunds which could be constructed as part of the ultimate abandonment bund.

More detailed flood risk assessment should be conducted as mine design progresses, including:

- Survey of natural surface to determine extent of 100 yr ARI flooding.
- Use of survey to refine the need for and required extent of flood protection bunds.
- Assess impact of climate change on rainfall intensity and flood risk for mine closure.

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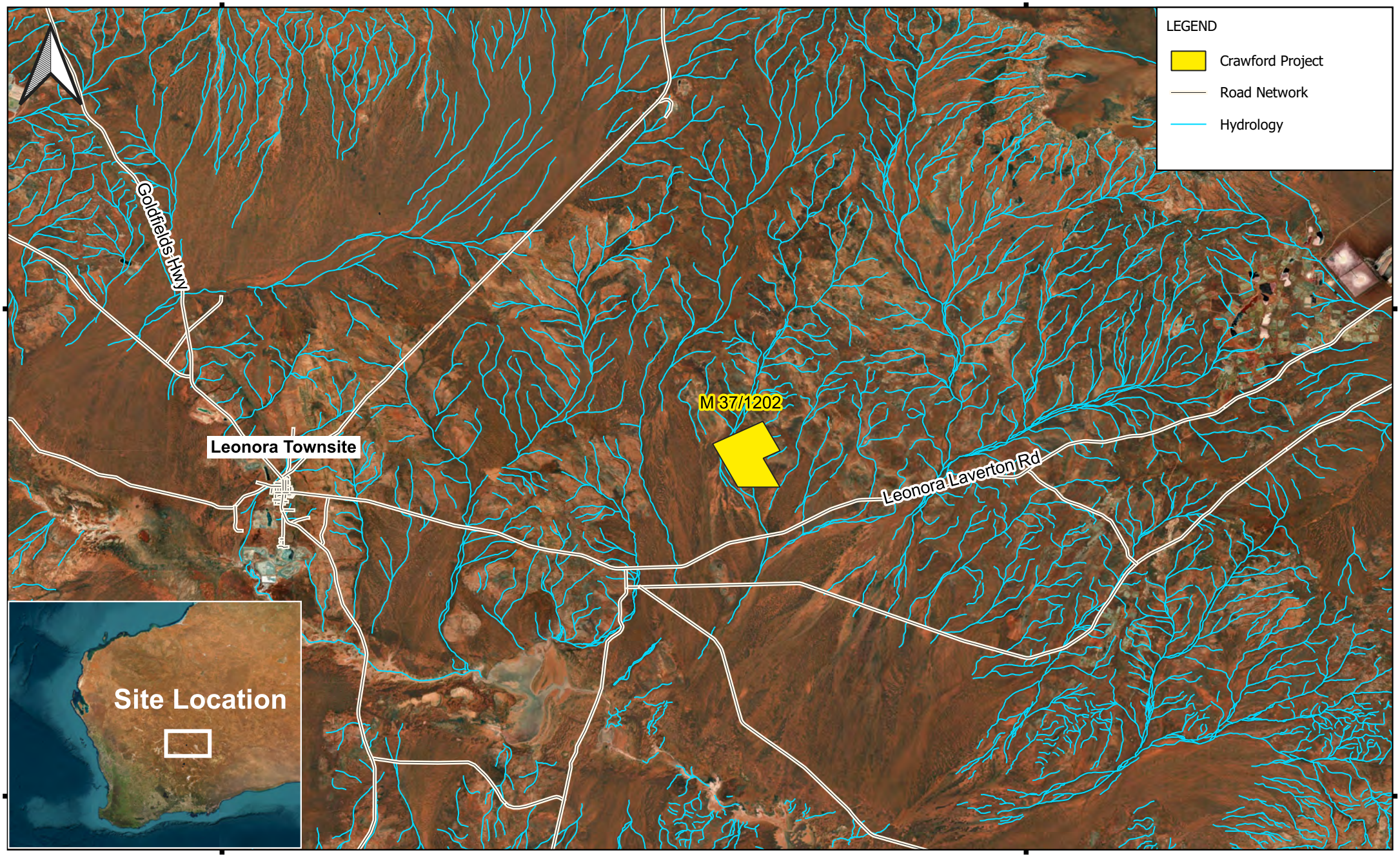
FIGURES



JDA

Scale 1:200000 at A4

0 2.5 5 km

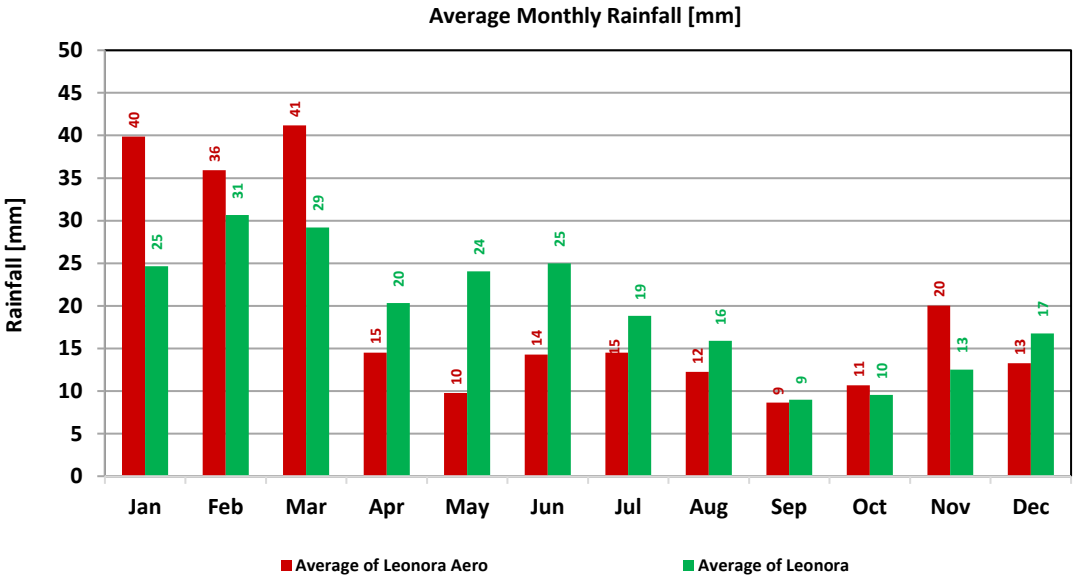
Job No: J7569

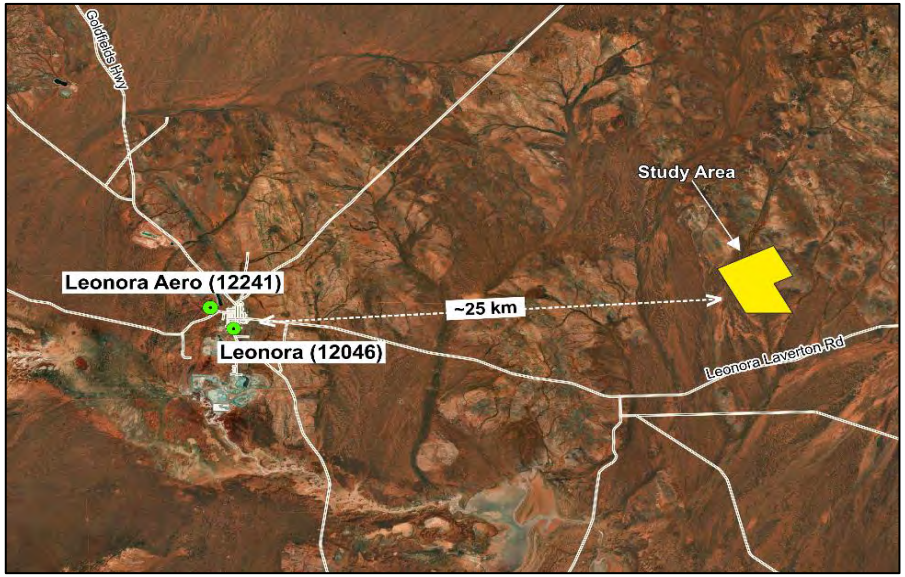
Data Source: Landgate, DMIRS

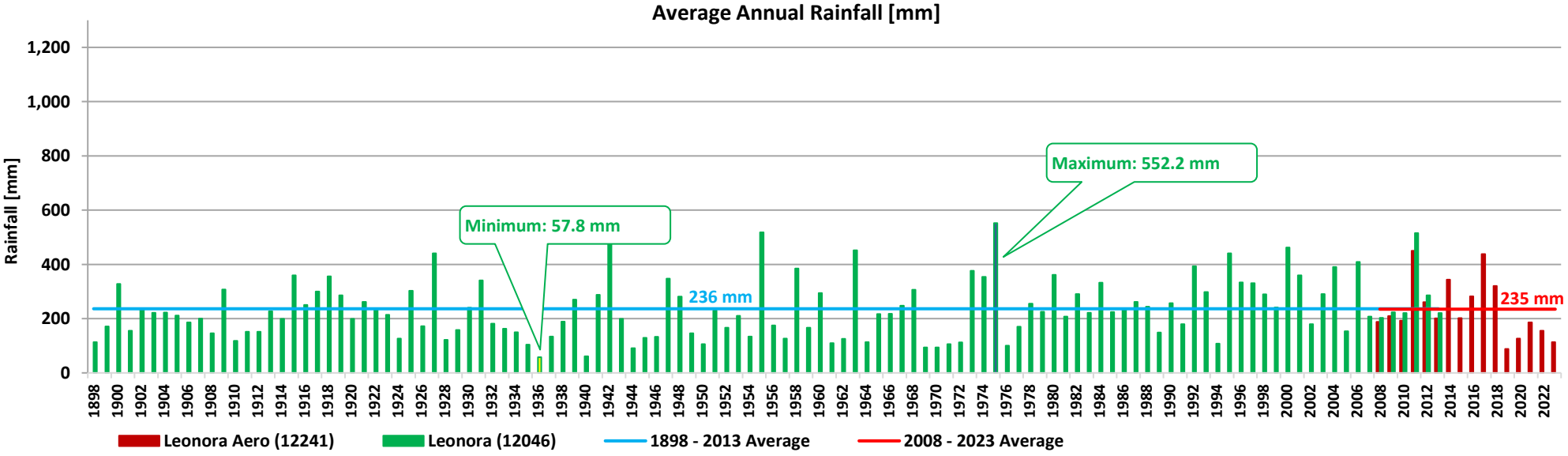
Cavalier Resources Limited

Crawford Gold Project Leonora

Figure 1: Location Plan







Data Source: BoM (2024) Climate Data Online - Leonora (12046) & Leonora Aero (12241)

Job No. J7569

Cavalier Resources Limited

Crawford Gold Project Leonora

Figure 2: Rainfall Data

Australian Government
Bureau of Meteorology

Location

Label: Not provided

Latitude: -28.8705 (Nearest grid cell: 28.8625 (S))

Longitude: 121.5755 (Nearest grid cell: 121.5875 (E))

IFD Design Rainfall Intensity (mm/h)

Issued: 23 May 2024

Rainfall intensity for Durations, Exceedance per Year (EY), and Annual Exceedance Probabilities (AEP).
FAQ for New ARR probability terminology

Unit: mm/h

	Annual Exceedance Probability (AEP)						
Duration	**63.2%**	**50%#**	**20%***	**10%**	**5%**	**2%**	**1%**
1 min	65.1	78.5	125	161	200	257	307
2 min	54.8	65.9	105	136	171	224	271
3 min	50.0	60.1	96.0	124	155	203	244
4 min	46.3	55.7	89.0	115	143	186	223
5 min	43.2	52.1	83.1	107	133	172	206
10 min	32.0	39.7	63.2	81.3	101	129	154
15 min	26.8	32.3	51.6	66.3	82.2	105	125
20 min	22.8	27.5	43.8	56.4	69.9	89.8	107
25 min	19.9	24.0	38.3	49.3	61.2	78.7	93.7
30 min	17.8	21.4	34.1	44.0	54.6	70.4	83.9
45 min	13.7	16.4	26.1	33.7	41.9	54.1	64.7
1 hour	11.3	13.5	21.4	27.6	34.4	44.6	53.4
1.5 hour	8.53	10.2	16.1	20.8	25.9	33.6	40.3
2 hour	7.00	8.37	13.2	17.0	21.1	27.4	32.9
3 hour	5.31	6.33	9.93	12.8	15.9	20.5	24.6
4.5 hour	4.04	4.81	7.51	9.63	11.9	15.4	18.4
6 hour	3.33	3.96	6.18	7.91	9.79	12.6	15.0
9 hour	2.54	3.02	4.70	6.01	7.43	9.51	11.3
12 hour	2.09	2.49	3.88	4.96	6.12	7.82	9.26
18 hour	1.58	1.89	2.95	3.77	4.66	5.95	7.04
24 hour	1.29	1.54	2.42	3.10	3.84	4.90	5.81
30 hour	1.09	1.31	2.07	2.65	3.29	4.22	5.00
36 hour	0.952	1.14	1.81	2.33	2.89	3.72	4.42
48 hour	0.758	0.911	1.45	1.88	2.35	3.04	3.63
72 hour	0.539	0.650	1.05	1.37	1.72	2.25	2.71
96 hour	0.416	0.503	0.816	1.07	1.35	1.78	2.16
120 hour	0.338	0.408	0.664	0.874	1.11	1.47	1.79
144 hour	0.284	0.343	0.557	0.736	0.937	1.24	1.51
168 hour	0.245	0.295	0.478	0.633	0.805	1.06	1.30

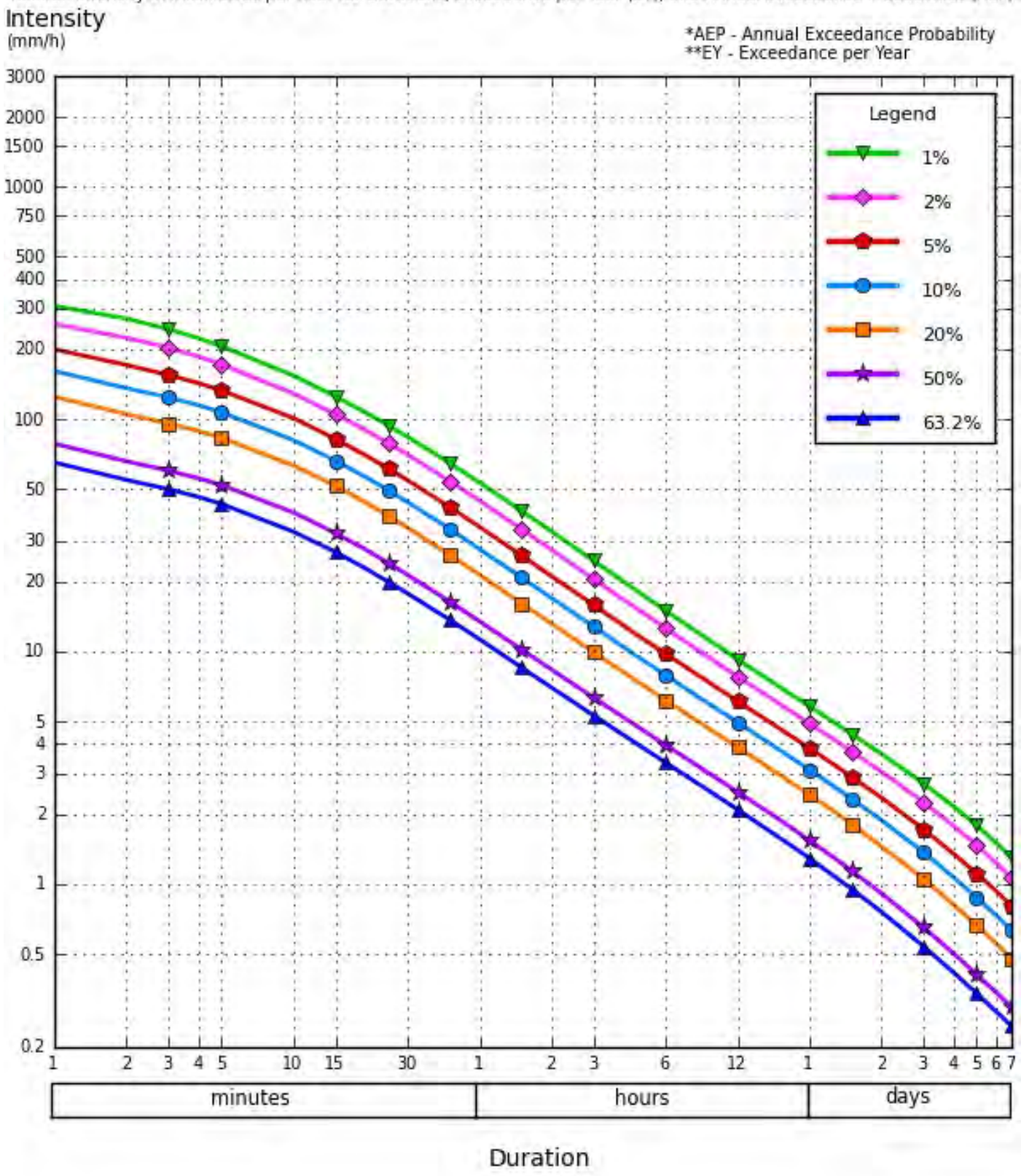
Note:
The 50% AEP IFD **does not** correspond to the 2 year Average Recurrence Interval (ARI) IFD. Rather it corresponds to the 1.44 ARI.
* The 20% AEP IFD **does not** correspond to the 5 year Average Recurrence Interval (ARI) IFD. Rather it corresponds to the 4.48 ARI.

Requested coordinate Latitude: -28.8705 Longitude: 121.5755
Nearest grid cell Latitude: 28.8625 (S) Longitude: 121.5875 (E)

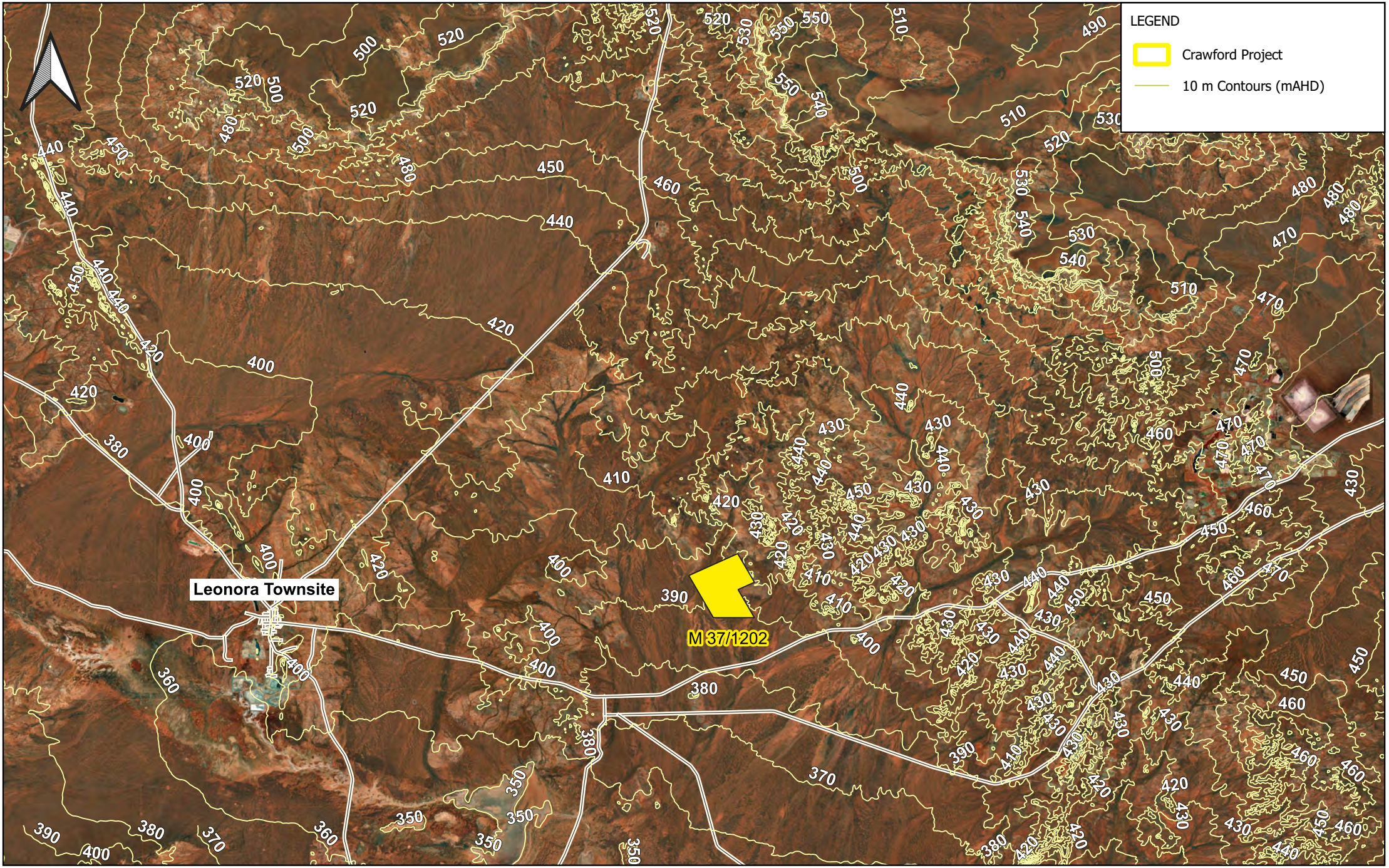
IFD Design Rainfall Intensity (mm/h)

Issued: 23 May 2024

Rainfall intensity in millimetres per hour for Durations, Exceedance per Year (EY), and Annual Exceedance Probabilities (AEP).



JDA	Job No: J7569 Data Source: Bureau of Meteorology (BoM) Design Rainfall Data System (2016)	Cavalier Resources Limited **Crawford Gold Project Leonora** **Figure 4: Leonora IFD Design Rainfall Intensity Chart**



JDA

Scale 1:200000 at A4

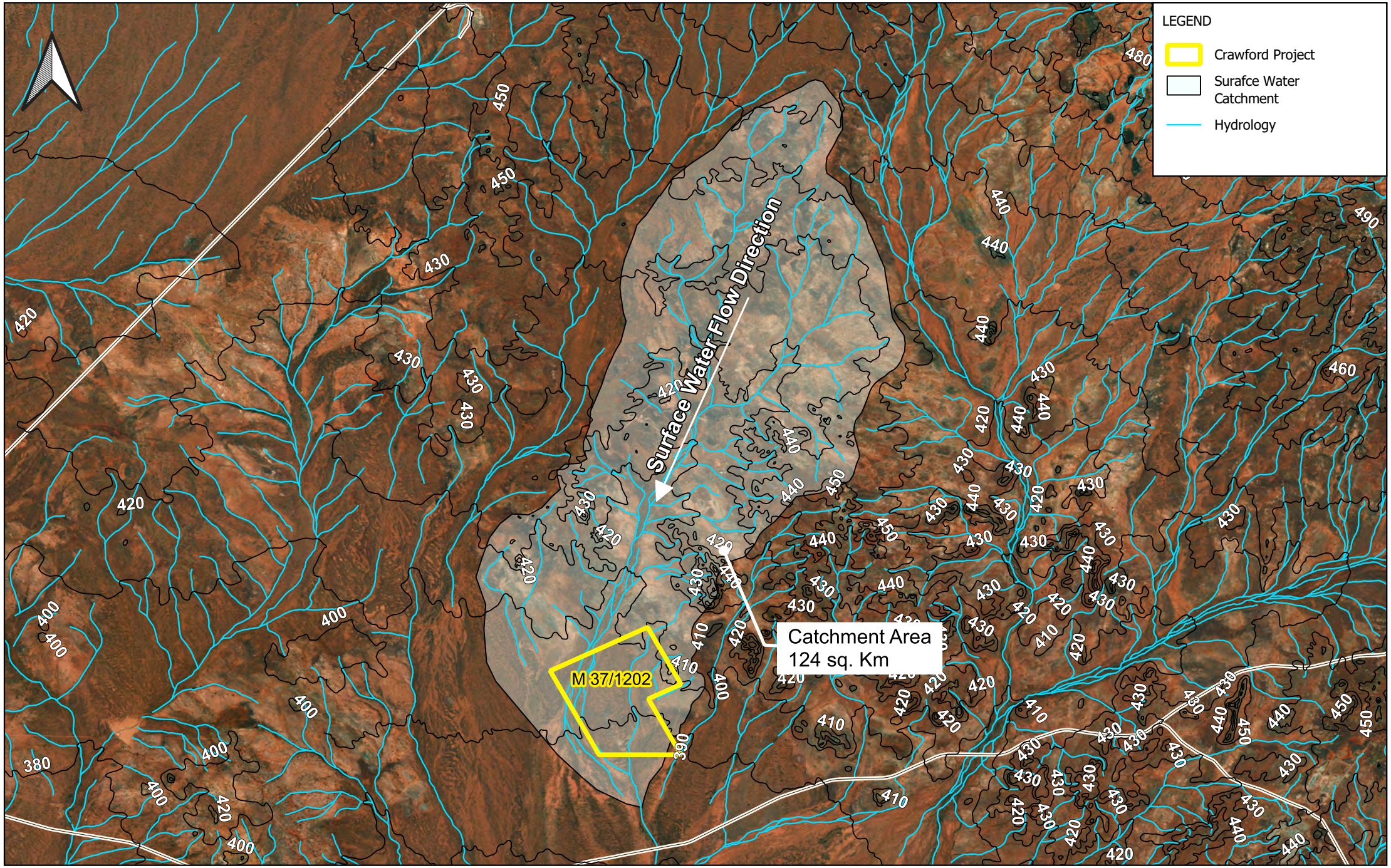
0 2.5 5 km

Job No: J7569
Data Source: Landgate

Cavalier Resources Limited

Crawford Gold Project Leonora

Figure 5: Land Contours



JDA

Scale 1:100000 at A4

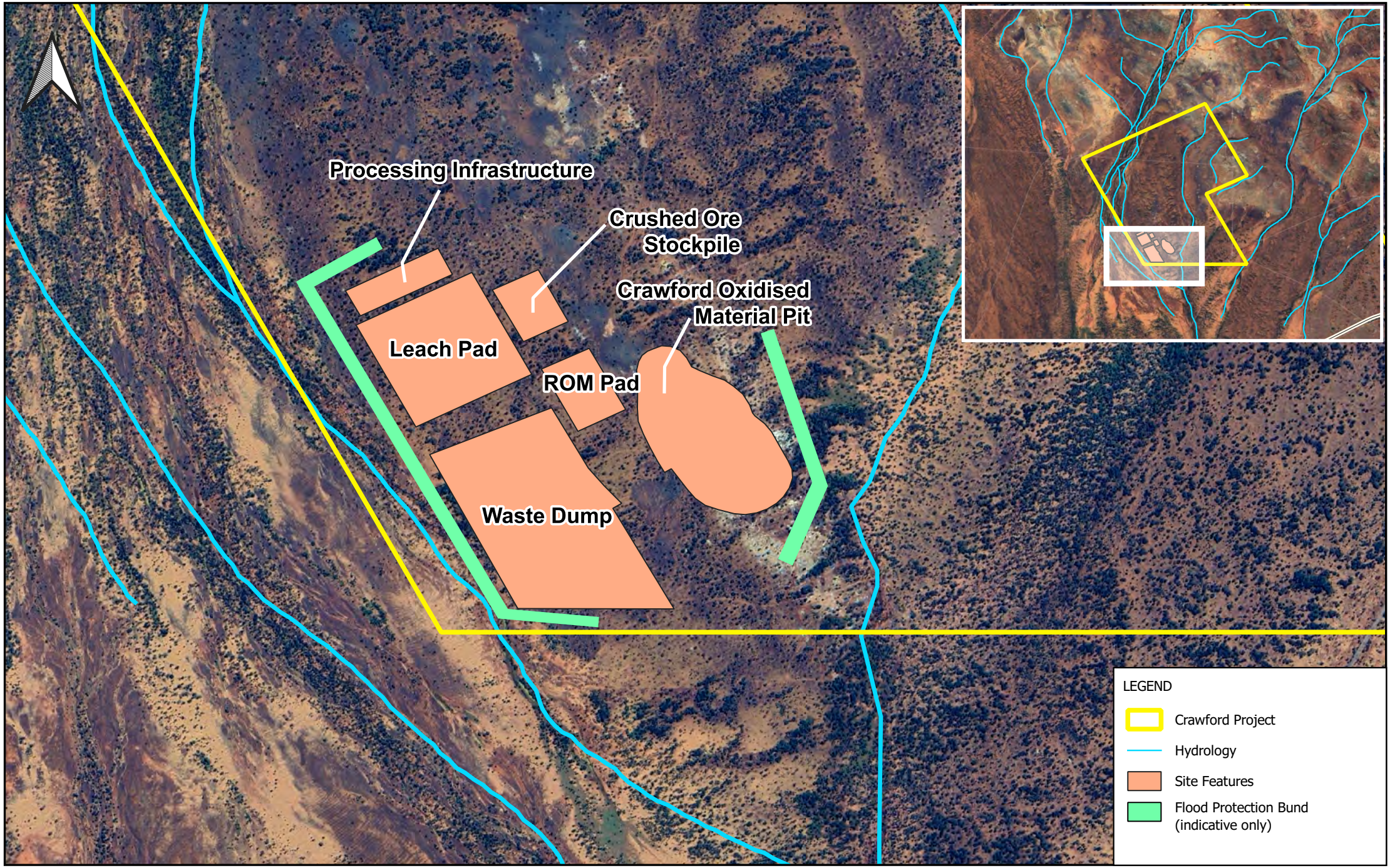
0 2.5 5 km

Job No: J7569
Data Source: Landgate, DMIRS

Cavalier Resources Limited

Crawford Gold Project Leonora

Figure 6: Catchment Area



JDA

Scale 1:7000 at A4

0 250 500 m

Job No: J7569
Data Source: Landgate, DMIRS

Cavalier Resources Limited

Crawford Gold Project Leonora

Figure 7: Flood Protection Bund

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APPENDIX B
Flora and Vegetation Survey

Reconnaissance Flora and Vegetation Survey of the Crawford Project- November 2020

Prepared for

Specrez Pty Ltd

FINAL V1.0
March 2021

Prepared by:
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Figures

Tables

1 INTRODUCTION

The Crawford Project area was acquired by Specrez Pty Ltd (SPL) in 2020. Native Vegetation Solutions (NVS) was commissioned by SPL to conduct a reconnaissance flora and vegetation survey of the Crawford Project area (survey area), within Mining Tenement M37/1202 and Prospecting License P37/8901.

The survey area (approximately 1,090 hectares) lies on the northern side of the Leonora-Laverton Road approximately 23km east of Leonora. The survey area also lies within the IBRA Murchison Region (MUR) of Western Australia (Figure 1).

Actual disturbance footprints were not defined prior to the survey field work; however, clearing required within the boundary of the survey area was anticipated to be less than the total survey area. This report will encompass results of the reconnaissance flora and vegetation survey within the Crawford Project survey area.

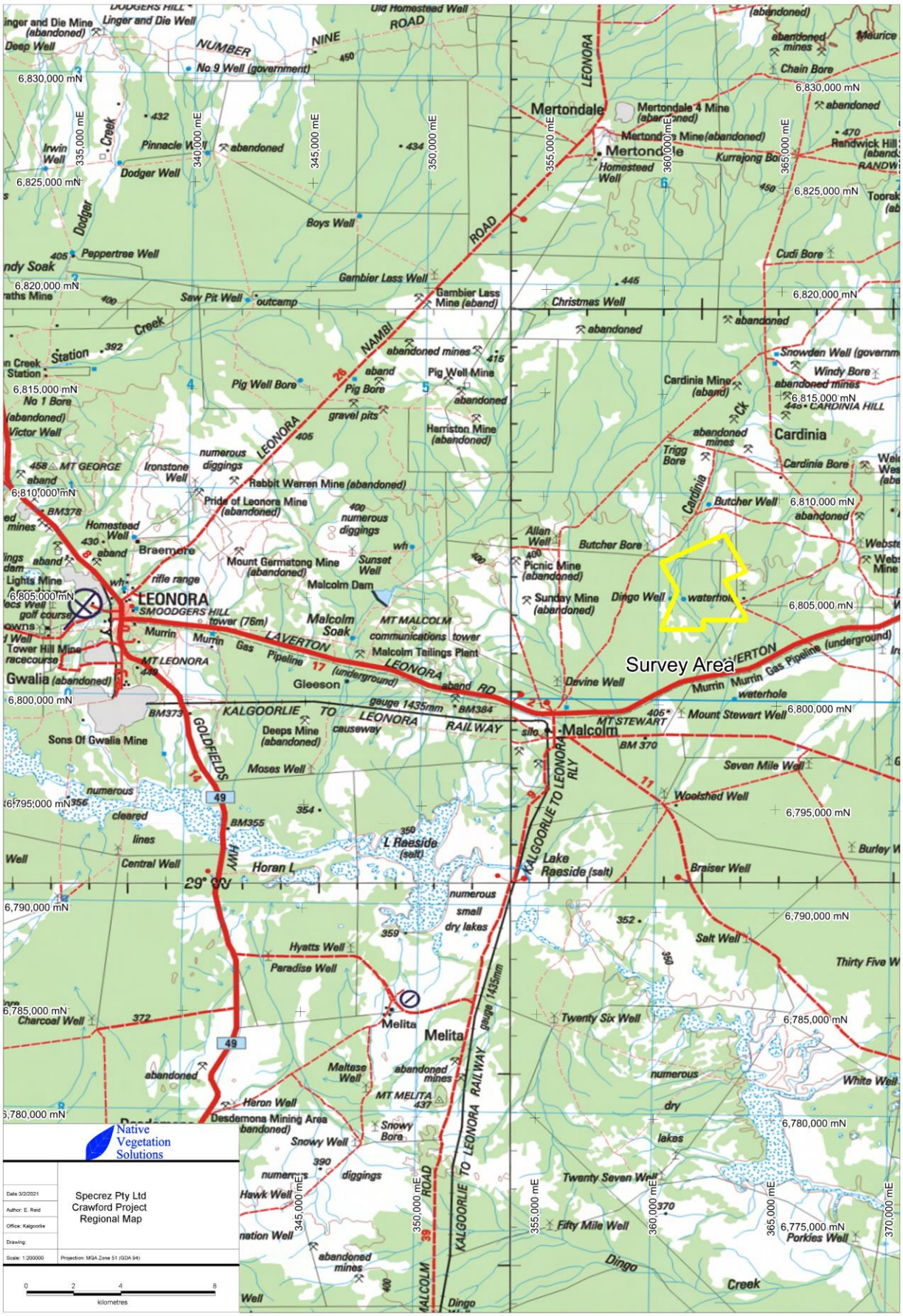

Figure 1: Regional map of survey location

1.1 Objectives

The objective of this report is to document the results of the flora and vegetation component of a reconnaissance assessment conducted in accordance with:

- *Environmental Factor Guideline- Flora and Vegetation* (EPA, 2016); and
- *Technical Guidance- Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA, 2016a).

A reconnaissance assessment has two components:

1). Desktop study which includes a literature review and a search of the relevant databases;
2). Reconnaissance survey of the survey area to verify the desktop survey, to define vegetation units present in the area, search for species of conservation significance and to determine potential sensitivity to impact.

As part of the reporting for the reconnaissance assessment, NVS has conducted a Flora and Vegetation Survey which includes broad-scale vegetation mapping and vegetation condition mapping of the survey area.

The scope of work for the reconnaissance flora and vegetation survey was to:

- conduct a desktop study that includes a literature review and search of the relevant databases;
- describe the vegetation associations in the survey area;
- prepare an inventory of species occurring in the survey area;
- identify any vegetation communities or flora species of conservation significance;
- Map broad-scale vegetation groups found within the survey area, including vegetation condition; and
- provide recommendations, including the management of perceived impacts to flora and vegetation within the survey area.

1.2 Geology and Vegetation

According to the Interim Biogeographic Regionalisation for Australia (IBRA, 2020), the survey area lies in the Murchison (MUR) IBRA bioregion within the Eastern Murchison (MUR01) subregion which totals over 21 million hectares (CALM, 2002). The MUR01 subregion comprises vegetation dominated by Mulga Woodlands often rich in ephemerals; hummock grasslands, saltbush shrublands and *Tecticornia* shrublands (CALM, 2002).

1.3 Climate

The arid climate of the MUR01 subregion generally relies on winter rainfall (CALM, 2002).

The rainfall that occurs during the autumn and early winter months of May to July tends to be more reliable, though generally of a lesser total amount than the less dependable, but more intense summer cyclonic rainfall from December to March.

The nearest official meteorological station to the survey area is located at Leonora, approximately 23 km west of the survey area. Recordings of the local climatic conditions commenced at Leonora in 1898 (BOM, 2021) and data collected at the stations 012046 and 12241 were used for this report.

1.3.1 Temperature

Mean annual minimum temperature at Leonora is 14°C and mean annual maximum temperature is 27.9°C. The coldest temperatures are attained in July (mean minimum temperature 6.1°C), the hottest is January (mean maximum temperature 37°C) and diurnal temperature variations are relatively consistent throughout the year (Figure 2).

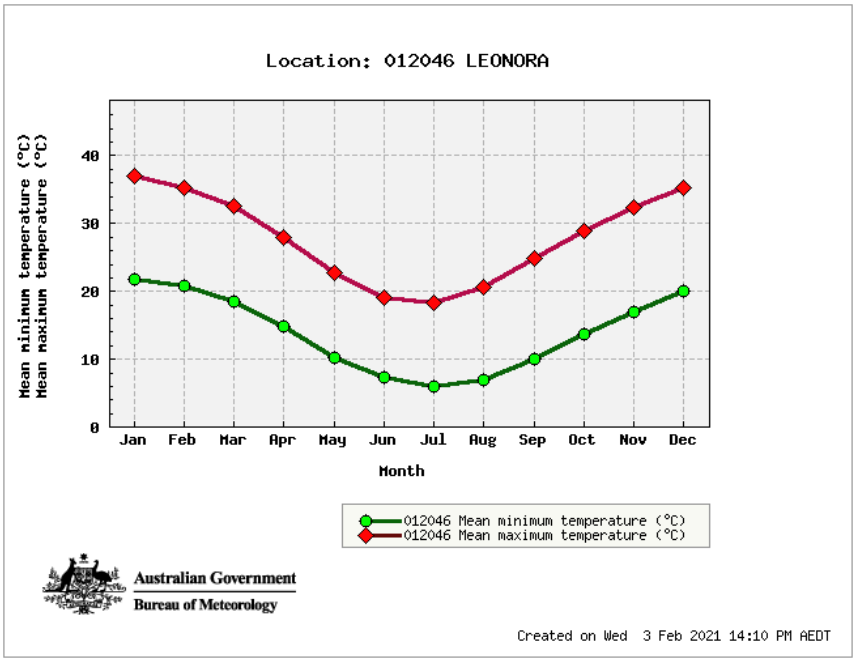

Figure 2: Mean temperature ranges for Leonora weather station

1.3.2 Rainfall

The annual average rainfall at Leonora is 236.5 mm, which falls (>1 mm) on an average of 28.9 days (BOM, 2021). Rainfall is relatively even throughout the year with slightly larger rainfall events occurring between the months of January and June (Figure 3). Prior to the survey in 2020, rainfall in January and March exceeded monthly averages, with January receiving more than double the average rainfall. All other months received below average rainfall (BOM, 2021).

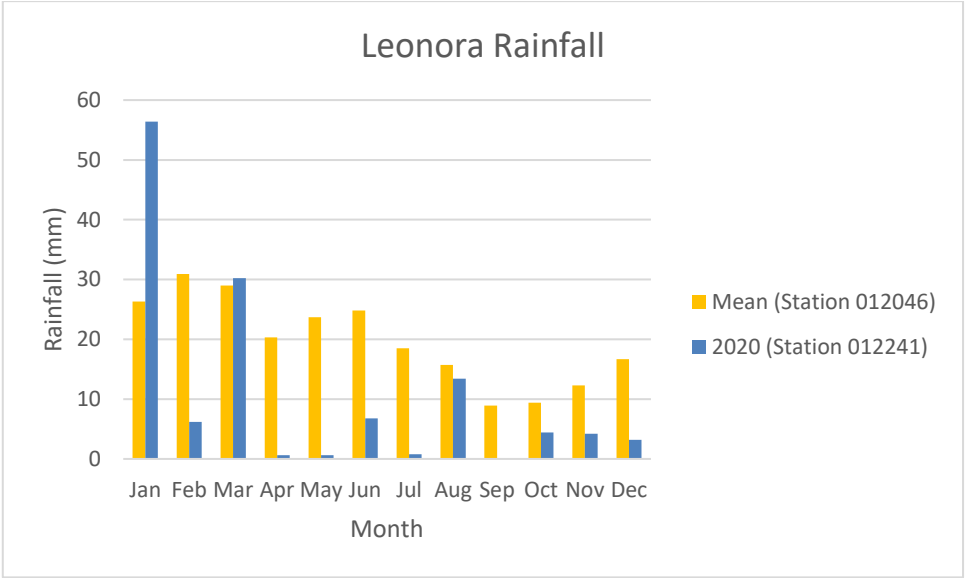

Figure 3: Monthly and mean rainfall for Leonora weather stations 2020

2. ASSESSMENT METHODOLOGY

2.1 Personnel and Reporting

The following personnel were involved in the Reconnaissance flora and vegetation survey:

- Mr Eren Reid (*BSc- Biological Science),* Principal Botanist, Native Vegetation Solutions, undertook the survey, vegetation mapping, data collation, field identification of flora, preparation and review of the report.

2.2 Preliminary Desktop Study

A preliminary assessment of the survey area and its potential constraints was undertaken by reviewing relevant government agency managed databases (Sections 2.2.1 to 2.2.6, and Appendices 1 & 2) and consulting with government agencies where necessary. The following sections provide a summary of desktop searches undertaken for the project.

2.2.1 *Environment Protection and Biodiversity Conservation Act* Protected Matters

The *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)* Protected Matters Search tool was utilised to provide results for matters of National Environmental Significance within the survey area using the survey area as the search criteria with a 1km buffer (DAWE, 2021).
(http://www.environment.gov.au/arcgis-framework/apps/pmst/pmst-coordinate.jsf)

2.2.2 Threatened Flora and Communities

The Threatened and Priority Flora Database managed by the Department of Biodiversity, Conservation and Attractions (DBCA) was searched for threatened and priority flora within a 20km radial area of the survey area.

The Threatened and Priority Ecological Communities (TECs and PECs) database was searched to determine the presence of PECs or TECs, with Geographic Information System (GIS) data supplied for assessment, within a 20km radial area of the survey area.

2.2.3 Environmentally Sensitive Areas (ESAs) and Conservation Reserves

The Department of Water and Environmental Regulation (DWER, 2021) Clearing Permit System Map Viewer was used to determine the location of any ESAs and Conservation Reserves (https://cps.der.wa.gov.au/main.html).

2.2.4 Vegetation Type, Extent and Status

Vegetation extent and status data was sourced from the Department of Agriculture and Food (DAFWA) report “Land-Use and Vegetation in Western Australia- National Land and Water Resources Audit Report” and its associated GIS file (Shepherd *et al*, 2002). This data comprises Beard’s Pre-European vegetation groups.

DBCA's Statewide Vegetation Statistics (DBCA, 2019) was also referenced for the current extent of Beard's Vegetation Groups.

2.2.5 Wetlands

The potential of wetlands within the project area was determined by examining DWER’s Clearing Permit System Map Viewer (DWER, 2021).

2.2.6 Dieback

Dieback is only considered a potential issue for the project if both the mean annual rainfall of the area is >400mm, and if the project area resides south of the 26th parallel (CALM, 2003).

2.3 Site Investigation

A site visit of the Crawford Project area was carried out by Botanist Eren Reid from Native Vegetation Solutions on 9th November 2020 to examine the flora and vegetation groups contained within the survey area. A total of 6 hours was spent on site traversing the survey area, by Yamaha Viking and on foot.

The survey was conducted in accordance with relevant EPA's Statements and Guidelines (Section 1.1).

The EPA uses the Interim Biogeographic Regionalisation of Australia (IBRA) as the largest unit for Environmental Impact Assessment decision making in relation to the conservation of biodiversity. Given the scale and nature of the proposed disturbance as well as the existing disturbance, and that the survey area is located within the Murchison (MUR) IBRA region, a reconnaissance flora and vegetation survey was deemed adequate.

2.3.1 Licenses

Field work was conducted under the following Scientific Licenses

- FB62000171, held by Mr Eren Reid with expiry 08/10/2022

2.3.2 Field Methods

Prior to the field work, the aerial photography was examined and representative sample sites for relevés were chosen to provide coverage over all viable vegetation groups.

In the field, these sites were visited and non-permanent 20 x 20m relevé sites established in appropriate locations, considering representativeness of the site to surrounding vegetation and vegetation boundaries. Relevé sites are represented in Appendix 4.

Each relevé site was captured on a TwoNav Aventura GPS at ±4m accuracy, using Universal Transverse Mercator location on GDA94 datum. Digital photographs were taken of each representative vegetation group present in the survey area.

Data collected at each relevé included:

- Photograph of representative vegetation group:
- GPS Location:
- Species Present;
- Population Count/Estimate of Conservation Significant Flora (if present);
- Disturbance Level; and
- Vegetation Condition

Specimens of taxa not recognised by the Botanists were collected and pressed along with specimens of taxa recognised as, or thought to be, conservation-significant species.

The vegetation structure was assessed using the method developed by Muir (1977). Definitions of the vegetation structure are presented in Appendix 3.

The condition of each relevé was assessed using the method developed by Keighery (1994). Definitions of the condition scale are presented in Appendix 3.

Vegetation groups were mapped (section 2.4.4 below).

Opportunistic sampling of plant taxa and vegetation group mapping was also utilised in the survey area between relevé sampling points, via wandering traverses. Smaller singular relevé sites were also utilised as opportunistic sample sites to collect flora specimens and assist in mapping vegetation groups.

All sample sites and GPS tracks are included in Appendix 4.

2.3.3 Post-Field Methods

Unknown specimens collected in the field were identified post field work by Eren Reid with reference to published keys, NVS' reference herbarium and information published on Florabase (WAHERB, 2021).

Species information was transferred into Microsoft Excel® worksheets representing presence/absence of species per vegetation group.

2.3.4 Mapping

Vegetation mapping was produced via GPS recorded information in the field, cross-referenced with vegetation descriptions made in the field, overlaid on aerial imagery of the survey area. The GPS utilized (TwoNav Aventura GPS) displayed aerial imagery, hence real-time mapping of vegetation groups was available during field work.

Vegetation Health Condition was assessed in the field with reference to Keighery (1994).

GPS tracks and waypoints recorded during field work are presented in Appendix 4.

2.3.5 IBSA Data Package

The Environmental Protection Authority (EPA), Department of Water and Environmental Regulation (DWER) and Department of Mines, Industry Regulation and Safety (DMIRS) require Index of Biodiversity Surveys for Assessments (IBSA) Data Packages to be submitted to support assessment and compliance under the *Environmental Protection Act 1986.*

An IBSA data package is a single file in .zip format, containing:

- one **Metadata and Licensing Statement** in .pdf format;
- one **survey report** in .pdf format;
- one **plain-text survey report** in .txt format; and
- a set of electronic data files, comprising:
    - one **survey details** spatial dataset in shapefile (.shp, etc.) or MapInfo (.tab, etc.) format; and
    - one or more **survey data** spatial datasets, as required, in shapefile (.shp, etc.) or MapInfo (.tab, etc.) format.

The information above has been supplied as a separate file to the client.

2.4 Limitations

Table 1 lists potential limitations that may have affected the survey. As shown, this survey was not limited by any factors listed below.

Table 1: List of potential survey limitations

Potential Limitations	Constraint (Y/N)	Comment
Competency and experience of the consultants undertaking the survey	N	Mr Eren Reid is an experienced botanist who has conducted many flora and vegetation surveys in the Goldfields, Murchison and South-west regions of WA.
Proportion of flora identified during survey	N	As the survey was planned to target species of conservation significance and flora within a known survey area, a complete census of the species present was attempted (Approx. 95%). Sufficient identifications were made to allow vegetation descriptions to be made.
Sources of information	N	Threatened and Priority Flora GIS information was available from DBCA.
Proportion of the task achieved	N	All tasks completed
Timing/Season	N	The targeted survey was conducted in Spring 2020. Conditions were slightly dry due to the lack of rain, however, enough flowering material of perennial plants was available for identification purposes.
Disturbance in survey area	N	Disturbance was present in the form of historic exploration.
Intensity of survey effort	N	Transects were walked through the survey area with all parts visited
Resources	N	Adequate resources were available
Access problems	N	No problems with access
Availability of contextual information on the region	N	Information on the Murchison (MUR) Bioregion is readily available.

3. RESULTS

3.1 Preliminary Desktop Assessment

3.1.1 EPBC Act Protected Matters

The EPBC Protected Matters search tool revealed no Threatened flora or suitable habitat for Threatened flora within a 3km buffer of the survey area, and no Environmentally Sensitive areas within 3 km of the survey area (DAWE, 2021).

The search results also indicated the survey area may contain suitable habitat for the weed species *Carrichtera annua* (Ward's Weed) and *Cenchrus ciliaris* (Buffel-grass) (DAWE, 2021).

3.1.2 Threatened Flora and Communities

The DBCA database searches revealed a potential for no Threatened and six Priority Flora species to occur within a 20km radius of the survey area (DBCA, 2020a). No known locations of these Flora occur within the survey area, while the closest location occurring approximately 4.3 km north of the survey area.

Results of the threatened flora database search are included in Appendix 2, which also reveals the likelihood of each species to occur in the survey area.

The PEC/TEC search (DBCA, 2020) revealed that there are no TECs or PECs in the survey area.

3.1.3 Environmentally Sensitive Areas and Conservation Reserves

No ESA's are located within the survey area (DWER, 2021 and DAWE, 2021).

3.1.4 Vegetation Type, Extent and Status

Two vegetation units defined by Beard (1990) were identified as part of the desktop assessment. The vegetation units identify the Pre-European extent of vegetation, as mapped by Beard (1990).

Information relating to known Beard (1990) vegetation units within the survey area has been summarised in Table 2 and Table 3 below. This information has been compiled through both desktop assessments and the site visit.

Table 2: Summary of information regarding Pre-European and current vegetation extent of Vegetation Association 18 within the survey area

Factor	Value				
Beard Vegetation Association*	18				
Vegetation Association Description*	Low woodland; mulga (*Acacia aneura*)				
Pre-European Extent (ha)	Scale				
	By Association *(WA)*	***By Association*** *(WA)*	***By IBRA Region*** *(MUR)*	***By IBRA Sub-region*** *(MUR01)*	***By Shire*** *(Shire of Leonora)*
	22,029,557 *	19,892,306**	12,403,172**	10,269,896**	2,010,057**
% Pre-European Extent Remaining	*100.00%**	*99.75%***	*99.68%***	*99.66%***	*99.62%***
Surrounding Land Use***	Mining, Exploration, Pastoral Lease				
Weed prevalence***	Low				

* Source: Shepherd *et al.* (2002) Appendix 2
**Source: DBCA, (2019)
***Source: Field Assessment

Table 3: Summary of information regarding Pre-European and current vegetation extent of Vegetation Association 39 within the survey area

Factor	Value				
Beard Vegetation Association*	39				
Vegetation Association Description*	Shrublands; mulga scrub				
Pre-European Extent (ha)	Scale				
	By Association *(WA)*	***By Association*** *(WA)*	***By IBRA Region*** *(MUR)*	***By IBRA Sub-region*** *(MUR01)*	***By Shire*** *(Shire of Leonora)*
	4,856,768*	6,613,567**	1,148,400**	711,328**	252,141**
% Pre-European Extent Remaining	*100.00%**	*99.83%***	*99.10%***	*98.68%***	*97.56%***
Surrounding Land Use***	Mining, Exploration, Pastoral Lease				
Weed prevalence***	Low				

* Source: Shepherd *et al.* (2002) Appendix 2
**Source: DBCA, (2019)
***Source: Field Assessment

The national objectives and targets for biodiversity conservation recognise that the retention of 30% or more of the pre-clearing extent of a vegetation association is necessary if Australia's biological diversity is to be protected. Beard vegetation associations 18 and 39 are above the 30% threshold at a State, bioregional and subregional level.

3.1.5 Wetlands

No wetlands recorded on the DWER Clearing Permit System Map Viewer occur within the survey area (DWER, 2021).

3.1.6 Dieback

The survey area lies south of the 26th parallel, however receives average annual rainfall of 236.5 mm, below the 400mm threshold mark. There is no record of *Phytophthora cinnamomi* establishing in natural ecosystems in regions receiving <400mm rainfall per annum (CALM, 2003). Therefore, Dieback is not considered an issue for this survey area, however all measures should be taken to prevent any possible soil contamination (seeds of non-native species *etc*.) which poses a risk in the survey area during seasonally favourable conditions.

3.2 Field Assessment

3.2.1 Threatened Flora

No flora located in the survey area, are gazetted as Threatened pursuant to Section 5(1) of the *Biodiversity Conservation Act 2016*. No plant taxa listed as Threatened pursuant to Schedule 1 of the *Environment Protection and Biodiversity Conservation Act 1999* were located within the survey area.

No Priority Flora Species were recorded in the survey area.

3.2.2 Vegetation Type, Extent and Status

A total of 15 Families, 26 Genera and 64 Species were recorded within the survey area. Four major vegetation groups were recorded in the survey area and are in Degraded, Good or Very Good condition (using the scale of Keighery 1994, see Appendix 3). Existing disturbance within the survey is comprised of historic exploration.

No unique or restricted vegetation communities were identified, and all vegetation types/communities are common, widespread and well represented in the Eastern Murchison subregion and adjoining subregions.

The summary of vegetation groups contained within the survey area is summarised in Table 4 below. Maps of the survey area can be seen in Appendix 4.

Table 4: Vegetation Group Summary

Vegetation Group	Vegetation Code	Families	Genera	Species	Area (ha)	Percentage of Survey Area (%)
Hakea preissii over *Eremophila pantonii* shrubland	a	7	16	23	86.76	7.96%
Acacia aneura and *Acacia burkittii* shrubland on undulating hills	b	11	13	24	25.67	2.35%
Mulga Shrubland- Drainage	c	8	9	21	300.25	27.54%
Open Mulga Shrubland	d	12	17	30	677.39	62.14%
Total		**15***	**26***	**64***	**1,090.07#**	**100.00%#**

Note: * Within total survey area (not sum of column)
Sum of column

The Crawford Project vegetation groups are described in more detail below.

3.2.2.1 *Hakea preissii* over *Eremophila pantonii* shrubland (a)

This vegetation group consisted of 7 Families, 16 Genera and 23 Species. The vegetation group was approximately 86.76 ha which makes up 7.96% of the survey area.

Scrub (Muir, 1977) was dominated by *Hakea preissii* over *Eremophila pantonii, Acacia victoriae, Sclerolaena diacantha, Sclerolaena densifolia, Enchylaena tomentosa* var. *tomentosa, Maireana triptera, Atriplex codonocarpa* and *Senna artemisioides* subsp. *filifolia.*

Figure 4: *Hakea preissii* over *Eremophila pantonii* shrubland within the survey area

3.2.2.2 *Acacia aneura* and *Acacia burkittii* shrubland on undulating hills (b)

This vegetation group consisted of 11 Families, 13 Genera and 24 Species. The vegetation group was approximately 25.67 ha which makes up 2.35% of the survey area.

Low Scrub B (Muir, 1977) was dominated by *Acacia aneura* and *Acacia burkittii* over *Ptilotus obovatus, Acacia tetragonophylla, Solanum lasiophyllum, Dodonaea rigida, Hakea preissii* and *Maireana triptera.*

Figure 5: Acacia *aneura* and *Acacia burkittii* shrubland on undulating hills within the survey area

3.2.2.3 Mulga Shrubland- Drainage (c)

This vegetation group consisted of 8 Families, 9 Genera and 21 Species. The vegetation group was approximately 300.25 ha which makes up 27.54% of the survey area.

Shrub Mallee (Muir, 1977) was dominated by *Acacia aneura, Acacia pteraneura* and *Acacia aptaneura* over *Eremophila platycarpa* subsp. Leonora*, Ptilotus obovatus, Acacia tetragonophylla, Maireana triptera, Sida ectogama, Eremophila compacta* and *Sida sp.* Golden calyces glabrous*.*

Figure 6: Mulga Shrubland- Drainage within the survey area

3.2.2.4 Open Mulga Shrubland (d)

This vegetation group consisted of 12 Families, 17 Genera and 30 Species. The vegetation group was approximately 677.39 ha which makes up 62.14% of the survey area.

Very Open Shrub Mallee (Muir, 1977) was dominated by *Acacia aneura* and *Acacia craspedocarpa* over *Senna artemisioides* subsp*. sturtii, Eremophila platycarpa* subsp. Leonora*, Eremophila metallicorum, Eremophila latrobei* subsp. *latrobei, Ptilotus obovatus* and *Solanum lasiophyllum.*

Figure 7: Open Mulga Shrubland within the survey area

3.2.3 Non-Native Species

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

3.2.4 Vegetation Condition

Evidence of historic disturbances were observed during the field assessment.

Overall, the condition of the vegetation was determined to be “Very Good” with areas which were affected by historic disturbances in “Good” or “Degraded” condition. A map of the vegetation condition within the survey is depicted in Appendix 4.

4. DISCUSSION

A total of 15 Families, 26 Genera and 64 Species were recorded within the survey area. Four major vegetation groups were recorded in the survey area.

The field assessment established that overall, the condition of the vegetation was determined to be “Very Good” with areas which were affected by historic disturbances in “Good” or “Degraded” condition. No areas of vegetation were assessed to be in “Pristine” condition.

No non-native species were recorded the survey area.

No Threatened Flora, Priority Flora, TECs or PECs were recorded in the survey area.

No unique or restricted vegetation communities were identified, and all vegetation types/communities are common, widespread and well represented in the Eastern Murchison subregion and adjoining subregions.

Any proposed disturbance/clearing of vegetation will result in a loss of species. However, given the size of the area and the extent of the Beard (1990) vegetation association elsewhere, the impact on the vegetation and its component flora will not affect the conservation values of either, or create fragmentation or patches of remnant vegetation.

The following recommendations arise from the reconnaissance flora survey:

- Weed control measures should be implemented during and following earthworks.
- Dust control measures should be implemented during earthworks.

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6. GLOSSARY

Acronyms:

BOM	Bureau of Meteorology, Australian Government
BSc	Bachelor of Science
CALM	Department of Conservation and Land Management (now DBCA)
CPS	Clearing Permit System (DWER)
DAWE	Department of Agriculture, Water and the Environment, Australian Government
DBCA	Department of Biodiversity, Conservation and Attractions, Western Australia
DMIRS	Department of Mines, Industry Regulation and Safety, Western Australia
DPAW	Department of Parks and Wildlife, Western Australia (now DBCA)
DPIRD	Department of Primary Industries and Regional Development, Western Australia
DRF	Declared Rare Flora (now classed as Threatened Flora)
DWER	Department of Water and Environmental Regulation, Western Australia
EPA	Environmental Protection Authority, Western Australia
EP Act	*Environmental Protection Act 1986*, Western Australia
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth Act)
ESA	Environmentally Sensitive Area
GIS	Geographical Information System
ha	Hectare (10,000 square metres)
IBRA	Interim Biogeographic Regionalisation for Australia, DAWE
IUCN	International Union for the Conservation of Nature and Natural Resources – commonly known as the World Conservation Union
km	Kilometres
m	Metres
MUR	Murchison Bioregion (IBRA)
MUR01	Eastern Murchison Subregion (IBRA)
NVS	Native Vegetation Solutions
PEC	Priority Ecological Community, Western Australia
Ramsar	A wetland site designated of international importance under the Ramsar Convention (UNESCO)
TEC	Threatened Ecological Community
UNESCO	United Nations Educational, Scientific and Cultural Organization
WA	Western Australia
WAHERB	Western Australian Herbarium (DBCA)

Definitions:

{DBCA (2019) Conservation Codes for Western Australian Flora and Fauna. Department of Biodiversity, Conservation and Attractions, Western Australia, January 2019}: -

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 <u>Priority Species</u>

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.

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.

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.

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.

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

(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands.
(b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent.
(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

Appendix 1

Relevant Government Database Search Results

Australian Government
Department of Agriculture, Water and the Environment

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.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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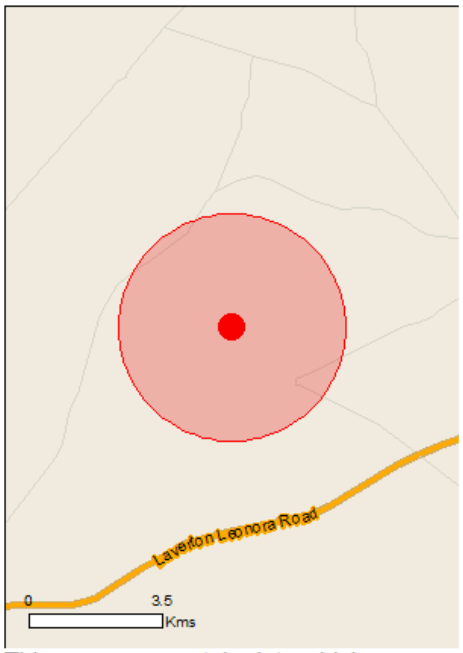
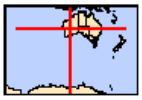


This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2015

Coordinates
Buffer: 3.0Km



Summary

Matters of National Environmental 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:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	4
Listed Migratory Species:	6

Other Matters Protected by the EPBC Act

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

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at 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 Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	9
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	10
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Polytelis alexandrae Princess Parrot, Alexandra's Parrot [758]	Vulnerable	Species or species habitat likely to occur within area
Mammals		
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area

Extra Information

Invasive Species	[Resource Information]
Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.	

Name	Status	Type of Presence
Mammals		
Camelus dromedarius Dromedary, Camel [7]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Equus asinus Donkey, Ass [4]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Carrichtera annua Ward's Weed [9511]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, 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 distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for 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 reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

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

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

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

Coordinates

-28.868 121.5841

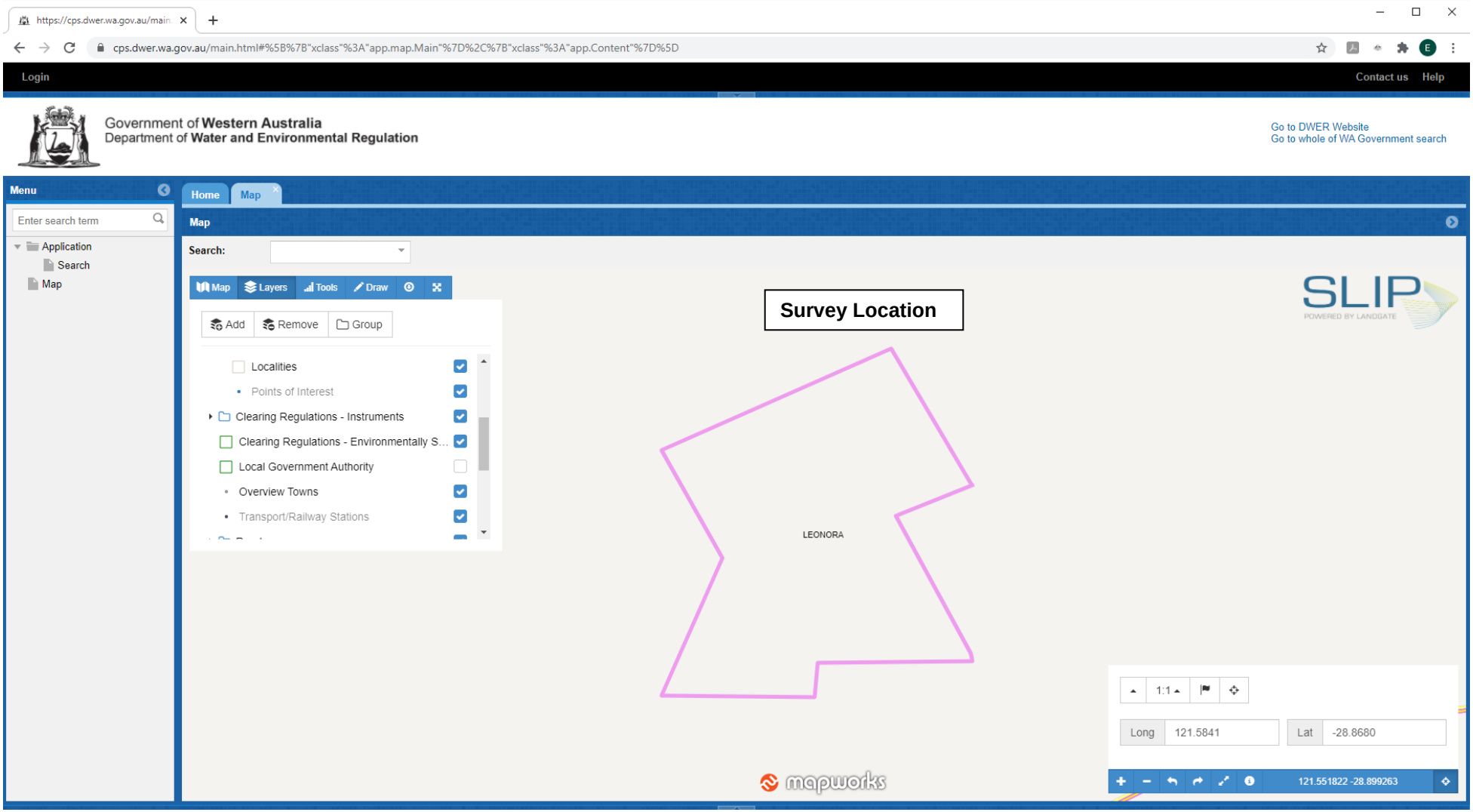
Acknowledgements

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

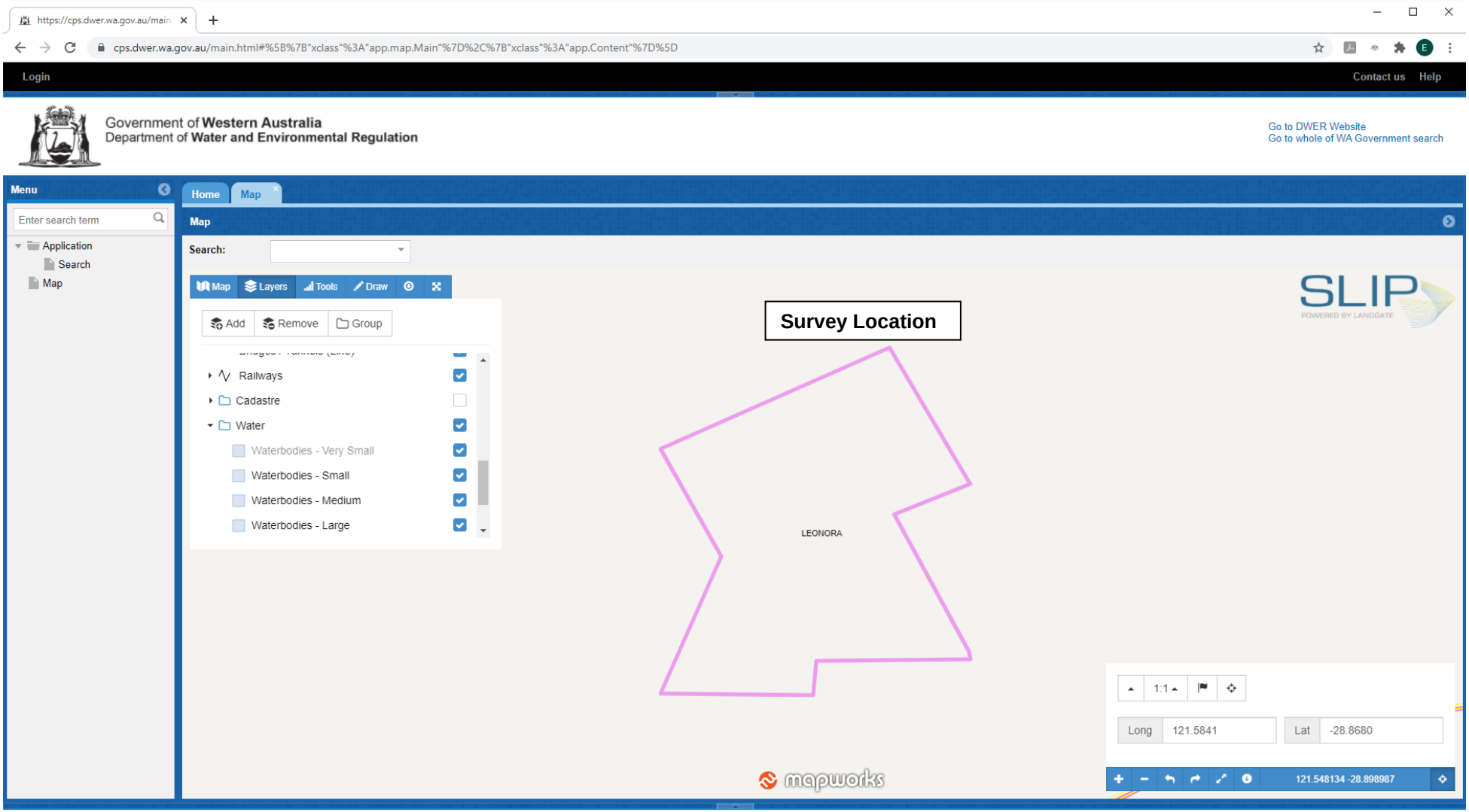
-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, 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.



DWER's Clearing Permit System Map Viewer showing no ESA's (dark green shaded areas) within the survey area (DWER, 2021)



DWER Clearing Permit System Map Viewer showing wetlands within the survey area (DWER, 2021)

Appendix 2

Threatened Flora Databases Search Results

GIS information provided in the Search results listed the following species within a 20km radius of the survey area:

Taxon	Status	Likelihood of occurring in the Survey Area
Acacia sp. Marshall Pool	P3	Possible –suitable habitat
Angianthus prostratus	P3	Unlikely – Lack of suitable habitat
Cratystylis centralis	P3	Unlikely – Lack of suitable habitat
Hemigenia exilis	P4	Possible –suitable habitat
Hybanthus floribundus subsp. *chloroxanthus*	P3	Unlikely – Lack of suitable habitat
Triglochin protuberans	P3	Unlikely – Lack of suitable habitat

Appendix 3

Vegetation Definitions

Vegetation Condition Definitions (Keighery, 1994)

Pristine (1). Pristine or nearly so, no obvious signs of disturbance.

Excellent (2). Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.

Very Good (3). Vegetation structure altered, obvious signs of disturbance.
For example, disturbance to vegetation structure caused by repeating fires, the presence of some more aggressive weeds, dieback, logging and grazing.

Good (4). Vegetation structure significantly altered by very obvious signs of multiple disturbance.
Retains basic vegetation structure or ability to regenerate it.
For example, disturbance to vegetation structure caused by frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.

Degraded (5). Basic vegetation structure severely impacted by disturbance.
Scope for regeneration but not to a state approaching good condition without intensive management.
For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.

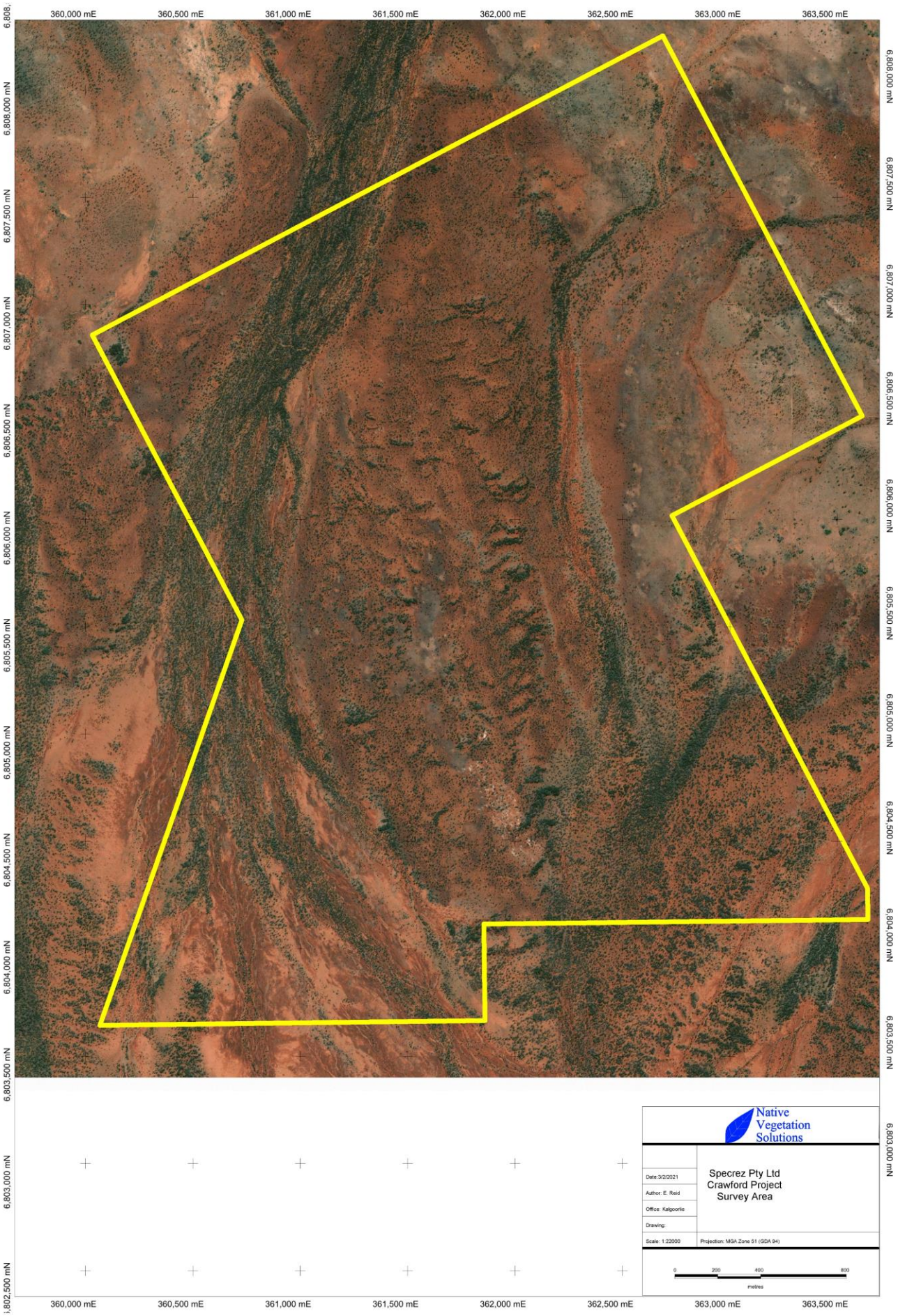
Completely Degraded (6). The structure of the vegetation is no longer intact and the area is completely or almost completely without native species.
These areas are often described as 'parkland cleared' with the flora compromising weed or crop species with isolated trees or shrubs.

Vegetation Structure Definitions (Muir, 1977)

Life Form/Height Class	Canopy Cover			
	Dense 70-100% d	Mid-Dense 30-70% c	Sparse 10-30% i	Very Sparse 2-10% r
T Trees>30m	Dense Tall Forest	Tall Forest	Tall Woodland	Open Tall Woodland
M Trees 15-30m	Dense Forest	Forest	Woodland	Open Woodlnd
LA Trees 5-15m	Dense Low Forest A	Low Forest A	Low Woodland A	Open Low Woodland A
LB Trees<5m	Dense Low Forest B	Low Forest B	Low Woodland B	Open Low Woodland B
KT Mallee tree form	Dense Tree Mallee	Tree Mallee	Open Tree Mallee	Very Open Tree Mallee
KS Mallee shrub form	Dense Shrub Mallee	Shrub Mallee	Open Shrub Mallee	Very Open Shrub Mallee
S Shrubs>2m	Dense Thicket	Thicket	Scrub	Open Scrub
SA Shrubs 1.5-2.0m	Dense Heath A	Heath A	Low Scrub A	Open Low Scrub A
SB Shrubs 1.0-1.5m	Dense Heath B	Heath B	Low Scrub B	Open Low Scrub B
SC Shrubs 0.5-1.0m	Dense Low Heath C	Low Heath C	Dwarf Scrub C	Open Dwarf Scrub C
SD Shrubs 0.0-0.5m	Dense Low Heath D	Low Heath D	Dwarf Scrub D	Open Dwarf Scrub D
P Mat plants	Dense Mat Plants	Mat Plants	Open Mat Plants	Very Open Mat Plants
H Hummock Grass	Dense Hummock Grass	Mid-Dense Hummock Grass	Hummock Grass	Open Hummock Grass
GT Bunch grass >0.5m	Dense Tall Grass	Tall Grass	Open Tall Grass	Very Open Tall Grass
GL Bunch grass <0.5m	Dense Low Grass	Low Grass	Open Low Grass	Very Open Low Grass
J Herbaceous spp.	Dense Herbs	Herbs	Open Herbs	Very Open Herbs
VT Sedges >0.5m	Dense Tall Sedges	Tall Sedges	Open Tall Sedges	Very Open Tall Sedges
VL Sedges <0.5m	Dense Low Sedges	Low Sedges	Open Low Sedges	Very Open Low Sedges
X Ferns	Dense Ferns	Ferns	Open Ferns	Very Open Ferns
Mosses, liverwort	Dense Mosses	Mosses	Open Mosses	Very Open Mosses

Appendix 4

Vegetation Mapping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Native Vegetation Solutions
Specrez Pty Ltd
Crawford Project
Survey Area
Date:3/2/2021
Author: E. Reid
Office: Kalgoorlie
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Projection: MGA Zone 51 (GDA 94)
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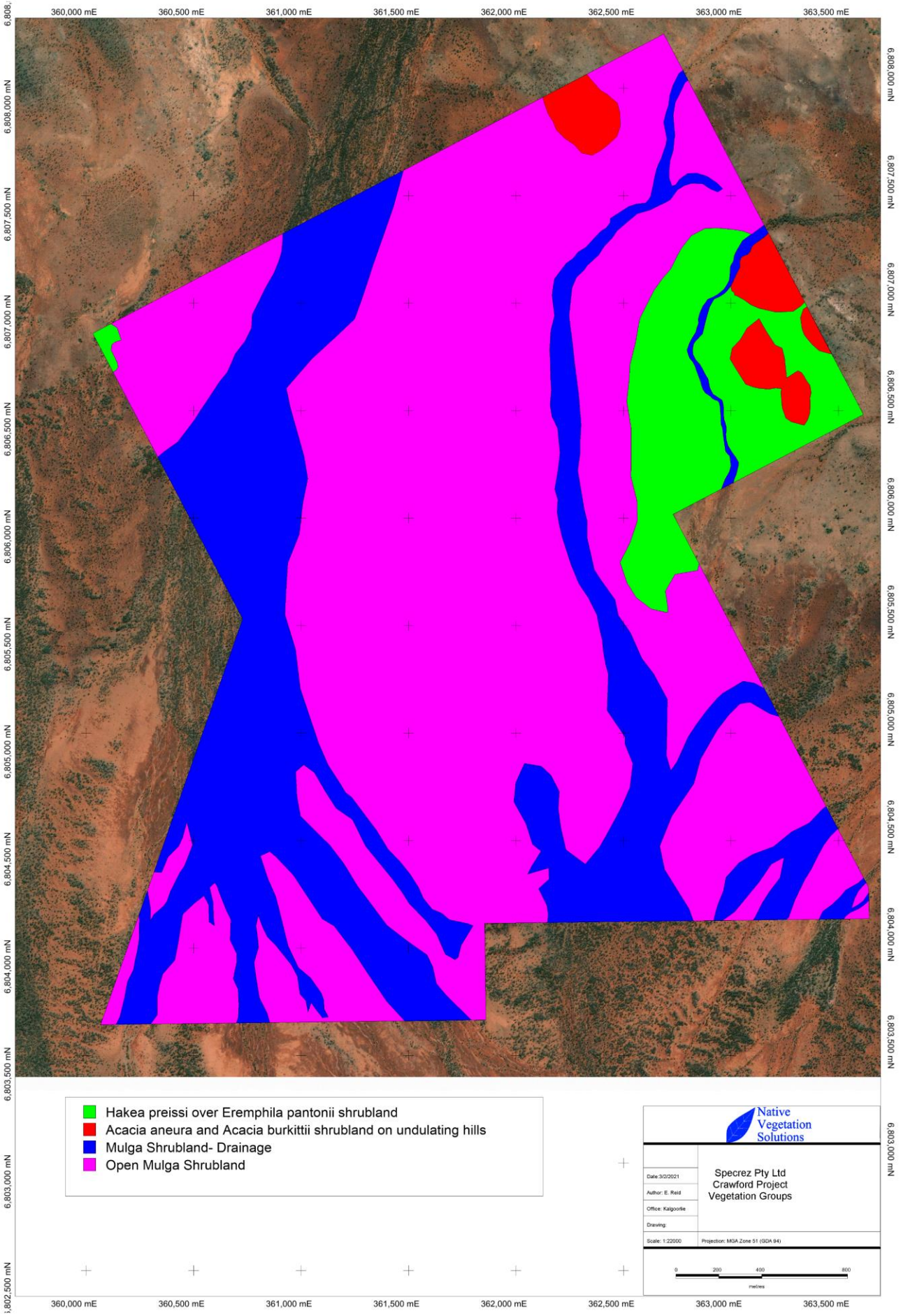
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Hakea preissi over Eremphila pantonii shrubland
Acacia aneura and Acacia burkittii shrubland on undulating hills
Mulga Shrubland- Drainage
Open Mulga Shrubland
Native Vegetation Solutions
Specrez Pty Ltd
Crawford Project
Vegetation Groups
Date:3/2/2021
Author: E. Reid
Office: Kalgoorlie
Drawing:
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Projection: MGA Zone 51 (GDA 94)
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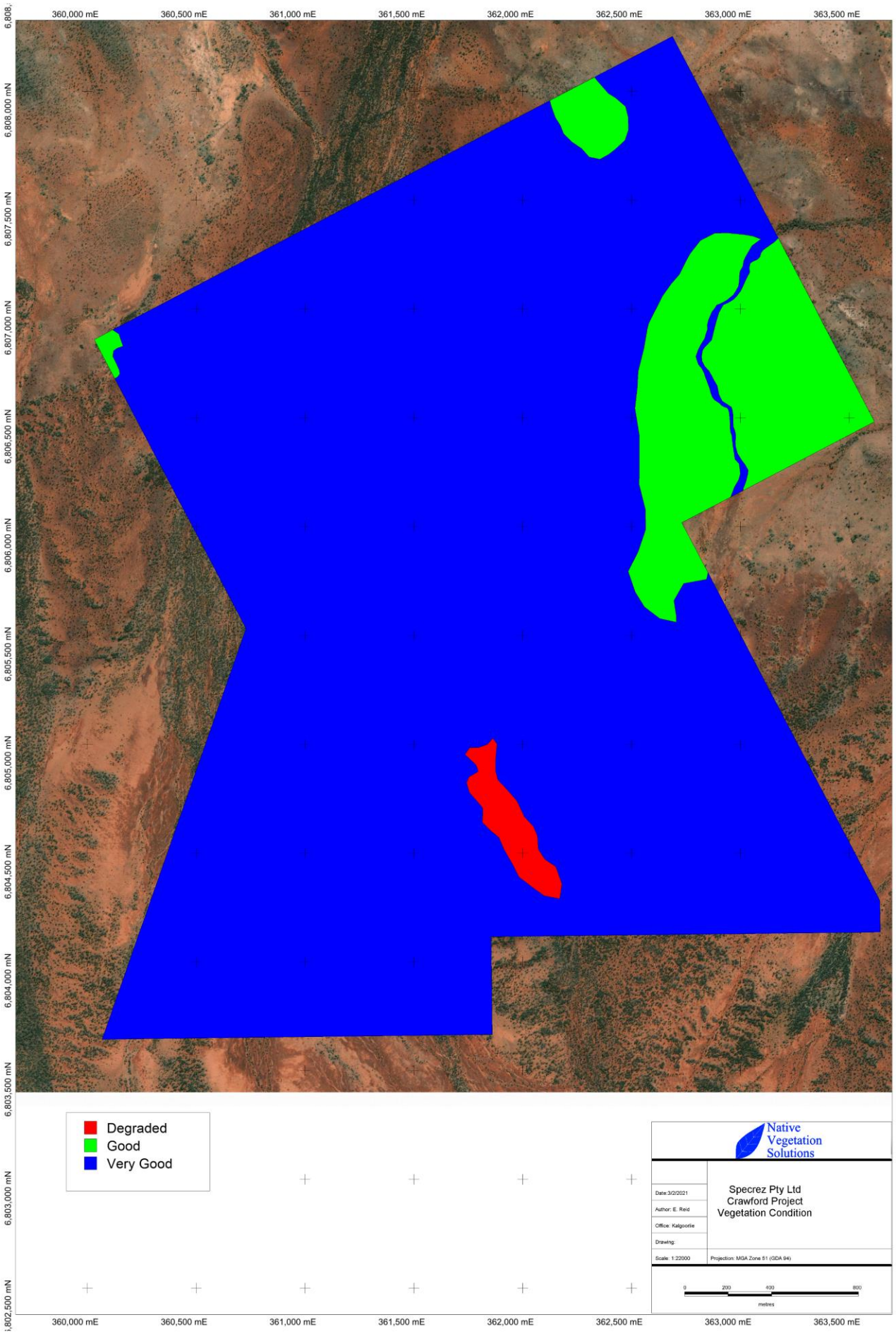
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Degraded
Good
Very Good
Native Vegetation Solutions
Specrez Pty Ltd
Crawford Project
Vegetation Condition
Date: 3/2/2021
Author: E. Reid
Office: Kalgoorlie
Drawing:
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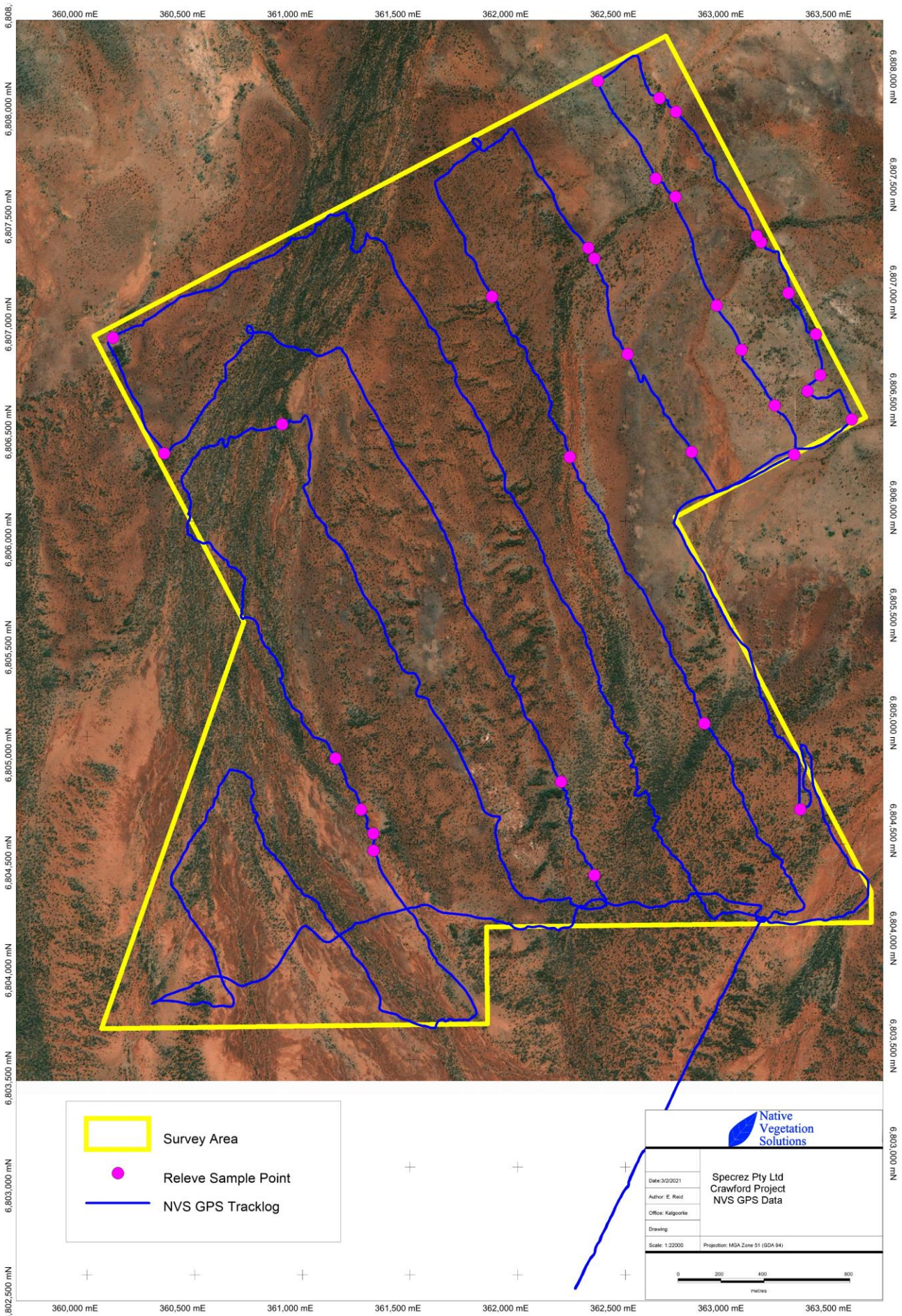
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Survey Area
Releve Sample Point
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Native Vegetation Solutions
Specrez Pty Ltd
Crawford Project
NVS GPS Data
Date:3/2/2021
Author: E. Reid
Office: Kalgoorlie
Drawing:
Scale: 1:22000
Projection: MGA Zone 51 (GDA 94)
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200
400
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Appendix 5

Species List

Family	Genus	Taxon	a	b	c	d
Amaranthaceae	*Ptilotus*	*Ptilotus divaricatus*			*	
Amaranthaceae	*Ptilotus*	*Ptilotus obovatus*	*	*	*	*
Amaranthaceae	*Ptilotus*	*Ptilotus schwartzii*		*		
Apocynaceae	*Marsdenia*	*Marsdenia australis*		*		
Chenopodiaceae	*Atriplex*	*Atriplex bunburyana*		*		
Chenopodiaceae	*Atriplex*	*Atriplex codonocarpa*	*			
Chenopodiaceae	*Atriplex*	*Atriplex holocarpa*	*			
Chenopodiaceae	*Atriplex*	*Atriplex vesicaria*		*		
Chenopodiaceae	*Enchylaena*	*Enchylaena tomentosa* var. *tomentosa*	*			
Chenopodiaceae	*Eriochiton*	*Eriochiton sclerolaenoides*	*			
Chenopodiaceae	*Maireana*	*Maireana georgei*		*		
Chenopodiaceae	*Maireana*	*Maireana pyramidata*	*			*
Chenopodiaceae	*Maireana*	*Maireana sedifolia*		*		
Chenopodiaceae	*Maireana*	*Maireana tomentosa*	*			
Chenopodiaceae	*Maireana*	*Maireana triptera*	*	*	*	*
Chenopodiaceae	*Rhagodia*	*Rhagodia drummondii*	*			
Chenopodiaceae	*Sclerolaena*	*Sclerolaena densiflora*	*			
Chenopodiaceae	*Sclerolaena*	*Sclerolaena diacantha*	*			
Chenopodiaceae	*Tecticornia*	*Tecticornia disarticulata*	*			
Fabaceae	*Acacia*	*Acacia aneura*		*	*	*
Fabaceae	*Acacia*	*Acacia aptaneura*			*	
Fabaceae	*Acacia*	*Acacia burkittii*		*		
Fabaceae	*Acacia*	*Acacia craspedocarpa*			*	*
Fabaceae	*Acacia*	*Acacia incurvaneura*				*
Fabaceae	*Acacia*	*Acacia mulganeura*			*	*
Fabaceae	*Acacia*	*Acacia pteraneura*		*	*	*
Fabaceae	*Acacia*	*Acacia ramulosa* var. *ramulosa*			*	
Fabaceae	*Acacia*	*Acacia teretifolia*		*		
Fabaceae	*Acacia*	*Acacia tetragonophylla*		*	*	*
Fabaceae	*Acacia*	*Acacia victoriae*	*			
Fabaceae	*Senna*	*Senna artemisioides* subsp. *artemisioides*	*			*
Fabaceae	*Senna*	*Senna artemisioides* subsp. *filifolia*	*		*	*
Fabaceae	*Senna*	*Senna artemisioides* subsp. *helmsii*		*		
Fabaceae	*Senna*	*Senna artemisioides* subsp. *sturtii*		*		*
Fabaceae	*Senna*	*Senna cardiosperma*	*			
Goodeniaceae	*Scaevola*	*Scaevola spinescens*		*		*
Lamiaceae	*Teucrium*	*Teucrium teucriiflorum*			*	
Malvaceae	*Sida*	*Sida calyxhymenia*		*	*	*
Malvaceae	*Sida*	*Sida ectogama*			*	*
Malvaceae	*Sida*	*Sida* sp. Golden calyces glabrous			*	
Pittosporaceae	*Pittosporum*	*Pittosporum angustifolium*				*
Poaceae	*Aristida*	*Aristida contorta*				*
Poaceae	*Enneapogon*	*Enneapogon caerulescens*	*			*
Poaceae	*Enteropogon*	*Enteropogon ramosus*	*			*
Poaceae	*Eragrostis*	*Eragrostis eriopoda*	*			*
Proteaceae	*Grevillea*	*Grevillea berryana*				*
Proteaceae	*Hakea*	*Hakea preissii*	*	*		*
Rubiaceae	*Psydrax*	*Psydrax latifolia*			*	
Rubiaceae	*Psydrax*	*Psydrax suaveolens*		*		*
Santalaceae	*Santalum*	*Santalum lanceolatum*				*
Santalaceae	*Santalum*	*Santalum spicatum*			*	
Sapindaceae	*Dodonaea*	*Dodonaea rigida*		*		
Scrophulariaceae	*Eremophila*	*Eremophila compacta*			*	
Scrophulariaceae	*Eremophila*	*Eremophila exilifolia*			*	
Scrophulariaceae	*Eremophila*	*Eremophila georgei*				*
Scrophulariaceae	*Eremophila*	*Eremophila glabra* subsp. *glabra*				*
Scrophulariaceae	*Eremophila*	*Eremophila latrobei* subsp. *latrobei*				*
Scrophulariaceae	*Eremophila*	*Eremophila longifolia*	*			
Scrophulariaceae	*Eremophila*	*Eremophila metallicorum*				*
Scrophulariaceae	*Eremophila*	*Eremophila pantonii*	*	*		
Scrophulariaceae	*Eremophila*	*Eremophila platycarpa* subsp. Leonora		*	*	*
Scrophulariaceae	*Eremophila*	*Eremophila youngii* subsp. *youngii*			*	
Solanaceae	*Solanum*	*Solanum lasiophyllum*	*	*		*

APPENDIX C
Fauna Survey

Basic Vertebrate Fauna Survey and Risk Assessment

Crawford Project

Prepared for: Specrez Pty Ltd

Version 1. February, 2021

RECORD OF DISTRIBUTION

No. of copies	Report File Name	Report Status	Date	Prepared for:	Initials
Electronic	2020-0099-002-GT V1.DOCX	DRAFT	1 January 2021	Specrez Pty Ltd	ST
Electronic	2020-0099-002-GT V1.DOCX	FINAL	2 February 2021	Specrez Pty Ltd	ST

Suggested Citation: Terrestrial Ecosystems 2021 *Basic Vertebrate Fauna Survey and Risk Assessment for the Crawford Project*, Unpublished report for Specrez Pty Ltd, Perth.

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EXECUTIVE SUMMARY

Specrez Pty Ltd has undertaken multiple exploration programs over recent years under Kingwest Resources for tenements M37/1202 and P37/9801 and are intending to seek approvals to develop mining operations. Specrez Pty Ltd requested a Basic vertebrate fauna survey and risk assessment to support a Native Vegetation Clearing Permit Application and Mining Proposal for its Crawford project which is approximately 25km east of Leonora.

The total assessed area was ~1,000ha but it is likely that only a portion of the area will be disturbed. There are three broad fauna habitats in the project area:

- Mulga woodland;
- Open Mulga woodland; and
- shrubland.

The mulga woodland is associated with an ephemeral drainage line that runs north-south through the flat plains and there is a small rocky ridge on the eastern boundary that has a shrubland habitat. Some small areas are highly degraded through exploration activity, but these are not significant in the context of the available fauna habitat in the area.

Clearing native vegetation in the project area is likely to result in the loss of a small number vertebrate fauna on-site that are unable to move away during the vegetation clearing process or development. This loss is not likely to be significant when viewed in a bioregional context. There may be an on-going loss of small native fauna to vehicle strikes on access tracks, but overall, this impact will be very low.

Impacts on vertebrate fauna associated with clearing vegetation in the project area in a landscape or bioregional context are likely to be very low due to the sparseness of the vegetation.

The proposed project is unlikely to significantly impact on a conservation significant species, so a referral under the *EPBC Act 1999* is not required. There is a low likelihood that the Long-tailed dunnart is occasionally present on the small rocky ridge on the eastern boundary of the project area, but it is too small to be a permanent refuge for the species.

It is recommended that:

- an induction program that includes a component on managing vertebrate fauna is mandatory for staff working in the project area; and
- the impact of dust on adjacent vegetation and therefore fauna habitat is managed and monitored against appropriate KPIs.

1. INTRODUCTION

1.1 BACKGROUND

Specrez Pty Ltd has undertaken multiple exploration programs over recent years under Kingwest Resources for tenements M37/1202 and P37/9801 and are intending to seek approvals to develop mining operations. Specrez Pty Ltd requested a Basic vertebrate fauna survey and risk assessment to support a Native Vegetation Clearing Permit Application and Mining Proposal for its Crawford project which is approximately 25km east of Leonora.

The total assessed area was ~1,000ha but it is likely that only a portion of the area will be disturbed.

1.2 PROJECT OBJECTIVES AND SCOPE OF WORKS

Terrestrial Ecosystems was commissioned by Specrez Pty Ltd to undertake a Basic vertebrate fauna survey and risk assessment for the Crawford project. The purpose of this survey and risk assessment was to provide information to the proponent on the potential impacts on the vertebrate fauna assemblage in the project area to enable the proposed development to be adequately assessed. The methodology broadly follows that described in the Environmental Protection Authority (2020) *Technical Guidance Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment.*

This Basic vertebrate fauna survey involved a desktop review and site investigation. The assessment objectives were to:

- provide an indication of the vertebrate fauna assemblage (reptiles, amphibians, mammals and birds) on and near the project area, so that potential impacts on the fauna and fauna assemblage might be adequately assessed;
- identify the presence and/or potential risk of impacts on species of conservation significance that are present or likely to be present in the project area;
- assess the impact and environmental risks associated with the proposed development on the vertebrate fauna assemblage;
- determine if any additional surveys are required to assess the potential impact on vertebrate fauna assemblage in the project area including impacts on species of conservation significance; and
- make recommendations that avoid, mitigate or minimise potential impacts on resident fauna.

To achieve these objectives, Terrestrial Ecosystems:

- reviewed Terrestrial Ecosystems' database [includes Atlas of Living Australia and Department of Biodiversity, Conservation and Attractions (DBCA) records in NatureMap] to identify potential vertebrate fauna within the area;
- searched the DBCA's NatureMap for Threatened and Priority Species;
- searched the Commonwealth Governments database of fauna of national environmental significance to identify species potentially occurring within the area that are protected under the *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act 1999*) or international migratory bird agreements (JAMBA/CAMBA);
- reviewed previous fauna surveys conducted in the surrounds of the project area;
- undertook a reconnaissance site survey to assess fauna habitat(s);
- undertook an assessment of the potential risks to the fauna associated with clearing additional areas of native vegetation;
- discussed the likelihood of *EPBC Act 1999* and *Biodiversity Conservation Act 2016* (*BC Act 2016*) listed species being present in the project area; and

- provided management recommendations to avoid, mitigate and minimise potential impacts on the fauna in the project area.

2. EXISTING ENVIRONMENT

2.1 LOCATION OF PROJECT AREA

The project area is in the Murchison 1 (MUR1 - East Murchison subregion) IBRA bioregion. Cowan (2003) described the subregion as mostly dominated by mulga woodlands that are often rich in ephemerals; hummock grasslands, salt bush shrub lands and haloscarcia shrub lands. Cowan (2003) recorded no threatened ecological communities in the vicinity of the project areas. Threatening processes for conservation significant fauna were listed by Cowan (2003) as foxes and cats. Wild dogs, goats and rabbits should be added to the list of threatening process.

2.2 LAND USE HISTORY

The dominant land uses for the bioregion are native pasture to support grazing on pastoral leases and crown land reserves, and to a lesser extent mining and exploration. The region surrounding the project area has been disturbed for mineral exploration and there are many operational and non-operational mining projects in the region.

2.3 CLIMATE

The project area is characterised as semi-arid. Leonora, 25km to the west, has an annual rainfall of approximately 235mm, although this varies considerably from year-to-year. The highest mean maximum and minimum temperatures in Leonora are in January with an average of 37°C and 21.8°C, respectively (Bureau of Meteorology, 2020). The lowest mean daily maximum and minimum temperatures occur in July (Chart 1). Average monthly rainfall is heaviest in January - March.

Summer rain is unpredictable and often results from thunderstorms coming from the north and the west or decaying cyclonic activity as low-pressure cells move from the Pilbara through the Goldfields.

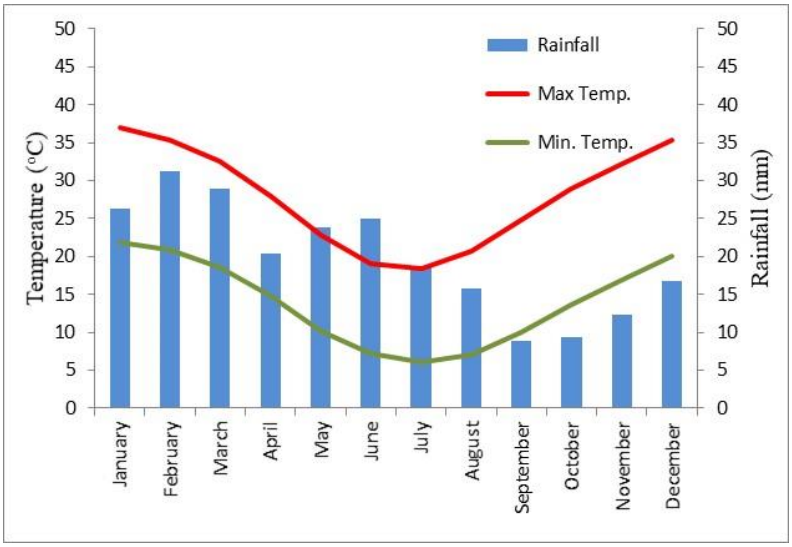

Chart 1. Climatic averages for Leonora

2.4 REGIONAL BIOLOGICAL FAUNA CONTEXT OF PROJECT AREA

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

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- Biota Environmental Sciences (2004) *Cosmos Nickel Mine Extension Fauna Survey*. Unpublished report for Sir Samuel Mines NL and URS, Perth.
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- Coffey Environments (2007) *Level 1 Fauna Assessment, Leinster Nickel Operations*, Perth.
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- Dunlop, J. N. (1990) The small vertebrate ground fauna of Mulga habitats near Wiluna, Western Australia. *Mulga Research Centre Journal*, 10, 19-27.
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- Harewood, G (2011) *Terrestrial Fauna Survey (Level 1) of the West Laverton Area (P38/3717, P38/3718, P38/3491, P38/3492, P38/3314, P38/3490, P38/3315, M38/0046, M38/0049, M38/0040, M38/0358, M38/0048, M38/0101, M38/0364, M38/0342, M38/0345, L38/0179, L38/0177, L38/0178, L38/0153, L38/0092, E38/1930, E38/2347, E38/2084 & E38/1966)*. Unpublished report for Crescent Gold Limited.
- Hart, Simpson and Associates (2000) Anaconda Nickel Ltd, *Cawse Expansion Project Fauna Survey*. Unpublished report for Anaconda Nickel Ltd, Perth.
- How, R. A. and Dell, J. (1992) Vertebrate fauna. In: The Biological Survey of the Eastern Goldfields of Western Australia Part 7. Duketon - Sir Samuel Study Area. *Records of the Western Australian Museum*; Supplement 40, 90-109.
- MBS Environmental (2004) *Vegetation and Habitat Assessment of the Euro, Sickle and Admiral Hill Project Areas, Laverton*. Unpublished report for Crescent Gold Limited.
- McKenzie, N. L., Rolfe, J. K. and Youngson, W. K. (1992) Vertebrate fauna. In: The Biological Survey of the Eastern Goldfields of Western Australia; Part 8; Kurnalpi - Kalgoorlie Study Area. *Records of the Western Australian Museum*, Supplement No 41, 37-65.

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- Murphy, D. (1994) *Vertebrate fauna species of the North-eastern Goldfields*. Report to Western Mining's Leinster Nickel and Mount Keith Operations, Perth.
- Ninox Wildlife Consulting (1998) *A Vertebrate Fauna Survey of the Murrin Expansion Project*. Unpublished report for Anaconda Nickel Ltd, Perth.
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- Terrestrial Ecosystems (2010) *Level 2 Fauna Risk Assessment for the Garden Well Project Area*. Unpublished report for Regis Resources Ltd, Perth.
- Terrestrial Ecosystems (2011a) *Level 2 Fauna Risk Assessment for Granny Deeps Project Area*. Unpublished report for Barrick Gold Corporation, Perth.
- Terrestrial Ecosystems (2011b) *Targeted Survey for Long-tailed Dunnarts for the Granny Deeps Project Area*. Perth.
- Terrestrial Ecosystems (2012g) *Level 1 Vertebrate Fauna Risk Assessment for the Proposed Exploration Areas around the Granny Open Pit Project Area*. Unpublished report for Granny Smith Mining Pty Ltd, Perth.
- Terrestrial Ecosystems (2012a) *Level 1 Fauna Risk Assessment for the Anchor Project*. Unpublished report for Regis Resources Ltd, Perth.
- Terrestrial Ecosystems (2012b) *Level 1 Fauna Risk Assessment for the Moolart Well to Garden Well Access Road on M38/354, M38/302, M38/303 and L38/216*. Perth.
- Terrestrial Ecosystems (2012c) *Level 1 Fauna Risk Assessment for the Petra Project*. Unpublished report for Regis Resources Ltd, Perth.
- Terrestrial Ecosystems (2012d) *Level 1 Fauna Risk Assessment for the Reichelt Project*. Unpublished report for Regis Resources Ltd, Perth.
- Terrestrial Ecosystems (2012e) *Level 1 Fauna Risk Assessment for the Rosemont Project Area*. Unpublished report for Regis Resources Ltd, Perth.
- Terrestrial Ecosystems (2012f) *Level 1 Fauna Risk Assessment for the Russell Find Project*. Unpublished report for Regis Resources Ltd, Perth.
- Terrestrial Ecosystems (2012h) *Level 1 Vertebrate Fauna Risk Assessment for the Proposed Mining Areas around the Granny Open Pit Project Area*. Unpublished report for Granny Smith Mining Pty Ltd, Perth.
- Terrestrial Ecosystems (2013) *Level 1 Fauna Risk Assessment for Two Waste Dumps either side of the proposed Rosemont Project Area (G38/29, G38/30, G38/31, G38/32) and a Slurry Pipeline from the Rosemont mine to the Garden Well processing plant (L38/219)*. Unpublished report for Regis Resources Ltd, Perth.
- Terrestrial Ecosystems (2014) *Level 1 Fauna Risk Assessment for a proposed power station site, Perth*. Unpublished report for Granny Smith Mining Pty Ltd, Perth.
- Terrestrial Ecosystems (2015a) *Fauna risk assessment of the proposed borrow pit expansion*. Unpublished report for Granny Smith Mining Pty Ltd, Perth.
- Terrestrial Ecosystems (2015b) *Level 1 Fauna Risk Assessment for the Gloster Project and haul road*. Unpublished report for Regis Resources Ltd, Perth.
- Terrestrial Ecosystems (2016a) *Level 1 Fauna Risk Assessment for the Anchor Project Area*. Unpublished report for Regis Resources Ltd, Perth.
- Terrestrial Ecosystems (2016b) *Level 1 Fauna Risk Assessment for the Baneygo Project*. Unpublished report for Regis Resources Ltd, Perth.

- Terrestrial Ecosystems (2016c) Level *1 Fauna Risk Assessment for the Dogbolter-Coopers Project Area*. Unpublished report for Regis Resources Ltd, Perth.
- Terrestrial Ecosystems (2016d) *Level 1 Fauna Risk Assessment for the Petra Project Area*. Unpublished report for Regis Resources Ltd, Perth.
- Terrestrial Ecosystems (2016e) *Level 1 Fauna Risk Assessment for the Tooheys Project Area*. Unpublished report for Regis Resources Ltd, Perth.
- Terrestrial Ecosystems (2017a) *Level 1 Fauna Risk Assessment for the proposal Haul Road to the Baneygo Project Area*. Unpublished report for Regis Resources Ltd, Perth.
- Terrestrial Ecosystems (2017b) *Level 1 Fauna Risk Assessment for the proposal Haul Road to the proposed Petra Mining area*. Unpublished report for Regis Resources Ltd, Perth.
- Terrestrial Ecosystems (2018a) *Level 1 Fauna Risk Assessment for the proposal Haul Road to the proposed Petra Mining area*. Unpublished report for Regis Resources Ltd, Perth.
- Terrestrial Ecosystems (2018c) *Vertebrate Fauna Risk Assessment for the Petra Mining Project*, Perth.
- Terrestrial Ecosystems (2018b) *Vertebrate Fauna Risk Assessment for the Granny Smith Solar Power Farm Project*, Unpublished report for Granny Smith Mining Company Pty Ltd, Perth.
- Terrestrial Ecosystems (2020b) Vertebrate Fauna Risk Assessment for Lot 51 Laverton-Leonora Road, Leonora. Unpublished report for Minesite Recycling, Perth.
- Terrestrial Ecosystems (2020a) Level 2 Vertebrate Fauna Assessment – King of the Hills Project, Unpublished report for Red 5, Perth.
- Volschenk, E. S. (2011) *Granny Deeps Scorpion Identification Report*. Perth.
- Whisson, C. and Slack-Smith, S. (2011) *Land Snails from the area of Laverton, Western Australia (Granny Deeps Project)*, Perth.

In addition, there are individual records for fauna contained in the Atlas of Living Australia, Western Australian Museum collection and in NatureMap's records that have also been accessed.

The most relevant and useful data are those from the three Terrestrial Ecosystems' (2010, 2011a, 2020a) Level 2 surveys as they comprehensive and incorporate habitat similar to that in the project area. The first two surveys were undertaken in 2010 and 2011 to the east of the project area, and the most recent survey was completed in March 2020 and is approximately 45km north-west of the project area. These surveys included pit trapping, funnel traps, echolocation bat detection surveys, avifauna surveys and short-range invertebrate surveys. Terrestrial Ecosystems has also completed multiple Level 1 fauna risk assessments in similar habitats nearby (Terrestrial Ecosystems 2012g, a, e, c, d, f, h, b, 2013, 2014, 2015a, b, 2016a, e, c, b, d, 2017b, a, 2018a, c, b, 2020b).

Western Australian Museum's (WAM) regional eastern goldfields biological surveys were undertaken in the Duketon-Sir Samuel, Sandstone–Sir Samuel and Laverton areas (How et al. 1992, McKenzie et al. 1994). These surveys were to the north-east of the project area. HGM (1999) undertook a terrestrial fauna assessment for the Rosemont Gold Project, which is also located to the north-east of the project area. A survey was undertaken by Terrestrial Ecosystems' staff for the Duketon Gold Project (Coffey Environments 2008) in the summer of 2007/08 and subsequently, Terrestrial Ecosystems' (2010) surveyed the Garden Well mine; both of these surveys included habitat similar to the project area. The WAM bioregional surveys of the Edjudina – Menzies and the Kurnalpi - Kalgoorlie areas (Dell and How 1988, McKenzie and Hall 1992) and the Murrin Murrin Expansion project fauna survey (Ninox Wildlife Consulting 1998); south-east of the project area, surveyed similar habitat. In addition, Terrestrial Ecosystems has included in the Thompson (2004) fauna survey result and data collected after Thompson's (2004) PhD was completed. These data are to the south of the project area.

These fauna surveys, when considered together, provide a near complete list of the vertebrate species likely to be found in the surrounds of the project area and surrounds. The composition of vertebrate fauna assemblages varies from habitat-to-habitat and site-to-site within the bioregion, but the survey data contained in the attached appendices provide a good indication of the vertebrate fauna assemblage that is likely to be found

in the surrounds of project area. These data therefore provide a good regional context and indicate the extent of fauna assemblage variation that might be anticipated from site-to-site and temporally.

2.5 FAUNA SPECIES AT RISK

Cowan (2003) reported the fauna species at risk in the East Murchison subregion as Bilby (*Macrotis lagotis*), Marsupial Mole (*Notoryctes typhlops*), Mulgara (*Dasycercus cristicauda / blythi*), Malleefowl (*Leipoa ocellata*), Princess Parrot (*Polytelis alexandrae*), Slender-billed Thornbill (*Acanthiza iredalei iredalei*), Giant Desert Skink (*Liopholis kintorei*) and Peregrine Falcon (*Falco peregrinus*). This report assesses the potential for these species to be found in the project area and the potential impact that the proposed mining development might have on these species, and other conservation significant fauna. The Cowan (2003) report is now very dated, and the DBCA has not updated the biodiversity audit for Western Australia since that report. Since 2003, the Night Parrot has been rediscovered in Western Australia and is also considered a species at risk in the region.

3. METHODOLOGY

3.1 DATABASE SEARCHES

A review of the *EPBC Act 1999* list of protected species was undertaken to identify species of conservation interest to the Commonwealth Government. The search circle had a radius of 50km around a centre point coordinate of -28.8680°S and 121.5808°E (Appendix A). In addition, a desktop search of Terrestrial Ecosystems' fauna survey database was used to develop an appreciation of the vertebrate fauna assemblages in relevant sections of the bioregion near the project area. The DBCA threatened and priority species database was searched via the records in NatureMap.

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

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

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

3.2 SITE INSPECTION AND FAUNA HABITAT ASSESSMENT

A site visit was undertaken on 9 November 2020 to assess fauna habitat types and condition in the project area. This fauna habitat assessment methodology required the assessor to stop at multiple locations within the project area and to assess a suite of data about the fauna habitat and its condition. This information included a description of the habitat structure, habitat condition, landform, soils, vegetation and time since last fire.

The fauna habitat assessment was undertaken for the entire project area. This field assessment had two foci:

- assessing fauna habitat types and their condition; and
- assessing the possible presence of and recording evidence of conservation significant fauna so that mitigation and management strategies might be implemented to reduce potential impacts.

Dr Scott Thompson, who undertook the site assessment, stopped at multiple locations within the project area and recorded a suite of data about the fauna habitat and its condition. This information included a description of the habitat structure, habitat condition, landform, soils and vegetation and time since last fire (Table 1).

Table 1. Variables assessed during the rapid habitat assessment

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

Observer's Name:	
assemblages in these areas are likely to be significantly different to what might have been in the area pre-disturbance.	
Habitat structure – combined into habitat description	
Upper stratum	
☐ Tall open woodland	☐ Scattered tall trees
☐ Tall woodland	☐ Scattered trees
☐ Open woodland	☐ Scattered low trees
☐ Woodland	☐ Low closed forest
☐ Open forest	☐ Low open forest
☐ Closed forest	☐ Low woodland
☐ Tall closed forest	☐ Low open woodland
☐ Tall open forest	
Middle stratum	
☐ Shrubland	☐ Open heath
☐ Tall shrubland	☐ Low closed heath
☐ Tall open shrubland	☐ Low open heath
☐ Low shrubland	☐ Tall closed scrub
☐ Scattered low shrubs	☐ Tall open scrub
☐ Low open shrubland	☐ Scattered tall shrubs
☐ Scattered tall shrubs	☐ Open shrubland
☐ Closed heath	☐ Scattered shrubs
Lower stratum	
☐ Closed hummock grassland	☐ Closed tussock grassland / sedgeland / herbland
☐ Mid-dense hummock grassland	☐ Tussock grass land / sedgeland / herbland
☐ Hummock grassland	☐ Open tussock grassland / sedgeland / herbland
☐ Open hummock grassland	☐ Scattered tussock / grasses / sedges / herbs
☐ Scattered hummock grassland	☐ Very open tussock grassland / herbland
Soil Type – options	
☐ Sand	☐ Silty loam
☐ Loamy sand	☐ Sand clay loam
☐ Clayey sand	☐ Clay
☐ Clay loam	☐ Peat / organic
☐ Silty clay loam	☐ Stony
☐ Sandy loam	
Soil colour - options	
☐ Black	☐ Red

Observer's Name:	
☐ Brown	☐ White
☐ Grey	☐ Yellow
☐ Orange	
Surface stones – options	
☐ None	☐ Boulders (>250mm)
☐ Pebbles (0-50mm)	☐ Rocks
☐ Cobbles (51-250)	

3.3 SURVEY AND REPORTING STAFF

Dr Scott Thompson undertook the field assessment in the company of Eren Reid, from Native Vegetation Solutions, who concurrently undertook a botanical assessment on 9 November 2020. Dr Graham Thompson prepared this report and Dr Scott Thompson reviewed the report before it was sent to the client. Both senior scientists have appropriate relevant post-graduate qualifications, extensive experience in conducting fauna assessments in the Goldfields, have published research articles on biodiversity, fauna assemblages, conservation significant species, trapping techniques and temporal variations in trapped fauna assemblages based on Goldfields surveys and are therefore appropriately trained and experienced for the task of preparing this assessment. Both Scott and Graham have undertaken multiple assessments in this bioregion and are familiar with the habitat in the project area and surrounds.

3.4 TAXONOMY AND NOMENCLATURE

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

3.5 LIMITATIONS

The EPA (2020) Technical Guidance Terrestrial Fauna Surveys suggested that fauna surveys may be limited by many variables. Limitations associated with each of these variables are assessed in Table 2.

Table 2. Fauna survey limitations and constraints

Possible limitations	Constraint (yes/no); significant, moderate or negligible	Comment
Availability of data and information	No	There is a significant quantity of vertebrate fauna survey and assessment data available for similar habitats in the bioregion.
Competency/experience of the survey team, including experience in the bioregion surveyed	No	The authors of this report have appropriate post-graduate qualifications, undertaken multiple surveys and assessments in the Goldfields, have published a book and multiple refereed journal articles based on fauna surveys in the region and are familiar with the vertebrate fauna in this bioregion.
Scope of the survey, e.g. where faunal groups were excluded from the survey	N/A	
Timing, weather and season	No	The weather was suitable.
Disturbance that may have affected results, e.g. fire, flood	No	Disturbances in the project area have been factored into this assessment.
The proportion of fauna identified, recorded or collected	N/A	
Adequacy of the survey intensity and proportion of survey achieved, e.g. the extent to which the area was surveyed	No	The entire project area was adequately assessed.
Access problems	No	The project area was accessible.
Problems with data and analysis, including sampling biases	N/A	

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

4. RESULTS

4.1 FAUNA HABITAT

There are three broad fauna habitats in the project area:

- Mulga woodland (Plates 1 and 2);
- Open Mulga woodland (Plates 3 and 4); and
- Shrubland (Plates 5 and 6).

The mulga woodland is associated with an ephemeral drainage line that runs north-south through the flat plains and there is a small rocky ridge (Plate 7) on the eastern boundary that has a shrubland habitat. Some small areas are highly degraded through exploration activity (Plate 8), but these are not significant in the context of the available fauna habitat in the area.

The rapid fauna habitat assessment results are provided in Appendix D.

Plate 1. Mulga woodland

Plate 2. Mulga woodland

Plate 3. Open Mulga woodland

Plate 4. Open Mulga woodland

Plate 5. Shrubland

Plate 6. Shrubland

Plate 7. Rocky ridge

Plate 8. Highly degraded

4.2 FAUNA ASSEMBLAGE

The site inspection indicated that the project area will have limited terrestrial vertebrate fauna, due primarily to the large quantity of sparsely vegetated area with very patchy and limited ground cover and leaf litter. Avian fauna will focus on the more densely treed areas along ephemeral creek lines. The project area will support a subset of the fauna assemblage that is typically found in a more densely vegetated mulga woodland with an understorey of scattered shrubs.

In 2010 and 2011 Terrestrial Ecosystems undertook Level 2 vertebrate fauna surveys east and north of Laverton and in 2020 undertook a Level 2 survey near Leonora (Terrestrial Ecosystems 2020a). These surveys largely supported one broad fauna habitat type – open mulga woodland and the density of trees and shrubs and understorey varied across the project area. These surveys were therefore the closest substantial vertebrate fauna surveys available for the habitat present in the project area. For all surveys, the pit-traps and drift fences were dug in prior to the field assessments and closed until the start of the trapping programs. Each survey site contained four trap lines and there were multiple survey sites in each trapping program. Each trap line contained three 20L PVC buckets, three 150mm by 500mm deep PVC pipes as pit-traps and three pair of funnel traps evenly spaced along a 30m fly-wire drift fence. Trap lines were arranged approximately 50m apart.

Avian surveys were undertaken concurrently with each trapping program. The avian surveys were conducted from sunrise for approximately four hours and on some surveys, again each afternoon for approximately four hours. The search protocol for each avian survey site was a 20-minute active walking transect search of approximately 2ha before moving to another area. All birds were identified by their call or direct observation and birds were also recorded opportunistically during the survey period by all field survey staff. Bat echolocation calls were recorded using an Anabat and SM2Bat+ detection systems on each survey.

Table 3 indicates the small mammals, reptiles and amphibians caught during the 2011 survey. The reptile, mammal and amphibian assemblage recorded is like that recorded in other patches of open mulga woodland in this part of the Goldfields, except for the capture of three Long-tailed Dunnarts. As indicated in the follow up targeted survey report for Long-tailed Dunnarts (Terrestrial Ecosystems 2011b), it was unexpected to record Long-tailed Dunnarts in this area and this record was more than 200km south-east of the previous known records. Since 2011, more Long-tailed Dunnarts have been recorded in the region between Laverton and Leonora. Data for Terrestrial Ecosystems (2020a) survey near Leonora have been reviewed for this risk assessment but are not in the public domain so cannot be summarised.

Table 3. Mammals, reptiles and amphibians caught at various trapping sites near Laverton

Species	TE 2010	TE 2011
Mammals		
Antechinomys laniger	17	
Sminthopsis dolichura	47	25
Sminthopsis hirtipes	1	
Sminthopsis longicaudata	3	
Sminthopsis macroura	27	8
Notomys alexis	3	
Pseudomys hermannsburgensis	22	2
Mus musculus	6	
Amphibians		
Cyclorana maini	18	
Cyclorana platycephala	11	
Neobatrachus kunapalari	1	
Neobatrachus sutor	36	
Reptiles		
Diporiphora amphiboluroides	4	7
Pogona minor		1
Tympanocryptis cephalus	7	5
Brachyurophis semifasciata		1
Parasuta monachus	2	1
Diplodactylus conspiculatus		2

Species	TE 2010	TE 2011
Diplodactylus granariensis	1	
Diplodactylus pulcher	15	41
Gehyra variegata	18	34
Heteronotia binoei	12	30
Underwoodisaurus milii		1
Rhynchoedura ornata	6	
Strophurus wellingtonae	7	27
Pygopus nigriceps		1
Cryptoblepharus buchananii		6
Ctenotus schomburgkii		1
Ctenotus uber		24
Ctenotus leonhardii	69	
Egernia depressa	25	7
Egernia formosa		12
Eremiascincus richardsonii	3	4
Lerista desertorum	2	17
Lerista distinguenda	1	
Lerista rhodonoides		18
Menetia greyii	1	2
Morethia butleri	14	11
Tiliqua multifasciata	1	

Species	TE 2010	TE 2011
Anilios australis	2	1
Anilios bicolor	1	

Species	TE 2010	TE 2011
Varanus caudolineatus	11	15
Varanus panoptes	30	3

The combined bird surveys recorded 1,147 individuals from 66 species; a large number of additional birds (but not species) were recorded opportunistically (Table 4). A proportion of these species are seldom seen in the north-eastern Goldfields (e.g. Musk Duck, Australian Wood Duck, Pink-eared Duck, Pacific Black Duck, Hardhead, stilts and White-faced Heron), and would not be recorded in the project area due to a lack of water. No Malleefowl nests or tracks were observed in either survey (Terrestrial Ecosystems 2010, 2011a). Data for Terrestrial Ecosystems (2020a) avian survey near Leonora have been reviewed during the risk assessment but are not in the public domain so cannot be summarised.

Table 4. Birds detected in the combined surveys near Leonora

Family	Species	Common Name	TE 2010	TE 2011
Accipitridae	*Aquila audax*	Wedge-tailed Eagle	3	
Anatidae	*Biziura lobata*	Musk Duck	2	
	Chenonetta jubata	Australian Wood Duck	81	
	Malacorhynchus membranaceus	Pink-eared Duck	5	
	Anas gracilis	Grey Teal	74	
	Anas superciliosa	Pacific Black Duck	13	
	Aythya australis	Hardhead	2	
Casuariidae	*Dromaius novaehollandiae*	Emu	4	1
Charadriidae	*Elseyornis melanops*	Black-fronted Dotterel	4	
Recurvirostridae	*Himantopus himantopus*	Black-winged Stilt	5	
	Cladorhynchus leucocephalus	Banded Stilt	14	
Ardeidae	*Egretta novaehollandiae*	White-faced Heron	2	
Columbidae	*Phaps chalcoptera*	Common Bronzewing	6	19
	Ocyphaps lophotes	Crested Pigeon	21	
Alcedinidae	*Todiramphus pyrrhopygius*	Red-backed Kingfisher	1	
Cuculidae	*Heteroscenes pallidus*	Pallid Cuckoo	3	
Falconidae	*Falco cenchroides*	Nankeen Kestrel	2	1
	Falco berigora	Brown Falcon	2	
Rallidae	*Fulica atra*	Eurasian Coot	21	
Acanthizidae	*Acanthiza robustirostris*	Slaty-backed Thornbill	68	34
	Acanthiza chrysorrhoa	Yellow-rumped Thornbill	1	1
	Acanthiza apicalis	Inland Thornbill	12	30

Family	Species	Common Name	TE 2010	TE 2011
	Acanthiza uropygialis	Chestnut-rumped Thornbill		8
	Aphelocephala leucopsis	Southern Whiteface	13	7
	Smicrornis brevirostris	Weebill		3
Artamidae	*Artamus personatus*	Masked Woodswallow	27	
	Artamus cinereus	Black-faced Woodswallow	6	5
	Artamus minor	Little Woodswallow	2	
	Cracticus torquatus	Grey Butcherbird	9	
	Cracticus nigrogularis	Pied Butcherbird	5	3
	Gymnorhina tibicen	Australian Magpie	1	
Campephagidae	*Coracina maxima*	Ground Cuckoo-Shrike	7	
	Coracina novaehollandiae	Black-faced Cuckoo-Shrike	7	2
	Lalage tricolor	White-winged Triller	4	
Corvidae	*Corvus bennetti*	Little Crow	5	14
	Corvus orru	Torresian Crow	2	1
Estrildidae	*Taeniopygia guttata*	Zebra Finch	2	
Hirundinidae	*Cheramoeca leucosterna*	White-backed Swallow	6	
	Hirundo neoxena	Welcome Swallow	6	
	Petrochelidon nigricans	Tree Martin	10	
Maluridae	*Malurus splendens*	Splendid Fairy-wren	12	19
	Malurus leucopterus	White-winged Fairy-wren	4	3
Meliphagidae	*Certhionyx variegatus*	Pied Honeyeater	2	
	Gavicalis virescens	Singing Honeyeater	40	24
	Manorina flavigula	Yellow-throated Miner	41	11
	Acanthagenys rufogularis	Spiny-cheeked Honeyeater	44	13
	Epthianura tricolor	Crimson Chat	4	
Monarchidae	*Grallina cyanoleuca*	Magpie-Lark	17	1
Motacilidae	*Anthus novaeseelandiae*	Australasian Pipit	8	1
Nectariniidae	*Dicaeum hirundinaceum*	Mistletoebird	4	3
Pachycephalidae	*Pachycephala rufiventris*	Rufous Whistler	22	22
	Colluricincla harmonica	Grey Shrike-thrush	3	13
	Oreoica gutturalis	Crested Bellbird	46	40
Pardalotidae	*Pardalotus striatus*	Striated Pardalote	1	
Petroicidae	*Petroica goodenovii*	Red-capped Robin	10	14

Family	Species	Common Name	TE 2010	TE 2011
	Melanodryas cucullata	Hooded Robin	7	3
	Microeca leucophaea	Jacky Winter		3
Pomatostomidae	*Pomatostomus superciliosus*	White-browed Babbler	14	9
Ptilonorhynchidae	*Ptilonorhynchus guttatus*	Western Bowerbird	7	4
Rhipiduridae	*Rhipidura leucophrys*	Willie Wagtail	10	4
Podicipedidae	*Poliocephalus poliocephalus*	Hoary-headed Grebe	30	
Psittacidae	*Barnardius zonarius*	Australian Ringneck	6	12
	Psephotus varius	Mulga Parrot	20	4
Caprimulgidae	*Eurostopodus argus*	Spotted Nightjar		1
Climacteridae	*Climacteris affinis*	White-browed Treecreeper		2
Cacatuidae	*Eolophus roseicapillus*	Galah		2

4.3 BIOREGIONAL VERTEBRATE FAUNA ASSEMBLAGE

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

Tables 5-8 provide a list of vertebrate species potentially found in the surrounds of the project area that have been compiled based on the fauna survey report results shown in Appendix B.

Table 5. Birds potentially found near the project area

Family	Species	Common Name
Casuariidae	*Dromaius novaehollandiae*	Emu
Anatidae	*Biziura lobata*	Musk Duck
	Tadorna tadornoides	Australian Shelduck
	Chenonetta jubata	Australian Wood Duck
	Malacorhynchus membranaceus	Pink-eared Duck
	Anas gracilis	Grey Teal
	Anas superciliosa	Pacific Black Duck
	Aythya australis	Hardhead
Podicipedidae	*Poliocephalus poliocephalus*	Hoary-headed Grebe
Columbidae	*Phaps chalcoptera*	Common Bronzewing
	Phaps histrionica	Flock Bronzewing
	Ocyphaps lophotes	Crested Pigeon
	Geopelia placida	Diamond Dove
Podargidae	*Podargus strigoides*	Tawny Frogmouth
Caprimulgidae	*Eurostopodus argus*	Spotted Nightjar
Aegothelidae	*Aegotheles cristatus*	Australian Owlet-nightjar
Apodidae	*Apus pacificus*	Fork-tailed Swift
Otididae	*Ardeotis australis*	Australian Bustard
Phalacrocoracidae	*Microcarbo melanoleucos*	Little Pied Cormorant
Ardeidae	*Ardea pacifica*	White-necked Heron
	Egretta novaehollandiae	White-faced Heron
Accipitridae	*Haliastur sphenurus*	Whistling Kite
	Accipiter fasciatus	Brown Goshawk
	Accipiter cirrocephalus	Collared Sparrowhawk
	Circus assimilis	Spotted Harrier
	Aquila audax	Wedge-tailed Eagle
	Hieraaetus morphnoides	Little Eagle
Falconidae	*Falco cenchroides*	Nankeen Kestrel
Falconidae	*Falco berigora*	Brown Falcon
	Falco longipennis	Australian Hobby
	Falco peregrinus	Peregrine Falcon
Rallidae	*Tribonyx ventralis*	Black-tailed Native-hen

Family	Species	Common Name
	Fulica atra	Eurasian Coot
Recurvirostridae	*Himantopus leucocephalus*	Pied Stilt
Recurvirostridae	*Cladorhynchus leucocephalus*	Banded Stilt
Charadriidae	*Charadrius ruficapillus*	Red-capped Plover
	Elseyornis melanops	Black-fronted Dotterel
	Vanellus tricolor	Banded Lapwing
Scolopacidae	*Actitis hypoleucos*	Common Sandpiper
Turnicidae	*Turnix velox*	Little Button-quail
Cacatuidae	*Eolophus roseicapillus*	Galah
	Nymphicus hollandicus	Cockatiel
Psittacidae	*Barnardius zonarius*	Australian Ringneck
	Psephotus varius	Mulga Parrot
	Melopsittacus undulatus	Budgerigar
	Neopsephotus bourkii	Bourke's Parrot
	Neophema splendida	Scarlet-chested Parrot
Cuculidae	*Chalcites basalis*	Horsfield's Bronze-cuckoo
	Chalcites osculans	Black-eared Cuckoo
	Heteroscenes pallidus	Pallid Cuckoo
Halcyonidae	*Todiramphus pyrrhopygius*	Red-backed Kingfisher
Meropidae	*Merops ornatus*	Rainbow Bee-eater
Climacteridae	*Climacteris affinis*	White-browed Treecreeper
	Climacteris rufa	Rufous Treecreeper
Ptilonorhynchidae	*Ptilonorhynchus maculatus*	Spotted Bowerbird
	Ptilonorhynchus guttatus	Western Bowerbird
Maluridae	*Malurus splendens*	Splendid Fairy-wren
	Malurus leucopterus	White-winged Fairy-wren
	Malurus lamberti	Variegated Fairy-wren
Acanthizidae	*Calamanthus fuliginosus*	Striated Fieldwren
	Pyrrholaemus brunneus	Redthroat
	Smicrornis brevirostris	Weebill
	Gerygone fusca	Western Gerygone
	Acanthiza robustirostris	Slaty-backed Thornbill
	Acanthiza chrysorrhoa	Yellow-rumped Thornbill

Family	Species	Common Name
	Acanthiza uropygialis	Chestnut-rumped Thornbill
	Acanthiza apicalis	Inland Thornbill
	Aphelocephala leucopsis	Southern Whiteface
Pardalotidae	*Pardalotus striatus*	Striated Pardalote
Meliphagidae	*Certhionyx variegatus*	Pied Honeyeater
	Gavicalis virescens	Singing Honeyeater
	Lichenostomus ornatus	Yellow-plumed Honeyeater
	Lichenostomus plumulus	Grey-fronted Honeyeater
	Purnella albifrons	White-fronted Honeyeater
	Manorina flavigula	Yellow-throated Miner
	Acanthagenys rufogularis	Spiny-cheeked Honeyeater
	Epthianura tricolor	Crimson Chat
	Epthianura aurifrons	Orange Chat
	Sugomel niger	Black Honeyeater
	Lichmera indistincta	Brown Honeyeater
Pomatostomidae	*Pomatostomus superciliosus*	White-browed Babbler
Psophodidae	*Cinclosoma castaneothorax*	Chestnut-breasted Quail-thrush
Neosittidae	*Daphoenositta chrysoptera*	Varied Sittella
Campephagidae	*Coracina maxima*	Ground Cuckoo-shrike
	Coracina novaehollandiae	Black-faced Cuckoo-shrike
	Lalage tricolor	White-winged Triller
Pachycephalidae	*Pachycephala rufiventris*	Rufous Whistler
	Colluricincla harmonica	Grey Shrike-thrush
	Oreoica gutturalis	Crested Bellbird
Artamidae	*Artamus personatus*	Masked Woodswallow
	Artamus cinereus	Black-faced Woodswallow
	Artamus minor	Little Woodswallow
	Cracticus torquatus	Grey Butcherbird
	Cracticus nigrogularis	Pied Butcherbird
	Gymnorhina tibicen	Australian Magpie
	Strepera versicolor	Grey Currawong
Rhipiduridae	*Rhipidura albiscapa*	Grey Fantail
	Rhipidura leucophrys	Willie Wagtail

Family	Species	Common Name
Corvidae	*Corvus coronoides*	Australian Raven
	Corvus bennetti	Little Crow
	Corvus orru	Torresian Crow
Monarchidae	*Grallina cyanoleuca*	Magpie-lark
Petroicidae	*Microeca fascinans*	Jacky Winter
	Petroica goodenovii	Red-capped Robin
	Melanodryas cucullata	Hooded Robin
Megaluridae	*Cincloramphus mathewsi*	Rufous Songlark
	Cincloramphus cruralis	Brown Songlark
Hirundinidae	*Cheramoeca leucosterna*	White-backed Swallow
	Hirundo neoxena	Welcome Swallow
	Petrochelidon ariel	Fairy Martin
	Petrochelidon nigricans	Tree Martin
Nectariniidae	*Dicaeum hirundinaceum*	Mistletoebird
Motacillidae	*Anthus novaeseelandiae*	Australasian Pipit

Table 6. Amphibians potentially found near the project area

Family	Species	Common Name
Hylidae	*Cyclorana maini*	Sheep Frog
	Cyclorana platycephala	Water-holding Frog
Limnodynastidae	*Neobatrachus aquilonius*	Northern Burrowing Frog
	Neobatrachus kunapalari	Kunapalari Frog
	Neobatrachus sudelli	Sudell's Frog
	Neobatrachus sutor	Shoemaker Frog
	Neobatrachus wilsmorei	Goldfields Bullfrog
	Platyplectrum spenceri	Spencer's Burrowing Frog

Table 7. Mammals potentially found near the project area

Family	Species	Common Name
Bovidae	*Bos taurus*	Cow
	Capra hircus	Goat
	Ovis aries	Sheep
Camelidae	*Camelus dromedarius*	Dromedary
Canidae	*Canis lupus*	Dingo/dog
	Vulpes vulpes	Red Fox
Felidae	*Felis catus*	House Cat
Emballonuridae	*Saccolaimus flaviventris*	Yellow-bellied Sheath-tail Bat
Molossidae	*Austronomus australis*	White-striped Free-tail Bat
	Mormopterus planiceps	Southern Free-tail Bat
Pteropodidae	*Syconycteris australis*	Common Blossom-bat
Vespertilionidae	*Chalinolobus gouldii*	Gould's Wattled Bat
	Chalinolobus morio	Chocolate Wattled Bat
	Nyctophilus geoffroyi	Lesser Long-eared Bat
	Scotorepens balstoni	Inland Broad-nosed Bat
	Scotorepens greyii	Little Broad-nosed Bat
	Vespadelus regulus	Southern Forest Bat
Dasyuridae	*Antechinomys laniger*	Kultarr
	Dasycercus cristicauda/blythi	Mulgara
	Ningaui ridei	Wongai Ningaui
	Sminthopsis crassicaudata	Fat-tailed Dunnart
	Sminthopsis dolichura	Little Long-tailed Dunnart
	Sminthopsis hirtipes	Hairy-footed Dunnart
	Sminthopsis longicaudata	Long-tailed Dunnart
	Sminthopsis macroura	Stripe-faced Dunnart
	Sminthopsis ooldea	Ooldea Dunnart
Macropodidae	*Osphranter robustus*	Euro
	Osphranter rufus	Red Kangaroo
Leporidae	*Oryctolagus cuniculus*	European Rabbit
Tachyglossidae	*Tachyglossus aculeatus*	Short-beaked Echidna
	Equus caballus	Domestic Horse
Equidae	*Mus musculus*	House Mouse
Muridae	*Notomys alexis*	Spinifex Hopping Mouse
	Pseudomys desertor	Desert Mouse
	Pseudomys hermannsburgensis	Sandy Inland Mouse

Table 8. Reptiles potentially found near the project area

Family	Species	Common Name
Agamidae	*Ctenophorus caudicinctus*	Ring-tailed Dragon
	Ctenophorus fordi	Mallee Dragon
	Ctenophorus inermis	Military Dragon
	Ctenophorus isolepis	Crested Dragon
	Ctenophorus maculatus	Spotted Dragon
	Ctenophorus nuchalis	Central Netted Dragon
	Ctenophorus reticulatus	Western Netted Dragon
	Ctenophorus salinarum	Saltpan Dragon
	Ctenophorus scutulatus	Lozenge-marked Dragon
	Diporiphora amphiboluroides	Mulga Dragon
	Moloch horridus	Thorny Devil
	Pogona minor	Western Bearded Dragon
	Tympanocryptis cephalus	Pebble Dragon
Boidae	*Antaresia stimsoni*	Stimson's Python
Carphodactylidae	*Nephrurus levis*	Three-lined Knob-tail
	Nephrurus vertebralis	Midline Knob-tail
	Nephrurus wheeleri	Banded Knob-tail
	Underwoodisaurus milii	Barking Gecko
Diplodactylidae	*Diplodactylus conspicillatus*	Fat-tailed Diplodactylus
	Diplodactylus granariensis	Wheat-belt Stone Gecko
	Diplodactylus pulcher	Fine-faced Gecko
	Lucasium damaeum	Beaded Gecko
	Lucasium squarrosum	Mottled Ground Gecko
	Strophurus assimilis	Goldfields Spiny-tailed Gecko
	Strophurus elderi	Jewelled Gecko
	Strophurus strophurus	Western Spiny-tailed Gecko
	Strophurus wellingtonae	Spiny-tailed Gecko
Elapidae	*Brachyurophis fasciolata*	Narrow-banded Burrowing Snake
	Brachyurophis semifasciata	Half-girdlerd Snake
	Furina ornata	Orange-naped Snake
	Parasuta monachus	Monk Snake
	Pseudechis australis	Mulga Snake
	Pseudechis butleri	Spotted Mulga Snake
	Pseudonaja mengdeni	Gwardar
	Pseudonaja modesta	Ringed Brown Snake
	Simoselaps bertholdi	Jan's Banded Snake
	Suta fasciata	Rosen's Snake

Family	Species	Common Name
Gekkonidae	*Gehyra purpurascens*	Purplish Dtella
	Gehyra variegata	Tree Dtella
	Gehyra xenopus	Crocodile-faced Dtella
	Heteronotia binoei	Bynoe's Prickly Gecko
	Rhynchoedura ornata	Western Beaked Gecko
Pygopodidae	*Aprasia picturata*	Black-headed Worm-lizard
	Delma butleri	Unbanded Delma
	Delma nasuta	Sharp-snouted Delma
	Lialis burtonis	Burton's Snake-lizard
	Pygopus nigriceps	Western Hooded Scaly-foot
Scincidae	*Cryptoblepharus australis*	Inland Snake-eyed Skink
	Cryptoblepharus buchananii	Buchanan's Snake-eyed Skink
	Ctenotus ariadnae	Ariadna's Ctenotus
	Ctenotus atlas	Southern Mallee Ctenotus
	Ctenotus dux	Fine Side-lined Ctenotus
	Ctenotus grandis	Grand Ctenotus
	Ctenotus greeri	Spotted-necked Ctenotus
	Ctenotus hanloni	Nimbel Ctenotus
	Ctenotus helenae	Clay-soil Ctenotus
	Ctenotus leonhardii	Leonhardi's Ctenotus
	Ctenotus pantherinus	Leopard Skink
	Ctenotus piankai	Coarse Sands Ctenotus
	Ctenotus quattuordecimlineatus	Fourteen-lined Ctenotus
	Ctenotus schomburgkii	Schomburgk's Ctenotus
	Ctenotus severus	Stern Ctenotus
	Ctenotus uber	Spotted Ctenotus
	Egernia depressa	Pygmy Spiny-tailed Skink
	Egernia formosa	Goldfields Crevice-skink
	Eremiascincus richardsonii	Broad-banded Sand Swimmer
	Lerista bipes	North-western Sandslider
	Lerista desertorum	Central Desert Robust Slider
	Lerista distinguenda	South-western Orange-tailed Slider
	Lerista kingi	King's Slider
	Lerista timida	Timid Slider
	Liopholis inornata	Desert Skink
	Liopholis striata	Nocturnal Desert Skink
	Menetia greyii	Common Dwarf Skink
	Morethia butleri	Woodland Morethia Skink

Family	Species	Common Name
	Tiliqua multifasciata	Centralian Blue-tongued Lizard
	Tiliqua occipitalis	Western Blue-tongued Lizard
Typhlopidae	*Anilios australis*	Austral Blind Snake
	Anilios bicolor	Dark-spined Blind Snake
	Anilios endoterus	Interior Blind Snake
	Anilios hamatus	Pale-headed Blind Snake
	Anilios waitii	Waite's Blind Snake
Varanidae	*Varanus brevicauda*	Short-tailed Pygmy Monitor
	Varanus caudolineatus	Stripe-tailed Monitor
	Varanus eremius	Pygmy Desert Monitor
	Varanus giganteus	Perentie
	Varanus gouldii	Gould's Goanna
	Varanus panoptes	Yellow-spotted Monitor
	Varanus tristis	Black-headed Monitor
Cheluidae	*Chelodina steindachneri*	Steindachner's Snake-necked Turtle

4.4 CONSERVATION SIGNIFICANT FAUNA

Conservation significant fauna are protected by the Commonwealth *EPBC Act 1999*, and this list includes species covered by international treaties such as the Japan-Australia Migratory Bird Agreement (JAMBA) and China-Australia Migratory Bird Agreement (CAMBA) and the *BC Act 2016*. The *BC Act 2016* provides for the publishing of the *Wildlife Conservation (Specially Protected Fauna) Notice* that lists species under multiple categories. In addition, the DBCA maintains a list of fauna that require monitoring under four priorities based on the current knowledge of their distribution, abundance and threatening processes. The *EPBC Act 1999* and *BC Act 2016* imply legislative requirements for the management of anthropogenic impacts to minimise the effects of disturbances on species and their habitats. Priority species have no statutory protection, other than the DBCA wishes to monitor potential impacts on these species. Environmental consultants and proponents of developments are encouraged to avoid and minimise impacts on these species. Definitions of the significant fauna under the *BC Act 2016* are provided in Appendix C.

Wetland and wetland migratory bird species have been excluded from the following list and assessments as there is no suitable habitat for these species in the project area. No threatened or priority species of fauna potentially occur in the project area. The following is an assessment of the likelihood of each of the species listed in Table 9 being found in the project area.

Table 9. Assessment of the potential presence of a conservation significant fauna species in the project area

Species	DBCA Schedule / Priority	Status under Commonwealth EPBC Act	Comment on the potential presence of a species
Night Parrot *Pezoporus occidentalis*	Critically Endangered	Endangered	Highly unlikely to be in the project area, due to a lack of suitable habitat. The potential for impacting on this species is therefore very low.
Malleefowl *Leipoa ocellata*	Vulnerable	Vulnerable	Highly unlikely to be in the project area due to a lack of suitable habitat. The potential for impacting on this species is therefore very low.
Grey Falcon *Falco hypoleucos*	Vulnerable	Vulnerable	Unlikely to occur in the project area as it is seldom seen in this area. The potential for impacting on this species is therefore very low.
Chuditch *Dasyurus geoffroii*	Vulnerable	Vulnerable	Highly unlikely to occur in the project area due to a lack of suitable habitat. The potential for impacting on this species is therefore very low.
Princess Parrot *Polytelis alexandrae*	Priority 4	Vulnerable	Unlikely to occur in the project area as it is seldom seen in this area. The potential for impacting on this species is therefore very low.
Mulgara *Dasycercus blythi*	Priority 4		Highly unlikely to occur in the project area due to a lack of suitable habitat. The potential for impacting on this species is therefore very low.
Oriental Plover *Charadrius veredus*	Migratory	Migratory	Highly unlikely to occur in the project area due to a lack of suitable habitat. The potential for impacting on this species is therefore very low.
Fork-tailed Swift *Apus pacificus*	Migratory	Migratory	May very infrequently be seen in the region, however, clearing vegetation is unlikely to impact on this aerial species.
Grey Wagtail *Motacilla cinereal*	Migratory	Migratory	Highly unlikely to be present in the project area. The potential for impacting on this species is therefore low.
Yellow Wagtail *Motacilla flava*	Migratory	Migratory	Highly unlikely to be present in the project area. The potential for impacting on this species is therefore low.
Peregrine Falcon *Falco peregrinus*	OS		May infrequently be seen in the region, however, clearing vegetation is unlikely to impact on this species.
Branchinella apophysata	Priority 1		Highly unlikely to be in the project area due to a lack of suitable habitat, so the potential for impact on this species is low.
Long-tailed Dunnart *Sminthopsis longicaudata*	Priority 4		Improbable in the project area, but if present would be in the rocky outcrop on the eastern boundary.

OS – Other Specially protected fauna

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

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

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

Wilson's (1937) summary of observations provided information on the early records of Night Parrots' preferred habitat and breeding sites. Recent information indicates its preferred habitat appears to be in Triodia grasslands, chenopod shrublands, shrubby samphire and floristically diverse habitats dominated by large-seeded species (Threatened Species Scientific Committee 2016, McCarthy 2017, Murphy et al. 2017b). At Pullen Pullen Reserve it nests in large, more or less ring-shaped *Triodia*, and the nest consists of a tunnel (25-30^{o} and 0^{o} to the ground; 20-33cm long) through an apron of dead spinifex leaves that leads to a chamber under a live hummock, with a shallow depression (3-4cm) excavated into the gravelly/sandy soil (Murphy et al. 2017a). In the northern Goldfields the nest was again in a spinifex hummock, it was circular, with an excavated depression (~1.5-2.0cm) in sandy substrate (Hamilton et al. 2017, Jackett et al. 2017). The entrance tunnel was 62cm long, and was downward sloping (27^{o}) with the entrance 28cm above the ground (Hamilton et al. 2017). It has clutches of two to four sub-elliptical, white eggs with a lustrous appearance (Murphy et al. 2017a). Breeding followed significant rains in March for the observations in Pullen-Pullen Reserve and in April in the northern Goldfields (Hamilton et al. 2017, Murphy et al. 2017a), but it is thought that breeding generally occurs between April and October (Murphy et al. 2017a).

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

There are no mature spinifex hummocks in the project area. As the preferred roosting and nesting sites for Night Parrots are not present in the project area and there is a significant threatening process for the species in the area (i.e. feral cats), it is Terrestrial Ecosystems' assessment that Night Parrots are not present in the project area and will therefore not be impacted by any proposed development.

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

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

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

Malleefowl have been found in mallee regions of southern Australia from approximately the 26th parallel of latitude southwards. Malleefowl are now only found throughout these regions in fragmented patches due to clearing of habitat for agriculture, increased fire frequency, competition with exotic herbivores (sheep, rabbits, cattle, goats) and kangaroos, predation by foxes and cats, inbreeding as a result of fragmentation and possibly hunting for food.

The sparsely vegetated project area would not typically support Malleefowl. As Malleefowl were not recorded and are unlikely to be present, Terrestrial Ecosystems' assessment is that Malleefowl will not be significantly impacted by a development.

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

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

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

It is highly unlikely that the Grey Falcon is in the project area due to a lack of substantive trees.

Chuditch (*Dasyurus geoffroii*) – Vulnerable under the *BC Act 2016* and *EPBC Act 1999*.

The Chuditch is the largest extant carnivorous marsupial in WA. It is usually active from dusk to dawn. Formally known from over 70% of Australia, the Chuditch now has a patchy distribution throughout the Jarrah forest and mixed Karri/Marri/Jarrah forest of south-west WA and other isolated areas. Chuditch are solitary animals for most of their life and den in hollow logs, burrows, culverts, etc. and have also been recorded in tree hollows and rock cavities. Chuditch are opportunistic feeders, and forage primarily on the ground at night. Their diet can include other mammals, birds, lizards, bird and reptile eggs but the majority is a mixture of large invertebrates (e.g. spiders, scorpions and crickets).

How et al. (1988) reported Chuditch being found near the Norseman-Lake King Road and near Mount Holland. DBCA records show that one specimen was recorded in 1974 in Kambalda East. There are multiple records south of Southern Cross and Marvel Loch and there have been other reported sightings east of Kambalda and near Norseman but Terrestrial Ecosystems can find none north of Kalgoorlie. It is therefore highly unlikely that the Chuditch will be found as far north as Leonora and in atypical habitat. As the project area is a significantly long way north of the species known distribution and the habitat is not suitable, it is unlikely that the Chuditch would be found in the project area. As a consequence, Terrestrial Ecosystems' assessment is that any development is unlikely to have a significant impact on this species.

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

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

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

Dr S. Thompson sighted this parrot in a survey near the Wanjarri Nature Reserve in 2006 and Moriarty (1972) also reported it in the same area, so it may occasionally be seen in the region. The project area is a long way from its typical geographical distribution, so it is unlikely to be seen in the project area.

Brush-tailed Mulgara (*Dasycercus blythi*) - Priority 4 with the DBCA

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

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

Fauna habitat in the project area is not suitable for Mulgara. It is therefore Terrestrial Ecosystems' view that they are unlikely of be found in the project area.

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

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

Terrestrial Ecosystems' assessment is that the Oriental Plover is unlikely to be seen in the project area and therefore unlikely to be impacted.

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

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

northwest, west and southeast coasts and rare to scarce elsewhere. It is rarely seen in the Goldfields (Plate 9), so it is unlikely to be impacted by the proposed development.

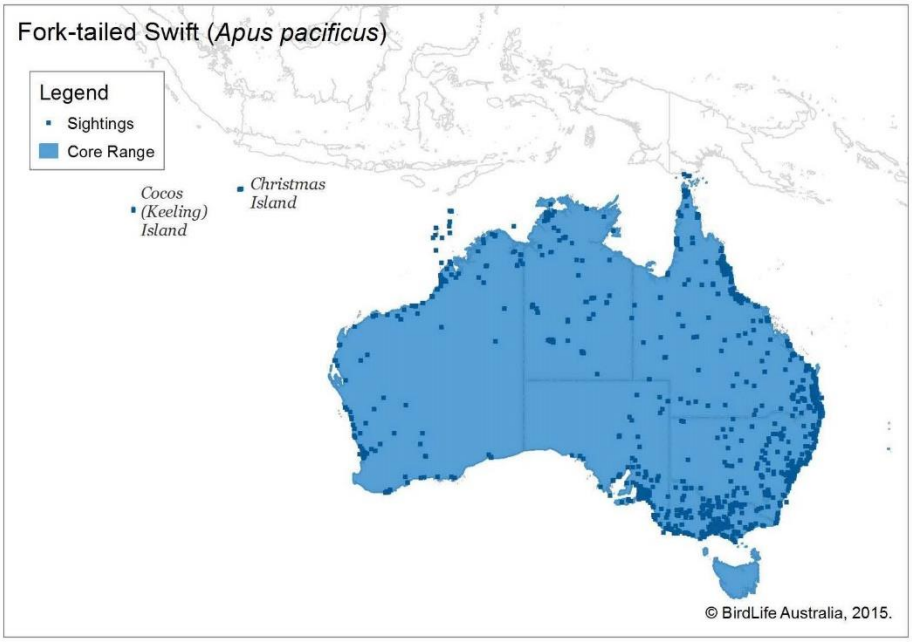

Plate 9. Range and actual reported sightings of the Fork-tailed Swift

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

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

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

The Atlas of Living Australia records two sightings on the south-coast of Western Australia and none around the project area. It is highly unlikely to be seen in the project area due to a lack of records and suitable habitat (Plate 10) so it is unlikely to be impacted by the proposed development.

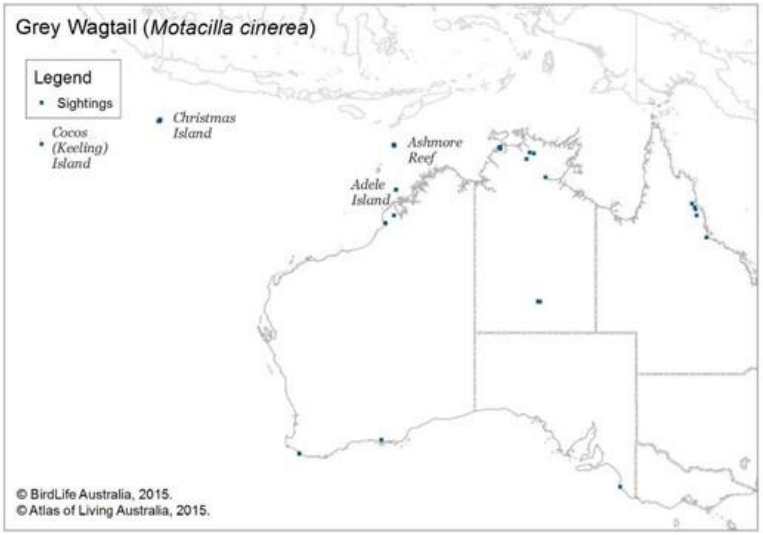

Plate 10. Reported sightings of the Grey Wagtail

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

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

The Yellow Wagtail is found it the millions in the norther hemisphere and the Atlas of Living Australia records multiple records of this bird in Australia in the coastal areas. There are no records for this species in inland Western Australia near the project area (Plate 11), therefore it is highly unlikely to be impacted by the proposed development.

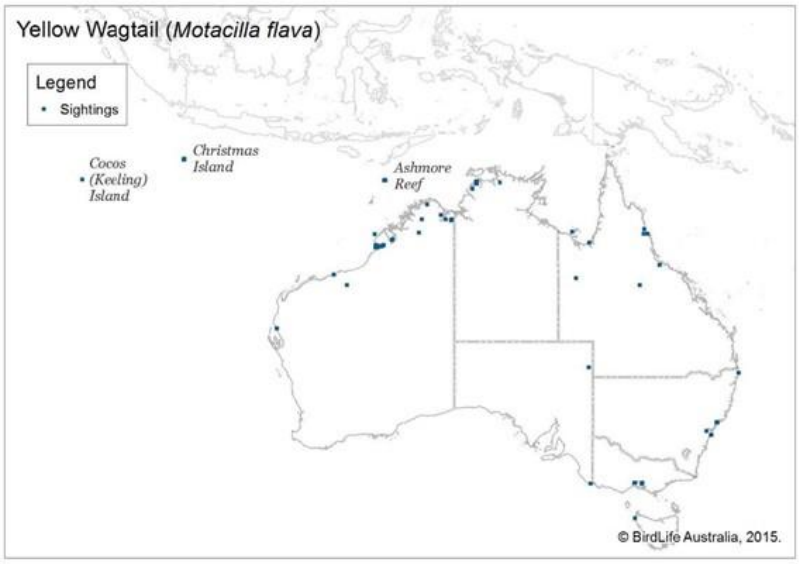

Plate 11. Reported sightings of the Yellow Wagtail

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

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

The Peregrine Falcon is uncommon, although widespread throughout much of Australia excluding the extremely dry areas and has a wide and patchy distribution. It shows habitat preference for areas near cliffs along coastlines, rivers and ranges and within woodlands along watercourses and around lakes. Nesting sites include ledges along cliffs, granite outcrops and quarries, hollow trees near wetlands and old nests of other large bird species. There is no evidence to suggest any change in status in the last 50 years. The Peregrine Falcon has been seen in the Wanjarri Nature Reserve (Moriarty 1972, Ninox Wildlife Consulting 1994), at Honeymoon Well (Ninox Wildlife Consulting 1994) and Mileura (Tingay and Tingay 1977), so they could infrequently be seen in the general area.

Terrestrial Ecosystems' assessment is that the Peregrine Falcon may infrequently be seen in the project area, however, mining development and operation is unlikely to have a significant impact on this species as it will readily move away from disturbance and there are abundant areas of similar habitat in the region.

Branchinella apophysata - Priority 1 species with DBCA

Notes from DBCA indicate that this fairy shrimp is known from a single location near Mt Margaret, but nothing is known of its habits or ecological requirements. As there are no salt lakes near the project area, it is Terrestrial Ecosystems' assessment that *B. apophysata* is unlikely to be impacted by the proposed development.

Long-tailed Dunnart (*Sminthopsis longicaudata*) - Priority 4 species with DBCA.

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

Three adult Long-tailed Dunnarts were caught in the Granny Smith Level 2 fauna survey (Terrestrial Ecosystems 2011a) and a single individual was caught in the follow up targeted survey (Terrestrial Ecosystems 2011b). Subsequently, Long-tailed Dunnarts have been caught at Mt Ida and Bottle Creek, which are west of Leonora. There are other unpublished records between Laverton and Leonora. The Dunnart's preferred habitat is rocky outcrops, one of which is on the eastern boundary of the project area. This is a small and isolated outcrop which means that the propensity for Long-tailed Dunnarts to be present is very low, as there is very limited capacity for them to get to the rocky outcrop across, sparsely vegetated plains.

It is therefore improbable that the project area supports Long-tailed Dunnarts.

5. DISCUSSION

5.1 ADEQUACY OF THE FAUNA SURVEY DATA FOR FAUNA HABITATS REPRESENTED IN THE PROJECT AREA

The EPA's (2020) Technical Guidance on terrestrial fauna surveys indicated that the type of survey should be determined based on:

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

The project area is ~1,000ha in a bioregion were Terrestrial Ecosystems has a substantial quantity of vertebrate fauna survey information (e.g. Coffey Environments 2008, Terrestrial Ecosystems 2010, 2011a, 2020a) for habitats similar to that in the project area. The sparseness of the vegetation and the very small and isolated rocky outcrop means that the project area is unlikely to support conservation significant fauna, and the vertebrate fauna present, will be in very low abundance and a subset of that in more vegetated areas.

5.1.1 Amphibians

Frogs are normally only detected immediately after rainfall or around semi-permanent pools, as the majority live underground when not surface active after rains. There may be a limited number of burrowed frogs along the edges of the ephemeral creeklines. None of these species are of conservation significance and all are widespread and abundant.

5.1.2 Reptiles

Typically, between 25 and 35 species of reptiles are caught in open mulga woodland (Coffey Environments 2008, Terrestrial Ecosystems 2010, 2011a, 2020a), but the sparseness of the vegetation and limited leaf litter in the project area would indicate that it only supports a limited variety of reptile species.

Terrestrial Ecosystems' view is that the development of the project area is unlikely to significantly impact on the reptile fauna of the bioregion.

5.1.3 Birds

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

The spareness of the vegetation in the project area indicates that it supports few avian species, and these would mostly be in the more densely treed areas other than those that fly overhead.

Terrestrial Ecosystems' view is that the proposed mining development and operation is unlikely to significantly impact on the avian fauna of the bioregion.

5.1.4 Mammals

The diversity of small terrestrial mammals potentially caught in the project area would be very low due the sparsely vegetated habitat. Cattle tracks and scats were present in some areas indicating station cattle occasionally move through the project area. One donkey was observed in the project area. There is a low possibility that the Long-tailed Dunnart is present in the small rocky outcrop on the eastern boundary of the project area, but given its size and isolation this is doubtful.

Terrestrial Ecosystems' view is that the development of the project area is unlikely to significantly impact on the mammal fauna of the bioregion.

5.2 BIODIVERSITY VALUE

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

Fauna habitat represented in the project area is abundant and in similar condition in adjacent areas. Most of the adjacent areas support more vegetation, so the fauna assemblage that is present in the project area will be a subset of what is present in the adjacent areas.

5.2.1 Ecological functional value at the ecosystem level

Other than a low possibility that the small rocky outcrop supports Long-tailed Dunnarts, this site doesn't support conservation significant fauna or a conservation significant ecosystem.

5.2.2 Maintenance of threatened ecological communities

Other than a low possibility that the small rocky outcrop supports Long-tailed Dunnarts, no threatened ecological fauna communities were identified in the project area.

5.2.3 Condition of fauna habitat

The fauna habitats present in the project area are similar to adjacent areas. The proposed development is therefore unlikely to have a significant impact on the vertebrate fauna when considered in a bioregional context.

5.2.4 Ecological linkages

The project area does not provide an important ecological linkage or fauna movement corridor.

5.2.5 Size and scale of the proposed disturbance

The project area is a small proportion of similar fauna habitat found in the adjacent area and bioregion. Given the available fauna survey data for these habitat types, no additional surveys are warranted.

5.2.6 Abundance and distribution of similar habitat in the adjacent areas

Fauna habitats present in the project area are present in adjacent areas.

5.2.7 Potential impacts on ecosystem function

Clearing native vegetation is likely to result in the loss of any remaining small vertebrate fauna on-site that are unable to move away during the clearing process. The sparseness of the vegetation, patchy and limited leaf litter and ground cover mean there is a very low abundance of terrestrial vertebrate fauna in the project area.

Impacts on the vertebrate fauna associated with clearing vegetation and development in the project area in a landscape or bioregional context are likely to be very low due to the low abundance of fauna and the sparseness of vegetation in the project area.

6. POTENTIAL ENVIRONMENTAL IMPACTS

Development of the area will potentially affect vertebrate fauna in numerous ways, including death/injury of fauna during vegetation clearing, impacts with vehicles and the loss of habitat.

Although there are anticipated short term impacts on a very small number of vertebrate fauna, they are not likely to result in significant impacts on fauna habitat and fauna assemblages in the long term.

6.1 DIRECT IMPACTS

6.1.1 Animal deaths during the clearing process and displacement of fauna

Clearing vegetation and activities associated with a mine development and operation will result in the loss of a small number of fauna that retreat to burrows, such as reptiles and mammals. Nocturnal species are unlikely to be active when most of the land clearing and construction work is taking place which may result in these individuals being adversely impacted when they attempt to escape. This loss of the remaining vegetation is unlikely to have a significant impact when considered in a bioregional context.

6.2 INDIRECT IMPACTS

In addition to the obvious impact of vegetation clearing there can be an equally significant or greater impact in the adjacent areas because of 'edge effects'. However, for this project area, the sparseness of vegetation and lack of ground cover mean there will be few 'edge effects' as a consequence of vegetation clearing.

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

6.2.1 Habitat fragmentation

In addition to direct impacts of vegetation clearing, infrastructure including construction or widening of tracks, has the potential to fragment habitat. Cleared linear tracks of land are 'unnatural' in much of the habitat. These linear structures often partition existing activity areas, isolate sections of established communities and may alter long and medium-term patterns of movement around established home ranges particularly for small mammals and reptiles. Clearing of the remaining vegetation in the project area is unlikely to result in greater habitat fragmentation due to the sparseness of the vegetation.

6.2.2 Introduced fauna and weeds

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

House mice, cats and wild dogs are known to be established in the area. One donkey was observed, and camels are common in the region. In many situations they have become a 'naturalised' species in the Australian bush. The lack of vegetation means the area is unlikely to support high densities of introduced vertebrate pest species, however, mine development and operation could introduce weeds to the project area.

6.2.3 Road fauna deaths

An increase in road fauna deaths is likely to occur where new roads / tracks are constructed or upgraded, in particular, affecting kangaroos, nocturnal birds and ground dwelling large carnivorous predators. Species such as goannas and raptors are attracted to carrion on road verges and therefore, there is an increased propensity for these species to be killed by vehicles. Given the size of the project area, the limited abundance of vertebrate fauna in the project area, the impacts associated with road fauna deaths are likely to be low.

6.2.4 Fire

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

Fires will not be a potential impact in the project area due to the sparseness of the vegetation.

6.2.5 Anthropogenic activity

Unnatural noises, vibrations, artificial light sources, and vehicle and human movement in an area may be sufficient to force individuals or fauna species to move from adjacent areas, or alter their activity periods. The limited abundance of fauna in the project area means that anthropogenic activity is unlikely to be a significant impact.

6.2.6 Dust

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

6.2.7 Risk assessment

Fauna surveys to support Environmental Impact Assessments (EIA) are part of the environmental risk assessment undertaken to consider what potential impacts a development might have on the biodiversity on a particular area and region. Potential impacts on fauna from the proposed development are identified and briefly described above. Tables 10, 11 and 12 provide a summary of the risk assessment associated with this project.

Any risk assessment is a product of the likelihood of an impact occurring and the consequences of that impact. Likelihood and consequences are categorised and described below. The assessed risk level (likelihood x consequences) is then calculated as the overall risk for the development. This is followed by an assessment of the acceptability of the risk associated with each of the impacts. Disturbances and vegetation clearing have an impact on the fauna at multiple scales – site, local, landscape and regional. Each of these is considered in the risk assessment. This assessment should be considered in the context of the summary in Table 12.

Table 10. Fauna impact risk assessment descriptors

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

Table 11. Levels of acceptable risk

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

Table 12. A risk assessment of the impact of ground disturbance activity on fauna

			Before management				With management		
	Potential impacts		**Inherent risk**			**Risk controls**	**Residual risk**		
Factor			Likelihood	Consequence	Significance		Likelihood	Consequence	Significance
Fauna survey data	Inadequate survey data to adequately assess the risks	Unknown loss of fauna, fauna of conservation significance, and fauna assemblages, and an incomplete fauna assessment.	A	1	Low				
	Inadequacy of comparative data	Limits on the availability of comparative data reduced the capacity to assess the uniqueness of the fauna assemblages in the project area.	A	1	Low				
Clearing vegetation	Loss of fauna habitat – local scale	Loss of terrestrial fauna in the project area.	E	1	Low				
	Loss of fauna habitat – landscape scale	Loss of some fauna during vegetation clearing.	A	1	Low				
	Loss of fauna habitat – regional scale	Small loss of some fauna from the region.	A	1	Low				
	Loss of a threatened ecological fauna community	Loss of an undetected threatened ecological fauna community.	A	3	Low				
	Habitat fragmentation	Fauna movement restricted resulting in the death of fauna and a loss of biodiversity.	A	2	Low				
Death or loss of conservation significant fauna	Loss of a unique terrestrial fauna ecosystem	Loss of an ecosystem containing fauna with high species richness, high abundance and numerous top of the food chain predators.	A	2	Low				
	Night Parrot	Loss of a Night Parrot or small population of Night Parrots	A	3	Low				
	Malleefowl	Loss of a Malleefowl or small population of Malleefowl	A	2	Low				
	Chuditch	Loss of a Chuditch or small population of Chuditch	A	2	Low				
	Princess Parrot	Loss of a Princess Parrot or small population of Princess Parrot	A	2	Low				

			Before management				With management		
	Mulgara	Loss of a Mulgara or small population of Mulgara	A	2	Low				
	Oriental Plover	Loss of a Oriental Plover or small population of Oriental Plover	A	2	Low				
	Fork-tailed Swift	Loss of a Fork-tailed Swift or small population of Fork-tailed Swift	A	2	Low				
	Grey Wagtail	Loss of a Grey Wagtail or small population of Grey Wagtail	A	2	Low				
	Yellow Wagtail	Loss of a Yellow Wagtail or small population of Yellow Wagtail	A	2	Low				
	Peregrine Falcon	Loss of a Peregrine Falcon or small population of Peregrine Falcon	A	2	Low				
	Branchinella anophysata	Loss of a small population of *Branchinella anophysata*	A	2	Low				
	Long-tailed Dunnart	Loss of a Long-tailed Dunnart or small population of Long-tailed Dunnart	A	2	Low				
Human impacts	Increase or spread of weeds	Changed vegetation and a resulting loss of fauna habitat.	E	2	Mod.	Implementation of a weed management plan.	D	2	Low
	Road kills	Animals being killed by vehicles as they cross roads	E	1	Low	Limiting speeds	E	1	Low
	Increase in feral mammals, specifically the dog and cat	Increased predation on the native fauna	B	2	Low				

6.3 NATIVE VEGETATION CLEARING PRINCIPLES AS THEY PERTAIN TO VERTEBRATE FAUNA

The *Environmental Protection Act (1986)* outlines 10 principles that are to be used in the assessment of native vegetation clearing permit applications which are also applicable for other assessments and approvals (Table 13). Where possible, native vegetation should not be cleared if any of the following principles are comprised.

Table 13. Assessment of impact using the native vegetation clearing principles

Principle	Response
It comprises a high level of biological diversity.	Clearing vegetation will not comprise a high level of biodiversity. Fauna habitat in the project area is abundant in adjacent areas, the vegetation is generally sparse with patchy and limited leaf litter and ground cover, with the consequence there will be a low abundance of terrestrial vertebrates in the project area. Avifauna will be also limited, with the highest abundance in the denser treed areas along ephemeral creeklines. There is a small rocky outcrop along the eastern boundary of the project area. It is this type of habitat that can support Long-tailed Dunnarts, a priority 4 species with the DBCA. The size of the rocky outcrop and its isolation would indicate there is only a low possibility that Long-tailed Dunnarts are in this area.
It comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.	There is a small rocky outcrop along the eastern boundary of the project area. It is this type of habitat that can support Long-tailed Dunnarts, a priority 4 species with the DBCA. The size of the rocky outcrop and its isolation would indicate there is only a low possibility that Long-tailed Dunnarts are in this area. Clearing the remaining vegetation will not result in the loss of significant habitat for indigenous fauna.
It includes, or is necessary for the continued existence or, rare flora.	N/A
It comprises the whole or a part of, or is necessary for the maintenance of, a threatened ecological community.	The area does not contain a threatened ecological fauna community.
It is significant as a remnant of native vegetation in an area that has been extensively cleared.	The area is not a remnant.
It is growing in, or in association with, an environment associated with a watercourses or wetland.	There are south flowing ephemeral creeklines in the project area, but similar drainage systems are abundant in the area, all flowing in the direction of a large claypan on the south side of the Laverton-Leonora Road. The area does not contain a natural wetland.
The clearing of the vegetation is likely to cause appreciable land degradation.	N/A

Principle	Response
The clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.	There are no conservation areas nearby, with Wanjarri Nature Reserve being 180km to the north, north-west and a small unnamed area south of the Kookynie Rd, 60km to the south. Clearing of vegetation is unlikely to impact on the environmental values of the bioregion.
The clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.	N/A
The clearing of the vegetation is likely to cause, or exacerbate the incidence of flooding.	N/A

6.4 REFERRAL UNDER THE EPBC ACT

The proposed project is unlikely to significantly impact on a conservation significant vertebrate fauna species, so a referral under the *EPBC Act 1999* is not required.

7. SUMMARY

The total assessed area is ~1,000ha but the development area is likely to be substantially less. There are three broad fauna habitats in the project area:

- Mulga woodland;
- Open Mulga woodland; and
- shrubland.

The mulga woodland is associated with an ephemeral drainage line that runs north-south through the flat plains and there is a small rocky ridge on the eastern boundary that has a shrubland habitat. Some small areas are highly degraded through exploration activity, but these are not significant in the context of the available fauna habitat in the area.

Clearing native vegetation in the project area is likely to result in the loss of a small number vertebrate fauna on-site that are unable to move away during the vegetation clearing process or development. This loss is not likely to be significant when viewed in a bioregional context. There may be an on-going loss of small native fauna to vehicle strikes on access tracks, but overall, this impact will be very low.

Impacts on vertebrate fauna associated with clearing vegetation in the project area in a landscape or bioregional context are likely to be very low due to the sparseness of the vegetation.

The proposed project is unlikely to significantly impact on a conservation significant species, so a referral under the *EPBC Act 1999* is not required. There is a low likelihood that the Long-tailed dunnart is occasionally present on the small rocky ridge on the eastern boundary of the project area, but it is too small to be a permanent refuge for the species.

8. MANAGEMENT STRATEGIES

The purpose of this section is to identify generic management and mitigation strategies to address the potential impacts of development in the project area.

8.1 INDUCTION AND AWARENESS

All contractors and staff involved in vegetation clearing, development and ongoing operations in the project area should be made aware of the possible presence and issues associated with terrestrial fauna in the area through the induction process.

> **Recommendation 1:** An induction program that includes a component on managing fauna is a mandatory for staff working in the project area.

8.2 DUST

Dust generated from the vegetation clearing and development could potentially degrade surrounding vegetation, reducing its ability to absorb sunlight and influencing photosynthetic rates. Degradation of these areas will potentially render habitat unsuitable for fauna. Dust suppression and management programs are an essential component of minimising mining impacts on fauna during the construction program.

> **Recommendation 2:** The impact of dust on adjacent vegetation and fauna habitat is managed against appropriate KPIs and in accordance with the clients' Construction Environmental Management Plan.

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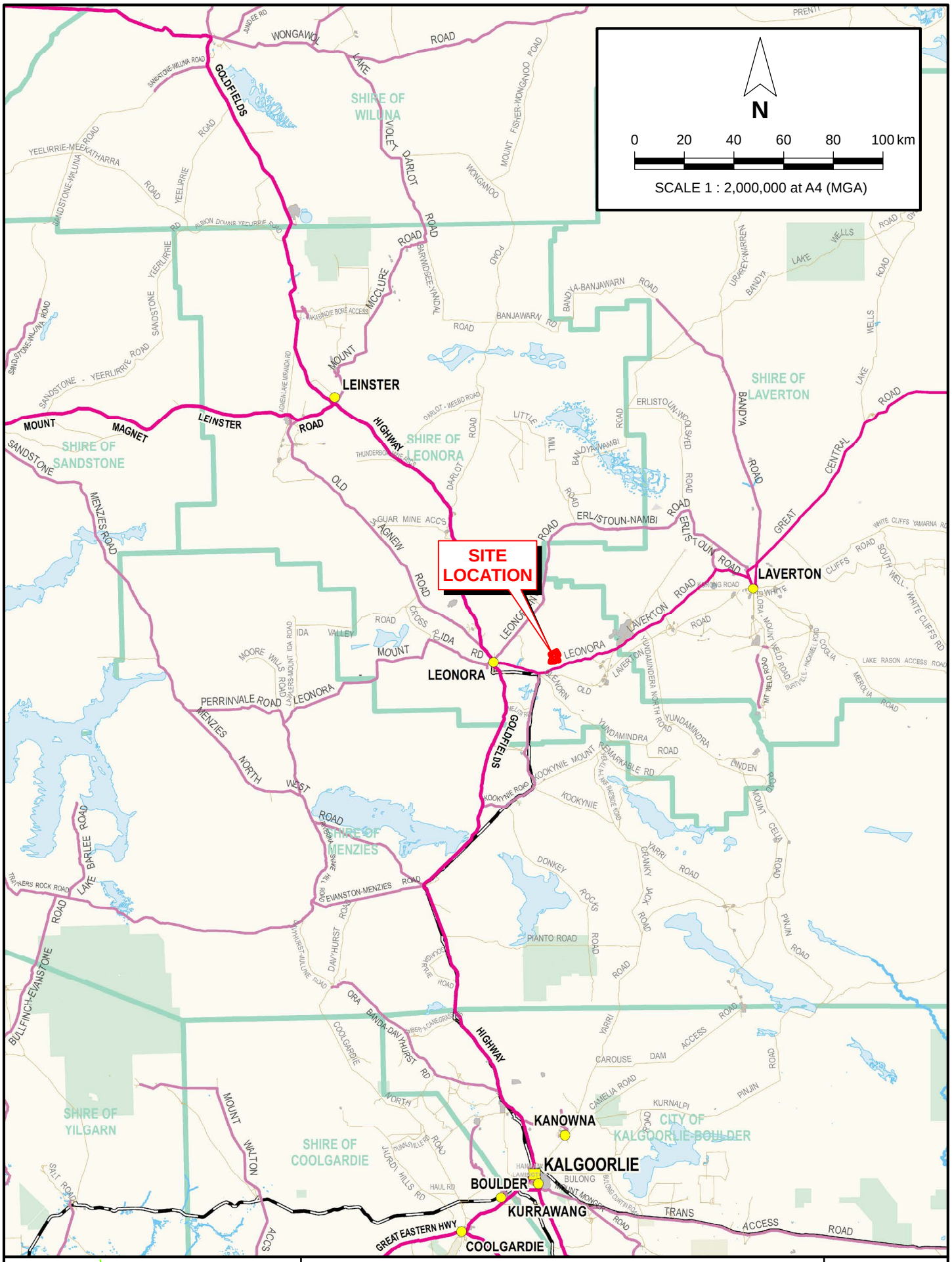
Figures

Basic Vertebrate Fauna Survey and Risk Assessment
Crawford Project



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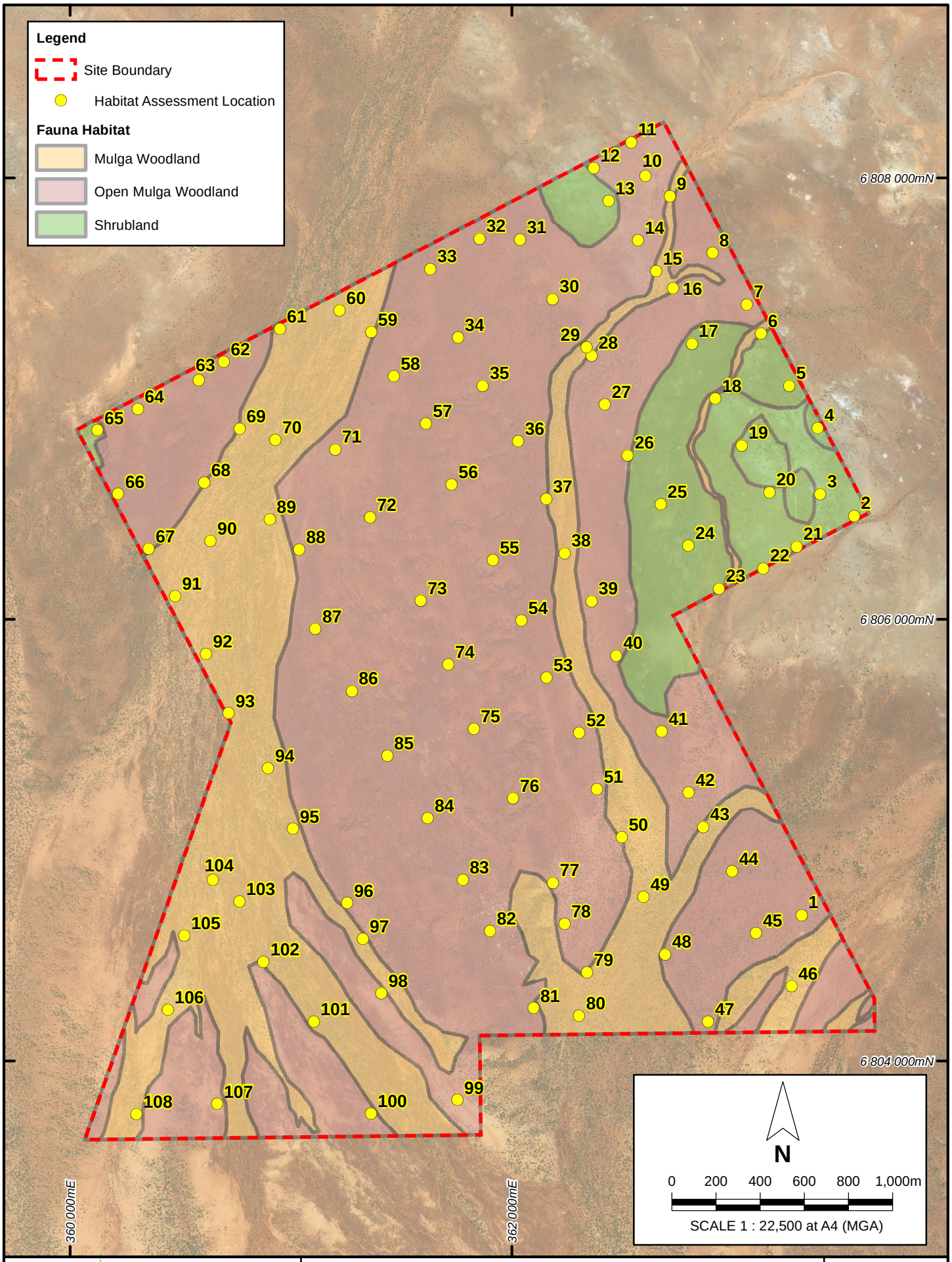
TERRESTRIAL ECOSYSTEMS

Specrez Pty Ltd
BASIC VERTEBRATE FAUNA SURVEY AND RISK ASSESSMENT
FOR THE CRAWFORD PROJECT

Figure 1

REGIONAL LOCATION

Drawn: S. Thompson | Date: 24 Dec 2020 | Job: 2020-0099



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TERRESTRIAL ECOSYSTEMS

Specrez Pty Ltd
BASIC VERTEBRATE FAUNA SURVEY AND RISK ASSESSMENT
FOR THE CRAWFORD PROJECT

FAUNA HABITAT TYPES AND ASSESSMENT LOCATIONS

Figure 2

Drawn: S. Thompson

Date: 24 Dec 2020

Job: 2020-0099

Appendix A.

Results of the EPBC Act Protected Matters Search

Basic Vertebrate Fauna Survey and Risk Assessment
Crawford Project

Australian Government

Department of Agriculture, Water and the Environment

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.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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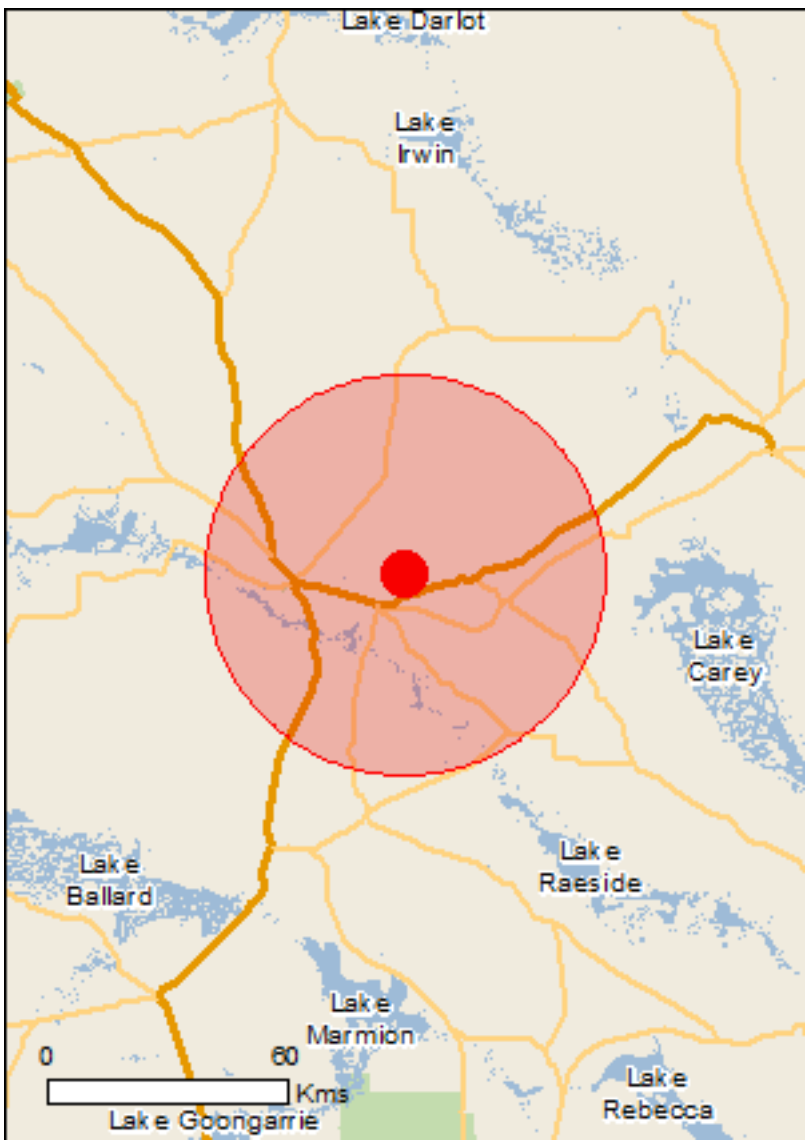
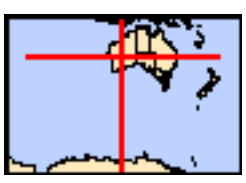


Coordinates

Buffer: 50.0Km



Summary

Matters of National Environmental 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:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	5
Listed Migratory Species:	8

Other Matters Protected by the EPBC Act

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

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at 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 Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	12
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	15
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat known to occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Polytelis alexandrae Princess Parrot, Alexandra's Parrot [758]	Vulnerable	Species or species habitat known to occur within area
Mammals		
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius veredus		
Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [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.

Name
Commonwealth Land -

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat known to occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius veredus		
Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Chrysococcyx osculans		
Black-eared Cuckoo [705]		Species or species habitat known to occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea		
Grey Wagtail [642]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Extra Information

Invasive Species	[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Mammals		
Camelus dromedarius Dromedary, Camel [7]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Equus asinus Donkey, Ass [4]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Carrichtera annua Ward's Weed [9511]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Cylindropuntia spp. Prickly Pears [85131]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, 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 distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for 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 reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

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

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

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

Coordinates

-28.868 121.5808

Acknowledgements

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

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

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

Please feel free to provide feedback via the Contact Us page.

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Appendix B.

Vertebrate Fauna Recorded in Biological Surveys in the Region

Basic Vertebrate Fauna Survey and Risk Assessment
Crawford Project

B.1 VERTEBRATE FAUNA RECORDED IN BIOLOGICAL SURVEYS IN THE REGION

		Survey	1																								2										3
Family	**Species**	**Common Name**	**Site 1E**	**Site 1W**	**Site SS18**	**Site SS21**	**Site SS1**	**Site 1W08**	**Site LL4**	**Site LL5**	**Site SS19**	**Site SS20**	**Site LL3**	**Site LL6**	**Site SS22**	**Site LL1**	**Site LL2**	**Site SS23**	**Site 2**	**Site 3**	**Site 6**	**Site 7**	**Site 8**	**Site 1**	**Site 4**	**Site 5**	**Pundin**	**Wells**	**Site 2**	**Site 10**	**Site 21**	**Site 18**	**Site 21a**	**Site 9**	**Weebo**	**Site 17**	**Opportunistic**	
Frogs																																						
Hylidae	*Cyclorana maini*	Sheep Frog	4	1	2	1																					1	2	4	1	2							
Limnodynastidae	*Neobatrachus kunapalari*	Kunapalari Frog	6	5	7		1	2	1	2	1	4																				1						
	Neobatrachus wilsmorei	Goldfields Bullfrog																												1	8	5	2					
	Platyplectrum spenceri	Spencer's Burrowing Frog																										3		6								
Reptiles																																						
Agamidae	*Ctenophorus caudicinctus*	Ring-tailed Dragon		2			3																				8											
	Ctenophorus fordi	Mallee Dragon	5																											14				19				
	Ctenophorus inermis	Military Dragon	2	6		1					1	1	1															5	1	2			2		1			
	Ctenophorus isolepis	Crested Dragon	7	2		3		1	4					1	3																	4				1		
	Ctenophorus reticulatus	Western Netted Dragon	2	2							2																											
	Ctenophorus salinarum	Saltpan Dragon	3	1												1	5										1							6				
	Ctenophorus scutulatus	Lozenge-marked Dragon	1										1																									
	Diporiphora amphiboluroides	Mulga Dragon		1			1																															
	Moloch horridus	Thorny Devil	3												1															1	1	2	1					
	Pogona minor	Dwarf Bearded Dragon	2	2					2	1			1																2	1								
Carphodactylidae	*Nephrurus vertebralis*	Midline Knob-tail																											1									
	Underwoodisaurus milii	Barking Gecko	1																																			
Diplodactylidae	*Diplodactylus pulcher*	Fine-faced Gecko			1	2																					2											
	Lucasium squarrosum	Mottled Ground Gecko	1													1																		18				
	Strophurus elderi	Jewelled Gecko											1																			1	10					

		Survey	1																										2												3
Family	Species	Common Name	Site 1E	Site 1W	Site SS18	Site SS21	Site SS1	Site 1W08	Site LL4	Site LL5	Site SS19	Site SS20	Site LL3	Site LL6	Site SS22	Site LL1	Site LL2	Site SS23	Site 2	Site 3	Site 6	Site 7	Site 8	Site 1	Site 4	Site 5	Pundin	Wells	Site 2	Site 10	Site 21	Site 18	Site 21a	Site 9	Weebo	Site 17	Opportunistic	
	Strophurus strophurus	Western Spiny-tailed Gecko	1					1																																
	Strophurus wellingtonae	Shield Spiny-tailed Gecko	1	1	1	1	1																																	
Elapidae	*Brachyurophis semifasciata*	Half-girdlerd Snake																											1		1								
	Furina ornata	Orange-naped Snake	2																																					
	Pseudechis australis	Mulga Snake	1																																					
	Pseudonaja mengdeni	Gwardar		1																											1								
	Pseudonaja modesta	Ringed Brown Snake																															1						
	Simoselaps bertholdi	Jan's Banded Snake	1																																					
Gekkonidae	*Gehyra purpurascens*	Purplish Dtella	1							1																		10								3			
	Gehyra variegata	Tree Dtella	25	2		1	8			1			1			1											5	7	3		3	2	1	3		1		X
	Heteronotia binoei	Bynoe's Prickly Gecko	5	2			2																					3	1			1						X
	Rhynchoedura ornata	Western Beaked Gecko	2	1			4																						2	2	6	3				1		
Pygopodidae	*Delma butleri*	Unbanded Delma			1				1																							1	1					
	Delma nasuta	Sharp-snouted Delma							1				1	3	1			1																				
	Lialis burtonis	Burton's Snake-lizard	1																												1	2	1			1		
	Pygopus nigriceps	Western Hooded Scaly-foot																														1						
Scincidae	*Cryptoblepharus buchananii*	Buchanan's Snake-eyed Skink	3													1																						
	Ctenotus ariadnae	Ariadna's Ctenotus				4																																	
	Ctenotus atlas	Southern Mallee Ctenotus																												1								
	Ctenotus calurus	Blue-tailed Finesnout Ctenotus				1																																	
	Ctenotus grandis	Grand Ctenotus		1																												1				1		
	Ctenotus greeri	Spotted-necked Ctenotus							2																														
	Ctenotus helenae	Clay-soil Ctenotus	3	1		2			3																					6		4	1					

		Survey	1																								2											3
Family	**Species**	**Common Name**	Site 1E	Site 1W	Site SS18	Site SS21	Site SS1	Site 1W08	Site LL4	Site LL5	Site SS19	Site SS20	Site LL3	Site LL6	Site SS22	Site LL1	Site LL2	Site SS23	Site 2	Site 3	Site 6	Site 7	Site 8	Site 1	Site 4	Site 5	Pundin	Wells	Site 2	Site 10	Site 21	Site 18	Site 21a	Site 9	Weebo	Site 17	Opportunistic	
	Ctenotus leonhardii	Leonhardi's Ctenotus		2	5	1					2																2		1	5	16	1	1	2				
	Ctenotus pantherinus	Leopard Skink						1	6				1					1																				
	Ctenotus quattuordecimlineatus	Fourteen-lined Ctenotus						2							1															1		5						
	Ctenotus schevilli	Scheville's Ctenotus						2							1																							
	Ctenotus schomburgkii	Schomburgk's Ctenotus							3																						3							
	Egernia depressa	Pygmy Spiny-tailed Skink		1	6	2			3		3	1																2										
	Egernia formosa	Goldfields Crevice-skink		2								1																							2			
	Eremiascincus richardsonii	Broad-banded Sand Swimmer					2																															
	Lerista bipes	North-western Sandslider					1																															
	Lerista desertorum	Central Desert Robust Slider	1							1		1	1			1												4	2				2			5		
	Leerista rhonoides																																					X
	Lerista sp.		4								1	1				1	1										1	4	2					2		1		
	Liopholis inornata	Desert Skink																													1	1						
	Liopholis striata	Nocturnal Desert Skink																													1							
	Menetia greyii	Common Dwarf Skink	2										1			1																	1					
	Morethia butleri	Woodland Morethia Skink	2	3	1		3																												1			X
	Tiliqua multifasciata	Centralian Blue-tongued Lizard		2																																		
	Tiliqua occipitalis	Western Blue-tongued Lizard	2			1																																
Typhlopidae	*Anilios hamatus*	Pale-headed Blind Snake					1						1																	1	1	1	1	2				
	Anilios waitii	Waite's Blind Snake																												2								
Varanidae	*Varanus brevicauda*	Short-tailed Pygmy Monitor							1								1																					
	Varanus caudolineatus	Stripe-tailed Monitor	1		2					1		3																			2		1					
	Varanus eremius	Pygmy Desert Monitor																														4						

		Survey	1																								2											3
Family	**Species**	**Common Name**	**Site 1E**	**Site 1W**	**Site SS18**	**Site SS21**	**Site SS1**	**Site 1W08**	**Site LL4**	**Site LL5**	**Site SS19**	**Site SS20**	**Site LL3**	**Site LL6**	**Site SS22**	**Site LL1**	**Site LL2**	**Site SS23**	**Site 2**	**Site 3**	**Site 6**	**Site 7**	**Site 8**	**Site 1**	**Site 4**	**Site 5**	**Pundin**	**Wells**	**Site 2**	**Site 10**	**Site 21**	**Site 18**	**Site 21a**	**Site 9**	**Weebo**	**Site 17**	**Opportunistic**	
	Varanus giganteus	Perentie																										1										
	Varanus gouldii	Gould's Goanna	1																											1	1							
	Varanus panoptes	Yellow-spotted Monitor					1																					1										
	Varanus tristis	Black-headed Monitor																											1									
Cheluidae	*Chelodina steindachneri*	Steindachner's Turtle																											1									
Birds																																						
Casuariidae	*Dromaius novaehollandiae*	Emu				1							2				1																				1	X
Anatidae	*Tadorna tadornoides*	Australian Shelduck	1	1																									1	1				7				
	Chenonetta jubata	Australian Wood Duck	1																										37									
	Malacorhynchus membranaceus	Pink-eared Duck	1																																			
	Anas gracilis	Grey Teal	1	1																									41									
	Anas superciliosa	Pacific Black Duck	1																																			
Podicipedidae	*Poliocephalus poliocephalus*	Hoary-headed Grebe	1																										2									
Columbidae	*Phaps chalcoptera*	Common Bronzewing					3			4																						4					54	
	Phaps histrionica	Flock Bronzewing																											22		38	21				33	1	
	Ocyphaps lophotes	Crested Pigeon		11	5		17		5	4	2					2																						X
	Geopelia cuneata	Diamond Dove								8																												
Podargidae	*Podargus strigoides*	Tawny Frogmouth	1																												2							
Caprimulgidae	*Eurostopodus argus*	Spotted Nightjar																												1	2							
Aegothelidae	*Aegotheles cristatus*	Australian Owlet-nightjar	1								1																				7	2				1	1	
Otididae	*Ardeotis australis*	Australian Bustard	1																																			
Phalacrocoracidae	*Microcarbo melanoleucos*	Little Pied Cormorant	1																																			
Ardeidae	*Ardea pacifica*	White-necked Heron	1	1																																	1	

		Survey	1																										2												3
Family	**Species**	**Common Name**	**Site 1E**	**Site 1W**	**Site SS18**	**Site SS21**	**Site SS1**	**Site 1W08**	**Site LL4**	**Site LL5**	**Site SS19**	**Site SS20**	**Site LL3**	**Site LL6**	**Site SS22**	**Site LL1**	**Site LL2**	**Site SS23**	**Site 2**	**Site 3**	**Site 6**	**Site 7**	**Site 8**	**Site 1**	**Site 4**	**Site 5**	**Pundin**	**Wells**	**Site 2**	**Site 10**	**Site 21**	**Site 18**	**Site 21a**	**Site 9**	**Weebo**	**Site 17**	**Opportunistic**	
	Egretta novaehollandiae	White-faced Heron	1																										1								1	
Accipitridae	*Haliastur sphenurus*	Whistling Kite																											6	1								
	Accipiter cirrocephalus	Collared Sparrowhawk					2																						5									
	Circus assimilis	Spotted Harrier	1																																			
	Aquila audax	Wedge-tailed Eagle					2						4			8	3												1			1					1	X
	Hieraaetus morphnoides	Little Eagle	1																										3									
Falconidae	*Falco cenchroides*	Nankeen Kestrel				3	3			1	1	2				1	2													1				1		1		
	Falco berigora	Brown Falcon			4		2				3		1																					1				
	Falco longipennis	Australian Hobby	1																										2									
	Falco peregrinus	Peregrine Falcon																											1									
Rallidae	*Tribonyx ventralis*	Black-tailed Native-hen	1																																			
	Fulica atra	Eurasian Coot	1																																			
Burhinidae	*Burhinus grallarius*	Bush Stone-curlew		1																																		
Recurvirostridae	*Himantopus himantopus*	Black-winged Stilt	1																																			
Charadriidae	*Charadrius ruficapillus*	Red-capped Plover	1																																			
	Elseyornis melanops	Black-fronted Dotterel	1																																			
	Vanellus tricolor	Banded Lapwing	1				2																						1								1	
Scolopacidae	*Actitis hypoleucos*	Common Sandpiper	1																																			
Turnicidae	*Turnix velox*	Little Button-quail																														1		1				
Cacatuidae	*Eolophus roseicapillus*	Galah					124		26	4	19					10													1	1		9				1	1	X
	Nymphicus hollandicus	Cockatiel				21	4		15	12						20													9	1	1	1		1			1	
Psittacidae	*Barnardius zonarius*	Australian Ringneck			2		5		3	4	2	2	3			2													115		7	13				1	1	X
	Psephotus varius	Mulga Parrot				4				9																											1	

		Survey	1																								2										3
Family	**Species**	**Common Name**	**Site 1E**	**Site 1W**	**Site SS18**	**Site SS21**	**Site SS1**	**Site 1W08**	**Site LL4**	**Site LL5**	**Site SS19**	**Site SS20**	**Site LL3**	**Site LL6**	**Site SS22**	**Site LL1**	**Site LL2**	**Site SS23**	**Site 2**	**Site 3**	**Site 6**	**Site 7**	**Site 8**	**Site 1**	**Site 4**	**Site 5**	**Pundin**	**Wells**	**Site 2**	**Site 10**	**Site 21**	**Site 18**	**Site 21a**	**Site 9**	**Weebo**	**Site 17**	**Opportunistic**	
	Melopsittacus undulatus	Budgerigar			16	18	5		6	9	5	29	6			5	8												1	1	1	1	1	1		1	1	
	Neopsephotus bourkii	Bourke's Parrot			2		3			6																					9						1	
Cuculidae	*Chalcites basalis*	Horsfield's Bronze-cuckoo			2	3	1			1																			1	5		1		5			1	
	Heteroscenes pallidus	Pallid Cuckoo	1			1					1																		1		3						2	X
Halcyonidae	*Todiramphus pyrrhopygius*	Red-backed Kingfisher	1			1																															1	
Climacteridae	*Climacteris affinis*	White-browed Treecreeper	1		9																										3	13				2		
Ptilonorhynchidae	*Ptilonorhynchus maculatus*	Spotted Bowerbird					2																								4					4	1	
Maluridae	*Malurus leucopterus*	White-winged Fairy-wren										2	69				57													143				142			1	
	Malurus lamberti	Variegated Fairy-wren								2																												
Acanthizidae	*Smicrornis brevirostris*	Weebill					10		8	6																			350			5				71		
	Gerygone fusca	Western Gerygone																											17							1		
	Acanthiza robustirostris	Slaty-backed Thornbill					10																															
	Acanthiza chrysorrhoa	Yellow-rumped Thornbill			11		1			3																			30		2	1					1	
	Acanthiza uropygialis	Chestnut-rumped Thornbill		1	40	22	19		3	20	8		3																		37					2	1	
	Acanthiza apicalis	Inland Thornbill								8																					2							
	Aphelocephala leucopsis	Southern Whiteface			17		2			9	12																											X
Pardalotidae	*Pardalotus striatus*	Striated Pardalote		1												2													188			1				4		
Meliphagidae	*Certhionyx variegatus*	Pied Honeyeater			1	3			2	4	1	1																			23	7				20	1	
	Gavicalis virescens	Singing Honeyeater			4	4	3			20	1	13	1																1	1		2				6	1	
	Lichenostomus penicillatus	White-plumed Honeyeater		1																																		
	Purnella albifrons	White-fronted Honeyeater			2	8	2		33	17		6	40			81	99													1	3	3				2		
	Manorina flavigula	Yellow-throated Miner																											216		9	17				32	1	
	Acanthagenys rufogularis	Spiny-cheeked Honeyeater			34	1	11		5	32	2	1	12																1		24	8				23		X

		Survey	1																										2												3
Family	Species	Common Name	Site 1E	Site 1W	Site SS18	Site SS21	Site SS1	Site 1W08	Site LL4	Site LL5	Site SS19	Site SS20	Site LL3	Site LL6	Site SS22	Site LL1	Site LL2	Site SS23	Site 2	Site 3	Site 6	Site 7	Site 8	Site 1	Site 4	Site 5	Pundin	Wells	Site 2	Site 10	Site 21	Site 18	Site 21a	Site 9	Weebo	Site 17	Opportunistic	
	Epthianura tricolor	Crimson Chat				3				11	28	55	43			20														1	47	4		44		1	1	X
	Epthianura aurifrons	Orange Chat																												8				14				
	Sugomel niger	Black Honeyeater	1																																			
	Lichmera indistincta	Brown Honeyeater		1						1																												
Pomatostomidae	*Pomatostomus superciliosus*	White-browed Babbler					34			22		2																			4							
Psophodidae	*Cinclosoma cinnamomeum*	Cinnamon Quail-thrush					1					2																										
Neosittidae	*Daphoenositta chrysoptera*	Varied Sittella				12																																
Campephagidae	*Coracina maxima*	Ground Cuckoo-shrike															3																				1	X
	Coracina novaehollandiae	Black-faced Cuckoo-shrike			1	1							1			2	2												20		12	1				9	1	X
	Lalage tricolor	White-winged Triller			2	7				1	1	7	11																									X
Pachycephalidae	*Pachycephala rufiventris*	Rufous Whistler			7	11	1		1	18																			7		12	2	2			6		X
	Colluricincla harmonica	Grey Shrike-thrush				1	4			1		1																										X
	Oreoica gutturalis	Crested Bellbird			3	8	6		2	18	7	1	17																		15	6				7		X
Artamidae	*Artamus personatus*	Masked Woodswallow			99	21	43			1		119																		1	2			20		10		X
	Artamus superciliosus	White-browed Woodswallow		1																																		
	Artamus cinereus	Black-faced Woodswallow			3	5			1	1	16	9	23			43	1												1	8	37	27		5		18	1	
	Cracticus torquatus	Grey Butcherbird							1																				2		1	6		2		1	1	
	Cracticus nigrogularis	Pied Butcherbird			1		5		1	3			15			5	2												55	1		2		3		28	1	X
	Gymnorhina tibicen	Australian Magpie	1																										31							1	X
	Strepera versicolor	Grey Currawong	1				1																															
Rhipiduridae	*Rhipidura leucophrys*	Willie Wagtail			1	7	4		1	7	2	1	3			2														5	2	2			2	1	X
Corvidae	*Corvus bennetti*	Little Crow			7		2										10												231	15	48	14		34		46	1	X
	Corvus orru	Torresian Crow																											1			1		1				

		Survey	1																								2											3
Family	**Species**	**Common Name**	**Site 1E**	**Site 1W**	**Site SS18**	**Site SS21**	**Site SS1**	**Site 1W08**	**Site LL4**	**Site LL5**	**Site SS19**	**Site SS20**	**Site LL3**	**Site LL6**	**Site SS22**	**Site LL1**	**Site LL2**	**Site SS23**	**Site 2**	**Site 3**	**Site 6**	**Site 7**	**Site 8**	**Site 1**	**Site 4**	**Site 5**	**Pundin**	**Wells**	**Site 2**	**Site 10**	**Site 21**	**Site 18**	**Site 21a**	**Site 9**	**Weebo**	**Site 17**	**Opportunistic**	
Monarchidae	*Grallina cyanoleuca*	Magpie-lark	1																										17								1	
Petroicidae	*Microeca fascinans*	Jacky Winter								3			1																									
	Petroica goodenovii	Red-capped Robin			18	8	11			33	2		12																4	4	22	7		1		4		X
	Melanodryas cucullata	Hooded Robin			3	4	3			5	9	6	3																	1	7					4		X
Megaluridae	*Cincloramphus mathewsi*	Rufous Songlark	1									1																										
	Cincloramphus cruralis	Brown Songlark	1									1																		23				18			1	
Hirundinidae	*Cheramoeca leucosterna*	White-backed Swallow	1																																			
	Petrochelidon nigricans	Tree Martin	1																																		1	X
Nectariniidae	*Dicaeum hirundinaceum*	Mistletoebird				3	1		4	7																			1		1	4				1		
Estrildidae	*Taeniopygia guttata*	Zebra Finch			12		99			22	2	4																	27		16	8		8		6	1	X
Motacillidae	*Anthus novaeseelandiae*	Australasian Pipit			1					2	1	7	5				4													9				43			1	X
Mammals																																						
Bovidae	*Bos taurus*	Cow		4																								1						1				
	Capra hircus	Goat																									1	1	1	1	1	1	1	1				
	Ovis aries	Sheep		10																							1	1	1	1	1	1	1	1		1		
Camelidae	*Camelus dromedarius*	Dromedary	1		1						1					1																						
Felidae	*Felis catus*	House Cat	2																													1		1				
Molossidae	*Austronomus australis*	White-striped Free-tail Bat																	1	1	1	1	1															
	Ozimops planiceps	Southern Free-tail Bat	2	3															1		1	1		1														
Pteropodidae	*Syconycteris australis*	Common Blossom-bat	2	9																																		
Vespertilionidae	*Chalinolobus gouldii*	Gould's Wattled Bat	5	14			1				1								1	1	1		1	1	1	1	2			5					1			
	Nyctophilus geoffroyi	Lesser Long-eared Bat	5	13						4									1	1	1		1	1			28			4								
	Scotorepens balstoni	Inland Broad-nosed Bat	6	21			1												1	1	1		1	1	1	1												

		Survey	1																									2												3
Family	**Species**	**Common Name**	**Site 1E**	**Site 1W**	**Site SS18**	**Site SS21**	**Site SS1**	**Site 1W08**	**Site LL4**	**Site LL5**	**Site SS19**	**Site SS20**	**Site LL3**	**Site LL6**	**Site SS22**	**Site LL1**	**Site LL2**	**Site SS23**	**Site 2**	**Site 3**	**Site 6**	**Site 7**	**Site 8**	**Site 1**	**Site 4**	**Site 5**	**Pundin**	**Wells**	**Site 2**	**Site 10**	**Site 21**	**Site 18**	**Site 21a**	**Site 9**	**Weebo**	**Site 17**	**Opportunistic**	
	Scotorepens greyii	Little Broad-nosed Bat																									10												
	Vespadelus finlaysoni	Finlayson's Cave Bat		3			1													1	1				1													
	Vespadelus regulus	Southern Forest Bat																									2												
Dasyuridae	*Antechinomys laniger*	Kultarr		2	6	3					2	3																							1			
	Ningaui ridei	Wongai Ningaui		1	2	3	1		5		1	1		1	7															7	2	8	2	4				
	Pseudantechinus woolleyae	Woolley's False Antechinus					1																															
	Sminthopsis crassicaudata	Fat-tailed Dunnart											1			4	7													3								
	Sminthopsis dolichura	Little Long-tailed Dunnart																											1			1						
	Sminthopsis hirtipes	Hairy-footed Dunnart												2	8			1												1			1					
	Sminthopsis macroura	Stripe-faced Dunnart			10					3	7	10	2				1														2			1				
	Sminthopsis ooldea	Ooldea Dunnart				2	2		2		2		1			1													1		2							
Macropodidae	*Osphranter robustus*	Euro	3	12	1		7				1	1			1												1	1			1	1		1				
	Osphranter rufus	Red Kangaroo	38	24	4					1	1	1	2		1	4											1	1			1	1		1	1	1		
Leporidae	*Oryctolagus cuniculus*	European Rabbit	3													1													1									
Tachyglossidae	*Tachyglossus aculeatus*	Short-beaked Echidna	1				1																															
Equidae	*Equus caballus*	Domestic Horse									1																											
Muridae	*Mus musculus*	House Mouse							2	3		1	3			3	8												2	3			2					
	Notomys alexis	Spinifex Hopping Mouse				1		1			3			1	9			2													1	1						
	Pseudomys hermannsburgensis	Sandy Inland Mouse	1	1	5	6	2		8	1	14	9	6	1	2	1														7	3		3			7		

(1) McKenzie, N. L., Rolfe, J. K. and Youngson, K. (1994) Vertebrate fauna In: The Biological Survey of the Eastern Goldfields of Western Australia Part 10, Sandstone-Sir Samuel and Laverton-Leonora Study Areas. Records of the Western Australian Museum Supplement No. 47:166.

(2) How, R. A. and Dell, J. (1992) Vertebrate fauna. In: The Biological Survey of the Eastern Goldfields of Western Australia Part 7. Duketon - Sir Samuel Study Area. Records of the Western Australian Museum; Supplement 40, 90-109.

(3) Rapallo (2010) Terrestrial Fauna Site Investigation (Reconnaissance – Level One) Great Western Project, Unpublished report for Terrain Minerals, Perth.

B.2 VERTEBRATE FAUNA RECORDED IN BIOLOGICAL SURVEYS IN THE REGION

		Survey	1										2															3					
Family	**Species**	Common Name	MME1	MME2	MME3	MME4	MME5	MME6	MME7	MME8	MME9	Opportunistic	Site 11	Site 11a	Site 14	Site 14a	Site 14b	Site 17a	Site 19	Site 1a	Site 20a	Site 21	Site 21a	Site 5a	Site 8	Site 9	Site 9a	CM001	CM002	CM003	CM004	CM005	Opportunistic
Frogs																																	
Hylidae	*Cyclorana maini*	Sheep Frog										1																					
Limnodynastidae	*Neobatrachus sutor*	Shoemaker Frog	1	1																						5	10						
	Neobatrachus wilsmorei	Goldfields Bullfrog																				2				11					3		
	Platyplectrum spenceri	Spencer's Burrowing Frog														8																	
Myobatrachidae	*Pseudophryne occidentalis*	Orange-crowned Toadlet																						2									
Reptiles																																	
Agamidae	*Ctenophorus caudicinctus*	Ring-tailed Dragon																		12													
	Ctenophorus fordi	Mallee Dragon																				2											
	Ctenophorus inermis	Military Dragon																1															
	Ctenophorus isolepis	Crested Dragon	1																														
	Ctenophorus reticulatus	Western Netted Dragon		1	1		1		3	1		1			2	1		2			4		4	13		2	1						
	Ctenophorus salinarum	Saltpan Dragon											5	1										1	2								
	Ctenophorus vadnappa	Red-barred Dragon																			1	7	2			2	1						
	Moloch horridus	Thorny Devil																						1			1						
	Pogona minor	Dwarf Bearded Dragon									1		2	1	1				2			2	1		2	2							
	Tympanocryptis cephalus	Pebble Dragon												1																	1		
Carphodactylidae	*Nephrurus vertebralis*	Midline Knob-tail											1												2						2		
	Underwoodisaurus milii	Barking Gecko						2										9						2									
Diplodactylidae	*Diplodactylus granariensis*	Wheat-belt Stone Gecko																				2	1						7				
	Diplodactylus pulcher	Fine-faced Gecko						1								4		3	1					3					2	1		1	

		Survey	1										2															3					
Family	**Species**	Common Name	MME1	MME2	MME3	MME4	MME5	MME6	MME7	MME8	MME9	Opportunistic	Site 11	Site 11a	Site 14	Site 14a	Site 14b	Site 17a	Site 19	Site 1a	Site 20a	Site 21	Site 21a	Site 5a	Site 8	Site 9	Site 9a	CM001	CM002	CM003	CM004	CM005	Opportunistic
	Lucasium maini	Main's Ground Gecko																				1											
	Lucasium squarrosum	Mottled Ground Gecko											1	3		1		3			2								6	3		2	
	Strophurus assimilis	Goldfields Spiny-tailed Gecko																											1			1	
	Strophurus ciliaris	Spiny-tailed Gecko														2		1			1			2									
	Strophurus strophurus	Western Spiny-tailed Gecko																							7						4		
	Strophurus wellingtonae	Western Shield Spiny-tailed Gecko		1																											1		
Elapidae	*Brachyurophis fasciolata*	Narrow-banded Burrowing Snake																			1												
	Parasuta monachus	Monk Snake										1				1		3											1		1		
	Pseudechis butleri	Spotted Mulga Snake										1																					
	Simoselaps bertholdi	Jan's Banded Snake																	1														
	Suta fasciata	Rosen's Snake																						2									
Gekkonidae	*Gehyra variegata*	Tree Dtella	3	9	3	16	3	9	2		3	1						15	1	1	1		2	15	1			1		5	2		
	Heteronotia binoei	Bynoe's Prickly Gecko		3		1						1						34					2	7							1	1	
	Rhynchoedura ornata	Western Beaked Gecko																				1			2	1					1		
Pygopodidae	*Pygopus nigriceps*	Western Hooded Scaly-foot																1			1	1											
Scincidae	*Cryptoblepharus buchananii*	Buchanan's Snake-eyed Skink		2								1				1						1	1										
	Ctenotus calurus	Blue-tailed Finesnout Ctenotus																	1														
	Ctenotus greeri	Spotted-necked Ctenotus																	12														
	Ctenotus helenae	Clay-soil Ctenotus																	1														
	Ctenotus leonhardii	Leonhardi's Ctenotus			1								5	4											2	5	9						
	Ctenotus pantherinus	Leopard Skink																	4														
	Ctenotus quattuordecimlineatus	Fourteen-lined Ctenotus																	11														

		Survey	1										2															3						
Family	**Species**	Common Name	MME1	MME2	MME3	MME4	MME5	MME6	MME7	MME8	MME9	Opportunistic	Site 11	Site 11a	Site 14	Site 14a	Site 14b	Site 17a	Site 19	Site 1a	Site 20a	Site 21	Site 21a	Site 5a	Site 8	Site 9	Site 9a	CM001	CM002	CM003	CM004	CM005	Opportunistic
	Ctenotus schomburgkii	Schomburgk's Ctenotus	1								2	1	3						11		2	3			15	1								
	Ctenotus severus	Stern Ctenotus																6		1														
	Ctenotus uber	Spotted Ctenotus														3		2			6	1	1											
	Egernia depressa	Pygmy Spiny-tailed Skink						1													4	2												
	Egernia formosa	Goldfields Crevice-skink																						3										
	Eremiascincus richardsonii	Broad-banded Sand Swimmer														1		1												1	1			
	Lerista desertorum	Central Desert Robust Slider						1			1	1						6	6		2										5			
	Lerista macropisthopus	Unpatterned Robust Slider																						2										
	Lerista muelleri	Wood Mulch-slider																											1		2			
	Lerista picturata	Southern Robust Slider																						2										
	Lerista rhonoides																																	
	Lerista sp.							2			1	1						9	1			1			5									
	Liopholis inornata	Desert Skink																				1	1											
	Liopholis striata	Nocturnal Desert Skink																			2													
	Menetia greyii	Common Dwarf Skink	4								1	1										1		4		1					2			
	Morethia butleri	Woodland Morethia Skink		2		4	2	3	1	1	1	1			2			6					2	4										
Typhlopidae	*Anilios hamatus*	Pale-headed Blind Snake														1									1									
	Anilios margaretae	Buff-snouted Blind Snake																																
	Anilios waitii	Waite's Blind Snake														2									1									
Varanidae	*Varanus caudolineatus*	Stripe-tailed Monitor		1				1								1					6			2		1		1						
	Varanus giganteus	Perentie																						1										
	Varanus gouldii	Gould's Goanna																1				2	2	1		1	1							
	Varanus panoptes	Yellow-spotted Monitor						1			1	1	1			2					1							1	4	2			

		Survey	1										2																3					
Family	**Species**	Common Name	MME1	MME2	MME3	MME4	MME5	MME6	MME7	MME8	MME9	Opportunistic	Site 11	Site 11a	Site 14	Site 14a	Site 14b	Site 17a	Site 19	Site 1a	Site 20a	Site 21	Site 21a	Site 5a	Site 8	Site 9	Site 9a	CM001	CM002	CM003	CM004	CM005	Opportunistic
Birds																																		
Casuariidae	*Dromaius novaehollandiae*	Emu	1	1				1		1	1	1		2		1	5		2				1	2		1				1				
Megapodiidae	*Leipoa ocellata*	Malleefowl										1																						
Phasianidae	*Coturnix pectoralis*	Stubble Quail															1																	
Anatidae	*Cygnus atratus*	Black Swan										1																						
	Tadorna tadornoides	Australian Shelduck										1																						
	Malacorhynchus membranaceus	Pink-eared Duck										1																						
	Anas gracilis	Grey Teal										1																						
	Anas superciliosa	Pacific Black Duck										1																						
Columbidae	*Phaps chalcoptera*	Common Bronzewing										1											1		1									
	Ocyphaps lophotes	Crested Pigeon	2					2			3	1			1	5	2	11			7			6	9	6			2		1			
Podargidae	*Podargus strigoides*	Tawny Frogmouth									2										1													
Caprimulgidae	*Eurostopodus argus*	Spotted Nightjar																		2				2										
Aegothelidae	*Aegotheles cristatus*	Australian Owlet-nightjar													3	3	2								1									
Otididae	*Ardeotis australis*	Australian Bustard												1		4																		
Ardeidae	*Ardea pacifica*	White-necked Heron										1																						
	Egretta novaehollandiae	White-faced Heron										1																						
Accipitridae	*Haliaeetus albicilla*	White-bellied Sea-eagle	1		2	1	1	1		1		1																						
	Accipiter fasciatus	Brown Goshawk																	3															
	Circus assimilis	Spotted Harrier															1					1												
	Aquila audax	Wedge-tailed Eagle													6	2		2							3				2					
	Hieraaetus morphnoides	Little Eagle		1															3		1													
Falconidae	*Falco cenchroides*	Nankeen Kestrel									1					5		2	3					4	2					1				

		Survey	1										2																3					
Family	**Species**	Common Name	MME1	MME2	MME3	MME4	MME5	MME6	MME7	MME8	MME9	Opportunistic	Site 11	Site 11a	Site 14	Site 14a	Site 14b	Site 17a	Site 19	Site 1a	Site 20a	Site 21	Site 21a	Site 5a	Site 8	Site 9	Site 9a	CM001	CM002	CM003	CM004	CM005	Opportunistic
	Falco berigora	Brown Falcon									1					3	1	2	5		3				3					2			
	Falco longipennis	Australian Hobby			1						1														1								
	Falco peregrinus	Peregrine Falcon		1																													
Rallidae	*Tribonyx ventralis*	Black-tailed Native-hen										1																					
Recurvirostridae	*Himantopus himantopus*	Black-winged Stilt										1																					
	Recurvirostra novaehollandiae	Red-necked Avocet										1																					
Charadriidae	*Charadrius ruficapillus*	Red-capped Plover										1																					
	Elseyornis melanops	Black-fronted Dotterel										1																					
	Vanellus tricolor	Banded Lapwing											9				4	4						1									
Turnicidae	*Turnix velox*	Little Button-quail															5				2												
Cacatuidae	*Eolophus roseicapillus*	Galah					15					1		1	44	908	8	2	5		7		62	7	4					3			
	Nymphicus hollandicus	Cockatiel												6		2	4		3				4		35							10	
Psittacidae	*Barnardius zonarius*	Australian Ringneck		1			4	3	2		2	1			25	31	36		16		3	3		1	9	10							
	Psephotus varius	Mulga Parrot			1			5	5			1					11		2		14	2				3							
	Melopsittacus undulatus	Budgerigar												20	11	9	15	2	29		17	38			170						6		
	Neopsephotus bourkii	Bourke's Parrot										1									4												
Cuculidae	*Chalcites basalis*	Horsfield's Bronze-cuckoo												3					3				2		1	1							
	Chalcites osculans	Black-eared Cuckoo																	1		2												
	Heteroscenes pallidus	Pallid Cuckoo										1			2				1		1	4			1					1			
Halcyonidae	*Todiramphus pyrrhopygius*	Red-backed Kingfisher															1	6			1												
Meropidae	*Merops ornatus*	Rainbow Bee-eater																	3		3												
Climacteridae	*Climacteris affinis*	White-browed Treecreeper							2			1									4	1	1										
Maluridae	*Malurus splendens*	Splendid Fairy-wren							9			1																					
	Malurus leucopterus	White-winged Fairy-wren	3								8		3	76		1	2								40	17							

		Survey	1										2														3					
Family	**Species**	Common Name	MME1	MME2	MME3	MME4	MME5	MME6	MME7	MME8	MME9	Opportunistic	Site 11	Site 11a	Site 14	Site 14a	Site 14b	Site 17a	Site 19	Site 1a	Site 20a	Site 21	Site 21a	Site 5a	Site 8	Site 9	Site 9a	CM001	CM002	CM003	CM004	CM005	Opportunistic
Acanthizidae	*Pyrrholaemus brunneus*	Redthroat				1						1					2					2	1		2								
	Smicrornis brevirostris	Weebill					10					1							98		7	2	2										
	Acanthiza robustirostris	Slaty-backed Thornbill							2			1							3		6												
	Acanthiza chrysorrhoa	Yellow-rumped Thornbill	5	6		6	17	2	4			1							4		8				9	4							
	Acanthiza uropygialis	Chestnut-rumped Thornbill	8	30	2	10	14	15	50			1				3	5		88		126		10	3	53	27							
	Acanthiza apicalis	Inland Thornbill	2					2	6			1							3		2	1	2										
	Aphelocephala leucopsis	Southern Whiteface				4		6	20			1					8		5		52		12		4								
Pardalotidae	*Pardalotus striatus*	Striated Pardalote					3					1					1		2														
Meliphagidae	*Certhionyx variegatus*	Pied Honeyeater												2	2																		
	Gavicalis virescens	Singing Honeyeater		4	2		1	1	1	1	1	1		3	11		3	2	2		3			1	8	4			7	6	2		
	Lichenostomus plumulus	Grey-fronted Honeyeater					7								56				3		2												
	Purnella albifrons	White-fronted Honeyeater	80	100	12	40	8	1	10	6	6	1		1	3		1		4			7	6		2	16							
	Manorina flavigula	Yellow-throated Miner	10	5	7		2	10		2	2	1			10	15	98	1	13		41	3			21	109				1	12		6
	Acanthagenys rufogularis	Spiny-cheeked Honeyeater	25	20		1	6	2	1	1	2	1			11	2	2	5	8		10	6	4	2	9	7				1	2		
	Anthochaera carunculata	Red Wattlebird									3								2		3					1							
	Conopophila whitei	Grey Honeyeater															18						17			1							
	Epthianura tricolor	Crimson Chat												18	154	24		6			29				75								
	Epthianura aurifrons	Orange Chat												5																			
Pomatostomidae	*Pomatostomus temporalis*	Grey-crowned Babbler																													12		
	Pomatostomus superciliosus	White-browed Babbler										1					3						3	2									
Psophodidae	*Cinclosoma castaneothorax*	Chestnut-breasted Quail-thrush												2							3									1			
Neosittidae	*Daphoenositta chrysoptera*	Varied Sittella															2		6														
Campephagidae	*Coracina maxima*	Ground Cuckoo-shrike												4		31	2	3															

		Survey	1										2															3					
Family	**Species**	Common Name	MME1	MME2	MME3	MME4	MME5	MME6	MME7	MME8	MME9	Opportunistic	Site 11	Site 11a	Site 14	Site 14a	Site 14b	Site 17a	Site 19	Site 1a	Site 20a	Site 21	Site 21a	Site 5a	Site 8	Site 9	Site 9a	CM001	CM002	CM003	CM004	CM005	Opportunistic
	Coracina novaehollandiae	Black-faced Cuckoo-shrike		2		1						1			4	5	6	1	9		10				7	3			1				
	Lalage tricolor	White-winged Triller														3	9				34		6		39	2							
Pachycephalidae	*Pachycephala rufiventris*	Rufous Whistler					1	1	1	1		1							8				1										
	Colluricincla harmonica	Grey Shrike-thrush						1	2			1							5				1										
	Oreoica gutturalis	Crested Bellbird	1	3	1	2	1	1	2			1		3	14	5	1		15	2	10		2		6	2			4				
Artamidae	*Artamus personatus*	Masked Woodswallow												2	2		31		2		72											
	Artamus superciliosus	White-browed Woodswallow			4		1	1				1									3											
	Artamus cinereus	Black-faced Woodswallow												7	55	25	6	11			1		1		12				9	2			6
	Cracticus torquatus	Grey Butcherbird	1	1	1		2	1	1		2	1			2	4	7		8		8				4	1			1	1	3		
	Cracticus nigrogularis	Pied Butcherbird	2	1	1						1	1			6	23	1		4	1			2	4	13	14				2	2		
	Gymnorhina tibicen	Australian Magpie	3								3	1				3		9			1					5			1	5		2	
	Strepera versicolor	Grey Currawong			1											2	3		2				1			4							
Rhipiduridae	*Rhipidura albiscapa*	Grey Fantail							1																								
	Rhipidura leucophrys	Willie Wagtail	1									1				2	2	1							12	1			1				1
Corvidae	*Corvus bennetti*	Little Crow		2			6		1			1		11	29	50	21	12	24		6			7	36	149				7	4		
	Corvus orru	Torresian Crow		1	2		1	1		2		1		2			2														2		
Monarchidae	*Grallina cyanoleuca*	Magpie-lark		1	2			2			2	1				12	7	2							3								
Petroicidae	*Microeca fascinans*	Jacky Winter														1			22		1												
	Petroica goodenovii	Red-capped Robin	1	2		1		2	6			1			1	5	3	1	29	3	47		4	3	3	4						1	
	Melanodryas cucullata	Hooded Robin			3							1		1	2	1					1		1		2				2				
Megaluridae	*Cincloramphus mathewsi*	Rufous Songlark															3						2										
	Cincloramphus cruralis	Brown Songlark											7	7	3	7		8			1												
Hirundinidae	*Cheramoeca leucosterna*	White-backed Swallow			2							1						2															
	Hirundo rustica	Barn Swallow						5																									

		Survey	1										2															3					
Family	**Species**	Common Name	MME1	MME2	MME3	MME4	MME5	MME6	MME7	MME8	MME9	Opportunistic	Site 11	Site 11a	Site 14	Site 14a	Site 14b	Site 17a	Site 19	Site 1a	Site 20a	Site 21	Site 21a	Site 5a	Site 8	Site 9	Site 9a	CM001	CM002	CM003	CM004	CM005	Opportunistic
	Petrochelidon ariel	Fairy Martin																											6				
Nectariniidae	*Dicaeum hirundinaceum*	Mistletoebird															4					1			5	4							
Estrildidae	*Taeniopygia guttata*	Zebra Finch										1		9	12		4		5						36				6				
Motacillidae	*Anthus novaeseelandiae*	Australasian Pipit			4							1	7	18		16	1	36								2			4	1			
Mammals																																	
Bovidae	*Capra hircus*	Goat										1			1	1			1					1									
	Ovis aries	Sheep														1			1		1	1				1	1						
Camelidae	*Camelus dromedarius*	Dromedary											1																				
Canidae	*Canis familiaris*	Dog											1																				
	Canis lupus	Dingo										1																					
	Vulpes vulpes	Red Fox										1							1		1		1	1									
Felidae	*Felis catus*	House Cat											1																				
Molossidae	*Austronomus australis*	White-striped Free-tail Bat																						1									
	Ozimops planiceps	Southern Free-tail Bat																						1									
Vespertilionidae	*Chalinolobus gouldii*	Gould's Wattled Bat														1								3									
	Nyctophilus geoffroyi	Lesser Long-eared Bat														4		9						3									
	Scotorepens balstoni	Inland Broad-nosed Bat														6								1									
Dasyuridae	*Ningaui ridei*	Wongai Ningaui																	5														
	Sminthopsis crassicaudata	Fat-tailed Dunnart	1		1								5								7			1			1						
	Sminthopsis fuliginosus	Grey-bellied Dunnart																															
	Sminthopsis dolichura	Little Long-tailed Dunnart											1			2			1		1	1		1	2								
	Sminthopsis macroura	Stripe-faced Dunnart																											2		2		
Macropodidae	*Macropus fuliginosus*	Western Grey Kangaroo										1												1	1								

		Survey	1										2														3					
Family	**Species**	Common Name	MME1	MME2	MME3	MME4	MME5	MME6	MME7	MME8	MME9	Opportunistic	Site 11	Site 11a	Site 14	Site 14a	Site 14b	Site 17a	Site 19	Site 1a	Site 20a	Site 21	Site 21a	Site 5a	Site 8	Site 9	Site 9a	CM001	CM002	CM003	CM004	CM005	Opportunistic
	Osphranter robustus	Euro				1						1						1	1		1	1		1	1								
Leporidae	*Oryctolagus cuniculus*	European Rabbit				1						1	1					1						2	1					1			
Tachyglossidae	*Tachyglossus aculeatus*	Short-beaked Echidna		1								1																		1	3	1	
Equidae	*Equus asinus*	Donkey										1																					
Muridae	*Mus musculus*	House Mouse	1	2	2	1	2	2					2					1	3					2									
	Notomys alexis	Spinifex Hopping Mouse	7						2													2			1								
	Notomys mitchellii	Mitchell's Hopping Mouse																				1											
	Pseudomys bolami	Bolam's Mouse																					3										
	Pseudomys hermannsburgensis	Sandy Inland Mouse						1			4		1			1			7		2				1								

(1) Ninox Wildlife Consulting (1998) A Vertebrate Fauna Survey of the Murrin Expansion Project. Unpublished report for Anaconda Nickel Ltd, Perth.

(2) Dell, J. and How, R. A. (1988) Vertebrate fauna. In: The biological survey of the Eastern Goldfields of Western Australia, Part 5, Edjudina - Menzies Study Area. Records of the Western Australian Museum, Supplement No 31, 38-77.

(3) Biota Environmental Sciences (2004) Cosmos Nickel Mine Extension Fauna Survey. Unpublished report for Sir Samuel Mines NL and URS, Perth.

B.3 VERTEBRATE FAUNA RECORDED IN BIOLOGICAL SURVEYS IN THE REGION

		Survey	1														2	3																	
Family	**Species**	Common Name	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13	Opportunistic	Granny Deeps	Agnew Gold	BKBO1	BKBO4	BKBO5	BKBO7	BKBO9	BKBS04	BKBO2	BKBO3	BKBO12	BKBO8	BKBO6	BKBO10	BKBO11	BKBS01	BKBHarp01	BKBS03
Frogs																																		
Hylidae	*Cyclorana maini*	Sheep Frog		1							11	5	1																					
	Cyclorana platycephala	Water-holding Frog		1	1						5	2		1	1																			
	Litoria rubella	Desert Tree Frog																1																
Limnodynastidae	*Neobatrachus kunapalari*	Kunapalari Frog									1																							
	Neobatrachus sudelli	Sudell's Frog																	2	1	1	1	2											
	Neobatrachus sutor	Shoemaker Frog	8	2	5	3	1			1	13	2		1																				
Reptiles																																		
Agamidae	*Ctenophorus caudicinctus*	Ring-tailed Dragon																1						1										
	Ctenophorus isolepis	Crested Dragon																1																
	Ctenophorus reticulatus	Western Netted Dragon																							2	1								
	Ctenophorus scutulatus	Lozenge-marked Dragon																1									3							
	Diporiphora amphiboluroides	Mulga Dragon				2	1	1																										
	Pogona minor	Dwarf Bearded Dragon																1			1													
	Tympanocryptis cephalus	Pebble Dragon				2	3	1		1																								
Carphodactylidae	*Nephrurus vertebralis*	Midline Knob-tail																	2				1		1									
Diplodactylidae	*Diplodactylus granariensis*	Wheat-belt Stone Gecko										1																1						
	Diplodactylus pulcher	Fine-faced Gecko	2			1	4	3	1			2	1		1					1	2				1	2		3	2					
	Strophurus assimilis	Goldfields Spiny-tailed Gecko																												1	1			
	Strophurus strophurus	Western Spiny-tailed Gecko																				1												
	Strophurus wellingtonae	Shield Spiny-tailed Gecko	4	2											1															1				

		Survey	1															2	3																		
Family	**Species**	Common Name	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13	Opportunistic	Granny Deeps	Agnew Gold	BKBO1	BKBO4	BKBO5	BKBO7	BKBO9	BKBS04	BKBO2	BKBO3	BKBO12	BKBO8	BKBO6	BKBO10	BKBO11	BKBS01	BKBHarp01	BKBS03
Elapidae	*Parasuta monachus*	Monk Snake						1		1																											
	Suta fasciata	Rosen's Snake																					1														
Gekkonidae	*Gehyra variegata*	Tree Dtella		3	2	4		1		3		2	1	2				1																			
	Heteronotia binoei	Bynoe's Prickly Gecko	2				1					1	2	1	5			1																			
	Rhynchoedura ornata	Western Beaked Gecko	3					2			1								11	5		5	3				6	9	3	1						
Pygopodidae	*Pygopus nigriceps*	Western Hooded Scaly-foot																			1															
Scincidae	*Ctenotus leonhardii*	Leonhardi's Ctenotus	2	2					1		5	9	7	16	27				2	3			1		4	4										
	Ctenotus schomburgkii	Schomburgk's Ctenotus																					2		1	2	4	2								
	Ctenotus severus	Stern Ctenotus																																		
	Ctenotus uber	Spotted Ctenotus																				2														
	Egernia depressa	Pygmy Spiny-tailed Skink		1	1	2	2	3	9	6		1																								
	Eremiascincus richardsonii	Broad-banded Sand Swimmer				2									1																					
	Lerista bipes	North-western Sandslider																																		
	Lerista desertorum	Central Desert Robust Slider													2															1		1				
	Lerista distinguenda	Orange-tailed Slider													1																					
	Lerista sp.																							2	1	1	1									
	Menetia greyii	Common Dwarf Skink											1											1												
	Morethia butleri	Woodland Morethia Skink		1		1		2			6	1		3																						
	Tiliqua multifasciata	Centralian Blue-tongued Lizard	1																																	
Typhlopidae	*Anilios australis*	Austral Blind Snake								1	1																									
	Anilios bicolor	Dark-spined Blind Snake			1																															
	Anilios waitii	Waite's Blind Snake																													1					
Varanidae	*Varanus caudolineatus*	Stripe-tailed Monitor		2		1	3	1	1			1		2							1	3	1		1				1	3						

		Survey	1															2	3																
Family	**Species**	Common Name	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13	Opportunistic	Granny Deeps	Agnew Gold	BKBO1	BKBO4	BKBO5	BKBO7	BKBO9	BKBS04	BKBO2	BKBO3	BKBO12	BKBO8	BKBO6	BKBO10	BKBO11	BKBS01	BKBHarp01	BKBS03
	Varanus gouldii	Gould's Goanna																1																	
	Varanus panoptes	Yellow-spotted Monitor	4		7		3	2	2			4	2		6							2						2		1					
Birds																																			
Casuariidae	*Dromaius novaehollandiae*	Emu														3		1				1													
Anatidae	*Biziura lobata*	Musk Duck														2																			
	Tadorna tadornoides	Australian Shelduck																1																	
	Chenonetta jubata	Australian Wood Duck														77		1																	
	Malacorhynchus membranaceus	Pink-eared Duck														5																			
	Anas gracilis	Grey Teal														74																			
	Anas superciliosa	Pacific Black Duck														13		1																	
	Aythya australis	Hardhead														2																			
Podicipedidae	*Tachybaptus novaehollandiae*	Australasian Grebe																1																	
	Poliocephalus poliocephalus	Hoary-headed Grebe														30		1																	
Columbidae	*Phaps chalcoptera*	Common Bronzewing																1																	
Columbidae	*Ocyphaps lophotes*	Crested Pigeon																1	6			2						9							
Caprimulgidae	*Eurostopodus argus*	Spotted Nightjar																1																	
Ardeidae	*Egretta novaehollandiae*	White-faced Heron														2																			
Accipitridae	*Elanus axillaris*	Black-shouldered Kite																1																	
	Haliastur sphenurus	Whistling Kite																							1										
	Accipiter fasciatus	Brown Goshawk																1																	
	Aquila audax	Wedge-tailed Eagle														2		1					3												
Falconidae	*Falco cenchroides*	Nankeen Kestrel														2		1					1						1						
	Falco berigora	Brown Falcon														1																			

		Survey	1															2	3																		
Family	**Species**	Common Name	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13	Opportunistic	Granny Deeps	Agnew Gold	BKBO1	BKBO4	BKBO5	BKBO7	BKBO9	BKBS04	BKBO2	BKBO3	BKBO12	BKBO8	BKBO6	BKBO10	BKBO11	BKBS01	BKBHarp01	BKBS03
Rallidae	*Fulica atra*	Eurasian Coot														21																			
Recurvirostridae	*Himantopus himantopus*	Black-winged Stilt														5																			
	Cladorhynchus leucocephalus	Banded Stilt														14																			
Charadriidae	*Elseyornis melanops*	Black-fronted Dotterel														1		1																	
Cacatuidae	*Eolophus roseicapillus*	Galah																											8					
Psittacidae	*Barnardius zonarius*	Australian Ringneck																1	1	2			1					1						
	Psephotus varius	Mulga Parrot														8				2		2												
	Melopsittacus undulatus	Budgerigar																1																
Cuculidae	*Chalcites basalis*	Horsfield's Bronze-cuckoo																			1					1		1						
	Heteroscenes pallidus	Pallid Cuckoo														2																		
Meropidae	*Merops ornatus*	Rainbow Bee-eater																1																
Ptilonorhynchidae	*Ptilonorhynchus guttatus*	Western Bowerbird														2	5		1															
Maluridae	*Malurus splendens*	Splendid Fairy-wren															12						8											
	Malurus leucopterus	White-winged Fairy-wren														1	3																	
Maluridae	*Malurus lamberti*	Variegated Fairy-wren																1																
Acanthizidae	*Gerygone fusca*	Western Gerygone																					2					1						
	Acanthiza robustirostris	Slaty-backed Thornbill															68								2					5				
	Acanthiza chrysorrhoa	Yellow-rumped Thornbill															1				2		3		2									
	Acanthiza uropygialis	Chestnut-rumped Thornbill																	16	7	4	23	11		33		2	11		3	9			
	Acanthiza apicalis	Inland Thornbill															12	1	4			5	11				3			2				
	Aphelocephala leucopsis	Southern Whiteface															13	1	1		1		5		4									
Pardalotidae	*Pardalotus striatus*	Striated Pardalote															1																	
Meliphagidae	*Certhionyx variegatus*	Pied Honeyeater															2				4													

		Survey	1															2	3																
Family	**Species**	Common Name	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13	Opportunistic	Granny Deeps	Agnew Gold	BKBO1	BKBO4	BKBO5	BKBO7	BKBO9	BKBS04	BKBO2	BKBO3	BKBO12	BKBO8	BKBO6	BKBO10	BKBO11	BKBS01	BKBHarp01	BKBS03
	Gavicalis virescens	Singing Honeyeater															68	1	8	9	7	2	1				2	4	3	1				
	Lichenostomus flavicollis	Yellow-throated Honeyeater																	3	4	3	15	4		4		5	9		3	4			
	Manorina flavigula	Yellow-throated Miner														3	38	1																
	Acanthagenys rufogularis	Spiny-cheeked Honeyeater															44	1			2	4			2									
	Epthianura tricolor	Crimson Chat															4				9		1						1					
	Epthianura albifrons	White-fronted Chat																1																
Pomatostomidae	*Pomatostomus superciliosus*	White-browed Babbler															14	1					4											
Psophodidae	*Cinclosoma castanotum*	Chestnut Quail-thrush																	3															
	Cinclosoma castaneothorax	Chestnut-breasted Quail-thrush																			2													
Neosittidae	*Daphoenositta chrysoptera*	Varied Sittella																		2														
Campephagidae	*Coracina maxima*	Ground Cuckoo-shrike														2	5												2					
	Coracina novaehollandiae	Black-faced Cuckoo-shrike															7					1						2		1				
	Lalage tricolor	White-winged Triller														4			1															
Pachycephalidae	*Pachycephala rufiventris*	Rufous Whistler															22		1			1	3		6		1			2				
	Colluricincla harmonica	Grey Shrike-thrush															3	1							1									
	Oreoica gutturalis	Crested Bellbird														1	45	1	6	1	4	2	2		6		1	5	1	4	1			
Artamidae	*Artamus personatus*	Masked Woodswallow														4	23	1																
	Artamus cinereus	Black-faced Woodswallow															6	1	5		9	2	2		1			7	7					
	Artamus minor	Little Woodswallow															2	1																
	Cracticus torquatus	Grey Butcherbird														4	5	1	1											2	1			
	Cracticus nigrogularis	Pied Butcherbird														2	3	1	5		2	1	4					6	1					
	Gymnorhina tibicen	Australian Magpie														1		1										1						
Rhipiduridae	*Rhipidura leucophrys*	Willie Wagtail														5	5	1	1			1	2											

		Survey	1															2	3																
Family	**Species**	Common Name	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13	Opportunistic	Granny Deeps	Agnew Gold	BKBO1	BKBO4	BKBO5	BKBO7	BKBO9	BKBS04	BKBO2	BKBO3	BKBO12	BKBO8	BKBO6	BKBO10	BKBO11	BKBS01	BKBHarp01	BKBS03
Corvidae	*Corvus bennetti*	Little Crow														4	1	1			2						1	6		3				
	Corvus orru	Torresian Crow															2	1							3									
Monarchidae	*Grallina cyanoleuca*	Magpie-lark														6	11	1	3	1								1						
Petroicidae	*Petroica goodenovii*	Red-capped Robin															10	1	5	1	2	1	3		8		3	1		1				
	Melanodryas cucullata	Hooded Robin															7	1	2		4									1				
Hirundinidae	*Cheramoeca leucosterna*	White-backed Swallow														4	2																	
	Hirundo neoxena	Welcome Swallow														2	4	1																
	Petrochelidon nigricans	Tree Martin														1	9	1																
Nectariniidae	*Dicaeum hirundinaceum*	Mistletoebird														2	2																	
Estrildidae	*Taeniopygia guttata*	Zebra Finch														2		1											2					
Motacillidae	*Anthus novaeseelandiae*	Australasian Pipit														6	2	1																
Mammals																																		
Bovidae	*Capra hircus*	Goat																1					1											
Molossidae	*Ozimops planiceps*	Southern Free-tail Bat																1																
Vespertilionidae	*Chalinolobus gouldii*	Gould's Wattled Bat																1																
	Nyctophilus geoffroyi	Lesser Long-eared Bat																1															2	
	Scotorepens balstoni	Inland Broad-nosed Bat																1																
	Vespadelus baverstocki	Inland Forest Bat																1																
	Vespadelus finlaysoni	Finlayson's Cave Bat																1																
Dasyuridae	*Antechinomys laniger*	Kultarr	2	1			3	3	3	2		2			1																			
	Sminthopsis dolichura	Little Long-tailed Dunnart	1	1	3	7	5	4	13	3	5	3		1	1																			
	Sminthopsis hirtipes	Hairy-footed Dunnart				1																												
	Sminthopsis longicaudata	Long-tailed Dunnart					1	1							1																			

		Survey	1															2	3																		
Family	**Species**	Common Name	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13	Opportunistic	Granny Deeps	Agnew Gold	BKBO1	BKBO4	BKBO5	BKBO7	BKBO9	BKBS04	BKBO2	BKBO3	BKBO12	BKBO8	BKBO6	BKBO10	BKBO11	BKBS01	BKBHarp01	BKBS03
	Sminthopsis macroura	Stripe-faced Dunnart	2	3		2	1	1	1	1	1	5	5	3	2						3						1	1	2	7				
	Sminthopsis ooldea	Ooldea Dunnart																		1														
Macropodidae	*Macropus fuliginosus*	Western Grey Kangaroo																1																
	Osphranter robustus	Euro																1				1							1	1				1
	Osphranter rufus	Red Kangaroo																1	4	2		4	1		2				3					
Leporidae	*Oryctolagus cuniculus*	European Rabbit																1																
Tachyglossidae	*Tachyglossus aculeatus*	Short-beaked Echidna																1					1							1	2			1
Muridae	*Mus musculus*	House Mouse						1					5																					
	Notomys alexis	Spinifex Hopping Mouse	3																															
	Pseudomys desertor	Desert Mouse																		1														
	Pseudomys hermannsburgensis	Sandy Inland Mouse	1	1	1	3				1	2	2	5	6					1		1				1					1				

(1) Terrestrial Ecosystems (2011a) Level 2 Fauna Risk Assessment for Granny Deeps Project Area. Unpublished report for Barrick Gold Corporation, Perth.

(2) ENV Australia (2008) Agnew Prospects Fauna Assessment. Unpublished report for Agnew Gold Mining Company Pty Limited, Perth.

(3) Biota Environmental Sciences (2007) Bannockburn Fauna Habitat and Assemblage Survey. Unpublished report for Jubilee Mines NL, Perth.

B.4 VERTEBRATE FAUNA RECORDED IN BIOLOGICAL SURVEYS IN THE REGION

		Survey	1																													
Family	**Species**	Common Name	REG Open spinifex 1	REG Open spinifex 2	REG Open spinifex 3	REG Open spinifex 4	REG Shrubs over spinifex 1	REG Shrubs over spinifex 2	REG Shrubs over spinifex 3	REG Shrubs over spinifex 4	REG Dogbolter 2	REG Mulga woodland 1	REG Mulga woodland 4	REG Eucalypt over spinifex 2	REG Eucalypt over spinifex 4	REG Eucalypt over spinifex 1	REG Dogbolter 1	REG Dogbolter 3	REG Dogbolter 4	REG Eucalypt over spinifex 3	REG Mulga woodland 2	REG Mulga woodland 3	REG Opportunistic	REG Open spinifex	REG Mulga woodland	REG Eucalypt over spinifex	REG Shrubs over spinifex	REG Mulga thicket 2	REG Turkeys	REG Mulga thicket 1	REG Dogbolter
Reptiles																																
Agamidae	*Ctenophorus isolepis*	Crested Dragon	1	10	8	2	3	5	1	1																						
	Ctenophorus nuchalis	Central Netted Dragon			1	1																										
	Ctenophorus scutulatus	Lozenge-marked Dragon									2	1	1																			
	Diporiphora amphiboluroides	Mulga Dragon										3	1																			
	Moloch horridus	Thorny Devil							1																							
	Pogona minor	Dwarf Bearded Dragon											1	3	1																	
Carphodactylidae	*Nephrurus laevissimus*	Smooth Knob-tail					2		1																							
	Nephrurus vertebralis	Midline Knob-tail												1		1																
Diplodactylidae	*Diplodactylus pulcher*	Fine-faced Gecko										1	3				1															
	Lucasium squarrosum	Mottled Ground Gecko					2	1	7	2																						
	Strophurus elderi	Jewelled Gecko	2	7						1																						
	Strophurus strophurus	Western Spiny-tailed Gecko					2	1	2	1																						
	Strophurus wellingtonae	Western Shield Spiny-tailed Gecko										3	9	1		1	7	3	1	1	4	2										
Elapidae	*Brachyurophis semifasciata*	Half-girdlerd Snake			1					2				3	6	3																
	Furina ornata	Orange-naped Snake								1		1																				
	Parasuta monachus	Monk Snake				1			1		2		1		1							1										
	Pseudechis australis	Mulga Snake														2																

		Survey	1																																
Family	**Species**	Common Name	REG Open spinifex 1	REG Open spinifex 2	REG Open spinifex 3	REG Open spinifex 4	REG Shrubs over spinifex 1	REG Shrubs over spinifex 2	REG Shrubs over spinifex 3	REG Shrubs over spinifex 4	REG Dogbolter 2	REG Mulga woodland 1	REG Mulga woodland 4	REG Eucalypt over spinifex 2	REG Eucalypt over spinifex 4	REG Eucalypt over spinifex 1	REG Dogbolter 1	REG Dogbolter 3	REG Dogbolter 4	REG Eucalypt over spinifex 3	REG Mulga woodland 2	REG Mulga woodland 3	REG Opportunistic	REG Open spinifex	REG Mulga woodland	REG Eucalypt over spinifex	REG Shrubs over spinifex	REG Mulga thicket 2	REG Turkeys	REG Mulga thicket 1	REG Dogbolter
	Pseudonaja mengdeni	Gwardar		2																															
	Pseudonaja modesta	Ringed Brown Snake																1																	
	Simoselaps bertholdi	Jan's Banded Snake							1																										
Gekkonidae	*Gehyra purpurascens*	Purplish Dtella		1						2					1																				
	Gehyra variegata	Tree Dtella	2			1			1	2					1	1	2		1	3	1	10													
	Heteronotia binoei	Bynoe's Prickly Gecko						2							1		1				1	3													
	Rhynchoedura ornata	Western Beaked Gecko											1	1			7	4																	
Pygopodidae	*Delma butleri*	Unbanded Delma	1	2	2	1	2	1	3	1		1								1															
	Lialis burtonis	Burton's Snake-lizard												1	2																				
	Pygopus nigriceps	Western Hooded Scaly-foot					1	1							1	3																			
Scincidae	*Ctenotus ariadnae*	Ariadna's Ctenotus	1		4	3	7	4	6	8					2					4														
	Ctenotus dux	Fine Side-lined Ctenotus		2	2		6	2	13	2				4		14				4														
	Ctenotus grandis	Grand Ctenotus	6	8	9	14	1	3	3	4				4	1																				
	Ctenotus greeri	Spotted-necked Ctenotus												9	7	8				6															
	Ctenotus helenae	Clay-soil Ctenotus	1	2			20	23	13	10				20	14	15				26															
	Ctenotus leonhardii	Leonhardi's Ctenotus	1		4	6					11	6	7	37	16	15	11	20	16	25	6	2												
	Ctenotus pantherinus	Leopard Skink	9		6	3	12	11	1	1				9	3	1				13															
	Ctenotus piankai	Coarse Sands Ctenotus	1	4	3	2		1	1	1																									
	Ctenotus quattuordecimlineatus	Fourteen-lined Ctenotus	4	12	3	2	19	16	9	5	4			2	3		1		1	9															
	Ctenotus schomburgkii	Schomburgk's Ctenotus				1					7		3				8	16			1														

		Survey	1																															
Family	**Species**	Common Name	REG Open spinifex 1	REG Open spinifex 2	REG Open spinifex 3	REG Open spinifex 4	REG Shrubs over spinifex 1	REG Shrubs over spinifex 2	REG Shrubs over spinifex 3	REG Shrubs over spinifex 4	REG Dogbolter 2	REG Mulga woodland 1	REG Mulga woodland 4	REG Eucalypt over spinifex 2	REG Eucalypt over spinifex 4	REG Eucalypt over spinifex 1	REG Dogbolter 1	REG Dogbolter 3	REG Dogbolter 4	REG Eucalypt over spinifex 3	REG Mulga woodland 2	REG Mulga woodland 3	REG Opportunistic	REG Open spinifex	REG Mulga woodland	REG Eucalypt over spinifex	REG Shrubs over spinifex	REG Mulga thicket 2	REG Turkeys	REG Mulga thicket 1	REG Dogbolter
	Ctenotus uber	Spotted Ctenotus									2	7	18				1	10	7		8										
	Egernia depressa	Southern Pygmy Spiny-tailed Skink											1	1					1		4	1									
	Egernia formosa	Goldfields Crevice-skink											1	1		1	1					2									
	Eremiascincus richardsonii	Broad-banded Sand Swimmer												2	1							1									
	Lerista bipes	North-western Sandslider	35	37	10	17	5	11	48	56																					
	Lerista desertorum	Central Desert Robust Slider	1	2		1		1		1	1	1	1		3	1				3											
	Lerista muelleri	Wood Mulch-slider										2		1		1		1			1										
	Liopholis inornata	Desert Skink					2	10	14	5																					
	Liopholis striata	Nocturnal Desert Skink	2	2	5	4																									
	Menetia greyii	Common Dwarf Skink	2	4	12	8						2				1		1		2	1										
	Morethia butleri	Woodland Morethia Skink													1					1		1									
	Tiliqua multifasciata	Centralian Blue-tongued Lizard		1	1	1		4																							
Typhlopidae	*Anilios bicolor*	Dark-spined Blind Snake			3					1			1	1	2					1											
	Anilios hamatus	Pale-headed Blind Snake	1	1		2	1		2	1					1	1				2											
	Anilios waitii	Waite's Blind Snake				1		1	1							1				1											
Varanidae	*Varanus brevicauda*	Short-tailed Pygmy Monitor	1	2	3	3		1							1					1											
	Varanus caudolineatus	Stripe-tailed Monitor									2	5		3	1	1	3	7	2		4	9									
	Varanus eremius	Pygmy Desert Monitor	2		6	2		2																							
	Varanus gouldii	Gould's Goanna	6	8	3	1	15	15	12	8		1	1	2	2	1															

		Survey	1																												
Family	**Species**	Common Name	REG Open spinifex 1	REG Open spinifex 2	REG Open spinifex 3	REG Open spinifex 4	REG Shrubs over spinifex 1	REG Shrubs over spinifex 2	REG Shrubs over spinifex 3	REG Shrubs over spinifex 4	REG Dogbolter 2	REG Mulga woodland 1	REG Mulga woodland 4	REG Eucalypt over spinifex 2	REG Eucalypt over spinifex 4	REG Eucalypt over spinifex 1	REG Dogbolter 1	REG Dogbolter 3	REG Dogbolter 4	REG Eucalypt over spinifex 3	REG Mulga woodland 2	REG Mulga woodland 3	REG Opportunistic	REG Open spinifex	REG Mulga woodland	REG Eucalypt over spinifex	REG Shrubs over spinifex	REG Mulga thicket 2	REG Turkeys	REG Mulga thicket 1	REG Dogbolter
	Varanus panoptes	Yellow-spotted Monitor															4			2		1									
	Varanus tristis	Black-headed Monitor												2																	
Birds																															
Casuariidae	*Dromaius novaehollandiae*	Emu																					5	3							
Columbidae	*Ocyphaps lophotes*	Crested Pigeon																					1		2						
Caprimulgidae	*Eurostopodus argus*	Spotted Nightjar																					1								
Aegothelidae	*Aegotheles cristatus*	Australian Owlet-nightjar																					1								
Apodidae	*Apus pacificus*	Fork-tailed Swift																							2						
Otididae	*Ardeotis australis*	Australian Bustard																					2								
Accipitridae	*Aquila audax*	Wedge-tailed Eagle																					3	1							
Falconidae	*Falco cenchroides*	Nankeen Kestrel																					2	1							
	Falco berigora	Brown Falcon																						2							
Charadriidae	*Elseyornis melanops*	Black-fronted Dotterel																					2								
Cacatuidae	*Eolophus roseicapillus*	Galah																					2								
Psittacidae	*Barnardius zonarius*	Australian Ringneck																					10			2	5				
	Psephotus varius	Mulga Parrot																					5								
Meropidae	*Merops ornatus*	Rainbow Bee-eater																					1								
Ptilonorhynchidae	*Ptilonorhynchus guttatus*	Western Bowerbird																					3								
Maluridae	*Malurus splendens*	Splendid Fairy-wren																					4	2	8	13		5	10	5	
	Malurus lamberti	Variegated Fairy-wren																									4				

		Survey	1																												
Family	**Species**	Common Name	REG Open spinifex 1	REG Open spinifex 2	REG Open spinifex 3	REG Open spinifex 4	REG Shrubs over spinifex 1	REG Shrubs over spinifex 2	REG Shrubs over spinifex 3	REG Shrubs over spinifex 4	REG Dogbolter 2	REG Mulga woodland 1	REG Mulga woodland 4	REG Eucalypt over spinifex 2	REG Eucalypt over spinifex 4	REG Eucalypt over spinifex 1	REG Dogbolter 1	REG Dogbolter 3	REG Dogbolter 4	REG Eucalypt over spinifex 3	REG Mulga woodland 2	REG Mulga woodland 3	REG Opportunistic	REG Open spinifex	REG Mulga woodland	REG Eucalypt over spinifex	REG Shrubs over spinifex	REG Mulga thicket 2	REG Turkeys	REG Mulga thicket 1	REG Dogbolter
Acanthizidae	*Pyrrholaemus brunneus*	Redthroat																							1						
	Smicrornis brevirostris	Weebill																					3			13	5				
	Gerygone fusca	Western Gerygone																													1
	Acanthiza robustirostris	Slaty-backed Thornbill																							4				2		6
	Acanthiza chrysorrhoa	Yellow-rumped Thornbill																							2				1		6
	Acanthiza uropygialis	Chestnut-rumped Thornbill																					1		7	5	3		3		8
	Acanthiza apicalis	Inland Thornbill																							8		1	6		6	4
	Aphelocephala leucopsis	Southern Whiteface																							3			2	1	2	2
Meliphagidae	*Gavicalis virescens*	Singing Honeyeater																					1	2	3	5	1	2	2	2	1
	Manorina flavigula	Yellow-throated Miner																					3	12	5	5	8	7	3	7	
Pomatostomidae	*Pomatostomus superciliosus*	White-browed Babbler																					3						2		
Psophodidae	*Cinclosoma castaneothorax*	Chestnut-breasted Quail-thrush																										1		1	
Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike																						2		3			2		
Pachycephalidae	*Pachycephala rufiventris*	Rufous Whistler																							4	3		3		3	2
	Pachycephala rufiventris	Rufous Whistler																													
	Colluricincla harmonica	Grey Shrike-thrush																								1	1				
	Oreoica gutturalis	Crested Bellbird																						3	3	5	4	1	1	1	3
Artamidae	*Artamus cinereus*	Black-faced Woodswallow																					3								
	Cracticus torquatus	Grey Butcherbird																					3	3	1	2	2	2		2	
	Cracticus nigrogularis	Pied Butcherbird																					2	4	2	2	4	1		1	2

		Survey	1																												
Family	**Species**	Common Name	REG Open spinifex 1	REG Open spinifex 2	REG Open spinifex 3	REG Open spinifex 4	REG Shrubs over spinifex 1	REG Shrubs over spinifex 2	REG Shrubs over spinifex 3	REG Shrubs over spinifex 4	REG Dogbolter 2	REG Mulga woodland 1	REG Mulga woodland 4	REG Eucalypt over spinifex 2	REG Eucalypt over spinifex 4	REG Eucalypt over spinifex 1	REG Dogbolter 1	REG Dogbolter 3	REG Dogbolter 4	REG Eucalypt over spinifex 3	REG Mulga woodland 2	REG Mulga woodland 3	REG Opportunistic	REG Open spinifex	REG Mulga woodland	REG Eucalypt over spinifex	REG Shrubs over spinifex	REG Mulga thicket 2	REG Turkeys	REG Mulga thicket 1	REG Dogbolter
	Gymnorhina tibicen	Australian Magpie																					2	3	2						
	Strepera versicolor	Grey Currawong																								1	2				
Rhipiduridae	*Rhipidura albiscapa*	Grey Fantail																													1
	Rhipidura leucophrys	Willie Wagtail																					3			4					
Corvidae	*Corvus orru*	Torresian Crow																								3					
Monarchidae	*Grallina cyanoleuca*	Magpie-lark																					7		4			3		3	
Petroicidae	*Microeca fascinans*	Jacky Winter																								1	1				
	Petroica goodenovii	Red-capped Robin																									1				
	Melanodryas cucullata	Hooded Robin																									1				1
Motacillidae	*Anthus novaeseelandiae*	Australasian Pipit																													1
Mammals																															
Emballonuridae	*Saccolaimus flaviventris*	Yellow-bellied Sheath-tail Bat				1																									
Vespertilionidae	*Chalinolobus gouldii*	Gould's Wattled Bat								1			1		1																
	Chalinolobus morio	Chocolate Wattled Bat				1							1																		
	Mormopterus sp.	Free-tail Bat Sp.				1				1			1		1																
	Nyctophilus sp.	Long-eared Bat Sp.								1	1		1		1																
	Scotorepens balstoni	Inland Broad-nosed Bat				1				1			1				1														
Dasyuridae	*Dasycercus cristicauda*	Crest-tailed Mulgara		1																											
	Ningaui ridei	Wongai Ningaui	2	3	1	2	1	3	5	1	2				6	2	1		1	2											
	Sminthopsis dolichura	Little Long-tailed Dunnart	1			2						1	1	2	1	5	5	3	3	4	2	3									

		Survey	1																																
Family	**Species**	Common Name	REG Open spinifex 1	REG Open spinifex 2	REG Open spinifex 3	REG Open spinifex 4	REG Shrubs over spinifex 1	REG Shrubs over spinifex 2	REG Shrubs over spinifex 3	REG Shrubs over spinifex 4	REG Dogbolter 2	REG Mulga woodland 1	REG Mulga woodland 4	REG Eucalypt over spinifex 2	REG Eucalypt over spinifex 4	REG Eucalypt over spinifex 1	REG Dogbolter 1	REG Dogbolter 3	REG Dogbolter 4	REG Eucalypt over spinifex 3	REG Mulga woodland 2	REG Mulga woodland 3	REG Opportunistic	REG Open spinifex	REG Mulga woodland	REG Eucalypt over spinifex	REG Shrubs over spinifex	REG Mulga thicket 2	REG Turkeys	REG Mulga thicket 1	REG Dogbolter
	Sminthopsis macroura	Stripe-faced Dunnart		1								2	1					1																	
Muridae	*Mus musculus*	House Mouse	7	1	3		2	1		1																									
	Notomys alexis	Spinifex Hopping Mouse		1			1		4				1																						
	Pseudomys desertor	Desert Mouse	1				1	3		1								1	1	1															
	Pseudomys hermannsburgensis	Sandy Inland Mouse	1		2						1				2						2													

(1) Coffey Environments (2008) Level 2 Fauna Assessment for the Duketon Gold Project. Unpublished report for Regis Resources, Perth.

B.5 VERTEBRATE FAUNA RECORDED IN BIOLOGICAL SURVEYS IN THE REGION

		Survey	1							2																
Family	**Species**	Common Name	Site 1	Site 2	Site 7	Site 5	Site 6	Site 3	Site 4	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13	Site 14	Site 15	Opportunistic	Birds
Reptiles																										
Agamidae	*Ctenophorus reticulatus*	Western Netted Dragon	1																							
	Diporiphora amphiboluroides	Mulga Dragon										1	2			1	1						1	1		
	Pogona minor	Dwarf Bearded Dragon		1																1						
	Tympanocryptis cephalus	Pebble Dragon								2			2	1												
Boidae	*Antaresia stimsoni*	Stimson's Python			1																					
Carphodactylidae	*Underwoodisaurus milii*	Barking Gecko		1											1											
Diplodactylidae	*Diplodactylus pulcher*	Fine-faced Gecko				1					1	1	3			5	3	2	3	7	4	6	3	3		
	Strophurus assimilis	Goldfields Spiny-tailed Gecko		1																						
	Strophurus wellingtonae	Western Shield Spiny-tailed Gecko								1	2		3	1			3	4	5	1		2	4	1		
Elapidae	*Parasuta monachus*	Monk Snake																		1						
Gekkonidae	*Heteronotia binoei*	Bynoe's Prickly Gecko	1				1				1			1	7	1	1		3	7		7	1	1		
Pygopodidae	*Pygopus nigriceps*	Western Hooded Scaly-foot									1															
Scincidae	*Cryptoblepharus buchananii*	Buchanan's Snake-eyed Skink		1																						
	Cryptoblepharus plagiocephalus	Peron's Snake-eyed Skink																	3				3			
	Ctenotus schomburgkii	Schomburgk's Ctenotus										1														

		Survey	1							2																
Family	**Species**	Common Name	Site 1	Site 2	Site 7	Site 5	Site 6	Site 3	Site 4	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13	Site 14	Site 15	Opportunistic	Birds
	Ctenotus uber	Spotted Ctenotus				1				3	1		8	4		2				1		1	2	2		
	Egernia depressa	Pygmy Spiny-tailed Skink			1		1	1	1				1				1				1	1		3		
	Egernia formosa	Goldfields Crevice-skink			1					1	1	1					2	2	4				1			
	Eremiascincus richardsonii	Broad-banded Sand Swimmer	1	1								2				1							1			
	Lerista desertorum	Central Desert Robust Slider		1												1		6	2	5		1	2			
	Lerista muelleri	Wood Mulch-slider								2						5				1	1		5	4		
	Lerista sp.					1	1		1																	
	Liopholis striata	Nocturnal Desert Skink					1																			
	Menetia greyii	Common Dwarf Skink	1	1		1										1							1			
	Morethia butleri	Woodland Morethia Skink								1							2	2		2	1	1	1	1		
Typhlopidae	*Anilios australis*	Austral Blind Snake																						1		
Varanidae	*Varanus caudolineatus*	Stripe-tailed Monitor		1						4		3		3			2		1	1			1			
	Varanus panoptes	Yellow-spotted Monitor													1		1						1			
	Varanus panoptes rubidus	Yellow-spotted Monitor	1	1	1	1	1	1	1																	
Cheluidae	*Chelodina steindachneri*	Steindachner's Turtle	1																							
Birds																										
Casuariidae	*Dromaius novaehollandiae*	Emu	1	1	1	1	1	1	1																1	
Columbidae	*Phaps chalcoptera*	Common Bronzewing	1	1		1	1		1																1	3
Columbidae	*Ocyphaps lophotes*	Crested Pigeon	1	1	1	1	1	1																	1	14
Caprimulgidae	*Eurostopodus argus*	Spotted Nightjar																								1

		Survey	1							2																	
Family	**Species**	Common Name	Site 1	Site 2	Site 7	Site 5	Site 6	Site 3	Site 4	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13	Site 14	Site 15	Opportunistic	Birds
Aegothelidae	*Aegotheles cristatus*	Australian Owlet-nightjar						1																		
Otididae	*Ardeotis australis*	Australian Bustard		1																						
Accipitridae	*Accipiter fasciatus*	Brown Goshawk	1																							
	Aquila audax	Wedge-tailed Eagle					1																			
	Hieraaetus morphnoides	Little Eagle		1																						
Falconidae	*Falco cenchroides*	Nankeen Kestrel		1	1	1		1	1																1	
	Falco berigora	Brown Falcon	1	1			1																			
Charadriidae	*Elseyornis melanops*	Black-fronted Dotterel	1																							
Charadriidae	*Vanellus tricolor*	Banded Lapwing					1																			
Turnicidae	*Turnix velox*	Little Button-quail							1																	
Cacatuidae	*Eolophus roseicapillus*	Galah	1	1	1	1	1	1																	1	1
Psittacidae	*Barnardius zonarius*	Australian Ringneck	1			1	1	1																		12
	Psephotus varius	Mulga Parrot	1			1	1																		1	3
	Melopsittacus undulatus	Budgerigar	1	1		1	1	1	1																	
	Neopsephotus bourkii	Bourke's Parrot				1	1																			
Cuculidae	*Chalcites basalis*	Horsfield's Bronze-cuckoo	1	1			1		1																	
	Chalcites osculans	Black-eared Cuckoo		1			1																			
	Heteroscenes pallidus	Pallid Cuckoo	1					1	1																	
Halcyonidae	*Todiramphus pyrrhopygius*	Red-backed Kingfisher		1				1	1																	
Meropidae	*Merops ornatus*	Rainbow Bee-eater	1					1																		

		Survey	1							2																
Family	**Species**	Common Name	Site 1	Site 2	Site 7	Site 5	Site 6	Site 3	Site 4	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13	Site 14	Site 15	Opportunistic	Birds
Climacteridae	*Climacteris affinis*	White-browed Treecreeper				1	1	1	1																1	1
Ptilonorhynchidae	*Ptilonorhynchus maculatus*	Spotted Bowerbird	1					1																		
	Ptilonorhynchus guttatus	Western Bowerbird																							1	3
Maluridae	*Malurus splendens*	Splendid Fairy-wren	1	1			1																			19
	Malurus leucopterus	White-winged Fairy-wren		1				1																		3
	Malurus lamberti	Variegated Fairy-wren	1	1			1																			
Acanthizidae	*Pyrrholaemus brunneus*	Redthroat		1																						
	Smicrornis brevirostris	Weebill		1																						3
	Gerygone fusca	Western Gerygone	1	1																						
	Acanthiza robustirostris	Slaty-backed Thornbill	1		1	1	1	1	1																	34
	Acanthiza chrysorrhoa	Yellow-rumped Thornbill	1		1	1	1	1	1																	1
	Acanthiza uropygialis	Chestnut-rumped Thornbill	1		1	1	1	1	1																	8
	Acanthiza apicalis	Inland Thornbill	1	1	1			1	1																	30
	Aphelocephala leucopsis	Southern Whiteface	1	1	1	1	1	1																		7
Meliphagidae	*Certhionyx variegatus*	Pied Honeyeater	1	1		1			1																	
	Gavicalis virescens	Singing Honeyeater	1	1	1	1	1	1	1																	24
	Purnella albifrons	White-fronted Honeyeater	1	1					1																	
	Manorina flavigula	Yellow-throated Miner	1	1	1	1	1	1	1																1	10
	Acanthagenys rufogularis	Spiny-cheeked Honeyeater	1	1		1	1	1	1																	13
	Epthianura tricolor	Crimson Chat		1		1	1	1	1																	

		Survey	1							2																	
Family	**Species**	Common Name	Site 1	Site 2	Site 7	Site 5	Site 6	Site 3	Site 4	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13	Site 14	Site 15	Opportunistic	Birds
	Sugomel niger	Black Honeyeater							1																	
	Lichmera indistincta	Brown Honeyeater		1																						
Pomatostomidae	*Pomatostomus superciliosus*	White-browed Babbler	1				1																		1	8
Psophodidae	*Cinclosoma castaneothorax*	Chestnut-breasted Quail-thrush				1	1	1	1																	
Neosittidae	*Daphoenositta chrysoptera*	Varied Sittella			1																					
Campephagidae	*Coracina maxima*	Ground Cuckoo-shrike	1	1				1																		
	Coracina novaehollandiae	Black-faced Cuckoo-shrike	1	1		1		1	1																	2
	Lalage tricolor	White-winged Triller		1			1																			
Pachycephalidae	*Pachycephala rufiventris*	Rufous Whistler	1	1	1	1	1	1	1																	22
	Colluricincla harmonica	Grey Shrike-thrush	1	1	1	1	1	1	1																	13
	Oreoica gutturalis	Crested Bellbird	1	1	1	1	1	1	1																	40
Artamidae	*Artamus cinereus*	Black-faced Woodswallow	1	1		1		1	1																2	3
	Cracticus torquatus	Grey Butcherbird	1	1	1	1	1	1	1																	
	Cracticus nigrogularis	Pied Butcherbird	1	1	1	1	1	1	1																1	2
	Gymnorhina tibicen	Australian Magpie	1		1		1																			
	Strepera versicolor	Grey Currawong	1																							
Rhipiduridae	*Rhipidura leucophrys*	Willie Wagtail	1	1			1		1																	
Corvidae	*Corvus bennetti*	Little Crow			1	1	1		1																	14
	Corvus orru	Torresian Crow	1	1	1		1	1	1																1	
Monarchidae	*Grallina cyanoleuca*	Magpie-lark	1	1																					1	

		Survey	1							2																
Family	**Species**	Common Name	Site 1	Site 2	Site 7	Site 5	Site 6	Site 3	Site 4	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13	Site 14	Site 15	Opportunistic	Birds
Petroicidae	*Petroica goodenovii*	Red-capped Robin	1	1	1	1	1	1	1																	14
	Melanodryas cucullata	Hooded Robin	1	1	1		1	1	1																	3
Megaluridae	*Cincloramphus mathewsi*	Rufous Songlark		1				1																		
Hirundinidae	*Hirundo neoxena*	Welcome Swallow	1				1	1	1																	
	Petrochelidon ariel	Fairy Martin							1																	
	Petrochelidon nigricans	Tree Martin						1	1																	
Estrildidae	*Taeniopygia guttata*	Zebra Finch	1	1	1	1		1	1																	
Motacillidae	*Anthus novaeseelandiae*	Australasian Pipit		1				1																	1	
Mammals																										
Bovidae	*Bos taurus*	Cow	1	1	1	1	1	1	1																	
	Capra hircus	Goat	1	1																						
Canidae	*Canis lupus*	Dingo	1																							
	Vulpes vulpes	Red Fox	1																							
Felidae	*Felis catus*	House Cat	1	1																						
Vespertilionidae	*Nyctophilus geoffroyi*	Lesser Long-eared Bat																					4			
Dasyuridae	*Sminthopsis crassicaudata*	Fat-tailed Dunnart		1																						
	Sminthopsis dolichura	Little Long-tailed Dunnart								1	5		1	4	4	2			1		1	1	3	2		
	Sminthopsis macroura	Stripe-faced Dunnart				1					1	1			1	3	1		1							
Macropodidae	*Osphranter robustus*	Euro			1																					
	Osphranter rufus	Red Kangaroo	1	1				1																		

		Survey	1							2																	
Family	**Species**	Common Name	Site 1	Site 2	Site 7	Site 5	Site 6	Site 3	Site 4	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13	Site 14	Site 15	Opportunistic	Birds
Leporidae	*Oryctolagus cuniculus*	European Rabbit	1			1																				
Tachyglossidae	*Tachyglossus aculeatus*	Short-beaked Echidna			1																					
Equidae	*Equus caballus*	Domestic Horse		1				1																		
Muridae	*Mus musculus*	House Mouse	1	1		1		1	1																	

(1) Halpern Glick Maunsell (1999) Rosemont Gold Project Biological Assessment Survey - Phases 1 & 2. Unpublished report for Johnson's Well Mining NL. Perth.

(2) Terrestrial Ecosystems (2010) Level 2 Fauna Risk Assessment for the Garden Well Project Area. Unpublished report for Regis Resources, Perth.

B.6 VERTEBRATE FAUNA RECORDED IN BIOLOGICAL SURVEYS IN THE REGION

		Survey	1									
Family	**Species**	Common Name	**TM1**	**JS2**	**WM2**	**WS2**	**WM1**	**WS1**	**JS3**	**JS1**	**JS4**	**HB1**
Frogs												
Limnodynastidae	*Neobatrachus wilsmorei*	Goldfields Bullfrog	3	1								
Reptiles												
Agamidae	*Ctenophorus inermis*	Military Dragon			1							
	Ctenophorus maculatus	Spotted Dragon				2						
	Ctenophorus reticulatus	Western Netted Dragon					1					
	Ctenophorus salinarum	Saltpan Dragon				2		1				
	Pogona minor	Dwarf Bearded Dragon	1		2				2	1	1	
Carphodactylidae	*Nephrurus vertebralis*	Midline Knob-tail					1		1			
Diplodactylidae	*Lucasium squarrosum*	Mottled Ground Gecko	2	1	5	2	1					2
	Strophurus elderi	Jewelled Gecko		1					1	2		
Elapidae	*Simoselaps bertholdi*	Jan's Banded Snake	1									
Gekkonidae	*Gehyra xenopus*	Crocodile-faced Dtella		1			1			1	1	
	Heteronotia binoei	Bynoe's Prickly Gecko	1				2				2	3
Pygopodidae	*Delma nasuta*	Sharp-snouted Delma									1	
	Pygopus nigriceps	Western Hooded Scaly-foot									1	
Scincidae	*Ctenotus helenae*	Clay-soil Ctenotus		2					2	1		
	Ctenotus leonhardii	Leonhardi's Ctenotus	6	3	3	6	7				2	4
	Lerista desertorum	Central Desert Robust Slider	4	1	1				1	2	1	
	Lerista kingi	King's Slider					1					
	Menetia greyii	Common Dwarf Skink				1	1					
Typhlopidae	*Anilios hamatus*	Pale-headed Blind Snake					1				1	
Varanidae	*Varanus caudolineatus*	Stripe-tailed Monitor			1							
	Varanus gouldii	Gould's Goanna					1		1			
Dasyuridae	*Ningaui ridei*	Wongai Ningaui							1			
Muridae	*Notomys alexis*	Spinifex Hopping Mouse							1			

Dunlop, J.N. and Payne, W. (1999) A vertebrate fauna survey of the North Lake Carey region, Unpublished report for Placer (Granny Smith) and Homestake.

Appendix C.

Definitions of Significant Fauna under the Biodiversity Conservation Act 2016 and Priority Species

Basic Vertebrate Fauna Survey and Risk Assessment
Crawford Project

C.1 DEFINITIONS OF SIGNIFICANT FAUNA UNDER THE WA BIODIVERSITY CONSERVATION ACT 2016

Threatened, Extinct and Specially Protected fauna or flora[1] are species[2] which have been adequately searched for and are deemed to be, in the wild, threatened, extinct or in need of special protection, and have been gazetted as such. The *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.

[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).

EN Endangered species

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

Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for endangered flora.

VU Vulnerable species

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

Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for vulnerable fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for vulnerable flora.

Extinct Species

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

EX Extinct species

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

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

EW Extinct in the wild species

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

Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.

Specially Protected Species

Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection.

Species that are listed as threatened species (critically endangered, endangered or vulnerable) or extinct species under the BC Act cannot also be listed as Specially Protected species.

MI Migratory birds protected under an international agreement

Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act).

Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the *Convention on the Conservation of Migratory Species of Wild Animals* (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals, that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species.

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

CD Species of special conservation interest (conservation dependant fauna)

Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act).

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

OS Other specially protected species

Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act).

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

P Priority species

Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened fauna or flora.

Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.

Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations

P1 Priority 1: Poorly-known species

Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.

P2 Priority 2: Poorly-known species

Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.

P3 Priority 3: Poorly-known species

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

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

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

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

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

Appendix D. Results of the Rapid Habitat Assessment

Basic Vertebrate Fauna Survey and Risk Assessment
Crawford Project

Date: 9/11/2020 | Habitat Assessment #: 1 | Observer: ST

Zone: 51 | Easting: 363313 mE | Northing: 6804660 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 2 | Observer: ST

Zone: 51 | Easting: 363551 mE | Northing: 6806469 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Shrubland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 3 | Observer: ST

Zone: 51 | Easting: 363397 mE | Northing: 6806568 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Shrubland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 4 | Observer: ST

Zone: 51 | Easting: 363385 mE | Northing: 6806867 mN

Fire History: >5 years | Landform: Rocky ridge | Soil Type: Rocky

Habitat Structure: Shrubland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020

Habitat Assessment #: 5

Observer: ST

Zone: 51

Easting: 363257 mE

Northing: 6807059 mN

Fire History: >5 years

Landform: Undulation

Soil Type: Rocky

Habitat Structure: Shrubland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 6 | Observer: ST

Zone: 51 | Easting: 363129 mE | Northing: 6807295 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 7 | Observer: ST

Zone: 51 | Easting: 363065 mE | Northing: 6807427 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 8 | Observer: ST

Zone: 51 | Easting: 362909 mE | Northing: 6807660 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 9 | Observer: ST

Zone: 51 | Easting: 362716 mE | Northing: 6807917 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 10 | Observer: ST

Zone: 51 | Easting: 362606 mE | Northing: 6808008 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 11 | Observer: ST

Zone: 51 | Easting: 362541 mE | Northing: 6808161 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 12 | Observer: ST

Zone: 51 | Easting: 362371 mE | Northing: 6808044 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 13 | Observer: ST

Zone: 51 | Easting: 362439 mE | Northing: 6807895 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Shrubland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 14 | Observer: ST

Zone: 51 | Easting: 362572 mE | Northing: 6807717 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 15 | Observer: ST

Zone: 51 | Easting: 362654 mE | Northing: 6807578 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 16 | Observer: ST

Zone: 51 | Easting: 362730 mE | Northing: 6807501 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

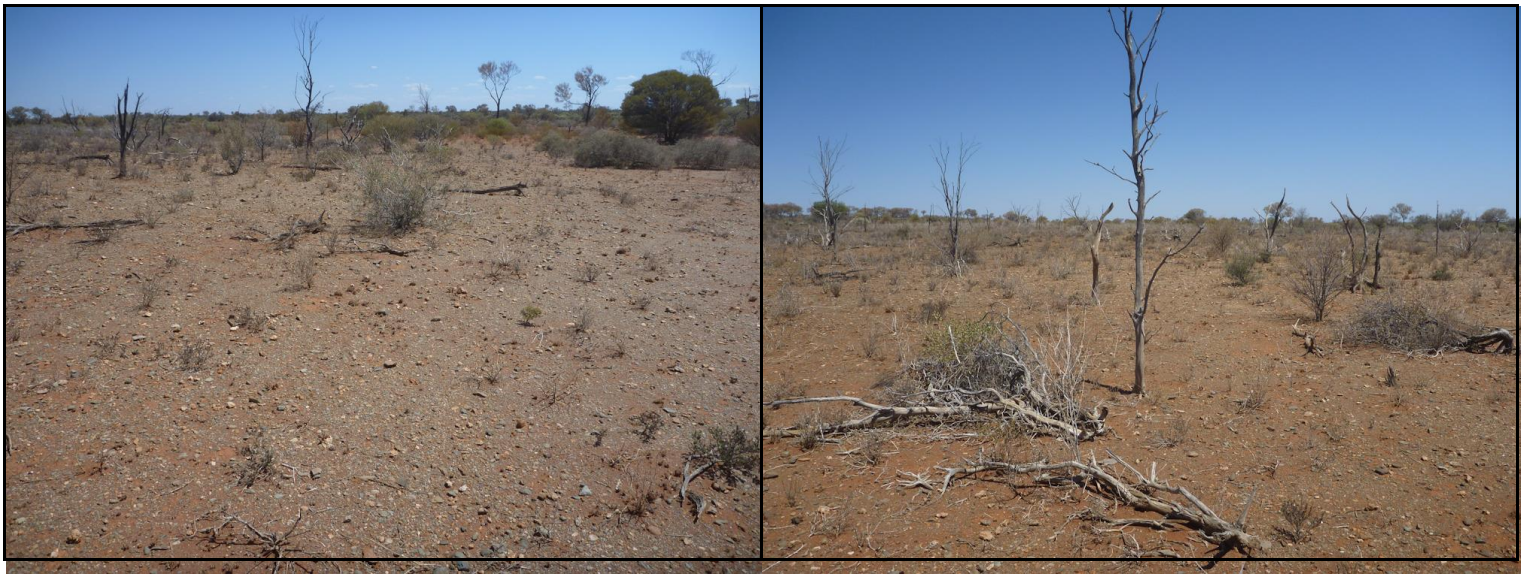
Date: 9/11/2020 | Habitat Assessment #: 17 | Observer: ST

Zone: 51 | Easting: 362817 mE | Northing: 6807249 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Shrubland

Habitat Quality: Good-very good



TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 18 | Observer: ST

Zone: 51 | Easting: 362922 mE | Northing: 6807001 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 19 | Observer: ST

Zone: 51 | Easting: 363042 mE | Northing: 6806788 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Shrubland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 20 | Observer: ST

Zone: 51 | Easting: 363167 mE | Northing: 6806576 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Shrubland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

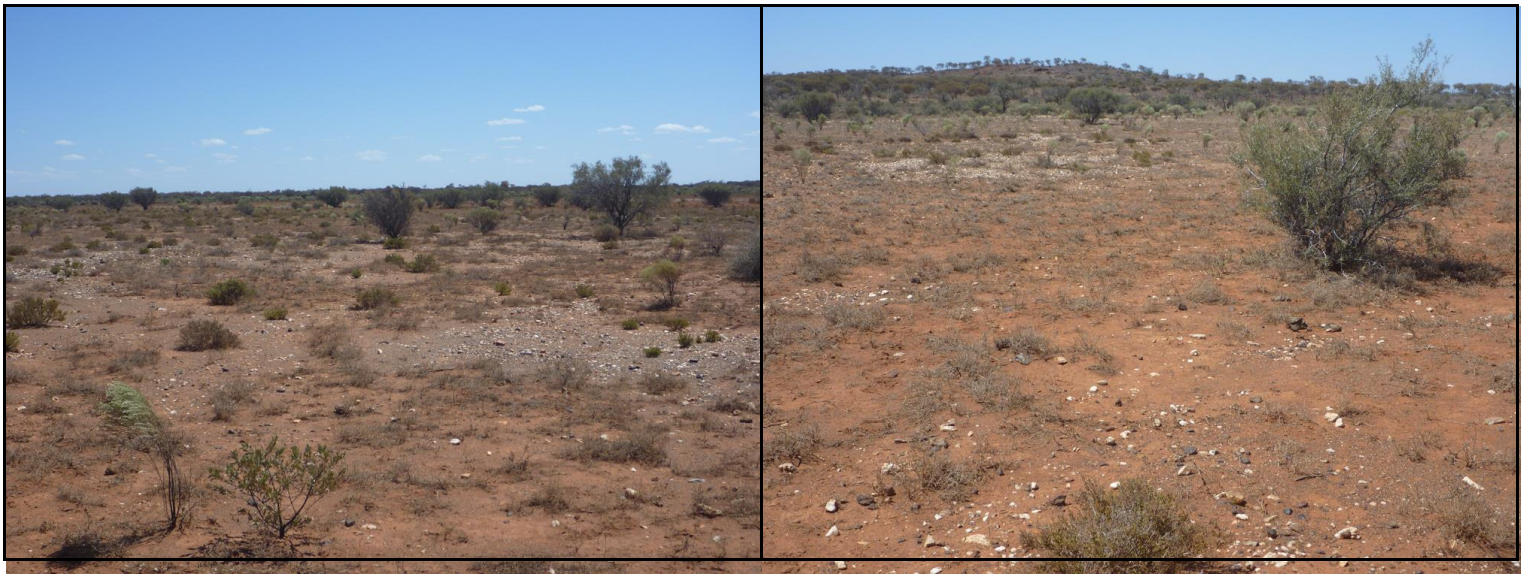
Date: 9/11/2020 | Habitat Assessment #: 21 | Observer: ST

Zone: 51 | Easting: 363290 mE | Northing: 6806330 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Shrubland

Habitat Quality: Good-very good



TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 22 | Observer: ST

Zone: 51 | Easting: 363139 mE | Northing: 6806231 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Shrubland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 23 | Observer: ST

Zone: 51 | Easting: 362939 mE | Northing: 6806139 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Shrubland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

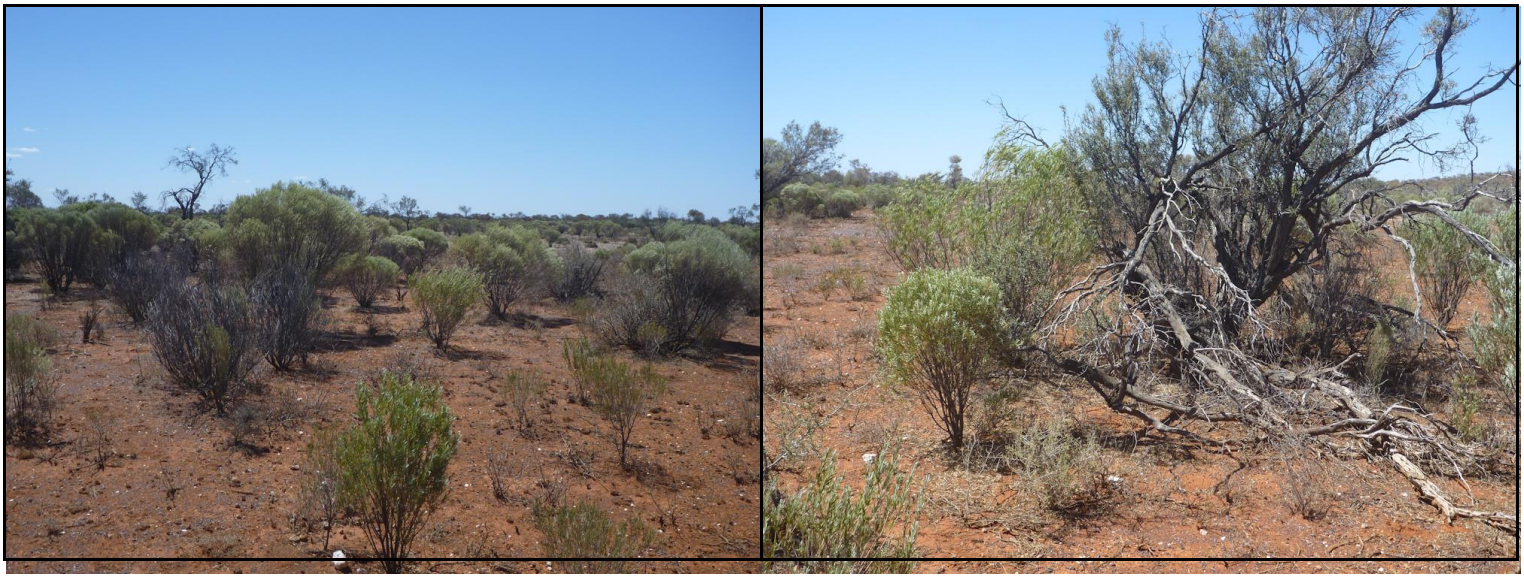
Date: 9/11/2020 | Habitat Assessment #: 24 | Observer: ST

Zone: 51 | Easting: 362800 mE | Northing: 6806334 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Shrubland

Habitat Quality: Good-very good



TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 25 | Observer: ST

Zone: 51 | Easting: 362675 mE | Northing: 6806521 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Shrubland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 26 | Observer: ST

Zone: 51 | Easting: 362525 mE | Northing: 6806743 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 27 | Observer: ST

Zone: 51 | Easting: 362421 mE | Northing: 6806973 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 28 | Observer: ST

Zone: 51 | Easting: 362362 mE | Northing: 6807195 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 29 | Observer: ST

Zone: 51 | Easting: 362339 mE | Northing: 6807232 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

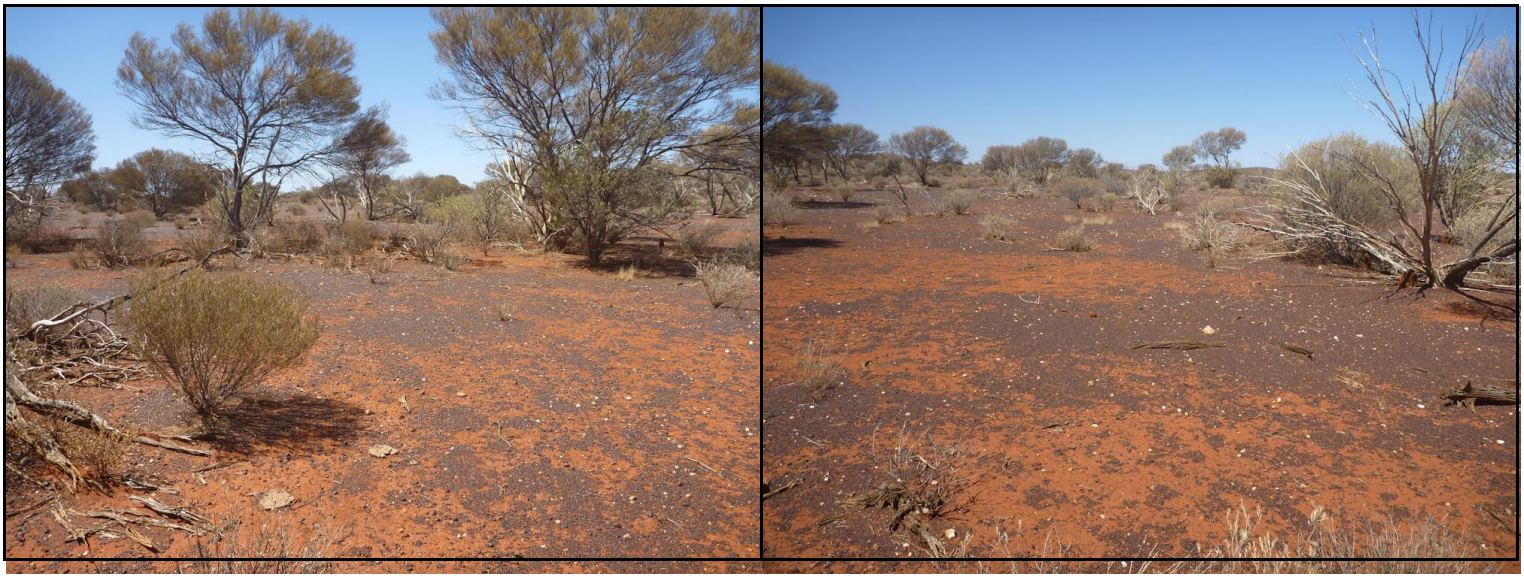
Date: 9/11/2020 | Habitat Assessment #: 30 | Observer: ST

Zone: 51 | Easting: 362186 mE | Northing: 6807451 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good



TERRESTRIAL ECOSYSTEMS

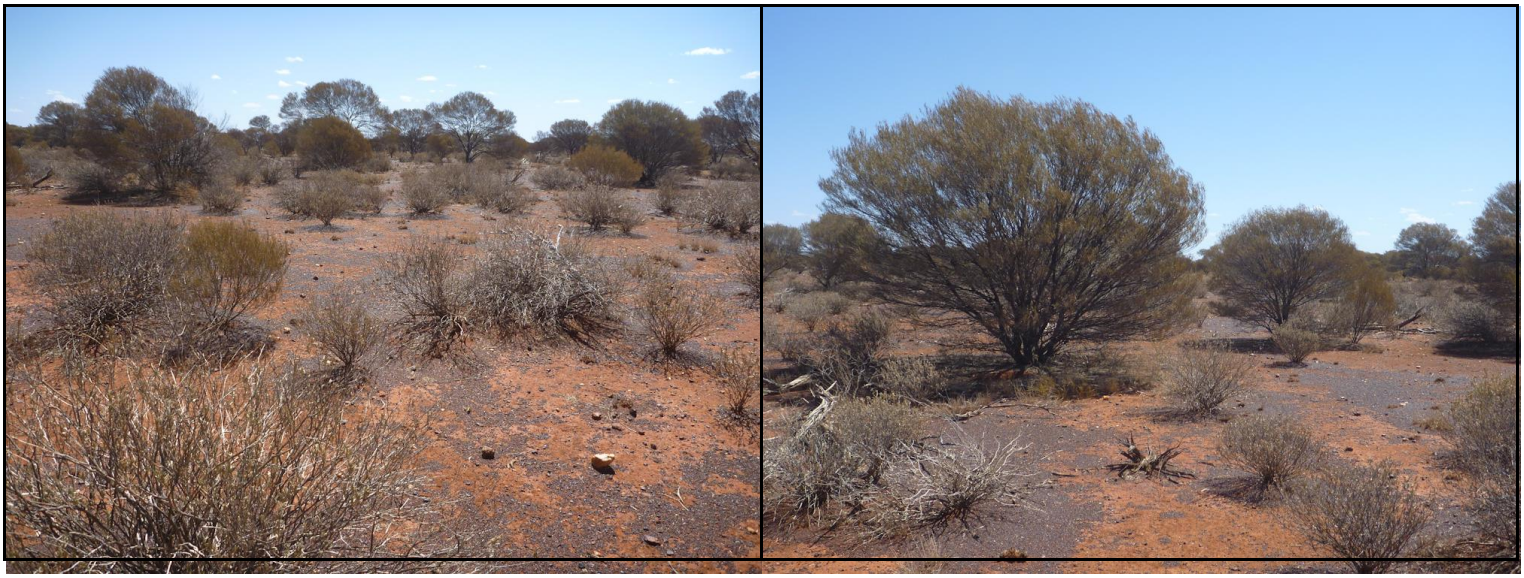
Date: 9/11/2020 | Habitat Assessment #: 31 | Observer: ST

Zone: 51 | Easting: 362038 mE | Northing: 6807720 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good



TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 32 | Observer: ST

Zone: 51 | Easting: 361854 mE | Northing: 6807725 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

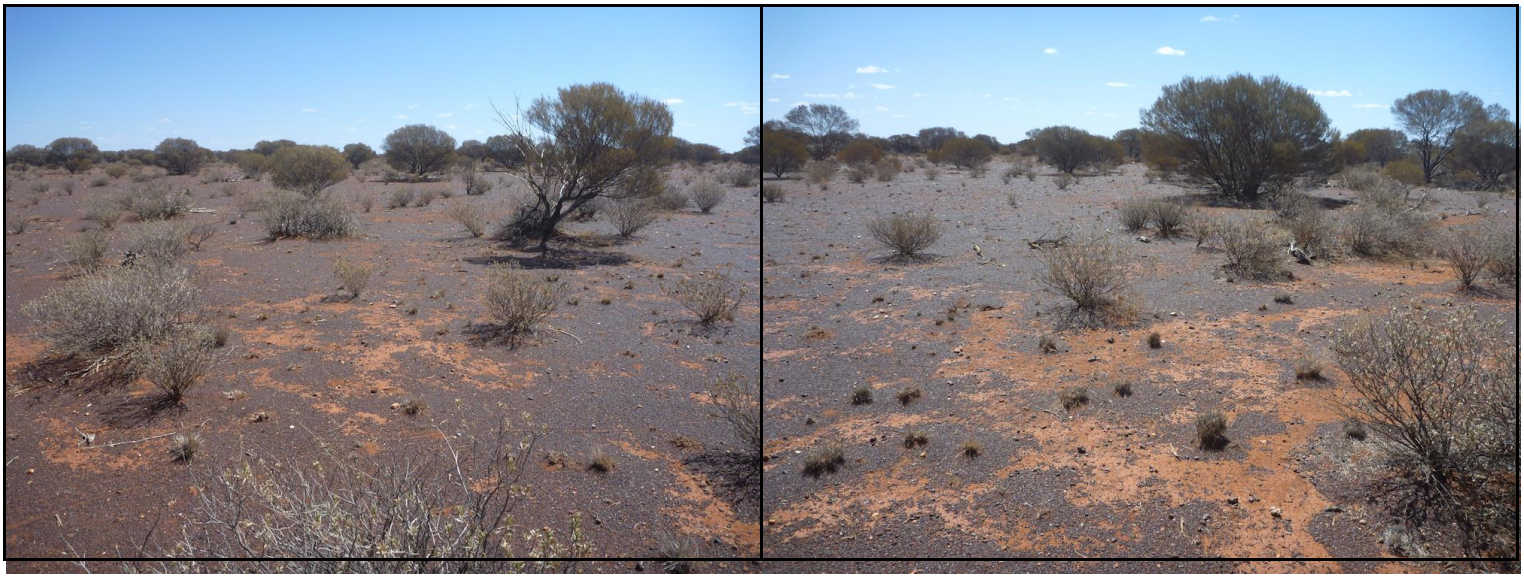
Date: 9/11/2020 | Habitat Assessment #: 33 | Observer: ST

Zone: 51 | Easting: 361632 mE | Northing: 6807587 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good



TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 34 | Observer: ST

Zone: 51 | Easting: 361757 mE | Northing: 6807276 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 36 | Observer: ST

Zone: 51 | Easting: 362029 mE | Northing: 6806807 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

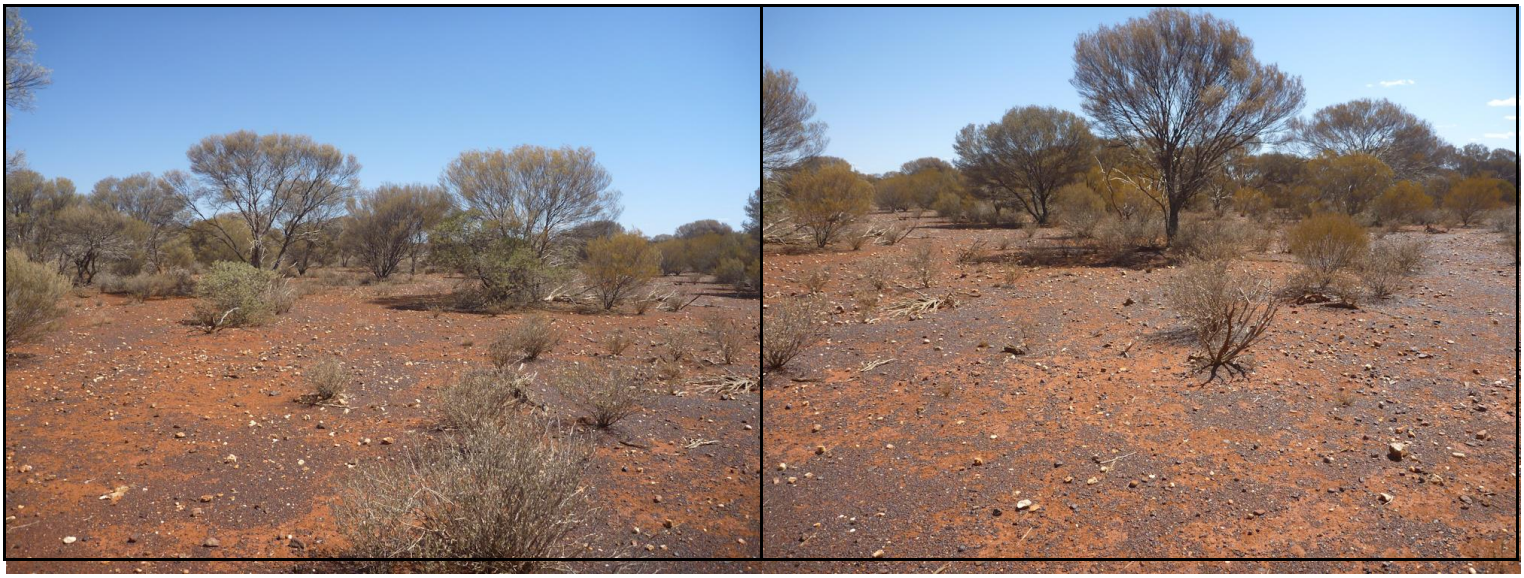
Date: 9/11/2020 | Habitat Assessment #: 37 | Observer: ST

Zone: 51 | Easting: 362156 mE | Northing: 6806545 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Mulga Woodland

Habitat Quality: Good-very good



TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 38 | Observer: ST

Zone: 51 | Easting: 362240 mE | Northing: 6806299 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 39 | Observer: ST

Zone: 51 | Easting: 362362 mE | Northing: 6806082 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 40 | Observer: ST

Zone: 51 | Easting: 362474 mE | Northing: 6805836 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 41 | Observer: ST

Zone: 51 | Easting: 362679 mE | Northing: 6805491 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 42 | Observer: ST

Zone: 51 | Easting: 362801 mE | Northing: 6805215 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 43 | Observer: ST

Zone: 51 | Easting: 362867 mE | Northing: 6805059 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 44 | Observer: ST

Zone: 51 | Easting: 362998 mE | Northing: 6804859 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 45 | Observer: ST

Zone: 51 | Easting: 363106 mE | Northing: 6804578 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

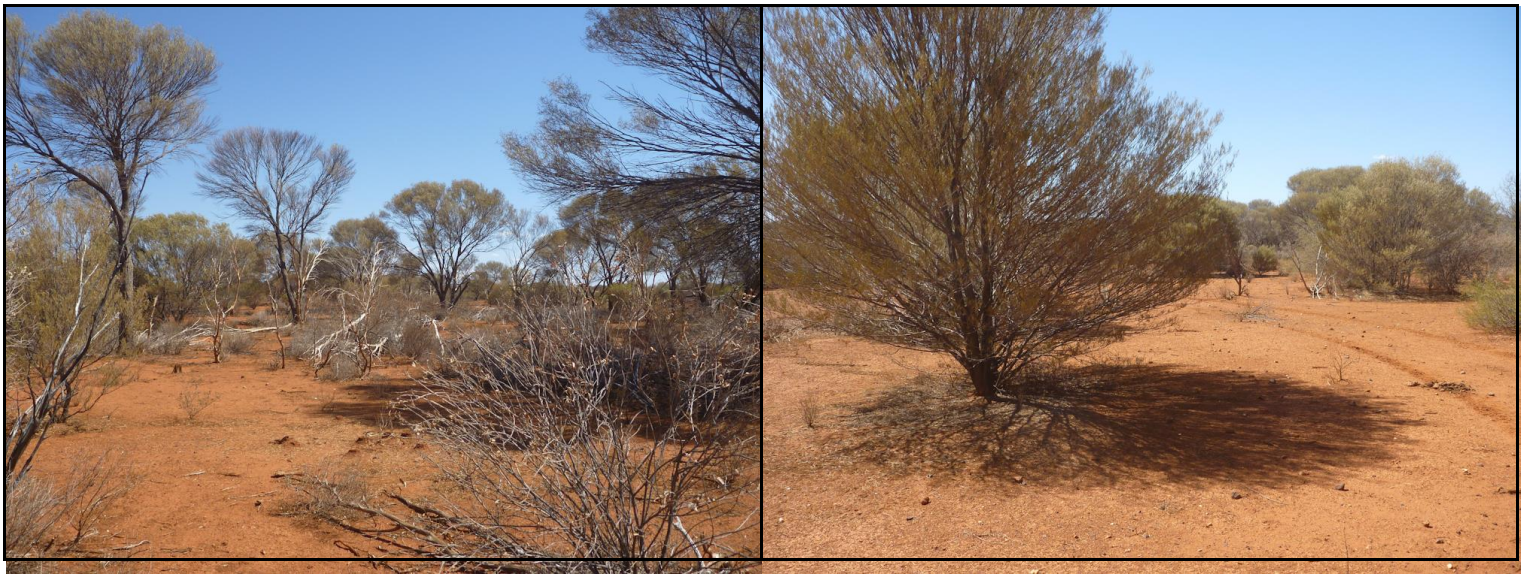
Date: 9/11/2020 | Habitat Assessment #: 46 | Observer: ST

Zone: 51 | Easting: 363267 mE | Northing: 6804339 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good



TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 47 | Observer: ST

Zone: 51 | Easting: 362889 mE | Northing: 6804177 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 48 | Observer: ST

Zone: 51 | Easting: 362695 mE | Northing: 6804482 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 49 | Observer: ST

Zone: 51 | Easting: 362597 mE | Northing: 6804743 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020
Habitat Assessment #: 50
Observer: ST

Zone: 51
Easting: 362499 mE
Northing: 6805012 mN

Fire History: >5 years
Landform: Flat
Soil Type: Sandy clay

Habitat Structure: Mulga Woodland

Habitat Quality: Good-very good

Date: 9/11/2020 | Habitat Assessment #: 51 | Observer: ST

Zone: 51 | Easting: 362386 mE | Northing: 6805230 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 52 | Observer: ST

Zone: 51 | Easting: 362306 mE | Northing: 6805485 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 53 | Observer: ST

Zone: 51 | Easting: 362158 mE | Northing: 6805735 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 54 | Observer: ST

Zone: 51 | Easting: 362044 mE | Northing: 6805995 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 55 | Observer: ST

Zone: 51 | Easting: 361915 mE | Northing: 6806267 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 56 | Observer: ST

Zone: 51 | Easting: 361728 mE | Northing: 6806610 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 57 | Observer: ST

Zone: 51 | Easting: 361612 mE | Northing: 6806886 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 58 | Observer: ST

Zone: 51 | Easting: 361466 mE | Northing: 6807100 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 59 | Observer: ST

Zone: 51 | Easting: 361364 mE | Northing: 6807301 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 60 | Observer: ST

Zone: 51 | Easting: 361220 mE | Northing: 6807399 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 61 | Observer: ST

Zone: 51 | Easting: 360951 mE | Northing: 6807315 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

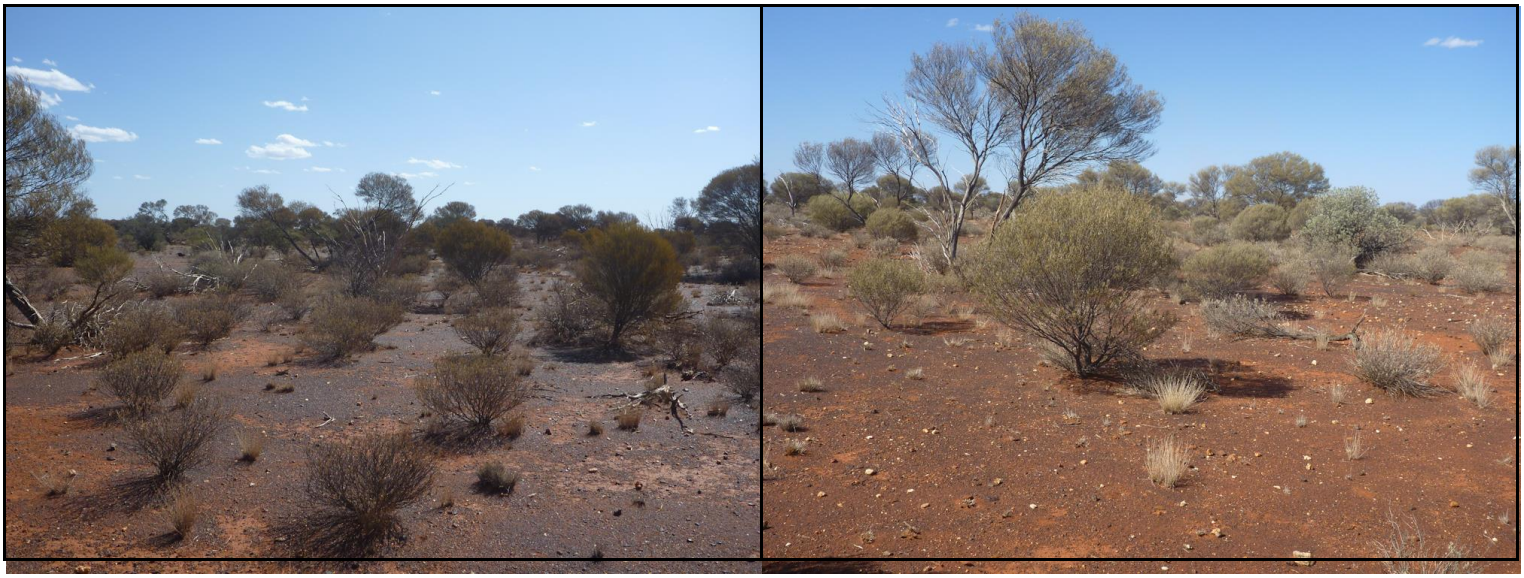
Date: 9/11/2020 | Habitat Assessment #: 62 | Observer: ST

Zone: 51 | Easting: 360696 mE | Northing: 6807165 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good



TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 63 | Observer: ST

Zone: 51 | Easting: 360583 mE | Northing: 6807082 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 64 | Observer: ST

Zone: 51 | Easting: 360307 mE | Northing: 6806952 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 65 | Observer: ST

Zone: 51 | Easting: 360124 mE | Northing: 6806855 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Shrubland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 66 | Observer: ST

Zone: 51 | Easting: 360218 mE | Northing: 6806567 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 67 | Observer: ST

Zone: 51 | Easting: 360356 mE | Northing: 6806319 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 68 | Observer: ST

Zone: 51 | Easting: 360608 mE | Northing: 6806618 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 69 | Observer: ST

Zone: 51 | Easting: 360768 mE | Northing: 6806862 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 70 | Observer: ST

Zone: 51 | Easting: 360930 mE | Northing: 6806811 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 71 | Observer: ST

Zone: 51 | Easting: 361201 mE | Northing: 6806769 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 72 | Observer: ST

Zone: 51 | Easting: 361359 mE | Northing: 6806461 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 73 | Observer: ST

Zone: 51 | Easting: 361588 mE | Northing: 6806084 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 74 | Observer: ST

Zone: 51 | Easting: 361713 mE | Northing: 6805794 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 75 | Observer: ST

Zone: 51 | Easting: 361829 mE | Northing: 6805503 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 76 | Observer: ST

Zone: 51 | Easting: 362006 mE | Northing: 6805189 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 77 | Observer: ST

Zone: 51 | Easting: 362187 mE | Northing: 6804806 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 78 | Observer: ST

Zone: 51 | Easting: 362240 mE | Northing: 6804619 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 79 | Observer: ST

Zone: 51 | Easting: 362341 mE | Northing: 6804400 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 80 | Observer: ST

Zone: 51 | Easting: 362305 mE | Northing: 6804203 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Mulga Woodland

Habitat Quality: Disturbed

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 81 | Observer: ST

Zone: 51 | Easting: 362099 mE | Northing: 6804238 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Mulga Woodland

Habitat Quality: Disturbed

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 82 | Observer: ST

Zone: 51 | Easting: 361902 mE | Northing: 6804586 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Disturbed

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 83 | Observer: ST

Zone: 51 | Easting: 361779 mE | Northing: 6804819 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 84 | Observer: ST

Zone: 51 | Easting: 361620 mE | Northing: 6805098 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 85 | Observer: ST

Zone: 51 | Easting: 361437 mE | Northing: 6805382 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 86 | Observer: ST

Zone: 51 | Easting: 361276 mE | Northing: 6805674 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 87 | Observer: ST

Zone: 51 | Easting: 361111 mE | Northing: 6805956 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 88 | Observer: ST

Zone: 51 | Easting: 361038 mE | Northing: 6806315 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 89 | Observer: ST

Zone: 51 | Easting: 360905 mE | Northing: 6806451 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 90 | Observer: ST

Zone: 51 | Easting: 360636 mE | Northing: 6806355 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 91 | Observer: ST

Zone: 51 | Easting: 360476 mE | Northing: 6806103 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 92 | Observer: ST

Zone: 51 | Easting: 360616 mE | Northing: 6805841 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 93 | Observer: ST

Zone: 51 | Easting: 360718 mE | Northing: 6805573 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 94 | Observer: ST

Zone: 51 | Easting: 360897 mE | Northing: 6805324 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 95 | Observer: ST

Zone: 51 | Easting: 361009 mE | Northing: 6805049 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 96 | Observer: ST

Zone: 51 | Easting: 361255 mE | Northing: 6804713 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 97 | Observer: ST

Zone: 51 | Easting: 361326 mE | Northing: 6804551 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 98 | Observer: ST

Zone: 51 | Easting: 361410 mE | Northing: 6804305 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 99 | Observer: ST

Zone: 51 | Easting: 361754 mE | Northing: 6803821 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 100 | Observer: ST

Zone: 51 | Easting: 361363 mE | Northing: 6803760 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 101 | Observer: ST

Zone: 51 | Easting: 361104 mE | Northing: 6804176 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 102 | Observer: ST

Zone: 51 | Easting: 360876 mE | Northing: 6804446 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 103 | Observer: ST

Zone: 51 | Easting: 360767 mE | Northing: 6804721 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 104 | Observer: ST

Zone: 51 | Easting: 360646 mE | Northing: 6804818 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 105 | Observer: ST

Zone: 51 | Easting: 360518 mE | Northing: 6804567 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 106 | Observer: ST

Zone: 51 | Easting: 360443 mE | Northing: 6804230 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 107 | Observer: ST

Zone: 51 | Easting: 360666 mE | Northing: 6803804 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Open Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS

Date: 9/11/2020 | Habitat Assessment #: 108 | Observer: ST

Zone: 51 | Easting: 360301 mE | Northing: 6803757 mN

Fire History: >5 years | Landform: Flat | Soil Type: Sandy clay

Habitat Structure: Mulga Woodland

Habitat Quality: Good-very good

TERRESTRIAL ECOSYSTEMS


DETECTION DOG

APPENDIX D

Subterranean Fauna Assessment

Bennelongia Environmental Consultants

Crawford Gold Project

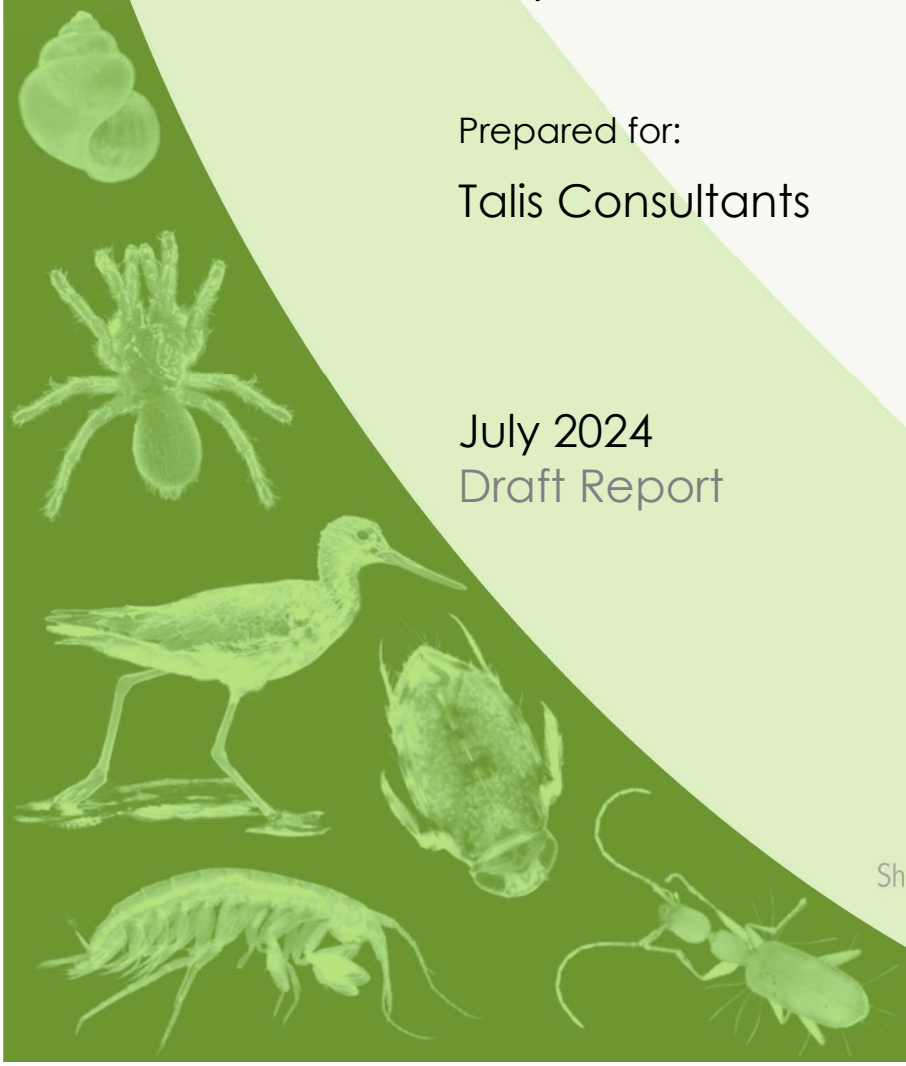
Subterranean Fauna Desktop Report

Prepared for:

Talis Consultants

July 2024

Draft Report



Short-Range Endemics | Subterranean Fauna

Waterbirds | Wetlands

Crawford Gold Project Subterranean Fauna Desktop Report

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ABN: 55 124 110 167

Report Number: 655

Report Version	Prepared by	Reviewed by	Submitted to Client	
			Method	Date
Draft	Jaxon Haines	Stuart Halse	Email	21 June 2024
Final	Jaxon Haines	Stuart Halse	Email	26 July 2024

K:\Projects\B_TAL_06\8_Report\Draft

EXECUTIVE SUMMARY

Cavalier Resources Limited (Cavalier) has several developments underway as part of the Leonora Gold Project. One of these is the Crawford Gold Project (the 'Project'), located approximately 20 km east of the town of Leonora. The Project has a development area of 1.9 km^2 that contains an open pit, waste dump, stockpile and other infrastructure covering an area of approximately 0.28 km^2. A hydrogeological survey determined that dewatering to allow groundwater mining would lead to groundwater drawdown extending approximately 750 m from the centre of the pit.

Given that mine pit excavation and groundwater drawdown may affect habitats of subterranean species such as troglofauna and stygofauna, Bennelongia Environmental Consultants was commissioned to complete a desktop review of the subterranean fauna occurrence in the Project area. Bennelongia reviewed available information on potential subterranean habitats and previous records of subterranean species to appraise the likelihood of subterranean fauna occurring within or in the vicinity of the Project.

The Project lies within a branch of the Raeside Palaeovalley system, which is host to calcrete formations including the Melita calcrete approximately 25 km from the Project. The Melita calcrete is classified as a Priority Ecological Community (PEC) and contains many unique subterranean fauna species including the diving beetles *Limbodessus melitaensis* and *Limbodessus micromelitaensis*.

The surface geology of the region is mostly colluvium, with alluvium drainage lines directed towards the lacustrine lake system formed by the Raeside Palaeovalley. Underlying bedrock geology reveals the area is mostly sandstone and other porous rock, with some intermittent banded iron formation and a section of exposed dolerite north-east of the project.

Databases of the Western Australian Museum, Atlas of Living Australia and Bennelongia were searched for subterranean fauna records within a 100 x 100 km area centred on the Project. At least 43 different species were recorded, with 25 of these species having only been recorded from the search area. Copepods were the most diverse and unique group, with 11 species being restricted to the search area. Amphipods were the next most unique group, with 4 species restricted to the search area. The Raeside Palaeovalley contains highly prospective habitat for subterranean fauna.

The Project area lies within a branch of the Raeside paleochannel, at the mouth of a major drainage line. It is about 8 km downstream from a cluster of subterranean fauna records from historical sampling and within 25 kms of two other areas of known subterranean fauna occurrence.

While the Project is primarily in granitic geology, the ubiquity of surrounding stygofauna records suggests the Project may support stygofauna species. The impact area of the Project is small, and it is unlikely that stygofauna or troglofauna species would have a range encompassed by the Project impact area. Overall, the data is inconclusive in determining the potential for subterranean fauna in and around the Project Area.

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1. INTRODUCTION

Cavalier Resources Limited (Cavalier) has a number of developments underway as part of the Leonora Gold Project. One of these is the Crawford Gold Project (the 'Project'), located approximately 20 km east of the town of Leonora (Figure 1). The Project has a development area totalling 1.9 km^2, including an area of 0.28 km^2 containing a proposed mine open pit, waste dump, stockpile and other infrastructure. A hydrogeological survey concluded that dewatering to allow groundwater mining would lead to groundwater drawdown extending approximately 750 m from the centre of the pit. (Figure 2).

Given that groundwater drawdown and excavation may in turn affect the habitat of subterranean fauna such as stygofauna and troglofauna, Bennelongia Environmental Consultants was commissioned to complete a desktop review of the Project area. Bennelongia reviewed available information about potential subterranean habitats and previous records of subterranean species to appraise the likelihood of subterranean fauna occurring within and in the vicinity of the Project.

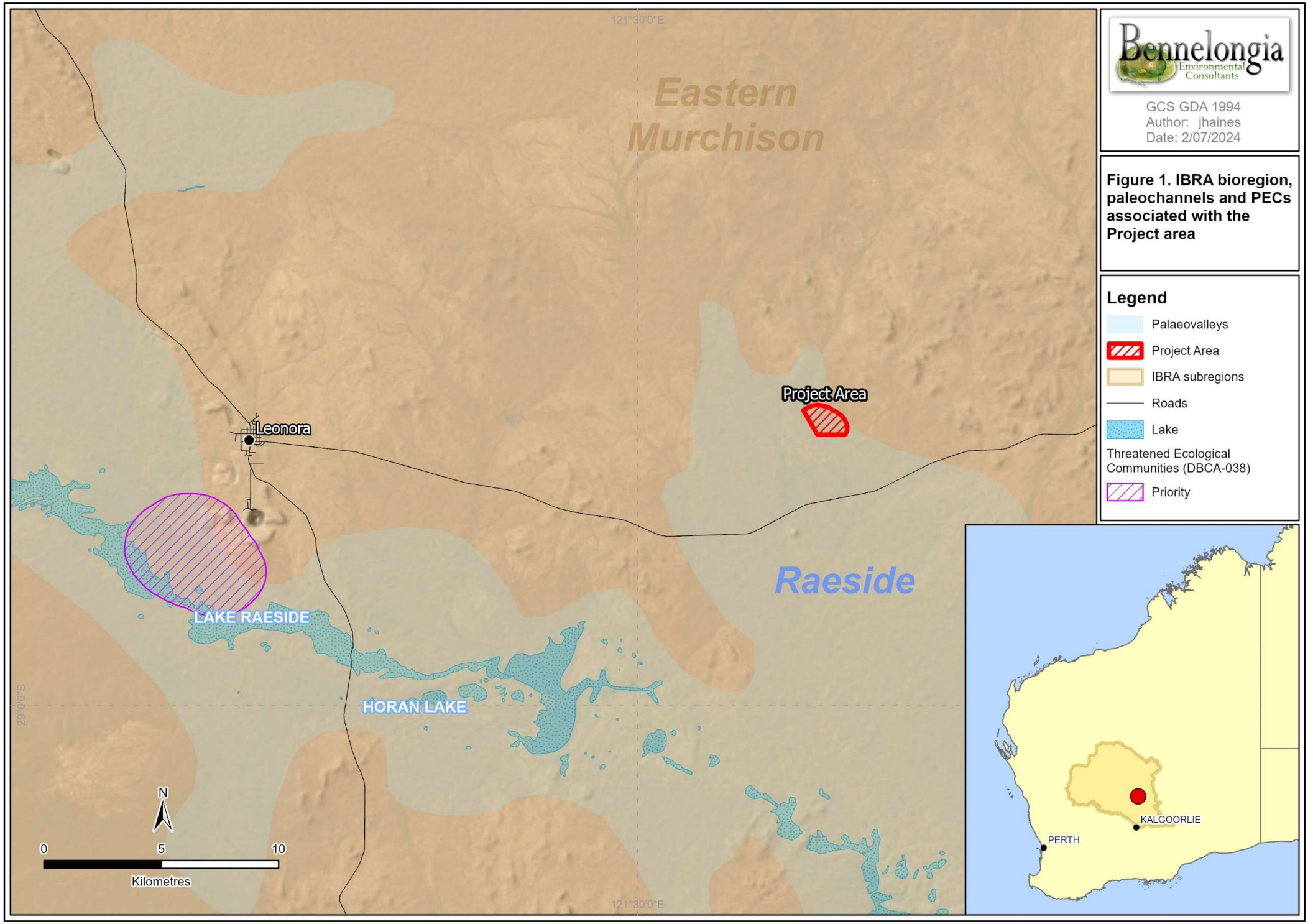
Subterranean fauna comprise two groups of animals: aquatic stygofauna and air-breathing troglofauna. Both groups typically lack eyes and are poorly pigmented due to lack of light. With the exception of a few species of fish, all subterranean fauna species in Western Australia are invertebrates. Although inconspicuous, subterranean fauna contribute significantly to the overall biodiversity of Western Australia. The majority of described species appear to be from the Pilbara and Yilgarn regions (Guzik *et al.* 2010; Halse 2018), with the fauna in the South West being comparatively depauperate although there has been less sampling.

Most subterranean species satisfy Harvey's (2002) criteria for short-range endemism (SRE), having total range size of less than 10,000 km^2 and occupying discontinuous or fragmented habitats. This makes them vulnerable to developments disturbing large areas of land and the Environment Protection Authority (EPA) in Western Australia requires consideration of subterranean fauna as part of environmental impact assessment.

2. CONSERVATION LEGISLATION

The Environmental Protection Authority (EPA) in Western Australia operates under the *Environmental Protection Act 1986*. The EPA has produced various policies to guide proponents of developments that include EPA (2016) *Environmental factor guideline: subterranean fauna*, EPA (2016) *Technical guidance: sampling methods for subterranean fauna* and EPA (2021) *Technical Guidance: subterranean fauna surveys for environmental impact assessment*.

Native flora and fauna in Western Australia are protected at both State and Commonwealth levels and the EPA guidances reflect conservation legislation. At the state level, this in the *Biodiversity Conservation Act 2016* (BC Act), which provides a legal framework for protection of species, particularly for species listed by the Minister for the Environment as threatened (DBCA 2016). In addition to the formal list of threatened species under the BC Act, the Department of Biodiversity, Conservation and Attractions (DBCA) also maintains a list of priority fauna species that are of conservation importance but, for various reasons, do not meet the criteria for listing as threatened. At the national level, the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a legal framework to protect and manage nationally and internationally important flora, fauna and ecological communities. Both the EPBC and BC Acts provide frameworks for the protection of threatened ecological communities (TECs). Within Western Australia, DBCA also informally recognises communities of potential conservation concern, but for which there is little information, as priority ecological communities (PECs). The list of subterranean fauna-based TECs recognised under the BC Act is larger than the EPBC Act list. Most listed Western Australian subterranean fauna communities are PECs rather than TECs.



Bennelongia Environmental Consultants

GCS GDA 1994
Author: jhaines
Date: 2/07/2024

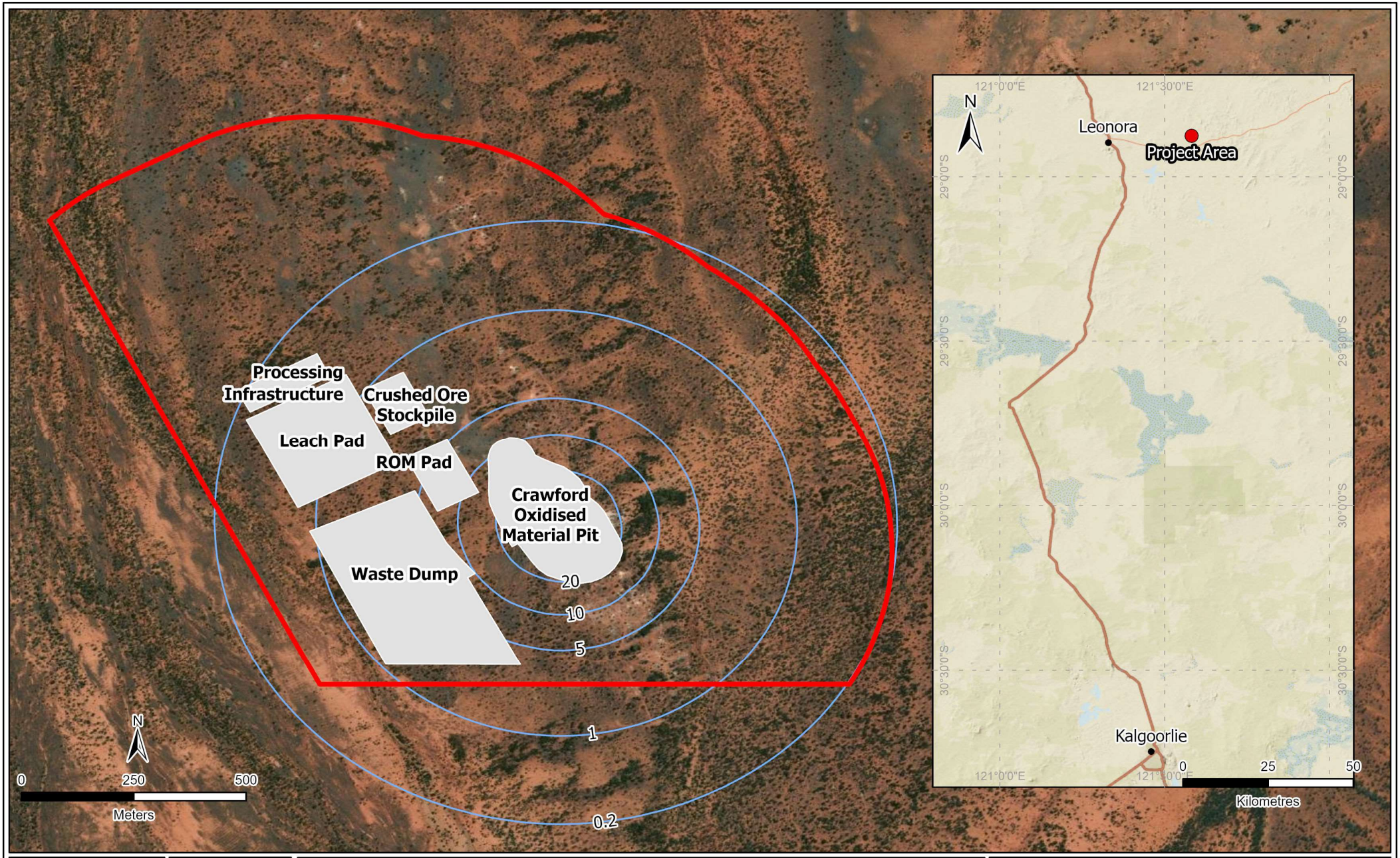
Figure 1. IBRA bioregion, paleochannels and PECs associated with the Project area

Legend

- Palaeovalleys
- Project Area
- IBRA subregions
- Roads
- Lake

Threatened Ecological Communities (DBCA-038)

- Priority



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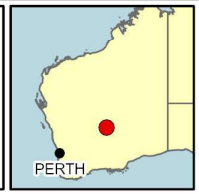

Legend

- Development Envelope
- Site Layout
- Estimated Drawdown (m)

Figure 2. Proposed site layout and location.

3. ENVIRONMENT

3.1. Regional Setting

The Project lies on the northern part of the Yilgarn Craton within the Murchison bioregion. The Murchison is split into two regions – the Eastern and Western Murchison. The Project is within the Eastern Murchison subregion (Figure 1). The Eastern Murchison is characterised by salt lakes interconnected with extensive paleo drainages, more specifically part of the Raeside palaeovalley system, which at least sometimes contain rich stygofauna communities (Cowan 2001).

Annual rainfall in the Murchison is highly variable but on average is a little over 200 mm (Figure 3). Average maximum and minimum temperature are approximately 30 ºC and 14 ºC, respectively, but January maximum temperatures are about 37 ºC and July minimum are about 6 ºC (data from Leonora).

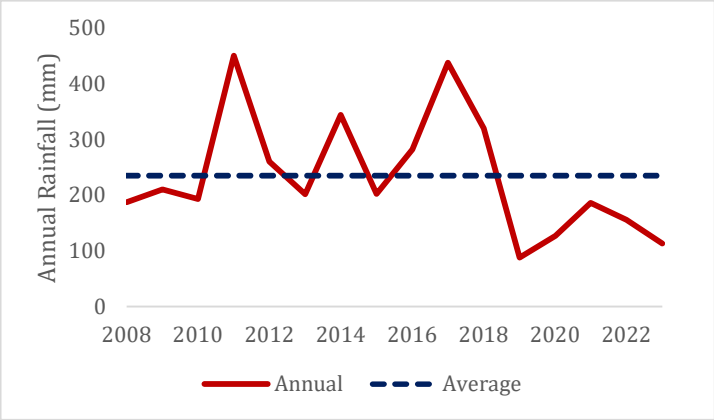

Figure 3: Historical rainfall data from Leonora Aero weather station 2007-23 (BOM 2020)

3.2. Geology

Surface geology of the Project area consists mostly of colluvium, with alluvium along a major drainage line passing through the eastern and western edges (Figure 4). Overall, the region's regolith is mostly composed of colluvium, although Lake Raeside and Horan Lake form part of a lacustrine lake system that is related to the Raeside Palaeovalley (Figure 1).

The general bedrock geology of the local area consists of Yilgarn Craton granites and Eastern Goldfield Superterrane greenstones (GSM 2021)). The Project itself lies on a conglomerate of granite, and silicate minerals, with sandstone. Most of the search area contains mafic rock but there are also intermittent small patches of banded iron formations.

3.3. Hydrogeology

The region is characterised by the Raeside Palaeovalley system, which remains visible on the surface as a system of salt lakes including Lake Raeside (Figure 3). The Raeside Palaeovalley extends into the Project area, bordering exposed sections of surface geology (Figure 4). The salinity of the palaeovalley exceeds 35,000 mg/L^{-1}, while rapidly lowering in concentration moving further away, reaching as low at 1000-3000 mg/L^{-1-} at the location of the Project (Figure 6).

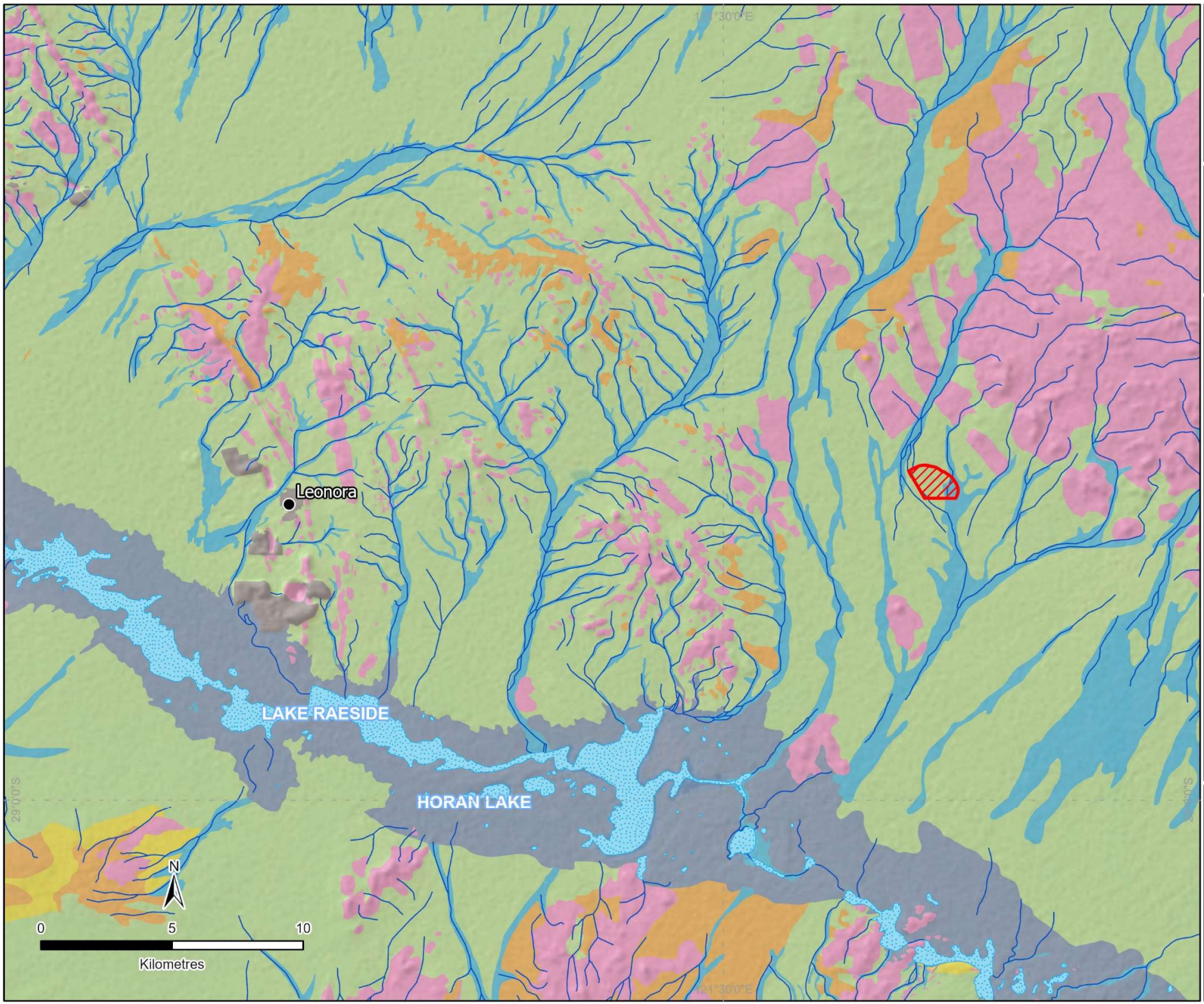

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Figure 4. Surface regolith of the Project and surrounding area.

Legend

- Towns
- Project Area
- Lake
- Watercourse
- Alluvium
- Anthropogenic areas
- Colluvium
- Exposed
- Lacustrine
- Residual
- Sandplain

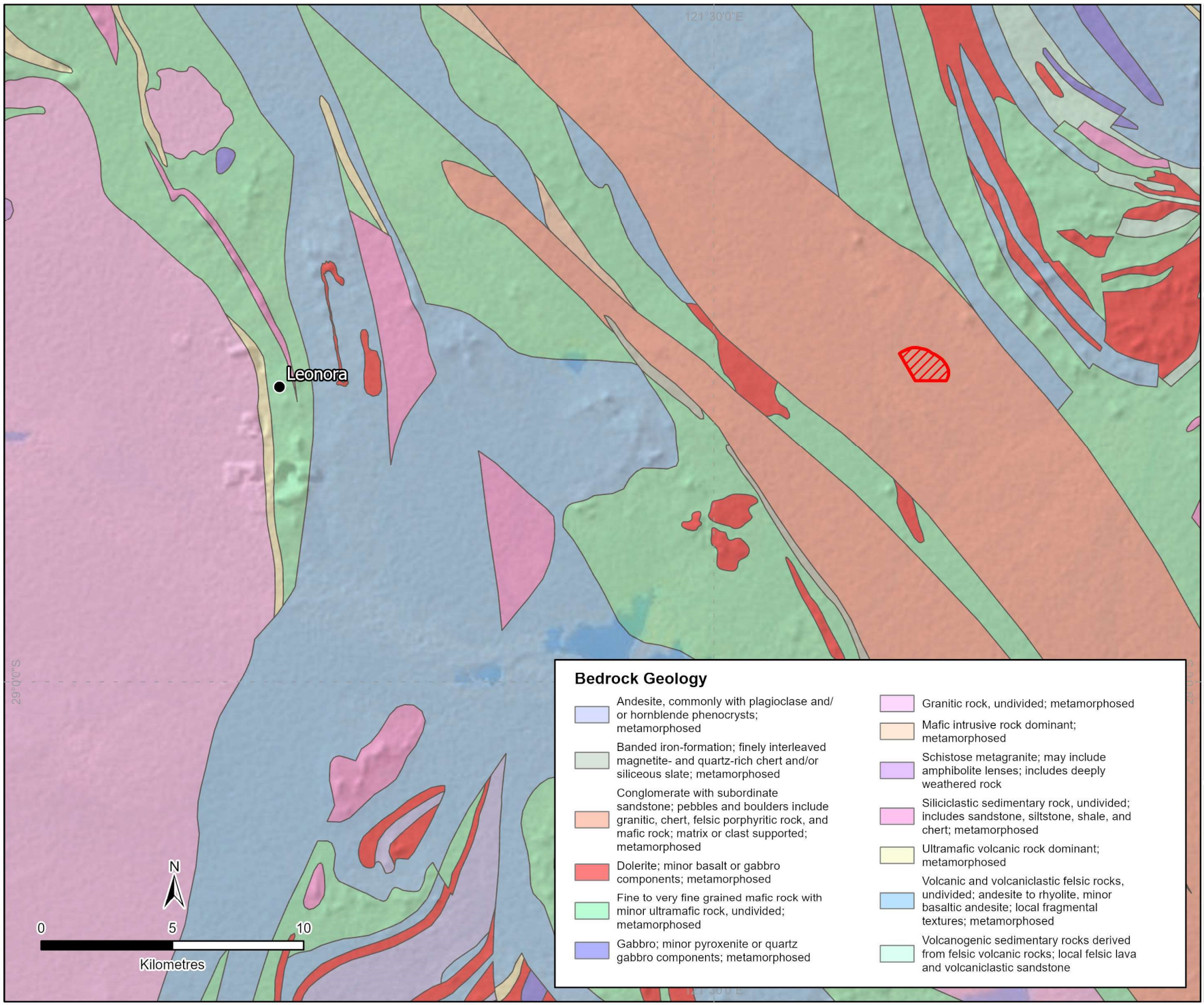

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Figure 5. Bedrock geology of the Project and surrounding area.

Legend

- Towns
- Project Area

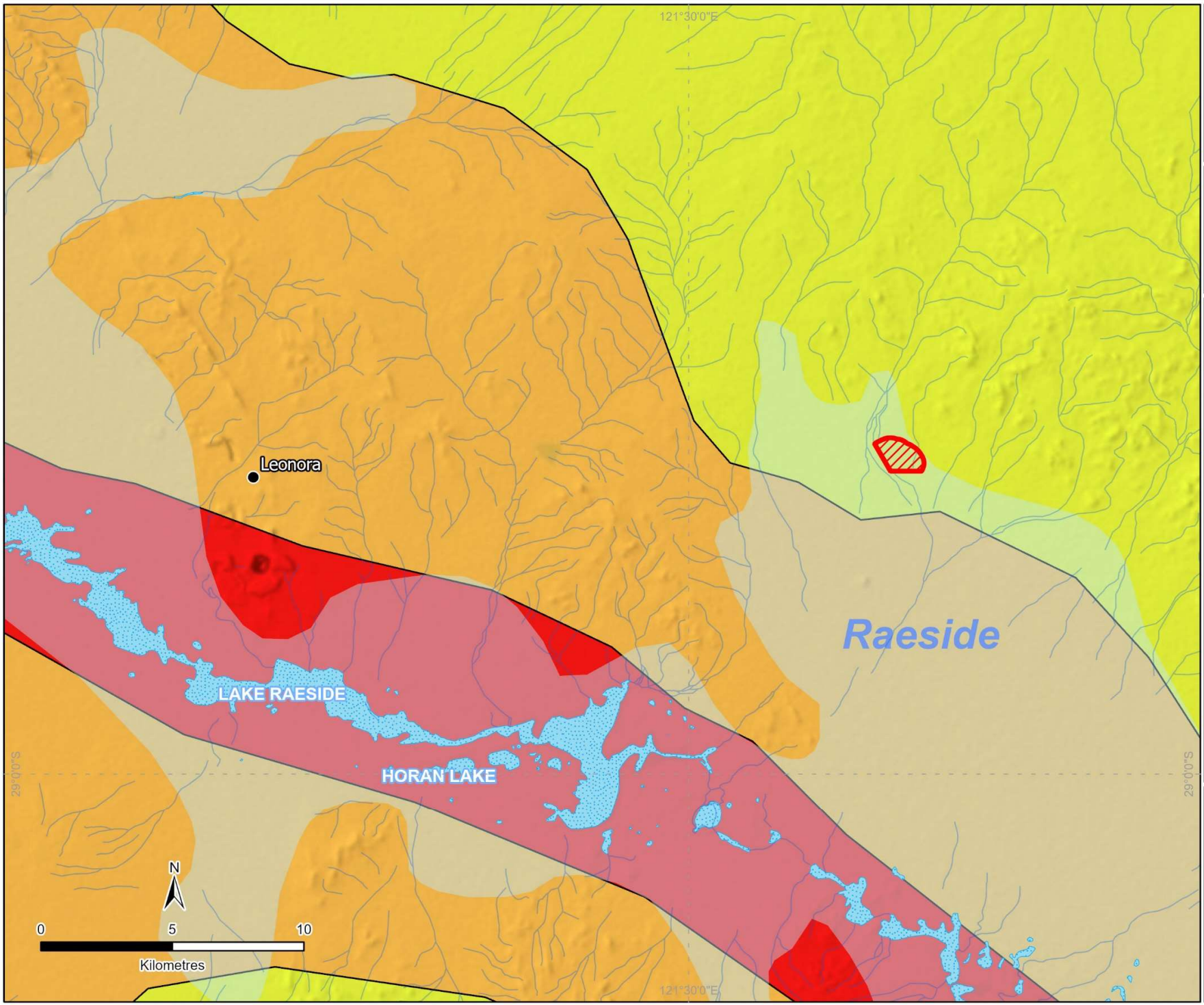

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Figure 6. Hydrogeology of the Project and surrounding area.

Legend

- Towns
- Project Area
- Palaeovalleys
- Watercourse
- Lake

Groundwater Salinity Statewide (DWER-026)

- 0 - 500
- 500-1000
- 1000-3000
- 3000-7000
- 7000-14000
- 14000-35000
- >35000

4. METHODS

A comprehensive review of literature and invertebrate fauna databases was conducted on a 100 x 100 km search area around the Project (GDA94 coordinates of limits: -28.416 [N] to -29.322 [S], and 121.090 [W] to 122.060 [E]). Data sources included:

- Western Australian Museum (WAM) and Bennelongia databases; and
- Scientific literature and previous subterranean fauna survey reports.
- Department of Biodiversity, Conservation and Attractions (DBCA) threatened and priority fauna lists, threatened and priority ecological communities (TECs and PECs) lists.
- Department of Water and Environmental Regulation (DWER) environmentally sensitive area (ESA) lists.
- Dandjoo Biodiversity Data Repository.
- Atlas of Living Australia database.

Collation of records and information from these data sources served to provide a broad indication of the subterranean fauna that may potentially occur in the region, as well as showing whether any threatened or priority species or communities occur in the vicinity of the Project. While this review provides an indication of the likelihood of subterranean fauna species occurring within the Project area, the empirical data collected during field surveys are a much better guide to what is or may be present.

Assessment of the prospectivity of Project habitat for subterranean fauna was based on:

- Regional and local geological and hydrogeological mapping;
- Geological and hydrogeological information in previous reports; and,
- Habitat information collected during any previous field survey.

This desktop review follows the relevant guidelines for subterranean fauna assessments (EPA 2021).

5. RESULTS

5.1. Threatened and Priority Ecological Communities

A TEC is an assemblage of organisms occurring within a particular habitat that are identified as having conservation value and is currently at risk of collapsing. PECs also have high conservation value but either do not meet the criteria of a TEC or are not well documented (Appendix 2; (DEC 2013).

One PEC, the *Melita calcrete groundwater assemblage type on Raeside palaeodrainage on Melita Station* (Melita Calcrete), occurs within the desktop search area. It is classified priority 1 (Species and Community Program 2023). The Melita Calcrete is located approximately 5 km south-east of Leonora, and approximately 25 km east of the Project area (Figure 2).

5.2. Desktop Records

A total of 160 subterranean fauna records were collated from the WAM, Bennelongia and Dandjoo databases (Table 1, Figure 7). Eighty-six records are identified to a higher level than species (e.g. order) and are listed in Appendix 1 instead of Table 1 unless the taxonomic group was not otherwise represented in Table 1. Overall, sampling in the desktop search area is sparse, resulting in many species only having single records and making it difficult to determine an accurate distribution of the subterranean fauna populations.

Details of the groups recorded in the search area are given below

5.2.1. Stygofauna Records

Rotifers

Two species of rotifers were collected from the class Bdelloidea, Bdelloidea 2:2 and Bdelloidea 7:7. This class of rotifer is very diverse (Fontenato and Ricci 2004) and can be found in a multitude of habitats outside of subterranean environments. Bdelloidea 2:2 is known to be widespread across Western Australia, although Bdelloidea 7:7 has only been recorded from a single site from within the desktop search area. Owing to the nature of Bdelloidea, it is highly likely that Bdelloidea 7:7 has a range that far exceeds a single bore.

Worms

The desktop search yielded seven records of worms from three different groups, including one platyhelminth (Turbellaria sp.). Among the annelids, the family Enchytraeidae was represented by two records, with both species being widespread across Western Australia. The sub-family Tubificinae was recorded four times, with three different species each collected from single sites around Leonora (25 km from the Project).

Ostracods

The desktop search yielded 17 records of Ostracoda, representing five species and two higher level records (see Appendix 1). The five species are mostly collected in surface water and are widespread.

Copepods

A total of 17 species of Copepods were identified from 65 records. While the majority of records were identified as higher order taxa, notably Harpacticoida sp. (see Appendix 1), this group clearly has rich diversity within the desktop search area. There were four species of Cyclopoida identified, all of which are widespread, but nearly all Harpacticoida species are known only from the desktop search area and were collected from only one or two sites.

Amphipods

Just one species of Amphipoda was recorded from the desktop search. *Yilgarniella* `BAM220` was collected and recorded as a new, undescribed species. Subterranean amphipods are a highly abundant and diverse group of animals. *Yilgarniella* is a genus currently comprised of a single described species, found also in the Raeside Paleochannel (King *et al.* 2012).

Syncarids

The desktop search yielded 14 records of Syncarida belonging to three different species. All three species were collected about 8 km north of the Project area, upstream along a major drainage line. The three species have been collected only from this area and are currently undescribed.

Isopods

A single species of stygofaunal isopod was recorded from the desktop search area. While many Haloniscus isopods are classified as troglofauna, *Haloniscus* `BIS516` is an exception. Other stygofaunal *Haloniscus species* has been recorded from areas nearby but outside the desktop search area (Taiti and Humphreys 2001).

Beetles

Limbodessus melitaensis and *Limbodessus micromelitaensis* are diving beetles, both collected only from within the Raeside Paleovalley. The current distribution for these species is described as the Malita calcrete (Watts and Humphreys 2006, 2009), about 25 km from the Project.

5.3. Troglofauna Records

Pseudoscorpions

Tyrannochthonius `Helens Bore` is the only record of subterranean pseudoscorpion revealed by the desktop search. The habitat requirements and distribution of this species is unknown. This species was recorded in Cardinia, 35 km north east of Leonora.

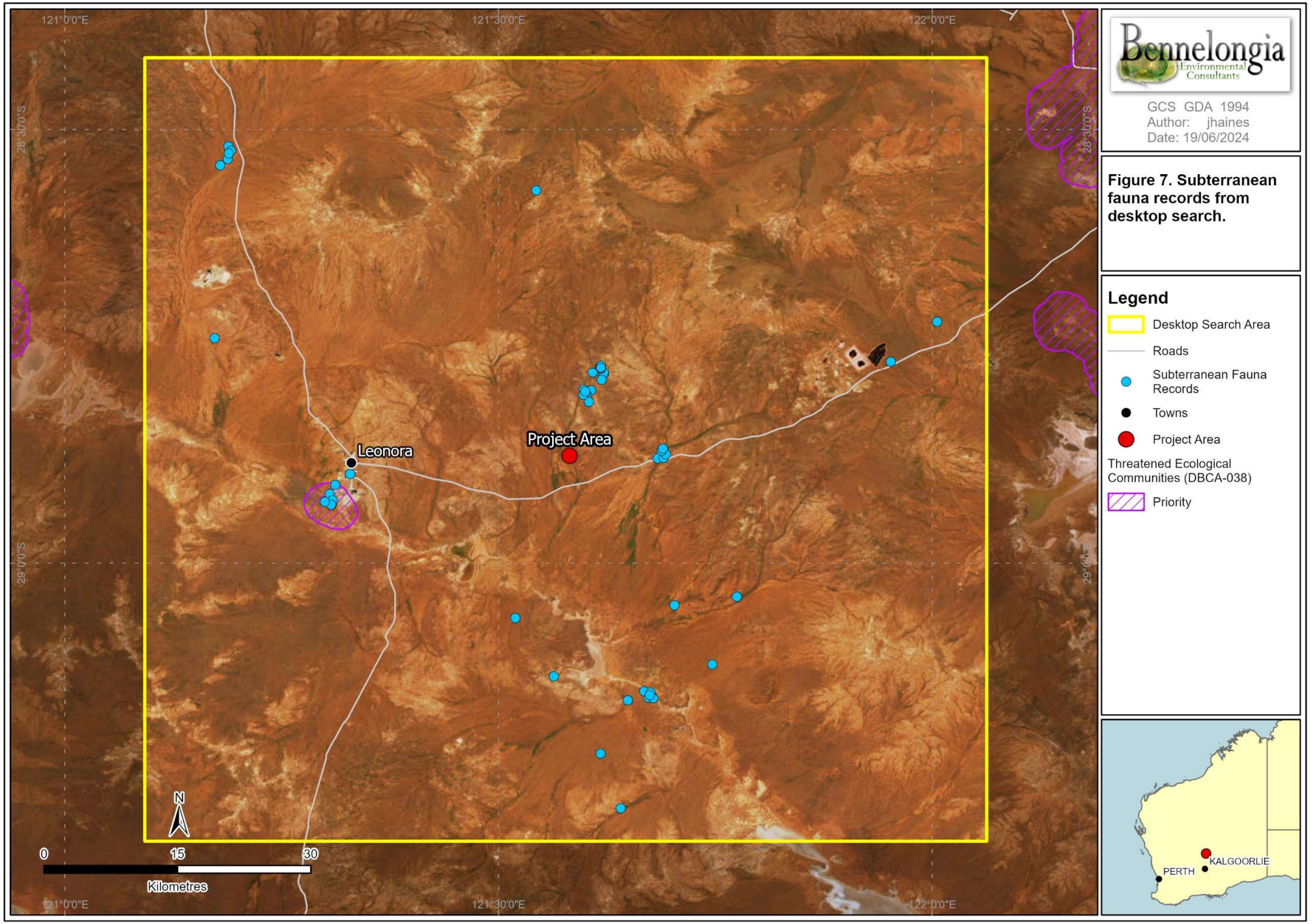

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Figure 7. Subterranean fauna records from desktop search.

Legend

- Desktop Search Area
- Roads
- Subterranean Fauna Records
- Towns
- Project Area

Threatened Ecological Communities (DBCA-038)

- Priority

Table 1: Stygofauna records collated from the desktop search.
Higher order records that are not represented by any other records of its respective taxonomic group are highlighted orange.

Higher Order	Lowest Identification	Specimens	Comments
Nematoda	Nematoda spp.	14	Not assessed as part of the EIA process.
Rotifera			
Bdelloidea			
	Bdelloidea sp. 2:2	1	Widespread
	Bdelloidea sp. 7:7	1	Singleton collected from 1 site ~45 km from Project area
Platyhelminthes			
Turbellaria	Turbellaria sp.	1	Higher order
Annelida			
Clitellata			
Enchytraeida			
Enchytraeidae	Enchytraeidae `2 bundle` s.l. (long thin 2 per seg)	1	Widespread
	Enchytraeidae `2 bundle` s.l. (short sclero 4 per seg)	2	Widespread
Tubificida			
Naididae	Tubificinae `BOL086`	26	Singleton collected from 1 site ~25 km from Project area
	Tubificinae `BOL088`	1	Singleton collected from 1 site ~25 km from Project area
	Tubificinae `BOL089`	3	Singleton collected from 2 sites ~25 km from Project area
Arthropoda			
Crustacea			
Ostracoda			
Podocopida			
Cyprididae	*Cypretta* `BOS866`	6	Widespread
	Patcypris outback	1	Widespread
	Sarscypridopsis `BOS306`	4	Widespread
	Sarscypridopsis aculeata	85	Widespread
	Sarscypridopsis ochracea	3	Widespread

Higher Order	Lowest Identification	Specimens	Comments
Maxillopoda			
Cyclopoida			
Cyclopidae	*Halicyclops ambiguus*	110	Widespread
	Halicyclops eberhardi s.l.	1	Widespread species complex
	Halicyclops pescei	17	Widespread across WA
	Mesocyclops brooksi	284	Widespread
Harpacticoida			
Ameiridae	Ameiridae gen. nov.`BHA362`	2	Singleton collected from 1 site ~25 km from Project area
	Hirtaleptomesochra `BHA358`	2	Singleton collected from 1 site ~25 km from Project area
	Nitocrella `BHA368`	1	Singleton collected from 1 site ~25 km from Project area
	Nitokra `BHA365`	1	Singleton collected from 1 site ~25 km from Project area
	Nitokra `BHA366`	5	Singleton collected from 1 site ~25 km from Project area
	Nitokra `BHA367`	15	Singleton collected from 1 site ~25 km from Project area
	nr Inermipes `BHA364`	20	Singleton of unknown genus collected from 1 site ~25 km from Project area
Canthocamptidae	*Australocamptus similis*	437	Widespread across WA
	Australocamptus hamondi	85	Widespread across WA
Ectinosomatidae	*Pseudectinosoma* `BHA363`	11	Singleton collected from 2 sites ~25 km from Project area
Miraciidae	*Schizopera* `BHA357`	1	Singleton collected from 1 site ~25 km from Project area
	Schizopera `BHA360`	1	Singleton collected from 1 site ~25 km from Project area
	Schizopera `BHA361`	2	Singleton collected from 1 site ~25 km from Project area
Malacostraca			
Amphipoda			
Chiltoniidae			
	Yilgarniella `BAM220`	9	Singleton collected from 1 site ~25 km from Project area
Syncarida			
Bathynellacea			
Bathynellidae	Bathynellidae `sp. OES28`	2	Singleton collected from 2 sites ~8 km from Project area

Higher Order	Lowest Identification	Specimens	Comments
Parabathynellidae	*Atopobathynella* `sp. OES2`	11	Only collected from multiple sites ~8 km from Project area
	Atopobathynella `sp. OES29`	1	Singleton collected from 1 site ~8 km from Project area
Isopoda			
Scyphacidae	*Haloniscus* `BIS516`	2	Singleton collected from 1 site ~25 km from Project area
Insecta			
Coleoptera			
Dytiscidae	*Limbodessus melitaensis*	56	Found only from the Melita calcrete (Watts and Humphreys 2006).
	Limbodessus micromelitaensis	8	Found only from the Melita calcrete (Watts and Humphreys 2009)

Table 2: Troglofauna records collated from the desktop search.

Higher Order	Lowest Identification	Specimens	Comments
Arthropoda			
Arachnida			
Pseudoscorpiones			
Chthoniidae	*Tyrannochthonius* `Helens Bore`	2	Singleton collected from 1 site ~8 km from Project area
Malacostraca			
Isopoda			
Paraplatyarthridae	*Paraplatyarthrus* `BIS514`	1	Singleton collected from 1 site ~25 km from Project area
Stenoniscidae	Stenoniscidae gen. nov. `BIS515`	3	Singleton collected from 1 site ~25 km from Project area
Diplopoda			
Polyxenida			
Lophoproctidae	*Lophoturus madecassus*	2	Widespread
Insecta			
Diptera			
Sciaridae	*Allopnyxia* sp. B01	2	Widespread

Isopods
The desktop search yielded two records of isopods. They are the undescribed species *Paraplatyarthrus* `BIS514` and Stenoniscidae gen. nov. `BIS515`. Both were recorded from a single site.

Millipedes
The millipede *Lophoturus madecassus* was recorded from the search area but has a near global distribution.

Flies
The fly *Allopnyxia* sp. B01 in the family Sciaridae occurs in subterranean habitats across most of eastern Australia.

6. DISCUSSION

The desktop search results yielded at least 43 different species of subterranean fauna, belonging to 10 major groups: rotifers, worms, ostracods, copepods, amphipods, syncarids, isopods, pseudoscorpions, millipedes and insects. Twenty-five of the species are known from single locations within the search area. The region hosts a rich community of stygofauna, although the degree to which species distribution are restricted is difficult to evaluate without widespread sampling.

The most diverse group is copepods, particularly the order Harpacticoida, with 11 species known only from the desktop search area. It is likely these records help form the basis for the Melita calcrete PEC, located ~ 25 km east of the Project towards Leonora.

Two described species of beetle, *Limbodessus melitaensis* and *L. micromelitaensis*, are also known from the Melita calcrete. Many individual calcretes in the Yilgarn support species known only from those calcretes (Watts and Humphreys 2006, 2009).

The geology and hydrogeology reveals sections of prosperous palaeodrainage (Figures 3 & 4), in which long term historical events isolating bodies of water may explain the novelty of subterranean communities within the search area (Humphreys 2001). The Project area lies primarily in granitic geology that would be expected to be less prospective for subterranean fauna than most other geology types in the vicinity, such as the Malita calcrete near Leonora.

While records of stygofauna are found across the desktop search area, they are concentrated north of the Project, near Leonora and, in a more spread-out way, south of the Project.

7. CONCLUSION

The Raeside Palaeovalley is a highly prospective habitat for subterranean fauna, and records show that the paleochannel is host to diverse populations of subterranean fauna. The Project area lies within a branch of the Raeside paleochannel, at the mouth of a major drainage line about 8 km downstream from a cluster of subterranean fauna records, and within 25 kms of two other isolated communities.

While the Project is primarily in granitic geology, the ubiquity of surrounding stygofauna records suggests the Project may support stygofauna species. The impact area of the Project is small, and it is unlikely that a stygofauna or troglofaunal species would have a range encompassed by the Project impact area. Overall, the data is inconclusive in determining the potential for subterranean fauna in and around the Project Area.

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9. APPENDICES

Desktop Records Identified to Higher Order

Higher Order	Lowest Identification	Specimens Collected
Arthropoda		
Crustacea		
Ostracoda		
Cyprididae	*Cypretta* sp.	4
	Sarscypridopsis sp.	8
Maxillopoda		
Cyclopoida	Cyclopoida sp.	1
Harpacticoida	Harpacticoida sp	N/A
Canthocamptidae	*Australocamptus* sp.	1
Malacostraca		
Amphipoda	Amphipoda sp.	23
Chiltoniidae	*Yilgarniella* sp.	1
Isopoda		
Scyphacidae	*Haloniscus* sp.	4

Definitions and Criteria for Priority Ecological Communities

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

***Priority One**: Poorly-known ecological communities*
Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤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.

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

***Priority Three**: Poorly known ecological communities*
(i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or:
(ii) communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat (within approximately 10 years), or;
(iii) communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, inappropriate fire regimes, clearing, hydrological change etc.
Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.

***Priority Four**: Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.*
(i) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands.
(ii) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for a higher threat category.

(iii) Ecological communities that have been removed from the list of threatened communities during the past five years.

***Priority Five**: Conservation Dependent ecological communities*
Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

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