



**Native Vegetation Clearing
Permit Supporting Document
– M39/1127, M39/1128 and
M39/1145**

Mt Celia Gold Project

**Legacy Iron Ore Ltd
May 2023**

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Corporate Endorsement:

I hereby certify that to the best of my knowledge, the information contained within this Native Vegetation Clearing Permit Supporting Document is true and correct and addresses all the requirements to support an application for a Native Vegetation Clearing Permit in Western Australia.

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EXECUTIVE SUMMARY

Legacy Iron Pty Ltd (Legacy Iron) is proposing to develop the Mt Celia Gold Project located approximately 95 km south of Laverton and approximately 180 kilometres northeast of Kalgoorlie in the South Laverton Region. Legacy Iron is applying to clear up to 261 ha of native vegetation under a Purpose Permit within the Mt Celia application area covering 1,872ha.

The application area is located within the Eastern Murchison subregion within the Murchison Interim Biogeographic Regionalisation of Australia (IBRA) within the southern rangelands of Western Australia. The application area extends 7 km across an east-west trending catchment, draining to Lake Raeside. Low ridges and hills define the eastern edge of the catchment, 5 km upstream of the application area. There are no pools or dams in the application area. The only surface water will be in intermittently flowing drainage lines (Hydrologia, 2023).

Where possible previously disturbed area, such as existing tracks, will be utilised to reduce the clearing footprint. Where this cannot occur, Legacy Iron will minimise the clearing were practicable while taking into consideration safety requirements.

The flora and vegetation survey undertaken indicates that the application area is located within Pre-European Beard vegetation association Group 18 in the Eastern Murchison subregion. Group 18 is described as low woodland comprised of mulga (*Acacia aneura*). There is >99% of Group 18 vegetation remaining in the Eastern Murchison subregion and the application comprises only 0.02% of this area.

The vegetation condition within the application area ranges from very good to degraded with some area having been subjected to exploration activities and grazing.

Twelve vegetation groups were identified during the survey. The most common and widespread species identified was *Ptilotus obovatus*, which was recorded within all 43 quadrats. Its canopy cover was 10-30%. The next most common and widespread species was *Acacia aneura*, recorded in 34 quadrats, with a canopy cover between 10-30% (Native Vegetation Solutions, 2020b). No conservation significant vegetation was identified within the survey area.

Six fauna habitat communities were identified and mapped. Fauna assemblage in the application area is similar to the many square kilometres of similar habitat in adjacent areas and the bioregion. Identified habitat is considered typical of that present in the wider region (Terrestrial Ecosystems, 2021a).

Two conservation significant species were noted as having a likely presence within the application area. Malleefowl (*Leipoa ocellata*) tracks were recorded within the fauna survey area although no mounds were sighted and it was concluded that the habitat within the survey area is unsuitable for Malleefowl habitat due to the sparseness of the vegetation (Terrestrial Ecosystems, 2021a). Long-tailed Dunnart (*Sminthopsis longicaudata*) were not recorded during the survey however it is thought that they are likely to be present in the breakaway and rocky outcrop areas within the application area. It is expected that Long-tailed dunnart will migrate to nearby adjacent rocky outcrop habitat outside of the infrastructure clearing footprint until suitable habitat is returned during rehabilitation activities.

Due to the clearing of Long-tailed Dunnart habitat, the assessment against the clearing principles (outlined in the Environmental Protection Act 1986) found that the proposed clearing may be at variance with Principle B - "Native vegetation should not be cleared if it comprises the whole or part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to WA". significant habitat for fauna indigenous to WA" (DWER, 2014)

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1. INTRODUCTION

1.1 Proposal Location, Ownership and Tenure

The owner and proponent of the Mt Celia Gold Mine is Legacy Iron Ore Limited (ABN 31 125 010 353). The Mt Celia Gold Project (the Project) is owned by Legacy Iron Ore Ltd (Legacy Iron) and located approximately 95 km south of Laverton and approximately 180 kilometres northeast of Kalgoorlie in the South Laverton Region. The Project can be accessed by gravel road from Kalgoorlie via Yarri Road and Mt Celia Road or by the sealed Goldfields Highway north of Menzies and Kookynie Road. Evidence of Authority for each tenement is provided in [Appendix 1](#).

Table 1.1 Tenement

Tenement	Area (ha)	Holder	Granted	Expiry
M39/1127	81.82	Legacy Iron Ore Ltd	07/06/2018	06/06/2039
M39/1128	390.67	Legacy Iron Ore Ltd	07/06/2018	06/11/2039
M39/1145	1,403.05	Legacy Iron Ore Ltd	23/05/2023	22/05/2044

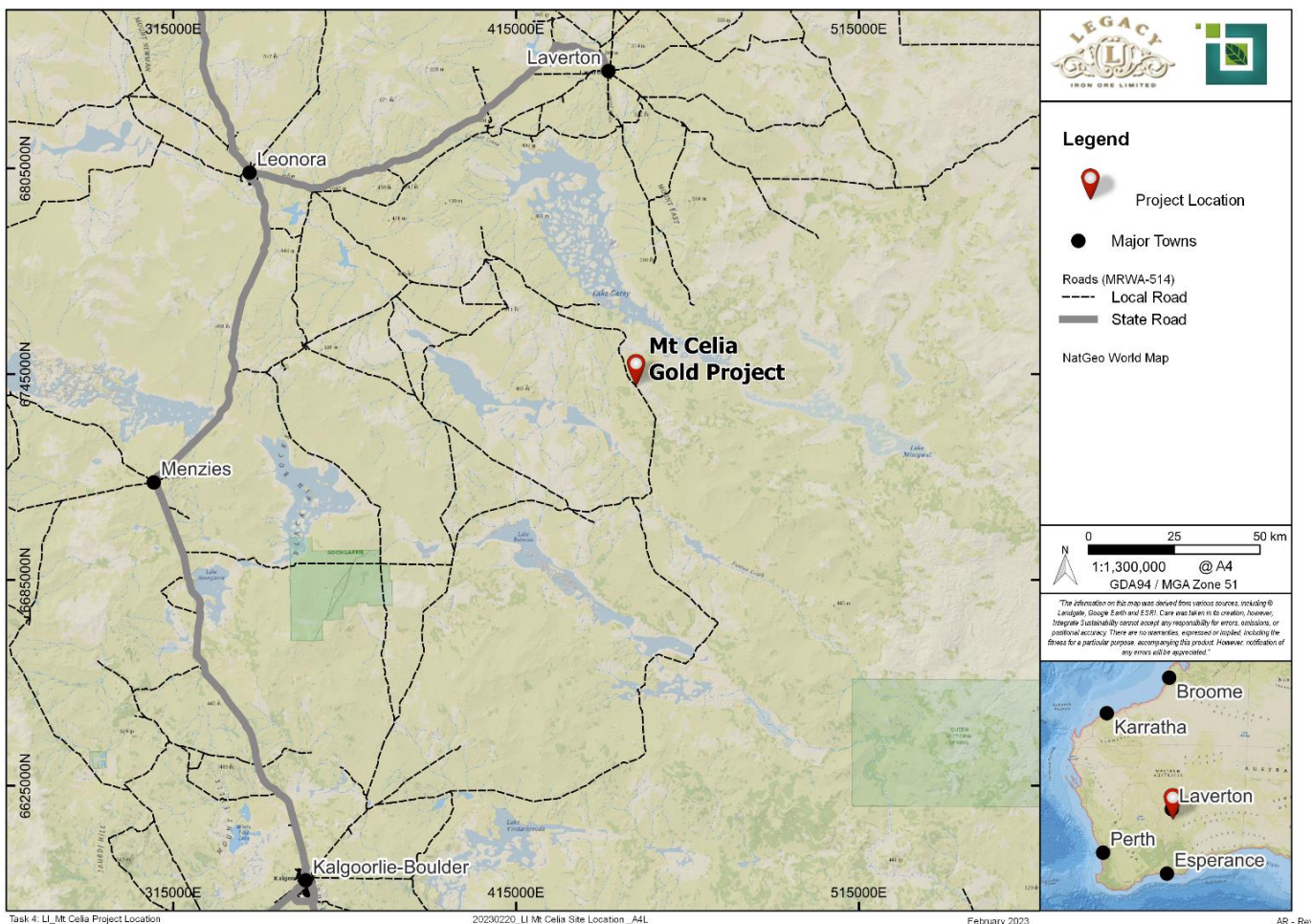


Figure 1.1 Regional Location

All compliance and regulatory requirements regarding this submission should be directed to:

Peter Preston
 Geology Manager
 Email: peterpreston@legacyiron.com.au
 Telephone: 0418 321 340

1.2 Proposal Description

The Mt Celia Gold Project (the Project) consists of two main gold deposits - Kangaroo Bore and Blue Peter. The Project will be developed via open pit mining, and the development will comprise 13 pits across the Blue Peter and Kangaroo Bore deposits.

Mining is expected to be undertaken via drill and blast with 50t excavators in backhoe configuration. Two waste dumps will be required in total for the Project, with one waste dump located adjacent to each deposit. Ore will be transported offsite for processing and no ore processing infrastructure is required for the Project. Camp accommodation and landfill facilities will be offsite.

Other infrastructure required to support mining activities at the Project are:

- ROM Pad
- Water Storage Dams
- Workshops
- Fuel Facility
- Offices
- Haul Roads
- Access Roads
- Borrow Pit

The Project is expected to have a mine life of 4 years, inclusive of construction and operations. An additional two years of closure monitoring and management is expected thereafter.

Table 1.2 Summary of Proposal

Site Details	
Project Name	Mt Celia Gold Project
Description of Operation	<ul style="list-style-type: none"> • Open pit mining with up to 13 pits across two deposits • Two Waste Dumps • ROM • Camp • Workshop • Fuel Facility • Offices • Haul Roads • Access Roads • Borrow Pit • Water Storage Dams
Total Clearing Proposed	261 ha
Project Commencement	July 2023
Clearing Details	
Clearing Method	Clearing will be undertaken by mechanical means.
Purpose of Clearing	Mine Development
Proponent Details	
Company Name	Legacy Iron Ore Ltd
ABN	31 125 010 353
Postal Address	Level 6, 200 Adelaide Terrace, Perth WA 6000
Key Contact	Peter Preston
	Geology Manager
	0418 321 340
	peterpreston@legacyiron.com.au

1.3 Proposed Clearing Activities

Legacy Iron is applying to clear up to 261 ha of native vegetation under a Purpose Permit within the Project application area (application area). The applications area is 1,872 ha (Figure 1.2). Clearing is required for the development of the following activities and infrastructure:

- Pits (13 pits across two deposits)
- Waste Rock Dumps (one for each deposit)
- ROM Pad
- Water Storage Dams
- Camp
- Workshops
- Fuel Facility
- Offices
- Haul Roads
- Access Roads
- Borrow Pit
- Topsoil stockpiles

Where possible, clearing will be minimised by utilising previously cleared areas. Where this cannot occur, Legacy Iron will minimise clearing were practicable whilst taking into consideration safety requirements.

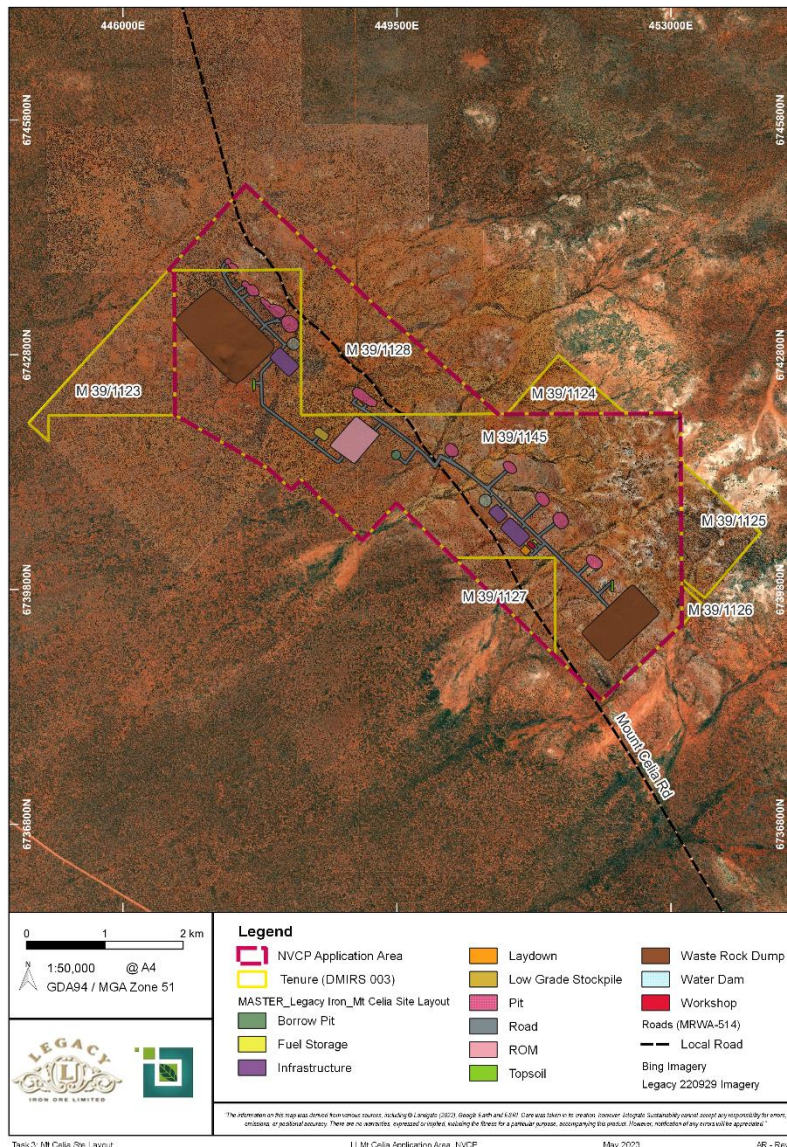


Figure 1.2 Application Area

1.4 Other Approvals

This application does not form part of an existing *Environmental Protection Act 1986 (EP Act)* Part IV proposal, nor is it envisaged that the proposed activities would require assessment under Part IV of the *EP Act*.

The proposed clearing does not require referral under the *Environment Protection and Biodiversity Act 1999* as no Matters of National Significance (MNES) have been recorded in the application area.

2. BASELINE ENVIRONMENTAL DATA

This section outlines the existing environmental data relevant to this application. The data has been used to define the environmental values and potential impacts, and to inform the impact assessment and management measures.

2.1 Climate

Typically, the climate of the application area is characterised as being arid to semi-arid Mediterranean with hot dry summers and cold winters. The nearest official meteorological weather station with the most complete and up to date information is Laverton Aero (station number 012305), which is located approximately 92 km north of the application area.

Mean annual minimum temperature at Laverton Aero is 14.1°C and mean annual maximum temperature is 27.2°C (BOM, 2022). The coldest temperatures occur in July (mean minimum temperature 5.9°C), and the hottest temperatures occur in January (mean maximum temperature 35.6°C) (BOM, 2022).

The annual average rainfall at Laverton Aero is 281.3mm (BOM, 2022). Average rainfall varies across the months, with larger rainfall events falling between January to March, and the least rainfall received in September (Figure 2.1). Intense rainfall can occur periodically in the summer months of December to April due to tropical cyclones. Potential evaporation averages 2,400 mm/year and exceeds rainfall in all months (BOM, 2023).

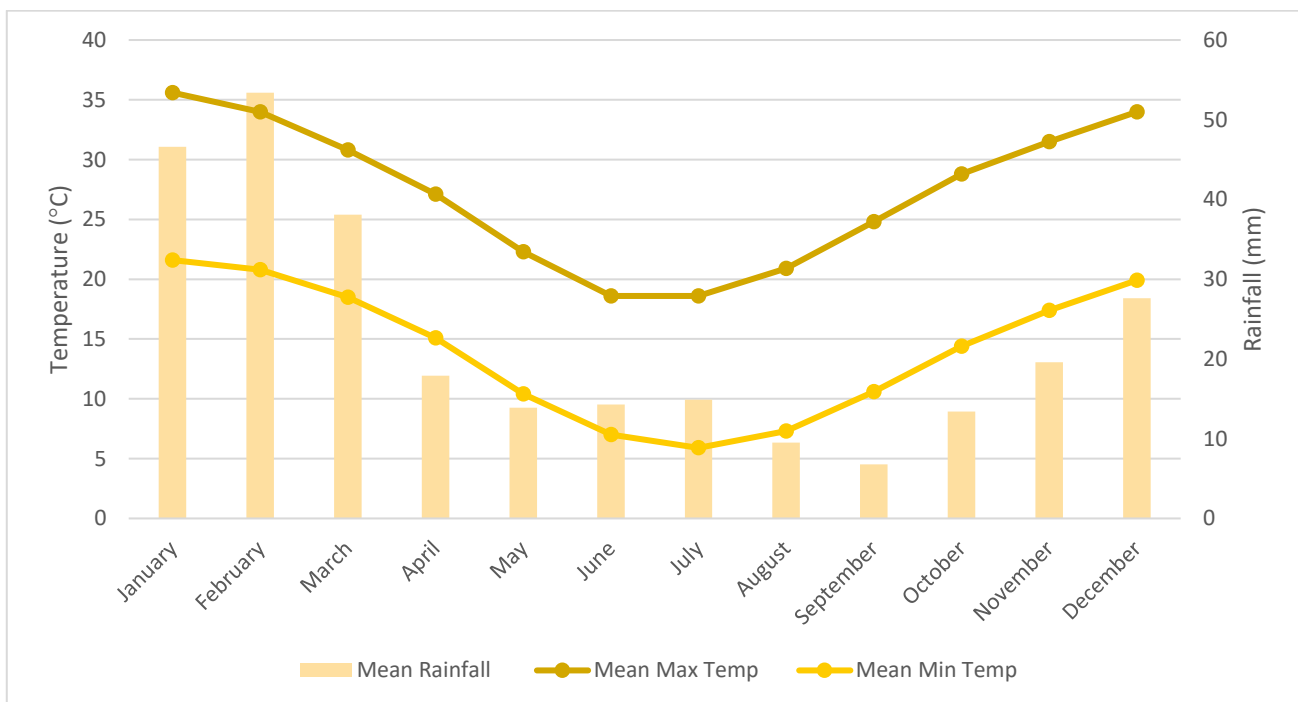


Figure 2.1 Monthly Mean Temperature and Rainfall Data Recorded at Laverton Aero Meteorological Station

2.2 Regional Environment

The application area is located within Eastern Murchison IBRA subregion (MU01), part of the Murchison Interim Biogeographic Regionalisation of Australia (IBRA) within the southern rangelands of Western Australia. The Murchison Province covers approximately 12.1% of Western Australia and covers the eastern Mid-west and northern Goldfields (Tille, 2006). Ninety-seven percent (97%) of the Murchison Province lies within the Rangelands and Arid interior, with the western edge extending into the Agricultural Area. The Murchison Province consists of an extensive plateau of low relief. Hardpan wash plains and sandplains characterise the landforms of the Murchison

Province with some stony plains, hills, mesas and salt lakes on granitic rocks and greenstones of the Yilgarn Craton (Tille, 2006). Laterite or silcrete mesas are found at the top of the landscape in areas with a granitic basement. These mesas have lateritic breakaways, kaolinized foot slopes (which are often saline) and are surrounded by gently sloping plains. Some low hills, domes and fields of granite, gneiss, and quartz found in upper parts of the landscape. The majority of the terrain consists of gently undulating plains and sandplains sitting below the mesas and hills (Tille, 2006).

The Eastern Murchison IBRA subregion (MUR01) can be described as representing the northern parts of the 'Southern Cross' and 'Eastern Goldfields' Terrains of the Yilgarn Craton (Cowan, 2001). Characterised by its internal drainage, and extensive areas of elevated red desert sandplains with minimal dune development. Salt lake systems associated with the occluded Paleodrainage system. Broad plains of red-brown soils and breakaway complexes as well as red sandplains (Cowan, 2001). Vegetation is dominated by Mulga Woodlands often rich in ephemerals; hummock grasslands, saltbush shrublands and Halosarcia shrublands. Arid climate, with mainly winter rainfall (200 mm). The subregional area for MUR01 is 7,847,996 ha (Cowan, 2001). Predominant land use in the subregion is for grazing of native pastures (85.47%) followed by mining (11.34%) and conservation estates (1.4%) (Cowan, 2001).

The application area within the Eastern Murchison (MU01) IBRA subregion is shown in Figure 2.2.

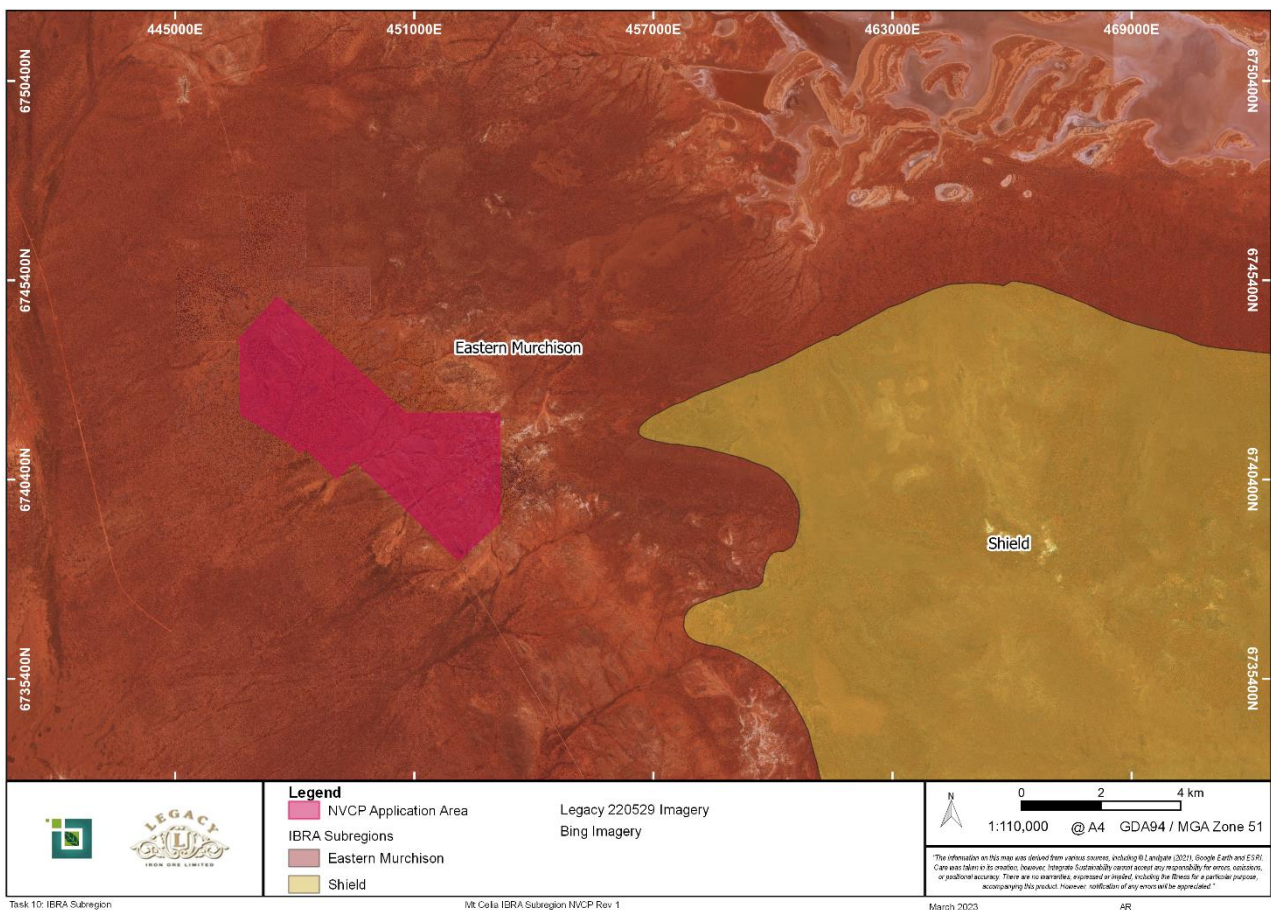


Figure 2.2 IBRA Subregion Location

2.3 Geology

The application area is located in the Eastern Goldfields Province of Western Australia, where a large number of Australia's gold deposits are located. This vast region lies in the Yilgarn Craton, which is an area in which granite and granodiorite intrusions are widespread (MBS Environmental, 2022). The Archaean Greenstone Belt occurring in a north to south direction within in Eastern Goldfields Province is associated with local rich gold resources (MBS Environmental, 2022). The belt is intruded by mafic, ultramafic, and felsic volcanics and intercalated with sedimentary rocks of Proterozoic and Permian age. The mode of occurrence of the gold mineralisation tends to be small- to medium-sized structurally controlled lodes, shears, and quartz veins (MBS Environmental, 2022).

The main gold deposits located within the application area are hosted by the Laverton Tectonic Complex, a strongly faulted and folded greenstone sequence that forms part of the larger Edjudina-Laverton greenstone belt of mafic and ultramafic rocks (MBS Environmental, 2022). A schematic representation of the regional geology is shown in Figure 2.3.

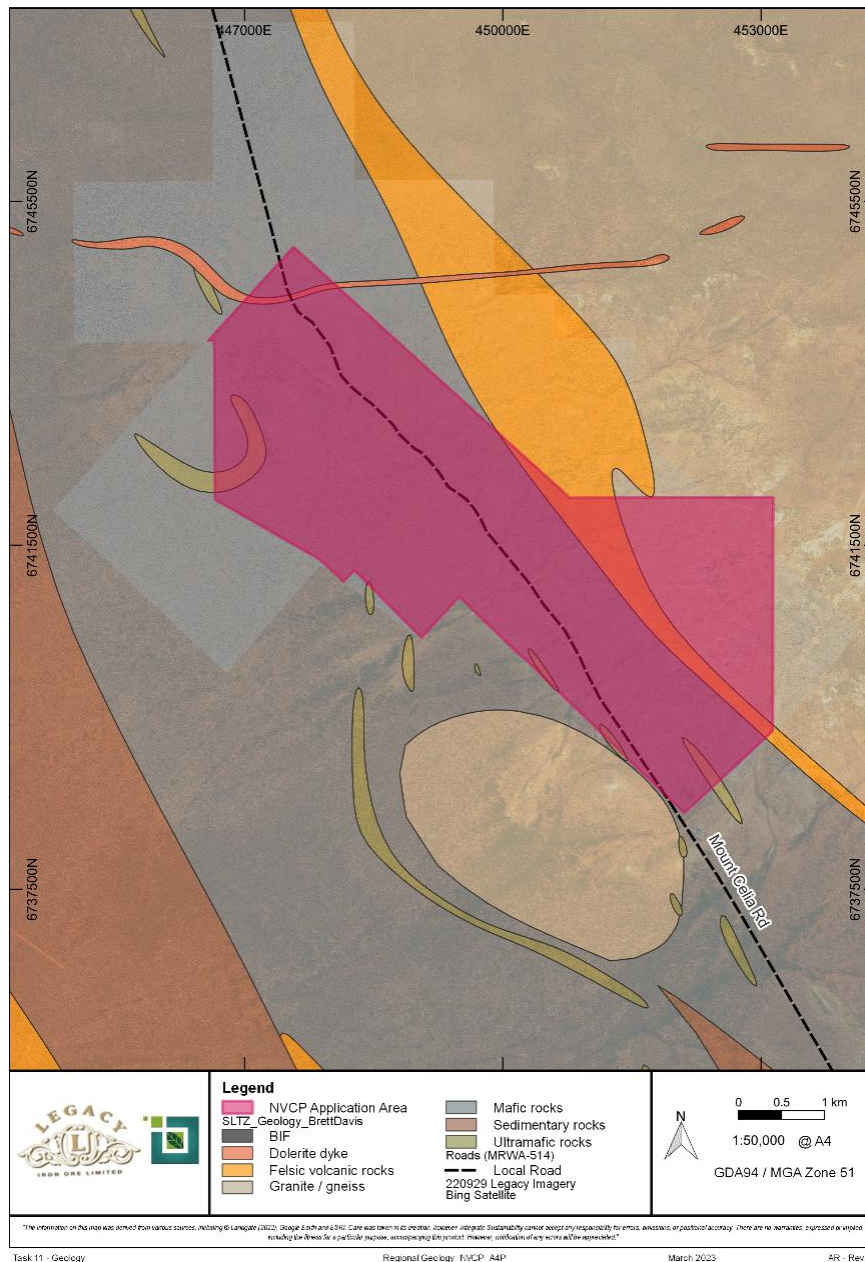


Figure 2.3 Regional Geology of the Application Area

2.4 Soils and Landscape Systems

Broadly, the Murchison Province's soils are red loamy and red sandy earth with shallow red loams, red-brown hardpan shallow loams with some areas of deep red sands (Tille, 2006). Sandplains have red sandy earth and deep sands, while on the mesas, there are shallow red loams and shallow red sandy duplexes with some stony soils and cracking clays also present. Sandy soils tend to be more common on granitic hills, while on stony plains, there are shallow red loams. Red-brown hardpan shallow loams are also present (Tille, 2006).

The application area extends across six soil groups as defined by the WA Soil groups (Schoknecht & Pathan, 2013). These are outlined in Table 2-1 and displayed in Figure 2.4.

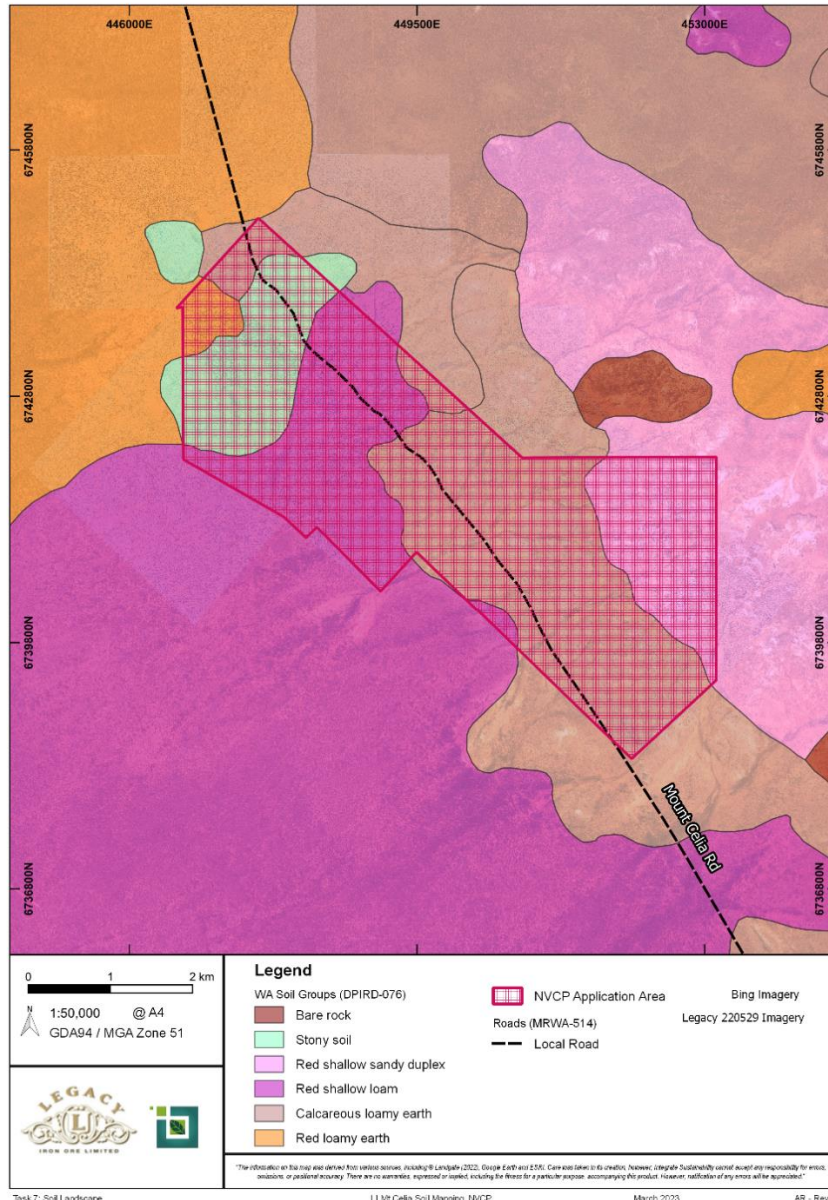


Figure 2.4 WA Soil Groups within the Application Area

Table 2-1: WA Soil Groups within the Application Area

Soil group	Characteristics
201 – Bare Rock	<ul style="list-style-type: none"> • Areas generally bare of soil on outcropping rock strata or bare rock surfaces • Includes some areas with minimal soil development • Excludes ferricrete/duricrust outcrop
203 - Stony Soil	<ul style="list-style-type: none"> • Rocks and stones or coarse gravels dominant throughout the profile • Usually very shallow • Sandy, loamy, clayey or gravelly soil matrix • Neutral to acid pH
406 - Red Shallow Sandy Duplex	<ul style="list-style-type: none"> • Red within top 30 cm • Neutral to alkaline pH subsoil • Subsoil may be calcareous (e.g. in Goldfields) • Usually hard setting surface • Clays may be underlain by rock or hardpan • Stony or gravelly surface mantle common • May be saline
522 - Red Shallow Loam	<ul style="list-style-type: none"> • Red loam over rock, hardpan or other cemented layer by 80 cm, and often <30 cm • A surface mantle of stones may be common

Soil group	Characteristics
	<ul style="list-style-type: none"> • Gravel may be present • Usually neutral to acid pH
542 - Calcareous Loamy Earth	<ul style="list-style-type: none"> • Loam throughout, or may grade to clay • Calcareous throughout, although may be non-calcareous in top 30 cm • Usually red or brown topsoil but may be grey • May have limestone or calcrete at depth • Calcareous gravel often present in profile • Hard setting or fluffy surface • Sometimes saline • Hard or soft carbonate segregations commonly occur in profile
544 - Red Loamy Earth	<ul style="list-style-type: none"> • Red top 30 cm • Usually massive or poorly structured • Usually porous (sometimes called earthy fabric) • Neutral to acid pH, or sometimes calcareous at depth • Hard setting or crusting • Sometimes with red-brown hardpan at >50 cm • Gravels (usually non-ironstone) may be present

The Project sits entirely within the Salinaland Plains soil landscape land quality zone (Tille, 2006). A description of the zone is provided in Table 2-2.

Table 2-2: Soil landscape land quality zones in the Application Area

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

2.5 Hydrology

Hydrologia were engaged to undertake a surface water assessment for the Mt Celia Project ([Appendix 2](#)). Hydrology was assessed via a site survey and modelling (Hydrologia, 2023).

The application area extends 7 km across an east-west trending catchment, draining to Lake Raeside. Low ridges and hills define the eastern edge of the catchment, 5 km upstream of the application area (Hydrologia, 2023).

Lake Raeside lies about 17 km southwest of the application area. Mount Celia Road traverses through the application area. Defined drainage lines, with shallow incised channels, form in the low hills on the eastern edge of the catchment (Hydrologia, 2023).

These drainage lines dissipate into overland flow through the area of Mount Celia Road and the application area footprint (Figure 2.5). Stormwater flow from the application area merges with flow from catchments to the north and south before entering Lake Raeside (Hydrologia, 2023).

No publicly available water quality data for surface water or stormwater for the local catchment is available, therefore the quality of surface water has been inferred from observations of land systems and weather patterns (Hydrologia, 2023).

It is likely that the quality of stormwater flows sourced from the area of the application area will largely be fresh but may be turbid. There are no pools or dams in the application area. The only surface water will be in intermittently flowing drainage lines (Hydrologia, 2023).

Lake Raeside is an internally drained, salt lake system. Salinity of water in the lake will vary from near fresh to hypersaline depending on water levels (Hydrologia, 2023).

The total area of the catchment containing the application area that contributes to Lake Raeside is 369 km². Catchments contributing to the Project area amount to 32 km² or 9% of the total catchment (Table 2.3). The overall Project footprint covers an area of approximately 9 km² or 2% of the total catchment (Hydrologia, 2023).

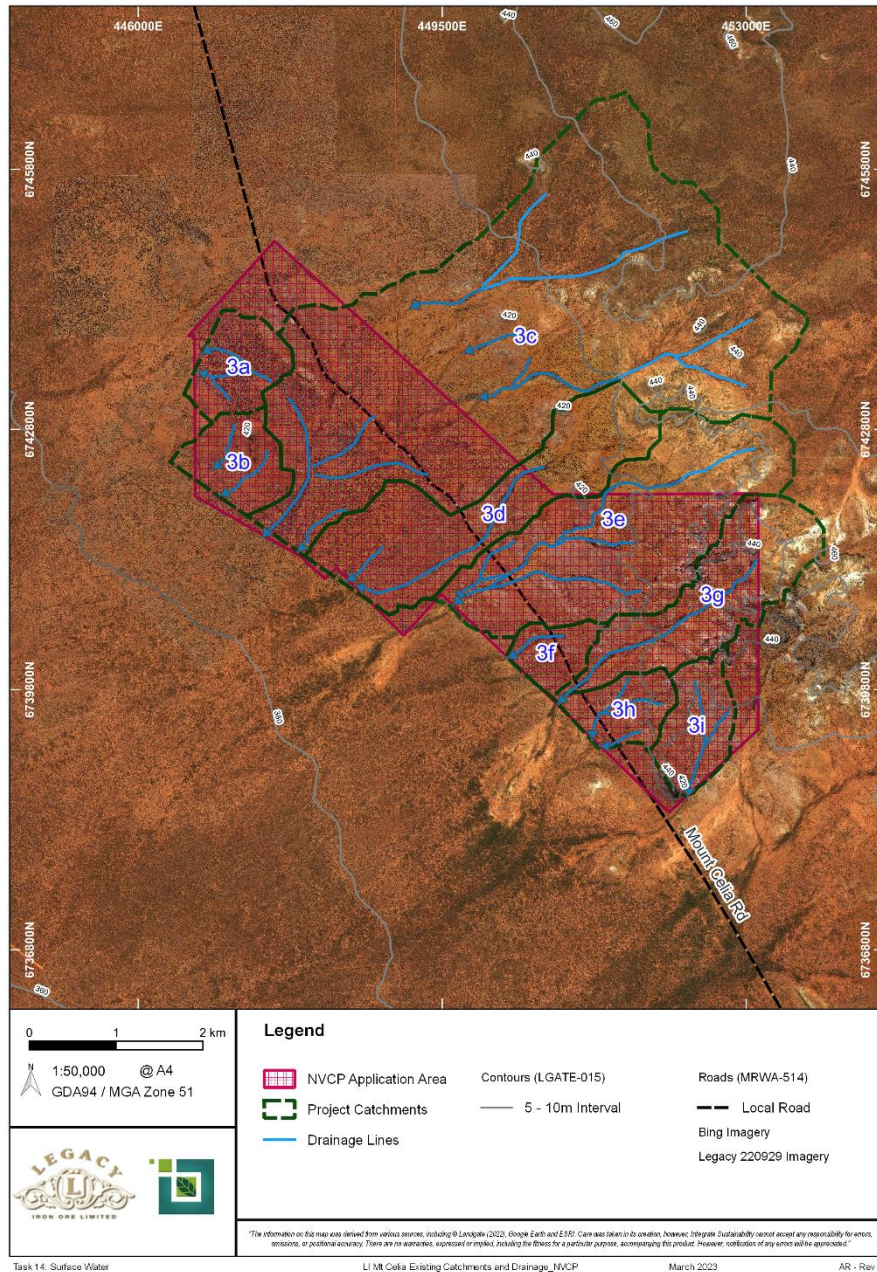


Figure 2.5 Surface Water and Drainage at the Application Area

Lake Raeside is a long chain of lakes and low-lying areas extending from west to south of the application area. The lake is saline, often dry, filling to various degrees after larger rainfall events. Inflow occurs from direct rainfall and flow from creeks and wash plain on all sides, including the application area (Hydrologia, 2023).

Table 2.3 Local Catchments

Catchment	Areas (km ²)	Description
Project		
3a	1.0	Several small overland flow pathways.
3b	1.0	Several small concentrated overland flow pathways.
3c	15.8	Larger catchment with variably defined drainage lines. Broad shallow flow through centre of site. Incised channels form in the upper catchment, dispersing into shallow flow above the Mt Celia Road. Possible flow between Regional Catchments 3 and 4.
3d	3.6	Large defined drainage line, dissipating through site.
3e	5.3	Defined drainage network through site; several tributaries and flow divergence; large lower channel. Possible flow from

Catchment	Areas (km ²)	Description
		Catchment 5 into 4.
3f	0.6	Small catchment with several overland flow paths.
3g	2.6	Defined drainage line with a shallow channel.
3h	0.8	Smaller defined drainage line, shallow channels.
3i	1.1	Smaller defined drainage line.
Total	31.9	Total across the application area.
Regional		
1	184	Upper catchment.
2	103	Middle catchment; includes site.
3	82	Lower catchment, south of site.
Total	369	Total to Lake Raeside.

2.6 Hydrogeology

The Project overlies the Raeside groundwater resource sub-area within the weathered and fractured Archaean bedrock, being part of the Yilgarn Goldfields fractured-rock groundwater province (Figure 2.6). These fractured-rock aquifers are composed of greenstones, granitoids and other intrusions with secondary porosity and permeability which could be increased by chemical dissolution along fracture lines. Furthermore, the occurrence of the fractured-rock aquifers is mainly decided by the local geological structure, meanwhile the lithology of rocks have little influence on it and only can change structural development of the aquifers to some extent (MBS Environmental, 2022). Although the lateral continuity of the aquifers along the dominant geological structure is still not clear, it's noted that ellipsoidal drawdowns of aquifers were associated with mine dewatering suggesting that the greatest permeability of the aquifers are parallel to the main geological structures (Johnson, Commander, & O'Boy, 1999).

Groundwater flow system in the region is dependent on rainfall recharge, and the supplies of groundwater could be significant from 100 m depth bores at fractured chert and banded iron formation, regional structural features, fault, and shear zones (Johnson, Commander, & O'Boy, 1999).

Assessment of the hydrogeological system for the application area included the construction of three test production bores and six monitoring wells (Figure 2.6) (Appendix 3). Results of the drilling found that the intersected stratigraphy typically comprised extremely weathered basalt or clays over basalt or quartz schist, with a static water table between 21 m and 37 m below ground level and water bearing fractures in some boreholes (AMC, 2021b).

Water quality analysis results from testing pumping demonstrated that groundwater is generally brackish with Total Dissolved Solids (TDS) between 6,700 mg/L and 16,000 mg/L. Groundwater was found to be slightly alkaline resulting in a pH of 7.7 and 7.9. Concentrations of metals and metalloids such as arsenic, cadmium, chromium, copper, lead, nickel and zinc are below concentrations set out in the Australian Drinking Water Quality Guidelines (NHMRC, 2022) (MBS Environmental, 2022).

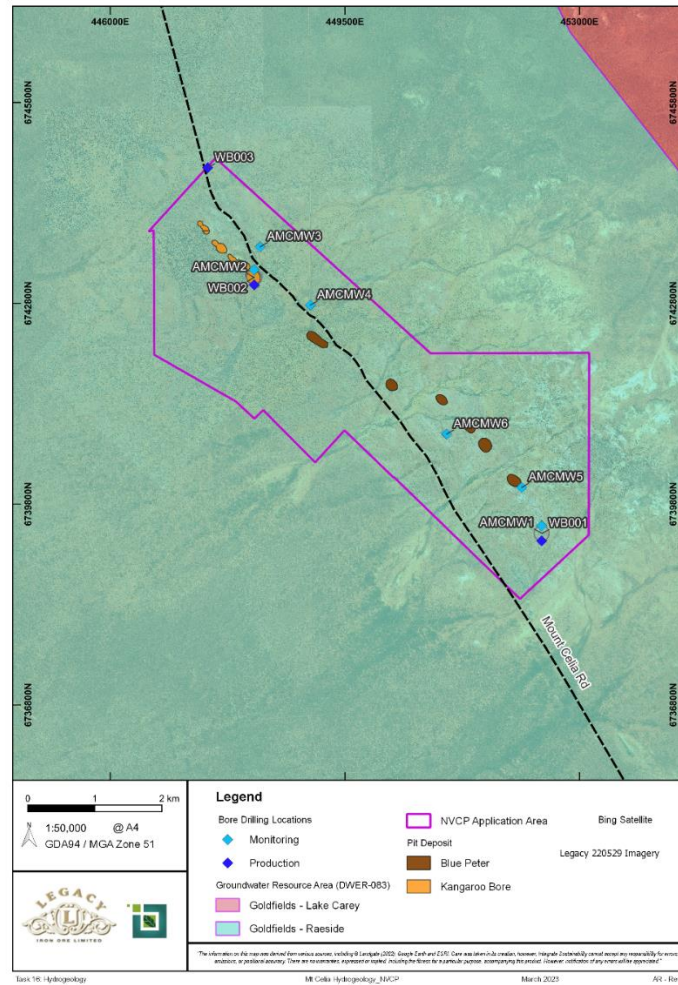


Figure 2.6 Hydrogeological assessment and Groundwater Resource Area

2.7 Flora and Vegetation

Legacy Iron commissioned Native Vegetation Solutions to undertake a desktop assessment and detailed vegetation survey of the Project area ([Appendix 4](#)). This encompassed the application area as well as surrounding Project tenure. The survey was undertaken in two stages and in accordance with guidance documents ‘Environmental Factor Guideline- Flora and Vegetation’ (EPA, 2016) and ‘Technical Guidance- Flora and Vegetation Surveys for Environmental Impact Assessment’ (EPA, 2016a).

The survey area encompassed an area totalling approximately 2,029 ha, which intersects Mining Tenements M39/1123, M39/1125, M39/1126, M39/1127, M39/1128.

The first stage of the field survey was undertaken on the 3rd to 8th June 2020 with 43 quadrats established within the Project area. A total of 58 hours was spent on site traversing the Project area in June 2020. A total of 123 vascular plant species within 12 vegetation types were recorded (Native Vegetation Solutions, 2020a).

The second stage of the field survey was conducted on the 8th to 9th September 2020. The already established 43 quadrats were resurveyed, recording 125 vascular plant species within 12 vegetation groups. A total of 20 hours was spent on site traversing the Project area in September 2020 (Native Vegetation Solutions, 2020b).

2.7.1 Pre-European Vegetation Types

Three vegetation units were identified as part of the desktop assessment. These vegetation units identify the pre-European extent of vegetation (Native Vegetation Solutions, 2020b). The extent of pre-European vegetation is shown in Table 2-4.

Table 2-4: Pre-European Vegetation Group Extent within the Project Area
(Native Vegetation Solutions, 2020b)

Factor	Value				
Beard Vegetation Association	18				
Vegetation Association Description*	Low woodland; mulga (<i>Acacia aneura</i>)				
Pre-European Extent (ha)	Scale				
	By Association (WA)	By Association (WA)	By IBRA Region (Murchison)	By IBRA Sub-region (Eastern Murchison)	By Shire (Shire of Menzies)
	22,029,557*	19,892,306**	12,403,172**	10,269,896**	2,010,840**
% Pre-European Extent Remaining	100.00%*	99.75%**	99.68%**	99.66%**	99.94%**
Surrounding Land Use***	Mining, Exploration, Pastoral Lease				
Weed prevalence***	Low				

* Source: Shepherd *et al.* 2002

**Source: DBCA (2019)

*** Source: Field Assessment

2.7.2 Vegetation Types

One hundred and twenty-five species were recorded within the surveyed Project area with 117 species recorded within quadrats. Twenty-nine families and 58 genera were found. Of the native species, Fabaceae had the highest representation, with 26 species from 3 genera, dominated by *Acacia*. Chenopodiaceae and Poaceae were the next best represented families with 20 species and 16 species respectively (Native Vegetation Solutions, 2020b).

The most common and widespread species was *Ptilotus obovatus*, which was recorded within all 43 quadrats. Its canopy cover was 10-30%. The next most common and widespread species was *Acacia aneura*, recorded in 34 quadrats, with a canopy cover between 10-30% (Native Vegetation Solutions, 2020b).

Twelve vegetation groups were identified during this survey, largely following topographical features and dominant species. Vegetation groups are displayed in Table 2-5 and Figure 2.7.

Table 2-5: Vegetation Group Extent within the Project Area

Vegetation Group	Vegetation Group Code	Quadrats	Family	Genus	Species	Area (ha)	Percentage of Surveyed Area (%)
Mulga over <i>Maireana sedifolia</i> and mixed sclerophyll shrubland	A	Q1, Q2, Q8, Q19, Q28	14	25	52	305.49	15.06
Mulga shrubland (sandy substrate)	B	Q4, Q5, Q13, Q21, Q27	15	24	50	635.26	32.20
Open Mulga shrubland (sandy substrate)	C	Q3, Q6, Q23	12	19	31	37.77	1.86
Mulga shrubland on rocky ironstone hills	D	Q7, Q9, Q10, Q12, Q20, Q26	13	23	51	216.93	10.69
<i>Acacia aneura</i> and <i>Acacia burkittii</i> on rocky basalt hills	E	Q11, Q14, Q15, Q18	18	31	55	32.90	1.62
Mulga over small rocky outcrops	F	Q16, Q30	15	24	35	8.32	0.41
Mulga over Chenopod shrubland	G	Q17, Q22, Q35	14	24	45	167.24	8.24
Mulga Thicket- Drainage	H	Q24, Q25, Q29	17	28	43	201.44	9.93
Open Mulga shrubland on ironstone flats	I	Q31, Q32	12	17	32	241.39	11.90
<i>Acacia quadrimarginea</i> shrubland over granite bedrock	J	Q33, Q34	10	15	21	39.99	1.97

Vegetation Group	Vegetation Group Code	Quadrats	Family	Genus	Species	Area (ha)	Percentage of Surveyed Area (%)
<i>Casuarina pauper</i> and <i>Acacia aneura</i> over sclerophyll shrubland on rocky laterite hills	K	Q36, Q37, Q38, Q39, Q40, Q41	17	24	44	110.72	5.46
Mulga over <i>Eremophila forrestii</i> on large rocky granite/basalt hills	L	Q42, Q43	11	16	23	13.23	0.65
Total			29*	58*	123*	2028.66#	100.00%#

*Denotes total recorded in the surveyed area (not sum of column)

Denotes sum of column

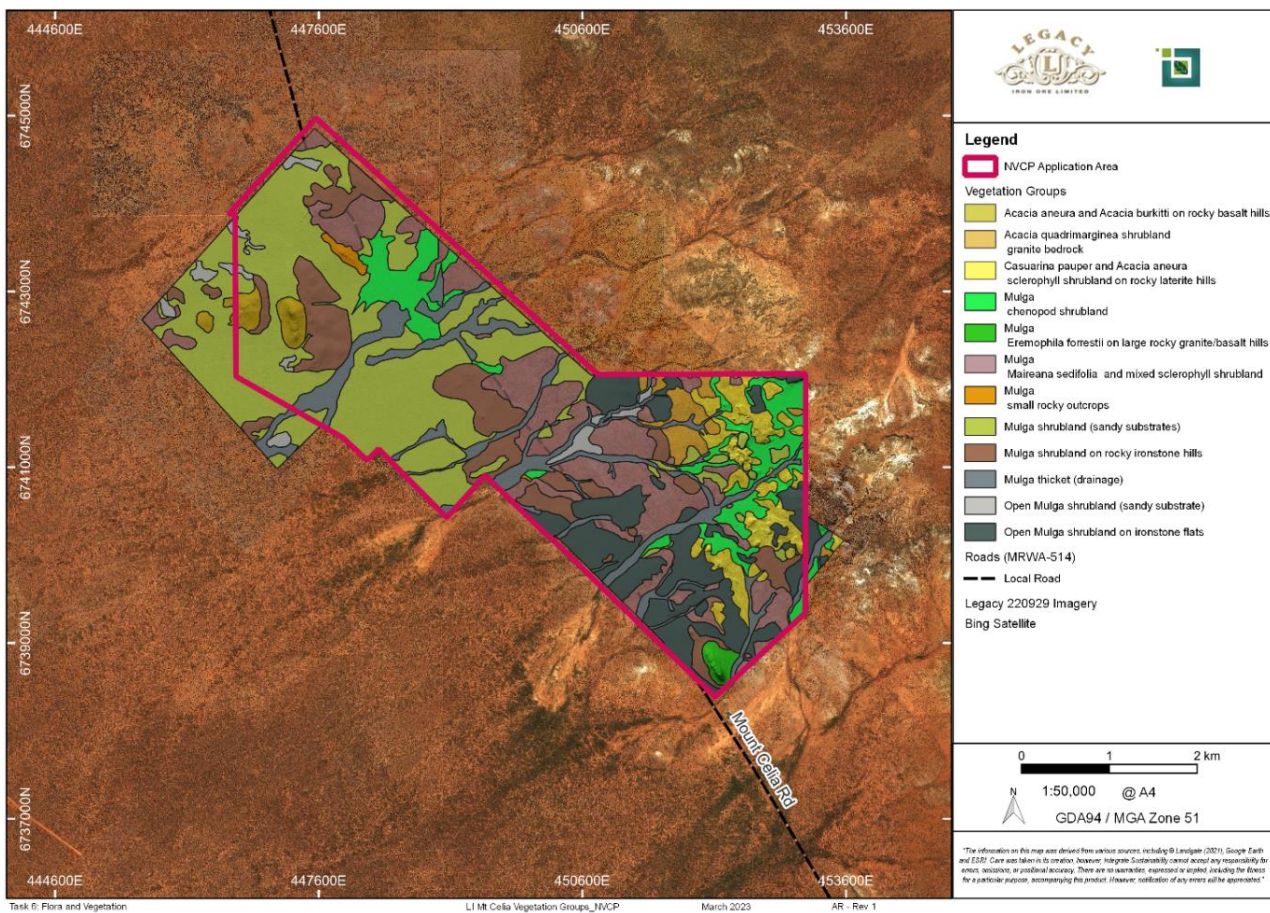


Figure 2.7 Vegetation Groups within the Application Area

2.7.3 Vegetation Condition

Vegetation in the application area has been subjected to historic exploration activities and grazing. Most of the sites/quadrats inspected were in Good to Very Good condition. There were existing vehicle tracks in some areas, due to mine exploration activities. The adjacent vegetation spanning 0.5m off these tracks was mostly in a Good to Very Good condition (Native Vegetation Solutions, 2020b).

The surveyed vegetation condition for the application area is displayed in Table 2-6 and Figure 2.8.

Table 2-6: Surveyed Vegetation Condition

Vegetation Condition Rating	Description	Surveyed Area (ha)	Area (%)
Very Good	Condition indicates vegetation structure has been altered by obvious signs of disturbance, such as disturbance caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.	1,488.14	73.45
Good	Condition depicts that vegetation structure has been significantly altered by very obvious signs of multiple disturbances, however, it retains basic vegetation structure or has ability to regenerate it. Disturbance to vegetation structure may be caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.	506.78	25.01
Degraded	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.	31.23	1.54
Total		2026.15	100

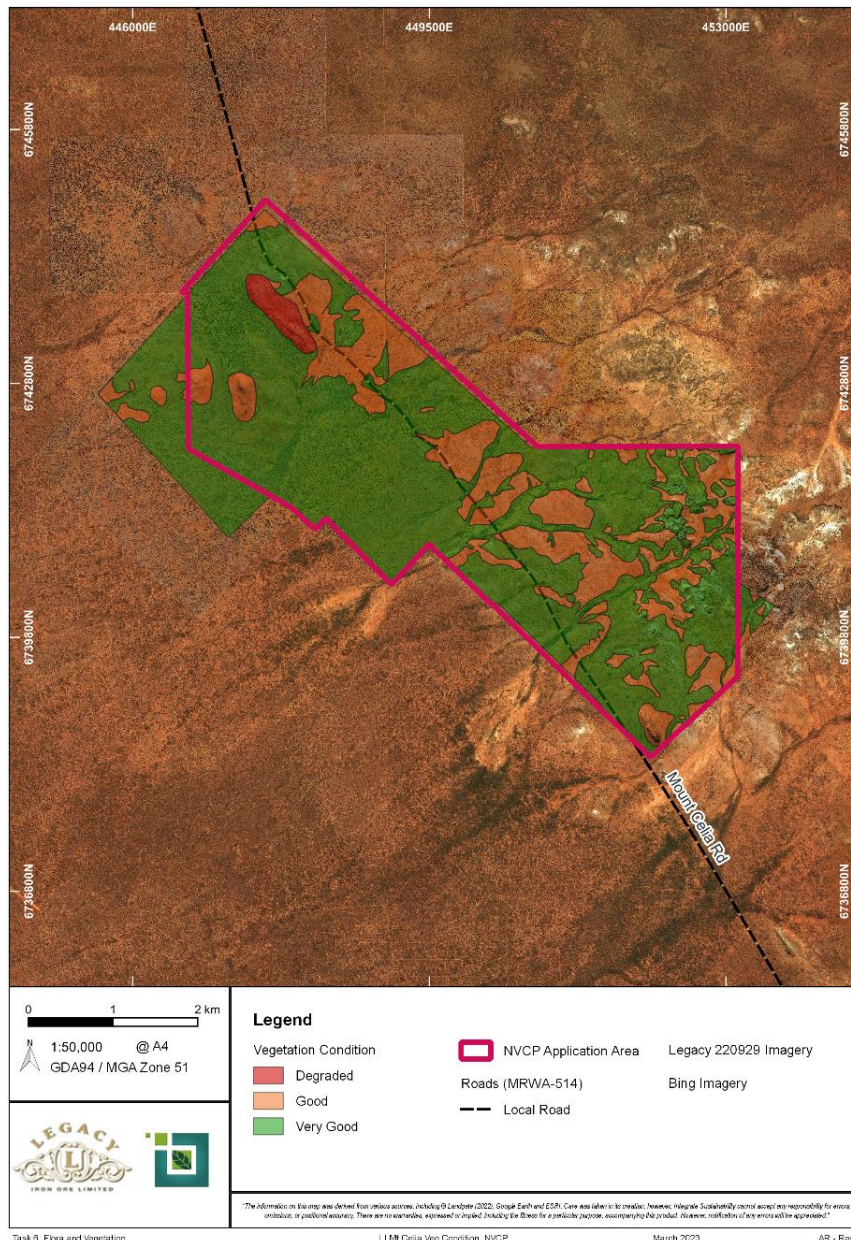


Figure 2.8 Vegetation Condition within the Application Area

2.7.4 Conservation Significant Species

A preliminary desktop assessment was undertaken to determine the presence of EBPC Matters of National Significance, threatened flora species and communities and Environmentally Sensitive Areas. The desktop study returned no findings applicable to the application area. No threatened or priority species were recorded during the survey (Native Vegetation Solutions, 2020b).

2.7.5 Introduced Species

The preliminary desktop assessment undertaken highlighted the potential presence of *Carrichtera annua* (Ward's Weed) and *Cenchrus ciliaris* (Buffel Grass) which are listed as invasive weed species under the *EPBC Act 1999*. The field survey determined the presence of Buffel Grass and there were three non-native species recorded in the quadrats, with four additional non-native species recorded near the old Mt Celia homestead (Native Vegetation Solutions, 2020b).

Seven introduced weed species were recorded, these being:

- *Citrullus amarus* (Pie Melon)- Q15
- *Cucumis myriocarpus* (Prickly Paddy Melon)- Q15 and Q30
- *Cenchrus ciliaris* (Buffel Grass)- Q29
- *Schinus mollee var. areira* (Pepper Tree)- old Mt Celia Homestead
- *Nerium oleander* (Oleander Tree)- old Mt Celia Homestead
- *Yucca aloifolia* (Yucca Tree)- old Mt Celia Homestead
- *Tamarix aphylla* (Athel pine)- old Mt Celia Homestead

Of the seven non-native species above, only *Tamarix aphylla* (Athel pine) is a declared pest in the state of Western Australia (Native Vegetation Solutions, 2020b).

2.8 Terrestrial Fauna

Legacy Iron commissioned Terrestrial Ecosystems to undertake a desktop assessment and basic vertebrate fauna survey and risk assessment for the Project area ([Appendix 5](#)). A total area of 2,031 ha was assessed (Terrestrial Ecosystems, 2021b). The survey was undertaken in accordance with the 'Technical Guidance - Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment' (EPA, 2016).

The field survey was undertaken on the 19-23 October 2020 to assess fauna habitat types and condition in the Project area. A field survey area of 1,404 ha was assessed at the Project, which encompassed the application area (Native Vegetation Solutions, 2020a).

Terrestrial Ecosystems concluded that Impacts on vertebrate fauna associated with clearing vegetation in the Project area in a landscape or bioregional context are likely to be low as there are vast tracts of similar fauna habitat in adjacent areas (Terrestrial Ecosystems, 2021a).

It was also determined that the sparseness of the vegetation and ground cover mean the abundance of terrestrial vertebrate in the Project area will be low (Terrestrial Ecosystems, 2021a).

2.8.1 Fauna Habitat

There is a variety of fauna habitats in the application area, which is typical for the bioregion. Fauna habitats represented in the application area are abundant and in reasonable condition in adjacent areas (Terrestrial Ecosystems, 2021a). It is likely that the fauna assemblage in the application area is similar to the many square kilometres of similar habitat in adjacent areas and the bioregion (Terrestrial Ecosystems, 2021a).

Six broad fauna habitats were identified during the survey efforts. The habitats consist of:

- Open Mulga shrubland on sandy soil;
- Mulga and chenopod shrubland on rocky soil;
- Mulga shrubland over rocky soil;
- Mulga on rocky slopes and hills;
- Shrubs on granite rocks and bedrock;
- Mulga drainage lines.

Habitat type and extent is shown in Figure 2.9.

The application area does not provide an important ecological linkage or fauna movement corridor (Terrestrial Ecosystems, 2021a).

It was noted during the survey that the application area has existing partial disturbance from mining and exploration activity (Terrestrial Ecosystems, 2021a). Drainage lines were noted running in a north-east direction, with the main access road in the area bisecting the application area in a south-east to north-west direction. The application area is surrounded by numerous mining developments within 10km and a number of salt lakes to the north and east (Terrestrial Ecosystems, 2021a).

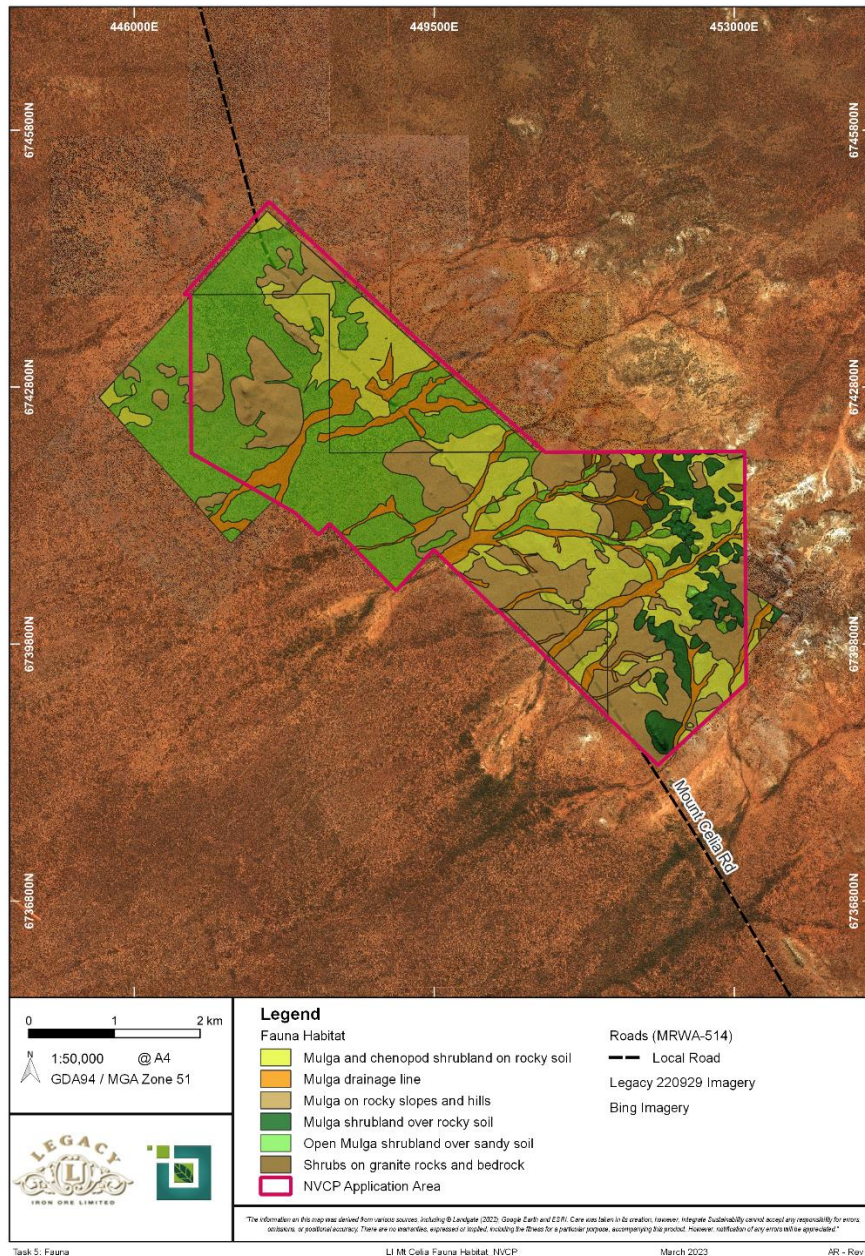


Figure 2.9 Fauna Habitats within the Application Area

2.8.2 Introduced Species

Dog and cat tracks indicate there is a low abundance of cats and wild dogs in the Project area. Rabbit scats were also noted within the Project area. House mice, cats and wild dogs are known to be established in the area, although in low abundance.

2.8.3 Conservation Significant Species

A desktop assessment identified the potential presence of 14 conservation significant fauna species within the application area. Out of these only two conservation significant fauna species were recorded as being likely to have a presence within the application area as well potentially being impacted by clearing activities (Terrestrial Ecosystems, 2021a). Results of the assessment as shown in Table 2-7.

Table 2-7: Potential Presence of Conservation Significant Fauna within the Application Area

Species	DBCAs Schedule / Priority	Status under Commonwealth EPBC Act	Comment on the potential presence of a species
Night Parrot <i>Pezoporus occidentalis</i>	Critically Endangered	Endangered	Highly unlikely to be in the project area due to a lack of suitable habitat (i.e. mature spinifex). The potential for impacting on this species is therefore very low.
Arid Bronze Azure Butterfly <i>Ogyris subterrestris petrina</i>	Critically Endangered	Critically Endangered	A lack of smooth-barked Eucalypt trees and thus <i>Camponotus terebrans</i> ants means it is highly improbable that the butterfly will be present and therefore impacted.
Sandhill Dunnart <i>Sminthopsis psammophil</i>	Endangered	Endangered	Highly unlikely to be in the project area due to a lack of suitable habitat (i.e. mature spinifex). The potential for impacting on this species is therefore very low.
Malleefowl <i>Leipoa ocellata</i>	Vulnerable	Vulnerable	No Malleefowl nesting mounds were recorded, however, Malleefowl tracks were present.
Grey Falcon <i>Falco hypoleucos</i>	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.
Chuditch <i>Dasyurus geoffroii</i>	Vulnerable	Vulnerable	Highly unlikely to occur in the project area. The potential for impacting on this species is therefore very low.
Princess Parrot <i>Polytelis alexandrae</i>	Priority 4	Vulnerable	May infrequently be seen in the region, however, clearing vegetation is unlikely to impact on this species.
Mulgara <i>Dasyercus blythi</i>	Priority 4	N/A	Highly unlikely to be in the project area due to a lack of suitable habitat (i.e. mature spinifex). The potential for impacting on this species is therefore very low.
Oriental Plover <i>Charadrius veredus</i>	Migratory	Migratory	Unlikely to be in the project area due to a lack of suitable habitat. The potential for impacting on this species is therefore low.
Fork-tailed Swift <i>Apus pacificus</i>	Migratory	Migratory	May very infrequently be seen in the region, however, clearing vegetation is unlikely to impact on this aerial species.
Grey Wagtail <i>Motacilla cinerea</i>	Migratory	Migratory	Highly unlikely to be present in the project area. The potential for impacting on this species is therefore low
Yellow Wagtail <i>Motacilla flava</i>	Migratory	Migratory	Highly unlikely to be present in the project area. The potential for impacting on this species is therefore low.
Peregrine Falcon <i>Falco peregrinus</i>	OS	N/A	May infrequently be seen in the region, however, clearing vegetation is unlikely to impact on this species.
Long tailed Dunnarts <i>Sminthopsis longicaudata</i>	P4	N/A	May be present in the breakaway areas and rocky hills in the project area.

IA – Migratory birds protected under international agreements

OS – Other Specially protected fauna

Malleefowl (*Leipoa ocellata*)

Malleefowl (*Leipoa ocellata*) are large, ground-dwelling birds that are listed as vulnerable under the *BC Act 2016* and the *EPBC Act 1999*. They rarely fly unless alarmed or are perching for the night (Terrestrial Ecosystems, 2021a).

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 (Terrestrial Ecosystems, 2021a).

Clearing and livestock grazing have since caused changes to the structure and floristic diversity of foraging habitats (Terrestrial Ecosystems, 2021a). 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 (Terrestrial Ecosystems, 2021a).

Malleefowl and their eggs are vulnerable to predation by foxes, and newly hatched chicks are vulnerable to foxes, cats and raptors. 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. Generally, the presence of nest mounds in an area provides an indication of the presence of Malleefowl (Terrestrial Ecosystems, 2021a).

Malleefowl have been observed in the bioregion, however, there are no recent records of active breeding mounds in the vicinity of the application area. Their abundance in the Goldfields is low and they are sparsely distributed, favouring those areas that are more densely vegetated (Terrestrial Ecosystems, 2021a).

Malleefowl tracks were recorded in the open Mulga with sandy soil areas of the Project, indicating they are foraging in the Project area (Figure 2.10 and Figure 2.11).

No Malleefowl mounds were located within the application area. Large portions of the habitat in the application area are very open and therefore not suitable for Malleefowl nesting due to predator presence (Terrestrial Ecosystems, 2021a).



Figure 2.10 Malleefowl tracks recorded within the survey area

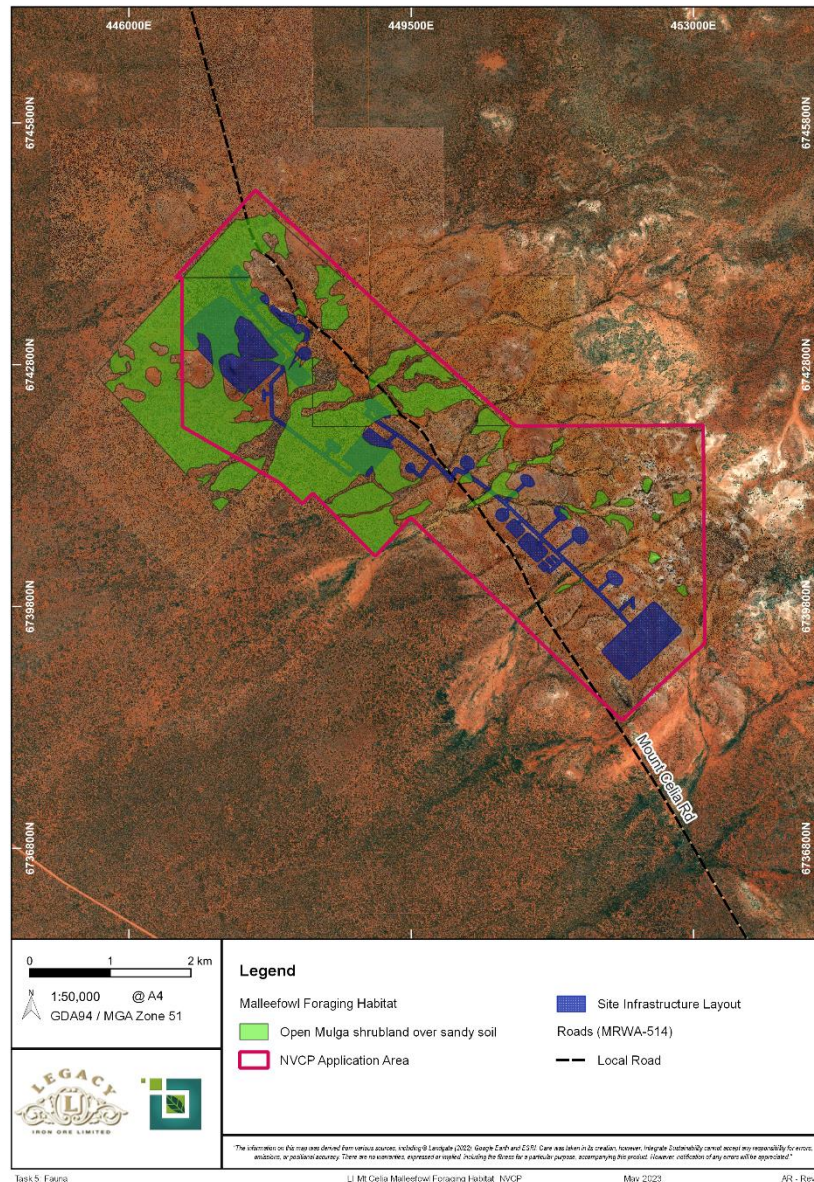


Figure 2.11 Potential Malleefowl foraging habitat

Long-tailed Dunnart (*Sminthopsis longicaudata*)

The Long-tailed Dunnart (*Sminthopsis longicaudata*) is listed as a Priority 4 species with the Department of Environment and Conservation. Its habitat is described as widely scattered in the arid zone where it inhabits rugged rocky areas (Terrestrial Ecosystems, 2021a).

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 were 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 (Terrestrial Ecosystems, 2021a).

Three adult Long-tailed Dunnarts were caught in a survey undertaken for the Granny Smith project (approximately 50km away) by Terrestrial Ecosystems and a single individual was caught in the follow up targeted survey (Terrestrial Ecosystems, 2021a). Subsequently, Long-tailed Dunnarts have been caught at Mt Ida and Bottle Creek, and an unnamed mine east of Granny Smith (pers. comm.). There are also other unpublished records in the vicinity of the application area (Terrestrial Ecosystems, 2021a).

There were no Long-Tailed Dunnarts observed during the survey, however it is likely that Long-tailed Dunnart are present in the breakaway and rocky areas as this is their preferred habitat (Figure 2.12). There will be some impact to the breakaway and rocky outcrop areas due to the footprint of the Project infrastructure. It is expected that the Long-Tailed Dunnart will migrate to nearby suitable habitat during disturbance activities.

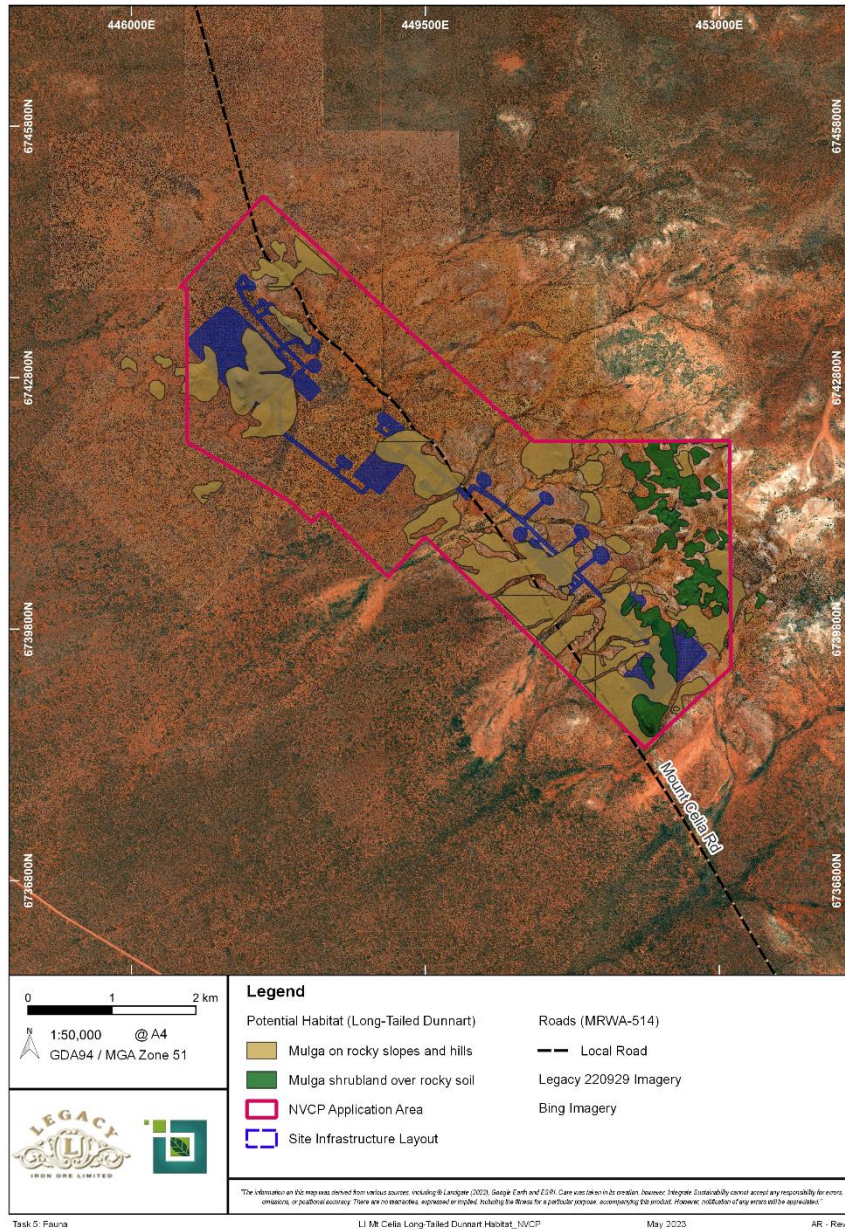


Figure 2.12 Potential Long-Tailed Dunnart Habitat within the Application Area

Table 2-8: Conservation Significant Fauna in the Project area

Conservation Status	Scientific Name	Preferred Habitat within the Region	Habitat within the Project area	Distance to nearest record	Recorded within the Project area	Likelihood of occurrence
Vulnerable under the BC Act 2016 and EPBC Act 1999	Malleefowl (<i>Leipoa ocellata</i>)	Densely vegetated areas area favoured	No suitable habitat within the Project area	Tracks recorded within the Project area	Yes (tracks only, no nesting sites)	Likely
Priority 4 BC Act 2016	Long-tailed Dunnart (<i>Sminthopsis longicaudata</i>)	Rugged rocky landscapes	Breakaway and rocky areas	Has been recorded in the regional vicinity of the Project area as well as approximately 50km away at Granny Smith mine.	No	Likely

2.9 Subterranean Fauna

Bennelongia was commissioned to undertake a desktop assessment and field survey to determine the significance of any potential impacts on subterranean fauna within the Project area.

The initial desktop assessment concluded that based on local and regional geology and hydrogeology, the Project is unlikely to contain prospective habitat for troglofaunal or significant habitat for stygofauna, however a field survey was recommended for stygofauna to confirm their presence.

The field survey was undertaken at Mt Celia between 5-6 December 2022 and collected 15 stygofauna samples in and around the immediate Project area and within the potential water production bore field (Bennelongia, 2023).

Sampling for stygofauna was conducted according to the general principles laid out for subterranean fauna sampling by the Environmental Protection Authority (EPA) in *Environmental Factor Guideline – subterranean fauna* (EPA, 2016) and (EPA, 2021).

2.9.1 Habitat

Stygofauna

Alluvial formations and calcretes are known to provide suitable habitat for stygofauna in the Yilgarn, particularly when associated with paleochannel aquifers. Comparable geologies are present in the Raeside paleochannel, located approximately 1 km west of Mt Celia, however these do not extend into the Project area (Bennelongia, 2023).

Fractured rock aquifers are known to occur throughout the area and are geological units that sometimes harbour stygofauna. The local groundwater levels and quality parameters are also well within the tolerances of stygofauna (Bennelongia, 2023).

Troglofauna

Although troglofauna is poorly sampled in the Yilgarn compared with stygofauna, high diversity is expected to be found in areas of unsaturated karstic calcrete (Bennelongia, 2023).

A lithological log from a bore (WB003) located north of Kangaroo Bore deposit, indicates the presence of calcrete near the surface. However, such deposits are likely to be small, followed by a thick layer of oxidised clays (5-26 m) (Bennelongia, 2023).

Other geologies associated with suitable habitat for troglofauna such as channel iron formations, BIF, weathered or fracture sandstone, are not present at the Project.

The presence of clays near the surface in places, together with the absence of prospective geologies for troglofauna, suggest troglofauna will be absent. The habitat within the Project is considered unlikely to harbour troglofauna (Bennelongia, 2023).

2.10 Social Surroundings

Legacy Iron commissioned Nyalpa Pirniku and Integritat to undertake a heritage survey of the Project in November 2022. The survey was undertaken in consultation with Nyalpa Pirniku representatives ([Appendix 6](#)).

The application area falls within the buffered boundary of Registered Heritage site 'Mount Celia Station' (Register Site 1562). The survey team confirmed that the application area does not impede on the actual location of DPLH 1562 (Integritat, 2022).

Another registered site 'Wongatha Soak' (Registered Site 17033) falls within the application area. The Soak could not be located during the survey and may have dried up. The Project activities will not impact on the current recorded location of Registered Site 17033.

The only place of significance that was discussed during the survey is ‘Wongatha Yabu’ (Registered Site 17031). The place is located approx. 500m North East of the application area and will not be impacted by the application area (Integritat, 2022).

The application area is situated within the Nyalpa Pirniku native title claim area (WC2019/00 and WAD91/2019). Heritage places and native title claims in proximity to the application area are shown in Figure 2.13. The application area overlies the Mt Weld and Yundamindra pastoral stations and Water Reserve R11185 (Figure 2.14).

Legacy Iron includes the Nyalpa Pirniku group, Mt Weld and Yundamindra pastoral stations and Water Corporation as stakeholders and will continue to undertake regular engagement with these stakeholders.

Legacy Iron will undertake all works in accordance with statutory and contractual requirements, in accordance with the appropriate approvals.

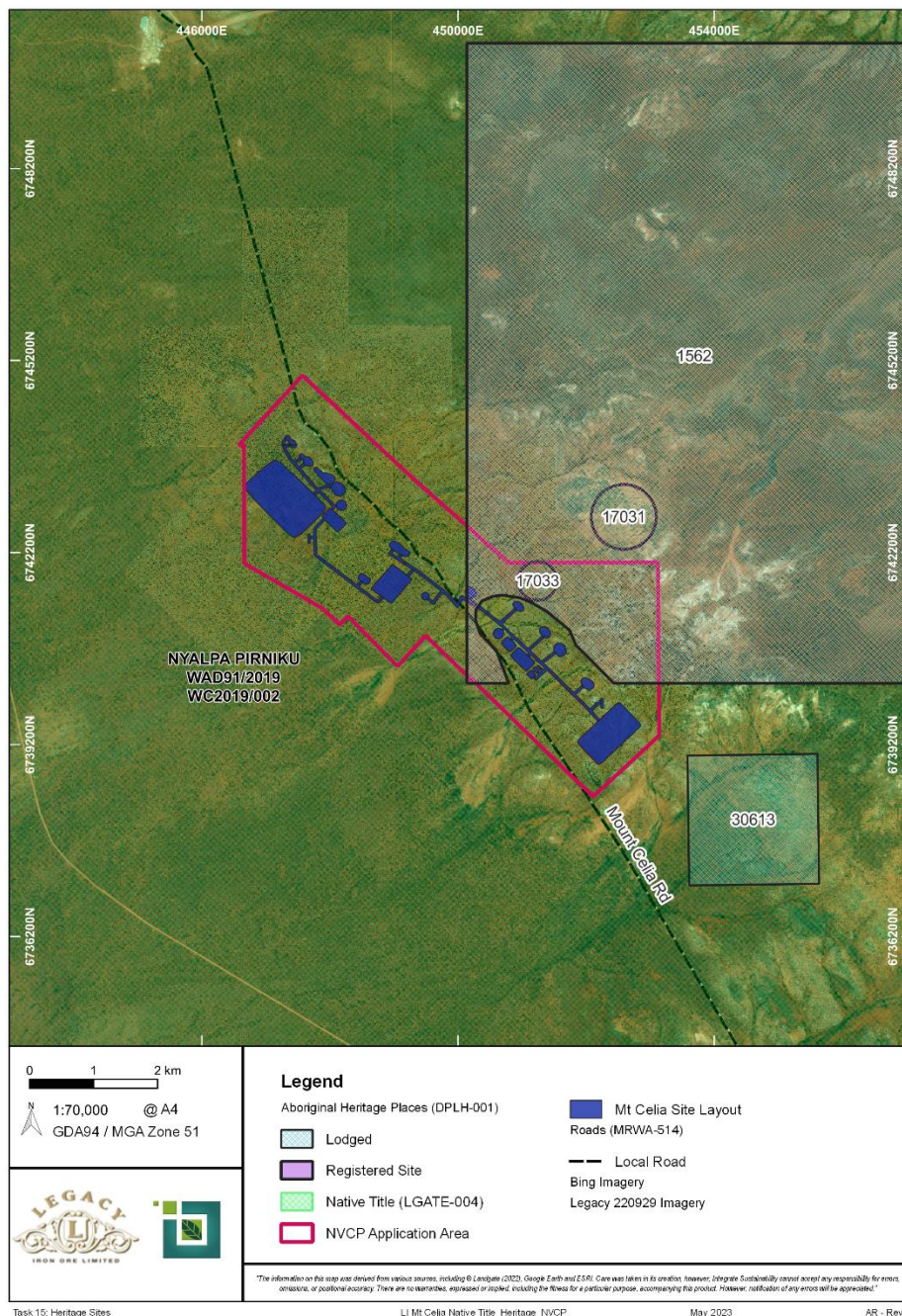


Figure 2.13 Heritage Sites and Native Title Claim Area

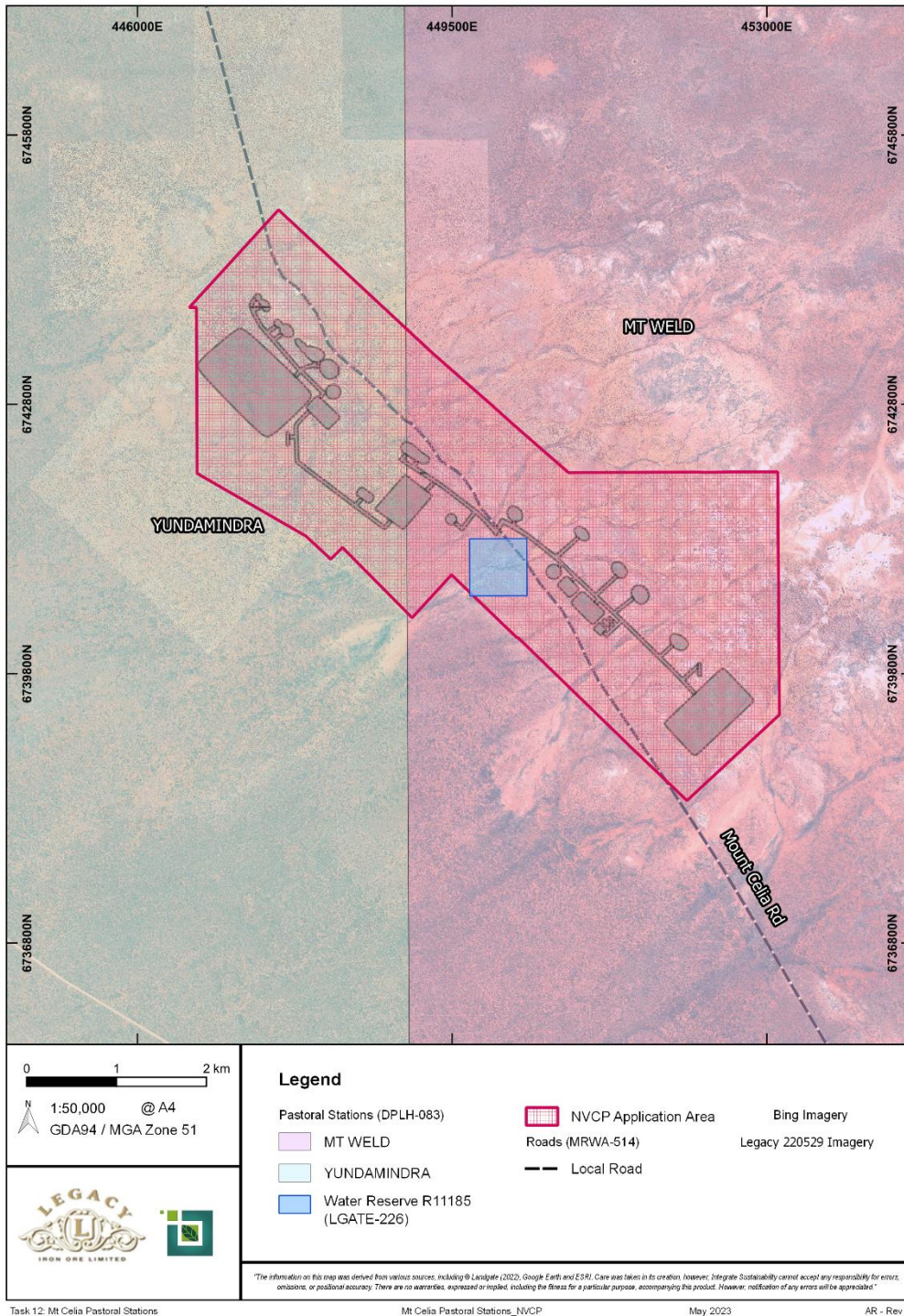


Figure 2.14 Pastoral Stations and Water Reserve overlying the Application Area

3. ENVIRONMENTAL IMPACTS AND MANAGEMENT

The environmental impacts of the proposed vegetation clearing have been considered in the following section.

3.1 Potential Impacts to Flora and Vegetation

3.1.1 Direct Loss of Vegetation

Legacy Iron is proposing to clear up to 261 ha of native vegetation within the applications area (the applications area is 1,872ha). Where practical, effort will be made to utilise as much historically disturbed land as possible and preserve uncleared vegetation.

3.1.2 Direct Loss of Flora of Conservation Significance

No threatened or priority flora listed under the *Environment Protection and Biodiversity Conservation Act 1999* or the *Biodiversity Conservation Act 2016* have been recorded within the application area (Native Vegetation Solutions, 2020a; Native Vegetation Solutions, 2020b).

3.1.3 Degradation of Vegetation

Degradation of vegetation may occur as a result of:

- Uncontrolled vehicle access leading to physical damage of vegetation;
- Dust deposition on vegetation resulting from land clearing and construction activities;
- Introduction or spread of weeds;
- Leaks of containment structures, pipes, vehicles or equipment leading to contamination of soils, surface water or groundwater;
- Spills of chemicals or hydrocarbons leading to the contamination of soils, surface water or groundwater;
- Inappropriate disposal of domestic waste, or waste hydrocarbons and chemicals, leading to contamination of soils, surface water or groundwater;
- Accidental fire from clearing and associated activities.

3.2 Potential Impacts to Terrestrial Fauna

3.2.1 Fauna Deaths Due to Displacement

Clearing vegetation and associated development activities are likely to destroy reptile and mammal burrows or foraging habitat that are currently in use or could be used again. Clearing vegetation that forms part of the activity area of individual fauna has the potential to force these animals into adjacent areas. These areas may offer fewer resources placing individuals under survival pressure. It could also cause individuals to move into the territories of other individuals increasing competition for resources. Forced relocations could increase the possibility of predation (Terrestrial Ecosystems, 2021a; Terrestrial Ecosystems, 2021b).

3.2.2 Loss of Foraging Area or Habitat

Clearing vegetation and activities associated with the development will result in the loss of some small fauna that retreat to burrows, such as reptiles and mammals. Nocturnal species are unlikely to be active when most of the land clearing and construction work is taking place which may result in these individuals being adversely impacted when they attempt to escape. This loss of vegetation is unlikely to have a significant impact when considered in a bioregional context. Larger terrestrial animals and avian species will most often move to adjacent areas. These species will be required to establish new activity areas and home ranges, and this could result in the temporary displacement of resident species (Terrestrial Ecosystems, 2021a; Terrestrial Ecosystems, 2021b).

3.2.3 Increased Vehicle Strikes

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 small size of the application area, the impacts of road fauna deaths are likely to be low (Terrestrial Ecosystems, 2021a; Terrestrial Ecosystems, 2021b).

3.2.4 Fragmentation of Habitat

The project area already contains sparse vegetation and existing vehicle tracks, therefore the impacts associated with habitat fragmentation due to additional vehicle tracks would therefore be very low (Terrestrial Ecosystems, 2021a; Terrestrial Ecosystems, 2021b).

3.2.5 Introduced Fauna and Weeds

Based on dog and cat tracks sighted in adjacent survey areas, there is likely to be a low abundance of cats and wild dogs traversing the application area (Terrestrial Ecosystems, 2021a; Terrestrial Ecosystems, 2021b).

Introduced plant species can successfully and rapidly invade areas of cleared native vegetation or otherwise disturbed by humans. Introduced plant species may replace native species that provide shelter or foraging areas for native fauna. Major changes to the structure of vegetation will alter the fauna habitat and consequently may influence fauna species composition (Terrestrial Ecosystems, 2021a; Terrestrial Ecosystems, 2021b).

3.2.1 Fire

Accidental fire can potential occur from clearing and associated activities. Fire has been identified as one of the threatening processes for some conservation significant species as numerous small mammal and bird species rely on long unburnt vegetation. Large and widespread fires are unlikely to be a significant threat to native fauna species in and adjacent to the application area due to the sparseness of the vegetation (Terrestrial Ecosystems, 2021a; Terrestrial Ecosystems, 2021b).

3.2.2 Anthropogenic Activity

Unnatural noises, vibrations, artificial light sources, and vehicle and human movement in an area may be sufficient to force individuals or fauna species to move from adjacent areas or alter their activity periods. This form of disturbance is likely to occur during the initial vegetation clearing and when development activity commences. The overall impact is likely to be confined to a relatively small area and is unlikely to be a significant impact (Terrestrial Ecosystems, 2021a; Terrestrial Ecosystems, 2021b).

3.2.3 Dust

Dust generated from shifting topsoil and increased vehicle traffic can potentially degrade surrounding vegetation, reducing its ability to absorb sunlight and influencing photosynthetic rates. Degradation of these areas may potentially render habitat unsuitable for fauna (Terrestrial Ecosystems, 2021a; Terrestrial Ecosystems, 2021b).

3.3 Potential Impacts to Surface Water

3.3.1 Increased Turbidity

Erosion of topsoil from disturbed areas and steep slopes could occur. This can be managed with appropriate design, construction of stormwater infrastructure and progressive rehabilitation. There is a considerable buffer between the application area and the main downstream receiving riverine environment (Lake Raeside). The application area is located in the upper catchment, 17 km from the lake. Local erosion is unlikely to affect the wider environment (Hydrologia, 2023).

3.3.2 Altered Surface Water Flows

Much of the clearing for the proposed project infrastructure interacts with flow paths from catchments to the east. Roads cross most flow paths. Pits and other operational landforms lie in areas with concentrated flow paths. Existing flow paths will be modified and diverted in places by landforms and site-service areas, having some impact on flow characteristics in local catchments. These impacts can be minimised by returning diverted streamflow to the same catchment (Hydrologia, 2023).

3.3.3 Reduction in Catchment Area

Tops and sides of waste rock dumps and pits to the abandonment bund will be internally drained reducing the local catchment area. The total area of residual internally drained structures is 1.4 km². This mainly affects Catchments 3a, 3b and 3e, which contain most of the waste rock dumps. The free draining areas of these catchments falls by between 10% and 38%. This reduction reduces to 4.5% of the larger catchment that the application area is located in (Catchment 3). Total catchment reduction, to Lake Raeside, is 0.8% (Hydrologia, 2023).

4. MANAGEMENT MEASURES

The proposed clearing within the application area has been minimised as far as possible for the development of the Mt Celia Gold Project.

Legacy Iron believes the potential impacts to flora and vegetation, fauna and surface water within the application area are low and can be mitigated appropriately with the management measures outlined in Table 4.1.

Table 4.1 Potential Impacts and Mitigation Measures

Impact	Pathways	Management Measures
Potential Impacts to Flora		
Direct Loss of Vegetation	<ul style="list-style-type: none"> Clearing 	<ul style="list-style-type: none"> Where possible previously disturbed area, such as existing tracks, will be utilised to minimise the clearing required to safely develop project infrastructure. Clearing Permit conditions will be read and understood prior to clearing activities commencing. Clearing will occur progressively. Education and training provided to contractors and staff on following clearing procedures. Areas will be adequately surveyed and visibly marked to ensure only the required clearing is undertaken. Inspection of clearing boundary prior to clearing. Cleared areas will be surveyed and disturbance tracked against approved limits. Access to the Project will be via approved roads and tracks only.
Direct Loss of Flora of Conservation Significance		<ul style="list-style-type: none"> No threatened or priority flora identified, if new threatened species are listed, they will be demarcated and avoided. Ensure staff and contractors are aware of the location of significant flora and vegetation on-site and their responsibility to ensure they are protected.
Degradation of Vegetation	<ul style="list-style-type: none"> Dust deposition Vehicle movements Weeds Accidental fire Chemical spills or leaks Waste handling 	<ul style="list-style-type: none"> Dust suppression activities will be implemented in high traffic areas. Speed limits will be implemented on vehicle access roads. Cleared areas will be progressively rehabilitated when no longer required. All vehicles and workshops will have fire extinguishing equipment. Staff and contractors will be trained in emergency procedures. Heavy machinery will have a prestart inspection before clearing activities commence. Hot work permits will be required for hot work. Smoking will occur only in designated areas with controlled disposal of cigarette butts. Weed hygiene procedure and inspection for vehicles and machinery will be implemented. Regular weed inspections will be undertaken across the Project. A weed management plan will be developed. A weed control program will be implemented if an increase in weed populations is observed. Chemicals and hydrocarbons will be kept banded and in designated storage areas. Refuelling will be undertaken in designated areas with appropriately secondary containment. Staff and contractors will be trained in spill response and clean up. Spill kits will be available in high-risk handling areas. Spills will be reported and cleaned up immediately. Consumable waste will be segregated into putrescible, inert, recyclable and contaminated streams. Separate bin receptacles will be available at strategical locations across the Project to ensure appropriate waste disposal. Hazardous wastes will be transported offsite for disposal by a licenced contractor. A licenced landfill facility will be operated on site for putrescible and inert waste materials. Staff and contractors will be educated on appropriate waste disposal at the project induction.
Potential Impacts to Fauna		
Fauna Deaths due to Displacement Loss of Foraging Area or Habitat Fragmentation of Habitat	<ul style="list-style-type: none"> Clearing 	<ul style="list-style-type: none"> Existing disturbed area and tracks will be utilised where possible. A Vertebrate Fauna Management Plan will be developed prior to clearing activities commencing. Education on fauna interactions for employees/contractors at site inductions. Reporting of fauna interactions. Clearing area will be checked for Malleefowl presence and mounds prior to clearing activity commencing and any mounds demarcated. Sightings and observations of Malleefowl, their mounds or Long-tailed dunnart will be recorded in the Project fauna register. Disturbance will be progressively rehabilitated as soon as areas become available. Habitat characteristics will be reinstated within the Project area during rehabilitation activities to encourage fauna recolonisation.

Impact	Pathways	Management Measures
Vehicle Strikes	<ul style="list-style-type: none"> Machinery and vehicle movements 	<ul style="list-style-type: none"> Driving to approved roads, tracks and to designated speed limits. Education on fauna interactions for employees/contractors at site inductions. Reporting of fauna interactions.
Introduced Fauna and Weeds	<ul style="list-style-type: none"> Clearing Vehicle hygiene practices Waste handling and disposal 	<ul style="list-style-type: none"> Weed hygiene procedure and inspection for vehicles and machinery will be implemented. Regular weed inspections will be undertaken across the Project. A weed management plan will be developed. A weed control program will be implemented if an increase in weed populations is observed. Driving to approved roads, tracks and to designated speed limits. Education on fauna interactions for employees/contractors at site inductions. Reporting of fauna interactions. Consumable waste will be segregated into putrescible, inert, recyclable and contaminated streams. Separate bin receptacles will be available at strategical locations across the Project to ensure appropriate waste disposal. Hazardous wastes will be transported offsite for disposal by a licenced contractor. A licenced landfill facility will be operated on site for putrescible and inert waste materials. Staff and contractors will be educated on appropriate waste disposal at the project induction. Non-native fauna sightings will be recorded. A feral animal control program will be implemented if sightings significantly increase.
Fire	<ul style="list-style-type: none"> Machinery use Human behaviour 	<ul style="list-style-type: none"> All vehicles and workshops will have fire extinguishing equipment. Staff and contractors will be trained in emergency procedures. Heavy machinery will have a prestart inspection before clearing activities commence. Hot work permits will be required for hot work. Smoking will occur only in designated areas with controlled disposal of cigarette butts.
Anthropogenic Activity	<ul style="list-style-type: none"> Interaction with fauna 	<ul style="list-style-type: none"> Education on fauna interactions for employees/contractors at site inductions. Reporting of fauna interactions.
Dust	<ul style="list-style-type: none"> Clearing Vehicle and machinery movements 	<ul style="list-style-type: none"> Dust suppression activities will be implemented in high traffic areas. Speed limits will be implemented on vehicle access roads. Cleared areas will be progressively rehabilitated when no longer required.
Potential Impacts to Surface Water		
Increased Turbidity	<ul style="list-style-type: none"> Stormwater runoff 	<ul style="list-style-type: none"> Diversion drains designed for storm events will be constructed to engineered designs for capacity of predicted maximum flow, and rip-rap at areas of predicted erosive potential Landform and stockpiles will have windrows surrounding to prevent migration of any sediment from erosion events. Landforms and stockpiles will have adequate drainage installed to direct water away from the base of the landform. Diverted flows will be returned to the same catchment area.
Altered Surface Water Flow	<ul style="list-style-type: none"> Clearing Infrastructure development 	

5. STAKEHOLDER CONSULTATION

Legacy Iron recognises the importance of developing and maintaining relationships with stakeholders. Legacy Iron have developed a Stakeholder Engagement Strategy to provide a framework for structured, meaningful, and effective stakeholder engagement and management.

The purpose of the Legacy Iron stakeholder engagement strategy is to ensure the effective involvement of stakeholders throughout the proposed life of the Project. This involvement is required for all phases of the operation from exploration, planning and approvals; to construction, commissioning and operation; to final decommissioning and closure.

The stakeholder strategy is used to:

- Identify the full range of stakeholders with an interest in the Project;

- Establish and maintain a consistent and coordinated approach for communication with the local community, government agencies, special interest groups and industry;
- Identify known and emerging environmental, social and cultural heritage factors associated with the Project, the potential impacts and management strategies to minimise or mitigate the potential impacts;
- Consider stakeholder concerns during all phases of the Project decision making process; and
- Ensure timely and accurate feedback and information on how any closure will be managed.

Legacy Iron understands that expectations regarding the types and level of stakeholder engagement are not static and will shift according to the Project phase and the social, economic and environmental conditions of the day.

To maintain an effective stakeholder engagement strategy and maintain its relevance over the long term, Legacy Iron will maintain a Stakeholder Engagement Register and undertake regular review of the register as part of its Environmental Management System (EMS). Legacy Iron aims to remain alert and sensitive to any changes in public perception of the Project and will continue to investigate, define and discuss issues with relevant stakeholders.

5.1 Ongoing Community and Stakeholder Engagement

Stakeholder engagement is a continuous process that will be conducted throughout the life of the operation. As a minimum, The Stakeholders and interested parties that have been identified are:

- Department of Water and Environmental Regulation (DWER)
- Department of Mines, Industry Regulation and Safety (DMIRS)
- Department of Planning, Lands & Heritage (DPLH)
- Department of Biodiversity, Conservation and Attractions (DBCA)
- Main Roads
- Nyalpa Pirniku Native Title Group
- Mt Weld Pastoral Station
- Yundamindra Pastoral Station
- The Local Government - Shire of Menzies
- Regional businesses including those located in Leonora, Menzies and Laverton

Table 5.1 Stakeholder Engagement Activities Summary

Date	Description of engagement	Stakeholders	Stakeholder comments/issue	Proponent Response and/or resolution	Stakeholder Response
Feb 2022 – Mar 2023	Site Visit	Nyalpa Pirniku	Land use and interaction with Registered Aboriginal Heritage Site and other heritage values	Communication with Nyalpa Pirniku re cultural heritage, potential employment / business opportunities and cultural awareness training	Nyalpa Pirniku agreement signed and comfortable with project proceeding
February 2023	Conversation	Mt Weld Pastoral Station	Land use and interaction with Mt Weld Pastoral Station	Communications with the Mt Weld Pastoral Station to explain the scope and layout of the Project.	Mt Weld Pastoral Station is satisfied with the proposed Mt Celia Project
February 2023	Conversation	Yundamindra Pastoral Station	Land use and interaction with Yundamindra Pastoral Station	Communications with the Yundamindra Pastoral Station to explain the scope and layout of the Project.	Yundamindra Pastoral Station is satisfied with the proposed Mt Celia Project
February 2023	Conversation	Shire of Menzies	Project interaction with Mt Celia Public Road	Project roads have been realigned so there is only one intersection crossing with Mt Celia Road	Shire of Menzies is satisfied with this resolution
May 2023	Meeting	DMIRS	Discussion regarding content expectations and timelines for the submission of the NVCP.	NVCP will be aligned with feedback from DMIRS and approval timelines taken into account.	DMIRS satisfied that Legacy Iron will align the NVCP to reflect feedback given and

Date	Description of engagement	Stakeholders	Stakeholder comments/issue	Proponent Response and/or resolution	Stakeholder Response
					have understood timelines involved.

6. ASSESSMENT AGAINST CLEARING PRINCIPLES

The Schedule 5 of the *EP Act* outline 10 principles that provide decision makers with a guide on whether native vegetation should be cleared. The principles are used as a comparative tool by Department of Water and Environmental Regulation and Department of Mining, Industry Regulation and Safety in determining whether clearing activities are environmentally acceptable and capable of being appropriately managed. An assessment of the proposed to clear up to 261 ha of clearing against the 10 clearing principles has been undertaken as is summarised in Table 6.1.

Table 6.1 Summary of Assessment Against the 10 Clearing Principles

Clearing Principle	In not at variance	May be at variance
a. Native vegetation should not be cleared if it comprises a high level of biological diversity.	X	
b. Native vegetation should not be cleared if it comprises the whole or part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to WA.		X
c. Native vegetation should not be cleared if it includes, or is necessary for the continued existence of rare flora.	X	
d. Native vegetation should not be cleared if it comprises the whole or part of or is necessary for the maintenance of a threatened ecological community (TEC).	X	
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.	X	
f. Native vegetation should not be cleared if it is growing, in, or in association with, an environment associated with a watercourse or wetland.	X	
g. Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	X	
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.	X	
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.	X	
j. Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.	X	

a. Native vegetation should not be cleared if it comprises a high level of biological diversity.

The vegetation communities described within the flora and fauna assessment is common throughout the wider region (Native Vegetation Solutions, 2020a; Native Vegetation Solutions, 2020b). The vegetation is not representative of a Threatened or Priority Ecological Community.

The vegetation within the application area ranges in condition between degraded and very good but is not considered of high biological diversity.

The proposed clearing is not considered at variance with this Principle.

b. Native vegetation should not be cleared if it comprises the whole or part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to WA.

Malleefowl tracks were recorded during the survey, indicating Malleefowl are foraging within the application area, however no mounds were sighted and it has been concluded that the habitat types observed within the application area are unsuitable for Malleefowl breeding habitat.

Although not recorded, it is likely that the Long-tailed Dunnart is present within the rocky outcrop areas within the application area. It is expected that Long-tailed dunnart will migrate to nearby adjacent rocky outcrop habitat outside of the infrastructure clearing footprint until suitable habitat is returned during rehabilitation activities.

Given the unavoidable clearing of some of the rocky outcrop habitat where Long-tailed Dunnart may be present, as well as the unavoidable clearing of potential foraging habitat for Malleefowl, clearing may be considered at variance with this Principle.

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

No flora listed as Threatened or Priority flora pursuant to the *EPBC Act* or the *BC Act* were identified in the flora and vegetation assessment (Native Vegetation Solutions, 2020a; Native Vegetation Solutions, 2020b).

Due to no conservation significant flora being identified within the application area, clearing is not considered at variance with this Principle.

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

No Threatened or Priority Ecological Community listed under the *EPBC Act* or by the *BC Act* occur within the application area.

Clearing is not considered at variance with this Principle.

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

The flora and vegetation survey undertaken indicates that the application area is located within Pre-European Beard vegetation association Group 18 in the Eastern Murchison subregion. Group 18 is described as low woodland comprised of mulga (*Acacia aneura*). There is >99% of Group 18 vegetation remaining in the Eastern Murchison subregion and the application comprises only 0.02% of this area.

Clearing is not considered at variance with this 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.

There are no water bodies or permanent rivers or creeks within or associated with the application area.

The proposed clearing is not considered at variance with this Principle.

g. Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.

The potential impacts of land degradation associated with clearing will be managed with the mitigation measures outlined in Section 4.

The clearing is not anticipated to cause significant land degradation and is not considered a variance to this 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.

Water Reserve R11185 (Figure 2.14) is located within the application area however no clearing activities will interact or impact on the water reserve.

The application area is not in proximity to any other conservation areas. The nearest conservation area of Goongarrie National Park is 85km to the south west of the application area.

The proposed clearing is not considered at variance with this 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.

Surface water quality of nearby Lake Raeside is highly saline when water levels are low to fresh or moderately saline when flooded (Hydrologia, 2023). Groundwater sampled at the application area is considered brackish with a TDS of between 6,700mg/L and 16,000 mg/L (AMC, 2021b).

The potential for contamination of surface or groundwater is low. Hazardous substances and contaminated water will be contained and banded to prevent release to the environment. Dust suppression of disturbed areas with saline water is unlikely to lead to significant salt build over the short term.

The proposed clearing is not considered at variance with this Principle.

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

Rainfall is variable with an average rainfall of approximately 281mm and an evaporation rate of approximately 2,400mm. Drainage channels through the application area receive intermittent, fresh storm flows after heavy rainfall and drainage lines dry out rapidly after flow events. Drainage lines are small and flows do not cause a significant flood risk (Hydrologia, 2023).

The proposed clearing is not considered at variance with this Principle.

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APPENDIX 1 – EVIDENCE OF AUTHORITY



MINING TENEMENT SUMMARY REPORT

MINING LEASE 39/1127

Status: Live

TENEMENT SUMMARY

Area: 80.75000 HA	Death Reason :
Mark Out : 15/11/2017 06:20:00	Death Date :
Received : 22/11/2017 15:00:21	Commence : 07/06/2018
Term Granted : 21 Years	

CURRENT HOLDER DETAILS

Name and Address

LEGACY IRON ORE LTD
LEGACY IRON ORE LIMITED, PO BOX 5768, ST. GEORGES TERRACE, PERTH ST GEORGES TCE, WA,
6831, xxxxxxxxxxxx@legacyiron.com.au, xxxxx000

DESCRIPTION

Locality: Mt Celia
Datum: Datum: GDA94, Zone 51 Datum situated
6740205.856mN 451520.068mE
Boundary: Then 6738947.301mN 451525.472mE Then
6739455.641mN 450994.058mE Then 6740200.193mN
450222.631mE Back to Datum Identical boundaries to
P39/5007

Area :	Type	Dealing No	Start Date	Area
	Surveyed		02/11/2018	80.75000 HA
	Granted		07/06/2018	81.82220 HA
	Applied For		15/11/2017	81.82220 HA

SHIRE DETAILS

Shire	Shire No	Start	End	Area
MENZIES SHIRE	5390	22/11/2017		80.75000 HA



MINING TENEMENT SUMMARY REPORT

MINING LEASE 39/1128

Status: Live

TENEMENT SUMMARY

Area: 391.00000 HA	Death Reason :
Mark Out : 15/11/2017 12:26:00	Death Date :
Received : 22/11/2017 15:00:21	Commence : 07/11/2018
Term Granted : 21 Years	

CURRENT HOLDER DETAILS

Name and Address

LEGACY IRON ORE LTD
LEGACY IRON ORE LIMITED, PO BOX 5768, ST. GEORGES TERRACE, PERTH ST GEORGES TCE, WA,
6831, xxxxxxxxxxxx@legacyiron.com.au, xxxxx000

DESCRIPTION

Locality: Mt Celia
Datum: Datum: GDA94, Zone 51 Datum situated
6743884.898mN 448271.122mE
Boundary: Then 6743877.388mN 446654.569mE Then
6743876.999mN 446573.371mE Then 6744977.339mN
447568.558mE Then 6743576.467mN 449057.694mE
Then 6743009.438mN 449702.852mE Then
6742049.415mN 450795.158mE Then 6742045.492mN
449895.858mE Then 6742038.210mN 448279.571mE
Then 6743002.996mN 448275.156mE Back to Datum
6743884.898mN 448271.122mE Identical boundaries to
P39/5002 and P39/5003

Area :	Type	Dealing No	Start Date	Area
	Surveyed		31/01/2019	391.00000 HA
	Granted		07/11/2018	390.67260 HA
	Applied For		15/11/2017	390.67260 HA

SHIRE DETAILS

Shire	Shire No	Start	End	Area
MENZIES SHIRE	5390	22/11/2017		391.00000 HA



MINING TENEMENT SUMMARY REPORT

MINING LEASE 39/1145

Status: Live

TENEMENT SUMMARY

Area: 1,403.05200 HA	Death Reason :
Mark Out : 03/09/2020 13:31:00	Death Date :
Received : 11/09/2020 11:32:00	Commence : 23/05/2023
Term Granted : 21 Years	

CURRENT HOLDER DETAILS

Name and Address

LEGACY IRON ORE LTD
HETHERINGTON EXPLORATION & MINING TITLE SERVICES PTY LTD, C/- HETHERINGTON EXPLORATION & MINING TITLE SERVICES PTY LTD, SUITE 404, GROUND FLOOR, 50 ST GEORGES TERRACE, PERTH, WA, 6000, xxxxx@hemts.com.au, xxxxxxx977

DESCRIPTION

Locality: Mount Celia
Datum: Datum situated at GDA94 Zone 51 6743878.187 metres North and 446656.214 metres East.
Boundary: thence to 6743887.449 metres North and 448274.469 metres East thence to 6742030.222 metres North and 448278.540 metres East thence to 6742059.363 metres North and 453128.423 metres East thence to 6739344.683 metres North and 453141.637 metres East thence to 6738387.451 metres North and 452111.288 metres East thence to 6738947.488 metres North and 451525.471 metres East thence to 6740203.540 metres North and 451516.872 metres East thence to 6740206.118 metres North and 450229.537 metres East thence to 6740904.116 metres North and 449493.359 metres East thence to 6740423.464 metres North and 449056.125 metres East thence to 6741207.588 metres North and 448277.130 metres East thence to 6741078.634 metres North and 448151.642 metres East thence to 6741333.350 metres North and 447873.343 metres East thence to 6742030.698 metres North and 446663.283 metres East Back to Datum 6743878.187 metres North and 446656.214 metres East.

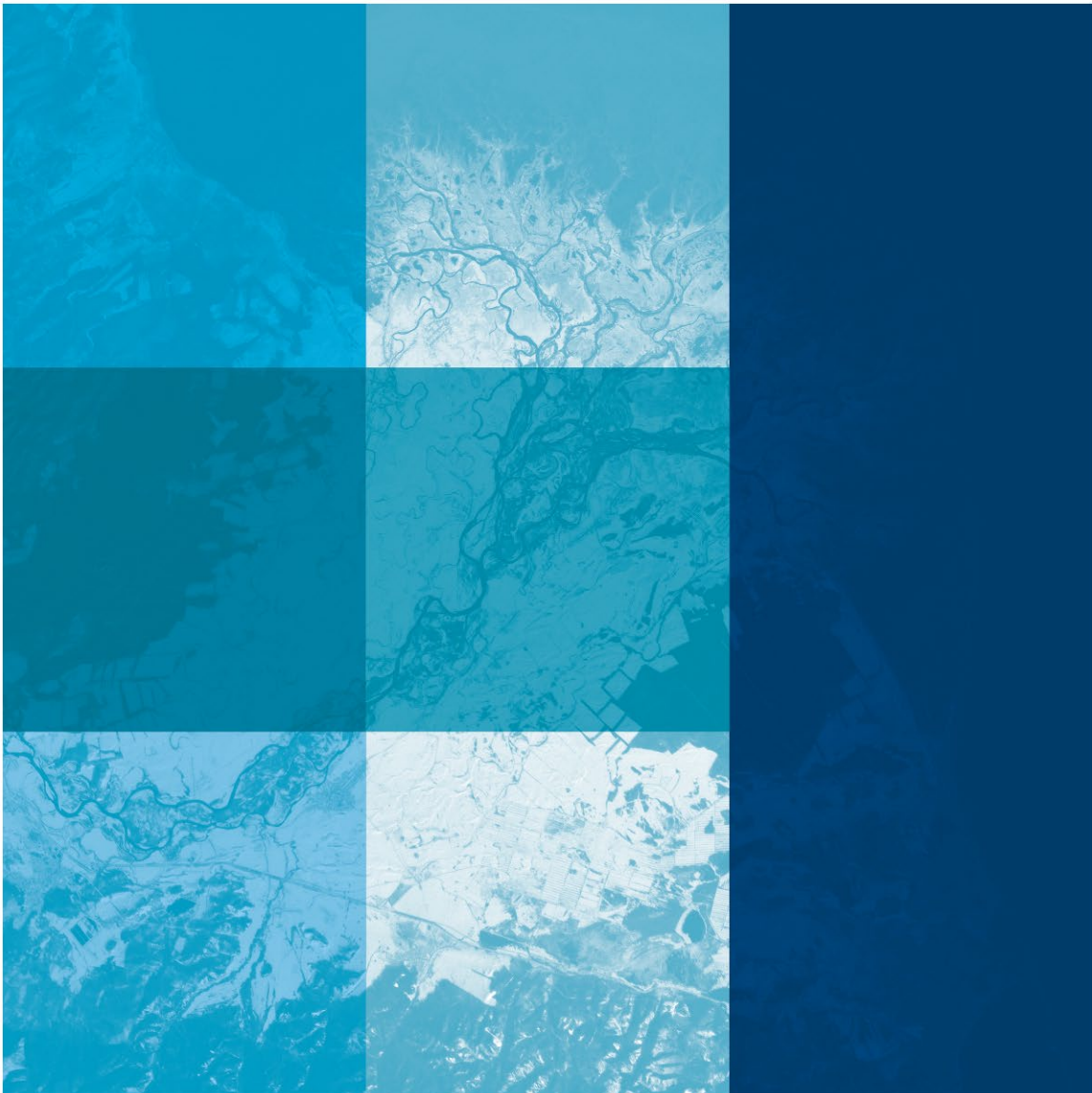
Area :	Type	Dealing No	Start Date	Area
	Granted		23/05/2023	1,403.05200 HA
	Applied For		03/09/2020	1,401.11000 HA

SHIRE DETAILS

Shire	Shire No	Start	End	Area
MENZIES SHIRE	5390	11/09/2020		1,403.05200 HA



APPENDIX 2 – HYDROLOGIA HYDROLOGY REPORT



Report: Surface Water Assessment - Mt Celia Gold Project

Client: Legacy Iron Ore Ltd

Job number: J0100163

Date: 28 February 2023

Executive Summary

Introduction

Legacy Iron Ore Ltd is planning to develop the Mt Celia Project. The site is located along the Mt Celia Road, 20 km northeast of Lake Raeside and 15 km southwest of Lake Carey. Proposed infrastructure includes a number of open-cut pits and associated waste rock dumps (WRD's), stockpiles, a camp, roads and support infrastructure. Ore will be trucked offsite for processing.

This report presents a surface water assessment for the project. It is expected that this assessment will contribute to the Mining Proposal and Mine Closure Plan.

Catchments

The mine site extends 7 km across an east-west trending catchment, draining to Lake Raeside. Low ridges and hills define the eastern edge of the catchment, 5 km upstream of the site. Lake Raeside lies about 17 km southwest of the site. Mount Celia Road traverses through the area of the site.

Defined drainage lines, with shallow incised channels, form in the low hills on the eastern edge of the catchment. These drainage lines dissipate into overland flow through the area of Mount Celia Road and the general site footprint.

Stormwater flow from the area of the site merges with flow from catchments to the north and south before entering Lake Raeside. The total area of the catchment containing the site that contributes to Lake Raeside is 369 km². Catchments contributing to the area of the site amount to 32 km² or 9% of the total catchment. The overall site footprint covers an area of approximately 9 km² or 2% of the total catchment.

Lake Raeside is a long chain of lakes and low-lying areas extending from west to south of the site. The lake is saline, often dry, filling to various degrees after larger rainfall events. Inflow occurs from direct rainfall and flow from creeks and wash plain on all sides, including the area of the site.

Surface hydrology

The site is located in the goldfields. The area is arid with low, variable rainfall and high evaporation year-round, very hot summers and cold winters.

Average annual rainfall (as observed at Laverton BoM Station 012045 from 1899-2022) is 235 mm. Annual rainfall can vary by between -50 and +182% (between the 10 and 90 percentiles around the median).

Average annual evaporation (as recorded at BoM Station 012038 Kalgoorlie-Boulder Airport for the years 1966 to 2016) is approximately 2,635 mm, much higher than average rainfall. Evaporation exceeds rainfall in every month of the year but June.

The landscape through the flatter central area of the site is plain with scattered dunes and small breakaways; chief soils are red earthy sands. Low lateritic breakaways on granites and gneisses lies in the hilly areas, particularly toward the northern and southern end of the site; chief soils are shallow stony sands on steeper slopes, sandy loams with some alluvial plains.

The site is located in a gold mining and pastoral area. There are a number of active and residual mines in the region. Parts of the site have been mined in the past. Agricultural

activity in the area is low intensity pastoral grazing. The Mount Celia Road passes through the site.

Downstream areas potentially affected by the project are:

- Drainage lines and overland flow paths crossing roads and intersected by project infrastructure (including pits and WRL's); and
- Drainage lines and flow paths immediately downstream of the main mine site infrastructure.

The main values and beneficiaries of surface water through the project area relate to:

- Maintenance of native vegetation communities; and
- Maintenance of the ecosystem of Lake Raeside.

The site is located in the Salt Lake Basin surface water management area (DWER 2022). It is not in a proclaimed surface water management area (under the *Rights in Water and Irrigation Act 1914*).

It is likely that the quality of stormwater flows sourced from the site will largely be fresh but may be turbid. There are no pools or dams in the area of the mine site. The only surface water will be in intermittently flowing drainage lines. Lake Raeside is an internally drained, salt lake system. Salinity of water in the lake will vary from near fresh to hypersaline depending on water levels.

Flood risk for the site is low. Relatively small catchments to the east of the site generate stormwater that traverses the site via a number of concentrated overland flow paths and shallow, diffuse drainage lines. There are no large drainage lines through the area of the proposed infrastructure.

However, management of stormwater flows where they intersect infrastructure is required to prevent scour and ponding. It is likely that these flow paths can be readily managed using land grading, small drainage structures (drains and road crossings) and levees (to protect pits from stormwater ingress).

Potential impacts on the environment

Potential impacts of the project on the downstream environment during the operational phase are:

- Diversion of flow paths changing flow conditions in downstream areas;
- Reduced streamflow as a result of a reduction in catchment area;
- Erosion associated with disturbed areas, steep slopes and site and road infrastructure, leading to scour and increased turbidity of stormwater; and
- Impacts of mine infrastructure and mining activities on stormwater quality.

Potential residual impacts of the project on the environment include:

- Modification to natural flow paths due to permanent diversions changing flow conditions in nearby downstream areas;
- Reduction in catchment area due to internal drainage on residual structures (proposed pits and WRD's) reducing flow to nearby downstream areas; and
- Erosion from steep slopes and in diversion drains causing siltation and increased turbidity of stormwater.

Most impacts can be managed using sound mine planning and infrastructure design practices and maintenance during the operational phase. On closure, a portion of the catchment

contributing to Lake Raeside, associated with residual pits and waste landforms, will be internally drained. Total catchment reduction, to Lake Raeside, is 0.8%. This is a small component of the Lake's catchment and is unlikely to affect the lake's water balance.

Closure stormwater management

Advice at a concept level on management of surface water across the site for the closure phase of the project is presented.

Elements of the mine site that need to be addressed for closure are:

- Residual pits;
- Waste rock dumps; and
- The rehabilitated site landform.

Residual pit voids will remain after closure and will be isolated by establishment of abandonment bunds. A number of levees and drains are suggested to protect pits from ingress of external stormwater in areas with substantial overland flow or near defined flow paths.

The final waste rock dumps should be stabilised to prevent scour. Stormwater generated on the dump top and sides should be retained and disposed of on the structure.

On closure, it is expected that general site infrastructure and roads will be removed, the topsoil stockpiles will be used in site rehabilitation and the landform returned to natural contours and revegetated.

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1. Introduction

1.1 Background

Legacy Iron Ore Ltd is planning to develop the Mt Celia Project. The site is located along the Mt Celia Road, about 20 km northeast of Lake Raeside and 15 km southwest of Lake Carey. A number of defined drainage pathways traverse the site. The site location and catchments are shown in Figure 1.

Proposed infrastructure at the site includes a number of open-cut pits and associated waste rock dumps (WRD's), stockpiles, camp, roads and support infrastructure. Ore will be trucked offsite for processing. The proposed site layout is shown in Figure 2.

This report presents a surface water assessment for the project. It is expected that this assessment will contribute to the Mining Proposal and Mine Closure Plan.

1.2 Scope of work

The scope of work was to undertake a surface water assessment for the Mt Celia Gold Project to inform the Mining Proposal and Mine Closure Plan.

The deliverable is this report presenting the results of the investigation.

1.3 Summary of methods

The work was undertaken in the following stages:

- Source and review data;
- Baseline hydrology description;
- Flood risk assessment;
- Closure surface water management; and
- Reporting.

Source data

The following data were used in the assessment:

- Site infrastructure layout, from Legacy Iron Ore;
- Site digital terrain model (DTM) and aerial imagery for the site, supplied by Legacy Iron Ore;
- Regional topographic data (SRTM DEM-H), supplied by Geoscience Australia;
- Weather data, supplied by the Bureau of Meteorology;
- Other data and reports, as referenced through this report.

Regional topographic data available for the area of the site and surrounding catchments were a one second SRTM digital elevation model, supplied by Geoscience Australia (GA 2011). This is a nation-wide ground surface model with a spatial resolution of approximately 30 m and a vertical accuracy of up to 7.6 m. This dataset was used to define drainage lines and catchments for the baseline assessment and to model catchment hydrology.

A one metre DTM for the area of the site was supplied by Legacy Iron Ore. The survey was undertaken on 22 September 2022 using UAV collected photogrammetry and processed into

a GeoTIF DTM format with 1 m cell size. Reported horizontal and vertical accuracy is ± 0.1 m RMSE.

The site survey extent did not cover the complete catchment contributing to the site, so a composite DTM was built by merging site survey with SRTM data. The SRTM elevation data were adjusted vertically to better match the upstream edge of the site survey. The merged DTM was used for the hydrologic and hydraulic modelling. The extent of the two topographic data sources is given in Appendix A.

For characterisation of climate, a daily record generated for the site using SILO Data Drill (Queensland Government 2022) and Bureau of Meteorology observed weather data for Stations 012045 Laverton and 012038 Kalgoorlie-Boulder Airport (BoM 2022a) were used. Design rainfall intensity data were used for the flood modelling (BoM 2003, BoM 2022b, ARR 2022).

Baseline assessment

The baseline assessment was developed to meet the WA guideline for mining proposals Government of WA (2020).

Assessment of potential impacts on the environment was included, based on assessment of the location of proposed infrastructure in the environment. It was assumed that footprints of waste rock dumps and pits are permanently internally drained on mine closure.

Flooding characteristics for the site were defined using hydraulic modelling of drainage lines that pass through the site. Potential risks of flood impacts to human life, mine operation and the environment were considered.

Closure surface water management

The closure water management strategy defines management of stormwater across the site at a concept level for the post-closure phase of the mine.

The baseline hydrology and flood risk modelling combined with the proposed mine closure layout were used to assess surface water interaction with residual mine infrastructure after closure of the site. This included assessment of flooding in the PMF event, post-closure surface water management structures and alteration of local hydrology.

Modelling

Hydrologic and hydraulic models were setup for the area of the site and used to model existing conditions throughout the site.

Hydrology and channel hydraulics was modelled using the Mike SHE model (DHI 2022). Mike SHE is a detailed catchment hydrology and hydraulic model. It was used here to characterise catchment hydrology and flooding characteristics of drainage lines through the site. A rain-on-grid approach was used.

The 1% and annual exceedance probability (AEP) and probable maximum precipitation (PMP) design rainfall events were modelled.

The Mike SHE model was parameterised and calibrated using the available data. The Australian Rainfall and Runoff (ARR) regional flood frequency estimation tool (ARR 2022; RFFE 2016; Ball *et al.* 2016) was not available for the site. Published sources and experience applying the model in similar environments were used to inform the model parameterisation.

Details of model parameters adopted are given in Appendix A. More detail on the Mike SHE software is given at DHI (2022).

1.4 Limitations

This report has been prepared by Hydrologia Pty Ltd for Legacy Iron Ore Ltd and may only be used and relied on by Legacy Iron Ore Ltd for the purpose agreed between Hydrologia Pty Ltd and Legacy Iron Ore Ltd as set out in Section 2.2 of this report.

Hydrologia Pty Ltd otherwise disclaims responsibility to any person other than Legacy Iron Ore Ltd arising in connection with this report. Hydrologia Pty Ltd also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by Hydrologia Pty Ltd in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

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

The opinions, conclusions and any recommendations in this report are based on assumptions made by Hydrologia Pty Ltd described in this report (refer Section 2.3 of this report). Hydrologia Pty Ltd disclaims liability arising from any of the assumptions being incorrect.

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

Model results and analysis

Flood magnitude predictions have a probability of occurrence. For example, a predicted 1% (or 1 in 100) AEP flood extent has a 1% probability of occurring or being exceeded in any given year. A flood of this magnitude could occur more than once in a year.

Floods greater than 1% AEP can occur. During such floods, impacts from flooding could be greater than indicated in this study. Conversely properties within the study area can be affected by floods of a lesser magnitude.

Predicted flood level, depth and velocity is predicted based on the available data and on assumptions and limitations described in our report. These results should be read in conjunction with this report.

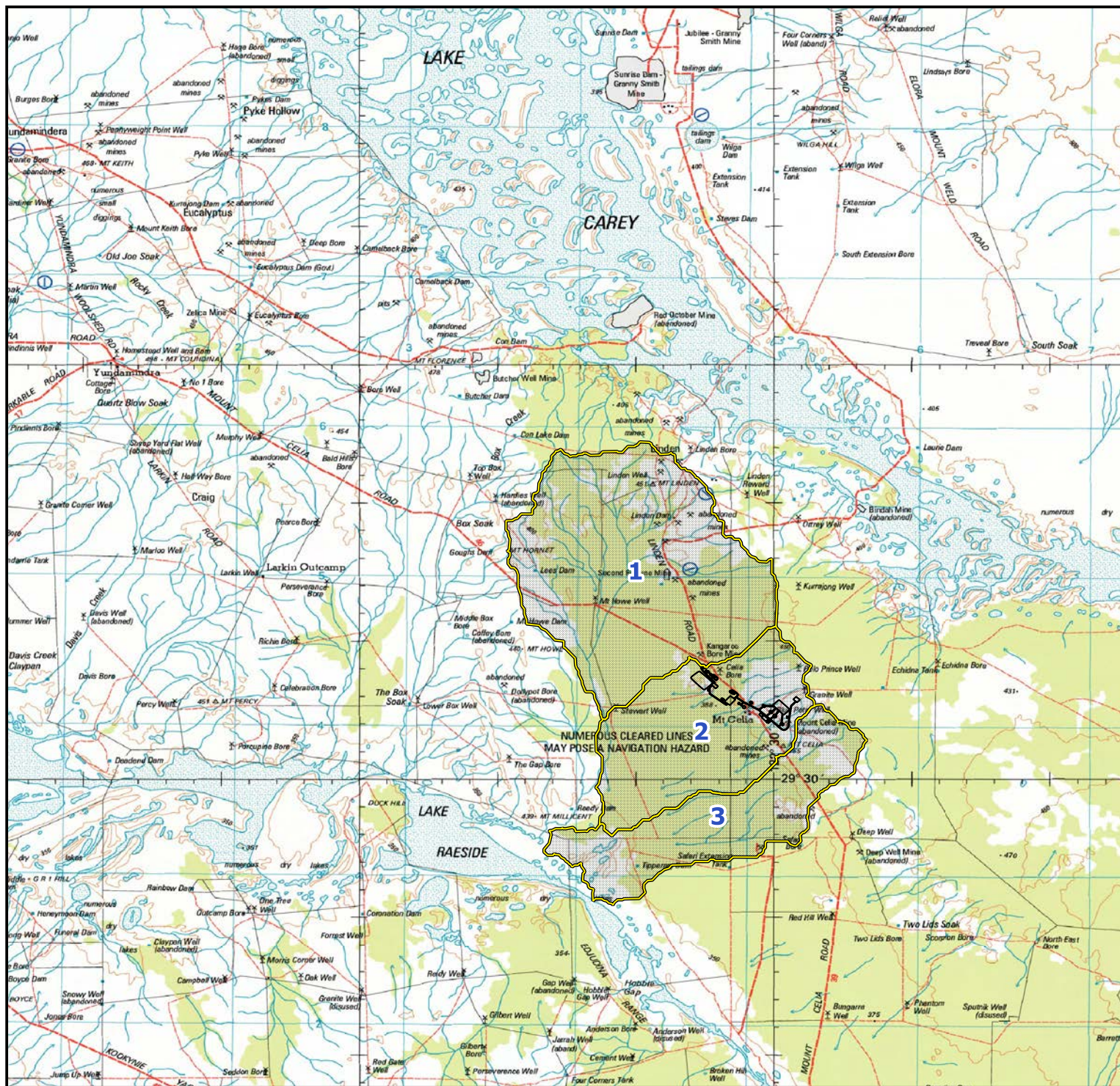
The Mike SHE model was applied using a 20 m square grid derived from the combined 1 second SRTM data provided by Geoscience Australia and site DTM provided by Legacy Iron Ore. Topographic and drainage features, such as swales, gutters, levees, roads, changes in land use or hydraulic roughness are not necessarily accurately represented in the model. Buildings or elevated flood levels at or in buildings are not represented in the original topographic data nor in the model. Underground pipework, culverts or other structures are not represented in the model.

Local increases in flood levels, depths and/or velocities from those predicted in this study can occur as a result of local factors. Using more accurate topography will also affect the predicted flood extent.

No account of the impact of climate change on the magnitude or frequency of occurrence of flood events has been considered. It is widely accepted in the scientific community that changing climate could affect rainfall and runoff in Australia, including in the project area. Accordingly, the probability of occurrence for predictions given in this study could change in the future.

Catchments and drainage lines are indicative and based on the available data.

The environmental impact assessment is based on the information available at this time. This information shows the location of pits and key mining infrastructure.



Legend

Infrastructure

Regional catchments

Data source:
 250K - Geoscience Australia
 Infrastructure - Legacy Iron Ore
 Catchments - Hydrologia

Location



Map sheet location

LAVERTON SH5102	RASON SH5103
EDJUPINA SH5106	MINIGWAL SH5107
KURNALPI SH5110	CUNDEELEE SH5111



1,750

3,500

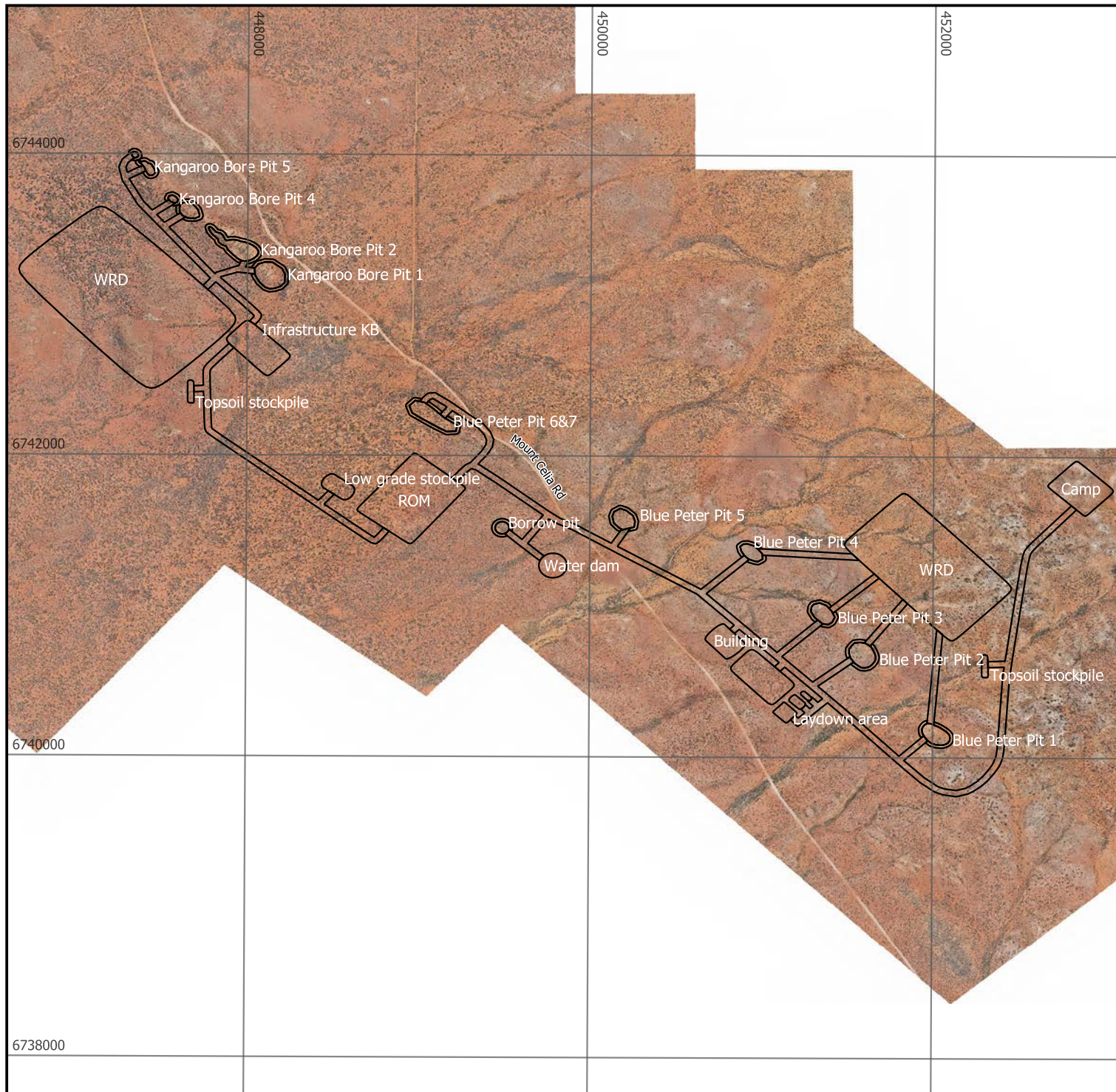
5,250 m



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Job No: J0100163

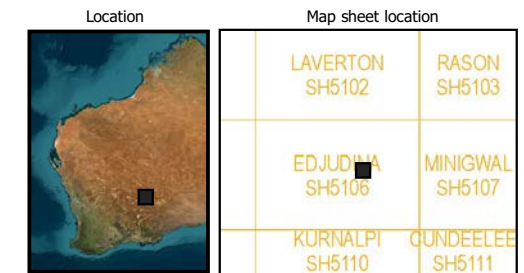
Figure 1
Site location and regional catchments



Legend

□ Infrastructure

Data source:
Imagery, Infrastructure - Legacy Iron Ore



**Project: Surface Water Assessment - Mt Celia
Gold Project**
Job No: J0100163

Figure 2
Proposed site layout

2. Baseline hydrology

2.1 Introduction

This section presents a description of baseline hydrology for the proposed Mt Celia mine site and local catchments.

The description is presented in a format recommended in the WA Government's guidelines for mining proposals (Government of WA 2020). Potential impacts of the mine on the environment are discussed in Section 4. This description of baseline hydrology and potential impacts informs the closure stormwater management strategy (Section 5).

2.2 Catchments

The mine site lies extends for 7 km across an east-west trending catchment, draining to Lake Raeside. Low ridges and hills define the eastern edge of the catchment, 5 km upstream of the site. Lake Raeside lies 17 km southwest of the site. Mount Celia Road traverses through the area of the site.

Regional catchments, showing the site in relation to drainage to Lake Raeside, are mapped in Figure 1; details of local catchments through and contributing to the site are mapped in Figure 3. Catchment details are given in Table 1.

The site and associated catchments lie in Regional Catchment 3 on Figure 1.

Table 1 Catchments

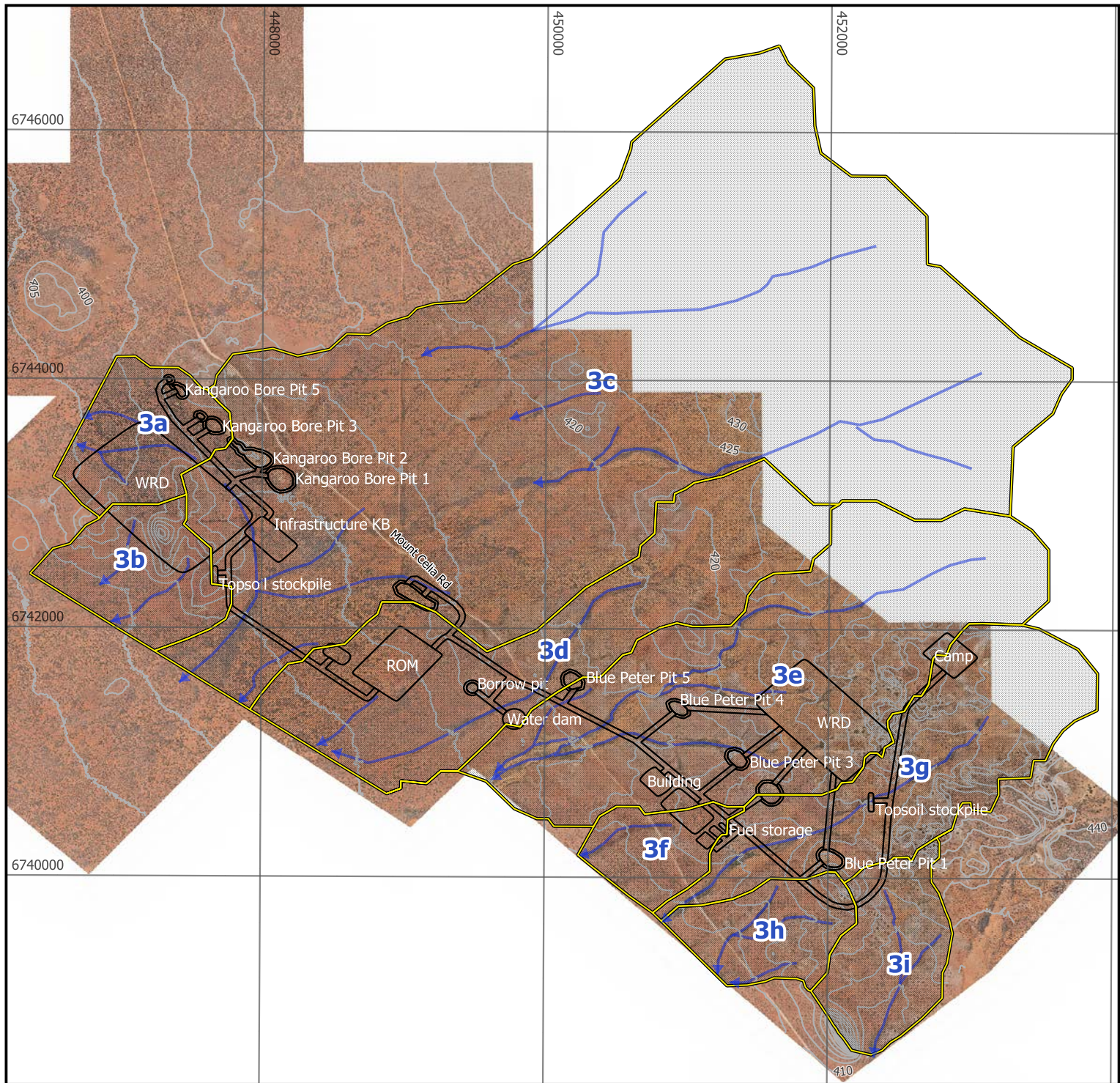
Catchment*	Area (km ²)	Description
Site:		
3a	1.0	Several small overland flow pathways.
3b	1.0	Several small concentrated overland flow pathways.
3c	15.8	Larger catchment with variably defined drainage lines. Broad shallow flow through centre of site. Incised channels form in the upper catchment, dispersing into shallow flow above the Mt Celia Road. Possible flow between Regional Catchments 3 and 4.
3d	3.6	Large defined drainage line, dissipating through site.
3e	5.3	Defined drainage network through site; several tributaries and flow divergence; large lower channel. Possible flow from Catchment 5 into 4.
3f	0.6	Small catchment with several overland flow paths.
3g	2.6	Defined drainage line with a shallow channel.
3h	0.8	Smaller defined drainage line, shallow channels.
3i	1.1	Smaller defined drainage line.
Total	31.9	Total across the site area.
Regional:		
1	184	Upper catchment.
2	103	Middle catchment; includes site.
3	82	Lower catchment, south of site.
Total	369	Total to Lake Raeside.

* Catchments are shown on Figures 1 and 3.

Defined drainage lines with shallow incised channels form in the low hills on the eastern edge of the catchment. These drainage lines dissipate into overland flow through the area of Mount Celia Road and through the general site footprint.

Stormwater flow from the area of the site merges with flow from catchments to the north and south before entering Lake Raeside. The total area of the catchment containing the site that contributes to Lake Raeside is approximately 369 km². Catchments contributing to the area of the site amount to 32 km² or 9% of the total catchment. The overall site footprint covers an area of approximately 9 km² or 2% of the total catchment.

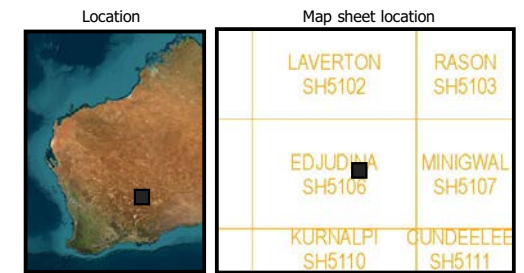
Lake Raeside is a long chain of lakes and low-lying areas extending from west to south of the site. The lake is saline, often dry, filling to various degrees after larger rainfall events. Inflow occurs from direct rainfall and flow from creeks and wash plain on all sides, including the area of the site.



Legend

- Infrastructure
- 1a Site catchments
- Contours (5 m)
- Drainage lines

Data source:
 Imagery, Infrastructure, Contours- Legacy Iron Ore
 Catchments, Drainage lines - Hydrologia



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Job No: J0100163

Figure 3
Existing site catchments and drainage

2.3 Surface hydrology

Climate

The site is located in the goldfields. The area is arid, with low, variable rainfall and high evaporation year-round, very hot summers and cold winters. Climate of the area is classified by the modified Köppen system (BoM 2022c) as Desert hot (persistently dry).

Average annual rainfall (as observed at Laverton BoM Station 012045 from 1899-2022) is 235 mm. Annual rainfall can vary by between -50 and +182% (between the 10 and 90 percentiles around the median).

Rainfall at the site often occurs as a result of decaying tropical cyclones in summer and cold fronts in winter. Thunderstorms also occur in the area. Spatial rainfall patterns tend to be highly variable, with individual rainfall event totals varying substantially across even short distances. Seasonal rainfall totals are variable.

Rainfall statistics for the site are plotted in Figure 4. Rain can fall all year round, but most tends to fall from January to June. Larger events tend to occur between January and March.

By comparison, the 1% AEP 1 day design rainfall total is 139 mm. The largest 24 hour event on record (from the Laverton BoM station data) is 234 mm. Therefore, much of the year's annual total could fall in a single event.

Average annual evaporation (as recorded at BoM Station 012038 Kalgoorlie-Boulder Airport for the years 1966 to 2016) is approximately 2,635 mm, much higher than average rainfall. Evaporation exceeds rainfall in every month of the year but June.

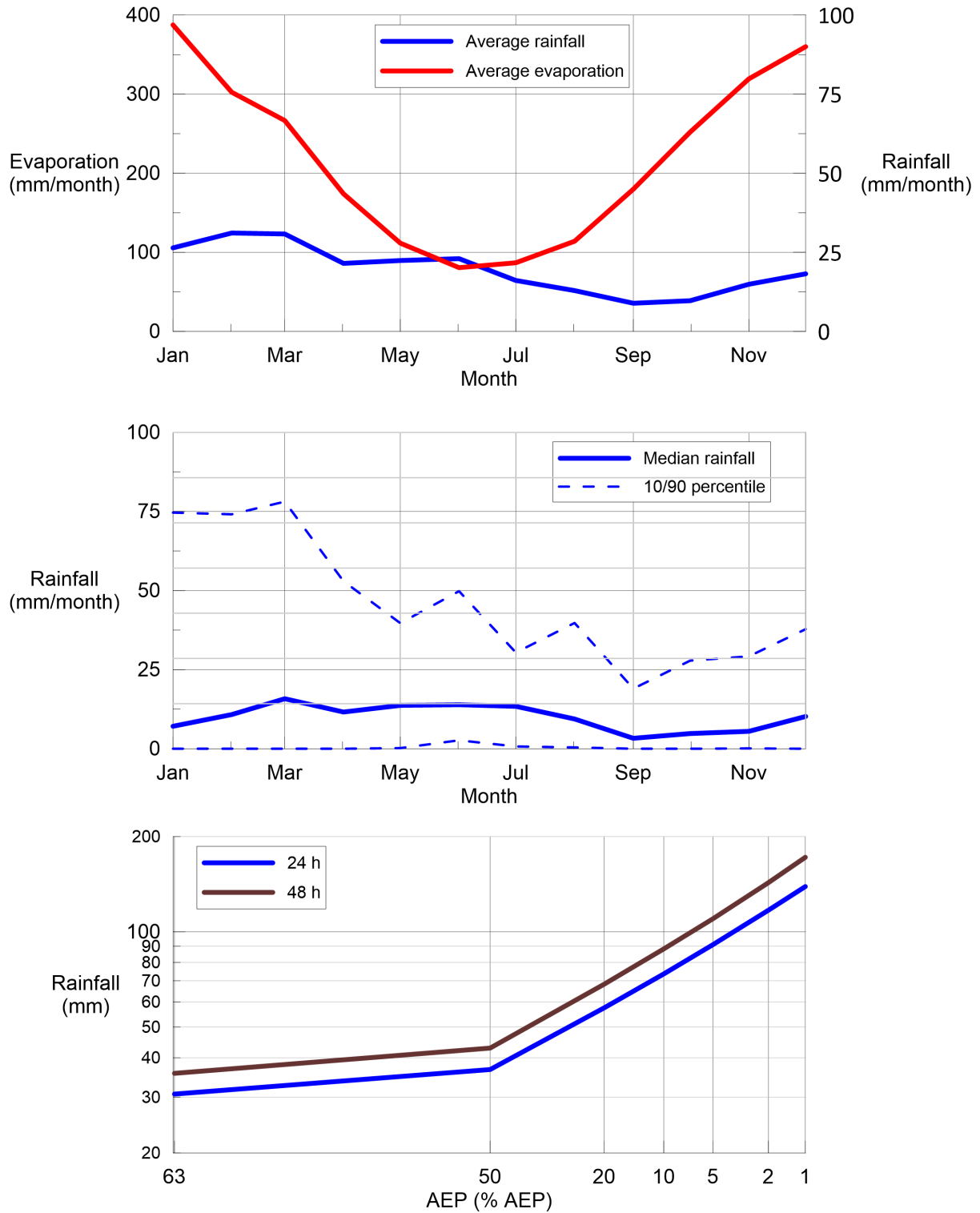


Figure 4 Rainfall and evaporation at the site

Data taken from BoM stations 012045 Laverton and 012038 Kalgoorlie-Boulder Airport, SILO Data Drill (Queensland Government 2022) and 2016 IFD data (BoM 2022b).

Land systems and soils

Land system and soil mapping data at a large scale are available for the site (CSIRO 1991). Surface geology is mapped by Geoscience Australia (GA 2012). Mapping in these reports is at a much larger scale than that of the site so only indicative conditions can be inferred.

The landscape through the flatter central area of the site is described in CSIRO (1991) as plains with scattered dunes and small breakaways; chief soils are red earthy sands. Scarpland lies in the hilly areas, particularly toward the southern end of the site, described as low lateritic breakaways on granites and gneisses; the main soils on the steeper slopes are shallow stony sands and sandy loams with some alluvial plains.

Surface geology through the flatter, central area of the site is mapped as colluvium (GA 2012). Hilly areas in the north and south of the site are mapped as various rocky formations.

Vegetation and land use

The site is located in a gold mining and pastoral area. There are a number of active and residual mines in the region. Parts of the site have been mined in the past. Agricultural activity in the area is low intensity pastoral grazing.

The Mount Celia Road passes through the site.

Vegetation at the site is disturbed in places as a result of previous mining activity.

Potentially affected downstream areas

Downstream areas potentially affected by the project are:

- Drainage lines and overland flow paths crossing roads and intersected by project infrastructure (including pits and WRL's); and
- Drainage lines and flow paths immediately downstream of the main mine site infrastructure.

2.4 Environmental values and beneficial uses

The main values and beneficiaries of surface water through the project area relate to:

- Maintenance of native vegetation communities; and
- Maintenance of the ecosystem of Lake Raeside.

Local vegetation communities through the mine site are generally dependent on in situ rainfall. Vegetation along the drainage lines is possibly affected by intermittent flows they receive after storm events and by local soil characteristics.

Local drainage lines receive intermittent, fresh storm flows after heavy rainfall. There are no pools or ponded water near the site and drainage lines dry out rapidly after flow events.

Lake Raeside receives fresh stormwater inflows from a wide network of drainage lines and from direct rainfall. After heavy rainfall, the lake fills to varying levels with fresh water which is then lost to evaporation over time. The lake is an internally drained, salt lake system. As such the quality of water ponded in the lake system would vary from highly saline when water levels are low to fresh or moderately saline when flooded.

2.5 Surface water management areas

The site is located in the Salt Lake Basin surface water management area (DWER 2022). It is not in a proclaimed surface water management area (under the *Rights in Water and Irrigation Act 1914*).

2.6 Water quality

No publicly available water quality data for surface water or stormwater for the local catchment are available. The quality of surface water is inferred here from observations of land systems and weather patterns.

It is likely that the quality of stormwater flows sourced from the area of the site will largely be fresh but may be turbid. There are no pools or dams in the area of the mine site. The only surface water will be in intermittently flowing drainage lines.

Lake Raeside is an internally drained, salt lake system. Salinity of water in the lake will vary from near fresh to hypersaline depending on water levels.

2.7 Flooding characteristics

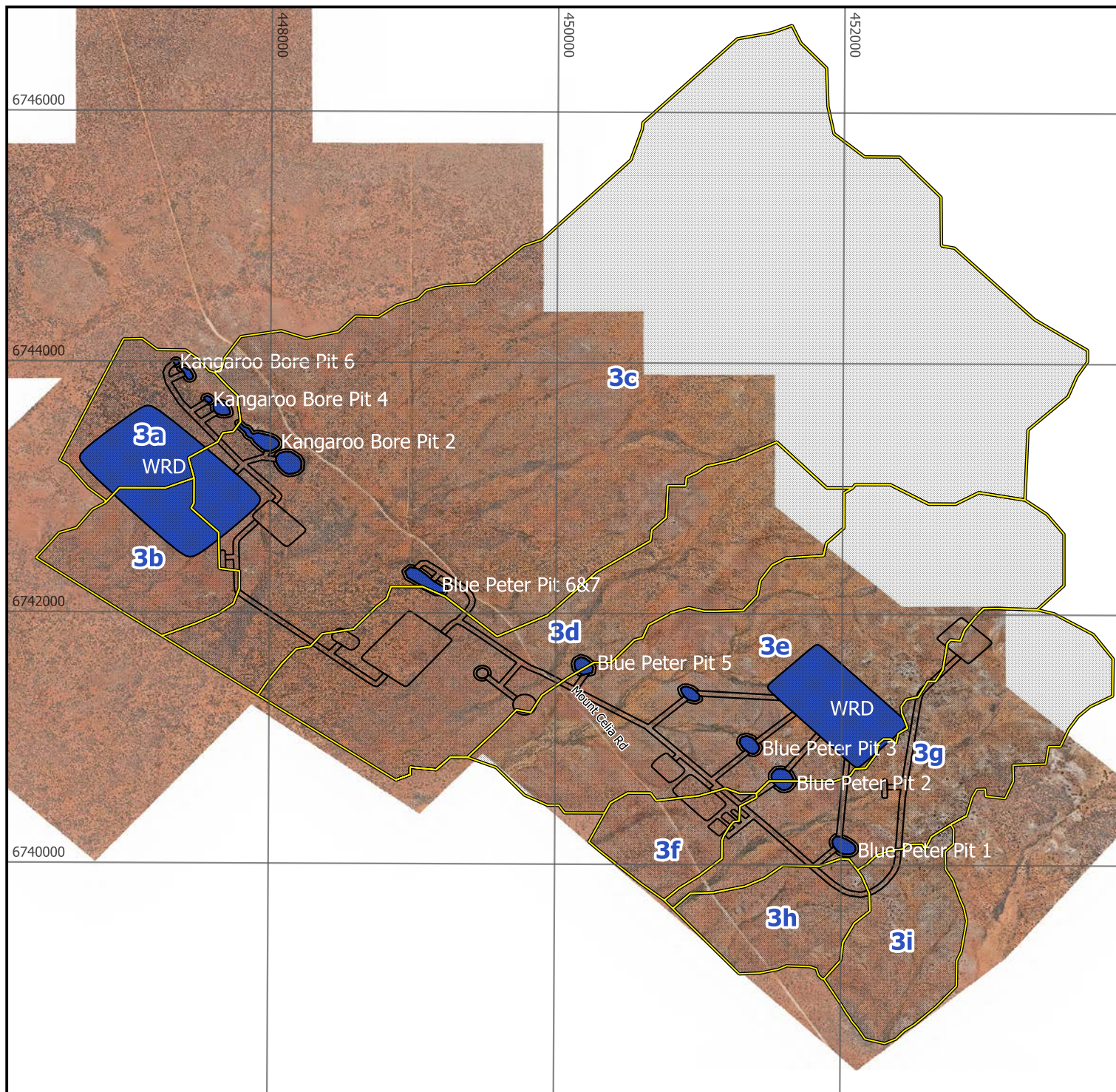
The site lies mainly across a relatively low-profile landscape with occasional hills. Relatively small catchments to the east of the site generate stormwater that traverses the site via a number of concentrated overland flow paths and shallow, diffuse drainage lines. There are no large drainage lines through the area of the proposed infrastructure.

Predicted flood extent through the area of the site is shown in Figure 5. This shows flooding for existing conditions (i.e., without proposed infrastructure) for the 1% AEP event.




Catchment 3c (Figure 3) is the largest catchment contributing to the area of the site. This generates broad overland flow across Mount Celia Road and in the area of the proposed Kangaroo Bore Pit 1. This overland flow is then concentrated through the Infrastructure KB area as it passes to the south of a hill (near a proposed topsoil stockpile).

Larger flow paths from Catchments 3d, 3e and 3g also pass through the area of proposed site infrastructure.

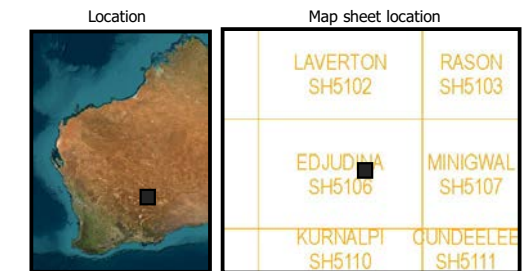
Drainage channels through the site are small and flows do not cause a significant flood risk for the site. However, management of these flows where they intersect infrastructure is required to prevent scour and ponding. It is likely that these flow paths can be readily managed using land grading, small drainage structures (drains and road crossings) and levees (to protect pits from stormwater ingress).



Legend

-  Infrastructure
-  1a Site catchments
-  Internally drained areas

Data source:
 Imagery, infrastructure - Legacy Iron Ore
 Catchments, internally drained areas - Hydrologia



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Figure 5
Internally drained areas

3. Potential impacts on the environment

3.1 Introduction

This section presents an assessment of potential impacts of the proposed development on the environment with respect to surface water. The assessment is focussed on the ultimate operational mine footprint and on closure. It is assumed that the ultimate operational extent of pits and WRD's remain on mine closure as internally drained structures and that the rest of the mine infrastructure is removed and the landscape rehabilitated.

Concepts for management of potential impacts are presented. This assessment builds on the description of the existing environment given in Section 3 and informs the closure stormwater management strategy given in Section 5.

It is not intended at this time to develop mitigation measures in detail but to indicate areas where attention to mitigation of potential impacts may be required as part of the environmental approvals and infrastructure design process.

3.2 Operational

Potential impacts of the project on the downstream environment during the operational phase are:

- Diversion of flow paths changing flow conditions in downstream areas;
- Reduced streamflow as a result of a reduction in catchment area;
- Erosion associated with disturbed areas, steep slopes and site and road infrastructure, leading to scour and increased turbidity of stormwater; and
- Impacts of mine infrastructure and mining activities on stormwater quality.

Diversion of flow paths

Much of the mine infrastructure interacts with flow paths from catchments to the east. Roads cross most flow paths. A number of pits and other operational landforms lie in areas with concentrated flow paths. Existing flow paths will be modified and diverted in places by landforms and site-service areas, having some impact on flow characteristics in local catchments. Impacts can be minimised by returning diverted streamflow to the same catchment.

Reduction in catchment area

Proposed pits and WRD's are likely to be internally drained, reducing local catchment area. Tops and sides of WRD's and pits to the abandonment bund will be internally drained. Drainage lines and flow paths near these facilities will be directed around the facilities and returned to the original alignment downstream.

An assessment of the amount of reduction for the ultimate developed landform for the local catchments extending to Lake Raeside is given in Table 2. Internally drained areas on mine closure are mapped in Figure 5.

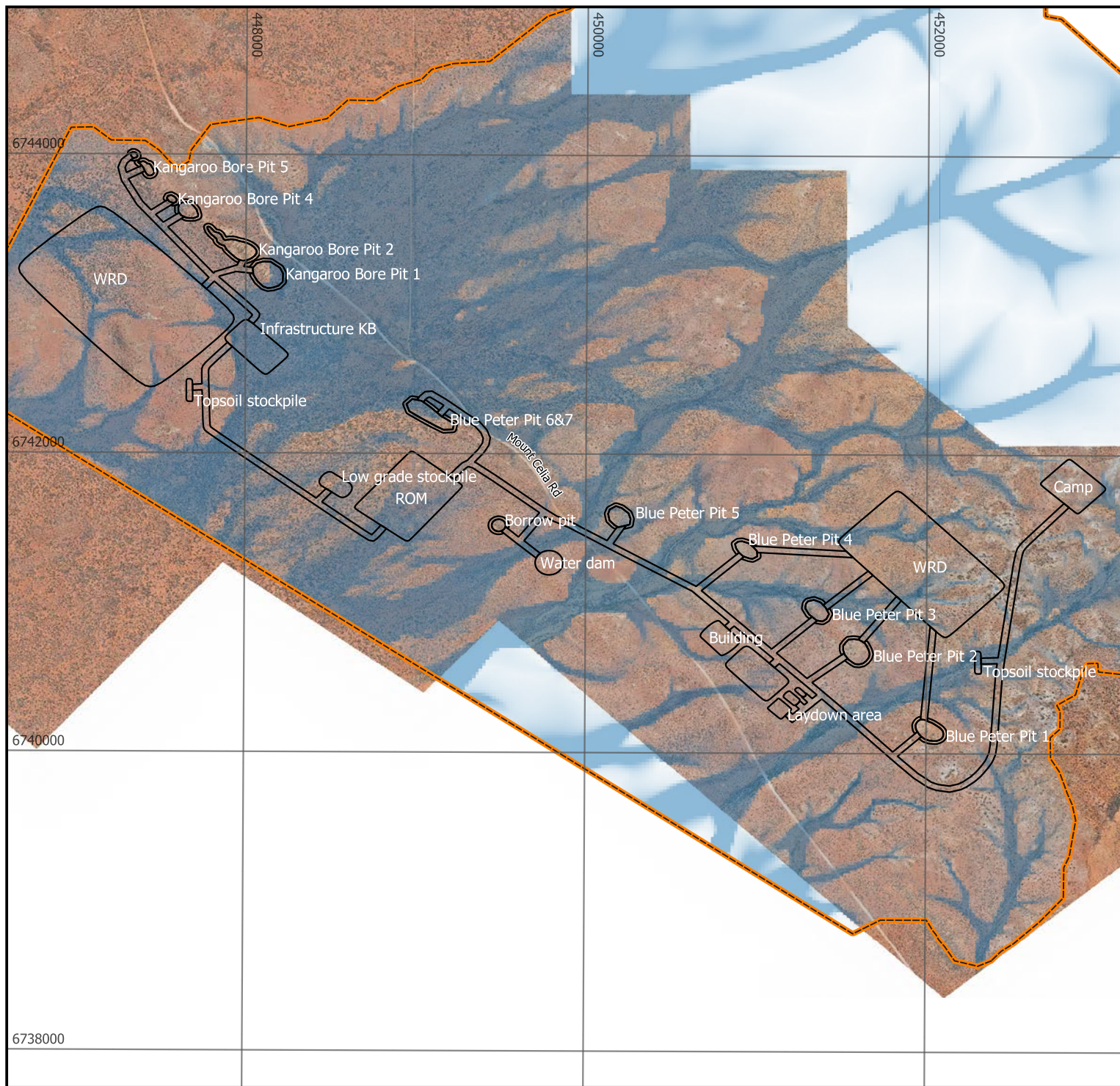
Residual landforms are located across most of the catchments in the area of the site. The largest structures are the two WRD's. Drainage around all of the residual areas can be maintained with drains and levees. No pondage or trapped catchments are expected upstream of residual structures.

The total area of residual internally drained structures is 1.4 km². This mainly affects Catchments 3a, 3b and 3e, which contain most of the WRD's. The free draining areas of these catchments falls by between 10% and 38%. This reduction reduces to 4.5% of the larger catchment that the site is located in (Catchment 3). Total catchment reduction, to Lake Raeside, is 0.8%.

Table 2 Reduction in catchment area

Catchment	Catchment area (km ²)*	Proposed		Comment
		Internally drained areas (km ²)**	Catchment reduction (%)	
Site:				
3a	1.0	0.38	37.8%	Kangaroo Bore Pits 3-6, part of Pit 2 and WRD.
3b	1.0	0.23	22.0%	Part of Kangaroo Bore WRD.
3c	15.8	0.29	1.8%	Kangaroo Bore Pit 1 and part of Pit 2 and WRD; Blue Peter Pit 6 & 7.
3d	3.6	0.01	0.2%	Part of Blue Peter Pit 5.
3e	5.3	0.50	9.5%	Blue Peter Pits 3 and 4, part of Pits 2 and 5 and most of the WRD.
3f	0.6	0.00	0.0%	No permanently internally drained infrastructure.
3g	2.6	0.03	1.0%	Blue Peter Pit 1.
3h	0.8	0.00	0.0%	No permanent internally drained infrastructure.
3i	1.1	0.00	0.0%	No permanent internally drained infrastructure.
Total	31.9	1.44	4.5%	Total for catchments covering the site.
Regional:				
1	184	0.0	0.0%	No permanent internally drained infrastructure.
2	103	0.0	0.0%	No permanent internally drained infrastructure.
3	82	1.4	1.8%	Includes all permanent internally drained infrastructure.
Total	369	2.9	0.8%	Total catchment covering the site that drains to Lake Raeside.

* Catchments are shown on Figures 1 and 3. ** internally drained catchments are shown on Figure 5.



Legend

Infrastructure

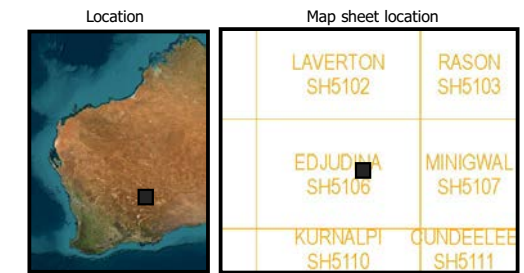
Model domain

Predicted flooding - 1% AEP

Flood extent

Data source:

Imagery, Infrastructure - Legacy Iron Ore
Flood extent, model domain- Hydrologia



Project: Surface Water Assessment - Mt Celia Gold Project
Job No: J0100163

Figure 6
Predicted flooding, existing - 1% AEP

Erosion

Erosion of topsoil from disturbed areas and steep slopes could occur. This should be managed with appropriate design and construction of stormwater and facility infrastructure and with rapid rehabilitation.

There is considerable buffer between the site and the main downstream receiving riverine environment (Lake Raeside). The site is located in the upper catchment, 17 km from the lake. Accordingly, local erosion is unlikely to affect the wider environment.

Water quality

The potential for contamination of stormwater is low. Workshop and fuel storage areas should manage stormwater generated on site internally. Watering of roads and disturbed areas with saline water is unlikely to lead to significant salt build over the short term. Stormwater generated on the pits and WRD's should be managed internally within the structure and should not be released to the environment.

3.3 Closure

On closure, it is expected that project infrastructure, including roads, buildings and plant, accommodation village, stockpiles and laydown areas will be removed, the landform returned to natural contours and revegetated.

Potential residual impacts on the environment include:

- Modification to natural flow paths due to permanent diversions changing flow conditions in nearby downstream areas;
- Reduction in catchment area due to internal drainage on residual structures (proposed pits and WRD's) reducing flow to nearby downstream areas; and
- Erosion from steep slopes and in diversion drains causing siltation and increased turbidity of stormwater.

Permanent modification to flow paths

Larger diversion drains and levees developed during the course of the mine operations phase will remain after closure. An indicative representation of these diversions, post-closure drainage lines and internally drained areas is discussed in Section 5 and marked on Figure 7.

As proposed, diverted streams re-join natural streamlines downstream within the same catchment, minimising impacts on the downstream environment.

Review of PMP modelling indicates that diversion drains and levees should be able to withstand large events and maintain structural integrity. Accordingly, closure landforms and drainage lines should remain in perpetuity.

Reduction in catchment area

On closure of the mine, residual landforms (pits and WRD's) will remain as internally drained areas. These are shown on Figure 6. Runoff from these areas will be permanently removed from the wider catchment. Analysis given in Table 2 suggests that total reduction in catchment area to Lake Raeside is 0.8%. This is a small component of the Lake's catchment and unlikely to affect the lake's water balance.

It is expected that drainage from the remainder of the site after rehabilitation will generally reflect pre-development conditions so will not affect the wider catchment area.

4. Closure stormwater management

4.1 Introduction

This section presents advice at a concept level on management of stormwater across the site for the closure phase of the project. This covers residual landforms that will remain at the site after mining has been completed and the site rehabilitated.

Details of potential for impact on the environment and flood risk are given in Section 4. This stormwater management strategy addresses these risks.

The strategy addresses management of stormwater external to structures. Internal drainage is being developed by others.

4.2 Objectives

The objective for surface water management at the site post-closure is to facilitate a stable landform with minimal impact on the surrounding environment.

4.3 Stormwater management on closure

Elements of the mine site that need to be addressed for closure are:

- Residual pits;
- Waste rock dumps; and
- The rehabilitated site landform.

Details of residual infrastructure are shown on Figure 7, including indicative locations of proposed drains and levees.

Pits

It is expected that pit voids will remain after closure and be isolated following the installation of an abandonment bund. Direct rainfall and runoff from any small contributing catchments will inflow to the pit. This ponding will be lost to evaporation over time. Accordingly, it is expected that any water level in the pit will be below ground level.

A number of levees and drains are suggested to protect pits from ingress of external stormwater in areas with substantial overland flow or near defined flow paths. These are marked indicatively on Figure 7. Levees should be designed to not overtop and fail in the PMP event.

The catchment surrounding the pit inside the abandonment berms and levees should be kept as close to the pit as possible to minimise this catchment area. The bund and final landform around the pits should be constructed to minimise ponding against the bund, either internally or externally, and to allow free drainage of stormwater collected inside the bund into the pit lake. Consideration should be given to ensuring that entry points for stormwater to the pit do not scour and breach the safety bund.

Waste Rock Dumps

The final waste rock dumps should be stabilised to prevent scour. Stormwater generated on the dump top and sides should be retained and disposed of on the structure.

Stormwater generated on top of the structure should be retained and dissipated to evaporation *in situ*. This is a simpler solution to allowing drainage off the structure but reduces local catchment area. Ponding or accumulation of stormwater on the top should be avoided by levelling of the landform. Evaporation and infiltration should be encouraged with vegetation and an absorbent soil profile.

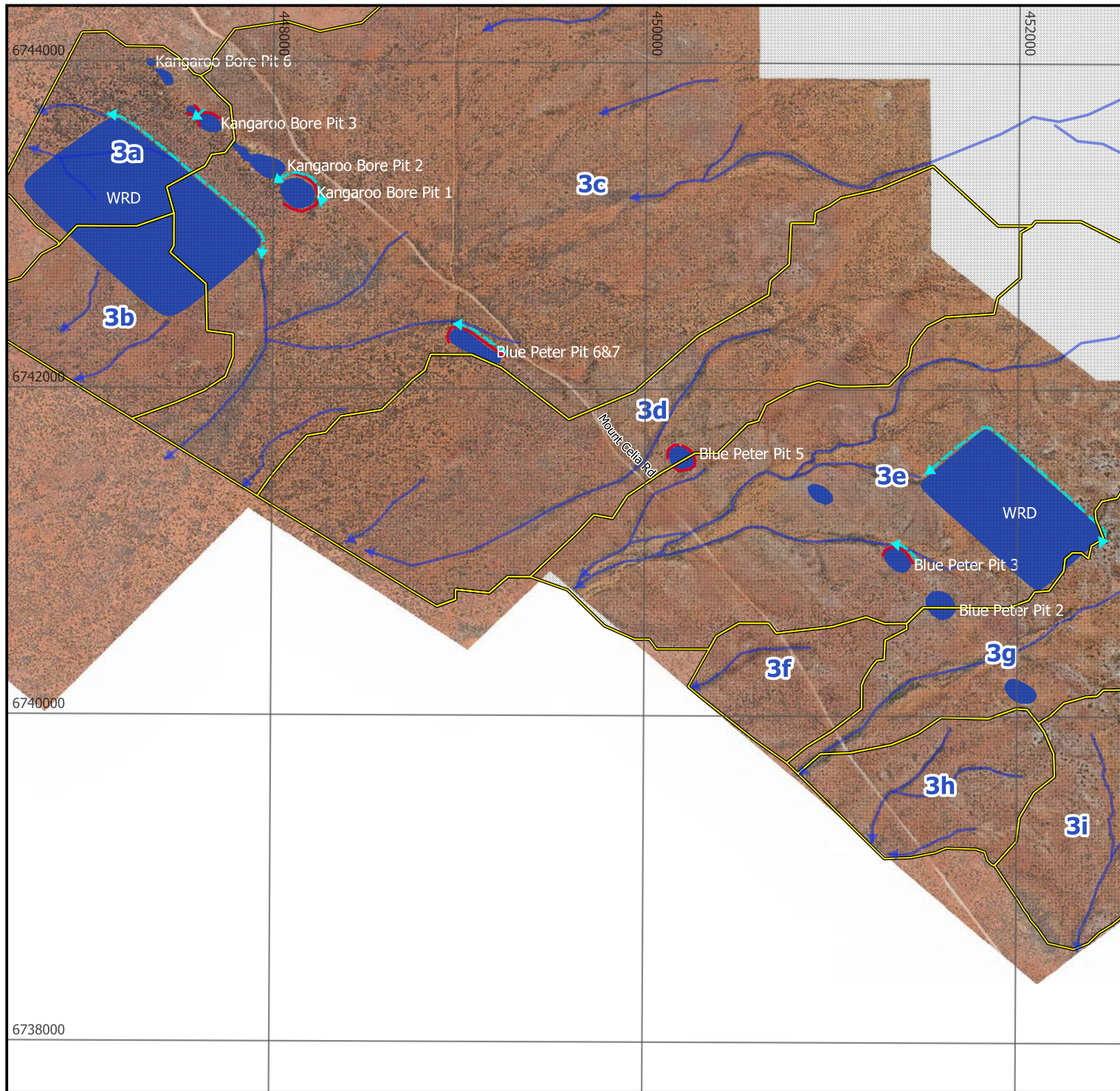
Stormwater generated on external slopes of the dumps will need to be managed to control flow and minimise scour. The slopes should be stabilised against erosion using a combination of landform shape, vegetation and ground protection (such as rock or timber). Concentration of stormwater flow on the slopes should be avoided. Low ground surface grade, high infiltration or vegetated areas on the downstream edge of slopes might be useful for containing any eroded material and filtering stormwater exiting the slope area to the environment. Stormwater from the slopes should be managed using toe drains.

Drains are suggested along the toe on the upstream edges of both WRD's to protect edges of the landform against scour by external stormwater and to allow local drainage. These are marked indicatively on Figure 7.

The general site

On closure, it is expected that general site infrastructure and roads will be removed, the topsoil stockpiles will be used in site rehabilitation and the landform returned to natural contours and revegetated.

Stormwater flows across the site can be managed as shallow overland flow with drainage similar to the natural landform. Concentrating flows should be avoided. Disturbed areas should be revegetated as quickly as possible.



Legend

- Internally drained areas
- Site catchments
- Drainage lines
- Proposed levees
- Proposed drains

Data source:

Imagery - Legacy Iron Ore

Internally drained areas, site catchments, drainage lines, proposed drains, proposed levees - Hydrologia

Location



Map sheet location

LAVERTON SH5102	RASON SH5103
EDJULHA SH5106	MINIGWAL SH5107
KURNALPI SH5110	GUNDEELEE SH5111



150

300

450 m



**Project: Surface Water Assessment - Mt Celia
Gold Project
Job No: J0100163**

**Figure 7
Stormwater management - closure**

5. References

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Appendices

Appendix A – Model parameter values

Mike SHE hydrology model

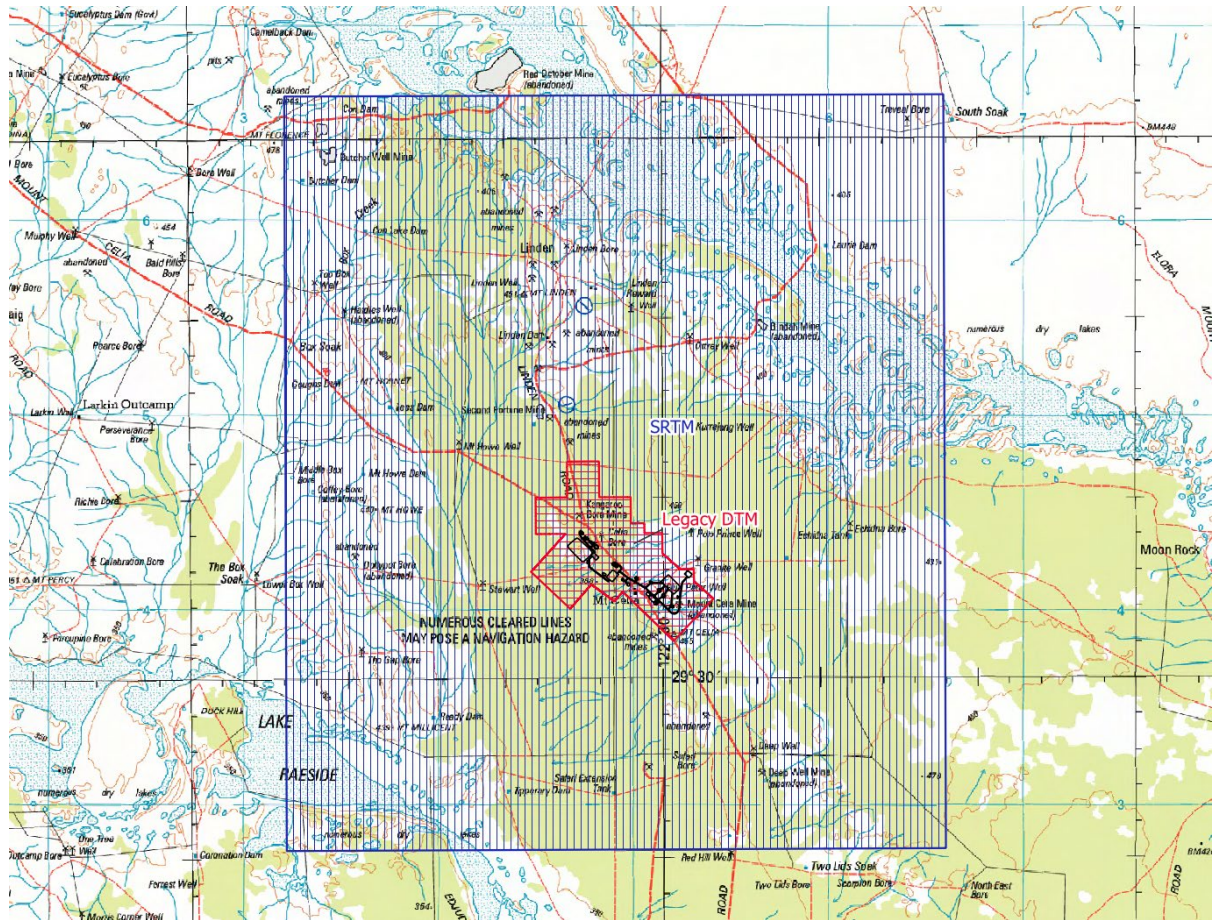
Software:

Mike SHE release 2021 Update 1.

Simulation specification:

- Domain covered the area of the mine site and contributing catchments;
- Overland flow represented using Mike SHE and rain-on-grid, 20 m square grid, topography derived from a combined site DTM and SRTM dataset;
- Mike SHE overland flow resistance: Manning's M of 20 (Manning's n = 0.05);
- Predicted flood extent for the 1% AEP event for two critical durations, 3 h for catchments 3c and 3d and 1 h for the remaining catchments, merged into one dataset;
- Predicted flood extent for PMF used a 3 h event;
- Design rainfall:
 - Point rainfall (i.e., no areal reduction) applied on-grid;
 - Design rainfall from 2016 IFD data (BoM 2022b);
 - Critical temporal pattern: 1% AEP: 1 h Pat02, 3 h Pat02; PMP: 3 h.
- Loss model:
 - 2 Layer UZ and evapotranspiration;
 - Evaporation 10.9 mm/day;
 - Detention storage: 1% AEP: 10.0 mm; PMP: 10.0 mm;
 - UZ hydraulic conductivity varying with soil type, all event magnitudes: 1.0 mm/h(rocky), 6.75 mm/h (colluvium).

Topographic data extents





APPENDIX 3 – AMC HYDROGEOLOGY REPORT

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Report

Mt Celia Hydrogeology Study Legacy Iron Ore Limited

AMC Project 221005
4 August 2021

Quality control

The signing of this statement confirms this report has been prepared and checked in accordance with the AMC Peer Review Process.

Project Manager

SIGNATURE REMOVED

Megan Walske

4 August 2021

Date

Peer Reviewer

SIGNATURE REMOVED

Asoka Herath

4 August 2021

Date

Author

SIGNATURE REMOVED

Carsten Kraut

4 August 2021

Date

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Distribution list

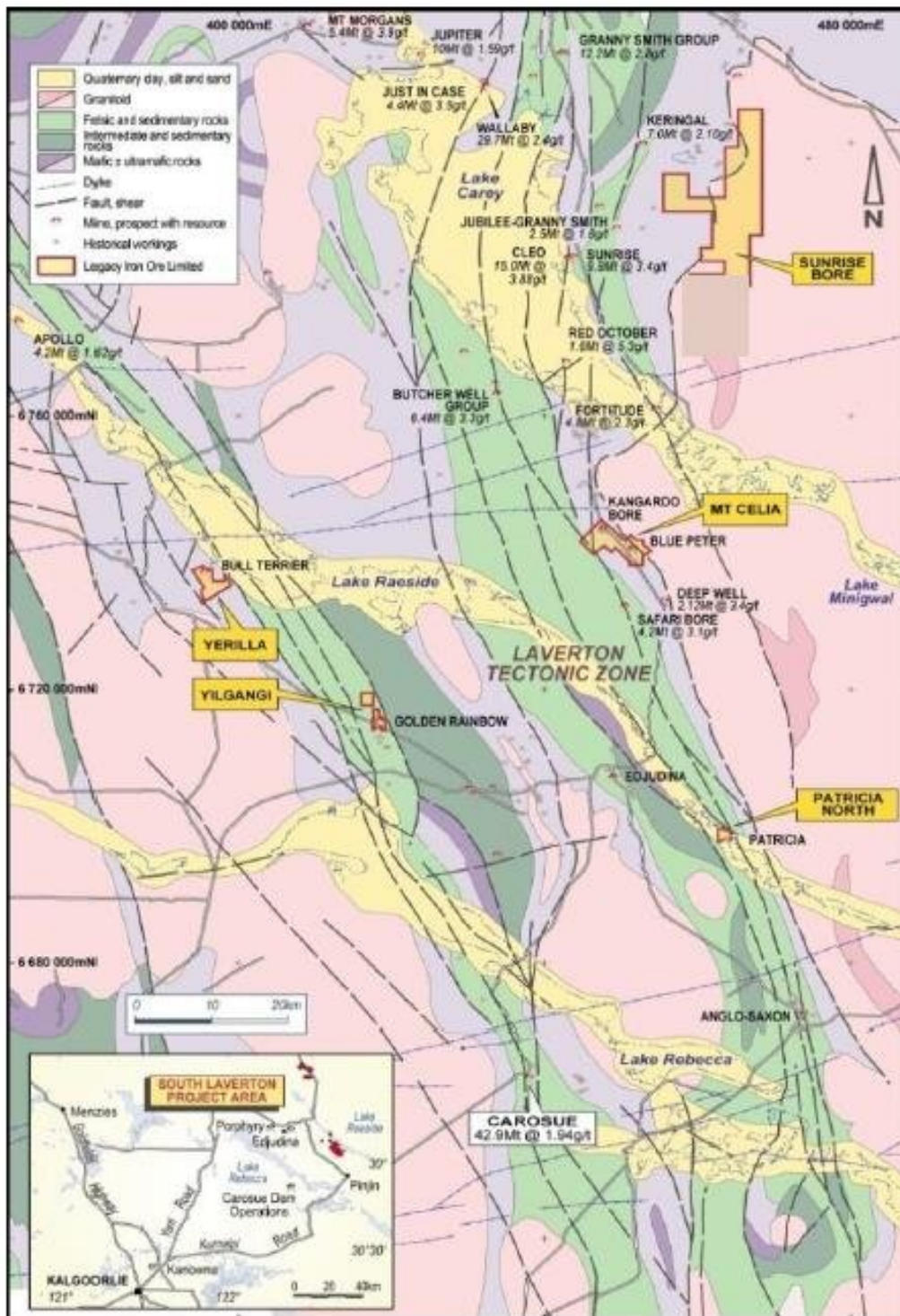
- 1 e-copy to David Mills, Legacy Iron Ore Limited
- 1 e-copy to AMC Perth office

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1 Introduction

Legacy Iron Ore Limited (Legacy) plans to establish the Mount Celia open pit gold project (Mount Celia). The Mount Celia site is located 180 km northeast of Kalgoorlie, and includes two separate mineralised deposits, Kangaroo Bore (KB) and Blue Peter (BP). The Mount Celia project is one of several that Legacy hold along the Keith Kilkenny Tectonic Zone ("KKTZ") and the southern part of the Laverton Tectonic Zone ("LTZ") (Figure 1.1 and Figure 1.2).

Figure 1.1 Project location



Source: Legacy Iron Ore Ltd Financial Report for Year Ended 31 March 2021

Figure 1.2 Legacy Iron Ore Ltd Mount Celia Tenements (DMP Tengraph)

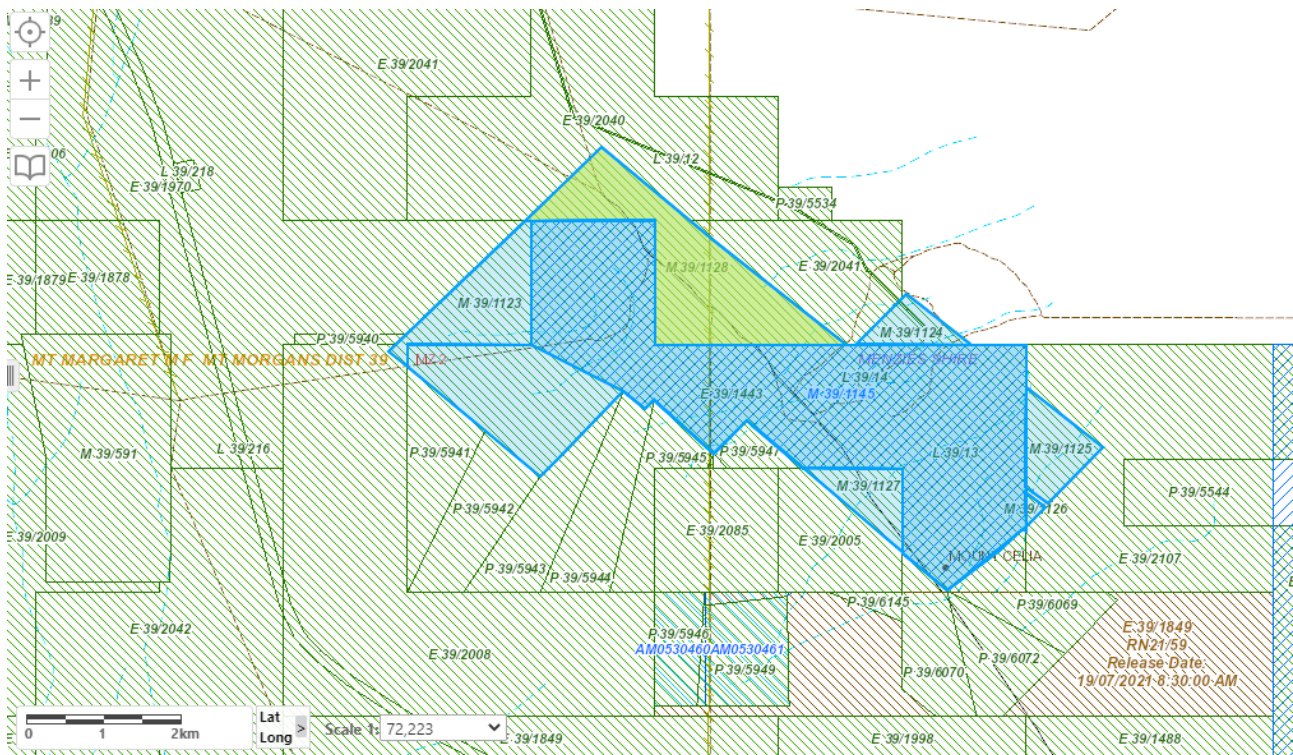


Table 1.1 shows Mt Celia Tenement Schedule (DMP 2021).

Table 1.1 Mt Celia Tenement Schedule (DMP 2021)

Tenement ID	Holder
E39/1443	Legacy Iron Ore Ltd
M39/1124	Legacy Iron Ore Ltd
M39/1128	Legacy Iron Ore Ltd
M39/1145	Legacy Iron Ore Ltd

Water will be required for camp, dust suppression and process water, while dewatering will be necessary to maintain dry mining conditions.

This report has been prepared to H2 Level requirements as set down in Department of Water Policy 5.12, November 2009, for preparing hydrogeological reports associated with a groundwater well licence.

The purpose of the report is to support application for a groundwater licence to be issued under Section 5C of Rights in Water and Irrigation Act 1914.

2 Climate and geomorphology

The region has a semi-arid climate characterised by low rainfall and a large temperature range. The mean annual rainfall is about 250 mm, but may vary annually from 100 mm to 500 mm. The winter months of May to August have the highest and most reliable average rainfall, but intense rainfall can occur periodically in the summer months of December to April as a result of tropical cyclones. Potential evaporation totals 2400 mm/year and exceeds rainfall in all months (Johnson et al, 1999).

The present landscape of the Northern Goldfields is generally of low relief with topography closely related to the underlying geology. The region is characterised by undulating areas of sandplain and granite outcrop with northerly trending ridges controlled by the strike of the greenstone belts, and by low-lying broad alluviated valleys containing playa lakes. The topography gradually increases in elevation to the north, ranging from about 350 m in Lake Raeside (south of Leonora) to 600 m above sea level in the Finlayson Ranges (north of Wiluna).

The drainage system of the area comprises three large, broad, sub-parallel, south-easterly trending drainage systems known as palaeodrainages. The Carey and Raeside Palaeodrainages extend from a regional divide to the west of the area and drain towards the Eucla Basin. In contrast, the headwaters of the Minigwal Palaeodrainage rise within the area northwest of Cosmo Newbery Community, and discharge into the Carey Palaeodrainage downstream of Lake Carey.

The palaeodrainages have very low gradients and frequently contain small to very large playa lakes such as Lake Carey and Lake Way (up to 1000 km²). The playa lakes are normally dry, floored by mud or salt crystals, and are commonly fringed by sand and gypsum (kopi) dunes that prevent the flow of surface runoff between lakes. These lakes become inundated during occasional, intense rainfall and in rare cyclonic events (Johnson et al, 1999¹).

¹ JOHNSON, S. L., COMMANDER, D. P. & O'BOY, C. A. 1999, Groundwater resources of the Northern Goldfields, Western Australia: Water and Rivers Commission, Hydrogeological Record Series, Report HG 2, 57p.

3 Hydrogeology

3.1 Regional setting

Mt Celia is in the Eastern Goldfields Province of the Archaean Yilgarn Craton. The province is characterised by granite–greenstone rocks that exhibit a prominent northwest tectonic trend and low- to medium-grade metamorphism.

The Archaean rocks are intruded by east–west dolerite dykes of Proterozoic age, and in the eastern area there are small, flat-lying outliers of Proterozoic and Permian sedimentary rocks. The basement rocks are generally poorly exposed owing to low relief, extensive superficial cover, and widespread deep weathering (Johnson et al, 1999).

3.2 Groundwater occurrence

The Northern Goldfields area is underlain by weathered and fractured Archaean bedrock, which forms the northern portion of the Yilgarn Goldfields fractured-rock groundwater province. Fractured-rock aquifers comprise greenstones, granitoids and minor intrusive rocks that are characterised by secondary porosity and permeability which may also be enhanced by chemical dissolution along fracture lines. Allen (1996) noted that large supplies of groundwater may be obtained from bores to 100 m depth, particularly where these intersect fractured chert and banded iron-formations, regional structural features, fault and shear zones.

The local geological structure is the dominant feature controlling the occurrence of fractured-rock aquifers, with the lithology of the rocks having limited influence and affecting only the extent of structural development. The lateral continuity of the aquifer systems along the dominant geological structures is poorly understood, although ellipsoidal drawdowns associated with mine dewatering suggest that the aquifers are strongly anisotropic with the greatest permeability parallel to the major structures (Johnson et al, 1999).

The groundwater flow systems in the Northern Goldfields are maintained by rainfall recharge (Allen, 1996²).

3.3 Existing groundwater use

The town water supplies of Leonora, Laverton and Wiluna are obtained through groundwater schemes operated by the Water Corporation. The potable water requirements for all the mine sites throughout the region are obtained from groundwater, mainly from elevated weathered and fractured-rock aquifers.

The location of potable water supplies for prospective mine sites is an important consideration during the initial phase of mine development. In general, there are sufficient supplies of potable to marginal groundwater available reasonably close to mine sites throughout the area, with the majority of domestic water supplies on mine sites abstracted from fractured-rock and calcrete aquifers. In localities where there are poor prospects for locating potable water, small-scale desalination of groundwater can also be used for some domestic supplies.

² Allen, A. D., 1996, Hydrogeology of the Northeastern Goldfields Western Australia: Western Australia Geological Survey, Record 1996/4, 43p

Domestic supplies on pastoral stations are usually provided by rainwater tanks supplemented by potable groundwater, if available. Most bores and wells used by the pastoral industry are less than 30 m deep and are typically equipped with windmill- powered pumps which yield up to 20 kL/day. The alluvium and calcrete deposits are the most extensively utilised aquifers owing to shallow watertable, less than 10 m below surface, and low groundwater salinity.

The groundwater requirement for gold mines in the Northern Goldfields is generally less than 1 GL/yr over periods of five to ten years, whereas the large-scale nickel operations will use up to 15 GL/yr over periods of 20 to 30 years.

Most groundwater is drawn from the palaeochannel sand aquifers, although groundwater supplies are also abstracted from borefields established in calcrete and fractured-rock aquifers (Johnson et al, 1999).

A Department of Water and Environmental Regulation (DWER) Water Information Reporting (WIR) query returned 9 entries, with only three appearing to be production bores and some 4 kilometres from Blue Peter. These database entries are all from the early 1980's and it is unclear whether these are still in existence (Table 3.1).

Table 3.1 DWER WIR query < 5 km of Mt Celia

Site Ref.	Site Sub-Type	Site Name	Zone	Easting	Northing	Geographic Datum	Groundwater Province	Site Comment
120413301	Bore or Well	Kookynie - No 2 (Lease 39-5067)	51	450639	6739850	GDA94	Combined Fractured Rock	Pwd licence no 6545. Particulars of borehole sheet records tested supply as 2.5 thousand gallons and recommended daily use 3 thousand gallons, rate not recorded. Accepted as gallons an hour.
120413802	Bore or Well	Kookynie - No2 (Lease 39-2)	51	451863	6743516	GDA94	Combined Fractured Rock	Pwd licence no 6545 particulars of completed borehole sheet records tested supply 2.5 thousand gallons, and recommended supplies per hour. When drilled:- March/April 1984.
120413803	Bore or Well	Kookynie - No2 (Lease 39-4)	51	452076	6742004	GDA94	Combined Fractured Rock	Pwd licence no 6545. Particulars of completed borehole sheet records. Tested supply 2.5 thousand gallons and recommended daily use 3 thousand gallons. Rate not stated accepted as gallons an hour.
120415960	Unknown	Kookynie - Twelve Mile Well	51	450367	6740804	GDA94	Combined Fractured Rock	Chem data validated CR 24/5/99.
120415961	Unknown	Kookynie - Blue Peter Well	51	451287	6740378	GDA94	Combined Fractured Rock	Chem data validated CR 26/5/99.
120415963	Unknown	Kookynie - Stewart Well	51	442290	6740858	GDA94	Combined Fractured Rock	Sample 27446. Pwd reported td as 66ft. Chem data validated CR 24/5/99.
120415964	Unknown	Kookynie - Kangaroo (47)	51	448425	6742564	GDA94	Combined Fractured Rock	Station advice to PWD (i and d)
120416103	Unknown	Kookynie - Polo Prince Well	51	451855	6743496	GDA94	Combined Fractured Rock	Incorrectly named on 1:250 000 topographic sheet as the polar rinse well. Chem data validated CR 24/5/99.
120416104	Unknown	Kookynie - Granite Well	51	452114	6742028	GDA94	Combined Fractured Rock	Chem data validated CR 24/5/99.

3.4 Intended use

Water consumption at Mount Celia will largely comprise pit dewatering and supply for camp, dust suppression and process water. For both the pit dewatering and supply, the water source is likely to be the fractured Archean basement.

4 Groundwater investigations

4.1 Drilling

Geoscience Australia geological and geophysical (magnetic) data were interrogated for structural targets which have the potential to host secondary porosity and permeability. The magnetic data combined with water strike records from resource drilling were used to locate drilling targets.

Assessment of the hydrogeological system included the construction of three (3) test production bores and six (6) monitoring wells. A summary is shown on Table 4.1 and full construction details are presented in Appendix A.

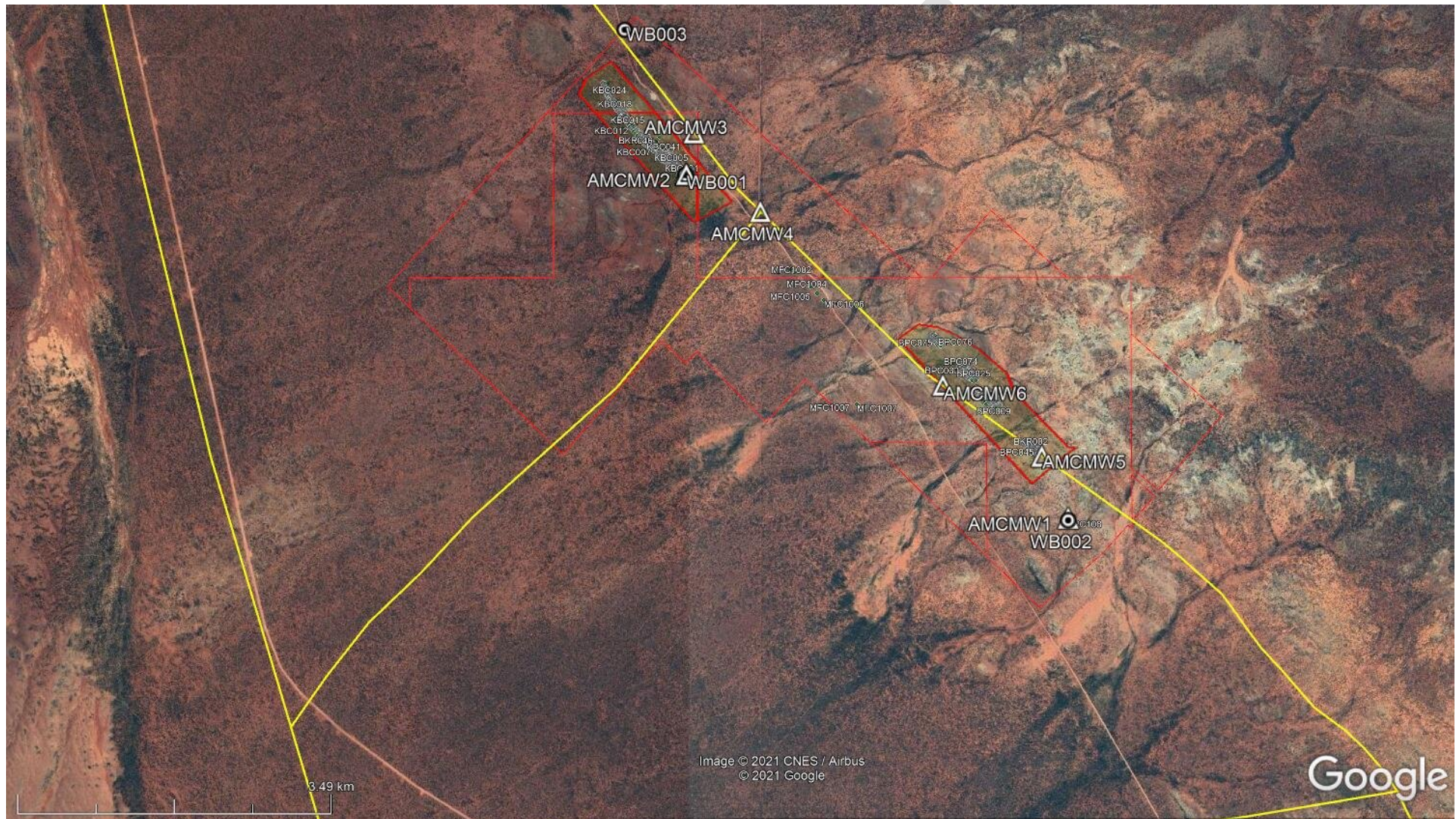
Table 4.1 Drilling summary

Name	Type	Grid: MGA Zone 51		Drilled Depth	Date	Drilling Airlift Yield l/s	Casing Diameter (mm)	Screen
		Northing	Easting					
WB001	Production	6739361	452438	84	-	5	155mm DIA uPVC Class 12	155mm DIA uPVC Class 12
WB002	Production	6743190	448148	72	-	3	155mm DIA uPVC Class 12	155mm DIA uPVC Class 12
WB003	Production	6744825	447453	60	-	2.2	155mm DIA uPVC Class 12	155mm DIA uPVC Class 12
AMCMW1	Monitoring	6739368	452429	80	3/04/2021	0.3	50mm DIA uPVC	PN9, 1mm Slot
AMCMW2	Monitoring	6743187	448144	80	2/04/2021	4	50mm DIA uPVC	PN9, 1mm Slot
AMCMW3	Monitoring	6743645	448236	80	6/04/2021	0.1	50mm DIA uPVC	PN9, 1mm Slot
AMCMW4	Monitoring	6742773	448983	80	6/04/2021	1	50mm DIA uPVC	PN9, 1mm Slot
AMCMW5	Monitoring	6740050	452136	80	7/04/2021	dry	50mm DIA uPVC	PN9, 1mm Slot
AMCMW6	Monitoring	6740847	451017	80	5/04/2021	dry	50mm DIA uPVC	PN9, 1mm Slot

Drilling locations, the proposed Kangaroo Bore (KB) and Blue Peter (BP) pit outlines, Legacy tenements, and lineaments, are shown in Figure 4.1.

The intersected stratigraphy typically comprised extremely weathered basalt or clays over basalt or quartz schist, with a static water table between 21 m and 37 m below ground level and water bearing fractures in some boreholes.

Figure 4.1 Mt Celia drilling locations



5 Test pumping

Test pumping was undertaken in Q1 2021 in accordance with Australian Standards (AS 2368-1990). The observation bores listed for each test are screened similarly to the test production bore and used to estimate aquifer parameters. Testing comprised a step drawdown test, a 24 hour constant rate test and monitoring of water level recovery.

Most bores had multiple fracture inflow zones. The proposed rates shown on Table 5.1, considered that predicted water levels remain above the primary inflow zone.

Once a good match had been achieved with the pumping and recovery data, the forward solution function using the assessed hydraulic parameters was used to estimate a sustainable pumping rate and drawdown at 12 months. This period is considered appropriate as rainfall, surface runoff and local flooding is likely to periodically recharge the aquifer.

WB002 is considered unsuitable for equipment as it was the poorest performing bore and also lies within the footprint of the planned Kangaroo Bore pit.

Analysis was undertaken using the Moench³, 1984, method which is conceptually the most appropriate for the fractured host aquifer. Output produced by Aqtesolv analytical software is presented graphically in Appendix B and summarised on Table 5.2.

³ Moench, A.F., 1984. Double-porosity models for a fissured groundwater reservoir with fracture skin, Water Resources Research, vol. 20, no. 7, pp. 831-846.

Table 5.1 Proposed rate and predicted drawdown

Production Bore	Production Bore Screen (mbgs)	Hole Depth (m)	Start of CRT	CRT Q (L/s)	SWL Prior to Test (mbmpt)	Monitoring Bore	R (m)	Top of Primary Fracture Inflow zone (mbgs)	Tested Rate (L/s)	Predicted Pumping Bore Drawdown after 12 months (m)
WB001	33-34, 49-50, 66-67	72	25/05/2021	12.2	21.44	AMCMW2	5.00	66	8	17
WB002	41-42, 43-44, 48-49	54	18/05/2021	0.8	37.91	AMCMW1	9.95	48	2.1	Not sustainable
WB003	27-28, 36-27, 45-47	60	29/05/2021	8.5	24.559	WB003*	12.62	45	9	15.5

*No response in monitored wells

Table 5.2 Test pumping interpretation

	Rate (l/s)	Aquifer Model	Solution Method	Monitoring Well	Hydraulic Conductivity K (m/day)	Assessed Storage (s)	Method	Theis, 1935 Distance Drawdown (Drawdown>3m)
WB001	8	Fractured	Moench ⁴ w/slab blocks	AMCMW2	0.3197	0.00553	Theis, 1935	900
WB002	2.1	Fractured	Moench w/slab blocks	AMCMW1	0.0341	0.0004078	Theis, 1935	-
WB003	9	Fractured	Moench w/slab blocks	WB003*	2.054	NA	Theis, 1935	140

*No response in monitored wells

⁴ Moench, A.F., 1984. Double-porosity models for a fissured groundwater reservoir with fracture skin, Water Resources Research, vol. 20, no. 7, pp. 831-846.

5.1 Groundwater chemistry

Comprehensive analyses were undertaken of samples collected at the conclusion of each pumping test and submitted to SGS Laboratory. The complete laboratory report is included in Appendix C and as shown, the samples are generally brackish with Total Dissolved Solids (TDS) between 6,700 mg/L and 16,000 mg/L. Reported pH is between 7.7 and 7.9.

6 Assessment of potential impacts

6.1 Pit inflow

The big well method (BWM) is a steady state analytical solution to predict water inflow into a pit and may be applied to relatively simple geological and boundary conditions. ANSDIMAT is an analytical tool developed by the Mining Institute of St-Petersburg (Russian State Technical University) which includes the BWM analytical solution for open pit dewatering.

In the case of Mt Celia, the Blue Peter (BP) main pit is currently designed to 75 m depth. The current design shows Kangaroo Bore pit is generally 40–60 m deep, with a central zone ~130 m deep.

Exploratory drill to date has exhibited water bearing fracture zones in some holes to approximately 60 metres depth, with lesser occurrence of water inflow below this depth.

ANSDIMAT was utilised to estimate steady state inflows to the larger pits and the predicted flows are in the order of 25 L/s when the pits are developed below 60 metres.

6.1 Radius of influence

This discussion relates to the tested production bores, and the proposed pits.

The radius of influence is the radial distance from a pumping well where significant drawdowns occur. R_0 is sometimes used to calculate where drawdown is effectively zero for a given time. However, the theoretical radius of 'zero' drawdown will be many kilometres from the production bore.

For this assessment, a more practical radius of drawdown of 3 metres has been calculated. This is a conservative assumption given the aquifer thickness in the order of tens of metres. Even if shallow groundwater exists near the project, drawdown of even 3 metres is unlikely to impact groundwater dependent flora or fauna.

The 3-metre radius of drawdown presented in Table 5.2 was calculated using the Theis, 1935⁵ equation and parameters calculated from observation well observations.

Applied to the open pit(s), the 3 metre radius of drawdown after 12 months is approximately 1400 metres. As discussed in Section 5, this period is considered appropriate as rainfall, surface runoff and local flooding is likely to periodically recharge the aquifer.

Given the fractured aquifers are likely to be highly anisotropic with the greatest permeability parallel to the major structure, ellipsoidal drawdowns are likely rather than the theoretical spherical drawdown predicted by the Theis equation. However, neither of the estimated radii of influence presented on Table 5.2 are large and even an ellipsoid 3 metre drawdown contour is likely to be less than 2 km from the production bore parallel to the major structure.

6.2 Groundwater Dependent Ecosystems

As discussed in Section 6.1, the predicted area of drawdown greater than 3 metres is no more than 1400 metres from the proposed pit(s), and in most instances much less. Most bores had multiple fracture inflow zones and the proposed rates were selected on the basis that pumping water levels in the bores remained above the primary inflow zone. There will therefore be no effective reduction in potential subterranean fauna habitat and it is not likely any groundwater dependent flora and fauna, if present, will be impacted.

⁵ Theis, C.V., 1935. The relation between the lowering of the piezometric surface and the rate and duration of discharge of a well using groundwater storage, Am. Geophys. Union Trans., vol. 16, pp. 519-524.

7 Groundwater monitoring

The monitoring program will be described in the Operating Strategy document for the Mount Celia project. The production and level data will be used to ensure water levels are not drawn below the major inflow zones.

A well survey will be conducted to assess the existence of other production bores, or pastoral bores. The Operating Strategy document will also detail the monitoring that will also be undertaken in the bores of and the mitigation measures to be undertaken in the event that adverse impacts occur.

8 Conclusions

This H2 level report presents the investigation undertaken to date and is designed to support an 5C application for the production of water for dewatering and supply requirements.

Appendix A

Drilling Construction Details

MONITORING BORE DRILLING DATA**AMCMW1**

Adjacent to WB002 36m to water level

Start - 3/04/2021 Finish - 3/04/2021

Easting - 452429 Northing - 6739368 UTM51

Drilling Method - Conventional, hammer and air Hole Angle & Azimuth - 90 , SWL- 36 4/03/2021

Drilling

Reaming - 12" (300mm) dia.

Drilling - 135mm dia.

From - surface To - 6m

From - 6m To - 80m EOH

~~Blank surface casing, steel-~~ (12")
Casing PVC~~From - surface To - 6m~~

Casing - 50mm PN9

From - surface To - 38m

Screen - 50mm PN9 0.5mm slot

From - 38m To - 44m

Casing - 50mm PN9

From - 44m To - 72m

Screen - 50mm PN9 0.5mm slot

From - 72m To - 80m EOH

Stickup - pvc 1 magl

Hydro (drilling)

Top m	Base m	Airlift L/s	Description
0	42	<0.1	@42m
36	48	<0.25	
48	80	0.3	

Logging Summary

From m	To m	Description
0	6	saprock

6	14 saprolite soil
6	18 extremely weathered grey basalt
18	19 grey soil
19	20 / weathered basalt
20	23 saprolite soil
23	28 extremely weathered grey basalt, disintegrates in fingers
28	31 highly weathered basalt
31	35 slightly we noticeable improvement in rock strength in drilling
35	38 moderately weather basalt, grey/orange, fractured ground
38	46 slightly to moderately weathered basalt
46	50 slightly weathered grey basalt, quartz rich
50	80 fresh basalt, dark grey, massive

MONITORING BORE DRILLING DATA**AMCMW2**

Adjacent to WB001 at Kangaroo E

Start - 2/04/2021 Finish - 2/04/2021

Easting - 448144 Northing - 6743187 UTM51

Drilling Method - Conventional, hammer and air Hole Angle & Azimuth - 90 , SWL- 20.2

Drilling

Reaming - 12" (300mm) dia.

From - surface To - 6m

Drilling - 135mm dia.

From - 6m To - 69 EOH

~~Blank surface casing, steel - (12")~~~~From - surface To - 6m~~**Casing PVC**

Casing - 50mm PN9

From - surface To - 30m

Screen - 50mm PN9 0.5mm slot

From - 30m To - 36m

Casing - 50mm PN9

From - 36m To - 72m

Screen - 50mm PN9 0.5mm slot

From - 72m To - 80m EOH

Stickup - pvc 1.2 magl

Hydro (drilling)

Top m	Base m	Airlift L/s	Description
0	36	0.25	
36	42	1	
54	50	4	
50	80	4	

Logging Summary

see logging sheet

Comments

fractures at 49m, 54m

MONITORING BORE DRILLING DATA**AMCMW3**

Start - 6/04/2021 **Finish -** drilling: 6/4/21 install 7/4/21

Easting - 448236 **Northing -** 6743645 UTM51

Drilling Method - Conventional, hammer and air **Hole Angle & Azimuth -** 90 , **SWL-**

Drilling

Reaming - 12" (300mm) dia.	From - surface	To - 6m	
Drilling - 135mm dia.	From - 6m	To - 80	EOH
Blank surface casing, steel - (12")	From - surface	To - 6m	

Casing PVC

Casing - 50mm PN9	From - surface	To - 44m	
Screen - 50mm PN9 0.5mm slot	From - 44m	To - 50m	
Casing - 50mm PN9	From - 50m	To - 74m	
Screen - 50mm PN9 0.5mm slot	From - 74m	To - 80m	EOH

Stickup - pvc 0.5 magl

Hydro (drilling)

Top	Base	Airlift	Description
m	m	L/s	
0	45	0.1	fracture at 22m, but no water;
45	80	0.1	observed fe staining 43-45m, water strike at 45.5m
			no chage to water flow

Logging Summary
from to

m	m	
0	7	red saprolite
7	30	extremely to highly weather mb
30	37	slightly weathered Mb grey, minor fe staining
37	43	fresh mb
43	45	SW mb, fe staining, water strike
45	80	fresh mb

Comments

fractures at 22 and 45m

MONITORING BORE DRILLING DATA**AMCMW4**

Start - 5/04/2021 **Finish -** drilling: 5/4/21 install 6/4/21

Easting - 448983 **Northing -** 6742773 UTM51

Drilling Method - Conventional, hammer and air **Hole Angle & Azimuth -** 90 , **SWL-** NA

Drilling

Reaming - 12" (300mm) dia.

From - surface **To -** 6m

Drilling - 135mm dia.

From - 6m **To -** 80 EOH

~~**Blank surface casing, steel -** (12")~~

~~**From -** surface **To -** 6m~~

Casing PVC

Casing - 50mm PN9

From - surface **To -** 62m

Screen - 50mm PN9 0.5mm slot

From - 62m **To -** 68m

Casing - 50mm PN9

From - 68m **To -** 74m

Screen - 50mm PN9 0.5mm slot

From - 74m **To -** 80m EOH

Stickup - pvc 0.15 magl

Hydro (drilling)

Top m	Base m	Airlift L/s	Description
0	60	0.5	passed through softer drilling zone with fe staining, 57-60m. First water strike at 60m
60	68	1	passed through softer drilling zone with fe staining, 65-66m. Water increase observed
68	80	~1	no observable change, water loss at collar so no airlift reading.

Logging Summary

from m	to m	
0	7	red saprolite
7	13	extremely weather mb
13	20	slightly weathered Mb grey, minor fe staining
20	55	fresh mb
55	58	fresh mb, minor fe staining, softer drilling
58	60	SW mb, fe staining, water strike @60m, softer drilling
60	63	fresh mb
63	65	sw mb, fracture and softer drilling, fe staining, increase in water
65	70	fresh mb
70	72	sm mb, fe staining, no change to drilling conditions or water
72	80	fresh mb, with occational evidence of fe staining.

Comments

fractures at 57-60m and 65-66m

MONITORING BORE DRILLING DATA**AMCMW5****Start -** 7/04/2021 **Finish -** 7/4/21 no well install**Easting -** 452136 **Northing -** 6740050 UTM51**Drilling Method -** Conventional, hammer and air **Hole Angle & Azimuth -** 90 , **SWL-** NA**Drilling****Reaming -** 12" (300mm) dia.**From -** surface **To -** 6m**Drilling -** 135mm dia.**From -** 6m **To -** 80 EOH~~**Blank surface casing, steel -** (12")~~~~**From -** surface **To -** 6m~~**Casing PVC****Casing -** 50mm PN9**From -** N/A **To -** N/A**Screen -** 50mm PN9 0.5mm slot**From -** N/A **To -** N/A**Stickup -** pvc N/A magl**Hydro (drilling)**

Top m	Base m	Airlift L/s	Description
0	80	0	dry

Logging Summary

from m	to m	Description
0	12	red saprolite
12	21	extremely weathered mb
21	32	moderately to highly weathered Mb grey, fe staining

32	45	slightly weathered Mb, iron staining
45	51	moderately weathered Mb
51	60	slightly weathered Mb, iron staining
60	80	fresh Mb

EOH

Comments

fractures at 46-48m and 61-64m characterised by increased weathering
dry hole
quartz veins

MONITORING BORE DRILLING DATA**AMCMW6****Start -** 4/04/2021 **Finish -** 4/4/21 install 5/4/21**Easting -** 451017 **Northing -** 670847 UTM51**Drilling Method -** Conventional, hammer and air **Hole Angle & Azimuth -** 90 , **SWL-** NA**Drilling****Reaming -** 12" (300mm) dia.**From -** surface **To -** 6m**Drilling -** 135mm dia.**From -** 6m **To -** 69 EOH~~**Blank surface casing, steel -** (12")~~~~**From -** surface **To -** 6m~~**Casing PVC****Casing -** 50mm PN9**From -** surface **To -** 74m**Screen -** 50mm PN9 0.5mm slot**From -** 74m **To -** 80m EOH**Stickup -** pvc 0.5 magl**Hydro (drilling)**

Top m	Base m		Airlift L/s	Description
0	80	EOH	0	dry

Logging Summary

from m	to m	Description
0	20	Extremely, highly weathered basalt






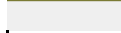




20	30		Slightly weathered basalt
30	35		SW/F basalt, competent rock, Fe staining
35	80	EOH	fresh, massive basalt, minor Fe staining at 40m. Qz veins

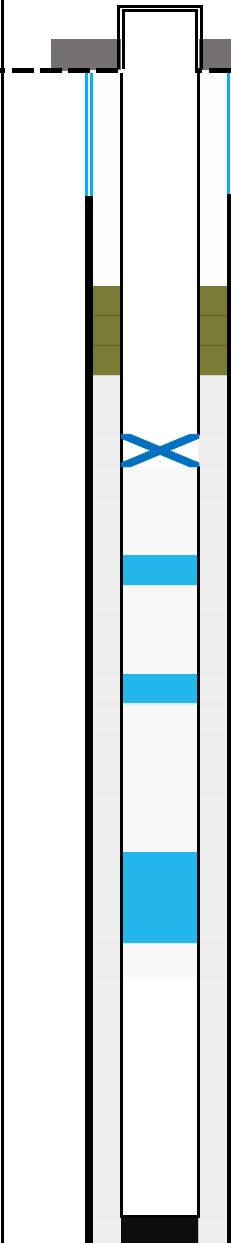
Comments

dry hole

NDRC Drilling











PO Box 78 Mundairing 6073
 Mobile: 0439 561 274
 Email: nigel_ndrc@bigpond.com

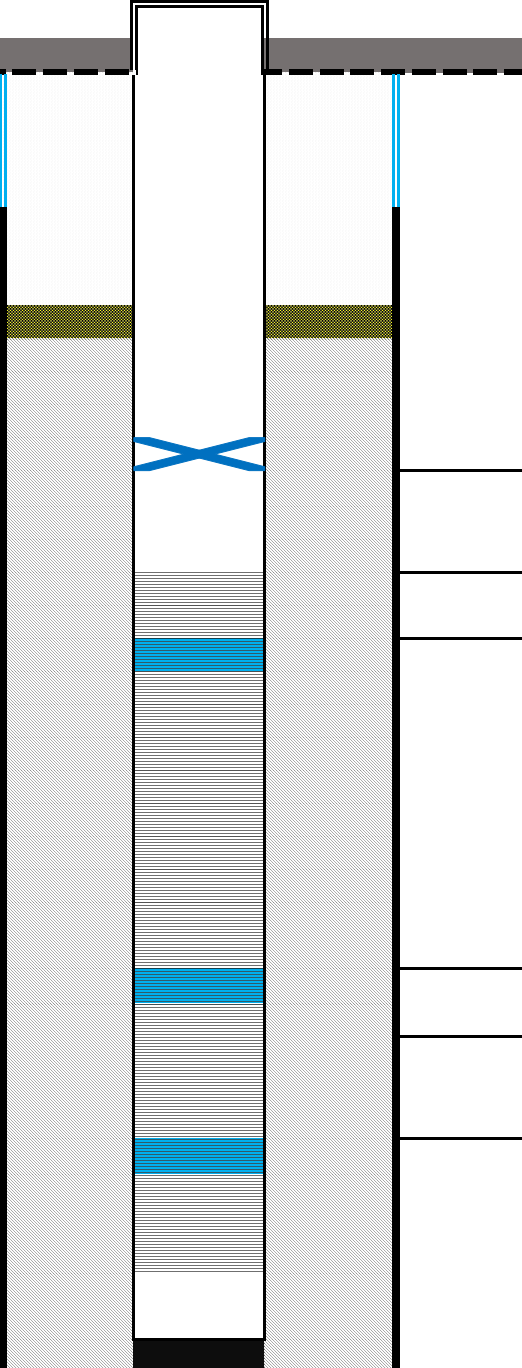
-  Lockable Steel Riser
-  Concrete Plinth
-  Surface casing: 250mm Sched 10 steel casing
-  Backfill
-  Bentonite Plug
-  Filter/gravel (> 3.2 mmDIA) Clean Washed
-  Solid casing: 155mm DIA uPVC Class 12, 9mm wall thickness.
-  Screens: 155mmDIA uPVC Class 12 9mm wall thickness. 1.5 mm slott
-  Ground Water Level (GWL, mAHD): 0.00
-  Water Strike

Well ID: WB 003		Well Construction	WaterStrike	Lithological Description / Remarks	
RL (m)	Depth (mbgl)				
	0				
	1				Sand
	2				Calcrete 2 - 4m
	3				
	4				
	5				Oxidised clays 5 - 26m
	6				
	7				
	8				
	9				
	10				
	11				
	12				
	13 - 24			GWL 23M	
	25				
	26				
	27				
	28			Water strike	Transitional
	29			0.700ml/s	
	30				Transitional
	35				
	36			Water strike	Fracture @ 36m
	37			1l/s	
	38				Transitional/fresh broken
	39				
	40				
	41 - 44				
	45		Water strike	Fresher / fractured 45 - 47m	
	46		45 - 47m		
	47		2.2l/s		
	48				
	49				
	50 - 53				
	54			52m Fresh rock Quartz Pyrophyllite schist/ fresh	
	55			white/grey	
	56				
	57				
	58				
	59				
	60			End of bore construction with end cap	

NDRC Drilling


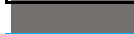








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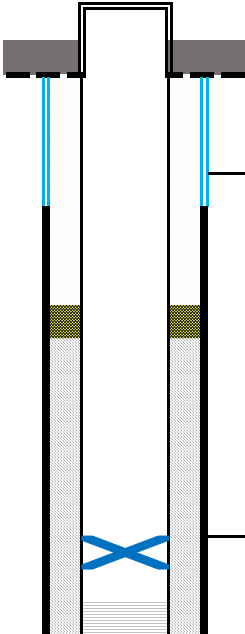
-  Lockable Steel Riser
-  Concrete Plinth
-  Surface casing: 250 n 250mm Sched 10 steel casing
-  Backfill
-  Bentonite Plug
-  Filter/gravel (> 3.2 mmDIA) Clean Washed
-  Solid casing: 155mm DIA uPVC Class 12, 9mm wall thickness.
-  Screens: 155mmDIA uPVC Class 12 9mm wall thickness. 1.5 mm slott
-  Ground Water Level (GWL, mAHD): 0.00
-  Water Strike

Well ID: WB 001		Well Construction		WaterStrike	Lithological Description / Remarks
RL (m)	Depth (mbgl)				
	0				
	1				Quartz Pyrophyllite schist, heavy weathering
	2				White in colour
	3				
	4				
	5				
	6				
	7				
	8				
	9				
	10				
	11				
	12				
	13				
	14 - 29				Quartz Pyrophyllite schist, heavy weathering
	30				Yellow/brown
	31				Clay Zone 31m - 38m
	32				
	33				
	34				Water strike
	35				0.25L/s
	36				
	37				
	38				
	39				
	40				
	41 - 47				
	48				
	49		Water strike		
	50		1.4L/s		
	51 - 63		Quartz Pyrophyllite schist, moderate weathering		
	64		red/brown/transitional zone		
	65				
	66				
	67		Water strike		
	68		5L/s		
	69				
	70				
	71				
	72		End of bore construction with end cap		

NDRC Drilling

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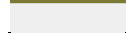

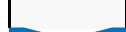


-  Lockable Steel Riser
-  Concrete Plinth
-  Surface casing: 250mm Sched 10 steel casing
-  Backfill
-  Bentonite Plug
-  Filter/gravel (> 3.2 mmDIA) Clean Washed
-  Solid casing: 155mm DIA uPVC Class 12, 9mm wall thickness.
-  Screens: 155mmDIA uPVC Class 12 9mm wall thickness. 1.5 mm slott
-  Ground Water Level (GWL, mAHD): 0.00
-  Water Strike

Well ID: WB 002		Well Construction	WaterStrike	Lithological Description / Remarks
RL (m)	Depth (mbgl)			
	0			
	1			Weathered Basalt / dark grey
	2			
	3			
	4			Moderatly weathered basalt / dark grey
	5			
	6			
	7			
	8			
	9			
	10			
	11			
	12			
	13			
	14 - 20			
	21		GWL 21m	
	22 - 30			
	31			

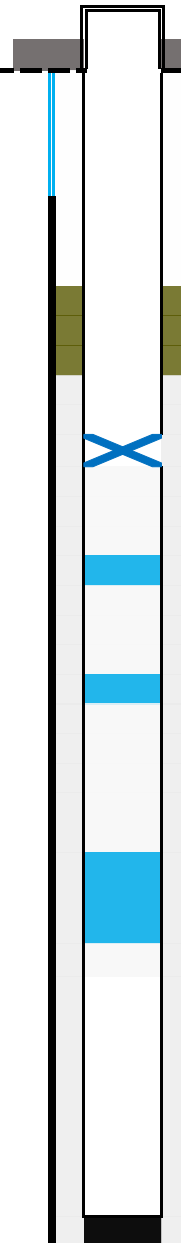
32			
33 - 34			Moderately weathered basalt / dark grey
35			Slightly weathered basalt / dark grey
36			
37 - 38			
39			
40			
41			Water strike
42			0.5l/s
43			Water strike
44			1.5l/s
45			
46			
47			
48			Water strike
49			3.0l/s
50			
51			
52			
53			End of bore construction with end cap
54			

NDRC Drilling

PO Box 78 Mundairing 6073
 Mobile: 0439 561 274
 Email: nigel_ndrc@bigpond.com

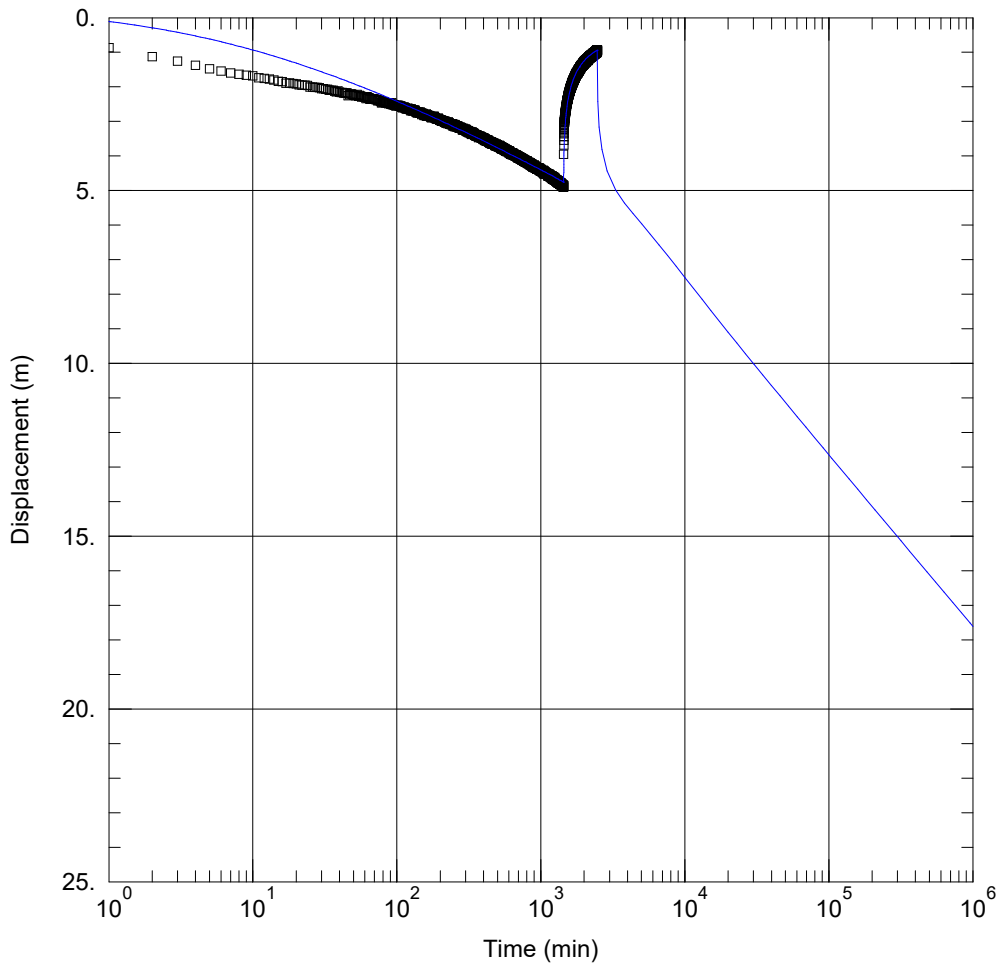
-  Lockable Steel Riser
-  Concrete Plinth
-  Surface casing: 250mm Sched 10 steel casing Backfill
-  Bentonite Plug
-  Filter/gravel (> 3.2 mmDIA) Clean Washed
-  Solid casing: 155mm DIA uPVC Class 12, 9mm wall thickness.
-  Screens: 155mmDIA uPVC Class 12 9mm wall thickness. 1.5 mm slott
-  Ground Water Level (GWL, mAHD): 0.00
-  Water Strike

51 J
 447453.00 m E
 6744825.00 m S

Well ID: WB 003		Well Construction	WaterStrike	Lithological Description / Remarks	
RL (m)	Depth (mbgl)				
	0				
	1				Sand
	2				Calcrete 2 - 4m
	3				
	4				
	5				Oxidised clays 5 - 26m
	6				
	7				
	8				
	9				
	10				
	11				
	12				
	13 - 24			GWL 23M	
	25				
	26				
	27				
	28			Water strike	Transitional
	29			0.700m/s	
	30				Transitional
	35				
	36			Water strike	Fracture @ 36m
	37			1l/s	
	38				Transitional/fresh broken
	39				
	40				
	41 - 44				
	45		Water strike	Fresher / fractured 45 - 47m	
	46		45 - 47m		
	47		2.2l/s		
	48				
	49				
	50 - 53				
	54			52m Fresh rock Quartz Pyrophyllite schist/ fresh white/grey	
	55				
	56				
	57				
	58				
	59				
	60			End of bore construction with end cap	

Appendix B

Aqtesolv Analytical Software



WELL TEST ANALYSIS

Data Set: C:\Users\Carsten\Documents\Mt Celia\WB001\WB001.aqt
 Date: 07/03/21 Time: 21:46:41

PROJECT INFORMATION

Company: AMC
 Project: 221005
 Location: Mt Celia
 Test Well: WB001
 Test Date: 25 May 2021

AQUIFER DATA

Saturated Thickness: 80. m Slab Block Thickness: 1. m

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
WB001	0	0

Observation Wells

Well Name	X (m)	Y (m)
□ AMCMW2	5	0

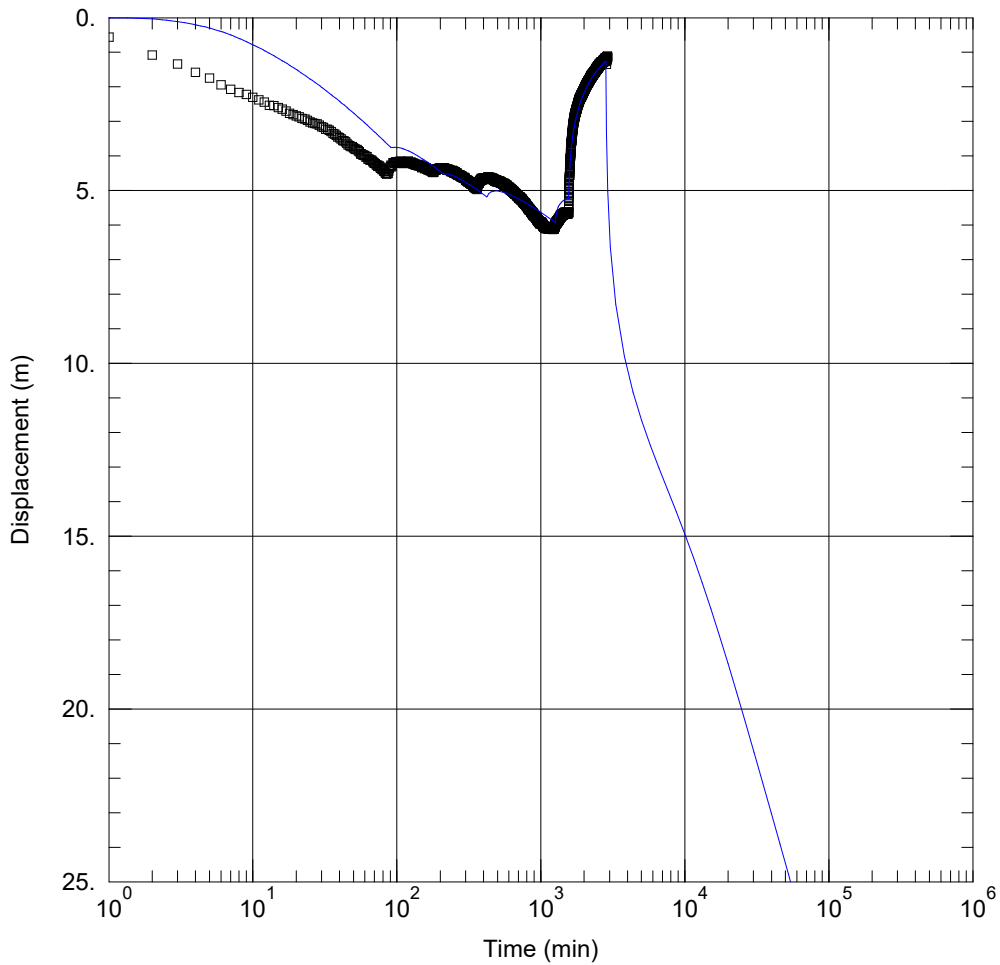
SOLUTION

Aquifer Model: Fractured

Solution Method: Moench w/slab blocks

K = 0.3197 m/day
 K' = 0.000339 m/day
 Sw = 0.
 r(w) = 0.0075 m

Ss = 1.906E-10 m⁻¹
 Ss' = 0.00553 m⁻¹
 Sf = 0.
 r(c) = 0.0075 m



WELL TEST ANALYSIS

Data Set: C:\Users\Carsten\Documents\Mt Celia\WB002\WB002.aqt
 Date: 07/03/21 Time: 21:21:05

PROJECT INFORMATION

Company: AMC
 Project: 221005
 Location: Mt Celia
 Test Well: WB002
 Test Date: 18 May 2021

AQUIFER DATA

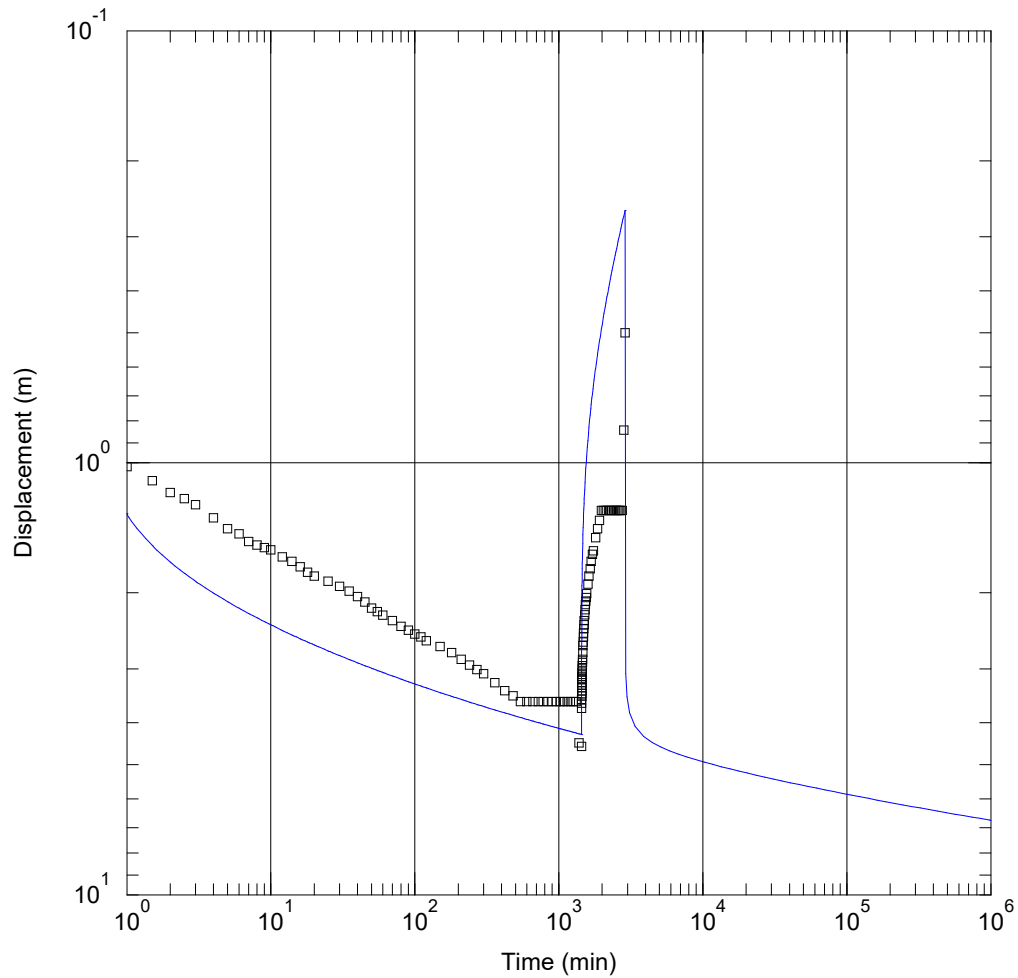
Saturated Thickness: 80. m Slab Block Thickness: 1. m

WELL DATA

Pumping Wells			Observation Wells		
Well Name	X (m)	Y (m)	Well Name	X (m)	Y (m)
WB002	0	0	□ AMCMW1	11.4	0

SOLUTION

Aquifer Model: <u>Fractured</u> K = <u>0.0341 m/day</u> K' = <u>8.462E-6 m/day</u> Sw = <u>0.</u> r(w) = <u>0.0075 m</u>	Solution Method: <u>Moench w/slab blocks</u> Ss = <u>1.906E-6 m⁻¹</u> Ss' = <u>0.0004078 m⁻¹</u> Sf = <u>0.</u> r(c) = <u>0.0075 m</u>
--	--



WELL TEST ANALYSIS

Data Set: C:\Users\Carsten\Documents\Mt Celia\WB003\WB003.aqt
 Date: 07/03/21 Time: 22:05:59

PROJECT INFORMATION

Company: AMC
 Project: 221005
 Location: Mt Celia
 Test Well: WB001
 Test Date: 25 May 2021

AQUIFER DATA

Saturated Thickness: 80. m Slab Block Thickness: 1. m

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
WB003	0	0

Observation Wells

Well Name	X (m)	Y (m)
□ WB003	0	0

SOLUTION

Aquifer Model: Fractured

Solution Method: Moench w/slab blocks

K = 2.054 m/day

Ss = 1.906E-6 m⁻¹

K' = 1440. m/day

Ss' = 1. m⁻¹

Sw = 0.

Sf = 0.

r(w) = 0.0075 m

r(c) = 0.0075 m

Appendix C

Groundwater Chemistry Laboratory Report

CLIENT DETAILS

Contact 58008129164 ABN
 Client AMC CONSULTANTS PTY LTD
 Address LEVEL 29
 140 WILLIAM STREET
 MELBOURNE VIC 3000
 Telephone 61 3 8601 3300
 Facsimile (Not specified)
 Email accounts@amcconsultants.com
 Project 221005
 Order Number (Not specified)
 Samples 3

LABORATORY DETAILS

Manager Marjana Siljanoska
 Laboratory SGS Perth Environmental
 Address 28 Reid Rd
 Perth Airport WA 6105
 Telephone (08) 9373 3500
 Facsimile (08) 9373 3556
 Email au.environmental.perth@sgs.com
 SGS Reference PE152307 R0
 Date Received 02 Jun 2021
 Date Reported 25 Jun 2021

COMMENTS

Accredited for compliance with ISO/IEC 17025 - Testing, NATA accredited laboratory 2562(898/20210).

Metals: LORs raised due to high conductivity.

Metals: Dissolved Cu : Spike recovery failed acceptance criteria due to the presence of significant concentration of analyte (i.e. the concentration of analyte exceeds the spike level).

For determination of soluble metals, filtered sample was not received so samples were laboratory filtered on receipt. This may give soluble metals results that do not represent the concentrations present at the time of sampling.

SIGNATORIES

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Parameter	Units	LOR	PE152307.001	PE152307.002	PE152307.003
Sample Number			PE152307.001	PE152307.002	PE152307.003
Sample Matrix			Water	Water	Water
Sample Date			26/5/21 13:00	19/5/21 11:30	30/5/21 7:30
Sample Name			WB001	WB002	WB003

pH in water Method: AN101 Tested: 3/6/2021

Parameter	Units	LOR	PE152307.001	PE152307.002	PE152307.003
pH**	pH Units	-	7.7	7.9	7.7

Conductivity and TDS by Calculation - Water Method: AN106 Tested: 3/6/2021

Parameter	Units	LOR	PE152307.001	PE152307.002	PE152307.003
Conductivity @ 25 C	µS/cm	2	23000	9500	23000

Total Dissolved Solids (TDS) in water Method: AN113 Tested: 8/6/2021

Parameter	Units	LOR	PE152307.001	PE152307.002	PE152307.003
Total Dissolved Solids Dried at 175-185°C	mg/L	10	15000	5700	14000

Acidity and Free CO2 Method: AN140 Tested: 10/6/2021

Parameter	Units	LOR	PE152307.001	PE152307.002	PE152307.003
Acidity to pH 8.3	mg CaCO3/L	5	47	38	45

Alkalinity Method: AN135 Tested: 3/6/2021

Parameter	Units	LOR	PE152307.001	PE152307.002	PE152307.003
Total Alkalinity as CaCO3	mg/L	5	450	560	530
Carbonate Alkalinity as CO3	mg/L	1	<1	<1	<1
Bicarbonate Alkalinity as HCO3	mg/L	5	550	690	640

Fluoride by Ion Selective Electrode in Water Method: AN141 Tested: 10/6/2021

Parameter	Units	LOR	PE152307.001	PE152307.002	PE152307.003
Fluoride by ISE	mg/L	0.1	1.1	1.3	1.2

	Sample Number	PE152307.001	PE152307.002	PE152307.003
	Sample Matrix	Water	Water	Water
	Sample Date	26/5/21 13:00	19/5/21 11:30	30/5/21 7:30
	Sample Name	WB001	WB002	WB003

Parameter	Units	LOR			
-----------	-------	-----	--	--	--

Chloride by Discrete Analyser in Water Method: AN274 Tested: 8/6/2021

Chloride, Cl	mg/L	1	7800	2500	7600
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Sulfate in water Method: AN275 Tested: 8/6/2021

Sulfate, SO4	mg/L	1	1300	880	1300
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Nitrate Nitrogen and Nitrite Nitrogen (NOx) by FIA Method: AN258 Tested: 8/6/2021

Nitrite Nitrogen, NO ₂ as N	mg/L	0.05	<0.05	<0.05	<0.05
Nitrate Nitrogen, NO ₃ as N	mg/L	0.05	16	10	23

Filterable Reactive Phosphorus (FRP) Method: AN278 Tested: 10/6/2021

Filterable Reactive Phosphorus as P	mg/L	0.005	0.005	0.007	0.009
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Metals in Water (Dissolved) by ICPOES Method: AN320 Tested: 8/6/2021

Calcium, Ca	mg/L	0.2	220	83	190
Iron, Fe	mg/L	0.02	<0.10†	<0.02	<0.10†
Magnesium, Mg	mg/L	0.1	440	200	370
Manganese, Mn	mg/L	0.005	0.037	<0.005	0.099
Potassium, K	mg/L	0.1	81	49	84
Soluble Silicon as Silica, SiO ₂	mg/L	0.05	15	26	19
Silicon, Si	mg/L	0.02	6.9	12	8.8
Sodium, Na	mg/L	0.5	4600	1700	4700

Trace Metals (Dissolved) in Water by ICPMS Method: AN318 Tested: 8/6/2021

Arsenic, As	µg/L	1	8	<5†	<5†
Cadmium, Cd	µg/L	0.1	<0.5†	<0.5†	<0.5†
Chromium, Cr	µg/L	1	<5†	<5†	<5†
Copper, Cu	µg/L	1	<5†	<5†	<5†
Lead, Pb	µg/L	1	<5†	<5†	<5†
Nickel, Ni	µg/L	1	<5†	<5†	<5†
Zinc, Zn	µg/L	5	<25†	<25†	<25†

Parameter	Units	LOR	PE152307.001	PE152307.002	PE152307.003
Mercury (dissolved) in Water Method: AN311(Perth)/AN312 Tested: 9/6/2021					
Mercury	mg/L	0.00005	<0.00005	<0.00005	<0.00005

MB blank results are compared to the Limit of Reporting
 LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
 DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA', the results are less than the LOR and thus the RPD is not applicable.

Acidity and Free CO2 Method: ME-(AU)-[ENV]AN140

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Acidity to pH 8.3	LB184635	mg CaCO3/L	5	<5	11%	99%

Alkalinity Method: ME-(AU)-[ENV]AN135

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Total Alkalinity as CaCO3	LB184496	mg/L	5	<5	0%	100%
Carbonate Alkalinity as CO3	LB184496	mg/L	1	<1		
Bicarbonate Alkalinity as HCO3	LB184496	mg/L	5	<5		

Chloride by Discrete Analyser in Water Method: ME-(AU)-[ENV]AN274

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Chloride, Cl	LB184555	mg/L	1	<1	0 - 1%	106 - 107%	107%

Conductivity and TDS by Calculation - Water Method: ME-(AU)-[ENV]AN106

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Conductivity @ 25 C	LB184494	µS/cm	2	<2	0 - 4%	99 - 100%

Filterable Reactive Phosphorus (FRP) Method: ME-(AU)-[ENV]AN278

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Filterable Reactive Phosphorus as P	LB184627	mg/L	0.005	<0.005	0%	95 - 98%	97%

Fluoride by Ion Selective Electrode in Water Method: ME-(AU)-[ENV]AN141

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Fluoride by ISE	LB184637	mg/L	0.1	<0.1	0 - 4%	98 - 99%	80 - 94%

MB blank results are compared to the Limit of Reporting
 LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample
 DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Mercury (dissolved) in Water Method: ME-(AU)-[ENV]AN311(Perth)/AN312

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Mercury	LB184565	mg/L	0.00005	<0.00005	0%	95%	93%

Metals in Water (Dissolved) by ICPOES Method: ME-(AU)-[ENV]AN320

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Calcium, Ca	LB184505	mg/L	0.2	<0.2	0 - 1%	100%	73%
Iron, Fe	LB184505	mg/L	0.02	<0.02		98%	102%
Magnesium, Mg	LB184505	mg/L	0.1	<0.1	0%	100%	101%
Manganese, Mn	LB184505	mg/L	0.005	<0.005		103%	105%
Potassium, K	LB184505	mg/L	0.1	<0.1	1%	100%	106%
Soluble Silicon as Silica, SiO2	LB184505	mg/L	0.05	<0.05			
Silicon, Si	LB184505	mg/L	0.02	<0.02	0%	103%	103%
Sodium, Na	LB184505	mg/L	0.5	<0.5	1%	99%	103%

Nitrate Nitrogen and Nitrite Nitrogen (NOx) by FIA Method: ME-(AU)-[ENV]AN258

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Nitrite Nitrogen, NO ₂ as N	LB184512	mg/L	0.05	<0.05	0%	103%
Nitrate Nitrogen, NO ₃ as N	LB184512	mg/L	0.05	<0.05	1%	NA

pH in water Method: ME-(AU)-[ENV]AN101

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
pH**	LB184494	pH Units	-	5.8	0 - 2%	100%

Sulfate in water Method: ME-(AU)-[ENV]AN275

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Sulfate, SO ₄	LB184555	mg/L	1	<1	1%	107%	94 - 97%

MB blank results are compared to the Limit of Reporting

LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.

DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA', the results are less than the LOR and thus the RPD is not applicable.

Total Dissolved Solids (TDS) in water Method: ME-(AU)-[ENV]AN113

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery	MSD %RPD
Total Dissolved Solids Dried at 175-185°C	LB184534	mg/L	10	<10	1%	104%	93%	0%

Trace Metals (Dissolved) in Water by ICPMS Method: ME-(AU)-[ENV]AN318

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Arsenic, As	LB184507	µg/L	1	<1	13%	110%	
Cadmium, Cd	LB184507	µg/L	0.1	<0.1	0%	105%	
Chromium, Cr	LB184507	µg/L	1	<1	0%	105%	
Copper, Cu	LB184507	µg/L	1	<1	2%	113%	64%
Lead, Pb	LB184507	µg/L	1	<1	0%	110%	
Nickel, Ni	LB184507	µg/L	1	<1	1%	113%	
Zinc, Zn	LB184507	µg/L	5	<5	0%	97%	

METHOD

METHODOLOGY SUMMARY

Nitrate and Nitrite by FIA: In an acidic medium, nitrate is reduced quantitatively to nitrite by cadmium metal. This nitrite plus any original nitrite is determined as an intense red-pink azo dye at 540 nm following diazotisation with sulphanilamide and subsequent coupling with N-(1-naphthyl) ethylenediamine dihydrochloride. Without the cadmium reduction only the original nitrite is determined. Reference APHA 4500-NO3- F.

AN101

pH in Soil Sludge Sediment and Water: pH is measured electrometrically using a combination electrode (glass plus reference electrode) and is calibrated against 3 buffers purchased commercially. For soils, an extract with water is made at a ratio of 1:5 and the pH determined and reported on the extract. Reference APHA 4500-H+.

AN106

Conductivity and TDS by Calculation: Conductivity is measured by meter with temperature compensation and is calibrated against a standard solution of potassium chloride. Conductivity is generally reported as $\mu\text{mhos/cm}$ or $\mu\text{S/cm}$ @ 25°C. For soils, an extract with water is made at a ratio of 1:5 and the EC determined and reported on the extract, or calculated back to the as-received sample. Total Dissolved Salts can be estimated from conductivity using a conversion factor, which for natural waters, is in the range 0.55 to 0.75. SGS use 0.6. Reference APHA 2510 B.

AN106

Salinity may be calculated in terms of NaCl from the sample conductivity. This assumes all soluble salts present, measured by the conductivity, are present as NaCl.

AN113

Total Dissolved Solids: A well-mixed filtered sample of known volume is evaporated to dryness at 180°C and the residue weighed. Approximate methods for correlating chemical analysis with dissolved solids are available. Reference APHA 2540 C.

AN113

The Total Dissolved Solids residue may also be ignited at 550 C and volatile TDS (Organic TDS) and non-volatile TDS (Inorganic) can be determined.

AN135

Alkalinity (and forms of) by Titration: The sample is titrated with standard acid to pH 8.3 (P titre) and pH 4.5 (T titre) and permanent and/or total alkalinity calculated. The results are expressed as equivalents of calcium carbonate or recalculated as bicarbonate, carbonate and hydroxide. Reference APHA 2320. Internal Reference AN135

AN140

Acidity by Titration: The water sample is titrated with sodium hydroxide to designated pH end point. In a sample containing only carbon dioxide, bicarbonates and carbonates, titration to pH 8.3 at 25°C corresponds to stoichiometric neutralisation of carbonic acid to bicarbonate. Method reference APHA 2310 B.

AN141

Determination of Fluoride by ISE: A fluoride ion selective electrode and reference electrode combination, in the presence of a pH/complexation buffer, is used to determine the fluoride concentration. The electrode millivolt response is measured logarithmically against fluoride concentration. Reference APHA F- C.

AN274

Chloride by Discrete Analyse: Chloride reacts with mercuric thiocyanate forming a mercuric chloride complex. In the presence of ferric iron, highly coloured ferric thiocyanate is formed which is proportional to the chloride concentration. Reference APHA 4500Cl-

AN275

sulfate by Discrete Analyse: sulfate is precipitated in an acidic medium with barium chloride. The resulting turbidity is measured photometrically at 405nm and compared with standard calibration solutions to determine the sulfate concentration in the sample. Reference APHA 4500-SO42-. Internal reference AN275.

AN278

Filterable Reactive Phosphorus by DA (determined on filtered sample): Orthophosphate reacts with ammonium molybdate (Mo VI) and potassium antimonyl tartrate (Sb III) in acid medium to form an antimony-phosphomolybdate complex. This complex is subsequently reduced with ascorbic acid to form a blue colour and the absorbance is read at 880 nm. The sensitivity of the automated method is 10-20 times that of the macro method. Reference APHA 4500-P F

METHOD

METHODOLOGY SUMMARY

AN311(Perth)/AN312

Mercury by Cold Vapour AAS in Waters: Mercury ions are reduced by stannous chloride reagent in acidic solution to elemental mercury. This mercury vapour is purged by nitrogen into a cold cell in an atomic absorption spectrometer or mercury analyser. Quantification is made by comparing absorbances to those of the calibration standards. Reference APHA 3112/3500.

AN318

Determination of elements at trace level in waters by ICP-MS technique,, referenced to USEPA 6020B and USEPA 200.8 (5.4).

AN320

Metals by ICP-OES: Samples are preserved with 10% nitric acid for a wide range of metals and some non-metals. This solution is measured by Inductively Coupled Plasma. Solutions are aspirated into an argon plasma at 8000-10000K and emit characteristic energy or light as a result of electron transitions through unique energy levels. The emitted light is focused onto a diffraction grating where it is separated into components .

AN320

Photomultipliers or CCDs are used to measure the light intensity at specific wavelengths. This intensity is directly proportional to concentration. Corrections are required to compensate for spectral overlap between elements. Reference APHA 3120 B.

Calculation

Free and Total Carbon Dioxide may be calculated using alkalinity forms only when the samples TDS is <500mg/L. If TDS is >500mg/L free or total carbon dioxide cannot be reported . APHA4500CO2 D.

FOOTNOTES

IS	Insufficient sample for analysis.	LOR	Limit of Reporting
LNR	Sample listed, but not received.	↑↓	Raised or Lowered Limit of Reporting
*	NATA accreditation does not cover the performance of this service.	QFH	QC result is above the upper tolerance
**	Indicative data, theoretical holding time exceeded.	QFL	QC result is below the lower tolerance
***	Indicates that both * and ** apply.	-	The sample was not analysed for this analyte
		NVL	Not Validated

Unless it is reported that sampling has been performed by SGS, the samples have been analysed as received.
Solid samples expressed on a dry weight basis.

Where "Total" analyte groups are reported (for example, Total PAHs, Total OC Pesticides) the total will be calculated as the sum of the individual analytes, with those analytes that are reported as <LOR being assumed to be zero. The summed (Total) limit of reporting is calculated by summing the individual analyte LORs and dividing by two. For example, where 16 individual analytes are being summed and each has an LOR of 0.1 mg/kg, the "Totals" LOR will be 1.6 / 2 (0.8 mg/kg). Where only 2 analytes are being summed, the "Total" LOR will be the sum of those two LORs.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

If reported, measurement uncertainty follow the ± sign after the analytical result and is expressed as the expanded uncertainty calculated using a coverage factor of 2, providing a level of confidence of approximately 95%, unless stated otherwise in the comments section of this report.

Results reported for samples tested under test methods with codes starting with ARS-SOP, radionuclide or gross radioactivity concentrations are expressed in becquerel (Bq) per unit of mass or volume or per wipe as stated on the report. Becquerel is the SI unit for activity and equals one nuclear transformation per second.

Note that in terms of units of radioactivity:

- a. 1 Bq is equivalent to 27 pCi
- b. 37 MBq is equivalent to 1 mCi

For results reported for samples tested under test methods with codes starting with ARS-SOP, less than (<) values indicate the detection limit for each radionuclide or parameter for the measurement system used. The respective detection limits have been calculated in accordance with ISO 11929.

The QC and MU criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here: www.sgs.com.au/en-gb/environment-health-and-safety.

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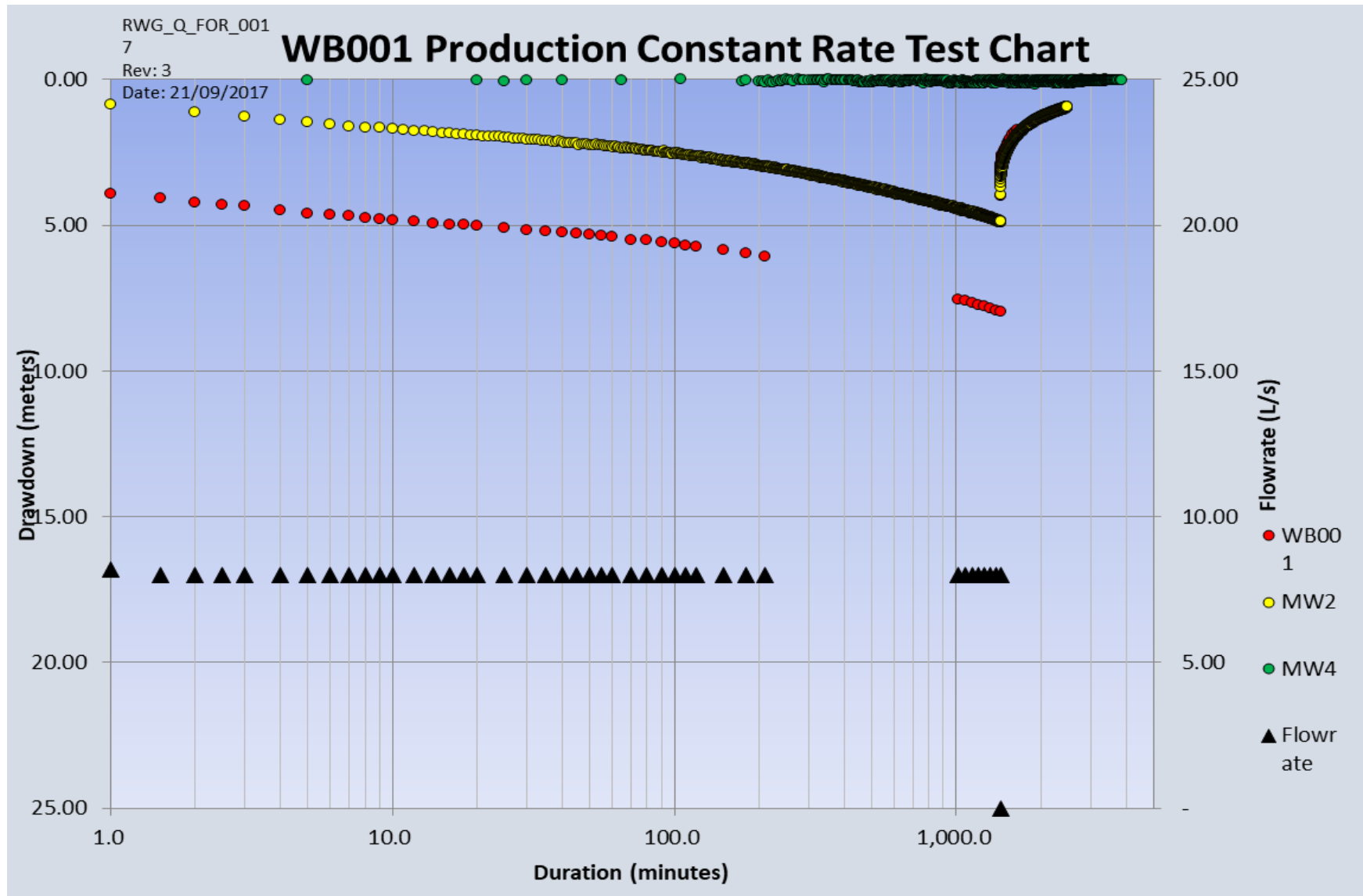
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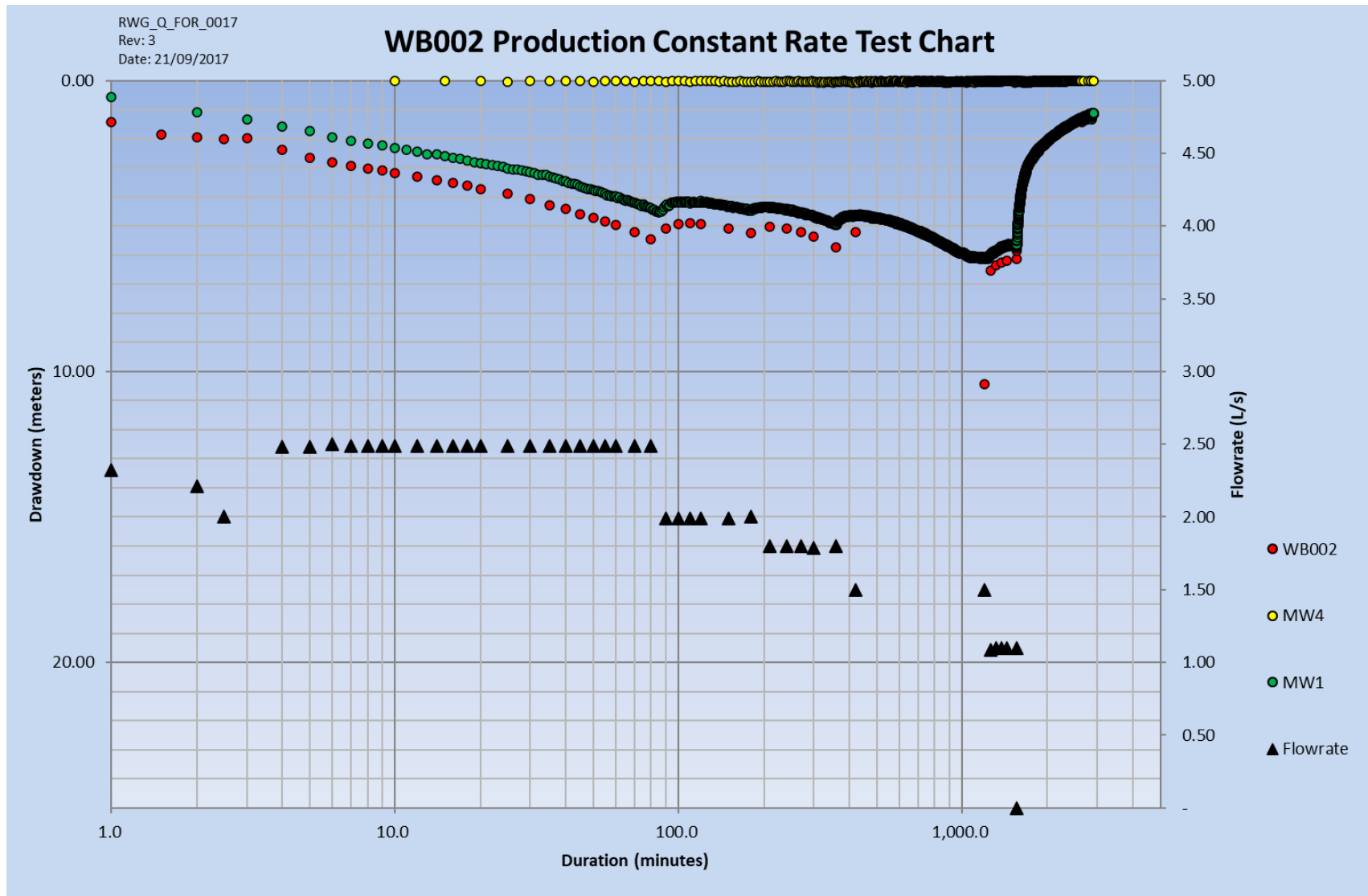
Appendix D

Constant Rate Tests

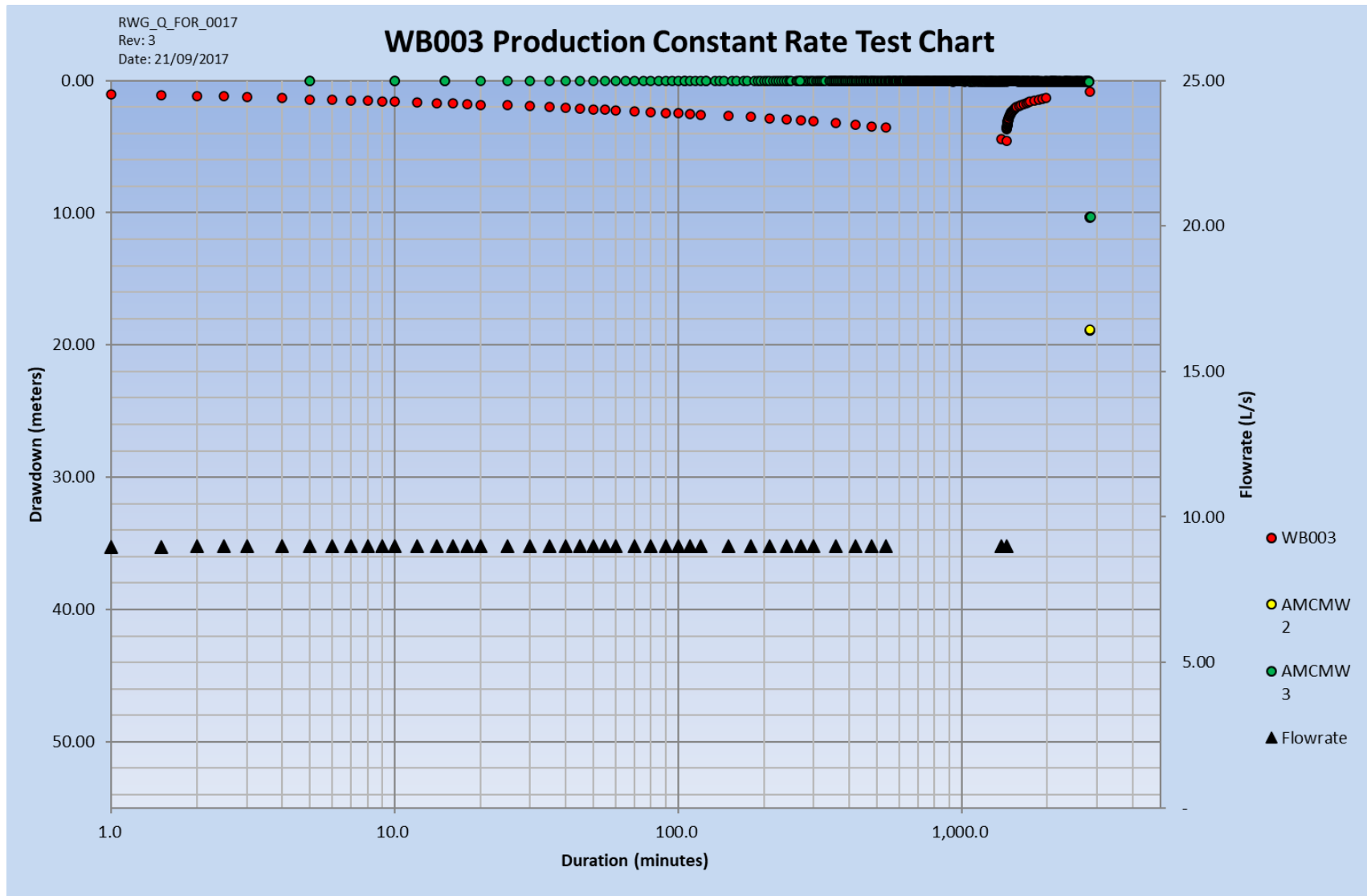
WB001 Constant Rate Test



WB002 Constant Rate Test



WB003 Constant Rate Test



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APPENDIX 4 – FLORA AND VEGETATION REPORTS



APPENDIX 4A – Native Vegetation Solutions - Detailed Flora and Vegetation Survey (Part 1)



DETAILED FLORA AND
VEGETATION SURVEY OF THE MT
CELIA PROJECT AREA
Part 1- June 2020

Prepared for:



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FINAL
V2.0
December 2020

EXECUTIVE SUMMARY

Legacy Iron Ore Ltd (ASX: LCY) has gold interests and is the operator of its Mt Celia Project in the Murchison Region of Western Australia. LCY provided Native Vegetation Solutions (NVS) with a survey area which encompasses the main mining areas as well as other infrastructure related to mining the Mt Celia mineral resource. The location of this survey area is approximately 169 km northeast of Kalgoorlie-Boulder, and approximately 89km south of Laverton in Western Australia.

The survey area, for the purposes of this report, encompasses an area totalling approximately 1,696 ha, which intersects Mining Tenements M39/1123, M39/1125, M39/1126, M39/1127, M39/1128 and Exploration License E39/1443. At this stage, the final footprint of mining related disturbances is yet to be finalised, however will be encompassed entirely within the survey area, and is expected to be approximately 400 hectares.

The survey area is located in the Eastern Murchison IBRA subregion. The vegetation of the Eastern Murchison botanical subregion is dominated by mulga woodlands and is often rich in ephemerals, hummock grasslands, saltbush shrublands and *Tecticornia* shrublands (CALM, 2002).

The EPBC Protected Matters Search Tool revealed that the survey area may contain habitat for the invasive weed species *Carrichtera annua* (Ward's Weed) and *Cenchrus ciliaris* (Buffel Grass) (DAWE, 2020). The EPBC Protected Matters report also indicated no TECs or Conservation Reserves within the requested search area.

The DBCA database searches revealed a potential for no Threatened and 10 Priority Flora species to occur within a 50km radius of the survey area (DBCA, 2020a). No known locations of these Flora occur within the survey area, while the closest location occurs approximately 5.8 km southwest of the survey area.

Results of the threatened flora database search are included in Appendix D.

The PEC/TEC search (DBCA, 2020) revealed no TECs or PECs within the survey area.

The survey area does not lie within or contain any ESA's or Conservation Reserves (DWER, 2020).

No water bodies were identified within the survey area via the CPS Map Viewer (DWER, 2020).

The survey area lies south of the 26th parallel, however receives average annual rainfall of approximately 284.8mm (BOM, 2020), 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.

Twelve vegetation groups were identified during this survey, largely following topographical features and dominant species. Mapping of the 12 vegetation groups, as well as the quadrat locations can be seen in Appendix C. Photographs of each quadrat and the relevant vegetation group can be seen in Appendix F.

One hundred and twenty-three species were recorded within the survey area with 115 species recorded within quadrats. Twenty-nine families and 57 genera were found. These are listed in Appendix E, per Quadrat as well as per vegetation group. Of the native species, Fabaceae had the highest representation, with 25 species from 3 genera, dominated by *Acacia*. Chenopodiaceae and Poaceae were the next best represented families with 20 species and 15 species respectively.

Of the 123 taxa recorded seven of these were introduced weed species. *Citrullus amarus* (Pie Melon) *Cucumis myriocarpus* (Prickly Paddy Melon) and *Cenchrus ciliaris* (Buffel Grass) were

captured within the quadrat sampling, whilst *Schinus mollee* var. *areira* (Pepper Tree), *Nerium oleander* (Oleander Tree), *Yucca aloifolia* (Yucca Tree), and *Tamarix aphylla* (Athel pine) were recorded from a single location within the vicinity of the the old Mt Celia homestead.

Of the seven non-native species above, only *Tamarix aphylla* (Athel pine) is a declared pest- s22(2) in the state of Western Australia.

The most common and widespread species was *Ptilotus obovatus*, which was recorded within all 43 quadrats. Its canopy cover was 10-30%. The next most common and widespread species was *Acacia aneura*, recorded in 34 quadrats, with a canopy cover between 10-30%.

There were 29 taxa recorded from within a single site, Q15. Of these, two were weed species.

No Threatened species were recorded during the survey.

No Priority species were identified in the survey area.

Vegetation condition was generally 'Good' to 'Very Good' (Keighery 1994). Disturbance was present within the survey area mostly attributed to historic mining activities, access tracks, exploration related activities, and also grazing.

The EPA objective for flora and vegetation is to maintain the abundance, species diversity and geographical distribution of flora and vegetation as well as protect Threatened flora consistent with the provisions of the *Biodiversity Conservation Act 2016*.

The proposed clearing of vegetation will result in the loss of some individuals from the local area; however, the impact will not be great enough to remove whole communities or populations. Most of the species and communities recorded during this survey are widespread throughout the Eastern Murchison subregion and adjoining regions, and therefore the loss of a small proportion from this area will not be significant.

This report summarises the results of the first stage of the detailed flora and vegetation survey, incorporating the Winter survey of 2020.

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1 INTRODUCTION

1.1 BACKGROUND

Legacy Iron Ore Ltd (ASX: LCY) has gold interests and is the operator of its Mt Celia Project in the Murchison Region of Western Australia. LCY provided Native Vegetation Solutions (NVS) with a survey area which encompasses the main mining areas as well as other infrastructure related to mining the Mt Celia mineral resource. The location of this survey area is approximately 169 km northeast of Kalgoorlie-Boulder, and approximately 89km south of Laverton in Western Australia (Figure 1).

This report will support numerous applications including mining proposals and clearing permits submitted to relative Government Departments.

The survey area, for the purposes of this report, encompasses an area totalling approximately 1,696 ha, which intersects Mining Tenements M39/1123, M39/1125, M39/1126, M39/1127, M39/1128 and Exploration License E39/1443. At this stage, the final footprint of mining related disturbances is yet to be finalised, however will be encompassed entirely within the survey area, and is expected to be approximately 400 hectares.



Figure 1: Regional Location of the Mt Celia Project Area

1.2 PURPOSE AND SCOPE

The objective of this report is to record and analyse the results of the flora and vegetation component of a Detailed assessment conducted in accordance with the following documents:

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

A Detailed Flora and Vegetation Survey has two components:

- 1) Reconnaissance Survey
 - a) Desktop study which includes a literature review and a search of the relevant databases; and
 - b) Reconnaissance survey of the subject area to verify the desktop survey, undertake low impact sampling, define vegetation groups present in the area, search for species of conservation significance and to determine potential sensitivity to impact.
- 2) Detailed Plot Based Survey
 - a) Detailed survey, comprising multiple visits in main flowering seasons or other seasons and replication of plots in vegetation units incorporating greater coverage than a reconnaissance survey; and
 - b) Comprehensive survey when necessary to: enhance the level of knowledge at the locality or sub-regional scale, in order to provide wider context for the local scale.

Therefore, the scope of work for the Detailed flora and vegetation survey was to:

- Conduct a desktop study that includes a literature review and search of relevant databases;
- Conduct a plot-based survey within the survey area (20m x 20m quadrats);
- Prepare an inventory of species occurring in the study area;
- Conduct PATN analysis of quadrat-based presence/absence data;
- Quantify survey intensity via Species Accumulation Curve;
- Describe the vegetation associations in the survey area;
- Identify any vegetation communities or flora species of particular 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, particularly flora of conservation significance, within the study area.

2 EXISTING ENVIRONMENT

2.1 CLIMATE

Typically, the climate of the general survey area is characterised as being arid to semi-arid Mediterranean with mainly winter rainfall as well as summer thunderstorms. The area receives approximately 250-300mm of rainfall per year (Beard, 1990; CALM, 2002). The nearest official meteorological weather station with the most complete and up to date information is Laverton Aero (station number 012305), which is located approximately 92 km north of the survey area.

2.1.1 Temperature

Mean annual minimum temperature at Laverton Aero is 14.1°C and mean annual maximum temperature is 27.2°C (BOM, 2020). The coldest temperatures occur in July (mean minimum temperature 5.9°C), the hottest is January (mean maximum temperature 35.6°C) and diurnal temperature variations are relatively consistent throughout the year (Figure 2).

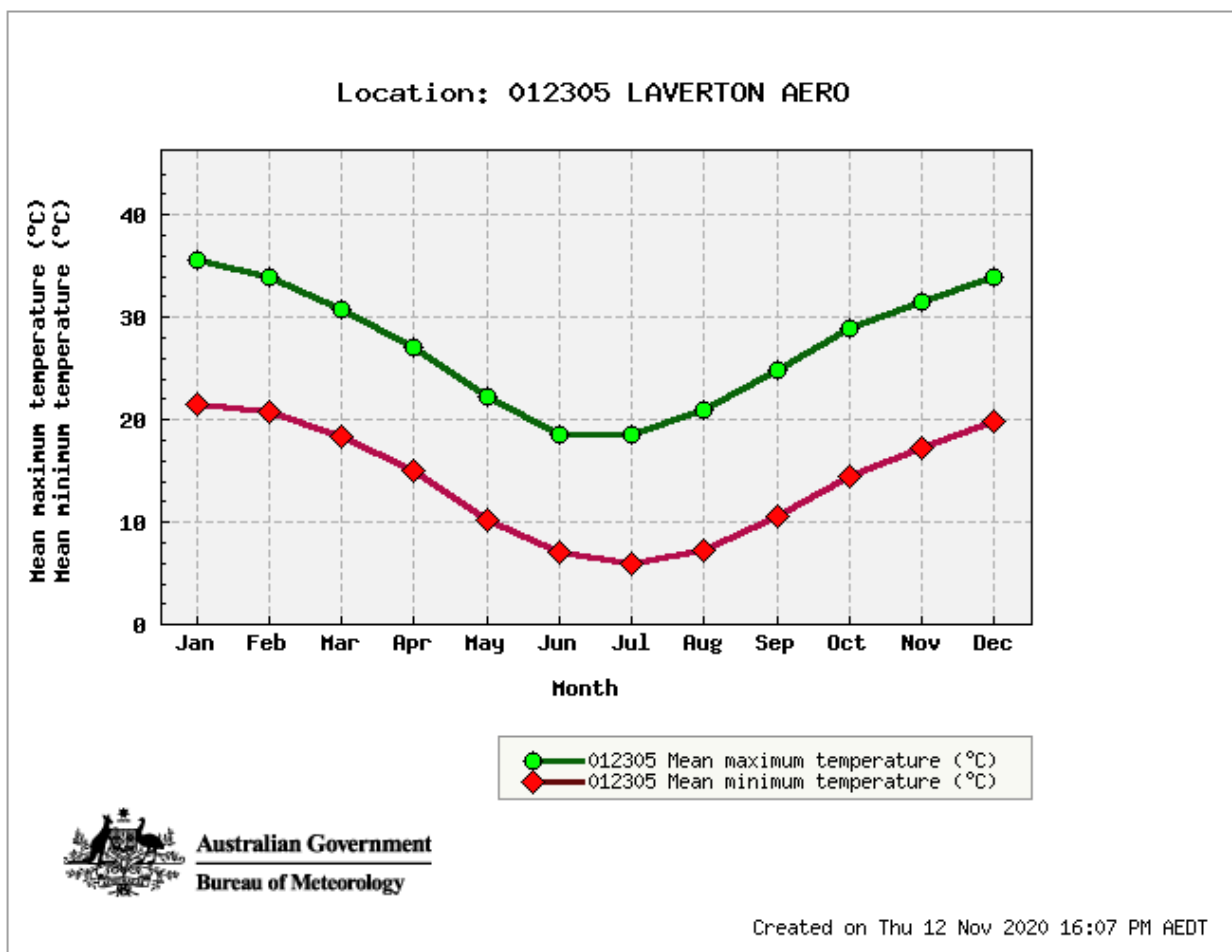


Figure 2: Mean temperature ranges for Laverton Aero Meteorological Station (BOM, 2020)

2.1.2 Rainfall

The annual average rainfall at Laverton Aero is 284.8mm over an average of 35 rain days (BOM, 2020). Average rainfall varies across the months, with slightly larger rainfall events falling between December to March (Figure 3), and the least rainfall received in September. Rainfall for 2020 was below average for all months prior to the survey with the exception of January.

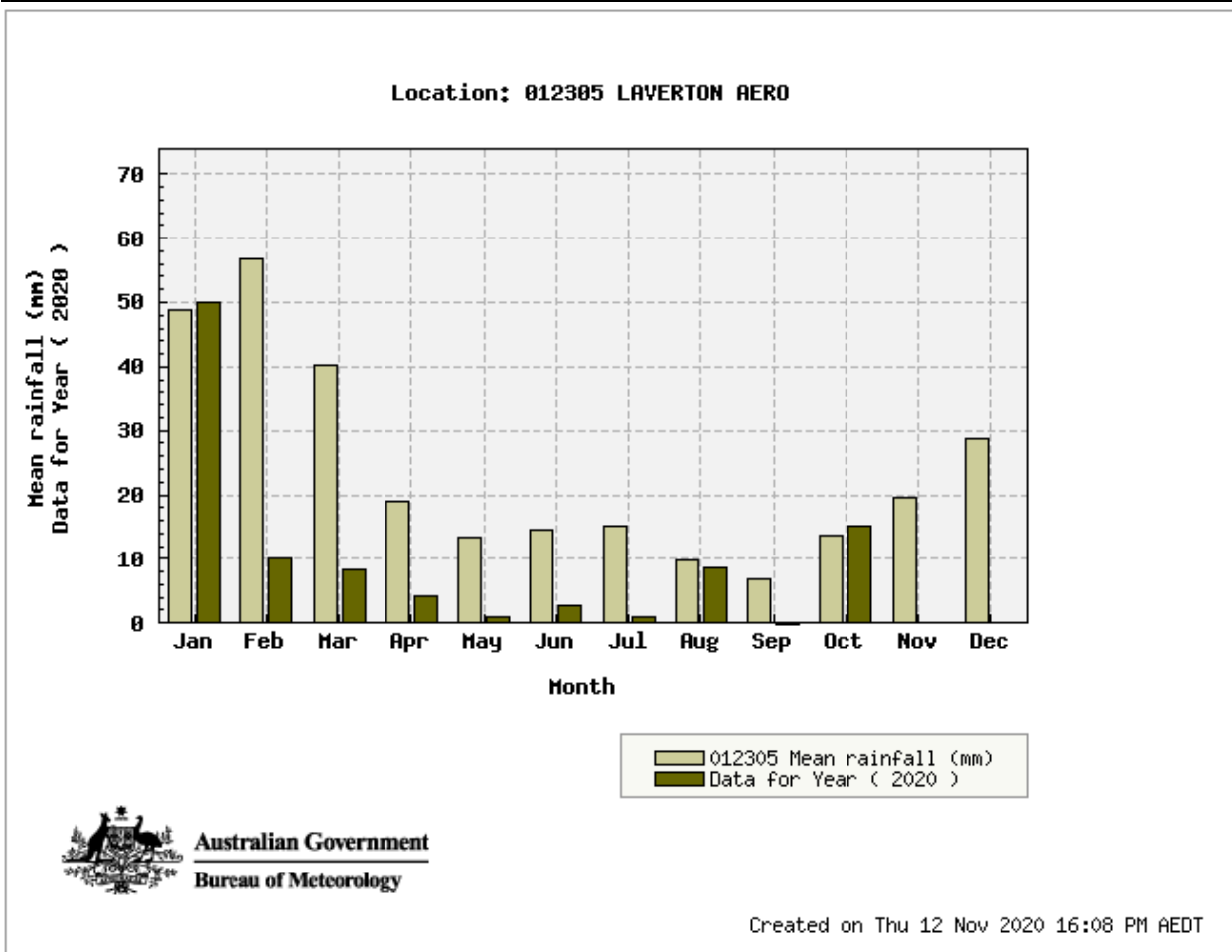


Figure 3: Rainfall data for the Laverton Aero Meteorological Station (BOM, 2020)

Looking at the Edjudina Meteorological Station (012027), which lies only 40km to the south of the survey area, rainfall recorded above average in January and March 2020 prior to the survey, with other months receiving below average (Figure 4).

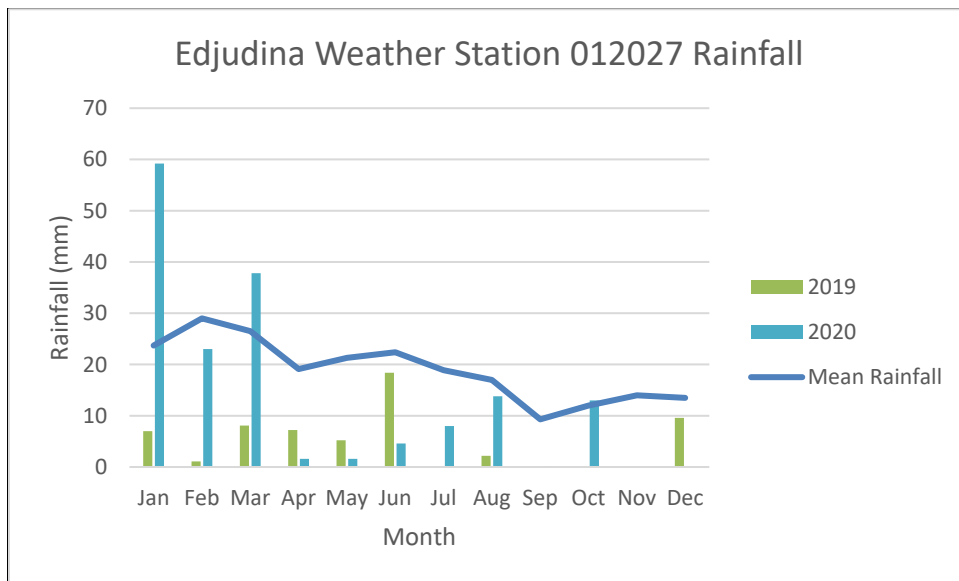


Figure 4: Rainfall data for the Edjudina Meteorological Station (BOM, 2020)

2.2 INTERIM BIOGEOGRAPHIC REGIONALISATION OF AUSTRALIA (IBRA) REGION

The IBRA recognises 89 bioregions within Australia and 419 subregions (DAWE, 2020). The project is located in the Eastern Murchison IBRA subregion (MUR01) which totals over 7.8 million hectares (CALM, 2002). The Eastern Murchison subregion is characterised by its internal drainage, and extensive areas of elevated red desert sandplains with minimal dune development. Salt lake systems are normally associated with the occluded Paleodrainage system.

2.3 LANDFORMS AND SOILS

The Eastern Murchison comprises the northern parts of the craton's 'Southern Cross' and 'Eastern Goldfields' Terrains, and is characterised by internal drainage and extensive areas of elevated red desert sandplains with minimal dune development. 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 (CALM, 2002).

2.4 BOTANICAL SUBREGION AND EXISTING VEGETATION

The vegetation of the Eastern Murchison botanical subregion is dominated by mulga woodlands and is often rich in ephemerals, hummock grasslands, saltbush shrublands and *Tecticornia* shrublands (CALM, 2002).

3 METHODS

3.1 PERSONNEL AND REPORTING

The following personnel were involved in part 1 of the detailed flora and vegetation survey (June 2020):

- Mr Eren Reid (BSc- Biological Science), Principal Botanist, Native Vegetation Solutions (NVS), undertook field work of part 1 of the detailed survey in June 2020, vegetation mapping, data collation, identification of flora during field work and preparation and review of the report; and
- Mr Frank Obbens (BSc) Consultant Botanist, Bushtech Consultancy, undertook the identification of unknown flora samples collected by NVS in the field.

3.2 PRELIMINARY DESKTOP STUDY

A preliminary assessment of the survey area and its potential constraints was undertaken by reviewing relevant government agency managed databases (Sections 3.2.1 to 3.2.6, and Appendices A & D) and consulting with government agencies where necessary. The following sections provide a summary of desktop searches undertaken for the project.

3.2.1 *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 coordinates displayed within the search results (Appendix A) with a 1km buffer (DAWE, 2020a).

(<http://www.environment.gov.au/arcgis-framework/apps/pmst/pmst-coordinate.jsf>)

3.2.2 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 90km radial area of the survey area shapefile (Reference: 07-0650FL).

The presence of Threatened and Priority Ecological Communities (TECs & PECs) was determined by examining Geographic Information System (GIS) data supplied by the DBCA upon request within a 50km buffer of the survey area shapefile (Reference: 23-0620EC).

3.2.3 Environmentally Sensitive Areas (ESAs) and Conservation Reserves

The Department of Water and Environmental Regulation (DWER) 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>).

3.2.4 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.

3.2.5 Wetlands

The potential of wetlands within the project area was determined by examining DWER's Clearing Permit System Map Viewer (DWER, 2020).

3.2.6 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.

3.3 SITE INVESTIGATION

The first stage of the field survey was conducted by Mr. Eren Reid, Botanist of Native Vegetation Solutions (NVS), from the 3rd to 8th June 2020. NVS established 43 quadrats within the survey area, recording one hundred and twenty-three vascular plant species within 12 vegetation types.

A total of 58 hours was spent on site traversing the survey area in June 2020. While a vehicle was used to reach the site, all traverses were made on foot or via Yamaha Viking.

The survey was conducted in accordance with relevant EPA's Statements and Guidelines (Section 1.2).

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 IBRA region, a detailed flora and vegetation survey was deemed adequate.

3.3.1 Licenses

Flora was collected for identification under the Scientific Collection License FB62000171, held by Mr Eren Reid with expiry 08/10/2022.

3.3.2 Field Methods

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

In the field, these sites were visited and 20 x 20m quadrats established in appropriate locations, taking into account representativeness of the site to surrounding vegetation and vegetation boundaries.

Each quadrat site was marked in all corners with a 97cm galvanized fence dropper and was defined by tape measures. The location of one corner was captured on a TwoNav Aventura GPS at ± 4 m accuracy, using Universal Transverse Mercator location on GDA94 datum. Digital photographs were taken of each quadrat site.

Data collected at each of the 43 quadrats included:

- Species Present;
- Topography;
- Rock Type;
- Soil Colour and Type;
- Aspect;
- % Bare Ground and Litter;
- Disturbance Level; and
- Vegetation Condition.

A complete list of all species encountered was also recorded, detailing the average height and estimated coverage of the dominant species from the three stratum levels (Tallest, Mid and Lower).

Specimens of taxa not recognised by the Botanist 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 B.

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

Vegetation groups were mapped (section 3.4.3 below).

Opportunistic sampling of plant taxa and vegetation group mapping was also utilised in the survey area between quadrat sampling points, via wandering traverses. 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 C.

3.3.3 Post-Field Methods

Unknown specimens collected in the field were identified post field work by Eren Reid and Frank Obbens with reference to published keys and samples held in the Reference Section of the Western Australian Herbarium (WAHERB).

Species information was transferred into Microsoft Excel® worksheets in preparation for PATN analysis (Belbin, 1994), via Bray and Curtis Flexible UPGMA, as well as input into a computer program which generates a species accumulation curve (Seaby & Henderson, 2006).

3.3.4 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.

GPS tracks and waypoints recorded during field work are presented in Appendix C. Vegetation Health Condition was assessed in the field with reference to Keighery (1994).

3.3.5 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 IBSA Data package for this survey has been submitted via the DWER IBSA Submission Portal.

3.4 NOMENCLATURE AND TAXONOMY

Nomenclature follows that used by the WAHERB.

The WAHERB has updated its sequence and arrangement of collections to conform to the systematic sequence of the Angiosperm Phylogeny Group (APGIII), with the result that many Families and Genera have been moved or renamed. This report attempts to follow those changes in relation to species recorded during this survey. Definitions of Threatened Flora are also included in Section 9 below.

3.5 LIMITATIONS

Table 1 lists potential limitations that may have affected the survey. As shown, this survey may have been limited by drier than average conditions, which affected most of the State of Western Australia in 2019 and 2020.

Table 1: List of potential survey limitations

Possible Limitation	Constraint	Comment
Competency/experience of the consultant carrying out the survey	No	Experienced and competent personnel conducted the survey. Eren Reid has over 16 years' experience in botanical surveys throughout the Goldfields and over a variety of environments across Western Australia.
Scope	No	The Scope of work was adequately defined. Vascular flora species were the focus of the survey and were thoroughly sampled.
Proportion of flora identified, recorded and/or collected	No	All taxa not identified in the field were collected and pressed, and later identified by Eren Reid or Frank Obbens. See also Species Accumulation Curves in section 4.2.2.2.
Sources of information	No	Information on flora and vegetation of the region and local area was available from publicly available databases, books and reports.
Proportion of the tasks achieved	No	All tasks completed.
Timing/season	Potential	This survey was undertaken in June 2020. Local rainfall never exceeded monthly averages in 2020 with the exception of January and March. Timing would have been ideal earlier in April/May for the first part of the survey.
Disturbance in survey area	No	Disturbance from grazing and exploration was apparent in the survey area. However, the structural dominants of the vegetation persist and, the vegetation remains in Good to Very Good condition.
Intensity of survey effort	No	The survey intensity is considered to have been sufficient for a detailed survey according to EPA (2016) guidelines. Areas most likely to contain threatened and priority species were targeted. Vegetation mapping sites were selected to provide adequate coverage of the survey area.
Resources	No	Resources, in terms of time, equipment, support and personnel were adequate to undertake and complete the detailed survey.
Remoteness and/or access problems	No	All the areas in need of survey were easily accessible from existing tracks, or by foot.
Availability of contextual information for the region	No	Contextual information regarding vegetation and flora around the Eastern Murchison subregion is readily available. Adequate information was able to be accessed from available databases.

4 RESULTS

4.1 PRELIMINARY DESKTOP ASSESSMENT

4.1.1 EPBC Protected Matters Search Tool

The EPBC Protected Matters Search Tool revealed that the survey area may contain habitat for the invasive weed species *Carrichtera annua* (Ward's Weed) and *Cenchrus ciliaris* (Buffel Grass) (DAWE, 2020).

Carrichtera annua was introduced into Australia from the eastern Mediterranean, and is now widespread throughout South Australia, the Interior, and Western Australia (Lamp & Collet, 1999). This species is not listed as a declared plant by DPIRD (2020), however according to the EPBC search tool this invasive weed species is considered a threat to the rangeland biodiversity within the Southern Australian Sheep and Cattle Grazing Land Management Zone (DAWE, 2020).

Cenchrus ciliaris is native to Africa and India, was widely planted in Western Australian pastoral regions as a pasture grass, and has become a widespread weed of roadsides, creeklines, river edges and most vegetation types from Geraldton to the Pilbara, Kimberley and adjacent desert (Hussey *etc.* 2007). In the Murchison region it often colonises roadside table drains, excluding native everlastings. It seriously alters the fire characteristics of invaded plant cover by generating highly flammable fuel that is prone to more frequent fires.

The EPBC Protected Matters report indicated no TECs or Commonwealth Reserves within the requested search area.

The results of the EPBC Protected Matters search are included in Appendix A.

4.1.2 Threatened Flora and Communities

The DBCA database searches revealed a potential for no Threatened and 10 Priority Flora species to occur within a 50km radius of the survey area (DBCA, 2020a). No known locations of these Flora occur within the survey area, while the closest location occurs approximately 5.8 km southwest of the survey area.

Results of the threatened flora database search are included in Appendix D.

The PEC/TEC search (DBCA, 2020) revealed no TECs or PECs within the survey area.

4.1.3 Environmentally Sensitive Areas and Conservation Reserves

The survey area does not lie within or contain any ESA's or Conservation Reserves (DWER, 2020).

4.1.4 Vegetation Type, Extent and Status

Three vegetation units defined by Beard (1990) were identified as part of the desktop assessment. These 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 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 (<i>Acacia aneura</i>)				
Pre-European Extent (ha)	Scale				
	<i>By Association (WA)</i>	<i>By Association (WA)</i>	<i>By IBRA Region (Murchison)</i>	<i>By IBRA Sub-region (Eastern Murchison)</i>	<i>By Shire (Shire of Menzies)</i>
	22,029,557*	19,892,306**	12,403,172**	10,269,896**	2,010,840**
% Pre-European Extent Remaining	100.00%*	99.75%**	99.68%**	99.66%**	99.94%**
Surrounding Land Use***	Mining, Exploration, Pastoral Lease				
Weed prevalence***	Low				

* Source: Shepherd *et al.* (2002) Appendix 2

**Source: DBCA, (2019)

*** Source: Field Assessment

4.1.5 Wetlands

No water bodies were identified within the survey area via the CPS Map Viewer (DWER, 2020).

4.1.6 Dieback

The survey area lies south of the 26th parallel, however receives average annual rainfall of approximately 284.8 mm (BOM, 2020), 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.

4.2 FIELD ASSESSMENT

4.2.1 Vegetation of the Survey Area

Beard's vegetation associations are very broad and are used over large areas in which there is also a large amount of variation at a more local level. The vegetation groups described below for the survey area fit into the broader Beard description above in section 4.1.4.

The vegetation groups described below were determined visually based on dominant species and topographical features, to form the descriptions taken at the time of the field survey

Descriptions of all 43 sites/quadrats are presented in Appendix F. For each site the physical features, vegetation description and unit, along with the species lists for the 20 x 20m plots with typical canopy cover and height, are provided.

4.2.1.1 Vegetation Groups

Twelve vegetation groups were identified during this survey, largely following topographical features and dominant species. Mapping of the 12 vegetation groups, as well as the quadrat locations can be seen in Appendix C. Photographs of each quadrat and the relevant vegetation group can be seen in Appendix F.

A. Mulga over *Maireana sedifolia* and mixed sclerophyll shrubland

Open Shrub Mallee (Muir, 1977) of *Acacia aneura*, *Acacia mulganeura*, *Casuarina pauper* and *Acacia ayersiana* over *Acacia ligulata*, *Senna artemisioides* subsp. *filifolia*, *Dodonaea lobulata*, *Acacia burkittii* and *Hakea preissii* over *Maireana sedifolia*, *Ptilotus obovatus* and occasional *Maireana pyramidata*.

Quadrats: 1, 2, 8, 19 and 28

B. Mulga shrubland (sandy substrates)

Open Shrub Mallee (Muir, 1977) of *Acacia incurvaneura*, *Acacia aneura*, *Acacia mulganeura* and occasional *Eucalyptus kingsmillii* and *Eucalyptus oleosa* subsp. *oleosa* over *Acacia ramulosa* var. *ramulosa*, *Eremophila forrestii* subsp. *forrestii*, *Senna artemisioides* subsp. *filifolia* and *Acacia burkittii* over *Ptilotus obovatus* and occasional grasses.

Quadrats: 4, 5, 13, 21, and 27

C. Open Mulga shrubland (sandy substrate)

Very Open Shrub Mallee (Muir, 1977) of *Acacia mulganeura*, *Acacia incurvaneura* and *Acacia aneura* over *Acacia ramulosa* var. *ramulosa*, *Senna artemisioides* subsp. *filifolia* and *Acacia ligulata* over *Ptilotus obovatus* and *Eragrostis eriopoda*.

Quadrats: 3, 6 and 23

D. Mulga shrubland on rocky ironstone hills

Open Shrub Mallee (Muir, 1977) of *Acacia aneura*, *Acacia incurvaneura*, *Acacia mulganeura* and *Casuarina pauper* over *Scaevola spinescens*, *Eremophila latrobei* subsp. *latrobei* and *Dodonaea lobulata* over *Ptilotus obovatus*.

Quadrats: 7, 9, 10, 12, 20 and 26

E. *Acacia aneura* and *Acacia burkittii* on greenstone hills

Open Shrub Mallee (Muir, 1977) of *Acacia aneura* and *Acacia mulganeura* over *Acacia burkittii*, *Scaevola spinescens* and *Senna artemisioides* subsp. *filifolia* over *Ptilotus obovatus* and occasional grasses.

Quadrats: 11, 14, 15 and 18

F. Mulga over small rocky outcrops

Very Open Shrub Mallee (Muir, 1977) of *Acacia aneura* and *Acacia mulganeura* over *Philothecca brucei* subsp. *brucei*, *Scaevola spinescens*, *Eremophila latrobei* subsp. *latrobei* and *Sida ectogama* over *Ptilotus obovatus* and *Enneapogon caerulescens*.

Quadrats: 16 and 30

G. Mulga over Chenopod shrubland

Very Open Shrub Mallee (Muir, 1977) of *Acacia aneura*, *Acacia ayersiana* and occasional *Eucalyptus lesouefii* over *Acacia caesaneura*, *Senna artemisioides* subsp. *filifolia*, and occasional *Acacia burkittii* over *Maireana pyramidata*, *Ptilotus obovatus*, and occasional *Frankenia setosa* and *Atriplex bunburyana*.

Quadrats: 17, 22 and 35

H. Mulga Thicket- Drainage

Tree/Shrub Mallee (Muir, 1977) of *Acacia ayersiana* and *Acacia incurvaneura* over *Acacia burkittii*, *Acacia ramulosa* var. *ramulosa* and *Acacia aneura* over *Ptilotus obovatus*, *Acacia tetragonophylla* and *Eremophila forrestii* subsp. *forrestii*.

Quadrats: 24, 25 and 29

I. Open Mulga shrubland on ironstone flats

Very Open Shrub Mallee (Muir, 1977) of *Acacia aneura*, *Acacia mulganeura* and *Acacia ayersiana* over *Acacia tetragonophylla* and *Acacia burkittii* over *Scaevola spinescens*, *Ptilotus obovatus*, *Senna artemisioides* subsp. *helmsii* and *Senna artemisioides* subsp. *artemisioides*.

Quadrats: 31 and 32

J. *Acacia quadrimarginea* shrubland over granite bedrock

Very Open Shrub Mallee (Muir, 1977) of *Acacia quadrimarginea* and *Acacia mulganeura* over *Acacia tetragonophylla*, *Acacia burkittii* and occasional *Acacia aneura* over *Eremophila forrestii* subsp. *forrestii* and *Ptilotus obovatus*.

Quadrats: 33 and 34

K. *Casuarina pauper* and *Acacia aneura* over sclerophyll shrubland on rocky laterite hills

Very Open Tree Mallee (Muir, 1977) of *Casuarina pauper*, *Acacia aneura*, *Eucalyptus salubris* and *Eucalyptus lesouefii* over *Dodonaea lobulata* and *Eremophila pantonii* over *Ptilotus obovatus* and *Maireana sedifolia*.

Quadrats: 36, 37, 38, 39, 40 and 41

L. Mulga over *Eremophila forrestii* on large rocky granite/basalt hills

Open Shrub Mallee (Muir, 1977) of *Acacia aneura*, *Acacia mulganeura* and *Acacia incurvaneura* over *Eremophila forrestii* subsp. *forrestii*, *Philothecca brucei* subsp. *brucei* over *Ptilotus obovatus*.

Quadrats: 42 and 43

Table 3: Vegetation Group Extent within Survey Area

Vegetation Group	Vegetation Group Code	Quadrats	Family	Genus	Species	Area (ha)	Percentage of Survey Area (%)
Mulga over <i>Maireana sedifolia</i> and mixed sclerophyll shrubland	A	Q1, Q2, Q8, Q19, Q28	14	25	52	291.39	17.18 %
Mulga shrubland (sandy substrate)	B	Q4, Q5, Q13, Q21, Q27	15	24	45	547.98	32.31 %
Open Mulga shrubland (sandy substrate)	C	Q3, Q6, Q23	12	19	31	36.37	2.14 %
Mulga shrubland on rocky ironstone hills	D	Q7, Q9, Q10, Q12, Q20, Q26	13	22	49	211.81	12.49 %
<i>Acacia aneura</i> and <i>Acacia burkittii</i> on rocky basalt hills	E	Q11, Q14, Q15, Q18	18	30	54	32.90	1.94 %
Mulga over small rocky outcrops	F	Q16, Q30	15	24	35	8.32	0.49 %
Mulga over Chenopod shrubland	G	Q17, Q22, Q35	13	23	42	108.13	6.38 %
Mulga Thicket- Drainage	H	Q24, Q25, Q29	17	28	42	180.02	10.62 %
Open Mulga shrubland on ironstone flats	I	Q31, Q32	12	17	32	199.58	11.77 %
<i>Acacia quadrimarginea</i> shrubland over granite bedrock	J	Q33, Q34	10	15	21	11.55	0.68 %
<i>Casuarina pauper</i> and <i>Acacia aneura</i> over sclerophyll shrubland on rocky laterite hills	K	Q36, Q37, Q38, Q39, Q40, Q41	17	24	44	54.98	3.24 %
Mulga over <i>Eremophila forrestii</i> on large rocky granite/basalt hills	L	Q42, Q43	11	16	23	12.87	0.76 %
		Total	29*	57*	123*	1695.90[#]	100.00%[#]

*Denotes total recorded in the survey area (not sum of column)

Denotes sum of column

4.2.1.2 PATN Analysis of Quadrat Data

PATN Analysis was completed on both the dominant species and all species recorded within each quadrat. The results are supplied below in Figure 5 and Figure 6.

The PATN analysis dendrogram of the dominant species in Figure 5, displays each quadrat with like symbols representing NVS mapped vegetation groups, and coloured lines depicting PATN defined vegetation groups. The dendrogram shows a good association between vegetation groups described in section 4.2.1.1, however there were some outliers (highlighted green).

These outliers are expected to occur for most vegetation groups. In most cases one or two dominant species will be present within a 20x20 quadrat, but it will not contain all the varieties of dominant species that will occur across that vegetation type, and as such some quadrats of the same vegetation group will be separated when assessed by the PATN Analysis.

Vegetation Group A was well represented via dominant species with Q1, Q2, Q19 and Q28 grouped together in the PATN Analysis. Q8 was an outlier and compared more similarly to Q10 which was also an outlier of Vegetation Group D. When all species were analysed via PATN, only Q2, Q19 and Q28 were significantly grouped together.

Vegetation Group B was quite an expansive and varied vegetation group, hence only significantly represented by the grouping of Q21 and Q27 in the dominant species PATN analysis. Q4, Q5 and Q13 were also grouped together, however were compared more similarly with Q6 and Q23 and Q32 from Vegetation Groups C and I.

Vegetation Group C was represented by the grouping of Q6 and Q23 via the dominant species and all species PATN analysis. Q3 was an outlier.

Vegetation Group D was well represented with the grouping of Q7, Q9, Q20 and Q26 via all species and dominant species PATN analysis. Q10 and Q12 were considered outliers with some slight variations in the dominant species.

Vegetation Group E was represented with the grouping of Q11 and Q14 via all species and Q11 and Q15 via the dominant species PATN analysis. Q18 was considered an outlier in both instances.

Vegetation Group F was well represented via both all species and dominant species PATN analysis.

Vegetation Group G was not well represented via either analysis with only Q35 being segregated in both instances. Whilst Q17 and Q22 were grouped together in both analysis, they were similarly related to other quadrats of different vegetation groups.

Vegetation Group H was well represented via all species PATN analysis with the grouping of Q24 and Q25. However, was not represented well via dominant species PATN analysis, as the dominant vegetation did vary in this vegetation group.

Vegetation Group I was not well represented by either dominant species or all species PATN analysis, however Q31 was considered a separate vegetation group when dominant species were subject to PATN analysis.

Vegetation Group J was well represented by all species and dominant species via PATN analysis.

Vegetation Group K was well represented by all species and dominant species via PATN analysis.

Vegetation Group L was well represented by all species, however Q42 and Q43 were not grouped together by the dominant species via the PATN analysis, suggesting some variation in the dominant species.

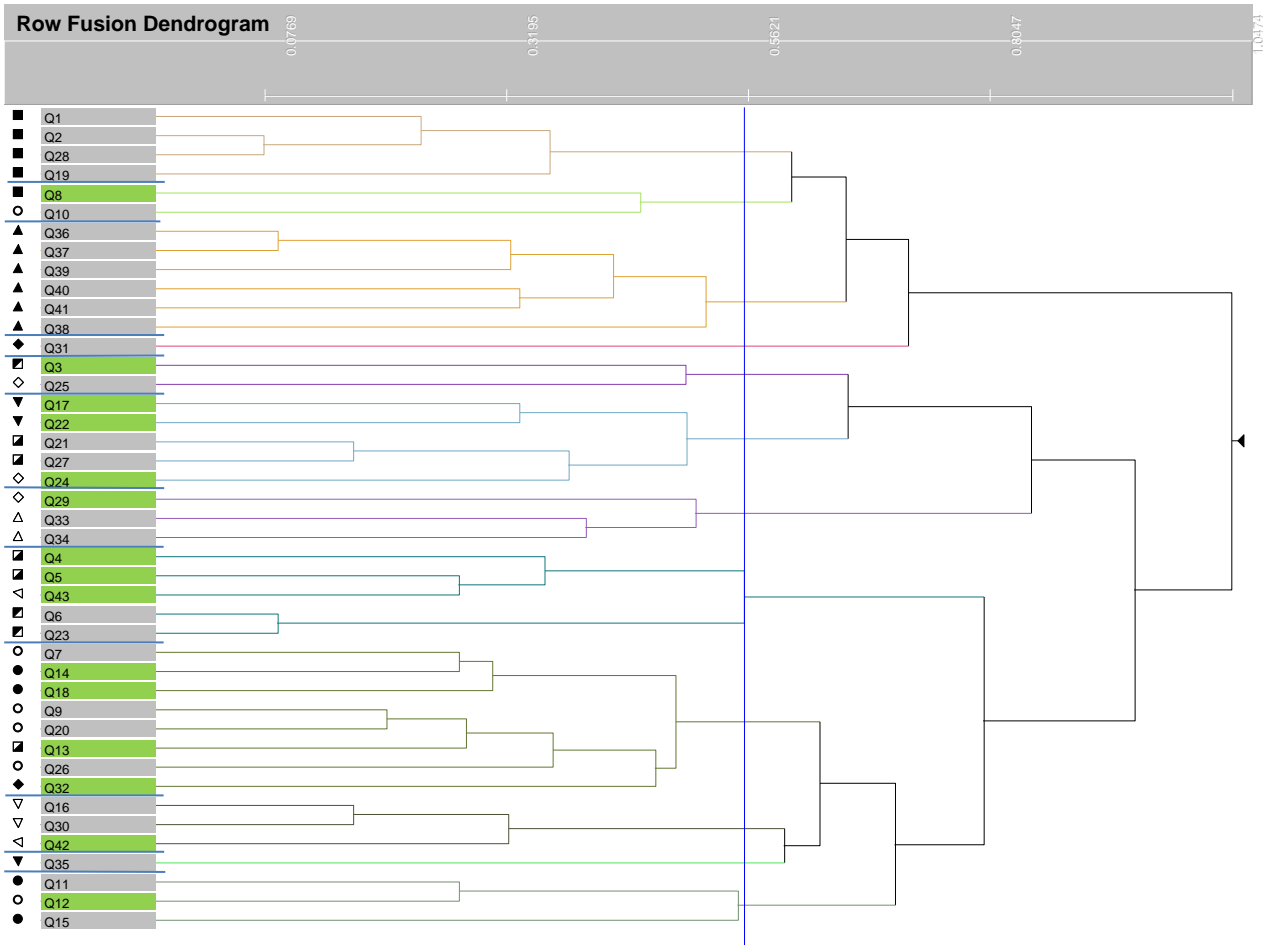


Figure 5: PATN Analysis of Dominant Species into 12 groups

The dendrogram below (Figure 6) of the analysis of all species shows a correlation to pre-grouped quadrats described in section 4.2.1.1. The dendrogram displays each quadrat with like symbols representing NVS mapped vegetation groups, and coloured lines depicting PATN defined vegetation groups. However, there were several outliers, and these are highlighted in green (Figure 5). Most of the quadrats depicted as outliers are representative of similar vegetation groups, which have been segregated by NVS based on differing plant density, topographical features or lithology. The PATN analysis (off all species present) demonstrates that some of these quadrats are very similar in species composition, and not necessarily distinct, when predetermined by topographical/litological variations.

When comparing outliers of the PATN analysis of all species versus dominant species, there are greater outliers in the later. Therefore, the vegetation groups mapped by NVS demonstrate a reliance on all species within the quadrat as opposed to dominants, suggesting some variation of dominant species between quadrats of similar vegetation groups.

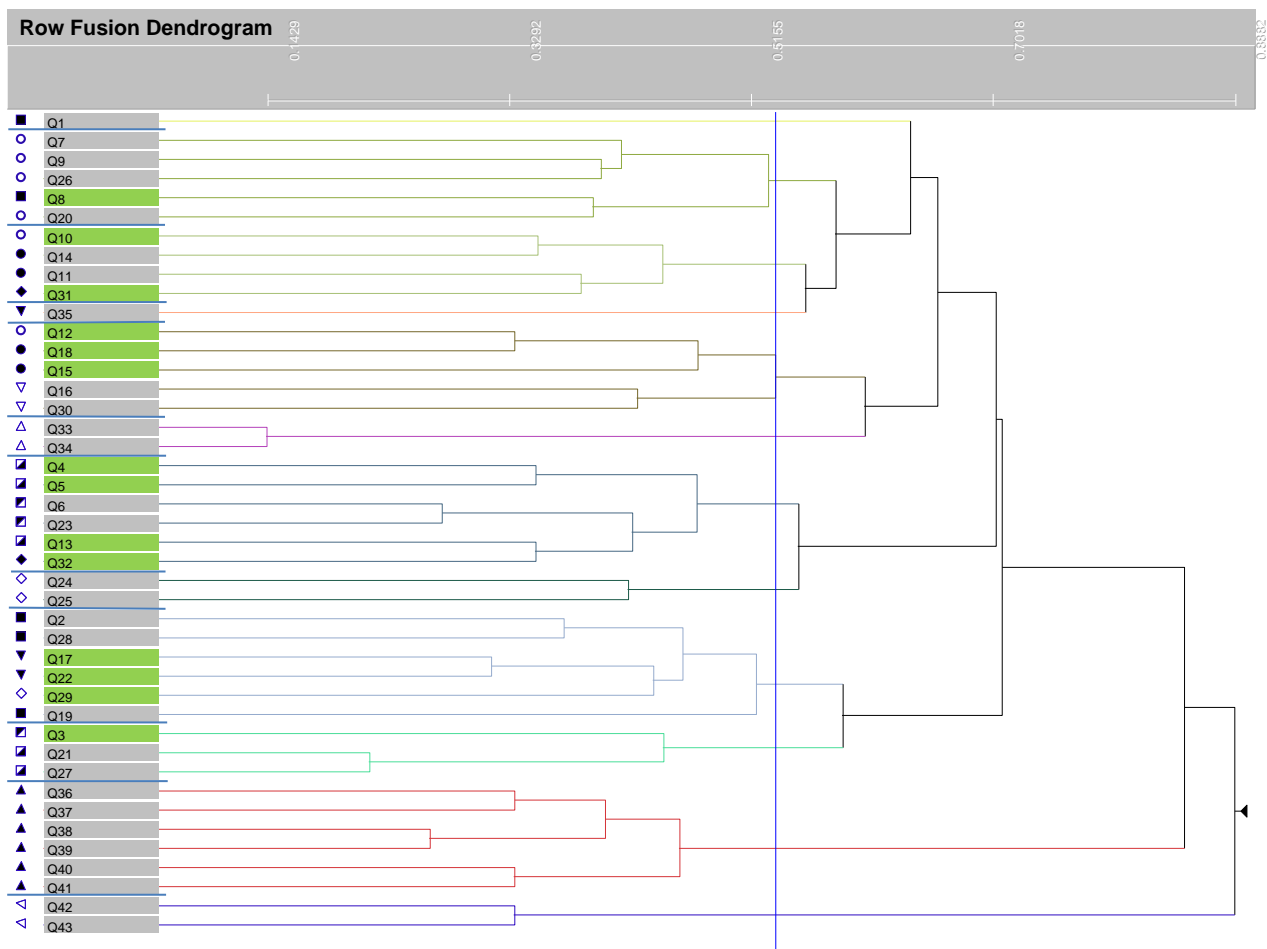


Figure 6: PATN Analysis of All Species into 12 groups

4.2.1.3 Vegetation Condition

Vegetation in the survey area has been subjected to historic exploration activities and grazing.

According to Keighery (1994), most of the sites/quadrats inspected were in Good to Very Good condition (Appendix F). There were existing vehicle tracks in some areas, due to mine exploration activities. The vegetation more than 0.5m off these tracks was mostly in a Good to Very Good condition (Keighery 1994).

As discussed below in Section 4.2.2.4, there were three non-native species recorded in the quadrats, with four additional non-native species recorded near the old Mt Celia homestead.

4.2.2 Flora of the Survey Area

4.2.2.1 General

One hundred and twenty-three species were recorded within the survey area with 115 species recorded within quadrats. Twenty-nine families and 57 genera were found. These are listed in Appendix E, per Quadrat as well as per vegetation group. Of the native species, Fabaceae had the highest representation, with 25 species from 3 genera, dominated by *Acacia*. Chenopodiaceae and Poaceae were the next best represented families with 20 species and 15 species respectively.

Of the 123 taxa recorded seven of these were introduced weed species. *Citrullus amarus* (Pie Melon) *Cucumis myriocarpus* (Prickly Paddy Melon) and *Cenchrus ciliaris* (Buffel Grass) were captured within the quadrat sampling, whilst *Schinus mollee* var. *areira* (Pepper Tree), *Nerium oleander* (Oleander Tree), *Yucca aloifolia* (Yucca Tree), and *Tamarix aphylla* (Athel pine) were recorded from a single location within the vicinity of the the old Mt Celia homestead.

Of the seven non-native species above, only *Tamarix aphylla* (Athel pine) is a declared pest-22(2) in the state of Western Australia.

The most common and widespread species was *Ptilotus obovatus*, which was recorded within all 43 quadrats. Its canopy cover was 10-30%. The next most common and widespread species was *Acacia aneura*, recorded in 34 quadrats, with a canopy cover between 10-30%.

There were 29 taxa recorded from within a single site, Q15. Of these, two were weed species.

4.2.2.2 Species Accumulation Curve

A Species Accumulation Curve was generated using the computer programme **Species Diversity and Richness Version 4.1.2** (Seaby & Henderson, 2006). This curve was then fitted to a logarithmic curve in **Excel**[®], which is plotted in Figure 7 below. According to the Species Accumulation Curve below, the R² value (0.991) shows an acceptable fit for a logarithmic curve of the total accumulated species per number of quadrats established (Figure 7).

Sufficient sampling was inferred via the effort of intensity (number of quadrats established) versus the return of species collected (total accumulated species). The logarithmic trend line and R² values were generated in **Excel**[®]. From this fitted logarithmic curve formula, the asymptote was calculated where the gain of new species was less than 1% for every new quadrat established. Based on this reasoning, the asymptote was reached at 28 quadrats, at which the extrapolated total accumulated number of species is 100. Therefore the 115 species collected within the 43 quadrats represents 114.23% of the projected asymptote.

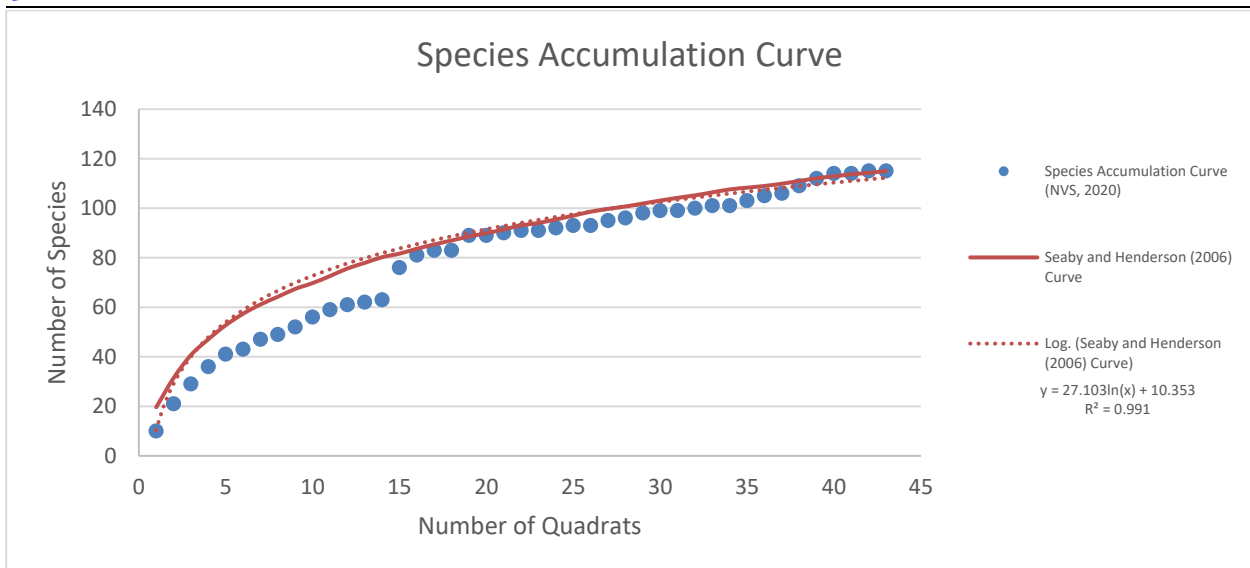


Figure 7: Species Accumulation Curve for the 43 sampled quadrats

4.2.2.3 Conservation significant species

No Threatened species were recorded during the survey.

No Priority species were identified in the survey area.

4.2.2.4 Introduced species

Seven introduced species recorded in the survey area are listed below;

- *Citrullus amarus* (Pie Melon)- Q15
- *Cucumis myriocarpus* (Prickly Paddy Melon)- Q15 and Q30
- *Cenchrus ciliaris* (Buffel Grass)- Q29
- *Schinus mollee* var. *areira* (Pepper Tree)- old Mt Celia Homestead
- *Nerium oleander* (Oleander Tree)- old Mt Celia Homestead
- *Yucca aloifolia* (Yucca Tree)- old Mt Celia Homestead
- *Tamarix aphylla* (Athel pine)- old Mt Celia Homestead

Of the seven non-native species above, only *Tamarix aphylla* (Athel pine) is a declared pest-s22(2) in the state of Western Australia.

5 DISCUSSION

The survey area is located within the Eastern Murchison subregion (CALM, 2002). This survey established that mostly, the flora within the project area is not unique, and is in fact common throughout the Eastern Murchison subregion and adjoining regions.

One hundred and twenty-three species were recorded within the survey area with 115 species recorded within quadrats. Twenty-nine families and 57 genera were found. These are listed in Appendix E, per Quadrat as well as per vegetation group. Of the native species, Fabaceae had the highest representation, with 25 species from 3 genera, dominated by *Acacia*. Chenopodiaceae and Poaceae were the next best represented families with 20 species and 15 species respectively.

Of the 123 taxa recorded seven of these were introduced weed species. *Citrullus amarus* (Pie Melon) *Cucumis myriocarpus* (Prickly Paddy Melon) and *Cenchrus ciliaris* (Buffel Grass) were captured within the quadrat sampling, whilst *Schinus mollee* var. *areira* (Pepper Tree), *Nerium oleander* (Oleander Tree), *Yucca aloifolia* (Yucca Tree), and *Tamarix aphylla* (Athel pine) were recorded from a single location within the vicinity of the the old Mt Celia homestead.

Of the seven non-native species above, only *Tamarix aphylla* (Athel pine) is a declared pest-s22(2) in the state of Western Australia.

The most common and widespread species was *Ptilotus obovatus*, which was recorded within all 43 quadrats. Its canopy cover was 10-30%. The next most common and widespread species was *Acacia aneura*, recorded in 34 quadrats, with a canopy cover between 10-30%.

There were 29 taxa recorded from within a single site, Q15. Of these, two were weed species.

No Threatened Flora were recorded in the survey area.

No TECs or PEC's were recorded within the survey area.

No Priority Flora were identified in the survey area.

Vegetation condition was generally 'Good' to 'Very Good' (Keighery 1994). Disturbance was present within the survey area mostly attributed to historic mining activities, access tracks, exploration related activities, and also grazing.

It is therefore not expected that the disturbance within the survey area will significantly negatively impact on the vegetation in the area in terms of fragmentation and loss of vegetation associations or species that may be unique. This is partially due to the overall size of the survey area as well as the similar abundant vegetation and habitat outside of the survey area.

6 IMPACT ASSESSMENT

6.1 THREATENING PROCESSES

The major processes likely to impact the Flora within the Survey area, if clearing were to proceed include:

- Vegetation clearing and therefore a reduction in biodiversity;
- Vehicle impacts on uncleared vegetation could increase if existing tracks are not adhered to;
- An increase in the area of disturbed land could result in an increase in non-native species;
- Dust generated during clearing of native vegetation and associated activities may settle on adjacent native vegetation, causing possible stress and perhaps death, especially during drier months; and
- Accidental fire arising from clearing and associated activities, may affect vegetation in surrounding areas.

7 CONCLUSIONS AND RECOMMENDATIONS

The survey established that the condition of the vegetation in the survey area is overall 'Good' to 'Very Good' condition. No Threatened Flora were recorded in the area. No TECs/PECs were recorded in the survey area.

No Priority Flora were recorded the survey area.

The EPA objective for flora and vegetation is to maintain the abundance, species diversity and geographical distribution of flora and vegetation as well as protect Threatened flora consistent with the provisions of the *Biodiversity Conservation Act 2016*.

The proposed clearing of vegetation will result in the loss of some individuals from the local area; however, the impact will not be great enough to remove whole communities or populations. Most of the species and communities recorded during this survey are widespread throughout the Eastern Murchison subregion and adjoining regions, and therefore the loss of a small proportion from this area will not be significant.

This report summarises the results of the first stage of a detailed flora and vegetation survey.

The following recommendations arise from the current flora survey:

- Any disturbance/clearing be minimised as much as practicable to reduce the loss of individual species;
- Weed control measures should be implemented during and post construction activities- it is recommended that any works within the vicinity of the old Mt Celia homestead be conducted in a manner where it incorporates the removal of non-native species nearby, particularly the delared pest *Tamarix aphylla*.
- Driving restrictions, ensuring that off-road driving is minimised; and
- All staff to be educated on the importance of fire prevention, and equipment provided for use in the event of fire.

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9 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
DWER	Department of Water and Environmental Regulation, Western Australia
EPA	Environmental Protection Authority, Western Australia
EP Act	<i>Environmental Protection Act 1986</i> , Western Australia
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (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 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.

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 A - EPBC and Other Government Database Search Results



EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

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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[Summary](#)

[Details](#)

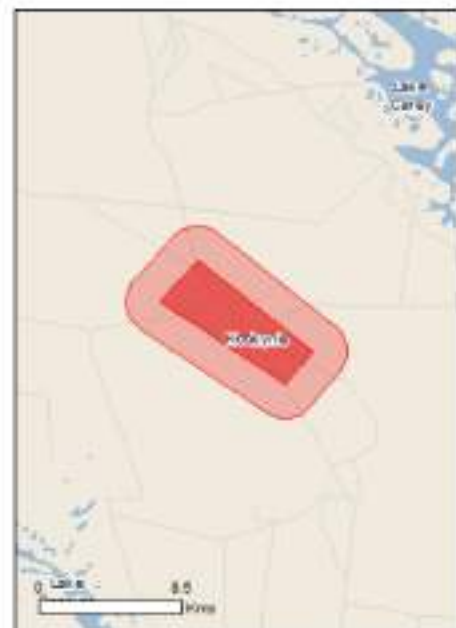
[Matters of NES](#)

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

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[Caveat](#)

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[Buffer: 2.0Km](#)



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 may occur within area
Mammals		
Dasyurus geoffroyi 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 [676]		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
Chrysocolaptes ocellatus		
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 Resources Audit, 2001.		
Name	Status	Type of Presence
Mammals		
Camelus dromedarius		
Dromedary, Camel [7]		Species or species

Name	Status	Type of Presence
Canis lupus familiaris Domestic Dog [82654]		habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Equus caballus Horse [5]		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 BIOTRIM habitat modeling) 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

-29.4441 122.4389,-29.424552 122.45829,-29.467079 122.521208,-39.482777 122.500058,-29.4441 122.4389

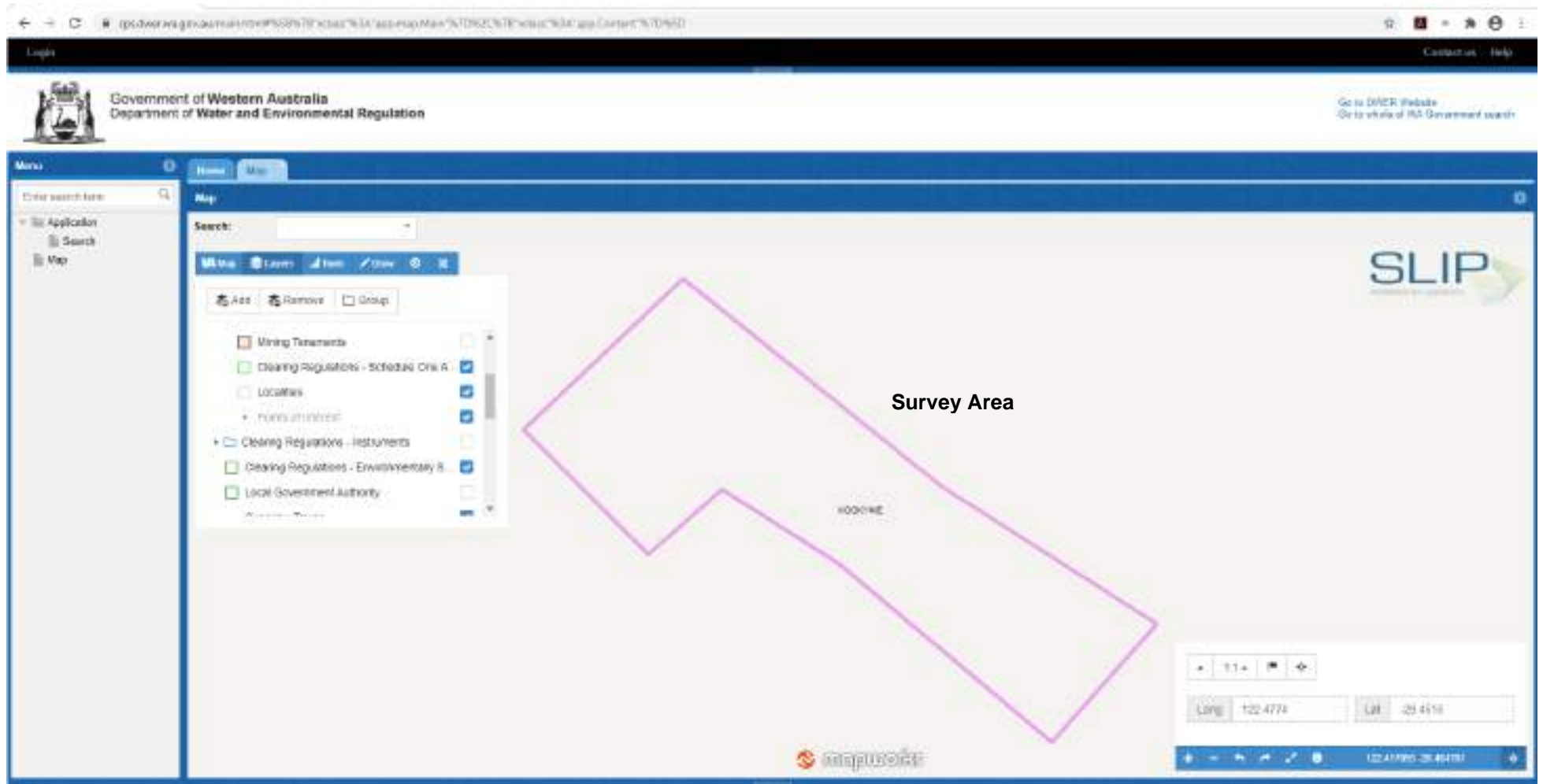
Acknowledgements

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

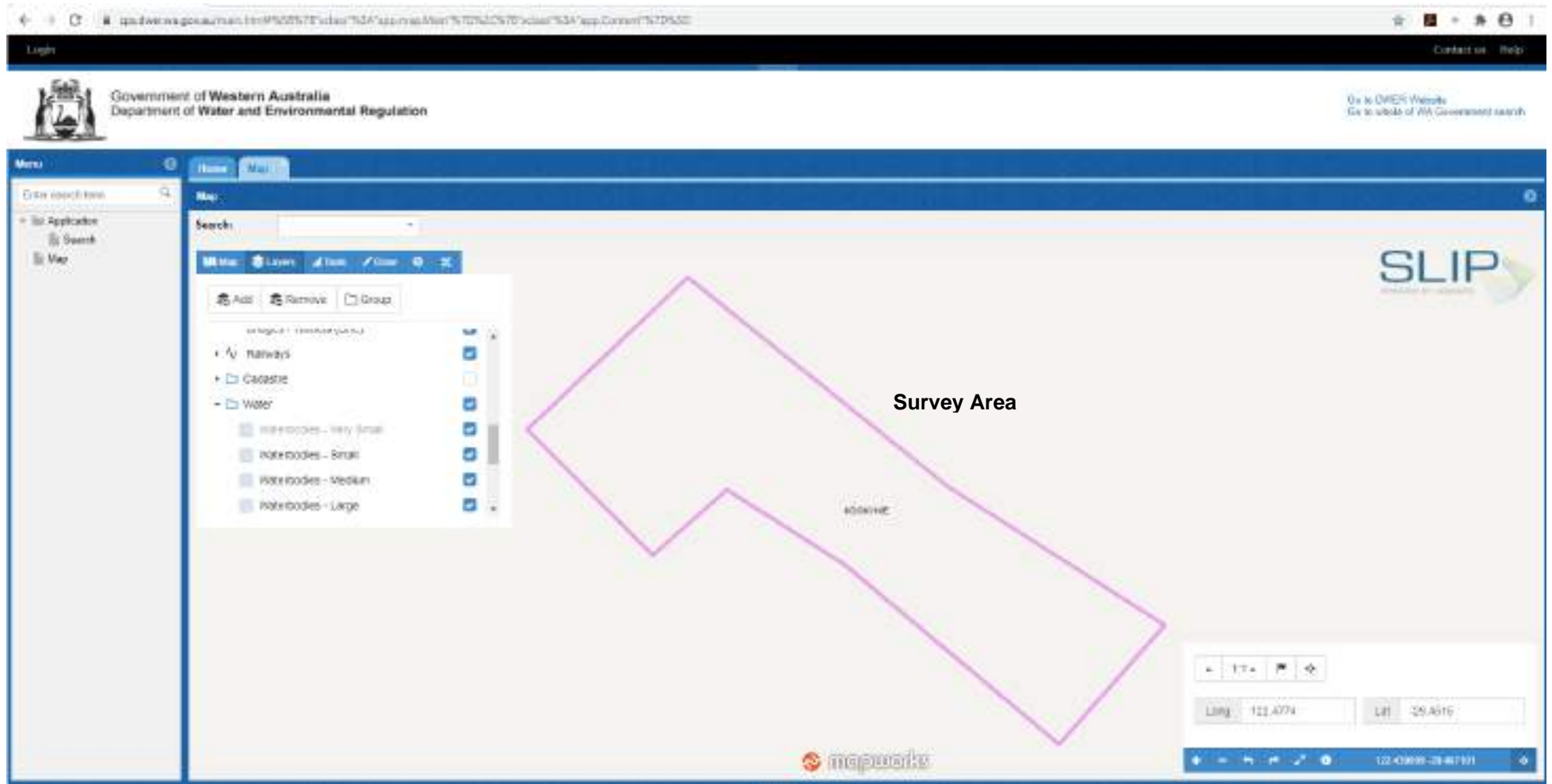
- [Office of Environment and Heritage, New South Wales](#)
- [Department of Environment and Primary Industries, Victoria](#)
- [Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [Department of Environment, Water and Natural Resources, South Australia](#)
- [Department of 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:

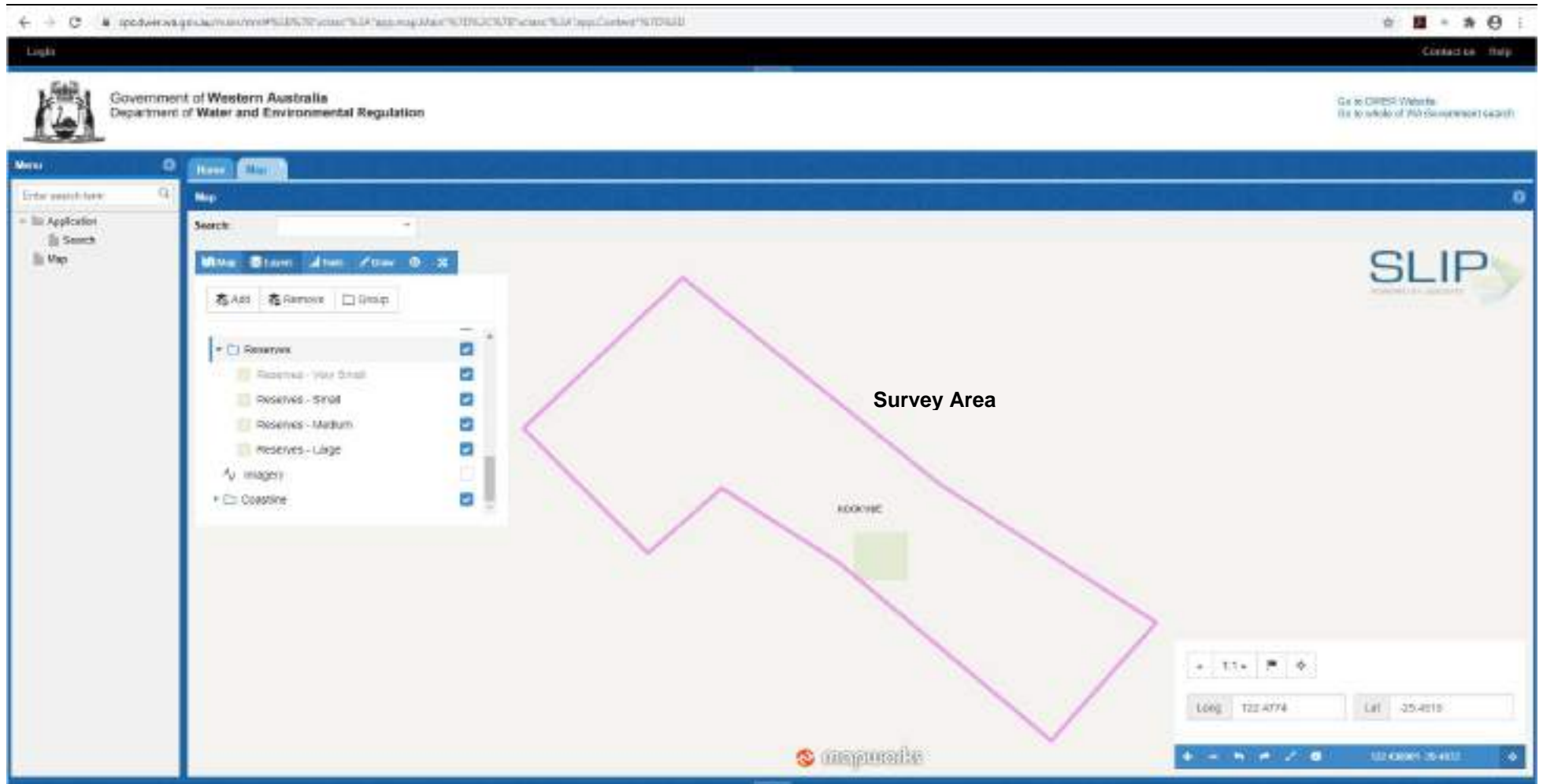
Please feel free to provide feedback via the [Contact Us](#) page.



DWER CPS Map Viewer - showing no ESA's (dark green shaded areas) within the survey area (pink polygon) (DWER, 2020)



DWER CPS Map Viewer - showing no water bodies within the survey area (pink polygon) (DWER, 2020)



DWER CPS Map Viewer - showing a small water Reserve (R11185) within the survey area (pink polygon) (DWER, 2020)

Appendix B - 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.

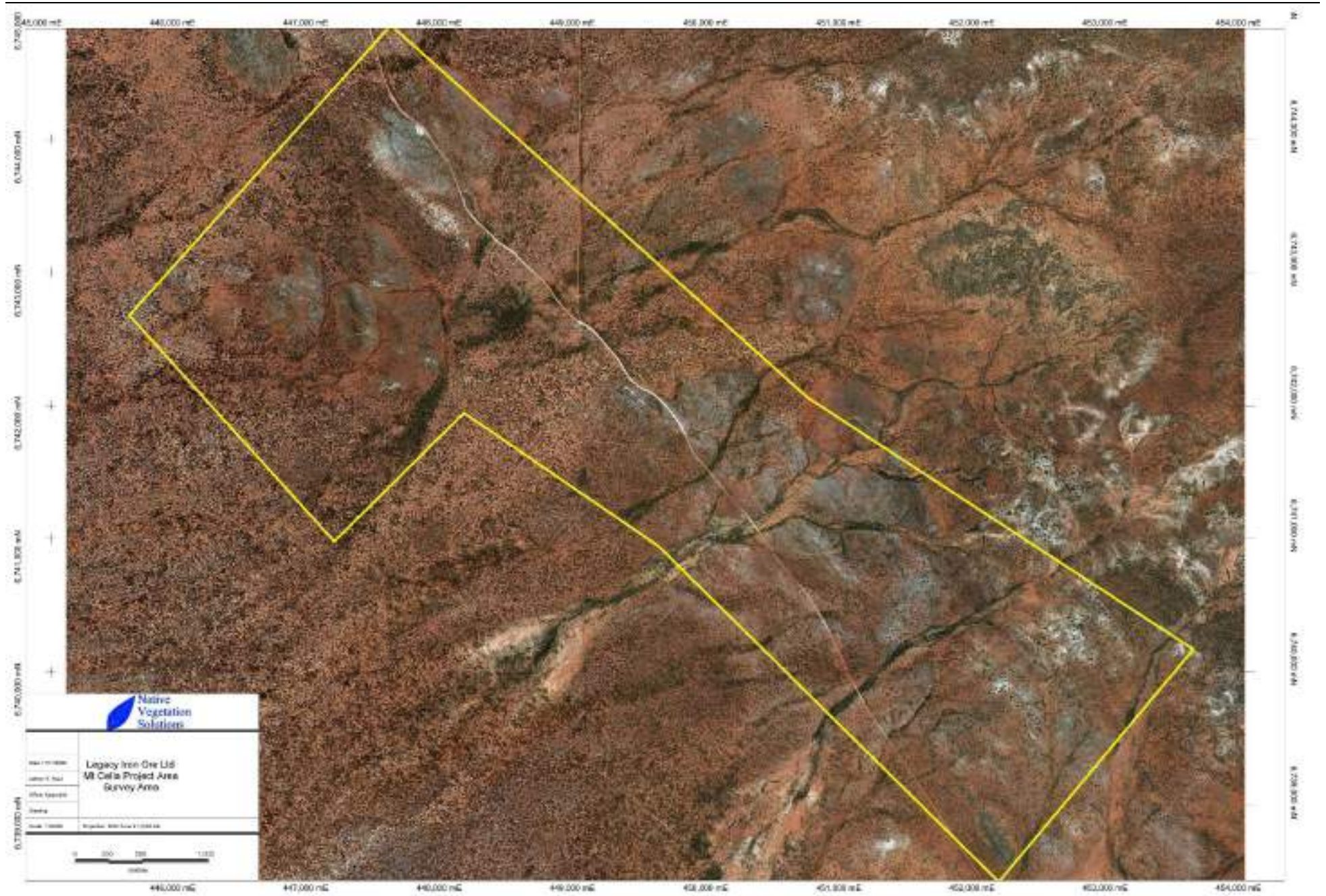
Completely Degraded (6). The structure of the vegetation is no longer intact and the area is completely or almost completely without native species.

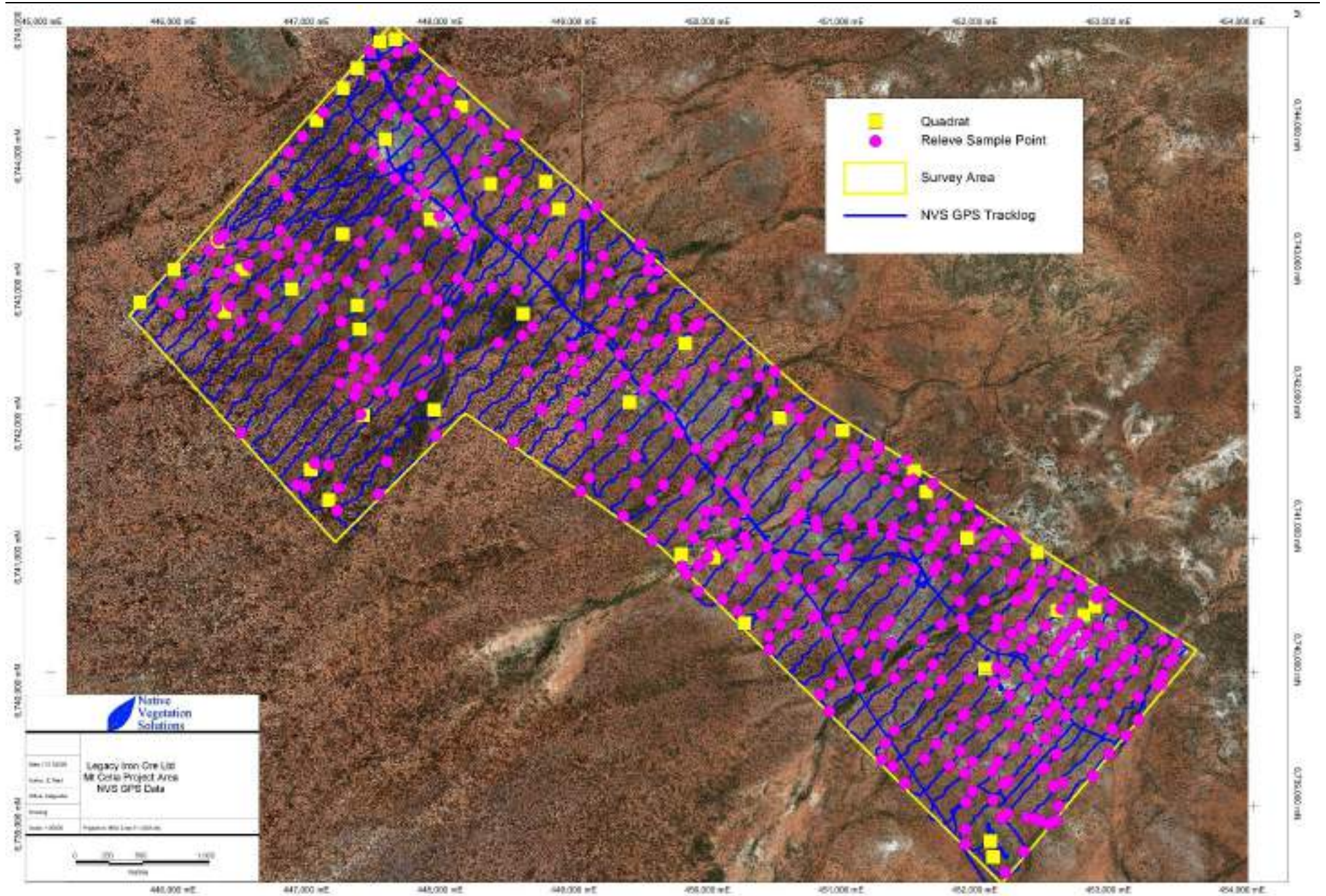
These areas are often described as 'parkland cleared' with the flora compromising weed or crop species with isolated trees or shrubs.

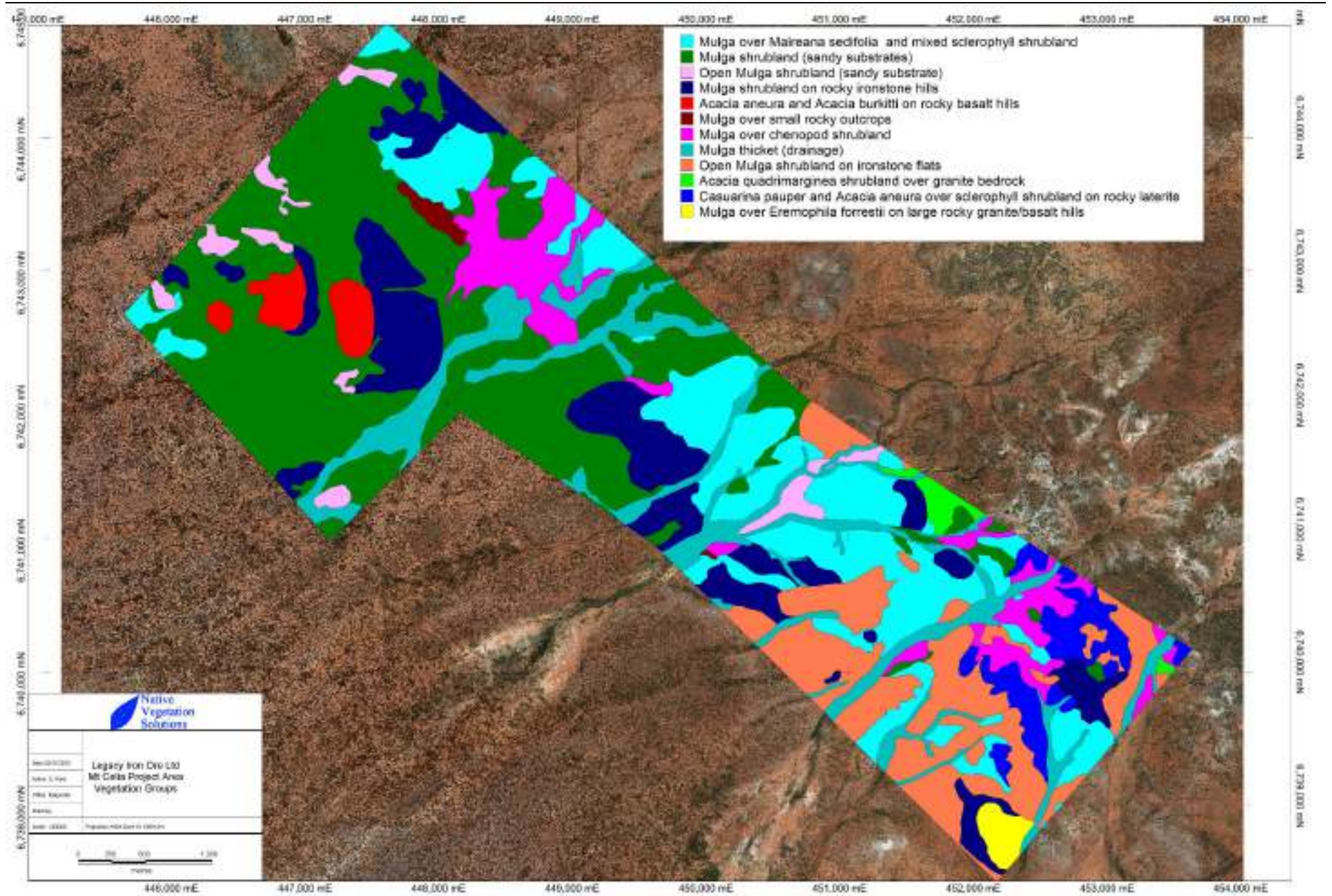
Vegetation Structure Definitions (Muir, 1977)

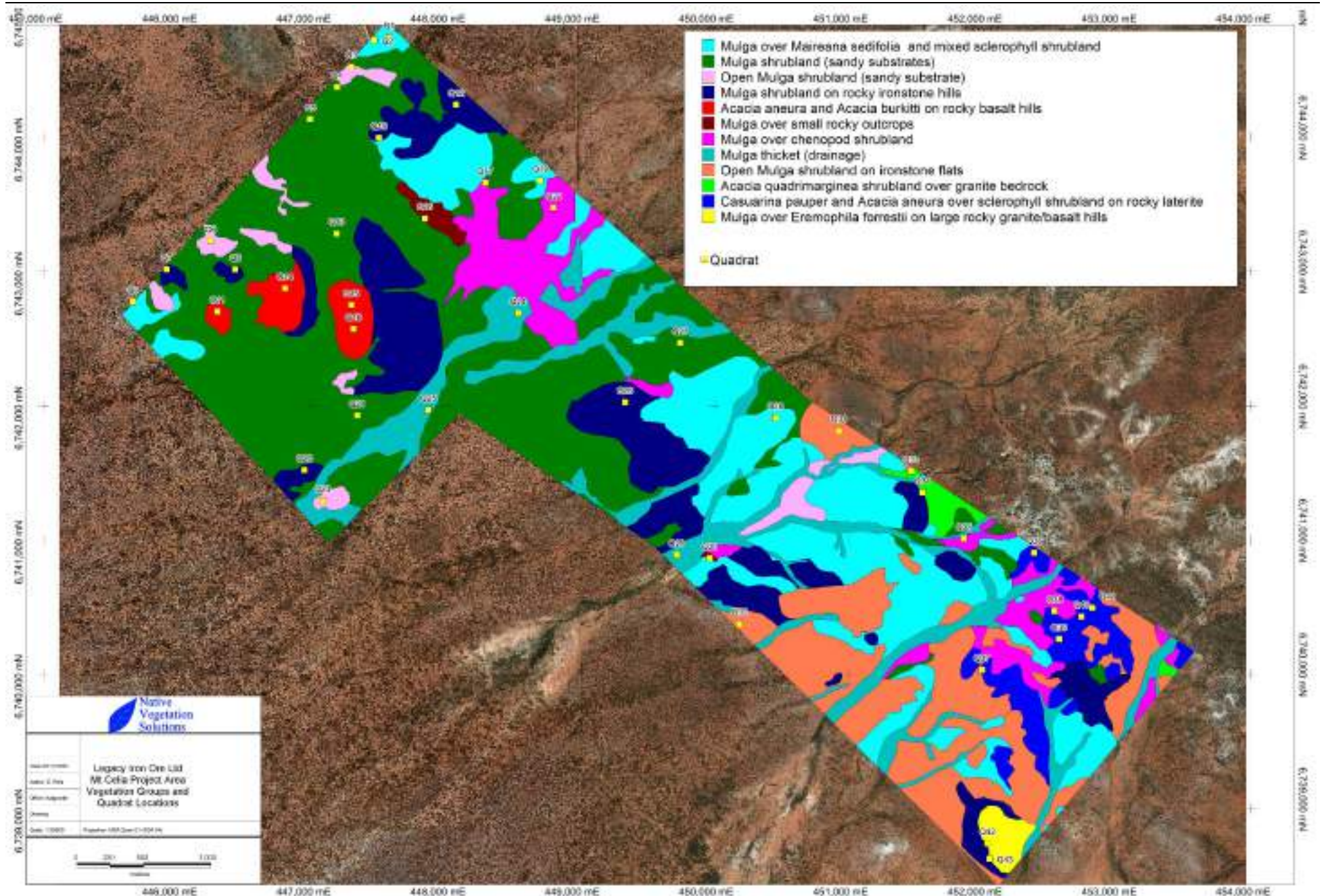
Life Form/Height Class	Canopy Cover			
	Dense 70-100% d	Mid-Dense 30-70% c	Sparse 10-30% f	Very Sparse 2-10% r
T Trees >30m	Dense Tall Forest	Tall Forest	Tall Woodland	Open Tall Woodland
M Trees 15-30m	Dense Forest	Forest	Woodland	Open Woodland
LA Trees 5-15m	Dense Low Forest A	Low Forest A	Low Woodland 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

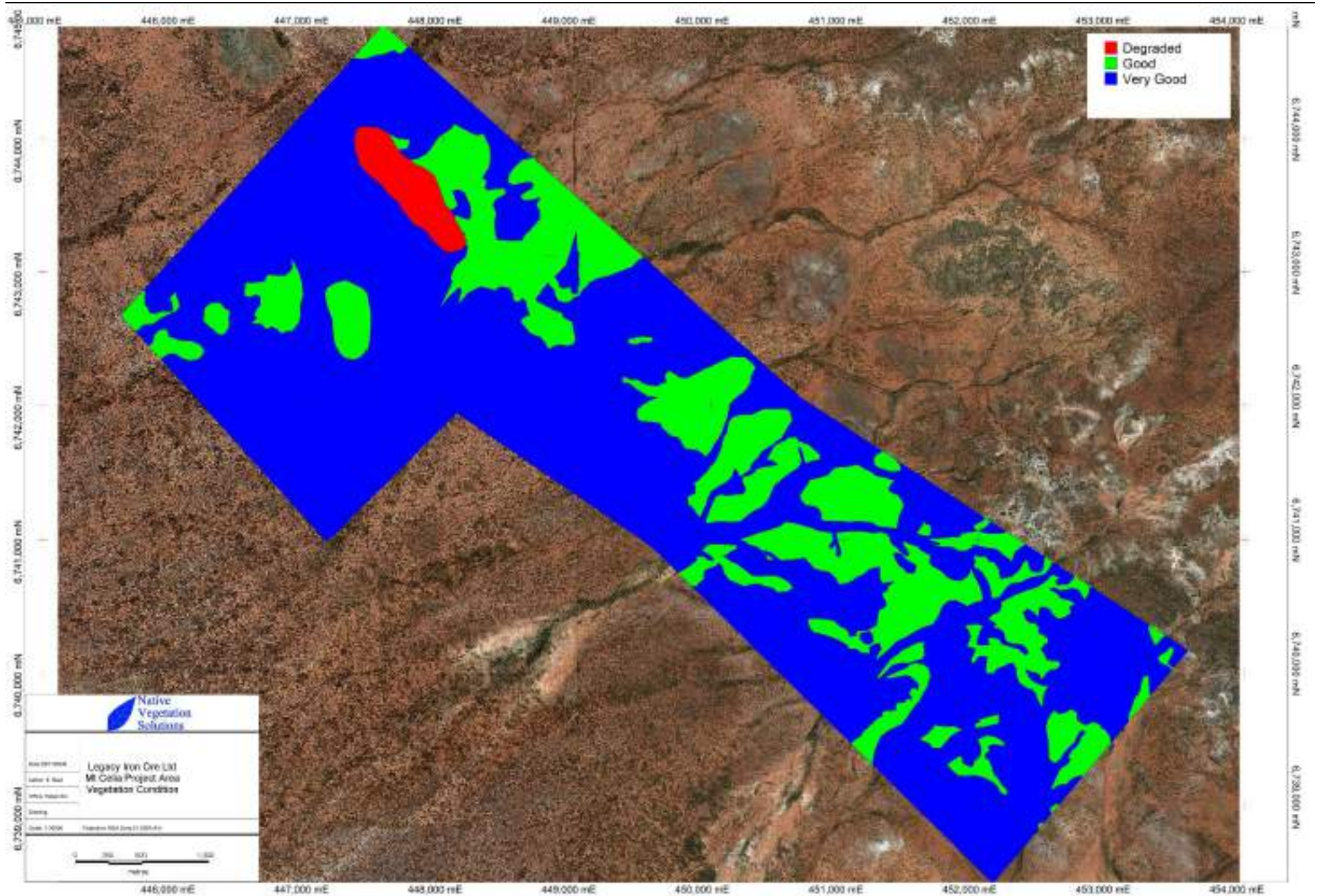
Appendix C - Mapping











Appendix D - Threatened Flora Database Search Results

Taxon	Cons_Code	Likelihood of occurring in survey area	Comment
Acacia eremophila var. Numerous-nerved variant (A.S.George 11924)	P3	Unlikely	Known records within 50km, Lack of suitable habitat
Calandrinia sp. Menzies (F. Hort et al. FH 4100)	P3	Unlikely	Possible suitable habitat, habitat searched extensively
Eremophila mirabilis	P2	Unlikely	Known records within 50km, Lack of suitable habitat
Hemigenia exilis	P4	Possible	Possible suitable habitat in the survey area, habitat searched extensively
Hybanthus floribundus subsp. chloroxanthus	P3	Possible	Suitable habitat in the survey area, habitat searched extensively
Melaleuca apostiba	P3	Unlikely	Known records within 50km, Lack of suitable habitat
Placynthium nigrum	P3	Unlikely	Known records within 50km, Lack of suitable habitat
Tecticornia mellarium	P1	Unlikely	Known records within 50km, Lack of suitable habitat
Tecticornia sp. Lake Way (P. Armstrong 05/961)	P1	Unlikely	Known records within 50km, Lack of suitable habitat
Thryptomene eremaea	P2	Unlikely	Known records within 50km, Lack of suitable habitat

Likely – suitable habitat, close (<10km) records and/or field survey completed in sub-optimal season, suggest species is likely to occur

Possible- suitable habitat, record(<50km) and/or field survey completed in sub-optimal season.

Unlikely- Lack of suitable habitat and/or no records(<50km) and /or field survey completed in optimal season, suggests species is unlikely to occur

Appendix E - Species Recorded During the June 2020 Survey

Species List per Vegetation Group (Quadrat data including opportunistic sampling)

Family	Genus	Taxon	a	b	c	d	e	f	g	h	i	j	k	l
Amaranthaceae	<i>Ptilotus</i>	<i>Ptilotus obovatus</i>	*	*	*	*	*	*	*	*	*	*	*	*
Amaranthaceae	<i>Ptilotus</i>	<i>Ptilotus schwartzii</i>				*					*			*
Anacardiaceae	<i>Schinus</i>	<i>Schinus molle</i> var. <i>areira</i> *								*				
Apocynaceae	<i>Marsdenia</i>	<i>Marsdenia australis</i>	*	*	*	*	*			*	*			*
Apocynaceae	<i>Nerium</i>	<i>Nerium oleander</i> *								*				
Asparagaceae	<i>Yucca</i>	<i>Yucca aloifolia</i> *								*				
Asteraceae	<i>Chrysocephalum</i>	<i>Chrysocephalum puteale</i>				*	*					*		
Asteraceae	<i>Olearia</i>	<i>Olearia muelleri</i>											*	
Asteraceae	<i>Podolepis</i>	<i>Podolepis capillaris</i>		*										
Casuarinaceae	<i>Casuarina</i>	<i>Casuarina pauper</i>	*			*							*	
Chenopodiaceae	<i>Atriplex</i>	<i>Atriplex bunburyana</i>	*						*				*	
Chenopodiaceae	<i>Chenopodium</i>	<i>Chenopodium gaudichaudianum</i>											*	
Chenopodiaceae	<i>Dysphania</i>	<i>Dysphania kalpari</i>					*	*		*				
Chenopodiaceae	<i>Enchylaena</i>	<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	*	*	*	*	*	*	*	*	*		*	
Chenopodiaceae	<i>Maireana</i>	<i>Maireana carnosa</i>	*											
Chenopodiaceae	<i>Maireana</i>	<i>Maireana georgei</i>	*	*	*	*	*	*	*	*	*		*	
Chenopodiaceae	<i>Maireana</i>	<i>Maireana glomerifolia</i>	*						*				*	
Chenopodiaceae	<i>Maireana</i>	<i>Maireana planifolia</i>	*		*									
Chenopodiaceae	<i>Maireana</i>	<i>Maireana pyramidata</i>	*	*			*		*	*			*	
Chenopodiaceae	<i>Maireana</i>	<i>Maireana sedifolia</i>	*			*	*		*	*			*	
Chenopodiaceae	<i>Maireana</i>	<i>Maireana tomentosa</i>	*	*		*	*		*	*			*	
Chenopodiaceae	<i>Maireana</i>	<i>Maireana trichoptera</i>	*			*	*		*	*			*	
Chenopodiaceae	<i>Maireana</i>	<i>Maireana triptera</i>	*	*	*	*	*	*	*	*	*		*	
Chenopodiaceae	<i>Rhagodia</i>	<i>Rhagodia drummondii</i>	*	*	*	*	*	*		*	*		*	
Chenopodiaceae	<i>Rhagodia</i>	<i>Rhagodia eremaea</i>	*											
Chenopodiaceae	<i>Salsola</i>	<i>Salsola australis</i>						*	*					
Chenopodiaceae	<i>Sclerolaena</i>	<i>Sclerolaena cuneata</i>	*						*					
Chenopodiaceae	<i>Sclerolaena</i>	<i>Sclerolaena densiflora</i>	*										*	
Chenopodiaceae	<i>Sclerolaena</i>	<i>Sclerolaena diacantha</i>						*					*	
Chenopodiaceae	<i>Sclerolaena</i>	<i>Sclerolaena patenticuspis</i>	*											
Convolvulaceae	<i>Duperreya</i>	<i>Duperreya sericea</i>					*							
Cucurbitaceae	<i>Citrullus</i>	<i>Citrullus amarus</i> *					*			*				
Cucurbitaceae	<i>Cucumis</i>	<i>Cucumis myriocarpus</i> *					*	*						
Cupressaceae	<i>Callitris</i>	<i>Callitris preissii</i>											*	
Fabaceae	<i>Acacia</i>	<i>Acacia aneura</i>	*	*	*	*	*	*	*	*	*	*	*	*
Fabaceae	<i>Acacia</i>	<i>Acacia ayersiana</i>	*	*		*	*	*	*	*	*	*	*	
Fabaceae	<i>Acacia</i>	<i>Acacia burkittii</i>	*	*		*	*	*	*	*	*	*	*	
Fabaceae	<i>Acacia</i>	<i>Acacia caesaneura</i>	*		*	*			*				*	
Fabaceae	<i>Acacia</i>	<i>Acacia craspedocarpa</i>		*	*	*					*			*
Fabaceae	<i>Acacia</i>	<i>Acacia hemiteles</i>					*							
Fabaceae	<i>Acacia</i>	<i>Acacia incurvaneura</i>	*	*	*	*	*		*	*				*
Fabaceae	<i>Acacia</i>	<i>Acacia kempeana</i>							*					
Fabaceae	<i>Acacia</i>	<i>Acacia ligulata</i>	*	*	*	*	*	*	*	*	*			
Fabaceae	<i>Acacia</i>	<i>Acacia mulganeura</i>	*	*	*	*	*	*	*	*	*	*	*	*
Fabaceae	<i>Acacia</i>	<i>Acacia murrayana</i>					*			*				
Fabaceae	<i>Acacia</i>	<i>Acacia oswaldii</i>	*											
Fabaceae	<i>Acacia</i>	<i>Acacia pteraneura</i>		*	*	*	*	*	*		*			
Fabaceae	<i>Acacia</i>	<i>Acacia quadrimarginea</i>										*		
Fabaceae	<i>Acacia</i>	<i>Acacia ramulosa</i> var. <i>ramulosa</i>	*	*	*	*	*		*	*			*	
Fabaceae	<i>Acacia</i>	<i>Acacia sibirica</i>				*								
Fabaceae	<i>Acacia</i>	<i>Acacia tetragonophylla</i>	*	*	*	*	*	*	*	*	*	*	*	*
Fabaceae	<i>Daviesia</i>	<i>Daviesia aphylla</i>	*	*		*								
Fabaceae	<i>Senna</i>	<i>Senna artemisioides</i> subsp. <i>xsturtii</i>				*								
Fabaceae	<i>Senna</i>	<i>Senna artemisioides</i> subsp. <i>artemisioides</i>	*	*	*	*	*	*	*	*	*	*	*	*
Fabaceae	<i>Senna</i>	<i>Senna artemisioides</i> subsp. <i>filifolia</i>	*	*	*	*	*	*	*	*	*	*	*	*
Fabaceae	<i>Senna</i>	<i>Senna artemisioides</i> subsp. <i>helmsii</i>				*	*				*			

Family	Genus	Taxon	a	b	c	d	e	f	g	h	i	j	k	l
Fabaceae	<i>Senna</i>	<i>Senna cardiosperma</i>				*							*	
Fabaceae	<i>Senna</i>	<i>Senna glutinosa subsp. chatelainiana</i>					*	*	*		*			
Fabaceae	<i>Senna</i>	<i>Senna sp. Meekatharra</i>											*	*
Frankeniaceae	<i>Frankenia</i>	<i>Frankenia ?fecunda</i>											*	
Frankeniaceae	<i>Frankenia</i>	<i>Frankenia setosa</i>							*					
Goodeniaceae	<i>Goodenia</i>	<i>Goodenia sp. (sterile)</i>					*							
Goodeniaceae	<i>Scaevola</i>	<i>Scaevola spinescens</i>	*	*	*	*	*	*	*	*	*	*	*	*
Lamiaceae	<i>Prostanthera</i>	<i>Prostanthera albiflora</i>					*							
Lamiaceae	<i>Teucrium</i>	<i>Teucrium teucriiflorum</i>		*	*			*	*		*			
Loranthaceae	<i>Amyema</i>	<i>Amyema gibberula var. gibberula</i>								*				
Loranthaceae	<i>Amyema</i>	<i>Amyema sp. Dead</i>		*										
Malvaceae	<i>Abutilon</i>	<i>Abutilon otocarpum</i>					*							
Malvaceae	<i>Abutilon</i>	<i>Abutilon oxycarpum</i>					*	*						
Malvaceae	<i>Alyogyne</i>	<i>Alyogyne pinoniana</i>						*						
Malvaceae	<i>Brachychiton</i>	<i>Brachychiton gregorii</i>			*					*		*		
Malvaceae	<i>Sida</i>	<i>Sida calyhymentia</i>	*	*		*	*							
Malvaceae	<i>Sida</i>	<i>Sida ectogama</i>		*	*	*	*	*			*		*	
Malvaceae	<i>Sida</i>	<i>Sida sp. Golden calyces glabrous</i>		*	*	*	*							
Myrtaceae	<i>Eucalyptus</i>	<i>Eucalyptus ewartiana</i>												*
Myrtaceae	<i>Eucalyptus</i>	<i>Eucalyptus kingsmillii</i>		*										
Myrtaceae	<i>Eucalyptus</i>	<i>Eucalyptus lesouefii</i>							*				*	
Myrtaceae	<i>Eucalyptus</i>	<i>Eucalyptus oleosa subsp. oleosa</i>	*	*										
Myrtaceae	<i>Eucalyptus</i>	<i>Eucalyptus salubris</i>											*	
Poaceae	<i>Aristida</i>	<i>Aristida contorta</i>	*	*	*	*	*	*	*	*	*	*	*	*
Poaceae	<i>Austrostipa</i>	<i>Austrostipa elegantissima</i>									*			
Poaceae	<i>Austrostipa</i>	<i>Austrostipa eremophila</i>	*	*	*	*	*	*	*	*	*	*	*	*
Poaceae	<i>Austrostipa</i>	<i>Austrostipa scabra</i>	*			*					*			
Poaceae	<i>Cenchrus</i>	<i>Cenchrus ciliaris*</i>								*				
Poaceae	<i>Enneapogon</i>	<i>Enneapogon caeruleus</i>	*	*	*	*	*	*	*	*	*	*	*	*
Poaceae	<i>Enteropogon</i>	<i>Enteropogon ramosus</i>	*			*	*	*	*	*	*	*	*	*
Poaceae	<i>Eragrostis</i>	<i>Eragrostis eriopoda</i>	*	*	*	*	*	*	*	*	*	*	*	*
Poaceae	<i>Eragrostis</i>	<i>Eragrostis pergracilis</i>		*										
Poaceae	<i>Eragrostis</i>	<i>Eragrostis setifolia</i>					*							
Poaceae	<i>Eriachne</i>	<i>Eriachne helmsii</i>				*	*				*		*	*
Poaceae	<i>Eriachne</i>	<i>Eriachne pulchella subsp. pulchella</i>					*		*					*
Poaceae	<i>Monachather</i>	<i>Monachather paradoxus</i>								*				
Poaceae	<i>Paspalidium</i>	<i>Paspalidium clementii</i>					*							*
Poaceae	<i>Triodia</i>	<i>Triodia basedowii</i>		*										
Portulacaceae	<i>Portulaca</i>	<i>Portulaca oleracea</i>	*				*		*					
Proteaceae	<i>Grevillea</i>	<i>Grevillea acuaria</i>											*	
Proteaceae	<i>Grevillea</i>	<i>Grevillea berryana</i>	*	*										
Proteaceae	<i>Hakea</i>	<i>Hakea lorea subsp. lorea</i>							*	*	*			
Proteaceae	<i>Hakea</i>	<i>Hakea preissii</i>	*	*		*	*		*				*	
Proteaceae	<i>Hakea</i>	<i>Hakea recurva subsp. recurva</i>	*				*							
Pteridaceae	<i>Cheilanthes</i>	<i>Cheilanthes lasiophylla</i>					*	*			*	*	*	*
Pteridaceae	<i>Cheilanthes</i>	<i>Cheilanthes sieberi subsp. sieberi</i>												*
Rubiaceae	<i>Psyrax</i>	<i>Psyrax rigidula</i>						*		*				*
Rubiaceae	<i>Psyrax</i>	<i>Psyrax suaveolens</i>			*		*	*	*	*				*
Rutaceae	<i>Philotheca</i>	<i>Philotheca brucei subsp. brucei</i>						*						*
Santalaceae	<i>Exocarpos</i>	<i>Exocarpos aphyllus</i>											*	
Sapindaceae	<i>Dodonaea</i>	<i>Dodonaea lobulata</i>	*	*		*	*		*		*	*	*	*
Sapindaceae	<i>Dodonaea</i>	<i>Dodonaea rigida</i>		*		*	*	*	*		*	*	*	*
Sapindaceae	<i>Dodonaea</i>	<i>Dodonaea viscosa subsp. angustissima</i>		*										
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila clarkei</i>					*			*				
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila exilifolia</i>	*		*					*				
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila forrestii subsp. forrestii</i>		*						*	*	*	*	*
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila georgei</i>	*											

Family	Genus	Taxon	a	b	c	d	e	f	g	h	i	j	k	l
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila latrobei</i> subsp. <i>latrobei</i>	*			*	*	*		*			*	*
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila longifolia</i>	*	*		*	*		*	*	*			
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila metallicorum</i>											*	
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila oldfieldii</i> subsp. <i>angustifolia</i>	*			*	*	*			*			
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila oppositifolia</i> subsp. <i>angustifolia</i>											*	
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila pantonii</i>				*			*				*	
Solanaceae	<i>Solanum</i>	<i>Solanum lasiophyllum</i>	*	*	*	*	*	*	*	*	*	*	*	*
Solanaceae	<i>Solanum</i>	<i>Solanum nummularium</i>	*	*										
Tamaricaceae	<i>Tamarix</i>	<i>Tamarix aphylla</i> *								*				
Thymelaeaceae	<i>Pimelea</i>	<i>Pimelea microcephala</i> subsp. <i>microcephala</i>			*			*		*				

Appendix F - Site Descriptions

Project Name: Mt Celia			
Date:	8/06/2020	Botanist:	Eren Reid
Location:	Mt Celia	Quadrat:	Q43
Quadrat size:	20x20		
Vegetation group:	Mulga over Eremophila forrestii on large rocky granite/basalt hills		
WP:	489		
Photo number:			159
Landform:			Lower slope/Hillslope
Land surface/disturbance:			No effective disturbance
Coarse fragments on the surface (abundance/size/shape):			Very; abundant/Cobbly; or cobbles/Subangular
Rock outcrop (abundance/runoff):			Very slightly rocky/Rapid
Soil (profile/field texture/soil surface):			Uniform/Sandy clay loam/Firm
% Cover leaf litter:			20
% Cover bare ground:			60
Tallest stratum		Mid-stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub
Height:	1-3m	Height:	0.5-1m
Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:	
Acacia incurvaneura		Eremophila forrestii subsp. forrestii	
Acacia mulganeura			
ALL SPECIES			
			Acacia incurvaneura
			Acacia mulganeura
			Eremophila forrestii subsp. forrestii
			Ptilotus obovatus
			Eremophila latrobei subsp. latrobei
			Senna sp. Meekatharra
			Solanum lasiophyllum
			Ptilotus schwartzii
			Acacia aneura
			Cheilanthes sieberi subsp. sieberi
			Austrostipa eremophila
			Aristida contorta
			Paspalidium clementii
			Enteropogon ramosus
			Eriachne helmsii
Outside			



Project Name: Mt Celia					
Date:	8/06/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q2		
Quadrat size:	20x20				
Vegetation group:	Mulga over Maireana sedifolia (calcrete)				
WP:	2				
Photo number:			69		
Landform:			Flat/Plain		
Land surface/disturbance:			No effective disturbance		
Coarse fragments on the surface (abundance/size/shape):			Slightly: few/Medium gravelly; medium pebbles/Subrounded		
Rock outcrop (abundance/runoff):			No bedrock exposed/Slow		
Soil (profile/field texture/soil surface):			Uniform/Loamy sand/Firm		
% Cover leaf litter:			20		
% Cover bare ground:			60		
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Shrub Mallee (< 8m)	Growth form:	Shrub	Growth form:	Shrub
Height:	6-12m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	10-30	Crown cover %:	10-30	Crown cover %:	10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia aneura		Acacia ligulata		Maireana sedifolia	
		Acacia burkittii		Ptilotus obovatus	
		Senna artemisioides subsp. filifolia		Dodonaea lobulata	
ALL SPECIES					
Acacia aneura					
Acacia ligulata					
Acacia burkittii					
Senna artemisioides subsp. filifolia					
Maireana sedifolia					
Ptilotus obovatus					
Dodonaea lobulata					
Eremophila latrobei subsp. latrobei					
Hakea preissii					
Maireana georgei					
Solanum lasiophyllum					
Rhagodia drummondii					
Aristida contorta					
Acacia ramulosa var. ramulosa					
Acacia caesaneura					
Austrostipa eremophila					
Enneapogon caeruleus					
Acacia tetragonophylla					
Outside					
Acacia incurvaneura					
Acacia mulganeura					
Eremophila longifolia					
Scaevola spinescens					
Maireana pyramidata					



Project Name: Mt Celia					
Date:	3/06/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q3		
Quadrat size:	20x20				
Vegetation group:	Mulga Shrubland				
WP:	4				
Photo number:					
Landform:	40				
Land surface/disturbance:	Flat/Plain				
Coarse fragments on the surface (abundance/size/shape):	No effective disturbance				
Rock outcrop (abundance/runoff):	No coarse fragments				
Soil (profile/field texture/soil surface):	No bedrock exposed/Slow				
% Cover leaf litter:	Uniform/Loamy sand/Hard setting				
% Cover bare ground:	40				
	50				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	M Tree Mallee (> 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	S 10-30	Crown cover %:	S 10-30	Crown cover %:	V <10
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia aneura		Acacia ramulosa var. ramulosa		Ptilotus obovatus	
Acacia incurvaneura					
Acacia caesaneura					
ALL SPECIES					
Acacia aneura					
Acacia incurvaneura					
Acacia caesaneura					
Acacia ramulosa var. ramulosa					
Ptilotus obovatus					
Eragrostis eriopoda					
Sida ectogama					
Sida sp. Golden calyces glabrous					
Maireana georgei					
Maireana planifolia					
Rhagodia drummondii					
Marsdenia australis					
Aristida contorta					
Austrostipa eremophila					
Enchylaena tomentosa var. tomentosa					
Solanum lasiophyllum					
Maireana triptera					
Outside					
Acacia ligulata					
Teucrium teucriiflorum					



Project Name: Mt Celia					
Date:	3/06/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q4		
Quadrat size:	20x20				
Vegetation group:	Mulga Shrubland				
WP:	5				
Photo number:			41		
Landform:			Flat/Plain		
Land surface/disturbance:			No effective disturbance		
Coarse fragments on the surface (abundance/size/shape):			No coarse fragments		
Rock outcrop (abundance/runoff):			No bedrock exposed/Slow		
Soil (profile/field texture/soil surface):			Uniform/Loamy sand/Hard setting		
% Cover leaf litter:			40		
% Cover bare ground:			50		
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	M Tree Mallee (> 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	5-12m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	S 10-30	Crown cover %:	S 10-30	Crown cover %:	V <10
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia incurvaneura		Acacia ramulosa var. ramulosa		Ptilotus obovatus	
Acacia mulganeura		Eremophila forrestii subsp. forrestii			
Eucalyptus kingsmillii		Senna artemisioides subsp. artemisioides			
ALL SPECIES					
Acacia incurvaneura					
Acacia mulganeura					
Eucalyptus kingsmillii					
Acacia ramulosa var. ramulosa					
Eremophila forrestii subsp. forrestii					
Senna artemisioides subsp. artemisioides					
Ptilotus obovatus					
Maireana pyramidata					
Acacia craspedocarpa					
Acacia aneura					
Solanum lasiophyllum					
Eragrostis eriopoda					
Teucrium teucriiflorum					
Rhagodia drummondii					
Aristida contorta					
Scaevola spinescens					
Outside					
Acacia ligulata					



Project Name: Mt Celia			
Date:	8/06/2020	Botanist:	Eren Reid
Location:	Mt Celia	Quadrat:	Q5
Quadrat size:	20x20		
Vegetation group:	Mulga shrubland		
WP:	7		
Photo number:			42
Landform:			Flat/Plain
Land surface/disturbance:			No effective disturbance
Coarse fragments on the surface (abundance/size/shape):			No coarse fragments
Rock outcrop (abundance/runoff):			No bedrock exposed/No runoff
Soil (profile/field texture/soil surface):			Gradational/Loamy sand/Hard setting
% Cover leaf litter:			80
% Cover bare ground:			80
Tallest stratum		Mid-stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m
Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:	
Acacia incurvaneura		Eremophila forrestii subsp. forrestii	
		Senna artemisioides subsp. filifolia	
		Acacia mulganeura	
		Ptilotus obovatus	
		Eragrostis eriopoda	
		Aristida contorta	
		Eucalyptus oleosa subsp. oleosa	
		Rhagodia drummondii	
		Acacia ramulosa var. ramulosa	
		Dodonaea rigida	
		Scaevola spinescens	
		Acacia aneura	
		Eragrostis pergracilis	
		Grevillea berryana	
		Teucrium teucriiflorum	
		Solanum lasiophyllum	
		Sida ectogama	
		Sida sp. Golden calyces glabrous	
		Senna artemisioides subsp. artemisioides	
		Austrostipa eremophila	
		Maireana georgei	
		Maireana tomentosa	
		Enchylaena tomentosa var. tomentosa	
ALL SPECIES			
Acacia incurvaneura			
Eremophila forrestii subsp. forrestii			
Senna artemisioides subsp. filifolia			
Acacia mulganeura			
Ptilotus obovatus			
Eragrostis eriopoda			
Aristida contorta			
Eucalyptus oleosa subsp. oleosa			
Rhagodia drummondii			
Acacia ramulosa var. ramulosa			
Dodonaea rigida			
Scaevola spinescens			
Acacia aneura			
Eragrostis pergracilis			
Grevillea berryana			
Teucrium teucriiflorum			
Solanum lasiophyllum			
Sida ectogama			
Sida sp. Golden calyces glabrous			
Senna artemisioides subsp. artemisioides			
Austrostipa eremophila			
Maireana georgei			
Maireana tomentosa			
Enchylaena tomentosa var. tomentosa			
Outside			
Acacia burkittii			
Acacia ligulata			
Hakea preissii			
Triodia basedowii			



Project Name: Mt Celia			
Date:	3/06/2020	Botanist:	Eren Reid
Location:	Mt Celia	Quadrat:	06
Quadrat size:	20x20		
Vegetation group:	Open Mulga shrubland on sandy soils		
WP:	11		
Photo number:			43
Landform:			Flat/Plain
Land surface/disturbance:			No effective disturbance
Coarse fragments on the surface (abundance/size/shape):			No coarse fragments
Rock outcrop (abundance/runoff):			No bedrock exposed/Slow
Soil (profile/field texture/soil surface):			Gradational/Loamy sand/Hard setting
% Cover leaf litter:			20
% Cover bare ground:			70
Tallest stratum	Mid-stratum	Lower stratum	
Growth form:	Shrub Mallee (< 8m)	Growth form:	Shrub
Height:	3-6m	Height:	0.25-0.5m
Crown cover %:	<10	Crown cover %:	10-30
Dominant taxa:	Senna artemisioides subsp. filifolia Acacia ramulosa var. ramulosa Acacia ligulata	Dominant taxa:	Ptilotus obovatus Eragrostis eriopoda
Acacia mulganeura			
ALL SPECIES			
Acacia mulganeura			
Senna artemisioides subsp. filifolia			
Acacia ramulosa var. ramulosa			
Acacia ligulata			
Ptilotus obovatus			
Eragrostis eriopoda			
Brachychiton gregorii			
Acacia tetragonophylla			
Acacia craspedocarpa			
Acacia incurvaneura			
Pimelea microcephala subsp. microcephala			
Rhagodia drummondii			
Maireana triptera			
Solanum lasiophyllum			
Aristida contorta			
Marsdenia australis			
Senna artemisioides subsp. artemisioides			
Enneapogon caeruleus			
Outside			
Acacia aneura			
Acacia pteraneura			



Project Name: Mt Celia					
Date:	4/06/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q7		
Quadrat size:	20x20				
Vegetation group:	Mulga shrubland on rocky ironstone				
WP:	12				
Photo number:			44		
Landform:			Hillock/Mound		
Land surface/disturbance:			No effective disturbance		
Coarse fragments on the surface (abundance/size/shape):			Very: abundant/Cobbly: or cobbles/Subangular tabular		
Rock outcrop (abundance/runoff):			No bedrock exposed/Moderately rapid		
Soil (profile/field texture/soil surface):			Uniform/Sandy clay loam/Hard setting		
% Cover leaf litter:			20		
% Cover bare ground:			65		
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	§ Shrub	Growth form:	§ Shrub	Growth form:	§ Shrub
Height:	1-3m	Height:	0.5-1m	Height:	0.25-0.5m
Crown cover %:	√ <10	Crown cover %:	§ 10-30	Crown cover %:	√ <10
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia aneura		Scaevola spinescens		Ptilotus obovatus	
Acacia mulganeura		Senna artemisioides subsp. filifolia			
		Eremophila latrobei subsp. latrobei			
ALL SPECIES					
Acacia aneura					
Acacia mulganeura					
Scaevola spinescens					
Senna artemisioides subsp. filifolia					
Eremophila latrobei subsp. latrobei					
Ptilotus obovatus					
Dodonaea lobulata					
Eremophila oldfieldii subsp. angustifolia					
Senna artemisioides subsp. artemisioides					
Sida ectogama					
Acacia tetragonophylla					
Rhagodia drummondii					
Acacia craspedocarpa					
Hakea preissii					
Solanum lasiophyllum					
Sida calyxhymenia					
Dodonaea rigida					
Austrostipa scabra					
Sida sp. Golden calyces glabrous					
Eremophila longifolia					
Maireana triptera					
Outside					
Acacia incurvaneura					
Acacia ligulata					



Project Name: Mt Celia					
Date:	4/06/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q8		
Quadrat size:	20x20				
Vegetation group:	Cas Pauper over Acacia ligulata, senna art fil and Dod lob				
WP:	13				
Photo number:			45		
Landform:	Flat/Plain				
Land surface/disturbance:	No effective disturbance				
Coarse fragments on the surface (abundance/size/shape):	No coarse fragments				
Rock outcrop (abundance/runoff):	No bedrock exposed/Slow				
Soil (profile/field texture/soil surface):	Gradational/Loamy sand/Hard setting				
% Cover leaf litter:	40				
% Cover bare ground:	40				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	M Tree Mallee (> 8m)	Growth form:	S Shrub	Growth form:	L Shrub Mallee (< 8m)
Height:	6-12m	Height:	1-3m	Height:	0.25-0.5m
Crown cover %:	<1	Crown cover %:	M 30-70	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Casuarina pauper		Acacia ligulata		Ptilotus obovatus	
		Senna artemisioides subsp. filifolia		Maireana pyramidata	
		Dodonaea lobulata			
ALL SPECIES					
Casuarina pauper					
Acacia ligulata					
Senna artemisioides subsp. filifolia					
Dodonaea lobulata					
Ptilotus obovatus					
Maireana pyramidata					
Daviesia aphylla					
Scaevola spinescens					
Acacia tetragonophylla					
Rhagodia drummondii					
Austrostipa scabra					
Maireana planifolia					
Maireana tomentosa					
Enchylaena tomentosa var. tomentosa					
Maireana triptera					
Marsdenia australis					
Solanum lasiophyllum					
Outside					
Eucalyptus oleosa subsp. oleosa					
Hakea preissii					



Project Name: Mt Celia		
Date:	4/06/2020	Botanist: Eren Reid
Location:	Mt Celia	Quadrat: Q9
Quadrat size:	20x20	
Vegetation group:	Mulga shrubland on rocky ironstone hills	
WP:	32	
Photo number:		46
Landform:		Hillock/Mound
Land surface/disturbance:		No effective disturbance
Coarse fragments on the surface (abundance/size/shape):		Very; abundant/Cobbly; or cobbles/Subangular tabular
Rock outcrop (abundance/runoff):		Rocky/Moderately rapid
Soil (profile/field texture/soil surface):		Uniform/Sandy clay loam/Hard setting
% Cover leaf litter:		30
% Cover bare ground:		60

Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	V <10	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia mulganeura		Scaevola spinescens		Ptilotus obovatus	
		Eremophila latrobei subsp. latrobei			
		Dodonaea lobulata			
		Ptilotus obovatus			

ALL SPECIES

Acacia mulganeura
Scaevola spinescens
Eremophila latrobei subsp. latrobei
Dodonaea lobulata
Ptilotus obovatus
Acacia pteraneura
Eremophila oldfieldii subsp. angustifolia
Acacia sibirica
Senna artemisioides subsp. filifolia
Acacia tetragonophylla
Maireana triptera
Solanum lasiophyllum
Dodonaea rigida
Maireana georgei
Enneapogon caeruleus
Sida calyxhymenia
Enchylaena tomentosa var. tomentosa
Ptilotus schwartzii
Marsdenia australis
Maireana sedifolia
Outside
Acacia aneura
Acacia burkittii
Eremophila longifolia
Senna cardiosperma
Hakea preissii
Acacia ligulata



Project Name: Mt Celia					
Date:	4/06/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q10		
Quadrat size:	20x20				
Vegetation group:	Mulga shrubland on rocky ironstone hills				
WP:	46				
Photo number:	47				
Landform:	Hillock/Mound				
Land surface/disturbance:	No effective disturbance				
Coarse fragments on the surface (abundance/size/shape):	Very; abundant/Cobbly; or cobbles/Angular tabular				
Rock outcrop (abundance/runoff):	Rocky/Moderately rapid				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Hard setting				
% Cover leaf litter:	20				
% Cover bare ground:	60				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.25-0.5m
Crown cover %:	V <10	Crown cover %:	S 10-30	Crown cover %:	V <10
Dominant taxa:	Acacia incurvaneura	Dominant taxa:	Senna artemisioides subsp. helmsii	Dominant taxa:	Ptilotus obovatus
			Dodonaea lobulata		
			Senna artemisioides subsp. filifolia		
ALL SPECIES					
Acacia incurvaneura					
Senna artemisioides subsp. helmsii					
Dodonaea lobulata					
Senna artemisioides subsp. filifolia					
Ptilotus obovatus					
Eremophila pantonii					
Eremophila oldfieldii subsp. angustifolia					
Senna artemisioides subsp. artemisioides					
Scaevola spinescens					
Senna artemisioides subsp. xsturtii					
Acacia mulganeura					
Acacia burkittii					
Enneapogon caeruleus					
Maireana triptera					
Solanum lasiophyllum					
Maireana trichoptera					
Acacia tetragonophylla					
Austrostipa eremophila					
Enchylaena tomentosa var. tomentosa					
Outside					



Project Name: Mt Celia					
Date:	4/06/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q11		
Quadrat size:	20x20				
Vegetation group:	Acacia aneura and Acacia burkittii on rocky basalt hills				
WP:	52				
Photo number:			48		
Landform:	Hillock/Mound				
Land surface/disturbance:	No effective disturbance				
Coarse fragments on the surface (abundance/size/shape):	Very: abundant/Cobbly: or cobbles/Subrounded				
Rock outcrop (abundance/runoff):	Rocky/Moderately rapid				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Hard setting				
% Cover leaf litter:	10				
% Cover bare ground:	70				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	
Height:	1-3m	Height:	0.5-1m	Height:	
Crown cover %:	V <10	Crown cover %:	S 10-30	Crown cover %:	
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia aneura		Acacia burkittii		Ptilotus obovatus	
Acacia pteraneura				Chrysocephalum puteale	
ALL SPECIES					
Acacia aneura					
Acacia pteraneura					
Acacia burkittii					
Ptilotus obovatus					
Chrysocephalum puteale					
Acacia ligulata					
Acacia incurvaneura					
Scaevola spinescens					
Acacia mulganeura					
Acacia hemiteles					
Dodonaea rigida					
Senna artemisioides subsp. filifolia					
Maireana triptera					
Solanum lasiophyllum					
Enneapogon caerulescens					
Acacia ramulosa var. ramulosa					
Austrostipa eremophila					
Eriachne pulchella subsp. pulchella					
Maireana georgei					
Marsdenia australis					
Outside					
Hakea preissii					
Acacia tetragonophylla					
Eremophila latrobei subsp. latrobei					



Project Name: Mt Celia			
Date:	4/06/2020	Botanist:	Eren Reid
Location:	Mt Celia	Quadrat:	Q12
Quadrat size:	20x20		
Vegetation group:	Mulga shrubland on rocky ironstone hills		
WP:	64		
Photo number:			52
Landform:			Hillock/Mound
Land surface/disturbance:			No effective disturbance
Coarse fragments on the surface (abundance/size/shape):			Very; abundant/Cobbly; or cobbles/Subrounded tabular
Rock outcrop (abundance/runoff):			Rocky/Moderately rapid
Soil (profile/field texture/soil surface):			Uniform/Sandy clay loam/Hard setting
% Cover leaf litter:			20
% Cover bare ground:			70

Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.25-0.5m
Crown cover %:	V <10	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia aneura		Acacia burkittii		Ptilotus obovatus	
Acacia mulganeura		Eremophila latrobei subsp. latrobei		Chrysocephalum puteale	

ALL SPECIES

Acacia aneura
Acacia mulganeura

Acacia burkittii
Eremophila latrobei subsp. latrobei

Ptilotus obovatus
Chrysocephalum puteale

Acacia incurvaneura
Acacia tetragonophylla
Scaevola spinescens
Dodonaea rigida
Dodonaea lobulata
Senna artemisioides subsp. helmsii
Solanum lasiophyllum
Enchylaena tomentosa var. tomentosa
Enneapogon caerulescens
Eriachne helmsii
Enteropogon ramosus
Maireana triptera

Outside



Project Name: Mt Celia					
Date:	4/06/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q13		
Quadrat size:	20x20				
Vegetation group:	Mulga shrubland (sandy)				
WP:	68				
Photo number:			53		
Landform:			Flat/Plain		
Land surface/disturbance:			No effective disturbance		
Coarse fragments on the surface (abundance/size/shape):			No coarse fragments		
Rock outcrop (abundance/runoff):			No bedrock exposed/Slow		
Soil (profile/field texture/soil surface):			Duplex/Clayey sand/Soft		
% Cover leaf litter:			20		
% Cover bare ground:			40		
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.25-0.5m
Crown cover %:	S 10-30	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia aneura		Scaevola spinescens		Ptilotus obovatus	
Acacia incurvaneura		Dodonaea lobulata			
Acacia mulganeura					
ALL SPECIES					
Acacia aneura					
Acacia incurvaneura					
Acacia mulganeura					
Scaevola spinescens					
Dodonaea lobulata					
Ptilotus obovatus					
Acacia ayersiana					
Acacia craspedocarpa					
Acacia pteraneura					
Solanum lasiophyllum					
Acacia tetragonophylla					
Senna artemisioides subsp. artemisioides					
Marsdenia australis					
Maireana tomentosa					
Eragrostis eriopoda					
Aristida contorta					
Enchylaena tomentosa var. tomentosa					
Outside					
Acacia ligulata					
Grevillea berryana					
Sida calyxhymenia					



Project Name: Mt Celia					
Date:	4/06/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q14		
Quadrat size:	20x20				
Vegetation group:	Acacia aneura and Acacia burkittii on rocky basalt hills				
WP:	71				
Photo number:	54-quadrat, 55 is general veg				
Landform:	Hillock/Mound				
Land surface/disturbance:	No effective disturbance				
Coarse fragments on the surface (abundance/size/shape):	Extremely; very abundant/Cobbly; or cobbles/Subrounded				
Rock outcrop (abundance/runoff):	Slightly rocky/Moderately rapid				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	20				
% Cover bare ground:	60				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	M Tree Mallee (> 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	6-12m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	S 10-30	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia aneura		Acacia mulganeura		Ptilotus obovatus	
		Acacia burkittii			
		Scaevola spinescens			
		Ptilotus obovatus			
ALL SPECIES					
Acacia aneura					
Acacia mulganeura					
Acacia burkittii					
Scaevola spinescens					
Ptilotus obovatus					
Eremophila oldfieldii subsp. angustifolia					
Acacia tetragonophylla					
Acacia pteraneura					
Senna artemisioides subsp. filifolia					
Maireana trichoptera					
Maireana triptera					
Enneapogon caeruleus					
Solanum lasiophyllum					
Chrysocephalum puteale					
Maireana sedifolia					
Eragrostis setifolia					
Austrostipa eremophila					
Maireana tomentosa					
Outside					
Acacia ligulata					
Senna artemisioides subsp. artemisioides					
Hakea recurva subsp. recurva					



Project Name: Mt Celia					
Date:	5/06/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q15		
Quadrat size:	20x20				
Vegetation group:	Acacia aneura and Acacia burkittii on rocky basalt hills				
WP:	92				
Photo number:	60-63				
Landform:	Crest/Hill Crest				
Land surface/disturbance:	No effective disturbance				
Coarse fragments on the surface (abundance/size/shape):	Extremely; very abundant/Cobbly; or cobbles/Subrounded				
Rock outcrop (abundance/runoff):	Rockland/Very rapid				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	10				
% Cover bare ground:	70				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.25-0.5m
Crown cover %:	V <10	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia mulganeura		Senna artemisioides subsp. artemisioides		Ptilotus obovatus	
		Acacia burkittii		Prostanthera albiflora	
ALL SPECIES					
Acacia mulganeura					
Senna artemisioides subsp. artemisioides					
Acacia burkittii					
Ptilotus obovatus					
Prostanthera albiflora					
Acacia aneura					
Psychrax suaveolens					
Acacia tetragonophylla					
Scaevola spinescens					
Senna artemisioides subsp. helmsii					
Eremophila latrobei subsp. latrobei					
Rhagodia drummondii					
Solanum lasiophyllum					
Enchylaena tomentosa var. tomentosa					
Abutilon otocarpum					
Abutilon oxycarpum					
Goodenia sp. (sterile)					
Portulaca oleracea					
Citrullus amarus*					
Enteropogon ramosus					
Cucumis myriocarpus*					
Cheilanthes lasiophylla					
Enneapogon caeruleus					
Maireana pyramidata					
Duperreya sericea					
Paspalidium clementii					
Dysphania kalpari					
Sida calyxhymenia					
Eremophila clarkei					
Outside					
Acacia murrayana					
Maireana triptera					



Project Name: Mt Celia					
Date:	5/06/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q16		
Quadrat size:	20x20				
Vegetation group:	Mulga over small rocky outcrops				
WP:	97				
Photo number:			70		
Landform:			Crest/Hill Crest		
Land surface/disturbance:			Limited clearing		
Coarse fragments on the surface (abundance/size/shape):			Very; abundant/Stony; stones/Subangular tabular		
Rock outcrop (abundance/runoff):			Rockland/Very rapid		
Soil (profile/field texture/soil surface):			Uniform/Sandy clay loam/Hard setting		
% Cover leaf litter:			40		
% Cover bare ground:			50		
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	6-12m	Height:	1-3m	Height:	0.25-0.5m
Crown cover %:	V <10	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia aneura		Philotheca brucei subsp. brucei		Ptilotus obovatus	
Acacia mulganeura		Sida ectogama			
		Scaevola spinescens			
ALL SPECIES					
Acacia aneura					
Acacia mulganeura					
Philotheca brucei subsp. brucei					
Sida ectogama					
Scaevola spinescens					
Ptilotus obovatus					
Acacia ayersiana					
Acacia pteraneura					
Acacia tetragonophylla					
Psychradax rigidula					
Rhogodia drummondii					
Dodonaea rigida					
Eremophila latrobei subsp. latrobei					
Psychradax suaveolens					
Senna glutinosa subsp. chatelainiana					
Acacia ligulata					
Acacia burkittii					
Eremophila oldfieldii subsp. angustifolia					
Cheilanthes lasiophylla					
Pimelea microcephala subsp. microcephala					
Enneapogon caeruleus					
Sclerolaena diacantha					
Alyogyne pinoniana					
Maireana triptera					
Outside					



Project Name: Mt Celia					
Date:		Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q17		
Quadrat size:	20x20				
Vegetation group:	Mulga over chenopod shrubland				
WP:	106				
Photo number:			76		
Landform:			Open depression (vale)/Drainage depression		
Land surface/disturbance:			No effective disturbance		
Coarse fragments on the surface (abundance/size/shape):			Moderately; many/Medium gravelly; medium pebbles/Rounded		
Rock outcrop (abundance/runoff):			No bedrock exposed/Slow		
Soil (profile/field texture/soil surface):			Uniform/Sandy clay loam/Cracking		
% Cover leaf litter:			10		
% Cover bare ground:			60		
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (<8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	V <10	Crown cover %:	V <10	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia aneura		Senna artemisioides subsp. filifolia		Maireana pyramidata	
		Acacia burkittii		Atriplex bunburyana	
		Acacia caesaneura			
ALL SPECIES					
Acacia aneura					
Senna artemisioides subsp. filifolia					
Acacia burkittii					
Acacia caesaneura					
Maireana pyramidata					
Atriplex bunburyana					
Acacia kempeana					
Acacia pteraneura					
Enneapogon caerulescens					
Enchylaena tomentosa var. tomentosa					
Maireana triptera					
Austrostipa eremophila					
Enteropogon ramosus					
Portulaca oleracea					
Ptilotus obovatus					
Solanum lasiophyllum					
Maireana tomentosa					
Aristida contorta					
Outside					
Eremophila longifolia					
Acacia ramulosa var. ramulosa					
Acacia ligulata					
Acacia tetragonophylla					
Scaevola spinescens					



Project Name: Mt Celia					
Date:	5/06/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q18		
Quadrat size:	20x20				
Vegetation group:	Acacia aneura and Acacia 79urkittii on rocky basalt hills				
WP:	112				
Photo number:	77				
Landform:	Hillock/Mound				
Land surface/disturbance:	No effective disturbance				
Coarse fragments on the surface (abundance/size/shape):	Very: abundant/Coarse gravelly: large pebbles/Subrounded tabular				
Rock outcrop (abundance/runoff):	Very rocky/Rapid				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Hard setting				
% Cover leaf litter:	20				
% Cover bare ground:	60				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.25-0.5m
Crown cover %:	S 10-30	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:	Acacia burkittii	Dominant taxa:	Senna artemisioides subsp. filifolia	Dominant taxa:	Ptilotus obovatus
Acacia mulganeura	Scaevola spinescens	Enneapogon caeruleus			
ALL SPECIES					
Acacia mulganeura					
Acacia burkittii					
Senna artemisioides subsp. filifolia					
Scaevola spinescens					
Ptilotus obovatus					
Enneapogon caeruleus					
Dodonaea lobulata					
Acacia tetragonophylla					
Senna artemisioides subsp. helmsii					
Senna artemisioides subsp. artemisioides					
Eremophila longifolia					
Hakea preissii					
Acacia aneura					
Maireana sedifolia					
Dodonaea rigida					
Senna glutinosa subsp. chatelainiana					
Maireana triptera					
Enchylaena tomentosa var. tomentosa					
Prostanthera albiflora					
Eriachne helmsii					
Enteropogon ramosus					
Cheilanthes lasiophylla					
Eremophila clarkii					
Abutilon oxycarpum					
Outside					
Psydrax suaveolens					



Project Name: Mt Celia					
Date:	5/06/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q19		
Quadrat size:	20x20				
Vegetation group:	Mulga over Maireana sedifolia and mixed sclerophyll shrubland				
WP:	124				
Photo number:			78		
Landform:			Flat/Plain		
Land surface/disturbance:			No effective disturbance		
Coarse fragments on the surface (abundance/size/shape):			No coarse fragments		
Rock outcrop (abundance/runoff):			No bedrock exposed/Slow		
Soil (profile/field texture/soil surface):			Uniform/Loamy sand/Firm		
% Cover leaf litter:			15		
% Cover bare ground:			60		
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	V <10	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia oswaldii		Acacia burkittii		Maireana sedifolia	
Acacia aneura		Hakea preissii		Senna artemisioides subsp. filifolia	
				Ptilotus obovatus	
ALL SPECIES					
Acacia oswaldii					
Acacia aneura					
Acacia burkittii					
Hakea preissii					
Maireana sedifolia					
Senna artemisioides subsp. filifolia					
Ptilotus obovatus					
Acacia ligulata					
Hakea recurva subsp. recurva					
Maireana pyramidata					
Atriplex bunburyana					
Marsdenia australis					
Sida calyxymenia					
Maireana tomentosa					
Aristida contorta					
Eragrostis eriopoda					
Austrostipa eremophila					
Enteropogon ramosus					
Solanum lasiophyllum					
Maireana glomerifolia					
Eremophila exilifolia					
Portulaca oleracea					
Sclerolaena cuneata					
Sclerolaena patentispis					
Outside					



Project Name: Mt Celia					
Date:	5/06/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q20		
Quadrat size:	20x20				
Vegetation group:	Mulga shrubland on rocky ironstone hills				
WP:	135				
Photo number:			81		
Landform:			Hillock/Mound		
Land surface/disturbance:			No effective disturbance		
Coarse fragments on the surface (abundance/size/shape):			Very: abundant/Cobbly; or cobbles/Subangular		
Rock outcrop (abundance/runoff):			Very slightly rocky/Slow		
Soil (profile/field texture/soil surface):			Uniform/Sandy clay loam/Firm		
% Cover leaf litter:			40		
% Cover bare ground:			60		
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.25-0.5m
Crown cover %:	V <10	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia mulganeura		Dodonaea lobulata		Ptilotus obovatus	
		Scaevola spinescens			
		Acacia tetragonophylla			
ALL SPECIES					
Acacia mulganeura					
Dodonaea lobulata					
Scaevola spinescens					
Acacia tetragonophylla					
Ptilotus obovatus					
Acacia ayersiana					
Senna artemisioides subsp. artemisioides					
Rhagodia drummondii					
Senna artemisioides subsp. filifolia					
Acacia ligulata					
Acacia caesaneura					
Maireana tomentosa					
Enneapogon caeruleus					
Marsdenia australis					
Austrostipa eremophila					
Enchylaena tomentosa var. tomentosa					
Outside					
Acacia burkittii					



Project Name: Mt Celia					
Date:	5/06/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q21		
Quadrat size:	20x20				
Vegetation group:	Mulga shrubland (sandy substrates)				
WP:	138				
Photo number:			92		
Landform:			Flat/Plain		
Land surface/disturbance:			No effective disturbance		
Coarse fragments on the surface (abundance/size/shape):			No coarse fragments		
Rock outcrop (abundance/runoff):			No bedrock exposed/Slow		
Soil (profile/field texture/soil surface):			Uniform/Loamy sand/Loose		
% Cover leaf litter:			70		
% Cover bare ground:			60		
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	S 10-30	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia aneura		Acacia ayersiana		Ptilotus obovatus	
Acacia incurvaneura		Acacia burkittii			
		Senna artemisioides subsp. filifolia			
ALL SPECIES					
Acacia aneura					
Acacia incurvaneura					
Acacia ayersiana					
Acacia burkittii					
Senna artemisioides subsp. filifolia					
Ptilotus obovatus					
Acacia ligulata					
Scaevola spinescens					
Rhagodia drummondii					
Amyema sp. Dead					
Solanum lasiophyllum					
Eragrostis eriopoda					
Sida calyxhymenia					
Enchylaena tomentosa var. tomentosa					
Maireana georgei					
Maireana triptera					
Marsdenia australis					
Outside					



Project Name: Mt Celia					
Date:	5/06/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q22		
Quadrat size:	20x20				
Vegetation group:	Mulga over chenopod shrubland				
WP:	145				
Photo number:			93		
Landform:			Flat/Plain		
Land surface/disturbance:			No effective disturbance		
Coarse fragments on the surface (abundance/size/shape):			No coarse fragments		
Rock outcrop (abundance/runoff):			No bedrock exposed/Slow		
Soil (profile/field texture/soil surface):			Uniform/Loamy sand/Loose		
% Cover leaf litter:			10		
% Cover bare ground:			70		
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	V <10	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia ayersiana		Acacia caesaneura		Senna artemisioides subsp. filifolia	
Acacia aneura				Maireana pyramidata	
				Ptilotus obovatus	
ALL SPECIES					
Acacia ayersiana					
Acacia aneura					
Acacia caesaneura					
Senna artemisioides subsp. filifolia					
Maireana pyramidata					
Ptilotus obovatus					
Acacia incurvaneura					
Hakea lorea subsp. lorea					
Acacia pteraneura					
Maireana sedifolia					
Maireana triptera					
Eragrostis eriopoda					
Enneapogon caeruleus					
Atriplex bunburyana					
Solanum lasiophyllum					
Aristida contorta					
Enteropogon ramosus					
Austrostipa eremophila					
Dodonaea lobulata					
Acacia tetragonophylla					
Outside					
Acacia ligulata					



Project Name: Mt Celia					
Date:	5/06/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q23		
Quadrat size:	20x20				
Vegetation group:	Open Mulga shrubland (sandy substrate)				
WP:	153				
Photo number:			95		
Landform:			flat/pl		
Land surface/disturbance:			No effective disturbance		
Coarse fragments on the surface (abundance/size/shape):			No coarse fragments		
Rock outcrop (abundance/runoff):			No bedrock exposed/Slow		
Soil (profile/field texture/soil surface):			Uniform/Clayey sand/Loose		
% Cover leaf litter:			40		
% Cover bare ground:			70		
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.25-0.5m
Crown cover %:	V <10	Crown cover %:	V <10	Crown cover %:	V <10
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia mulganeura		Acacia ramulosa var. ramulosa		Ptilotus obovatus	
		Senna artemisioides subsp. filifolia		Eragrostis eriopoda	
ALL SPECIES					
Acacia mulganeura					
Acacia ramulosa var. ramulosa					
Senna artemisioides subsp. filifolia					
Ptilotus obovatus					
Eragrostis eriopoda					
Acacia aneura					
Acacia incurvaneura					
Acacia pteraneura					
Acacia tetragonophylla					
Senna artemisioides subsp. artemisioides					
Eremophila exilifolia					
Psydrax suaveolens					
Brachychiton gregorii					
Solanum lasiophyllum					
Enneapogon caeruleascens					
Scaevola spinescens					
Marsdenia australis					
Aristida contorta					
Outside					
Acacia ligulata					



Project Name: Mt Celia					
Date:	5/06/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q24		
Quadrat size:	20x20				
Vegetation group:	mulga thicket -drainage				
WP:	160				
Photo number:			96-104		
Landform:			Open depression (vale)/Drainage depression		
Land surface/disturbance:			No effective disturbance		
Coarse fragments on the surface (abundance/size/shape):			No coarse fragments		
Rock outcrop (abundance/runoff):			No bedrock exposed/Slow		
Soil (profile/field texture/soil surface):			Uniform/Clay loam/Cracking		
% Cover leaf litter:			80		
% Cover bare ground:			20		
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	6-12m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	M 30-70	Crown cover %:	M 30-70	Crown cover %:	M 30-70
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia incurvaneura		Acacia burkittii		Maireana pyramidata	
Acacia ayersiana				Ptilotus obovatus	
ALL SPECIES					
Acacia incurvaneura					
Acacia ayersiana					
Acacia burkittii					
Maireana pyramidata					
Ptilotus obovatus					
Eremophila longifolia					
Hakea lorea subsp. lorea					
Acacia tetragonophylla					
Eremophila clarkei					
Eremophila exilifolia					
Brachychiton gregorii					
Acacia mulganeura					
Senna artemisioides subsp. artemisioides					
Senna artemisioides subsp. filifolia					
Rhagodia drummondii					
Marsdenia australis					
Amyema gibberula var. gibberula					
Enchylaena tomentosa var. tomentosa					
Scaevola spinescens					
Psychotria suaveolens					
Aristida contorta					
Outside					



Project Name: Mt Celia					
Date:	5/06/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q25		
Quadrat size:	20x20				
Vegetation group:	Mulga thicket- drainage				
WP:	162				
Photo number:			107		
Landform:			Open depression (vale)/Drainage depression		
Land surface/disturbance:			No effective disturbance		
Coarse fragments on the surface (abundance/size/shape):			No coarse fragments		
Rock outcrop (abundance/runoff):			No bedrock exposed/Slow		
Soil (profile/field texture/soil surface):			Uniform/Loamy sand/Loose		
% Cover leaf litter:			80		
% Cover bare ground:			40		
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	6-12m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	S 10-30	Crown cover %:	M 30-70	Crown cover %:	M 30-70
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia ayersiana		Acacia ramulosa var. ramulosa		Ptilotus obovatus	
ALL SPECIES					
Acacia ayersiana					
Acacia ramulosa var. ramulosa					
Ptilotus obovatus					
Senna artemisioides subsp. artemisioides					
Senna artemisioides subsp. filifolia					
Acacia incurvaneura					
Acacia mulganeura					
Psychodax rigidula					
Acacia aneura					
Acacia burkittii					
Eremophila latrobei subsp. latrobei					
Rhagodia drummondii					
Psychodax suaveolens					
Pimelea microcephala subsp. microcephala					
Monachather paradoxus					
Marsdenia australis					
Acacia tetragonophylla					
Outside					



Project Name: Mt Celia					
Date:	6/06/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q26		
Quadrat size:	20x20				
Vegetation group:	Mulga shrubland on rocky ironstone hills				
WP:	206				
Photo number:			122		
Landform:	Hillock/Mound				
Land surface/disturbance:	No effective disturbance				
Coarse fragments on the surface (abundance/size/shape):	Very; abundant/Coarse gravelly; large pebbles/Angular				
Rock outcrop (abundance/runoff):	Very rocky/Slow				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	40				
% Cover bare ground:	60				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	V <10	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Casuarina pauper		Acacia ramulosa var. ramulosa		Sida ectogama	
Acacia mulganeura		Scaevola spinescens		Dodonaea lobulata	
				Ptilotus obovatus	
ALL SPECIES					
Casuarina pauper					
Acacia mulganeura					
Acacia ramulosa var. ramulosa					
Scaevola spinescens					
Sida ectogama					
Dodonaea lobulata					
Ptilotus obovatus					
Eremophila oldfieldii subsp. angustifolia					
Rhagodia drummondii					
Hakea preissii					
Acacia tetragonophylla					
Senna artemisioides subsp. filifolia					
Maireana triptera					
Maireana sedifolia					
Eragrostis eriopoda					
Maireana georgei					
Maireana tomentosa					
Enchylaena tomentosa var. tomentosa					
Solanum lasiophyllum					
Aristida contorta					
Outside					
Acacia aneura					
Acacia ligulata					
Daviesia aphylla					
Eremophila longifolia					
Eremophila latrobei subsp. latrobei					
Dodonaea rigida					
Enneapogon caeruleus					



Project Name: Mt Celia			
Date:	6/06/2020	Botanist:	Eren Reid
Location:	Mt Celia	Quadrat:	Q27
Quadrat size:	20x20		
Vegetation group:	Mulga shrubland (sandy substrates)		
WP:	209		
Photo number:			123
Landform:			Flat/Plain
Land surface/disturbance:			No effective disturbance
Coarse fragments on the surface (abundance/size/shape):			No coarse fragments
Rock outcrop (abundance/runoff):			No bedrock exposed/Slow
Soil (profile/field texture/soil surface):			Uniform/Loamy sand/Firm
% Cover leaf litter:			20
% Cover bare ground:			60
Tallest stratum		Mid-stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m
Crown cover %:	S 10-30	Crown cover %:	M 30-70
Dominant taxa:		Dominant taxa:	
Acacia ayersiana		Senna artemisioides subsp. filifolia	
Acacia aneura		Acacia burkittii	
		Acacia ligulata	
		Ptilotus obovatus	
ALL SPECIES			
Acacia ayersiana			
Acacia aneura			
Senna artemisioides subsp. filifolia			
Acacia burkittii			
Acacia ligulata			
Ptilotus obovatus			
Solanum nummularium			
Solanum lasiophyllum			
Daviesia aphylla			
Maireana triptera			
Maireana georgei			
Podolepis capillaris			
Enneapogon caerulescens			
Aristida contorta			
Eragrostis eriopoda			
Scaevola spinescens			
Rhagodia drummondii			
Enchylaena tomentosa var. tomentosa			
Marsdenia australis			
Outside			
Hakea preissii			
Eremophila longifolia			
Dodonaea lobulata			
Eremophila forrestii subsp. forrestii			



Project Name: Mt Celia					
Date:	6/06/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q28		
Quadrat size:	20x20				
Vegetation group:	Mulga over Maireana sedifolia and mixed sclerophyll shrubland				
WP:	245				
Photo number:	126				
Landform:	Flat/Plain				
Land surface/disturbance:	No effective disturbance				
Coarse fragments on the surface (abundance/size/shape):	No qualifier; common/Coarse gravelly; large pebbles/Subrounded				
Rock outcrop (abundance/runoff):	No bedrock exposed/Slow				
Soil (profile/field texture/soil surface):	Uniform/Loamy sand/Firm				
% Cover leaf litter:	40				
% Cover bare ground:	70				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	V <10	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia aneura		Acacia burkittii		Maireana sedifolia	
		Acacia ligulata		Ptilotus obovatus	
				Dodonaea lobulata	
				Senna artemisioides subsp. filifolia	
				Enneapogon caeruleus	
				Solanum lasiophyllum	
				Austrostipa eremophila	
				Enchylaena tomentosa var. tomentosa	
				Eragrostis eriopoda	
				Maireana triptera	
				Solanum nummularium	
				Austrostipa scabra	
				Sclerolaena densiflora	
				Aristida contorta	
Outside					
					Casuarina pauper
					Acacia ayersiana
					Eremophila longifolia



Project Name: Mt Celia					
Date:	6/06/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q29		
Quadrat size:	20x20				
Vegetation group:	Mulga thicket (drainage)				
WP:	254				
Photo number:			127		
Landform:			Open depression (vale)/Drainage depression		
Land surface/disturbance:			No effective disturbance except grazing by hoofed animals		
Coarse fragments on the surface (abundance/size/shape):			No coarse fragments		
Rock outcrop (abundance/runoff):			No bedrock exposed/Moderately rapid		
Soil (profile/field texture/soil surface):			Uniform/Loamy sand/Firm		
% Cover leaf litter:			50		
% Cover bare ground:			40		
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	T Tree	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	V <10	Crown cover %:	M 30-70	Crown cover %:	M 30-70
Dominant taxa:		Dominant taxa:		Dominant taxa:	
	Hakea lorea subsp. lorea		Acacia burkittii		Eremophila forrestii subsp. forrestii
	Acacia ayersiana		Acacia aneura		Acacia tetragonophylla
					Enchylaena tomentosa var. tomentosa
ALL SPECIES					
Hakea lorea subsp. lorea					
Acacia ayersiana					
Acacia burkittii					
Acacia aneura					
Eremophila forrestii subsp. forrestii					
Acacia tetragonophylla					
Enchylaena tomentosa var. tomentosa					
Eremophila longifolia					
Senna artemisioides subsp. artemisioides					
Senna artemisioides subsp. filifolia					
Acacia ligulata					
Rhagodia drummondii					
Acacia murrayana					
Solanum lasiophyllum					
Enteropogon ramosus					
Enneapogon caerulescens					
Ptilotus obovatus					
Cenchrus ciliaris*					
Maireana pyramidata					
Eragrostis eriopoda					
Dysphania kalpari					
Aristida contorta					
Austrostipa eremophila					
Outside					



Project Name: Mt Celia					
Date:	6/06/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q30		
Quadrat size:	20x20				
Vegetation group:	Mulga over small rocky outcrops				
WP:	259				
Photo number:			128		
Landform:			Hillock/Mound		
Land surface/disturbance:			No effective disturbance		
Coarse fragments on the surface (abundance/size/shape):			Very; abundant/Coarse gravelly; large pebbles/Subangular tabular		
Rock outcrop (abundance/runoff):			Rockland/Rapid		
Soil (profile/field texture/soil surface):			Uniform/Sandy clay loam/Firm		
% Cover leaf litter:			20		
% Cover bare ground:			70		
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.25-0.5m
Crown cover %:	V <10	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia aneura		Philotheca brucei subsp. brucei		Ptilotus obovatus	
Acacia mulganeura		Sida ectogama			
		Eremophila latrobei subsp. latrobei			
ALL SPECIES					
Acacia aneura					
Acacia mulganeura					
Philotheca brucei subsp. brucei					
Sida ectogama					
Eremophila latrobei subsp. latrobei					
Ptilotus obovatus					
Senna artemisioides subsp. artemisioides					
Acacia tetragonophylla					
Psyrax suaveolens					
Dodonaea rigida					
Senna artemisioides subsp. filifolia					
Acacia burkittii					
Solanum lasiophyllum					
Maireana triptera					
Enneapogon caerulescens					
Psyrax rigidula					
Cheilanthes lasiophylla					
Enchylaena tomentosa var. tomentosa					
Teucrium teucriiflorum					
Maireana georgei					
Abutilon oxycarpum					
Aristida contorta					
Dysphania kalpari					
Salsola australis					
Cucumis myriocarpus*					
Outside					



Project Name: Mt Celia					
Date:	6/06/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q31		
Quadrat size:	20x20				
Vegetation group:	Open Mulga shrubland on ironstone flats				
WP:	266				
Photo number:			137		
Landform:			Flat/Plain		
Land surface/disturbance:			No effective disturbance		
Coarse fragments on the surface (abundance/size/shape):			Moderately; many/Coarse gravelly; large pebbles/Subangular		
Rock outcrop (abundance/runoff):			No bedrock exposed/Slow		
Soil (profile/field texture/soil surface):			Uniform/Sandy clay loam/Firm		
% Cover leaf litter:			10		
% Cover bare ground:			70		
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	V <10	Crown cover %:	S 10-30	Crown cover %:	V <10
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia aneura		Acacia burkittii		Scaevola spinescens	
				Senna artemisioides subsp. helmsii	
				Dodonaea lobulata	
				Acacia tetragonophylla	
				Acacia pteraneura	
				Senna artemisioides subsp. artemisioides	
				Aristida contorta	
				Senna artemisioides subsp. filifolia	
				Solanum lasiophyllum	
				Maireana triptera	
				Hakea lorea subsp. lorea	
				Ptilotus obovatus	
				Enneapogon caerulescens	
				Eremophila forrestii subsp. forrestii	
				Dodonaea rigida	
				Marsdenia australis	
				Maireana georgei	
ALL SPECIES					
Acacia aneura					
Acacia burkittii					
Scaevola spinescens					
Senna artemisioides subsp. helmsii					
Dodonaea lobulata					
Acacia tetragonophylla					
Acacia pteraneura					
Senna artemisioides subsp. artemisioides					
Aristida contorta					
Senna artemisioides subsp. filifolia					
Solanum lasiophyllum					
Maireana triptera					
Hakea lorea subsp. lorea					
Ptilotus obovatus					
Enneapogon caerulescens					
Eremophila forrestii subsp. forrestii					
Dodonaea rigida					
Marsdenia australis					
Maireana georgei					
Outside					
Acacia ligulata					



Project Name: Mt Celia					
Date:	7/06/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q32		
Quadrat size:	20x20				
Vegetation group:	Open Mulga shrubland on ironstone flats				
WP:	295				
Photo number:			138		
Landform:			Flat/Plain		
Land surface/disturbance:			No effective disturbance		
Coarse fragments on the surface (abundance/size/shape):			Very: abundant/Coarse gravelly; large pebbles/Subrounded		
Rock outcrop (abundance/runoff):			No bedrock exposed/Slow		
Soil (profile/field texture/soil surface):			Uniform/Sandy clay loam/Firm		
% Cover leaf litter:			10		
% Cover bare ground:			70		
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	0.5-1m	Height:	0.25-0.5m
Crown cover %:	V <10	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia mulganeura		Scaevola spinescens		Ptilotus obovatus	
Acacia ayersiana		Senna glutinosa subsp. chatelainiana			
		Acacia tetragonophylla			

ALL SPECIES

Acacia mulganeura
Acacia ayersiana

Scaevola spinescens

Senna glutinosa subsp. chatelainiana

Acacia tetragonophylla

Ptilotus obovatus

Sida ectogama

Acacia ligulata

Senna artemisioides subsp. artemisioides

Teucrium teucriflorum

Acacia aneura

Senna artemisioides subsp. filifolia

Eremophila forrestii subsp. forrestii

Rhagodia drummondii

Maireana triptera

Aristida contorta

Ptilotus schwartzii

Solanum lasiophyllum

Acacia craspedocarpa

Acacia pteraneura

Marsdenia australis

Enchylaena tomentosa var. tomentosa

Austrostipa elegantissima

Outside

Eremophila oldfieldii subsp. angustifolia

Eremophila longifolia

Acacia burkittii



Project Name: Mt Celia					
Date:	7/06/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q33		
Quadrat size:	20x20				
Vegetation group:	Acacia quadrimarginea shrubland over granite bedrock				
WP:	305				
Photo number:	139 and 140				
Landform:	Hillock/Mound				
Land surface/disturbance:	No effective disturbance				
Coarse fragments on the surface (abundance/size/shape):	No qualifier; common/Cobbly; or cobbles/Subangular				
Rock outcrop (abundance/runoff):	Rockland/Slow				
Soil (profile/field texture/soil surface):	Uniform/Loamy sand/Loose				
% Cover leaf litter:	10				
% Cover bare ground:	80				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.25-0.5m
Crown cover %:	I <1	Crown cover %:	V <10	Crown cover %:	V <10
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia quadrimarginea		Acacia tetragonophylla		Eremophila forrestii subsp. forrestii	
Acacia mulganeura		Acacia aneura			
ALL SPECIES					
Acacia quadrimarginea					
Acacia mulganeura					
Acacia tetragonophylla					
Acacia aneura					
Eremophila forrestii subsp. forrestii					
Acacia burkittii					
Solanum lasiophyllum					
Eragrostis eriopoda					
Eriachne helmsii					
Aristida contorta					
Enneapogon caerulescens					
Ptilotus obovatus					
Scaevola spinescens					
Dodonaea rigida					
Dodonaea lobulata					
Chrysocephalum puteale					
Austrostipa scabra					
Outside					



Project Name: Mt Celia					
Date:	7/06/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q34		
Quadrat size:	20x20				
Vegetation group:	Acacia quadrimarginea shrubland over granite bedrock				
WP:	326				
Photo number:	141				
Landform:	Hillock/Mound				
Land surface/disturbance:	No effective disturbance				
Coarse fragments on the surface (abundance/size/shape):	No qualifier; common/Coarse gravelly; large pebbles/Subangular				
Rock outcrop (abundance/runoff):	Rockland/Slow				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	10				
% Cover bare ground:	60				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	V <10	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia quadrimarginea		Acacia aneura		Eremophila forrestii subsp. forrestii	
		Acacia burkittii		Ptilotus obovatus	
ALL SPECIES					
Acacia quadrimarginea					
Acacia aneura					
Acacia burkittii					
Eremophila forrestii subsp. forrestii					
Ptilotus obovatus					
Acacia tetragonophylla					
Enneapogon caerulescens					
Solanum lasiophyllum					
Dodonaea lobulata					
Aristida contorta					
Eragrostis eriopoda					
Senna artemisioides subsp. filifolia					
Dodonaea rigida					
Eriachne helmsii					
Senna artemisioides subsp. artemisioides					
Cheilanthes lasiophylla					
Austrostipa scabra					
Chrysocephalum puteale					
Outside					



Project Name: Mt Celia					
Date:	7/06/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q35		
Quadrat size:	20x20				
Vegetation group:	Mulga over chenopod shrubland				
WP:	349				
Photo number:			142		
Landform:			Open depression (vale)/Drainage depression		
Land surface/disturbance:			No effective disturbance		
Coarse fragments on the surface (abundance/size/shape):			Very slightly: very few/Fine gravelly; small pebbles/Subrounded		
Rock outcrop (abundance/runoff):			No bedrock exposed/Moderately rapid		
Soil (profile/field texture/soil surface):			Uniform/Clay loam/Loose		
% Cover leaf litter:			20		
% Cover bare ground:			70		
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	M Tree Mallee (> 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.25-0.5m
Crown cover %:	V <10	Crown cover %:	V <10	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia aneura		Acacia mulganeura		Frankenia setosa	
		Hakea preissii		Maireana pyramidata	
		Acacia ligulata		Ptilotus obovatus	
ALL SPECIES					
Acacia aneura					
Acacia mulganeura					
Hakea preissii					
Acacia ligulata					
Frankenia setosa					
Maireana pyramidata					
Ptilotus obovatus					
Senna artemisioides subsp. filifolia					
Acacia burkittii					
Eremophila pantonii					
Scaevola spinescens					
Maireana sedifolia					
Acacia ayersiana					
Acacia pteraneura					
Sclerolaena cuneata					
Atriplex bunburyana					
Dodonaea lobulata					
Maireana glomerifolia					
Maireana georgei					
Maireana tomentosa					
Enneapogon caeruleus					
Eriachne pulchella subsp. pulchella					
Senna glutinosa subsp. chatelainiana					
Maireana triptera					
Salsola australis					
Teucrium teucriiflorum					
Maireana trichoptera					
Eucalyptus lesouefii					
Outside					



Project Name: Mt Celia					
Date:	7/06/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q36		
Quadrat size:	20x20				
Vegetation group:	Casuarina pauper and Acacia aneura over sclerophyll shrubland on rocky laterite hills				
WP:	389				
Photo number:	146				
Landform:	Crest/Hill Crest				
Land surface/disturbance:	No effective disturbance				
Coarse fragments on the surface (abundance/size/shape):	Very; abundant/Coarse gravelly; large pebbles/Subrounded				
Rock outcrop (abundance/runoff):	Rocky/Rapid				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	10				
% Cover bare ground:	70				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	0.5-1m	Height:	0.25-0.5m
Crown cover %:	V <10	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia aneura		Dodonaea lobulata		Ptilotus obovatus	
Casuarina pauper		Maireana sedifolia			
ALL SPECIES					
Acacia aneura					
Casuarina pauper					
Dodonaea lobulata					
Maireana sedifolia					
Ptilotus obovatus					
Sida ectogama					
Senna artemisioides subsp. artemisioides					
Senna artemisioides subsp. filifolia					
Rhagodia drummondii					
Acacia mulganeura					
Acacia tetragonophylla					
Scaevola spinescens					
Eremophila latrobei subsp. latrobei					
Atriplex bunburyana					
Maireana trichoptera					
Maireana georgei					
Chenopodium gaudichaudianum					
Enchylaena tomentosa var. tomentosa					
Senna sp. Meekatharra					
Aristida contorta					
Sclerolaena diacantha					
Sclerolaena densiflora					
Outside					
Acacia burkittii					
Acacia ramulosa var. ramulosa					



Project Name: Mt Celia					
Date:	7/06/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q37		
Quadrat size:	20x20				
Vegetation group:	Casuarina pauper and Acacia aneura over sclerophyll shrubland on rocky laterite hills				
WP:	404				
Photo number:	148				
Landform:	Mid slope/Hillslope				
Land surface/disturbance:	No effective disturbance				
Coarse fragments on the surface (abundance/size/shape):	Very; abundant/Stone; stones/Subrounded				
Rock outcrop (abundance/runoff):	Rocky/Rapid				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	20				
% Cover bare ground:	60				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	0.5-1m	Height:	0.25-0.5m
Crown cover %:	V <10	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Casuarina pauper		Dodonaea lobulata		Sida ectogama	
Acacia aneura		Maireana sedifolia		Ptilotus obovatus	
ALL SPECIES					
Casuarina pauper					
Acacia aneura					
Dodonaea lobulata					
Maireana sedifolia					
Sida ectogama					
Ptilotus obovatus					
Eremophila latrobei subsp. latrobei					
Acacia tetragonophylla					
Eremophila oppositifolia subsp. angustifolia					
Scaevola spinescens					
Senna artemisioides subsp. filifolia					
Senna artemisioides subsp. artemisioides					
Rhagodia drummondii					
Maireana pyramidata					
Cheilanthes lasiophylla					
Dodonaea rigida					
Atriplex bunburyana					
Outside					



Project Name: Mt Celia					
Date:	7/06/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q38		
Quadrat size:	20x20				
Vegetation group:	Casuarina pauper and Acacia aneura over sclerophyll shrubland on rocky laterite hills				
WP:	415				
Photo number:	151				
Landform:	Mid slope/Hillslope				
Land surface/disturbance:	No effective disturbance				
Coarse fragments on the surface (abundance/size/shape):	Very: abundant/Coarse gravelly; large pebbles/Subangular				
Rock outcrop (abundance/runoff):	Rockland/Rapid				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	10				
% Cover bare ground:	70				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	0.5-1m	Height:	0.25-0.5m
Crown cover %:	V <10	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Casuarina pauper		Dodonaea lobulata		Frankenia ?fecunda	
Acacia aneura		Eremophila pantonii			
		Grevillea acuaria			
ALL SPECIES					
Casuarina pauper					
Acacia aneura					
Dodonaea lobulata					
Eremophila pantonii					
Grevillea acuaria					
Frankenia ?fecunda					
Acacia mulganeura					
Senna sp. Meeekatharra					
Scaevola spinescens					
Exocarpos aphyllus					
Maireana sedifolia					
Maireana pyramidata					
Senna artemisioides subsp. artemisioides					
Acacia tetragonophylla					
Eremophila oppositifolia subsp. angustifolia					
Eremophila latrobei subsp. latrobei					
Sida ectogama					
Maireana glomerifolia					
Ptilotus obovatus					
Outside					



Project Name: Mt Celia					
Date:	8/06/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q39		
Quadrat size:	20x20				
Vegetation group:	Casuarina pauper and Acacia aneura over sclerophyll shrubland on rocky laterite hills				
WP:	437				
Photo number:		152-153			
Landform:		Hillock/Mound			
Land surface/disturbance:		No effective disturbance			
Coarse fragments on the surface (abundance/size/shape):		Very: abundant/Coarse gravelly; large pebbles/Subrounded			
Rock outcrop (abundance/runoff):		Rocky/Rapid			
Soil (profile/field texture/soil surface):		Uniform/Sandy clay loam/Firm			
% Cover leaf litter:		10			
% Cover bare ground:		70			
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	0.5-1m	Height:	0.25-0.5m
Crown cover %:	V <10	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Casuarina pauper		Eremophila pantonii		Dodonaea lobulata	
Acacia aneura		Eremophila oppositifolia subsp. angustifolia		Maireana sedifolia	
ALL SPECIES					
Casuarina pauper					
Acacia aneura					
Eremophila pantonii					
Eremophila oppositifolia subsp. angustifolia					
Dodonaea lobulata					
Maireana sedifolia					
Sida ectogama					
Acacia tetragonophylla					
Senna artemisioides subsp. artemisioides					
Eremophila latrobei subsp. latrobei					
Callitris preissii					
Grevillea acurata					
Senna artemisioides subsp. filifolia					
Scaevola spinescens					
Ptilotus obovatus					
Olearia muelleri					
Frankenia ?fecunda					
Maireana trichoptera					
Maireana glomerifolia					
Hakea preissii					
Enchylaena tomentosa var. tomentosa					
Eremophila metallicorum					
Outside					



Project Name: Mt Celia					
Date:	8/09/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q40		
Quadrat size:	20x20				
Vegetation group:	Casuarina pauper and Acacia aneura over sclerophyll shrubland on rocky laterite hills				
WP:	441				
Photo number:		154-155			
Landform:		Hillock/Mound			
Land surface/disturbance:		No effective disturbance			
Coarse fragments on the surface (abundance/size/shape):		Very; abundant/Coarse gravelly; large pebbles/Subangular			
Rock outcrop (abundance/runoff):		Rocky/Moderately rapid			
Soil (profile/field texture/soil surface):		Uniform/Sandy clay loam/Firm			
% Cover leaf litter:		10			
% Cover bare ground:		70			
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	M Tree Mallee (> 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	6-12m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	S 10-30	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Casuarina pauper		Acacia burkittii		Ptilotus obovatus	
Eucalyptus salubris		Eremophila pantonii		Maireana sedifolia	
Acacia mulganeura				Dodonaea lobulata	
ALL SPECIES					
Casuarina pauper					
Eucalyptus salubris					
Acacia mulganeura					
Acacia burkittii					
Eremophila pantonii					
Ptilotus obovatus					
Maireana sedifolia					
Dodonaea lobulata					
Eremophila oppositifolia subsp. angustifolia					
Acacia caesaneura					
Eremophila latrobei subsp. latrobei					
Sida ectogama					
Senna sp. Meekatharra					
Senna cardiosperma					
Scaevola spinescens					
Senna artemisioides subsp. filifolia					
Maireana triptera					
Maireana tomentosa					
Senna artemisioides subsp. artemisioides					
Rhagodia drummondii					
Frankenia ?fecunda					
Outside					



Project Name: Mt Celia			
Date:	8/06/2020	Botanist:	Eren Reid
Location:	Mt Celia	Quadrat:	Q41
Quadrat size:	20x20		
Vegetation group:	Casuarina pauper and Acacia aneura over sclerophyll shrubland on rocky laterite hills		
WP:	442		
Photo number:		156 and 157	
Landform:		Simple slope/Hillslope	
Land surface/disturbance:		No effective disturbance	
Coarse fragments on the surface (abundance/size/shape):		Very: abundant/Coarse gravelly; large pebbles/Subrounded	
Rock outcrop (abundance/runoff):		Rocky/Moderately rapid	
Soil (profile/field texture/soil surface):		Uniform/Sandy clay loam/Firm	
% Cover leaf litter:		20	
% Cover bare ground:		70	
Tallest stratum		Mid-stratum	
Growth form:	M Tree Mallee (> 8m)	Growth form:	S Shrub
Height:	6-12m	Height:	1-3m
Crown cover %:	V <10	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:	
Casuarina pauper		Eremophila pantonii	
Eucalyptus lesouefii		Acacia caesaneura	
		Dominant taxa:	Maireana sedifolia
			Dodonaea lobulata
			Ptilotus obovatus
ALL SPECIES			
Casuarina pauper			
Eucalyptus lesouefii			
Eremophila pantonii			
Acacia caesaneura			
Maireana sedifolia			
Dodonaea lobulata			
Ptilotus obovatus			
Acacia tetragonophylla			
Senna artemisioides subsp. artemisioides			
Senna artemisioides subsp. filifolia			
Senna sp. Meeatharra			
Senna cardiosperma			
Olearia muelleri			
Sida ectogama			
Scaevola spinescens			
Maireana triptera			
Solanum lasiophyllum			
Maireana trichoptera			
Outside			



Project Name: Mt Celia					
Date:	8/06/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q42		
Quadrat size:	20x20				
Vegetation group:	Mulga over Eremophila forrestii on large rocky granite/basalt hills				
WP:	488				
Photo number:			158		
Landform:			Upper slope/Hillslope		
Land surface/disturbance:			No effective disturbance		
Coarse fragments on the surface (abundance/size/shape):			Very; abundant/Cobbly; or cobbles/Subangular tabular		
Rock outcrop (abundance/runoff):			Very rocky/Rapid		
Soil (profile/field texture/soil surface):			Uniform/Sandy clay loam/Firm		
% Cover leaf litter:			30		
% Cover bare ground:			70		
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	0.5-1m	Height:	0.25-0.5m
Crown cover %:	S 10-30	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia aneura		Phlotoeca brucei subsp. brucei		Eremophila forrestii subsp. forrestii	
Acacia incurvaneura		Eremophila latrobei subsp. latrobei		Ptilotus obovatus	
Acacia mulganeura					
ALL SPECIES					
Acacia aneura					
Acacia incurvaneura					
Acacia mulganeura					
Phlotoeca brucei subsp. brucei					
Eremophila latrobei subsp. latrobei					
Eremophila forrestii subsp. forrestii					
Ptilotus obovatus					
Acacia craspedocarpa					
Solanum lasiophyllum					
Cheilanthes sieberi subsp. sieberi					
Eriachne pulchella subsp. pulchella					
Marsdenia australis					
Paspalidium clementii					
Enteropogon ramosus					
Dodonaea rigida					
Psydrax rigidula					
Psydrax suaveolens					
Eriachne helmsii					
Outside					



Project Name: Mt Celia					
Date:	8/06/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q43		
Quadrat size:	20x20				
Vegetation group:	Mulga over Eremophila forrestii on large rocky granite/basalt hills				
WP:	489				
Photo number:	159				
Landform:	Lower slope/Hillslope				
Land surface/disturbance:	No effective disturbance				
Coarse fragments on the surface (abundance/size/shape):	Very; abundant/Cobbly; or cobbles/Subangular				
Rock outcrop (abundance/runoff):	Very slightly rocky/Rapid				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	20				
% Cover bare ground:	60				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	1-3m	Height:	0.5-1m	Height:	0.25-0.5m
Crown cover %:	S 10-30	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia incurvaneura		Eremophila forrestii subsp. forrestii		Ptilotus obovatus	
Acacia mulganeura					
ALL SPECIES					
Acacia incurvaneura					
Acacia mulganeura					
Eremophila forrestii subsp. forrestii					
Ptilotus obovatus					
Eremophila latrobei subsp. latrobei					
Senna sp. Meekatharra					
Solanum lasiophyllum					
Ptilotus schwartzii					
Acacia aneura					
Cheilanthes sieberi subsp. sieberi					
Austrostipa eremophila					
Aristida contorta					
Paspalidium clementii					
Enteropogon ramosus					
Eriachne helmsii					
Outside					





APPENDIX 4B – Native Vegetation Solutions - Detailed Flora and Vegetation Survey (Part 2)



DETAILED FLORA AND
VEGETATION SURVEY OF THE MT
CELIA PROJECT AREA
Part 2- September 2020

Prepared for:



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EXECUTIVE SUMMARY

Legacy Iron Ore Ltd (ASX: LCY) has gold interests and is the operator of its Mt Celia Project in the Murchison Region of Western Australia. LCY provided Native Vegetation Solutions (NVS) with a survey area which encompasses the main mining areas as well as other infrastructure related to mining the Mt Celia mineral resource. The location of this survey area is approximately 169 km northeast of Kalgoorlie-Boulder, and approximately 89km south of Laverton in Western Australia.

The survey area, for the purposes of this report, encompasses an area totalling approximately 2,029 ha, which intersects Mining Tenements M39/1123, M39/1125, M39/1126, M39/1127, M39/1128 and Exploration License E39/1443. The stage 1 survey in June 2020 only covered an area of 1,696 hectares. LCY increased the survey area for the second stage of the survey to enable additional area for infrastructure layout. At this stage, the final footprint of mining related disturbances is yet to be finalised, however will be encompassed entirely within the survey area, and is expected to be approximately 400 hectares.

The survey area is located in the Eastern Murchison IBRA subregion. The vegetation of the Eastern Murchison botanical subregion is dominated by mulga woodlands and is often rich in ephemerals, hummock grasslands, saltbush shrublands and *Tecticornia* shrublands (CALM, 2002).

The EPBC Protected Matters Search Tool revealed that the survey area may contain habitat for the invasive weed species *Carrichtera annua* (Ward's Weed) and *Cenchrus ciliaris* (Buffel Grass) (DAWE, 2020). The EPBC Protected Matters report also indicated no TECs or Conservation Reserves within the requested search area.

The DBCA database searches revealed a potential for no Threatened and 10 Priority Flora species to occur within a 50km radius of the survey area (DBCA, 2020a). No known locations of these Flora occur within the survey area, while the closest location occurs approximately 5.8 km southwest of the survey area.

Results of the threatened flora database search are included in Appendix D.

The PEC/TEC search (DBCA, 2020) revealed no TECs or PECs within the survey area.

The survey area does not lie within or contain any ESA's or Conservation Reserves (DWER, 2020).

No water bodies were identified within the survey area via the CPS Map Viewer (DWER, 2020).

The survey area lies south of the 26th parallel, however receives average annual rainfall of approximately 284.8mm (BOM, 2020), 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.

Twelve vegetation groups were identified during this survey, largely following topographical features and dominant species. Mapping of the 12 vegetation groups, as well as the quadrat locations can be seen in Appendix C. Photographs of each quadrat and the relevant vegetation group can be seen in Appendix F.

One hundred and twenty-five species were recorded within the survey area with 117 species recorded within quadrats. Twenty-nine families and 58 genera were found. These are listed in Appendix E, per Quadrat as well as per vegetation group. Of the native species, Fabaceae had the highest representation, with 26 species from 3 genera, dominated by *Acacia*. Chenopodiaceae and Poaceae were the next best represented families with 20 species and 16 species respectively.

Of the 125 taxa recorded seven of these were introduced weed species. *Citrullus amarus* (Pie Melon) *Cucumis myriocarpus* (Prickly Paddy Melon) and *Cenchrus ciliaris* (Buffel Grass) were captured within the quadrat sampling, whilst *Schinus mollee* var. *areira* (Pepper Tree), *Nerium oleander* (Oleander Tree), *Yucca aloifolia* (Yucca Tree), and *Tamarix aphylla* (Athel pine) were recorded from a single location within the vicinity of the the old Mt Celia homestead.

Of the seven non-native species above, only *Tamarix aphylla* (Athel pine) is a declared pest- s22(2) in the state of Western Australia.

The most common and widespread species was *Ptilotus obovatus*, which was recorded within all 43 quadrats. Its canopy cover was 10-30%. The next most common and widespread species was *Acacia aneura*, recorded in 34 quadrats, with a canopy cover between 10-30%.

There were 30 taxa recorded from within a single site, Q15. Of these, two were non-native species.

No Threatened species were recorded during the survey.

No Priority species were identified in the survey area.

Vegetation condition was generally 'Good' to 'Very Good' (Keighery 1994). Disturbance was present within the survey area mostly attributed to historic mining activities, access tracks, exploration related activities, and also grazing.

The EPA objective for flora and vegetation is to maintain the abundance, species diversity and geographical distribution of flora and vegetation as well as protect Threatened flora consistent with the provisions of the *Biodiversity Conservation Act 2016*.

The proposed clearing of vegetation will result in the loss of some individuals from the local area; however, the impact will not be great enough to remove whole communities or populations. Most of the species and communities recorded during this survey are widespread throughout the Eastern Murchison subregion and adjoining regions, and therefore the loss of a small proportion from this area will not be significant.

This report summarises the results of the first and second stage of the detailed flora and vegetation survey, incorporating the Winter and Spring surveys of 2020.

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1 INTRODUCTION

1.1 BACKGROUND

Legacy Iron Ore Ltd (ASX: LCY) has gold interests and is the operator of its Mt Celia Project in the Murchison Region of Western Australia. LCY provided Native Vegetation Solutions (NVS) with a survey area which encompasses the main mining areas as well as other infrastructure related to mining the Mt Celia mineral resource. The location of this survey area is approximately 169 km northeast of Kalgoorlie-Boulder, and approximately 89km south of Laverton in Western Australia (Figure 1).

This report will support numerous applications including mining proposals and clearing permits submitted to relative Government Departments.

The survey area, for the purposes of this report, encompasses an area totalling approximately 2,029 ha, which intersects Mining Tenements M39/1123, M39/1125, M39/1126, M39/1127, M39/1128 and Exploration License E39/1443. The stage 1 survey in June 2020 only covered an area of 1,696 hectares. LCY increased the survey area for the second stage of the survey to enable additional area for infrastructure layout. At this stage, the final footprint of mining related disturbances is yet to be finalised, however will be encompassed entirely within the survey area, and is expected to be approximately 400 hectares.

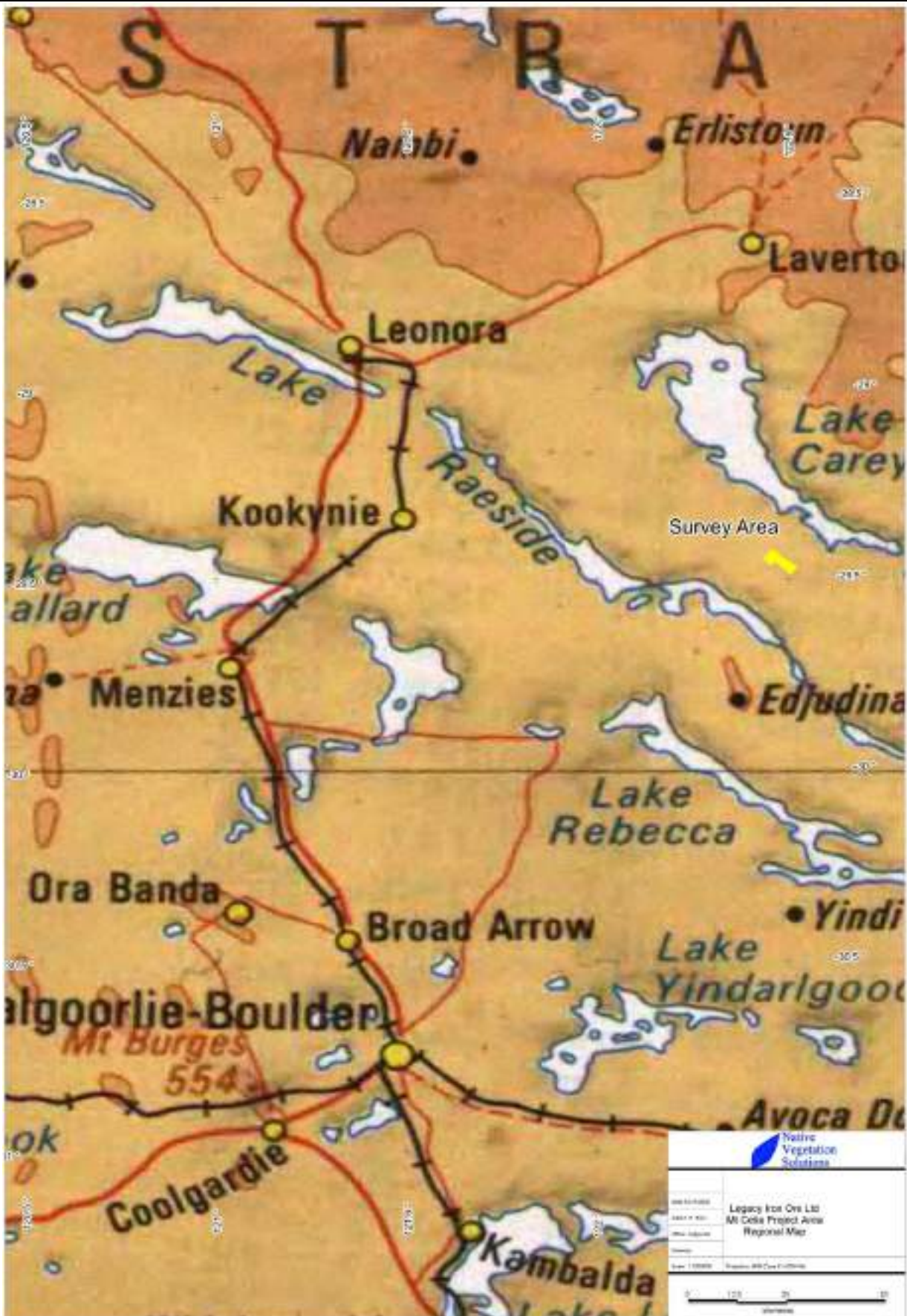


Figure 1: Regional Location of the Mt Celia Project Area

1.2 PURPOSE AND SCOPE

The objective of this report is to record and analyse the results of the flora and vegetation component of a Detailed assessment conducted in accordance with the following documents:

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

A Detailed Flora and Vegetation Survey has two components:

- 1) Reconnaissance Survey
 - a) Desktop study which includes a literature review and a search of the relevant databases; and
 - b) Reconnaissance survey of the subject area to verify the desktop survey, undertake low impact sampling, define vegetation groups present in the area, search for species of conservation significance and to determine potential sensitivity to impact.
- 2) Detailed Plot Based Survey
 - a) Detailed survey, comprising multiple visits in main flowering seasons or other seasons and replication of plots in vegetation units incorporating greater coverage than a reconnaissance survey; and
 - b) Comprehensive survey when necessary to: enhance the level of knowledge at the locality or sub-regional scale, in order to provide wider context for the local scale.

Therefore, the scope of work for the Detailed flora and vegetation survey was to:

- Conduct a desktop study that includes a literature review and search of relevant databases;
- Conduct a plot-based survey within the survey area (20m x 20m quadrats);
- Prepare an inventory of species occurring in the study area;
- Conduct PATN analysis of quadrat-based presence/absence data;
- Quantify survey intensity via Species Accumulation Curve;
- Describe the vegetation associations in the survey area;
- Identify any vegetation communities or flora species of particular 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, particularly flora of conservation significance, within the study area.

2 EXISTING ENVIRONMENT

2.1 CLIMATE

Typically, the climate of the general survey area is characterised as being arid to semi-arid Mediterranean with mainly winter rainfall as well as summer thunderstorms. The area receives approximately 250-300mm of rainfall per year (Beard, 1990; CALM, 2002). The nearest official meteorological weather station with the most complete and up to date information is Laverton Aero (station number 012305), which is located approximately 92 km north of the survey area.

2.1.1 Temperature

Mean annual minimum temperature at Laverton Aero is 14.1°C and mean annual maximum temperature is 27.2°C (BOM, 2020). The coldest temperatures occur in July (mean minimum temperature 5.9°C), the hottest is January (mean maximum temperature 35.6°C) and diurnal temperature variations are relatively consistent throughout the year (Figure 2).

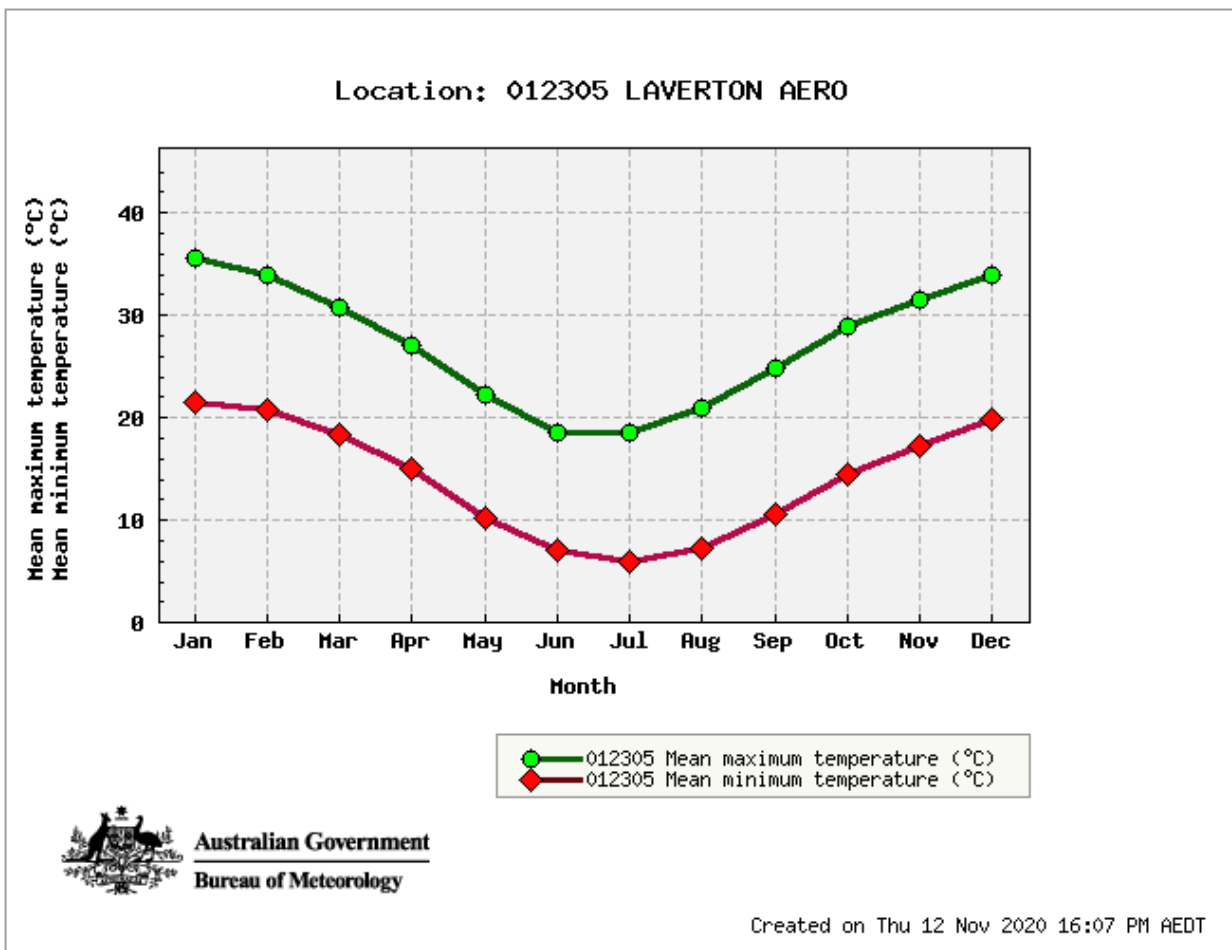


Figure 2: Mean temperature ranges for Laverton Aero Meteorological Station (BOM, 2020)

2.1.2 Rainfall

The annual average rainfall at Laverton Aero is 284.8mm over an average of 35 rain days (BOM, 2020). Average rainfall varies across the months, with slightly larger rainfall events falling between December to March (Figure 3), and the least rainfall received in September. Rainfall for 2020 was below average for all months prior to the survey with the exception of January.

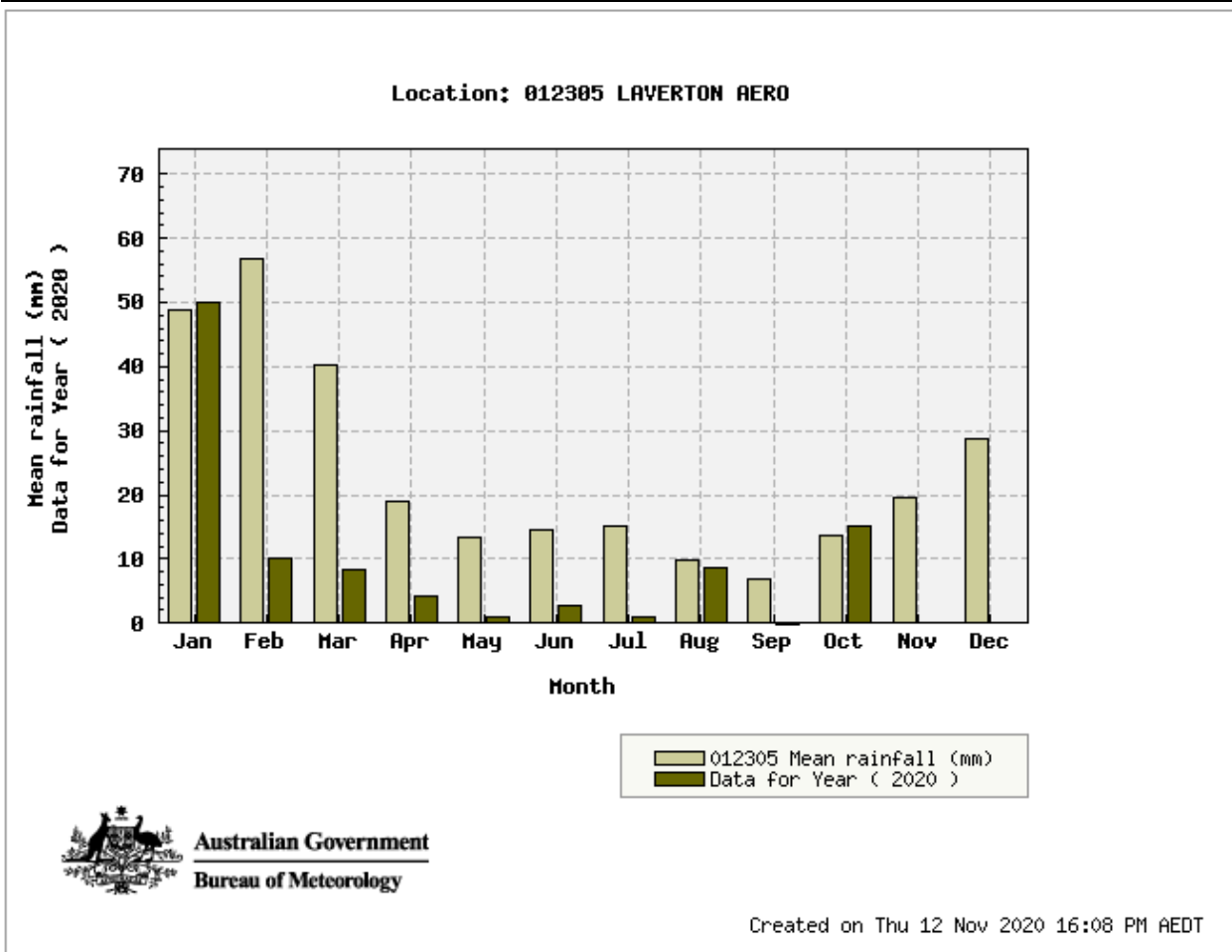


Figure 3: Rainfall data for the Laverton Aero Meteorological Station (BOM, 2020)

Looking at the Edjudina Meteorological Station (012027), which lies only 40km to the south of the survey area, rainfall recorded above average in January and March 2020 prior to the survey, with other months receiving below average (Figure 4).

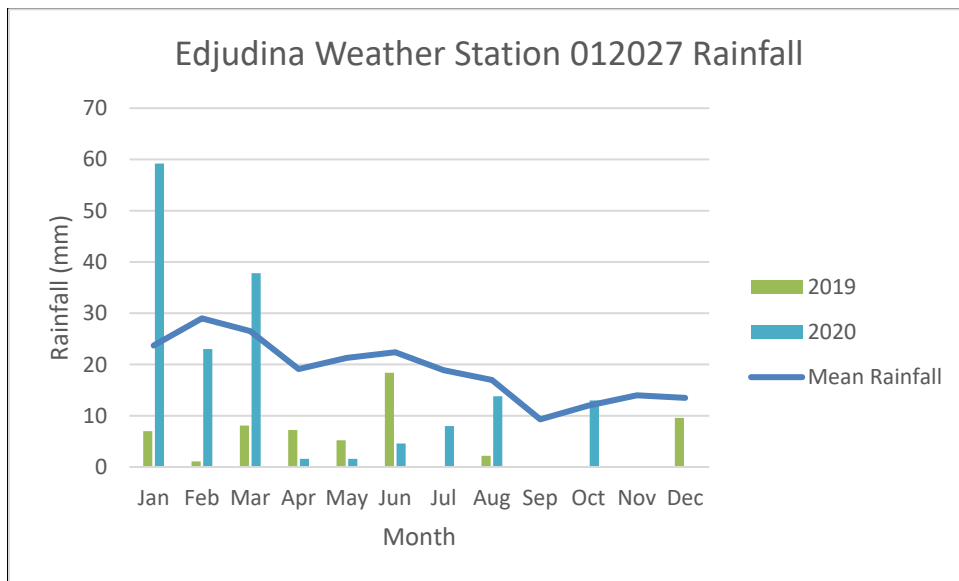


Figure 4: Rainfall data for the Edjudina Meteorological Station (BOM, 2020)

2.2 INTERIM BIOGEOGRAPHIC REGIONALISATION OF AUSTRALIA (IBRA) REGION

The IBRA recognises 89 bioregions within Australia and 419 subregions (DAWE, 2020). The project is located in the Eastern Murchison IBRA subregion (MUR01) which totals over 7.8 million hectares (CALM, 2002). The Eastern Murchison subregion is characterised by its internal drainage, and extensive areas of elevated red desert sandplains with minimal dune development. Salt lake systems are normally associated with the occluded Paleodrainage system.

2.3 LANDFORMS AND SOILS

The Eastern Murchison comprises the northern parts of the craton's 'Southern Cross' and 'Eastern Goldfields' Terrains, and is characterised by internal drainage and extensive areas of elevated red desert sandplains with minimal dune development. 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 (CALM, 2002).

2.4 BOTANICAL SUBREGION AND EXISTING VEGETATION

The vegetation of the Eastern Murchison botanical subregion is dominated by mulga woodlands and is often rich in ephemerals, hummock grasslands, saltbush shrublands and *Tecticornia* shrublands (CALM, 2002).

3 METHODS

3.1 PERSONNEL AND REPORTING

The following personnel were involved in part 1 of the detailed flora and vegetation survey (June 2020):

- Mr Eren Reid (BSc- Biological Science), Principal Botanist, Native Vegetation Solutions (NVS), undertook field work of part 1 of the detailed survey in June 2020, vegetation mapping, data collation, identification of flora during field work and preparation and review of the report; and
- Mr Frank Obbens (BSc) Consultant Botanist, Bushtech Consultancy, undertook the identification of unknown flora samples collected by NVS in the field.

The following personnel were involved in part 2 of the detailed flora and vegetation survey (September 2020):

- Mr Eren Reid (BSc- Biological Science), Principal Botanist, Native Vegetation Solutions (NVS), undertook field work of part 2 of the detailed survey in September 2020, vegetation mapping, data collation, identification of flora during field work and preparation and review of the report; and
- Mr Frank Obbens (BSc) Consultant Botanist, Bushtech Consultancy, undertook the identification of unknown flora samples collected by NVS in the field.

3.2 PRELIMINARY DESKTOP STUDY

A preliminary assessment of the survey area and its potential constraints was undertaken by reviewing relevant government agency managed databases (Sections 3.2.1 to 3.2.6, and Appendices A & D) and consulting with government agencies where necessary. The following sections provide a summary of desktop searches undertaken for the project.

3.2.1 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 coordinates displayed within the search results (Appendix A) with a 1km buffer (DAWE, 2020a).

(<http://www.environment.gov.au/arcgis-framework/apps/pmst/pmst-coordinate.jsf>)

3.2.2 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 90km radial area of the survey area shapefile (Reference: 07-0650FL).

The presence of Threatened and Priority Ecological Communities (TECs & PECs) was determined by examining Geographic Information System (GIS) data supplied by the DBCA upon request within a 50km buffer of the survey area shapefile (Reference: 23-0620EC).

3.2.3 Environmentally Sensitive Areas (ESAs) and Conservation Reserves

The Department of Water and Environmental Regulation (DWER) 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>).

3.2.4 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.

3.2.5 Wetlands

The potential of wetlands within the project area was determined by examining DWER's Clearing Permit System Map Viewer (DWER, 2020).

3.2.6 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.

3.3 SITE INVESTIGATION

The first stage of the field survey was conducted by Mr. Eren Reid, Botanist of Native Vegetation Solutions (NVS), from the 3rd to 8th June 2020. NVS established 43 quadrats within the survey area, recording one hundred and twenty-three vascular plant species within 12 vegetation types.

A total of 58 hours was spent on site traversing the survey area in June 2020. While a vehicle was used to reach the site, all traverses were made on foot or via Yamaha Viking.

The second stage of the field survey was conducted by Mr. Eren Reid, Botanist of Native Vegetation Solutions (NVS), from the 8th to 9th September 2020. NVS resurveyed the already established 43 quadrats within the survey area, recording one hundred and twenty-five vascular plant species within 12 vegetation types.

A total of 20 hours was spent on site traversing the survey area in September 2020. While a vehicle was used to reach the site, all traverses were made on foot or via Yamaha Viking.

Additional areas were added to the survey area in September 2020 by LCY. These areas were covered within the two days, as these areas were extensions of previously mapped vegetation groups.

The surveys were conducted in accordance with relevant EPA's Statements and Guidelines (Section 1.2).

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 IBRA region, a detailed flora and vegetation survey was deemed adequate.

3.3.1 Licenses

Flora was collected for identification under the Scientific Collection License FB62000171, held by Mr Eren Reid with expiry 08/10/2022.

3.3.2 Field Methods

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

In the field, these sites were visited and 20 x 20m quadrats established in appropriate locations, taking into account representativeness of the site to surrounding vegetation and vegetation boundaries.

Each quadrat site was marked in all corners with a 97cm galvanized fence dropper and was defined by tape measures. The location of one corner was captured on a TwoNav Aventura GPS at ± 4 m accuracy, using Universal Transverse Mercator location on GDA94 datum. Digital photographs were taken of each quadrat site.

Data collected at each of the 43 quadrats included:

- Species Present;
- Topography;
- Rock Type;
- Soil Colour and Type;
- Aspect;
- % Bare Ground and Litter;
- Disturbance Level; and
- Vegetation Condition.

A complete list of all species encountered was also recorded, detailing the average height and estimated coverage of the dominant species from the three stratum levels (Tallest, Mid and Lower).

Specimens of taxa not recognised by the Botanist 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 B.

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

Vegetation groups were mapped (section 3.4.3 below).

Opportunistic sampling of plant taxa and vegetation group mapping was also utilised in the survey area between quadrat sampling points, via wandering traverses. 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 C.

3.3.3 Post-Field Methods

Unknown specimens collected in the field were identified post field work by Eren Reid and Frank Obbens with reference to published keys and samples held in the Reference Section of the Western Australian Herbarium (WAHERB).

Species information was transferred into Microsoft Excel® worksheets in preparation for PATN analysis (Belbin, 1994), via Bray and Curtis Flexible UPGMA, as well as input into a computer program which generates a species accumulation curve (Seaby & Henderson, 2006).

3.3.4 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.

GPS tracks and waypoints recorded during field work are presented in Appendix C. Vegetation Health Condition was assessed in the field with reference to Keighery (1994).

3.3.5 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 IBSA Data package for this survey has been submitted via the DWER IBSA Submission Portal.

3.4 NOMENCLATURE AND TAXONOMY

Nomenclature follows that used by the WAHERB.

The WAHERB has updated its sequence and arrangement of collections to conform to the systematic sequence of the Angiosperm Phylogeny Group (APGIII), with the result that many Families and Genera have been moved or renamed. This report attempts to follow those changes in relation to species recorded during this survey. Definitions of Threatened Flora are also included in Section 9 below.

3.5 LIMITATIONS

Table 1 lists potential limitations that may have affected the survey. As shown, this survey may have been limited by drier than average conditions, which affected most of the State of Western Australia in 2019 and 2020.

Table 1: List of potential survey limitations

Possible Limitation	Constraint	Comment
Competency/experience of the consultant carrying out the survey	No	Experienced and competent personnel conducted the survey. Eren Reid has over 16 years' experience in botanical surveys throughout the Goldfields and over a variety of environments across Western Australia.
Scope	No	The Scope of work was adequately defined. Vascular flora species were the focus of the survey and were thoroughly sampled.
Proportion of flora identified, recorded and/or collected	No	All taxa not identified in the field were collected and pressed, and later identified by Eren Reid or Frank Obbens. See also Species Accumulation Curves in section 4.2.2.2.
Sources of information	No	Information on flora and vegetation of the region and local area was available from publicly available databases, books and reports.
Proportion of the tasks achieved	No	All tasks completed.
Timing/season	Potential	This survey was undertaken in June and September 2020. Local rainfall never exceeded monthly averages in 2020 with the exception of January and March. Timing would have been ideal earlier in April/May for the first part of the survey, however ideal conditions were observed for the second part of the survey.
Disturbance in survey area	No	Disturbance from grazing and exploration was apparent in the survey area. However, the structural dominants of the vegetation persist and, the vegetation remains in Good to Very Good condition.
Intensity of survey effort	No	The survey intensity is considered to have been sufficient for a detailed survey according to EPA (2016) guidelines. Areas most likely to contain threatened and priority species were targeted. Vegetation mapping sites were selected to provide adequate coverage of the survey area.
Resources	No	Resources, in terms of time, equipment, support and personnel were adequate to undertake and complete the detailed survey.
Remoteness and/or access problems	No	All the areas in need of survey were easily accessible from existing tracks, or by foot.
Availability of contextual information for the region	No	Contextual information regarding vegetation and flora around the Eastern Murchison subregion is readily available. Adequate information was able to be accessed from available databases.

4 RESULTS

4.1 PRELIMINARY DESKTOP ASSESSMENT

4.1.1 EPBC Protected Matters Search Tool

The EPBC Protected Matters Search Tool revealed that the survey area may contain habitat for the invasive weed species *Carrichtera annua* (Ward's Weed) and *Cenchrus ciliaris* (Buffel Grass) (DAWE, 2020).

Carrichtera annua was introduced into Australia from the eastern Mediterranean, and is now widespread throughout South Australia, the Interior, and Western Australia (Lamp & Collet, 1999). This species is not listed as a declared plant by DPIRD (2020), however according to the EPBC search tool this invasive weed species is considered a threat to the rangeland biodiversity within the Southern Australian Sheep and Cattle Grazing Land Management Zone (DAWE, 2020).

Cenchrus ciliaris is native to Africa and India, was widely planted in Western Australian pastoral regions as a pasture grass, and has become a widespread weed of roadsides, creeklines, river edges and most vegetation types from Geraldton to the Pilbara, Kimberley and adjacent desert (Hussey *etc.* 2007). In the Murchison region it often colonises roadside table drains, excluding native everlastings. It seriously alters the fire characteristics of invaded plant cover by generating highly flammable fuel that is prone to more frequent fires.

The EPBC Protected Matters report indicated no TECs or Commonwealth Reserves within the requested search area.

The results of the EPBC Protected Matters search are included in Appendix A.

4.1.2 Threatened Flora and Communities

The DBCA database searches revealed a potential for no Threatened and 10 Priority Flora species to occur within a 50km radius of the survey area (DBCA, 2020a). No known locations of these Flora occur within the survey area, while the closest location occurs approximately 5.8 km southwest of the survey area.

Results of the threatened flora database search are included in Appendix D.

The PEC/TEC search (DBCA, 2020) revealed no TECs or PECs within the survey area.

4.1.3 Environmentally Sensitive Areas and Conservation Reserves

The survey area does not lie within or contain any ESA's or Conservation Reserves (DWER, 2020).

4.1.4 Vegetation Type, Extent and Status

Three vegetation units defined by Beard (1990) were identified as part of the desktop assessment. These 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 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 (<i>Acacia aneura</i>)				
Pre-European Extent (ha)	Scale				
	By Association (WA)	By Association (WA)	By IBRA Region (Murchison)	By IBRA Sub-region (Eastern Murchison)	By Shire (Shire of Menzies)
	22,029,557*	19,892,306**	12,403,172**	10,269,896**	2,010,840**
% Pre-European Extent Remaining	100.00%*	99.75%**	99.68%**	99.66%**	99.94%**
Surrounding Land Use***	Mining, Exploration, Pastoral Lease				
Weed prevalence***	Low				

* Source: Shepherd *et al.* (2002) Appendix 2

**Source: DBCA, (2019)

*** Source: Field Assessment

4.1.5 Wetlands

No water bodies were identified within the survey area via the CPS Map Viewer (DWER, 2020).

4.1.6 Dieback

The survey area lies south of the 26th parallel, however receives average annual rainfall of approximately 284.8 mm (BOM, 2020), 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.

4.2 FIELD ASSESSMENT

4.2.1 Vegetation of the Survey Area

Beard's vegetation associations are very broad and are used over large areas in which there is also a large amount of variation at a more local level. The vegetation groups described below for the survey area fit into the broader Beard description above in section 4.1.4.

The vegetation groups described below were determined visually based on dominant species and topographical features, to form the descriptions taken at the time of the field survey

Descriptions of all 43 sites/quadrats are presented in Appendix F. For each site the physical features, vegetation description and unit, along with the species lists for the 20 x 20m plots with typical canopy cover and height, are provided.

4.2.1.1 Vegetation Groups

Twelve vegetation groups were identified during this survey, largely following topographical features and dominant species. Mapping of the 12 vegetation groups, as well as the quadrat locations can be seen in Appendix C. Photographs of each quadrat and the relevant vegetation group can be seen in Appendix F.

A. Mulga over *Maireana sedifolia* and mixed sclerophyll shrubland

Open Shrub Mallee (Muir, 1977) of *Acacia aneura*, *Acacia mulganeura*, *Casuarina pauper* and *Acacia ayersiana* over *Acacia ligulata*, *Senna artemisioides* subsp. *filifolia*, *Dodonaea lobulata*, *Acacia burkittii* and *Hakea preissii* over *Maireana sedifolia*, *Ptilotus obovatus* and occasional *Maireana pyramidata*.

Quadrats: 1, 2, 8, 19 and 28

B. Mulga shrubland (sandy substrates)

Open Shrub Mallee (Muir, 1977) of *Acacia incurvaneura*, *Acacia aneura*, *Acacia mulganeura* and occasional *Eucalyptus kingsmillii* and *Eucalyptus oleosa* subsp. *oleosa* over *Acacia ramulosa* var. *ramulosa*, *Eremophila forrestii* subsp. *forrestii*, *Senna artemisioides* subsp. *filifolia* and *Acacia burkittii* over *Ptilotus obovatus* and occasional grasses.

Quadrats: 4, 5, 13, 21, and 27

C. Open Mulga shrubland (sandy substrate)

Very Open Shrub Mallee (Muir, 1977) of *Acacia mulganeura*, *Acacia incurvaneura* and *Acacia aneura* over *Acacia ramulosa* var. *ramulosa*, *Senna artemisioides* subsp. *filifolia* and *Acacia ligulata* over *Ptilotus obovatus* and *Eragrostis eriopoda*.

Quadrats: 3, 6 and 23

D. Mulga shrubland on rocky ironstone hills

Open Shrub Mallee (Muir, 1977) of *Acacia aneura*, *Acacia incurvaneura*, *Acacia mulganeura* and *Casuarina pauper* over *Scaevola spinescens*, *Eremophila latrobei* subsp. *latrobei* and *Dodonaea lobulata* over *Ptilotus obovatus*.

Quadrats: 7, 9, 10, 12, 20 and 26

E. *Acacia aneura* and *Acacia burkittii* on greenstone hills

Open Shrub Mallee (Muir, 1977) of *Acacia aneura* and *Acacia mulganeura* over *Acacia burkittii*, *Scaevola spinescens* and *Senna artemisioides* subsp. *filifolia* over *Ptilotus obovatus* and occasional grasses.

Quadrats: 11, 14, 15 and 18

F. Mulga over small rocky outcrops

Very Open Shrub Mallee (Muir, 1977) of *Acacia aneura* and *Acacia mulganeura* over *Philothecca brucei* subsp. *brucei*, *Scaevola spinescens*, *Eremophila latrobei* subsp. *latrobei* and *Sida ectogama* over *Ptilotus obovatus* and *Enneapogon caerulescens*.

Quadrats: 16 and 30

G. Mulga over Chenopod shrubland

Very Open Shrub Mallee (Muir, 1977) of *Acacia aneura*, *Acacia ayersiana* and occasional *Eucalyptus lesouefii* over *Acacia caesaneura*, *Senna artemisioides* subsp. *filifolia*, and occasional *Acacia burkittii* over *Maireana pyramidata*, *Ptilotus obovatus*, and occasional *Frankenia setosa* and *Atriplex bunburyana*.

Quadrats: 17, 22 and 35

H. Mulga Thicket- Drainage

Tree/Shrub Mallee (Muir, 1977) of *Acacia ayersiana* and *Acacia incurvaneura* over *Acacia burkittii*, *Acacia ramulosa* var. *ramulosa* and *Acacia aneura* over *Ptilotus obovatus*, *Acacia tetragonophylla* and *Eremophila forrestii* subsp. *forrestii*.

Quadrats: 24, 25 and 29

I. Open Mulga shrubland on ironstone flats

Very Open Shrub Mallee (Muir, 1977) of *Acacia aneura*, *Acacia mulganeura* and *Acacia ayersiana* over *Acacia tetragonophylla* and *Acacia burkittii* over *Scaevola spinescens*, *Ptilotus obovatus*, *Senna artemisioides* subsp. *helmsii* and *Senna artemisioides* subsp. *artemisioides*.

Quadrats: 31 and 32

J. *Acacia quadrimarginea* shrubland over granite bedrock

Very Open Shrub Mallee (Muir, 1977) of *Acacia quadrimarginea* and *Acacia mulganeura* over *Acacia tetragonophylla*, *Acacia burkittii* and occasional *Acacia aneura* over *Eremophila forrestii* subsp. *forrestii* and *Ptilotus obovatus*.

Quadrats: 33 and 34

K. *Casuarina pauper* and *Acacia aneura* over sclerophyll shrubland on rocky laterite hills

Very Open Tree Mallee (Muir, 1977) of *Casuarina pauper*, *Acacia aneura*, *Eucalyptus salubris* and *Eucalyptus lesouefii* over *Dodonaea lobulata* and *Eremophila pantonii* over *Ptilotus obovatus* and *Maireana sedifolia*.

Quadrats: 36, 37, 38, 39, 40 and 41

L. Mulga over *Eremophila forrestii* on large rocky granite/basalt hills

Open Shrub Mallee (Muir, 1977) of *Acacia aneura*, *Acacia mulganeura* and *Acacia incurvaneura* over *Eremophila forrestii* subsp. *forrestii*, *Philothecca brucei* subsp. *brucei* over *Ptilotus obovatus*.

Quadrats: 42 and 43

Table 3: Vegetation Group Extent within Survey Area

Vegetation Group	Vegetation Group Code	Quadrats	Family	Genus	Species	Area (ha)	Percentage of Survey Area (%)
Mulga over <i>Maireana sedifolia</i> and mixed sclerophyll shrubland	A	Q1, Q2, Q8, Q19, Q28	14	25	52	305.49	15.06
Mulga shrubland (sandy substrate)	B	Q4, Q5, Q13, Q21, Q27	15	24	50	635.26	32.20
Open Mulga shrubland (sandy substrate)	C	Q3, Q6, Q23	12	19	31	37.77	1.86
Mulga shrubland on rocky ironstone hills	D	Q7, Q9, Q10, Q12, Q20, Q26	13	23	51	216.93	10.69
<i>Acacia aneura</i> and <i>Acacia burkittii</i> on rocky basalt hills	E	Q11, Q14, Q15, Q18	18	31	55	32.90	1.62
Mulga over small rocky outcrops	F	Q16, Q30	15	24	35	8.32	0.41
Mulga over Chenopod shrubland	G	Q17, Q22, Q35	14	24	45	167.24	8.24
Mulga Thicket- Drainage	H	Q24, Q25, Q29	17	28	43	201.44	9.93
Open Mulga shrubland on ironstone flats	I	Q31, Q32	12	17	32	241.39	11.90
<i>Acacia quadrimarginea</i> shrubland over granite bedrock	J	Q33, Q34	10	15	21	39.99	1.97
<i>Casuarina pauper</i> and <i>Acacia aneura</i> over sclerophyll shrubland on rocky laterite hills	K	Q36, Q37, Q38, Q39, Q40, Q41	17	24	44	110.72	5.46
Mulga over <i>Eremophila forrestii</i> on large rocky granite/basalt hills	L	Q42, Q43	11	16	23	13.23	0.65
		Total	29*	58*	125*	2028.66#	100.00%#

*Denotes total recorded in the survey area (not sum of column)

Denotes sum of column

4.2.1.2 PATN Analysis of Quadrat Data

PATN Analysis was completed on both the dominant species and all species recorded within each quadrat. The results are supplied below in Figure 5 and Figure 6.

The PATN analysis dendrogram of the dominant species in Figure 5, displays each quadrat with like symbols representing NVS mapped vegetation groups, and coloured lines depicting PATN defined vegetation groups. The dendrogram shows a good association between vegetation groups described in section 4.2.1.1, however there were some outliers (highlighted green).

These outliers are expected to occur for most vegetation groups. In most cases one or two dominant species will be present within a 20x20 quadrat, but it will not contain all the varieties of dominant species that will occur across that vegetation type, and as such some quadrats of the same vegetation group will be separated when assessed by the PATN Analysis.

Vegetation Group A was well represented via dominant species with Q1, Q2, Q19 and Q28 grouped together in the PATN Analysis. Q8 was an outlier and compared more similarly to Q10 which was also an outlier of Vegetation Group D. When all species were analysed via PATN, Q1, Q2, Q8 and Q28 were significantly grouped together.

Vegetation Group B was quite an expansive and varied vegetation group, hence only significantly represented by the grouping of Q21 and Q27 in the dominant species PATN analysis. Q4, Q5 and Q13 were considered outliers as these quadrat locations were chosen to represent small, isolated pockets containing Eucalypts and a slightly different species composition. However, these small pockets were not considered large enough to segregate into separate vegetation groups. Similarly, the variation in species composition of all species was too large to significantly segregate these Quadrats into a separate vegetation group.

Vegetation Group C was well represented by the grouping of Q6 and Q23 via the dominant species and all species PATN analysis. Q3 was an outlier, grouped more similarly with Q25. When all species were analysed via PATN, Q3, Q6 and Q23 were grouped together.

Vegetation Group D was well represented with the grouping of Q7, Q9, Q20 and Q26 via the dominant species PATN analysis. Q10 and Q12 were considered outliers with some slight variations in the dominant species. When all species were analysed via PATN, only Q9 and Q10 were grouped together, with Q7 also representing a standalone group.

Vegetation Group E was represented with the grouping of Q11 and Q15 via the dominant species PATN analysis. Q14 and Q18 was considered outliers. When all species were analysed via PATN, only Q15 was considered representative. Q11 and Q14 were grouped together, however were also grouped with other quadrats from different vegetation groups.

Vegetation Group F was well represented via dominant species, and all species when subjected to PATN analysis, with the grouping of Q16 and Q30 in both instances.

Vegetation Group G was not well represented via dominant species, as Q25 was the only segregated quadrat for the vegetation group. However, Vegetation Group G was represented well via all species via PATN analysis, with Q17 and Q22 grouped together.

Vegetation Group H was not well represented via dominant species but was represented well via all species via PATN analysis, with Q24 and Q25 grouped together.

Vegetation Group I was not well represented by either dominant species or all species PATN analysis, however Q31 was considered a separate vegetation group when dominant species were subject to PATN analysis.

Vegetation Group J was well represented by all species and dominant species via PATN analysis.

Vegetation Group K was well represented by all species and dominant species via PATN analysis, with all quadrats grouped together as a separate group.

Vegetation Group L was well represented by all species, however Q42 and Q43 were not grouped together by the dominant species via the PATN analysis, suggesting some variation in the dominant species.

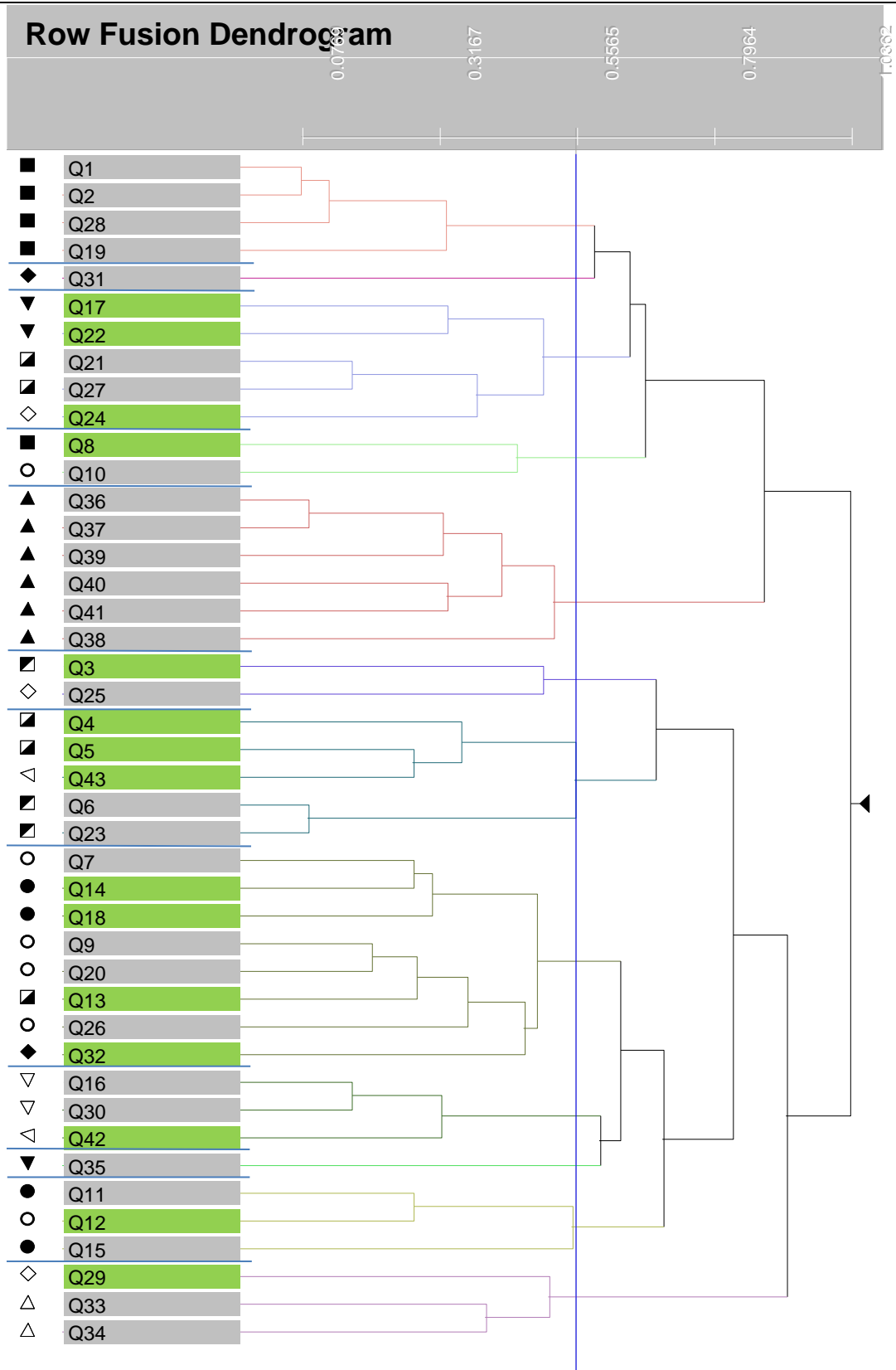


Figure 5: PATN Analysis of Dominant Species into 12 groups

The dendrogram below (Figure 6) of the analysis of all species shows a correlation to pre-grouped quadrats described in section 4.2.1.1. The dendrogram displays each quadrat with like symbols representing NVS mapped vegetation groups, and coloured lines depicting PATN defined vegetation groups. However, there were several outliers, and these are highlighted in green (Figure 5). Most of the quadrats depicted as outliers are representative of similar vegetation groups, which have been segregated by NVS based on differing plant density, topographical features or lithology. The PATN analysis (off all species present) demonstrates that some of these quadrats are very similar in species composition, and not necessarily distinct, when predetermined by topographical/litological variations.

When comparing outliers of the PATN analysis of dominant species versus all species, there were similar outliers in both. However more reliant vegetation grouping was determined via the analysis of all species within the quadrats. Therefore, the vegetation groups mapped by NVS demonstrate a greater reliance on all species within the quadrat as apposed to the dominant, suggesting some variation in dominant species between vegetation groups, and less variation in the non-dominant species.

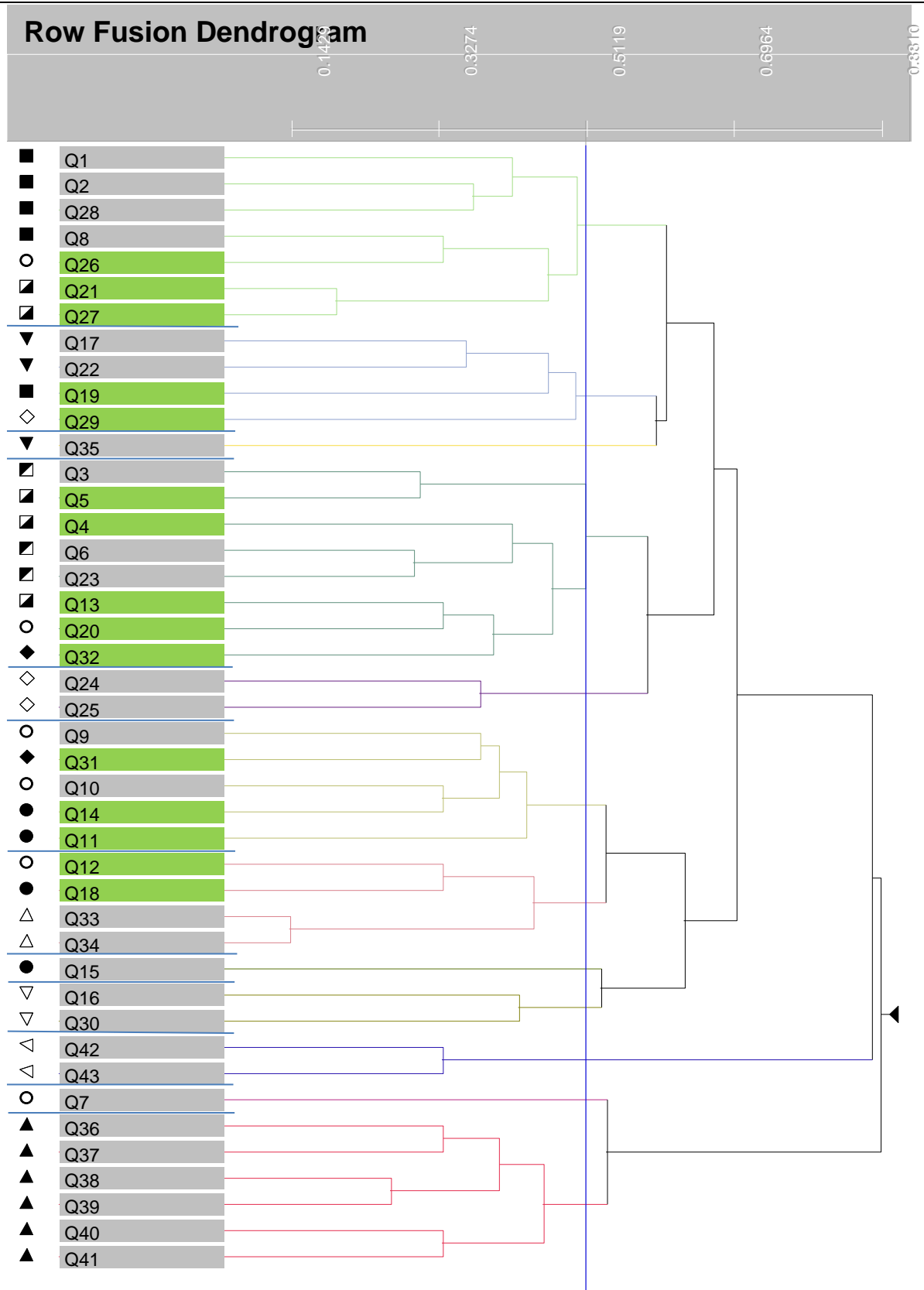


Figure 6: PATN Analysis of All Species into 12 groups

4.2.1.3 Vegetation Condition

Vegetation in the survey area has been subjected to historic exploration activities and grazing.

According to Keighery (1994), most of the sites/quadrats inspected were in Good to Very Good condition (Appendix F). There were existing vehicle tracks in some areas, due to mine exploration activities. The vegetation more than 0.5m off these tracks was mostly in a Good to Very Good condition (Keighery 1994).

As discussed below in Section 4.2.2.4, there were three non-native species recorded in the quadrats, with four additional non-native species recorded near the old Mt Celia homestead.

4.2.2 Flora of the Survey Area

4.2.2.1 General

One hundred and twenty-five species were recorded within the survey area with 117 species recorded within quadrats. Twenty-nine families and 58 genera were found. These are listed in Appendix E, per Quadrat as well as per vegetation group. Of the native species, Fabaceae had the highest representation, with 26 species from 3 genera, dominated by *Acacia*. Chenopodiaceae and Poaceae were the next best represented families with 20 species and 16 species respectively.

Of the 125 taxa recorded seven of these were introduced weed species. *Citrullus amarus* (Pie Melon) *Cucumis myriocarpus* (Prickly Paddy Melon) and *Cenchrus ciliaris* (Buffel Grass) were captured within the quadrat sampling, whilst *Schinus mollee* var. *areira* (Pepper Tree), *Nerium oleander* (Oleander Tree), *Yucca aloifolia* (Yucca Tree), and *Tamarix aphylla* (Athel pine) were recorded from a single location within the vicinity of the the old Mt Celia homestead.

Of the seven non-native species above, only *Tamarix aphylla* (Athel pine) is a declared pest-22(2) in the state of Western Australia.

The most common and widespread species was *Ptilotus obovatus*, which was recorded within all 43 quadrats. Its canopy cover was 10-30%. The next most common and widespread species was *Acacia aneura*, recorded in 34 quadrats, with a canopy cover between 10-30%.

There were 30 taxa recorded from within a single site, Q15. Of these, two were non-native species.

4.2.2.2 Species Accumulation Curve

A Species Accumulation Curve was generated using the computer programme **Species Diversity and Richness Version 4.1.2** (Seaby & Henderson, 2006). This curve was then fitted to a logarithmic curve in **Excel**[®], which is plotted in Figure 7 below. According to the Species Accumulation Curve below, the R² value (0.99) shows an acceptable fit for a logarithmic curve of the total accumulated species per number of quadrats established (Figure 7).

Sufficient sampling was inferred via the effort of intensity (number of quadrats established) versus the return of species collected (total accumulated species). The logarithmic trend line and R² values were generated in **Excel**[®]. From this fitted logarithmic curve formula, the asymptote was calculated where the gain of new species was less than 1% for every new quadrat established. Based on this reasoning, the asymptote was reached at 28 quadrats, at which the extrapolated total accumulated number of species was 103. Therefore the 117 species collected within the 43 quadrats represents 113.40% of the projected asymptote.

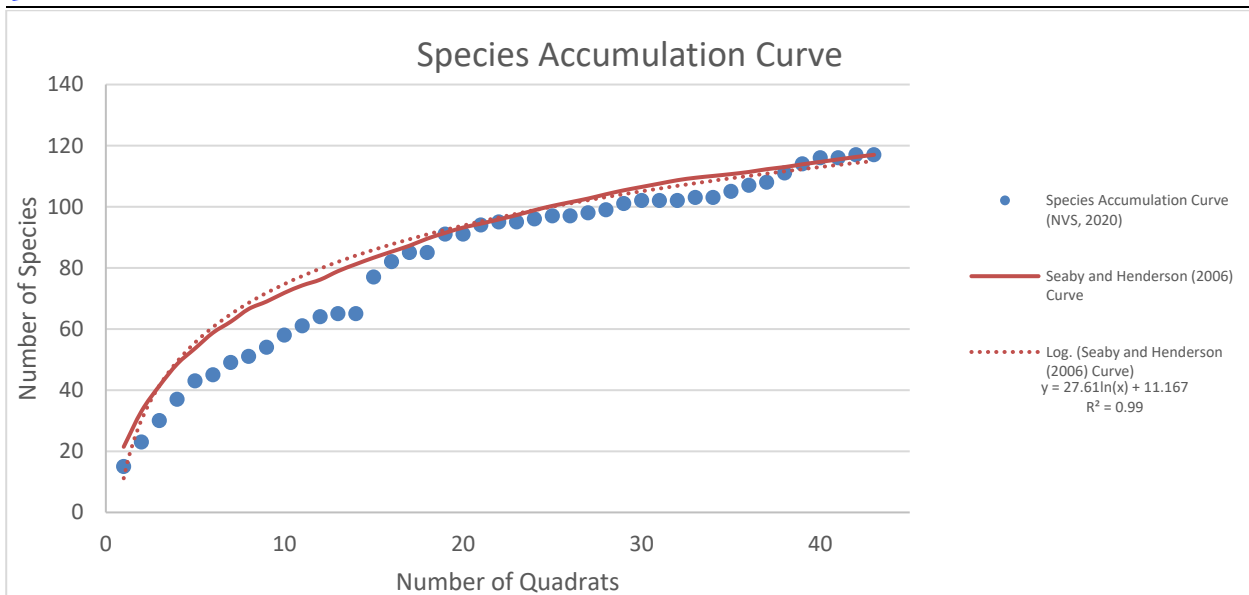


Figure 7: Species Accumulation Curve for the 43 sampled quadrats

4.2.2.3 Conservation significant species

No Threatened species were recorded during the survey.

No Priority species were identified in the survey area.

4.2.2.4 Introduced species

Seven introduced species recorded in the survey area are listed below;

- *Citrullus amarus* (Pie Melon)- Q15
- *Cucumis myriocarpus* (Prickly Paddy Melon)- Q15 and Q30
- *Cenchrus ciliaris* (Buffel Grass)- Q29
- *Schinus mollee* var. *areira* (Pepper Tree)- old Mt Celia Homestead
- *Nerium oleander* (Oleander Tree)- old Mt Celia Homestead
- *Yucca aloifolia* (Yucca Tree)- old Mt Celia Homestead
- *Tamarix aphylla* (Athel pine)- old Mt Celia Homestead

Of the seven non-native species above, only *Tamarix aphylla* (Athel pine) is a declared pest-s22(2) in the state of Western Australia.

5 DISCUSSION

The survey area is located within the Eastern Murchison subregion (CALM, 2002). This survey established that mostly, the flora within the project area is not unique, and is in fact common throughout the Eastern Murchison subregion and adjoining regions.

One hundred and twenty-five species were recorded within the survey area with 117 species recorded within quadrats. Twenty-nine families and 58 genera were found. These are listed in Appendix E, per Quadrat as well as per vegetation group. Of the native species, Fabaceae had the highest representation, with 26 species from 3 genera, dominated by *Acacia*. Chenopodiaceae and Poaceae were the next best represented families with 20 species and 16 species respectively.

Of the 125 taxa recorded seven of these were introduced weed species. *Citrullus amarus* (Pie Melon) *Cucumis myriocarpus* (Prickly Paddy Melon) and *Cenchrus ciliaris* (Buffel Grass) were captured within the quadrat sampling, whilst *Schinus mollee* var. *areira* (Pepper Tree), *Nerium oleander* (Oleander Tree), *Yucca aloifolia* (Yucca Tree), and *Tamarix aphylla* (Athel pine) were recorded from a single location within the vicinity of the the old Mt Celia homestead.

Of the seven non-native species above, only *Tamarix aphylla* (Athel pine) is a declared pest-s22(2) in the state of Western Australia.

The most common and widespread species was *Ptilotus obovatus*, which was recorded within all 43 quadrats. Its canopy cover was 10-30%. The next most common and widespread species was *Acacia aneura*, recorded in 34 quadrats, with a canopy cover between 10-30%.

There were 30 taxa recorded from within a single site, Q15. Of these, two were non-native species.

No Threatened Flora were recorded in the survey area.

No TECs or PEC's were recorded within the survey area.

No Priority Flora were identified in the survey area.

Vegetation condition was generally 'Good' to 'Very Good' (Keighery 1994). Disturbance was present within the survey area mostly attributed to historic mining activities, access tracks, exploration related activities, and also grazing.

It is therefore not expected that the disturbance within the survey area will significantly negatively impact on the vegetation in the area in terms of fragmentation and loss of vegetation associations or species that may be unique. This is partially due to the overall size of the survey area as well as the similar abundant vegetation and habitat outside of the survey area.

6 IMPACT ASSESSMENT

6.1 THREATENING PROCESSES

The major processes likely to impact the Flora within the Survey area, if clearing were to proceed include:

- Vegetation clearing and therefore a reduction in biodiversity;
- Vehicle impacts on uncleared vegetation could increase if existing tracks are not adhered to;
- An increase in the area of disturbed land could result in an increase in non-native species;
- Dust generated during clearing of native vegetation and associated activities may settle on adjacent native vegetation, causing possible stress and perhaps death, especially during drier months; and
- Accidental fire arising from clearing and associated activities, may affect vegetation in surrounding areas.

7 CONCLUSIONS AND RECOMMENDATIONS

The survey established that the condition of the vegetation in the survey area is overall 'Good' to 'Very Good' condition. No Threatened Flora were recorded in the area. No TECs/PECs were recorded in the survey area.

No Priority Flora were recorded the survey area.

The EPA objective for flora and vegetation is to maintain the abundance, species diversity and geographical distribution of flora and vegetation as well as protect Threatened flora consistent with the provisions of the *Biodiversity Conservation Act 2016*.

The proposed clearing of vegetation will result in the loss of some individuals from the local area; however, the impact will not be great enough to remove whole communities or populations. Most of the species and communities recorded during this survey are widespread throughout the Eastern Murchison subregion and adjoining regions, and therefore the loss of a small proportion from this area will not be significant.

This report summarises the results of the first and second stage of a detailed flora and vegetation survey.

The following recommendations arise from the current flora survey:

- Any disturbance/clearing be minimised as much as practicable to reduce the loss of individual species;
- Weed control measures should be implemented during and post construction activities- it is recommended that any works within the vicinity of the old Mt Celia homestead be conducted in a manner where it incorporates the removal of non-native species nearby, particularly the delared pest *Tamarix aphylla*.
- Driving restrictions, ensuring that off-road driving is minimised; and
- All staff to be educated on the importance of fire prevention, and equipment provided for use in the event of fire.

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9 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
DWER	Department of Water and Environmental Regulation, Western Australia
EPA	Environmental Protection Authority, Western Australia
EP Act	<i>Environmental Protection Act 1986</i> , Western Australia
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (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 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.

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 A - EPBC and Other Government Database Search Results



EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

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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[Summary](#)

[Details](#)

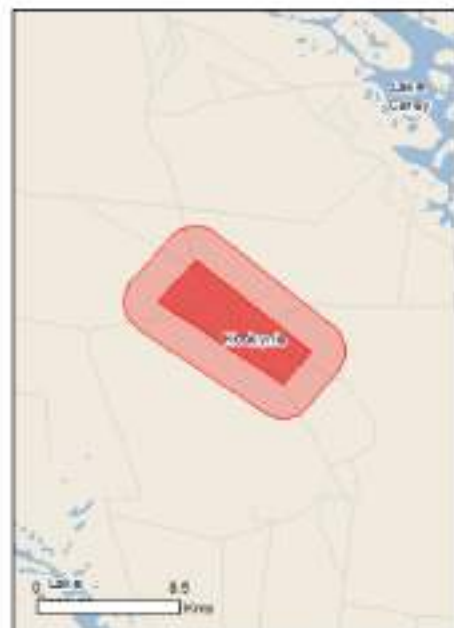
[Matters of NES](#)

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

[Extra Information](#)

[Caveat](#)

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[Buffer: 2.0Km](#)



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 may 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 [676]		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
Chrysocolaptes ocellatus		
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 Resources Audit, 2001.		
Name	Status	Type of Presence
Mammals		
Camelus dromedarius		
Dromedary, Camel [7]		Species or species

Name	Status	Type of Presence
Canis lupus familiaris Domestic Dog [82654]		habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Equus caballus Horse [5]		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 BIOTRIM habitat modeling) 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

-29.4441 122.4389,-29.424552 122.45829,-29.467079 122.521208,-39.482777 122.500058,-29.4441 122.4389

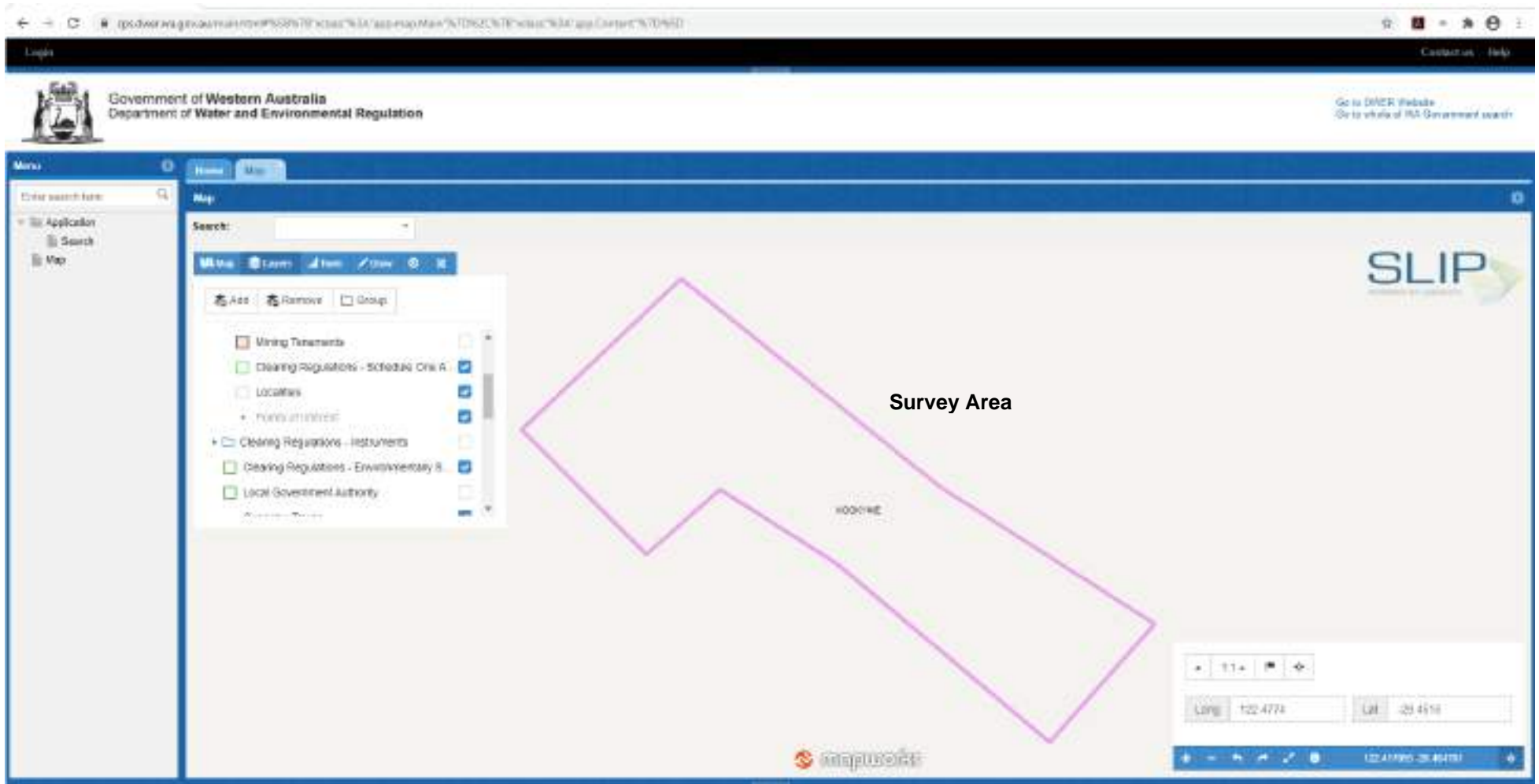
Acknowledgements

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

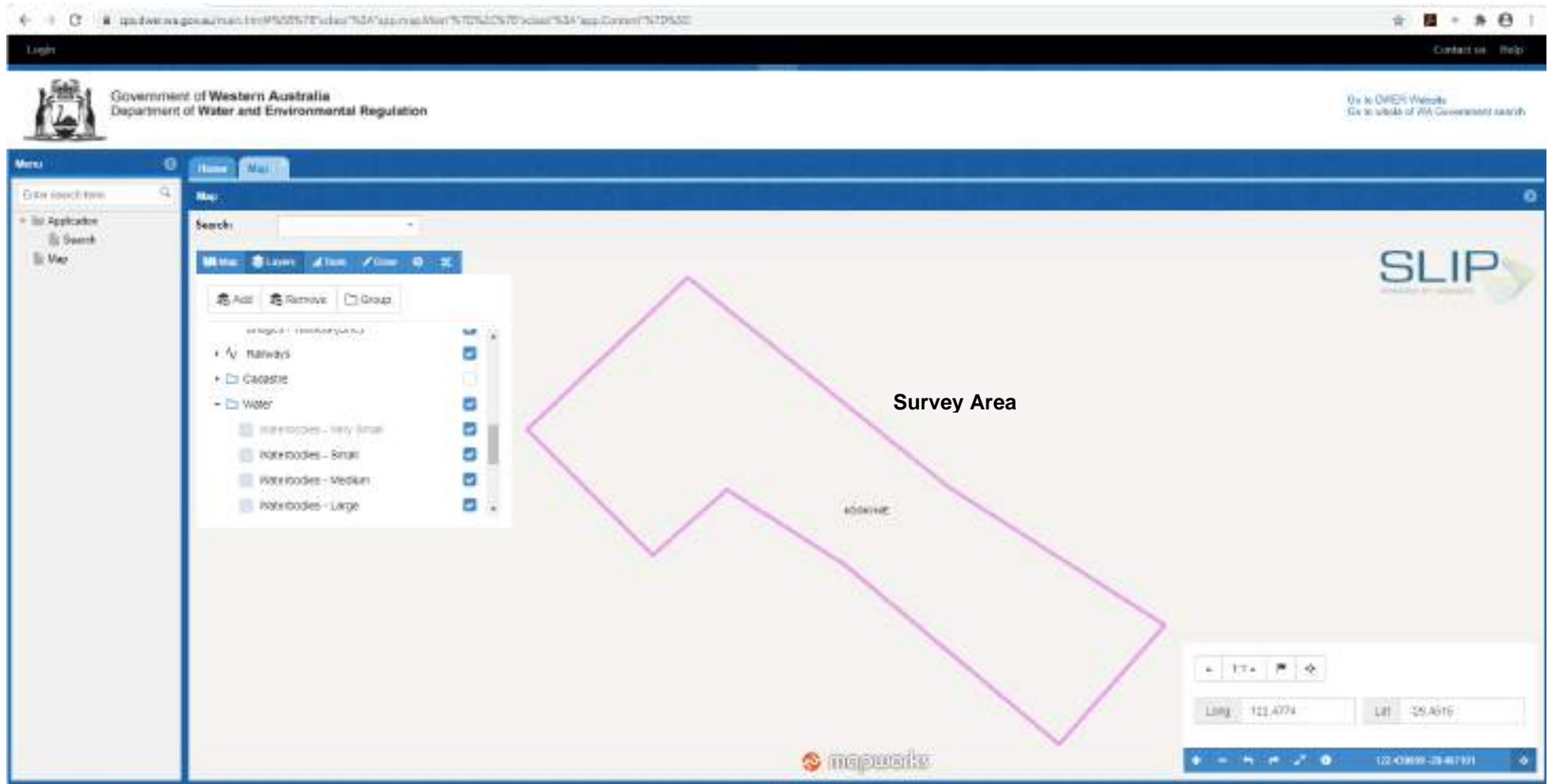
- [Office of Environment and Heritage, New South Wales](#)
- [Department of Environment and Primary Industries, Victoria](#)
- [Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [Department of Environment, Water and Natural Resources, South Australia](#)
- [Department of 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:

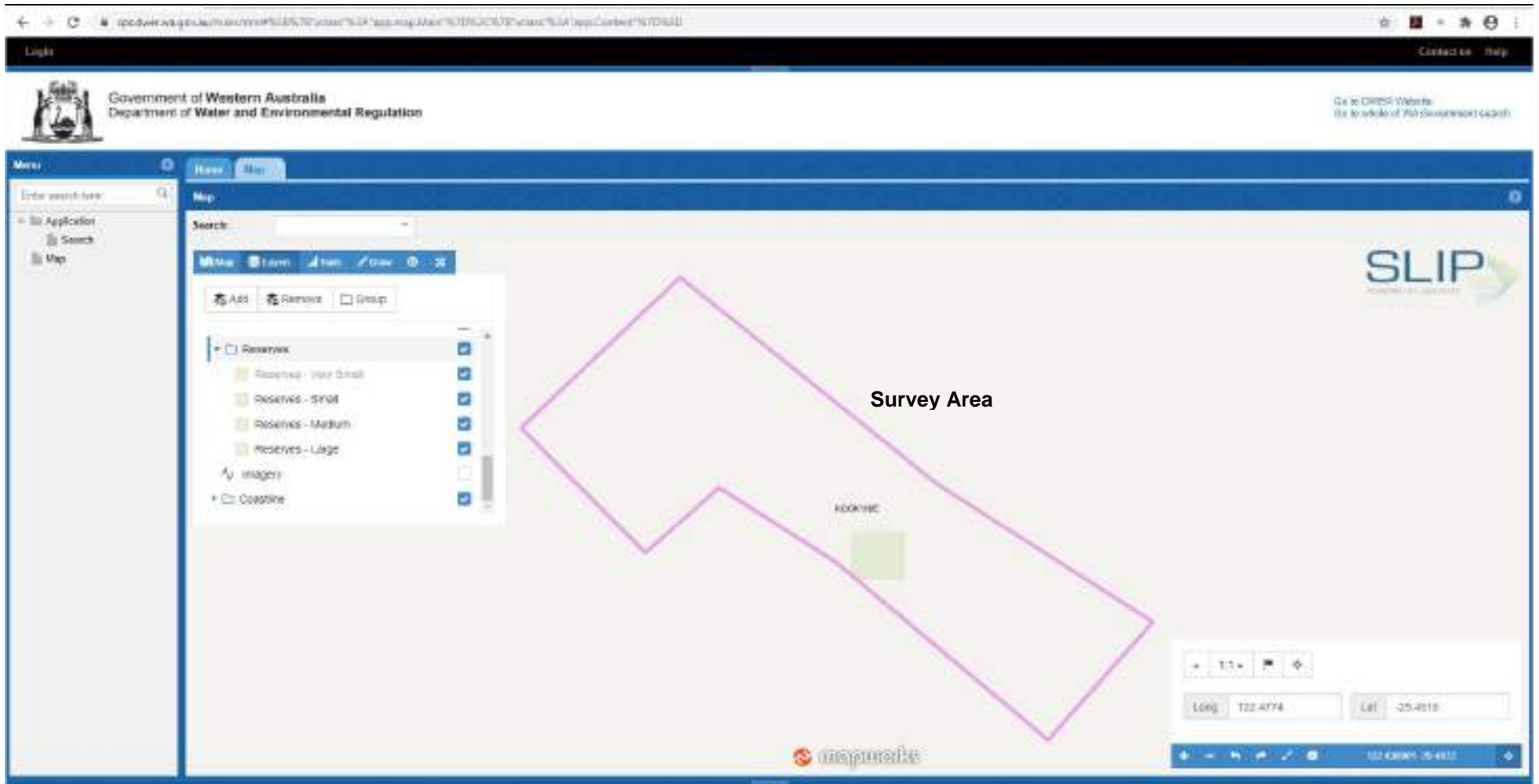
Please feel free to provide feedback via the [Contact Us](#) page.



DWER CPS Map Viewer - showing no ESA's (dark green shaded areas) within the survey area (pink polygon) (DWER, 2020)



DWER CPS Map Viewer - showing no water bodies within the survey area (pink polygon) (DWER, 2020)



DWER CPS Map Viewer - showing a small water Reserve (R11185) within the survey area (pink polygon) (DWER, 2020)

Appendix B - 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.

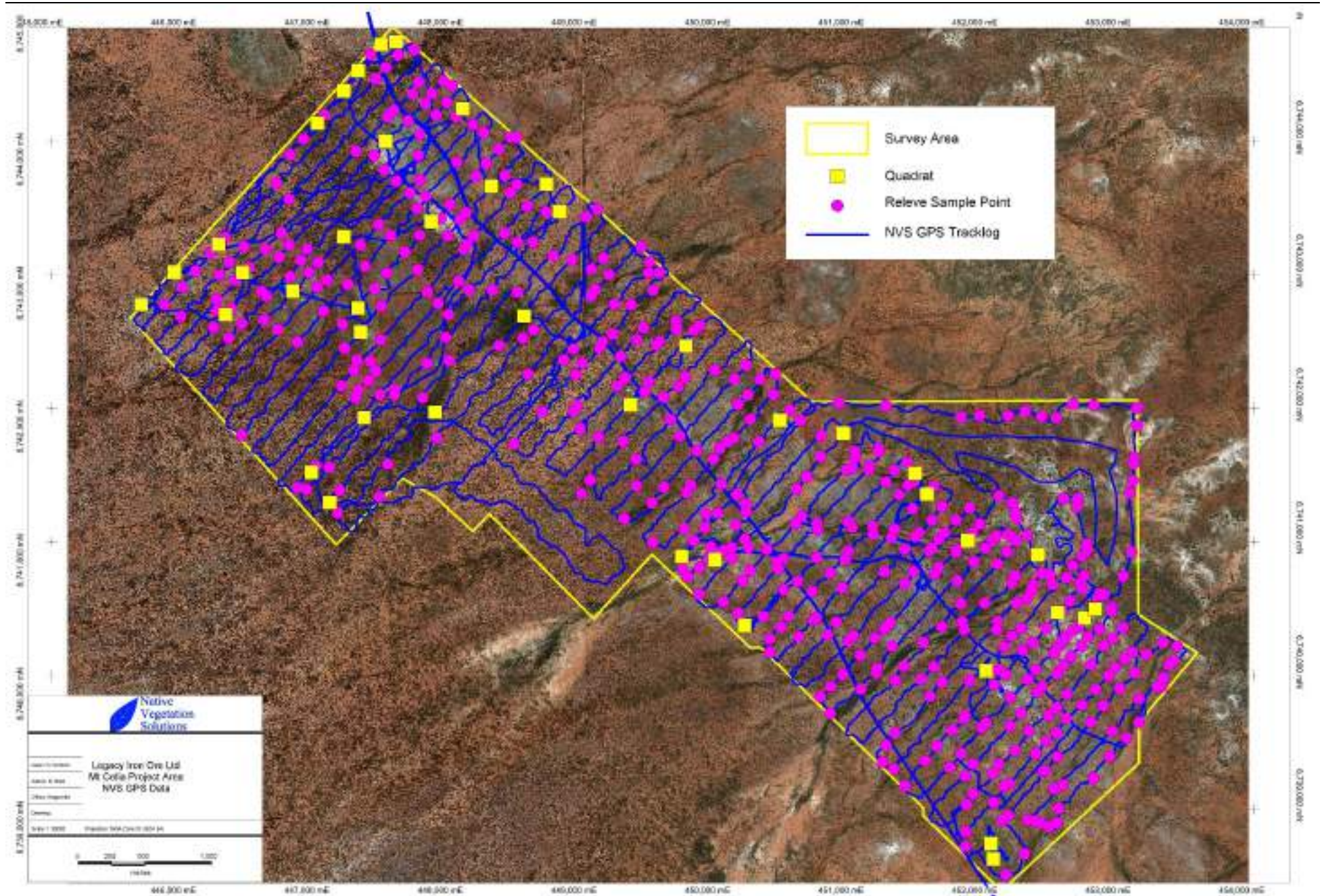
These areas are often described as 'parkland cleared' with the flora compromising weed or crop species with isolated trees or shrubs.

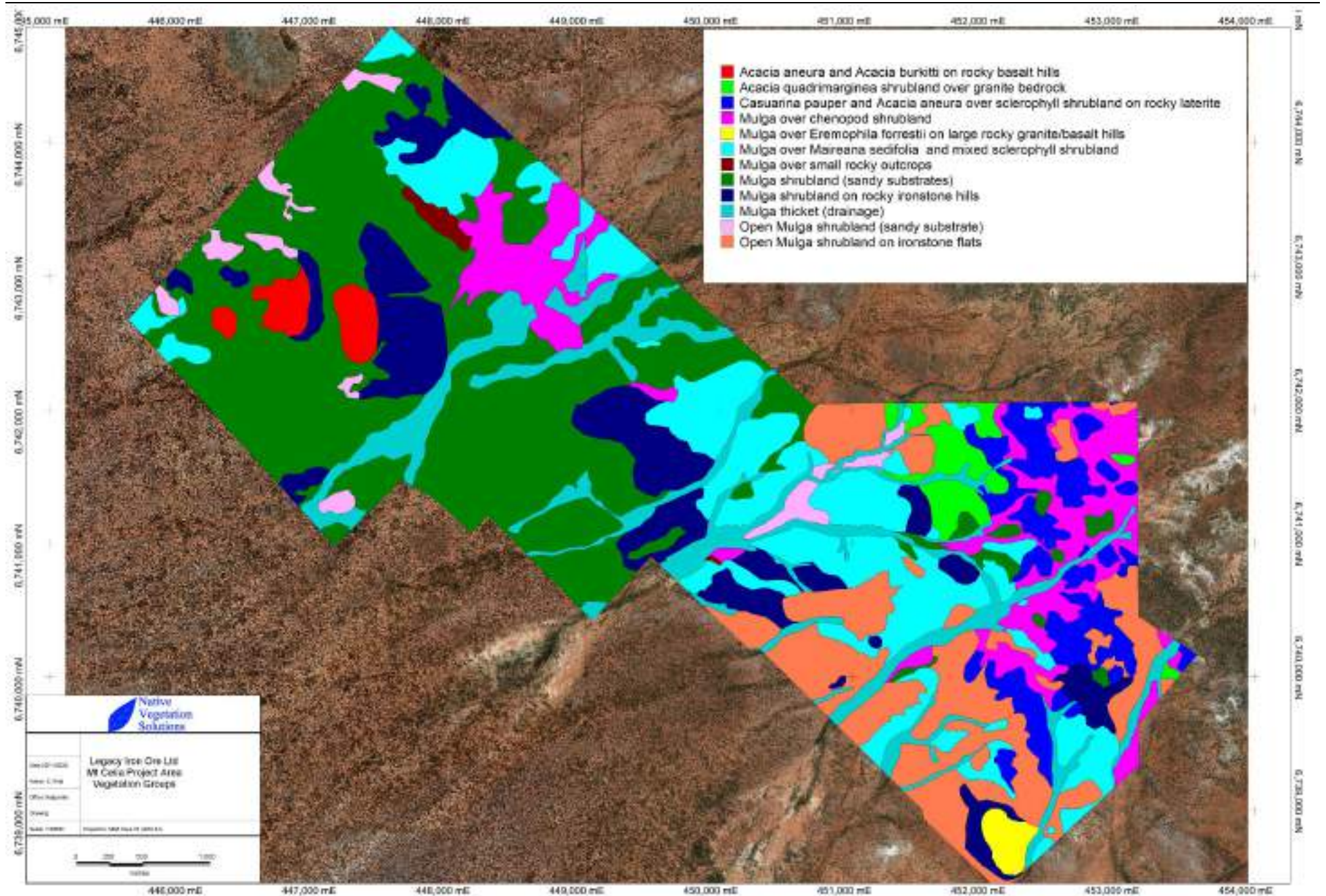
Vegetation Structure Definitions (Muir, 1977)

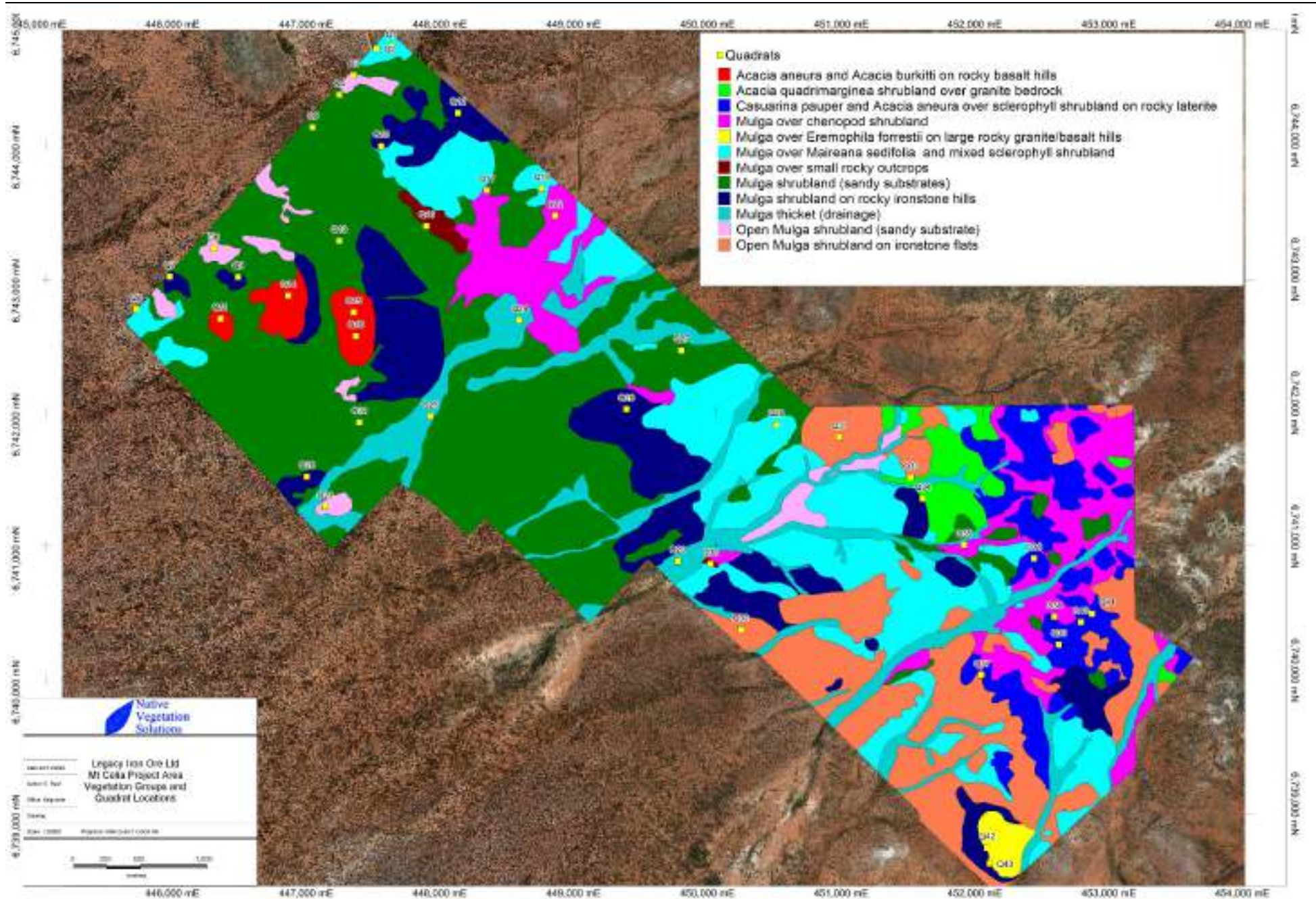
Life Form/Height Class	Canopy Cover			
	Dense 70-100% d	Mid-Dense 30-70% c	Sparse 10-30% l	Very Sparse 2-10% r
T Trees >30m	Dense Tall Forest	Tall Forest	Tall Woodland	Open Tall Woodland
M Trees 15-30m	Dense Forest	Forest	Woodland	Open Woodland
LA Trees 5-15m	Dense Low Forest A	Low Forest A	Low Woodland 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

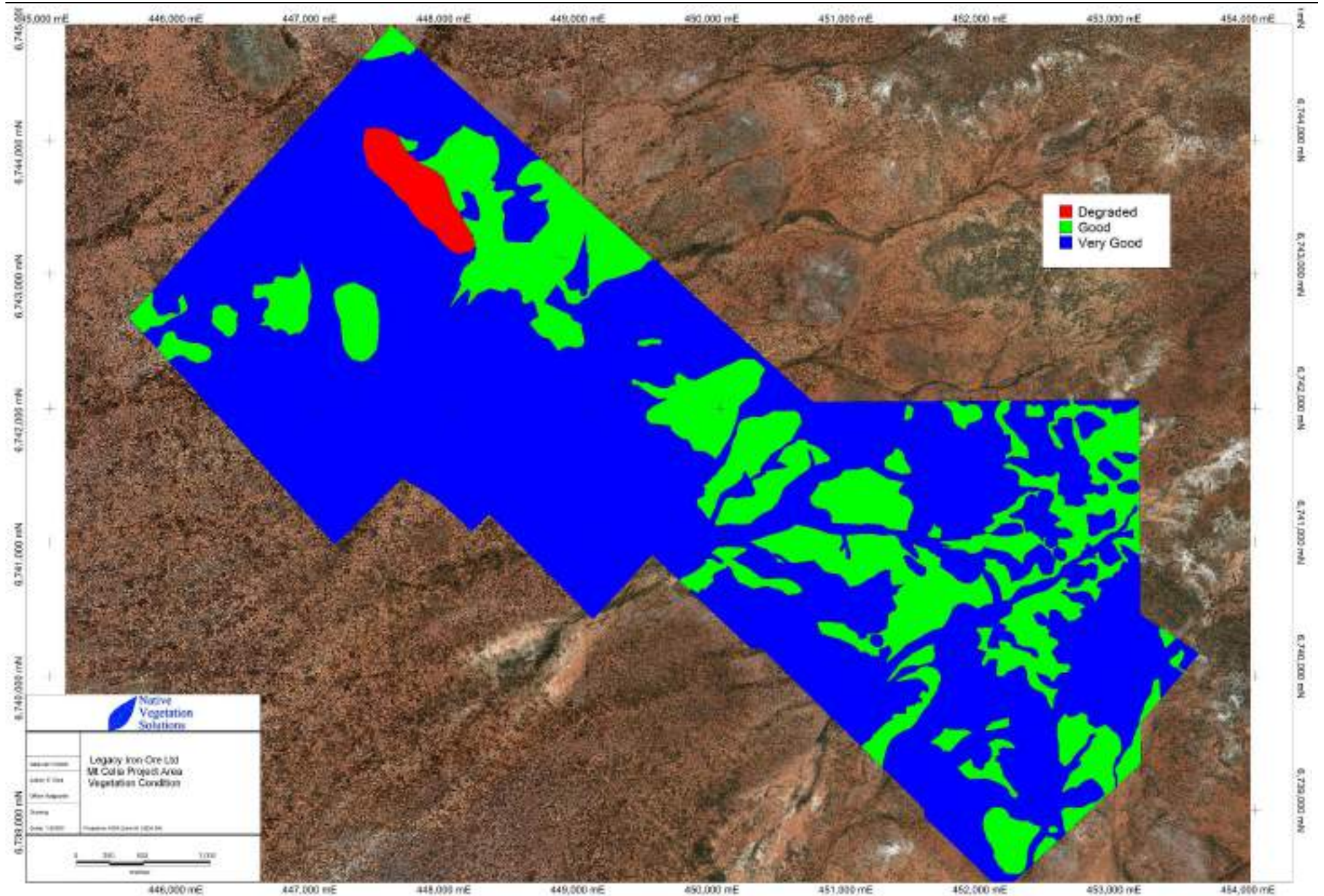
Appendix C - Mapping











Appendix D - Threatened Flora Database Search Results

Taxon	Cons_Code	Likelihood of occurring in survey area	Comment
Acacia eremophila var. Numerous-nerved variant (A.S.George 11924)	P3	Unlikely	Known records within 50km, Lack of suitable habitat
Calandrinia sp. Menzies (F. Hort et al. FH 4100)	P3	Unlikely	Possible suitable habitat, habitat searched extensively
Eremophila mirabilis	P2	Unlikely	Known records within 50km, Lack of suitable habitat
Hemigenia exilis	P4	Possible	Possible suitable habitat in the survey area, habitat searched extensively
Hybanthus floribundus subsp. chloroxanthus	P3	Possible	Suitable habitat in the survey area, habitat searched extensively
Melaleuca apostiba	P3	Unlikely	Known records within 50km, Lack of suitable habitat
Placynthium nigrum	P3	Unlikely	Known records within 50km, Lack of suitable habitat
Tecticornia mellarium	P1	Unlikely	Known records within 50km, Lack of suitable habitat
Tecticornia sp. Lake Way (P. Armstrong 05/961)	P1	Unlikely	Known records within 50km, Lack of suitable habitat
Thryptomene eremaea	P2	Unlikely	Known records within 50km, Lack of suitable habitat

Likely – suitable habitat, close (<10km) records and/or field survey completed in sub-optimal season, suggest species is likely to occur

Possible- suitable habitat, record(<50km) and/or field survey completed in sub-optimal season.

Unlikely- Lack of suitable habitat and/or no records(<50km) and /or field survey completed in optimal season, suggests species is unlikely to occur

Appendix E - Species Recorded During the June and September 2020 Survey

Species List per Vegetation Group (Quadrat data including opportunistic sampling)

Family	Genus	Taxon	a	b	c	d	e	f	g	h	i	j	k	l
Amaranthaceae	Ptilotus	Ptilotus obovatus	*	*	*	*	*	*	*	*	*	*	*	*
Amaranthaceae	Ptilotus	Ptilotus schwartzii				*					*			*
Anacardiaceae	Schinus	Schinus molle var. areira*								*				
Apocynaceae	Marsdenia	Marsdenia australis	*	*	*	*	*		*	*	*			*
Apocynaceae	Nerium	Nerium oleander*								*				
Asparagaceae	Yucca	Yucca aloifolia*								*				
Asteraceae	Chrysocephalum	Chrysocephalum puteale				*	*					*		
Asteraceae	Olearia	Olearia muelleri											*	
Asteraceae	Podolepis	Podolepis capillaris		*						*				
Casuarinaceae	Casuarina	Casuarina pauper	*			*							*	
Chenopodiaceae	Atriplex	Atriplex bunburyana	*						*				*	
Chenopodiaceae	Chenopodium	Chenopodium gaudichaudianum												*
Chenopodiaceae	Dysphania	Dysphania kalpari					*	*		*				
Chenopodiaceae	Enchylaena	Enchylaena tomentosa var. tomentosa	*	*	*	*	*	*	*	*	*		*	
Chenopodiaceae	Maireana	Maireana carnososa	*											
Chenopodiaceae	Maireana	Maireana georgei	*	*	*	*	*	*	*		*		*	
Chenopodiaceae	Maireana	Maireana glomerifolia	*						*				*	
Chenopodiaceae	Maireana	Maireana planifolia	*		*									
Chenopodiaceae	Maireana	Maireana pyramidata	*	*		*	*		*	*			*	
Chenopodiaceae	Maireana	Maireana sedifolia	*	*		*	*		*				*	
Chenopodiaceae	Maireana	Maireana tomentosa	*	*		*	*		*				*	
Chenopodiaceae	Maireana	Maireana trichoptera				*	*		*				*	
Chenopodiaceae	Maireana	Maireana triptera	*	*	*	*	*	*	*		*		*	
Chenopodiaceae	Rhagodia	Rhagodia drummondii	*	*	*	*	*	*		*	*		*	
Chenopodiaceae	Rhagodia	Rhagodia eremaea	*											
Chenopodiaceae	Salsola	Salsola australis						*	*					
Chenopodiaceae	Sclerolaena	Sclerolaena cuneata	*						*					
Chenopodiaceae	Sclerolaena	Sclerolaena densiflora	*										*	
Chenopodiaceae	Sclerolaena	Sclerolaena diacantha						*					*	
Chenopodiaceae	Sclerolaena	Sclerolaena patenticuspis	*											
Convolvulaceae	Duperreya	Duperreya sericea					*							
Cucurbitaceae	Citrullus	Citrullus amarus*					*							
Cucurbitaceae	Cucumis	Cucumis myriocarpus*					*	*						
Cupressaceae	Callitris	Callitris preissii											*	
Fabaceae	Acacia	Acacia aneura	*	*	*	*	*	*	*	*	*	*	*	*
Fabaceae	Acacia	Acacia ayersiana	*	*		*		*	*	*	*			
Fabaceae	Acacia	Acacia burkittii	*	*		*	*	*	*	*	*	*	*	
Fabaceae	Acacia	Acacia caesaneura	*	*	*	*			*	*			*	
Fabaceae	Acacia	Acacia craspedocarpa		*	*	*					*			*
Fabaceae	Acacia	Acacia hemiteles					*							
Fabaceae	Acacia	Acacia incurvaneura	*	*	*	*	*		*	*				*

Family	Genus	Taxon	a	b	c	d	e	f	g	h	i	j	k	l
Fabaceae	Acacia	Acacia kempeana							*					
Fabaceae	Acacia	Acacia ligulata	*	*	*	*	*	*	*	*	*			
Fabaceae	Acacia	Acacia minyura							*					
Fabaceae	Acacia	Acacia mulganeura	*	*	*	*	*	*	*	*	*	*	*	*
Fabaceae	Acacia	Acacia murrayana					*			*				
Fabaceae	Acacia	Acacia oswaldii	*											
Fabaceae	Acacia	Acacia pteraneura		*	*	*	*	*	*		*			
Fabaceae	Acacia	Acacia quadrimarginea										*		
Fabaceae	Acacia	Acacia ramulosa var. ramulosa	*	*	*	*	*		*	*			*	
Fabaceae	Acacia	Acacia sibirica				*			*					
Fabaceae	Acacia	Acacia tetragonophylla	*	*	*	*	*	*	*	*	*	*	*	*
Fabaceae	Daviesia	Daviesia aphylla	*	*		*								
Fabaceae	Senna	Senna artemisioides subsp. xsturtii				*								
Fabaceae	Senna	Senna artemisioides subsp. artemisioides	*	*	*	*	*	*		*	*	*	*	*
Fabaceae	Senna	Senna artemisioides subsp. filifolia	*	*	*	*	*	*	*	*	*	*	*	*
Fabaceae	Senna	Senna artemisioides subsp. helmsii				*	*				*			
Fabaceae	Senna	Senna cardiosperma				*							*	
Fabaceae	Senna	Senna glutinosa subsp. chatelainiana					*	*	*		*			
Fabaceae	Senna	Senna sp. Meekatharra											*	*
Frankeniaceae	Frankenia	Frankenia ?fecunda											*	
Frankeniaceae	Frankenia	Frankenia setosa							*					
Goodeniaceae	Goodenia	Goodenia sp.					*							
Goodeniaceae	Scaevola	Scaevola spinescens	*	*	*	*	*	*	*	*	*	*	*	*
Lamiaceae	Prostanthera	Prostanthera albiflora					*							
Lamiaceae	Teucrium	Teucrium teucriiflorum		*	*			*	*		*			
Loranthaceae	Amyema	Amyema gibberula var. gibberula								*				
Loranthaceae	Amyema	Amyema sp. Dead		*										
Malvaceae	Abutilon	Abutilon otocarpum					*							
Malvaceae	Abutilon	Abutilon oxycarpum					*	*						
Malvaceae	Alyogyne	Alyogyne pinoniana						*						
Malvaceae	Brachychiton	Brachychiton gregorii			*					*		*		
Malvaceae	Sida	Sida calyxhymenia	*	*		*	*							
Malvaceae	Sida	Sida ectogama		*	*	*		*			*		*	
Malvaceae	Sida	Sida sp. Golden calyces glabrous		*	*	*								
Myrtaceae	Eucalyptus	Eucalyptus ewartiana												*
Myrtaceae	Eucalyptus	Eucalyptus kingsmillii		*										
Myrtaceae	Eucalyptus	Eucalyptus lesouefii							*				*	
Myrtaceae	Eucalyptus	Eucalyptus oleosa subsp. oleosa	*	*										
Myrtaceae	Eucalyptus	Eucalyptus salubris											*	
Poaceae	Aristida	Aristida contorta	*	*	*	*	*	*	*	*	*	*	*	*
Poaceae	Austrostipa	Austrostipa elegantissima		*							*			
Poaceae	Austrostipa	Austrostipa eremophila	*	*	*	*	*		*	*				*
Poaceae	Austrostipa	Austrostipa scabra	*			*						*		

Family	Genus	Taxon	a	b	c	d	e	f	g	h	i	j	k	l
Poaceae	Cenchrus	Cenchrus ciliaris*								*				
Poaceae	Cymbopogon	Cymbopogon ambiguus				*								
Poaceae	Enneapogon	Enneapogon caerulescens	*	*	*	*	*	*	*	*	*	*		
Poaceae	Enteropogon	Enteropogon ramosus	*			*	*		*	*				*
Poaceae	Eragrostis	Eragrostis eriopoda	*	*	*	*			*	*		*		
Poaceae	Eragrostis	Eragrostis pergracilis		*										
Poaceae	Eragrostis	Eragrostis setifolia		*			*							
Poaceae	Eriachne	Eriachne helmsii				*	*					*		*
Poaceae	Eriachne	Eriachne pulchella subsp. pulchella					*		*					*
Poaceae	Monachather	Monachather paradoxus								*				
Poaceae	Paspalidium	Paspalidium clementii					*							*
Poaceae	Triodia	Triodia basedowii		*										
Portulacaceae	Portulaca	Portulaca oleracea	*				*		*					
Proteaceae	Grevillea	Grevillea acuaria											*	
Proteaceae	Grevillea	Grevillea berryana	*	*										
Proteaceae	Hakea	Hakea lorea subsp. lorea							*	*	*			
Proteaceae	Hakea	Hakea preissii	*	*		*	*		*				*	
Proteaceae	Hakea	Hakea recurva subsp. recurva	*				*							
Pteridaceae	Cheilanthes	Cheilanthes lasiophylla					*	*				*	*	
Pteridaceae	Cheilanthes	Cheilanthes sieberi subsp. sieberi												*
Rubiaceae	Psyrax	Psyrax rigidula						*		*				*
Rubiaceae	Psyrax	Psyrax suaveolens			*		*	*		*				*
Rutaceae	Philotheca	Philotheca brucei subsp. brucei						*						*
Santalaceae	Exocarpos	Exocarpos aphyllus											*	
Sapindaceae	Dodonaea	Dodonaea lobulata	*	*		*	*		*		*	*	*	
Sapindaceae	Dodonaea	Dodonaea rigida		*		*	*	*			*	*	*	*
Sapindaceae	Dodonaea	Dodonaea viscosa subsp. angustissima		*										
Scrophulariaceae	Eremophila	Eremophila clarkei					*			*				
Scrophulariaceae	Eremophila	Eremophila exilifolia	*	*	*					*				
Scrophulariaceae	Eremophila	Eremophila forrestii subsp. forrestii		*						*	*	*		*
Scrophulariaceae	Eremophila	Eremophila georgei	*											
Scrophulariaceae	Eremophila	Eremophila latrobei subsp. latrobei	*			*	*	*		*			*	*
Scrophulariaceae	Eremophila	Eremophila longifolia	*	*		*	*		*	*	*			
Scrophulariaceae	Eremophila	Eremophila metallicorum											*	
Scrophulariaceae	Eremophila	Eremophila oldfieldii subsp. angustifolia	*			*	*	*			*			
Scrophulariaceae	Eremophila	Eremophila oppositifolia subsp. angustifolia											*	
Scrophulariaceae	Eremophila	Eremophila pantonii				*			*				*	
Solanaceae	Solanum	Solanum lasiophyllum	*	*	*	*	*	*	*	*	*	*	*	*
Solanaceae	Solanum	Solanum nummularium	*	*										
Tamaricaceae	Tamarix	Tamarix aphylla*								*				
Thymelaeaceae	Pimelea	Pimelea microcephala subsp. microcephala			*			*		*				

Appendix F - Site Descriptions

Project Name: Mt Celia					
Date:	3/06/2020 & 8/09/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q1		
Quadrat size:	20x20				
Vegetation group:	Mulga over Maireana sedifolia (calcrete)				
WP:	1				
Photo number:			35		
Landform:			Flat/Plain		
Land surface/disturbance:			No effective disturbance		
Coarse fragments on the surface (abundance/size/shape):			Very slightly; very few/Fine gravelly; small pebbles/Rounded		
Rock outcrop (abundance/runoff):			No bedrock exposed/Slow		
Soil (profile/field texture/soil surface):			Uniform/Loamy sand/Firm		
% Cover leaf litter:			10		
% Cover bare ground:			60		
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	6-12m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	V <10	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia aneura		Dodonaea lobulata		Maireana sedifolia	
		Acacia burkittii		Ptilotus obovatus	
		Senna artemisioides subsp. filifolia			
ALL SPECIES					
Acacia aneura					
Dodonaea lobulata					
Acacia burkittii					
Senna artemisioides subsp. filifolia					
Maireana sedifolia					
Ptilotus obovatus					
Maireana carmosa					
Maireana georgei					
Rhagodia eremaea					
Scaevola spinescens					
Solanum lasiophyllum					
Enchylaena tomentosa var. tomentosa					
Aristida contorta					
Hakea preissii					
Marsdenia australis					
Outside					
Acacia ligulata					
Acacia mulganeura					
Acacia tetragonophylla					
Eremophila georgei					
Eremophila longifolia					
Eremophila oldfieldii subsp. angustifolia					
Grevillea berryana					
Senna artemisioides subsp. artemisioides					
Solanum nummularium					



Project Name: Mt Celia					
Date:	3/06/2020 & 8/09/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q3		
Quadrat size:	20x20				
Vegetation group:	Mulga Shrubland				
WP:	4				
Photo number:	40				
Landform:	Flat/Plain				
Land surface/disturbance:	No effective disturbance				
Coarse fragments on the surface (abundance/size/shape):	No coarse fragments				
Rock outcrop (abundance/runoff):	No bedrock exposed/Slow				
Soil (profile/field texture/soil surface):	Uniform/Loamy sand/Hard setting				
% Cover leaf litter:	40				
% Cover bare ground:	60				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	M Tree Mallee (> 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-8m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	S 10-30	Crown cover %:	S 10-30	Crown cover %:	V <10
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia aneura		Acacia ramulosa var. ramulosa		Ptilotus obovatus	
Acacia incurvaneura					
Acacia caesaneura					
ALL SPECIES					
Acacia aneura					
Acacia incurvaneura					
Acacia caesaneura					
Acacia ramulosa var. ramulosa					
Ptilotus obovatus					
Eragrostis eriopoda					
Sida ectogama					
Sida sp. Golden calyces glabrous					
Maireana georgei					
Maireana planifolia					
Rhagodia drummondii					
Marsdenia australis					
Aristida contorta					
Austrostipa eremophila					
Enchylaena tomentosa var. tomentosa					
Psychrax suaveolens					
Solanum lasiophyllum					
Maireana triptera					
Outside					
Acacia liquilata					
Teucrium teucriiflorum					



Project Name: Mt Celia					
Date:	3/06/2020 & 8/09/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q4		
Quadrat size:	20x20				
Vegetation group:	Mulga Shrubland				
WP:	5				
Photo number:	41				
Landform:	Flat/Plain				
Land surface/disturbance:	No effective disturbance				
Coarse fragments on the surface (abundance/size/shape):	No coarse fragments				
Rock outcrop (abundance/runoff):	No bedrock exposed/Slow				
Soil (profile/field texture/soil surface):	Uniform/Loamy sand/Hard setting				
% Cover leaf litter:	40				
% Cover bare ground:	60				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	M Tree Mallee (> 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	6-12m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	S 10-30	Crown cover %:	S 10-30	Crown cover %:	V <10
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia incurvaneura		Acacia ramulosa var. ramulosa		Ptilotus obovatus	
Acacia mulganeura		Eremophila forrestii subsp. forrestii			
Eucalyptus kingsmillii		Senna artemisioides subsp. artemisioides			
ALL SPECIES					
Acacia incurvaneura					
Acacia mulganeura					
Eucalyptus kingsmillii					
Acacia ramulosa var. ramulosa					
Eremophila forrestii subsp. forrestii					
Senna artemisioides subsp. artemisioides					
Ptilotus obovatus					
Maireana pyramidata					
Acacia craspedocarpa					
Acacia aneura					
Solanum lasiophyllum					
Eragrostis eriopoda					
Teucrium teucriformum					
Rhagodia drummondii					
Aristida contorta					
Scaevola spinescens					
Enchylaena tomentosa var. tomentosa					
Outside					
Acacia liquilata					
Hakea preissii					



Project Name: Mt Celia			
Date:	3/06/2020 & 8/09/2020	Botanist:	Eren Reid
Location:	Mt Celia	Quadrat:	Q6
Quadrat size:	20x20		
Vegetation group:	Open Mulga shrubland on sandy soils		
WP:	11		
Photo number:			43
Landform:			Flat/Plain
Land surface/disturbance:			No effective disturbance
Coarse fragments on the surface (abundance/size/shape):			No coarse fragments
Rock outcrop (abundance/runoff):			No bedrock exposed/Slow
Soil (profile/field texture/soil surface):			Gradational/Loamy sand/Hard setting
% Cover leaf litter:			20
% Cover bare ground:			70
Tallest stratum	Mid-stratum	Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m
Crown cover %:	V <10	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:	
Acacia mulganeura	Senna artemisioides subsp. filifolia	Ptilotus obovatus	
	Acacia ramulosa var. ramulosa	Eragrostis eriopoda	
	Acacia ligulata		
	Ptilotus obovatus		
	Eragrostis eriopoda		
	Brachychiton gregorii		
	Acacia tetragonophylla		
	Acacia craspedocarpa		
	Acacia incurvaneura		
	Pimelea microcephala subsp. microcephala		
	Rhagodia drummondii		
	Maireana triptera		
	Solanum lasiophyllum		
	Aristida contorta		
	Marsdenia australis		
	Senna artemisioides subsp. artemisioides		
	Enneapogon caeruleus		
	Enchylaena tomentosa var. tomentosa		
Outside			
	Acacia aneura		
	Acacia pteraneura		



Project Name: Mt Celia					
Date:	4/06/2020 & 8/09/2020		Botanist:	Eren Reid	
Location:	Mt Celia		Quadrat:	Q7	
Quadrat size:	20x20				
Vegetation group:	Mulga shrubland on rocky ironstone				
WP:	12				
Photo number:	44				
Landform:	Hillock/Mound				
Land surface/disturbance:	No effective disturbance				
Coarse fragments on the surface (abundance/size/shape):	Very: abundant/Cobbly: or cobbles/Subangular tabular				
Rock outcrop (abundance/runoff):	No bedrock exposed/Moderately rapid				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Hard setting				
% Cover leaf litter:	20				
% Cover bare ground:	65				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	1-3m	Height:	0.5-1m	Height:	0.25-0.5m
Crown cover %:	V <10	Crown cover %:	S 10-30	Crown cover %:	V <10
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia aneura		Scaevola spinescens		Ptilotus obovatus	
Acacia mulganeura		Senna artemisioides subsp. filifolia			
		Eremophila latrobei subsp. latrobei			
ALL SPECIES					
Acacia aneura					
Acacia mulganeura					
Scaevola spinescens					
Senna artemisioides subsp. filifolia					
Eremophila latrobei subsp. latrobei					
Ptilotus obovatus					
Dodonaea lobulata					
Eremophila oldfieldii subsp. angustifolia					
Senna artemisioides subsp. artemisioides					
Sida ectogama					
Acacia tetragonophylla					
Rhagodia drummondii					
Acacia craspedocarpa					
Hakea preissii					
Solanum lasiophyllum					
Sida calyxhymenia					
Dodonaea rigida					
Austrostipa scabra					
Sida sp. Golden calyces glabrous					
Eremophila longifolia					
Maireana triptera					
Acacia caesaneura					
Outside					
Acacia incurvaneura					
Acacia ligulata					



Project Name: Mt Celia					
Date:	4/06/2020 & 8/09/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q8		
Quadrat size:	20x20				
Vegetation group:	Cas Pauper over Acacia ligulata, senna art fil and Dod lob				
WP:	13				
Photo number:			45		
Landform:	Flat/Plain				
Land surface/disturbance:	No effective disturbance				
Coarse fragments on the surface (abundance/size/shape):	No coarse fragments				
Rock outcrop (abundance/runoff):	No bedrock exposed/Slow				
Soil (profile/field texture/soil surface):	Gradational/Loamy sand/Hard setting				
% Cover leaf litter:	40				
% Cover bare ground:	40				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	M Tree Mallee (> 8m)	Growth form:	S Shrub	Growth form:	Y Shrub Mallee (< 8m)
Height:	6-12m	Height:	1-3m	Height:	0.25-0.5m
Crown cover %:	1 <1	Crown cover %:	M 30-70	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Casuarina pauper		Acacia ligulata		Ptilotus obovatus	
		Senna artemisioides subsp. filifolia		Maireana pyramidata	
		Dodonaea lobulata			
ALL SPECIES					
Casuarina pauper					
Acacia ligulata					
Senna artemisioides subsp. filifolia					
Dodonaea lobulata					
Ptilotus obovatus					
Maireana pyramidata					
Daviesia aphylla					
Scaevola spinescens					
Acacia tetragonophylla					
Rhagodia drummondii					
Austrostipa scabra					
Maireana planifolia					
Maireana tomentosa					
Enchylaena tomentosa var. tomentosa					
Maireana triptera					
Marsdenia australis					
Solanum lasiophyllum					
Aristida contorta					
Eragrostis eriopoda					
Outside					
Eucalyptus oleosa subsp. oleosa					
Hakea preissii					



Project Name: Mt Celia				
Date:	4/06/2020 & 8/09/2020		Botanist:	Eren Reid
Location:	Mt Celia		Quadrat:	Q11
Quadrat size:	20x20			
Vegetation group:	Acacia aneura and Acacia burkittii on rocky basalt hills			
WP:	52			
Photo number:			48	
Landform:	Hillock/Mound			
Land surface/disturbance:	No effective disturbance			
Coarse fragments on the surface (abundance/size/shape):	Very: abundant/Cobbly; or cobbles/Subrounded			
Rock outcrop (abundance/runoff):	Rocky/Moderately rapid			
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Hard setting			
% Cover leaf litter:	10			
% Cover bare ground:	70			
Tallest stratum		Mid-stratum		Lower stratum
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:
Height:	1-3m	Height:	0.5-1m	Height:
Crown cover %:	V <10	Crown cover %:	S 10-30	Crown cover %:
Dominant taxa:		Dominant taxa:		Dominant taxa:
Acacia aneura		Acacia burkittii		Ptilotus obovatus
Acacia pteraneura				Chrysocephalum puteale
ALL SPECIES				
Acacia aneura				
Acacia pteraneura				
Acacia burkittii				
Ptilotus obovatus				
Chrysocephalum puteale				
Acacia ligulata				
Acacia incurvaneura				
Scaevola spinescens				
Acacia mulganeura				
Acacia hemiteles				
Dodonaea rigida				
Senna artemisioides subsp. filifolia				
Maireana triptera				
Solunum lasiophyllum				
Enneapogon caeruleus				
Acacia ramulosa var. ramulosa				
Austrostipa eremophila				
Eriachne pulchella subsp. pulchella				
Maireana georgei				
Marsdenia australis				
Outside				
Hakea preissii				
Acacia tetragonophylla				
Eremophila latrobei subsp. latrobei				



Project Name: Mt Celia					
Date:	4/06/2020 & 08/09/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q12		
Quadrat size:	20x20				
Vegetation group:	Mulga shrubland on rocky ironstone hills				
WP:	64				
Photo number:	52				
Landform:	Hillock/Mound				
Land surface/disturbance:	No effective disturbance				
Coarse fragments on the surface (abundance/size/shape):	Very: abundant/Cobbly: or cobbles/Subrounded tabular				
Rock outcrop (abundance/runoff):	Rocky/Moderately rapid				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Hard setting				
% Cover leaf litter:	20				
% Cover bare ground:	70				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.25-0.5m
Crown cover %:	V <10	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia aneura		Acacia burkittii		Ptilotus obovatus	
Acacia mulganeura		Eremophila latrobei subsp. latrobei		Chrysocephalum puteale	
ALL SPECIES					
Acacia aneura					
Acacia mulganeura					
Acacia burkittii					
Eremophila latrobei subsp. latrobei					
Ptilotus obovatus					
Chrysocephalum puteale					
Acacia incurvaneura					
Acacia tetragonophylla					
Scaevola spinescens					
Dodonaea rigida					
Dodonaea lobulata					
Senna artemisioides subsp. helmsii					
Solunum lasiophyllum					
Enchylaena tomentosa var. tomentosa					
Enneapogon caeruleus					
Eriachne helmsii					
Enteropogon ramosus					
Maireana triptera					
Cymbopogon ambiguus					
Outside					



Project Name: Mt Celia					
Date:	4/06/2020 & 8/09/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q13		
Quadrat size:	20x20				
Vegetation group:	Mulga shrubland (sandy)				
WP:	68				
Photo number:			53		
Landform:			Flat/Plain		
Land surface/disturbance:			No effective disturbance		
Coarse fragments on the surface (abundance/size/shape):			No coarse fragments		
Rock outcrop (abundance/runoff):			No bedrock exposed/Slow		
Soil (profile/field texture/soil surface):			Duplex/Clayey sand/Soft		
% Cover leaf litter:			20		
% Cover bare ground:			40		
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.25-0.5m
Crown cover %:	S 10-30	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia aneura		Scaevola spinescens		Ptilotus obovatus	
Acacia incurvaneura		Dodonaea lobulata			
Acacia mulganeura					
ALL SPECIES					
Acacia aneura					
Acacia incurvaneura					
Acacia mulganeura					
Scaevola spinescens					
Dodonaea lobulata					
Ptilotus obovatus					
Acacia ayersiana					
Acacia craspedocarpa					
Acacia pteraneura					
Solanum lasiophyllum					
Acacia tetragonophylla					
Senna artemisioides subsp. artemisioides					
Marsdenia australis					
Maireana tomentosa					
Eragrostis eriopoda					
Aristida contorta					
Acacia caesaneura					
Austrostipa eremophila					
Enchylaena tomentosa var. tomentosa					
Outside					
Acacia liquilata					
Grevillea berryana					
Sida calyxhymenia					



Project Name: Mt Celia					
Date:	4/06/2020 & 8/09/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q14		
Quadrat size:	20x20				
Vegetation group:	Acacia aneura and Acacia burkittii on rocky basalt hills				
WP:	71				
Photo number:	54-quadrat, 55 is general veg				
Landform:	Hillock/Mound				
Land surface/disturbance:	No effective disturbance				
Coarse fragments on the surface (abundance/size/shape):	Extremely: very abundant/Cobbly; or cobbles/Subrounded				
Rock outcrop (abundance/runoff):	Slightly rocky/Moderately rapid				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	20				
% Cover bare ground:	60				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	M Tree Mallee (> 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	6-12m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	S 10-30	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia aneura		Acacia mulganeura		Ptilotus obovatus	
		Acacia burkittii			
		Scaevola spinescens			
		ALL SPECIES			
		Acacia aneura			
		Acacia mulganeura			
		Acacia burkittii			
		Scaevola spinescens			
		Ptilotus obovatus			
		Eremophila oldfieldii subsp. angustifolia			
		Acacia tetragonophylla			
		Acacia pteraneura			
		Senna artemisioides subsp. filifolia			
		Maireana trichoptera			
		Maireana triptera			
		Enneapogon caerulescens			
		Solanum lasiophyllum			
		Chrysocephalum puteale			
		Maireana sedifolia			
		Eragrostis setifolia			
		Austrostipa eremophila			
		Maireana tomentosa			
		Aristida contorta			
		Outside			
		Acacia ligulata			
		Senna artemisioides subsp. artemisioides			
		Hakea recurva subsp. recurva			



Project Name: Mt Celia			
Date:	5/06/2020 & 8/09/2020	Botanist:	Eren Reid
Location:	Mt Celia	Quadrat:	Q16
Quadrat size:	20x20		
Vegetation group:	Mulga over small rocky outcrops		
WP:	97		
Photo number:			70
Landform:			Crest/Hill Crest
Land surface/disturbance:			Limited clearing
Coarse fragments on the surface (abundance/size/shape):			Very: abundant/Stony; stones/Subangular tabular
Rock outcrop (abundance/runoff):			Rockland/Very rapid
Soil (profile/field texture/soil surface):			Uniform/Sandy clay loam/Hard setting
% Cover leaf litter:			40
% Cover bare ground:			50
Tallest stratum	Mid-stratum		Lower stratum
Growth form:	Y Shrub Mallee (< 8m)	S Shrub	S Shrub
Height:	6-12m	1-3m	0.25-0.5m
Crown cover %:	V <10	S 10-30	S 10-30
Dominant taxa:			
Acacia aneura	Philothea brucei subsp. brucei		Ptilotus obovatus
Acacia mulganeura	Sida ectogama		
	Scaevola spinescens		
	ALL SPECIES		
	Acacia aneura		
	Acacia mulganeura		
	Philothea brucei subsp. brucei		
	Sida ectogama		
	Scaevola spinescens		
	Ptilotus obovatus		
	Acacia ayersiana		
	Acacia pteraneura		
	Acacia tetragonophylla		
	Psyrax rigidula		
	Rhagodia drummondii		
	Dodonaea rigida		
	Eremophila latrobei subsp. latrobei		
	Psyrax suaveolens		
	Senna glutinosa subsp. chatelainiana		
	Acacia liquata		
	Acacia burkittii		
	Eremophila oldfieldii subsp. angustifolia		
	Cheilanthes lasiophylla		
	Pimelea microcephala subsp. microcephala		
	Enneapogon caeruleascens		
	Sclerolaena diacantha		
	Alyogyne pinoniana		
	Maireana triptera		
	Outside		



Project Name: Mt Celia			
Date:	05/06/2020 & 08/09/2020	Botanist:	Eren Reid
Location:	Mt Celia	Quadrat:	Q17
Quadrat size:	20x20		
Vegetation group:	Mulga over chenopod shrubland		
WP:	106		
Photo number:	76		
Landform:	Open depression (vale)/Drainage depression		
Land surface/disturbance:	No effective disturbance		
Coarse fragments on the surface (abundance/size/shape):	Moderately many/Medium gravelly; medium pebbles/Rounded		
Rock outcrop (abundance/runoff):	No bedrock exposed/Slow		
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Cracking		
% Cover leaf litter:	10		
% Cover bare ground:	60		
Tallest stratum	Mid-stratum	Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	S Shrub	S Shrub
Height:	3-6m	1-3m	0.5-1m
Crown cover %:	V <10	V <10	S 10-30
Dominant taxa:	Senna artemisioides subsp. filifolia	Maireana pyramidata	
Acacia aneura	Acacia burkittii	Atriplex bunburyana	
	Acacia caesaneura		
	ALL SPECIES		
	Acacia aneura		
	Senna artemisioides subsp. filifolia		
	Acacia burkittii		
	Acacia caesaneura		
	Maireana pyramidata		
	Atriplex bunburyana		
	Acacia kempeana		
	Acacia pteraneura		
	Enneapogon caeruleus		
	Enchylaena tomentosa var. tomentosa		
	Maireana triptera		
	Austrostipa eremophila		
	Enteropogon ramosus		
	Portulaca oleracea		
	Ptilotus obovatus		
	Solanum lasiophyllum		
	Maireana tomentosa		
	Aristida contorta		
	Acacia minvura		
	Acacia sibirica		
	Marsdenia australis		
	Outside		
	Eremophila longifolia		
	Acacia ramulosa var. ramulosa		
	Acacia ligulata		
	Acacia tetragonophylla		
	Scaevola spinescens		



Project Name: Mt Celia					
Date:	5/06/2020 & 8/09/2020		Botanist:	Eren Reid	
Location:	Mt Celia		Quadrat:	Q18	
Quadrat size:	20x20				
Vegetation group:	Acacia aneura and Acacia burkittii on rocky basalt hills				
WP:	112				
Photo number:	77				
Landform:	Hillock/Mound				
Land surface/disturbance:	No effective disturbance				
Coarse fragments on the surface (abundance/size/shape):	Very; abundant/Coarse gravelly; large pebbles/Subrounded tabular				
Rock outcrop (abundance/runoff):	Very rocky/Rapid				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Hard setting				
% Cover leaf litter:	20				
% Cover bare ground:	60				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.25-0.5m
Crown cover %:	S 10-30	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia mulganeura		Acacia burkittii		Ptilotus obovatus	
		Senna artemisioides subsp. filifolia		Enneapogon caeruleus	
		Scaevola spinescens			
ALL SPECIES					
Acacia mulganeura					
Acacia burkittii					
Senna artemisioides subsp. filifolia					
Scaevola spinescens					
Ptilotus obovatus					
Enneapogon caeruleus					
Dodonaea lobulata					
Acacia tetragonophylla					
Senna artemisioides subsp. helmsii					
Senna artemisioides subsp. artemisioides					
Eremophila longifolia					
Hakea preissii					
Acacia aneura					
Maireana sedifolia					
Dodonaea rigida					
Senna glutinosa subsp. chatelainiana					
Maireana triptera					
Enchylaena tomentosa var. tomentosa					
Prostanthera albiflora					
Eriachne helmsii					
Enteropogon ramosus					
Chelanthus lasiophylla					
Eremophila clarkei					
Abutilon oxycarpum					
Chrysocephalum puteale					
Aristida contorta					
Outside					
Psydraz suaveolens					



Project Name: Mt Celia					
Date:	5/06/2020 & 8/09/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q19		
Quadrat size:	20x20				
Vegetation group:	Mulga over Maireana sedifolia and mixed sclerophyll shrubland				
WP:	124				
Photo number:			78		
Landform:			Flat/Plain		
Land surface/disturbance:			No effective disturbance		
Coarse fragments on the surface (abundance/size/shape):			No coarse fragments		
Rock outcrop (abundance/runoff):			No bedrock exposed/Slow		
Soil (profile/field texture/soil surface):			Uniform/Loamy sand/Firm		
% Cover leaf litter:			15		
% Cover bare ground:			60		
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	V <10	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia oswaldii		Acacia burkittii		Maireana sedifolia	
Acacia aneura		Hakea preissii		Senna artemisioides subsp. filifolia	
				Ptilotus obovatus	
ALL SPECIES					
Acacia oswaldii					
Acacia aneura					
Acacia burkittii					
Hakea preissii					
Maireana sedifolia					
Senna artemisioides subsp. filifolia					
Ptilotus obovatus					
Acacia ligulata					
Hakea recurva subsp. recurva					
Maireana pyramidata					
Atriplex bunburyana					
Marsdenia australis					
Sida calythymeria					
Maireana tomentosa					
Aristida contorta					
Eragrostis eriopoda					
Austrostipa eremophila					
Enteropogon ramosus					
Solanum lasiophyllum					
Maireana glomerifolia					
Eremophila exilifolia					
Portulaca oleracea					
Sclerolaena cuneata					
Sclerolaena patentispis					
Outside					



Project Name: Mt Celia					
Date:	5/06/2020 & 9/09/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q21		
Quadrat size:	20x20				
Vegetation group:	Mulga shrubland (sandy substrates)				
WP:	138				
Photo number:			92		
Landform:			Flat/Plain		
Land surface/disturbance:			No effective disturbance		
Coarse fragments on the surface (abundance/size/shape):			No coarse fragments		
Rock outcrop (abundance/runoff):			No bedrock exposed/Slow		
Soil (profile/field texture/soil surface):			Uniform/Loamy sand/Loose		
% Cover leaf litter:			70		
% Cover bare ground:			60		
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	S 10-30	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia aneura		Acacia ayersiana		Ptilotus obovatus	
Acacia incurvaneura		Acacia burkittii			
		Senna artemisioides subsp. filifolia			
ALL SPECIES					
Acacia aneura					
Acacia incurvaneura					
Acacia ayersiana					
Acacia burkittii					
Senna artemisioides subsp. filifolia					
Ptilotus obovatus					
Acacia ligulata					
Scaevola spinescens					
Rhagodia drummondii					
Amyema sp. Dead					
Solanum lasiophyllum					
Eragrostis eriopoda					
Sida calythymania					
Enchylaena tomentosa var. tomentosa					
Maireana georgei					
Maireana triptera					
Marsdenia australis					
Austrostipa elegantissima					
Podolepis capillaris					
Aristida contorta					
Maireana tomentosa					
Outside					
Eremophila exilifolia					



Project Name: Mt Celia			
Date:	5/06/2020 & 9/09/2020	Botanist:	Eren Reid
Location:	Mt Celia	Quadrat:	Q23
Quadrat size:	20x20		
Vegetation group:	Open Mulga shrubland (sandy substrate)		
WP:	153		
Photo number:			95
Landform:	flat/pl		
Land surface/disturbance:	No effective disturbance		
Coarse fragments on the surface (abundance/size/shape):	No coarse fragments		
Rock outcrop (abundance/runoff):	No bedrock exposed/Slow		
Soil (profile/field texture/soil surface):	Uniform/Clayey sand/Loose		
% Cover leaf litter:	40		
% Cover bare ground:	70		
Tallest stratum	Mid-stratum		Lower stratum
Growth form:	Y Shrub Mallee (< 8m)	S Shrub	S Shrub
Height:	3-6m	1-3m	0.25-0.5m
Crown cover %:	V <10	V <10	V <10
Dominant taxa:	Acacia ramulosa var. ramulosa		Ptilotus obovatus
Acacia mulganeura	Senna artemisioides subsp. filifolia		Eragrostis eriopoda
ALL SPECIES			
Acacia mulganeura			
Acacia ramulosa var. ramulosa			
Senna artemisioides subsp. filifolia			
Ptilotus obovatus			
Eragrostis eriopoda			
Acacia aneura			
Acacia incurvaneura			
Acacia pteraneura			
Acacia tetragonophylla			
Senna artemisioides subsp. artemisioides			
Eremophila exilifolia			
Psydraz suaveolens			
Brachychiton gregorii			
Solanum lasiophyllum			
Enneapogon caeruleus			
Scaevola spinescens			
Marsdenia australis			
Aristida contorta			
Outside			
Acacia liquilata			



Project Name: Mt Celia					
Date:	5/06/2020 & 9/09/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q24		
Quadrat size:	20x20				
Vegetation group:	mulga thicket -drainage				
WP:	160				
Photo number:	96-104				
Landform:	Open depression (vale)/Drainage depression				
Land surface/disturbance:	No effective disturbance				
Coarse fragments on the surface (abundance/size/shape):	No coarse fragments				
Rock outcrop (abundance/runoff):	No bedrock exposed/Slow				
Soil (profile/field texture/soil surface):	Uniform/Clay loam/Cracking				
% Cover leaf litter:	80				
% Cover bare ground:	20				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	6-12m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	M 30-70	Crown cover %:	M 30-70	Crown cover %:	M 30-70
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia incurvaneura		Acacia burkittii		Maireana pyramidata	
Acacia ayersiana				Ptilotus obovatus	
ALL SPECIES					
Acacia incurvaneura					
Acacia ayersiana					
Acacia burkittii					
Maireana pyramidata					
Ptilotus obovatus					
Eremophila longifolia					
Hakea lorea subsp. lorea					
Acacia tetragonophylla					
Eremophila clarkei					
Eremophila exilifolia					
Brachychiton gregorii					
Acacia mulganeura					
Senna artemisioides subsp. artemisioides					
Senna artemisioides subsp. filifolia					
Rhapodia drummondii					
Marsdenia australis					
Amyema gibberula var. gibberula					
Enchylaena tomentosa var. tomentosa					
Scaevola spinescens					
Psychotria suaveolens					
Aristida contorta					
Podolepis capillaris					
Outside					



Project Name: Mt Celia					
Date:	5/06/2020 & 9/09/2020		Botanist:	Eren Reid	
Location:	Mt Celia		Quadrat:	Q25	
Quadrat size:	20x20				
Vegetation group:	Mulga thicket- drainage				
WP:	162				
Photo number:				107	
Landform:				Open depression (vale)/Drainage depression	
Land surface/disturbance:				No effective disturbance	
Coarse fragments on the surface (abundance/size/shape):				No coarse fragments	
Rock outcrop (abundance/runoff):				No bedrock exposed/Slow	
Soil (profile/field texture/soil surface):				Uniform/Loamy sand/Loose	
% Cover leaf litter:				80	
% Cover bare ground:				40	
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	6-12m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	S 10-30	Crown cover %:	M 30-70	Crown cover %:	M 30-70
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia ayersiana		Acacia ramulosa var. ramulosa		Ptilotus obovatus	
ALL SPECIES					
Acacia ayersiana					
Acacia ramulosa var. ramulosa					
Ptilotus obovatus					
Senna artemisioides subsp. artemisioides					
Senna artemisioides subsp. filifolia					
Acacia incurvaneura					
Acacia mulganeura					
Psychdrax rigidula					
Acacia aneura					
Acacia burkittii					
Eremophila latrobei subsp. latrobei					
Rhagodia drummondii					
Psychdrax suaveolens					
Pimelea microcephala subsp. microcephala					
Monachather paradoxus					
Marsdenia australis					
Acacia tetragonophylla					
Podolepis capillaris					
Hakea lorea subsp. lorea					
Acacia caesaneura					
Outside					



Project Name: Mt Celia					
Date:	6/06/2020 & 9/09/2020		Botanist:	Eren Reid	
Location:	Mt Celia		Quadrat:	Q26	
Quadrat size:	20x20				
Vegetation group:	Mulga shrubland on rocky ironstone hills				
WP:	206				
Photo number:	122				
Landform:	Hillock/Mound				
Land surface/disturbance:	No effective disturbance				
Coarse fragments on the surface (abundance/size/shape):	Very; abundant/Coarse gravelly; large pebbles/Angular				
Rock outcrop (abundance/runoff):	Very rocky/Slow				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	40				
% Cover bare ground:	60				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	V <10	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Casuarina pauper		Acacia ramulosa var. ramulosa		Sida ectogama	
Acacia mulganeura		Scaevola spinescens		Dodonaea lobulata	
				Ptilotus obovatus	
ALL SPECIES					
Casuarina pauper					
Acacia mulganeura					
Acacia ramulosa var. ramulosa					
Scaevola spinescens					
Sida ectogama					
Dodonaea lobulata					
Ptilotus obovatus					
Eremophila oldfieldii subsp. angustifolia					
Rhaqodia drummondii					
Hakea preissii					
Acacia tetragonophylla					
Senna artemisioides subsp. filifolia					
Maireana triptera					
Maireana sedifolia					
Eragrostis eriopoda					
Maireana georgei					
Maireana tomentosa					
Enchylaena tomentosa var. tomentosa					
Solanum lasiophyllum					
Aristida contorta					
Outside					
Acacia aneura					
Acacia ligulata					
Daviesia aphylla					
Eremophila longifolia					
Eremophila latrobei subsp. latrobei					
Dodonaea rigida					
Enneapogon caerulescens					



Project Name: Mt Celia			
Date:	6/06/2020 & 9/09/2020	Botanist:	Eren Reid
Location:	Mt Celia	Quadrat:	Q27
Quadrat size:	20x20		
Vegetation group:	Mulga shrubland (sandy substrates)		
WP:	209		
Photo number:			123
Landform:			Flat/Plain
Land surface/disturbance:			No effective disturbance
Coarse fragments on the surface (abundance/size/shape):			No coarse fragments
Rock outcrop (abundance/runoff):			No bedrock exposed/Slow
Soil (profile/field texture/soil surface):			Uniform/Loamy sand/Firm
% Cover leaf litter:			20
% Cover bare ground:			60

Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.25-0.5m
Crown cover %:	S 10-30	Crown cover %:	M 30-70	Crown cover %:	V <10
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia ayersiana		Senna artemisioides subsp. filifolia		Ptilotus obovatus	
Acacia aneura		Acacia burkittii			
		Acacia ligulata			
		Acacia ligulata			

ALL SPECIES

Acacia ayersiana
Acacia aneura

Senna artemisioides subsp. filifolia

Acacia burkittii
Acacia ligulata
Ptilotus obovatus

Solanum nummularium

Solanum lasiophyllum

Daviesia aphylla

Maireana triptera

Maireana georgei

Podolepis capillaris

Enneapogon caeruleus

Aristida contorta

Eragrostis eriopoda

Scaevola spinescens

Rhagodia drummondii

Enchylaena tomentosa var. tomentosa

Marsdenia australis

Outside

Hakea preissii

Eremophila longifolia

Dodonaea lobulata

Eremophila forrestii subsp. forrestii



Project Name: Mt Celia					
Date:	6/06/2020 & 9/09/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q28		
Quadrat size:	20x20				
Vegetation group:	Mulga over Maireana sedifolia and mixed sclerophyll shrubland				
WP:	245				
Photo number:			126		
Landform:			Flat/Plain		
Land surface/disturbance:			No effective disturbance		
Coarse fragments on the surface (abundance/size/shape):			No qualifier; common/Coarse gravelly; large pebbles/Subrounded		
Rock outcrop (abundance/runoff):			No bedrock exposed/Slow		
Soil (profile/field texture/soil surface):			Uniform/Loamy sand/Firm		
% Cover leaf litter:			40		
% Cover bare ground:			70		
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	V <10	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia aneura		Acacia burkittii		Maireana sedifolia	
		Acacia ligulata		Ptilotus obovatus	
				Dodonaea lobulata	
ALL SPECIES					
Acacia aneura					
Acacia burkittii					
Acacia ligulata					
Maireana sedifolia					
Ptilotus obovatus					
Dodonaea lobulata					
Senna artemisioides subsp. filifolia					
Enneapogon caeruleus					
Solanum lasiophyllum					
Austrostipa eremophila					
Enchylaena tomentosa var. tomentosa					
Eragrostis eriopoda					
Maireana triptera					
Solanum nummularium					
Austrostipa scabra					
Sclerolaena densiflora					
Aristida contorta					
Outside					
Casuarina pauper					
Acacia ayersiana					
Eremophila longifolia					



Project Name: Mt Celia					
Date:	6/06/2020 & 9/09/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q29		
Quadrat size:	20x20				
Vegetation group:	Mulga thicket (drainage)				
WP:	254				
Photo number:			127		
Landform:			Open depression (vale)/Drainage depression		
Land surface/disturbance:			No effective disturbance except grazing by hoofed animals		
Coarse fragments on the surface (abundance/size/shape):			No coarse fragments		
Rock outcrop (abundance/runoff):			No bedrock exposed/Moderately rapid		
Soil (profile/field texture/soil surface):			Uniform/Loamy sand/Firm		
% Cover leaf litter:			50		
% Cover bare ground:			40		
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	T Tree	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	V <10	Crown cover %:	M 30-70	Crown cover %:	M 30-70
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Hakea lorea subsp. lorea		Acacia burkittii		Eremophila forrestii subsp. forrestii	
Acacia ayersiana		Acacia aneura		Acacia tetragonophylla	
				Enchylaena tomentosa var. tomentosa	
ALL SPECIES					
Hakea lorea subsp. lorea					
Acacia ayersiana					
Acacia burkittii					
Acacia aneura					
Eremophila forrestii subsp. forrestii					
Acacia tetragonophylla					
Enchylaena tomentosa var. tomentosa					
Eremophila longifolia					
Senna artemisioides subsp. artemisioides					
Senna artemisioides subsp. filifolia					
Acacia ligulata					
Rhagodia drummondii					
Acacia murrayana					
Solanum lasiophyllum					
Enteropogon ramosus					
Enneapogon caerulescens					
Ptilotus obovatus					
Cenchrus ciliaris*					
Maireana pyramidata					
Eragrostis eriopoda					
Dysphania kalpari					
Aristida contorta					
Austrostipa eremophila					
Outside					



Project Name: Mt Celia					
Date:	6/06/2020 & 9/09/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q30		
Quadrat size:	20x20				
Vegetation group:	Mulga over small rocky outcrops				
WP:	259				
Photo number:			128		
Landform:			Hillock/Mound		
Land surface/disturbance:			No effective disturbance		
Coarse fragments on the surface (abundance/size/shape):			Very: abundant/Coarse gravelly; large pebbles/Subangular tabular		
Rock outcrop (abundance/runoff):			Rockland/Rapid		
Soil (profile/field texture/soil surface):			Uniform/Sandy clay loam/Firm		
% Cover leaf litter:			20		
% Cover bare ground:			70		
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.25-0.5m
Crown cover %:	V <10	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia aneura		Philothea brucei subsp. brucei		Ptilotus obovatus	
Acacia mulganeura		Sida ectogama			
		Eremophila latrobei subsp. latrobei			
		ALL SPECIES			
		Acacia aneura			
		Acacia mulganeura			
		Philothea brucei subsp. brucei			
		Sida ectogama			
		Eremophila latrobei subsp. latrobei			
		Ptilotus obovatus			
		Senna artemisioides subsp. artemisioides			
		Acacia tetragonophylla			
		Psyrax suaveolens			
		Dodonaea rigida			
		Senna artemisioides subsp. filifolia			
		Acacia burkittii			
		Solanum lasiophyllum			
		Maireana triptera			
		Enneapogon caeruleus			
		Psyrax rigidula			
		Cheilanthes lasiophylla			
		Enchylaena tomentosa var. tomentosa			
		Teucrium teucriiflorum			
		Maireana georgei			
		Abutilon oxycarpum			
		Aristida contorta			
		Dysphania kalpari			
		Salsola australis			
		Cucumis myriocarpus*			
		Outside			



Project Name: Mt Celia			
Date:	6/06/2020 & 9/09/2020	Botanist:	Eren Reid
Location:	Mt Celia	Quadrat:	Q31
Quadrat size:	20x20		
Vegetation group:	Open Mulga shrubland on ironstone flats		
WP:	266		
Photo number:			137
Landform:			Flat/Plain
Land surface/disturbance:			No effective disturbance
Coarse fragments on the surface (abundance/size/shape):			Moderately many/Coarse gravelly; large pebbles/Subangular
Rock outcrop (abundance/runoff):			No bedrock exposed/Slow
Soil (profile/field texture/soil surface):			Uniform/Sandy clay loam/Firm
% Cover leaf litter:			10
% Cover bare ground:			70
	Tallest stratum	Mid-stratum	Lower stratum
Growth form:	Y Shrub Mallee (< 8m)	S Shrub	S Shrub
Height:	3-6m	1-3m	0.5-1m
Crown cover %:	V <10	S 10-30	V <10
Dominant taxa:			
Acacia aneura	Acacia burkittii		Scaevola spinescens Senna artemisioides subsp. helmsii Dodonaea lobulata
ALL SPECIES			
Acacia aneura			
Acacia burkittii			
Scaevola spinescens			
Senna artemisioides subsp. helmsii			
Dodonaea lobulata			
Acacia tetragonophylla			
Acacia pteraneura			
Senna artemisioides subsp. artemisioides			
Aristida contorta			
Senna artemisioides subsp. filifolia			
Solanum lasiophyllum			
Maireana triptera			
Hakea lorea subsp. lorea			
Ptilotus obovatus			
Enneapogon caeruleascens			
Eremophila forrestii subsp. forrestii			
Dodonaea rigida			
Marsdenia australis			
Maireana georgei			
Outside			
Acacia ligulata			



Project Name: Mt Celia					
Date:	7/06/2020 & 9/09/2020		Botanist:	Eren Reid	
Location:	Mt Celia		Quadrat:	Q32	
Quadrat size:	20x20				
Vegetation group:	Open Mulga shrubland on ironstone flats				
WP:	295				
Photo number:	138				
Landform:	Flat/Plain				
Land surface/disturbance:	No effective disturbance				
Coarse fragments on the surface (abundance/size/shape):	Very: abundant/Coarse gravelly; large pebbles/Subrounded				
Rock outcrop (abundance/runoff):	No bedrock exposed/Slow				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	10				
% Cover bare ground:	70				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	0.5-1m	Height:	0.25-0.5m
Crown cover %:	V <10	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia mulganeura		Scaevola spinescens		Ptilotus obovatus	
Acacia ayersiana		Senna glutinosa subsp. chatelainiana			
		Acacia tetragonophylla			
ALL SPECIES					
Acacia mulganeura					
Acacia ayersiana					
Scaevola spinescens					
Senna glutinosa subsp. chatelainiana					
Acacia tetragonophylla					
Ptilotus obovatus					
Sida ectogama					
Acacia ligulata					
Senna artemisioides subsp. artemisioides					
Teucrium teucriflorum					
Acacia aneura					
Senna artemisioides subsp. filifolia					
Eremophila forrestii subsp. forrestii					
Rhapodia drummondii					
Maireana triptera					
Aristida contorta					
Ptilotus schwartzii					
Solanum lasiophyllum					
Acacia craspedocarpa					
Acacia pteraneura					
Marsdenia australis					
Enchylaena tomentosa var. tomentosa					
Austrostipa elegantissima					
Outside					
Eremophila oldfieldii subsp. angustifolia					
Eremophila longifolia					
Acacia burkittii					



Project Name: Mt Celia					
Date:	7/06/2020 & 9/09/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q33		
Quadrat size:	20x20				
Vegetation group:	Acacia quadrimarginea shrubland over granite bedrock				
WP:	305				
Photo number:	139 and 140				
Landform:	Hillock/Mound				
Land surface/disturbance:	No effective disturbance				
Coarse fragments on the surface (abundance/size/shape):	No qualifier: common/Cobbly; or cobbles/Subangular				
Rock outcrop (abundance/runoff):	Rockland/Slow				
Soil (profile/field texture/soil surface):	Uniform/Loamy sand/Loose				
% Cover leaf litter:	10				
% Cover bare ground:	80				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.25-0.5m
Crown cover %:	1 <1	Crown cover %:	V <10	Crown cover %:	V <10
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia quadrimarginea		Acacia tetragonophylla		Eremophila forrestii subsp. forrestii	
Acacia mulganeura		Acacia aneura			
ALL SPECIES					
Acacia quadrimarginea					
Acacia mulganeura					
Acacia tetragonophylla					
Acacia aneura					
Eremophila forrestii subsp. forrestii					
Acacia burkittii					
Solanum lasiophyllum					
Eragrostis eriopoda					
Eriachne helmsii					
Aristida contorta					
Enneapogon caerulescens					
Ptilotus obovatus					
Scaevola spinescens					
Dodonaea rigida					
Dodonaea lobulata					
Chrysocephalum puteale					
Austrostipa scabra					
Outside					



Project Name: Mt Celia					
Date:	7/06/2020 & 9/09/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q34		
Quadrat size:	20x20				
Vegetation group:	Acacia quadrimarginea shrubland over granite bedrock				
WP:	326				
Photo number:			141		
Landform:			Hillock/Mound		
Land surface/disturbance:			No effective disturbance		
Coarse fragments on the surface (abundance/size/shape):			No qualifier; common/Coarse gravelly; large pebbles/Subangular		
Rock outcrop (abundance/runoff):			Rockland/Slow		
Soil (profile/field texture/soil surface):			Uniform/Sandy clay loam/Firm		
% Cover leaf litter:			10		
% Cover bare ground:			60		
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	V <10	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia quadrimarginea		Acacia aneura		Eremophila forrestii subsp. forrestii	
		Acacia burkittii		Ptilotus obovatus	
ALL SPECIES					
Acacia quadrimarginea					
Acacia aneura					
Acacia burkittii					
Eremophila forrestii subsp. forrestii					
Ptilotus obovatus					
Acacia tetragonophylla					
Enneapogon caerulescens					
Solanum lasiophyllum					
Dodonaea lobulata					
Aristida contorta					
Eragrostis eriopoda					
Senna artemisioides subsp. filifolia					
Dodonaea rigida					
Eriachne helmsii					
Senna artemisioides subsp. artemisioides					
Cheilanthes lasiophylla					
Austrostipa scabra					
Chrysocephalum puteale					
Outside					



Project Name: Mt Celia					
Date:	7/06/2020 & 9/09/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q35		
Quadrat size:	20x20				
Vegetation group:	Mulga over chenopod shrubland				
WP:	349				
Photo number:			142		
Landform:			Open depression (vale)/Drainage depression		
Land surface/disturbance:			No effective disturbance		
Coarse fragments on the surface (abundance/size/shape):			Very slightly; very few/Fine gravelly; small pebbles/Subrounded		
Rock outcrop (abundance/runoff):			No bedrock exposed/Moderately rapid		
Soil (profile/field texture/soil surface):			Uniform/Clay loam/Loose		
% Cover leaf litter:			20		
% Cover bare ground:			70		
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	M Tree Mallee (> 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-8m	Height:	1-3m	Height:	0.25-0.5m
Crown cover %:	V <10	Crown cover %:	V <10	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia aneura		Acacia mulganeura		Frankenia setosa	
		Hakea preissii		Maireana pyramidata	
		Acacia ligulata		Ptilotus obovatus	
ALL SPECIES					
Acacia aneura					
Acacia mulganeura					
Hakea preissii					
Acacia ligulata					
Frankenia setosa					
Maireana pyramidata					
Ptilotus obovatus					
Senna artemisioides subsp. filifolia					
Acacia burkittii					
Eremophila pantonii					
Scaevola spinescens					
Maireana sedifolia					
Acacia ayersiana					
Acacia pteraneura					
Sclerolaena cuneata					
Atriplex bunburyana					
Dodonaea lobulata					
Maireana glomerifolia					
Maireana georgei					
Maireana tomentosa					
Enneapogon caeruleus					
Eriachne pulchella subsp. pulchella					
Senna glutinosa subsp. chatelainiana					
Maireana triptera					
Salsola australis					
Teucrium teucriflorum					
Maireana trichoptera					
Eucalyptus lesouefii					
Outside					



Project Name: Mt Celia					
Date:	7/06/2020 & 9/09/2020		Botanist:	Eren Reid	
Location:	Mt Celia		Quadrat:	Q36	
Quadrat size:	20x20				
Vegetation group:	Casuarina pauper and Acacia aneura over sclerophyll shrubland on rocky laterite hills				
WP:	389				
Photo number:	146				
Landform:	Crest/Hill Crest				
Land surface/disturbance:	No effective disturbance				
Coarse fragments on the surface (abundance/size/shape):	Very; abundant/Coarse gravelly; large pebbles/Subrounded				
Rock outcrop (abundance/runoff):	Rocky/Rapid				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	10				
% Cover bare ground:	70				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	0.5-1m	Height:	0.25-0.5m
Crown cover %:	V <10	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia aneura		Dodonaea lobulata		Ptilotus obovatus	
Casuarina pauper		Maireana sedifolia			
ALL SPECIES					
Acacia aneura					
Casuarina pauper					
Dodonaea lobulata					
Maireana sedifolia					
Ptilotus obovatus					
Sida ectogama					
Senna artemisioides subsp. artemisioides					
Senna artemisioides subsp. filifolia					
Rhagodia drummondii					
Acacia mulganeura					
Acacia tetragonophylla					
Scaevola spinescens					
Eremophila latrobei subsp. latrobei					
Atriplex bunburyana					
Maireana trichoptera					
Maireana georgei					
Chenopodium gaudichaudianum					
Enchylaena tomentosa var. tomentosa					
Senna sp. Meekatharra					
Aristida contorta					
Sclerolaena diacantha					
Sclerolaena densiflora					
Outside					
Acacia burkittii					
Acacia ramulosa var. ramulosa					



Project Name: Mt Celia					
Date:	7/06/2020 & 9/09/2020		Botanist:	Eren Reid	
Location:	Mt Celia		Quadrat:	Q37	
Quadrat size:	20x20				
Vegetation group:	Casuarina pauper and Acacia aneura over sclerophyll shrubland on rocky laterite hills				
WP:	404				
Photo number:	148				
Landform:	Mid slope/Hillslope				
Land surface/disturbance:	No effective disturbance				
Coarse fragments on the surface (abundance/size/shape):	Very; abundant/Stony; stones/Subrounded				
Rock outcrop (abundance/runoff):	Rocky/Rapid				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	20				
% Cover bare ground:	60				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	0.5-1m	Height:	0.25-0.5m
Crown cover %:	V <10	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Casuarina pauper		Dodonaea lobulata		Sida ectogama	
Acacia aneura		Maireana sedifolia		Ptilotus obovatus	
ALL SPECIES					
Casuarina pauper					
Acacia aneura					
Dodonaea lobulata					
Maireana sedifolia					
Sida ectogama					
Ptilotus obovatus					
Eremophila latrobei subsp. latrobei					
Acacia tetragonophylla					
Eremophila oppositifolia subsp. angustifolia					
Scaevola spinescens					
Senna artemisioides subsp. filifolia					
Senna artemisioides subsp. artemisioides					
Rhapodia drummondii					
Maireana pyramidata					
Cheilanthes lasiophylla					
Dodonaea rigida					
Atriplex bunburyana					
Outside					



Project Name: Mt Celia					
Date:	7/06/2020 & 9/09/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q38		
Quadrat size:	20x20				
Vegetation group:	Casuarina pauper and Acacia aneura over sclerophyll shrubland on rocky laterite hills				
WP:	415				
Photo number:			151		
Landform:			Mid slope/Hillslope		
Land surface/disturbance:			No effective disturbance		
Coarse fragments on the surface (abundance/size/shape):			Very: abundant/Coarse gravelly; large pebbles/Subangular		
Rock outcrop (abundance/runoff):			Rockland/Rapid		
Soil (profile/field texture/soil surface):			Uniform/Sandy clay loam/Firm		
% Cover leaf litter:			10		
% Cover bare ground:			70		
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	0.5-1m	Height:	0.25-0.5m
Crown cover %:	V <10	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Casuarina pauper		Dodonaea lobulata		Frankenia ?fecunda	
Acacia aneura		Eremophila pantonii			
		Grevillea acuaria			
ALL SPECIES					
Casuarina pauper					
Acacia aneura					
Dodonaea lobulata					
Eremophila pantonii					
Grevillea acuaria					
Frankenia ?fecunda					
Acacia mulganeura					
Senna sp. Meekatharra					
Scaevola spinescens					
Exocarpos aphyllus					
Maireana sedifolia					
Maireana pyramidata					
Senna artemisioides subsp. artemisioides					
Acacia tetragonophylla					
Eremophila oppositifolia subsp. angustifolia					
Eremophila latrobei subsp. latrobei					
Sida ectogama					
Maireana glomerifolia					
Ptilotus obovatus					
Outside					



Project Name: Mt Celia					
Date:	8/06/2020 & 9/09/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q39		
Quadrat size:	20x20				
Vegetation group:	Casuarina pauper and Acacia aneura over sclerophyll shrubland on rocky laterite hills				
WP:	437				
Photo number:		152-153			
Landform:		Hillock/Mound			
Land surface/disturbance:		No effective disturbance			
Coarse fragments on the surface (abundance/size/shape):		Very: abundant/Coarse gravelly; large pebbles/Subrounded			
Rock outcrop (abundance/runoff):		Rocky/Rapid			
Soil (profile/field texture/soil surface):		Uniform/Sandy clay loam/Firm			
% Cover leaf litter:		10			
% Cover bare ground:		70			
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	0.5-1m	Height:	0.25-0.5m
Crown cover %:	V <10	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Casuarina pauper		Eremophila pantonii		Dodonaea lobulata	
Acacia aneura		Eremophila oppositifolia subsp. angustifolia		Maireana sedifolia	
ALL SPECIES					
Casuarina pauper					
Acacia aneura					
Eremophila pantonii					
Eremophila oppositifolia subsp. angustifolia					
Dodonaea lobulata					
Maireana sedifolia					
Sida ectogama					
Acacia tetragonophylla					
Senna artemisioides subsp. artemisioides					
Eremophila latrobei subsp. latrobei					
Callitris preissii					
Grevillea acuarua					
Senna artemisioides subsp. filifolia					
Scaevola spinescens					
Ptilotus obovatus					
Olearia muelleri					
Frankenia 2facunda					
Maireana trichoptera					
Maireana glomerifolia					
Hakea preissii					
Enchylaena tomentosa var. tomentosa					
Eremophila metallicorum					
Outside					



Project Name: Mt Celia					
Date:	8/06/2020 & 9/09/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q40		
Quadrat size:	20x20				
Vegetation group:	Casuarina pauper and Acacia aneura over sclerophyll shrubland on rocky laterite hills				
WP:	441				
Photo number:			154-155		
Landform:	Hillock/Mound				
Land surface/disturbance:	No effective disturbance				
Coarse fragments on the surface (abundance/size/shape):	Very: abundant/Coarse gravelly; large pebbles/Subangular				
Rock outcrop (abundance/runoff):	Rocky/Moderately rapid				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	10				
% Cover bare ground:	70				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	M Tree Mallee (> 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	6-12m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	S 10-30	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Casuarina pauper		Acacia burkittii		Ptilotus obovatus	
Eucalyptus salubris		Eremophila pantonii		Maireana sedifolia	
Acacia mulganeura				Dodonaea lobulata	
ALL SPECIES					
Casuarina pauper					
Eucalyptus salubris					
Acacia mulganeura					
Acacia burkittii					
Eremophila pantonii					
Ptilotus obovatus					
Maireana sedifolia					
Dodonaea lobulata					
Eremophila oppositifolia subsp. angustifolia					
Acacia caesaneura					
Eremophila latrobei subsp. latrobei					
Sida ectogama					
Senna sp. Meekatharra					
Senna cardiosperma					
Scaevola spinescens					
Senna artemisioides subsp. filifolia					
Maireana triptera					
Maireana tomentosa					
Senna artemisioides subsp. artemisioides					
Rhagodia drummondii					
Frankenia ?fecunda					
Outside					



Project Name: Mt Celia					
Date:	8/06/2020 & 9/09/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q41		
Quadrat size:	20x20				
Vegetation group:	Casuarina pauper and Acacia aneura over sclerophyll shrubland on rocky laterite hills				
WP:	442				
Photo number:	156 and 157				
Landform:	Simple slope/Hillslope				
Land surface/disturbance:	No effective disturbance				
Coarse fragments on the surface (abundance/size/shape):	Very: abundant/Coarse gravelly; large pebbles/Subrounded				
Rock outcrop (abundance/runoff):	Rocky/Moderately rapid				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	20				
% Cover bare ground:	70				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	M Tree Mallee (> 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	6-12m	Height:	1-3m	Height:	0.25-0.5m
Crown cover %:	V <10	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Casuarina pauper		Eremophila pantonii		Maireana sedifolia	
Eucalyptus lesouefii		Acacia caesaneura		Dodonaea lobulata	
				Ptilotus obovatus	
ALL SPECIES					
Casuarina pauper					
Eucalyptus lesouefii					
Eremophila pantonii					
Acacia caesaneura					
Maireana sedifolia					
Dodonaea lobulata					
Ptilotus obovatus					
Acacia tetragonophylla					
Senna artemisioides subsp. artemisioides					
Senna artemisioides subsp. filifolia					
Senna sp. Meekatharra					
Senna cardiosperma					
Olearia muelleri					
Sida ectogama					
Scaevola spinescens					
Maireana triptera					
Solanum lasiophyllum					
Maireana trichoptera					
Outside					



Project Name: Mt Celia					
Date:	8/06/2020 & 9/09/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q42		
Quadrat size:	20x20				
Vegetation group:	Mulga over Eremophila forrestii on large rocky granite/basalt hills				
WP:	488				
Photo number:			158		
Landform:	Upper slope/Hillslope				
Land surface/disturbance:	No effective disturbance				
Coarse fragments on the surface (abundance/size/shape):	Very; abundant/Cobbly; or cobbles/Subangular tabular				
Rock outcrop (abundance/runoff):	Very rocky/Rapid				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	30				
% Cover bare ground:	70				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	0.5-1m	Height:	0.25-0.5m
Crown cover %:	S 10-30	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia aneura		Philothea brucei subsp. brucei		Eremophila forrestii subsp. forrestii	
Acacia incurvaneura		Eremophila latrobei subsp. latrobei		Ptilotus obovatus	
Acacia mulganeura					
ALL SPECIES					
Acacia aneura					
Acacia incurvaneura					
Acacia mulganeura					
Philothea brucei subsp. brucei					
Eremophila latrobei subsp. latrobei					
Eremophila forrestii subsp. forrestii					
Ptilotus obovatus					
Acacia craspedocarpa					
Solanum lasiophyllum					
Cheilanthes sieberi subsp. sieberi					
Eriachne pulchella subsp. pulchella					
Marsdenia australis					
Paspalidium clementii					
Enteropogon ramosus					
Dodonaea rigida					
Psychotria rigida					
Psychotria suaveolens					
Eriachne helmsii					
Outside					



Project Name: Mt Celia					
Date:	8/06/2020 & 9/09/2020	Botanist:	Eren Reid		
Location:	Mt Celia	Quadrat:	Q43		
Quadrat size:	20x20				
Vegetation group:	Mulga over Eremophila forrestii on large rocky granite/basalt hills				
WP:	489				
Photo number:			159		
Landform:	Lower slope/Hillslope				
Land surface/disturbance:	No effective disturbance				
Coarse fragments on the surface (abundance/size/shape):	Very: abundant/Cobbly: or cobbles/Subangular				
Rock outcrop (abundance/runoff):	Very slightly rocky/Rapid				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	20				
% Cover bare ground:	60				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	1-3m	Height:	0.5-1m	Height:	0.25-0.5m
Crown cover %:	S 10-30	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia incurvaneura		Eremophila forrestii subsp. forrestii		Ptilotus obovatus	
Acacia mulganeura					
ALL SPECIES					
Acacia incurvaneura					
Acacia mulganeura					
Eremophila forrestii subsp. forrestii					
Ptilotus obovatus					
Eremophila latrobei subsp. latrobei					
Senna sp. Meekatharra					
Solanum lasiophyllum					
Ptilotus schwartzii					
Acacia aneura					
Cheilanthes sieberi subsp. sieberi					
Austrostipa eremophila					
Aristida contorta					
Paspalidium clementii					
Enteropogon ramosus					
Eriachne helmsii					
Outside					



APPENDIX 5 - TERRESTRIAL FAUNA REPORTS



APPENDIX 5A – Terrestrial Ecosystems - Vertebrate Fauna Survey and Risk Assessment

Basic vertebrate fauna survey and risk assessment

Mt Celia Gold Project

Prepared for: Native Vegetation Solutions

Version 3. January, 2021



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EXECUTIVE SUMMARY

Native Vegetation Solutions on behalf of Legacy Iron Ore Limited requested a basic vertebrate fauna survey and risk assessment to support a Native Vegetation Clearing Permit Application and Mining Proposal for the Mt Celia mining project which is approximately 175km north, north east of Kalgoorlie (i.e. project area).

The total assessed area was approximately 1,404ha, however, a smaller area will be impacted by the proposed mining development and operations.

No Malleefowl mounds were recorded in the project area, however, Malleefowl tracks were recorded in the project area, indicating that Malleefowl are present in low abundance. Large portions of the habitat in the project area were very open and therefore not suitable for Malleefowl nesting when predators are present in the general area.

Prior to any vegetation clearing or disturbance activity, Legacy Iron Ore Limited should complete a risk assessment to determine if conservation significant fauna are likely to be present, and if present, likely to be impacted. If Malleefowl or its foraging habitat is likely to be significantly impacted, then a referral to the Commonwealth Government under the *EPBC Act 1999* is recommended.

It is likely that Long-tailed Dunnart are present in the breakaway and rocky areas. If these areas are not going to be impacted by mining development or operations, then impacts are likely to be low. The Long-tailed Dunnart is not listed as a threatened species under the *EPBC Act* so there is no reporting requirement under the Commonwealth Act for this species.

It is recommended that:

- Prior to vegetation clearing and disturbance, the mine undertakes a risk assessment to determine if conservation significant fauna are likely to be present, and if present, likely to be impacted;
- if Malleefowl or its foraging habitat are likely to be significantly impacted, as judged by the risk assessment, then the proposed action is referred to the Commonwealth Government under the *EPBC Act 1999* to assess the significance of the potential impact on this species;
- a Malleefowl Management Plan is prepared once more detail is available about the proposed potential impacts on this species. If an *EPBC Act* referral is submitted, then it is recommended that the Malleefowl Management Plan is submitted with the referral to demonstrate how the development will minimise, mitigate and manage potential impacts on the species;
- an induction program that includes a component on managing fauna is mandatory for staff and contractors working in the project area;
- the impact of dust on adjacent vegetation and therefore fauna habitat is managed and monitored against appropriate KPIs; and
- preparation of a Vertebrate Fauna Management Plan prior to vegetation clearing and development is completed.

1. INTRODUCTION

1.1 BACKGROUND

Native Vegetation Solutions, on behalf of Legacy Iron Ore Limited requested a basic vertebrate fauna survey and risk assessment of the proposed Mt Celia mining project area, which is approximately 175km north, north east of Kalgoorlie (i.e. project area; Figure 1). The total assessed area was approximately 1,404ha but only a portion of the area will be disturbed.

1.2 PROJECT OBJECTIVES AND SCOPE OF WORKS

Terrestrial Ecosystems was commissioned to undertake a basic vertebrate fauna survey and risk assessment for the Mt Celia mine project area. The purpose of this fauna survey and risk assessment is 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 and risk assessment involved a desktop review and analysis of photos taken on-site. The assessment objectives were to:

- provide an indication of the vertebrate fauna assemblage (reptiles, amphibians, mammals, birds and fish) 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 near the project area and in similar habitat;
- undertook a site reconnaissance survey;
- 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 process for conservation significant fauna were listed by Cowan (2003) as foxes and cats.

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 much lesser extent mining and exploration. The region surrounding the project area is relatively undisturbed, with a chain of salt lakes approximately 15km to the north-east and south-west (Figure 2).

2.3 CLIMATE

The project area is characterised as semi-arid. As the project area is between two weather stations, we have provided both data sets for comparison. Laverton, ~100km to the north, has an annual rainfall of approximately 235mm, although this varies considerably from year-to-year. The highest mean maximum and minimum temperatures in Laverton are in January with an average of 35.8°C and 20.5°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.

Kalgoorlie, 175km to the south, south-west, has an annual rainfall of approximately 266mm, although this varies considerably from year-to-year. The highest mean maximum and minimum temperatures in Kalgoorlie are in January with an average of 33.7°C and 18.3°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 – February, with another peak in May to July.

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.

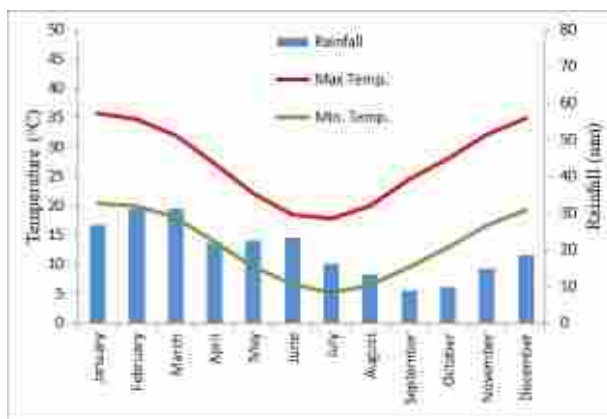


Chart 1. Climatic averages for Laverton

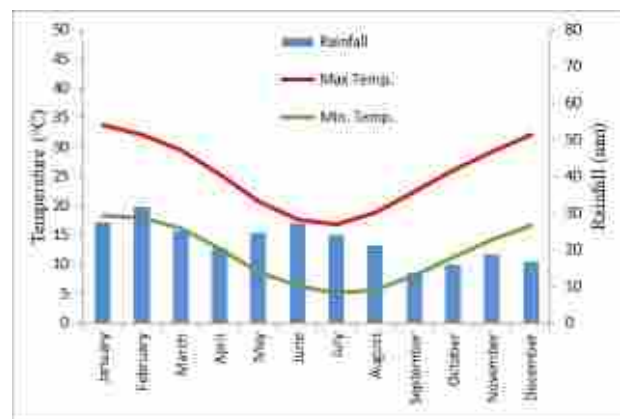


Chart 2. Climatic averages for Kalgoorlie

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:

- Bamford Consulting Ecologists (2007) *Fauna Assessment and Targeted Mulgara Search of the Fish Deposit, Laverton Gold Project*, Perth.
- Bell, D. T., Bell, R. C. and Loneragan, W. A. (2007) Winter bird assemblages across an arid gradient in south-west Western Australia. *Journal of the Royal Society of Western Australia* 90, 219-227.
- Biota Environmental Sciences (2004) *Cosmos Nickel Mine Extension Fauna Survey*. Unpublished report for Sir Samuel Mines NL and URS, Perth.
- Biota Environmental Sciences (2007) *Bannockburn Fauna Habitat and Assemblage Survey*. Unpublished report for Jubilee Mines NL, Perth.
- Coffey Environments (2007) *Level 1 Fauna Assessment, Leinster Nickel Operations*, Perth.
- Coffey Environments (2008) *Level 2 Fauna Assessment for the Duketon Gold Project*. Unpublished report for Regis Resources, Perth.
- Craig, M. D. and Chapman, A. (2003) Effects of short-term drought on the avifauna of Wanjarri Nature Reserve: What do they tell us about drought refugia. *Journal of the Royal Society of Western Australia* 86: 133-137.
- 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.
- Dell, J., How, R. A. and Milewski, A. V. (1992) The biological survey of the Eastern Goldfields, Part 6, Youanmi-Leonora Study Area. *Records of the Western Australian Museum*, Supplement No 40, 131.
- Donarto Environmental Services (2005) *Leinster Nickel Operations Tailing Storage Facility and Water Storage Areas: Wildlife Interactions and Assessment of Risks*, Perth.
- Dunlop, J. N. (1990) The small vertebrate ground fauna of Mulga habitats near Wiluna, Western Australia. *Mulga Research Centre Journal*, 10, 19-27.
- Dunlop, J.N. and Payne, W. (1999) *A vertebrate Fauna Survey of the North Lake Carey Region including Hillside Prospect, Wallaby Prospect and Just in Time / Just in Case and the Teatree Dam Area*, Unpublished report for Placer (Granny Smith) and Homestake, Perth,
- Ecologia Environment (2007) *Jump Up Dam Fauna Assessment*, Unpublished report for Heron Resources Limited, Perth.
- ENV Australia (2008) *Agnew Prospects Fauna Assessment*. Unpublished report for Agnew Gold Mining Company Pty Limited, Perth.
- Hall, N.J, McKenzie, N.L. and Keighery, B.J. (1994) 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.
- Halpern Glick Maunsell (1999) *Rosemont Gold Project Biological Assessment Survey - Phases 1 & 2*. Unpublished report for Johnson's Well Mining NL, Perth.
- 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.
- Kingfisher Environmental Consulting (2014) *Sunrise Dam - Tropicana Infrastructure Corridor Fauna Survey*, Unpublished report for Anglogold Ashanti Australia, Perth.
- MBS Environmental (2004) *Vegetation and Habitat Assessment of the Euro, Sickle and Admiral Hill Project Areas, Laverton*. Unpublished report for Crescent Gold Limited, Perth.
- 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.
- McKenzie, N. L., Rolfe, J. K. and Youngson, W. 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, pp. 51-85.
- Minesite Rehabilitation Services Pty Ltd (1997) *Tarmoola Gold Mine Flora and Fauna Survey*, Unpublished report for Mt Edon Gold Mines (Aust) Ltd, Kalgoorlie.
- Moriarty, T. K. (1972) Birds of Wanjarri; WA (27°; 25'S; 120° 40'E) *The Emu*, 72, 1-7.
- 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 Murrin Expansion Project*, Unpublished report for Anaconda Nickel Ltd, Perth.
- Ninox Wildlife Consulting (1998) *A Vertebrate Fauna Survey of the Murrin Expansion Project*. Unpublished report for Anaconda Nickel Ltd, Perth.
- Ninox Wildlife Consulting (2005) *Vertebrate Fauna Habitat Assessment of the Proposed Expansions to the Cosmos Nickel Mine, near Leinster, Western Australia*. Unpublished report for URS Australia Pty Ltd, Perth.
- Ninox Wildlife Consulting (2006) *A Vertebrate Fauna Assessment of the Tarmoola Area*, Unpublished report for St Barbara Ltd, Perth.
- Onus, M. L., Rolfe, J.K., and Algar, D. (2011) *Assessment of feral cat abundance and control options at Barrick, Granny Smith*. Perth.
- Terrestrial Ecosystems (2010) *Level 2 Fauna Risk Assessment for the Garden Well Project Area*. Unpublished report for Regis Resources Ltd, Perth.
- Terrestrial Ecosystems (2011) *Level 2 Fauna Risk Assessment for the Granny Deeps Project Area*, Unpublished report for Barrick Gold Corporation, 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 (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 (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 (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 (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 (2018c) *Vertebrate Fauna Risk Assessment for the Petra Mining Project*, Perth.
- Van Leeuwen, S. (1997) *Biological Survey of the Southern Little Sandy Desert*, Department of Conservation and land Management, 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.

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 (*Dasyercus 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 development might have on these species, and other conservation significant fauna. The Cowan (2003) report is now very dated, and 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 100km around a centre point coordinate of 29.4551°S and 122.51685°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. Bilby, Lesser Stick-nest Rat). 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 19–23 October 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	
<input type="checkbox"/> > 5 years	
<input type="checkbox"/> 1-5 years	
<input type="checkbox"/> < 1 year	
Landform – options	
<input type="checkbox"/> Beach	<input type="checkbox"/> Lower slope
<input type="checkbox"/> Clay plain	<input type="checkbox"/> Mid slope
<input type="checkbox"/> Cliff	<input type="checkbox"/> Ridge
<input type="checkbox"/> Creek line	<input type="checkbox"/> River
<input type="checkbox"/> Dam	<input type="checkbox"/> Rocky outcrop / breakaway
<input type="checkbox"/> Drainage line	<input type="checkbox"/> Salt lake
<input type="checkbox"/> Dune crest	<input type="checkbox"/> Sand dune
<input type="checkbox"/> Dune slope	<input type="checkbox"/> Sand plain
<input type="checkbox"/> Dune swale	<input type="checkbox"/> Stony plain
<input type="checkbox"/> Escarpment	<input type="checkbox"/> Swamp
<input type="checkbox"/> Flat	<input type="checkbox"/> Undulating
<input type="checkbox"/> Gorge	<input type="checkbox"/> Upper slope
<input type="checkbox"/> Gully	<input type="checkbox"/> Wetland
<input type="checkbox"/> Intertidal / mangrove	<input type="checkbox"/> Water hole
<input type="checkbox"/> Lake / lake edge	
Habitat quality – options	
<input type="checkbox"/> <i>High quality fauna habitat</i> – These areas closely approximate the vegetation mix and quality that would have been in the area prior to any disturbance. The habitat has connectivity with other habitats and is likely to contain the most natural vertebrate fauna assemblage.	
<input type="checkbox"/> <i>Very good fauna habitat</i> - These areas show minimal signs of disturbance (e.g. grazing, clearing, fragmentation, weeds) and generally retain many of the characteristics of the habitat if it had not been disturbed. The habitat has connectivity with other habitats and fauna assemblages in these areas are likely to be minimally effected by disturbance.	
<input type="checkbox"/> <i>Good fauna habitat</i> – These areas showed signs of disturbance (e.g. grazing, clearing, fragmentation, weeds) but generally retain many of the characteristics of the habitat if it had not been disturbed. The habitat has connectivity with other habitats and fauna assemblages in these areas are likely to be affected by disturbance.	
<input type="checkbox"/> <i>Disturbed fauna habitat</i> – These areas showed signs of significant disturbance. Many of the trees, shrubs and undergrowth are cleared. These areas may be in the early succession and regeneration stages. Areas	

Observer's Name:	
<p>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.</p>	
<p><input type="checkbox"/> <i>Highly degraded fauna habitat</i> – These areas often have a significant loss of vegetation, an abundance of weeds, and a large number of vehicle tracks or are completely cleared. Limited or no fauna habitat connectivity. Fauna assemblages in these areas are likely to be significantly different to what might have been in the area pre-disturbance.</p>	
Habitat structure – combined into habitat description	
<i>Upper stratum</i>	
<input type="checkbox"/> Tall open woodland	<input type="checkbox"/> Scattered tall trees
<input type="checkbox"/> Tall woodland	<input type="checkbox"/> Scattered trees
<input type="checkbox"/> Open woodland	<input type="checkbox"/> Scattered low trees
<input type="checkbox"/> Woodland	<input type="checkbox"/> Low closed forest
<input type="checkbox"/> Open forest	<input type="checkbox"/> Low open forest
<input type="checkbox"/> Closed forest	<input type="checkbox"/> Low woodland
<input type="checkbox"/> Tall closed forest	<input type="checkbox"/> Low open woodland
<input type="checkbox"/> Tall open forest	
<i>Middle stratum</i>	
<input type="checkbox"/> Shrubland	<input type="checkbox"/> Open heath
<input type="checkbox"/> Tall shrubland	<input type="checkbox"/> Low closed heath
<input type="checkbox"/> Tall open shrubland	<input type="checkbox"/> Low open heath
<input type="checkbox"/> Low shrubland	<input type="checkbox"/> Tall closed scrub
<input type="checkbox"/> Scattered low shrubs	<input type="checkbox"/> Tall open scrub
<input type="checkbox"/> Low open shrubland	<input type="checkbox"/> Scattered tall shrubs
<input type="checkbox"/> Scattered tall shrubs	<input type="checkbox"/> Open shrubland
<input type="checkbox"/> Closed heath	<input type="checkbox"/> Scattered shrubs
<i>Lower stratum</i>	
<input type="checkbox"/> Closed hummock grassland	<input type="checkbox"/> Closed tussock grassland / sedgeland / herbland
<input type="checkbox"/> Mid-dense hummock grassland	<input type="checkbox"/> Tussock grass land / sedgeland / herbland
<input type="checkbox"/> Hummock grassland	<input type="checkbox"/> Open tussock grassland / sedgeland / herbland
<input type="checkbox"/> Open hummock grassland	<input type="checkbox"/> Scattered tussock / grasses / sedges / herbs
<input type="checkbox"/> Scattered hummock grassland	<input type="checkbox"/> Very open tussock grassland / herbland
Soil Type – options	
<input type="checkbox"/> Sand	<input type="checkbox"/> Silty loam
<input type="checkbox"/> Loamy sand	<input type="checkbox"/> Sand clay loam
<input type="checkbox"/> Clayey sand	<input type="checkbox"/> Clay

Observer's Name:	
<input type="checkbox"/> Clay loam	<input type="checkbox"/> Peat / organic
<input type="checkbox"/> Silty clay loam	<input type="checkbox"/> Stony
<input type="checkbox"/> Sandy loam	
Soil colour - options	
<input type="checkbox"/> Black	<input type="checkbox"/> Red
<input type="checkbox"/> Brown	<input type="checkbox"/> White
<input type="checkbox"/> Grey	<input type="checkbox"/> Yellow
<input type="checkbox"/> Orange	
Surface stones – options	
<input type="checkbox"/> None	<input type="checkbox"/> Boulders (>250mm)
<input type="checkbox"/> Pebbles (0-50mm)	<input type="checkbox"/> Rocks
<input type="checkbox"/> Cobbles (51-250)	

3.3 SURVEY AND REPORTING STAFF

Dr Scott Thompson undertook the field assessment from 19–23 October 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 near Leonora and Laverton 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. 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

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

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 are limited fauna survey data for the adjacent areas.
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 and season were both suitable for the field assessment.
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 project area was comprehensively searched for Malleefowl tracks and mounds, and to complete the fauna habitat assessment.
Access problems	N/A	
Problems with data and analysis, including sampling biases	No	

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 six broad fauna habitat types:

- Open Mulga shrubland on sandy soil (Plates 1-4);
- Mulga and chenopod shrubland on rocky soil (Plate 5-6);
- Mulga shrubland over rocky soil (Plate 7-8)
- Mulga on rocky slopes and hills (Plates 9-10)
- Shrubs on granite rocks and bedrock (Plates 11-12);
- Mulga drainage lines (Plate 13-14).

There are also areas disturbed by exploration activity and old mining activity (Plate 15-18).

There are drainage lines running in a north-east direction, with the main access road in the area bisecting the project area in a south-east to north-west direction. There are numerous other mining developments within 10km and a number of salt lakes to the north and east.



Plate 1. Open Mulga shrubland on sandy soil



Plate 2. Open Mulga shrubland on sandy soil



Plate 3. Open Mulga shrubland on sandy soil



Plate 4. Open Mulga shrubland on sandy soil



Plate 5. Mulga and chenopod shrubland on rocky soil



Plate 6. Mulga and chenopod shrubland on rocky soil



Plate 7. Mulga shrubland over rocky soil



Plate 8. Mulga shrubland over rocky soil



Plate 9. Mulga on rocky slopes and hills



Plate 10. Mulga on rocky slopes and hills



Plate 11. Shrubs on granite rocks and bedrock



Plate 12. Shrubs on granite rocks and bedrock



Plate 13. Mulga drainage lines



Plate 14. Mulga drainage lines



Plate 15. Disturbed by exploration activity and old mining activity



Plate 16. Disturbed by exploration activity and old mining activity



Plate 17. Disturbed by exploration activity and old mining activity



Plate 18. Disturbed by exploration activity and old mining activity

4.2 MALLEEFOWL

Malleefowl tracks were found in the project area (Plates 25-26). No Malleefowl nests were recorded.

4.3 FERAL PESTS

Rabbit scats (Plate 23-24) and tracks of cats and wild dogs (Plates 19-20) were present in the project area.



Plate 19. Rabbit scats



Plate 20. Rabbit scats



Plate 21. Cat tracks



Plate 22. Dog tracks

4.4 ARID BRONZE AZURE BUTTERFLY

There were a very low number of smooth-barked Eucalypts trees in the project area, which is a requirement for the *Camponotus terebrans* ant to be present.

4.5 FAUNA ASSEMBLAGE

4.6 BIOREGIONAL VERTEBRATE FAUNA ASSEMBLAGE

Appendix B provides a summary of the fauna survey data that are available near the project area. There are appreciable differences in the recorded fauna assemblages within and among fauna surveys shown in Appendix B. These differences are partially due to the 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 3-6 provide a list of vertebrate species potentially found near the project area that have been compiled based on the fauna survey report results shown in Appendix B. The water and wetland bird species in Table 3 are unlikely to be present in the project area due to a lack of suitable habitat.

Table 3. Birds potentially found near the project area

Family	Species	Common Name
Casuariidae	<i>Dromaius novaehollandiae</i>	Emu
Anatidae	<i>Cygnus atratus</i>	Black Swan
	<i>Tadorna tadornoides</i>	Australian Shelduck

Family	Species	Common Name
	<i>Chenonetta jubata</i>	Australian Wood Duck
	<i>Anas superciliosa</i>	Pacific Black Duck
	<i>Anas gracilis</i>	Grey Teal
	<i>Malacorhynchus membranaceus</i>	Pink-eared Duck

Family	Species	Common Name
	<i>Aythya australis</i>	Hardhead
	<i>Biziura lobata</i>	Musk Duck
Megapodiidae	<i>Leipoa ocellata</i>	Malleefowl
Phasianidae	<i>Coturnix pectoralis</i>	Stubble Quail
Podicipedidae	<i>Tachybaptus novaehollandiae</i>	Australasian Grebe
	<i>Poliiocephalus poliocephalus</i>	Hoary-headed Grebe
Columbidae	<i>Phaps chalcoptera</i>	Common Bronzewing
	<i>Ocyphaps lophotes</i>	Crested Pigeon
	<i>Geophaps plumifera</i>	Spinifex Pigeon
	<i>Geopelia cuneata</i>	Diamond Dove
Cuculidae	<i>Chrysococcyx basalis</i>	Horsfield's Bronze-Cuckoo
	<i>Chrysococcyx osculans</i>	Black-eared Cuckoo
Aegothelidae	<i>Aegotheles cristatus</i>	Australian Owlet-nightjar
Podargidae	<i>Podargus strigoides</i>	Tawny Frogmouth
Caprimulgidae	<i>Eurostopodus argus</i>	Spotted Nightjar
	<i>Apus pacificus</i>	Pacific Swift
Rallidae	<i>Tribonyx ventralis</i>	Black-tailed Nativehen
	<i>Fulica atra</i>	Eurasian Coot
Recurvirostridae	<i>Himantopus himantopus</i>	Black-winged Stilt
	<i>Himantopus leucocephalus</i>	Pied Stilt
	<i>Cladorhynchus leucocephalus</i>	Banded Stilt
	<i>Recurvirostra novaehollandiae</i>	Red-necked Avocet
Charadriidae	<i>Vanellus tricolor</i>	Banded Lapwing
	<i>Charadrius ruficapillus</i>	Red-capped Plover
	<i>Erythronys cinctus</i>	Red-kneed Dotterel
	<i>Elseyonis melanops</i>	Black-fronted Dotterel
Scolopacidae	<i>Actitis hypoleucos</i>	Common Sandpiper
Turnicidae	<i>Turnix velox</i>	Little Buttonquail

Family	Species	Common Name
Laridae	<i>Chlidonias hybrida</i>	Whiskered Tern
Otididae	<i>Ardeotis australis</i>	Australian Bustard
Ardeidae	<i>Ardea pacifica</i>	White-necked Heron
	<i>Egretta novaehollandiae</i>	White-faced Heron
Accipitridae	<i>Haliaeetus albicilla</i>	
Anhingidae	<i>Anhinga melanogaster</i>	Australasian Darter
Accipitridae	<i>Hamirostra melanosternon</i>	Black-breasted Buzzard
	<i>Hieraaetus morphnoides</i>	Little Eagle
	<i>Aquila audax</i>	Wedge-tailed Eagle
	<i>Circus assimilis</i>	Spotted Harrier
	<i>Accipiter fasciatus</i>	Brown Goshawk
	<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk
	<i>Milvus migrans</i>	Black Kite
	<i>Haliastur sphenurus</i>	Whistling Kite
Cuculidae	<i>Heteroscenes pallidus</i>	Pallid Cuckoo
Strigidae	<i>Ninox boobook</i>	Southern Boobook
Alcedinidae	<i>Todiramphus pyrrhopygius</i>	Red-backed Kingfisher
Meropidae	<i>Merops ornatus</i>	Rainbow Bee-eater
Falconidae	<i>Falco cenchroides</i>	Nankeen Kestrel
	<i>Falco longipennis</i>	Australian Hobby
	<i>Falco berigora</i>	Brown Falcon
	<i>Falco peregrinus</i>	Peregrine Falcon
Megaluridae	<i>Poodytes carteri</i>	Spinifexbird
Cacatuidae	<i>Eolophus roseicapilla</i>	Galah
	<i>Cacatua sanguinea</i>	Little Corella
	<i>Nymphicus hollandicus</i>	Cockatiel
Psittaculidae	<i>Neopsephotus bourkii</i>	Bourke's Parrot

Family	Species	Common Name
	<i>Barnardius zonarius</i>	Australian Ringneck
	<i>Psephotus varius</i>	Mulga Parrot
	<i>Melopsittacus undulatus</i>	Budgerigar
Ptilonorhynchidae	<i>Chlamydera guttata</i>	Western Bowerbird
Climacteridae	<i>Climacteris affinis</i>	White-browed Treecreeper
Maluridae	<i>Amytornis striatus</i>	Striated Grasswren
	<i>Stipiturus ruficeps</i>	Rufous-crowned Emuwren
	<i>Malurus assimilis</i>	Purple-backed Fairywren
	<i>Malurus lamberti</i>	Variiegated Fairywren
	<i>Malurus splendens</i>	Splendid Fairywren
	<i>Malurus leucopterus</i>	White-winged Fairywren
	<i>Malurus leucopterus</i>	White-winged Fairywren
Meliphagidae	<i>Certhionyx variegatus</i>	Pied Honeyeater
	<i>Purnella albifrons</i>	White-fronted Honeyeater
	<i>Manorina flavigula</i>	Yellow-throated Miner
	<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater
	<i>Anthochaera carunculata</i>	Red Wattlebird
	<i>Gavicalis virescens</i>	Singing Honeyeater
	<i>Ptilotula penicillata</i>	White-plumed Honeyeater
	<i>Ptilotula keartlandi</i>	Grey-headed Honeyeater
	<i>Conopophila whitei</i>	Grey Honeyeater
	<i>Epthianura tricolor</i>	Crimson Chat
	<i>Epthianura aurifrons</i>	Orange Chat
	<i>Sugomel nigrum</i>	Black Honeyeater
	<i>Lichmera indistincta</i>	Brown Honeyeater
	<i>Nesoptilotis flavicollis</i>	Yellow-throated Honeyeater
Pardalotidae	<i>Pardalotus striatus</i>	Striated Pardalote
Acanthizidae	<i>Pyrrholaemus brunneus</i>	Redthroat

Family	Species	Common Name
	<i>Acanthiza iredalei</i>	Slender-billed Thornbill
	<i>Acanthiza apicalis</i>	Inland Thornbill
	<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill
	<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill
	<i>Acanthiza robustirostris</i>	Slaty-backed Thornbill
	<i>Smicromis brevirostris</i>	Weebill
	<i>Gerygone fusca</i>	Western Gerygone
	<i>Aphelocephala leucopsis</i>	Southern Whiteface
	<i>Aphelocephala nigricincta</i>	Banded Whiteface
Pomatostomidae	<i>Pomatostomus temporalis</i>	Grey-crowned Babbler
	<i>Pomatostomus superciliosus</i>	White-browed Babbler
Cinclosoma	<i>castaneothorax</i>	Chestnut-breasted Quail-thrush
Cinclosoma	<i>cinnamomeum</i>	Cinnamon Quail-thrush
Campephagidae	<i>Coracina maxima</i>	Ground Cuckooshrike
	<i>Coracina novaehollandiae</i>	Black-faced Cuckooshrike
	<i>Lalage tricolor</i>	White-winged Triller
Neosittidae	<i>Daphoenositta chrysoptera</i>	Varied Sittella
Oreocidae	<i>Oreoica gutturalis</i>	Crested Bellbird
Pachycephalidae	<i>Colluricincla harmonica</i>	Grey Shrikethrush
	<i>Pachycephala rufiventris</i>	Rufous Whistler
Artamidae	<i>Artamus personatus</i>	Masked Woodswallow
	<i>Artamus superciliosus</i>	White-browed Woodswallow
	<i>Artamus cinereus</i>	Black-faced Woodswallow
	<i>Artamus cyanopterus</i>	Dusky Woodswallow

Family	Species	Common Name
	<i>Artamus minor</i>	Little Woodswallow
	<i>Cracticus torquatus</i>	Grey Butcherbird
	<i>Cracticus nigrogularis</i>	Pied Butcherbird
	<i>Gymnorhina tibicen</i>	Australian Magpie
	<i>Strepera versicolor</i>	Grey Currawong
Rhipiduridae	<i>Rhipidura leucophrys</i>	Willie Wagtail
	<i>Rhipidura albiscapa</i>	Grey Fantail
Monarchidae	<i>Grallina cyanoleuca</i>	Magpie-lark
Corvidae	<i>Corvus orru</i>	Torresian Crow
	<i>Corvus bennetti</i>	Little Crow
	<i>Corvus coronoides</i>	Australian Raven
Petroicidae	<i>Microeca fascinans</i>	Jacky Winter
	<i>Petroica goodenovii</i>	Red-capped Robin
	<i>Melanodryas cucullata</i>	Hooded Robin

Family	Species	Common Name
Alaudidae	<i>Mirafra javanica</i>	Australasian Bushlark
Locustellidae	<i>Cincloramphus cruralis</i>	Brown Songlark
	<i>Cincloramphus mathewsi</i>	Rufous Songlark
Hirundinidae	<i>Hirundo rustica</i>	Barn Swallow
	<i>Hirundo neoxena</i>	Welcome Swallow
	<i>Petrochelidon nigricans</i>	Tree Martin
	<i>Cheramoeca leucosterna</i>	White-backed Swallow
Dicaeidae	<i>Dicaeum hirundinaceum</i>	Mistletoebird
Estrildidae	<i>Emblema pictum</i>	Painted Finch
	<i>Taeniopygia guttata</i>	Zebra Finch
Motacillidae	<i>Anthus novaeseelandiae</i>	Australasian Pipit

Table 4. Amphibians potentially found near the project area

Family	Species	Common Name
Limnodynastidae	<i>Neobatrachus kunapalari</i>	Wheatbelt Frog
	<i>Neobatrachus sutor</i>	Shoemaker Frog
	<i>Neobatrachus wilmorei</i>	Plonking Frog
	<i>Notaden nichollsi</i>	Desert Spadefoot
	<i>Platyplectrum spenceri</i>	Spencer's Burrowing Frog

Family	Species	Common Name
Myobatrachidae	<i>Pseudophryne occidentalis</i>	Western Toadlet
Pelodyadidae	<i>Cyclorana maini</i>	Main's Frog
	<i>Cyclorana occidentalis</i>	Western Water-holding Frog
	<i>Litoria rubella</i>	Desert Tree Frog

Table 5. Mammals potentially found near the project area

Family	Species	Common Name
Tachyglossidae	<i>Tachyglossus aculeatus</i>	Short-beaked Echidna
Bovidae	<i>Bos taurus</i>	Cow
	<i>Capra hircus</i>	Goat
	<i>Ovis aries</i>	Sheep
Camelidae	<i>Camelus dromedarius</i>	Dromedary
Canidae	<i>Canis lupus</i>	Dingo

Family	Species	Common Name
	<i>Vulpes vulpes</i>	Red Fox
Felidae	<i>Felis catus</i>	Cat
Molossidae	<i>Austronomus australis</i>	White-striped Freetail Bat
	<i>Mormopterus planiceps</i>	Southern Free-tail Bat
	<i>Mormopterus</i> sp. 4	South-western Free-tail Bat

Family	Species	Common Name	Family	Species	Common Name
Vespertilionidae	<i>Nyctophilus</i> sp.	Long-eared Bat sp.		<i>Sminthopsis longicaudata</i>	Long-tailed Dunnart
	<i>Chalinolobus gouldii</i>	Gould's Wattled Bat		<i>Sminthopsis macroura</i>	Stripe-faced Dunnart
	<i>Chalinolobus morio</i>	Chocolate Wattled Bat		<i>Sminthopsis murina</i>	Slender-tailed Dunnart
	<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat		<i>Sminthopsis ooldea</i>	Ooldea Dunnart
	<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat		<i>Sminthopsis youngsoni</i>	Lesser Hairy-footed Dunnart
Dasyuridae	<i>Ningai</i> sp.	Ningai sp.	Macropodidae	<i>Macropus fuliginosus</i>	Western Grey Kangaroo
	<i>Planigale</i> sp.	Planigale sp.		<i>Osphranter robustus</i>	Euro
	<i>Antechinomys laniger</i>	Kultarr		<i>Osphranter rufus</i>	Red Kangaroo
	<i>Dasymercus blythi</i>	Brush-tailed Mulgara	Phalangeridae	<i>Trichosurus vulpecula</i>	Common Brushtail Possum
	<i>Dasykaluta rosamondae</i>	Kaluta	Leporidae	<i>Oryctolagus cuniculus</i>	Rabbit
	<i>Ningai ridei</i>	Wongai Ningai	Equidae	<i>Equus asinus</i>	Donkey
	<i>Ningai yvonneae</i>	Mallee Ningai		<i>Equus caballus</i>	Horse
	<i>Pseudantechinus woolleyae</i>	Woolley's False Antechinus	Muridae	<i>Leporillus apicalis</i>	Lesser Stick-nest Rat
	<i>Sminthopsis crassicaudata</i>	Fat-tailed Dunnart		<i>Mus musculus</i>	House Mouse
	<i>Sminthopsis dolichura</i>	Little Long-tailed Dunnart		<i>Notomys alexis</i>	Spinifex Hopping Mouse
	<i>Sminthopsis hirtipes</i>	Hairy-footed Dunnart			

Table 6. Reptiles potentially found near the project area

Family	Species	Common Name	Family	Species	Common Name
Agamidae	<i>Ctenophorus caudicinctus</i>	Ring-tailed Dragon		<i>Ctenophorus salinarum</i>	Saltpan Dragon
	<i>Ctenophorus cristatus</i>	Crested Dragon		<i>Ctenophorus scutulatus</i>	Lozenge-marked Dragon
	<i>Ctenophorus fordi</i>	Mallee Dragon		<i>Diporiphora amphiboluroides</i>	Mulga Dragon
	<i>Ctenophorus inermis</i>	Military Dragon		<i>Diporiphora valens</i>	Southern Pilbara Tree Dragon
	<i>Ctenophorus infans</i>	Ring-tailed Dragon		<i>Gowidon longirostris</i>	Long-nosed Dragon
	<i>Ctenophorus isolepis</i>	Central Military Dragon		<i>Moloch horridus</i>	Thorny Devil
	<i>Ctenophorus isolepis</i>	Central Military Dragon		<i>Pogona minor</i>	Western Bearded Dragon
	<i>Ctenophorus maculatus</i>	Spotted Dragon		<i>Tympanocryptis cephalus</i>	Pebble Dragon
	<i>Ctenophorus nuchalis</i>	Central Netted Dragon	Carphodactylidae	<i>Nephrurus laevis</i>	Smooth Knob-tail
	<i>Ctenophorus reticulatus</i>	Western Netted Dragon		<i>Nephrurus levis</i>	Three-lined Knob-tail

Family	Species	Common Name
	<i>Nephurus vertebralis</i>	Midline Knob-tail
	<i>Underwoodisaurus milii</i>	Barking Gecko
Diplodactylidae	<i>Diplodactylus conspicillatus</i>	Fat-tailed Gecko
	<i>Diplodactylus granariensis</i>	Wheatbelt Stone Gecko
	<i>Diplodactylus pulcher</i>	Beautiful Gecko
	<i>Lucasium damaeum</i>	Beaded Gecko
	<i>Lucasium squarrosum</i>	Mottled Ground Gecko
	<i>Lucasium stenodactylum</i>	Crowned Gecko
	<i>Rhynchoedura ornata</i>	Beaked Gecko
	<i>Strophurus ciliaris</i>	Spiny-tailed Gecko
	<i>Strophurus elderi</i>	Jewelled Gecko
	<i>Strophurus strophurus</i>	Western Spiny-tailed Gecko
	<i>Strophurus wellingtonae</i>	Western Shield Spiny-tailed Gecko
Elapidae	<i>Brachyuropis fasciolatus</i>	Narrow-banded Burrowing Snake
	<i>Brachyuropis semifasciata</i>	Half-girdled Snake
	<i>Demansia psammophis</i>	Yellow-faced Whipsnake
	<i>Demansia rufescens</i>	Rufous Whipsnake
	<i>Furina ornata</i>	Orange-naped Snake
	<i>Parasuta monachus</i>	Hooded Snake
	<i>Pseudechis australis</i>	Mulga Snake
	<i>Pseudechis butleri</i>	Spotted Mulga Snake
	<i>Pseudonaja mengdeni</i>	Western Brown Snake
	<i>Pseudonaja modesta</i>	Ringed Brown Snake
	<i>Simoselaps anomalus</i>	Desert Banded Snake
	<i>Simoselaps bertholdi</i>	Jan's Banded Snake
	<i>Suta fasciata</i>	Rosen's Snake
Gekkonidae	<i>Christinus marmoratus</i>	Marbled Gecko

Family	Species	Common Name
	<i>Gehyra punctata</i>	Spotted Dtella
	<i>Gehyra purpurascens</i>	Purplish Dtella
	<i>Gehyra variegata</i>	Variogated Gehyra
	<i>Heteronotia binoei</i>	Bynoe's Gecko
	<i>Gehyra xenopus</i>	Crocodile-faced Dtella
Pygopodidae	<i>Aprasia picturata</i>	Black-headed Worm-lizard
	<i>Delma butleri</i>	Unbanded Delma
	<i>Delma nasuta</i>	Sharp-snouted Delma
	<i>Delma pax</i>	Peace Delma
	<i>Lialis burtonis</i>	Burton's Legless Lizard
	<i>Pygopus nigriceps</i>	Western Hooded Scaly-foot
Pythonidae	<i>Antaresia perthensis</i>	Pygmy Python
Scincidae	<i>Carlia triacantha</i>	Desert Rainbow-skink
	<i>Cryptoblepharus buchananii</i>	Buchanan's Snake-eyed Skink
	<i>Cryptoblepharus plagioccephalus</i>	Peron's Snake-eyed Skink
	<i>Ctenotus ariadnae</i>	Ariadna's Ctenotus
	<i>Ctenotus atlas</i>	Southern Mallee Ctenotus
	<i>Ctenotus brooksi</i>	Wedgsnout Ctenotus
	<i>Ctenotus calurus</i>	Blue-tailed Finesnout Ctenotus
	<i>Ctenotus dux</i>	Fine Side-lined Ctenotus
	<i>Ctenotus grandis</i>	Grand Ctenotus
	<i>Ctenotus greeri</i>	Spotted-necked Ctenotus
	<i>Ctenotus helenae</i>	Clay-soil Ctenotus
	<i>Ctenotus leae</i>	Orange-tailed Finesnout Ctenotus
	<i>Ctenotus leonhardii</i>	Leonhardi's Ctenotus
	<i>Ctenotus nasutus</i>	Nasute Finsnout Ctenotus
	<i>Ctenotus pantherinus</i>	Leopard Ctenotus
	<i>Ctenotus piankai</i>	Coarse Sands Ctenotus
	<i>Ctenotus quattuordecimlineatus</i>	Fourteen-lined Ctenotus

Family	Species	Common Name
	<i>Ctenotus schomburgkii</i>	Barred Wedgesnout Ctenotus
	<i>Ctenotus severus</i>	Stern Ctenotus
	<i>Ctenotus uber</i>	Spotted Ctenotus
	<i>Cyclodomorphus melanops</i>	Spinifex Slender Blue-tongue
	<i>Egernia depressa</i>	Southern Pygmy Spiny-tailed Skink
	<i>Egernia formosa</i>	Goldfields Crevice Skink
	<i>Eremiascincus fasciolatus</i>	Narrow-banded Sand Swimmer
	<i>Eremiascincus richardsonii</i>	Broad-banded Sand-swimmer
	<i>Lerista amicornum</i>	Fortescue Slider
	<i>Lerista bipes</i>	North-western Sandslider
	<i>Lerista desertorum</i>	Central Desert Robust Slider
	<i>Lerista distinguenda</i>	South-western Orange-tailed Slider
	<i>Lerista ips</i>	Robust Duneslider
	<i>Lerista kingi</i>	King's Slider
	<i>Lerista macropisthopus</i>	Unpatterned Robust Slider
	<i>Lerista neander</i>	Pilbara Robust Slider
	<i>Lerista picturata</i>	Southern Robust Slider
	<i>Lerista timida</i>	Timid Slider
	<i>Lerista vermicularis</i>	Slender Duneslider

Family	Species	Common Name
	<i>Liopholis striata</i>	Nocturnal Desert Skink
	<i>Menetia greyii</i>	Common Dwarf Skink
	<i>Morethia butleri</i>	Woodland Morethia Skink
	<i>Morethia ruficauda</i>	Lined Fire-tailed Skink
	<i>Proablepharus reginae</i>	Western Soil-crevice Skink
	<i>Tiliqua multifasciata</i>	Central Blue-tongue
	<i>Tiliqua occipitalis</i>	Western Blue-tongued Lizard
	<i>Tiliqua rugosa</i>	Bobtail
Typhlopidae	<i>Anilius australis</i>	Austral Blind Snake
	<i>Anilius bicolor</i>	Dark-spined Blind Snake
	<i>Anilius grypus</i>	Long-beaked Blind Snake
	<i>Anilius hamatus</i>	Pale-headed Blind Snake
	<i>Anilius waitii</i>	Waite's Blind Snake
Varanidae	<i>Varanus acanthurus</i>	Spiny-tailed Monitor
	<i>Varanus brevicauda</i>	Short-tailed Pygmy Monitor
	<i>Varanus caudolineatus</i>	Stripe-tailed Monitor
	<i>Varanus eremius</i>	Pygmy Desert Monitor
	<i>Varanus giganteus</i>	Perentie
	<i>Varanus gilleni</i>	Pygmy Mulga Monitor
	<i>Varanus gouldii</i>	Gould's Goanna
	<i>Varanus panoptes</i>	Yellow-spotted Monitor
	<i>Varanus tristis</i>	Black-headed Monitor

4.7 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. Two threatened species of fauna and one migratory/marine species of birds identified under the *EPBC Act 1999* potentially occur in the project area. There are three Schedule species listed under the *BC Act 2016* and one species listed on the DBCA's Priority Fauna List that potentially occur in the project area. The following is an assessment of the likelihood of each of the species listed in Table 7 being found in the project area.

Table 7. Assessment of the potential presence of a conservation significant fauna species in the project area

Species	DBCAs Schedule / Priority	Status under Commonwealth EPBC Act	Comment on the potential presence of a species
Night Parrot <i>Pezoporus occidentalis</i>	Critically Endangered	Endangered	Highly unlikely to be in the project area due to a lack of suitable habitat (i.e. mature spinifex). The potential for impacting on this species is therefore very low.
Arid Bronze Azure Butterfly <i>Ogyris subterrestris petrina</i>	Critically Endangered	Critically Endangered	A lack of smooth-barked Eucalypt trees and thus <i>Camponotus terebrans</i> ants means it is highly improbable that the butterfly will be present and therefore impacted.
Sandhill Dunnart <i>Sminthopsis psammophila</i>	Endangered	Endangered	Highly unlikely to be in the project area due to a lack of suitable habitat (i.e. mature spinifex). The potential for impacting on this species is therefore very low.
Malleefowl <i>Leipoa ocellata</i>	Vulnerable	Vulnerable	No Malleefowl nesting mounds were recorded, however, Malleefowl tracks were present.
Grey Falcon <i>Falco hypoleucos</i>	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.
Chuditch <i>Dasyurus geoffroii</i>	Vulnerable	Vulnerable	Highly unlikely to occur in the project area. The potential for impacting on this species is therefore very low.
Princess Parrot <i>Polytelis alexandrae</i>	Priority 4	Vulnerable	May infrequently be seen in the region, however, clearing vegetation is unlikely to impact on this species.
Mulgara <i>Dasyercus blythi</i>	Priority 4		Highly unlikely to be in the project area due to a lack of suitable habitat (i.e. mature spinifex). The potential for impacting on this species is therefore very low.
Oriental Plover <i>Charadrius veredus</i>	Migratory	Migratory	Unlikely to be in the project area due to a lack of suitable habitat. The potential for impacting on this species is therefore low.
Fork-tailed Swift <i>Apus pacificus</i>	Migratory	Migratory	May very infrequently be seen in the region, however, clearing vegetation is unlikely to impact on this aerial species.
Grey Wagtail <i>Motacilla cinerea</i>	Migratory	Migratory	Highly unlikely to be present in the project area. The potential for impacting on this species is therefore low.
Yellow Wagtail <i>Motacilla flava</i>	Migratory	Migratory	Highly unlikely to be present in the project area. The potential for impacting on this species is therefore low.
Peregrine Falcon <i>Falco peregrinus</i>	OS		May infrequently be seen in the region, however, clearing vegetation is unlikely to impact on this species.
Long tailed Dunnarts <i>Sminthopsis longicaudata</i>	P4		May be present in the breakaway areas and rocky hills in the project area.

IA – Migratory birds protected under international agreements;

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 the semi-arid and arid Australia (Garnett et al. 2011, Threatened Species Scientific Committee 2016). Recordings in north-west and western Queensland in the early 1990-2000s were in a broad cross section of the habitats available (Cupitt and Cupitt 2008, Garnett et al. 2011, Boles et al. 2016). There have been recent sightings in the Pilbara in 1980, 2005 and 2017, central WA in 1979, north-eastern South Australia in 1979, western Queensland (including Pullen-Pullen-Mt Windsor-Diamantina population) in 1980, 1990, 1993, 2006 and 2013-17 (Davis and Metcalf 2008, Garnett et al. 2011, Charalambous 2016, Pickrell 2016, AG staff 2017, Palaszczuk and Miles 2017, Rykers 2017, AG staff 2018), Pilbara in 2017 (Jones 2017), and the northern Goldfields (Jackett et al. 2017). Garnett et al. (2011) suggested that there were between 50-250 mature individuals in less than 5% of its previous range. Prior to 2007 there were very few records of the Night Parrot (Plate 23).

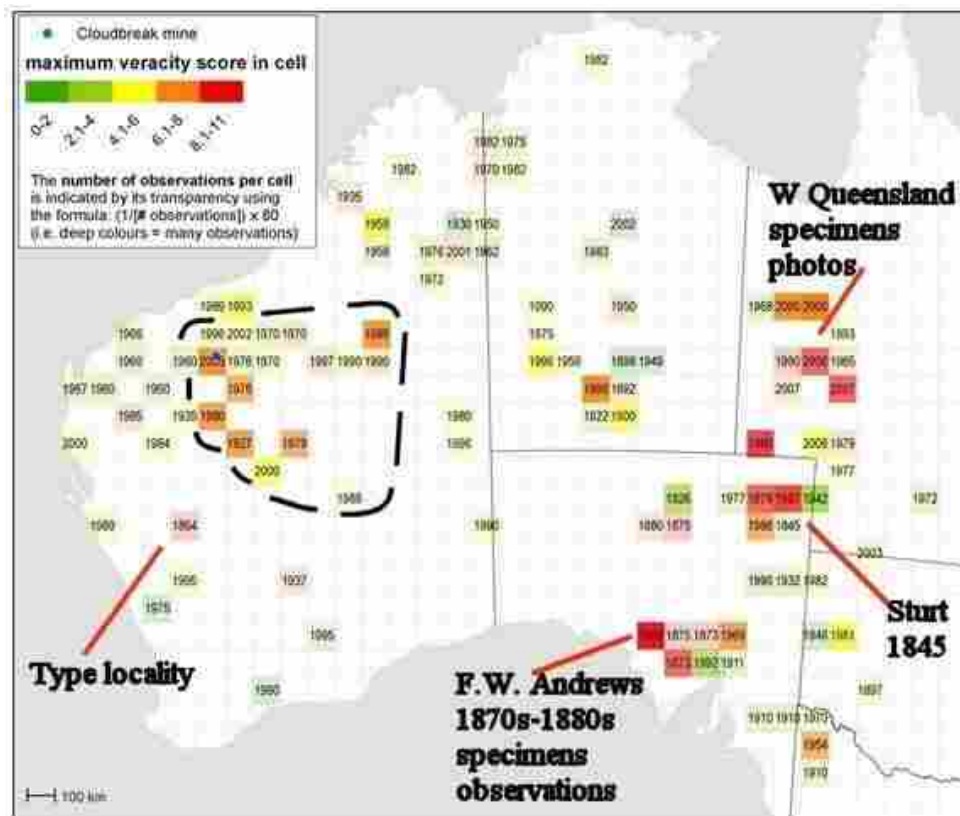


Plate 23. Map of historical Night Parrot records compiled by S. Murphy et al., including records to 2007

(taken from <https://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/threatened-animals/night-parrot>)

Wilson’s (1937) summary of observations provided information on the early records of Night Parrots’ preferred habitat and breeding sites. Recent information indicates its preferred habitat appears to be in *Triodia* grasslands, chenopod shrublands, shrubby samphire and floristically diverse habitats dominated by large-seeded species (Threatened Species Scientific Committee 2016, McCarthy 2017, Murphy et al. 2017b). At Pullen Pullen Reserve it nests in large, more or less ring-shaped *Triodia*, and the nest consists of a tunnel (25-30° and

0° to the ground; 20-33cm long) through an apron of dead spinifex leaves that leads to a chamber under a live hummock, with a shallow depression (3-4cm) excavated into the gravelly/sandy soil (Murphy et al. 2017a). In the northern Goldfields the nest was again in a spinifex hummock; it was circular, with an excavated depression (~1.5-2.0cm) in sandy substrate (Hamilton et al. 2017, Jackett et al. 2017). The entrance tunnel was 62cm long, and was downward sloping (27°) with the entrance 28cm above the ground (Hamilton et al. 2017). It has clutches of two to four sub-elliptical, white eggs with a lustrous appearance (Murphy et al. 2017a). Breeding followed significant rains in March for the observations in Pullen-Pullen Reserve and in April in the northern Goldfields (Hamilton et al. 2017, Murphy et al. 2017a), but it is thought that breeding generally occurs between April and October (Murphy et al. 2017a).

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.

The project area is within the high priority area for Night Parrots as indicated by the then Department of Parks and Wildlife (Plate 24; 2017). Both the Commonwealth and State government assessors may require a Night Parrot survey for particular project areas where there is long-unburnt spinifex.

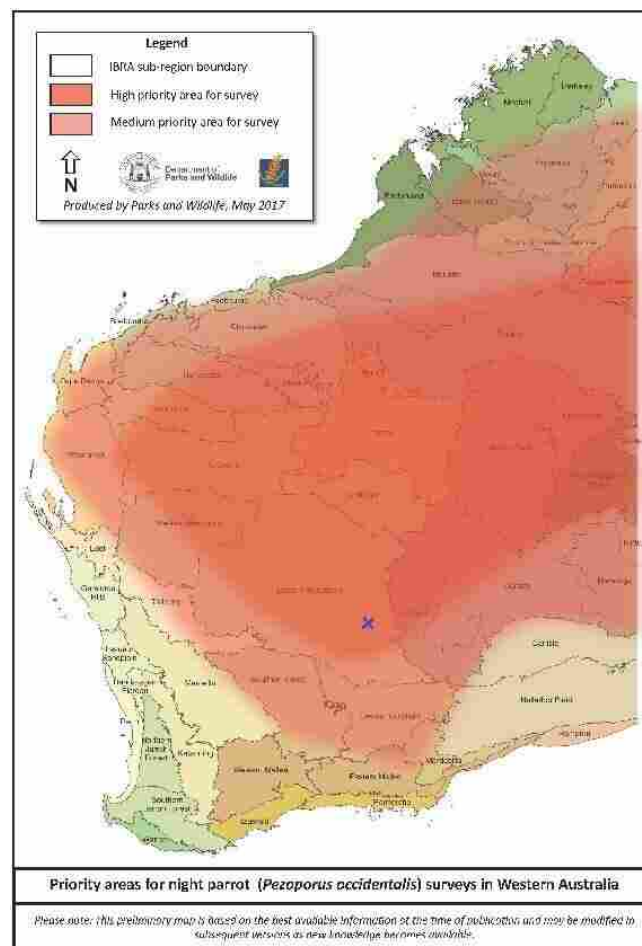


Plate 24. Probability of finding a Night Parrot in Western Australia, with the project area marked as a blue cross

The Night Parrot has been recorded in the northern goldfields and the record is thought to be about 370km north of the project area. There is no mature, ring-forming spinifex in the project area, the preferred roosting and nesting habitat for Night Parrots; therefore it is highly unlikely that it is present in the project area.

Arid Bronze Azure Butterfly (*Ogyris subterrestris petrina*) – Critically endangered under the *BC Act 2016* and *EPBC Act 1999*

Arid Bronze Azure Butterfly is associated with colonies of the ant *Camponotus terebrans* in mallee vegetation on sandy soil, often near flood plains, and the ant typically digs its nest at the base of eucalypts (Threatened Species Scientific Committee 2014). Butterfly larvae hatching from eggs laid near an ant nest entrance (often near the bases of various mallee eucalypts) are carried, by the ants, into their nest. Details of *C. terebrans* biology and of any form of herbivory by the larvae are unknown; however, it is likely that the larvae are myrmecophilous. These butterflies fly close to the ground and have been observed flying over agricultural lands near presumed breeding colonies (Williams and Williams 2008). The goldfields population was originally known from Lake Douglas, about 12kms south-west of Kalgoorlie (Field 1999), however, this population is reported to have become extinct (Williams et al. 2008, Williams and Williams 2008, Williams et al. 2018) and also in the Barbalin Nature Reserve (~11km west of Mukinbudin) in the Avon Wheatbelt (Threatened Species Scientific Committee 2014). There is also an additional extant population 100km from Barbalin Nature Reserve but the DBCA have not provided its location.

Camponotus terebrans is typically only found in areas with smooth bark Eucalypts including Gimlet (*Eucalyptus salubris*) and Lake Grace Gum (*Eucalyptus loxophleba* ssp. *gratiae*), but also Wheatbelt Wandoo (*E. capillosa capillosa*) and Salmon Gum (*E. salmonophloia*). At Lake Douglas, the host tree was *Eucalyptus concinna* (Field 1999, Threatened Species Scientific Committee 2014).

Williams and Williams (2008) commented that 'Over 30 surveys have been conducted in the region by DEC staff and experienced volunteers between 1992 and 2008' (p. 8) and 'include extensive surveys between Payne's Find and Kalgoorlie, including most of the major conservation reserves. The surveys have covered extensive parts of the region in which *O. s. petrina* might occur, but have not detected any individuals or additional populations of the butterfly' (p. 8). The fact that further populations have not been located, despite the species being conspicuous, demonstrates the rarity of this butterfly and the significance of the Barbalin site.' (Williams and Williams 2008)(p. 9).

There were only a very small number of smooth-barked Eucalypt trees (i.e. *Eucalyptus salubris*) near the eastern extent of the project area. Due to the lack of suitable habitat *Camponotus terebrans* will not be present, so it is highly improbable that the Arid Bronze Azure Butterfly is present, without *C. terebrans* being present.

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

The Sandhill Dunnart is the second largest of the dunnarts and its three extant populations are in the western Great Victoria Desert, Yellabinna Regional Reserves in the south-eastern Great Victoria Desert and the Eyre Peninsula in South Australia. In WA its habitat is sandplains and dunes with mature hummock grassland often in association with Mallee, Marble Gum and Callitris (GHD 2020). This is a highly mobile species that typically shelters during the day in stands of mature spinifex.

There is no mature spinifex hummocks in the project area nor is there any sand dunes, so it is highly improbable that the Sandhill Dunnart is present in the project area.

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.

Malleefowl have been observed in the bioregion, however, there are no recent records of active breeding mounds in the vicinity of the project area. Although no Malleefowl mounds were recorded, Malleefowl tracks were relatively common in the Open Mulga with sandy soil, indicating that they are foraging in the project area (Plates 25 and 26).



Plate 25. Malleefowl tracks



Plate 26. Malleefowl tracks

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.

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 further to the east.

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 at Leonora and in atypical habitat. As the project area is a significantly long way north-east of the species known distribution it is unlikely that the Chuditch would be found in the project area and the habitat is not suitable. 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.

It is a nomadic species that moves around the arid interior of Australia in search of resources. If it was present any proposed development is unlikely to significantly impact on this species as it will move away to other areas if it is disturbed.

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

The Long-tailed Dunnart (*Sminthopsis longicaudata*) is listed as a Priority 4 species with the Department of Environment and Conservation. Burbidge et al. (2008) summarised its habitat as widely scattered in the 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 were 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, and an unnamed mine east of Granny Smith (pers. comm.). There are also other unpublished records in the vicinity of the project area. This dunnart is likely to be in the project area in the breakaway and rocky areas. If the proposed development and mining area does not impact on the breakaway and rocky areas, then it is unlikely that it will have a significant impact on this species.

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

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

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

Fauna habitat in the project area is generally not suitable for Mulgara (i.e. lack of spinifex hummocks), so it is highly unlikely that Mulgara are present in the project area.

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

A migrant species with patchy distribution in Australia, the Oriental Plover is sparsely distributed across arid and semi-arid Australia but avoids truly desert regions. Its preferred habitat is dry plains. It was not recorded in other fauna surveys undertaken near the project area. The species is under threat because of habitat reduction due to agriculture and changing fire regimes. 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 earth, usually only for breeding. It is common in the Kimberley, uncommon to moderately common near northwest, west and southeast coasts and rare to scarce elsewhere. It is rarely seen in the Goldfields (Plate 27), so it is unlikely to be impacted by the proposed development.

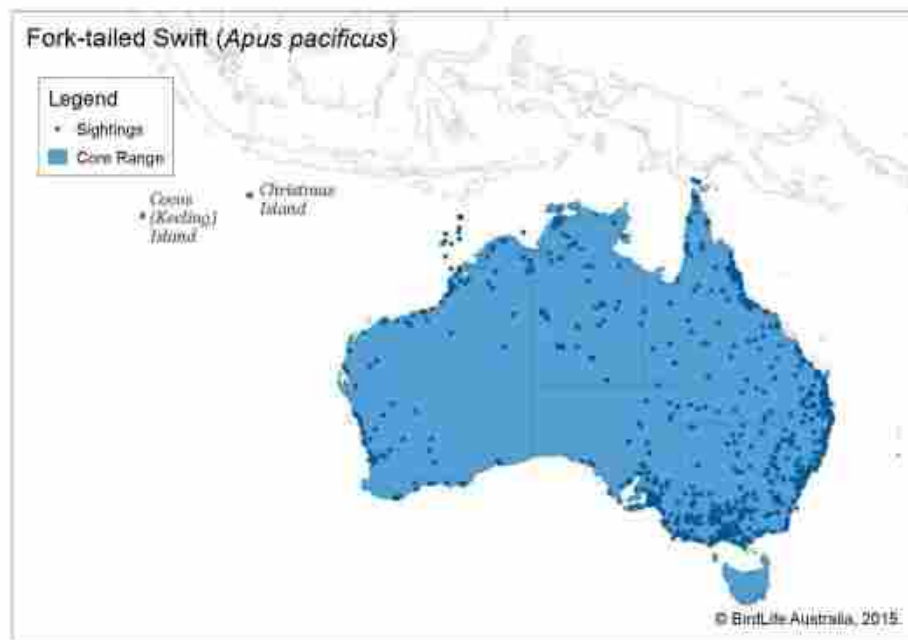


Plate 27. Range and actual reported sightings of the Fork-tailed Swift

(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 28) so it is unlikely to be impacted by the proposed development.

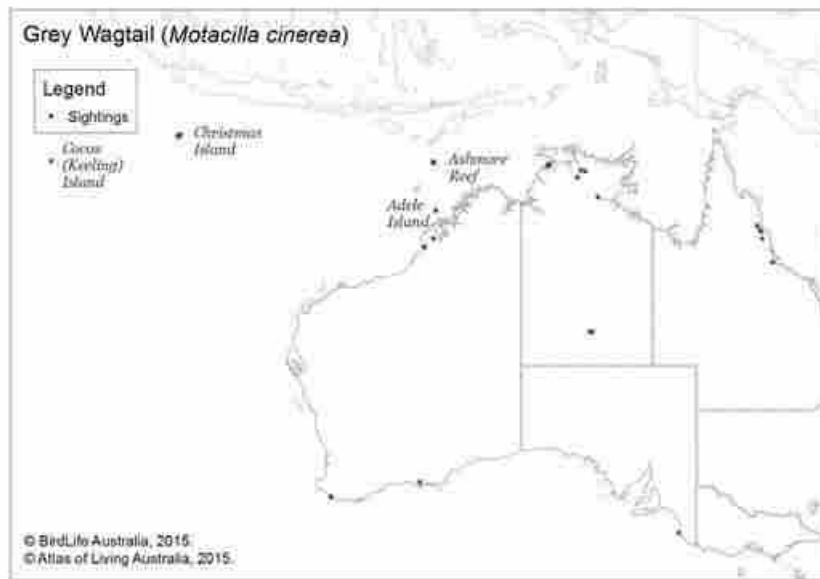


Plate 28. Reported sightings of the Grey Wagtail

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

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

The Yellow Wagtail is found in the millions in the northern hemisphere and the Atlas of Living Australia records multiple records of this bird in Australia in the coastal areas. There are no records for this species in inland Western Australia near the project area (Plate 29), therefore it is highly unlikely to be impacted by the proposed development.

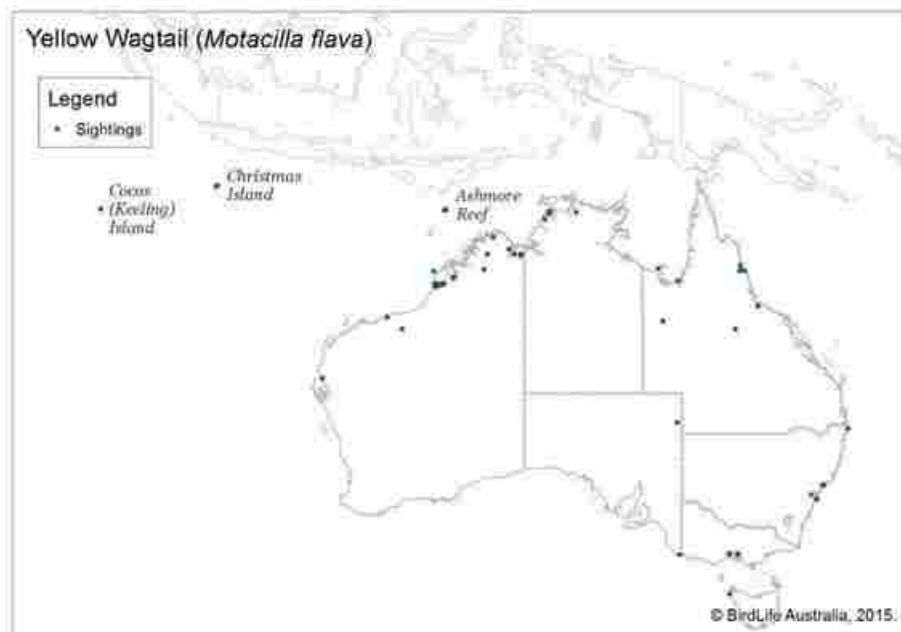


Plate 29. Reported sightings of the Yellow Wagtail

(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, development 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.

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 1,404ha in an area where there is very little quantified fauna survey data for similar habitat in adjacent area. The project area has been partially disturbed for mining activity and exploration machinery were on-site during the field work undertaking exploratory drilling. There is a vast quantity of similar habitat in adjacent areas, so the fauna assemblage in the project area will be similar to that in adjacent areas. It is unlikely that further survey effort in the project area will provide new species not previously identified for this region.

5.1.1 Amphibians

Frogs are normally only detected immediately after rainfall or around semi-permanent pools. It is likely that *Cyclorana maini*, *Pseudophryne occidentalis*, *Neobatrachus kunapalari* and *Neobatrachus wilsmorei* could also be found in the general area. These species, other than *P. occidentalis* and *L. rubella*, burrow into the ground and aestivate between rainfall events. *Pseudophryne occidentalis* and *L. rubella* find shelter under rocks and in crevices during the dry periods and enter temporary ponds to breed after major rainfall events. All species have a wide-spread distribution and are abundant. Development of the project area is likely to result in a loss of individuals within the disturbed area, however, is unlikely to have a significant impact on these species when assessed in a regional context.

5.1.2 Reptiles

Typically, between 25 and 35 species of reptiles are caught in open Acacia woodland (Coffey Environments 2008, Terrestrial Ecosystems 2010, 2011a, 2020). However, the sparse ground cover and lack of leaf litter in much of the project area will mean the terrestrial vertebrate fauna will be in low abundance. None of the species likely to be in the project area are of conservation significance. Given that there were large expanses of similar habitat in adjacent areas, development of the project area is unlikely to have significant impact on reptiles when assessed in a regional context.

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 project area is likely to support a similar assemblage to that present in the adjacent areas.

Malleefowl are present in the area, but no breeding mounds were found after an extensive search. Given the sparseness of the vegetation and the presence of wild dogs and feral cats, Malleefowl are likely to be in low abundance. The Peregrine Falcon and Princess Parrot may infrequently be seen in the project area. The Princess Parrot is nomadic and moves around the arid interior often in search of water and resources and the Peregrine Falcon will normally have a very large home range.

Terrestrial Ecosystems' view is that the proposed development is unlikely to significantly impact on the avian fauna of the bioregion, however, plans to avoid, minimise and mitigate impacts on Malleefowl are recommended.

5.1.4 Mammals

The diversity of small terrestrial mammals potentially caught in the project area would be typical of that found in a diverse habitat in the sandy-clay with occasional rocky breakaways and ridges with limited vegetation. Wild dogs and feral cats are present in the area.

It is likely that the breakaway and rocky areas support Long-tailed Dunnarts, as this is its preferred habitat. Long-tailed Dunnarts have been recorded at the Granny Smith mine and another unnamed mine to the east, and other unnamed projects in the vicinity of the project area. If the proposed development and mining area does not impact on the breakaway and rocky areas, then it is unlikely that the project will have a significant impact on this species.

Terrestrial Ecosystems' view is that the development of the project area is unlikely to significantly impact on the mammal fauna of the bioregion, other than Long-tailed Dunnarts which are discussed above. Management of wild dogs and feral cats would see an increase in the native vertebrate fauna over a period of years.

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.

There is a variety of fauna habitats in the project area, which is typical for this part of the bioregion. Fauna habitats represented in the project area are abundant and in reasonable condition in adjacent areas. The most significant impact on the vertebrate fauna community in this area would be the presence of feral cats and wild dogs. The fauna assemblage that is present in the project area will also be present and abundant in the adjacent areas. The available fauna survey data (Appendix B) provides a good indication of the vertebrate fauna that are potentially in the project area.

5.2.1 Ecological functional value at the ecosystem level

Some of the project area has been disturbed by previous and the current exploration activity and mining, with the consequence that these areas and surrounds will have a depleted vertebrate fauna assemblage. The most significant impact on vertebrate fauna in the project area and surrounds will have been feral cats and wild dogs.

This site supports the conservation significant Malleefowl in low abundance.

5.2.2 Maintenance of threatened ecological communities

No Malleefowl mounds were recorded in the project area, however, the presence of Malleefowl tracks indicates that they are foraging in the project area.

5.2.3 Condition of fauna habitat

Some of the project area has been disturbed due to historical and current exploration activity (i.e. tracks, drill holes, bag farms and dilapidated buildings) and past mining. The uncleared fauna habitat present in the project area is similar to many square kilometres of adjacent habitat. 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 region. 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 abundant in adjacent areas. It is therefore likely that the fauna assemblage in the project area is similar to the many square kilometres of similar habitat in adjacent areas and the bioregion.

5.2.7 Potential impacts on ecosystem function

Clearing native vegetation is likely to result in the loss of small vertebrate fauna on-site that are unable to move away during the clearing process. The few larger animals, such as kangaroos and large goannas, and most of the birds will move into adjacent areas once clearing commences. Shifting animals into adjacent areas will increase the pressure on resources in those areas and it is likely that there will be some disruption to the ecosystems in these areas for a short period until a balance is restored.

Impacts associated with clearing vegetation and development in the project area in a landscape or bioregional context on the vertebrate fauna are likely to be low as the proposed disturbance area is small relative to the quantity of similar habitat in the bioregion.

The impact of feral and pest fauna which are present in the project area will be doing more environmental damage than the combined impacts of proposed development, vegetation clearing and fragmentation of 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 fauna, they are not likely to result in significant impacts on fauna habitat and fauna assemblages in the long term. The overall impact on fauna species and species of conservation significance will be minimal provided the recommended management procedures are implemented and adhered to.

6.1 DIRECT IMPACTS

6.1.1 Animal deaths during the clearing process and displacement of fauna

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

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

Edge effects can lead to the disruption of ecological processes such as predation and dispersal, animal movements and can change assemblage structure. The consequence is that the impact area will always be much larger than the cleared area. However, for this project area, the sparseness of vegetation and ground cover mean there will be few 'edge effects' as a consequence of vegetation clearing.

6.1.2 Reduction or loss of activity areas and closure of burrows

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

6.2 INDIRECT IMPACTS

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

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, although in low abundance. In many situations they have become a 'naturalised' species in the Australian bush. Increases in dog or cat numbers can have a detrimental impact on native fauna because they predate on and compete with native species, severely disrupting the natural balance. The feral cat is a particularly damaging predator on native fauna and any increase in their numbers could have a detrimental effect on local native fauna (Kinnear 1993, Bamford 1995, Woinarski et al. 2017, Woinarski et al. 2018, Murphy et al. 2019); hence it is important to ensure that populations of the feral predators, such as cats are under control.

Dog and cat tracks indicate there is a low abundance of cats and wild dogs in the project area. These dogs and cats will almost certainly have very large home ranges, part of which will include the project area. Infrastructure known to support feral species, such as rubbish disposal sites and bins, and permanent water should be managed to minimise increases in these populations.

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

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 small size of the project area, the impacts of road fauna deaths are likely to be low.

6.2.4 Fire

Increased human activity is often associated with an altered fire regime which can 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.

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

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. This form of disturbance is likely to occur during the initial vegetation clearing and when development activity commences. The overall impact is likely to be confined to a relatively small area and is unlikely to be a significant impact.

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. Degradation of these areas may potentially render habitat unsuitable for fauna. Dust suppression and management programs are an essential component of minimising impacts on fauna in areas adjacent to the mine. 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 8, 9 and 10 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 10.

Table 8. 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 to 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 9. 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 10. 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.	B	2	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.	B	2	Low				
Clearing vegetation	Loss of fauna habitat – local scale	Loss of terrestrial fauna in the project area.	E	2	Mod				
	Loss of fauna habitat – landscape scale	Loss of some fauna during vegetation clearing.	B	1	Low				
	Loss of fauna habitat – regional scale	Small loss of some fauna from the region.	B	1	Low				
	Loss of a threatened ecological fauna community	Loss of an undetected threatened ecological fauna community.	A	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	C	3	Mod	Implement feral and pest animal control and vertebrate fauna management plan	B	2	Low
	Long-tailed Dunnart	Loss of a Long-tailed Dunnart or small population of Long-tailed Dunnarts	B	2	Low				

			Before management			With management			
	Arid Broze Azure	Loss of a Arid Bronze Azure Butterfly or small population of Arid Bronze Azure Butterfly	A	3	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				
	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				
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	C	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 11). Where possible, native vegetation should not be cleared if any of the following principles are comprised.

Table 11. 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. Malleefowl (listed as Vulnerable under the <i>EPBC Act</i> and <i>BC Act</i>) are present in the project area, and probably in the adjacent areas. A vertebrate fauna management plan will need to be prepared and implemented for this species to avoid, minimise and mitigate any impacts. If mining was to occur in the breakaway and rocky areas, then it is likely that it could impact on Long-tailed Dunnarts (listed as a Priority 4 species with <i>DBCAs</i>). As a priority species, there is no special legislative protection for this species.
It comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.	Clearing the vegetation will not result in the loss of significant habitat for indigenous fauna. It could however, impact on a low number of Malleefowl and Long-tailed Dunnarts. Neither species are dependent on this habitat for their long-term survival.
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 of native vegetation.
It is growing in, or in association with, an environment associated with a watercourses or wetland.	The area does not contain a natural wetland.
The clearing of the vegetation is likely to cause appreciable land degradation.	N/A
The clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.	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

No Malleefowl mounds were recorded in the project area, however, Malleefowl tracks were recorded in the project area, indicating that Malleefowl are present in low abundance. Large portions of the habitat in the project area were very open and therefore not suitable for Malleefowl nesting when predators are present in the general area.

The potential impact on this species is unknown until more is known about the proposed development and its operation. Prior to any vegetation clearing or disturbance activity, Legacy Iron Ore Limited should undertake a risk assessment to determine if conservation significant fauna are likely to be present, and if present, likely to be impacted. If Malleefowl or their foraging habitat are likely to be significantly impacted, then a referral to the Commonwealth Government under the *EPBC Act 1999* is recommended.

7. SUMMARY

The total assessed area is 1,404ha but the development area is likely to be substantially less. There are six broad fauna habitats:

- Open Mulga shrubland on sandy soil;
- Mulga and chenopod shrubland on rocky soil;
- Mulga shrubland over rocky soil;
- Mulga on rocky slopes and hills;
- Shrubs on granite rocks and bedrock;
- Mulga drainage lines.

There are also areas disturbed by exploration activity and old mining activity. The habitat substrate varies from red sandplain with no stones/pebbles to an abundance of stones/pebbles, to rocky ridges and breakaways.

No Malleefowl mounds were recorded in the project area, however, Malleefowl tracks were recorded in the project area, indicating that Malleefowl are present in low abundance. Large portions of the habitat in the project area were very open and therefore not suitable for Malleefowl nesting when predators are present in the general area.

Prior to any vegetation clearing or disturbance activity, Legacy Iron Ore Limited should undertake a risk assessment to determine if conservation significant fauna are likely to be present, and if present, likely to be impacted. If Malleefowl or its foraging habitat is likely to be significantly impacted, then a referral to the Commonwealth Government under the *EPBC Act 1999* is recommended.

It is likely that Long-tailed Dunnart are present in the breakaway and rocky areas. If these areas are not going to be impacted by mining development or operations, then impacts are likely to be low. The Long-tailed Dunnart is not listed as a threatened species under the *EPBC Act* so there is no reporting requirement under the Commonwealth Act for this species.

Clearing native vegetation in the project area is likely to result in the loss of small vertebrate fauna on-site that are unable to move away during the clearing process, however, this loss is not likely to be significant when viewed in a bioregional context. The few larger animals, such as kangaroos, large goannas and snakes, and most of the birds will move into adjacent areas once vegetation clearing commences, so potential impacts will be low. 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. Forced fauna migrants as a result of vegetation clearing increase competition for resources, which may result in the subsequent loss of migrants or local individuals. Individuals shifted out of their established activity areas are also vulnerable to predation until they have become established in their new areas.

Impacts on vertebrate fauna associated with clearing vegetation in the project area in a landscape or bioregional context are likely to be low as there are vast tracts of similar fauna habitat in adjacent areas, and the sparseness of the vegetation and ground cover mean the abundance of terrestrial vertebrate in the project area will be low.

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. Specific management and mitigation strategies to address potential impacts should be addressed in the recommended Vertebrate Fauna Management Plan and Construction Environmental Management Plan.

8.1 PRESENCE OF MALLEEFOWL

No Malleefowl mounds were recorded in the project area, however, Malleefowl tracks were recorded in the project area, indicating that Malleefowl are present in low abundance. Large portions of the habitat in the project area were very open and therefore not suitable for Malleefowl nesting when predators are present in the general area. Prior to any vegetation clearing or disturbance activity, Legacy Iron Ore Limited should undertake a risk assessment to determine if conservation significant fauna are likely to be present, and if present, likely to be impacted. If Malleefowl or their foraging habitat are likely to be significantly impacted, then a referral to the Commonwealth Government under the *EPBC Act 1999* is recommended.

Recommendation 1: Prior to any vegetation clearing or disturbance activity, Legacy Iron Ore Limited undertake a risk assessment to determine if conservation significant fauna are likely to be present, and if present, likely to be impacted.

Recommendation 2: If Malleefowl or its foraging habitat are likely to be significantly impacted, then the proposed action is referred to the Commonwealth Government under the *EPBC Act 1999* to assess the significance of the potential impact on this species.

Recommendation 3: A Malleefowl Management Plan is prepared once more detail is available about the proposed potential impacts on this species. If an *EPBC Act* referral is submitted, then it is recommended that the Malleefowl Management Plan is submitted with the referral to demonstrate how the operations will avoid, minimise and mitigate impacts on Malleefowl.

8.2 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 4: An induction program that includes a component on managing fauna is a mandatory for staff working in the project area. A Malleefowl Management Plan will also have requirements that staff and contractors should be aware of and this information should be conveyed to these people as part of the induction.

8.3 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 5: 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.

8.4 MINIMISING SECONDARY IMPACTS TO FAUNA AND FAUNA HABITAT

Pets and feral animals have the potential to impact on fauna. Pets should not be permitted on site and feral and pest fauna numbers monitored and if they appreciably increase then culled. All rubbish likely to attract animals should be suitably contained and disposed of so as not to encourage the feeding of fauna around the site.

Based on wild dog and feral cat tracks recorded in the project reducing the impacts of these pest species will reduce the stress on fauna and fauna assemblages in the area, and in particular it will reduce predation pressure on Malleefowl. Increased anthropogenic activity will result in increased traffic and a consequential increase in the fauna deaths on tracks. Limiting vehicle speed on mine roads can reduce collisions with fauna, particularly larger animals such as kangaroos and emus. Dead animals on the road also have the propensity to attract raptors, goannas and even cattle, which are then likely to be killed.

Management of secondary impacts on habitat and fauna should be addressed in a Vertebrate Fauna Management Plan. The plan should include:

- Control and reduction methods for feral and pest fauna;
- Management of pets on site;
- Strategies to minimise habitat fragmentation and barriers to fauna movement (e.g. fencing);
- Vegetation clearing and development protocols;
- Vehicle impacts on vertebrate fauna (short and long term);
- Vehicle speed limits on site; and
- Anthropogenic activity.

Recommendation 6: Preparation of a Vertebrate Fauna Management prior to vegetation clearing and development is completed.

9. REFERENCES

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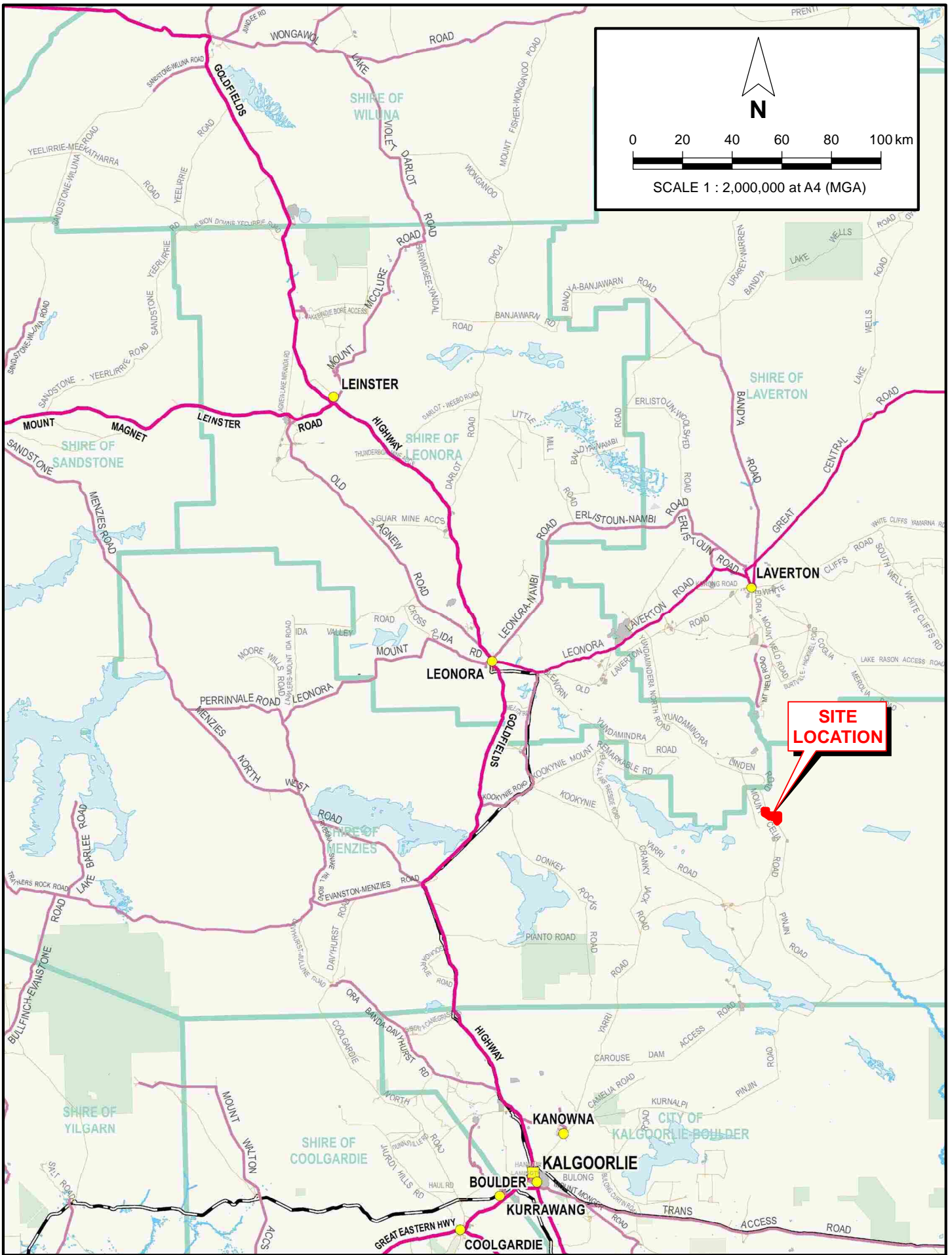
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Figures

Basic vertebrate fauna survey and risk assessment
Mt Celia Gold Project





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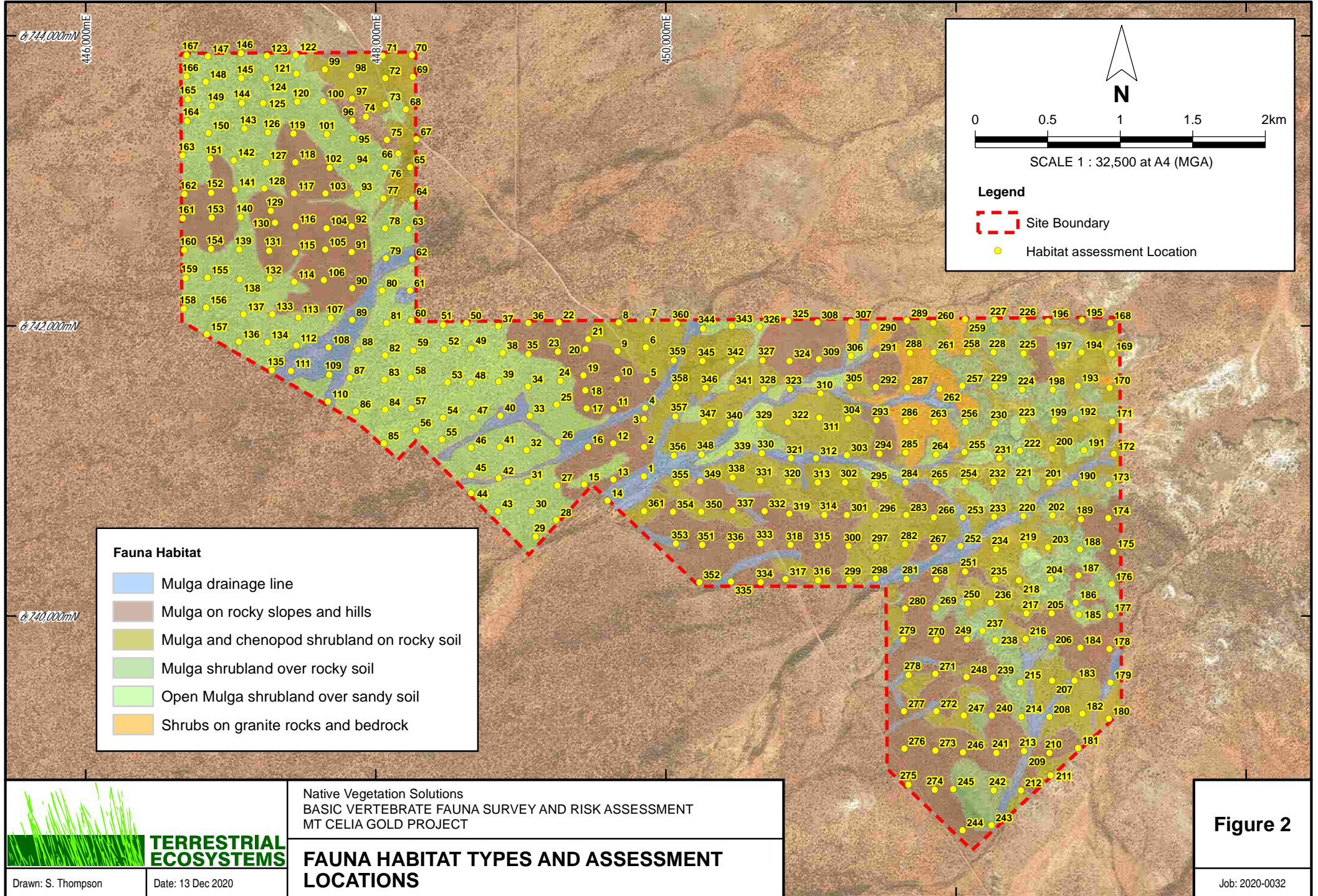
 TERRESTRIAL ECOSYSTEMS	
Drawn: S. Thompson	Date: 29 Nov 2020

Native Vegetation Solutions
 BASIC VERTEBRATE FAUNA SURVEY AND RISK ASSESSMENT
 MT CELIA GOLD PROJECT

REGIONAL LOCATION

Figure 1

Job: 2020-0032



N

0 0.5 1 1.5 2km

SCALE 1 : 32,500 at A4 (MGA)

Legend

- Site Boundary
- Habitat assessment Location

Fauna Habitat

- Mulga drainage line
- Mulga on rocky slopes and hills
- Mulga and chenopod shrubland on rocky soil
- Mulga shrubland over rocky soil
- Open Mulga shrubland over sandy soil
- Shrubs on granite rocks and bedrock



Native Vegetation Solutions
 BASIC VERTEBRATE FAUNA SURVEY AND RISK ASSESSMENT
 MT CELIA GOLD PROJECT

FAUNA HABITAT TYPES AND ASSESSMENT LOCATIONS

Drawn: S. Thompson

Date: 13 Dec 2020

Figure 2

Job: 2020-0032

Appendix A.

Results of the EPBC Act Protected Matters Search

Basic vertebrate fauna survey and risk assessment
Mt Celia Gold Project





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.

Report created: 06/11/20 17:44:12

[Summary](#)

[Details](#)

[Matters of NES](#)

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

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)



This map may contain data which are
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[Coordinates](#)

Buffer: 100.0Km



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:	8
Listed Migratory Species:	9

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:	13
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:	14
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		
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
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
Sminthopsis psammophila Sandhill Dunnart [291]	Endangered	Species or species habitat likely to occur within area

Plants

Hibbertia crispula Ooldea Guinea-flower [15222]	Vulnerable	Species or species habitat may occur within area
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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
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Name	Threatened	Type of Presence
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 ferruginea Curlew Sandpiper [856]	Critically Endangered	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
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 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 ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
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 area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat may 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 Resources 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 chinensis Spotted Turtle-Dove [780]		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

Name	Status	Type of Presence 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
Equus caballus Horse [5]		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

-29.4551 122.51685

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
Mt Celia Gold Project



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

Family	Species	Common Name	Surveys																										
			A	B													C												
				Site 9	Site 10	Site 2	Site 3	Site 12	Site 4	Site 5	Site 1	Site 8	Site 11	Site 13	Site 6	Site 7	Opportunistic	Birds	MME1	MME2	Opportunistic	MME3	MME5	MME7	MME8	MME9	MME6	MME4	
Amphibians																													
Limnodynastidae	<i>Neobatrachus kunapalari</i>	Wheatbelt Frog	X	1																									
	<i>Neobatrachus sutor</i>	Shoemaker Frog		13	2	2	5	1	3	1	8	1								1	1								
	<i>Platyplectrum spenceri</i>	Spencer's Burrowing Frog	X																										
Pelodyadidae	<i>Cyclorana maini</i>	Main's Frog		11	5	1							1									1							
	<i>Cyclorana occidentalis</i>	Western Water-holding Frog		5	2	1	1	1						1															
Reptiles																													
Agamidae	<i>Ctenophorus cristatus</i>	Crested Dragon	X																										
	<i>Ctenophorus fordi</i>	Mallee Dragon	X																										
	<i>Ctenophorus infans</i>	Ring-tailed Dragon	X																										
	<i>Ctenophorus isolepis</i>	Central Military Dragon	X																		1								
	<i>Ctenophorus nuchalis</i>	Central Netted Dragon	X																										
	<i>Ctenophorus reticulatus</i>	Western Netted Dragon	X																			1	1	1	1	3	1		
	<i>Ctenophorus salinarum</i>	Saltpan Dragon	X																										
	<i>Ctenophorus scutulatus</i>	Lozenge-marked Dragon	X																										
	<i>Diporiphora amphibolurooides</i>	Mulga Dragon	X						2	1					1														
	<i>Moloch horridus</i>	Thorny Devil	X																										
	<i>Pogona minor</i>	Western Bearded Dragon	X																								1		
	<i>Tympanocryptis cephalus</i>	Pebble Dragon	X						2	3		1			1														
Carphodactylidae	<i>Nephrurus vertebralis</i>	Midline Knob-tail	X																										
	<i>Underwoodisaurus milii</i>	Barking Gecko	X																									2	

Family	Species	Common Name	Surveys													C											
			A	B																							
			Site 9	Site 10	Site 2	Site 3	Site 12	Site 4	Site 5	Site 1	Site 8	Site 11	Site 13	Site 6	Site 7	Opportunistic	Birds	MME1	MME2	Opportunistic	MME3	MME5	MME7	MME8	MME9	MME6	MME4
	<i>Lialis burtonis</i>	Burton's Legless Lizard	X																								
	<i>Pygopus nigriceps</i>	Western Hooded Scaly-foot	X																								
Scincidae	<i>Cryptoblepharus buchananii</i>	Buchanan's Snake-eyed Skink	X																2	1							
	<i>Ctenotus calurus</i>	Blue-tailed Finesnout Ctenotus	X																								
	<i>Ctenotus greeri</i>	Spotted-necked Ctenotus	X																								
	<i>Ctenotus helena</i>	Clay-soil Ctenotus	X																								
	<i>Ctenotus leonhardii</i>	Leonhardi's Ctenotus	X	5	9	2	16			2	7	27		1							1						
	<i>Ctenotus pantherinus</i>	Leopard Ctenotus	X																								
	<i>Ctenotus quattuordecimlineatus</i>	Fourteen-lined Ctenotus	X																								
	<i>Ctenotus schomburgkii</i>	Barred Wedgesnout Ctenotus	X															1	1						2		
	<i>Ctenotus severus</i>	Stern Ctenotus	X																								
	<i>Ctenotus uber</i>	Spotted Ctenotus	X																								
	<i>Cyclodomorphus melanops</i>	Spinifex Slender Blue-tongue	X																								
	<i>Egernia depressa</i>	Southern Pygmy Spiny-tailed Skink	X		1	1	1	2	2	6			3	9													1
	<i>Egernia formosa</i>	Goldfields Crevice Skink	X																								
	<i>Eremiascincus richardsonii</i>	Broad-banded Sand-swimmer	X				2					1															
	<i>Lerista bipes</i>	North-western Sandslider	X																								
	<i>Lerista desertorum</i>	Central Desert Robust Slider	X									2								1					1	1	
	<i>Lerista distinguenda</i>	South-western Orange-tailed Slider										1															
	<i>Lerista picturata</i>	Southern Robust Slider	X																								
	<i>Lerista timida</i>	Timid Slider	X																								
	<i>Liopholis striata</i>	Nocturnal Desert Skink	X																								
	<i>Menetia greyii</i>	Common Dwarf Skink	X								1							4	1						1		

Family	Species	Common Name	Surveys														C												
			A	B																									
				Site 9	Site 10	Site 2	Site 3	Site 12	Site 4	Site 5	Site 1	Site 8	Site 11	Site 13	Site 6	Site 7	Opportunistic	Birds	MME1	MME2	Opportunistic	MME3	MME5	MME7	MME8	MME9	MME6	MME4	
	<i>Morethia butleri</i>	Woodland Morethia Skink	X	6	1	1		3	1						2						2	1		2	1	1	1	3	4
	<i>Tiliqua multifasciata</i>	Central Blue-tongue									1																		
	<i>Tiliqua occipitalis</i>	Western Blue-tongued Lizard	X																										
	<i>Tiliqua rugosa</i>	Bobtail	X																										
Typhlopidae	<i>Anilius australis</i>	Austral Blind Snake		1								1																	
	<i>Anilius bicolor</i>	Dark-spined Blind Snake					1																						
Varanidae	<i>Varanus caudolineatus</i>	Stripe-tailed Monitor	X		1	2		2	1	3					1	1					1							1	
	<i>Varanus gouldii</i>	Gould's Goanna	X																										
	<i>Varanus panoptes</i>	Yellow-spotted Monitor	X		4		7			3	4		2	6	2	2						1					1	1	
	<i>Varanus tristis</i>	Black-headed Monitor	X																										
Birds																													
Casuariidae	<i>Dromaius novaehollandiae</i>	Emu																3	1	1	1	1				1	1	1	
Anatidae	<i>Cygnus atratus</i>	Black Swan																				1							
	<i>Tadorna tadornoides</i>	Australian Shelduck																				1							
	<i>Chenonetta jubata</i>	Australian Wood Duck																77	4										
	<i>Anas superciliosa</i>	Pacific Black Duck																13			1								
	<i>Anas gracilis</i>	Grey Teal																74			1								
	<i>Malacorhynchus membranaceus</i>	Pink-eared Duck																5			1								
	<i>Aythya australis</i>	Hardhead																2											
	<i>Biziura lobata</i>	Musk Duck																2											
Megapodiidae	<i>Leipoa ocellata</i>	Malleefowl																				1							
Podicipedidae	<i>Poliocephalus poliocephalus</i>	Hoary-headed Grebe																30											
Columbidae	<i>Phaps chalcoptera</i>	Common Bronzewing																6			1								

Family	Species	Common Name	Surveys													C											
			A	B																							
			Site 9	Site 10	Site 2	Site 3	Site 12	Site 4	Site 5	Site 1	Site 8	Site 11	Site 13	Site 6	Site 7	Opportunistic	Birds	MME1	MME2	Opportunistic	MME3	MME5	MME7	MME8	MME9	MME6	MME4
	<i>Ocyphaps lophotes</i>	Crested Pigeon															21	2		1					3	2	
Podargidae	<i>Podargus strigoides</i>	Tawny Frogmouth																							2		
Rallidae	<i>Tribonyx ventralis</i>	Black-tailed Nativehen																		1							
	<i>Fulica atra</i>	Eurasian Coot														21											
Recurvirostridae	<i>Himantopus leucocephalus</i>	Pied Stilt														5				1							
	<i>Cladorhynchus leucocephalus</i>	Banded Stilt														14											
	<i>Recurvirostra novaehollandiae</i>	Red-necked Avocet																		1							
Charadriidae	<i>Charadrius ruficapillus</i>	Red-capped Plover																		1							
	<i>Elseyornis melanops</i>	Black-fronted Dotterel															1	3		1							
Ardeidae	<i>Ardea pacifica</i>	White-necked Heron																		1							
	<i>Egretta novaehollandiae</i>	White-faced Heron														2				1							
Accipitridae	<i>Haliaeetus albicilla</i>																	1		1	2	1		1		1	
	<i>Hieraaetus morphnoides</i>	Little Eagle																		1							
	<i>Aquila audax</i>	Wedge-tailed Eagle														2	1										
Cuculidae	<i>Heteroscenes pallidus</i>	Pallid Cuckoo														2	1			1							
Alcedinidae	<i>Todiramphus pyrrhopygius</i>	Red-backed Kingfisher															1										
Falconidae	<i>Falco cenchroides</i>	Nankeen Kestrel														2									1		
	<i>Falco longipennis</i>	Australian Hobby																			1				1		
	<i>Falco berigora</i>	Brown Falcon														1									1		
	<i>Falco peregrinus</i>	Peregrine Falcon																		1							
Cacatuidae	<i>Eolophus roseicapilla</i>	Galah																		1		15					
Psittaculidae	<i>Neopsephotus bourkii</i>	Bourke's Parrot																		1							
	<i>Barnardius zonarius</i>	Australian Ringneck															6		1	1		4	2		2	3	

Family	Species	Common Name	Surveys													C												
			A	B																								
			Site 9	Site 10	Site 2	Site 3	Site 12	Site 4	Site 5	Site 1	Site 8	Site 11	Site 13	Site 6	Site 7	Opportunistic	Birds	MME1	MME2	Opportunistic	MME3	MME5	MME7	MME8	MME9	MME6	MME4	
	<i>Barnardius zonarius</i>	Australian Ringneck																										
	<i>Psephotus varius</i>	Mulga Parrot															8	12		1	1		5				5	
Ptilonorhynchidae	<i>Chlamydera guttata</i>	Western Bowerbird	X														2	5										
Climacteridae	<i>Climacteris affinis</i>	White-browed Treecreeper	X																	1			2					
Maluridae	<i>Malurus splendens</i>	Splendid Fairywren															12			1			9					
	<i>Malurus splendens</i>	Splendid Fairywren	X																									
	<i>Malurus leucopterus</i>	White-winged Fairywren	X														1	3	3							8		
Meliphagidae	<i>Certhionyx variegatus</i>	Pied Honeyeater	X															2										
	<i>Purnella albifrons</i>	White-fronted Honeyeater	X																80	100	1	12	8	10	6	6	1	40
	<i>Manorina flavigula</i>	Yellow-throated Miner	X														3	38	10	5	1	7	2	2	2	10		
	<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater	X																44	25	20	1	6	1	1	2	2	1
	<i>Anthochaera carunculata</i>	Red Wattlebird	X																						3			
	<i>Gavicalis virescens</i>	Singing Honeyeater	X																68	4	1	2	1	1	1	1	1	
	<i>Ptilotula plumula</i>	Grey-fronted Honeyeater																				7						
	<i>Epthianura tricolor</i>	Crimson Chat	X																4									
	<i>Epthianura aurifrons</i>	Orange Chat	X																									
	<i>Sugomel nigrum</i>	Black Honeyeater	X																									
	<i>Lichmera indistincta</i>	Brown Honeyeater	X																									
Pardalotidae	<i>Pardalotus striatus</i>	Striated Pardalote	X																1		1	3						
Acanthizidae	<i>Pyrrholaemus brunneus</i>	Redthroat	X																		1						1	
	<i>Acanthiza iredalei</i>	Slender-billed Thornbill	X																									
	<i>Acanthiza apicalis</i>	Inland Thornbill	X																12	2	1		6			2		
	<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill																	1	5	6	1	17	4		2	6	

Family	Species	Common Name	Surveys															C																														
			A	B														Site 9	Site 10	Site 2	Site 3	Site 12	Site 4	Site 5	Site 1	Site 8	Site 11	Site 13	Site 6	Site 7	Opportunistic	Birds	MME1	MME2	Opportunistic	MME3	MME5	MME7	MME8	MME9	MME6	MME4						
	<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill	X																														8	30	1	2	14	50				15	10					
	<i>Acanthiza robustirostris</i>	Slaty-backed Thornbill	X																													68		1		2												
	<i>Smicromis brevirostris</i>	Weebill	X																															1		10												
	<i>Gerygone fusca</i>	Western Gerygone	X																																													
	<i>Aphelocephala leucopsis</i>	Southern Whiteface																														13		1			20				6	4						
	<i>Aphelocephala leucopsis</i>	Southern Whiteface (Southwest)	X																																													
Pomatostomidae	<i>Pomatostomus superciliosus</i>	White-browed Babbler	X																													14		1														
Cinlosoma	<i>castaneothorax</i>	Chestnut-breasted Quail-thrush	X																																													
Campephagidae	<i>Coracina maxima</i>	Ground Cuckooshrike	X																																													
	<i>Coracina novaehollandiae</i>	Black-faced Cuckooshrike	X																																													
	<i>Lalage tricolor</i>	White-winged Triller	X																																													
Oreoicidae	<i>Oreoica gutturalis</i>	Crested Bellbird	X																																													
Pachycephalidae	<i>Colluricincla harmonica</i>	Grey Shrikethrush	X																																													
	<i>Pachycephala rufiventris</i>	Rufous Whistler	X																																													
Artamidae	<i>Artamus personatus</i>	Masked Woodswallow	X																																													
	<i>Artamus superciliosus</i>	White-browed Woodswallow																																														
	<i>Artamus cinereus</i>	Black-faced Woodswallow	X																																													
	<i>Artamus cyanopterus</i>	Dusky Woodswallow	X																																													
	<i>Artamus minor</i>	Little Woodswallow	X																																													
	<i>Cracticus torquatus</i>	Grey Butcherbird	X																																													
	<i>Cracticus nigrogularis</i>	Pied Butcherbird	X																																													
	<i>Gymnorhina tibicen</i>	Australian Magpie	X																																													
	<i>Strepera versicolor</i>	Grey Currawong	X																																													

Family	Species	Common Name	Surveys														C												
			A	B																									
				Site 9	Site 10	Site 2	Site 3	Site 12	Site 4	Site 5	Site 1	Site 8	Site 11	Site 13	Site 6	Site 7	Opportunistic	Birds	MME1	MME2	Opportunistic	MME3	MME5	MME7	MME8	MME9	MME6	MME4	
	<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat	X																										
Dasyuridae	<i>Antechinomys laniger</i>	Kultarr			2	1				3	2	2		1	3	3													
	<i>Ningauai ridei</i>	Wongai Ningauai	X																										
	<i>Ningauai yvonneae</i>	Mallee Ningauai	X																										
	<i>Sminthopsis crassicaudata</i>	Fat-tailed Dunnart	X																										
	<i>Sminthopsis dolichura</i>	Little Long-tailed Dunnart	X	5	3	1	3	1	7	5	1	3		1	4	13													
	<i>Sminthopsis hirtipes</i>	Hairy-footed Dunnart	X						1																				
	<i>Sminthopsis longicaudata</i>	Long-tailed Dunnart								1				1	1														
	<i>Sminthopsis macroura</i>	Stripe-faced Dunnart		1	5	3		3	2	1	2	1	5	2	1	1													
	<i>Sminthopsis murina</i>	Slender-tailed Dunnart	X																										
	<i>Sminthopsis ooldea</i>	Ooldea Dunnart	X																										
Macropodidae	<i>Macropus fuliginosus</i>	Western Grey Kangaroo	X																										
	<i>Osphranter robustus</i>	Euro	X																		1								1
	<i>Osphranter rufus</i>	Red Kangaroo	X																		1	5				6			
Leporidae	<i>Oryctolagus cuniculus</i>	Rabbit	X																		1								1
Equidae	<i>Equus asinus</i>	Donkey																			1								
Muridae	<i>Mus musculus</i>	House Mouse	X									5		1					1	2		2	2				2	1	
	<i>Notomys alexis</i>	Spinifex Hopping Mouse	X								3								7					2					
	<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse	X	1	2	1	1	5	3		1		2	6												4	1		

A Atlas of Living Australia

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

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

B2. VERTEBRATE FAUNA RECORDED IN BIOLOGICAL SURVEYS IN THE REGION

Family	Species	Common Name	Surveys																												
			A					B					C					D		E											
			TM1	JS2	WM2	WS2	WM1	WS1	JS3	JS1	JS4	HB1	Unknown	Site 14a	Site 5a	Site 1a	Site 17a	Site 14	Site 20a	Site 11	Site 11a	Site 8	Site 19	Site 14b	Site 1 13	Site 3 13	Site 2 13	Unknown	Jump Up		
Amphibians																															
Limnodynastidae	<i>Neobatrachus kunapalari</i>	Wheatbelt Frog																													
	<i>Neobatrachus sutor</i>	Shoemaker Frog																													
	<i>Neobatrachus wilsmorei</i>	Plonking Frog	3	1																											
	<i>Notaden nicholli</i>	Desert Spadefoot											X																		
	<i>Platyplectrum spenceri</i>	Spencer's Burrowing Frog												8																	
Myobatrachidae	<i>Pseudophryne occidentalis</i>	Western Toadlet													2																
Pelodyadidae	<i>Cyclorana maini</i>	Main's Frog											X																		
	<i>Cyclorana occidentalis</i>	Western Water-holding Frog																													
	<i>Litoria rubella</i>	Desert Tree Frog											X																		
Reptiles																															
Agamidae	<i>Ctenophorus caudicinctus</i>	Ring-tailed Dragon													12																
	<i>Ctenophorus caudicinctus</i>	Ring-tailed Dragon											X																		
	<i>Ctenophorus cristatus</i>	Crested Dragon																													
	<i>Ctenophorus fordi</i>	Mallee Dragon																													
	<i>Ctenophorus inermis</i>	Military Dragon				1							X			1															
	<i>Ctenophorus infans</i>	Ring-tailed Dragon																													
	<i>Ctenophorus isolepis</i>	Central Military Dragon																													
	<i>Ctenophorus isolepis</i>	Central Military Dragon																													

Family	Species	Common Name	Surveys																										
			A								B	C				D					E								
			TM1	JS2	WM2	WS2	WM1	WS1	JS3	JS1	JS4	HB1	Unknown	Site 14a	Site 5a	Site 1a	Site 17a	Site 14	Site 20a	Site 11	Site 11a	Site 8	Site 19	Site 14b	Site 1 13	Site 3 13	Site 2 13	Unknown	Jump Up
	<i>Ctenophorus isolepis</i>	Central Military Dragon												X												1	2		
	<i>Ctenophorus maculatus</i>	Spotted Dragon				2																							
	<i>Ctenophorus nuchalis</i>	Central Netted Dragon																											
	<i>Ctenophorus pictus</i>	Painted Dragon																											
	<i>Ctenophorus reticulatus</i>	Western Netted Dragon					1							1	13	2	2	4											1
	<i>Ctenophorus salinarum</i>	Saltpan Dragon			2		1								1					5	1	2							
	<i>Ctenophorus scutulatus</i>	Lozenge-marked Dragon											X																
	<i>Ctenophorus vadrappa</i>	Red-barred Dragon																	1										
	<i>Diporiphora amphiboluroides</i>	Mulga Dragon																											1
	<i>Diporiphora valens</i>	Southern Pilbara Tree Dragon											X																
	<i>Gowidon longirostris</i>	Long-nosed Dragon											X																
	<i>Moloch horridus</i>	Thorny Devil											X	1												1	1		
	<i>Pogona minor</i>	Western Bearded Dragon	1	2					2	1	1		X				1		2	1	2	2							
	<i>Tympanocryptis cephalus</i>	Pebble Dragon																			1								
Carphodactylidae	<i>Nephrurus laevis</i>	Smooth Knob-tail											X																
	<i>Nephrurus levis</i>	Three-lined Knob-tail											X																
	<i>Nephrurus vertebralis</i>	Midline Knob-tail					1		1										1		2								
	<i>Underwoodisaurus milii</i>	Barking Gecko													2	9													1
Diplodactylidae	<i>Diplodactylus conspicillatus</i>	Fat-tailed Gecko											X																
	<i>Diplodactylus granariensis</i>	Wheatbelt Stone Gecko																											
	<i>Diplodactylus pulcher</i>	Beautiful Gecko												4	3	3							1						

Family	Species	Common Name	Surveys											Surveys															
			A			B			C					D			E												
			TM1	JS2	WM2	WS2	WM1	WS1	JS3	JS1	JS4	HB1	Unknown	Site 14a	Site 5a	Site 1a	Site 17a	Site 14	Site 20a	Site 11	Site 11a	Site 8	Site 19	Site 14b	Site 1 13	Site 3 13	Site 2 13	Unknown	Jump Up
	<i>Lucasium damaeum</i>	Beaded Gecko																											
	<i>Lucasium squarrosum</i>	Mottled Ground Gecko	2	1	5	2	1					2		1			3		2	1	3								
	<i>Lucasium stenodactylum</i>	Crowned Gecko											X																
	<i>Rhynchoedura ornata</i>	Beaked Gecko											X								2				1				1
	<i>Strophurus ciliaris</i>	Spiny-tailed Gecko												2	2	1		1											
	<i>Strophurus ciliaris</i>	Spiny-tailed Gecko											X																
	<i>Strophurus elderi</i>	Jewelled Gecko		1					1	2			X												1		1		
	<i>Strophurus strophurus</i>	Western Spiny-tailed Gecko																			7								
	<i>Strophurus wellingtonae</i>	Western Shield Spiny-tailed Gecko																											
Elapidae	<i>Brachyuropis fasciolatus</i>	Narrow-banded Burrowing Snake																	1										
	<i>Brachyuropis fasciolatus</i>	Narrow-banded Burrowing Snake											X																
	<i>Brachyuropis fasciolatus</i>	Narrow-banded Burrowing Snake																											
	<i>Brachyuropis semifasciata</i>	Half-girdled Snake																							1				1
	<i>Demansia psammophis</i>	Yellow-faced Whipsnake																							1				
	<i>Demansia rufescens</i>	Rufous Whipsnake											X																
	<i>Furina ornata</i>	Orange-naped Snake											X																
	<i>Parasuta monachus</i>	Hooded Snake												1		3													
	<i>Pseudechis australis</i>	Mulga Snake																											
	<i>Pseudechis butleri</i>	Spotted Mulga Snake																											
	<i>Pseudonaja mengdeni</i>	Western Brown Snake											X																
	<i>Pseudonaja modesta</i>	Ringed Brown Snake											X																

Family	Species	Common Name	Surveys											B	C	D	E												
			A																										
			TM1	JS2	WM2	WS2	WM1	WS1	JS3	JS1	JS4	HB1	Unknown	Site 14a	Site 5a	Site 1a	Site 17a	Site 14	Site 20a	Site 11	Site 11a	Site 8	Site 19	Site 14b	Site 1 13	Site 3 13	Site 2 13	Unknown	Jump Up
	<i>Simoselaps anomalus</i>	Desert Banded Snake												X															
	<i>Simoselaps bertholdi</i>	Jan's Banded Snake	1											X									1		1				
	<i>Suta fasciata</i>	Rosen's Snake													2														
Gekkonidae	<i>Christinus marmoratus</i>	Marbled Gecko												X															
	<i>Gehyra punctata</i>	Spotted Dtella												X															
	<i>Gehyra purpurascens</i>	Purplish Dtella												X															
	<i>Gehyra variegata</i>	Variiegated Gehyra												X	15	1	15		1			1	1						1
	<i>Heteronotia binoei</i>	Bynoe's Gecko	1				2				2	3	X	7		34													1
	<i>Gehyra xenopus</i>	Crocodile-faced Dtella		1			1			1	1																		
Pygopodidae	<i>Aprasia picturata</i>	Black-headed Worm-lizard																											
	<i>Delma butleri</i>	Unbanded Delma												X															
	<i>Delma nasuta</i>	Sharp-snouted Delma									1		X																
	<i>Delma pax</i>	Peace Delma											X																
	<i>Lialis burtonis</i>	Burton's Legless Lizard									1		X																
	<i>Pygopus nigriceps</i>	Western Hooded Scaly-foot										1				1		1											
	<i>Pygopus nigriceps</i>	Western Hooded Scaly-foot											X																
Pythonidae	<i>Antaresia perthensis</i>	Pygmy Python											X																
Scincidae	<i>Carlia triacantha</i>	Desert Rainbow-skink											X																
	<i>Cryptoblepharus buchananii</i>	Buchanan's Snake-eyed Skink											X	1															
	<i>Cryptoblepharus plagiocephalus</i>	Peron's Snake-eyed Skink																											
	<i>Ctenotus ariadnae</i>	Ariadna's Ctenotus											X																

Family	Species	Surveys Common Name	A											B	C					D					E									
			TM1	JS2	WM2	WS2	WM1	WS1	JS3	JS1	JS4	HB1	Unknown	Site 14a	Site 5a	Site 1a	Site 17a	Site 14	Site 20a	Site 11	Site 11a	Site 8	Site 19	Site 14b	Site 1 13	Site 3 13	Site 2 13	Unknown	Jump Up					
	<i>Ctenotus atlas</i>	Southern Mallee Ctenotus												X																				
	<i>Ctenotus brooksi</i>	Wedgsnout Ctenotus												X																				
	<i>Ctenotus calurus</i>	Blue-tailed Finesnout Ctenotus												X									1		3									
	<i>Ctenotus dux</i>	Fine Side-lined Ctenotus												X																				
	<i>Ctenotus grandis</i>	Grand Ctenotus												X																				
	<i>Ctenotus greeri</i>	Spotted-necked Ctenotus																					12											
	<i>Ctenotus helenae</i>	Clay-soil Ctenotus		2					2	1				X									1		1	2	3							
	<i>Ctenotus leae</i>	Ornate-tailed Finesnout Ctenotus												X																				
	<i>Ctenotus leonhardii</i>	Leonhardi's Ctenotus	6	3	3	6	7				2	4	X							5	4	2												
	<i>Ctenotus nasutus</i>	Nasute Finsnout Ctenotus											X																					
	<i>Ctenotus pantherinus</i>	Leopard Ctenotus																					4											
	<i>Ctenotus pantherinus</i>	Leopard Ctenotus											X												2	1								
	<i>Ctenotus pantherinus</i>	Leopard Ctenotus																																
	<i>Ctenotus piankai</i>	Coarse Sands Ctenotus											X																					
	<i>Ctenotus quattuordecimlineatus</i>	Fourteen-lined Ctenotus											X										11								1			
	<i>Ctenotus schomburgkii</i>	Barred Wedgesnout Ctenotus											X							2	3	15	11		2		1							
	<i>Ctenotus severus</i>	Stern Ctenotus															1	6																
	<i>Ctenotus uber</i>	Spotted Ctenotus													3		2	6																
	<i>Ctenotus uber</i>	Spotted Ctenotus																																
	<i>Cyclodomorphus melanops</i>	Spinifex Slender Blue-tongue																																
	<i>Egernia depressa</i>	Southern Pygmy Spiny-tailed Skink											X									4											1	

Family	Species	Common Name	Surveys													D	E												
			A	B	C	D	E	F	G	H	I	J	K	L															
			TM1	JS2	WM2	WS2	WM1	WS1	JS3	JS1	JS4	HB1	Unknown	Site 14a	Site 5a	Site 1a	Site 17a	Site 14	Site 20a	Site 11	Site 11a	Site 8	Site 19	Site 14b	Site 1 13	Site 3 13	Site 2 13	Unknown	Jump Up
	<i>Egernia formosa</i>	Goldfields Crevice Skink													3														1
	<i>Eremiascincus fasciolatus</i>	Narrow-banded Sand Swimmer											X																
	<i>Eremiascincus richardsonii</i>	Broad-banded Sand-swimmer											X	1		1													
	<i>Lerista amicornum</i>	Fortescue Slider											X																
	<i>Lerista bipes</i>	North-western Sandslider											X												25	3			
	<i>Lerista desertorum</i>	Central Desert Robust Slider	4	1	1				1	2	1					6		2					6		1				
	<i>Lerista distinguenda</i>	South-western Orange-tailed Slider																											
	<i>Lerista ips</i>	Robust Duneslider											X																
	<i>Lerista kingi</i>	King's Slider					1																						
	<i>Lerista macropisthopus</i>	Unpatterned Robust Slider													2														
	<i>Lerista macropisthopus</i>	Unpatterned Robust Slider											X																
	<i>Lerista neander</i>	Pilbara Robust Slider											X																
	<i>Lerista picturata</i>	Southern Robust Slider													2														
	<i>Lerista timida</i>	Timid Slider																									1		
	<i>Lerista vermicularis</i>	Slender Duneslider											X																
	<i>Liopholis striata</i>	Nocturnal Desert Skink											X						2										
	<i>Menetia greyii</i>	Common Dwarf Skink				1	1						X		4										1				
	<i>Morethia butleri</i>	Woodland Morethia Skink													4	6	2								1	1			
	<i>Morethia ruficauda</i>	Lined Fire-tailed Skink											X																
	<i>Proablepharus reginae</i>	Western Soil-crevice Skink																											
	<i>Tiliqua multifasciata</i>	Central Blue-tongue											X																

Family	Species	Common Name	Surveys																											
			A					B					C					D		E										
			TM1	JS2	WM2	WS2	WM1	WS1	JS3	JS1	JS4	HB1	Unknown	Site 14a	Site 5a	Site 1a	Site 17a	Site 14	Site 20a	Site 11	Site 11a	Site 8	Site 19	Site 14b	Site 1 13	Site 3 13	Site 2 13	Unknown	Jump Up	
	<i>Tiliqua occipitalis</i>	Western Blue-tongued Lizard																								1				
	<i>Tiliqua rugosa</i>	Bobtail																												
Typhlopidae	<i>Anilius australis</i>	Austral Blind Snake																												
	<i>Anilius bicolor</i>	Dark-spined Blind Snake																												
	<i>Anilius grypus</i>	Long-beaked Blind Snake											X																	
	<i>Anilius hamatus</i>	Pale-headed Blind Snake					1			1				1							1									
	<i>Anilius waitii</i>	Waite's Blind Snake												2							1									
Varanidae	<i>Varanus acanthurus</i>	Spiny-tailed Monitor											X																	
	<i>Varanus breviceauda</i>	Short-tailed Pygmy Monitor											X																	
	<i>Varanus caudolineatus</i>	Stripe-tailed Monitor			1								X	1	2				6											
	<i>Varanus eremius</i>	Pygmy Desert Monitor											X																	
	<i>Varanus giganteus</i>	Perentie											X		1															
	<i>Varanus gilleni</i>	Pygmy Mulga Monitor											X																	
	<i>Varanus gouldii</i>	Gould's Goanna					1		1				X		1	1											2			
	<i>Varanus panoptes</i>	Yellow-spotted Monitor											X	2					1	1										1
	<i>Varanus tristis</i>	Black-headed Monitor											X	1																
Chelidae	<i>Chelodina steindachneri</i>	Flat-shelled Turtle											X																	
Birds																														
Casuariidae	<i>Dromaius novaehollandiae</i>	Emu											X	1	2						2		2	5						1
Anatidae	<i>Cygnus atratus</i>	Black Swan											X																	
	<i>Tadorna tadornoides</i>	Australian Shelduck											X																	

Family	Species	Common Name	Surveys													D	E													
			A	B										C																
			TM1	JS2	WM2	WS2	WM1	WS1	JS3	JS1	JS4	HB1	Unknown	Site 14a	Site 5a	Site 1a	Site 17a	Site 14	Site 20a	Site 11	Site 11a	Site 8	Site 19	Site 14b	Site 1 13	Site 3 13	Site 2 13	Unknown	Jump Up	
	<i>Chenonetta jubata</i>	Australian Wood Duck												X																
	<i>Anas superciliosa</i>	Pacific Black Duck												X																
	<i>Anas gracilis</i>	Grey Teal												X																
	<i>Malacorhynchus membranaceus</i>	Pink-eared Duck												X																
	<i>Aythya australis</i>	Hardhead																												
	<i>Biziura lobata</i>	Musk Duck																												
Megapodiidae	<i>Leipoa ocellata</i>	Malleefowl																										X	1	
Phasianidae	<i>Coturnix pectoralis</i>	Stubble Quail																							1					
Podicipedidae	<i>Tachybaptus novaehollandiae</i>	Australasian Grebe												X																
	<i>Poliiocephalus poliocephalus</i>	Hoary-headed Grebe																												
Columbidae	<i>Phaps chalcoptera</i>	Common Bronzewing												X								1								1
	<i>Ocyphaps lophotes</i>	Crested Pigeon												X	5	6	11	1	7			9		2						1
	<i>Geophaps plumifera</i>	Spinifex Pigeon												X																
	<i>Geopelia cuneata</i>	Diamond Dove												X																
Cuculidae	<i>Chrysococcyx basalis</i>	Horsfield's Bronze-Cuckoo												X							3	1	3							1
	<i>Chrysococcyx osculans</i>	Black-eared Cuckoo																	2				1							1
Aegothelidae	<i>Aegotheles cristatus</i>	Australian Owlet-nightjar												X	3			3				1		2						1
Podargidae	<i>Podargus strigoides</i>	Tawny Frogmouth												X					1											
Caprimulgidae	<i>Eurostopodus argus</i>	Spotted Nightjar												X		2	2													1
	<i>Apus pacificus</i>	Pacific Swift																												1
Rallidae	<i>Tribonyx ventralis</i>	Black-tailed Nativehen																												

Family	Species	Common Name	Surveys													B		C				D				E										
			A												Unknown	Site 14a	Site 5a	Site 1a	Site 17a	Site 14	Site 20a	Site 11	Site 11a	Site 8	Site 19	Site 14b	Site 1 13	Site 3 13	Site 2 13	Unknown	Jump Up					
	<i>Fulica atra</i>	Eurasian Coot															X																			
Recurvirostridae	<i>Himantopus himantopus</i>	Black-winged Stilt															X																			
	<i>Himantopus leucocephalus</i>	Pied Stilt																																		
	<i>Cladorhynchus leucocephalus</i>	Banded Stilt																																		
	<i>Recurvirostra novaehollandiae</i>	Red-necked Avocet																																		
Charadriidae	<i>Vanellus tricolor</i>	Banded Lapwing															X	1	4			9			4											
	<i>Charadrius ruficapillus</i>	Red-capped Plover															X																			
	<i>Erythrogonys cinctus</i>	Red-kneed Dotterel															X																			
	<i>Elseynornis melanops</i>	Black-fronted Dotterel															X																			
Scolopacidae	<i>Actitis hypoleucos</i>	Common Sandpiper															X																			
Turnicidae	<i>Turnix velox</i>	Little Buttonquail															X					2			5									1		
Laridae	<i>Chlidonias hybrida</i>	Whiskered Tern															X																			
Otididae	<i>Ardeotis australis</i>	Australian Bustard															X	4						1								X	1			
Ardeidae	<i>Ardea pacifica</i>	White-necked Heron															X																			
	<i>Egretta novaehollandiae</i>	White-faced Heron															X																			
Accipitridae	<i>Haliaeetus albicilla</i>																																			
Anhingidae	<i>Anhinga melanogaster</i>	Australasian Darter															X																			
Accipitridae	<i>Hamirostra melanosternon</i>	Black-breasted Buzzard															X																			
	<i>Hieraaetus morphnoides</i>	Little Eagle															X					1			3											
	<i>Aquila audax</i>	Wedge-tailed Eagle															X	2		2	6			3												
	<i>Circus assimilis</i>	Spotted Harrier															X											1								

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	<i>Accipiter fasciatus</i>	Brown Goshawk												X										3						
	<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk												X																1
	<i>Milvus migrans</i>	Black Kite												X																
	<i>Haliastur sphenurus</i>	Whistling Kite												X																
Cuculidae	<i>Heterosceles pallidus</i>	Pallid Cuckoo												X				2	1			1	1							
Strigidae	<i>Ninox boobook</i>	Southern Boobook												X																
Alcedinidae	<i>Todiramphus pyrrhopygius</i>	Red-backed Kingfisher															6		1						1					
Meropidae	<i>Merops ornatus</i>	Rainbow Bee-eater																	3				3							1
Falconidae	<i>Falco cenchroides</i>	Nankeen Kestrel												X	5	4	2					2	3							
	<i>Falco longipennis</i>	Australian Hobby												X								1								1
	<i>Falco berigora</i>	Brown Falcon												X	3		2		3			3	5	1						1
	<i>Falco peregrinus</i>	Peregrine Falcon																												
Megaluridae	<i>Poodytes carteri</i>	Spinifexbird												X																
Cacatuidae	<i>Eolophus roseicapilla</i>	Galah												X	908	7	2	44	7		1	4	5	8						1
	<i>Cacatua sanguinea</i>	Little Corella												X																
	<i>Nymphicus hollandicus</i>	Cockatiel												X	2						6	35	3	4						1
Psittaculidae	<i>Neopsephotus bourkii</i>	Bourke's Parrot																	4											1
	<i>Barnardius zonarius</i>	Australian Ringneck												X	31	1		25	3			9	16	36						1
	<i>Psephotus varius</i>	Mulga Parrot												X					14				2	11						1
	<i>Melopsittacus undulatus</i>	Budgerigar												X	9		2	11	17		20	170	29	15						1
Ptilonorhynchidae	<i>Chlamydera guttata</i>	Western Bowerbird																												1

Family	Species	Common Name	Surveys																												
			A					B		C					D					E											
			TM1	JS2	WM2	WS2	WM1	WS1	JS3	JS1	JS4	HB1	Unknown	Site 14a	Site 5a	Site 1a	Site 17a	Site 14	Site 20a	Site 11	Site 11a	Site 8	Site 19	Site 14b	Site 1 13	Site 3 13	Site 2 13	Unknown	Jump Up		
Climacteridae	<i>Climacteris affinis</i>	White-browed Treecreeper																		4										1	
Maluridae	<i>Amytornis striatus</i>	Striated Grasswren												X															X		
	<i>Stipiturus ruficeps</i>	Rufous-crowned Emuwren												X																	
	<i>Malurus assimilis</i>	Purple-backed Fairywren												X																	
	<i>Malurus lamberti</i>	Variegated Fairywren																													
	<i>Malurus splendens</i>	Splendid Fairywren																												1	
	<i>Malurus splendens</i>	Splendid Fairywren																													
	<i>Malurus leucopterus</i>	White-winged Fairywren													1						3	76	40		2					1	
	<i>Malurus leucopterus</i>	White-winged Fairywren												X																	
Meliphagidae	<i>Certhionyx variegatus</i>	Pied Honeyeater												X				2			2										
	<i>Purnella albifrons</i>	White-fronted Honeyeater												X				3			1	2	4	1						1	
	<i>Manorina flavigula</i>	Yellow-throated Miner													15		1	10	41			21	13	98						1	
	<i>Manorina flavigula</i>	Yellow-throated Miner																													
	<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater												X	2	2	5	11	10			9	8	2						1	
	<i>Anthochaera carunculata</i>	Red Wattlebird																		3				2						1	
	<i>Anthochaera carunculata</i>	Red Wattlebird																													
	<i>Gavicalis virescens</i>	Singing Honeyeater													1	2	11	3			3	8	2	3						1	
	<i>Gavicalis virescens</i>	Singing Honeyeater												X																	
	<i>Gavicalis virescens</i>	Singing Honeyeater																													
	<i>Ptilotula penicillata</i>	White-plumed Honeyeater (Western)												X																	
	<i>Ptilotula keartlandi</i>	Grey-headed Honeyeater												X																	

Family	Species	Common Name	Surveys																											
			A					B	C					D					E											
			TM1	JS2	WM2	WS2	WM1	WS1	JS3	JS1	JS4	HB1	Unknown	Site 14a	Site 5a	Site 1a	Site 17a	Site 14	Site 20a	Site 11	Site 11a	Site 8	Site 19	Site 14b	Site 1 13	Site 3 13	Site 2 13	Unknown	Jump Up	
	<i>Ptilotula plumula</i>	Grey-fronted Honeyeater																	56	2			3							
	<i>Conopophila whitei</i>	Grey Honeyeater																						18						
	<i>Epthianura tricolor</i>	Crimson Chat												X	24		6	154	29		18	75								1
	<i>Epthianura aurifrons</i>	Orange Chat												X							5									
	<i>Sugomel nigrum</i>	Black Honeyeater												X																
	<i>Lichmera indistincta</i>	Brown Honeyeater												X																1
	<i>Nesoptilotis flavicollis</i>	Yellow-throated Honeyeater												X																
Pardalotidae	<i>Pardalotus striatus</i>	Striated Pardalote																					2	1						1
	<i>Pardalotus striatus</i>	Striated Pardalote												X																
Acanthizidae	<i>Pyrrholaemus brunneus</i>	Redthroat																				2		2						1
	<i>Acanthiza iredalei</i>	Slender-billed Thornbill (Western)																												
	<i>Acanthiza apicalis</i>	Inland Thornbill																		2				3						1
	<i>Acanthiza apicalis</i>	Inland Thornbill												X																
	<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill												X						8		9	4							1
	<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill												X	3	3				126		53	88	5						1
	<i>Acanthiza robustirostris</i>	Slaty-backed Thornbill												X						6			3							
	<i>Smicronis brevirostris</i>	Weebill												X						7			98							1
	<i>Gerygone fusca</i>	Western Gerygone												X																
	<i>Aphelocephala leucopsis</i>	Southern Whiteface												X						52		4	5	8						1
Acanthizidae	<i>Aphelocephala nigricincta</i>	Banded Whiteface												X																
Pomatostomidae	<i>Pomatostomus temporalis</i>	Grey-crowned Babbler												X																

Family	Species	Common Name	Surveys																												
			A											B	C			D		E											
			TM1	JS2	WM2	WS2	WM1	WS1	JS3	JS1	JS4	HB1	Unknown	Site 14a	Site 5a	Site 1a	Site 17a	Site 14	Site 20a	Site 11	Site 11a	Site 8	Site 19	Site 14b	Site 1 13	Site 3 13	Site 2 13	Unknown	Jump Up		
	<i>Pomatostomus superciliosus</i>	White-browed Babbler											X		2									3							
Cinclosoma	<i>castaneothorax</i>	Chestnut-breasted Quail-thrush																	3		2										
	<i>cinnamomeum</i>	Cinnamon Quail-thrush											X																		
Campephagidae	<i>Coracina maxima</i>	Ground Cuckooshrike											X	31		3					4			2							
	<i>Coracina novaehollandiae</i>	Black-faced Cuckooshrike											X	5		1	4	10			7	9	6							1	
	<i>Lalage tricolor</i>	White-winged Triller											X	3				34			39		9							1	
Neosittidae	<i>Daphoenositta chrysoptera</i>	Varied Sittella											X									6	2								
Oreoicidae	<i>Oreoica gutturalis</i>	Crested Bellbird											X	5	2	14	10			3	6	15	1							1	
Pachycephalidae	<i>Colluricincla harmonica</i>	Grey Shrikethrush											X									5									1
Pachycephalidae	<i>Pachycephala rufiventris</i>	Rufous Whistler											X									8									1
Artamidae	<i>Artamus personatus</i>	Masked Woodswallow											X				2	72		2		2	31							1	
	<i>Artamus superciliosus</i>	White-browed Woodswallow																	3												
	<i>Artamus cinereus</i>	Black-faced Woodswallow											X	25		11	55	1			7	12		6							
	<i>Artamus cyanopterus</i>	Dusky Woodswallow																													
	<i>Artamus minor</i>	Little Woodswallow											X																		
	<i>Cracticus torquatus</i>	Grey Butcherbird											X	4			2	8			4	8	7								
	<i>Cracticus nigrogularis</i>	Pied Butcherbird											X	23	4	1	6				13	4	1							1	
	<i>Gymnorhina tibicen</i>	Australian Magpie											X	3		9	1														1
	<i>Strepera versicolor</i>	Grey Currawong												2									2	3							1
Rhipiduridae	<i>Rhipidura leucophrys</i>	Willie Wagtail											X	2		1						12		2							1
Monarchidae	<i>Grallina cyanoleuca</i>	Magpie-lark											X	12		2						3		7							

Family	Species	Common Name	Surveys													E															
			A			B							C				D														
			TM1	JS2	WM2	WS2	WM1	WS1	JS3	JS1	JS4	HB1	Unknown	Site 14a	Site 5a	Site 1a	Site 17a	Site 14	Site 20a	Site 11	Site 11a	Site 8	Site 19	Site 14b	Site 1 13	Site 3 13	Site 2 13	Unknown	Jump Up		
Corvidae	<i>Corvus orru</i>	Torresian Crow											X								2				2						
	<i>Corvus bennetti</i>	Little Crow											X	50	7	12	29	6		11	36	24	21							1	
Petroicidae	<i>Microeca fascinans</i>	Jacky Winter											X	1					1				22								
	<i>Petroica goodenovii</i>	Red-capped Robin											X	5	3	3	1	1	47		3	29	3							1	
	<i>Melanodryas cucullata</i>	Hooded Robin											X	1			2	1		1	2										
Alaudidae	<i>Mirafra javanica</i>	Australasian Bushlark											X																		
Locustellidae	<i>Cincloramphus cruralis</i>	Brown Songlark											X	7		8	3	1	7	7											
	<i>Cincloramphus mathewsi</i>	Rufous Songlark											X											3							
Hirundinidae	<i>Hirundo rustica</i>	Barn Swallow																													
	<i>Hirundo neoxena</i>	Welcome Swallow																													
	<i>Petrochelidon nigricans</i>	Tree Martin											X																		
	<i>Cheramoeca leucosterna</i>	White-backed Swallow											X			2															
Dicaeidae	<i>Dicaeum hirundinaceum</i>	Mistletoebird																			5	4							1		
	<i>Emblema pictum</i>	Painted Finch											X																		
	<i>Taeniopygia guttata</i>	Zebra Finch											X				12			9	36	5	4								
Motacillidae	<i>Anthus novaeseelandiae</i>	Australasian Pipit												16		36			7	18		1							1		
Mammals																															
Tachyglossidae	<i>Tachyglossus aculeatus</i>	Short-beaked Echidna											X																1		
Bovidae	<i>Bos taurus</i>	Cow											X																1		
	<i>Capra hircus</i>	Goat												1	1		1					1								1	
	<i>Ovis aries</i>	Sheep												1					1				1								

Family	Species	Common Name	Surveys													E														
			A	B										C	D															
			TM1	JS2	WM2	WS2	WM1	WS1	JS3	JS1	JS4	HB1	Unknown	Site 14a	Site 5a	Site 1a	Site 17a	Site 14	Site 20a	Site 11	Site 11a	Site 8	Site 19	Site 14b	Site 1 13	Site 3 13	Site 2 13	Unknown	Jump Up	
Camelidae	<i>Camelus dromedarius</i>	Dromedary												X							1									
Canidae	<i>Canis lupus</i>	Dingo												X							1									
	<i>Vulpes vulpes</i>	Red Fox													1				1				1							1
Felidae	<i>Felis catus</i>	Cat												X							1									1
Molossidae	<i>Austronomus australis</i>	White-striped Freetail Bat													1															
	<i>Mormopterus planiceps</i>	Southern Free-tail Bat													1															
	<i>Mormopterus sp. 4</i>	South-western Free-tail Bat																												1
Vespertilionidae	<i>Nyctophilus sp.</i>	Long-eared Bat Sp.																												1
	<i>Chalinolobus gouldii</i>	Gould's Wattled Bat													1	3														1
	<i>Chalinolobus morio</i>	Chocolate Wattled Bat																												1
	<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat													4	3	9													
	<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat													6	1														1
Dasyuridae	<i>Ningau sp.</i>	Ningau sp.																										1		
	<i>Planigale sp.</i>	Planigale sp.												X																
	<i>Antechinomys laniger</i>	Kultarr																												
	<i>Dasyercus blythi</i>	Brush-tailed Mulgara												X													2		2	
	<i>Dasykaluta rosamondae</i>	Kaluta												X																
	<i>Ningau ridei</i>	Wongai Ningau							1					X									5							
	<i>Ningau yvonneae</i>	Mallee Ningau																												
	<i>Pseudantechinus woolleyae</i>	Woolley's False Antechinus												X																
	<i>Sminthopsis crassicaudata</i>	Fat-tailed Dunnart													1					7	5									

Family	Species	Common Name	Surveys																										
			A								B	C				D					E								
			TM1	JS2	WM2	WS2	WM1	WS1	JS3	JS1	JS4	HB1	Unknown	Site 14a	Site 5a	Site 1a	Site 17a	Site 14	Site 20a	Site 11	Site 11a	Site 8	Site 19	Site 14b	Site 1 13	Site 3 13	Site 2 13	Unknown	Jump Up
	<i>Sminthopsis dolichura</i>	Little Long-tailed Dunnart													2	1			1	1		2	1						
	<i>Sminthopsis hirtipes</i>	Hairy-footed Dunnart												X															
	<i>Sminthopsis longicaudata</i>	Long-tailed Dunnart												X															
	<i>Sminthopsis macroura</i>	Stripe-faced Dunnart												X															
	<i>Sminthopsis murina</i>	Slender-tailed Dunnart																											
	<i>Sminthopsis ooldea</i>	Ooldea Dunnart																											
	<i>Sminthopsis youngsoni</i>	Lesser Hairy-footed Dunnart												X															
Macropodidae	<i>Macropus fuliginosus</i>	Western Grey Kangaroo														1						1							
	<i>Osphranter robustus</i>	Euro												X	1	1	1	1	1	1	1	1	1						1
	<i>Osphranter rufus</i>	Red Kangaroo												X	1	1	1	1	1	1	1	1							1
Leporidae	<i>Oryctolagus cuniculus</i>	Rabbit												X	2	1				1	1								1
Equidae	<i>Equus asinus</i>	Donkey												X															
	<i>Equus caballus</i>	Horse												X															
Muridae	<i>Leporillus apicalis</i>	Lesser Stick-nest Rat												X															
	<i>Mus musculus</i>	House Mouse												X	2	1				2			3						
	<i>Notomys alexis</i>	Spinifex Hopping Mouse							1					X								1							
	<i>Pseudomys chapmani</i>	Western Pebble-mound Mouse												X															
	<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse												X	1					2	1	1	7						

- A Dunlop, J.N. and Payne, W. (1999) *A vertebrate Fauna Survey of the North Lake Carey Region including Hillside Prospect, Wallaby Prospect and Just in Time / Just in Case and the Teatree Dam Area*, Unpublished report for Placer (Granny Smith) and Homestake, Perth,
- B Van Leeuwen, S. (1997) *Biological Survey of the Southern Little Sandy Desert*, Department of Conservation and land Management, Perth.
- C Kingfisher Environmental Consulting (2014) *Sunrise Dam - Tropicana Infrastructure Corridor Fauna Survey*, Unpublished report for Anglogold Ashanti Australia, Perth.
- D Ecologia Environment (2007) *Jump Up Dam Fauna Assessment*, Unpublished report for Heron Resources Limited, Perth.

Appendix C.

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

Basic vertebrate fauna survey and risk assessment
Mt Celia Gold Project



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

Threatened, Extinct and Specially Protected fauna or flora¹ are species² which have been adequately searched for and are deemed to be, in the wild, threatened, extinct or in need of special protection, and have been gazetted as such. The *Wildlife Conservation (Specially Protected Fauna) Notice 2018* and the *Wildlife Conservation (Rare Flora) Notice 2018* have been transitioned under regulations 170, 171 and 172 of the *Biodiversity Conservation Regulations 2018* to be the lists of Threatened, Extinct and Specially Protected species under Part 2 of the *Biodiversity Conservation Act 2016*. Categories of Threatened, Extinct and Specially Protected fauna and flora are:

T Threatened Species

Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the *Biodiversity Conservation Act 2016* (BC Act).

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

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

The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.

CR Critically endangered species

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

Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for critically endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for critically endangered flora.

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.

Rapid Fauna Habitat Assessment

Basic vertebrate fauna survey and risk assessment
Mt Celia Gold Project



Date: 20/10/2020

Habitat Assessment #: 1

Observer: ST

Zone: 51

Easting: 449849 mE

Northing: 6740965 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga drainage line

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 2

Observer: ST

Zone: 51

Easting: 449850 mE

Northing: 6741164 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 3

Observer: ST

Zone: 51

Easting: 449851 mE

Northing: 6741357 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 4

Observer: ST

Zone: 51

Easting: 449858 mE

Northing: 6741433 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga drainage line

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 5

Observer: ST

Zone: 51

Easting: 449868 mE

Northing: 6741626 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 6

Observer: ST

Zone: 51

Easting: 449863 mE

Northing: 6741851 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 7

Observer: ST

Zone: 51

Easting: 449871 mE

Northing: 6742038 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 8

Observer: ST

Zone: 51

Easting: 449675 mE

Northing: 6742023 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 9

Observer: ST

Zone: 51

Easting: 449667 mE

Northing: 6741827 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 10

Observer: ST

Zone: 51

Easting: 449664 mE

Northing: 6741633 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 11

Observer: ST

Zone: 51

Easting: 449640 mE

Northing: 6741425 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 12

Observer: ST

Zone: 51

Easting: 449636 mE

Northing: 6741190 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 13

Observer: ST

Zone: 51

Easting: 449638 mE

Northing: 6740942 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 14

Observer: ST

Zone: 51

Easting: 449598 mE

Northing: 6740794 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga drainage line

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 15

Observer: ST

Zone: 51

Easting: 449438 mE

Northing: 6740908 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 16

Observer: ST

Zone: 51

Easting: 449463 mE

Northing: 6741164 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 17

Observer: ST

Zone: 51

Easting: 449454 mE

Northing: 6741432 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 18

Observer: ST

Zone: 51

Easting: 449445 mE

Northing: 6741554 mN

Fire History: >5 years

Landform: Rocky hill

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 19

Observer: ST

Zone: 51

Easting: 449431 mE

Northing: 6741659 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 20

Observer: ST

Zone: 51

Easting: 449447 mE

Northing: 6741838 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 21

Observer: ST

Zone: 51

Easting: 449464 mE

Northing: 6741909 mN

Fire History: >5 years

Landform: Rocky hill

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 22

Observer: ST

Zone: 51

Easting: 449264 mE

Northing: 6742022 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 23

Observer: ST

Zone: 51

Easting: 449255 mE

Northing: 6741822 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 24

Observer: ST

Zone: 51

Easting: 449274 mE

Northing: 6741619 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 25

Observer: ST

Zone: 51

Easting: 449247 mE

Northing: 6741455 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 26

Observer: ST

Zone: 51

Easting: 449255 mE

Northing: 6741225 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga drainage line

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 27

Observer: ST

Zone: 51

Easting: 449251 mE

Northing: 6740900 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 28

Observer: ST

Zone: 51

Easting: 449245 mE

Northing: 6740661 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 29

Observer: ST

Zone: 51

Easting: 449103 mE

Northing: 6740545 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga drainage line

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 30

Observer: ST

Zone: 51

Easting: 449074 mE

Northing: 6740722 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 31

Observer: ST

Zone: 51

Easting: 449046 mE

Northing: 6740923 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 32

Observer: ST

Zone: 51

Easting: 449040 mE

Northing: 6741142 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 33

Observer: ST

Zone: 51

Easting: 449062 mE

Northing: 6741379 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 34

Observer: ST

Zone: 51

Easting: 449049 mE

Northing: 6741581 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 35

Observer: ST

Zone: 51

Easting: 449054 mE

Northing: 6741806 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 36

Observer: ST

Zone: 51

Easting: 449054 mE

Northing: 6742019 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 37

Observer: ST

Zone: 51

Easting: 448845 mE

Northing: 6741999 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 38

Observer: ST

Zone: 51

Easting: 448875 mE

Northing: 6741815 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 39

Observer: ST

Zone: 51

Easting: 448848 mE

Northing: 6741614 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 40

Observer: ST

Zone: 51

Easting: 448859 mE

Northing: 6741382 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga drainage line

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 41

Observer: ST

Zone: 51

Easting: 448857 mE

Northing: 6741164 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 42

Observer: ST

Zone: 51

Easting: 448849 mE

Northing: 6740948 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga drainage line

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 43

Observer: ST

Zone: 51

Easting: 448842 mE

Northing: 6740723 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 44

Observer: ST

Zone: 51

Easting: 448658 mE

Northing: 6740845 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 45

Observer: ST

Zone: 51

Easting: 448658 mE

Northing: 6740972 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 46

Observer: ST

Zone: 51

Easting: 448658 mE

Northing: 6741159 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 47

Observer: ST

Zone: 51

Easting: 448669 mE

Northing: 6741368 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 48

Observer: ST

Zone: 51

Easting: 448654 mE

Northing: 6741608 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 49

Observer: ST

Zone: 51

Easting: 448658 mE

Northing: 6741845 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 50

Observer: ST

Zone: 51

Easting: 448624 mE

Northing: 6742020 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 51

Observer: ST

Zone: 51

Easting: 448463 mE

Northing: 6742009 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 52

Observer: ST

Zone: 51

Easting: 448472 mE

Northing: 6741841 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 53

Observer: ST

Zone: 51

Easting: 448495 mE

Northing: 6741610 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 54

Observer: ST

Zone: 51

Easting: 448465 mE

Northing: 6741367 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 55

Observer: ST

Zone: 51

Easting: 448456 mE

Northing: 6741218 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 56

Observer: ST

Zone: 51

Easting: 448278 mE

Northing: 6741279 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 57

Observer: ST

Zone: 51

Easting: 448245 mE

Northing: 6741432 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 58

Observer: ST

Zone: 51

Easting: 448243 mE

Northing: 6741640 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 59

Observer: ST

Zone: 51

Easting: 448260 mE

Northing: 6741833 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 60

Observer: ST

Zone: 51

Easting: 448243 mE

Northing: 6742036 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 61

Observer: ST

Zone: 51

Easting: 448236 mE

Northing: 6742242 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga drainage line

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 62

Observer: ST

Zone: 51

Easting: 448250 mE

Northing: 6742435 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga drainage line

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 63

Observer: ST

Zone: 51

Easting: 448225 mE

Northing: 6742669 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 64

Observer: ST

Zone: 51

Easting: 448251 mE

Northing: 6742875 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 65

Observer: ST

Zone: 51

Easting: 448236 mE

Northing: 6743093 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 66

Observer: ST

Zone: 51

Easting: 448157 mE

Northing: 6743187 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Disturbed



Date: 20/10/2020

Habitat Assessment #: 67

Observer: ST

Zone: 51

Easting: 448280 mE

Northing: 6743288 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 68

Observer: ST

Zone: 51

Easting: 448207 mE

Northing: 6743493 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 69

Observer: ST

Zone: 51

Easting: 448255 mE

Northing: 6743717 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 70

Observer: ST

Zone: 51

Easting: 448249 mE

Northing: 6743867 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 71

Observer: ST

Zone: 51

Easting: 448048 mE

Northing: 6743864 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 72

Observer: ST

Zone: 51

Easting: 448066 mE

Northing: 6743705 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 73

Observer: ST

Zone: 51

Easting: 448068 mE

Northing: 6743528 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 74

Observer: ST

Zone: 51

Easting: 447933 mE

Northing: 6743442 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Disturbed



Date: 20/10/2020

Habitat Assessment #: 75

Observer: ST

Zone: 51

Easting: 448077 mE

Northing: 6743282 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Disturbed



Date: 20/10/2020

Habitat Assessment #: 76

Observer: ST

Zone: 51

Easting: 448064 mE

Northing: 6743093 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 77

Observer: ST

Zone: 51

Easting: 448053 mE

Northing: 6742881 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 78

Observer: ST

Zone: 51

Easting: 448065 mE

Northing: 6742673 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 79

Observer: ST

Zone: 51

Easting: 448070 mE

Northing: 6742466 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga drainage line

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 80

Observer: ST

Zone: 51

Easting: 448044 mE

Northing: 6742243 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 81

Observer: ST

Zone: 51

Easting: 448074 mE

Northing: 6742020 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 82

Observer: ST

Zone: 51

Easting: 448065 mE

Northing: 6741795 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 83

Observer: ST

Zone: 51

Easting: 448060 mE

Northing: 6741628 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 84

Observer: ST

Zone: 51

Easting: 448064 mE

Northing: 6741423 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 85

Observer: ST

Zone: 51

Easting: 448056 mE

Northing: 6741192 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 86

Observer: ST

Zone: 51

Easting: 447862 mE

Northing: 6741408 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 87

Observer: ST

Zone: 51

Easting: 447821 mE

Northing: 6741640 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 88

Observer: ST

Zone: 51

Easting: 447877 mE

Northing: 6741837 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 89

Observer: ST

Zone: 51

Easting: 447836 mE

Northing: 6742042 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga drainage line

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 90

Observer: ST

Zone: 51

Easting: 447838 mE

Northing: 6742259 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 91

Observer: ST

Zone: 51

Easting: 447833 mE

Northing: 6742508 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 92

Observer: ST

Zone: 51

Easting: 447834 mE

Northing: 6742685 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 93

Observer: ST

Zone: 51

Easting: 447872 mE

Northing: 6742907 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 94

Observer: ST

Zone: 51

Easting: 447841 mE

Northing: 6743097 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 95

Observer: ST

Zone: 51

Easting: 447844 mE

Northing: 6743289 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 96

Observer: ST

Zone: 51

Easting: 447839 mE

Northing: 6743416 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 97

Observer: ST

Zone: 51

Easting: 447837 mE

Northing: 6743566 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 98

Observer: ST

Zone: 51

Easting: 447831 mE

Northing: 6743726 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 99

Observer: ST

Zone: 51

Easting: 447649 mE

Northing: 6743769 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 100

Observer: ST

Zone: 51

Easting: 447638 mE

Northing: 6743546 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 101

Observer: ST

Zone: 51

Easting: 447663 mE

Northing: 6743319 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 102

Observer: ST

Zone: 51

Easting: 447682 mE

Northing: 6743090 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 103

Observer: ST

Zone: 51

Easting: 447653 mE

Northing: 6742911 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 104

Observer: ST

Zone: 51

Easting: 447660 mE

Northing: 6742672 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 105

Observer: ST

Zone: 51

Easting: 447652 mE

Northing: 6742524 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 106

Observer: ST

Zone: 51

Easting: 447643 mE

Northing: 6742316 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 107

Observer: ST

Zone: 51

Easting: 447691 mE

Northing: 6742053 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 108

Observer: ST

Zone: 51

Easting: 447676 mE

Northing: 6741852 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga drainage line

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 109

Observer: ST

Zone: 51

Easting: 447680 mE

Northing: 6741665 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 110

Observer: ST

Zone: 51

Easting: 447671 mE

Northing: 6741476 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga drainage line

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 111

Observer: ST

Zone: 51

Easting: 447416 mE

Northing: 6741690 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga drainage line

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 112

Observer: ST

Zone: 51

Easting: 447453 mE

Northing: 6741863 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 113

Observer: ST

Zone: 51

Easting: 447468 mE

Northing: 6742060 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 114

Observer: ST

Zone: 51

Easting: 447439 mE

Northing: 6742303 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 115

Observer: ST

Zone: 51

Easting: 447443 mE

Northing: 6742505 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 116

Observer: ST

Zone: 51

Easting: 447447 mE

Northing: 6742684 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 117

Observer: ST

Zone: 51

Easting: 447438 mE

Northing: 6742912 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Disturbed



Date: 20/10/2020

Habitat Assessment #: 118

Observer: ST

Zone: 51

Easting: 447446 mE

Northing: 6743129 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 119

Observer: ST

Zone: 51

Easting: 447433 mE

Northing: 6743324 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 120

Observer: ST

Zone: 51

Easting: 447458 mE

Northing: 6743544 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 121

Observer: ST

Zone: 51

Easting: 447452 mE

Northing: 6743737 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 122

Observer: ST

Zone: 51

Easting: 447448 mE

Northing: 6743868 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Disturbed



Date: 20/10/2020

Habitat Assessment #: 123

Observer: ST

Zone: 51

Easting: 447251 mE

Northing: 6743859 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 124

Observer: ST

Zone: 51

Easting: 447243 mE

Northing: 6743703 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 125

Observer: ST

Zone: 51

Easting: 447224 mE

Northing: 6743536 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 126

Observer: ST

Zone: 51

Easting: 447257 mE

Northing: 6743333 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 127

Observer: ST

Zone: 51

Easting: 447244 mE

Northing: 6743124 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 128

Observer: ST

Zone: 51

Easting: 447232 mE

Northing: 6742947 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 129

Observer: ST

Zone: 51

Easting: 447277 mE

Northing: 6742792 mN

Fire History: >5 years

Landform: Rocky hill

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 130

Observer: ST

Zone: 51

Easting: 447306 mE

Northing: 6742710 mN

Fire History: >5 years

Landform: Rocky hill

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 131

Observer: ST

Zone: 51

Easting: 447265 mE

Northing: 6742519 mN

Fire History: >5 years

Landform: Rocky hill

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 132

Observer: ST

Zone: 51

Easting: 447268 mE

Northing: 6742323 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 133

Observer: ST

Zone: 51

Easting: 447287 mE

Northing: 6742081 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 134

Observer: ST

Zone: 51

Easting: 447254 mE

Northing: 6741887 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 135

Observer: ST

Zone: 51

Easting: 447284 mE

Northing: 6741691 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 136

Observer: ST

Zone: 51

Easting: 447057 mE

Northing: 6741889 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 137

Observer: ST

Zone: 51

Easting: 447089 mE

Northing: 6742080 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 138

Observer: ST

Zone: 51

Easting: 447062 mE

Northing: 6742319 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 139

Observer: ST

Zone: 51

Easting: 447060 mE

Northing: 6742524 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 140

Observer: ST

Zone: 51

Easting: 447068 mE

Northing: 6742750 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 141

Observer: ST

Zone: 51

Easting: 447029 mE

Northing: 6742937 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 142

Observer: ST

Zone: 51

Easting: 447022 mE

Northing: 6743142 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 143

Observer: ST

Zone: 51

Easting: 447095 mE

Northing: 6743357 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 144

Observer: ST

Zone: 51

Easting: 447077 mE

Northing: 6743535 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 145

Observer: ST

Zone: 51

Easting: 447073 mE

Northing: 6743705 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 146

Observer: ST

Zone: 51

Easting: 447070 mE

Northing: 6743878 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 147

Observer: ST

Zone: 51

Easting: 446844 mE

Northing: 6743857 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 148

Observer: ST

Zone: 51

Easting: 446828 mE

Northing: 6743679 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 149

Observer: ST

Zone: 51

Easting: 446871 mE

Northing: 6743516 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 150

Observer: ST

Zone: 51

Easting: 446847 mE

Northing: 6743329 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 151

Observer: ST

Zone: 51

Easting: 446858 mE

Northing: 6743151 mN

Fire History: >5 years

Landform: Slope

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 152

Observer: ST

Zone: 51

Easting: 446865 mE

Northing: 6742919 mN

Fire History: >5 years

Landform: Slope

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 153

Observer: ST

Zone: 51

Easting: 446870 mE

Northing: 6742745 mN

Fire History: >5 years

Landform: Slope

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 154

Observer: ST

Zone: 51

Easting: 446864 mE

Northing: 6742530 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 155

Observer: ST

Zone: 51

Easting: 446841 mE

Northing: 6742333 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 156

Observer: ST

Zone: 51

Easting: 446831 mE

Northing: 6742127 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 157

Observer: ST

Zone: 51

Easting: 446836 mE

Northing: 6741941 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 158

Observer: ST

Zone: 51

Easting: 446677 mE

Northing: 6742119 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 159

Observer: ST

Zone: 51

Easting: 446689 mE

Northing: 6742331 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 160

Observer: ST

Zone: 51

Easting: 446680 mE

Northing: 6742522 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 161

Observer: ST

Zone: 51

Easting: 446670 mE

Northing: 6742739 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 162

Observer: ST

Zone: 51

Easting: 446681 mE

Northing: 6742907 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 163

Observer: ST

Zone: 51

Easting: 446669 mE

Northing: 6743174 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 164

Observer: ST

Zone: 51

Easting: 446700 mE

Northing: 6743412 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 165

Observer: ST

Zone: 51

Easting: 446704 mE

Northing: 6743561 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 166

Observer: ST

Zone: 51

Easting: 446696 mE

Northing: 6743718 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 167

Observer: ST

Zone: 51

Easting: 446695 mE

Northing: 6743868 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 168

Observer: ST

Zone: 51

Easting: 453064 mE

Northing: 6742018 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 169

Observer: ST

Zone: 51

Easting: 453075 mE

Northing: 6741808 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 170

Observer: ST

Zone: 51

Easting: 453059 mE

Northing: 6741571 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 171

Observer: ST

Zone: 51

Easting: 453077 mE

Northing: 6741343 mN

Fire History: >5 years

Landform: Hill

Soil Type: Stony/Rocky

Habitat Structure: Mulga on rocky slopes and hills

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 172

Observer: ST

Zone: 51

Easting: 453090 mE

Northing: 6741118 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 173

Observer: ST

Zone: 51

Easting: 453053 mE

Northing: 6740906 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony/Rocky

Habitat Structure: Mulga on rocky slopes and hills

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 174

Observer: ST

Zone: 51

Easting: 453052 mE

Northing: 6740673 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 175

Observer: ST

Zone: 51

Easting: 453086 mE

Northing: 6740445 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 176

Observer: ST

Zone: 51

Easting: 453073 mE

Northing: 6740221 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 177

Observer: ST

Zone: 51

Easting: 453065 mE

Northing: 6740006 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 178

Observer: ST

Zone: 51

Easting: 453058 mE

Northing: 6739772 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 179

Observer: ST

Zone: 51

Easting: 453065 mE

Northing: 6739543 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga drainage line

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 180

Observer: ST

Zone: 51

Easting: 453054 mE

Northing: 6739293 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 181

Observer: ST

Zone: 51

Easting: 452842 mE

Northing: 6739091 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 182

Observer: ST

Zone: 51

Easting: 452872 mE

Northing: 6739326 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 183

Observer: ST

Zone: 51

Easting: 452818 mE

Northing: 6739554 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 184

Observer: ST

Zone: 51

Easting: 452858 mE

Northing: 6739782 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 185

Observer: ST

Zone: 51

Easting: 452846 mE

Northing: 6740012 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 186

Observer: ST

Zone: 51

Easting: 452826 mE

Northing: 6740093 mN

Fire History: >5 years

Landform: Hill

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 187

Observer: ST

Zone: 51

Easting: 452845 mE

Northing: 6740278 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 188

Observer: ST

Zone: 51

Easting: 452855 mE

Northing: 6740459 mN

Fire History: >5 years

Landform: Hill

Soil Type: Stony/Rocky

Habitat Structure: Mulga on rocky slopes and hills

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 189

Observer: ST

Zone: 51

Easting: 452861 mE

Northing: 6740668 mN

Fire History: >5 years

Landform: Hill

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 190

Observer: ST

Zone: 51

Easting: 452820 mE

Northing: 6740914 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 191

Observer: ST

Zone: 51

Easting: 452884 mE

Northing: 6741142 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 192

Observer: ST

Zone: 51

Easting: 452823 mE

Northing: 6741359 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony/Rocky

Habitat Structure: Mulga on rocky slopes and hills

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 193

Observer: ST

Zone: 51

Easting: 452841 mE

Northing: 6741587 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony/Rocky

Habitat Structure: Mulga on rocky slopes and hills

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 194

Observer: ST

Zone: 51

Easting: 452865 mE

Northing: 6741817 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony/Rocky

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 195

Observer: ST

Zone: 51

Easting: 452868 mE

Northing: 6742040 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 196

Observer: ST

Zone: 51

Easting: 452635 mE

Northing: 6742031 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony/Rocky

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 197

Observer: ST

Zone: 51

Easting: 452658 mE

Northing: 6741810 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 198

Observer: ST

Zone: 51

Easting: 452668 mE

Northing: 6741560 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony/Rocky

Habitat Structure: Mulga on rocky slopes and hills

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 199

Observer: ST

Zone: 51

Easting: 452679 mE

Northing: 6741344 mN

Fire History: >5 years

Landform: Hill

Soil Type: Stony/Rocky

Habitat Structure: Mulga on rocky slopes and hills

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 200

Observer: ST

Zone: 51

Easting: 452662 mE

Northing: 6741150 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 201

Observer: ST

Zone: 51

Easting: 452646 mE

Northing: 6740921 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 202

Observer: ST

Zone: 51

Easting: 452667 mE

Northing: 6740692 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony/Rocky

Habitat Structure: Mulga on rocky slopes and hills

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 203

Observer: ST

Zone: 51

Easting: 452635 mE

Northing: 6740475 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony/Rocky

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 204

Observer: ST

Zone: 51

Easting: 452652 mE

Northing: 6740256 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony/Rocky

Habitat Structure: Mulga on rocky slopes and hills

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 205

Observer: ST

Zone: 51

Easting: 452659 mE

Northing: 6740017 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 206

Observer: ST

Zone: 51

Easting: 452657 mE

Northing: 6739785 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony/Rocky

Habitat Structure: Mulga on rocky slopes and hills

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 207

Observer: ST

Zone: 51

Easting: 452663 mE

Northing: 6739553 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 208

Observer: ST

Zone: 51

Easting: 452644 mE

Northing: 6739305 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga drainage line

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 209

Observer: ST

Zone: 51

Easting: 452645 mE

Northing: 6739056 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 211

Observer: ST

Zone: 51

Easting: 452653 mE

Northing: 6738900 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony/Rocky

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 212

Observer: ST

Zone: 51

Easting: 452448 mE

Northing: 6738800 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 213

Observer: ST

Zone: 51

Easting: 452469 mE

Northing: 6739068 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga drainage line

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 214

Observer: ST

Zone: 51

Easting: 452452 mE

Northing: 6739308 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony/Rocky

Habitat Structure: Mulga on rocky slopes and hills

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 215

Observer: ST

Zone: 51

Easting: 452444 mE

Northing: 6739543 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony/Rocky

Habitat Structure: Mulga on rocky slopes and hills

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 216

Observer: ST

Zone: 51

Easting: 452481 mE

Northing: 6739844 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 217

Observer: ST

Zone: 51

Easting: 452488 mE

Northing: 6740017 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 218

Observer: ST

Zone: 51

Easting: 452434 mE

Northing: 6740245 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 219

Observer: ST

Zone: 51

Easting: 452472 mE

Northing: 6740484 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 220

Observer: ST

Zone: 51

Easting: 452465 mE

Northing: 6740689 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga drainage line

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 221

Observer: ST

Zone: 51

Easting: 452441 mE

Northing: 6740929 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony/Rocky

Habitat Structure: Mulga on rocky slopes and hills

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 222

Observer: ST

Zone: 51

Easting: 452441 mE

Northing: 6741139 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony/Rocky

Habitat Structure: Mulga on rocky slopes and hills

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 223

Observer: ST

Zone: 51

Easting: 452463 mE

Northing: 6741345 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 224

Observer: ST

Zone: 51

Easting: 452457 mE

Northing: 6741559 mN

Fire History: >5 years

Landform: Slope

Soil Type: Stony/Rocky

Habitat Structure: Mulga on rocky slopes and hills

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 225

Observer: ST

Zone: 51

Easting: 452467 mE

Northing: 6741810 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 226

Observer: ST

Zone: 51

Easting: 452467 mE

Northing: 6742036 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony/Rocky

Habitat Structure: Mulga on rocky slopes and hills

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 227

Observer: ST

Zone: 51

Easting: 452266 mE

Northing: 6742041 mN

Fire History: >5 years

Landform: Slope

Soil Type: Stony/Rocky

Habitat Structure: Mulga on rocky slopes and hills

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 228

Observer: ST

Zone: 51

Easting: 452259 mE

Northing: 6741817 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony/Rocky

Habitat Structure: Mulga on rocky slopes and hills

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 229

Observer: ST

Zone: 51

Easting: 452269 mE

Northing: 6741579 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony/Rocky

Habitat Structure: Mulga on rocky slopes and hills

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 230

Observer: ST

Zone: 51

Easting: 452268 mE

Northing: 6741328 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 231

Observer: ST

Zone: 51

Easting: 452299 mE

Northing: 6741086 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony/Rocky

Habitat Structure: Mulga on rocky slopes and hills

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 232

Observer: ST

Zone: 51

Easting: 452260 mE

Northing: 6740924 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 233

Observer: ST

Zone: 51

Easting: 452263 mE

Northing: 6740684 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 234

Observer: ST

Zone: 51

Easting: 452276 mE

Northing: 6740460 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 20/10/2020

Habitat Assessment #: 235

Observer: ST

Zone: 51

Easting: 452270 mE

Northing: 6740249 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 236

Observer: ST

Zone: 51

Easting: 452238 mE

Northing: 6740092 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 237

Observer: ST

Zone: 51

Easting: 452184 mE

Northing: 6739896 mN

Fire History: >5 years

Landform: Slope

Soil Type: Stony/Rocky

Habitat Structure: Mulga on rocky slopes and hills

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 238

Observer: ST

Zone: 51

Easting: 452271 mE

Northing: 6739834 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony/Rocky

Habitat Structure: Mulga on rocky slopes and hills

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 239

Observer: ST

Zone: 51

Easting: 452257 mE

Northing: 6739577 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 240

Observer: ST

Zone: 51

Easting: 452248 mE

Northing: 6739314 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 241

Observer: ST

Zone: 51

Easting: 452280 mE

Northing: 6739057 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 242

Observer: ST

Zone: 51

Easting: 452260 mE

Northing: 6738799 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony/Rocky

Habitat Structure: Mulga on rocky slopes and hills

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 243

Observer: ST

Zone: 51

Easting: 452246 mE

Northing: 6738556 mN

Fire History: >5 years

Landform: Slope

Soil Type: Stony/Rocky

Habitat Structure: Mulga on rocky slopes and hills

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 244

Observer: ST

Zone: 51

Easting: 452046 mE

Northing: 6738522 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 245

Observer: ST

Zone: 51

Easting: 451982 mE

Northing: 6738806 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony/Rocky

Habitat Structure: Mulga on rocky slopes and hills

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 246

Observer: ST

Zone: 51

Easting: 452049 mE

Northing: 6739058 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 247

Observer: ST

Zone: 51

Easting: 452054 mE

Northing: 6739314 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 248

Observer: ST

Zone: 51

Easting: 452074 mE

Northing: 6739579 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 249

Observer: ST

Zone: 51

Easting: 452077 mE

Northing: 6739840 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony/Rocky

Habitat Structure: Mulga on rocky slopes and hills

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 250

Observer: ST

Zone: 51

Easting: 452083 mE

Northing: 6740089 mN

Fire History: >5 years

Landform: Slope

Soil Type: Stony/Rocky

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 251

Observer: ST

Zone: 51

Easting: 452062 mE

Northing: 6740307 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 252

Observer: ST

Zone: 51

Easting: 452031 mE

Northing: 6740483 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga drainage line

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 253

Observer: ST

Zone: 51

Easting: 452048 mE

Northing: 6740680 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga drainage line

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 254

Observer: ST

Zone: 51

Easting: 452062 mE

Northing: 6740923 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 255

Observer: ST

Zone: 51

Easting: 452059 mE

Northing: 6741131 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 256

Observer: ST

Zone: 51

Easting: 452066 mE

Northing: 6741336 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony/Rocky

Habitat Structure: Mulga on rocky slopes and hills

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 257

Observer: ST

Zone: 51

Easting: 452045 mE

Northing: 6741585 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony/Rocky

Habitat Structure: Mulga on rocky slopes and hills

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 258

Observer: ST

Zone: 51

Easting: 452082 mE

Northing: 6741817 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony/Rocky

Habitat Structure: Shrubs on granite rocks and bedrock

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 259

Observer: ST

Zone: 51

Easting: 452062 mE

Northing: 6742045 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony/Rocky

Habitat Structure: Shrubs on granite rocks and bedrock

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 260

Observer: ST

Zone: 51

Easting: 451844 mE

Northing: 6742018 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony/Rocky

Habitat Structure: Shrubs on granite rocks and bedrock

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 261

Observer: ST

Zone: 51

Easting: 451847 mE

Northing: 6741817 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony/Rocky

Habitat Structure: Mulga on rocky slopes and hills

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 262

Observer: ST

Zone: 51

Easting: 451886 mE

Northing: 6741566 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony/Rocky

Habitat Structure: Shrubs on granite rocks and bedrock

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 263

Observer: ST

Zone: 51

Easting: 451854 mE

Northing: 6741335 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony/Rocky

Habitat Structure: Shrubs on granite rocks and bedrock

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 264

Observer: ST

Zone: 51

Easting: 451865 mE

Northing: 6741113 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 265

Observer: ST

Zone: 51

Easting: 451860 mE

Northing: 6740918 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 266

Observer: ST

Zone: 51

Easting: 451848 mE

Northing: 6740680 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 267

Observer: ST

Zone: 51

Easting: 451851 mE

Northing: 6740473 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 268

Observer: ST

Zone: 51

Easting: 451863 mE

Northing: 6740251 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 269

Observer: ST

Zone: 51

Easting: 451861 mE

Northing: 6740055 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony/Rocky

Habitat Structure: Mulga on rocky slopes and hills

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 270

Observer: ST

Zone: 51

Easting: 451866 mE

Northing: 6739831 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 271

Observer: ST

Zone: 51

Easting: 451858 mE

Northing: 6739601 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 272

Observer: ST

Zone: 51

Easting: 451866 mE

Northing: 6739342 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 273

Observer: ST

Zone: 51

Easting: 451857 mE

Northing: 6739074 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 274

Observer: ST

Zone: 51

Easting: 451853 mE

Northing: 6738801 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 275

Observer: ST

Zone: 51

Easting: 451672 mE

Northing: 6738839 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 276

Observer: ST

Zone: 51

Easting: 451644 mE

Northing: 6739084 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 277

Observer: ST

Zone: 51

Easting: 451642 mE

Northing: 6739343 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 278

Observer: ST

Zone: 51

Easting: 451674 mE

Northing: 6739595 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 279

Observer: ST

Zone: 51

Easting: 451638 mE

Northing: 6739839 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 280

Observer: ST

Zone: 51

Easting: 451649 mE

Northing: 6740052 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 281

Observer: ST

Zone: 51

Easting: 451659 mE

Northing: 6740257 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga drainage line

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 282

Observer: ST

Zone: 51

Easting: 451649 mE

Northing: 6740493 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 283

Observer: ST

Zone: 51

Easting: 451658 mE

Northing: 6740696 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Disturbed



Date: 21/10/2020

Habitat Assessment #: 284

Observer: ST

Zone: 51

Easting: 451653 mE

Northing: 6740921 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga drainage line

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 285

Observer: ST

Zone: 51

Easting: 451653 mE

Northing: 6741126 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony/Rocky

Habitat Structure: Shrubs on granite rocks and bedrock

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 286

Observer: ST

Zone: 51

Easting: 451654 mE

Northing: 6741343 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony/Rocky

Habitat Structure: Shrubs on granite rocks and bedrock

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 287

Observer: ST

Zone: 51

Easting: 451665 mE

Northing: 6741573 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony/Rocky

Habitat Structure: Shrubs on granite rocks and bedrock

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 288

Observer: ST

Zone: 51

Easting: 451682 mE

Northing: 6741815 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony/Rocky

Habitat Structure: Shrubs on granite rocks and bedrock

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 289

Observer: ST

Zone: 51

Easting: 451662 mE

Northing: 6742034 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 290

Observer: ST

Zone: 51

Easting: 451437 mE

Northing: 6741993 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony/Rocky

Habitat Structure: Shrubs on granite rocks and bedrock

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 291

Observer: ST

Zone: 51

Easting: 451450 mE

Northing: 6741799 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 292

Observer: ST

Zone: 51

Easting: 451449 mE

Northing: 6741576 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 293

Observer: ST

Zone: 51

Easting: 451453 mE

Northing: 6741350 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 294

Observer: ST

Zone: 51

Easting: 451472 mE

Northing: 6741119 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 295

Observer: ST

Zone: 51

Easting: 451441 mE

Northing: 6740905 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Disturbed



Date: 21/10/2020

Habitat Assessment #: 296

Observer: ST

Zone: 51

Easting: 451444 mE

Northing: 6740692 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 297

Observer: ST

Zone: 51

Easting: 451448 mE

Northing: 6740478 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 298

Observer: ST

Zone: 51

Easting: 451447 mE

Northing: 6740258 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga drainage line

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 299

Observer: ST

Zone: 51

Easting: 451262 mE

Northing: 6740250 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 300

Observer: ST

Zone: 51

Easting: 451260 mE

Northing: 6740482 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 301

Observer: ST

Zone: 51

Easting: 451249 mE

Northing: 6740697 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 302

Observer: ST

Zone: 51

Easting: 451234 mE

Northing: 6740921 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 303

Observer: ST

Zone: 51

Easting: 451248 mE

Northing: 6741109 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 304

Observer: ST

Zone: 51

Easting: 451256 mE

Northing: 6741360 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 305

Observer: ST

Zone: 51

Easting: 451270 mE

Northing: 6741579 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 306

Observer: ST

Zone: 51

Easting: 451277 mE

Northing: 6741790 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 307

Observer: ST

Zone: 51

Easting: 451277 mE

Northing: 6742027 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony/Rocky

Habitat Structure: Shrubs on granite rocks and bedrock

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 308

Observer: ST

Zone: 51

Easting: 451045 mE

Northing: 6742024 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 309

Observer: ST

Zone: 51

Easting: 451054 mE

Northing: 6741769 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 310

Observer: ST

Zone: 51

Easting: 451067 mE

Northing: 6741532 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 311

Observer: ST

Zone: 51

Easting: 451057 mE

Northing: 6741366 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 312

Observer: ST

Zone: 51

Easting: 451036 mE

Northing: 6741086 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga drainage line

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 313

Observer: ST

Zone: 51

Easting: 451048 mE

Northing: 6740920 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 314

Observer: ST

Zone: 51

Easting: 451093 mE

Northing: 6740698 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 315

Observer: ST

Zone: 51

Easting: 451049 mE

Northing: 6740487 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 316

Observer: ST

Zone: 51

Easting: 451050 mE

Northing: 6740247 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 317

Observer: ST

Zone: 51

Easting: 450826 mE

Northing: 6740255 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 318

Observer: ST

Zone: 51

Easting: 450860 mE

Northing: 6740489 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 319

Observer: ST

Zone: 51

Easting: 450851 mE

Northing: 6740706 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 320

Observer: ST

Zone: 51

Easting: 450846 mE

Northing: 6740923 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 321

Observer: ST

Zone: 51

Easting: 450863 mE

Northing: 6741086 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga drainage line

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 322

Observer: ST

Zone: 51

Easting: 450841 mE

Northing: 6741334 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 323

Observer: ST

Zone: 51

Easting: 450855 mE

Northing: 6741565 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 324

Observer: ST

Zone: 51

Easting: 450853 mE

Northing: 6741756 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 325

Observer: ST

Zone: 51

Easting: 450844 mE

Northing: 6742030 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 326

Observer: ST

Zone: 51

Easting: 450644 mE

Northing: 6741994 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 327

Observer: ST

Zone: 51

Easting: 450667 mE

Northing: 6741763 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 328

Observer: ST

Zone: 51

Easting: 450675 mE

Northing: 6741566 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga drainage line

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 329

Observer: ST

Zone: 51

Easting: 450649 mE

Northing: 6741325 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 330

Observer: ST

Zone: 51

Easting: 450662 mE

Northing: 6741123 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga drainage line

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 331

Observer: ST

Zone: 51

Easting: 450651 mE

Northing: 6740933 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 332

Observer: ST

Zone: 51

Easting: 450681 mE

Northing: 6740722 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 333

Observer: ST

Zone: 51

Easting: 450653 mE

Northing: 6740500 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 334

Observer: ST

Zone: 51

Easting: 450654 mE

Northing: 6740232 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 335

Observer: ST

Zone: 51

Easting: 450450 mE

Northing: 6740236 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 336

Observer: ST

Zone: 51

Easting: 450453 mE

Northing: 6740484 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 337

Observer: ST

Zone: 51

Easting: 450461 mE

Northing: 6740728 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 338

Observer: ST

Zone: 51

Easting: 450461 mE

Northing: 6740955 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 339

Observer: ST

Zone: 51

Easting: 450443 mE

Northing: 6741122 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga drainage line

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 340

Observer: ST

Zone: 51

Easting: 450446 mE

Northing: 6741323 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga drainage line

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 341

Observer: ST

Zone: 51

Easting: 450455 mE

Northing: 6741572 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 342

Observer: ST

Zone: 51

Easting: 450454 mE

Northing: 6741758 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 343

Observer: ST

Zone: 51

Easting: 450455 mE

Northing: 6741996 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 344

Observer: ST

Zone: 51

Easting: 450255 mE

Northing: 6741982 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Open Mulga shrubland on sandy soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 345

Observer: ST

Zone: 51

Easting: 450253 mE

Northing: 6741757 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 346

Observer: ST

Zone: 51

Easting: 450274 mE

Northing: 6741572 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 347

Observer: ST

Zone: 51

Easting: 450264 mE

Northing: 6741334 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 348

Observer: ST

Zone: 51

Easting: 450246 mE

Northing: 6741115 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Sandy

Habitat Structure: Mulga drainage line

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 349

Observer: ST

Zone: 51

Easting: 450237 mE

Northing: 6740929 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 350

Observer: ST

Zone: 51

Easting: 450245 mE

Northing: 6740718 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 351

Observer: ST

Zone: 51

Easting: 450252 mE

Northing: 6740490 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 352

Observer: ST

Zone: 51

Easting: 450231 mE

Northing: 6740232 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 353

Observer: ST

Zone: 51

Easting: 450070 mE

Northing: 6740498 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga drainage line

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 354

Observer: ST

Zone: 51

Easting: 450049 mE

Northing: 6740719 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga shrubland over rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 355

Observer: ST

Zone: 51

Easting: 450073 mE

Northing: 6740915 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 356

Observer: ST

Zone: 51

Easting: 450055 mE

Northing: 6741106 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga drainage line

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 357

Observer: ST

Zone: 51

Easting: 450065 mE

Northing: 6741377 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga drainage line

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 358

Observer: ST

Zone: 51

Easting: 450071 mE

Northing: 6741578 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 359

Observer: ST

Zone: 51

Easting: 450054 mE

Northing: 6741762 mN

Fire History: >5 years

Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good



Date: 21/10/2020

Habitat Assessment #: 360

Observer: ST

Zone: 51

Easting: 450076 mE

Northing: 6742017 mN

Fire History: >5 years

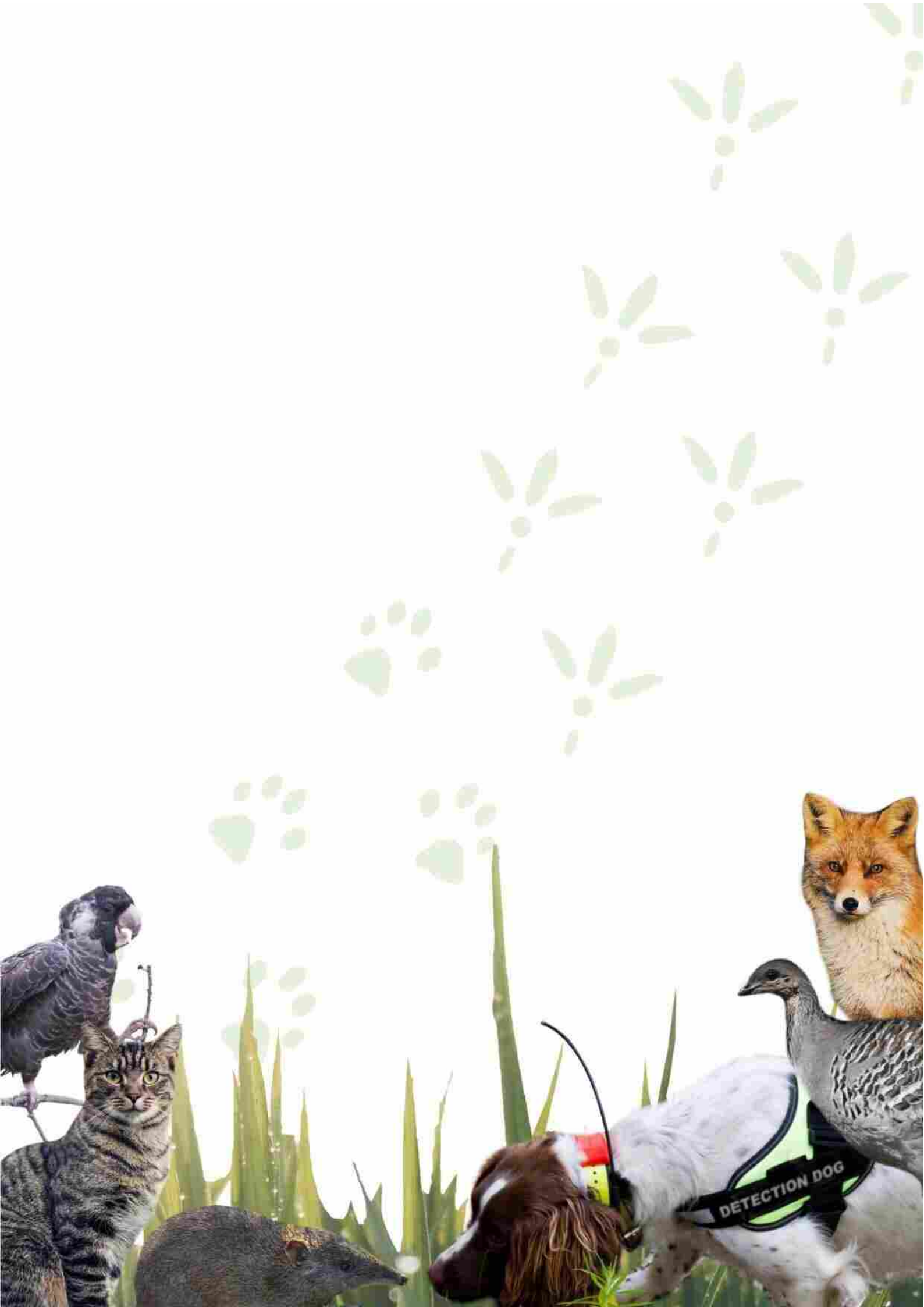
Landform: Flat Plain

Soil Type: Stony

Habitat Structure: Mulga and chenopod shrubland on rocky soil

Habitat Quality: Good-Very Good







APPENDIX 5B – Terrestrial Ecosystems - Desktop Vertebrate Fauna Risk Assessment

Desktop Vertebrate Fauna Risk Assessment

Mt Celia Gold Project

Prepared for: Legacy Iron Ore Limited

Version 2. March, 2023



RECORD OF DISTRIBUTION

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EXECUTIVE SUMMARY

Legacy Iron Ore Limited requested a desktop vertebrate fauna risk assessment to supplement an earlier Basic vertebrate fauna survey and risk assessment completed for an adjacent area. The combined reports will be used to support a Native Vegetation Clearing Permit Application and Mining Proposal for the Mt Celia mining project which is approximately 175km north, north east of Kalgoorlie (i.e. project area).

The project area was approximately 623ha, and it surrounds the area assessed in 2020 by Terrestrial Ecosystems (2021). Not all of the area will be included in the development envelop for mine development and operations. The combined reports cover an area of approximately 2031.5ha.

No habitat assessment or ground truthing was undertaken for this assessment, but data, photographs, and mapping from an extensive flora and vegetation assessment (Native Vegetation Solutions 2020) have been used for the fauna risk assessment.

No Malleefowl mounds were recorded in the project area, however, Malleefowl tracks were recorded by Eren Reid (Native Vegetation Solutions 2020) in multiple locations, indicating that Malleefowl are present in low abundance. Large portions of the habitat in the project area were very open and therefore not suitable for Malleefowl nesting when predators are present in the general area.

Prior to any vegetation clearing or disturbance activity, Legacy Iron Ore Limited should complete a risk assessment to determine if conservation significant fauna are likely to be present, and if present, likely to be impacted. If Malleefowl or its foraging habitat is likely to be significantly impacted, then a referral to the Commonwealth Government under the *EPBC Act 1999* is recommended.

It is likely that Long-tailed Dunnart are present in the breakaway and rocky areas. If these areas are not going to be impacted by mining development or operations, then impacts are likely to be low. The Long-tailed Dunnart is not listed as a threatened species under the *EPBC Act* or the *WA Biodiversity Conservation Act* so there is no reporting requirement under the Commonwealth Act or special consideration by State government agencies for this species.

It is recommended that:

- a Vertebrate Fauna Management Plan is prepared and implemented prior to vegetation clearing, and is effective during mine development and operation;
- prior to vegetation clearing and disturbance, the mine undertakes a risk assessment to determine if conservation significant fauna are likely to be present, and if present, likely to be impacted;
- if Malleefowl or its foraging habitat are likely to be significantly impacted, as judged by the risk assessment, then the proposed action is referred to the Commonwealth Government under the *EPBC Act 1999* to assess the significance of the potential impact on this species;
- there is a specific section in the Vertebrate Fauna Management Plan that addresses the management of Malleefowl. This is prepared once more detail is available about the proposed potential impacts on this species. If an *EPBC Act* referral is submitted, then it is recommended that the Vertebrate Fauna Management Plan is submitted with the referral to demonstrate how the development will minimise, mitigate and manage potential impacts on the species;
- an induction program that includes a component on managing fauna is mandatory for staff and contractors 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

Legacy Iron Ore Limited requested a desktop vertebrate fauna risk assessment to supplement an earlier Basic vertebrate fauna survey and risk assessment completed by Terrestrial Ecosystems (2021) for an adjacent area. The combined reports are being used to support a Native Vegetation Clearing Permit Application and Mining Proposal for the Mt Celia mining project, which is approximately 175km north, north east of Kalgoorlie (i.e. project area; Figure 1).

The project area was approximately 623ha, however, a smaller area will be impacted by the proposed mining development and operations. The combined reports cover an area of approximately 2031.5ha.

1.2 PROJECT OBJECTIVES AND SCOPE OF WORKS

Terrestrial Ecosystems was commissioned to undertake a desktop vertebrate fauna risk assessment to supplement the existing Basic vertebrate fauna survey and risk assessment for the Mt Celia mine project area. The purpose of this desktop fauna risk assessment is 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 desktop vertebrate fauna risk assessment involved a desktop review, and analysis of vegetation mapping and photographs taken on-site by Eren Reid from Native Vegetation Solutions (Native Vegetation Solutions 2020). The assessment's objectives were to:

- provide an indication of the vertebrate fauna assemblage (reptiles, amphibians, mammals, birds and fish) 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 near the project area and in similar habitat;
- reviewed photographs and vegetation mapping provided by Native Vegetation Solutions for the project area;

- 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 process for conservation significant fauna were listed by Cowan (2003) as foxes and cats.

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 much lesser extent mining and exploration. The region surrounding the project area is relatively undisturbed, with a chain of salt lakes approximately 15km to the north-east and south-west (Figure 2).

2.3 CLIMATE

The project area is characterised as semi-arid. As the project area is between two weather stations, we have provided both data sets for comparison. Laverton, ~100km to the north, has an annual rainfall of approximately 235mm, although this varies considerably from year-to-year. The highest mean maximum and minimum temperatures in Laverton are in January with an average of 35.8°C and 20.5°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.

Kalgoorlie, 175km to the south, south-west, has an annual rainfall of approximately 266mm, although this varies considerably from year-to-year. The highest mean maximum and minimum temperatures in Kalgoorlie are in January with an average of 33.7°C and 18.3°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 – February, with another peak in May to July.

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.

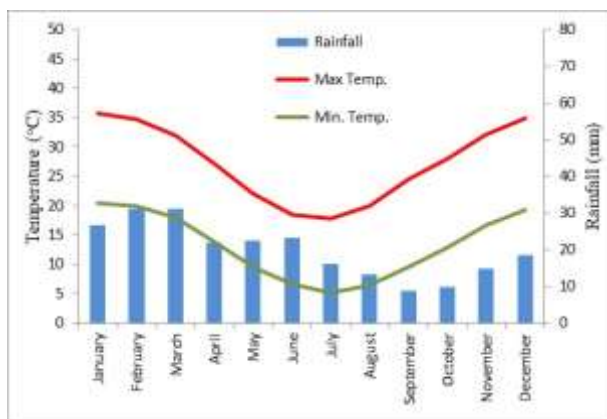


Chart 1. Climatic averages for Laverton

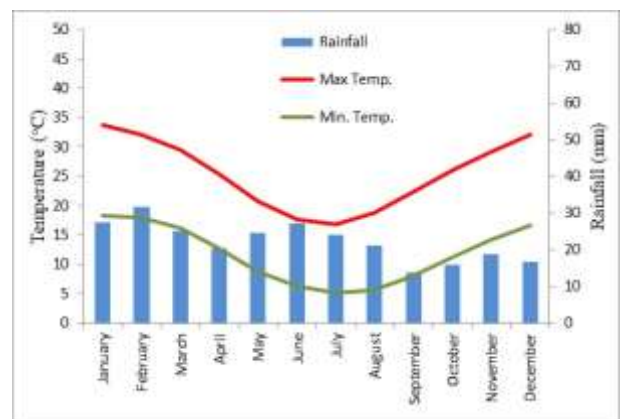


Chart 2. Climatic averages for Kalgoorlie

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:

- Bamford Consulting Ecologists (2007) *Fauna Assessment and Targeted Mulgara Search of the Fish Deposit, Laverton Gold Project*, Perth.
- Bell, D. T., Bell, R. C. and Loneragan, W. A. (2007) Winter bird assemblages across an arid gradient in south-west Western Australia. *Journal of the Royal Society of Western Australia* 90, 219-227.
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- Halpern Glick Maunsell (1999) *Rosemont Gold Project Biological Assessment Survey - Phases 1 & 2*. Unpublished report for Johnson's Well Mining NL, Perth.
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- Hart, Simpson and Associates (2000) *Anaconda Nickel Ltd, Cawse Expansion Project Fauna Survey*. Unpublished report for Anaconda Nickel Ltd, Perth.

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- 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.

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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.

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 (*Dasyercus 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 development might have on these species, and other conservation significant fauna. The Cowan (2003) report is now very dated, and 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 and the Department of Biodiversity, Conservation and Attractions (DBCA) is now more concerned about Critically Endangered the Arid Bronze Azure (*Ogyris subterrestris petrina*) being impacted in the region. The Long-tailed Dunnart, which is a Priority 4 species with DBCA, has now been recorded at multiple locations 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 100km around a centre point coordinate of 29.4551°S and 122.51685°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. Bilby, Lesser Stick-nest Rat). 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 FAUNA HABITAT ASSESSMENT

No site inspection has been undertaken for this desktop assessment, however, photographs and vegetation mapping provide by Native Vegetation Solutions have been used in this assessment.

3.3 REPORTING STAFF

Dr Scott Thompson prepared this report and Dr Graham Thompson reviewed the report before it was sent to the client. Dr Scott Thompson completed the field investigations for the adjacent areas (Terrestrial Ecosystems 2021). 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 near Leonora and Laverton 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. 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

This desktop vertebrate fauna risk assessment is based on information contained in the Commonwealth Government database and other published and unpublished fauna survey data for the bioregion, and photographs and mapping provided by Native Vegetation Solutions. It is acknowledged that multiple surveys conducted in different seasons, repeated over several years are necessary to fully appreciate the fauna assemblage in a project area.

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 1.

Table 1. Fauna survey limitations and constraints

Possible limitations	Constraint (yes/no); significant, moderate or negligible	Comment
Availability of data and information	No	There are limited fauna survey data for the adjacent areas. This desktop assessment relies on photographs and mapping provided by Native Vegetation Solutions who completed the detailed flora and vegetation assessment for the project area and the vertebrate fauna assessment undertaken by Terrestrial Ecosystems for the adjacent area.
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	N/A	
Disturbance that may have affected results, e.g. fire, flood	N/A	
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	Moderate	This desktop assessment relies on photographs and mapping provided by Native Vegetation Solutions who completed the detailed flora and vegetation assessment for the project area and the vertebrate fauna assessment undertaken by Terrestrial Ecosystems for the adjacent area.
Access problems	N/A	
Problems with data and analysis, including sampling biases	Moderate	This desktop assessment relies on photographs and mapping provided by Native Vegetation Solutions who completed the detailed flora and vegetation assessment for the project area and the vertebrate fauna assessment undertaken by Terrestrial Ecosystems for the adjacent area.

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

Based on the provided flora and vegetation mapping and field investigations of adjacent areas, there are six broad fauna habitat types:

- Open Mulga shrubland on sandy soil (Plates 1-2);
- Mulga and chenopod shrubland on rocky soil (Plate 3-4);
- Mulga shrubland over rocky soil (Plate 5-6)
- Mulga on rocky slopes and hills (Plates 7-8)
- Shrubs on granite rocks and bedrock (Plates 9-10);
- Mulga drainage lines (Plate 11-12).

There are also areas disturbed by exploration activity, old mining activity and a road.

There are drainage lines running in a north-east direction, with the main access road in the area bisecting the project area in a south-east to north-west direction. There are numerous other mining developments within 10km and a number of salt lakes to the north and east.



Plate 1. Open Mulga shrubland on sandy soil



Plate 2. Open Mulga shrubland on sandy soil



Plate 3. Mulga and chenopod shrubland on rocky soil



Plate 4. Mulga and chenopod shrubland on rocky soil



Plate 5. Mulga shrubland over rocky soil



Plate 6. Mulga shrubland over rocky soil



Plate 7. Mulga on rocky slopes and hills



Plate 8. Mulga on rocky slopes and hills



Plate 9. Shrubs on granite rocks and bedrock



Plate 10. Shrubs on granite rocks and bedrock



Plate 11. Mulga drainage lines



Plate 12. Mulga drainage lines

4.2 MALLEEFOWL

Malleefowl tracks were found in the project area (Plates 15-16). No Malleefowl nests were recorded.

4.3 FERAL PESTS

Rabbits, feral cats and wild dogs are present in the project area.

4.4 ARID BRONZE AZURE BUTTERFLY

There were a very low number of smooth-barked Eucalypts trees in the project area, which is a requirement for the *Camponotus terebrans* ant to be present.

4.5 FAUNA ASSEMBLAGE

4.6 BIOREGIONAL VERTEBRATE FAUNA ASSEMBLAGE

Appendix B provides a summary of the fauna survey data that are available near the project area. There are appreciable differences in the recorded fauna assemblages within and among fauna surveys shown in Appendix B. These differences are partially due to the 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 2-5 provide a list of vertebrate species potentially found near the project area that have been compiled based on the fauna survey report results shown in Appendix B. The water and wetland bird species in Table 2 are unlikely to be present in the project area due to a lack of suitable habitat.

Table 2. Birds potentially found near the project area

Family	Species	Common Name	Family	Species	Common Name
Casuariidae	<i>Dromaius novaehollandiae</i>	Emu	Cuculidae	<i>Chrysococcyx basalis</i>	Horsfield's Bronze-Cuckoo
Anatidae	<i>Cygnus atratus</i>	Black Swan		<i>Chrysococcyx osculans</i>	Black-eared Cuckoo
	<i>Tadorna tadornoides</i>	Australian Shelduck	Aegothelidae	<i>Aegotheles cristatus</i>	Australian Owlet-nightjar
	<i>Chenonetta jubata</i>	Australian Wood Duck	Podargidae	<i>Podargus strigoides</i>	Tawny Frogmouth
	<i>Anas superciliosa</i>	Pacific Black Duck	Caprimulgidae	<i>Eurostopodus argus</i>	Spotted Nightjar
	<i>Anas gracilis</i>	Grey Teal		<i>Apus pacificus</i>	Pacific Swift
	<i>Malacorhynchus membranaceus</i>	Pink-eared Duck	Rallidae	<i>Tribonyx ventralis</i>	Black-tailed Nativehen
	<i>Aythya australis</i>	Hardhead		<i>Fulica atra</i>	Eurasian Coot
	<i>Biziura lobata</i>	Musk Duck	Recurvirostridae	<i>Himantopus himantopus</i>	Black-winged Stilt
Megapodiidae	<i>Leipoa ocellata</i>	Malleefowl		<i>Himantopus leucocephalus</i>	Pied Stilt
Phasianidae	<i>Coturnix pectoralis</i>	Stubble Quail		<i>Cladorhynchus leucocephalus</i>	Banded Stilt
Podicipedidae	<i>Tachybaptus novaehollandiae</i>	Australasian Grebe		<i>Recurvirostra novaehollandiae</i>	Red-necked Avocet
	<i>Poliiocephalus poliocephalus</i>	Hoary-headed Grebe	Charadriidae	<i>Vanellus tricolor</i>	Banded Lapwing
Columbidae	<i>Phaps chalcoptera</i>	Common Bronzewing		<i>Charadrius ruficapillus</i>	Red-capped Plover
	<i>Ocyphaps lophotes</i>	Crested Pigeon		<i>Erythronyctes cinctus</i>	Red-kneed Dotterel
	<i>Geophaps plumifera</i>	Spinifex Pigeon			
	<i>Geopelia cuneata</i>	Diamond Dove			

Family	Species	Common Name
	<i>Euseyornis melanops</i>	Black-fronted Dotterel
Scolopacidae	<i>Actitis hypoleucos</i>	Common Sandpiper
Turnicidae	<i>Turnix velox</i>	Little Buttonquail
Laridae	<i>Chlidonias hybrida</i>	Whiskered Tern
Otididae	<i>Ardeotis australis</i>	Australian Bustard
Ardeidae	<i>Ardea pacifica</i>	White-necked Heron
	<i>Egretta novaehollandiae</i>	White-faced Heron
Accipitridae	<i>Haliaeetus albicilla</i>	
Anhingidae	<i>Anhinga melanogaster</i>	Australasian Darter
Accipitridae	<i>Hamirostra melanosternon</i>	Black-breasted Buzzard
	<i>Hieraetus morphnoides</i>	Little Eagle
	<i>Aquila audax</i>	Wedge-tailed Eagle
	<i>Circus assimilis</i>	Spotted Harrier
	<i>Accipiter fasciatus</i>	Brown Goshawk
	<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk
	<i>Milvus migrans</i>	Black Kite
	<i>Haliastur sphenurus</i>	Whistling Kite
Cuculidae	<i>Heteroscenes pallidus</i>	Pallid Cuckoo
Strigidae	<i>Ninox boobook</i>	Southern Boobook
Alcedinidae	<i>Todiramphus pyrrhopygius</i>	Red-backed Kingfisher
Meropidae	<i>Merops ornatus</i>	Rainbow Bee-eater
Falconidae	<i>Falco cenchroides</i>	Nankeen Kestrel
	<i>Falco longipennis</i>	Australian Hobby
	<i>Falco berigora</i>	Brown Falcon
	<i>Falco peregrinus</i>	Peregrine Falcon
Megaluridae	<i>Poodytes carteri</i>	Spinifexbird
Cacatuidae	<i>Eolophus roseicapilla</i>	Galah

Family	Species	Common Name
	<i>Cacatua sanguinea</i>	Little Corella
	<i>Nymphicus hollandicus</i>	Cockatiel
Psittaculidae	<i>Neopsephotus bourkii</i>	Bourke's Parrot
	<i>Barnardius zonarius</i>	Australian Ringneck
	<i>Psephotus varius</i>	Mulga Parrot
	<i>Melopsittacus undulatus</i>	Budgerigar
Ptilonorhynchidae	<i>Chlamydera guttata</i>	Western Bowerbird
Climacteridae	<i>Climacteris affinis</i>	White-browed Treecreeper
Maluridae	<i>Amytornis striatus</i>	Striated Grasswren
	<i>Stipiturus ruficeps</i>	Rufous-crowned Emuwren
	<i>Malurus assimilis</i>	Purple-backed Fairywren
	<i>Malurus lamberti</i>	Variiegated Fairywren
	<i>Malurus splendens</i>	Splendid Fairywren
	<i>Malurus leucopterus</i>	White-winged Fairywren
Meliphagidae	<i>Certhionyx variegatus</i>	Pied Honeyeater
	<i>Purnella albifrons</i>	White-fronted Honeyeater
	<i>Manorina flavigula</i>	Yellow-throated Miner
	<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater
	<i>Anthochaera carunculata</i>	Red Wattlebird
	<i>Gavicalis virescens</i>	Singing Honeyeater
	<i>Ptilotula penicillata</i>	White-plumed Honeyeater
	<i>Ptilotula keartlandi</i>	Grey-headed Honeyeater
	<i>Conopophila whitei</i>	Grey Honeyeater
	<i>Epthianura tricolor</i>	Crimson Chat
	<i>Epthianura aurifrons</i>	Orange Chat
	<i>Sugomel nigrum</i>	Black Honeyeater

Family	Species	Common Name
	<i>Lichmera indistincta</i>	Brown Honeyeater
	<i>Nesoptilotis flavicollis</i>	Yellow-throated Honeyeater
Pardalotidae	<i>Pardalotus striatus</i>	Striated Pardalote
Acanthizidae	<i>Pyrrholaemus brunneus</i>	Redthroat
	<i>Acanthiza iredalei</i>	Slender-billed Thornbill
	<i>Acanthiza apicalis</i>	Inland Thornbill
	<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill
	<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill
	<i>Acanthiza robustirostris</i>	Slaty-backed Thornbill
	<i>Smicromis brevirostris</i>	Weebill
	<i>Gerygone fusca</i>	Western Gerygone
	<i>Aphelocephala leucopsis</i>	Southern Whiteface
	<i>Aphelocephala nigrincincta</i>	Banded Whiteface
Pomatostomidae	<i>Pomatostomus temporalis</i>	Grey-crowned Babbler
	<i>Pomatostomus superciliosus</i>	White-browed Babbler
Cinclosoma	<i>castaneothorax</i>	Chestnut-breasted Quail-thrush
Cinclosoma	<i>cinnamomeum</i>	Cinnamon Quail-thrush
Campephagidae	<i>Coracina maxima</i>	Ground Cuckooshrike
	<i>Coracina novaehollandiae</i>	Black-faced Cuckooshrike
	<i>Lalage tricolor</i>	White-winged Triller
Neosittidae	<i>Daphoenositta chrysoptera</i>	Varied Sittella
Oreoicidae	<i>Oreoica gutturalis</i>	Crested Bellbird
Pachycephalidae	<i>Colluricincla harmonica</i>	Grey Shrikethrush
	<i>Pachycephala rufiventris</i>	Rufous Whistler

Family	Species	Common Name
Artamidae	<i>Artamus personatus</i>	Masked Woodswallow
	<i>Artamus superciliosus</i>	White-browed Woodswallow
	<i>Artamus cinereus</i>	Black-faced Woodswallow
	<i>Artamus cyanopterus</i>	Dusky Woodswallow
	<i>Artamus minor</i>	Little Woodswallow
	<i>Cracticus torquatus</i>	Grey Butcherbird
	<i>Cracticus nigrogularis</i>	Pied Butcherbird
	<i>Gymnorhina tibicen</i>	Australian Magpie
	<i>Strepera versicolor</i>	Grey Currawong
Rhipiduridae	<i>Rhipidura leucophrys</i>	Willie Wagtail
	<i>Rhipidura albiscapa</i>	Grey Fantail
Monarchidae	<i>Grallina cyanoleuca</i>	Magpie-lark
Corvidae	<i>Corvus orru</i>	Torresian Crow
	<i>Corvus bennetti</i>	Little Crow
	<i>Corvus coronoides</i>	Australian Raven
Petroicidae	<i>Microeca fascians</i>	Jacky Winter
	<i>Petroica goodenovii</i>	Red-capped Robin
	<i>Melanodryas cucullata</i>	Hooded Robin
Alaudidae	<i>Mirafrja javanica</i>	Australasian Bushlark
Locustellidae	<i>Cincloramphus cruralis</i>	Brown Songlark
	<i>Cincloramphus mathewsi</i>	Rufous Songlark
Hirundinidae	<i>Hirundo rustica</i>	Barn Swallow
	<i>Hirundo neoxena</i>	Welcome Swallow
	<i>Petrochelidon nigricans</i>	Tree Martin
	<i>Cheramoeca leucosterna</i>	White-backed Swallow

Family	Species	Common Name
Dicaeidae	<i>Dicaeum hirundinaceum</i>	Mistletoebird
Estrildidae	<i>Emblema pictum</i>	Painted Finch

Family	Species	Common Name
	<i>Taeniopygia guttata</i>	Zebra Finch
Motacillidae	<i>Anthus novaeseelandiae</i>	Australasian Pipit

Table 3. Amphibians potentially found near the project

Family	Species	Common Name
Limnodynastidae	<i>Neobatrachus kunapalari</i>	Wheatbelt Frog
	<i>Neobatrachus sutor</i>	Shoemaker Frog
	<i>Neobatrachus wilmorei</i>	Plonking Frog
	<i>Notaden nichollsi</i>	Desert Spadefoot
	<i>Platyplectrum spenceri</i>	Spencer's Burrowing Frog

Family	Species	Common Name
Myobatrachidae	<i>Pseudophryne occidentalis</i>	Western Toadlet
Pelodyridae	<i>Cyclorana maini</i>	Main's Frog
	<i>Cyclorana occidentalis</i>	Western Water-holding Frog
	<i>Litoria rubella</i>	Desert Tree Frog

Table 4. Mammals potentially found near the project area

Family	Species	Common Name	Family	Species	Common Name
Tachyglossidae	<i>Tachyglossus aculeatus</i>	Short-beaked Echidna	Dasyuridae	<i>Ningai sp.</i>	Ningai sp.
Bovidae	<i>Bos taurus</i>	Cow		<i>Planigale sp.</i>	Planigale sp.
	<i>Capra hircus</i>	Goat		<i>Antechinomys laniger</i>	Kultarr
	<i>Ovis aries</i>	Sheep		<i>Dasyercus blythi</i>	Brush-tailed Mulgara
Camelidae	<i>Camelus dromedarius</i>	Dromedary		<i>Dasykaluta rosamondae</i>	Kaluta
Canidae	<i>Canis lupus</i>	Dingo		<i>Ningai ridei</i>	Wongai Ningai
	<i>Vulpes vulpes</i>	Red Fox		<i>Ningai yvonneae</i>	Mallee Ningai
Felidae	<i>Felis catus</i>	Cat		<i>Pseudantechinus woolleyae</i>	Woolley's False Antechinus
Molossidae	<i>Austronomus australis</i>	White-striped Freetail Bat		<i>Sminthopsis crassicaudata</i>	Fat-tailed Dunnart
	<i>Mormopterus planiceps</i>	Southern Free-tail Bat		<i>Sminthopsis dolichura</i>	Little Long-tailed Dunnart
	<i>Mormopterus sp. 4</i>	South-western Free-tail Bat		<i>Sminthopsis hirtipes</i>	Hairy-footed Dunnart
Vespertilionidae	<i>Nyctophilus sp.</i>	Long-eared Bat sp.		<i>Sminthopsis longicaudata</i>	Long-tailed Dunnart
	<i>Chalinolobus gouldii</i>	Gould's Wattled Bat		<i>Sminthopsis macroura</i>	Stripe-faced Dunnart
	<i>Chalinolobus morio</i>	Chocolate Wattled Bat		<i>Sminthopsis murina</i>	Slender-tailed Dunnart
	<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat		<i>Sminthopsis ooldea</i>	Ooldea Dunnart
	<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat			

Family	Species	Common Name	Family	Species	Common Name
	<i>Sminthopsis youngsoni</i>	Lesser Hairy-footed Dunnart	Leporidae	<i>Oryctolagus cuniculus</i>	Rabbit
Macropodidae	<i>Macropus fuliginosus</i>	Western Grey Kangaroo	Equidae	<i>Equus asinus</i>	Donkey
	<i>Osphranter robustus</i>	Euro		<i>Equus caballus</i>	Horse
	<i>Osphranter rufus</i>	Red Kangaroo	Muridae	<i>Leporillus apicalis</i>	Lesser Stick-nest Rat
Phalangeridae	<i>Trichosurus vulpecula</i>	Common Brushtail Possum		<i>Mus musculus</i>	House Mouse
				<i>Notomys alexis</i>	Spinifex Hopping Mouse

Table 5. Reptiles potentially found near the project area

Family	Species	Common Name	Family	Species	Common Name
Agamidae	<i>Ctenophorus caudicinctus</i>	Ring-tailed Dragon		<i>Nephurus vertebralis</i>	Midline Knob-tail
	<i>Ctenophorus cristatus</i>	Crested Dragon		<i>Underwoodisaurus millii</i>	Barking Gecko
	<i>Ctenophorus fordi</i>	Mallee Dragon	Diplodactylidae	<i>Diplodactylus conspicillatus</i>	Fat-tailed Gecko
	<i>Ctenophorus inermis</i>	Military Dragon		<i>Diplodactylus granariensis</i>	Wheatbelt Stone Gecko
	<i>Ctenophorus infans</i>	Ring-tailed Dragon		<i>Diplodactylus pulcher</i>	Beautiful Gecko
	<i>Ctenophorus isolepis</i>	Central Military Dragon		<i>Lucasium damaeum</i>	Beaded Gecko
	<i>Ctenophorus maculatus</i>	Spotted Dragon		<i>Lucasium squarrosum</i>	Mottled Ground Gecko
	<i>Ctenophorus nuchalis</i>	Central Netted Dragon		<i>Lucasium stenodactylum</i>	Crowned Gecko
	<i>Ctenophorus reticulatus</i>	Western Netted Dragon		<i>Rhynchoedura ornata</i>	Beaked Gecko
	<i>Ctenophorus salinarum</i>	Saltpan Dragon		<i>Strophurus ciliaris</i>	Spiny-tailed Gecko
	<i>Ctenophorus scutulatus</i>	Lozenge-marked Dragon		<i>Strophurus elderi</i>	Jewelled Gecko
	<i>Diporiphora amphiboluroides</i>	Mulga Dragon		<i>Strophurus strophurus</i>	Western Spiny-tailed Gecko
	<i>Diporiphora valens</i>	Southern Pilbara Tree Dragon		<i>Strophurus wellingtonae</i>	Western Shield Spiny-tailed Gecko
	<i>Gowidon longirostris</i>	Long-nosed Dragon	Elapidae	<i>Brachyuropis fasciolatus</i>	Narrow-banded Burrowing Snake
	<i>Moloch horridus</i>	Thorny Devil		<i>Brachyuropis semifasciata</i>	Half-girdled Snake
	<i>Pogona minor</i>	Western Bearded Dragon		<i>Demansia psammophis</i>	Yellow-faced Whipsnake
	<i>Tympanocryptis cephalus</i>	Pebble Dragon		<i>Demansia rufescens</i>	Rufous Whipsnake
Carphodactylidae	<i>Nephurus laevis</i>	Smooth Knob-tail		<i>Furina ornata</i>	Orange-naped Snake
	<i>Nephurus levis</i>	Three-lined Knob-tail		<i>Parasuta monachus</i>	Hooded Snake

Family	Species	Common Name
	<i>Pseudechis australis</i>	Mulga Snake
	<i>Pseudechis butleri</i>	Spotted Mulga Snake
	<i>Pseudonaja mengdeni</i>	Western Brown Snake
	<i>Pseudonaja modesta</i>	Ringed Brown Snake
	<i>Simoselaps anomalus</i>	Desert Banded Snake
	<i>Simoselaps bertholdi</i>	Jan's Banded Snake
	<i>Suta fasciata</i>	Rosen's Snake
Gekkonidae	<i>Christinus marmoratus</i>	Marbled Gecko
	<i>Gehyra punctata</i>	Spotted Dtella
	<i>Gehyra purpurascens</i>	Purplish Dtella
	<i>Gehyra variegata</i>	Variiegated Gehyra
	<i>Heteronotia binoei</i>	Bynoe's Gecko
	<i>Gehyra xenopus</i>	Crocodile-faced Dtella
Pygopodidae	<i>Aprasia picturata</i>	Black-headed Worm-lizard
	<i>Delma butleri</i>	Unbanded Delma
	<i>Delma nasuta</i>	Sharp-snouted Delma
	<i>Delma pax</i>	Peace Delma
	<i>Lialis burtonis</i>	Burton's Legless Lizard
	<i>Pygopus nigriceps</i>	Western Hooded Scaly-foot
Pythonidae	<i>Antaresia perthensis</i>	Pygmy Python
Scincidae	<i>Carlia triacantha</i>	Desert Rainbow-skink
	<i>Cryptoblepharus buchananii</i>	Buchanan's Snake-eyed Skink
	<i>Cryptoblepharus plagioccephalus</i>	Peron's Snake-eyed Skink
	<i>Ctenotus ariadnae</i>	Ariadna's Ctenotus
	<i>Ctenotus atlas</i>	Southern Mallee Ctenotus
	<i>Ctenotus brooksi</i>	Wedgsnout Ctenotus
	<i>Ctenotus calurus</i>	Blue-tailed Finesnout Ctenotus
	<i>Ctenotus dux</i>	Fine Side-lined Ctenotus
	<i>Ctenotus grandis</i>	Grand Ctenotus

Family	Species	Common Name
	<i>Ctenotus greeri</i>	Spotted-necked Ctenotus
	<i>Ctenotus helenae</i>	Clay-soil Ctenotus
	<i>Ctenotus leae</i>	Orange-tailed Finesnout Ctenotus
	<i>Ctenotus leonhardii</i>	Leonhardi's Ctenotus
	<i>Ctenotus nasutus</i>	Nasute Finsnout Ctenotus
	<i>Ctenotus pantherinus</i>	Leopard Ctenotus
	<i>Ctenotus piankai</i>	Coarse Sands Ctenotus
	<i>Ctenotus quattuordecimlineatus</i>	Fourteen-lined Ctenotus
	<i>Ctenotus schomburgkii</i>	Barred Wedgesnout Ctenotus
	<i>Ctenotus severus</i>	Stern Ctenotus
	<i>Ctenotus uber</i>	Spotted Ctenotus
	<i>Cyclodomorphus melanops</i>	Spinifex Slender Blue-tongue
	<i>Egernia depressa</i>	Southern Pygmy Spiny-tailed Skink
	<i>Egernia formosa</i>	Goldfields Crevice Skink
	<i>Eremiascincus fasciolatus</i>	Narrow-banded Sand Swimmer
	<i>Eremiascincus richardsonii</i>	Broad-banded Sand-swimmer
	<i>Lerista amicorum</i>	Fortescue Slider
	<i>Lerista bipes</i>	North-western Sandslider
	<i>Lerista desertorum</i>	Central Desert Robust Slider
	<i>Lerista distinguenda</i>	South-western Orange-tailed Slider
	<i>Lerista ips</i>	Robust Duneslider
	<i>Lerista kingi</i>	King's Slider
	<i>Lerista macropisthopus</i>	Unpatterned Robust Slider
	<i>Lerista neander</i>	Pilbara Robust Slider
	<i>Lerista picturata</i>	Southern Robust Slider
	<i>Lerista timida</i>	Timid Slider
	<i>Lerista vermicularis</i>	Slender Duneslider

Family	Species	Common Name
	<i>Liopholis striata</i>	Nocturnal Desert Skink
	<i>Menetia greyii</i>	Common Dwarf Skink
	<i>Morethia butleri</i>	Woodland Morethia Skink
	<i>Morethia ruficauda</i>	Lined Fire-tailed Skink
	<i>Proablepharus reginae</i>	Western Soil-crevice Skink
	<i>Tiliqua multifasciata</i>	Central Blue-tongue
	<i>Tiliqua occipitalis</i>	Western Blue-tongued Lizard
	<i>Tiliqua rugosa</i>	Bobtail
Typhlopidae	<i>Anilius australis</i>	Austral Blind Snake
	<i>Anilius bicolor</i>	Dark-spined Blind Snake
	<i>Anilius grypys</i>	Long-beaked Blind Snake

Family	Species	Common Name
	<i>Anilius hamatus</i>	Pale-headed Blind Snake
	<i>Anilius waitii</i>	Waite's Blind Snake
Varanidae	<i>Varanus acanthurus</i>	Spiny-tailed Monitor
	<i>Varanus breviceauda</i>	Short-tailed Pygmy Monitor
	<i>Varanus caudolineatus</i>	Stripe-tailed Monitor
	<i>Varanus eremius</i>	Pygmy Desert Monitor
	<i>Varanus giganteus</i>	Perentie
	<i>Varanus gilleni</i>	Pygmy Mulga Monitor
	<i>Varanus gouldii</i>	Gould's Goanna
	<i>Varanus panoptes</i>	Yellow-spotted Monitor
	<i>Varanus tristis</i>	Black-headed Monitor

4.7 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. Two threatened species of fauna and one migratory/marine species of birds identified under the *EPBC Act 1999* potentially occur in the project area. There are three Schedule species listed under the *BC Act 2016* and one species listed on the DBCA's Priority Fauna List that potentially occur in the project area. The following is an assessment of the likelihood of each of the species listed in Table 6 being found in the project area.

Table 6. Assessment of the potential presence of a conservation significant fauna species in the project area

Species	DBCAs Schedule / Priority	Status under Commonwealth EPBC Act	Comment on the potential presence of a species
Night Parrot <i>Pezoporus occidentalis</i>	Critically Endangered	Endangered	Highly unlikely to be in the project area due to a lack of suitable habitat (i.e. mature spinifex). The potential for impacting on this species is therefore very low.
Arid Bronze Azure Butterfly <i>Ogyris subterrestris petrina</i>	Critically Endangered	Critically Endangered	A lack of smooth-barked Eucalypt trees and thus <i>Camponotus terebrans</i> ants means it is highly improbable that the butterfly will be present and therefore impacted.
Sandhill Dunnart <i>Sminthopsis psammophila</i>	Endangered	Endangered	Highly unlikely to be in the project area due to a lack of suitable habitat (i.e. mature spinifex). The potential for impacting on this species is therefore very low.
Malleefowl <i>Leipoa ocellata</i>	Vulnerable	Vulnerable	No Malleefowl nesting mounds were recorded, however, Malleefowl tracks were present.
Grey Falcon <i>Falco hypoleucos</i>	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.
Chuditch <i>Dasyurus geoffroii</i>	Vulnerable	Vulnerable	Highly unlikely to occur in the project area. The potential for impacting on this species is therefore very low.
Princess Parrot <i>Polytelis alexandrae</i>	Priority 4	Vulnerable	May infrequently be seen in the region, however, clearing vegetation is unlikely to impact on this species.
Mulgara <i>Dasyercus blythi</i>	Priority 4		Highly unlikely to be in the project area due to a lack of suitable habitat (i.e. mature spinifex). The potential for impacting on this species is therefore very low.
Oriental Plover <i>Charadrius veredus</i>	Migratory	Migratory	Unlikely to be in the project area due to a lack of suitable habitat. The potential for impacting on this species is therefore low.
Fork-tailed Swift <i>Apus pacificus</i>	Migratory	Migratory	May very infrequently be seen in the region, however, clearing vegetation is unlikely to impact on this aerial species.
Grey Wagtail <i>Motacilla cinerea</i>	Migratory	Migratory	Highly unlikely to be present in the project area. The potential for impacting on this species is therefore low.
Yellow Wagtail <i>Motacilla flava</i>	Migratory	Migratory	Highly unlikely to be present in the project area. The potential for impacting on this species is therefore low.
Peregrine Falcon <i>Falco peregrinus</i>	OS		May infrequently be seen in the region, however, clearing vegetation is unlikely to impact on this species.
Long tailed Dunnart <i>Sminthopsis longicaudata</i>	P4		Likely to be present in the breakaway areas and rocky hills in the project area.

IA – Migratory birds protected under international agreements;

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 the semi-arid and arid Australia (Garnett et al. 2011, Threatened Species Scientific Committee 2016). Recordings in north-west and western Queensland in the early 1990-2000s were in a broad cross section of the habitats available (Cupitt and Cupitt 2008, Garnett et al. 2011, Boles et al. 2016). There have been recent sightings in the Pilbara in 1980, 2005 and 2017, central WA in 1979, north-eastern South Australia in 1979, western Queensland (including Pullen-Pullen-Mt Windsor-Diamantina population) in 1980, 1990, 1993, 2006 and 2013-17 (Davis and Metcalf 2008, Garnett et al. 2011, Charalambous 2016, Pickrell 2016, AG staff 2017, Palaszczuk and Miles 2017, Rykers 2017, AG staff 2018), Pilbara in 2017 (Jones 2017), and the northern Goldfields (Jackett et al. 2017). Garnett et al. (2011) suggested that there were between 50-250 mature individuals in less than 5% of its previous range. Prior to 2007 there were very few records of the Night Parrot (Plate 13).

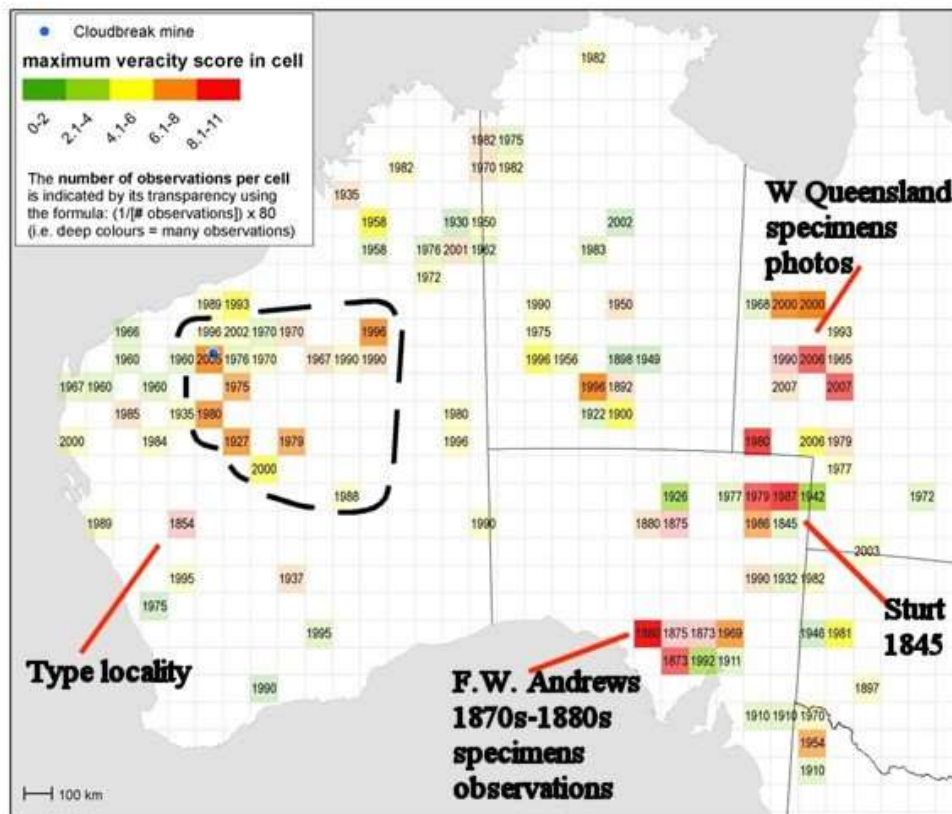


Plate 13. Map of historical Night Parrot records compiled by S. Murphy et al., including records to 2007

(taken from <https://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/threatened-animals/night-parrot>)

Wilson’s (1937) summary of observations provided information on the early records of Night Parrots’ preferred habitat and breeding sites. Recent information indicates its preferred habitat appears to be in *Triodia* grasslands, chenopod shrublands, shrubby samphire and floristically diverse habitats dominated by large-seeded species (Threatened Species Scientific Committee 2016, McCarthy 2017, Murphy et al. 2017b). At Pullen Pullen Reserve it nests in large, more or less ring-shaped *Triodia*, and the nest consists of a tunnel (25-30° and

0° to the ground; 20-33cm long) through an apron of dead spinifex leaves that leads to a chamber under a live hummock, with a shallow depression (3-4cm) excavated into the gravelly/sandy soil (Murphy et al. 2017a). In the northern Goldfields the nest was again in a spinifex hummock; it was circular, with an excavated depression (~1.5-2.0cm) in sandy substrate (Hamilton et al. 2017, Jackett et al. 2017). The entrance tunnel was 62cm long, and was downward sloping (27°) with the entrance 28cm above the ground (Hamilton et al. 2017). It has clutches of two to four sub-elliptical, white eggs with a lustrous appearance (Murphy et al. 2017a). Breeding followed significant rains in March for the observations in Pullen-Pullen Reserve and in April in the northern Goldfields (Hamilton et al. 2017, Murphy et al. 2017a), but it is thought that breeding generally occurs between April and October (Murphy et al. 2017a).

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.

The project area is within the high priority area for Night Parrots as indicated by the then Department of Parks and Wildlife (Plate 14; 2017). Both the Commonwealth and State government assessors may require a Night Parrot survey for particular project areas where there is long-unburnt spinifex.

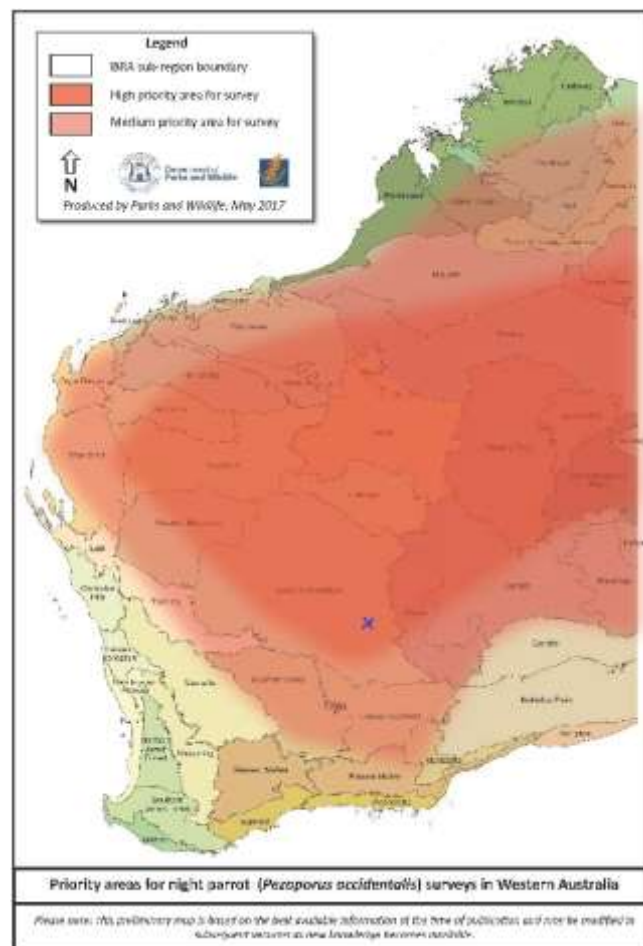


Plate 14. Probability of finding a Night Parrot in Western Australia, with the project area marked as a blue cross

The Night Parrot has been recorded in the northern goldfields and the record is thought to be about 370km north of the project area. There is no mature, ring-forming spinifex in the project area, the preferred roosting and nesting habitat for Night Parrots; therefore it is highly unlikely that it is present in the project area.

Arid Bronze Azure Butterfly (*Ogyris subterrestris petrina*) – Critically endangered under the *BC Act 2016* and *EPBC Act 1999*

Arid Bronze Azure Butterfly is associated with colonies of the ant *Camponotus terebrans* in mallee vegetation on sandy soil, often near flood plains, and the ant typically digs its nest at the base of eucalypts (Threatened Species Scientific Committee 2014). Butterfly larvae hatching from eggs laid near an ant nest entrance (often near the bases of various mallee eucalypts) are carried, by the ants, into their nest. Details of *C. terebrans* biology and of any form of herbivory by the larvae are unknown; however, it is likely that the larvae are myrmecophilous. These butterflies fly close to the ground and have been observed flying over agricultural lands near presumed breeding colonies (Williams and Williams 2008). The goldfields population was originally known from Lake Douglas, about 12kms south-west of Kalgoorlie (Field 1999), however, this population is reported to have become extinct (Williams et al. 2008, Williams and Williams 2008, Williams et al. 2018) and also in the Barbalin Nature Reserve (~11km west of Mukinbudin) in the Avon Wheatbelt (Threatened Species Scientific Committee 2014). There is also an additional extant population 100km from Barbalin Nature Reserve but the DBCA have not provided its location.

Camponotus terebrans is typically only found in areas with smooth bark Eucalypts including Gimlet (*Eucalyptus salubris*) and Lake Grace Gum (*Eucalyptus loxophleba* ssp. *gratiae*), but also Wheatbelt Wandoo (*E. capillosa capillosa*) and Salmon Gum (*E. salmonophloia*). At Lake Douglas, the host tree was *Eucalyptus concinna* (Field 1999, Threatened Species Scientific Committee 2014).

Williams and Williams (2008) commented that 'Over 30 surveys have been conducted in the region by DEC staff and experienced volunteers between 1992 and 2008' (p. 8) and 'include extensive surveys between Payne's Find and Kalgoorlie, including most of the major conservation reserves. The surveys have covered extensive parts of the region in which *O. s. petrina* might occur, but have not detected any individuals or additional populations of the butterfly' (p. 8). The fact that further populations have not been located, despite the species being conspicuous, demonstrates the rarity of this butterfly and the significance of the Barbalin site.' (Williams and Williams 2008)(p. 9).

There were only a very small number of smooth-barked Eucalypt trees (i.e. *Eucalyptus salubris*) near the eastern extent of the project area. Due to the lack of suitable habitat *Camponotus terebrans* will not be present, so it is highly improbable that the Arid Bronze Azure Butterfly is present, without *C. terebrans* being present.

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

The Sandhill Dunnart is the second largest of the dunnarts and its three extant populations are in the western Great Victoria Desert, Yellabinna Regional Reserves in the south-eastern Great Victoria Desert and the Eyre Peninsula in South Australia. In WA its habitat is sandplains and dunes with mature hummock grassland often in association with Mallee, Marble Gum and Callitris (GHD 2020). This is a highly mobile species that typically shelters during the day in stands of mature spinifex.

There is no mature spinifex hummocks in the project area nor is there any sand dunes, so it is highly improbable that the Sandhill Dunnart is present in the project area.

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.

Malleefowl have been observed in the bioregion, however, there are no recent records of active breeding mounds in the vicinity of the project area. Although no Malleefowl mounds were recorded by Native Vegetation Solutions, Malleefowl tracks were relatively common in the open mulga with sandy soil, indicating that they are foraging in the project area (Plates 15 and 16; provided by Eren Reid).



Plate 15. Malleefowl tracks

Plate 16. Malleefowl tracks

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.

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 further to the east.

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 at Leonora and in atypical habitat. As the project area is a significantly long way north-east of the species known distribution it is unlikely that the Chuditch would be found in the project area and the habitat is not suitable. 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.

It is a nomadic species that moves around the arid interior of Australia in search of resources. If it was present any proposed development is unlikely to significantly impact on this species as it will move away to other areas if it is disturbed.

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

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

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

Fauna habitat in the project area is generally not suitable for Mulgara (i.e. lack of spinifex hummocks), so it is highly unlikely that Mulgara are present in the project area.

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

A migrant species with patchy distribution in Australia, the Oriental Plover is sparsely distributed across arid and semi-arid Australia but avoids truly desert regions. Its preferred habitat is dry plains. It was not recorded in other fauna surveys undertaken near the project area. The species is under threat because of habitat reduction due to agriculture and changing fire regimes. 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 earth, usually only for breeding. It is common in the Kimberley, uncommon to moderately common near northwest, west and southeast coasts and rare to scarce elsewhere. It is rarely seen in the Goldfields (Plate 17), so it is unlikely to be impacted by the proposed development.

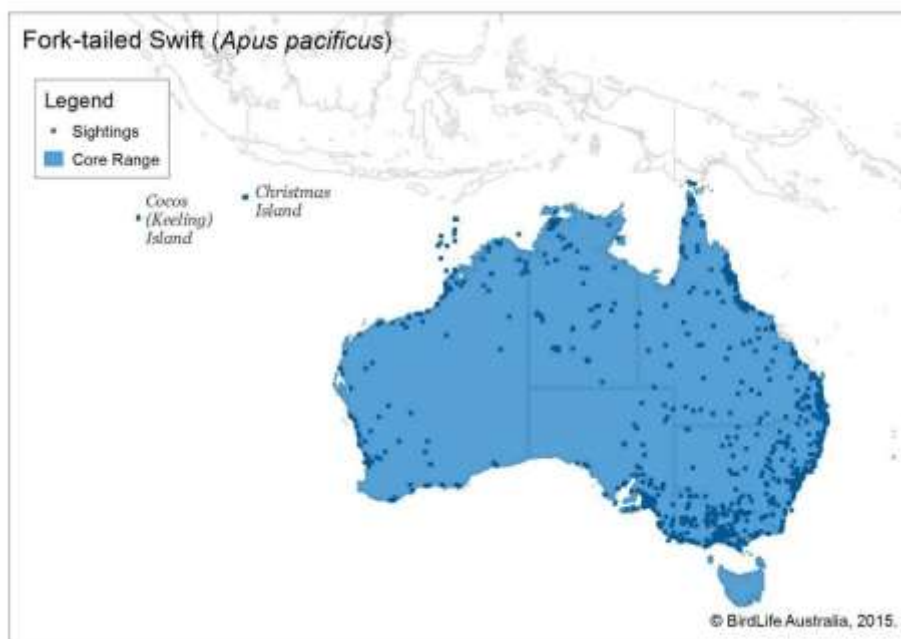


Plate 17. Range and actual reported sightings of the Fork-tailed Swift

(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 18) so it is unlikely to be impacted by the proposed development.

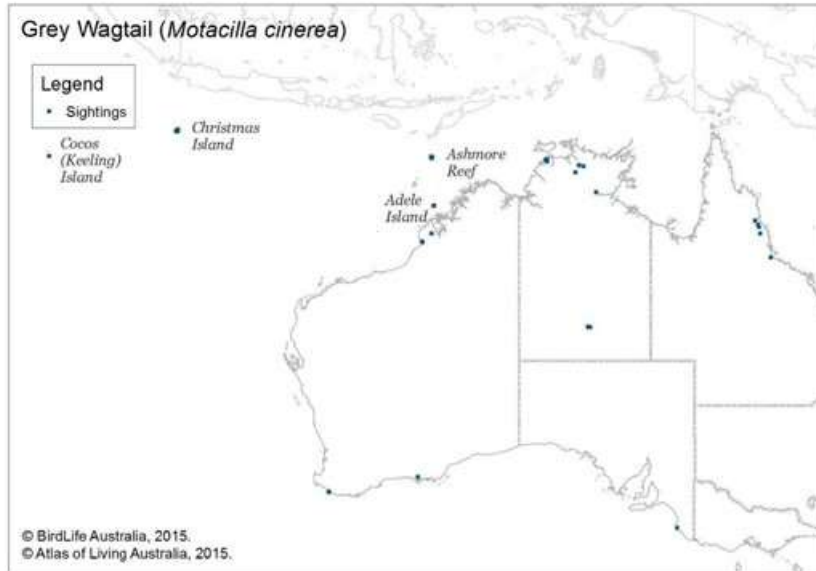


Plate 18. Reported sightings of the Grey Wagtail

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

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

The Yellow Wagtail is found in the millions in the northern hemisphere and the Atlas of Living Australia records multiple records of this bird in Australia in the coastal areas. There are no records for this species in inland Western Australia near the project area (Plate 19), therefore it is highly unlikely to be impacted by the proposed development.

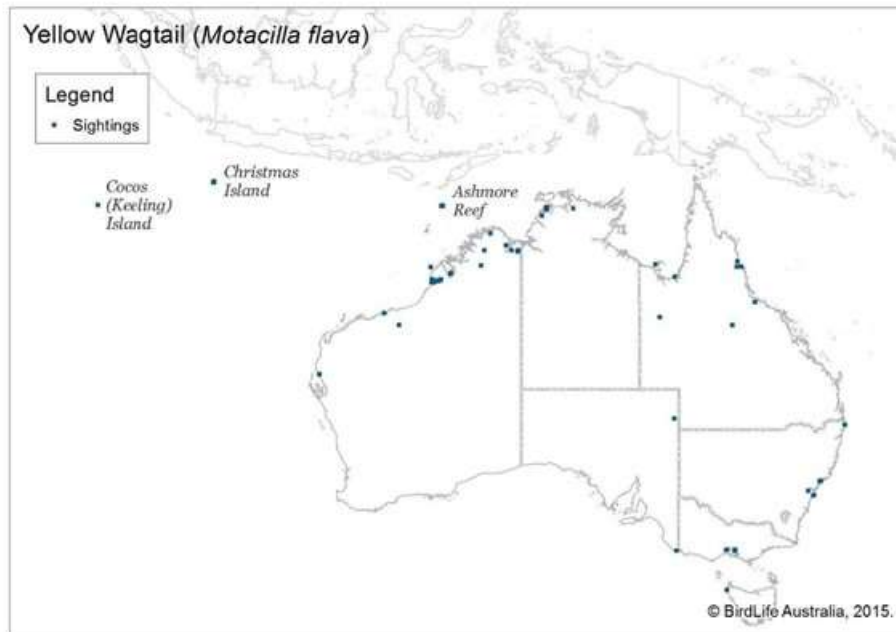


Plate 19. Reported sightings of the Yellow Wagtail

(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, development 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.

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

The Long-tailed Dunnart (*Sminthopsis longicaudata*) is listed as a Priority 4 species with the Department of Environment and Conservation. Burbidge et al. (2008) summarised its habitat as widely scattered in the 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 were within rugged rocky landscapes that support a low open woodland or shrubland of Acacias (especially mulga) with an understorey of spinifex hummocks, and (occasionally) also perennial grasses and cassias.

Long-tailed Dunnarts are present on numerous BIFs, rocky ridges and hills in the Goldfields and Midwest (Cowan 2003, Burbidge et al. 2008, Terrestrial Ecosystems 2011b, a, Stantec 2020, Terrestrial Ecosystems 2020). 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, and an unnamed mine east of Granny Smith (pers. comm.). There are also other unpublished records in the vicinity of the project area. This dunnart is likely to be in the project area in the breakaway and rocky areas. If the proposed development and mining area does not impact on the breakaway and rocky areas, then it is unlikely that it will have a significant impact on this species.

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 assessed area was approximately 623ha, however, a smaller area will be impacted by the proposed mining development and operations. The combined reports cover an area of approximately 2031.5ha in a region where there is very little quantified fauna survey data for similar habitat. The project area has been partially disturbed for mining and exploration activity. There is a vast quantity of similar habitat in adjacent areas, so the fauna assemblage in the project area is likely to be similar to that in adjacent areas. It is unlikely that further survey effort in the project area will provide new species not previously identified for this region.

5.1.1 Amphibians

Frogs are normally only detected immediately after rainfall or around semi-permanent pools. It is likely that *Cyclorana maini*, *Pseudophryne occidentalis*, *Neobatrachus kunapalari* and *Neobatrachus wilsmorei* could also be found in the general area. These species, other than *P. occidentalis* and *L. rubella*, burrow into the ground and aestivate between rainfall events. *Pseudophryne occidentalis* and *L. rubella* find shelter under rocks and in crevices during the dry periods and enter temporary ponds to breed after major rainfall events. All species have a wide-spread distribution and are abundant. Development of the project area is likely to result in a loss of individuals within the disturbed area, however, is unlikely to have a significant impact on these species when assessed in a regional context.

5.1.2 Reptiles

Typically, between 25 and 35 species of reptiles are caught in open Acacia woodland (Coffey Environments 2008, Terrestrial Ecosystems 2010, 2011a, 2020). However, the sparse ground cover and lack of leaf litter in much of the project area will mean the terrestrial vertebrate fauna will be in low abundance. None of the species likely to be in the project area are of conservation significance. Given that there were large expanses of similar habitat in adjacent areas, development of the project area is unlikely to have significant impact on reptiles when assessed in a regional context.

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 project area is likely to support a similar assemblage to that present in the adjacent areas.

Malleefowl are present in the area, but no breeding mounds were found after an extensive search. Given the sparseness of the vegetation and the presence of wild dogs and feral cats, Malleefowl are likely to be in low abundance. The Peregrine Falcon and Princess Parrot may infrequently be seen in the project area. The Princess Parrot is nomadic and moves around the arid interior often in search of water and resources and the Peregrine Falcon will normally have a very large home range.

Terrestrial Ecosystems' view is that the proposed development is unlikely to significantly impact on the avian fauna of the bioregion, however, plans to avoid, minimise and mitigate impacts on Malleefowl are recommended.

5.1.4 Mammals

The diversity of small terrestrial mammals potentially caught in the project area would be typical of that found in a diverse habitat in the sandy-clay with occasional rocky breakaways and ridges with limited vegetation. Wild dogs and feral cats are present in the area.

It is likely that the breakaway and rocky areas support Long-tailed Dunnarts, as this is its preferred habitat. Long-tailed Dunnarts have been recorded at the Granny Smith mine and another unnamed mine to the east, and other unnamed projects in the vicinity of the project area. If the proposed development and mining area does not impact on the breakaway and rocky areas, then it is unlikely that the project will have a significant impact on this species.

Terrestrial Ecosystems' view is that the development of the project area is unlikely to significantly impact on the mammal fauna of the bioregion, other than Long-tailed Dunnarts which are discussed above. Management of wild dogs and feral cats would see an increase in the native vertebrate fauna over a period of years.

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.

There is a variety of fauna habitats in the project area, which is typical for this part of the bioregion. Fauna habitats represented in the project area are abundant and in reasonable condition in adjacent areas. The most significant impact on the vertebrate fauna community in this area would be the presence of feral cats and wild dogs. The fauna assemblage that is present in the project area will also be present and abundant in the adjacent areas. The available fauna survey data (**Error! Reference source not found.**) provides a good indication of the vertebrate fauna that are potentially in the project area.

5.2.1 Ecological functional value at the ecosystem level

Some of the project area has been disturbed by previous and the current exploration activity and mining, with the consequence that these areas and surrounds will have a depleted vertebrate fauna assemblage. The most significant impact on vertebrate fauna in the project area and surrounds will have been feral cats and wild dogs.

This site supports the conservation significant Malleefowl in low abundance.

5.2.2 Maintenance of threatened ecological communities

No Malleefowl mounds were recorded in the project area, however, the presence of Malleefowl tracks indicates that they are foraging in the project area.

5.2.3 Condition of fauna habitat

Some of the project area has been disturbed due to historical and current exploration activity (i.e. tracks, drill holes, bag farms and dilapidated buildings) and past mining. The uncleared fauna habitat present in the project area is similar to many square kilometres of adjacent habitat. 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 region. 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 abundant in adjacent areas. It is therefore likely that the fauna assemblage in the project area is similar to the many square kilometres of similar habitat in adjacent areas and the bioregion.

5.2.7 Potential impacts on ecosystem function

Clearing native vegetation is likely to result in the loss of small vertebrate fauna on-site that are unable to move away during the clearing process. The few larger animals, such as kangaroos and large goannas, and most of the birds will move into adjacent areas once clearing commences. Shifting animals into adjacent areas will increase the pressure on resources in those areas and it is likely that there will be some disruption to the ecosystems in these areas for a short period until a balance is restored.

Impacts associated with clearing vegetation and development in the project area in a landscape or bioregional context on the vertebrate fauna are likely to be low as the proposed disturbance area is small relative to the quantity of similar habitat in the bioregion.

The impact of feral and pest fauna which are present in the project area will be doing more environmental damage than the combined impacts of proposed development, vegetation clearing and fragmentation of 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 fauna, they are not likely to result in significant impacts on fauna habitat and fauna assemblages in the long term. The overall impact on fauna species and species of conservation significance will be minimal provided the recommended management procedures are implemented and adhered to.

6.1 DIRECT IMPACTS

6.1.1 Animal deaths during the clearing process and displacement of fauna

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

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

Edge effects can lead to the disruption of ecological processes such as predation and dispersal, animal movements and can change assemblage structure. The consequence is that the impact area will always be much larger than the cleared area. However, for this project area, the sparseness of vegetation and ground cover mean there will be few 'edge effects' as a consequence of vegetation clearing.

6.1.2 Reduction or loss of activity areas and closure of burrows

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

6.2 INDIRECT IMPACTS

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

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, although in low abundance. In many situations they have become a 'naturalised' species in the Australian bush. Increases in dog or cat numbers can have a detrimental impact on native fauna because they predate on and compete with native species, severely disrupting the natural balance. The feral cat is a particularly damaging predator on native fauna and any increase in their numbers could have a detrimental effect on local native fauna (Kinnear 1993, Bamford 1995, Woinarski et al. 2017, Woinarski et al. 2018, Murphy et al. 2019); hence it is important to ensure that populations of the feral predators, such as cats are under control.

Dog and cat tracks indicate there is a low abundance of cats and wild dogs in the adjacent areas and therefore likely to be in the project area in similar abundance. These dogs and cats will almost certainly have very large home ranges, part of which will include the project area. Infrastructure known to support feral species, such as rubbish disposal sites and bins, and permanent water should be managed to minimise increases in these populations.

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

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 small size of the project area, the impacts of road fauna deaths are likely to be low.

6.2.4 Fire

Increased human activity is often associated with an altered fire regime which can 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.

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

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. This form of disturbance is likely to occur during the initial vegetation clearing and when development activity commences. The overall impact is likely to be confined to a relatively small area and is unlikely to be a significant impact.

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. Degradation of these areas may potentially render habitat unsuitable for fauna. Dust suppression and management programs are an essential component of minimising impacts on fauna in areas adjacent to the mine. 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 7, 8 and 9 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 9.

Table 7. 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 to 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 8. 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 9. 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.	B	2	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.	B	2	Low				
Clearing vegetation	Loss of fauna habitat – local scale	Loss of terrestrial fauna in the project area.	E	2	Mod				
	Loss of fauna habitat – landscape scale	Loss of some fauna during vegetation clearing.	B	1	Low				
	Loss of fauna habitat – regional scale	Small loss of some fauna from the region.	B	1	Low				
	Loss of a threatened ecological fauna community	Loss of an undetected threatened ecological fauna community.	A	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	C	3	Mod	Implement feral and pest animal control and vertebrate fauna management plan	B	2	Low
	Long-tailed Dunnart	Loss of a Long-tailed Dunnart or small population of Long-tailed Dunnarts	B	2	Low				

			Before management			With management			
	Arid Broze Azure	Loss of a Arid Bronze Azure Butterfly or small population of Arid Bronze Azure Butterfly	A	3	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				
	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				
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	C	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 10). Where possible, native vegetation should not be cleared if any of the following principles are comprised.

Table 10. 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. Malleefowl (listed as Vulnerable under the <i>EPBC Act</i> and <i>BC Act</i>) are present in the project area, and probably in the adjacent areas. A vertebrate fauna management plan will need to be prepared and implemented for this species to avoid, minimise and mitigate any impacts. If mining was to occur in the breakaway and rocky areas, then it is likely that it could impact on Long-tailed Dunnarts (listed as a Priority 4 species with <i>DBCAs</i>). As a priority species, there is no special legislative protection for this species.
It comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.	Clearing the vegetation will not result in the loss of significant habitat for indigenous fauna. It could however, impact on a low number of Malleefowl and Long-tailed Dunnarts. Neither species are dependent on this habitat for their long-term survival.
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 of native vegetation.
It is growing in, or in association with, an environment associated with a watercourses or wetland.	The area does not contain a natural wetland.
The clearing of the vegetation is likely to cause appreciable land degradation.	N/A
The clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.	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

No Malleefowl mounds were recorded in the project area, however, Malleefowl tracks were recorded in the project area, indicating that Malleefowl are present in low abundance. Large portions of the habitat in the project area were very open and therefore not suitable for Malleefowl nesting when predators are present in the general area.

The potential impact on this species is unknown until more is known about the proposed development and its operation. Prior to any vegetation clearing or disturbance activity, Legacy Iron Ore Limited should undertake a risk assessment to determine if conservation significant fauna are likely to be present, and if present, likely to be impacted. If Malleefowl or their foraging habitat are likely to be significantly impacted, then a referral to the Commonwealth Government under the *EPBC Act 1999* is recommended.

7. SUMMARY

The assessed area was approximately 623ha, however, a smaller area will be impacted by the proposed mining development and operations. The combined reports cover an area of approximately 2031.5ha. There are six broad fauna habitats:

- Open Mulga shrubland on sandy soil;
- Mulga and chenopod shrubland on rocky soil;
- Mulga shrubland over rocky soil;
- Mulga on rocky slopes and hills;
- Shrubs on granite rocks and bedrock;
- Mulga drainage lines.

There are also areas disturbed by exploration activity. The habitat substrate varies from red sandplain with no stones/pebbles to an abundance of stones/pebbles, to rocky ridges and breakaways.

No Malleefowl mounds were recorded in the project area, however, Malleefowl tracks were recorded in the project area, indicating that Malleefowl are present in low abundance. Large portions of the habitat in the project area were very open and therefore not suitable for Malleefowl nesting when predators are present in the general area.

Prior to any vegetation clearing or disturbance activity, Legacy Iron Ore Limited should undertake a risk assessment to determine if conservation significant fauna are likely to be present, and if present, likely to be impacted. If Malleefowl or its foraging habitat is likely to be significantly impacted, then a referral to the Commonwealth Government under the *EPBC Act 1999* is recommended.

It is likely that Long-tailed Dunnart are present in the breakaway and rocky areas. If these areas are not going to be impacted by mining development or operations, then impacts are likely to be low. The Long-tailed Dunnart is not listed as a threatened species under the *EPBC Act* so there is no reporting requirement under the Commonwealth Act for this species.

Clearing native vegetation in the project area is likely to result in the loss of small vertebrate fauna on-site that are unable to move away during the clearing process, however, this loss is not likely to be significant when viewed in a bioregional context. The few larger animals, such as kangaroos, large goannas and snakes, and most of the birds will move into adjacent areas once vegetation clearing commences, so potential impacts will be low. 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. Forced fauna migrants as a result of vegetation clearing increase competition for resources, which may result in the subsequent loss of migrants or local individuals. Individuals shifted out of their established activity areas are also vulnerable to predation until they have become established in their new areas.

Impacts on vertebrate fauna associated with clearing vegetation in the project area in a landscape or bioregional context are likely to be low as there are vast tracts of similar fauna habitat in adjacent areas, and the sparseness of the vegetation and ground cover mean the abundance of terrestrial vertebrate in the project area will be low.

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. Specific management and mitigation strategies to address potential impacts should be addressed in the recommended Vertebrate Fauna Management Plan and Construction Environmental Management Plan.

Pets and feral animals have the potential to impact on fauna. Pets should not be permitted on site and feral and pest fauna numbers monitored and if they appreciably increase then culled. All rubbish likely to attract animals should be suitably contained and disposed of so as not to encourage the feeding of fauna around the site.

Based on wild dog and feral cat tracks recorded in the adjacent areas reducing the impacts of these pest species will reduce the stress on fauna and fauna assemblages in the area, and in particular it will reduce predation pressure on Malleefowl. Increased anthropogenic activity will result in increased traffic and a consequential increase in the fauna deaths on tracks. Limiting vehicle speed on mine roads can reduce collisions with fauna, particularly larger animals such as kangaroos and emus. Dead animals on the road also have the propensity to attract raptors, goannas and even cattle, which are then likely to be killed.

Management of secondary impacts on habitat and fauna should be addressed in a Vertebrate Fauna Management Plan. The plan should include:

- Control and reduction methods for feral and pest fauna;
- Management of pets on site;
- Strategies to minimise habitat fragmentation and barriers to fauna movement (e.g. fencing);
- Vegetation clearing and development protocols;
- Vehicle impacts on vertebrate fauna (short and long term);
- Vehicle speed limits on site; and
- Anthropogenic activity.

Recommendation 1: A Vertebrate Fauna Management Plan is prepared and implemented prior to vegetation clearing, and is effective during mine development and operation.

8.1 PRESENCE OF MALLEEFOWL

No Malleefowl mounds were recorded in the project area, however, Malleefowl tracks were recorded in the project area, indicating that Malleefowl are present in low abundance. Large portions of the habitat in the project area were very open and therefore not suitable for Malleefowl nesting when predators are present in the general area. Prior to any vegetation clearing or disturbance activity, Legacy Iron Ore Limited should undertake a risk assessment to determine if conservation significant fauna are likely to be present, and if present, likely to be impacted. If Malleefowl or their foraging habitat are likely to be significantly impacted, then a referral to the Commonwealth Government under the *EPBC Act 1999* is recommended.

Recommendation 2: Prior to vegetation clearing and disturbance, the mine undertakes a risk assessment to determine if conservation significant fauna are likely to be present, and if present, likely to be impacted.

Recommendation 3: If Malleefowl or its foraging habitat are likely to be significantly impacted, as judged by the risk assessment, then the proposed action is referred to the Commonwealth Government under the *EPBC Act 1999* to assess the significance of the potential impact on this species.

Recommendation 4: There is a specific section in the Vertebrate Fauna Management Plan that addresses the management of Malleefowl. This is prepared once more detail is available about the proposed potential impacts on this species. If an *EPBC Act* referral is submitted, then it is recommended that the Vertebrate Fauna Management Plan is submitted with the referral to demonstrate how the development will minimise, mitigate and manage potential impacts on the species.

8.2 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 5: an induction program that includes a component on managing fauna is mandatory for staff and contractors working in the project area.

8.3 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 6: the impact of dust on adjacent vegetation and therefore fauna habitat is managed and monitored against appropriate KPIs.

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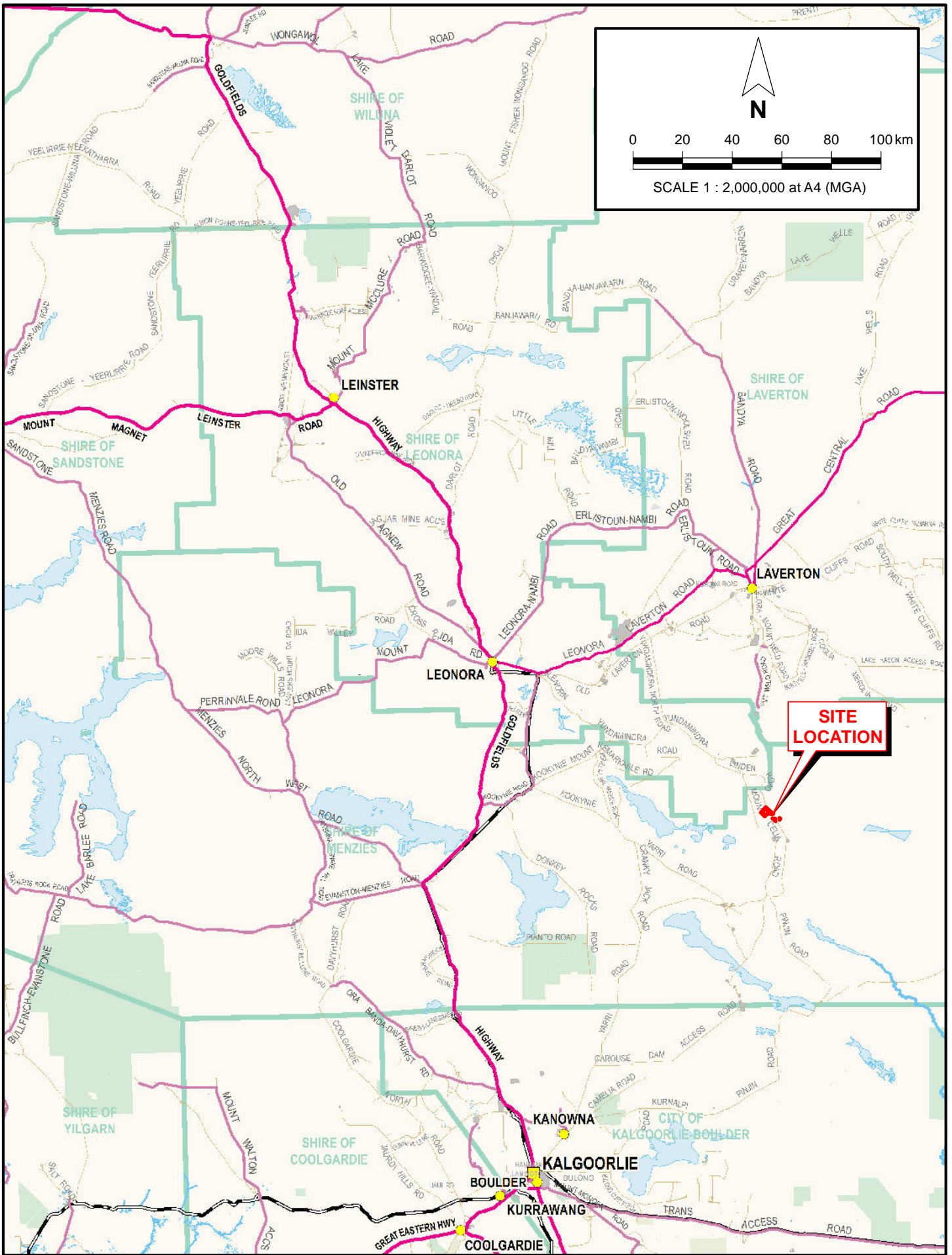
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Figures

Desktop Vertebrate Fauna Risk Assessment
Mt Celia Gold Project





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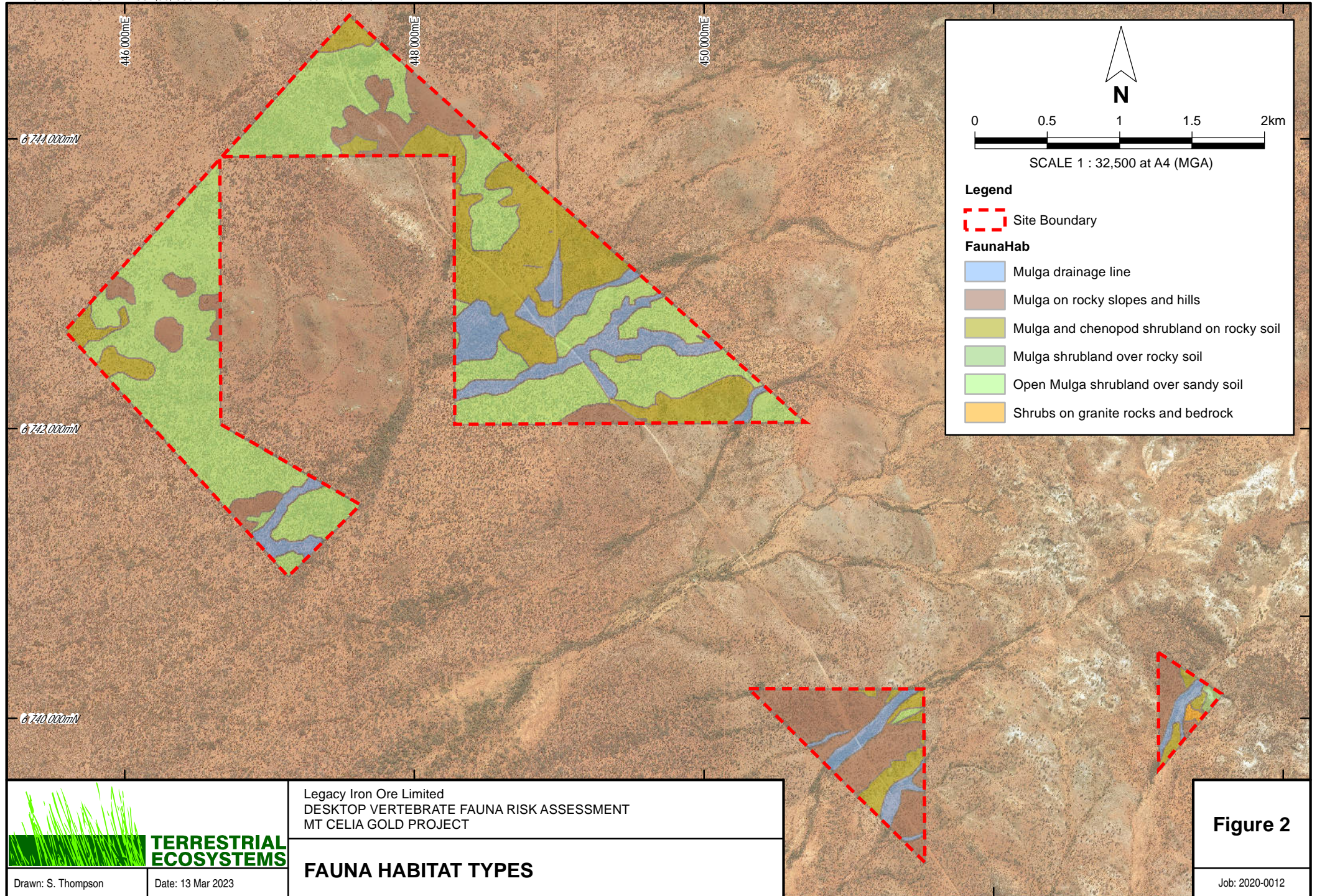
 TERRESTRIAL ECOSYSTEMS	
Drawn: S. Thompson	Date: 13 Mar 2023

Legacy Iron Ore Limited
 DESKTOP VERTEBRATE FAUNA RISK ASSESSMENT
 MT CELIA GOLD PROJECT

REGIONAL LOCATION

Figure 1

Job: 2021-0012



N

0 0.5 1 1.5 2km

SCALE 1 : 32,500 at A4 (MGA)

Legend

Site Boundary

FaunaHab

- Mulga drainage line
- Mulga on rocky slopes and hills
- Mulga and chenopod shrubland on rocky soil
- Mulga shrubland over rocky soil
- Open Mulga shrubland over sandy soil
- Shrubs on granite rocks and bedrock

TERRESTRIAL ECOSYSTEMS

Drawn: S. Thompson Date: 13 Mar 2023

Legacy Iron Ore Limited
DESKTOP VERTEBRATE FAUNA RISK ASSESSMENT
MT CELIA GOLD PROJECT

FAUNA HABITAT TYPES

Figure 2

Job: 2020-0012

Appendix A.

Results of the EPBC Protected Matters Search

Desktop Vertebrate Fauna Risk Assessment
Mt Celia Gold Project





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.

Report created: 06/11/20 17:44:12

[Summary](#)

[Details](#)

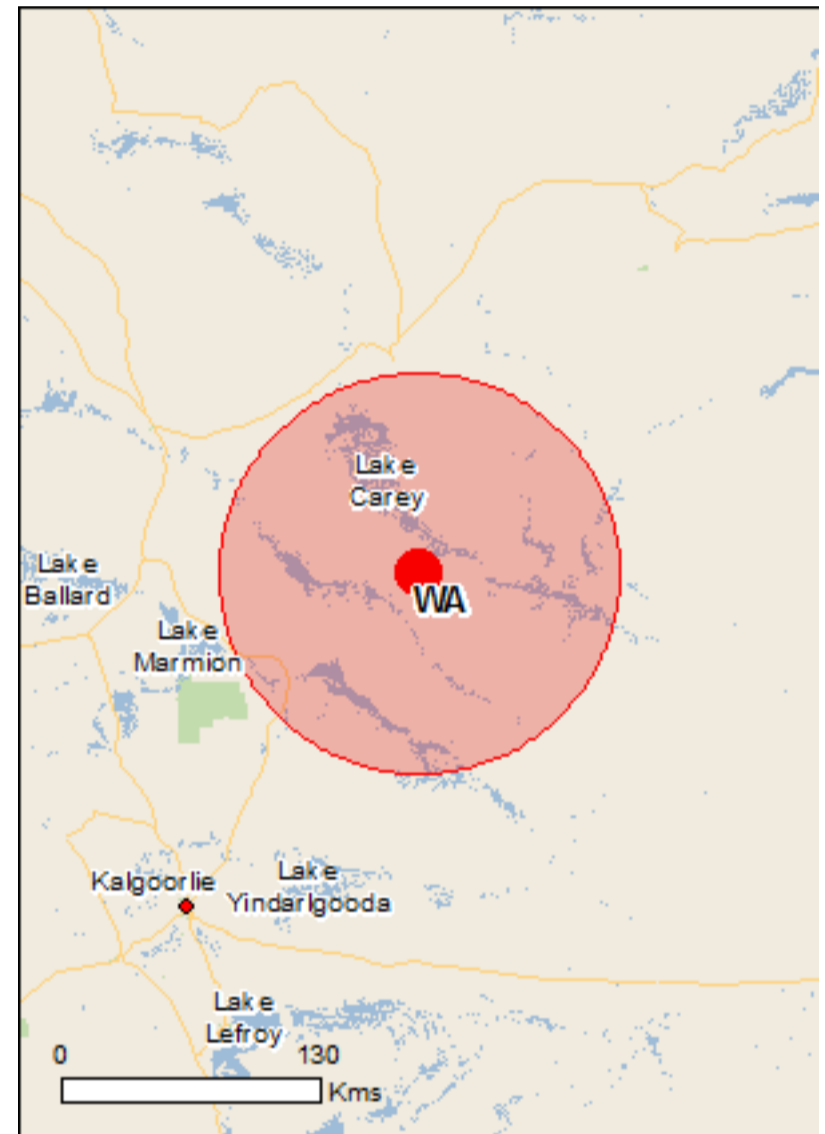
[Matters of NES](#)

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

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)



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

[Coordinates](#)

Buffer: 100.0Km



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:	8
Listed Migratory Species:	9

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:	13
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:	14
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		
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
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
Sminthopsis psammophila Sandhill Dunnart [291]	Endangered	Species or species habitat likely to occur within area
Plants		
Hibbertia crispula Ooldea Guinea-flower [15222]	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

Name	Threatened	Type of Presence
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 ferruginea Curlew Sandpiper [856]	Critically Endangered	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
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 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 ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
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 area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat may 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 Resources 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 chinensis Spotted Turtle-Dove [780]		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

Name	Status	Type of Presence 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
Equus caballus Horse [5]		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

-29.4551 122.51685

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 area

Desktop Vertebrate Fauna Risk Assessment
Mt Celia Gold Project



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

Family	Species	Common Name	Surveys																										
			A	B															C										
				Site 9	Site 10	Site 2	Site 3	Site 12	Site 4	Site 5	Site 1	Site 8	Site 11	Site 13	Site 6	Site 7	Opportunistic	Birds	MME1	MME2	Opportunistic	MME3	MME5	MME7	MME8	MME9	MME6	MME4	
Amphibians																													
Limnodynastidae	<i>Neobatrachus kunapalari</i>	Wheatbelt Frog	X	1																									
	<i>Neobatrachus sutor</i>	Shoemaker Frog		13	2	2	5	1	3	1	8	1								1	1								
	<i>Platyplectrum spenceri</i>	Spencer's Burrowing Frog	X																										
Pelodyadidae	<i>Cyclorana maini</i>	Main's Frog		11	5	1							1									1							
	<i>Cyclorana occidentalis</i>	Western Water-holding Frog		5	2	1	1	1						1															
Reptiles																													
Agamidae	<i>Ctenophorus cristatus</i>	Crested Dragon	X																										
	<i>Ctenophorus fordi</i>	Mallee Dragon	X																										
	<i>Ctenophorus infans</i>	Ring-tailed Dragon	X																										
	<i>Ctenophorus isolepis</i>	Central Military Dragon	X																		1								
	<i>Ctenophorus nuchalis</i>	Central Netted Dragon	X																										
	<i>Ctenophorus reticulatus</i>	Western Netted Dragon	X																			1	1	1	1	3	1		
	<i>Ctenophorus salinarum</i>	Saltpan Dragon	X																										
	<i>Ctenophorus scutulatus</i>	Lozenge-marked Dragon	X																										
	<i>Diporiphora amphibolurooides</i>	Mulga Dragon	X						2	1					1														
	<i>Moloch horridus</i>	Thorny Devil	X																										
	<i>Pogona minor</i>	Western Bearded Dragon	X																								1		
	<i>Tympanocryptis cephalus</i>	Pebble Dragon	X						2	3		1			1														
Carphodactylidae	<i>Nephrurus vertebralis</i>	Midline Knob-tail	X																										

Family	Species	Common Name	Surveys																									
			A	B														C										
			Site 9	Site 10	Site 2	Site 3	Site 12	Site 4	Site 5	Site 1	Site 8	Site 11	Site 13	Site 6	Site 7	Opportunistic	Birds	MME1	MME2	Opportunistic	MME3	MME5	MME7	MME8	MME9	MME6	MME4	
	<i>Underwoodisaurus millii</i>	Barking Gecko	X																								2	
Diplodactylidae	<i>Diplodactylus conspicillatus</i>	Fat-tailed Gecko	X																									
	<i>Diplodactylus granariensis</i>	Wheatbelt Stone Gecko			1																							
	<i>Diplodactylus pulcher</i>	Beautiful Gecko	X	2				1	4	2		1	1	3	1												1	
	<i>Lucasium damaeum</i>	Beaded Gecko	X																									
	<i>Lucasium squarrosus</i>	Mottled Ground Gecko	X																									
	<i>Rhynchoedura ornata</i>	Beaked Gecko	X	1						3				2														
	<i>Strophurus elderi</i>	Jewelled Gecko	X																									
	<i>Strophurus strophurus</i>	Western Spiny-tailed Gecko	X																									
	<i>Strophurus wellingtonae</i>	Western Shield Spiny-tailed Gecko	X		2					4		1								1								
Elapidae	<i>Brachyuropsis fasciolatus</i>	Narrow-banded Burrowing Snake	X																									
	<i>Parasuta monachus</i>	Hooded Snake	X								1		1								1							
	<i>Pseudechis australis</i>	Mulga Snake	X																									
	<i>Pseudechis butleri</i>	Spotted Mulga Snake	X																		1							
	<i>Pseudonaja mengdeni</i>	Western Brown Snake	X																									
	<i>Pseudonaja modesta</i>	Ringed Brown Snake	X																									
	<i>Simoselaps bertholdi</i>	Jan's Banded Snake	X																									
	<i>Suta fasciata</i>	Rosen's Snake	X																									
Gekkonidae	<i>Christinus marmoratus</i>	Marbled Gecko	X																									
	<i>Gehyra purpurascens</i>	Purplish Dtella	X																									
	<i>Gehyra variegata</i>	Variiegated Gehyra	X		2	3	2	2	4		3	1		1					3	9	1	3	3	2		3	9	16
	<i>Heteronotia binoei</i>	Bynoe's Gecko	X		1			1	1	2		2	5						3	1							1	
Pygopodidae	<i>Aprasia picturata</i>	Black-headed Worm-lizard	X																									

Family	Species	Common Name	Surveys													C											
			A	B																							
			Site 9	Site 10	Site 2	Site 3	Site 12	Site 4	Site 5	Site 1	Site 8	Site 11	Site 13	Site 6	Site 7	Opportunistic	Birds	MME1	MME2	Opportunistic	MME3	MME5	MME7	MME8	MME9	MME6	MME4
Pygopodidae	<i>Delma nasuta</i>	Sharp-snouted Delma	X																								
	<i>Lialis burtonis</i>	Burton's Legless Lizard	X																								
	<i>Pygopus nigriceps</i>	Western Hooded Scaly-foot	X																								
Scincidae	<i>Cryptoblepharus buchanani</i>	Buchanan's Snake-eyed Skink	X																	2	1						
	<i>Ctenotus calurus</i>	Blue-tailed Finesnout Ctenotus	X																								
	<i>Ctenotus greeri</i>	Spotted-necked Ctenotus	X																								
	<i>Ctenotus helenae</i>	Clay-soil Ctenotus	X																								
	<i>Ctenotus leonhardii</i>	Leonhardi's Ctenotus	X	5	9	2		16		2		7	27		1							1					
	<i>Ctenotus pantherinus</i>	Leopard Ctenotus	X																								
	<i>Ctenotus quattuordecimlineatus</i>	Fourteen-lined Ctenotus	X																								
	<i>Ctenotus schomburgkii</i>	Barred Wedgesnout Ctenotus	X															1		1					2		
	<i>Ctenotus severus</i>	Stern Ctenotus	X																								
	<i>Ctenotus uber</i>	Spotted Ctenotus	X																								
	<i>Cyclodomorphus melanops</i>	Spinifex Slender Blue-tongue	X																								
	<i>Egernia depressa</i>	Southern Pygmy Spiny-tailed Skink	X		1	1	1		2	2		6		3	9												1
	<i>Egernia formosa</i>	Goldfields Crevice Skink	X																								
	<i>Eremiascincus richardsonii</i>	Broad-banded Sand-swimmer	X					2					1														
	<i>Lerista bipes</i>	North-western Sandslider	X																								
	<i>Lerista desertorum</i>	Central Desert Robust Slider	X										2							1					1	1	
	<i>Lerista distinguenda</i>	South-western Orange-tailed Slider											1														
	<i>Lerista picturata</i>	Southern Robust Slider	X																								
	<i>Lerista timida</i>	Timid Slider	X																								
	<i>Liopholis striata</i>	Nocturnal Desert Skink	X																								

Family	Species	Common Name	Surveys													C												
			A	B																								
			Site 9	Site 10	Site 2	Site 3	Site 12	Site 4	Site 5	Site 1	Site 8	Site 11	Site 13	Site 6	Site 7	Opportunistic	Birds	MME1	MME2	Opportunistic	MME3	MME5	MME7	MME8	MME9	MME6	MME4	
Columbidae	<i>Phaps chalcoptera</i>	Common Bronzewing															6			1								
	<i>Ocyphaps lophotes</i>	Crested Pigeon															21	2		1						3	2	
Podargidae	<i>Podargus strigoides</i>	Tawny Frogmouth																								2		
Rallidae	<i>Tribonyx ventralis</i>	Black-tailed Nativehen																		1								
	<i>Fulica atra</i>	Eurasian Coot															21											
Recurvirostridae	<i>Himantopus leucocephalus</i>	Pied Stilt															5			1								
	<i>Cladorhynchus leucocephalus</i>	Banded Stilt															14											
	<i>Recurvirostra novaehollandiae</i>	Red-necked Avocet																		1								
Charadriidae	<i>Charadrius ruficapillus</i>	Red-capped Plover																		1								
	<i>Euseyornis melanops</i>	Black-fronted Dotterel															1	3		1								
Ardeidae	<i>Ardea pacifica</i>	White-necked Heron																		1								
	<i>Egretta novaehollandiae</i>	White-faced Heron															2			1								
Accipitridae	<i>Haliaeetus albicilla</i>																	1		1	2	1		1		1	1	
	<i>Hieraaetus morphnoides</i>	Little Eagle																	1									
	<i>Aquila audax</i>	Wedge-tailed Eagle															2	1										
Cuculidae	<i>Heteroscenes pallidus</i>	Pallid Cuckoo															2	1		1								
Alcedinidae	<i>Todiramphus pyrrhopygius</i>	Red-backed Kingfisher																1										
Falconidae	<i>Falco cenchroides</i>	Nankeen Kestrel															2									1		
	<i>Falco longipennis</i>	Australian Hobby																			1				1			
	<i>Falco berigora</i>	Brown Falcon															1								1			
	<i>Falco peregrinus</i>	Peregrine Falcon																	1									
Cacatuidae	<i>Eolophus roseicapilla</i>	Galah																		1		15						
Psittaculidae	<i>Neopsephotus bourkii</i>	Bourke's Parrot																		1								

Family	Species	Common Name	Surveys													C											
			A	B																							
			Site 9	Site 10	Site 2	Site 3	Site 12	Site 4	Site 5	Site 1	Site 8	Site 11	Site 13	Site 6	Site 7	Opportunistic	Birds	MME1	MME2	Opportunistic	MME3	MME5	MME7	MME8	MME9	MME6	MME4
	<i>Barnardius zonarius</i>	Australian Ringneck															6	1	1		4	2		2	3		
	<i>Barnardius zonarius</i>	Australian Ringneck																									
	<i>Psephotus varius</i>	Mulga Parrot														8	12		1	1		5			5		
Ptilonorhynchidae	<i>Chlamydera guttata</i>	Western Bowerbird	X													2	5										
Climacteridae	<i>Climacteris affinis</i>	White-browed Treecreeper	X																	1			2				
Maluridae	<i>Malurus splendens</i>	Splendid Fairywren															12			1			9				
	<i>Malurus splendens</i>	Splendid Fairywren	X																								
	<i>Malurus leucopterus</i>	White-winged Fairywren	X													1	3	3							8		
Meliphagidae	<i>Certhionyx variegatus</i>	Pied Honeyeater	X														2										
	<i>Purnella albifrons</i>	White-fronted Honeyeater	X															80	100	1	12	8	10	6	6	1	40
	<i>Manorina flavigula</i>	Yellow-throated Miner	X													3	38	10	5	1	7	2		2	2	10	
	<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater	X														44	25	20	1		6	1	1	2	2	1
	<i>Anthochaera carunculata</i>	Red Wattlebird	X																						3		
	<i>Gavicalis virescens</i>	Singing Honeyeater	X														68		4	1	2	1	1	1	1	1	
	<i>Ptilotula plumula</i>	Grey-fronted Honeyeater																				7					
	<i>Epthianura tricolor</i>	Crimson Chat	X														4										
	<i>Epthianura aurifrons</i>	Orange Chat	X																								
	<i>Sugomel nigrum</i>	Black Honeyeater	X																								
	<i>Lichmera indistincta</i>	Brown Honeyeater	X																								
Pardalotidae	<i>Pardalotus striatus</i>	Striated Pardalote	X														1			1		3					
Acanthizidae	<i>Pyrrholaemus brunneus</i>	Redthroat	X																	1						1	
	<i>Acanthiza iredalei</i>	Slender-billed Thornbill	X																								
	<i>Acanthiza apicalis</i>	Inland Thornbill	X														12	2		1			6		2		

Family	Species	Common Name	Surveys																								
			A	B													C										
			Site 9	Site 10	Site 2	Site 3	Site 12	Site 4	Site 5	Site 1	Site 8	Site 11	Site 13	Site 6	Site 7	Opportunistic	Birds	MME1	MME2	Opportunistic	MME3	MME5	MME7	MME8	MME9	MME6	MME4
	<i>Strepera versicolor</i>	Grey Currawong	X																		1						
Rhipiduridae	<i>Rhipidura leucophrys</i>	Willie Wagtail	X														5	5	1	1							
	<i>Rhipidura albiscapa</i>	Grey Fantail	X																			1					
Monarchidae	<i>Grallina cyanoleuca</i>	Magpie-lark	X														6	11		1	1	2			2	2	
Corvidae	<i>Corvus orru</i>	Torresian Crow	X														2		1	1	2	1		2		1	
	<i>Corvus bennetti</i>	Little Crow	X														4	1		2	1		6	1			
	<i>Corvus coronoides</i>	Australian Raven	X																								
Petroicidae	<i>Microeca fascinans</i>	Jacky Winter	X																								
	<i>Petroica goodenovii</i>	Red-capped Robin	X														10	1	2	1			6			2	1
	<i>Melanodryas cucullata</i>	Hooded Robin	X														7			1	3						
Locustellidae	<i>Cincloramphus mathewsi</i>	Rufous Songlark	X																								
Hirundinidae	<i>Hirundo rustica</i>	Barn Swallow																								5	
	<i>Hirundo neoxena</i>	Welcome Swallow	X														2	4									
	<i>Petrochelidon nigricans</i>	Tree Martin	X														1	9									
	<i>Cheramoeca leucosterna</i>	White-backed Swallow	X														4	2		1	2						
Dicaeidae	<i>Dicaeum hirundinaceum</i>	Mistletoebird	X														2	2									
Estrildidae	<i>Taeniopygia guttata</i>	Zebra Finch	X														2			1							
Motacillidae	<i>Anthus novaeseelandiae</i>	Australasian Pipit	X														6	2		1	4						
Mammals																											
Tachyglossidae	<i>Tachyglossus aculeatus</i>	Short-beaked Echidna																		1	1						
Bovidae	<i>Capra hircus</i>	Goat																			1						
Canidae	<i>Canis lupus</i>	Dingo	X																		1						
Vespertilionidae	<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	X																								

Family	Species	Common Name	Surveys																								
			A	B													C										
			Site 9	Site 10	Site 2	Site 3	Site 12	Site 4	Site 5	Site 1	Site 8	Site 11	Site 13	Site 6	Site 7	Opportunistic	Birds	MME1	MME2	Opportunistic	MME3	MME5	MME7	MME8	MME9	MME6	MME4
	<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat	X																								
	<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat	X																								
Dasyuridae	<i>Antechinomys laniger</i>	Kultarr		2	1				3	2	2		1	3	3												
	<i>Ningauai ridei</i>	Wongai Ningauai	X																								
	<i>Ningauai yvonneae</i>	Mallee Ningauai	X																								
	<i>Sminthopsis crassicaudata</i>	Fat-tailed Dunnart	X																								
	<i>Sminthopsis dolichura</i>	Little Long-tailed Dunnart	X	5	3	1	3	1	7	5	1	3		1	4	13											
	<i>Sminthopsis hirtipes</i>	Hairy-footed Dunnart	X						1																		
	<i>Sminthopsis longicaudata</i>	Long-tailed Dunnart								1				1	1												
	<i>Sminthopsis macroura</i>	Stripe-faced Dunnart		1	5	3		3	2	1	2	1	5	2	1	1											
	<i>Sminthopsis murina</i>	Slender-tailed Dunnart	X																								
	<i>Sminthopsis ooldea</i>	Ooldea Dunnart	X																								
Macropodidae	<i>Macropus fuliginosus</i>	Western Grey Kangaroo	X																								
	<i>Osphranter robustus</i>	Euro	X																		1						1
	<i>Osphranter rufus</i>	Red Kangaroo	X																		1	5			6		
Leporidae	<i>Oryctolagus cuniculus</i>	Rabbit	X																		1						1
Equidae	<i>Equus asinus</i>	Donkey																			1						
Muridae	<i>Mus musculus</i>	House Mouse	X									5		1					1	2		2	2			2	1
	<i>Notomys alexis</i>	Spinifex Hopping Mouse	X							3									7				2				
	<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse	X	1	2	1	1	5	3	1		2	6												4	1	

A Atlas of Living Australia

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

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

B2. VERTEBRATE FAUNA RECORDED IN BIOLOGICAL SURVEYS IN THE REGION

Family	Species	Common Name	Surveys																										
			A					B					C					D		E									
			TM1	JS2	WM2	WS2	WM1	WS1	JS3	JS1	JS4	HB1	Unknown	Site 14a	Site 5a	Site 1a	Site 17a	Site 14	Site 20a	Site 11	Site 11a	Site 8	Site 19	Site 14b	Site 1 13	Site 3 13	Site 2 13	Unknown	Jump Up
Amphibians																													
Limnodynastidae	<i>Neobatrachus kunapalari</i>	Wheatbelt Frog																											
	<i>Neobatrachus sutor</i>	Shoemaker Frog																											
	<i>Neobatrachus wilsmorei</i>	Plonking Frog	3	1																									
	<i>Notaden nicholli</i>	Desert Spadefoot											X																
	<i>Platyplectrum spenceri</i>	Spencer's Burrowing Frog												8															
Myobatrachidae	<i>Pseudophryne occidentalis</i>	Western Toadlet													2														
Pelodyadidae	<i>Cyclorana maini</i>	Main's Frog											X																
	<i>Cyclorana occidentalis</i>	Western Water-holding Frog																											
	<i>Litoria rubella</i>	Desert Tree Frog											X																
Reptiles																													
Agamidae	<i>Ctenophorus caudicinctus</i>	Ring-tailed Dragon													12														
	<i>Ctenophorus caudicinctus</i>	Ring-tailed Dragon											X																
	<i>Ctenophorus cristatus</i>	Crested Dragon																											
	<i>Ctenophorus fordi</i>	Mallee Dragon																											
	<i>Ctenophorus inermis</i>	Military Dragon				1							X			1													
	<i>Ctenophorus infans</i>	Ring-tailed Dragon																											
	<i>Ctenophorus isolepis</i>	Central Military Dragon																											
	<i>Ctenophorus isolepis</i>	Central Military Dragon																											

Family	Species	Common Name	Surveys																										
			A				B				C				D					E									
			TM1	JS2	WM2	WS2	WM1	WS1	JS3	JS1	JS4	HB1	Unknown	Site 14a	Site 5a	Site 1a	Site 17a	Site 14	Site 20a	Site 11	Site 11a	Site 8	Site 19	Site 14b	Site 1 13	Site 3 13	Site 2 13	Unknown	Jump Up
	<i>Ctenophorus isolepis</i>	Central Military Dragon												X												1	2		
	<i>Ctenophorus maculatus</i>	Spotted Dragon				2																							
	<i>Ctenophorus nuchalis</i>	Central Netted Dragon																											
	<i>Ctenophorus pictus</i>	Painted Dragon																											
	<i>Ctenophorus reticulatus</i>	Western Netted Dragon					1							1	13	2	2	4											1
	<i>Ctenophorus salinarum</i>	Saltpan Dragon				2		1							1					5	1	2							
	<i>Ctenophorus scutulatus</i>	Lozenge-marked Dragon											X																
	<i>Ctenophorus vadrappa</i>	Red-barred Dragon																	1										
	<i>Diporiphora amphiboluroides</i>	Mulga Dragon																											1
	<i>Diporiphora valens</i>	Southern Pilbara Tree Dragon											X																
	<i>Gowidon longirostris</i>	Long-nosed Dragon											X																
	<i>Moloch horridus</i>	Thorny Devil											X	1											1	1			
	<i>Pogona minor</i>	Western Bearded Dragon	1	2					2	1	1		X				1		2	1	2	2							
	<i>Tympanocryptis cephalus</i>	Pebble Dragon																			1								
Carphodactylidae	<i>Nephrurus laevis</i>	Smooth Knob-tail											X																
	<i>Nephrurus levis</i>	Three-lined Knob-tail											X																
	<i>Nephrurus vertebralis</i>	Midline Knob-tail					1		1										1	2									
	<i>Underwoodisaurus milii</i>	Barking Gecko													2	9													1
Diplodactylidae	<i>Diplodactylus conspicillatus</i>	Fat-tailed Gecko											X																
	<i>Diplodactylus granariensis</i>	Wheatbelt Stone Gecko																											
	<i>Diplodactylus pulcher</i>	Beautiful Gecko												4	3	3							1						

Family	Species	Common Name	Surveys																										
			A					B					C					D		E									
			TM1	JS2	WM2	WS2	WM1	WS1	JS3	JS1	JS4	HB1	Unknown	Site 14a	Site 5a	Site 1a	Site 17a	Site 14	Site 20a	Site 11	Site 11a	Site 8	Site 19	Site 14b	Site 1 13	Site 3 13	Site 2 13	Unknown	Jump Up
	<i>Lucasium damaeum</i>	Beaded Gecko																											
	<i>Lucasium squarrosum</i>	Mottled Ground Gecko	2	1	5	2	1					2		1			3	2	1	3									
	<i>Lucasium stenodactylum</i>	Crowned Gecko											X																
	<i>Rhynchoedura ornata</i>	Beaked Gecko											X								2				1				1
	<i>Strophurus ciliaris</i>	Spiny-tailed Gecko												2	2	1		1											
	<i>Strophurus ciliaris</i>	Spiny-tailed Gecko											X																
	<i>Strophurus elderi</i>	Jewelled Gecko		1					1	2			X												1		1		
	<i>Strophurus strophurus</i>	Western Spiny-tailed Gecko																			7								
	<i>Strophurus wellingtonae</i>	Western Shield Spiny-tailed Gecko																											
Elapidae	<i>Brachyuropis fasciolatus</i>	Narrow-banded Burrowing Snake																	1										
	<i>Brachyuropis fasciolatus</i>	Narrow-banded Burrowing Snake											X																
	<i>Brachyuropis fasciolatus</i>	Narrow-banded Burrowing Snake																											
	<i>Brachyuropis semifasciata</i>	Half-girdled Snake																							1				1
	<i>Demansia psammophis</i>	Yellow-faced Whipsnake																							1				
	<i>Demansia rufescens</i>	Rufous Whipsnake											X																
	<i>Furina ornata</i>	Orange-naped Snake											X																
	<i>Parasuta monachus</i>	Hooded Snake												1		3													
	<i>Pseudechis australis</i>	Mulga Snake																											
	<i>Pseudechis butleri</i>	Spotted Mulga Snake																											
	<i>Pseudonaja mengdeni</i>	Western Brown Snake											X																
	<i>Pseudonaja modesta</i>	Ringed Brown Snake											X																

Family	Species	Common Name	Surveys											B	C					D	E																
			A												Unknown	Site 14a	Site 5a	Site 1a	Site 17a		Site 14	Site 20a	Site 11	Site 11a	Site 8	Site 19	Site 14b	Site 1 13	Site 3 13	Site 2 13	Unknown	Jump Up					
	<i>Simoselaps anomalus</i>	Desert Banded Snake													X																						
	<i>Simoselaps bertholdi</i>	Jan's Banded Snake	1												X																						
	<i>Suta fasciata</i>	Rosen's Snake																2																			
Gekkonidae	<i>Christinus marmoratus</i>	Marbled Gecko													X																						
	<i>Gehyra punctata</i>	Spotted Dtella													X																						
	<i>Gehyra purpurascens</i>	Purplish Dtella													X																						
	<i>Gehyra variegata</i>	Variiegated Gehyra													X		15	1	15				1													1	
	<i>Heteronotia binoei</i>	Bynoe's Gecko	1				2						2	3	X		7		34																	1	
	<i>Gehyra xenopus</i>	Crocodile-faced Dtella		1			1				1	1																									
Pygopodidae	<i>Aprasia picturata</i>	Black-headed Worm-lizard																																			
	<i>Delma butleri</i>	Unbanded Delma													X																						
	<i>Delma nasuta</i>	Sharp-snouted Delma										1			X																						
	<i>Delma pax</i>	Peace Delma													X																						
	<i>Lialis burtonis</i>	Burton's Legless Lizard										1			X																						
	<i>Pygopus nigriceps</i>	Western Hooded Scaly-foot											1						1				1														
	<i>Pygopus nigriceps</i>	Western Hooded Scaly-foot													X																						
Pythonidae	<i>Antaresia perthensis</i>	Pygmy Python													X																						
Scincidae	<i>Carlia triacantha</i>	Desert Rainbow-skink													X																						
	<i>Cryptoblepharus buchananii</i>	Buchanan's Snake-eyed Skink													X		1																				
	<i>Cryptoblepharus plagiocephalus</i>	Peron's Snake-eyed Skink																																			
	<i>Ctenotus ariadnae</i>	Ariadna's Ctenotus													X																						

Family	Species	Surveys Common Name	A											B	C					D					E										
			TM1	JS2	WM2	WS2	WM1	WS1	JS3	JS1	JS4	HB1	Unknown	Site 14a	Site 5a	Site 1a	Site 17a	Site 14	Site 20a	Site 11	Site 11a	Site 8	Site 19	Site 14b	Site 1 13	Site 3 13	Site 2 13	Unknown	Jump Up						
	<i>Ctenotus atlas</i>	Southern Mallee Ctenotus												X																					
	<i>Ctenotus brooksi</i>	Wedgsnout Ctenotus												X																					
	<i>Ctenotus calurus</i>	Blue-tailed Finesnout Ctenotus												X									1			3									
	<i>Ctenotus dux</i>	Fine Side-lined Ctenotus												X																					
	<i>Ctenotus grandis</i>	Grand Ctenotus												X																					
	<i>Ctenotus greeri</i>	Spotted-necked Ctenotus																					12												
	<i>Ctenotus helenae</i>	Clay-soil Ctenotus		2					2	1				X									1			1	2	3							
	<i>Ctenotus leae</i>	Ornate-tailed Finesnout Ctenotus												X																					
	<i>Ctenotus leonhardii</i>	Leonhardi's Ctenotus	6	3	3	6	7				2	4	X							5	4	2													
	<i>Ctenotus nasutus</i>	Nasute Finsnout Ctenotus											X																						
	<i>Ctenotus pantherinus</i>	Leopard Ctenotus																					4												
	<i>Ctenotus pantherinus</i>	Leopard Ctenotus											X																						
	<i>Ctenotus pantherinus</i>	Leopard Ctenotus																																	
	<i>Ctenotus piankai</i>	Coarse Sands Ctenotus											X																						
	<i>Ctenotus quattuordecimlineatus</i>	Fourteen-lined Ctenotus											X																						
	<i>Ctenotus schomburgkii</i>	Barred Wedgesnout Ctenotus											X																						
	<i>Ctenotus severus</i>	Stern Ctenotus																																	
	<i>Ctenotus uber</i>	Spotted Ctenotus														3																			
	<i>Ctenotus uber</i>	Spotted Ctenotus																																	
	<i>Cyclodomorphus melanops</i>	Spinifex Slender Blue-tongue																																	
	<i>Egernia depressa</i>	Southern Pygmy Spiny-tailed Skink											X																						1

Family	Species	Common Name	Surveys													E														
			A	B										C	D															
			TM1	JS2	WM2	WS2	WM1	WS1	JS3	JS1	JS4	HB1	Unknown	Site 14a	Site 5a	Site 1a	Site 17a	Site 14	Site 20a	Site 11	Site 11a	Site 8	Site 19	Site 14b	Site 1 13	Site 3 13	Site 2 13	Unknown	Jump Up	
	<i>Egernia formosa</i>	Goldfields Crevice Skink													3															1
	<i>Eremiascincus fasciolatus</i>	Narrow-banded Sand Swimmer												X																
	<i>Eremiascincus richardsonii</i>	Broad-banded Sand-swimmer												X	1		1													
	<i>Lerista amicorum</i>	Fortescue Slider												X																
	<i>Lerista bipes</i>	North-western Sandslider												X											25	3				
	<i>Lerista desertorum</i>	Central Desert Robust Slider	4	1	1				1	2	1						6		2				6		1					
	<i>Lerista distinguenda</i>	South-western Orange-tailed Slider																												
	<i>Lerista ips</i>	Robust Duneslider												X																
	<i>Lerista kingi</i>	King's Slider					1																							
	<i>Lerista macropisthopus</i>	Unpatterned Robust Slider													2															
	<i>Lerista macropisthopus</i>	Unpatterned Robust Slider												X																
	<i>Lerista neander</i>	Pilbara Robust Slider												X																
	<i>Lerista picturata</i>	Southern Robust Slider													2															
	<i>Lerista timida</i>	Timid Slider																										1		
	<i>Lerista vermicularis</i>	Slender Duneslider												X																
	<i>Liopholis striata</i>	Nocturnal Desert Skink												X					2											
	<i>Menetia greyii</i>	Common Dwarf Skink				1	1							X	4										1					
	<i>Morethia butleri</i>	Woodland Morethia Skink													4	6	2								1	1				
	<i>Morethia ruficauda</i>	Lined Fire-tailed Skink												X																
	<i>Proablepharus reginae</i>	Western Soil-crevice Skink																												
	<i>Tiliqua multifasciata</i>	Central Blue-tongue												X																

Family	Species	Common Name	Surveys																										
			A					B					C					D		E									
			TM1	JS2	WM2	WS2	WM1	WS1	JS3	JS1	JS4	HB1	Unknown	Site 14a	Site 5a	Site 1a	Site 17a	Site 14	Site 20a	Site 11	Site 11a	Site 8	Site 19	Site 14b	Site 1 13	Site 3 13	Site 2 13	Unknown	Jump Up
	<i>Tiliqua occipitalis</i>	Western Blue-tongued Lizard																								1			
	<i>Tiliqua rugosa</i>	Bobtail																											
Typhlopidae	<i>Anilius australis</i>	Austral Blind Snake																											
	<i>Anilius bicolor</i>	Dark-spined Blind Snake																											
	<i>Anilius grypus</i>	Long-beaked Blind Snake											X																
	<i>Anilius hamatus</i>	Pale-headed Blind Snake					1			1				1							1								
	<i>Anilius waitii</i>	Waite's Blind Snake												2							1								
Varanidae	<i>Varanus acanthurus</i>	Spiny-tailed Monitor											X																
	<i>Varanus breviceauda</i>	Short-tailed Pygmy Monitor											X																
	<i>Varanus caudolineatus</i>	Stripe-tailed Monitor			1								X	1	2				6										
	<i>Varanus eremius</i>	Pygmy Desert Monitor											X																
	<i>Varanus giganteus</i>	Perentie											X		1														
	<i>Varanus gilleni</i>	Pygmy Mulga Monitor											X																
	<i>Varanus gouldii</i>	Gould's Goanna					1		1				X		1	1										2			
	<i>Varanus panoptes</i>	Yellow-spotted Monitor											X	2					1	1									1
	<i>Varanus tristis</i>	Black-headed Monitor											X	1															
Chelidae	<i>Chelodina steindachneri</i>	Flat-shelled Turtle											X																
Birds																													
Casuariidae	<i>Dromaius novaehollandiae</i>	Emu											X	1	2						2		2	5					1
Anatidae	<i>Cygnus atratus</i>	Black Swan											X																
	<i>Tadorna tadornoides</i>	Australian Shelduck											X																

Family	Species	Common Name	Surveys													E														
			A	B										C	D															
			TM1	JS2	WM2	WS2	WM1	WS1	JS3	JS1	JS4	HB1	Unknown	Site 14a	Site 5a	Site 1a	Site 17a	Site 14	Site 20a	Site 11	Site 11a	Site 8	Site 19	Site 14b	Site 1 13	Site 3 13	Site 2 13	Unknown	Jump Up	
	<i>Chenonetta jubata</i>	Australian Wood Duck												X																
	<i>Anas superciliosa</i>	Pacific Black Duck												X																
	<i>Anas gracilis</i>	Grey Teal												X																
	<i>Malacorhynchus membranaceus</i>	Pink-eared Duck												X																
	<i>Aythya australis</i>	Hardhead																												
	<i>Biziura lobata</i>	Musk Duck																												
Megapodiidae	<i>Leipoa ocellata</i>	Malleefowl																										X	1	
Phasianidae	<i>Coturnix pectoralis</i>	Stubble Quail																							1					
Podicipedidae	<i>Tachybaptus novaehollandiae</i>	Australasian Grebe												X																
	<i>Poliiocephalus poliocephalus</i>	Hoary-headed Grebe																												
Columbidae	<i>Phaps chalcoptera</i>	Common Bronzewing												X								1								1
	<i>Ocyphaps lophotes</i>	Crested Pigeon												X	5	6	11	1	7			9		2						1
	<i>Geophaps plumifera</i>	Spinifex Pigeon												X																
	<i>Geopelia cuneata</i>	Diamond Dove												X																
Cuculidae	<i>Chrysococcyx basalis</i>	Horsfield's Bronze-Cuckoo												X							3	1	3							1
	<i>Chrysococcyx osculans</i>	Black-eared Cuckoo																	2				1							1
Aegothelidae	<i>Aegotheles cristatus</i>	Australian Owlet-nightjar												X	3			3				1		2						1
Podargidae	<i>Podargus strigoides</i>	Tawny Frogmouth												X						1										
Caprimulgidae	<i>Eurostopodus argus</i>	Spotted Nightjar												X		2	2													1
	<i>Apus pacificus</i>	Pacific Swift																												1
Rallidae	<i>Tribonyx ventralis</i>	Black-tailed Nativehen																												

Family	Species	Common Name	Surveys													E														
			A	B										C	D															
			TM1	JS2	WM2	WS2	WM1	WS1	JS3	JS1	JS4	HB1	Unknown	Site 14a	Site 5a	Site 1a	Site 17a	Site 14	Site 20a	Site 11	Site 11a	Site 8	Site 19	Site 14b	Site 1 13	Site 3 13	Site 2 13	Unknown	Jump Up	
	<i>Fulica atra</i>	Eurasian Coot												X																
Recurvirostridae	<i>Himantopus himantopus</i>	Black-winged Stilt												X																
	<i>Himantopus leucocephalus</i>	Pied Stilt																												
	<i>Cladorhynchus leucocephalus</i>	Banded Stilt																												
	<i>Recurvirostra novaehollandiae</i>	Red-necked Avocet																												
Charadriidae	<i>Vanellus tricolor</i>	Banded Lapwing												X	1	4			9					4						
	<i>Charadrius ruficapillus</i>	Red-capped Plover												X																
	<i>Erythrogonys cinctus</i>	Red-kneed Dotterel												X																
	<i>Elseynornis melanops</i>	Black-fronted Dotterel												X																
Scolopacidae	<i>Actitis hypoleucos</i>	Common Sandpiper												X																
Turnicidae	<i>Turnix velox</i>	Little Buttonquail												X					2					5						1
Laridae	<i>Chlidonias hybrida</i>	Whiskered Tern												X																
Otididae	<i>Ardeotis australis</i>	Australian Bustard												X	4							1							X	1
Ardeidae	<i>Ardea pacifica</i>	White-necked Heron												X																
	<i>Egretta novaehollandiae</i>	White-faced Heron												X																
Accipitridae	<i>Haliaeetus albicilla</i>																													
Anhingidae	<i>Anhinga melanogaster</i>	Australasian Darter												X																
Accipitridae	<i>Hamirostra melanosternon</i>	Black-breasted Buzzard												X																
	<i>Hieraaetus morphnoides</i>	Little Eagle												X					1				3							
	<i>Aquila audax</i>	Wedge-tailed Eagle												X	2		2	6				3								
	<i>Circus assimilis</i>	Spotted Harrier												X										1						

Family	Species	Common Name	Surveys													E														
			A			B							C				D													
			TM1	JS2	WM2	WS2	WM1	WS1	JS3	JS1	JS4	HB1	Unknown	Site 14a	Site 5a	Site 1a	Site 17a	Site 14	Site 20a	Site 11	Site 11a	Site 8	Site 19	Site 14b	Site 1 13	Site 3 13	Site 2 13	Unknown	Jump Up	
	<i>Accipiter fasciatus</i>	Brown Goshawk											X										3							
	<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk											X																	1
	<i>Milvus migrans</i>	Black Kite											X																	
	<i>Haliastur sphenurus</i>	Whistling Kite											X																	
Cuculidae	<i>Heteroscenes pallidus</i>	Pallid Cuckoo											X				2	1			1	1								
Strigidae	<i>Ninox boobook</i>	Southern Boobook											X																	
Alcedinidae	<i>Todiramphus pyrrhopygius</i>	Red-backed Kingfisher															6	1					1							
Meropidae	<i>Merops ornatus</i>	Rainbow Bee-eater																3				3								1
Falconidae	<i>Falco cenchroides</i>	Nankeen Kestrel											X	5	4	2					2	3								
	<i>Falco longipennis</i>	Australian Hobby											X									1								1
	<i>Falco berigora</i>	Brown Falcon											X	3		2	3				3	5	1							1
	<i>Falco peregrinus</i>	Peregrine Falcon																												
Megaluridae	<i>Poodytes carteri</i>	Spinifexbird											X																	
Cacatuidae	<i>Eolophus roseicapilla</i>	Galah											X	908	7	2	44	7			1	4	5	8						1
	<i>Cacatua sanguinea</i>	Little Corella											X																	
	<i>Nymphicus hollandicus</i>	Cockatiel											X	2							6	35	3	4						1
Psittaculidae	<i>Neopsephotus bourkii</i>	Bourke's Parrot																4												1
	<i>Barnardius zonarius</i>	Australian Ringneck											X	31	1		25	3			9	16	36							1
	<i>Psephotus varius</i>	Mulga Parrot											X					14				2	11							1
	<i>Melopsittacus undulatus</i>	Budgerigar											X	9		2	11	17			20	170	29	15						1
Ptilonorhynchidae	<i>Chlamydera guttata</i>	Western Bowerbird																												1

Family	Species	Common Name	Surveys																												
			A					B	C					D					E												
			TM1	JS2	WM2	WS2	WM1	WS1	JS3	JS1	JS4	HB1	Unknown	Site 14a	Site 5a	Site 1a	Site 17a	Site 14	Site 20a	Site 11	Site 11a	Site 8	Site 19	Site 14b	Site 1 13	Site 3 13	Site 2 13	Unknown	Jump Up		
Climacteridae	<i>Climacteris affinis</i>	White-browed Treecreeper																		4										1	
Maluridae	<i>Amytornis striatus</i>	Striated Grasswren												X															X		
	<i>Stipiturus ruficeps</i>	Rufous-crowned Emuwren												X																	
	<i>Malurus assimilis</i>	Purple-backed Fairywren												X																	
	<i>Malurus lamberti</i>	Variegated Fairywren																													
	<i>Malurus splendens</i>	Splendid Fairywren																												1	
	<i>Malurus splendens</i>	Splendid Fairywren																													
	<i>Malurus leucopterus</i>	White-winged Fairywren													1						3	76	40		2					1	
	<i>Malurus leucopterus</i>	White-winged Fairywren												X																	
Meliphagidae	<i>Certhionyx variegatus</i>	Pied Honeyeater												X				2			2										
	<i>Purnella albifrons</i>	White-fronted Honeyeater												X				3			1	2	4	1						1	
	<i>Manorina flavigula</i>	Yellow-throated Miner													15		1	10	41			21	13	98						1	
	<i>Manorina flavigula</i>	Yellow-throated Miner																													
	<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater												X	2	2	5	11	10			9	8	2						1	
	<i>Anthochaera carunculata</i>	Red Wattlebird																		3				2						1	
	<i>Anthochaera carunculata</i>	Red Wattlebird																													
	<i>Gavicalis virescens</i>	Singing Honeyeater														1	2	11	3		3	8	2	3						1	
	<i>Gavicalis virescens</i>	Singing Honeyeater												X																	
	<i>Gavicalis virescens</i>	Singing Honeyeater																													
	<i>Ptilotula penicillata</i>	White-plumed Honeyeater (Western)												X																	
	<i>Ptilotula keartlandi</i>	Grey-headed Honeyeater												X																	

Family	Species	Common Name	Surveys																										
			A					B	C							D				E									
			TM1	JS2	WM2	WS2	WM1	WS1	JS3	JS1	JS4	HB1	Unknown	Site 14a	Site 5a	Site 1a	Site 17a	Site 14	Site 20a	Site 11	Site 11a	Site 8	Site 19	Site 14b	Site 1 13	Site 3 13	Site 2 13	Unknown	Jump Up
	<i>Ptilotula plumula</i>	Grey-fronted Honeyeater																	56	2			3						
	<i>Conopophila whitei</i>	Grey Honeyeater																						18					
	<i>Epthianura tricolor</i>	Crimson Chat											X	24		6	154	29			18	75							1
	<i>Epthianura aurifrons</i>	Orange Chat											X								5								
	<i>Sugomel nigrum</i>	Black Honeyeater											X																
	<i>Lichmera indistincta</i>	Brown Honeyeater											X																1
	<i>Nesoptilotis flavicollis</i>	Yellow-throated Honeyeater											X																
Pardalotidae	<i>Pardalotus striatus</i>	Striated Pardalote																					2	1					1
	<i>Pardalotus striatus</i>	Striated Pardalote											X																
Acanthizidae	<i>Pyrrholaemus brunneus</i>	Redthroat																				2		2					1
	<i>Acanthiza iredalei</i>	Slender-billed Thornbill (Western)																											
	<i>Acanthiza apicalis</i>	Inland Thornbill																		2			3						1
	<i>Acanthiza apicalis</i>	Inland Thornbill											X																
	<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill											X						8		9	4							1
	<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill											X	3	3				126		53	88	5						1
	<i>Acanthiza robustirostris</i>	Slaty-backed Thornbill											X						6			3							
	<i>Smicronis brevirostris</i>	Weebill											X						7			98							1
	<i>Gerygone fusca</i>	Western Gerygone											X																
	<i>Aphelocephala leucopsis</i>	Southern Whiteface											X						52		4	5	8						1
Acanthizidae	<i>Aphelocephala nigrincincta</i>	Banded Whiteface											X																
Pomatostomidae	<i>Pomatostomus temporalis</i>	Grey-crowned Babbler											X																

Family	Species	Common Name	Surveys													E														
			A	B										C	D															
			TM1	JS2	WM2	WS2	WM1	WS1	JS3	JS1	JS4	HB1	Unknown	Site 14a	Site 5a	Site 1a	Site 17a	Site 14	Site 20a	Site 11	Site 11a	Site 8	Site 19	Site 14b	Site 1 13	Site 3 13	Site 2 13	Unknown	Jump Up	
	<i>Pomatostomus superciliosus</i>	White-browed Babbler											X		2									3						1
Cinclosoma	<i>castaneothorax</i>	Chestnut-breasted Quail-thrush																	3		2									1
	<i>cinnamomeum</i>	Cinnamon Quail-thrush											X																	
Campephagidae	<i>Coracina maxima</i>	Ground Cuckooshrike											X	31			3				4			2						
	<i>Coracina novaehollandiae</i>	Black-faced Cuckooshrike											X	5			1	4	10			7	9	6						1
	<i>Lalage tricolor</i>	White-winged Triller											X	3					34			39		9						1
Neosittidae	<i>Daphoenositta chrysoptera</i>	Varied Sittella											X										6	2						
Oreoicidae	<i>Oreoica gutturalis</i>	Crested Bellbird											X	5		2	14	10			3	6	15	1						1
Pachycephalidae	<i>Colluricincla harmonica</i>	Grey Shrikethrush											X										5							1
Pachycephalidae	<i>Pachycephala rufiventris</i>	Rufous Whistler											X										8							1
Artamidae	<i>Artamus personatus</i>	Masked Woodswallow											X					2	72		2		2	31						1
	<i>Artamus superciliosus</i>	White-browed Woodswallow																	3											
	<i>Artamus cinereus</i>	Black-faced Woodswallow											X	25			11	55	1			7	12		6					
	<i>Artamus cyanopterus</i>	Dusky Woodswallow																												
	<i>Artamus minor</i>	Little Woodswallow											X																	
	<i>Cracticus torquatus</i>	Grey Butcherbird											X	4				2	8			4	8	7						
	<i>Cracticus nigrogularis</i>	Pied Butcherbird											X	23	4	1		6				13	4	1						1
	<i>Gymnorhina tibicen</i>	Australian Magpie											X	3			9		1											1
	<i>Strepera versicolor</i>	Grey Currawong													2								2	3						1
Rhipiduridae	<i>Rhipidura leucophrys</i>	Willie Wagtail											X	2			1					12		2						1
Monarchidae	<i>Grallina cyanoleuca</i>	Magpie-lark											X	12			2						3		7					

Family	Species	Common Name	Surveys													E															
			A			B							C				D														
			TM1	JS2	WM2	WS2	WM1	WS1	JS3	JS1	JS4	HB1	Unknown	Site 14a	Site 5a	Site 1a	Site 17a	Site 14	Site 20a	Site 11	Site 11a	Site 8	Site 19	Site 14b	Site 1 13	Site 3 13	Site 2 13	Unknown	Jump Up		
Corvidae	<i>Corvus orru</i>	Torresian Crow											X								2				2						
	<i>Corvus bennetti</i>	Little Crow											X	50	7	12	29	6		11	36	24	21								
Petroicidae	<i>Microeca fascinans</i>	Jacky Winter											X	1					1				22								
	<i>Petroica goodenovii</i>	Red-capped Robin											X	5	3	3	1	1	47		3	29	3								
	<i>Melanodryas cucullata</i>	Hooded Robin											X	1			2	1		1	2										
Alaudidae	<i>Mirafra javanica</i>	Australasian Bushlark											X																		
Locustellidae	<i>Cincloramphus cruralis</i>	Brown Songlark											X	7		8	3	1	7	7											
	<i>Cincloramphus mathewsi</i>	Rufous Songlark											X											3							
Hirundinidae	<i>Hirundo rustica</i>	Barn Swallow																													
	<i>Hirundo neoxena</i>	Welcome Swallow																													
	<i>Petrochelidon nigricans</i>	Tree Martin											X																		
	<i>Cheramoeca leucosterna</i>	White-backed Swallow											X			2															
Dicaeidae	<i>Dicaeum hirundinaceum</i>	Mistletoebird																			5	4									
	<i>Emblema pictum</i>	Painted Finch											X																		
	<i>Taeniopygia guttata</i>	Zebra Finch											X				12			9	36	5	4								
Motacillidae	<i>Anthus novaeseelandiae</i>	Australasian Pipit												16		36			7	18		1									
Mammals																															
Tachyglossidae	<i>Tachyglossus aculeatus</i>	Short-beaked Echidna											X																		
Bovidae	<i>Bos taurus</i>	Cow											X																		
	<i>Capra hircus</i>	Goat												1	1		1						1								
	<i>Ovis aries</i>	Sheep												1					1					1							

Family	Species	Common Name	Surveys													E														
			A			B							C				D													
			TM1	JS2	WM2	WS2	WM1	WS1	JS3	JS1	JS4	HB1	Unknown	Site 14a	Site 5a	Site 1a	Site 17a	Site 14	Site 20a	Site 11	Site 11a	Site 8	Site 19	Site 14b	Site 1 13	Site 3 13	Site 2 13	Unknown	Jump Up	
Camelidae	<i>Camelus dromedarius</i>	Dromedary											X								1									
Canidae	<i>Canis lupus</i>	Dingo											X								1									
	<i>Vulpes vulpes</i>	Red Fox													1				1				1							1
Felidae	<i>Felis catus</i>	Cat											X							1										1
Molossidae	<i>Austronomus australis</i>	White-striped Freetail Bat													1															
	<i>Mormopterus planiceps</i>	Southern Free-tail Bat													1															
	<i>Mormopterus sp. 4</i>	South-western Free-tail Bat																												1
Vespertilionidae	<i>Nyctophilus sp.</i>	Long-eared Bat Sp.																												1
	<i>Chalinolobus gouldii</i>	Gould's Wattled Bat													1	3														1
	<i>Chalinolobus morio</i>	Chocolate Wattled Bat																												1
	<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat													4	3	9													
	<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat													6	1														1
Dasyuridae	<i>Ningauai sp.</i>	Ningauai sp.																										1		
	<i>Planigale sp.</i>	Planigale sp.											X																	
	<i>Antechinomys laniger</i>	Kultarr																												
	<i>Dasyercus blythi</i>	Brush-tailed Mulgara											X													2		2		
	<i>Dasykaluta rosamondae</i>	Kaluta											X																	
	<i>Ningauai ridei</i>	Wongai Ningauai							1				X										5							
	<i>Ningauai yvonneae</i>	Mallee Ningauai																												
	<i>Pseudantechinus woolleyae</i>	Woolley's False Antechinus											X																	
	<i>Sminthopsis crassicaudata</i>	Fat-tailed Dunnart													1					7	5									

Family	Species	Common Name	Surveys													E														
			A	B										C	D															
			TM1	JS2	WM2	WS2	WM1	WS1	JS3	JS1	JS4	HB1	Unknown	Site 14a	Site 5a	Site 1a	Site 17a	Site 14	Site 20a	Site 11	Site 11a	Site 8	Site 19	Site 14b	Site 1 13	Site 3 13	Site 2 13	Unknown	Jump Up	
	<i>Sminthopsis dolichura</i>	Little Long-tailed Dunnart													2	1				1	1	2	1							
	<i>Sminthopsis hirtipes</i>	Hairy-footed Dunnart												X																
	<i>Sminthopsis longicaudata</i>	Long-tailed Dunnart												X																
	<i>Sminthopsis macroura</i>	Stripe-faced Dunnart												X																
	<i>Sminthopsis murina</i>	Slender-tailed Dunnart																												
	<i>Sminthopsis ooldea</i>	Ooldea Dunnart																												
	<i>Sminthopsis youngsoni</i>	Lesser Hairy-footed Dunnart												X																
Macropodidae	<i>Macropus fuliginosus</i>	Western Grey Kangaroo														1						1								
	<i>Osphranter robustus</i>	Euro												X	1	1	1	1	1	1	1	1	1							1
	<i>Osphranter rufus</i>	Red Kangaroo												X	1	1	1	1	1	1	1	1								1
Leporidae	<i>Oryctolagus cuniculus</i>	Rabbit												X	2	1				1	1									1
Equidae	<i>Equus asinus</i>	Donkey												X																
	<i>Equus caballus</i>	Horse												X																
Muridae	<i>Leporillus apicalis</i>	Lesser Stick-nest Rat												X																
	<i>Mus musculus</i>	House Mouse												X	2	1				2			3							
	<i>Notomys alexis</i>	Spinifex Hopping Mouse							1					X								1								
	<i>Pseudomys chapmani</i>	Western Pebble-mound Mouse												X																
	<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse												X	1					2	1	1	7							

- A Dunlop, J.N. and Payne, W. (1999) *A vertebrate Fauna Survey of the North Lake Carey Region including Hillside Prospect, Wallaby Prospect and Just in Time / Just in Case and the Teatree Dam Area*, Unpublished report for Placer (Granny Smith) and Homestake, Perth,
- B Van Leeuwen, S. (1997) *Biological Survey of the Southern Little Sandy Desert*, Department of Conservation and land Management, Perth.
- C Kingfisher Environmental Consulting (2014) *Sunrise Dam - Tropicana Infrastructure Corridor Fauna Survey*, Unpublished report for Anglogold Ashanti Australia, Perth.
- D Ecologia Environment (2007) *Jump Up Dam Fauna Assessment*, Unpublished report for Heron Resources Limited, Perth.

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

**Desktop Vertebrate Fauna Risk Assessment
Mt Celia Gold Project**



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

Threatened, Extinct and Specially Protected fauna or flora¹ are species² which have been adequately searched for and are deemed to be, in the wild, threatened, extinct or in need of special protection, and have been gazetted as such. The *Wildlife Conservation (Specially Protected Fauna) Notice 2018* and the *Wildlife Conservation (Rare Flora) Notice 2018* have been transitioned under regulations 170, 171 and 172 of the *Biodiversity Conservation Regulations 2018* to be the lists of Threatened, Extinct and Specially Protected species under Part 2 of the *Biodiversity Conservation Act 2016*. Categories of Threatened, Extinct and Specially Protected fauna and flora are:

T Threatened Species

Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the *Biodiversity Conservation Act 2016* (BC Act).

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

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

The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.

CR Critically endangered species

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

Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for critically endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for critically endangered flora.

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 6 – INTEGRITAT HERITAGE REPORT

Report on a Heritage Survey for Legacy Iron Ore Limited with Nyalpa Pirniku, Northern Goldfields, WA



November 2022

Client: Legacy Iron Ore Limited

Attention: Aubrey Lynch, Colin Earl, Belinda Bastow

Disclaimer

Despite all efforts made to ensure that all relevant information has been considered in this document completeness cannot be guaranteed. The Author is not accountable for omissions and inconsistencies that may result from information which was not available at the time or will come to light in the future. The conclusions and recommendation of this report are based on information available at the time of preparation and do not constitute legal advice.

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Legacy may use, copy, and distribute the report for project planning, and exploration purposes relating to the Survey Area and to comply with any obligations or duties arising under any applicable law, including but not limited to:

- i. in order to meet their obligations under relevant environmental, heritage, water, public works legislation.
- ii. Applications to DMIRS in relation to exploration Program Of Works
- iii. for any purpose relating to the *Aboriginal Cultural Heritage Act 2021* (WA) and or the *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* (Cth).
- iv. Any other legal obligation

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Spatial data is provided in GDA 94 or GDA 2020.

The Author

Daniel Bruckner holds a double Master in Anthropology and Political Sciences from Heidelberg University, Germany. During his fully sponsored PhD period he was awarded a 3-year Research Fellowship at the University of Western Australia. He has undertaken substantial research in the field of behavioral and cognitive anthropology and lived in remote Aboriginal Community during these periods. He also underwent formal Lithics training at UWA. In 2011 he was nominated, by the then Minister of Aboriginal Affairs, as the Specialist Anthropologist on the Aboriginal Cultural Material Committee. Between 2015 and 2018 Daniel chaired the working group for Native Title and Heritage at the West Australian Chamber of Minerals and Energy. Since departure from the resources industry, he has been engaged by various parties, including Native Title Representative bodies, Aboriginal Corporations and Land Developers in relation to Heritage, Native Title, Agreement Negotiation and Land Management Strategies. The Author is a professional member of the Anthropological Society of Western Australia with 15+ years' experience in the field of Aboriginal Heritage and Native Title.

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Executive Summary

Legacy Iron Ore Limited (Legacy) has engaged the Author to conduct a Heritage Work Area Clearance and/or Site Avoidance survey to support their development of an Iron Ore Project (the Project) at Mount Celia in the Northern Goldfields. Additionally the group inspected Legacy's exploration tenement E31/1034, which falls within the DPLH boundary of registered site Lake Reyside to confirm if the group would support exploration activities in that area. The survey scope falls entirely within the Nyalpa Pirniku registered Native Title claim (WC2019/002). The survey was conducted in collaboration with Senior Aboriginal knowledge holders that are intimately associated with the Land subject to the survey and have a high level of seniority under traditional aboriginal lore and custom. Both areas have been subject to surveys in the past and the group knew about the relevant places of cultural significance in the area.

The two (2) survey areas have been adequately covered by the survey team. No new Heritage sites have been identified during the survey. The Mount Celia project area falls within the buffered boundary of registered Heritage site Mount Celia Station DPLH 1562. The survey team can confirm that the project area does not impede on the actual location of DPLH 1562. Another site Wongatha Soak DPLH 17033 falls within the project area. The Soak could not be relocated by the survey team and may have dried up over the years. The project will not impact on the current recorded location of DPLH 17033. The only place of significance that was discussed during the survey is Wongatha Yabu DPLH 17031. The place is located approx. 500m North East of the Project area and will not be impacted. E31/1034 falls entirely within the registered site boundary of Lake Reyside DPLH 2708. The group confirmed that they did, in principle, not oppose exploration within E31/1034 since it was only a small area and that drilling activities would not impact on the significance and the cultural values of the site.

Relevant Legislation

Aboriginal Heritage Act

All Aboriginal sites within Western Australia are protected under the Aboriginal Heritage Act 1972 (AHA). An Aboriginal site is defined under Section 5 of the AHA. For ethnographic sites, Sections 5b, c, & d have the most relevance whereas 5a focuses mainly on archaeological sites:

- (a) any place of importance and significance where persons of Aboriginal descent have, or appear to have, left any object, natural or artificial, used for, or made or adapted for use for, any purpose connected with the traditional cultural life of the Aboriginal people, past or present;
- (b) any sacred, ritual or ceremonial site, which is of importance and special significance to persons of Aboriginal descent;
- (c) any place which, in the opinion of the Committee, is or was associated with the Aboriginal people and which is of historical, anthropological, archaeological or ethnographical interest and should be preserved because of its importance and significance to the cultural heritage of the State;
- (d) any place where objects to which this Act applies are traditionally stored, or to which, under the provisions of this Act, such objects have been taken or removed.

It is an offence under Section 17 of the AHA to excavate, destroy, damage, conceal or in any way alter any Aboriginal site without prior consent, under Section 18 of the AHA, from the Minister of Aboriginal Affairs. Penalties apply for breaches of the AHA. For the administration of Section 18 of the AHA, the ACMC makes recommendations to the Minister of Aboriginal Affairs regarding whether a place meets criteria under Section 5 of the AHA and, where relevant, whether impacts to Aboriginal sites can or may occur. The Minister of Aboriginal Affairs must be informed by these recommendations prior to granting or not granting consent to use the land where that use will impact Aboriginal sites. Under Section 39(2&3) of the AHA, the ACMC use a set of standardized criteria in the evaluation of Aboriginal sites.

(http://www.austlii.edu.au/au/legis/wa/consol_act/aha1972164/).

Social Surrounds under the Environmental Protection Act 1986

Aboriginal heritage and culture: Western Australia has numerous Aboriginal heritage sites which provide an important link for Aboriginal people to their past and their culture. The Aboriginal Heritage Act 1972 provides for the preservation of Aboriginal heritage sites. The Act requires the reporting of Aboriginal sites to the Registrar, and it is an offence to interfere with a registered site unless otherwise authorised under the Act. It is also an offence to interfere with any Aboriginal site knowingly or where it would be reasonable to know, regardless of whether or not it is registered. The EP Act can, in some instances, complement the AH Act, for example, in cases where actual physical protection of the environment is required to protect sites of heritage significance. In addition to Aboriginal heritage, matters of Aboriginal cultural associations, including traditional Aboriginal customs, directly linked to the physical or biological aspects of the environment, may also be considered significant. This may include, for example, traditional hunting and gathering activities for native fauna and flora as bush tucker.

For the full version of the Social Surrounds Guidelines, refer to the following link:
http://www.epa.wa.gov.au/sites/default/files/Policies_and_Guidance/Guideline-Social-Surroundings-131216_2.pdf

The Scope

The scope was to conduct a comprehensive Heritage Site Avoidance survey over two individual parcels of land South of Laverton. The purpose was to identify any sites of cultural significance and assess the potential of Legacy's activities to impact any of these sites. The scope included an initial desktop assessment and review of previous heritage survey reports, available via DPLH or in the Authors personal archive. Additionally, a search was conducted on the DPLH AHIS system to identify any sites that had either been lodged, registered, or assessed as not meeting the site criteria by the ACMC. The desktop review further informed the on the ground inspection the Mount Celia Project and the exploration at E31/1034. The inspection was done by 4 WD access and, where applicable, pedestrian transects through the survey area. Once the survey was finalized, the results and recommendations were provided to the Nyalpa Pirniku knowledge holders for confirmation before the preparation of this survey report.

Cultural Context

There is scant ethnographic information about the pre-European contact social and cultural organisation of the Aboriginal groups belonging to the region of the Perrinvale Project Area.

Existing information about Aboriginal groups of the region of the Project Area is generally limited to the ethnocentric observations and summary notes of colonial administrators and government officials such as those of Travelling Inspectors of Aborigines, Native Welfare officers and Police officers. By the time professional ethnographic research was conducted in frontier regions of Australia, European impact had already altered the social and cultural fabric of traditional Aboriginal society in those regions.

Early anthropologists, such as Daisy Bates, who conducted interview and fieldwork in the Laverton, Leonora and Sandstone region early in the twentieth century, stated that the integrity of the social and cultural organization of Aboriginal people was so fundamentally affected by European impact, that at the beginning of the 20th century there were but 'few remnants of traditional Aboriginal society' (Bates 1985). An essential aspect of land tenure in traditional Aboriginal societies is based on the notion of The Dreaming (*Tjukurpa*). The Dreaming refers to a creative epoch in which ancestral beings formed the world, people, animals, and plants, as well as establishing the relationships that exist within and between them.

In traditional Aboriginal Australia, specific localities and sites are linked by Dreaming Tracks, and are associated with specific species and groups of humans. These Dreaming Tracks, and the ensuing contemporaries of specific places, and groups of humans and species, were made by the ancestral beings that crisscrossed the country performing heroic deeds, hunting and fighting. The ancestral beings left memorials of their activities in the landscape in the form of geological, geographical, or vegetative features that are imbued with the creative force of these ancestral beings. In traditional Aboriginal society, 'country' cannot be considered without considering the mythological contemporaries this 'country' invokes. This is because whenever particular 'country' is referred to, references are made to Dreamtime events that made 'country' what it is. Hence, places cannot be referred to without considering their mythological contemporaries. Since traditional Aboriginal mythology consists mainly of narratives of the deeds and the travels of ancestral beings, all places are simultaneously discrete, separate and contain their own meaning, as well as being a part of a continuum of places linked by a larger story or myth.

Methodology

The Heritage survey was conducted on a work area clearance basis. This means that potential sites of cultural significance are recorded to a basic level of detail. Aspects of the recording cover the spatial extends of the site, recorded with a Garmin handheld GPS in GDA94. The relevant ethnographic or archaeological details, not subject to cultural restrictions, are recorded and an

assessment of cultural significance would be undertaken in consultation with the relevant Traditional Owners. Where any identified cultural site might be exposed to potential impact by the exploration activities proposed by Legacy, mitigation options will be discussed in this report. Both survey areas have been accessed by 4WD. The Author and the survey participants discussed potential focus areas that were then subject to pedestrian transect surveys.

Individual Survey Areas - associated DPLH places and surveys

Mount Celia and E31/1034 have been subject to the desktop review. Three sites have been identified, intersecting the survey areas. Despite this, the survey team was confident that, based on the information provided by Legacy, that none of the places will be impacted by Legacy's projects.

Table 1 Survey Areas and Associated Places

Survey Area	Area sqkm	DPLH ID Intersect	Site Name	Site Type	DPLH Status
Mount Celia	19	yes	Wongatha Soak	Archaeological	Registered
		yes	Mount Celia Station	Historical	Registered
E31/1034	0.4	Yes	Lake Reyside (Raeside)	Ethnographic	Registered

Two Heritage survey reports have been requested and received from DPLH. The Author has also discussed the Closed Stevens report with the Author to understand potential cultural sensitivities. No issues have been identified in relation to the Mount Celia Project.

Table 2 Survey Reports

Year	Survey Title	Survey Type	Author
2014	Results of a Heritage Survey at Mount Celia, East of Kookynie Tenements E39/1443 and P39/5007 : Closed report	Archaeological and Ethnographic	Robin Stevens
2014	Results of an Ethnographic Heritage Survey : Legacy Iron Ore Ltd Stophanis Well Project	Ethnographic	Russ Barrett

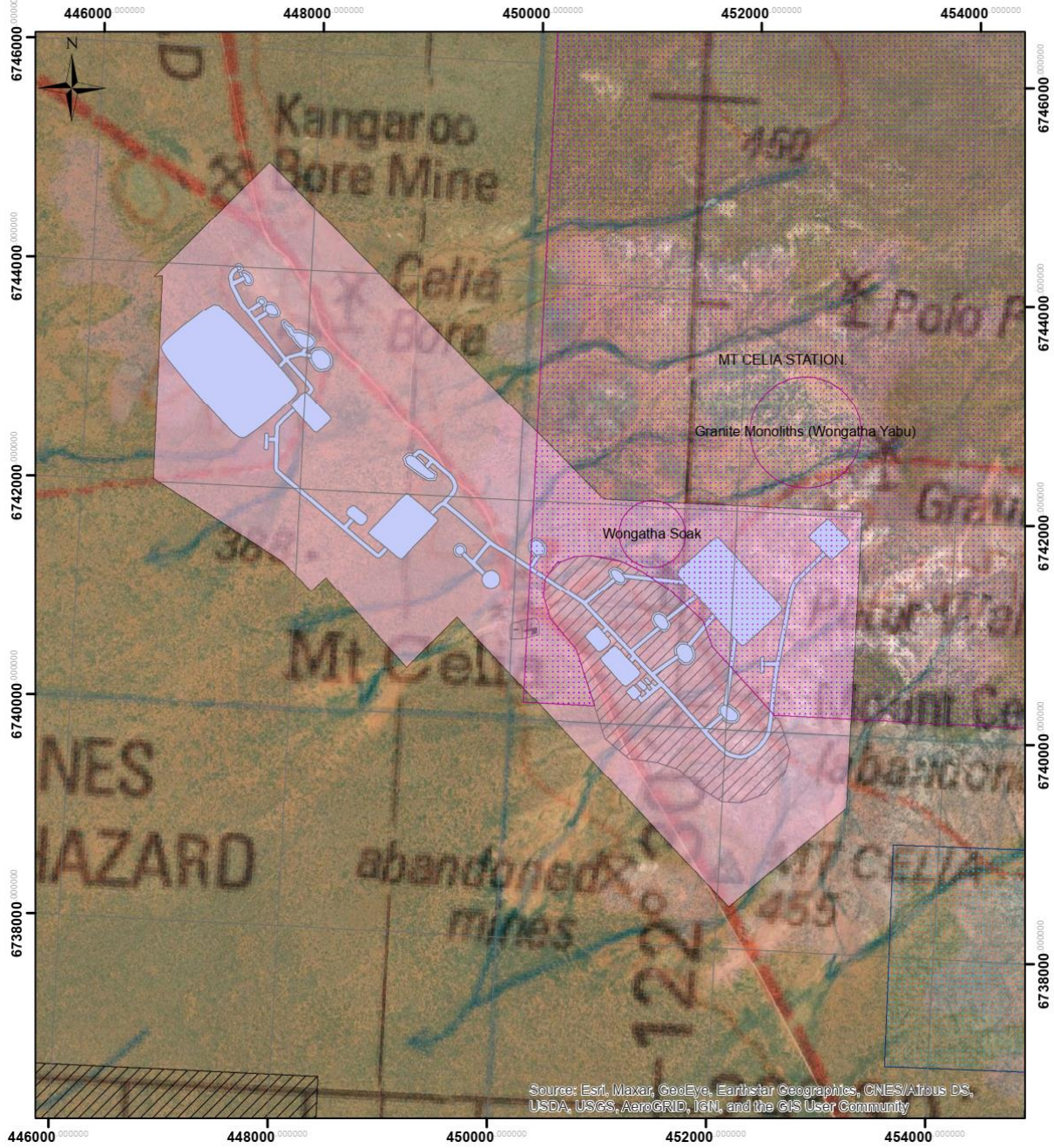
Survey participants and dates

The Heritage survey was conducted between the 28th November and the 2nd of December 2022

Survey Participants

- Aubrey Lynch
- Fabian Tucker
- Hector O'Loughlin
- Dennis Forrest
- Shane Lynch
- Leo Thomas
- Daniel Bruckner (Senior Heritage Consultant)

Survey Maps



Legend

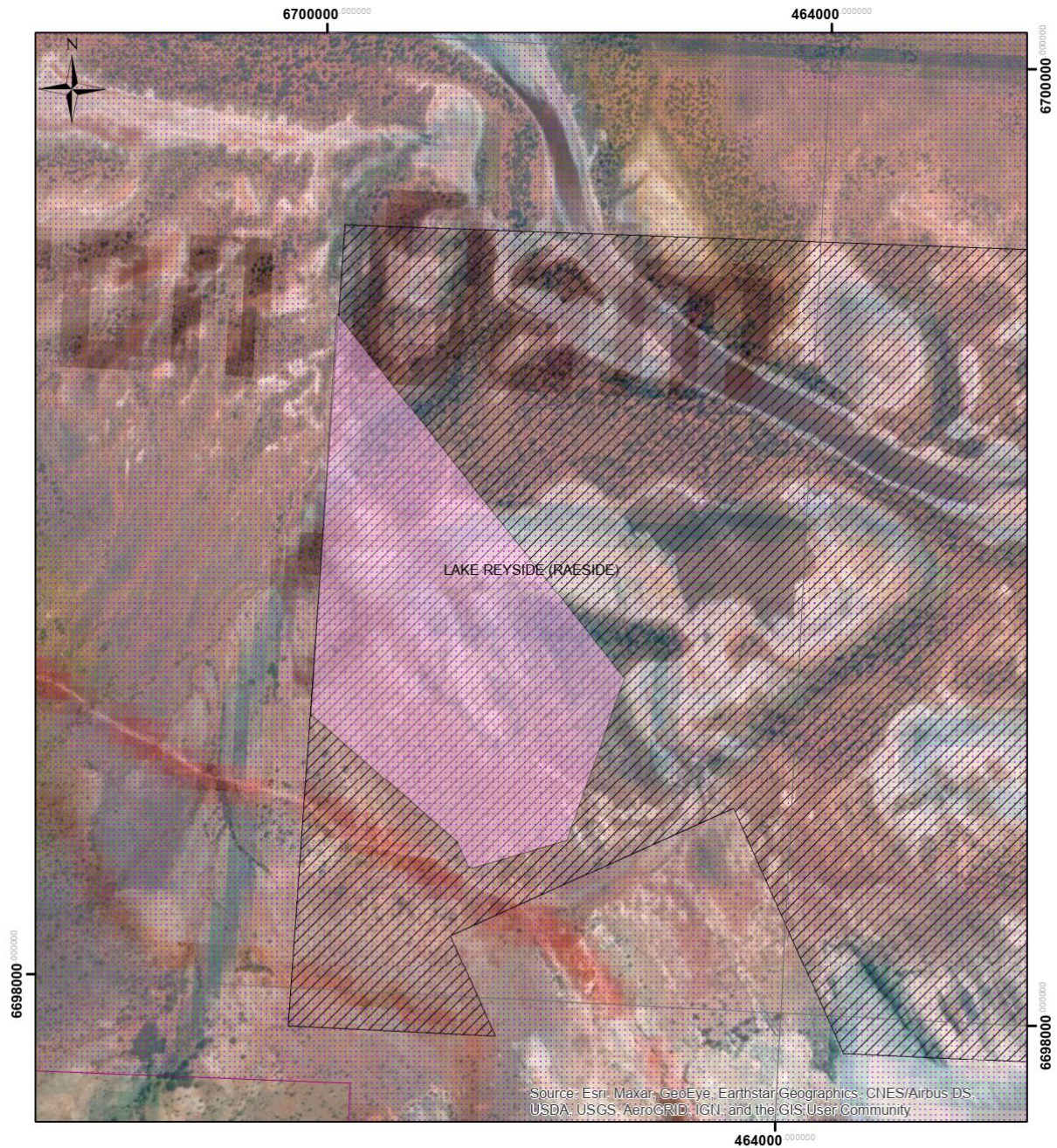
-  Aboriginal_Heritage_Places_Registered
-  Aboriginal_Heritage_Places_Lodged
-  MASTER_Legacy_Iron_Mt_Celia_Site_Layout
-  Legacy_Iron_20220727_Heritage_Survey_Boundary_GK_v2
-  Legacy_Iron_20220921_E31_1034_Heritage_Survey_Area
-  AboriginalHeritageSurveyAreasDPLH_080

Legacy Iron Ore Heritage Survey Mount Celia






Prepared by daniel@integritat.com.au
25/01/2023

Figure 1 Mount Celia Survey Map



Legend

-  Aboriginal_Heritage_Places_Registered
-  Aboriginal_Heritage_Places_Lodged
-  MASTER_Legacy Iron_Mt Celia_Site Layout
-  Legacy Iron 20220727_Heritage Survey Boundary_GK_v2
-  Legacy Iron 20220921_E31_1034 Heritage Survey Area
-  AboriginalHeritageSurveyAreasDPLH_080

**Legacy Iron Ore Heritage Survey
E31/1034**



Prepared by daniel@integritat.com.au
25/01/2023

Figure 2 E31/1034 Survey Map

Site 1562 Mount Celia Station

455135mE 6745159mN (Listed on the DIA Aboriginal Heritage Inquiry System as *Unreliable* location)

This site was reported in 1988 by the then pastoralist of Weld Station, but its exact location has not been verified. As a result DIA have imposed a substantial buffer of 10km by 10km (that is, 100 square kilometres). It is located on a flat granite outcrop, consisting of an 'emu feet painting',

4

GLSC Heritage Survey – Legacy Iron Ore: Mount Celia

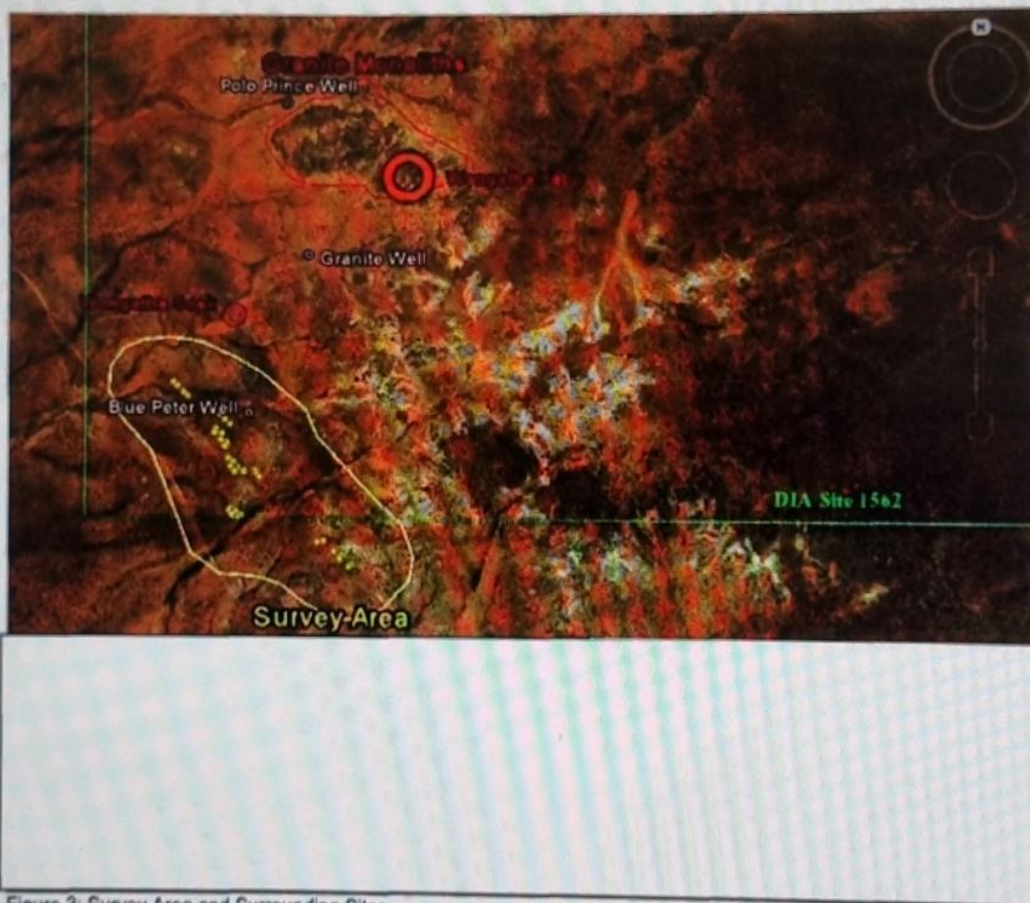


Figure 3: Survey Area and Surrounding Sites

Note: in investigating the wider region, the team decided to use known wells and access tracks as a means of navigation through the area. It was noted that of the three wells identified they all appeared at first to be in the wrong locations. After some checking and rechecking GPS coordinates, wondering whether there were other unlisted wells present, and finally undertaking a detailed search and measurement of published topographic maps and Google Earth it was established that the three wells – respectively, Blue Peter Well, Granite Well and Polo Prince Well are indicated in the wrong locations (up to a kilometre out) on the SH51-6 Edjunina topographic map (including that one used by DIA as a topographic underlay in plotting Aboriginal sites on their Aboriginal Heritage Inquiry System). The author has plotted these three wells correctly on the maps produced in this report.

Figure 3 Mount Celia Site File

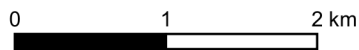
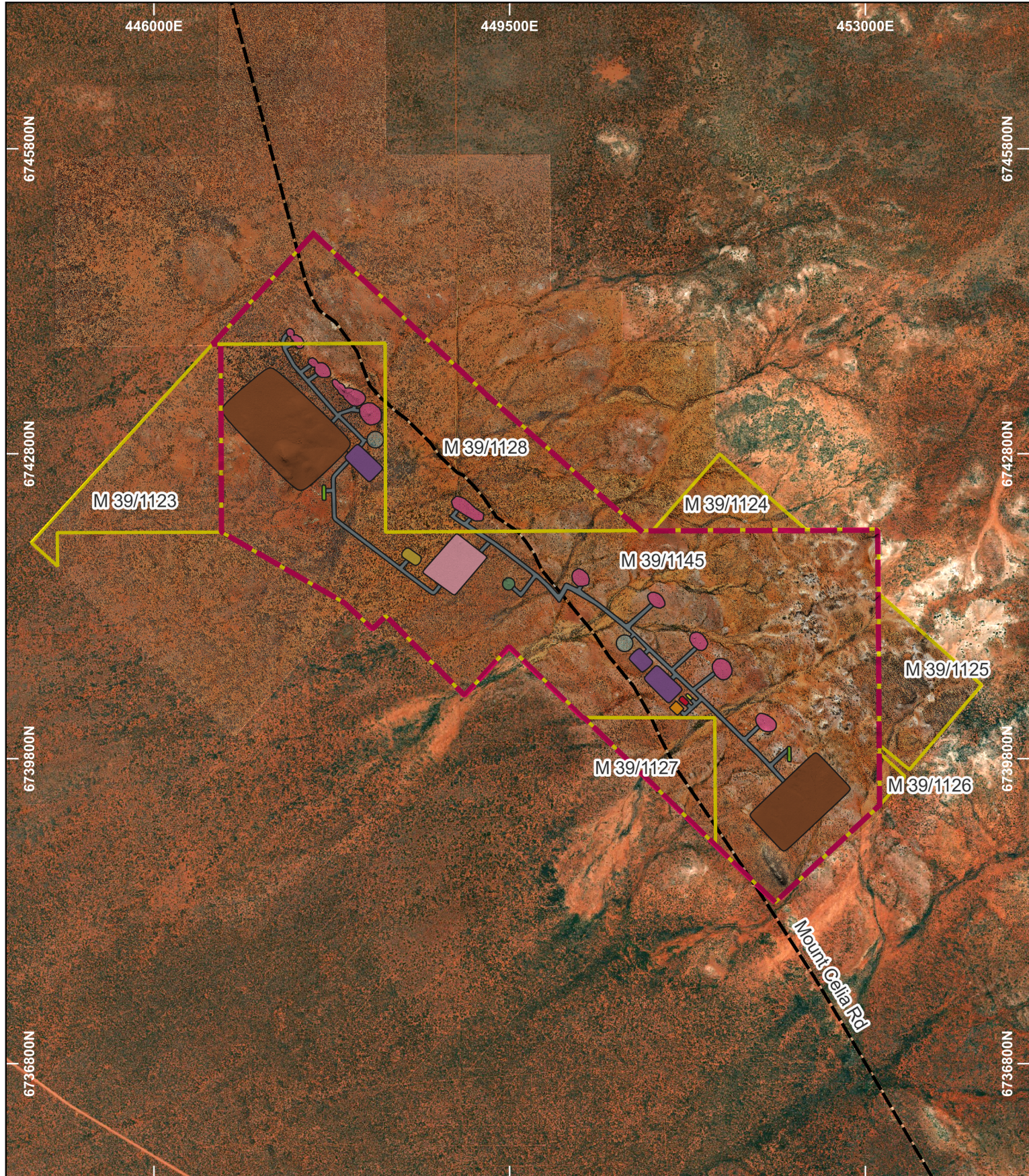
Outcomes and Recommendations

The Author and the Traditional Owners (TOs) were satisfied that sufficient time was available to conduct the survey and discuss the outcomes of the initial desktop survey and associated mapping. The TOs confirmed that were aware of the sites associated with the 2 survey areas and that the project will not have an impact on the sites. Mount Celia Station was identified as being outside of the survey area and the Wongatha Soak would not be impacted by the Project. In relation to the proposed Exploration within E31/1034, the survey team was comfortable that this would not have a real impact on Lake Raeside. The group is supportive of Legacy's Mount Celia project and requested to be updated on the progress.



Figure 4 fltr: Leo, Aubrey, Shane, Fabian, Hector and Dennis

APPENDIX 7 – MAP OF PROPOSED CLEARING AREA



N
1:50,000 @ A4
GDA94 / MGA Zone 51

Legend

- | | | |
|---|---------------------|-----------------------|
| NVCP Application Area | Laydown | Waste Rock Dump |
| Tenure (DMIRS 003) | Low Grade Stockpile | Water Dam |
| MASTER_Legacy Iron_Mt Celia Site Layout | | |
| Borrow Pit | Pit | Workshop |
| Fuel Storage | Road | Roads (MRWA-514) |
| Infrastructure | ROM | Local Road |
| | Topsoil | Bing Imagery |
| | | Legacy 220929 Imagery |



"The information on this map was derived from various sources, including © Landgate (2022), Google Earth and ESRI. Care was taken in its creation, however, Integrate Sustainability cannot accept any responsibility for errors, omissions, or positional accuracy. There are no warranties, expressed or implied, including the fitness for a particular purpose, accompanying this product. However, notification of any errors will be appreciated."