Mount Marion Lithium Project

North

Supporting document for a native vegetation clearing permit application

23 August 2022

Revision 1

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EXECUTIVE SUMMARY

Mineral Resources Limited (MRL) operates the Mount (Mt) Marion Lithium Mine approximately 36 kilometres (km) south of Kalgoorlie in the Eastern Goldfields region, Western Australia (WA) (Figure 1). MRL proposes to explore for lithium in areas around the mine. If viable, these explored areas will be mined and included into the disturbance envelope through the appropriate environmental approvals processes. This application is to support the clearing of up to 120 hectares (ha) of native vegetation at the [redacted] on [redacted] The [redacted] is 1,310.67 ha. [redacted] is the proposed clearing permit area boundary (Figure 2).

This report comprises of the supporting documentation required for the Native Vegetation Clearing Permit application to clear 120 ha of native vegetation in the proposed clearing area boundary of 1,310.67 ha. Supporting biological surveys completed to support this application, include a Detailed Flora and Vegetation Survey (Native Vegetation Solutions, 2022) (Appendix A) and a Basic and Targeted Fauna Assessment (Bamford Consulting Ecologists, 2022) (Appendix B). In accordance with the *Native Vegetation Clearing Regulations 2004* (WA), an assessment of the proposed clearing has been completed against the Ten Clearing Principles and is included as part of this report.

The proposed clearing permit boundary excludes any formal waterbodies and conservation reserves. The nearest water bodies are located over 10km to the north of the proposed clearing area (Lake Douglas, Lake Red and Lake Brown). Conservation reserves are located over 200 metres to the north-west (Karramindie Forest) and over 3.5 km to the southwest (Yallari Timber Reserve) of the proposed clearing boundaries (Figure 1).

A Detailed Flora and Vegetation Survey was completed by Native Vegetation Solutions (NVS) on 7 – 15th October 2021. The survey was completed to cover both this project area ([redacted] and a potential future project to the south of the Mt Marion operation. For the purposes of this supporting document, only the information relating to the [redacted] area will be referred to in this document.

The field results indicated that the flora within the survey area is common throughout the Eastern Goldfields subregion and adjoining areas. Eleven vegetation groups were identified during the survey, largely following topographical features and dominant species and mostly comprising of *Eucalyptus* woodlands. Despite evidence of historic exploration and grazing, the vegetation was mostly in a Good to Very Good condition, in accordance with the Keighery scale (1994). There were no Threatened or Priority Ecological Communities recorded in the survey area (NVS, 2022).

Desktop assessment completed as part of the flora and vegetation survey, indicate that Pre-European vegetation associations (Beard, 1990) present in the proposed clearing area extend to less than 1% of the total area and above the 30% threshold at a state, bioregional and subregional level (NVS, 2022).

Of 148 species recorded in the survey, 141 species were recorded in the [redacted] prosed clearing area, with one species being an introduced species, which is not listed as a Declared Pest by DPIRD (2022). There was one Priority (*Eremophila acutifolia* (P3)) and one Threatened (*Seringia exastia*) flora species recorded during the survey, despite there being no records of these species occurring in the DBCA database, within a 20 km radius of the survey area (DBCA, 2021).

A Basic and Targeted Fauna Assessment (desktop assessment and targeted survey for conservation significant species) was completed by Bamford Consulting Ecologists (BCE) on 10 – 14th September 2021. Similar to the flora survey, the fauna survey was completed for supporting a larger project area. For the purposes of this supporting document, only the information relating to the [redacted] area will be referred to in this document. The assessment included the identification of fauna habitat; opportunistic fauna observations; records of bird encounters; and targeted searches for Malleefowl, Chuditch, Arid Bronze Azure Butterfly (associated with *Camponotus* ants) and Trapdoor spiders.

Three fauna habitat types (or Vegetation and Substrate Associations (VSAs)) were identified in the project area with all VSAs considered important for fauna. Field investigations confirmed the presence of three reptiles, 34 birds, two native mammals and one introduced mammal (BCE, 2022).

Several Trapdoor Spider burrows and two Malleefowl mounds were recorded in Hamptons, with one of these being recent but inactive. They were located within a densely vegetated area in the southern part of Hamptons, which is considered likely to provide suitable habitat for Malleefowl. No Chuditch or *Camponotus* ants (associated with the Arid Bronze Azure Butterfly) were recorded in the field (BCE, 2022).

An assessment against the 10 principles for the clearing of native vegetation concluded that the clearing of up to 120 ha of native vegetation within [redacted] on [redacted] is not at variance with Principles (A) to (J).

In summary, the environmental impacts of the proposal involving the clearing of native vegetation can be adequately managed by MRL's Mt Marion Lithium Mine Environmental Management System. Furthermore, MRL has the environmental management resources to adequately enable this.

1. INTRODUCTION

The Mt Marion Lithium Mine is located 40 km southwest of Kalgoorlie (MRL, 2021). Process Minerals International Pty Ltd (PMI) operates the Mt Marion Lithium Project (the Project). PMI is a 100% subsidiary of Mineral Resources Limited (MRL), who holds an exclusive Life of Mine (LOM) Mining Services Agreement (MSA) with Reed Industrial Minerals Pty Ltd (RIM). In March 2021, Westgold Resources (Westgold) sold its lithium assets including a royalty over the Mt Marion Lithium Mine, the exploration and developing rights on adjoining land tenure to Reed Industrial Minerals (RIM) (Westgold, 2021). Pursuant to the MSA, MRL designed and built, and now operates, the Project through joint venture company RIM, with PMI (50%) and Gangfeng Lithium Co. Ltd (50%).

MRL intends to explore for tin, tantalum and lithium within the special land category area, [redacted]

Once exploration is completed and determined feasible, MRL intends to expand mining operations into this area.

2. PURPOSE AND METHODOLOGY

The purpose of this document is to support a purpose permit application at [redacted] for clearing of 120 ha (Figure 1). The area excludes conservation estate or sites registered under the *Aboriginal Heritage Act 1972*.

The methods employed for this assessment have included a Detailed Flora and Vegetation Survey (Native Vegetation Solutions, 2022) (Appendix A); a Basic and Targeted Fauna Assessment (Bamford Consulting Ecologists, 2022) (Appendix A); and an assessment of the proposed clearing has been completed against the *Native Vegetation Clearing Regulations 2004* (WA) Clearing Principles (Section 8).

Figure 1: Project location and reserve areas

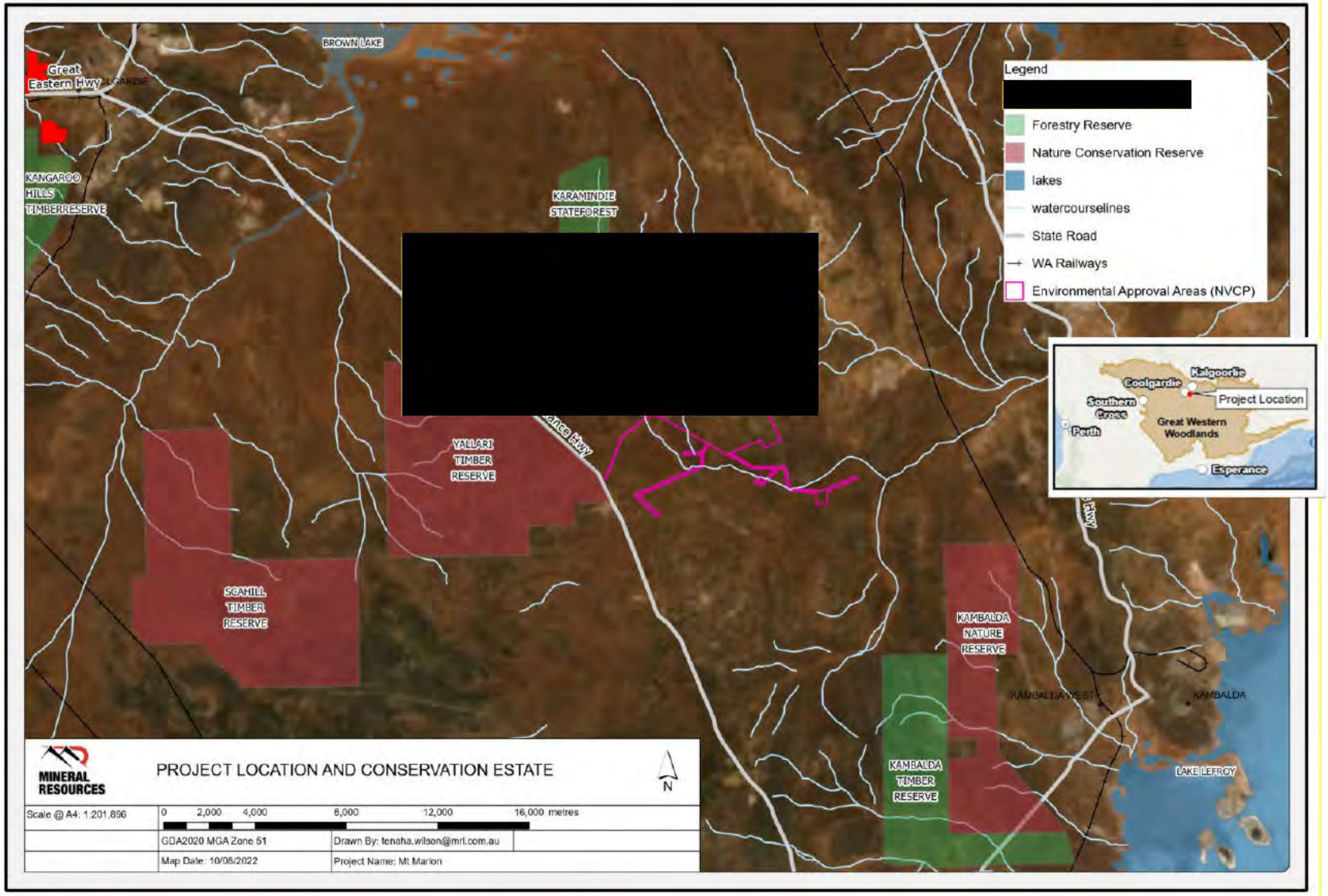
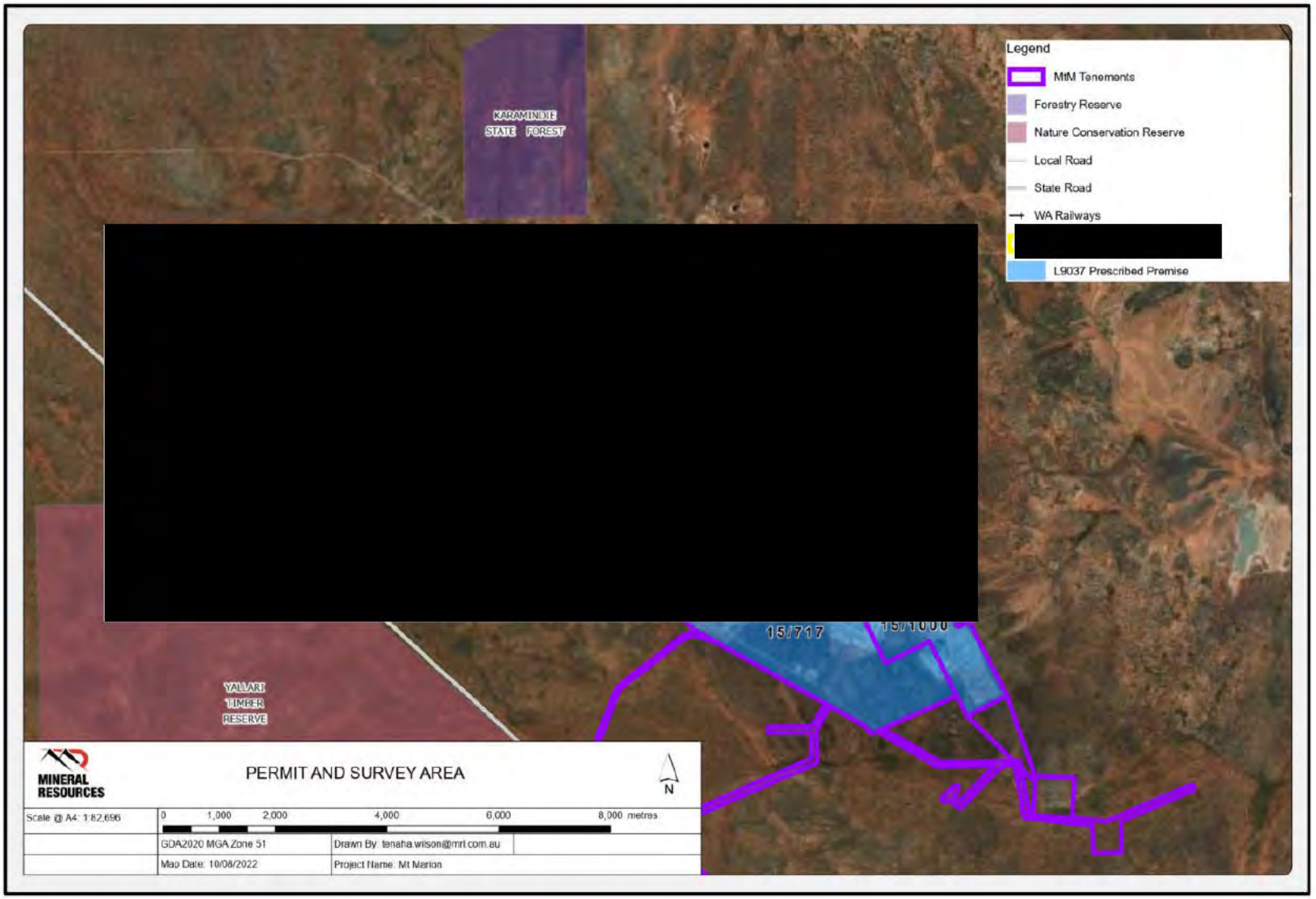


Figure 2: Proposed 120 ha clearing within Permit and Survey Boundary



3. PROJECT DESCRIPTION

3.1 REGIONAL SETTING

[redacted] is located within the Coolgardie Bioregion and Eastern Goldfields Subregion (COO03) of the Interim Biogeographic Regionalisation of Australia (IBRA) region (BCE, 2022). The Eastern Goldfields subregion is characterised by undulating plains, greenstone ridges, playa lakes, and scattered exposed bedrock. The subregion lies on the Yilgarn Craton's Eastern Goldfields Terrain and comprises of gently undulating plains interrupted in the west by Archaean greenstone ridges and low hills, while the east contains a horst of Proterozoic granulite. In the western half there are a series of large playa lakes which are remnants of an ancient major drainage line. The dominant soil type is Calcareous earth, which cover most of the plains and greenstone areas (CALM 2002).

The Eastern Goldfields subregion is dominated by Mallees, Acacia thickets and shrub heaths on sandplains. Diverse Eucalyptus woodlands occur around salt lakes, on ranges, and in valleys and dwarf shrublands of samphire are common in salt areas (NVS, 2022). The survey area is also within the Great Western Woodlands comprising of approximately 16 million hectares from the Wheatbelt to Kalgoorlie-Boulder in the north to the deserts northeast of the Nullarbor Plain (Figure 1).

3.2 SURVEY AREA AND PERMIT AREA

The permit area, referred to as [redacted] is 120ha within a total boundary of 1,310.67 ha (Figure 2).

3.3 TENURE AND LAND ACCESS

The underlying tenure is freehold EEL 53. The permit area is [redacted] Lot 105, Karramindie on Deposited Plan 40396 (Table 3-1 and Figure 2). Lot 105 on Deposited Plan 40396, Volume 2668 Folio 420 is held by Northern Star (Hamptons Gold Mining Areas) Limited and is managed under Section 27 of the *Mining Act 1978*. A copy of the Certificate of Title and Authorisation for MRL to access the location is attached as Appendix C and Appendix D.

RIM and Northern Star (Hampton Gold Mining Areas) Limited are party to an agreement pursuant to which Reed is entitled to conduct mining on a portion of Lot 105 on Deposited Plan 40396 (known as the 'Hamptons Lease Area 53') (Table 3-1). The agreement authorises PMI to conduct exploration and mining operations within the lease agreement area. Other approvals required in association with this application for a Native Vegetation Clearing Permit in the Hamptons Lease Area 53 are likely to include authorisation from the Shire of Coolgardie under the *Local Government Act 1955*. The property is zoned as Rural under the Shire of Coolgardie Local Planning Scheme.

Table 3-1: Land tenure

Property	Polygon Identification No. (PIN)	Certificate of Title	Ownership
Lot 105	P040396 105	Deposited Plan 40396	Northern Star (Hampton Gold Mining Areas) Limited

Access to the site is via the Coolgardie-Esperance Highway (Figure 2).

3.4 PROXIMITY TO DBCA MANAGED LANDS

There are no Department of Biodiversity, Conservation and Attractions (DBCA) managed lands in the permit area, however, Karamindie State Forest bounds the area to the northwest and Yallari Timber Reserve to the southwest. There are five additional DBCA managed lands located beyond the boundary of West [redacted] (Figure 1) including Kangaroo Hills Timber Reserve, Scahill Timber Reserve, Kambalda Timber and Kambalda Nature Reserve (Figure 1).

3.5 HISTORICAL AND FUTURE LAND USE

The dominant land use within the Eastern Goldfield subregion is grazing, with smaller areas of crown reserves, mining, freehold, and conservation (BCE, 2022) with 4.35 % of the sub-region vested within conservation reserves (Cowan, 2001). Cowan (2001) describes the Goldfields Woodlands as having an exceptionally high diversity of Eucalyptus species with as many as 170 species occurring in the bioregion. The project area lies within the Coolgardie Vegetation System. All woodlands in the Coolgardie System have been logged in the past for mining timber and firewood and current vegetation is secondary growth regenerated from seed and coppice (Beard, 1972).

Although the vegetation in the survey area has been subjected to historic exploration activities and grazing, NVS (2022) observed minimal disturbance within the survey area, including fire history which was noted to exceed 30 years in each of the survey quadrats.

As mentioned, MRL intends to conduct exploration in the proposed clearing area. If feasible, the mining operations will expand into this area.

4. ENVIRONMENTAL SETTING

The environmental setting for [redacted] is discussed in Sections 4.1 to 4.10 below.

4.1 CLIMATE

The region is characterised by hot summers and cold winters with low rainfall distributed throughout the year (approximately 270 millimetres (mm) per year) (BoM, 2021). The closest and most complete climate statistical data was obtained from Kalgoorlie Boulder Airport, Station Number 012038, (BoM, 2021) (Figure 3).

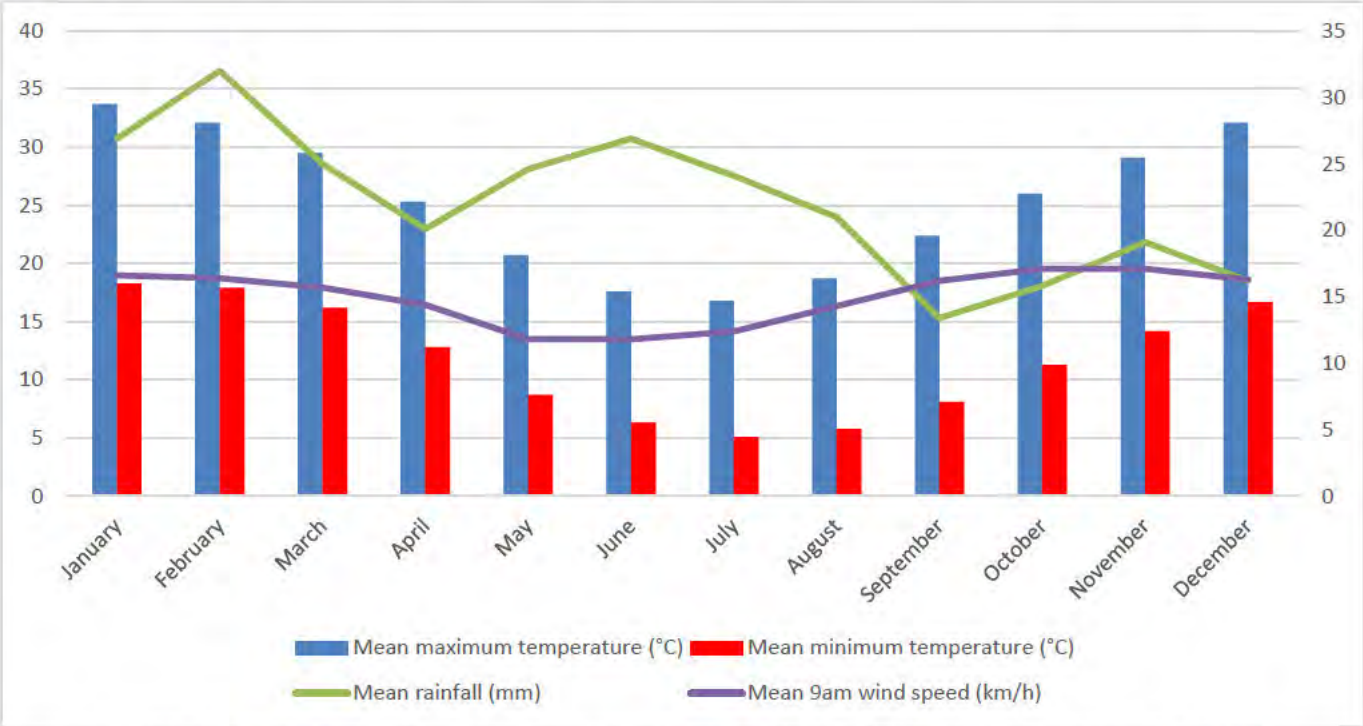


Figure 3: Monthly maximum and minimum temperatures, rainfall and windspeed (BoM, 2022)

4.2 UNDERLYING GEOLOGY

The underlying geology of the subregion is gneiss and granites that have eroded into a flat plane covered by tertiary soils and with scattered exposed bedrock. Calcareous earths are the dominant soil group and cover much of the plains and greenstone areas (Cowan, 2001). The vegetation associated with this underlying geology typically consists of Mallees, Acacia thickets and shrubheaths on sandplains. Diverse Eucalyptus woodlands occur around salt lakes, on ranges, and in valleys. Salt lakes support dwarf shrublands of samphire. Woodlands and *Dodonaea* shrubland are known to occur on basic granulites of the Fraser Range some distance to the southeast of the survey area (CALM, 2002).

4.3 SOILS AND SOIL LANDSCAPES

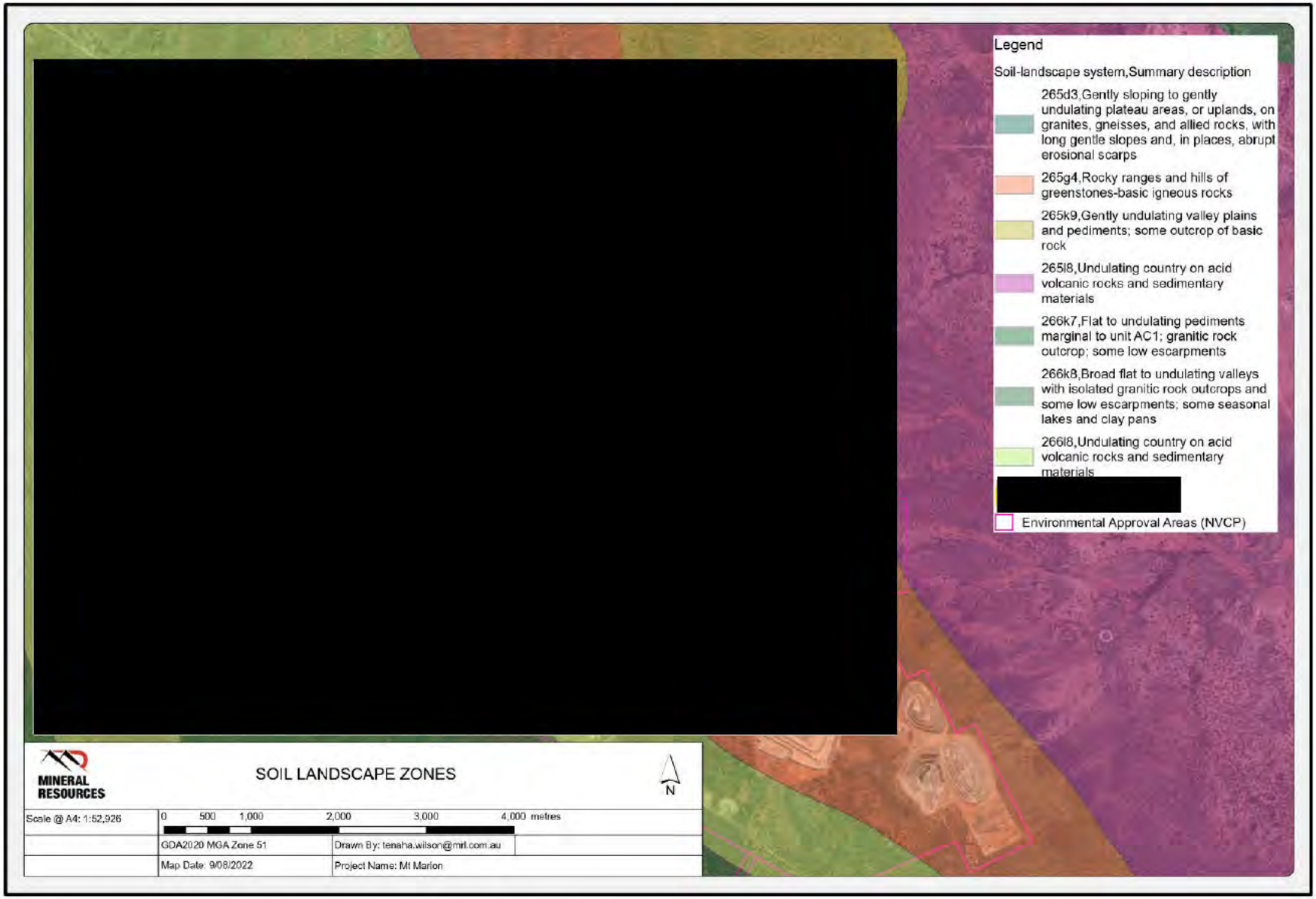
The project is located across the Kambalda and Norseman Zones in the Kalgoorlie Province soil landscape region of the Department of Industries and Regional Development (DPIRD) system, which has been described at the regional level as undulating plains (with some sandplains, hills and salt lakes) on the

granitic rocks and greenstone of the Yilgarn Craton (Tille, 2006). DPIRD Soil landscape mapping identified seven soil landscape types in the permit area (Figure 4 and Table 4-1).

Table 4-1 Soil Landscape Map Descriptions (DPIRD, 2022)

Soil Landscape Zone	Soil Landscape System	Map Unit Name	Description
266 Norseman Zone	266l8	My154	Undulating country on acid volcanic rocks and sedimentary
265 Kambalda Zone	265g4	BB5	Rocky ranges and hills of greenstones-basic igneous rocks
265 Kambalda Zone	265l8	My154	Undulating country on acid volcanic rocks and sedimentary materials
265 Kambalda Zone	265k9	Mx43	Gently undulating valley plains and pediments; some outcrop of basic rock
266 Norseman Zone	266k7	Mx41	Flat to undulating pediments marginal to unit AC1; granitic rock outcrop; some low escarpments

Figure 4: Soils and soil landscapes



4.4 SURFACE WATER

The permit area is located within the Lake Lefroy Catchment (Lefroy Dundas Sub Area) (Clarke, 1991). Lake Lefroy is a shallow lake located approximately 26 km southeast of the [redacted] The lake is poorly developed and typically dry, requiring intense rainfall to fill (EMM 2019). The nature of the local climate (dominated by low rainfall and high evaporation rates) combined with the scale of the local surface water systems, results in highly ephemeral and flashy surface water responses only occurring after significant rainfall events. Based on historic surface water responses to local playa and lake systems, surface runoff events in these environments are unlikely to be observed on a seasonal basis and likely occur once every two to five years (AQ2 2021).

The nearest water bodies are located over 10km to the north of the proposed clearing area (Lake Douglas, Lake Red and Lake Brown).

4.5 GROUNDWATER

The [redacted] is within the Goldfields Groundwater Area and includes shallow ephemeral lakes or unconfined aquifers that are saline or hypersaline. The Mt Marion Lithium Mine has recorded groundwater quality with a pH of 6.4 and with Total Dissolved Solids (TDS) concentrations of 30,000 milligrams per litre (mg/L) to 40,000 mg/L. Deeper regional aquifers in the area host hypersaline water quality, typically of 140,000 mg/L TDS (Aquaterra, 2008). Groundwater is typically 50 m below ground level.

4.6 LAND DEGRADATION

Land degradation can result from multiple processes including soil erosion, salinity, nutrient export, acidification, waterlogging, and flooding. Land degradation risk analysis within the proposal area using publicly available data was not possible due to the absence of acidity, salinity, erosion, waterlogging and flood risk data in this area. The Australian Soil Resource Information System indicates that the survey area has “No Known Occurrence” of acid sulphate soils (GHD, 2018).

An assessment of the project’s risk on land degradation has considered the landscape units which are Kambalda (265) and Norseman (266) (DPIRD, 2019b). Description of these landscape units, with the topographical and lithological features, are listed in Table 4-1. Both areas have similar topography with variations in calcareous loamy earths which when extensively cleared and left unrehabilitated are prone to erosion. The area is arid, and unlikely to flood or become waterlogged with minor ephemeral water courses recorded in vegetation surveys by GHD (2018). The risk by land degradation processes by this proposal is low.

5. Flora and Vegetation

The flora and vegetation for [redacted] was assessed by Native Vegetation Solutions (2022) and is referred to in Sections 5.1 to 5.2, below and included as Appendix A.

The survey was completed to cover both this project area ([redacted] and a potential future project to the south of the Mt Marion operation, covering a total of 1,439 ha. For the purposes of this supporting document, only the information relating to the [redacted] proposed clearing area (1,310.67 ha) will be referred to in this document.

5.1 Desktop Assessment

Prior to the field survey, NVS completed a preliminary desktop assessment of the survey area to identify potential conservation matters that would need to be considered as part of future environmental approvals. The preliminary desktop assessment included a review of various regulatory databases including the EPBC Protected Matters Search Tool and DBCA database, as well an assessment against the extent and status of the pre-European vegetation (Beard).

The EPBC Protected Matters Search Tool indicated no TECs or Commonwealth Reserves; could potentially contain habitat for the invasive weed species *Carrichtera annua* (Ward's Weed) (DAWE, 2021); and the proximity of the Yallari Timber Reserve 5(1)(h), located to the Southwest of the proposed clearing area.

The closest reserve is Yallari Timber Reserve, located on the western side of the Coolgardie-Esperance Highway (DWER, 2021), reserved under the Land Administration Act (1997) and vested in the Conservation and Parks Commission of WA, for the purpose of Timber Production. The Reserve is managed by DBCA as a Class C reserve, for the conservation of flora and fauna.

The proposed clearing area does not lie within or contain any ESA's or Conservation Reserves or water bodies (DWER, 2021).

The DBCA database searches revealed no PEC/TECs within the survey area (DBCA, 2021), with the potential for one Threatened and 22 Priority Flora species to occur within a 20 km radius of the survey area (DBCA, 2021a). No known locations of Threatened or Priority Flora occur within the survey area, with the closest Threatened Flora and the closest Priority Flora located approximately 19 km south and 1 km south of the survey area respectively.

An assessment of pre-European vegetation units (Beard, 1990) was compiled through both desktop assessment and the site visit. Four vegetation units were identified, with the extent of all four Beard vegetation units within the survey area being less than 1% of the total area, and above the 30% threshold at a State, bioregional, subregional and Shire level. A summary of Pre-European and current extent of Beard vegetation types is provided in Section 4.1.5 of the flora survey (Appendix A). More explicitly, the percentage of Pre-European vegetation extent remaining within the Coolgardie Shire includes:

- Beard Vegetation Association 128, Bare areas and rock outcrops – 99.98%
- Beard Vegetation Association 9, Medium woodland; coral gum (*Eucalyptus torquata*) & Goldfields blackbutt (*Eucalyptus lesouefii*)– 98.29%

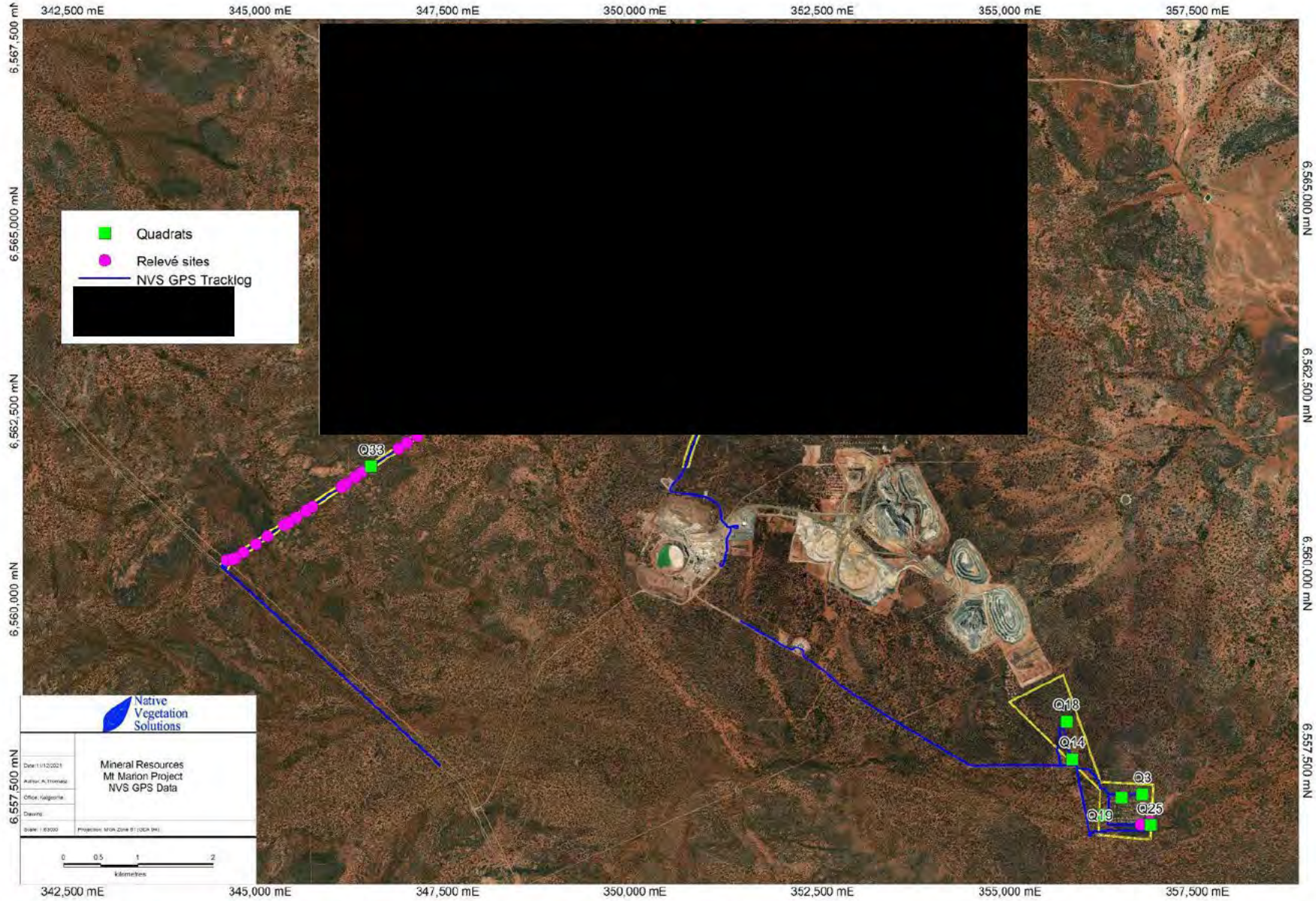
- Beard Vegetation Association 936, Medium woodland; salmon gum – 99.32 %
- Beard Vegetation Association 1413, Shrublands; *Acacia, Casuarina* & *Melaleuca* thicket – 99.32 %

The results of the database searches and details of the extent of these vegetation units within the survey area are included in the Appendices of the flora and vegetation survey (NVS, 2022).

5.2 FIELD SURVEY

The field survey was conducted from 7th to 15 h October 2021, with 149 vascular plant species recorded within the survey area, with 141 species in the proposed clearing boundary, representing 31 families and 72 genera within 11 vegetation groups. One hundred and twenty two species were recorded specifically within the 27 established quadrats. Relevé sites were used between quadrat sampling points, via wandering traverses, for opportunistic sampling of plant taxa, to collect flora specimens and to aid vegetation group mapping in the survey area (NVS, 2022). Figure 5 provides an overview of the quadrat and relevé locations.

Figure 5: Field survey locations (Source: NVS, 2022)



Chenopodiaceae was the highest represented Family recorded during the survey, with 27 species from ten genera (NVS, 2022). The next best represented families were Myrtaceae and Scrophulariaceae each with 18 species. The most common and widespread species were *Exocarpos aphyllus* (recorded in 30 quadrats), followed by *Ptilotus obovatus* and *Maireana trichoptera* (recorded in 26 quadrats).

One introduced species, *Oncosiphon suffruticosum* (Calomba daisy) was recorded within the survey area. This is not listed as a State Declared Pest or Weed of National Significance (NVS, 2022).

Although the DBCA database searches indicated no records of Priority or Threatened species within a 20 km radius of the survey area (DBCA, 2021a), one Priority (*Eremophila acutifolia* (P3)) and one Threatened flora species (*Seringia exastia (T))* was recorded.

Seringia exastia (T) is gazetted as Threatened under both the *Biodiversity Conservation Act 2016* (WA) and *Environment Protection and Biodiversity Conservation Act 1999* (Cwth). A recent taxonomic study (Binks et al. 2020) concluded that *Seringia exastia* and *Seringia elliptica* are the same species and common and widespread throughout the Pilbara region, central WA, Northern Territory, and South Australia. With the regional extent of this species recorded north of Kalgoorlie, it is likely that *Seringia exastia* may have been introduced by earthworks machinery.

Although *Seringia exastia* has been identified to be delisted, the species is currently still legally listed as threatened flora under the *Biodiversity Conservation Act 2016* (WA). Although some loss of plants is likely to have occurred and will continue to occur during mining and road works, this is not expected to be significant in the context of the entire population.

Priority flora *Eremophila acutifolia* (P3) is both widespread and found in large numbers throughout the local and regional area. Recorded locations range from Coolgardie, Norseman, Kambalda, Widgiemooltha and Madoonia Down (NVS, 2022).

5.3 VEGETATION COMMUNITIES AND CONDITION

Eleven vegetation communities were identified in the flora and vegetation survey, comprising mainly of various *Eucalyptus* spp. woodland and largely following topographical features and dominant species. No vegetation community's representative of any Commonwealth or State listed Threatened or Priority Ecological Communities were recorded in the area (NVS, 2022).

An overview of the vegetation community extent within the survey area is provided in Table 5-1 and Figure 6. *Eucalyptus griffithsii* woodland (R) and *Eucalyptus gracilis* woodland (N) make up over 80% of the vegetation communities within the survey area, respectively 46.23% and 34.97% of the total survey area (NVS, 2022).

Most of the sites/quadrats inspected were in Good to Very Good condition (Keighery, 1994). Disturbed areas were mostly attributed to access tracks and exploration activities. The vegetation more than 0.5m off these tracks was mostly in a Good to Very Good condition (Keighery, 1994), as illustrated in Figure 7.

Table 5-1 Extent of vegetation Communities in Survey Area (NVS, 2022)

Vegetation Group	Vegetation Group Code	% Represented in Survey Area
Transitional *Eucalyptus* Woodland over mixed shrubland	A	4.39
Mixed *Eucalyptus* woodland over sclerophyll shrubland on undulating hills	B	4.37
Acacia acuminata shrubland with emergent *Eucalyptus griffithsii*	C	0.09
Open *Eucalyptus salmonophloia* woodland	D	0.03
Eucalyptus lesouefii and *Eucalyptus gracilis* on rocky hill slopes	G	0.28
Mixed *Eucalyptus* over *Melaleuca sheathiana* shrubland	H	4.49
Eucalyptus ravida woodland	I	0.56
Mixed *Eucalyptus* woodland over sclerophyll shrubland with *Eremophilaacutifolia* (P3) on undulating hills	K	1.47
Eucalyptus gracilis woodland	N	34.97
Eucalyptus griffithsii woodland	R	46.23
Acacia quadrimarginea shrubland on undulating hills	X	3.12

Figure 6: Vegetation Communities

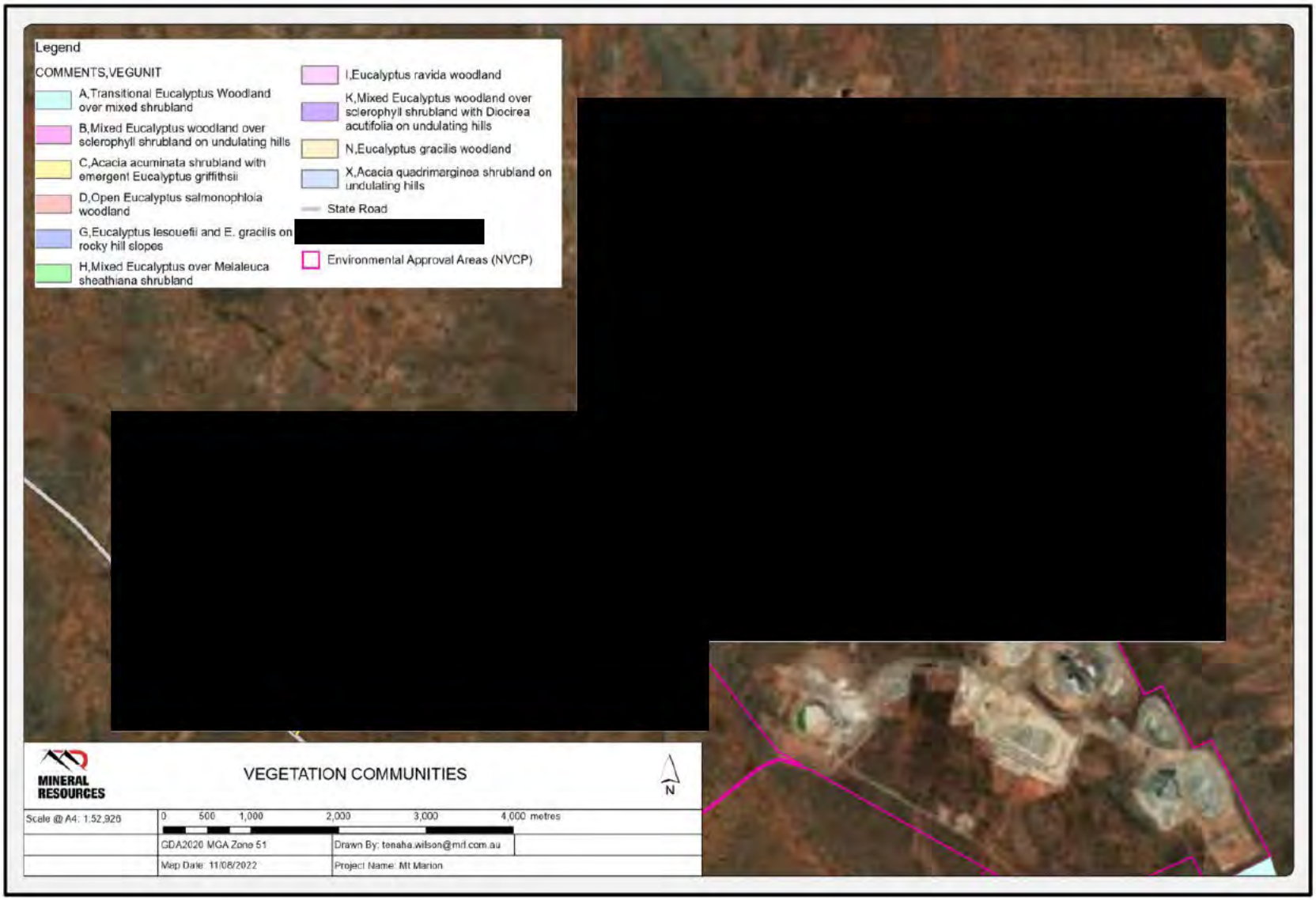
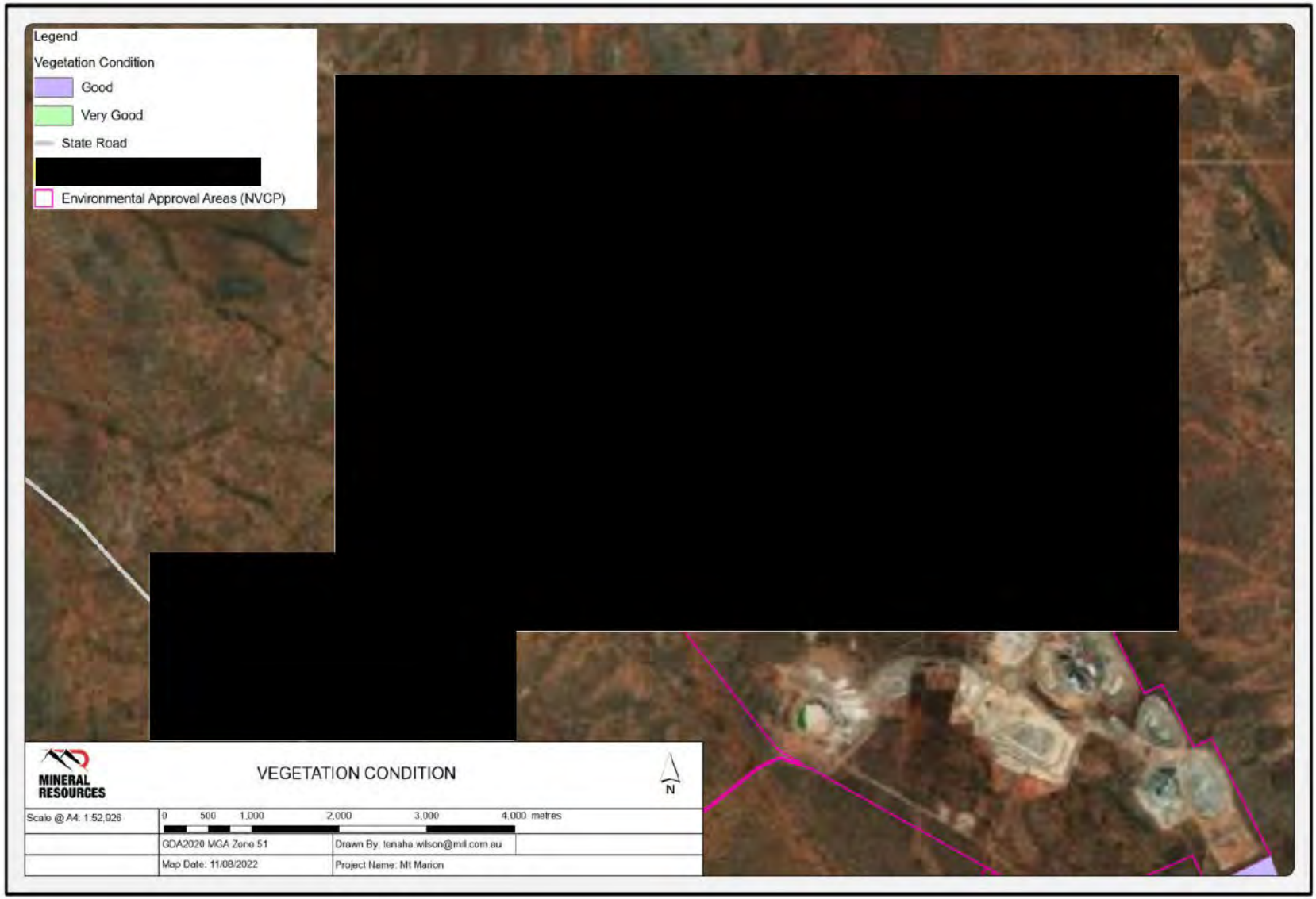


Figure 7: Vegetation Condition



6. Fauna and Habitat

A Basic and Targeted Fauna Assessment (desktop assessment and targeted survey for conservation significant species) was completed by Bamford Consulting Ecologists (BCE) on 10 – 14th September 2021 and is included as Appendix B. Similar to the flora survey, the fauna survey was completed for supporting a larger project area. For the purposes of this supporting document, only the information relating to the [redacted] area will be referred to in this document.

The assessment included the identification of fauna habitat (Section 6.1); opportunistic fauna observations; records of bird encounters; and targeted searches for Malleefowl, Chuditch, Arid Bronze Azure Butterfly (associated with *Camponotus* ants) and Trapdoor spiders (Section 6.2).

6.1 Fauna Habitat

Fauna habitat are referred to as vegetation and substrate associations (VSAs) in the fauna survey (BCE, 2022). The VSAs within the project area are a complex mosaic, largely reflecting soil types. Previous surveys in the Mt Marion area were utilised and compared to provide an understanding of the VSAs considered likely to be present. From this, and observations made during the field investigations, seven major VSAs were identified in relation to fauna in the survey area. Three of the seven identified VSAs, were observed in the Hamptons area, including:

- Mixed Eucalypt woodland over sclerophyll shrubland on undulating hills
- Acacia shrubland on slopes with scattered Eucalypts over rocky loam
- Open to closed Eucalypt woodland or Mallee over mixed shrubland on flats.

BCE (2022) considered all VSAs important for fauna, noting large Salmon Gums (*Eucalyptus salmonophloia*) to provide important nesting opportunities for fauna and dense vegetation provide cover and habitat for species such as the Golden Whistler, Western Yellow Robin and Malleefowl (BCE, 2022).

The presence of a range of VSAs are factors in patterns of biodiversity. Fauna that occur in eucalypt woodlands throughout the region are likely to utilise the project area, areas of dense thicket are important for species that prefer dense cover, areas with exposed granite may support a unique suite of species, with large, hollow-bearing trees in woodlands providing potential important nesting opportunities (BCE, 2022).

6.2 Fauna

The desktop study identified 288 vertebrate fauna species as potentially occurring in the project area: five frogs, 85 reptiles, 164 birds, 25 native and ten introduced mammals. The presence of at least 95 species (one frog, 12 reptiles, 66 bird species, ten native mammals and six introduced mammals) has been recorded from surveys thus far. 2021 field investigations confirmed the presence of three reptiles, 34 birds, two native mammals and one introduced mammal. Notable camera trap detections included one incidence of mating Spotted Nightjars, a family of Emus (one adult male and six juveniles) and a feral cat (BCE, 2022).

The expected fauna assemblage is typical of the Coolgardie region and Goldfields eucalypt woodlands, with some species occurring at the edge of their range in the project area. The assemblage contains a high level of richness which is expected in such relatively undisturbed intact woodland vegetation and is mostly complete, with a portion of the mammal fauna considered locally extinct (BCE, 2022).

Several Trapdoor Spider burrows and two Malleefowl mounds were recorded in [redacted] with one of these being recent but inactive. They were located within a densely vegetated area in the southern part of Hamptons, which is considered likely to provide suitable habitat for Malleefowl. No Chuditch or *Camponotus* ants (associated with the Arid Bronze Azure Butterfly) were recorded in the field (BCE, 2022).

One introduced species (Feral Cat - *Felis catus*) was recorded on camera (BCE, 2022).

6.3 SURVEY AREA

Three broad levels of conservation significance were used in the fauna report:

- Conservation Significance 1 (CS1) – species listed under State or Commonwealth Acts.
- Conservation Significance 2 (CS2) – species listed as Priority by DBCA but not listed under State or Commonwealth Acts.
- Conservation Significance 3 (CS3) – species not listed under Acts or in publications but considered of at least local significance because of their pattern of distribution.

The desktop assessment identified 33 species of conservation significant fauna expected to occur within the survey area, comprising 10 CS1, two CS2 and 21 CS3 species. One CS1 (Malleefowl) and nine CS3 species were recorded in the field.

Malleefowl are expected to be a regular visitor to the area, with recent breeding recorded in the Hamptons lease (in the past 1 to 5 years) (BCE, 2022). Although there no Malleefowl or signs of the species (eg. Tracks, droppings, feathers), two mounds were recorded in the Hamptons lease (BCE, 2022).

CS3 species recorded in this survey included the White-browed Babbler *(Pomatostomus superciliosus*) and Copper-backed Quail-thrush (*Cinclosoma clarum)*, with several other species being recorded in previous surveys. More detail on likely conservation significant species is noted in the fauna survey report (Appendix B).

Table 6-1 summarises the species of conservation significance present or considered likely to occur in the survey area.

Table 6-1: Conservation significant taxa

Common Name BCA	Latin Name	Conservation Status				Expected status in project area	Local records
		EP BC	BCA	Priority	CS3		
Conservation Significance 1 (CS1)							
Malleefowl	*Leipoa ocellata*	Vul	Vul			Visitor	Mt Marion
Fork-tailed Swift	*Apus pacificus*	Mig	Mig			Irregular visitor	Woolgangie
Hooded Plover	*Thinornis rubricollis*	Mig	Mig			Vagrant	Bulong
Sharp-tailed Sandpiper	*Calidris acuminata*	Mig	Mig			Vagrant	Kambalda West
Curlew Sandpiper	*Calidris ferruginea*	Mig	Mig			Vagrant	Kambalda East
Red-necked Stint	*Calidris ruficollis*	Mig	Mig			Vagrant	Kambalda East
Common Greenshank	*Tringa nebularia*	Mig	Mig			Vagrant	Kambalda East
Wood Sandpiper	*Tringa glareola*	Mig	Mig			Vagrant	Kambalda East
Peregrine Falcon	*Falco peregrinus*		OS			Visitor	St Ives
Chuditch	*Dasyurus geoffroyii*	Vul	Vul			Vagrant to Irregular Visitor	Kalgoorlie
Conservation Significance 2 (CS2)							
Western Rosella (Inland)	*Platycercus icterotis xanthogenys*			4		Irregular Visitor	Kalgoorlie
Central Long-eared Bat	*Nyctophilus major tor*			3		Resident	Coolgardie
Conservation Significance Level 3							
Carpet Python	*Morelia spilota imbricata*				X	Resident	Kalgoorlie
Australian Bustard	*Ardeotis australis*				X	Irregular Visitor	Coolgardie
Bush Stone-curlew	*Burhinus grallarius*				X	Visitor	Jilbadji
Square-tailed Kite	*Lophoictinia isura*				X	Visitor	St Ives
Purple-crowned Lor keet	*Glossopsitta porphyrocephala*				X	Resident	Mt Marion
Regent Parrot	*Polytelis anthopeplus*				X	Visitor	St Ives
Scarlet-chested Parrot	*Neophema splendida*				X	Irregular Visitor	St Ives
Major Mitchell's Cockatoo	*Cacatua leadbeateri*				X	Visitor	Coolgardie
Rainbow Bee-eater	*Merops ornatus*				X	Regular Visitor	Mt Marion
White-browed Treecreeper	*Climacteris affinis*				X	Resident	Cannon
Rufous Treecreeper	*Climacteris rufus*				X	Resident	Mt Marion
Blue-breasted Fairy- wren	*Malurus pulcherrimus*				X	Resident	Mt Marion
Purple-gaped Honeyeater	*Lichenostomus cratitius*				X	Resident	Kalgoorlie
Shy Heathwren	*Hylacola cauta whitlocki*				X	Irregular visitor	St Ives
White-browed Babbler	*Pomatostomus superciliosus*				X	Resident	Mt Marion
Copper-backed Quail-thrush	*Cinclosoma clarum*				X	Resident	Mt Marion
Gilbert's Whistler	*Pachycephala inornata*				X	Resident	Mt Marion
Crested Shrike-tit	*Falcunculus frontatus*				X	Resident	Kalgoorlie
Western Yellow Robin	*Eopsaltria griseogularis*				X	Resident	Mt Marion
Southern Scrub-robin	*Drymodes brunneopygia*				X	Irregular Visitor	Mt Marion
Kultarr	*Antechinomys laniger*				X	Resident	Kalgoorlie

Note: EPBC Act (EPBC) and Biodiversity Conservation Act (BCA): Vul: Vulnerable; End: Endangered; CE: Critically Endangered, Mig: Migratory, OS: Other Specially Protected Fauna; DBCA Priority: P1 – P4 = Priority 1 - 4. CS3: locally significant but not listed.

7. AVOIDANCE AND MITIGATION

MRL has an Environmental Management System (EMS) applicable to the proposed exploration activities at West [redacted] This system includes awareness training, plans, procedures and forms to avoid, minimise and ensure the effective management of environmental and heritage values. Strategies to avoid, minimise and manage environmental impacts include the maintaining of a 50 m buffer around habitat trees, malleefowl mounds and Priority flora locations.

The list of procedures applicable to exploration are provided in Table 7-1. These are considered sufficient to ensure the effective management of environmental and heritage risk by the proposal.

Table 7-1: Mt Marion environmental management plan (MRL, 2019)

Document number	Document name
MRL-EN-PRO-0004	Land Clearing Procedure
MRL-EN-PRO-0005	Site Disturbance Procedure
MRL-EN-PRO-0001	Fauna Management Procedure
MRL-TS-WIN-0006	Clearing Work Instruction
MRL-EN-PRO-0007	Weed Hygiene and Control
MRL-EN-PRO-0009	Land Rehabilitation Procedure

8. ASSESSMENT AGAINST THE TEN CLEARING PRINCIPLES

An assessment has been completed against the Ten Clearing Principles (*EP Act 1986,* Schedule 5) to determine if there is a likely significant environmental impact as a result of the clearing native vegetation for the purposes of this project, within the proposed application area.

Each principle was assessed in accordance with Department of Environmental Regulation's (DER) "A Guide to the Assessment of Applications to Clear Native Vegetation" (DER, 2014).

In summary, the proposed clearing is not likely to be or at variance to Clearing Principles (A) to (J), as referenced below.

Table 8-1: Identified Impacts against Clearing Principles

Red – Likely to be at variance, **Orange** – May be at variance, **Green** – Not likely to be or not at variance

Clearing Principle	Impact Category	Assessment of Clearing Principle
(a) Native vegetation should not be cleared if it comprises a high level of biological diversity	**Green**	The vegetation and flora survey (NVS, 2022) desktop assessment identified 141 species in the proposed clearing boundary, representing 31 families and 72 genera within 11 vegetation groups. One hundred and twenty two species were recorded specifically within the 27 established quadrats that lie within this proposed clearing area. NVS (2022) recorded one Priority and one Threatened recorded during the survey. Both Threatened flora *Seringia exastia (T)* and Priority flora *Eremophila acutifolia* (P3) are considered widespread and common, and therefore is not anticipated that the clearing will have an impact on the conservation significance of either species. This is further elaborated against Principle (c). Species composition and vegetation types within the application area are typical of the local region and not considered to be unusually diverse (NVS, 2022). Based on the low level of disturbance, the lack of fragmentation of vegetation and vegetation condition generally rated as 'Good' to 'Very Good' (Keighery, 1994), the area proposed to be cleared is not considered to be remnant vegetation. One weed species was identified within the survey area and is therefore not considered to be a significant threat to biodiversity in the area. Weeds have the potential to significantly change the dynamics of a natural ecosystem and lower the biodiversity of an area. No Threatened or Priority Ecological Communities were identified within the survey area. No reserves, conservation areas or other DBCA Managed Estate are located within the survey area. The expected fauna assemblage is typical of the Coolgardie region and Goldfields eucalypt woodlands, with some species occurring at the edge of their range in the project area. The fauna desktop assessment (BCE, 2022) identified 288 vertebrate fauna species as potentially occurring in the project area: five frogs, 85 reptiles, 164 birds, 25 native and ten introduced mammals. The presence of at least 95 species (one frog, 12 reptiles, 66 bird species, ten native mammals and six introduced mammals) has been recorded from surveys thus far (BCE, 2022). 2021 field investigations confirmed the presence of three reptiles, 34 birds, two native mammals and one introduced mammal. With the management measures in place, the proposed clearing is expected to be of minimal risk to biodiversity values. Proposed clearing of this proposal is therefore unlikely to be at variance to this Principle.
(b) Native vegetation should not be cleared if it	**Green**	As noted by BCE (2022) the overall residual impact on conservation significant species is negligible.

Clearing Principle	Impact Category	Assessment of Clearing Principle
comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.		Several Trapdoor Spider burrows and two Malleefowl mounds were recorded in Hamptons, with one of these mounds being recent but inactive. They were located within a densely vegetated area in the southern part of Hamptons, which is considered likely to provide suitable habitat for Malleefowl. Any Malleefowl utilising habitat in the permit area are unlikely to exclusively rely on this area for all habitat resource requirements. Impacts to Malleefowl and Malleefowl mounds can be effectively managed through reconnaissance assessment of areas proposed for exploration by MRL's field technicians prior to exploration. Reconnaissance assessments should include checking areas for mallee mounds, recording the locations and placing a 50 m buffer for the exclusion of these areas to protect Malleefowl and their nesting sites. The loss of potential breeding areas for Malleefowl is unlikely to impact the local population provided any active nests are protected to ensure breeding success. The habitat types within the survey area are not fragmented or threatened by edge effect. Three types of VSAs were observed in the Hamptons area and considered important for fauna. Although population decline is inevitable with some habitat loss, the significance depends on proportion of VSA and populations impacted. Most of the project area contains VSAs that are well represented in the region (BCE, 2022). Large, hollow-bearing Eucalypt trees occur within the project area, support conservation significant fauna and contain breeding or roosting sites (tree hollows) for a range of fauna. These are well represented within the region. MRL intends to avoid and minimise impacts to significant habitat for fauna. Clearing therefore is unlikely be at variance to this principle.
(c) Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.	Orange	Desktop searches identified the potential for one Threatened and 22 Priority Flora species to occur within a 20 km radius of the survey area (DBCA, 2021a). None of these known locations of Threatened or Priority Flora occur within the survey area, with the closest Threatened Flora and the closest Priority Flora located approximately 19 km south and 1 km south of the survey area respectively. NVS (2022) recorded one Priority (*Eremophila acutifolia* (P3)) and one Threatened flora (*Seringia exastia* (T)) within the survey area. Both species are considered common and widespread. Although some loss of plants is likely to occur, this is not expected to be significant in the context of the entire population. As described in Section 5.2, *Seringia exastia* (T) is waiting assessment to be legally delisted as Threatened under the *Biodiversity Conservation Act 2016* (WA) and *Environment Protection and Biodiversity Conservation Act 1999* (Cwth). A recent taxonomic study (Binks et al. 2020) concluded that *Seringia exastia* and *Seringia elliptica* are the same species and common and widespread throughout the Pilbara region, central WA, Northern Territory, and South Australia. With the regional extent of this species recorded north of

Clearing Principle	Impact Category	Assessment of Clearing Principle
		Kalgoorlie, it is likely that *Seringia exastia* may have been introduced by earthworks machinery. Hence, although some loss of plants is likely to occur as a result of this proposal, this will not be significant in the context of the entire population. Priority flora Eremophila *acutifolia* (P3) populations were dominant lower stratum species. This species is in large numbers throughout the local and regional area and is well documented by previous flora surveys. Using data from the NVS (2019) survey to compare local numbers of *Eremophila acutifolia* (P3) with the current survey area, the survey area contains less than 7.39% of the wider local population, and hence clearing is unlikely to have an impact on the conservation significance of this species. Based on the above, although the presence of one Priority and one Threatened flora exists, the proposed clearing bears no impact on the continued existence of rare flora, is not likely to be at variance to this Principle.
d) Native vegetation should not be cleared if it comprises the whole or a part of or is necessary for the maintenance of a threatened ecological community.	Green	Desktop searches identified no PEC or TECs within 50 km of the survey area. Field surveys confirmed that there are no PEC or TECs within the survey area, and hence the proposed clearing area. The clearing of native vegetation is therefore not at variance to 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.	Green	Species composition and vegetation types within the application area are typical of the local region and not considered to be unusually diverse (NVS, 2022). Based on the low level of disturbance, the lack of fragmentation of vegetation and vegetation condition generally rated as 'Good' to 'Very Good' (Keighery, 1994), the area proposed to be cleared is not considered to be remnant vegetation. Four Beard vegetation associations fall within the survey area, each with less than 1% of the total association extent inside the survey area at all scales. All four vegetation associations are above the 30% threshold of their known spatial area remaining post European settlement at a state, bioregional and subregional level, and are not adversely affected by extensive clearing (NVS, 2002). The percentage of Pre-European vegetation extent remaining within the Coolgardie Shire for Beard Vegetation Associations 128; 9; 936; and 1413 is 99.98%; 98.29%; and 99.32% and 99.33 %, respectively. Further details of the extents of these vegetation associations is included in Section 4.1.5 of the flora survey. As noted in BCE (2022), the project area lies within the Coolgardie Vegetation System. All woodlands in the Coolgardie System have been logged in the past for mining timber and firewood and current vegetation is secondary growth regenerated from seed and coppice (Beard, 1972). Given the above, the clearing of native vegetation is unlikely to be at variance to this principle.

Clearing Principle	Impact Category	Assessment of Clearing Principle
(f) Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.	Green	There are no permanent watercourses or wetlands within or in the vicinity of the survey area. The nearest water bodies are located over 10km to the north of the proposed clearing area (Lake Douglas, Lake Red and Lake Brown), with the next closest water body being Lake Lefroy, located approximately 26km to the southeast of the proposed clearing area. The clearing of native vegetation is unlikely to be at variance to this principle.
(g) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	Green	Any clearing of native vegetation within the survey area has the potential to cause soil and wind erosion. The landscape units for this survey area are Kambalda (265) and Norseman (266) (DPIRD, 2019). Both have similar topography with variations in calcareous loamy earths, which when extensively cleared and left unrehabilitated, are prone to erosion. The area is arid, and unlikely to flood or become waterlogged with minor ephemeral water courses recorded in vegetation surveys by GHD (2018). The potential for soil erosion and appreciable land degradation to occur from the implementation of this proposal is unlikely. The clearing of native vegetation is unlikely to be at 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.	Green	No reserves, conservation areas or other DBCA-managed estates are located within the survey area. Two conservation areas occur adjacent to the survey area: • Karamindie Forest, northwest of the project and • Yallari Timber Reserve, southwest of the access to the project. The proposal would not significantly impact upon either of the areas above or affect the values associated with these areas. The clearing of native vegetation is unlikely to be at variance to 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.	Green	The survey area is located in the *Rights in Water and Irrigation Act 1914* (RIWI Act) listed Goldfields Groundwater Area (DWER, 2022) and the Salt Lake Basin Surface Water Management Area and Sub-area. No rivers or surface water bodies listed under the RIWI Act were identified within the survey area. There are minor ephemeral drainage lines located within the survey area. No lakes, wetlands or natural water bodies were recorded in the survey area. Average rainfall for the area is 270 mm and relatively evenly distributed throughout the year. However, rainfall is erratic from year to year. During heavy localised rainfall events erosion may

Clearing Principle	Impact Category	Assessment of Clearing Principle
		occur in cleared areas leading to temporary soil erosion and/or sedimentation, particularly in the vicinity of ephemeral drainage lines. Clearing within or near a drainage line should be avoided. On this basis, clearing of vegetation in the permit area is unlikely to cause appreciable deterioration in the quality of surface or underground water. The clearing of native vegetation is unlikely to be at variance to this principle.
(j). Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.	**Green**	The climate of the region is described as semi-arid with an average annual rainfall of 270 mm. Rainfall is relatively evenly spread throughout the year but can occur in heavy localised falls. Based on an average daily evaporation rate of 7.2 mm, any surface water resulting from rainfall events is likely to be relatively short lived. In addition, the survey area is surrounded by native vegetation, and it is likely that a large proportion of runoff will be absorbed by this natural environment. There are no permanent drainage channels or wetlands within or in the vicinity of the survey area. There is one minor ephemeral drainage line within the survey area that is only likely to flow following heavy rain. The survey area is characterised by flat to gently undulating plains with silty clay soils and occasional rocky rises scattered throughout the survey area. Any surface flow is expected to be minimal, and it is unlikely that clearing for exploration in the Permit Area will lead to an appreciable increase in runoff that could cause, or exacerbate, the incidence of flooding. According to GIS analysis and examination of aerial imagery of the area, vegetation is well represented in the local area and comprises of low woodland or low open woodland. There are no extensively cleared areas of riverbank, paddock, pasture or fallow land near the proposal area that could exacerbate flooding. The clearing of native vegetation is unlikely to be at variance to this principle.

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10. GLOSSARY

Exempt East Location	A land parcel in the Eastern Goldfields that had freehold issued prior to 1899 whereby the owner is entitled to retain the Minerals Rights where provisions under the Mining Act and Regulations 1981 do not apply.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. 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; grazing (Keighery, 1994).
Habitat trees	Habitat trees are trees with a Diameter Breast Height of more than 500 mm and 300 mm.
Permit area	The within which up to 120 ha of clearing of native vegetation is proposed in the [redacted] comprising of 1,310.67 ha on [redacted]
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
Survey area	The survey is the area surveyed by GHD in 2018 and included the Hamptons West Area 53 comprising of 1, 439 ha on [redacted]
Study area	The study area is the area referred by NVS and BCE (2022) to the area assessed in desk environmental impact assessment used to inform the field survey.
Very Good	Vegetation structure altered, very obvious signs of disturbance. 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 (Keighery, 1994).

11. ABBREVIATIONS

BC Act	*Biodiversity Conservation Act 2016 (WA)*
CAR	Comprehensive Adequate Representative
CPS	Clearing Permit System
DBCA	Western Australian Department of Biodiversity, Conservation and Attractions
DAWE	Australian Department of Agriculture, Water and the Environment
DER	Department of Environmental Regulation
DMIRS	Department of Mines, Industry Regulation and Safety
DWER	Western Australian Department of Water and Environmental Regulation (formerly DoW)
[redacted]	[redacted]
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EP Act	*Environmental Protection Act 1986*
GIS	Geospatial Information Systems
GoWA	Government of Western Australia
ha	hectare(s)
IBRA	Interim Biogeographic Regionalisation for Australia
km	kilometre(s)
LGA	Local Government Area
LOM	Life of Mine
m	metre(s)
mg/L	milligrams per litre
Mining Act	*Mining Act 1978*
mm	millimetres
MRL	Mineral Resources Limited
MSA	Mine Services Agreement
Mt	Mount
NSRL	Northern Star Resources Limited
P	Priority
PEC	Priority Ecological Community
pH	measure
PMI	Process Minerals International Pty Ltd
PMST	Protected Matters Search Tool
RIM	Reed Industrial Minerals
TDS	total dissolved solids
TEC	Threatened Ecological Community
VSA	Vegetation and Substrate Associations
WA	Western Australia
[redacted]	[redacted]

APPENDICES

Appendix	Title
A	Vegetation Survey of the Mt Marion Project Area, October 2021 (GHD, 2018)
B	Mt Marion Fauna Assessment: [redacted], L15/353, M15/999 and East E15/1599 (Bamford Consulting Ecologists, 2022)
C	Certificate of Title
D	Authority to Access

Appendix A
Detailed Flora and Vegetation Survey of the Mt Marion Project Area, October 2021 (Native Vegetation Solutions, 2022)

DETAILED FLORA AND VEGETATION SURVEY OF THE MT MARION PROJECT AREA

October 2021

Prepared for:

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FINAL
V1.0
May 2022

EXECUTIVE SUMMARY

Mineral Resources Ltd. (ASX: MIN) is a mining services company, with a growing world-class portfolio of mining operations across multiple commodities, including iron ore and lithium and is the operator of its Mt Marion project in Western Australia. Mineral Resources 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 Marion mineral resource. The location of this survey area is approximately 36 km south of Kalgoorlie-Boulder in the Coolgardie Bioregion of Western Australia (Figure 1).

The survey area, for the purposes of this report, covers an area totalling approximately 1,439 ha. The area encompasses sections of land within the [redacted] Mining Licence M 15/0999 and Miscellaneous Licence L 15/0353. At this stage, the final footprint of mining related disturbances is yet to be finalised, however will be entirely within the survey area, and is expected to be less than 1,439 hectares.

The survey area is located in the Eastern Goldfields Interim Biogeographic Regionalisation for Australia (IBRA) subregion. The vegetation of the Eastern Goldfields botanical subregion consists of Mallees, *Acacia* thickets and shrubheaths on sandplains. Diverse *Eucalyptus* woodlands occur around salt lakes, on ranges, and in valleys. Salt lakes support dwarf shrublands of samphire. Woodlands and *Dodonaea* shrubland are known to occur on basic graninulites of the Fraser Range some distance to the southeast of the survey area (CALM, 2002).

The *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* Protected Matters Search Tool revealed that the survey area may contain habitat for the invasive weed species *Carrichtera annua* (Ward's Weed) (DAWE, 2021). The EPBC Protected Matters report indicated no Threatened Ecological Communities (TECs) or Commonwealth Reserves within the requested search area, however, the Yallari Timber Reserve is located adjacent to the western extent of the survey area.

The Western Australian Department of Biodiversity Conservation and Attractions (DBCA) database searches revealed a potential for one Threatened and 22 Priority Flora species to occur within a 20 km radius of the survey area (DBCA, 2021a). No known locations of Threatened or Priority Flora occur within the survey area, with the closest Threatened Flora and the closest Priority Flora located approximately 19 km south and 1 km south of the survey area respectively.

The Priority Ecological Communities (PEC) and Threatened Ecological Communities (TEC) search revealed no PEC/TECs within the survey area (DBCA, 2021).

The survey area does not lie within or contain any Environmentally Sensitive Areas (ESA) or Conservation Reserves (DWER, 2021).

No water bodies were identified within the survey area via the Clearing Permit System (CPS) Map Viewer (DWER, 2021).

The survey area lies south of the 26th parallel, however receives average annual rainfall of approximately 264.9mm (BOM, 2021). There is no record of *Phytophthora cinnamomi* (Dieback) 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.

Eleven vegetation groups were identified during this survey, largely following topographical features and dominant species. Mapping of the 11 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 forty-eight species were recorded within the survey area with 130 species recorded within quadrats. Thirty-one families and 72 genera were found. These are listed in Appendix E, per Quadrat as well as per Vegetation Group. Of the native species, Chenopodiaceae was the highest represented family, with 27 species from 10 genera. The next best represented families were Myrtaceae and Scrophulariaceae each with 18 species.

Of the 148 taxa recorded one was an introduced weed species. *Oncosiphon suffruticosum* (Calomba daisy) was recorded in Quadrat 12. This species is not listed as a declared pest in the state of Western Australia by the Department of Primary Industries and Regional Development (DPIRD, 2021).

The most common and widespread species were *Exocarpos aphyllus* which was recorded within 30 quadrats followed by *Ptilotus obovatus* and *Maireana trichoptera* which were both recorded within 26 quadrats.

There were 36 taxa recorded from within a single site, which was Quadrat 4 (Q4).

There was one Priority and one Threatened flora recorded during the survey. Threatened flora *Seringia exastia (T)* was identified within the survey area and is gazetted as Threatened pursuant to Section 5(1) of the *Biodiversity Conservation Act 2016*, and as Threatened pursuant to Schedule 1 of the *Environment Protection and Biodiversity Conservation Act 1999.* A nomination to delist the species due to no plausible significant threats to the species has been prepared and considered by the WA Threatened Species Scientific Committee (TSSC). However, until changes are officially made to the threatened species list, *S. exastia* is still legally listed as Threatened flora, and authorisation to take under section 40 of the *Biodiversity Conservation Act 2016* is still required.

Priority flora *Eremophila acutifolia* (P3) was recored in Quadrats 30 and 31. Both populations were dominant lower stratum species. This species is both widespread and in large numbers throughout the local and regional area and is well documented by previous flora surveys. Recorded locations range from Coolgardie, Norseman, Kambalda, Widgiemooltha and Madoonia Downs. Using data from the NVS (2019) survey to compare local numbers of *Eremophila acutifolia* (P3) with the current survey area, clearing within the proposed survey area will likely affect approximately 7.39% of the local population.

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

The Environmental Protection Authority’s (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 Goldfields 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 a detailed flora and vegetation survey, incorporating the Spring survey of 2021.

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APPENDICES

1 INTRODUCTION

1.1 BACKGROUND

Mineral Resources (ASX: MIN) is a mining services company, with a growing portfolio of mining operations across multiple commodities, including iron ore and lithium and is the operator of its Mt Marion project in Western Australia. Mineral Resources 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 Marion mineral resource. The location of this survey area is approximately 36 km south of Kalgoorlie-Boulder in the Coolgardie Bioregion of 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, covers [redacted] Mining Licence M 15/999 and Miscellaneous Licence L 15/353. At this stage, the final footprint of mining related disturbances is yet to be finalised, however will be entirely within the survey area, and is expected to be less than 1,439 hectares.

Figure 1: Regional Location of the Mt Marion 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 (incorporating 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 a 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.

1.3 STATUTORY FRAMEWORK AND GUIDANCE

This assessment took into account relevant sections of Commonwealth and State legislation and guidelines:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- *Environmental Protection Act 1986* (EP Act)
- *Biodiversity Conservation Act 2016* (BC Act)
- *Biosecurity and Agriculture Management Act 2007* (BAM Act)

The Minister for the Environment publishes lists of flora species in need of special protection because they are considered rare, likely to become extinct, or are presumed extinct. The current listings were published in the Government Gazette on 5 December 2018 (Smith and Jones, 2018) and were taken into account.

As well as those listed above, the assessment took into account relevant sections of:

- EPA (2016) *Statement of Environmental Principles, Factors and Objectives*; and
- EPA (2016a) *Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment*, known as *Flora and Vegetation Technical Guidance*

1.3.1 Western Australian *Biodiversity Conservation Act 2016*

The Western Australian *Biodiversity Conservation Act 2016* (BC Act, the Act) provides for the conservation, protection and ecologically sustainable use of biodiversity and biodiversity components in Western Australia. The BC Act replaces the *Wildlife Conservation Act 1950*.

Threatened species (both flora and fauna) that meet the categories listed within the Act are highly protected and require authorisation by the Ministerial to take or disturb. These are known as Threatened Flora and Threatened Fauna. The conservation categories of Critically Endangered, Endangered and Vulnerable have been aligned with those detailed in the EPBC Act, as below.

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

Threatened Ecological Communities (TECs) are also protected under the Act and are categorised using the same criteria as threatened species.

1.3.2 Environmental Protection Act 1986

The *EP Act 1986* was created to provide for an Environmental Protection Authority (the EPA) that has the responsibility for:

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

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

1.3.3 Environment Protection and Biodiversity Conservation Act 1999

At a Commonwealth level, Threatened taxa are protected under the EPBC Act, which lists species and ecological communities that are considered Critically Endangered, Endangered, Vulnerable, Conservation Dependent, Extinct, or Extinct in the Wild (Section 6 below).

1.3.4 Flora

1.3.4.1 Threatened and Priority Flora

Conservation significant flora species are those that are listed as TF (Threatened Flora) and (within Western Australia) as PF (Priority Flora). TF species are listed as threatened by the

Western Australian Department of Biodiversity Conservation and Attractions (DBCA) and protected under the provisions of the BC Act. Some State-listed TF are provided with additional protection as they are also listed under the Commonwealth EPBC Act.

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

There are seven categories covering State-listed TF and PF species (DBCA, 2019) which are defined in Section 8 below. PF for Western Australia are regularly reviewed by DBCA whenever new information becomes available, with species status altered or removed from the list (Smith and Jones, 2018) when data indicates that they no longer meet the requirements outlined in Section 8 below.

1.3.4.2 Other Significant Flora

According to the Flora and Vegetation Technical Guidance (EPA 2016a) other than being listed as Threatened or Priority Flora, a species can be considered as significant if it is considered to be:

- locally endemic or association with a restricted habitat type (e.g., surface water or groundwater dependent ecosystems)
- a new species or has anomalous features that indicate a potential new species
- at the extremes of range, recently discovered range extensions (generally considered greater than 100 km or in a different bioregion), or isolated outliers of the main range
- unusual species, including restricted subspecies, varieties or naturally occurring hybrids and
- relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

1.3.5 Ecological Communities and Vegetation

1.3.5.1 Threatened and Priority Ecological Communities

Nationally Listed Threatened Ecological Communities
An ecological community is a naturally occurring group of plants, animals and other organisms interacting in a unique habitat. The complex range of interactions between the component species provides an important level of biological diversity in addition to genetics and species. At Commonwealth level, Threatened Flora and Threatened Ecological Communities (TECs) are protected under the Commonwealth EPBC Act. An ecological community may be categorised into one of the three subcategories:

- Critically Endangered, if it is facing an extremely high risk of extinction in the wild in the immediate future
- Endangered, if it is not critically endangered and is facing a very high risk of extinction in the wild in the near future and
- Vulnerable, if it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future.

State Listed Threatened Ecological Communities
The Western Australian DBCA also maintains a list of TECs which are further categorised into three subcategories much like those of the EPBC Act.

State Listed Priority Ecological Communities
DBCA maintains a list of Priority Ecological Communities (PECs). PECs include potential TECs that do not meet survey criteria, or that are not adequately defined.

1.3.5.2 Other Significant Vegetation

According to the Flora and Vegetation Technical Guidance (EPA 2016a), other than being listed as a TEC or PEC, vegetation can be considered as significant if it is considered to have:

- restricted distribution
- a degree of historical impact from threatening processes
- a role as a refuge; and/or
- provides an important function required to maintain ecological integrity of a significant ecosystem.

1.3.5.3 Declared Pest Plants

The Western Australian Organism List (WAOL) details organisms listed as Declared Pests under the BAM Act). Under the BAM Act, Declared Pests are listed as one of the three categories, or exempt:

- C1 (exclusion), that applies to pests not established in Western Australia; control measures are to be taken to prevent their entry and establishment
- C2 (eradication), that applies to pests that are present in Western Australia but in low numbers or in limited areas where eradication is still a possibility
- C3 (management), that applies to established pests where it is not feasible or desirable to manage them in order to limit their damage; or
- Exempt (no category).

2 EXISTING ENVIRONMENT

2.1 CLIMATE

The subregion climate is Arid to Semi-arid with 200-300 mm of rainfall, sometimes in summer but usually in winter (CALM, 2002). The nearest official meteorological weather station with the most complete and up to date information is Kalgoorlie- Boulder Airport, which is located approximately 32 km north of the survey area. Recordings of the local climatic conditions commenced at Kalgoorlie-Boulder in 1939 (BOM, 2021) and data collected at this station 012038 was used for this report.

2.1.1 Temperature

Mean annual minimum temperature at Kalgoorlie is 11.8°C and mean annual maximum temperature is 25.3°C. The coldest temperatures occur in July (mean minimum temperature 5.1°C), the hottest is January (mean maximum temperature 33.6°C) and diurnal temperature variations are relatively consistent throughout the year (Figure 2).

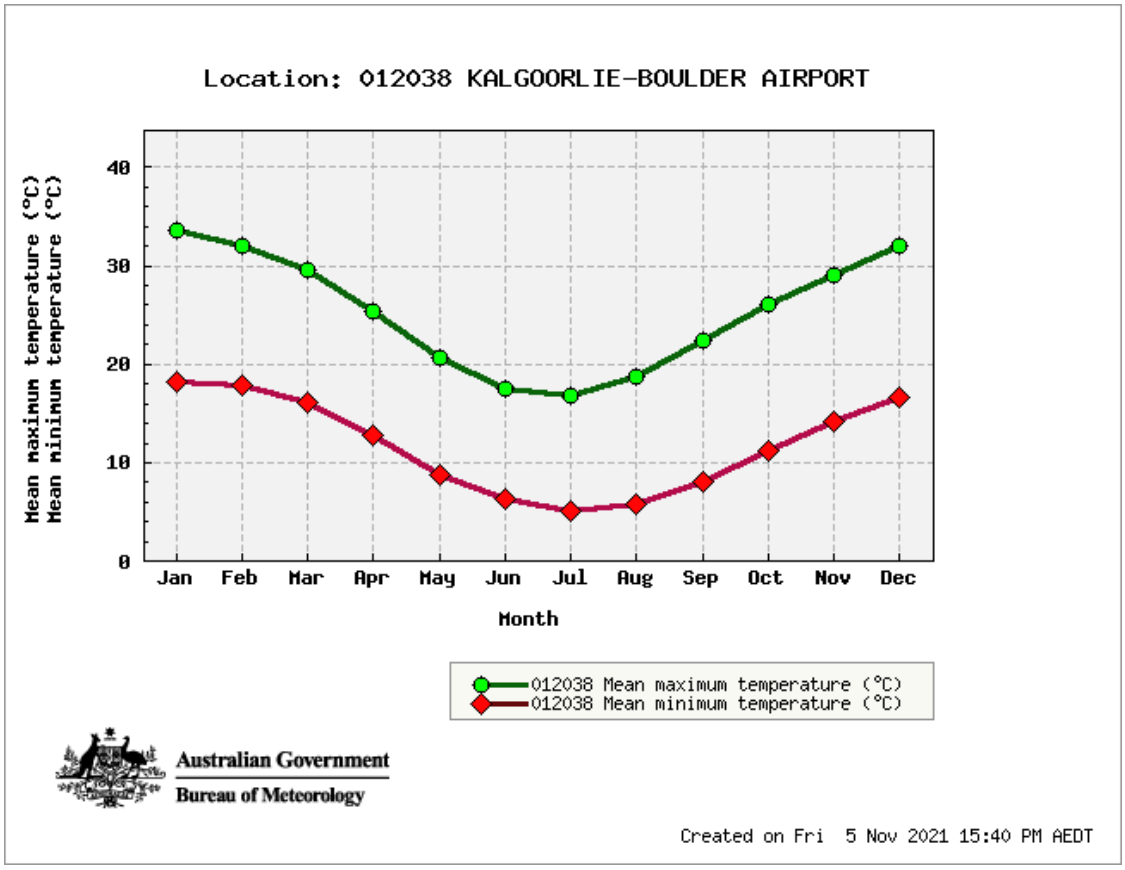

Figure 2: Mean temperature ranges for Kalgoorlie-Boulder Airport Meteorological Station (BOM, 2021)

2.1.2 Rainfall

The annual average rainfall at Kalgoorlie-Boulder Airport is 264.9mm over an average of 39 rain days (BOM, 2021). Average rainfall varies across the months, with slightly larger rainfall events falling between January to March and May to July (Figure 3). Rainfall for 2021 was above average for the months of February, March, May, June, July and October, and below average for all other months prior to the survey.

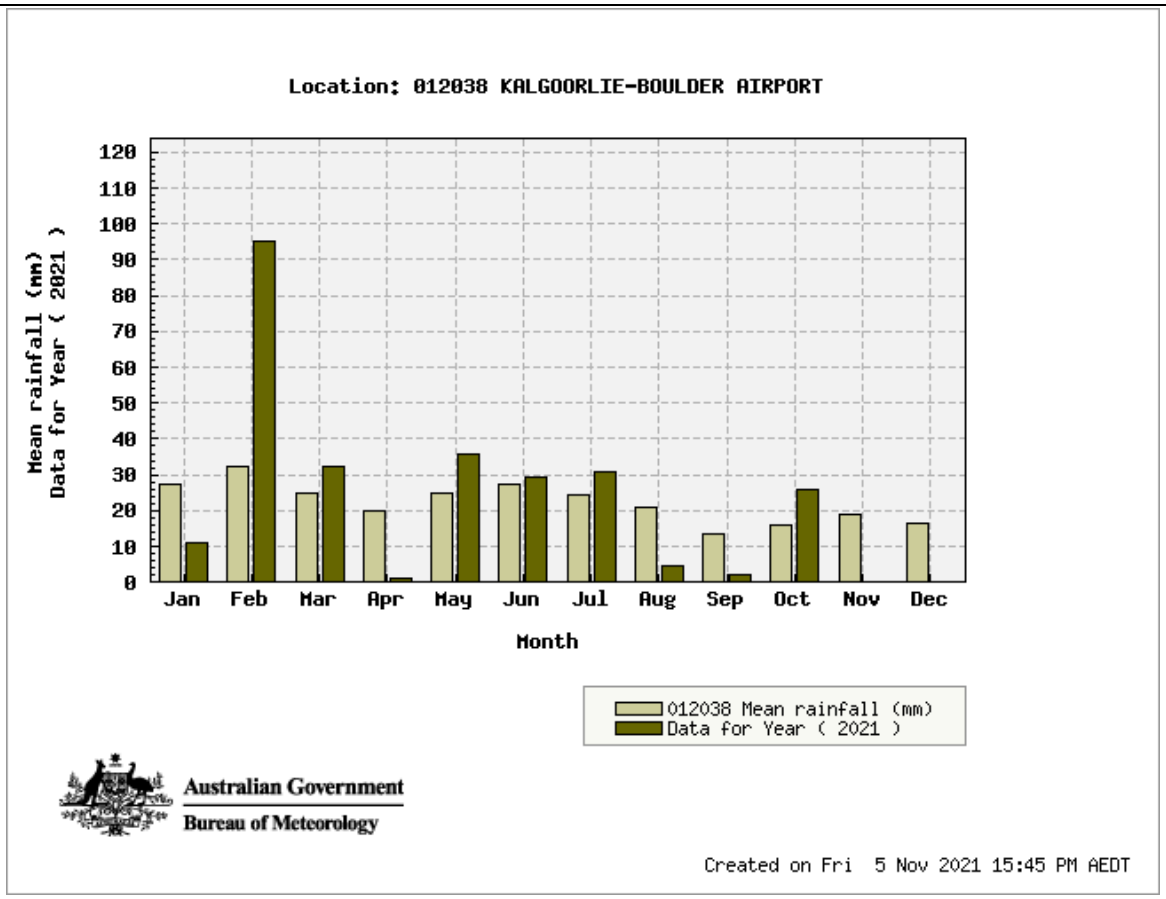

Figure 3: Rainfall data for the Kalgoorlie-Boulder Airport Meteorological Station (BOM, 2021)

2.2 INTERIM BIOGEOGRAPHIC REGIONALISATION OF AUSTRALIA (IBRA) REGION

The IBRA recognises 89 bioregions within Australia and 419 subregions (DAWE, 2021). The project is located in the Eastern Goldfields IBRA subregion (COO03) which totals over 5 million hectares (CALM, 2002). The Eastern Goldfields subregion is characterised by undulating plains, greenstone ridges, playa lakes, and scattered exposed bedrock (CALM 2002).

2.3 LANDFORMS AND SOILS

The Eastern Goldfields comprises Yilgarn craton's 'Eastern Goldfields' Terrains, and is characterised by gentle undulating plains, the west containing Archaean greenstone ridges and low hills, while the east contains a horst of Proterozoic granulite. In the western half there are a series of large playa lakes which are remnants of an ancient major drainage line. The dominant soil type is Calcareous earth, which cover most of the plains and greenstone areas (CALM 2002).

2.4 BOTANICAL SUBREGION AND EXISTING VEGETATION

The vegetation of the Eastern Goldfields botanical subregion consists of Mallees, *Acacia* thickets and shrubheaths on sandplains. Diverse *Eucalyptus* woodlands occur around salt lakes, on ranges, and in valleys. Salt lakes support dwarf shrublands of *Tecticornia* (samphire). Woodlands and *Dodonaea* shrubland are known to occur on basic graninulites of the Fraser Range some distance to the southeast of the survey area (CALM, 2002).

3 METHODS

3.1 PERSONNEL AND REPORTING

The following personnel were involved in the single season detailed flora and vegetation survey (October 2021):

- Mr Eren Reid (*BSc*- Biological Science), Principal Botanist, Native Vegetation Solutions (NVS), undertook field work of the detailed survey in October 2021, vegetation mapping, data collation, identification of flora during field work and preparation and review of the report
- Ms Adele Thomasz (*BSc*- Conservation and Wildlife Biology), Native Vegetation Solutions, data collation and preparation 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. Threatened flora range extensions and new locations were submitted to the WAHERB as per the EPA Technical Guidelines (EPA 2016a).

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 *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 1 km buffer (DAWE, 2021a).

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 20 km radial area of the survey area shapefile (DBCA, 2021a).

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 50 km buffer of the survey area shapefile (DBCA, 2021).

3.2.3 Environmentally Sensitive Areas (ESAs) and Conservation Reserves

The Department of Water and Environmental Regulation (DWER) Clearing Permit System (CPS) Map Viewer was used to determine the location of any ESAs and Conservation Reserves (DWER, 2021).

3.2.4 Land Systems

As part of the Rangeland resource surveys, the Department of Agriculture mapped the Land Systems of Western Australia (DPIRD, 2017). The purpose of the survey was to provide comprehensive description and mapping of the biophysical resources of the region, together with an evaluation of the condition of the soils and vegetation throughout. The report and the accompanying series of maps at 1:250,000 scale, are primarily intended as a reference for land managers, land management advisers and land administrators, that is, the people most involved in planning and implementing land management practices. The report and complementary maps

also provide researchers and the public with a basic reference on the landscape resources in Western Australia.

3.2.5 Vegetation Type, Extent and Status

Vegetation extent and status data was sourced from the Department of Agriculture and Food (DAFWA) 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. The purpose of examining this information is to determine if the survey area lies within any vegetation groups defined by Beard that may have been subjected to widescale clearing for European settlement. The national objectives and targets for biodiversity conservation recognise that the retention of 30% or more of the pre-clearing extent of a Beard vegetation association is necessary if Australia's biological diversity is to be protected.

3.2.6 Wetlands

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

3.2.7 Dieback

Dieback is only considered a potential issue for any project if both of the below factors are relevant for the project (CALM, 2003):

- The project area lies within the South West Land Division; and
- the mean annual rainfall of the area is greater than 400 mm.

3.3 SITE INVESTIGATION

The field survey was conducted by Mr. Eren Reid, Botanist of Native Vegetation Solutions (NVS), from the 7th to 15th October 2021. NVS established 33 quadrats within the survey area, recording 149 vascular plant species within 11 vegetation groups.

A Reconnaissance Flora and Vegetation survey was conducted in the area by NVS in April 2019 (NVS, 2019). Vegetation mapping from the 2019 report was used in the 2021 report for the majority of the survey area, alongside field notes taken in the 2021 survey.

A total of 48 hours was spent on site traversing the survey area in October 2021. While a vehicle was used to reach the site, all traverses were made on foot or via a 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 Coolgardie IBRA region, a detailed flora and vegetation survey was deemed appropriate.

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.

20 x 20m quadrats were established at these sites in appropriate locations, taking into account representation of 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 the North-East (NE) corner was captured on a TwoNav Aventura GPS at ±4m accuracy, using Universal Transverse Mercator location on GDA2020 datum. Digital photographs were taken of each quadrat site from the NE corner.

Data collected at each of the 33 quadrats included:

- Species Present
- Topography
- Rock Type
- Soil Colour and Type
- % Bare Ground and Litter
- Disturbance Level
- 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 3.3.4 below).

Relevé sites were used between quadrat sampling points, via wandering traverses, for opportunistic sampling of plant taxa, to collect flora specimens and to aid vegetation group mapping in the survey area. Opportunistic sampled plant taxa are listed in the table “Species List per Vegetation Group” in Appendix E.

Maps of all sample sites are included in Appendix C, Map 2, with detailed quadrat information listed in Appendix F.

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). Threatened flora range extensions and new locations were submitted to the WAHERB as per the EPA Technical Guidelines (EPA 2016a).

Species information was transferred into Microsoft Excel® worksheets in preparation for PATN analysis (Belbin, 1994), via Bray and Curtis Flexible unweighted pair group method with arithmetic mean (UPGMA).

PATN Analysis was completed on both the dominant species and all species recorded within each quadrat. PATN is a software package that aims to try and display patterns in complex data. Complex in PATN's terms, requires a minimum of 6 objects (i.e., different species) and a suite of more than 4 variables (i.e., different quadrats) that describe the objects. The vegetation groups listed in Section 4.2.1.2 show the grouping of quadrats based on similarities in the flora species that are present or absent in each quadrat. This data is entered into the PATN Analysis software which produces a quantitative estimate of the relationship between species composition of each quadrat.

A Species Accumulation Curve is also generated via input into a computer program (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 8 below.

3.5 LIMITATIONS

Table 1 lists potential limitations that may have affected the survey.

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 18 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. New Threatened flora locations or range extensions were submitted to the WAHERB as per the EPA Technical Guidelines (EPA 2016a). 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	No	This survey was undertaken in October 2021. Local rainfall in 2021 was above average for most months prior to the survey excluding January, April, August and September. Timing was good as the survey coincided with flowering of many flora species.
Disturbance in survey area	No	Minimal disturbance (historical access tracks and exploration) was observed within the survey area, however did not compromise the results of the survey as these areas were avoided whilst collecting data.
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 Goldfields 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) (DAWE, 2021).

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 (2021), 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, 2021).

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

The EPBC report indicated that the Yallari Timber Reserve 5(1)(h) is located to the Southwest of the Survey Area. As defined in the CALM Act, land categorised as 5(1)(h) Reserve, is land reserved under the Land Administration Act (1997), which is vested in the Conservation and Parks Commission of WA that is not a National Park, Conservation Park, Nature Reserve, Marine Park or Marine Nature Reserve (DMIRS, 2021). The Reserve is separated from the survey area by the Coolgardie-Esperance Highway.

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 one Threatened and 22 Priority Flora species to occur within a 20 km radius of the survey area (DBCA, 2021a). No known locations of Threatened or Priority Flora occur within the survey area, with the closest Threatened Flora and the closest Priority Flora located approximately 19 km south and 1 km south of the survey area respectively.

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

The PEC/TEC search revealed no PEC/TECs within the survey area (DBCA, 2021).

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, 2021). The closest DBCA Managed land was the Class C Yallari Timber Reserve located on the western side of the Coolgardie-Esperance Highway (DWER, 2021). This Timber Reserve is vested with the Conservation Commission for the purpose of Timber Production, however, is considered by the DBCA as an area for the conservation of flora and fauna.

4.1.4 Land Systems

As part of the Rangeland resource surveys, the Department of Agriculture mapped the Land Systems of Western Australia (DPIRD, 2017). The Land Systems occurring within the survey area are listed in Table 2 below, and displayed in Appendix C.

Table 2: Land Systems occurring within the survey area (DPIRD, 2017)

Land System	Description	Extent of Survey Area (ha)	% Of Survey Area (%)
BB5	Rocky ranges and hills of greenstones-basic igneous rocks	1116.40	77.58
Mx41	Flat to undulating pediments marginal to unit AC1; granitic rock outcrop; some low escarpments	13.32	0.93
Mx43	Gently undulating valley plains and pediments; some outcrop of basic rock	69.06	4.80
My154	Undulating country on acid volcanic rocks and sedimentary materials	240.21	16.69

4.1.5 Vegetation Type, Extent and Status

Four 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). The national objectives and targets for biodiversity conservation recognise that the retention of 30% or more of the pre-clearing extent of Beard's vegetation associations is necessary if Australia's biological diversity is to be protected.

Information relating to known Beard (1990) vegetation units within the survey area have been summarised in Tables 3 to 7 below. This information has been compiled through both desktop assessments and the site visit. The extent of all four Beard vegetation units within the survey area is less than 1% of the total area at each scale (Table 3), and each are above the 30% threshold at a State, bioregional and subregional level (Tables 4 to 7).

Table 3: Extent of Beard Associations within the survey area

Beard Vegetation Association	Extent within survey area (ha)	% of survey area (%)	% of extent at each scale^
9	1355.10	94.18	<1%
128	4.69	0.33	<1%
936	65.30	4.54	<1%
1413	13.79	0.96	<1%

^ **By Association** (WA) (Shepherd et al., 2002), **By Association** (WA), **By IBRA Region** (Coolgardie), **By IBRA Sub-region** (Eastern Goldfield) and **By LGA** (Shire of Coolgardie) (DBCA, 2019).

Table 4: Summary of information regarding Pre-European and current vegetation extent of vegetation association 9 within the survey area

Factor	Value				
Beard Vegetation Association*	9				
Vegetation Association Description*	Medium woodland; coral gum (*E. torquata*) & Goldfields blackbutt (*E. lesouefii*)				
Pre-European Extent (ha)	**Scale**				
	By Association *(WA)*	***By Association*** *(WA)*	***By IBRA Region*** *(Coolgardie)*	***By IBRA Sub-region*** *(Eastern Goldfield)*	***By LGA*** *(Shire of Coolgardie)*
	244,735*	240,509.33**	240,441.99**	235,047.15**	166,572.37**
% Pre-European Extent Remaining	*100.00%**	*97.78%***	*97.78%***	*97.75%***	*98.29%***
Surrounding Land Use***	Mining, Exploration, Prospecting, Pastoral Lease				
Weed prevalence***	Low				

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

Table 5: Summary of information regarding Pre-European and current vegetation extent of vegetation association 128 within the survey area

Factor	**Value**				
Beard Vegetation Association*	128				
Vegetation Association Description*	Bare areas; rock outcrops				
Pre-European Extent (ha)	**Scale**				
	By Association *(WA)*	***By Association*** *(WA)*	***By IBRA Region*** *(Coolgardie)*	***By IBRA Sub-region*** *(Eastern Goldfield)*	***By LGA*** *(Shire of Coolgardie)*
	503,092*	329,836.19**	184,549.90**	26,871.74**	96,232.93**
% Pre-European Extent Remaining	*60.14%**	*87.56%***	*99.64%***	*99.93%***	*99.98%***
Surrounding Land Use***	Mining, Exploration, Prospecting, Pastoral Lease				
Weed prevalence***	Low				

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

Table 6: Summary of information regarding Pre-European and current vegetation extent of vegetation association 936 within the survey area

Factor	**Value**				
Beard Vegetation Association*	936				
Vegetation Association Description*	Medium woodland; salmon gum				
Pre-European Extent (ha)	**Scale**				
	By Association *(WA)*	***By Association*** *(WA)*	***By IBRA Region*** *(Coolgardie)*	***By IBRA Sub-region*** *(Eastern Goldfield)*	***By LGA*** *(Shire of Coolgardie)*
	924,675*	698,752**	586,792.23**	310,897.74**	359,122.73**
% Pre-European Extent Remaining	*96.46%**	*96.84%***	*99.58%***	*99.22%***	*99.32%***
Surrounding Land Use***	Mining, Exploration, Prospecting, Pastoral Lease				
Weed prevalence***	Low				

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

Table 7: Summary of information regarding Pre-European and current vegetation extent of vegetation association 1413 within the survey area

Factor	**Value**				
Beard Vegetation Association*	1413				
Vegetation Association Description*	Shrublands; *Acacia*, *Casuarina* & *Melaleuca* thicket				
Pre-European Extent (ha)	**Scale**				
	By Association *(WA)*	***By Association*** *(WA)*	***By IBRA Region*** *(Coolgardie)*	***By IBRA Sub-region*** *(Eastern Goldfield)*	***By LGA*** *(Shire of Coolgardie)*
	1,981,503*	1,679,916.32**	1,061,212.28**	107,974.55**	334,488.08**
% Pre-European Extent Remaining	*67.05%**	*76.60%***	*98.24%***	*99.77%***	*99.93%***
Surrounding Land Use***	Mining, Exploration, Prospecting, Pastoral Lease				
Weed prevalence***	Low				

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

4.1.6 Wetlands

No water bodies were identified within the survey area via the CPS Map Viewer. The closest waterbody lies 24 km to the southeast from the survey area (DWER, 2021).

4.1.7 Dieback

The survey area receives average annual rainfall of approximately 264.9mm (BOM, 2021). There is no record of *Phytophthora cinnamomi* establishing in natural ecosystems in regions receiving less than 400mm of rainfall per annum (CALM, 2003).

Given the above, 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 33 sites/quadrats are presented in Appendix F. For each of these sites, 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

Eleven vegetation groups were identified during this survey, largely following topographical features and dominant species. Table 8 summarises the vegetation group extent and relative Quadrat and flora information. Mapping of the 11 vegetation groups, as well as the quadrat locations can be seen in Appendix C, Maps 4 and 5. Photographs of each quadrat and the relevant vegetation group can be seen in Appendix F. The Vegetation Group Code in Table 8 below is synonymous to the 2019 reconnaissance flora and vegetation survey report (NVS, 2019).

Table 8: Vegetation Group Extent within Survey Area

Vegetation Group	Vegetation Group Code	Quadrats	Family	Genus	Species	Area (ha)	Percentage of Survey Area (%)
Transitional *Eucalyptus* Woodland over mixed shrubland	A	Q1, Q2, Q3, Q4, Q22, Q27	20	31	75	63.12	4.39
Mixed *Eucalyptus* woodland over sclerophyll shrubland on undulating hills	B	Q5, Q6, Q7, Q26, Q28	23	31	55	62.91	4.37
Acacia acuminata shrubland with emergent *Eucalyptus griffithsii*	C	Q10, Q33	15	30	40	1.27	0.09
Open *Eucalyptus salmonophloia* woodland	D	Q11, Q12, Q13, Q14	13	23	50	0.42	0.03
Eucalyptus lesouefii and *Eucalyptus gracilis* on rocky hill slopes	G	Q16	8	14	25	3.99	0.28
Mixed *Eucalyptus* over *Melaleuca sheathiana* shrubland	H	Q17, Q18, Q19	12	21	36	64.58	4.49
Eucalyptus ravida woodland	I	Q15, Q20, Q21, Q29	14	25	51	8.12	0.56
Mixed *Eucalyptus* woodland over sclerophyll shrubland with *Eremophila acutifolia* (P3) on undulating hills	K	Q30, Q31	12	18	30	21.08	1.47
Eucalyptus gracilis woodland	N	Q23	10	13	22	502.98	34.97
Eucalyptus griffithsii woodland	R	Q24, Q25	13	26	40	665.02	46.23
Acacia quadrimarginea shrubland on undulating hills	X	Q8, Q9, Q32	22	29	41	44.87	3.12
		Total	**31***	**72***	**148***	**1438.36#**	**100#**

*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 used to determine the similarities or differences between and within the delineated vegetation groups. The results are supplied below in Figure 4 and Figure 5 as dendrograms. Dendrograms demonstrate the hierarchical relationship between objects.

Quadrats representing similar vegetation groups (as depicted in field work by NVS) are based on species composition, density, topographical features and/or lithology. The PATN analysis does not take these factors into account, and only demonstrates similarities based on presence/absence data within each quadrat. Therefore, PATN analysis groupings are not necessarily distinct, when defining vegetation groups. Hence quadrats depicted as outliers are expected when variations in species composition occurs between quadrats of the same predetermined vegetation grouping.

The PATN analysis dendrogram of the dominant species in Figure 4, displays each quadrat with like symbols representing the 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). Outliers are quadrats that do not show a good association with other quadrats in the same NVS mapped vegetation group.

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 represented via dominant species, with Q1, Q22 and Q27 grouped together in the PATN Analysis. Q2, Q3, and Q4 were considered outliers, as Q3 compared more similarly to Q5 from Vegetation Group D, Q2 was grouped with Vegetation Group I, and Q4 compared more similarly to Q23 (Vegetation Group N) and Q26 (Vegetation Group B).

When all species were analysed via PATN, Q2, Q4, Q22 and Q24 were most similar, grouped alongside Vegetation Groups D, G and I, as well as Q17. The three remaining Quadrats from Vegetation Group A were segregated.

Vegetation Group A is quite vast and varied due to the intricate transition of upper-storey (*Eucalyptus* spp.) and lower-storey species. The delineation of these dominant species is almost impossible to map, hence the name of the vegetation group. The present/absent data analysed by PATN shows some outliers due to the variation of these dominant species, and their similarity to other Vegetation groups which were more obvious standalone vegetation groups.

Similarly to Vegetation Group A, Vegetation Group B was quite an expansive and varied vegetation group, however the lower-storey species and topographical feature determined this vegetation group more readily from others. In the dominant species PATN analysis Q6, Q7 and Q28 were compared most similarly to Q1, Q22 and Q27 from Vegetation Group A and Q17 (Vegetation Group H). Q5 compared most similarly to outlier Q3, while Q26 compared most similarly to Vegetation Group N and outlier Q4. In the all species PATN analysis Q5, Q6 and Q28 compared most similarly to outliers Q1 and Q18, while Q26 compared most similarly to Q30, and Q7 formed its own group. These outliers can be mostly attributed to the varied upper storey species (*Eucalyptus* spp.).

Vegetation Group C was well represented by dominant species via PATN analysis, but not well represented in the all species PATN analysis. Q10 compared more similarly to Vegetation Group R and Q33 formed its own group. Therefore, the dominant species of Vegetation Group C are

more distinct to this group, while the all species PATN analysis suggests the composition of species grouped in Vegetation Group C are less distinct to this group.

Vegetation Group D was not well represented via dominant species PATN analysis with Q12 and Q13 comparing most similarly to Vegetation Group R, Q11 comparing most similarly to Vegetation Group G, and Q14 forming its own group. In the all species PATN analysis, Vegetation Group D was considered significantly similar to Vegetation Groups G and I, as well as quadrats from Vegetation Groups A and H. *Eucalyptus salmonophloia* is a very common species and was recorded in five additional quadrats outside of the Vegetation Group D defined by NVS, as both a dominant and non-dominant species, (depending on the vegetation group). Hence, PATN displayed an unweighted bias of present/absent data and did not take into account the topographical/lithological features of each vegetation group or the density of other significant species within the quadrats, that help to define each vegetation group.

Vegetation Group G was considered most similar to outlier Q11 via dominant species PATN analysis. In the all species PATN analysis, Vegetation Group G was grouped alongside Vegetation Groups D and I, as well as quadrats from Vegetation Groups A and H. This vegetation group was geographically smaller than other vegetation groups and was only able to be represented by one quadrat, and perhaps was not statistically differentiated from other more varied vegetation groups like Vegetation Group A.

Vegetation Group H was represented via dominant species PATN analysis with Q18 and Q19 forming a group, while Q17 was compared most similarly to Q1, Q22 and Q27 (Vegetation Group A) and Q6, Q7 and Q28 (Vegetation Group B). Vegetation Group H was not well represented via all species PATN analysis. Q19 formed its own group, Q18 compared most similarly with quadrats from Vegetation Group B and outlier Q1, and Q17 was considered significantly similar to Vegetation Groups D, G and I, as well as quadrats from Vegetation Group A. Again the statistical analysis via PATN did not account for the density of dominant species that determine this group, suggesting that the composition is similar to other vegetation groups, however is mapped separately based on the density of dominant species.

Vegetation Group I was well represented via dominant species PATN analysis and all species analysis, with all quadrats grouped together.

Vegetation Group K was well represented via dominant species PATN analysis with both quadrats forming one group. In the all species PATN analysis Q30 compared most similarly to outlier Q26 (Vegetation Group B), while Q31 was an outlier comparing most similarly to Vegetation Group N. The transitional variation of the upper-storey species may have attributed to this analysis.

Vegetation Group N was considered most similar to outliers Q4 (Vegetation Group A) and Q26 (Vegetation Group B) via the dominant species PATN analysis, while in the all species PATN analysis Vegetation Group N compared most similarly to outlier Q21 (Vegetation Group I). This vegetation group was considered a separate group due to the density/dominance of the upper storey species (*Eucalyptus gracilis*) however PATN analysis produced some anomalies due to the unweighted nature of the analysis, and perhaps the variation of the understorey species.

Vegetation Group R was well represented by both PATN analyses. However, in the dominant species analysis Vegetation Group R was grouped alongside outliers Q12 and Q13 from Vegetation Group D, and in the all species analysis Vegetation Group R was grouped alongside outlier Q10 from Vegetation Group C. This vegetation group was considered a separate group due to the density/dominance of the upper storey species (*Eucalyptus griffithsii*) however PATN analysis produced some anomalies due to the unweighted nature of the analysis, and perhaps the variation of the understorey species.

Vegetation Group X was well represented by dominant species via PATN analysis. When all species were analysed via PATN analysis Q8 and Q32 were grouped together, and Q9 was an

outlier. Again the unweighted nature of the presence/absence data did not take into account the dominance/density of the key species for this group.

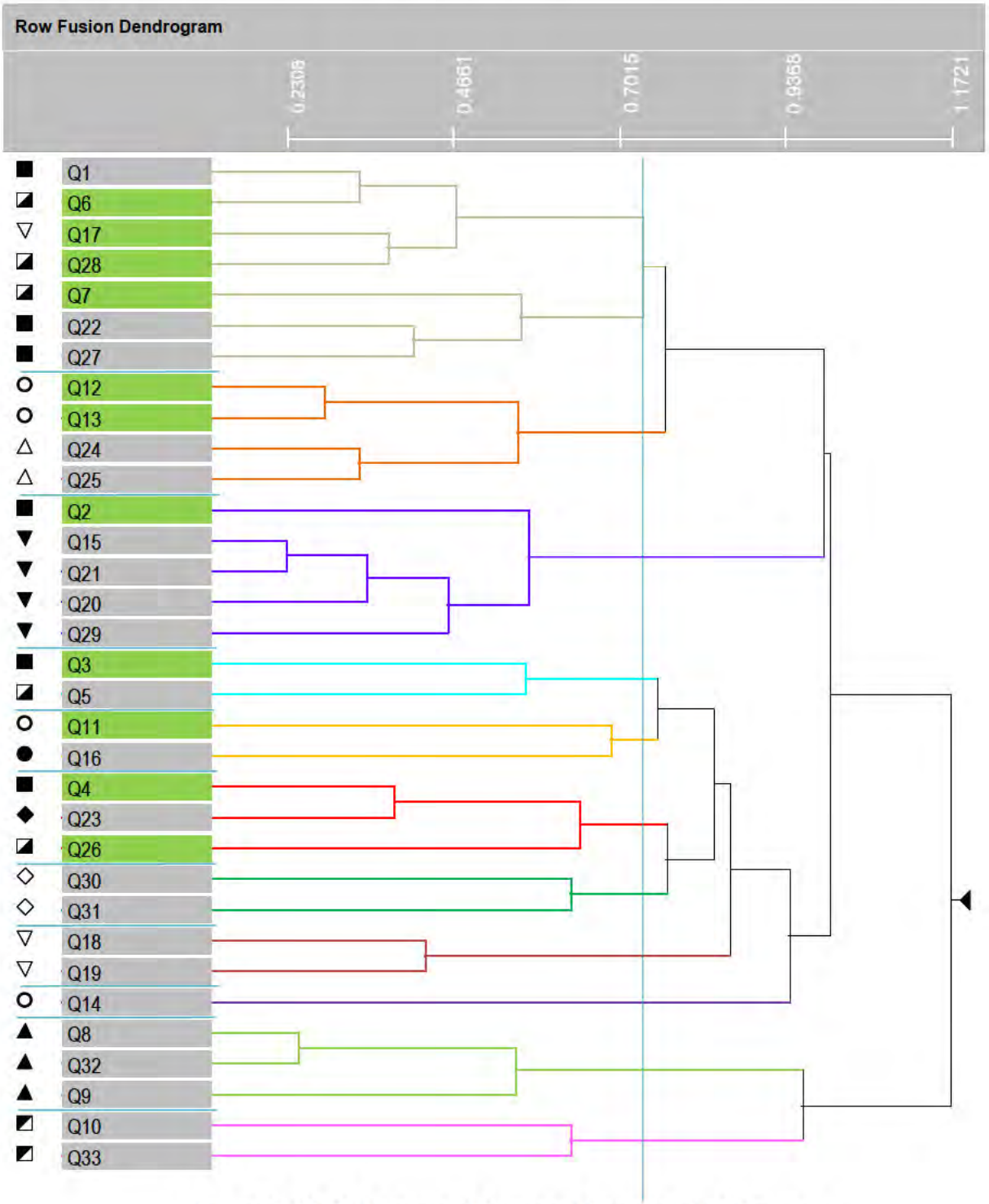

Figure 4: PATN Analysis of Dominant Species into 11 groups

The dendrogram below (Figure 5) 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). Outliers are quadrats that do not show a good association with other quadrats in the same NVS mapped vegetation group, which is expected due to the unweighted nature of PATN analysis, which does not take into account topographical/lithological features or the density of key species defining the vegetation group.

When comparing outliers of the PATN analysis of all species versus dominant species, there are greater outliers in the former. Therefore, the vegetation groups mapped by NVS demonstrate a reliance on dominant species within the quadrat as opposed to all species present.

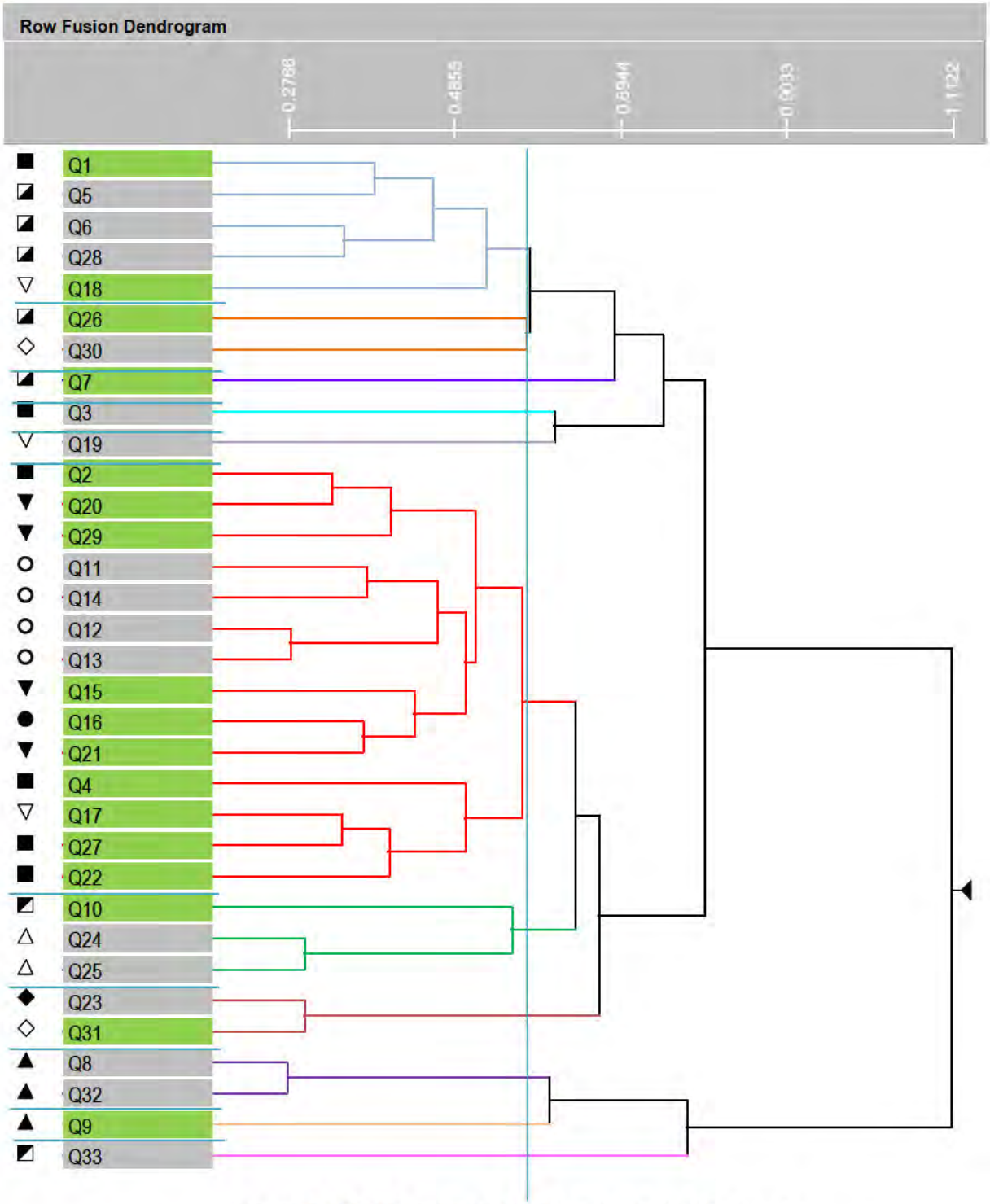

Figure 5: PATN Analysis of All Species into 11 groups

4.2.1.3 Vegetation Condition

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

In accordance with the Keighery (1994) scale, most of the sites/quadrats inspected were in Good to Very Good condition (Appendix F). Disturbed areas were present within the survey area, mostly attributed to access tracks and 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 was one non-native species recorded in the quadrats, and no non-native species recorded elsewhere within the survey area.

4.2.2 Flora of the Survey Area

4.2.2.1 General

One hundred and forty-eight species were recorded within the survey area with 130 species recorded within quadrats. Thirty-one families and 72 genera were recorded overall. These are listed in Appendix E, per Quadrat as well as per vegetation group. Of the native species, Chenopodiaceae had the highest representation, with 27 species from 10 genera. The next best represented families were Myrtaceae and Scrophulariaceae each with 18 species.

Of the 148 taxa recorded one was an introduced weed species. *Oncosiphon suffruticosum* (Calomba daisy) was recorded in quadrat 12. This species is not listed as a declared pest in the state of Western Australia by DPIRD (2022).

The most common and widespread species were *Exocarpos aphyllus* which was recorded within 30 quadrats, followed by *Ptilotus obovatus* and *Maireana trichoptera* which were both recorded within 26 quadrats.

Quadrat 4 had the richest species list with 36 taxa recorded.

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). The model assumed 33 random selections of sample order. This curve was then fitted to a logarithmic curve in Excel® (Figure 6). The logarithmic trend line and R^2 values were generated in Excel®. According to the Species Accumulation Curve below, the R^2 value (0.995) shows an acceptable fit for a logarithmic curve of the total accumulated species per number of quadrats established (Figure 6).

Sufficient sampling was inferred via the effort of intensity (number of quadrats established) versus the return of species collected (total accumulated species). From this fitted logarithmic curve formula, sufficient sampling was determined where the gain of new species was less than 1% for every new quadrat established. Based on this reasoning, sufficient sampling was reached at 27 quadrats, at which the extrapolated total accumulated number of species was 118. Therefore the 130 species collected within the 33 quadrats represents 105.84% of the predicted total abundance.

Hence sufficient quadrat sampling can be assumed for the survey area.

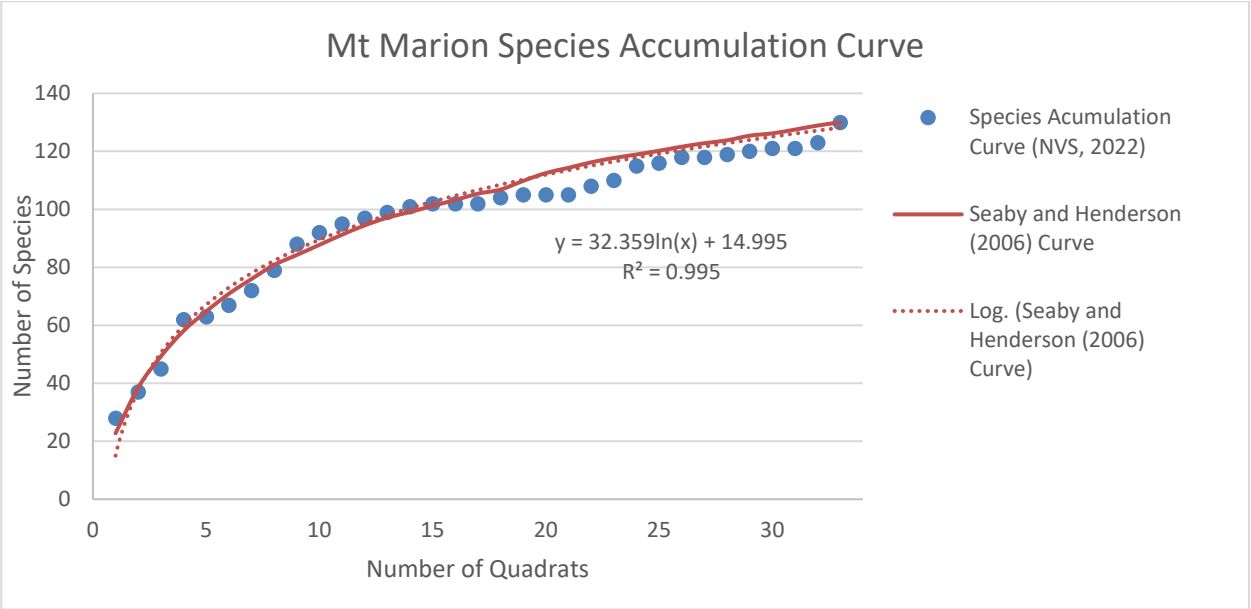

Figure 6: Species Accumulation Curve for the 33 sampled quadrats

4.2.2.3 Conservation significant species

There was one Priority and one Threatened flora recorded during the survey. The DBCA database searches had no records of these species occurring within a 20 km radius of the survey area (DBCA, 2021a).

The Threatened taxon recorded in the survey area (gazetted as Threatened pursuant to Section 5(1) of the *Biodiversity Conservation Act 2016*, and as Threatened pursuant to Schedule 1 of the *Environment Protection and Biodiversity Conservation Act 1999),* was *Seringia exastia (T).*

Seringia exastia (previous known as *Keraudrenia exastia*) was a species only known from the Kimberley Region. A recently completed taxonomic study that assessed genomic and morphological characters in several *Seringia* taxa (Binks et al. 2020) concluded that *Seringia exastia* and *S. elliptica* are the same species. The taxonomy of the genus has been revised to synonymise *S. exastia* and *S. elliptica* under the oldest valid name of *S. exastia*. Because *S. elliptica* was common and widespread throughout the Pilbara region, central WA, Northern Territory and also extends into South Australia, following the taxonomic revision, *S. exastia* is now considered common and widespread. When observing the regional extent of this species, all records are located north of Kalgoorlie in Western Australia. Hence, the location of this species within the survey area suggests that this species may have been introduced by earthworks machinery utilised whilst clearing vegetation for the construction of a Pastoral Station fence at this location.

A nomination to delist the species due to no plausible significant threats to the species has been prepared and considered by the WA Threatened Species Scientific Committee (TSSC). It is anticipated that at the next TSSC meeting, recommendations will be made to the Minister to delist. However, until changes are officially made to the threatened species list, *S. exastia* is still legally listed as threatened flora, and authorisation to take under section 40 of the *Biodiversity Conservation Act 2016* is still required. Although some loss of plants is likely to have occurred and will continue to occur during mining and road works in some parts of the species' distribution, this is not expected to be significant in the context of the entire population. Therefore, there should be no impediments to granting authorisation, following the standard process of application made to DBCA's Species and Communities Program.

Priority flora *Eremophila acutifolia* (P3) was found in Quadrats 30 and 31. Both populations were dominant lower stratum species. *Eremophila acutifolia* (P3) is both widespread and found in large

numbers throughout the local and regional area and is well documented by previous flora surveys. Recorded locations range from Coolgardie, Norseman, Kambalda, Widgiemooltha and Madoonia Downs.

Population numbers and GPS locations of priority flora recorded within the survey area are included in Table 9 below. This data is also included in the IBSA Data Package.

Table 9: Priority flora recorded in Quadrats within the survey area

Taxon	Abundance	Total observed	Date of observation	Longitude	Latitude	Location
Eremophila acutifolia (P3)	45	231	14/10/2021	121.43819	-31.06226	Q30
Eremophila acutifolia (P3)	186		14/10/2021	121.43580	-31.06497	Q31
Seringia exastia (T)	1	1	14/10/2021	121.36896	-31.08042	Western extent of survey Area

Data from the NVS (2019) survey is included in table 10 below to compare local numbers of *Eremophila acutifolia* (P3) with the current survey area. The NVS survey in 2019 included a local search/count of Priority flora that occurred in the greater Mt Marion Project Area. The number of plants of *Eremophila acutifolia* (P3) counted within the survey area represents approximately 7.39% of the wider local population recorded by NVS (2019).

Table 10: Local Priority Flora Population numbers to be affected by proposed clearing

Taxon	Population abundance inside survey area	Population abundance outside survey area	Total population abundance	% of population within survey area (%)
Eremophila acutifolia (P3)	674	380	1054	63.95%
Eremophila acutifolia (P3)	171	122	293	58.36%
Eremophila acutifolia (P3)	736	19,814	20,048	3.67%
Total	**1581**	**19814**	**21395**	**7.39%**

4.2.2.4 Introduced species

The introduced weed species *Oncosiphon suffruticosum* (Calomba daisy) was recorded at Quadrat 12. This species is not listed as a declared plant by DPIRD (2021).

4.3 ASSESSMENT OF THE CLEARING PRINCIPLES

The DMIRS and DWER assess clearing permits against ten principles relating to the effect of clearing. NVS submits the following comments regarding the clearing principles specifically related to Native Vegetation.

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

One hundred and forty-eight species were recorded within the survey area with 130 species recorded within quadrats. Thirty-one families and 72 genera were found. Species composition and vegetation types within the application area are typical of the local region and not considered to be unusually diverse. Based on the low level of disturbance, the lack of fragmentation of vegetation and vegetation condition generally rated as 'Good' to 'Very Good' on the Keighery scale (Keighery, 1994), the area proposed to be cleared is not considered to be remnant vegetation.

No Threatened or Priority Ecological Communities were identified within the survey area.

One weed species was identified within the survey area and is therefore not considered to be a significant threat to biodiversity in the area. Weeds have the potential to significantly change the dynamics of a natural ecosystem and lower the biodiversity of an area.

Based on the above, the proposed clearing is not likely to be at variance to this Principle.

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

Not addressed in this assessment.

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

The DBCA database searches revealed a potential for one Threatened and 22 Priority Flora species to occur within a 20 km radius of the survey area (DBCA, 2021a). None of these known locations of Threatened or Priority Flora occur within the survey area, with the closest Threatened Flora and the closest Priority Flora located approximately 19 km south and 1 km south of the survey area respectively.

NVS recorded one Priority and one Threatened flora recorded during the survey.

Threatened flora *Seringia exastia (T)* was identified within the survey area. Because *S. exastia* is still legally listed as threatened flora, an authorisation to take under section 40 of the *Biodiversity Conservation Act 2016* is still required. However, there should be no impediments to granting authorisation, following the standard process of application made to DBCA's Species and Communities Program, as this species is considered both common and widespread. Although some loss of plants is likely to occur, this is not expected to be significant in the context of the entire population.

Priority flora *Eremophila acutifolia* (P3) was found in Quadrats 30 and 31. Both populations were dominant lower stratum species. This species is both widespread and in large numbers throughout the local and regional area and is well documented by previous flora surveys. Recorded locations range from Coolgardie, Norseman, Kambalda, Widgiemooltha and Madoonia Downs. Using data from the NVS (2019) survey to compare local numbers of *Eremophila*

acutifolia (P3) with the current survey area, the survey area contains less than 7.39% of the wider local population, and hence clearing is unlikely to have an impact on the conservation significance of this species.

Based on the above, the proposed clearing is not likely to be at variance to 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

There are no known Threatened or Priority Ecological communities previously recorded in the survey area and none were recorded in this survey.

Based on the above, the proposed clearing is not likely to be at variance to 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

As demonstrated in section 4.1.4, four beard vegetation associations fall within the survey area, each with less than 1% of the total association extent inside the survey area at all scales. All four vegetation associations are above the 30% threshold of their known spatial area remaining post European settlement at a state, bioregional and subregional level, and are not adversely affected by extensive clearing.

Based on the above, the proposed clearing is not likely to be at variance to 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

The survey area contains no watercourses or wetlands. The closest waterbody lies 24 km to the southeast from the survey area (DWER, 2021).

Based on the above, the proposed clearing is not likely to be at variance to this Principle.

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

Not addressed in this assessment.

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

No conservation areas occur within the survey area.

The DBCA managed Yallari Timber Reserve 5(1)(h) is separated from the survey area by the Coolgardie-Esperance Highway. This Timber Reserve is vested with the Conservation Commission for the purpose of Timber Production, however, is considered by the DBCA as an area for the conservation of flora and fauna.

Given the distance of the survey area from the nearest conservation area, the proposed clearing is not likely to prevent a significant ecological linkage and is not likely to impact the environmental values of the conservation area.

Based on the above, the proposed clearing is not likely to be at variance to 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

Not addressed in this assessment.

5 DISCUSSION

The survey area is located within the Eastern Goldfields subregion (CALM, 2002). Results of this survey indicate that the majority of the flora within the survey area is not unique and is in fact common throughout the Eastern Goldfields subregion and adjoining regions.

One hundred and forty-eight species were recorded within the survey area with 130 species recorded within quadrats. Thirty-one families and 72 genera were found. These are listed in Appendix E, per Quadrat as well as per vegetation group. Of the native species, Chenopodiaceae had the highest representation, with 27 species from 10 genera. The next best represented Family were Myrtaceae and Scrophulariaceae each with 18 species.

Of the 148 taxa recorded one was an introduced weed species. *Oncosiphon suffruticosum* (Calomba daisy) was recorded in Quadrat 12. This species is not listed as a declared pest in the state of Western Australia by DPIRD (2021).

The most common and widespread species were *Exocarpos aphyllus* which was recorded within 30 quadrats, followed by *Ptilotus obovatus* and *Maireana trichoptera* which were both recorded within 26 quadrats.

Quadrat 4 demonstrated the largest species richness with 36 taxa recorded from within a single site.

The DBCA database searches revealed a potential for one Threatened and 22 Priority Flora species to occur within a 20 km radius of the survey area (DBCA, 2021a). No known locations of Threatened or Priority Flora occur within the survey area, with the closest Threatened Flora and the closest Priority Flora located approximately 19 km south and 1 km south of the survey area respectively.

There was one Priority and one Threatened flora recorded during the survey. Threatened flora *Seringia exastia (T)* was identified within the survey area and is gazetted as Threatened pursuant to Section 5(1) of the *Biodiversity Conservation Act 2016*, and as Threatened pursuant to Schedule 1 of the *Environment Protection and Biodiversity Conservation Act 1999.* A nomination to delist the species (due to no plausible significant threats) has been prepared by the WA Threatened Species Scientific Committee (TSSC) for the Minister to consider. However, until changes are officially made to the threatened species list, *S. exastia* is still legally listed as threatened flora, and authorisation to take under section 40 of the *Biodiversity Conservation Act 2016* is still required. Although some loss of plants is likely to have occurred and will continue to occur during mining and road works in some parts of the species' distribution, this is not expected to be significant in the context of the entire population. Therefore, there should be no impediments to granting authorisation, following the standard process of application made to DBCA's Species and Communities Program.

Priority flora *Eremophila acutifolia* (P3) was found in Quadrats 30 and 31. This species is both widespread and in large numbers throughout the local and regional area and is well documented by previous flora surveys. Recorded locations range from Coolgardie, Norseman, Kambalda, Widgiemooltha and Madoonia Downs. Using data from the NVS (2019) survey to compare local numbers of *Eremophila acutifolia* (P3) with the current survey area, clearing within the proposed survey area will likely affect approximately 7.39% of the local population.

The PEC/TEC search revealed no PEC/TECs within the survey area (DBCA, 2021).

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

Given the above it is not expected that the proposed clearing will result in significant impacts such as vegetation fragmentation or the loss of vegetation associations or species that may be unique. This is partially due to the relevant size of the proposed clearing in comparison to similar abundant vegetation and habitat represented and retained outside of the survey area.

IMPACT ASSESSMENT

5.1 THREATENING PROCESSES

The processes that may impact the Flora within the survey area as a result of the proposed clearing include:

- Localised vegetation clearing resulting in a reduction in biodiversity in the immediate area, however it is adequately represented in the surrounding vegetation in the local area and region
- Vehicle use damaging vegetation if existing tracks are not adhered to
- The introduction and increased abundance of 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.

6 CONCLUSIONS

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

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. The survey area lies to the northeast of the Yallari Timber Reserve and is separated from the survey area by the Coolgardie-Esperance Highway. No PEC/TECs were recorded in the survey area.

There was one Priority and one Threatened flora recorded during the survey. Clearing within the survey area that directly affects these species will not significantly impact on the conservation significance of either.

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 Goldfields subregion and adjoining regions, and therefore the loss of a small proportion from this area will not be significant.

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8 GLOSSARY

Acronyms:

BAM Act	*Biosecurity and Agriculture Management Act 2007,* Western Australia
BC Act	*Biodiversity Conservation Act 2016* (partly enacted), Western Australia
BOM	Bureau of Meteorology, Australian Government
BSc	Bachelor of Science
CALM	Department of Conservation and Land Management (now DBCA)
COO	Coolgardie Bioregion, IBRA
COO03	Eastern Goldfields Subregion, IBRA
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	*Environmental Protection Act 1986*, Western Australia
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth Act)
ESA	Environmentally Sensitive Area
GIS	Geographical Information System
ha	Hectare (10,000 square metres)
IBRA	Interim Biogeographic Regionalisation for Australia, DAWE
IUCN	International Union for the Conservation of Nature and Natural Resources – commonly known as the World Conservation Union
km	Kilometres
m	Metres
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
WAOL	Western Australian Organism List
WC Act	*Wildlife Conservation Act 1950*, Western Australia

Definitions:

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

T Threatened species:
Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the *Biodiversity Conservation Act 2016* (BC Act).

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

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

The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.

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

Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the *Wildlife Conservation (Specially*

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

EN Endangered species

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

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

VU Vulnerable species

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

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

Extinct species:

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

EX Extinct species

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

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

EW Extinct in the wild species

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

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

Specially protected species

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

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

MI Migratory species

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

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

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

CD Species of special conservation interest (conservation dependent fauna)

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

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

OS Other specially protected species

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

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

P <u>Priority Species</u>

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

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

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

Priority 1: Poorly known species

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

Priority 2: Poorly known species

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

Priority 3: Poorly known species

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

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

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

Appendix A - EPBC and Other Government Database Search Results

Australian Government
Department of Agriculture, Water and the Environment

EPBC Act Protected Matters Report

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

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

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

Report created: 05/11/21 19:47:51

Coordinates
Buffer: 1.0Km

Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	5
Listed Migratory Species:	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:	1
Regional Forest Agreements:	None
Invasive Species:	11
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 likely to occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	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 [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
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

Name	Threatened	Type of Presence
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 ibis		
Cattle Egret [59542]		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
Chrysococcyx osculans		
Black-eared Cuckoo [705]		Species or species habitat likely to occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea		
Grey Wagtail [642]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Yallari Timber Reserve	WA

Invasive Species	[Resource Information]

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

Name	Status	Type of Presence
Birds		
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Mammals		
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Equus asinus Donkey, Ass [4]		Species or species habitat likely to occur within area
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

Name	Status	Type of Presence
		habitat likely to occur within area
Plants		
Carrichtera annua Ward's Weed [9511]		Species or species habitat likely to occur within area

Caveat

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

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

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

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

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

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

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

- migratory and
- marine

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

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

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

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

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

Coordinates

-31.01756 121.40407,-31.01778 121.45049,-31.11412 121.50842,-31.11943 121.49091,-31.08174 121.3691,-31.08057 121.36774,-31.01756 121.40407

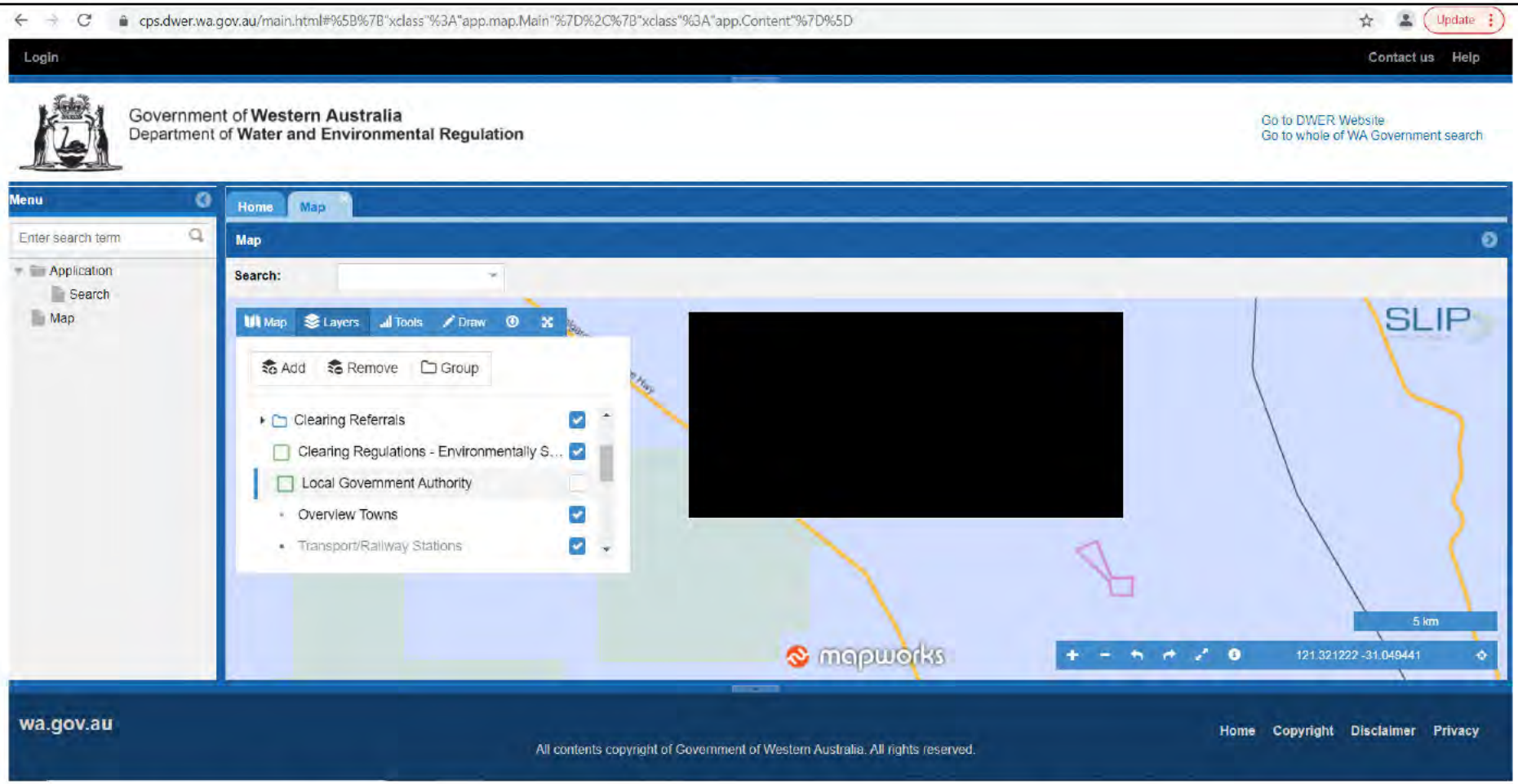
Acknowledgements

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

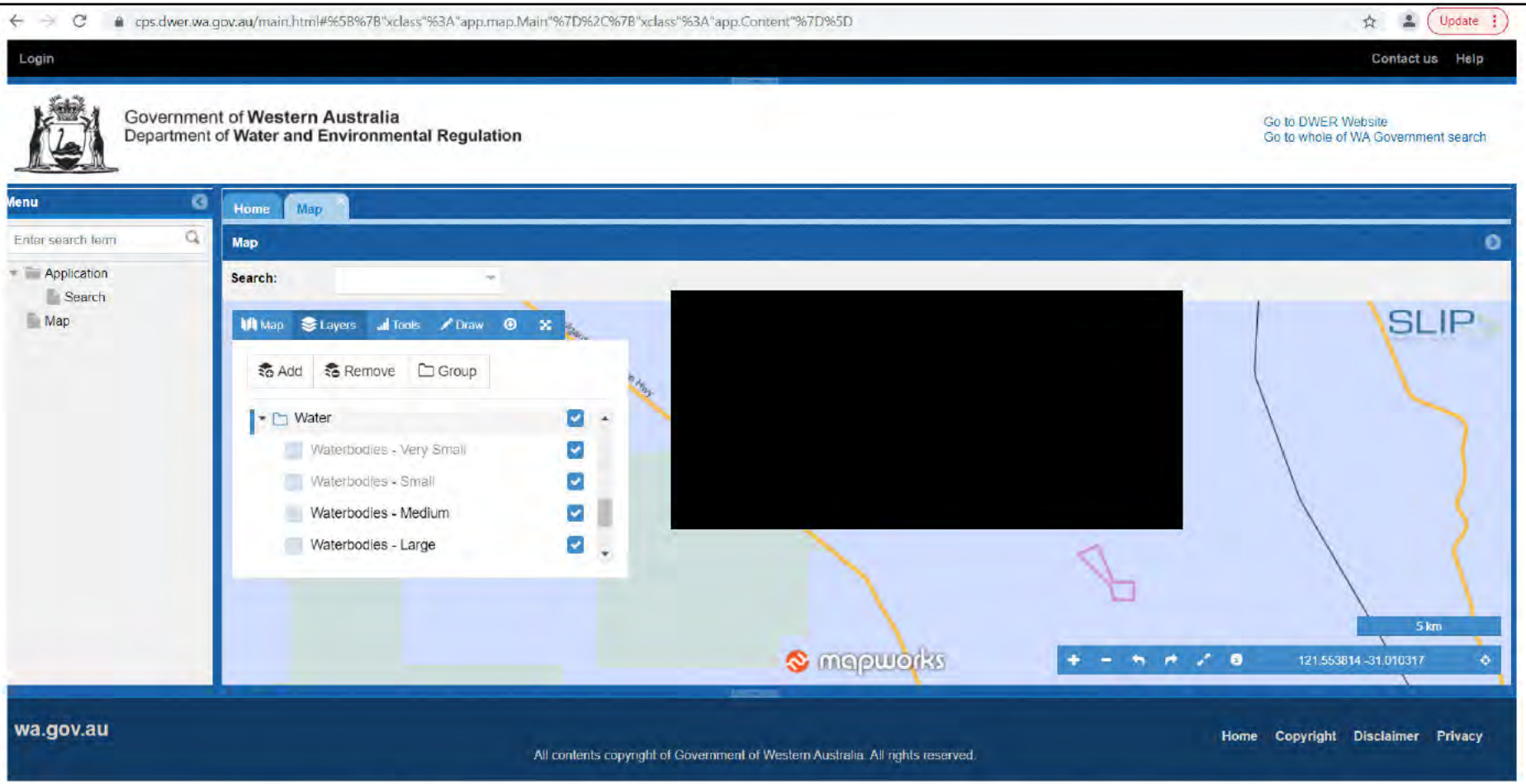
-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, 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 polygons) (DWER, 2021)



DWER CPS Map Viewer - showing no water bodies within the survey area (pink polygons) (DWER, 2021)

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.

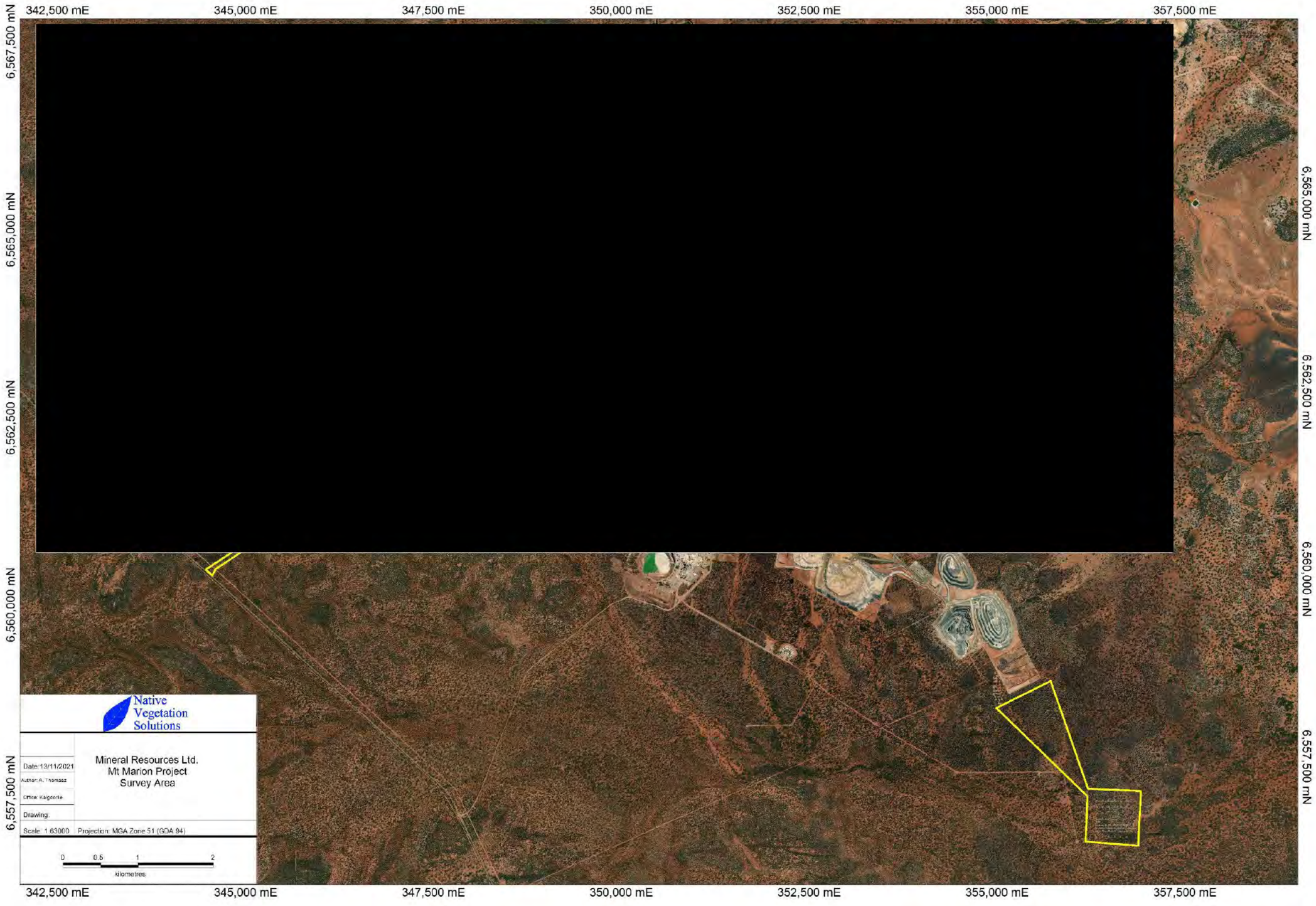
Degraded (5). Basic vegetation structure severely impacted by disturbance.
Scope for regeneration but not to a state approaching good condition without intensive management.
For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial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

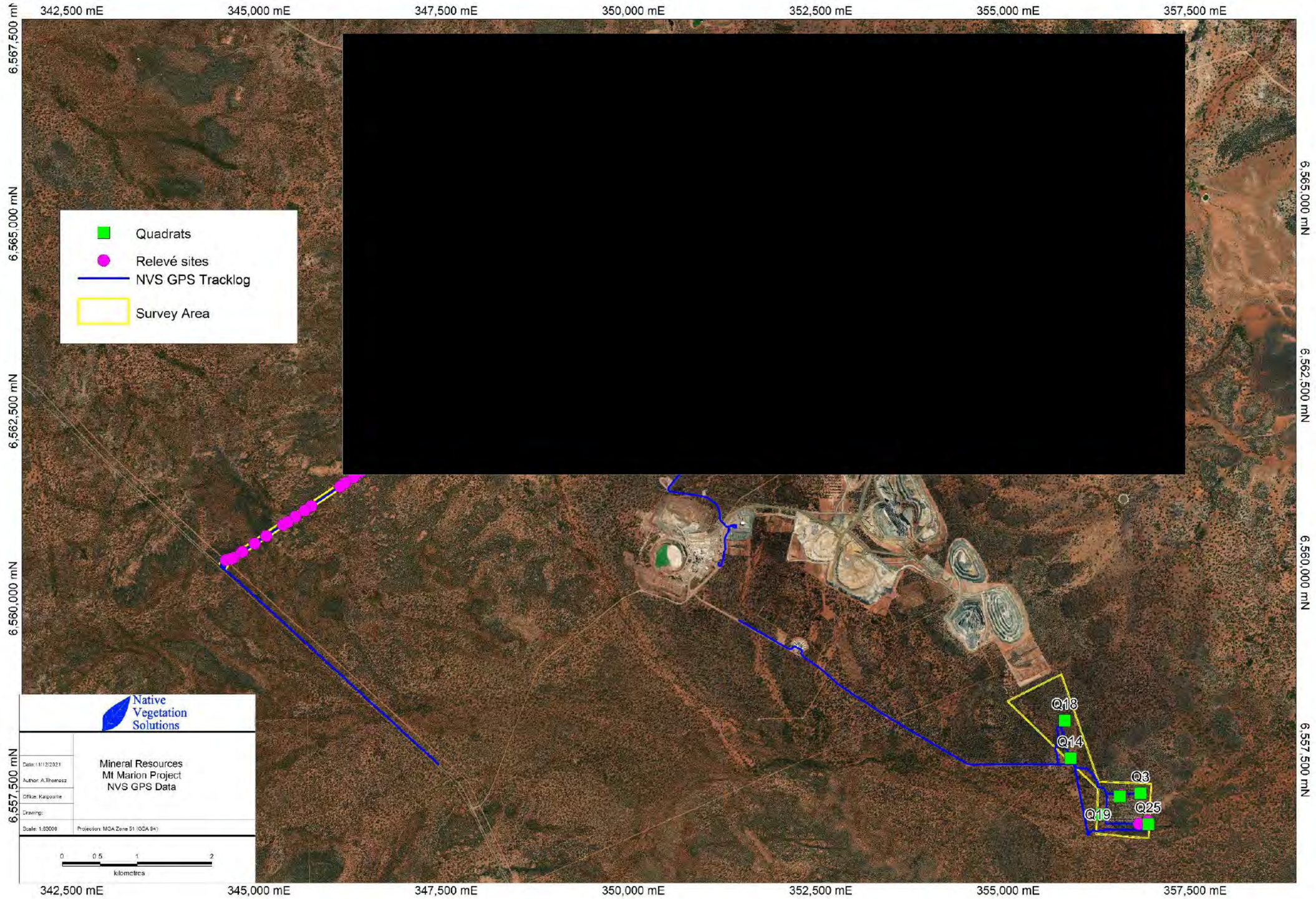
Vegetation Structure Definitions (Muir, 1977)

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

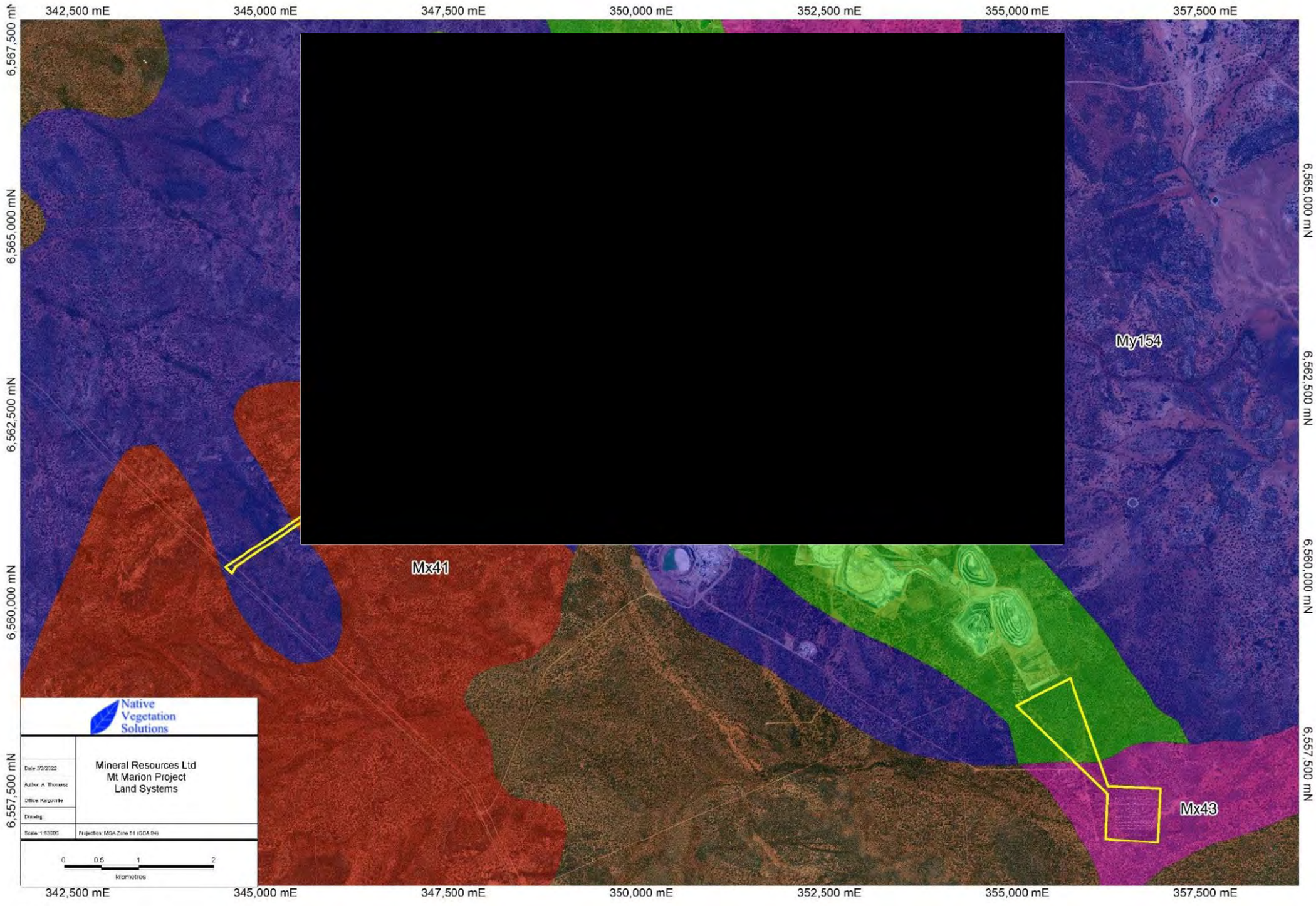
Appendix C - Mapping



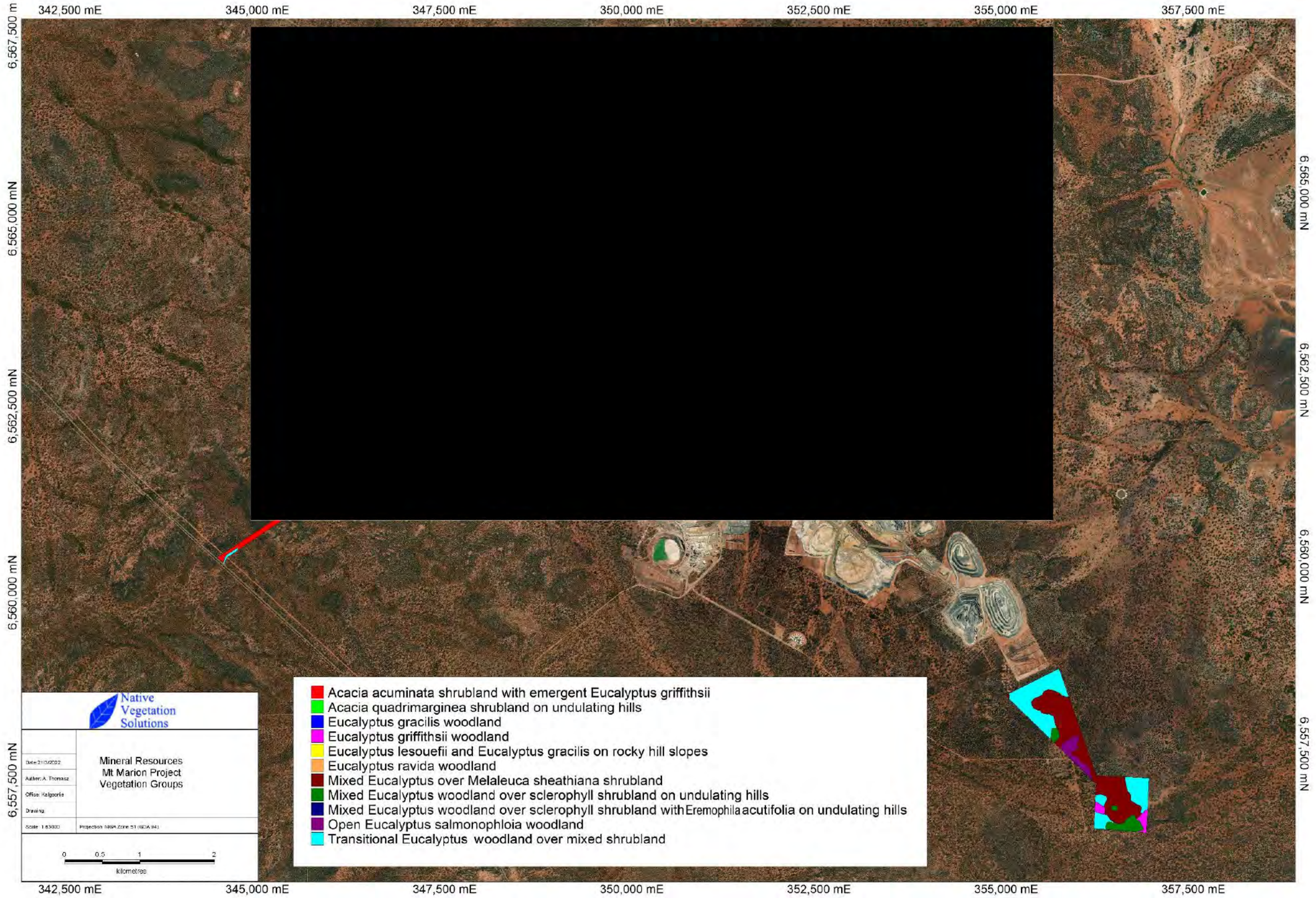
Map 1: Mt Marion Project Survey Area



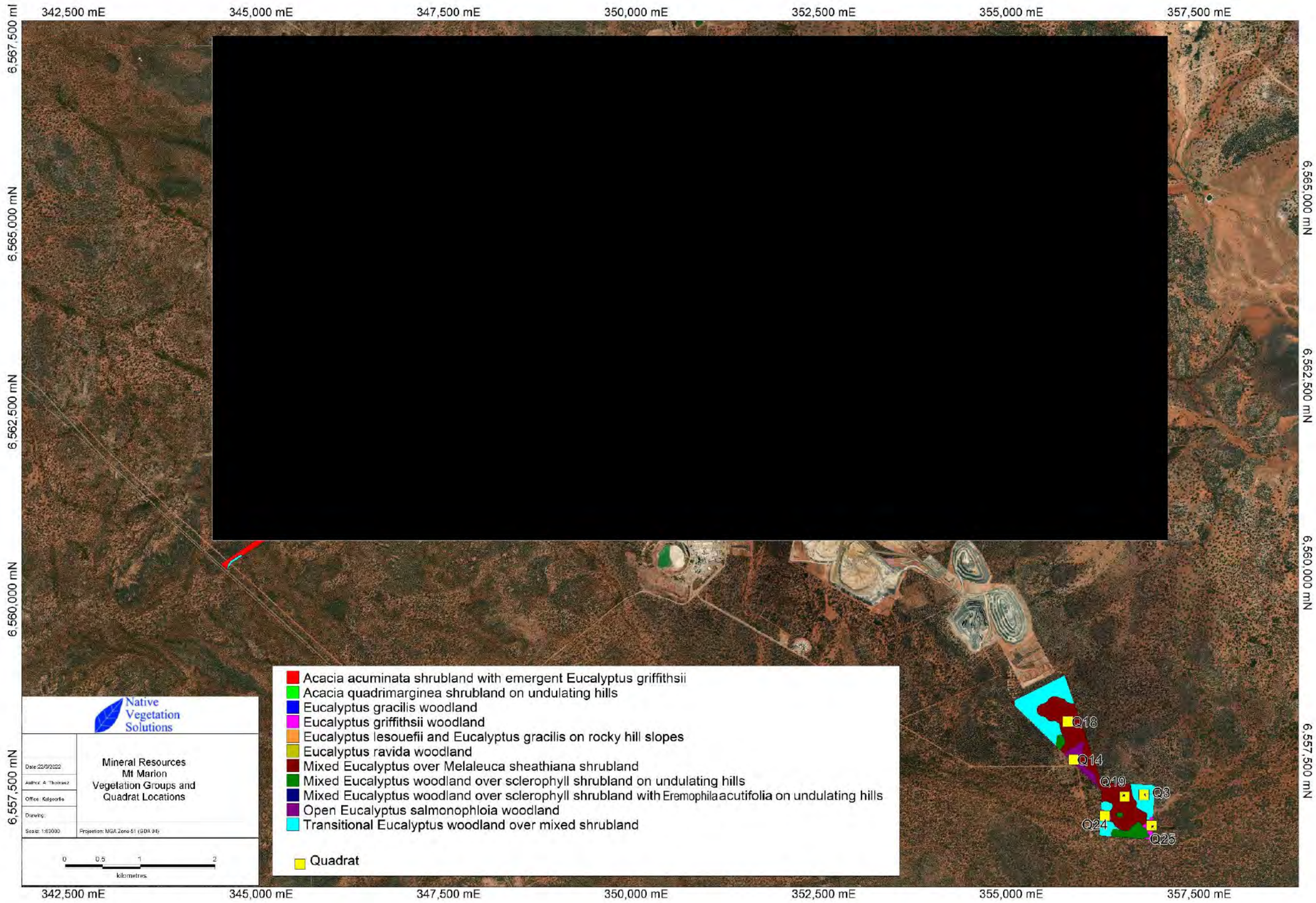
Map 2: NVS GPS Data for Mt Marion Project



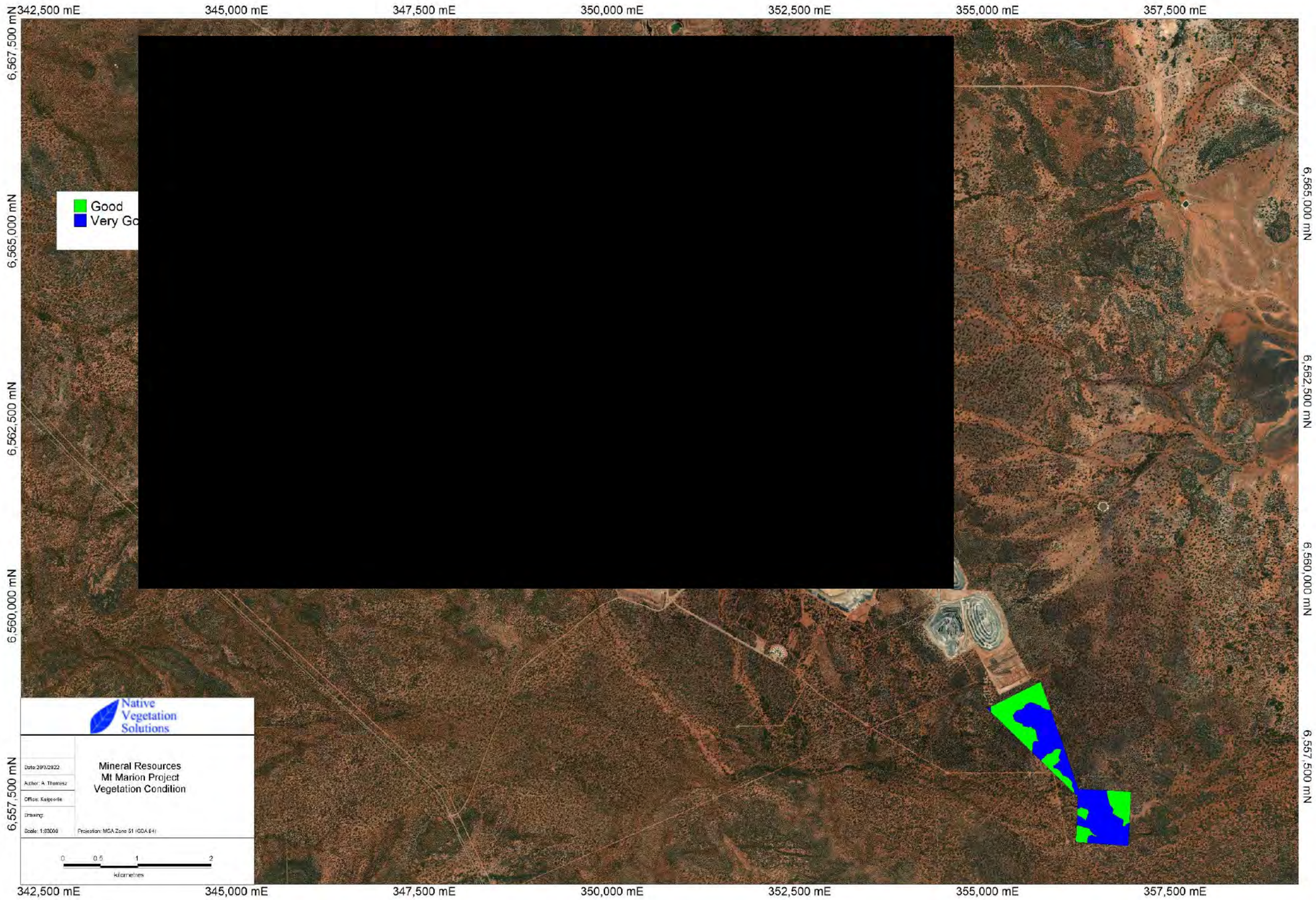
Map 3: Land Systems for Mt Marion Project



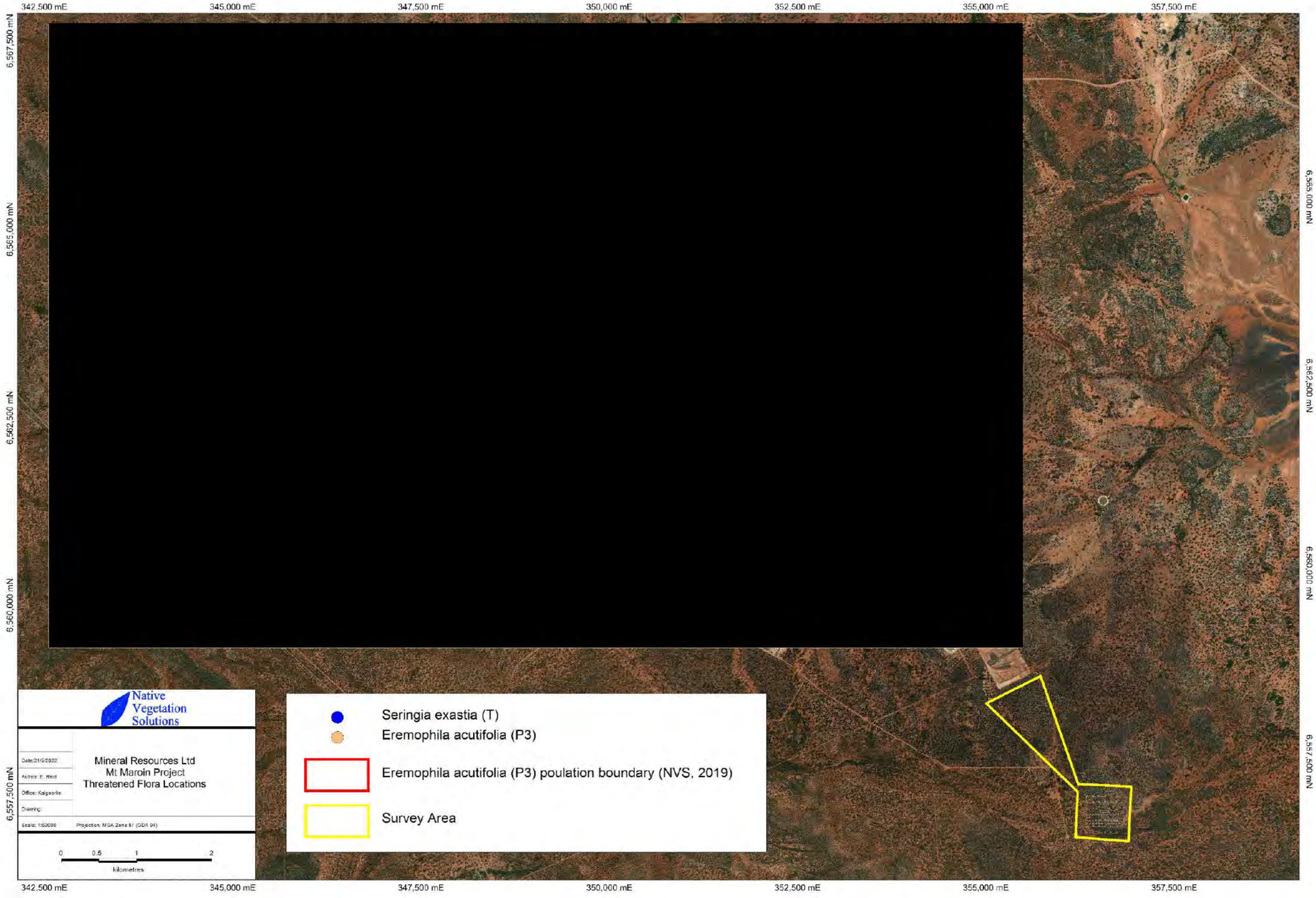
Map 4: Vegetation Groups for Mt Marion Project



Map 5: Vegetation Groups and Quadrat Locations for Mt Marion Project



Map 6: Vegetation Condition for Mt Marion Project



Map 7: Threatened Flora within Mt Marion Survey Area

Appendix D - Threatened Flora Database Search Results

TAXON	CONS CODE	Likelihood of occurring in survey area- Comment post field work
Acacia crenulata	P3	Unlikely- possible habitat however survey area searched extensively
Acacia kerryana	P2	Unlikely- possible habitat however survey area searched extensively
Acacia websteri	P1	Unlikely- possible habitat however survey area searched extensively
Allocasuarina eriochlamys subsp. grossa	P3	Unlikely- possible habitat however survey area searched extensively
Alyxia tetanifolia	P3	Unlikely- no suitable habitat
Austrostipa blackii	P3	Unlikely- possible habitat however survey area searched extensively
Austrostipa turbinata	P3	Unlikely- possible habitat however survey area searched extensively
Calandrinia lefroyensis	P1	Unlikely- possible habitat however survey area searched extensively
Cratystylis centralis	P3	Unlikely- no suitable habitat
Cyathostemon divaricatus	P1	Unlikely- possible habitat however survey area searched extensively
Goodenia salina	P2	Unlikely- no suitable habitat
Isolepis australiensis	P3	Unlikely- no suitable habitat
Lepidosperma sp. Kambalda (A.A. Mitchell 5156)	P2	Unlikely- possible habitat however survey area searched extensively
Lepidosperma sp. Parker Range (N. Gibson & M. Lyons 2094)	P1	Unlikely- possible habitat however survey area searched extensively
Notisia intonsa	P3	Unlikely- no suitable habitat
Phebalium clavatum	P2	Unlikely- no suitable habitat
Pterostylis xerampelina	P1	Unlikely- possible habitat however survey area searched extensively
Ricinocarpos digynus	P1	Unlikely- possible habitat however survey area searched extensively
Stylidium choreanthum	P3	Unlikely- possible habitat however survey area searched extensively
Styphelia rectiloba	P3	Unlikely- no suitable habitat
Tetratheca spenceri	T	Unlikely- no suitable habitat
Thryptomene planiflora	P1	Unlikely- possible habitat however survey area searched extensively
Phlegmatospermum eremaeum	P3	Unlikely- no suitable habitat

Appendix E - Species Recorded During the October 2021 Survey

Species List per Quadrat

Family	Genus	Taxon	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30	Q31	Q32	Q33
Aizoaceae	*Disphyma*	*Disphyma crassifolium*			*																														
Aizoaceae	*Gunniopsis*	*Gunniopsis propinqua*																													*				
Amaranthaceae	*Ptilotus*	*Ptilotus aervoides*				*											*			*															
Amaranthaceae	*Ptilotus*	*Ptilotus exaltatus*				*								*	*	*	*						*			*		*			*		*		
Amaranthaceae	*Ptilotus*	*Ptilotus obovatus*	*	*	*	*		*	*	*		*		*	*		*	*	*	*	*	*	*	*		*	*	*	*	*	*			*	*
Apocynaceae	*Alyxia*	*Alyxia buxifolia*				*	*	*	*	*					*	*									*			*		*		*		*	
Apocynaceae	*Leichhardtia*	*Leichhardtia australis*				*				*		*	*	*	*				*			*	*	*		*	*		*					*	
Asparagaceae	*Thysanotus*	*Thysanotus manglesianus*							*	*																									*	*
Asteraceae	*Calotis*	*Calotis hispidula*																								*									
Asteraceae	*Chrysocephalum*	*Chrysocephalum puteale*								*	*																							*	
Asteraceae	*Cratystylis*	*Cratystylis conocephala*			*	*	*																	*								*		
Asteraceae	*Cratystylis*	*Cratystylis subspinescens*														*		*																	
Asteraceae	*Olearia*	*Olearia muelleri*	*			*	*	*	*				*			*			*	*			*	*	*	*		*	*	*	*		*	*	
Asteraceae	*Olearia*	*Olearia pimeleoides*																								*									*
Asteraceae	*Oncosiphon*	*Oncosiphon suffruticosum**												*																					
Asteraceae	*Waitzia*	*Waitzia acuminata var. acuminata*																																	*
Boraginaceae	*Halgania*	*Halgania andromedifolia*	*					*																						*					
Casuarinaceae	*Allocasuarina*	*Allocasuarina campestris*									*																							*	
Casuarinaceae	*Casuarina*	*Casuarina pauper*	*				*						*																						
Chenopodiaceae	*Atriplex*	*Atriplex codonocarpa*		*										*								*									*				
Chenopodiaceae	*Atriplex*	*Atriplex nummularia subsp. spathulata*	*		*		*					*	*	*	*	*	*	*		*			*	*		*						*			
Chenopodiaceae	*Atriplex*	*Atriplex stipitata*			*											*										*	*								
Chenopodiaceae	*Atriplex*	*Atriplex vesicaria*	*		*		*						*	*		*	*	*	*		*	*	*					*							
Chenopodiaceae	*Chenopodium*	*Chenopodium gaudichaudianum*																		*			*												
Chenopodiaceae	*Dissocarpus*	*Dissocarpus paradoxus*																																	*
Chenopodiaceae	*Enchylaena*	*Enchylaena tomentosa var. tomentosa*										*	*	*	*		*	*	2	*		*	*		*	*					*		*		
Chenopodiaceae	*Eriochiton*	*Eriochiton sclerolaenoides*				*											*	*	*										*		*				
Chenopodiaceae	*Maireana*	*Maireana georgei*										*	*	*	*	*	*	*	*	*		*		*	*	*	*				*		*		
Chenopodiaceae	*Maireana*	*Maireana pentatropis*														*				*				*											
Chenopodiaceae	*Maireana*	*Maireana planifolia*													*																				
Chenopodiaceae	*Maireana*	*Maireana pyramidata*												*	*			*					*												
Chenopodiaceae	*Maireana*	*Maireana sedifolia*	*													*	*																		
Chenopodiaceae	*Maireana*	*Maireana thesioides*											*			*																			
Chenopodiaceae	*Maireana*	*Maireana tomentosa*	*	*	*	*	*					*		*	*	*		*	*	*		*	*	*	*	*			*		*		*		
Chenopodiaceae	*Maireana*	*Maireana trichoptera*	*	*		*	*	*					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
Chenopodiaceae	*Maireana*	*Maireana triptera*	*	*	*	*						*	*	*	*	*	*	*	*		*	*		*	*	*	*		*				*		
Chenopodiaceae	*Rhagodia*	*Rhagodia drummondii*	*	*	*	*							*		*	*	*	*		*		*	*			*	*	*							
Chenopodiaceae	*Rhagodia*	*Rhagodia eremaea*																							*										

Family	Genus	Taxon	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30	Q31	Q32	Q33
Chenopodiaceae	*Sclerolaena*	*Sclerolaena cuneata*				*							*		*	*									*				*		*		*		
Chenopodiaceae	*Sclerolaena*	*Sclerolaena densiflora*		*	*	*						*	*			*	*		*						*			*					*		
Chenopodiaceae	*Sclerolaena*	*Sclerolaena diacantha*	*	*	*	*							*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		
Chenopodiaceae	*Sclerolaena*	*Sclerolaena eriacantha*			*		*								*	*			*	*		*	*	*		*	*	*	*				*		
Chenopodiaceae	*Sclerolaena*	*Sclerolaena patenticuspis*													*	*						*							*						
Chenopodiaceae	*Tecticornia*	*Tecticornia disarticulata*			*											*																			
Convolvulaceae	*Wilsonia*	*Wilsonia humilis*																							*										
Euphorbiaceae	*Beyeria*	*Beyeria sulcata var. brevipes*																										*							
Euphorbiaceae	*Monotaxis*	*Monotaxis luteiflora*									*																								
Fabaceae	*Acacia*	*Acacia acuminata*									*	*												*			*							*	*
Fabaceae	*Acacia*	*Acacia eremophila var. eremophila*																																	*
Fabaceae	*Acacia*	*Acacia erinacea*	*	*			*	*	*				*									*		*				*	*	*	*	*			
Fabaceae	*Acacia*	*Acacia hemiteles*	*	*		*			*				*	*	*	*						*		*		*	*		*		*				
Fabaceae	*Acacia*	*Acacia heteroneura var. jutsonii*																																	*
Fabaceae	*Acacia*	*Acacia jennerae*																						*		*									
Fabaceae	*Acacia*	*Acacia ligulata*																						*											
Fabaceae	*Acacia*	*Acacia merrallii*																			*			*											
Fabaceae	*Acacia*	*Acacia quadrimarginea*								*	*																							*	
Fabaceae	*Acacia*	*Acacia tetragonophylla*				*				*		*	*																		*			*	
Fabaceae	*Daviesia*	*Daviesia aphylla*															*					*									*				
Fabaceae	*Senna*	*Senna artemisioides subsp. artemisioides*		*						*		*		*	*										*					*				
Fabaceae	*Senna*	*Senna artemisioides subsp. filifolia*	*	*			*	*				*		*	*	*			*	*				*	*	*	*	*	*	*	*	*		*	
Fabaceae	*Senna*	*Senna cardiosperma*				*																													
Fabaceae	*Swainsona*	*Swainsona canescens*																								*	*								
Frankeniaceae	*Frankenia*	*Frankenia pauciflora var. pauciflora*											*										*												
Frankeniaceae	*Frankenia*	*Frankenia setosa*			*											*																			
Goodeniaceae	*Goodenia*	*Goodenia berardiana*						*		*	*																								
Goodeniaceae	*Scaevola*	*Scaevola spinescens*	*			*	*		*	*	*		*	*		*		*	*	*		*	*	*				*	*	*		*		*	
Haloragaceae	*Haloragis*	*Haloragis trigonocarpa*				*					*	*												*											
Lamiaceae	*Prostanthera*	*Prostanthera althoferi subsp. althoferi*																																*	*
Lamiaceae	*Prostanthera*	*Prostanthera campbellii*								*	*																							*	
Lamiaceae	*Prostanthera*	*Prostanthera grylloana*																																	*
Lamiaceae	*Westringia*	*Westringia rigida*	*				*	*	*											*				*					*	*					*
Malvaceae	*Brachychiton*	*Brachychiton gregorii*																																*	
Myrtaceae	*Eucalyptus*	*Eucalyptus flocktoniae subsp. flocktoniae*	*	*																			*						*						
Myrtaceae	*Eucalyptus*	*Eucalyptus flocktoniae subsp. hebes*						*																											
Myrtaceae	*Eucalyptus*	*Eucalyptus gracilis*				*												*		*					*			*				*	*		
Myrtaceae	*Eucalyptus*	*Eucalyptus griffithsii*					*	*				*												*		*	*								*
Myrtaceae	*Eucalyptus*	*Eucalyptus lesouefii*			*	*	*	*										*		*	*									*					
Myrtaceae	*Eucalyptus*	*Eucalyptus oleosa subsp. oleosa*	*				*	*					*						*							*				*					

Family	Genus	Taxon	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30	Q31	Q32	Q33
Myrtaceae	*Eucalyptus*	*Eucalyptus ravida*		*													*					*	*		*			*			*		*		
Myrtaceae	*Eucalyptus*	*Eucalyptus salmonophloia*				*							*	*	*	*								*				*	*			*			
Myrtaceae	*Eucalyptus*	*Eucalyptus salubris*																										*							
Myrtaceae	*Eucalyptus*	*Eucalyptus stricklandii*							*																										
Myrtaceae	*Eucalyptus*	*Eucalyptus torquata*																												*					
Myrtaceae	*Eucalyptus*	*Eucalyptus transcontinentalis*		*																									*						
Myrtaceae	*Melaleuca*	*Melaleuca hamata*																																	*
Myrtaceae	*Melaleuca*	*Melaleuca sheathiana*						*											*	*	*									*		*			
Myrtaceae	*Thryptomene*	*Thryptomene australis subsp. brachyandra*																																	*
Poaceae	*Aristida*	*Aristida contorta*									*															*	*								
Poaceae	*Austrostipa*	*Austrostipa elegantissima*	*	*		*		*		*		*	*		*		*		*					*	*	2			*	*	*			*	*
Poaceae	*Austrostipa*	*Austrostipa nitida*		*															*					*		*					*				
Poaceae	*Austrostipa*	*Austrostipa scabra*				*				*	*	*			*		*		*					*	*	*	*		*				*	*	*
Poaceae	*Enneapogon*	*Enneapogon caerulescens*																								*	*				*				
Poaceae	*Eragrostis*	*Eragrostis dielsii*										*														*									
Poaceae	*Monachather*	*Monachather paradoxus*										*														*									
Poaceae	*Triodia*	*Triodia rigidissima*																									*								
Proteaceae	*Grevillea*	*Grevillea acuaria*							*																	*	*								
Pteridaceae	*Cheilanthes*	*Cheilanthes lasiophylla*									*																								
Pteridaceae	*Cheilanthes*	*Cheilanthes sieberi subsp. sieberi*									*																								
Rhamnaceae	*Trymalium*	*Trymalium myrtillus subsp. myrtillus*							*																					*					
Rutaceae	*Phebalium*	*Phebalium laevigatum*							*																										
Rutaceae	*Philotheca*	*Philotheca brucei subsp. brucei*									*																								
Santalaceae	*Exocarpos*	*Exocarpos aphyllus*	*	*	*	*	*	*	*	*	*		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*		*
Santalaceae	*Santalum*	*Santalum acuminatum*				*		*		*								*					*					*							
Santalaceae	*Santalum*	*Santalum spicatum*								*																								*	
Sapindaceae	*Dodonaea*	*Dodonaea lobulata*	*			*		*	*	*									*					*					*				*	
Sapindaceae	*Dodonaea*	*Dodonaea microzyga subsp. acrolobata*																						*											
Sapindaceae	*Dodonaea*	*Dodonaea viscosa subsp. angustissima*																								*									
Scrophulariaceae	*Eremophila*	*Eremophila acutifolia (P3)*																														*	*		
Scrophulariaceae	*Eremophila*	*Eremophila alternifolia*								*																								*	
Scrophulariaceae	*Eremophila*	*Eremophila caerulea subsp. caerulea*				*		*										*				*			*				*					
Scrophulariaceae	*Eremophila*	*Eremophila caperata*			*		*																												
Scrophulariaceae	*Eremophila*	*Eremophila decipiens subsp. decipiens*		*	*	*						*	*			*	*	*				*	*			*	*		*		*	*			
Scrophulariaceae	*Eremophila*	*Eremophila dempsteri*		*													*	*				*	*												
Scrophulariaceae	*Eremophila*	*Eremophila georgei*								*																									
Scrophulariaceae	*Eremophila*	*Eremophila glabra subsp. glabra*											*																	*	*				
Scrophulariaceae	*Eremophila*	*Eremophila granitica*									*																							*	*
Scrophulariaceae	*Eremophila*	*Eremophila interstans subsp. virgata*	*	*	*	*	*															*		*	*			*			*				
Scrophulariaceae	*Eremophila*	*Eremophila ionantha*				*							*			*						*	*			*	*							

Family	Genus	Taxon	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30	Q31	Q32	Q33
Scrophulariaceae	*Eremophila*	*Eremophila maculata subsp. brevifolia*				*																													
Scrophulariaceae	*Eremophila*	*Eremophila oldfieldii subsp. angustifolia*	*	*				*	*	*	*		*	*	*			*	*			*	*	*					*	*		*		*	
Scrophulariaceae	*Eremophila*	*Eremophila oppositifolia subsp. angustifolia*						*	*				*					*	*										*						
Scrophulariaceae	*Eremophila*	*Eremophila parvifolia subsp. auricampa*	*				*	*												*	*									*		*			
Scrophulariaceae	*Eremophila*	*Eremophila scoparia*	*	*	*	*	*	*					*	*	*	*	*	*		*		*	*			*	*	*	*		*	*			
Scrophulariaceae	*Myoporum*	*Myoporum platycarpum*																		*	*														
Solanaceae	*Lycium*	*Lycium australe*		*									*		*	*		*				*					*				*			
Solanaceae	*Solanum*	*Solanum lasiophyllum*								*	*													*			*							
Solanaceae	*Solanum*	*Solanum nummularium*	*					*							*								*	*				*					*	
Solanaceae	*Solanum*	*Solanum plicatile*									*																							
Thymelaeaceae	*Pimelea*	*Pimelea microcephala subsp. microcephala*				*				*																				*			*	
Zygophyllaceae	*Roepera*	*Roepera eremaea*	*			*				*															*					*			*	

Species List per Vegetation Group (Quadrat data including opportunistic sampled species - Identified in Bold type)

Family	Genus	Taxon	a	b	x	c	d	i	g	h	n	r	k
Aizoaceae	*Disphyma*	*Disphyma crassifolium*	*										
Aizoaceae	*Gunniopsis*	*Gunniopsis propinqua*						*					
Amaranthaceae	*Ptilotus*	*Ptilotus aervoides*	*					*		*			
Amaranthaceae	*Ptilotus*	*Ptilotus exaltatus*	*	*			*	*				*	*
Amaranthaceae	*Ptilotus*	*Ptilotus obovatus*	*	*	*	*	*	*	*	*		*	
Apocynaceae	*Alyxia*	*Alyxia buxifolia*	*	*	*		*				*		*
Apocynaceae	*Leichhardtia*	*Leichhardtia australis*	*		*	*	*	*		*		*	
Asparagaceae	*Thysanotus*	*Thysanotus manglesianus*		*	*	*							
Asteraceae	*Calotis*	*Calotis hispidula*										*	
Asteraceae	*Chrysocephalum*	*Chrysocephalum puteale*			*								
Asteraceae	*Cratystylis*	*Cratystylis conocephala*	*	*									*
Asteraceae	***Cratystylis***	***Cratystylis microphylla***		*									
Asteraceae	*Cratystylis*	*Cratystylis subspinescens*					*		*				
Asteraceae	*Olearia*	*Olearia muelleri*	*	*	*		*	*		*	*	*	*
Asteraceae	*Olearia*	*Olearia pimeleoides*				*						*	
Asteraceae	*Oncosiphon*	*Oncosiphon suffruticosum**					*						
Asteraceae	*Waitzia*	*Waitzia acuminata var. acuminata*				*							
Boraginaceae	*Halgania*	*Halgania andromedifolia*	*	*									
Casuarinaceae	*Allocasuarina*	*Allocasuarina campestris*			*								
Casuarinaceae	*Casuarina*	*Casuarina pauper*	*	*			*						
Celastraceae	***Stackhousia***	***Stackhousia sp. Mt Keith***			*								
Chenopodiaceae	*Atriplex*	*Atriplex codonocarpa*	*				*	*					
Chenopodiaceae	***Atriplex***	***Atriplex holocarpa***						*					
Chenopodiaceae	*Atriplex*	*Atriplex nummularia subsp. spathulata*	*	*		*	*	*	*	*		*	*
Chenopodiaceae	*Atriplex*	*Atriplex stipitata*	*				*					*	
Chenopodiaceae	*Atriplex*	*Atriplex vesicaria*	*	*			*	*	*	*			
Chenopodiaceae	*Chenopodium*	*Chenopodium gaudichaudianum*						*		*			
Chenopodiaceae	*Dissocarpus*	*Dissocarpus paradoxus*				*							
Chenopodiaceae	*Enchylaena*	*Enchylaena tomentosa var. tomentosa*				*	*	*	*	*	*	*	*
Chenopodiaceae	*Eriochiton*	*Eriochiton sclerolaenoides*	*					*	*	*			
Chenopodiaceae	***Lepidosperma***	***Lepidosperma aff. fimbriatum***	*			*							
Chenopodiaceae	*Maireana*	*Maireana georgei*	*			*	*	*	*	*	*	*	*
Chenopodiaceae	*Maireana*	*Maireana pentatropis*	*				*			*			
Chenopodiaceae	*Maireana*	*Maireana planifolia*					*						
Chenopodiaceae	*Maireana*	*Maireana pyramidata*					*	*	*				
Chenopodiaceae	*Maireana*	*Maireana sedifolia*	*				*	*					
Chenopodiaceae	*Maireana*	*Maireana thesioides*					*						
Chenopodiaceae	*Maireana*	*Maireana tomentosa*	*	*		*	*	*	*	*	*	*	*
Chenopodiaceae	*Maireana*	*Maireana trichoptera*	*	*			*	*	*	*	*	*	*
Chenopodiaceae	*Maireana*	*Maireana triptera*	*			*	*	*	*	*	*	*	*
Chenopodiaceae	*Rhagodia*	*Rhagodia drummondii*	*	*			*	*	*	*		*	
Chenopodiaceae	*Rhagodia*	*Rhagodia eremaea*									*		
Chenopodiaceae	*Sclerolaena*	*Sclerolaena cuneata*	*				*	*			*		*
Chenopodiaceae	*Sclerolaena*	*Sclerolaena densiflora*	*	*		*	*	*		*	*		*
Chenopodiaceae	*Sclerolaena*	*Sclerolaena diacantha*	*	*			*	*	*	*	*	*	*
Chenopodiaceae	*Sclerolaena*	*Sclerolaena eriacantha*	*	*			*	*		*		*	*
Chenopodiaceae	*Sclerolaena*	*Sclerolaena patenticuspis*	*				*	*					
Chenopodiaceae	*Tecticornia*	*Tecticornia disarticulata*	*				*						
Convolvulaceae	*Wilsonia*	*Wilsonia humilis*									*		
Ericaceae	***Leucopogon***	***Leucopogon sp. Clyde Hill***		*									
Euphorbiaceae	*Beyeria*	*Beyeria sulcata var. brevipes*		*									
Euphorbiaceae	*Monotaxis*	*Monotaxis luteiflora*			*								
Fabaceae	*Acacia*	*Acacia acuminata*	*		*	*						*	
Fabaceae	*Acacia*	*Acacia eremophila var. eremophila*				*							
Fabaceae	*Acacia*	*Acacia erinacea*	*	*			*	*					*
Fabaceae	*Acacia*	*Acacia hemiteles*	*	*			*	*				*	

Family	Genus	Taxon	a	b	x	c	d	i	g	h	n	r	k
Fabaceae	*Acacia*	*Acacia heteroneura var. jutsonii*				*							
Fabaceae	*Acacia*	*Acacia jennerae*	*									*	
Fabaceae	*Acacia*	*Acacia ligulata*	*										
Fabaceae	*Acacia*	*Acacia merrallii*	*							*			
Fabaceae	***Acacia***	***Acacia multispicata***				*							
Fabaceae	*Acacia*	*Acacia quadrimarginea*			*								
Fabaceae	*Acacia*	*Acacia tetragonophylla*	*		*	*	*	*					
Fabaceae	*Daviesia*	*Daviesia aphylla*						*					
Fabaceae	*Senna*	*Senna artemisioides subsp. ×artemisioides*	*	*	*	*	*				*		
Fabaceae	*Senna*	*Senna artemisioides subsp. filifolia*	*	*	*	*	*	*		*	*	*	*
Fabaceae	*Senna*	*Senna cardiosperma*	*										
Fabaceae	*Swainsona*	*Swainsona canescens*										*	
Frankeniaceae	*Frankenia*	*Frankenia pauciflora var. pauciflora*					*	*					
Frankeniaceae	*Frankenia*	*Frankenia setosa*	*				*						
Goodeniaceae	***Dampiera***	***Dampiera latealata***			*								
Goodeniaceae	*Goodenia*	*Goodenia berardiana*		*	*								
Goodeniaceae	*Scaevola*	*Scaevola spinescens*	*	*	*		*	*	*	*			*
Haloragaceae	*Haloragis*	*Haloragis trigonocarpa*	*		*	*							
Hemerocallidaceae	***Dianella***	***Dianella revoluta var. divaricata***				*							
Lamiaceae	*Prostanthera*	*Prostanthera althoferi subsp. althoferi*			*	*							
Lamiaceae	*Prostanthera*	*Prostanthera campbellii*			*								
Lamiaceae	*Prostanthera*	*Prostanthera grylloana*				*							
Lamiaceae	***Teucrium***	***Teucrium disjunctum***										*	
Lamiaceae	*Westringia*	*Westringia rigida*	*	*		*				*			
Malvaceae	*Brachychiton*	*Brachychiton gregorii*			*								
Malvaceae	***Commersonia***	***Commersonia craurophylla***		*									
Malvaceae	***Hannafordia***	***Hannafordia bissillii subsp. latifolia***				*							
Malvaceae	***Seringia***	***Seringia exastia* (T)**				*							
Myrtaceae	*Eucalyptus*	*Eucalyptus flocktoniae subsp. flocktoniae*	*					*					
Myrtaceae	*Eucalyptus*	*Eucalyptus flocktoniae subsp. hebes*		*									
Myrtaceae	*Eucalyptus*	*Eucalyptus gracilis*	*	*					*	*	*		*
Myrtaceae	*Eucalyptus*	*Eucalyptus griffithsii*	*	*		*						*	
Myrtaceae	*Eucalyptus*	*Eucalyptus lesouefii*	*	*					*	*			
Myrtaceae	*Eucalyptus*	*Eucalyptus oleosa subsp. oleosa*	*	*			*			*		*	
Myrtaceae	*Eucalyptus*	*Eucalyptus ravida*	*	*				*			*		*
Myrtaceae	*Eucalyptus*	*Eucalyptus salmonophloia*	*	*			*						*
Myrtaceae	*Eucalyptus*	*Eucalyptus salubris*		*									
Myrtaceae	*Eucalyptus*	*Eucalyptus stricklandii*		*									
Myrtaceae	*Eucalyptus*	*Eucalyptus torquata*		*									
Myrtaceae	*Eucalyptus*	*Eucalyptus transcontinentalis*	*										
Myrtaceae	***Eucalyptus***	***Eucalyptus websteriana subsp. websteriana***			*								
Myrtaceae	***Homalocalyx***	***Homalocalyx thryptomenoides***				*							
Myrtaceae	***Leptospermum***	***Leptospermum erubescens***				*							
Myrtaceae	*Melaleuca*	*Melaleuca hamata*				*							
Myrtaceae	*Melaleuca*	*Melaleuca sheathiana*		*						*			*
Myrtaceae	*Thryptomene*	*Thryptomene australis subsp. brachyandra*				*							
Poaceae	*Aristida*	*Aristida contorta*			*							*	
Poaceae	*Austrostipa*	*Austrostipa elegantissima*	*	*	*	*	*	*		*	*	*	
Poaceae	*Austrostipa*	*Austrostipa nitida*	*					*		*		*	
Poaceae	*Austrostipa*	*Austrostipa scabra*	*		*	*	*	*		*	*	*	*
Poaceae	*Enneapogon*	*Enneapogon caerulescens*						*				*	
Poaceae	*Eragrostis*	*Eragrostis dielsii*				*						*	
Poaceae	*Monachather*	*Monachather paradoxus*				*						*	
Poaceae	*Triodia*	*Triodia rigidissima*										*	
Proteaceae	*Grevillea*	*Grevillea acuaria*		*								*	
Pteridaceae	*Cheilanthes*	*Cheilanthes lasiophylla*			*								
Pteridaceae	*Cheilanthes*	*Cheilanthes sieberi subsp. sieberi*			*								

Family	Genus	Taxon	a	b	x	c	d	i	g	h	n	r	k
Rhamnaceae	*Trymalium*	*Trymalium myrtillus subsp. myrtillus*		*									
Rutaceae	***Phebalium***	***Phebalium filifolium***				*							
Rutaceae	*Phebalium*	*Phebalium laevigatum*		*									
Rutaceae	*Philotheca*	*Philotheca brucei subsp. brucei*			*								
Santalaceae	*Exocarpos*	*Exocarpos aphyllus*	*	*	*	*	*	*	*	*	*	*	*
Santalaceae	*Santalum*	*Santalum acuminatum*	*	*	*			*	*				
Santalaceae	*Santalum*	*Santalum spicatum*			*								
Sapindaceae	*Dodonaea*	*Dodonaea lobulata*	*	*	*					*			
Sapindaceae	*Dodonaea*	*Dodonaea microzyga subsp. acrolobata*	*										
Sapindaceae	*Dodonaea*	*Dodonaea viscosa subsp. angustissima*										*	
Scrophulariaceae	*Eremophila*	*Eremophila acutifolia (P3)*											*
Scrophulariaceae	*Eremophila*	*Eremophila alternifolia*			*								
Scrophulariaceae	*Eremophila*	*Eremophila caerulea subsp. caerulea*	*	*				*	*		*		
Scrophulariaceae	*Eremophila*	*Eremophila caperata*	*	*									
Scrophulariaceae	*Eremophila*	*Eremophila decipiens subsp. decipiens*	*			*	*	*	*			*	*
Scrophulariaceae	*Eremophila*	*Eremophila dempsteri*	*					*	*				
Scrophulariaceae	*Eremophila*	*Eremophila georgei*			*								
Scrophulariaceae	*Eremophila*	*Eremophila glabra subsp. glabra*		*			*	*					
Scrophulariaceae	*Eremophila*	*Eremophila granitica*			*	*							
Scrophulariaceae	*Eremophila*	*Eremophila interstans subsp. virgata*	*	*				*			*		
Scrophulariaceae	*Eremophila*	*Eremophila ionantha*	*				*	*				*	
Scrophulariaceae	*Eremophila*	*Eremophila maculata subsp. brevifolia*	*										
Scrophulariaceae	***Eremophila***	***Eremophila oblonga***	*										
Scrophulariaceae	*Eremophila*	*Eremophila oldfieldii subsp. angustifolia*	*	*	*		*	*	*	*			*
Scrophulariaceae	*Eremophila*	*Eremophila oppositifolia subsp. angustifolia*	*	*			*		*	*			
Scrophulariaceae	*Eremophila*	*Eremophila parvifolia subsp. auricampa*	*	*						*			*
Scrophulariaceae	*Eremophila*	*Eremophila scoparia*	*	*			*	*	*	*		*	*
Scrophulariaceae	*Myoporum*	*Myoporum platycarpum*								*			
Solanaceae	*Lycium*	*Lycium australe*	*				*	*	*			*	
Solanaceae	***Solanum***	***Solanum hoplopetalum***			*								
Solanaceae	*Solanum*	*Solanum lasiophyllum*	*		*							*	
Solanaceae	*Solanum*	*Solanum nummularium*	*	*			*	*					*
Solanaceae	*Solanum*	*Solanum plicatile*			*								
Thymelaeaceae	*Pimelea*	*Pimelea microcephala subsp. microcephala*	*		*			*					
Zygophyllaceae	*Roepera*	*Roepera eremaea*	*	*	*						*		*

Appendix F - Site Descriptions

Project Name: Mt Marion Project Area - October 2021				
Date:	12/10/2021		**Botanist:**	Eren Reid
Location (Longitude/Latitude):	121.41846	-31.02502	**Quadrat:**	Q1
Quadrat size:	20x20 m			
Quadrat marking method:	Fence dropper at each corner. TwoNav Aventura GPS waypoint @ NE corner (±4 m accuracy). Using GDA2020 datum			
Vegetation group:	A			
Vegetation condition:	Good			
WP:	1			
Photo number:			4	
Landform:			Simple slope/Hillslope	
Land surface/disturbance:			No effective disturbance	
Fire history:			>30 years	
Coarse fragments on the surface (abundance/size/shape):			Moderately; many/Cobbly; or cobbles/Subangular platy	
Rock outcrop (abundance/runoff):			No bedrock exposed/Moderately rapid	
Soil (profile/field texture/soil surface):			Uniform/Sandy clay loam/Firm	
% Cover leaf litter:			30	
% Cover bare ground:			65	

Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	M Tree Mallee (> 8m)	**Growth form:**	S Shrub	**Growth form:**	S Shrub
Height:	12-20m	**Height:**	1-3m	**Height:**	0.5-1m
Crown cover %:	S 10-30	**Crown cover %:**	V <10	**Crown cover %:**	S 10-30
Dominant taxa:		**Dominant taxa:**		**Dominant taxa:**	
Eucalyptus oleosa subsp. oleosa		Exocarpos aphyllus		Scaevola spinescens	
Eucalyptus flocktoniae subsp. flocktoniae		Senna artemisioides subsp. filifolia		Acacia erinacea	
		Eremophila scoparia		Westringia rigida	

ALL SPECIES
Eucalyptus oleosa subsp. oleosa
Eucalyptus flocktoniae subsp. flocktoniae
Exocarpos aphyllus
Senna artemisioides subsp. filifolia
Eremophila scoparia
Scaevola spinescens
Acacia erinacea
Westringia rigida
Olearia muelleri
Eremophila parvifolia subsp. auricampa
Maireana trichoptera
Ptilotus obovatus
Atriplex nummularia subsp. spathulata
Rhagodia drummondii
Maireana tomentosa
Dodonaea lobulata
Casuarina pauper
Eremophila oldfieldii subsp. angustifolia
Solanum nummularium
Maireana sedifolia
Roepera eremaea
Acacia hemiteles
Maireana triptera
Eremophila interstans subsp. virgata
Atriplex vesicaria
Sclerolaena diacantha
Halgania andromedifolia
Austrostipa elegantissima
Outside
Santalum spicatum
Eucalyptus lesouefii

Project Name: Mt Marion Project Area - October 2021				
Date:	12/10/2021		**Botanist:**	Eren Reid
Location (Longitude/Latitude):	121.44492	-31.03682	**Quadrat:**	Q2
Quadrat size:	20x20 m			
Quadrat marking method:	Fence dropper at each corner. TwoNav Aventura GPS waypoint @ NE corner (±4 m accuracy). Using GDA2020 datum			
Vegetation group:	A			
Vegetation condition:	Good			
WP:	2			
Photo number:			11	
Landform:			Flat/Plain	
Land surface/disturbance:			No effective disturbance	
Fire history:			>30 years	
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/Sandy clay loam/Firm	
% Cover leaf litter:			60	
% Cover bare ground:			60	

Tallest stratum		**Mid-stratum**		**Lower stratum**	
Growth form:	T Tree	**Growth form:**	S Shrub	**Growth form:**	S Shrub
Height:	12-20m	**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:**	
Eucalyptus transcontinentalis		Eremophila dempsteri		Maireana triptera	
Eucalyptus ravida		Exocarpos aphyllus		Maireana tomentosa	
Eucalyptus flocktoniae subsp. flocktoniae		Eremophila scoparia		Eremophila decipiens subsp. decipiens	

ALL SPECIES
Eucalyptus transcontinentalis
Eucalyptus ravida
Eucalyptus flocktoniae subsp. flocktoniae
Eremophila dempsteri
Exocarpos aphyllus
Eremophila scoparia
Maireana triptera
Maireana tomentosa
Eremophila decipiens subsp. decipiens
Sclerolaena densiflora
Sclerolaena diacantha
Rhagodia drummondii
Maireana trichoptera
Acacia hemiteles
Senna artemisioides subsp. artemisioides
Ptilotus obovatus
Austrostipa elegantissima
Senna artemisioides subsp. filifolia
Eremophila oldfieldii subsp. angustifolia
Lycium australe
Eremophila interstans subsp. virgata
Acacia erinacea
Austrostipa nitida
Atriplex codonocarpa
Outside
Eucalyptus salmonophloia

Project Name: Mt Marion Project Area - October 2021				
Date:	15/10/2021		**Botanist:**	Eren Reid
Location (Longitude/Latitude):	121.49649	-31.11009	**Quadrat:**	Q3
Quadrat size:	20x20 m			
Quadrat marking method:	Fence dropper at each corner. TwoNav Aventura GPS waypoint @ NE corner (±4 m accuracy). Using GDA2020 datum			
Vegetation group:	A			
Vegetation condition:	Good			
WP:	3			
Photo number:			61	
Landform:			Flat/Plain	
Land surface/disturbance:			No effective disturbance	
Fire history:			>30 years	
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):			Uniform/Sandy clay loam/Loose	
% Cover leaf litter:			45	
% Cover bare ground:			65	

Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	T Tree	**Growth form:**	S Shrub	**Growth form:**	S Shrub
Height:	12-20m	**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:**	
Eucalyptus lesouefii		Eremophila scoparia		Tecticornia disarticulata	
		Atriplex nummularia subsp. spathulata		Atriplex vesicaria	
		Eremophila interstans subsp. virgata			

ALL SPECIES
Eucalyptus lesouefii
Eremophila scoparia
Atriplex nummularia subsp. spathulata
Eremophila interstans subsp. virgata
Tecticornia disarticulata
Atriplex vesicaria
Frankenia setosa
Atriplex stipitata
Sclerolaena diacantha
Sclerolaena eriacantha
Maireana triptera
Ptilotus obovatus
Disphyma crassifolium
Rhagodia drummondii
Maireana tomentosa
Sclerolaena densiflora
Cratystylis conocephala
Exocarpos aphyllus
Eremophila caperata
Eremophila decipiens subsp. decipiens
Outside
Eucalyptus transcontinentalis
Eucalyptus salubris
Cratystylis subspinescens
Santalum acuminatum

Project Name: Mt Marion Project Area - October 2021				
Date:	14/10/2021		**Botanist:**	Eren Reid
Location (Longitude/Latitude):	121.40565	-31.05952	**Quadrat:**	Q4
Quadrat size:	20x20 m			
Quadrat marking method:	Fence dropper at each corner. TwoNav Aventura GPS waypoint @ NE corner (±4 m accuracy). Using GDA2020 datum			
Vegetation group:	A			
Vegetation condition:	Good			
WP:	4			
Photo number:			33	
Landform:				
Land surface/disturbance:			No effective disturbance	
Fire history:			>30 years	
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/Sandy clay loam/Cracking	
% 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 %:**	M 30-70	**Crown cover %:**	S 10-30
Dominant taxa:		**Dominant taxa:**		**Dominant taxa:**	
Eucalyptus gracilis		Eremophila interstans subsp. virgata		Exocarpos aphyllus	
Eucalyptus salmonophloia		Eremophila scoparia		Senna cardiosperma	
Eucalyptus lesouefii		Cratystylis conocephala		Eremophila caerulea subsp. caerulea	

ALL SPECIES
Eucalyptus gracilis
Eucalyptus salmonophloia
Eucalyptus lesouefii
Eremophila interstans subsp. virgata
Eremophila scoparia
Cratystylis conocephala
Exocarpos aphyllus
Senna cardiosperma
Eremophila caerulea subsp. caerulea
Santalum acuminatum
Austrostipa elegantissima
Scaevola spinescens
Maireana triptera
Sclerolaena diacantha
Sclerolaena cuneata
Olearia muelleri
Maireana trichoptera
Ptilotus obovatus
Ptilotus exaltatus
Acacia hemiteles
Maireana tomentosa
Eriochiton sclerolaenoides
Sclerolaena densiflora
Acacia tetragonophylla
Leichhardtia australis
Ptilotus aervoides
Eremophila decipiens subsp. decipiens
Haloragis trigonocarpa
Rhagodia drummondii
Eremophila maculata subsp. brevifolia
Eremophila ionantha
Austrostipa scabra
Alyxia buxifolia
Dodonaea lobulata
Pimelea microcephala subsp. microcephala
Roepera eremaea
Outside
Eucalyptus salubris
Maireana sedifolia
Maireana pentatropis
Eucalyptus transcontinentalis

Project Name: Mt Marion Project Area - October 2021				
Date:	12/10/2021		**Botanist:**	Eren Reid
Location (Longitude/Latitude):	121.41615	-31.02184	**Quadrat:**	Q5
Quadrat size:	20x20 m			
Quadrat marking method:	Fence dropper at each corner. TwoNav Aventura GPS waypoint @ NE corner (±4 m accuracy). Using GDA2020 datum			
Vegetation group:	B			
Vegetation condition:	Very Good			
WP:	5			
Photo number:			2-3	
Landform:			Crest/Hill Crest	
Land surface/disturbance:			No effective disturbance	
Fire history:			>30 years	
Coarse fragments on the surface (abundance/size/shape):			Very; abundant/Cobbly; or cobbles/Subangular tabular	
Rock outcrop (abundance/runoff):			No bedrock exposed/Rapid	
Soil (profile/field texture/soil surface):			Uniform/Sandy clay loam/Firm	
% Cover leaf litter:			50	
% Cover bare ground:			60	

Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	T Tree	**Growth form:**	S Shrub	**Growth form:**	S Shrub
Height:	6-12m	**Height:**	3-6m	**Height:**	0.5-1m
Crown cover %:	S 10-30	**Crown cover %:**	V <10	**Crown cover %:**	S 10-30
Dominant taxa:		**Dominant taxa:**		**Dominant taxa:**	
Eucalyptus oleosa subsp. oleosa		Casuarina pauper		Eremophila scoparia	
Eucalyptus lesouefii		Eremophila interstans subsp. virgata		Scaevola spinescens	
Eucalyptus griffithsii				Acacia erinacea	

ALL SPECIES
Eucalyptus oleosa subsp. oleosa
Eucalyptus lesouefii
Eucalyptus griffithsii
Casuarina pauper
Eremophila interstans subsp. virgata
Eremophila scoparia
Scaevola spinescens
Acacia erinacea
Westringia rigida
Atriplex nummularia subsp. spathulata
Eremophila parvifolia subsp. auricampa
Olearia muelleri
Maireana trichoptera
Sclerolaena eriacantha
Maireana tomentosa
Senna artemisioides subsp. filifolia
Exocarpos aphyllus
Alyxia buxifolia
Cratystylis conocephala
Eremophila caperata
Atriplex vesicaria
Outside
Melaleuca sheathiana
Eremophila oldfieldii subsp. angustifolia
Acacia tetragonophylla
Ptilotus obovatus
Leichhardtia australis
Maireana pentatropis
Santalum spicatum
Dodonaea lobulata
Trymalium myrtillus subsp. myrtillus

Project Name: Mt Marion Project Area - October 2021					
Date:	12/10/2021		**Botanist:**	Eren Reid	
Location (Longitude/Latitude):	121.43599	-31.02682	**Quadrat:**	Q6	
Quadrat size:	20x20 m				
Quadrat marking method:	Fence dropper at each corner. TwoNav Aventura GPS waypoint @ NE corner (±4 m accuracy). Using GDA2020 datum				
Vegetation group:	B				
Vegetation condition:	Very Good				
WP:	6				
Photo number:			7		
Landform:			Flat/Valley flat		
Land surface/disturbance:			No effective disturbance		
Fire history:			>30 years		
Coarse fragments on the surface (abundance/size/shape):			Moderately; many/Coarse gravelly; large pebbles/Subrounded platy		
Rock outcrop (abundance/runoff):			No bedrock exposed/Slow		
Soil (profile/field texture/soil surface):			Uniform/Sandy clay loam/Loose		
% Cover leaf litter:			80		
% Cover bare ground:			20		

Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	M Tree Mallee (> 8m)	**Growth form:**	S Shrub	**Growth form:**	S Shrub
Height:	12-20m	**Height:**	3-6m	**Height:**	0.5-1m
Crown cover %:	M 30-70	**Crown cover %:**	S 10-30	**Crown cover %:**	M 30-70
Dominant taxa:		**Dominant taxa:**		**Dominant taxa:**	
Eucalyptus griffithsii		Melaleuca sheathiana		Senna artemisioides subsp. filifolia	
Eucalyptus oleosa subsp. oleosa		Exocarpos aphyllus		Acacia erinacea	
				Eremophila scoparia	

ALL SPECIES
Eucalyptus griffithsii
Eucalyptus oleosa subsp. oleosa
Melaleuca sheathiana
Exocarpos aphyllus
Senna artemisioides subsp. filifolia
Acacia erinacea
Eremophila scoparia
Eremophila parvifolia subsp. auricampa
Dodonaea lobulata
Westringia rigida
Solanum nummularium
Olearia muelleri
Eucalyptus lesouefii
Eremophila oppositifolia subsp. angustifolia
Eremophila oldfieldii subsp. angustifolia
Santalum acuminatum
Alyxia buxifolia
Halgania andromedifolia
Eremophila caerulea subsp. caerulea
Goodenia berardiana
Ptilotus obovatus
Maireana trichoptera
Eucalyptus flocktoniae subsp. hebes
Austrostipa elegantissima
Outside
Trymalium myrtillus subsp. myrtillus
Cratystylis microphylla

Project Name: Mt Marion Project Area – October 2021				
Date:	13/10/2021		**Botanist:**	Eren Reid
Location (Longitude/Latitude):	121.45802	-31.04804	**Quadrat:**	Q7
Quadrat size:	20x20 m			
Quadrat marking method:	Fence dropper at each corner. TwoNav Aventura GPS waypoint @ NE corner (±4 m accuracy). Using GDA2020 datum			
Vegetation group:	B			
Vegetation condition:	Very Good			
WP:	7			
Photo number:			17	
Landform:			Mid slope/Hillslope	
Land surface/disturbance:			No effective disturbance	
Fire history:			>30 years	
Coarse fragments on the surface (abundance/size/shape):			Moderately; many/Cobbly; or cobbles/Subrounded	
Rock outcrop (abundance/runoff):			Very rocky/Rapid	
Soil (profile/field texture/soil surface):			Uniform/Sandy clay loam/Firm	
% Cover leaf litter:			80	
% Cover bare ground:			60	

Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	T Tree	**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:**	
Eucalyptus stricklandii		Exocarpos aphyllus		Westringia rigida	
		Eremophila oldfieldii subsp. Angustifolia		Acacia erinacea	
		Scaevola spinescens		Olearia muelleri	

ALL SPECIES
Eucalyptus stricklandii
Exocarpos aphyllus
Eremophila oldfieldii subsp. Angustifolia
Scaevola spinescens
Westringia rigida
Acacia erinacea
Olearia muelleri
Dodonaea lobulata
Thysanotus manglesianus
Trymalium myrtillus subsp. Myrtillus
Eremophila oppositifolia subsp. Angustifolia
Acacia hemiteles
Grevillea acuaria
Phebalium laevigatum
Alyxia buxifolia
Ptilotus obovatus
Outside
Acacia quadrimarginea
Casuarina pauper
Senna artemisioides subsp. Filifolia
Leucopogon sp. Clyde Hill
Brachychiton gregorii

Project Name: Mt Marion Project Area – October 2021				
Date:	12/10/2021		**Botanist:**	Eren Reid
Location (Longitude/Latitude):	121.42902	-31.02607	**Quadrat:**	Q8
Quadrat size:	20x20 m			
Quadrat marking method:	Fence dropper at each corner. TwoNav Aventura GPS waypoint @ NE corner (±4 m accuracy). Using GDA2020 datum			
Vegetation group:	Ac quad shrubland on undulating hills			
Vegetation condition:	Very Good			
WP:	8			
Photo number:			6	
Landform:			Mid slope/Hillslope	
Land surface/disturbance:			No effective disturbance	
Fire history:			>30 years	
Coarse fragments on the surface (abundance/size/shape):			Very; abundant/Cobbly; or cobbles/Subrounded platy	
Rock outcrop (abundance/runoff):			No bedrock exposed/Very rapid	
Soil (profile/field texture/soil surface):			Uniform/Sandy clay loam/Firm	
% Cover leaf litter:			20	
% Cover bare ground:			35	

Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	**Growth form:**	S Shrub	**Growth form:**	S Shrub
Height:	3-8m	**Height:**	1-3m	**Height:**	0.5-1m
Crown cover %:	M 30-70	**Crown cover %:**	M 30-70	**Crown cover %:**	S 10-30
Dominant taxa:		**Dominant taxa:**		**Dominant taxa:**	
Acacia quadrimarginea		Dodonaea lobulata		Ptilotus obovatus	
Eremophila oldfieldii subsp. Angustifolia		Eremophila alternifolia		Eremophila georgei	
		Alyxia buxifolia		Scaevola spinescens	

ALL SPECIES
Acacia quadrimarginea
Eremophila oldfieldii subsp. Angustifolia
Dodonaea lobulata
Eremophila alternifolia
Alyxia buxifolia
Ptilotus obovatus
Eremophila georgei
Scaevola spinescens
Roepera eremaea
Santalum spicatum
Acacia tetragonophylla
Leichhardtia australis
Senna artemisioides subsp. Artemisioides
Austrostipa elegantissima
Austrostipa scabra
Santalum acuminatum
Pimelea microcephala subsp. Microcephala
Thysanotus manglesianus
Goodenia berardiana
Exocarpos aphyllus
Chrysocephalum puteale
Solanum lasiophyllum
Prostanthera campbellii
Outside
Olearia muelleri
Eucalyptus griffithsii

Project Name: Mt Marion Project Area – October 2021				
Date:	13/10/2021		**Botanist:**	Eren Reid
Location (Longitude/Latitude):	121.44795	-31.05051	**Quadrat:**	Q9
Quadrat size:	20x20 m			
Quadrat marking method:	Fence dropper at each corner. TwoNav Aventura GPS waypoint @ NE corner (±4 m accuracy). Using GDA2020 datum			
Vegetation group:	Ac quad shrubland on undulating hills			
Vegetation condition:	Very Good			
WP:	9			
Photo number:			18	
Landform:			Mid slope/Hillslope	
Land surface/disturbance:			No effective disturbance	
Fire History:			>30 years	
Coarse fragments on the surface (abundance/size/shape):			Extremely; very abundant/Cobbly; or cobbles/Subangular	
Rock outcrop (abundance/runoff):			Rocky/Moderately rapid	
Soil (profile/field texture/soil surface):			Uniform/Sandy clay loam/Firm	
% Cover leaf litter:			55	
% Cover bare ground:			40	

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 %:	M 30-70	**Crown cover %:**	S 10-30	**Crown cover %:**	S 10-30
Dominant taxa:		**Dominant taxa:**		**Dominant taxa:**	
Acacia quadrimarginea		Scaevola spinescens		Prostanthera campbellii	
Allocasuarina campestris		Eremophila oldfieldii subsp. Angustifolia		Chrysocephalum puteale	
Acacia acuminata		Eremophila granitica		Philotheca brucei subsp. brucei	

ALL SPECIES
Acacia quadrimarginea
Allocasuarina campestris
Acacia acuminata
Scaevola spinescens
Eremophila oldfieldii subsp. angustifolia
Eremophila granitica
Prostanthera campbellii
Chrysocephalum puteale
Philotheca brucei subsp. brucei
Cheilanthes lasiophylla
Exocarpos aphyllus
Solanum plicatile
Solanum lasiophyllum
Cheilanthes sieberi subsp. sieberi
Goodenia berardiana
Austrostipa scabra
Haloragis trigonocarpa
Monotaxis luteiflora
Aristida contorta
Outside
Eucalyptus websteriana subsp. websteriana
Brachychiton gregorii
Dampiera latealata
Stackhousia sp. Mt Keith
Thryptomene australis subsp. brachyandra
Solanum hoplopetalum

Project Name: Mt Marion Project Area - October 2021				
Date:	13/10/2021		**Botanist:**	Eren Reid
Location (Longitude/Latitude):	121.43539	-31.05695	**Quadrat:**	Q10
Quadrat size:	20x20 m			
Quadrat marking method:	Fence dropper at each corner. TwoNav Aventura GPS waypoint @ NE corner (±4 m accuracy). Using GDA2020 datum			
Vegetation group:	C			
Vegetation condition:	Very Good			
WP:	13			
Photo number:			23	
Landform:			Flat/Plain	
Land surface/disturbance:			No effective disturbance	
Fire history:			>30 years	
Coarse fragments on the surface (abundance/size/shape):			Very slightly; very few/Medium gravelly; medium pebbles/Rounded	
Rock outcrop (abundance/runoff):			No bedrock exposed/Very slow	
Soil (profile/field texture/soil surface):			Uniform/Silty clay loam/Firm	
% Cover leaf litter:			25	
% Cover bare ground:			45	

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 %:**	M 30-70	**Crown cover %:**	S 10-30
Dominant taxa:		**Dominant taxa:**		**Dominant taxa:**	
Eucalyptus griffithsii		Acacia acuminata		Acacia tetragonophylla	
				Ptilotus obovatus	
				Senna artemisioides subsp. filifolia	

ALL SPECIES
Eucalyptus griffithsii
Acacia acuminata
Acacia tetragonophylla
Ptilotus obovatus
Senna artemisioides subsp. filifolia
Eremophila decipiens subsp. decipiens
Senna artemisioides subsp. artemisioides
Leichhardtia australis
Maireana georgei
Haloragis trigonocarpa
Monachather paradoxus
Austrostipa scabra
Enchylaena tomentosa var. tomentosa
Maireana tomentosa
Sclerolaena densiflora
Atriplex nummularia subsp. spathulata
Eragrostis dielsii
Austrostipa elegantissima
Maireana triptera
Outside
Eremophila oldfieldii subsp. angustifolia
Brachychiton gregorii
Olearia muelleri
Acacia ligulata

Project Name: Mt Marion Project Area - October 2021				
Date:	12/10/2021		**Botanist:**	Eren Reid
Location (Longitude/Latitude):	121.41105	-31.02267	**Quadrat:**	Q11
Quadrat size:	20x20 m			
Quadrat marking method:	Fence dropper at each corner. TwoNav Aventura GPS waypoint @ NE corner (±4 m accuracy). Using GDA2020 datum			
Vegetation group:	D			
Vegetation condition:	Good			
WP:	11			
Photo number:			1	
Landform:			Flat/Plain	
Land surface/disturbance:			No effective disturbance except grazing by hoofed animals	
Fire history:			>30 years	
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/Sandy clay loam/Firm	
% Cover leaf litter:			30	
% Cover bare ground:			50	

Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	T Tree	**Growth form:**	S Shrub	**Growth form:**	S Shrub
Height:	12-20m	**Height:**	3-6m	**Height:**	1-3m
Crown cover %:	V <10	**Crown cover %:**	V <10	**Crown cover %:**	S 10-30
Dominant taxa:		**Dominant taxa:**		**Dominant taxa:**	
Eucalyptus salmonophloia		Eremophila oppositifolia subsp. angustifolia		Eremophila scoparia	
Eucalyptus oleosa subsp. oleosa				Eremophila ionantha	
				Atriplex vesicaria	

ALL SPECIES
Eucalyptus salmonophloia
Eucalyptus oleosa subsp. oleosa
Eremophila oppositifolia subsp. angustifolia
Eremophila scoparia
Eremophila ionantha
Atriplex vesicaria
Eremophila glabra subsp. glabra
Atriplex nummularia subsp. spathulata
Enchylaena tomentosa var. tomentosa
Maireana triptera
Acacia hemiteles
Maireana georgei
Acacia erinacea
Exocarpos aphyllus
Frankenia pauciflora var. pauciflora
Maireana trichoptera
Scaevola spinescens
Sclerolaena diacantha
Casuarina pauper
Sclerolaena cuneata
Rhagodia drummondii
Lycium australe
Olearia muelleri
Sclerolaena densiflora
Eremophila decipiens subsp. decipiens
Eremophila oldfieldii subsp. angustifolia
Acacia tetragonophylla
Austrostipa elegantissima
Leichhardtia australis
Maireana thesioides
Outside
Cratystylis conocephala
Senna artemisioides subsp. filifolia

Project Name: Mt Marion Project Area - October 2021				
Date:	13/10/2021		**Botanist:**	Eren Reid
Location (Longitude/Latitude):	121.45602	-31.04127	**Quadrat:**	Q12
Quadrat size:	20x20 m			
Quadrat marking method:	Fence dropper at each corner. TwoNav Aventura GPS waypoint @ NE corner (±4 m accuracy). Using GDA2020 datum			
Vegetation group:	D			
Vegetation condition:	Good			
WP:	12			
Photo number:			14	
Landform:			Open depression (vale)/Drainage depression	
Land surface/disturbance:			No effective disturbance	
Fire history:			>30 years	
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/Sandy clay loam/Loose	
% Cover leaf litter:			50	
% Cover bare ground:			60	

Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	T Tree	**Growth form:**	S Shrub	**Growth form:**	S Shrub
Height:	12-20m	**Height:**	1-3m	**Height:**	0.5-1m
Crown cover %:	V <10	**Crown cover %:**	S 10-30	**Crown cover %:**	M 30-70
Dominant taxa:		**Dominant taxa:**		**Dominant taxa:**	
Eucalyptus salmonophloia		Eremophila scoparia		Maireana pyramidata	
		Atriplex nummularia subsp. spathulata		Atriplex vesicaria	
		Acacia hemiteles		Exocarpos aphyllus	

ALL SPECIES
Eucalyptus salmonophloia
Eremophila scoparia
Atriplex nummularia subsp. spathulata
Acacia hemiteles
Maireana pyramidata
Atriplex vesicaria
Exocarpos aphyllus
Enchylaena tomentosa var. tomentosa
Ptilotus obovatus
Scaevola spinescens
Leichhardtia australis
Maireana triptera
Maireana trichoptera
Senna artemisioides subsp. filifolia
Senna artemisioides subsp. artemisioides
Sclerolaena diacantha
Eremophila oldfieldii subsp. angustifolia
Ptilotus exaltatus
Maireana georgei
Maireana tomentosa
Atriplex codonocarpa
Oncosiphon suffruticosum*
Outside
Lycium australe

a				
Date:	13/10/2021		**Botanist:**	Eren Reid
Location (Longitude/Latitude):	121.43214	-31.05402	**Quadrat:**	Q13
Quadrat size:	20x20 m			
Quadrat marking method:	Fence dropper at each corner. TwoNav Aventura GPS waypoint @ NE corner (±4 m accuracy). Using GDA2020 datum			
Vegetation group:	D			
Vegetation condition:	Good			
WP:	13			
Photo number:			22	
Landform:			Flat/Plain	
Land surface/disturbance:			No effective disturbance	
Fire history:			>30 years	
Coarse fragments on the surface (abundance/size/shape):			Very slightly; very few/Coarse gravelly; large pebbles/Subrounded	
Rock outcrop (abundance/runoff):			No bedrock exposed/Very slow	
Soil (profile/field texture/soil surface):			Uniform/Sandy clay loam/Firm	
% Cover leaf litter:			70	
% Cover bare ground:			70	

Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	T Tree	**Growth form:**	S Shrub	**Growth form:**	S Shrub
Height:	12-20m	**Height:**	1-3m	**Height:**	0.5-1m
Crown cover %:	S 10-30	**Crown cover %:**	V <10	**Crown cover %:**	V <10
Dominant taxa:		**Dominant taxa:**		**Dominant taxa:**	
Eucalyptus salmonophloia		Exocarpos aphyllus		Acacia hemiteles	
		Eremophila scoparia		Senna artemisioides subsp. filifolia	
		Atriplex nummularia subsp. spathulata		Maireana georgei	

ALL SPECIES
Eucalyptus salmonophloia
Exocarpos aphyllus
Eremophila scoparia
Atriplex nummularia subsp. spathulata
Acacia hemiteles
Senna artemisioides subsp. filifolia
Maireana georgei
Eremophila oldfieldii subsp. angustifolia
Enchylaena tomentosa var. tomentosa
Maireana tomentosa
Sclerolaena diacantha
Sclerolaena eriacantha
Maireana triptera
Rhagodia drummondii
Ptilotus exaltatus
Maireana trichoptera
Sclerolaena patenticuspis
Sclerolaena cuneata
Maireana pyramidata
Maireana planifolia
Austrostipa elegantissima
Leichhardtia australis
Lycium australe
Alyxia buxifolia
Austrostipa scabra
Senna artemisioides subsp. artemisioides
Solanum nummularium
Ptilotus obovatus
Outside
Maireana pentatropis
Olearia muelleri

Project Name: Mt Marion Project Area - October 2021				
Date:	15/10/2021		**Botanist:**	Eren Reid
Location (Longitude/Latitude):	121.48674	-31.10576	**Quadrat:**	Q14
Quadrat size:	20x20 m			
Quadrat marking method:	Fence dropper at each corner. TwoNav Aventura GPS waypoint @ NE corner (±4 m accuracy). Using GDA2020 datum			
Vegetation group:	D			
Vegetation condition:	Good			
WP:	14			
Photo number:			62	
Landform:			Flat/Plain	
Land surface/disturbance:			No effective disturbance	
Fire history:			>30 years	
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/Sandy clay loam/Loose	
% Cover leaf litter:			35	
% Cover bare ground:			75	

Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	T Tree	**Growth form:**	S Shrub	**Growth form:**	S Shrub
Height:	12-20m	**Height:**	1-3m	**Height:**	0.5-1m
Crown cover %:	S 10-30	**Crown cover %:**	V <10	**Crown cover %:**	S 10-30
Dominant taxa:		**Dominant taxa:**		**Dominant taxa:**	
Eucalyptus salmonophloia		Eremophila ionantha		Lycium australe	
		Maireana sedifolia		Cratystylis subspinescens	
		Atriplex nummularia subsp. spathulata		Tecticornia disarticulata	

ALL SPECIES
Eucalyptus salmonophloia
Eremophila ionantha
Maireana sedifolia
Atriplex nummularia subsp. spathulata
Lycium australe
Cratystylis subspinescens
Tecticornia disarticulata
Eremophila decipiens subsp. decipiens
Maireana triptera
Acacia hemiteles
Atriplex vesicaria
Sclerolaena cuneata
Sclerolaena diacantha
Sclerolaena eriacantha
Rhagodia drummondii
Atriplex stipitata
Maireana thesioides
Exocarpos aphyllus
Maireana georgei
Eremophila scoparia
Sclerolaena densiflora
Maireana tomentosa
Frankenia setosa
Sclerolaena patenticuspis
Olearia muelleri
Alyxia buxifolia
Scaevola spinescens
Ptilotus exaltatus
Maireana pentatropis
Senna artemisioides subsp. filifolia
Maireana trichoptera
Outside
Eucalyptus lesouefii

Project Name: Mt Marion Project Area - October 2021				
Date:	13/10/2021		**Botanist:**	Eren Reid
Location (Longitude/Latitude):	121.45436	-31.03802	**Quadrat:**	Q15
Quadrat size:	20x20 m			
Quadrat marking method:	Fence dropper at each corner. TwoNav Aventura GPS waypoint @ NE corner (±4 m accuracy). Using GDA2020 datum			
Vegetation group:	I			
Vegetation condition:	Very Good			
WP:	15			
Photo number:			12	
Landform:			Flat/Plain	
Land surface/disturbance:			No effective disturbance	
Fire history:			>30 years	
Coarse fragments on the surface (abundance/size/shape):			No coarse fragments	
Rock outcrop (abundance/runoff):			No bedrock exposed/Very slow	
Soil (profile/field texture/soil surface):			Uniform/Clay loam/Cracking	
% Cover leaf litter:			80	
% Cover bare ground:			40	

Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	T Tree	**Growth form:**	S Shrub	**Growth form:**	S Shrub
Height:	6-12m	**Height:**	1-3m	**Height:**	0.25-0.5m
Crown cover %:	M 30-70	**Crown cover %:**	M 30-70	**Crown cover %:**	V <10
Dominant taxa:		**Dominant taxa:**		**Dominant taxa:**	
Eucalyptus ravida		Eremophila dempsteri		Sclerolaena diacantha	
		Eremophila scoparia		Ptilotus obovatus	
				Exocarpos aphyllus	

ALL SPECIES
Eucalyptus ravida
Eremophila dempsteri
Eremophila scoparia
Sclerolaena diacantha
Ptilotus obovatus
Exocarpos aphyllus
Sclerolaena densiflora
Eremophila decipiens subsp. decipiens
Eriochiton sclerolaenoides
Ptilotus exaltatus
Maireana triptera
Atriplex nummularia subsp. spathulata
Maireana georgei
Maireana trichoptera
Rhagodia drummondii
Enchylaena tomentosa var. tomentosa
Atriplex vesicaria
Austrostipa scabra
Austrostipa elegantissima
Daviesia aphylla
Maireana sedifolia
Ptilotus aervoides
Outside
Eucalyptus salmonophloia
Atriplex codonocarpa
Atriplex holocarpa

Project Name: Mt Marion Project Area - October 2021				
Date:	13/10/2021		**Botanist:**	Eren Reid
Location (Longitude/Latitude):	121.45411	-31.03970	**Quadrat:**	Q16
Quadrat size:	20x20 m			
Quadrat marking method:	Fence dropper at each corner. TwoNav Aventura GPS waypoint @ NE corner (±4 m accuracy). Using GDA2020 datum			
Vegetation group:	G			
Vegetation condition:	Good			
WP:	16			
Photo number:			13	
Landform:			Flat/Plain	
Land surface/disturbance:			No effective disturbance	
Fire history:			>30 years	
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):			Uniform/Clay loam/Cracking	
% Cover leaf litter:			80	
% Cover bare ground:			40	

Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	M Tree Mallee (> 8m)	**Growth form:**	S Shrub	**Growth form:**	S Shrub
Height:	6-12m	**Height:**	0.5-1m	**Height:**	0.25-0.5m
Crown cover %:	M 30-70	**Crown cover %:**	S 10-30	**Crown cover %:**	S 10-30
Dominant taxa:		**Dominant taxa:**		**Dominant taxa:**	
Eucalyptus gracilis		Eremophila oldfieldii subsp. angustifolia		Eremophila caerulea subsp. caerulea	
Eucalyptus lesouefii		Eremophila oppositifolia subsp. angustifolia		Ptilotus obovatus	
				Atriplex vesicaria	

ALL SPECIES
Eucalyptus gracilis
Eucalyptus lesouefii
Eremophila oldfieldii subsp. angustifolia
Eremophila oppositifolia subsp. angustifolia
Eremophila caerulea subsp. caerulea
Ptilotus obovatus
Atriplex vesicaria
Scaevola spinescens
Lycium australe
Cratystylis subspinescens
Santalum acuminatum
Rhagodia drummondii
Enchylaena tomentosa var. tomentosa
Maireana tomentosa
Sclerolaena diacantha
Maireana triptera
Maireana georgei
Maireana trichoptera
Maireana pyramidata
Exocarpos aphyllus
Eremophila decipiens subsp. decipiens
Eremophila scoparia
Eremophila dempsteri
Atriplex nummularia subsp. spathulata
Eriochiton sclerolaenoides
Outside
Eucalyptus salmonophloia
Eucalyptus ravida
Maireana sedifolia

Project Name: Mt Marion Project Area - October 2021				
Date:	12/10/2021		**Botanist:**	Eren Reid
Location (Longitude/Latitude):	121.43997	-31.03297	**Quadrat:**	Q17
Quadrat size:	20x20 m			
Quadrat marking method:	Fence dropper at each corner. TwoNav Aventura GPS waypoint @ NE corner (±4 m accuracy). Using GDA2020 datum			
Vegetation group:	H			
Vegetation condition:	Very Good			
WP:	17			
Photo number:			9	
Landform:			Flat/Plain	
Land surface/disturbance:			No effective disturbance	
Fire history:			>30 years	
Coarse fragments on the surface (abundance/size/shape):			Extremely; very abundant/Fine gravelly; small pebbles/Subrounded	
Rock outcrop (abundance/runoff):			No bedrock exposed/Very slow	
Soil (profile/field texture/soil surface):			Uniform/Sandy clay loam/Firm	
% Cover leaf litter:			50	
% 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:	12-20m	**Height:**	1-3m	**Height:**	0.5-1m
Crown cover %:	S 10-30	**Crown cover %:**	M 30-70	**Crown cover %:**	V <10
Dominant taxa:		**Dominant taxa:**		**Dominant taxa:**	
Eucalyptus oleosa subsp. oleosa		Melaleuca sheathiana		Ptilotus obovatus	
		Dodonaea lobulata		Exocarpos aphyllus	
		Senna artemisioides subsp. filifolia		Scaevola spinescens	

ALL SPECIES
Eucalyptus oleosa subsp. oleosa
Melaleuca sheathiana
Dodonaea lobulata
Senna artemisioides subsp. filifolia
Ptilotus obovatus
Exocarpos aphyllus
Scaevola spinescens
Maireana trichoptera
Maireana triptera
Eremophila oldfieldii subsp. angustifolia
Eremophila oppositifolia subsp. angustifolia
Sclerolaena eriacantha
Sclerolaena diacantha
Olearia muelleri
Enchylaena tomentosa var. tomentosa
Maireana tomentosa
Leichhardtia australis
Eriochiton sclerolaenoides
Maireana georgei
Austrostipa elegantissima
Austrostipa scabra
Austrostipa nitida
Sclerolaena densiflora
Atriplex vesicaria
Enchylaena tomentosa var. tomentosa
Outside
Casuarina pauper
Eremophila interstans subsp. virgata
Maireana pentatropis
Eremophila parvifolia subsp. auricampa

Project Name: Mt Marion Project Area - October 2021				
Date:	15/10/2021		**Botanist:**	Eren Reid
Location (Longitude/Latitude):	121.48602	-31.10121	**Quadrat:**	Q18
Quadrat size:	20x20 m			
Quadrat marking method:	Fence dropper at each corner. TwoNav Aventura GPS waypoint @ NE corner (±4 m accuracy). Using GDA2020 datum			
Vegetation group:	H			
Vegetation condition:	Very Good			
WP:	18			
Photo number:			63	
Landform:			Flat/Plain	
Land surface/disturbance:			No effective disturbance	
Fire history:			>30 years	
Coarse fragments on the surface (abundance/size/shape):			No coarse fragments	
Rock outcrop (abundance/runoff):			No bedrock exposed/Very slow	
Soil (profile/field texture/soil surface):			Uniform/Sandy clay loam/Firm	
% Cover leaf litter:			20	
% Cover bare ground:			40	

Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	T Tree	**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 %:**	I <1
Dominant taxa:		**Dominant taxa:**		**Dominant taxa:**	
Eucalyptus lesouefii		Melaleuca sheathiana		Atriplex nummularia subsp. spathulata	
Eucalyptus gracilis					

ALL SPECIES
Eucalyptus lesouefii
Eucalyptus gracilis
Melaleuca sheathiana
Atriplex nummularia subsp. spathulata
Ptilotus obovatus
Maireana trichoptera
Scaevola spinescens
Maireana tomentosa
Sclerolaena eriacantha
Sclerolaena diacantha
Maireana georgei
Olearia muelleri
Exocarpos aphyllus
Eremophila parvifolia subsp. auricampa
Maireana pentatropis
Senna artemisioides subsp. filifolia
Myoporum platycarpum
Westringia rigida
Enchylaena tomentosa var. tomentosa
Rhagodia drummondii
Chenopodium gaudichaudianum
Eremophila scoparia
Ptilotus aervoides
Outside
Acacia merrallii

Project Name: Mt Marion Project Area - October 2021				
Date:	15/10/2021		**Botanist:**	Eren Reid
Location (Longitude/Latitude):	121.49380	-31.11026	**Quadrat:**	Q19
Quadrat size:	20x20 m			
Quadrat marking method:	Fence dropper at each corner. TwoNav Aventura GPS waypoint @ NE corner (±4 m accuracy). Using GDA2020 datum			
Vegetation group:	H			
Vegetation condition:	Very Good			
WP:	19			
Photo number:			60	
Landform:			Crest/Hill Crest	
Land surface/disturbance:			No effective disturbance	
Fire history:			>30 years	
Coarse fragments on the surface (abundance/size/shape):			Extremely; very abundant/Coarse gravelly; large pebbles/Rounded	
Rock outcrop (abundance/runoff):			No bedrock exposed/Moderately rapid	
Soil (profile/field texture/soil surface):			Uniform/Sandy clay loam/Firm	
% Cover leaf litter:			20	
% Cover bare ground:			50	

Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	T Tree	**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 %:**	I <1
Dominant taxa:		**Dominant taxa:**		**Dominant taxa:**	
Eucalyptus lesouefii		Melaleuca sheathiana		Exocarpos aphyllus	

ALL SPECIES
Eucalyptus lesouefii
Melaleuca sheathiana
Exocarpos aphyllus
Acacia merrallii
Sclerolaena diacantha
Ptilotus obovatus
Maireana triptera
Atriplex vesicaria
Maireana trichoptera
Eremophila parvifolia subsp. auricampa
Myoporum platycarpum
Outside
Atriplex nummularia subsp. spathulata

Project Name: Mt Marion Project Area - October 2021				
Date:	13/10/2021		**Botanist:**	Eren Reid
Location (Longitude/Latitude):	121.45642	-31.04284	**Quadrat:**	Q20
Quadrat size:	20x20 m			
Quadrat marking method:	Fence dropper at each corner. TwoNav Aventura GPS waypoint @ NE corner (±4 m accuracy). Using GDA2020 datum			
Vegetation group:	I			
Vegetation condition:	Very good			
WP:	20			
Photo number:			15	
Landform:			Flat/Plain	
Land surface/disturbance:			No effective disturbance	
Fire history:			>30 years	
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:			70	
% Cover bare ground:			40	

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 %:	M 30-70	**Crown cover %:**	M 30-70	**Crown cover %:**	S 10-30
Dominant taxa:		**Dominant taxa:**		**Dominant taxa:**	
Eucalyptus ravida		Eremophila interstans subsp. virgata		Eremophila ionantha	
		Eremophila dempsteri		Rhagodia drummondii	
		Eremophila scoparia		Exocarpos aphyllus	

ALL SPECIES
Eucalyptus ravida
Eremophila interstans subsp. virgata
Eremophila dempsteri
Eremophila scoparia
Eremophila ionantha
Rhagodia drummondii
Exocarpos aphyllus
Daviesia aphylla
Maireana tomentosa
Enchylaena tomentosa var. tomentosa
Maireana trichoptera
Acacia hemiteles
Maireana triptera
Maireana georgei
Eremophila decipiens subsp. decipiens
Ptilotus obovatus
Sclerolaena eriacantha
Sclerolaena diacantha
Leichhardtia australis
Lycium australe
Eremophila oldfieldii subsp. angustifolia
Scaevola spinescens
Acacia erinacea
Eremophila caerulea subsp. caerulea
Atriplex codonocarpa
Sclerolaena patenticuspis
Atriplex vesicaria
Outside
Eucalyptus salmonophloia
Eucalyptus gracilis
Eremophila glabra subsp. glabra
Maireana pyramidata

Project Name: Mt Marion Project Area - October 2021				
Date:	13/10/2021		**Botanist:**	Eren Reid
Location (Longitude/Latitude):	121.45914	-31.04328	**Quadrat:**	Q21
Quadrat size:	20x20 m			
Quadrat marking method:	Fence dropper at each corner. TwoNav Aventura GPS waypoint @ NE corner (±4 m accuracy). Using GDA2020 datum			
Vegetation group:	I			
Vegetation condition:	Very Good			
WP:	21			
Photo number:			16	
Landform:			Open depression (vale)/Drainage depression	
Land surface/disturbance:			No effective disturbance	
Fire history:			>30 years	
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:			40	

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 %:	M 30-70	**Crown cover %:**	M 30-70	**Crown cover %:**	S 10-30
Dominant taxa:		**Dominant taxa:**		**Dominant taxa:**	
Eucalyptus ravida		Eremophila dempsteri		Atriplex vesicaria	
		Exocarpos aphyllus		Ptilotus obovatus	
		Eremophila scoparia		Eremophila ionantha	

ALL SPECIES
Eucalyptus ravida
Eremophila dempsteri
Exocarpos aphyllus
Eremophila scoparia
Atriplex vesicaria
Ptilotus obovatus
Eremophila ionantha
Rhagodia drummondii
Sclerolaena diacantha
Enchylaena tomentosa var. tomentosa
Maireana tomentosa
Maireana trichoptera
Eremophila decipiens subsp. decipiens
Eremophila oldfieldii subsp. angustifolia
Ptilotus exaltatus
Scaevola spinescens
Eucalyptus flocktoniae subsp. flocktoniae
Frankenia pauciflora var. pauciflora
Maireana pyramidata
Leichhardtia australis
Olearia muelleri
Solanum nummularium
Atriplex nummularia subsp. spathulata
Santalum acuminatum
Sclerolaena eriacantha
Chenopodium gaudichaudianum
Outside
Atriplex codonocarpa
Sclerolaena cuneata
Sclerolaena patenticuspis
Eucalyptus gracilis
Maireana sedifolia

Project Name: Mt Marion Project Area - October 2021				
Date:	13/10/2021		**Botanist:**	Eren Reid
Location (Longitude/Latitude):	121.43939	-31.05482	**Quadrat:**	Q22
Quadrat size:	20x20 m			
Quadrat marking method:	Fence dropper at each corner. TwoNav Aventura GPS waypoint @ NE corner (±4 m accuracy). Using GDA2020 datum			
Vegetation group:	A			
Vegetation condition:	Good			
WP:	22			
Photo number:			24	
Landform:			Flat/Plain	
Land surface/disturbance:			No effective disturbance	
Fire history:			>30 years	
Coarse fragments on the surface (abundance/size/shape):			No coarse fragments	
Rock outcrop (abundance/runoff):			No bedrock exposed/Very slow	
Soil (profile/field texture/soil surface):			Uniform/Sandy clay loam/Firm	
% Cover leaf litter:			45	
% 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:**	
Eucalyptus griffithsii		Eremophila interstans subsp. virgata		Olearia muelleri	
Eucalyptus salmonophloia		Eremophila oldfieldii subsp. angustifolia		Senna artemisioides subsp. filifolia	
		Exocarpos aphyllus		Ptilotus obovatus	

ALL SPECIES
Eucalyptus griffithsii
Eucalyptus salmonophloia
Eremophila interstans subsp. virgata
Eremophila oldfieldii subsp. angustifolia
Exocarpos aphyllus
Olearia muelleri
Senna artemisioides subsp. filifolia
Ptilotus obovatus
Sclerolaena diacantha
Sclerolaena eriacantha
Austrostipa nitida
Austrostipa scabra
Maireana trichoptera
Atriplex nummularia subsp. spathulata
Acacia merrallii
Maireana georgei
Maireana triptera
Acacia acuminata
Solanum nummularium
Austrostipa elegantissima
Acacia hemiteles
Westringia rigida
Acacia erinacea
Leichhardtia australis
Maireana tomentosa
Solanum lasiophyllum
Maireana pentatropis
Acacia ligulata
Dodonaea microzyga subsp. acrolobata
Haloragis trigonocarpa
Scaevola spinescens
Cratystylis conocephala
Dodonaea lobulata
Acacia jennerae
Outside
Eucalyptus oleosa subsp. oleosa

Project Name: Mt Marion Project Area - October 2021				
Date:	14/10/2021		**Botanist:**	Eren Reid
Location (Longitude/Latitude):	121.40377	-31.05830	**Quadrat:**	Q23
Quadrat size:	20x20 m			
Quadrat marking method:	Fence dropper at each corner. TwoNav Aventura GPS waypoint @ NE corner (±4 m accuracy). Using GDA2020 datum			
Vegetation group:	N			
Vegetation condition:	Good			
WP:	23			
Photo number:			34	
Landform:			Flat/Plain	
Land surface/disturbance:			No effective disturbance	
Fire history:			>30 years	
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/Sandy clay loam/Loose	
% Cover leaf litter:			60	
% 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:**	0.25-0.5m
Crown cover %:	S 10-30	**Crown cover %:**	S 10-30	**Crown cover %:**	M 30-70
Dominant taxa:		**Dominant taxa:**		**Dominant taxa:**	
Eucalyptus gracilis		Eremophila interstans subsp. virgata		Eremophila caerulea subsp. caerulea	
		Exocarpos aphyllus			

ALL SPECIES
Eucalyptus gracilis
Eremophila interstans subsp. virgata
Exocarpos aphyllus
Eremophila caerulea subsp. caerulea
Maireana trichoptera
Sclerolaena diacantha
Sclerolaena densiflora
Maireana tomentosa
Enchylaena tomentosa var. tomentosa
Olearia muelleri
Roepera eremaea
Maireana georgei
Senna artemisioides subsp. filifolia
Rhagodia eremaea
Eucalyptus ravida
Wilsonia humilis
Sclerolaena cuneata
Maireana triptera
Senna artemisioides subsp. artemisioides
Austrostipa scabra
Alyxia buxifolia
Austrostipa elegantissima
Outside
Santalum spicatum
Eucalyptus griffithsii
Grevillea acuaria

Project Name: Mt Marion Project Area - October 2021				
Date:	15/10/2021		**Botanist:**	Eren Reid
Location (Longitude/Latitude):	121.49103	-31.11255	**Quadrat:**	Q24
Quadrat size:	20x20 m			
Quadrat marking method:	Fence dropper at each corner. TwoNav Aventura GPS waypoint @ NE corner (±4 m accuracy). Using GDA2020 datum			
Vegetation group:	R			
Vegetation condition:	Very Good			
WP:	24			
Photo number:			59	
Landform:			Flat/Plain	
Land surface/disturbance:			No effective disturbance	
Fire history:			>30 years	
Coarse fragments on the surface (abundance/size/shape):			No coarse fragments	
Rock outcrop (abundance/runoff):			No bedrock exposed/Very slow	
Soil (profile/field texture/soil surface):			Uniform/Sandy clay loam/Loose	
% Cover leaf litter:			65	
% 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:**	
Eucalyptus griffithsii		Exocarpos aphyllus		Olearia pimeleoides	
Eucalyptus oleosa subsp. oleosa		Eremophila scoparia		Olearia muelleri	
		Acacia hemiteles		Senna artemisioides subsp. filifolia	

ALL SPECIES
Eucalyptus griffithsii
Eucalyptus oleosa subsp. oleosa
Exocarpos aphyllus
Eremophila scoparia
Acacia hemiteles
Olearia pimeleoides
Olearia muelleri
Senna artemisioides subsp. filifolia
Austrostipa nitida
Austrostipa scabra
Dodonaea viscosa subsp. angustissima
Eremophila ionantha
Eremophila decipiens subsp. decipiens
Maireana triptera
Aristida contorta
Austrostipa elegantissima
Monachather paradoxus
Sclerolaena diacantha
Sclerolaena eriacantha
Enchylaena tomentosa var. tomentosa
Ptilotus exaltatus
Acacia jennerae
Grevillea acuaria
Atriplex nummularia subsp. spathulata
Enneapogon caerulescens
Maireana georgei
Maireana trichoptera
Calotis hispidula
Maireana tomentosa
Ptilotus obovatus
Leichhardtia australis
Rhagodia drummondii
Atriplex stipitata
Swainsona canescens
Eragrostis dielsii
Outside
Eucalyptus salmonophloia
Eucalyptus transcontinentalis
Acacia merrallii

Project Name: Mt Marion Project Area - October 2021				
Date:	15/10/2021		**Botanist:**	Eren Reid
Location (Longitude/Latitude):	121.49751	-31.11382	**Quadrat:**	Q25
Quadrat size:	20x20 m			
Quadrat marking method:	Fence dropper at each corner. TwoNav Aventura GPS waypoint @ NE corner (±4 m accuracy). Using GDA2020 datum			
Vegetation group:	R			
Vegetation condition:	Very Good			
WP:	25			
Photo number:			53	
Landform:			Flat/Plain	
Land surface/disturbance:			No effective disturbance	
Fire history:			>30 years	
Coarse fragments on the surface (abundance/size/shape):			No coarse fragments	
Rock outcrop (abundance/runoff):			No bedrock exposed/Very 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:	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:**	
Eucalyptus griffithsii		Exocarpos aphyllus		Ptilotus obovatus	
		Eremophila ionantha		Senna artemisioides subsp. filifolia	
		Acacia hemiteles		Eremophila scoparia	

ALL SPECIES
Eucalyptus griffithsii
Exocarpos aphyllus
Eremophila ionantha
Acacia hemiteles
Ptilotus obovatus
Senna artemisioides subsp. filifolia
Eremophila scoparia
Rhagodia drummondii
Austrostipa scabra
Grevillea acuaria
Aristida contorta
Leichhardtia australis
Maireana triptera
Sclerolaena diacantha
Sclerolaena eriacantha
Maireana georgei
Maireana trichoptera
Eremophila decipiens subsp. decipiens
Acacia acuminata
Swainsona canescens
Triodia rigidissima
Enneapogon caerulescens
Lycium australe
Solanum lasiophyllum
Atriplex stipitata
Outside
Alyxia buxifolia
Olearia pimeleoides
Maireana tomentosa
Teucrium disjunctum
Austrostipa elegantissima
Acacia merrallii

Project Name: Mt Marion Project Area - October 2021				
Date:	13/10/2021		**Botanist:**	Eren Reid
Location (Longitude/Latitude):	121.43425	-31.05059	**Quadrat:**	Q26
Quadrat size:	20x20 m			
Quadrat marking method:	Fence dropper at each corner. TwoNav Aventura GPS waypoint @ NE corner (±4 m accuracy). Using GDA2020 datum			
Vegetation group:	B			
Vegetation condition:	Very Good			
WP:	26			
Photo number:			21	
Landform:			Simple slope/Hillslope	
Land surface/disturbance:			No effective disturbance	
Fire history:			>30 years	
Coarse fragments on the surface (abundance/size/shape):			Very; abundant/Cobbly; or cobbles/Subrounded platy	
Rock outcrop (abundance/runoff):			Rocky/Rapid	
Soil (profile/field texture/soil surface):			Uniform/Sandy clay loam/Firm	
% Cover leaf litter:			55	
% Cover bare ground:			60	

Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	T Tree	**Growth form:**	S Shrub	**Growth form:**	S Shrub
Height:	12-20m	**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:**	
Eucalyptus ravida		Eremophila interstans subsp. virgata		Olearia muelleri	
Eucalyptus salmonophloia		Eremophila scoparia		Scaevola spinescens	
Eucalyptus gracilis		Beyeria sulcata var. brevipes		Alyxia buxifolia	

ALL SPECIES
Eucalyptus ravida
Eucalyptus salmonophloia
Eucalyptus gracilis
Eremophila interstans subsp. virgata
Eremophila scoparia
Beyeria sulcata var. brevipes
Olearia muelleri
Scaevola spinescens
Alyxia buxifolia
Eucalyptus salubris
Solanum nummularium
Ptilotus exaltatus
Ptilotus obovatus
Exocarpos aphyllus
Acacia erinacea
Santalum acuminatum
Atriplex vesicaria
Sclerolaena densiflora
Sclerolaena eriacantha
Senna artemisioides subsp. filifolia
Maireana trichoptera
Rhagodia drummondii
Outside

Project Name: Mt Marion Project Area - October 2021				
Date:	12/10/2021		**Botanist:**	Eren Reid
Location (Longitude/Latitude):	121.42810	-31.03685	**Quadrat:**	Q27
Quadrat size:	20x20 m			
Quadrat marking method:	Fence dropper at each corner. TwoNav Aventura GPS waypoint @ NE corner (±4 m accuracy). Using GDA2020 datum			
Vegetation group:	A			
Vegetation condition:	Good			
WP:	27			
Photo number:			8	
Landform:			Flat/Plain	
Land surface/disturbance:			No effective disturbance	
Fire history:			>30 years	
Coarse fragments on the surface (abundance/size/shape):			Extremely; very abundant/Fine gravelly; small pebbles/Rounded	
Rock outcrop (abundance/runoff):			No bedrock exposed/Slow	
Soil (profile/field texture/soil surface):			Uniform/Sandy clay loam/Loose	
% Cover leaf litter:			50	
% Cover bare ground:			60	

Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	T Tree	**Growth form:**	S Shrub	**Growth form:**	S Shrub
Height:	12-20m	**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:**	
Eucalyptus salmonophloia		Senna artemisioides subsp. filifolia		Scaevola spinescens	
Eucalyptus transcontinentalis		Exocarpos aphyllus		Eremophila caerulea subsp. caerulea	
Eucalyptus flocktoniae subsp. flocktoniae		Eremophila oldfieldii subsp. angustifolia		Olearia muelleri	

ALL SPECIES
Eucalyptus salmonophloia
Eucalyptus transcontinentalis
Eucalyptus flocktoniae subsp. flocktoniae
Senna artemisioides subsp. filifolia
Exocarpos aphyllus
Eremophila oldfieldii subsp. angustifolia
Scaevola spinescens
Eremophila caerulea subsp. caerulea
Olearia muelleri
Austrostipa elegantissima
Austrostipa scabra
Acacia hemiteles
Sclerolaena diacantha
Ptilotus obovatus
Dodonaea lobulata
Westringia rigida
Eremophila decipiens subsp. decipiens
Acacia erinacea
Eremophila oppositifolia subsp. angustifolia
Leichhardtia australis
Eremophila scoparia
Maireana trichoptera
Sclerolaena patenticuspis
Sclerolaena cuneata
Eriochiton sclerolaenoides
Maireana triptera
Maireana tomentosa
Sclerolaena eriacantha
Outside
Eucalyptus lesouefii

Project Name: Mt Marion Project Area - October 2021				
Date:	13/10/2021		**Botanist:**	Eren Reid
Location (Longitude/Latitude):	121.44434	-31.04481	**Quadrat:**	Q28
Quadrat size:	20x20 m			
Quadrat marking method:	Fence dropper at each corner. TwoNav Aventura GPS waypoint @ NE corner (±4 m accuracy). Using GDA2020 datum			
Vegetation group:	B			
Vegetation condition:	Very Good			
WP:	28			
Photo number:			19	
Landform:			Simple slope/Hillslope	
Land surface/disturbance:			No effective disturbance	
Fire history:			>30 years	
Coarse fragments on the surface (abundance/size/shape):			Moderately; many/Cobbly; or cobbles/Subrounded	
Rock outcrop (abundance/runoff):			Slightly rocky/Moderately rapid	
Soil (profile/field texture/soil surface):			Uniform/Clay loam sandy/Firm	
% Cover leaf litter:			30	
% 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:	12-20m	**Height:**	1-3m	**Height:**	0.5-1m
Crown cover %:	S 10-30	**Crown cover %:**	V <10	**Crown cover %:**	S 10-30
Dominant taxa:		**Dominant taxa:**		**Dominant taxa:**	
Eucalyptus oleosa subsp. oleosa		Exocarpos aphyllus		Halgania andromedifolia	
Eucalyptus lesouefii		Senna artemisioides subsp. filifolia		Scaevola spinescens	
Eucalyptus torquata		Melaleuca sheathiana		Westringia rigida	

ALL SPECIES
Eucalyptus oleosa subsp. oleosa
Eucalyptus lesouefii
Eucalyptus torquata
Exocarpos aphyllus
Senna artemisioides subsp. filifolia
Melaleuca sheathiana
Halgania andromedifolia
Scaevola spinescens
Westringia rigida
Trymalium myrtillus subsp. myrtillus
Eremophila glabra subsp. glabra
Austrostipa elegantissima
Olearia muelleri
Acacia erinacea
Alyxia buxifolia
Eremophila parvifolia subsp. auricampa
Maireana trichoptera
Sclerolaena diacantha
Senna artemisioides subsp. artemisioides
Ptilotus obovatus
Eremophila oldfieldii subsp. angustifolia
Roepera eremaea

Outside

Project Name: Mt Marion Project Area - October 2021				
Date:	12/10/2021		**Botanist:**	Eren Reid
Location (Longitude/Latitude):	121.44486	-31.03431	**Quadrat:**	Q29
Quadrat size:	20x20 m			
Quadrat marking method:	Fence dropper at each corner. TwoNav Aventura GPS waypoint @ NE corner (±4 m accuracy). Using GDA2020 datum			
Vegetation group:	I			
Vegetation condition:	Very Good			
WP:	29			
Photo number:			10	
Landform:			Flat/Plain	
Land surface/disturbance:			No effective disturbance	
Fire history:			>30 years	
Coarse fragments on the surface (abundance/size/shape):			No coarse fragments	
Rock outcrop (abundance/runoff):			No bedrock exposed/Very slow	
Soil (profile/field texture/soil surface):			Uniform/Clay loam/Cracking	
% Cover leaf litter:			90	
% 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 %:	M 30-70	**Crown cover %:**	V <10	**Crown cover %:**	S 10-30
Dominant taxa:		**Dominant taxa:**		**Dominant taxa:**	
Eucalyptus ravida		Eremophila interstans subsp. virgata		Ptilotus obovatus	
				Eremophila scoparia	

ALL SPECIES
Eucalyptus ravida
Eremophila interstans subsp. virgata
Ptilotus obovatus
Eremophila scoparia
Maireana georgei
Sclerolaena diacantha
Maireana tomentosa
Atriplex codonocarpa
Maireana trichoptera
Senna artemisioides subsp. filifolia
Olearia muelleri
Lycium australe
Acacia tetragonophylla
Exocarpos aphyllus
Enneapogon caerulescens
Eriochiton sclerolaenoides
Enchylaena tomentosa var. tomentosa
Pimelea microcephala subsp. microcephala
Sclerolaena cuneata
Ptilotus exaltatus
Eremophila glabra subsp. glabra
Eremophila decipiens subsp. decipiens
Austrostipa nitida
Acacia erinacea
Austrostipa elegantissima
Acacia hemiteles
Daviesia aphylla
Gunniopsis propinqua
Outside
Eucalyptus salmonophloia
Alyxia buxifolia

Project Name: Mt Marion Project Area - October 2021				
Date:	14/10/2021		**Botanist:**	Eren Reid
Location (Longitude/Latitude):	121.43819	-31.06226	**Quadrat:**	Q30
Quadrat size:	20x20 m			
Quadrat marking method:	Fence dropper at each corner. TwoNav Aventura GPS waypoint @ NE corner (±4 m accuracy). Using GDA2020 datum			
Vegetation group:	K			
Vegetation condition:	Very Good			
WP:	30			
Photo number:			25-30	
Landform:			Simple slope/Hillslope	
Land surface/disturbance:			No effective disturbance	
Fire history:			>30 years	
Coarse fragments on the surface (abundance/size/shape):			No qualifier; common/Coarse gravelly; large pebbles/Rounded	
Rock outcrop (abundance/runoff):			No bedrock exposed/Slow	
Soil (profile/field texture/soil surface):			Uniform/Sandy clay loam/Firm	
% Cover leaf litter:			85	
% Cover bare ground:			50	

Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	T Tree	**Growth form:**	S Shrub	**Growth form:**	S Shrub
Height:	12-20m	**Height:**	1-3m	**Height:**	0.25-0.5m
Crown cover %:	S 10-30	**Crown cover %:**	S 10-30	**Crown cover %:**	M 30-70
Dominant taxa:		**Dominant taxa:**		**Dominant taxa:**	
Eucalyptus salmonophloia		Melaleuca sheathiana		Eremophila acutifolia (P3)	
Eucalyptus gracilis		Eremophila oldfieldii subsp. angustifolia		Acacia erinacea	
		Atriplex nummularia subsp. spathulata		Eremophila scoparia	

ALL SPECIES
Eucalyptus salmonophloia
Eucalyptus gracilis
Melaleuca sheathiana
Eremophila oldfieldii subsp. angustifolia
Atriplex nummularia subsp. spathulata
Eremophila acutifolia (P3)
Acacia erinacea
Eremophila scoparia
Cratystylis conocephala
Scaevola spinescens
Senna artemisioides subsp. filifolia
Eremophila decipiens subsp. decipiens
Alyxia buxifolia
Eremophila parvifolia subsp. auricampa
Maireana trichoptera
Sclerolaena diacantha
Outside
Exocarpos aphyllus
Eucalyptus lesouefii
Eucalyptus oleosa subsp. oleosa
Eremophila interstans subsp. virgata
Maireana pentatropis

Project Name: Mt Marion Project Area - October 2021				
Date:	14/10/2021		**Botanist:**	Eren Reid
Location (Longitude/Latitude):	121.43580	-31.06497	**Quadrat:**	Q31
Quadrat size:	20x20 m			
Quadrat marking method:	Fence dropper at each corner. TwoNav Aventura GPS waypoint @ NE corner (±4 m accuracy). Using GDA2020 datum			
Vegetation group:	K			
Vegetation condition:	Very Good			
WP:	31			
Photo number:			31-32	
Landform:			Simple slope/Hillslope	
Land surface/disturbance:			No effective disturbance	
Fire history:			>30 years	
Coarse fragments on the surface (abundance/size/shape):			Moderately; many/Medium gravelly; medium pebbles/Subrounded	
Rock outcrop (abundance/runoff):			Slightly rocky/Slow	
Soil (profile/field texture/soil surface):			Uniform/Sandy clay loam/Cracking	
% Cover leaf litter:			55	
% Cover bare ground:			30	

Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	M Tree Mallee (> 8m)	**Growth form:**		**Growth form:**	S Shrub
Height:	6-12m	**Height:**		**Height:**	0.25-0.5m
Crown cover %:	S 10-30	**Crown cover %:**		**Crown cover %:**	M 30-70
Dominant taxa:		**Dominant taxa:**		**Dominant taxa:**	
Eucalyptus ravida				Eremophila acutifolia (P3)	
Eucalyptus gracilis					

ALL SPECIES
Eucalyptus ravida
Eucalyptus gracilis
Eremophila acutifolia (P3)
Olearia muelleri
Exocarpos aphyllus
Solanum nummularium
Ptilotus exaltatus
Maireana triptera
Maireana georgei
Maireana trichoptera
Sclerolaena diacantha
Enchylaena tomentosa var. tomentosa
Roepera eremaea
Maireana tomentosa
Sclerolaena cuneata
Sclerolaena densiflora
Sclerolaena eriacantha
Austrostipa scabra
Outside
Melaleuca sheathiana
Eremophila interstans subsp. virgata
Beyeria sulcata var. brevipes
Eremophila scoparia
Eucalyptus salmonophloia
Eremophila oldfieldii subsp. angustifolia

Project Name: Mt Marion Project Area - October 2021				
Date:	12/11/2021		**Botanist:**	Eren Reid
Location (Longitude/Latitude):	121.42642	-31.02584	**Quadrat:**	Q32
Quadrat size:	20x20 m			
Quadrat marking method:	Fence dropper at each corner. TwoNav Aventura GPS waypoint @ NE corner (±4 m accuracy). Using GDA2020 datum			
Vegetation group:	Ac quad shrubland on undulating hills			
Vegetation condition:	Very Good			
WP:	32			
Photo number:			5	
Landform:			Crest/Hill Crest	
Land surface/disturbance:			No effective disturbance	
Fire history:			>30 years	
Coarse fragments on the surface (abundance/size/shape):			Very; abundant/Cobbly; or cobbles/Subangular platy	
Rock outcrop (abundance/runoff):			No bedrock exposed/Rapid	
Soil (profile/field texture/soil surface):			Uniform/Silty clay loam/Firm	
% Cover leaf litter:			30	
% Cover bare ground:			30	

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 %:	M 30-70	**Crown cover %:**	S 10-30	**Crown cover %:**	S 10-30
Dominant taxa:		**Dominant taxa:**		**Dominant taxa:**	
Acacia quadrimarginea		Allocasuarina campestris		Ptilotus obovatus	
Eremophila oldfieldii subsp. angustifolia		Eremophila alternifolia		Scaevola spinescens	
		Dodonaea lobulata		Eremophila granitica	

ALL SPECIES
Acacia quadrimarginea
Eremophila oldfieldii subsp. angustifolia
Allocasuarina campestris
Eremophila alternifolia
Dodonaea lobulata
Ptilotus obovatus
Scaevola spinescens
Eremophila granitica
Acacia acuminata
Alyxia buxifolia
Chrysocephalum puteale
Acacia tetragonophylla
Brachychiton gregorii
Santalum spicatum
Roepera eremaea
Olearia muelleri
Leichhardtia australis
Prostanthera althoferi subsp. althoferi
Senna artemisioides subsp. filifolia
Thysanotus manglesianus
Austrostipa scabra
Pimelea microcephala subsp. microcephala
Prostanthera campbellii
Austrostipa elegantissima
Outside

Project Name: Mt Marion Project Area - October 2021				
Date:	14/10/2021		**Botanist:**	Eren Reid
Location (Longitude/Latitude):	121.38935	-31.06941	**Quadrat:**	Q33
Quadrat size:	20x20 m			
Quadrat marking method:	Fence dropper at each corner. TwoNav Aventura GPS waypoint @ NE corner (±4 m accuracy). Using GDA2020 datum			
Vegetation group:	C			
Vegetation condition:	Very Good			
WP:	33			
Photo number:			36	
Landform:			Flat/Plain	
Land surface/disturbance:			No effective disturbance	
Fire history:			>30 years	
Coarse fragments on the surface (abundance/size/shape):			No coarse fragments	
Rock outcrop (abundance/runoff):			No bedrock exposed/Very slow	
Soil (profile/field texture/soil surface):			Uniform/Sandy loam/Hard setting	
% Cover leaf litter:			70	
% Cover bare ground:			25	

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 %:	V <10	**Crown cover %:**	M 30-70	**Crown cover %:**	M 30-70
Dominant taxa:		**Dominant taxa:**		**Dominant taxa:**	
Eucalyptus griffithsii		Acacia acuminata		Eremophila granitica	
		Melaleuca hamata		Prostanthera grylloana	
				Prostanthera althoferi subsp. althoferi	

ALL SPECIES
Eucalyptus griffithsii
Acacia acuminata
Melaleuca hamata
Eremophila granitica
Prostanthera grylloana
Prostanthera althoferi subsp. althoferi
Waitzia acuminata var. acuminata
Austrostipa scabra
Olearia pimeleoides
Westringia rigida
Exocarpos aphyllus
Austrostipa elegantissima
Thysanotus manglesianus
Thryptomene australis subsp. brachyandra
Dissocarpus paradoxus
Ptilotus obovatus
Acacia eremophila var. eremophila
Acacia heteroneura var. jutsonii
Outside
Senna artemisioides subsp. filifolia
Acacia multispicata
Dianella revoluta var. divaricata
Leptospermum erubescens

Appendix B

Mt Marion Fauna Assessment: Hamptons Lease Area 53, L15/353, M15/999 and East E15/1599 (Bamford Consulting Ecologists, 2022)

Mt Marion
Fauna Assessment:
[redacted]L15/353, M15/999 and East E15/1599

Malleefowl mound recorded in Hamptons lease. Photo: Tim Gamblin

Prepared for: Mineral Resources Limited
1 Sleat Road
Applecross WA 6153

Prepared by: Natalia Huang, Jamie Wadey and Mike Bamford
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20th January 2022

Executive Summary

Introduction

Bamford Consulting Ecologists (BCE) were commissioned by Mineral Resource Limited (MRL) to conduct a Basic (formerly level 1) and Targeted (*sensu* EPA 2020) Fauna Assessment (desktop assessment and targeted survey for conservation significant species) around MRL's active Mt Marion Lithium Project located approximately 35 kilometres (km) south of Kalgoorlie, in the Coolgardie Bioregion and the Eastern Goldfields Subregion (COO03) of Western Australia. The Fauna Assessment focused specifically within [redacted] L15/353, M15/999, and East 15/1599. This involved:

- Identification of Vegetation and Substrate Associations (VSAs) (that provide fauna habitats);
- Targeted searches for significant fauna and an assessment of their likelihood of occurrence based on VSAs present; target species include:
    - Malleefowl – opportunistic records of mounds;
    - Chuditch – camera trap survey;
    - Arid Bronze Azure Butterfly (ABAB) – opportunistic searching for associated *Camponotus* ants in smooth-barked eucalypts;
    - Trapdoor Spiders – opportunistic searching for trapdoor spider burrows in suitable habitat.
- Continuous recording of bird species encountered; and
- Opportunistic fauna observations.

BCE use a 'values and impacts' assessment process with the following components:

- The identification of **fauna values**:
    - Assemblage characteristics: uniqueness, completeness and richness;
    - Species of conservation significance;
    - Recognition of ecotypes or vegetation/substrate associations (VSAs) that provide habitat for fauna, particularly those that are rare, unusual and/or support significant fauna;
    - Patterns of biodiversity across the landscape; and
    - Ecological processes upon which the fauna depend.
- The review of **impacting processes** such as:
    - Habitat loss leading to population decline;
    - Habitat loss leading to population fragmentation;
    - Degradation of habitat due to weed invasion leading to population decline;
    - Ongoing mortality from operations;
    - Species interactions including feral and overabundant native species;
    - Hydrological change;
    - Altered fire regimes; and
    - Disturbance (dust, light, noise).
- The **recommendation** of actions to mitigate impacts (if requested).

The desktop assessment draws on the findings of extensive surveys which were conducted in the Mt Marion Project area and nearby areas between 2010 and 2020 (mostly by BCE), including a BCE review of these surveys 2019.

Description of project area

The Mt Marion Lithium Project ('the Project') is located approximately 35 kilometres (km) south of Kalgoorlie, in the Goldfields region of Western Australia. The project area consists of three leases located adjacent to the existing Project:

(1) [redacted] 4326 hectares (ha); located just north of existing mining infrastructure;
(2) L15/353 and M15/999 (hereafter "L" and "M" respectively or Priority 2 combined): 67 ha and 50 ha respectively; located southeast and adjacent to existing mining infrastructure; and
(3) E15/1599 (hereafter "East" or Priority 3): 3379 ha; located southwest of existing mining infrastructure.

The Project area lies within the Coolgardie Bioregion and the Eastern Goldfields Subregion (COO03). The Coolgardie Bioregion falls within the Bioregion Group 3 (Northern Botanical Province) classification of the Environmental Protection Authority (EPA) where "native vegetation is largely contiguous but used for commercial grazing".

Key fauna values

<u>Vegetation and Substrate Associations (VSAs) that provide habitat for fauna</u>
Seven major Vegetation and Substrate Associations (VSAs) were identified in the project area:

1) Mixed Eucalypt woodland over sclerophyll shrubland on undulating hills (VSA 1);
2) Acacia shrubland on rocky rises (VSA 2);
3) Eucalypt woodland over mixed shrubs on red loam flats (VSA 3);
4) Mixed Eucalypt woodland over *Melaleuca sheathiana* on gravelly rises (VSA 4);
5) Dense Mallee and Eucalypt woodland associated with minor drainage lines (VSA 5);
6) Acacia shrubland on brown loam flats (VSA 6); and
7) Dense Acacia shrubland on exposed granite (VSA 7).

All VSAs are considered important for fauna. Large Salmon Gums (*Eucalyptus salmonophloia*) provide important nesting opportunities for fauna and dense vegetation provide cover and habitat for species such as the Golden Whistler, Western Yellow Robin and Malleefowl.

<u>Fauna assemblage</u>
The desktop study identified 288 vertebrate fauna species as potentially occurring in the project area: five frogs, 85 reptiles, 164 birds, 25 native and ten introduced mammals. The presence of at least 95 species (one frog, 12 reptiles, 66 bird species, ten native mammals and six introduced mammals) has been recorded from surveys thus far. The 2021 field investigations confirmed the presence of three reptiles, 34 birds, two native mammals and one introduced mammal. The expected fauna assemblage is typical of the Coolgardie region and Goldfields eucalypt woodlands, with some species occurring at

the edge of their range in the project area. The assemblage contains a high level of richness which is expected in such relatively undisturbed intact woodland vegetation and is mostly complete, with a portion of the mammal fauna considered locally extinct.

Species of conservation significance

Three broad levels of conservation significance are used in this report:

- Conservation Significance 1 (CS1) – species listed under State or Commonwealth Acts.
- Conservation Significance 2 (CS2) – species listed as Priority by DBCA but not listed under State or Commonwealth Acts.
- Conservation Significance 3 (CS3) – species not listed under Acts or in publications but considered of at least local significance because of their pattern of distribution.

There are 33 species of conservation significance expected to occur in the project area, comprising 10 CS1, two CS2 and 21 CS3 species. The majority of conservation significant species are expected as residents (13 species), following by vagrants (7 species), regular visitors (7 species) and irregular visitors (6 species). Ten conservation significant species have been recorded to date, comprising one CS1 and 9 CS3 species (one CS3 species was recorded in the 2021 field investigations).

Two Malleefowl mounds were recorded in Hamptons, with one of these being recent but inactive. They were located within a densely-vegetated area in the southern part of Hamptons and this area is considered likely to provide suitable habitat for Malleefowl. No Chuditch were recorded on camera traps. With the closest known population located 200 km southwest of the project, dispersing individuals may move through the area and the species is expected to occur in the project area as a vagrant or possibly an irregular visitor.

No *Camponotus* ants which are associated with the ABAB were recorded and it is considered unlikely for the butterfly to occur in the project area. Several Trapdoor Spider burrows were detected (all within Hamptons) and were identified as species of the genus *Idiosoma*, with the potential for these to be the CS2 species.

Patterns of biodiversity

The presence of a range of VSAs are factors in patterns of biodiversity; fauna that occur in eucalypt woodlands throughout the region are likely to utilise the project area, areas of dense thicket are important for species that prefer dense cover, areas with exposed granite may support a unique suite of species, with large, hollow-bearing trees in woodlands providing potential important nesting opportunities.

Key ecological processes

Key ecological processes affecting the fauna assemblage in the project area are hydrology, feral species and possibly over-abundant native species.

Potential impacts upon fauna

Impacting processes included: habitat loss leading to population decline and population fragmentation, local hydrological change, degradation of habitat due to weed invasion, ongoing mortality from operations (i.e., roadkill of Malleefowl and Chuditch), impacts of feral and

overabundant native species, fire and disturbance (dust, noise and light). Potential impacts are considered negligible to minor as the project area is small, relative to the broad and largely intact landscape. Recommendations related to conservation significant species include: detailed targeted surveys for conservation significant species when a clearing footprint is available; protection of active Malleefowl nests; roadkill management; feral species management; conserving mature trees; avoiding overabundant native species. Recommendations related to key fauna values include: feral and overabundant native species management; minimise disturbance footprint; habitat preservation – retain important areas (such as large mature hollow-bearing trees); manage hydrology; and minimise disturbance to mature eucalypt trees and areas of dense understorey.

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1 Introduction

Bamford Consulting Ecologists (BCE) was commissioned by Mineral Resource Limited (MRL) to conduct a Basic (formerly level 1) and Targeted (*sensu* EPA 2020) Fauna Assessment (desktop assessment and targeted survey for conservation significant species) around MRL's active Mt Marion Lithium Project located approximately 35 kilometres (km) south of Kalgoorlie, in the Coolgardie Bioregion and the Eastern Goldfields Subregion (COO03) of Western Australia. The Fauna Assessment focused specifically within [redacted] L15/353, M15/999, and East 15/1599. This report presents the results of that fauna desktop review and targeted survey.

1.1 General approach to fauna impact assessment

The purpose of impact assessment is to provide government agencies with the information they need to decide what significance the impacts of a proposed development will have, and to provide information to proponents which assist them to develop appropriate strategies for avoiding and minimising impacts from their activities. This relies on information regarding the fauna assemblage and its environment. Bamford Consulting Ecologists uses an approach with the following components:

- The identification of **fauna values**:
  - Assemblage characteristics: uniqueness, completeness and richness;
  - Species of conservation significance;
  - Recognition of ecotypes or vegetation/substrate associations (VSAs) that provide habitat for fauna, particularly those that are rare, unusual and/or support significant fauna;
  - Patterns of biodiversity across the landscape; and
  - Ecological processes upon which the fauna depend.

- The review of **impacting processes** such as:
  - Habitat loss leading to population decline;
  - Habitat loss leading to population fragmentation;
  - Degradation of habitat due to weed invasion leading to population decline;
  - Ongoing mortality from operations;
  - Species interactions including feral and overabundant native species;
  - Hydrological change;
  - Altered fire regimes; and
  - Disturbance (dust, light, noise).

- The **recommendation** of actions to mitigate impacts (if requested).

Based on the impact assessment process above, the objectives of the study are therefore to:

1. Conduct a literature review and searches of Commonwealth and State fauna databases;
2. Review the list of fauna expected to occur on the site in the light of fauna habitats present, with a focus on investigating the likelihood of significant species being present;
3. Identify significant or fragile fauna habitats within the project area;
4. Identify any ecological processes in the project area upon which fauna may depend;
5. Identify general patterns of biodiversity within or adjacent to the project area; and

6. Identify potential impacts upon fauna and propose recommendations to minimise impacts.

Descriptions and background information on these values and processes can be found in **Appendices 1 to 4**. Based on this impact assessment process, the objectives of investigations are to: identify fauna values; review impacting processes with respect to these values and the proposed development; and provide recommendations to mitigate these impacts.

1.2 Description of project area and background environmental information

1.2.1 Project area

For spatial terminology (i.e. definitions of project, survey and study areas) see Section 2.1.1 below.

The Project is located approximately 35 kilometres (km) south of Kalgoorlie in the Goldfields region of Western Australia **(Figure 1-1)**. The project area is comprised of three leases located adjacent to the existing Project **(Figure 1-2)**. Bamford Consulting Ecologists was requested by MRL to conduct the Fauna Assessment at each lease by level of priority, as indicated below. The project area comprises the following leases:

1. [redacted] 4326 hectares (ha); located just north of existing mining infrastructure;
2. L15/353 and M15/999 (hereafter "L" and "M" respectively or Priority 2 combined): 67 ha and 50 ha respectively; located southeast and adjacent to existing mining infrastructure; and
3. E15/1599 (hereafter "East" or Priority 3): 3379 ha; located southwest of existing mining infrastructure.

The field investigations in this environmental impact assessment were conducted within the project area only and, therefore, the 'survey area' and project area are treated as synonymous from hereon.

Figure 1-1. Regional location of the Mt Marion Lithium Project.

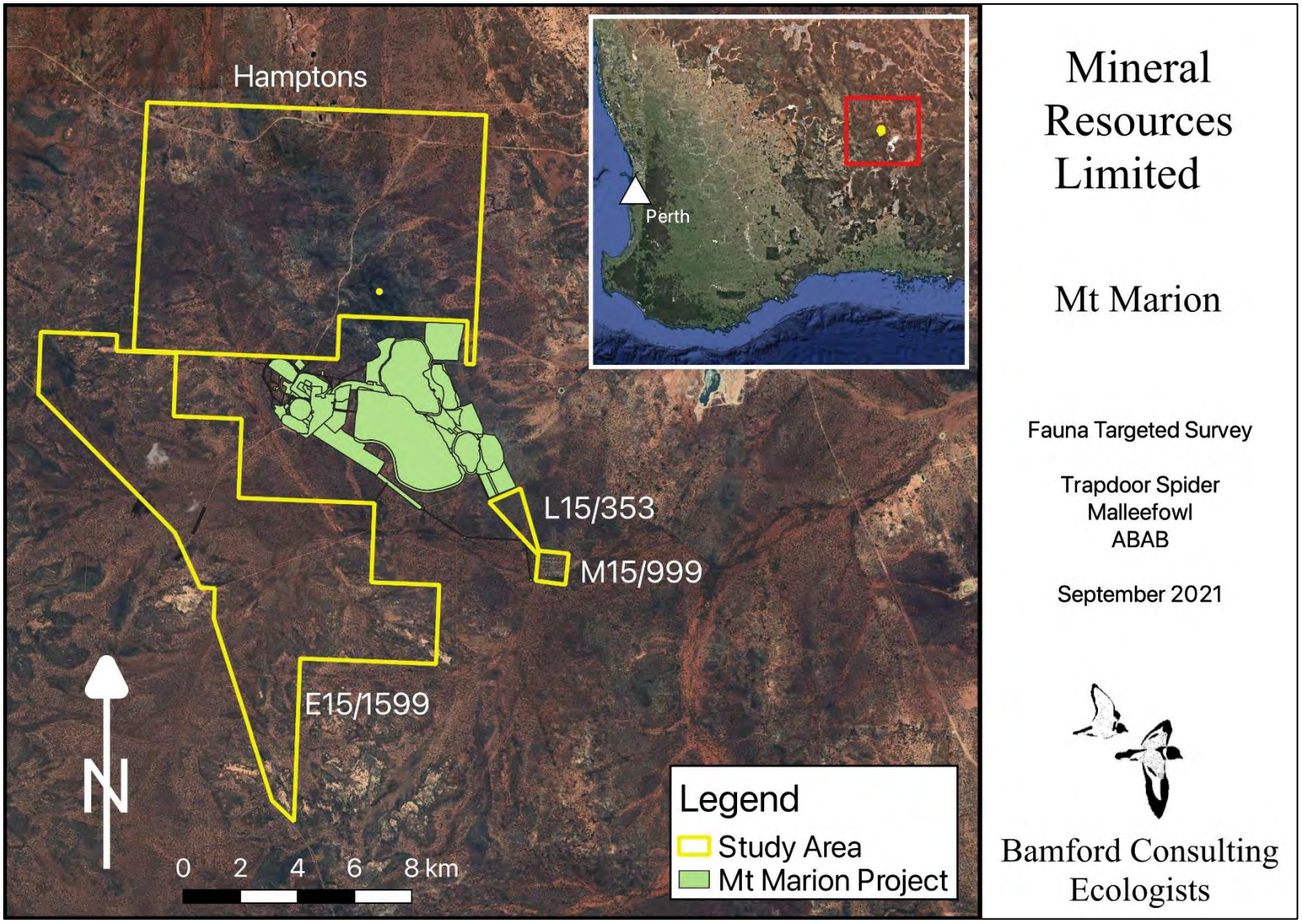


Figure 1-2. Location of project area and four leases.

1.2.2 Interim Biogeographic Regionalisation of Australia (IBRA) and landscape characteristics

The Interim Biogeographic Regionalisation of Australia (IBRA) has identified 26 bioregions in Western Australia which are further divided into subregions (DAWE 2021b). Bioregions are classified on the basis of climate, geology, landforms, vegetation and fauna (Thackway and Cresswell 1995). IBRA Bioregions are affected by a range of different threatening processes and have varying levels of sensitivity to impact (EPA 2016c).

The Mt Marion project area lies within the Coolgardie Bioregion and the Eastern Goldfields Subregion (COO03) **(Figure 1-3)**. The Coolgardie Bioregion falls within the Bioregion Group 3 (Northern Botanical Province) classification of EPA (2016c) where "native vegetation is largely contiguous but used for commercial grazing". Cowan (2001) describes the Eastern Goldfields subregion as: "*The vegetation is of Mallees, Acacia thickets and shrub heaths on sandplains. Diverse Eucalyptus woodlands occur around salt lakes, on ranges, and in valleys. Salt lakes support dwarf shrublands of samphire. The area is rich in endemic Acacias. The climate is Arid to Semi-arid with 200-300 mm of rainfall, sometimes in summer but usually in winter. The subregional area is 5,102,428ha*."

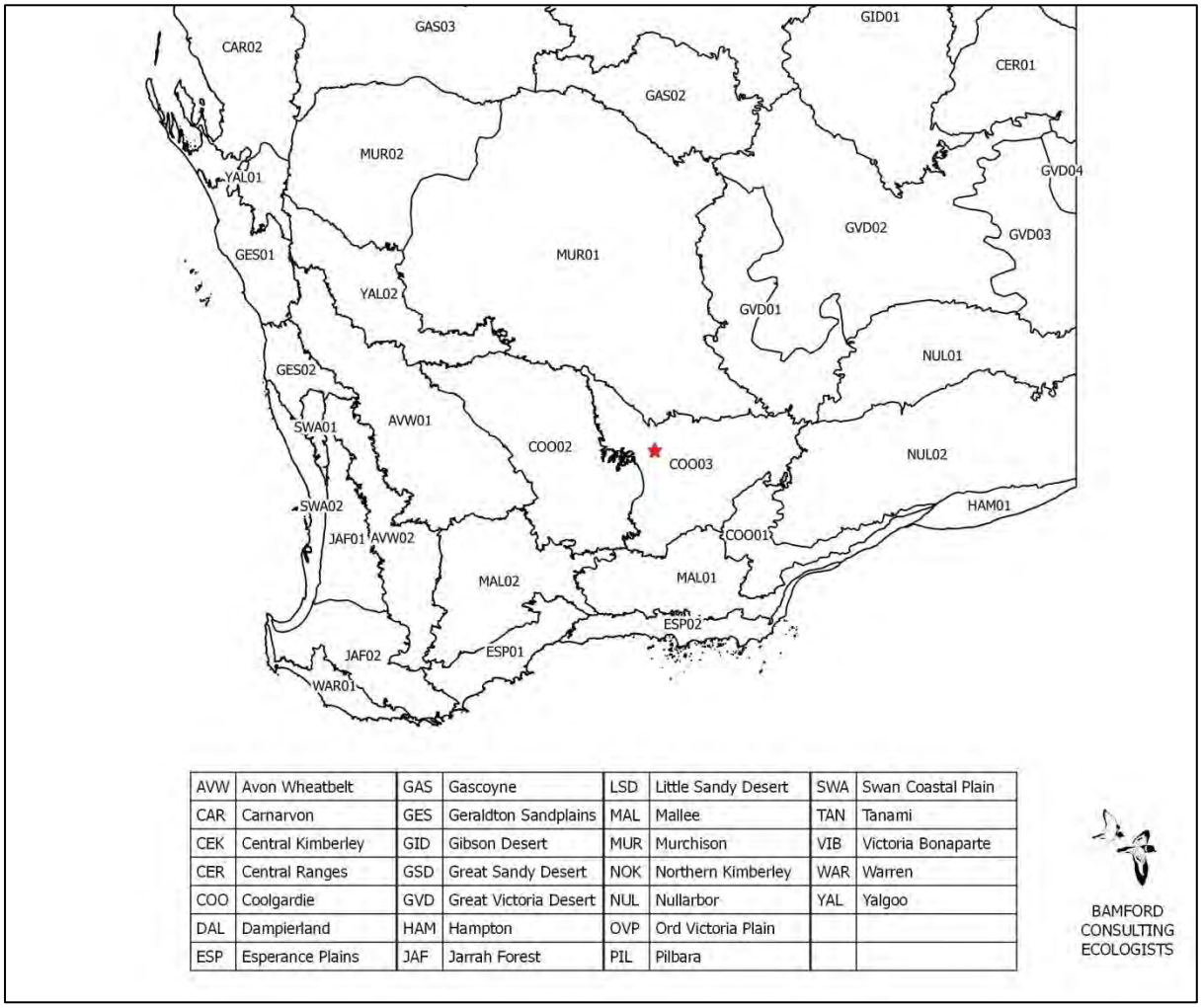
The dominant land use within the Eastern Goldfield subregion is grazing, with smaller areas of crown reserves, mining, freehold, and conservation. Only 4.35 % of the sub-region is vested within conservation reserves (Cowan, 2001). Cowan (2001) describes the Goldfields Woodlands as having an exceptionally high diversity of Eucalyptus species with as many as 170 species occurring in the bioregion. The project area lies within the Coolgardie Vegetation System. The region is characterised by woodlands of *Eucalyptus torquata*, *Eucalyptus lesouefii* and *Eucalyptus clelandii* with *Eremophila scoparia*, *Eremophila glabra* and *Eremophila oldfieldii* shrubs. All woodlands in the Coolgardie System have been logged in the past for mining timber and firewood and current vegetation is secondary growth regenerated from seed and coppice (Beard 1972). Beard (1972) describes the vegetation of the region as:

- Greenstone Ridges supporting a characteristic *Eucalyptus torquata – E. lesouefii* association. Both *E. torquata* and *E. lesouefii* are co-dominant, abundant and characteristic. Associated trees include *E. clelandii*, *E. campaspe*, *Casuarina pauper* and *Grevillea nematophylla*. There is an open shrub understorey, largely of *Eremophila* spp. ("Broombush"), *Dodenia lobulata*, *Senna cardiosperma* and *Acacia* species, interspersed with *Atriplex nummularia*. Two understorey types, "broombush" and "saltbush", occur on slopes, with broombush appearing on less alkaline soils;

- Eucalypt Woodlands of the lower slopes and flats consist typically of *Eucalyptus salmonophloia*, often with *E. salubris*, *E. torquata* and *E. longicornis*. *Melaleuca pauperiflora* (boree) occurs as a dominant understorey on heavy, periodically wet soils;

- Salt lakes and samphire flats. Distinct localised vegetation communities occur in saline or alkaline soils and fringed with open saltbush or bluebush, lightly wooded with *Casuarina pauper*, *Myoporum platycarpum* and some *Acacia* species; and

- Red sand dunes with scattered *Callitris columellaris*, *Pittosporum angustifolium*, *Acacia tetragonophylla*, *Eremophila miniata* and shrubs of *Grevillea sarissa* and *Acacia* species (Beard, 1972).



AVW	Avon Wheatbelt	GAS	Gascoyne	LSD	Little Sandy Desert	SWA	Swan Coastal Plain
CAR	Carnarvon	GES	Geraldton Sandplains	MAL	Mallee	TAN	Tanami
CEK	Central Kimberley	GID	Gibson Desert	MUR	Murchison	VIB	Victoria Bonaparte
CER	Central Ranges	GSD	Great Sandy Desert	NOK	Northern Kimberley	WAR	Warren
COO	Coolgardie	GVD	Great Victoria Desert	NUL	Nullarbor	YAL	Yalgoo
DAL	Dampierland	HAM	Hampton	OVP	Ord Victoria Plain		
ESP	Esperance Plains	JAF	Jarrah Forest	PIL	Pilbara		

Figure 1-3. Project location within the Eastern Goldfield (COO03) subregion of Interim Biogeographic Regionalisation of Australia (IBRA) regions.

2 Methods

2.1 Overview

This approach to fauna impact assessment has been developed with reference to guidelines and recommendations set out by the Western Australian Environmental Protection Authority (EPA) on fauna surveys and environmental protection (EPA 2002, 2016b, 2016c, 2020), and Commonwealth biodiversity legislation (DotE 2013, DSEWPaC 2013). The EPA (2020) recommends three levels of investigation that differ in their approach for field investigations:

- Basic – a low-intensity survey, conducted at the local scale to gather broad fauna and habitat information (formerly referred to as 'Level 1'). The primary objectives are to verify the overall adequacy of the desktop study, and to map and describe habitats. A basic survey can also be used to identify future survey site locations and determine site logistics and access. The results from the basic survey are used to determine whether a detailed and/or targeted survey is required. During a basic survey, opportunistic fauna observations should be made and low-intensity sampling can be used to gather data on the general faunal assemblages present.

While referred to as 'basic', this level of survey is involved and powerful, and should be considered the primary level of assessment. Other levels of assessment (where deemed necessary) add information to inform this primary level.

- Detailed – a detailed survey to gather quantitative data on species, assemblages and habitats in an area (formerly referred to as 'Level 2'). A detailed survey requires comprehensive survey design and should include at least two survey phases appropriate to the biogeographic region (bioregion). Surveys should be undertaken during the seasons of maximum activity of the relevant fauna and techniques should be selected to maximise the likelihood that the survey will detect most of the species that occur, and to provide data to enable some community analyses to be carried out.
- Targeted – to gather information on significant fauna and/or habitats, or to collect data where a desktop study or field survey has identified knowledge gaps. Because impacts must be placed into context, targeted surveys are not necessarily confined to potential impact areas. A targeted survey usually requires one or more site visits to detect and record significant fauna and habitats. For areas with multiple significant species there may not be a single time of year suitable to detect all species. In these cases, multiple visits, each targeting different species or groups, should be conducted.

The level of assessment recommended by the EPA (2020) is determined by geographic position, with a generic statement that detailed surveys are expected across all of the state except the south-west, but also recommending that site and project characteristics be considered, such as the survey objectives, existing available data, information required, the scale and nature of the potential impacts of the proposal and the sensitivity of the surrounding environment in which the disturbance is planned. These aspects should be considered in the context of the information acquired by the desktop study. When determining the type of survey required, the EPA (2020) suggested that the following be considered:

- 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.

Guidance for field investigations methods is provided by the EPA (2016c, 2020) and by Bamford *et al.* (2013).

A 'basic' level survey (desktop review, fauna habitat identification and a site inspection) is considered appropriate for the project area. This is based upon the in-depth level of existing knowledge (see Section 2.3 below), the stage in the approvals process, and the extent, distribution and significance of habitats (widespread) likely to be present.

The approach and methods utilised in this report are divided into three groupings that relate to the stages and the objectives of impact assessment:

- **Desktop assessment.** The purpose of the desktop review is to produce a species list that represents the vertebrate fauna assemblage of the project area, based on unpublished and published data using a precautionary approach.
- **Field investigations.** The purpose of the field investigations carried out for a Basic assessment is to gather information on the vegetation and soil associations ('habitats') supporting the fauna assemblage. Additionally, it places the list generated by the desktop review into the context of the project areas surrounding environment. Targeted surveys allow for assessing the likelihood of conservation significant species to occur in the project area, which may trigger further detailed study. The brief field investigations that form part of a Basic assessment also allow fauna observations to be made. This assists the consultant to develop further understanding of the ecological processes that may be occurring in the project area.
- **Impact assessment.** Determines how the fauna assemblage may be affected by the proposed development; this is based on the interaction of the project with a suite of ecological and threatening processes.

2.1.1 Spatial terminology

A range of terms are used through the report to refer to the spatial environment around the proposed project, and these are defined below:

- Development footprint – the expected extent of land clearing and/or development. Usually a subset of the project area but in some cases this will be equivalent to project area (where the entire project area is proposed to be developed).
- Project area – the outermost boundary within which the proposed project will be located (the maximum envelope in which development could occur). This will usually be a lease area or land over which the proponent has some tenure. In this report, the project area comprises the three leases as described in Section 1.2.1.
- Survey area – the outermost boundary of the environmental impact assessment (including the area to which the results of the desktop analysis are directed and/or the area where field investigations are conducted). While the minimum survey area boundary is equivalent to project area, often this boundary will exceed that of the project area where reference, contextual or regional information is sourced (including field investigations outside of the project area; i.e. outside the land over which the proponent has tenure). Note that while the term 'survey area' is used throughout the guidance provided by EPA (2020), it does not appear to be explicitly defined and, therefore, the above definition has been developed with interpretation of both the guidance and BCE report structure.
- Study area – the outermost boundary of the desktop assessment that is almost always a specified buffer distance (see Section 2.3.1 below) around the project area, or the project area centroid. This is generally the area from which databases are sourced.

2.2 Identification of Vegetation and Substrate Associations (VSAs)

Vegetation and Substrate Associations (VSAs) combine vegetation types, the soils or other substrate they are associated with, and the landform. In the context of fauna assessment, VSAs are the environments that provide habitats for fauna.

BCE deliberately makes the distinction between 'habitat' (a species-specific term that may encompass the whole or part of one or more VSAs and is the physical subset of an ecosystem that a given species, or species group, utilises) and 'VSA' (a general, discrete and mutually exclusive spatial division of a target area, based on soil, vegetation and topography). It is recognised, however, that, within the broader EIA literature/guidance, the former term is used more or less synonymously to indicate the latter (e.g.' habitat assessment' used by EPA 2020). Further discussion is provided in **Appendix 1.**

For the current assessment, VSAs were identified based on extensive previous surveys by BCE (which included identification of VSAs) in the Mt Marion area and on observations made during the field investigations.

2.3 Desktop assessment of expected species

2.3.1 Sources of information

As per the recommendations of EPA (2020), information on the fauna assemblage of the project area was drawn from a range of sources including databases (as listed in **Table 2-1**). In addition, extensive surveys have been conducted by BCE in the region and on MRL leases, some of which overlap the leases surveyed in this report; these reports were consulted as part of the desktop assessment (as listed in **Table 2-2**). Information from these sources was supplemented with species expected in the area based on general patterns of distribution. Sources of information used for these general patterns are listed in **Table 2-3**. As extensive surveys have been conducted across the Mt Marion area and the project area is located within search boundaries, the database search conducted in 2019 as part of the review was considered sufficient for the present desktop assessment.

Table 2-1. Databases searched for the desktop review, accessed May 2019.

Source	Type of records	Year/Area searched
Atlas of Living Australia	Records of biodiversity data from multiple sources across Australia.	Project area centre point plus 20 km buffer. Searched 8/5/2019.
NatureMap (DBCA 2019)	Records in the WAM and DBCA databases. Includes historical data and records on Threatened and Priority species in WA.	Project area centre point plus 20 km buffer. Searched 8/5/2019.
BirdLife Australia Atlas Database (Birdlife Australia 2019)	Records of bird observations in Australia, 1998-2019.	One-degree cell containing project area Searched 8/5/2019.
EPBC Protected Matters (DEE 2019)	Records on matters of national environmental significance protected under the EPBC Act.	Project area centre point plus 20 km buffer. Searched 8/5/2019.

Table 2-2. Literature sources for the desktop review.

Source	Type of records	Year/Area searched
Mt Marion Lithium Project Malleefowl Survey, January 2020	Systematic targeted survey for Malleefowl mounds conducted by BCE.	Mt Marion Project Area, 2020.
Review of Fauna Assessments within the Mt Marion Lithium Project area	Review of all surveys conducted in and around MRL leases, conducted by BCE.	Mt Marion Project Area, 2019.
Fauna Assessment of a proposed borefield pipeline corridor (Woolibar borefield Stage 2)	Level 1 Fauna Survey conducted by BCE in 2018.	Borefield area, Mt Marion Project Area 2018.
Fauna Assessment of a proposed borefield pipeline corridor (Woolibar borefield Stage 1)	Level 1 Fauna Survey conducted by BCE in 2017.	Borefield area, Mt Marion Project Area, 2017.
Fauna Assessment of M15/717 lease area, part of the Mt Marion Lithium Project.	Level 1 Fauna Survey conducted by BCE in 2017.	M15/717 lease area, Mt Marion Project Area, 2017.
Fauna Assessment of the Mt Marion Study Area.	Level 2 Fauna Survey conducted by BCE in 2016.	Mt Marion Project Area, 2016.
Fauna Assessment of the Gunga West Project.	Level 1 Fauna Survey conducted by BCE in 2016.	Gunga West Project, 2016.
Fauna Assessment of the Cannon Project.	Level 1 Fauna Survey conducted by BCE in 2015.	Cannon Project, 2015.
Fauna Assessment of the Southern Gold Bulong Project.	Level 1 Survey conducted by BCE in 2012.	Bulong, 2012.
Fauna Assessment of the Mt Marion Mining Lease Area.	Level 1 Survey conducted by BCE in 2012.	Mount Marion, 2012.
Fauna Assessment of the South Kalgoorlie TSF.	Level 1 Survey conducted by BCE in 2012.	South Kalgoorlie, 2012.
Fauna Assessment of the South Kalgoorlie Pipeline.	Level 1 Survey conducted by BCE in 2012.	South Kalgoorlie, 2012.
Fauna Assessment of the Bardoc Mining Lease Area.	Level 1 Survey conducted by BCE in 2012.	Bardoc, 2012.
Fauna Assessment of the St Ives Mining Area.	Level 2 Survey conducted by BCE in 2010.	Lake Lefroy, 2010.
Fauna Assessment of the St Ives Pistol Club Mining Area.	Level 1 Fauna Survey conducted in 2015.	Kambalda, 2015.
Rapallo Level 1 Fauna Survey of Mount Marion	Level 1 Fauna Survey conducted by Rapallo in 2010.	Mount Marion, 2010.
Fauna Assessment of the Kangaroo Hills and Calooli Nature Reserves	Level 2 report by M. Bamford and S. Davies.	Kangaroo Hills and Calooli 1990.

Table 2-3. Sources of information used for general patterns of fauna distribution.

Taxa	Sources
Frogs	Tyler and Doughty (2009), Anstis (2017).
Reptiles	Storr *et al.* (1983, 1990, 1999, 2002), Bush and Maryan (2011), Wilson and Swan (2021).
Birds	Johnstone and Storr (1998, 2004), Menkhorst *et al.* (2017).
Mammals	Van Dyck and Strahan (2008), Churchill (2009), Menkhorst and Knight (2011).

2.3.2 Previous fauna surveys

In 2019, BCE conducted a review of fauna assessments within the vicinity of the project area (Metcalf and Bamford 2019). The review was based primarily on the findings from previous fauna assessments within the Mt Marion Lithium Project Area, but also drew on the findings from surveys outside the project area, but within the greater Goldfields region (e.g., BCE 2010, BCE 2012c, BCE 2012d, BCE 2012e, BCE 2015, BCE 2016a). Multiple Level 1 and Level 2 fauna assessments, including targeted Malleefowl assessments, have been conducted in the area covering parts of the project area (Rapallo 2010, BCE 2012a, BCE 2012b, BCE 2016b, Metcalf and Bamford 2017a, Metcalf and Bamford 2017b, Bancroft and Bamford 2020); see **Table 2-4** for a list of lease areas and relevant fauna assessments.

Table 2-4. Fauna Assessments covering Mt Marion lease areas.

Lease Area	Relevant Fauna Assessment/s
M15/717	BCE 2012a, BCE 2012b, BCE 2016b, Metcalf and Bamford 2017a
All leases previously surveyed	Metcalf and Bamford 2019
Scattered around Mt Marion site	Bancroft and Bamford 2020
M15/1000	Rapallo 2010, BCE 2016b
M15/999	Bamford, 2016b
L15/353	Bamford 2016b, Metcalf and Bamford 2017b (lease area was updated from L15/321).
L15/220	Bamford 2016b
L15/360	Bamford 2016b
L15/392	Metcalf and Bamford 2018
[redacted]	Bamford 2016b

A number of fauna assessments, both Level 1 and Level 2, have also been conducted by BCE in the greater area, including near Coolgardie, Kambalda, Bulong and Kalgoorlie (see Table 2-2). The reports provide data on conservation significant species recorded in VSAs in some cases similar to those found across the Project area. VSAs observed at the project area are presented in Section 3.1.

2.3.3 Nomenclature and taxonomy

As per the recommendations of the EPA (2020), the nomenclature and taxonomic order presented in this report are generally based on the Western Australian Museum's (WAM) Checklist of the Fauna of Western Australia 2020. The authorities used for each vertebrate group were: frogs (Doughty 2020a), reptiles (Doughty 2020b), birds (BirdLife Australia 2019, Gill *et al.* 2021), and mammals (Travouillon 2020). In some cases, more widely-recognised names and naming conventions have been followed, particularly for birds where there are national and international naming conventions in place (e.g. the BirdLife Australia working list of names for Australian Birds, and the International Ornithological Congress' 'World Bird List'). English common names of species, where available, are used throughout the text; Latin names are presented with corresponding English names in tables in the appendices. The use of subspecies is limited to situations where there is an important (and relevant) geographically distinct population, or where the taxonomic distinction has direct relevance to the conservation status or listing of a taxon.

2.3.4 Interpretation of species lists

2.3.4.1 Expected occurrence

Species lists generated from the review of sources are generous as they include records drawn from a large region (the study area, see **Figure 1-2**) and possibly from environments not represented in the project area. Therefore, some species that were returned by one or more of the database and literature searches have been excluded. This is because their ecology, or the environment within the project area, determine that it is highly unlikely that these species will be present. Such species can include, for example, seabirds that might occur as extremely rare vagrants at a terrestrial, inland site, but for which the site is of no importance. Species returned from the databases and not excluded on the basis of ecology or environment are therefore considered. They are potentially present or expected to be present in the project area at least occasionally, whether they were recorded during field surveys or not, and whether or not the project area is likely to be important for them. This list of expected species is therefore subject to interpretation by assigning each a predicted status, the expected occurrence, in the project area. The status categories used are:

- **Resident:** species with a population permanently present in the project area;
- **Regular migrant or visitor:** species that occur within the project area regularly in at least moderate numbers, such as part of an annual cycle;
- **Irregular visitor:** species that occur within the project area irregularly such as nomadic and irruptive species. The length of time between visitations could be decades but when the species is present, it uses the project area in at least moderate numbers and for some time;
- **Vagrant:** species that occur within the project area unpredictably, in small numbers and/or for very brief periods. Therefore, the project area is unlikely to be of importance for the species; and
- **Locally extinct:** species that would have been present but has not been recently recorded in the local area and therefore is almost certainly no longer present in the project area.

These status categories make it possible to distinguish between vagrant species, which may be recorded at any time but for which the site is not important in a conservation sense, and species which use the site in other ways but for which the site is important at least occasionally. This is particularly

useful for birds that may naturally be migratory or nomadic, and for some mammals that can also be mobile or irruptive, and further recognises that even the most detailed field survey can fail to record species which will be present at times. The status categories are assigned conservatively based on the precautionary principle. For example, a lizard known from the general area is assumed to be a resident unless there is very good evidence the site will not support it, and even then, it may be classed as a vagrant rather than assumed to be absent if the site might support dispersing individuals. It must be stressed that these status categories are predictions only and that often very intensive sampling would be required to confirm a species' status.

The results of the database searches were reviewed and interpreted, and obvious errors and out of date taxonomic names were removed.

2.3.4.2 Conservation significance

All expected species were assessed for conservation significance as detailed in **Appendix 1.** Three broad levels of conservation significance are used in this report:

- Conservation Significance 1 (CS1) – species listed under State or Commonwealth Acts such as the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the Western Australian *Biodiversity Conservation Act 2016* (BC Act);
- Conservation Significance 2 (CS2) – species listed as Priority by DBCA but not listed under State or Commonwealth Acts; and
- Conservation Significance 3 (CS3) – species not listed under Acts or in publications but considered of at least local significance because of their pattern of distribution.

See **Appendix 1** for an expanded discussion of these categories and **Appendix 2** for a description of the categories used in the legislation (EPBC and BC Acts) and by the DBCA.

2.4 Field investigations

2.4.1 Overview

A survey of the project area was conducted (10-14 September 2021) to familiarise the consultants with the leases and to search for specific conservation significant species. This involved inspecting as much of the project area as possible, including walking through areas that did not have direct vehicle access. This enabled:

- identification of VSAs (that provide fauna habitats);
- targeted searches for significant fauna and an assessment of their likelihood of occurrence based on VSAs present; target species include Malleefowl, Chuditch, ABAB and Trapdoor Spiders;
- continuous recording of bird species encountered; and
- opportunistic fauna observations.

2.4.2 Malleefowl

2.4.2.1 Overview

The project area was assessed for habitat which may have the potential to support Malleefowl, i.e., dense woodland and Acacia on stony or sandy substrates. This involved traversing the area and

assessing suitability of vegetation and substrate to support Malleefowl and its breeding efforts. Suitable areas were searched for Malleefowl nest mounds. Note that this was not a targeted Malleefowl survey (which involves systematic transects to search for mounds).

Results of previous Malleefowl surveys conducted in 2019 and 2020 by BCE were consulted and summarised.

2.4.2.2 Malleefowl nest mounds

Opportunistic records of Malleefowl mounds were made at all times of the field investigations. Mounds were recorded, measured (diameter across mound in metres, height of mound in centimetres and depth of crater in centimetres) and scored for mound profile and age, as described below:

Mound Profile

The profile of a Malleefowl mound changes with breeding activity and age (erosion and vegetation growth). A number of profile stages are classified according to age (NHT 2007):

- Profile 1: Typical crater with raised rims. This is the typical shape of an inactive nest. However, this is also the profile of a mound being worked early in the breeding season;
- Profile 2: Nest fully dug out. The characteristic of this profile is that the crater slopes down steeply and at the base the sides drop vertically to form a box- like structure with side usually 20 to 30 cm deep. Often, litter will have been raked into windrows, and may have started to enter the nest;
- Profile 3: Nest with litter. This is the next stage after profile 2. Litter will have been raked into the nest by Malleefowl, and thick layers of litter are evident on the surface. There may or may not be sand mixed with the litter at this stage;
- Profile 4: Nest mounded up (no crater). This is the typical profile of an active but unopened Malleefowl nest. The active mound is closed and dome shaped;
- Profile 5: Nest a crater with peak in centre. This is a typical profile of an active nest which is in the process of being closed by Malleefowl; and
- Profile 6: Nest low and flat without peak or crater. This mound has not been used for some time and weathering and erosion have 'flattened" the original mound.

Mound Age

- Active: Fresh scratching, Malleefowl scats, loose soil, mound may be dug out in preparation for the breeding season or mounded for breeding;
- Recently used: (1-5 years): Mound contains signs of recent activity (e.g., eggshell fragments) and mound may still contain large amounts of leaf litter if not excavated. Soil surface compacted, mound structure intact with well-defined central depression. No vegetation colonising mound;
- Moderately old: (5-20 years): No recent activity, mound compacted. Surface of mound showing some weathering and some minor plant colonisation possibly present. Mound profile raised; central depression defined;
- Old: (20-100 years): Mound moderately to very weathered, often with a veneer of gravel on the slopes because of removal of fine materials from the surface. Extensive plant colonisation. Mound profile raised; no or minimal central depression; and

- Very old: (100+ years): Mound very weathered, with a low profile. Bushes and even small trees growing on mound. No central depression.

2.4.2.3 Malleefowl critical habitat

Only a brief general definition of 'critical habitat' is provided under section 207B of the *EPBC Act*: "habitat identified … as being critical to the survival of a listed threatened species or listed threatened ecological community" (DEH 2000). Critical habitat specifically for Malleefowl is not presently defined (DoE 2020a) and, therefore, it is not currently listed on the Federal (*EPBC Act*) Register of Critical Habitat (DoE 2020b).

In the assessment of "Habitat critical for survival" for the *National Recovery Plan for Malleefowl*, Benshemesh (2007) noted that, at a national level at least, critical habitat is "not well understood". Habitat studies available at that time were not of sufficient scope to adequately describe the habitat features that are important for Malleefowl across their range (Benshemesh 2007). Benshemesh (2007) also noted that, at the time of publication, no particular populations or general areas can be described as being of greater importance for the long-term survival of Malleefowl.

In the absence of direct guidance at the national scale, for the purposes of this survey, we define critical habitat at the regional scale with the purpose of protecting a buffer zone around any active nest mound such that there is minimal disruption to the breeding success of that mound. There are no data available to guide the establishment of buffer widths, however, it is noted that active Malleefowl mounds have been observed in close proximity to disturbance areas (e.g. along the edges of active tracks or drill-lines; M. Bamford and W. Bancroft, pers. obs.). It is vital to preserve any connectivity of the active mound area to broadscale areas of native vegetation to facilitate movement through the natural landscape for parents (e.g. for foraging, while tending the mound) and offspring (for dispersal).

Suitable *potential* nesting habitat is not a limiting factor in the region (soils suited to mound construction, including loam-sand to gravel but not clay, with sufficient surrounding vegetation to provide leaf litter), additionally the Malleefowl is a mobile species that has the ability to transit to other areas without assistance. Therefore, the loss of inactive mounds at the local scale is highly unlikely to affect the long term survival of local individuals and will not affect the regional survival of the species. Suitable potential nesting habitat could be considered to be critical habitat if it supported active mounds (i.e. supported a breeding population of the species).

In the absence of a clear definition of critical habitat for Malleefowl, we concluded that this should be decided on a case by case basis where an active mound is found.

2.4.3 Chuditch

Motion-sensitive cameras are commonly used to detect mammals which may be otherwise difficult to detect, such as Chuditch. A total of ten camera traps was installed in areas containing suitable Chuditch habitat, i.e., rocky areas (**Figure 2-1**). They were left operational for a period of 33 to 36 nights with the first date of deployment being 10th September 2021 (**Table 2-5**). A non-reward lure was used to attract fauna to the camera in the form of bait tubes filled with universal bait (peanut butter, oats and sardines). Bait tubes were placed into the camera frame and attached to a solid

object to immobilise the tubes. Cameras were positioned in areas selected to maximise fauna detection such as along a trail and near suitable microhabitat such as hollow logs. Details of camera traps, including GPS coordinates, are given in **Table 2-5.**

Table 2-5. Details of camera traps deployed across project area (Zone 51J).

CT No.	Easting	Northing	Date Deployed	Date Collected	Priority Area	Duration (days)
BCE05	356195	6556763	10/9/21	16/10/21	2	36
BCE04	355794	6557667	10/9/21	16/10/21	2	36
BCE11	351453	6563419	11/9/21	17/10/21	1	36
BCE06	353192	6566439	11/9/21	17/10/21	1	36
BCE13	348878	6566791	11/9/21	17/10/21	1	36
BCE33	351037	6563964	12/9/21	17/10/21	1	35
BCE32	346713	6566556	12/9/21	17/10/21	1	35
BCE34	349686	6556571	13/9/21	16/10/21	3	33
BCE30	348792	6555276	13/9/21	16/10/21	3	33
BCE31	350373	6564123	13/9/21	17/10/21	1	34

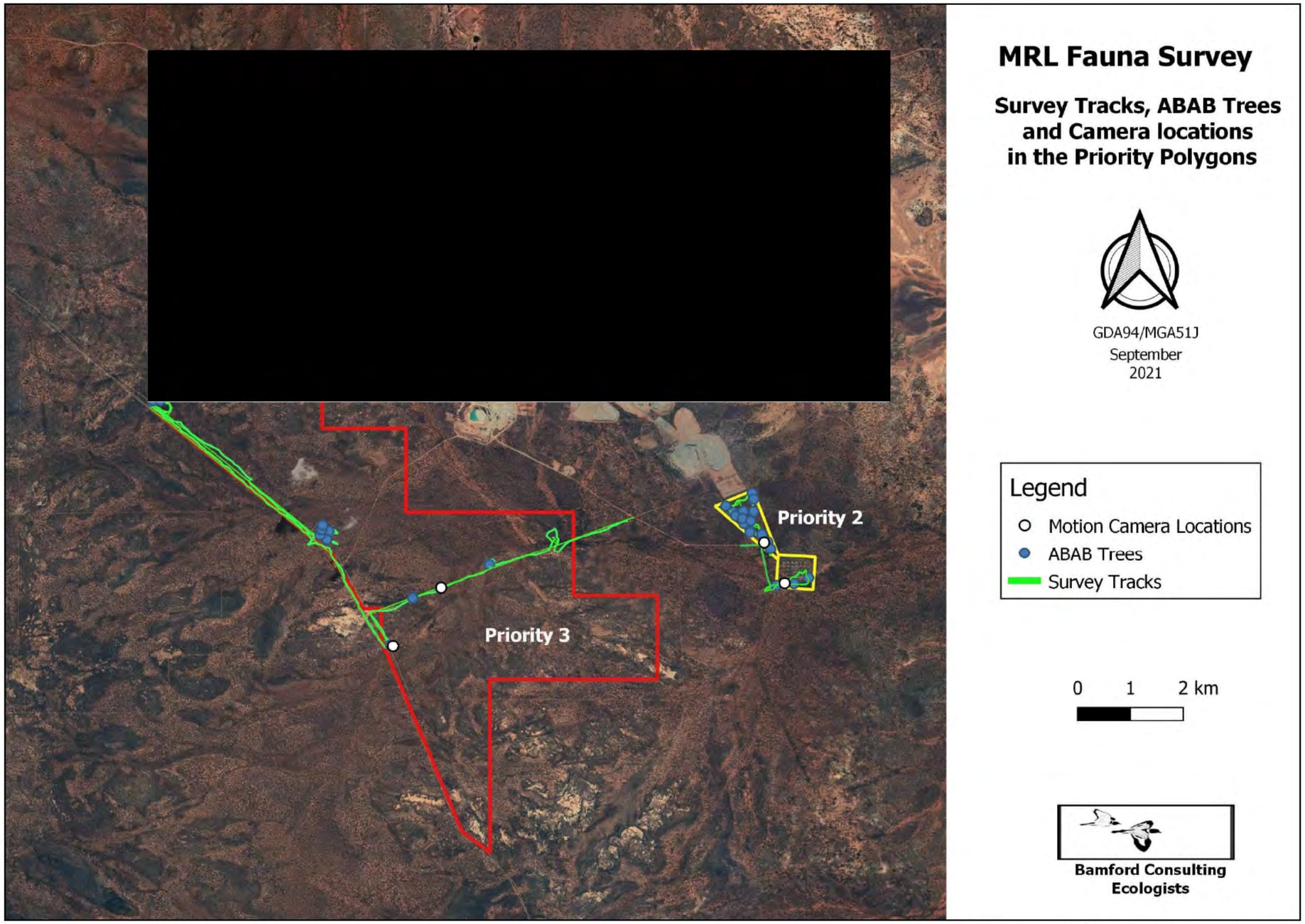


Figure 2-1. Map showing survey tracks, locations of camera traps and locations of ABAB trees. Fauna assessment priority levels for each lease as requested by MRL are indicated.

2.4.4 Arid Bronze Azure Butterfly

The Arid Bronze Azure Butterfly (ABAB) *Ogyris subterrestris petrina* has an obligate association with a sugar ant *Camponotus* sp. nr. *terebrans*, with the most critical factor for ABAB being the presence of these large host ant colonies. The sugar ants build nests at the base of smooth-barked eucalypts. Therefore, surveys for potential ABAB habitat involves searching for (i) smooth-barked eucalypts; and (ii) nests of these sugar ants. DBCA (2020) recommends a direct survey for ABAB being conducted only if large colonies of these ants are present.

The field investigations involved searching for ants around smooth-barked eucalypts when such trees were encountered. This involved disturbing the ground at the base of a tree (of DBH > 100 mm) to a depth of 10 cm and observing emerging ants. Locations of trees where this searching took place are indicated on **Figure 2-1**. Any ants of similar morphology to the sugar ant were collected (as per guidelines in DBCA 2020).

2.4.5 Trapdoor Spiders

Field investigations involved opportunistic searches for Trapdoor Spider burrows when suitable habitat was encountered (generally areas with leaf litter). Burrows have a camouflaged leaf litter door at the ground surface with leaves and/or twigs fanning out from the burrow rim. This distinctive leaf litter arrangement makes it possible to identify these burrows in the field. Species of interest are *Idiosoma sp.* as they are of conservation significance and considered likely to occur in the project area, but all spider burrows observed were recorded. Several specimens of the Shield-backed Trapdoor Spider were collected and sent to Volker W. Framenau of Murdoch University for identification.

2.4.6 Dates and Personnel

The project area was visited on the 10th to 14th September 2021. Personnel involved in the field investigations and report preparation (including desktop review) are listed in **Table 2-6**.

Table 2-6. Personnel involved in the field investigations and report preparation.

Personnel	Experience	Field Investigations	Report Preparation
Mr Tim Gamblin *B.Sc. (Zoology), Cert. Env. Mngmt.*	11 years	+	
Dr Jamie Wadey *BSc (Zoology/Ecology), Hons (Ecology), PhD (Movement Ecology)*	7 years	+	+
Ms Natalia Huang *BSc (Environmental Science/Zoology), Hons (Conservation Biology), MBA*	15 years		+
Dr Mike Bamford *BSc (Biology), Hons (Biology), PhD (Biology)*	40 years		+

2.5 Survey limitations

The EPA Guidance Statement 56 (EPA 2004) and the EPA (2020) outline a number of limitations that may arise during field investigations for Environmental Impact Assessment. These survey limitations are discussed in the context of the BCE investigation of the project area in **Table 2-7**. No limitations were identified.

The lack of detailed survey (i.e. intensive sampling of the fauna assemblage) is not considered a limitation as this assemblage is well-understood in the area due to multiple previous field investigations. Furthermore, EPA guidance does not consider limitations related to the effectiveness of field sampling for fauna but appears to make an assumption that the purpose of such sampling is to confirm the fauna assemblage. This is implicit in the EPA (2020) technical guidance that does provide suggestions for sampling techniques, but the level of field investigations suggested cannot confirm the presence of an entire assemblage, or confirm the absence of a species. This requires far more work than is possible (or recommended) for studies contributing to the EIA process because fauna assemblages vary seasonally and annually, and often have high levels of variation even over short distances (Beta diversity). For example, in an intensive trapping study, How and Dell (1990) recorded in any one year only about 70% of the vertebrate species found over three years. In a study spanning over two decades, Bamford *et al.* (2010) found that the vertebrate assemblage varies over time and space, meaning that even complete sampling at a set of sites only defines the assemblage of those sites at the time of sampling. The limited effectiveness of short periods of fauna sampling is not a limitation for impact assessment *per se*, as long as database information is interpreted effectively and field investigations are targeted appropriately. That is the approach taken by BCE.

Table 2-7. Survey limitations as outlined by EPA (2020).

EPA Survey Limitations	BCE Comment with regard to 2021 field investigations
Availability of data and information	Extensive information from databases and previous studies (see Section 2.3.1). Not a limitation.
Competency/experience of the survey team, including experience in the bioregion surveyed	The ecologists have had extensive experience in conducting desktop reviews, and basic and targeted surveys for environmental impact assessment fauna studies and have undertaken many studies within the region. Not a limitation.
Scope of the survey (e.g. were faunal groups were excluded from the survey)	The survey focused on terrestrial vertebrate fauna and fauna values. Not a limitation.
Timing, weather and season	Timing is not of great importance for Basic level field investigations in this region. Not a limitation.
Disturbance that may have affected results	None. Not a limitation.
The proportion of fauna identified, recorded or collected	All fauna observed were identified. Not a limitation.
Adequacy of the survey intensity and proportion of survey achieved (e.g. the extent to which the area was surveyed)	The site was adequately surveyed to the level appropriate for a Basic level assessment. Fauna database searches covered a 25 km radius beyond the centroid of the project area. The Basic level assessment was completed. Not a limitation.
Access problems	There were no access problems encountered. Not a limitation.
Problems with data and analysis, including sampling biases	There were no data problems. Not a limitation.

2.6 Presentation of results for Impact Assessment

While some impacts are unavoidable during development, the concerns are long-term, deleterious impacts upon biodiversity. This is reflected in documents such as the Significant Impact Guidelines provided by DSEWPaC (2013) (see **Appendix 4**). Significant impacts may occur if:

- There is direct impact upon a VSA and the VSA is rare, a large proportion of the VSA is affected and/or the VSA supports significant fauna;
- There is direct impact upon conservation significant fauna; or
- Ecological processes are altered and this affects large numbers of species or large proportions of populations, including significant species.

The impact assessment process therefore involves reviewing the fauna values identified through the desktop assessment and field investigations, with respect to the project and impacting processes. The severity of impacts on the fauna assemblage and conservation significant fauna can then be quantified on the basis of predicted population change. The presentation of this assessment follows the general

approach to impact assessment as given in Section 1.1, but modified to suit the characteristics of the site. Key components to the general approach to impact assessment are addressed as follows:

Fauna values

This section presents the results of the desktop and field investigations in terms of key fauna values (described in detail in **Appendix 1**) and includes:

- Recognition of ecotypes or vegetation/substrate associations (VSAs);
- Assemblage characteristics (uniqueness, completeness and richness);
- Species of conservation significance;
- Patterns of biodiversity across the landscape; and
- Ecological processes upon which the fauna depend.

Impact assessment

This section reviews impacting processes (as described in detail in **Appendix 3**) with respect to the proposed development and examines the potential effect these impacts may have on the faunal biodiversity of the project area. It thus expands upon Section 1.1 and discusses the contribution of the project to impacting processes, and the consequences of this with respect to biodiversity. A major component of impact assessment is consideration of threats to species of conservation significance, as these are a major and sensitive element of biodiversity. Therefore, the impact assessment section includes the following:

- Review of impacting processes; will the proposal result in:
    - Habitat loss leading to population decline, especially for significant species;
    - Habitat loss leading to population fragmentation, especially for significant species;
    - Weed invasion that leads to habitat degradation;
    - Ongoing mortality;
    - Species interactions that adversely affect native fauna, particularly significant species;
    - Hydrological change;
    - Altered fire regimes; or
    - Disturbance (dust, light, noise).
- Summary of impacts upon significant species, and other fauna values.

The impact assessment concludes with recommendations for impact mitigation, based upon predicted impacts. Note that the terms direct and indirect impacts are not used in this report; for further explanation see **Appendix 2**.

2.6.1 Criteria for impact assessment

Impact assessment criteria are based on the severity of impacts on the fauna assemblage and conservation significant fauna. It is quantified on the basis of predicted population change (**Table 2-8**). Population change can be the result of direct habitat loss and/or impacts upon ecological processes.

The significance of population change is contextual. The EPA (2016c) suggested that the availability of fauna habitats within a radius of 15 km can be used as a basis to predict low, moderate or high impacts. In this case, a high impact is where the impacted environment and its component fauna are rare (less than 5% of the landscape within a 15 km radius or within the Bioregion), whereas a low

impact is where the environment is widespread (e.g. >10% of the local landscape). Under the Ramsar Convention, a wetland that regularly supports 1% of a population of a waterbird species is considered to be significant. These provide some guidance for impact assessment criteria. In the following criteria (**Table 2-8**), the significance of impacts is based upon the percentage of population decline within a 15 km radius (effectively local impact) and upon the effect of the decline upon the conservation status of a recognised taxon (recognisably discrete genetic population, sub-species or species). Note that percentage declines can usually only be estimated on the basis of the distribution of a species derived from the extent of available habitat while for a few species, such as the Black-Cockatoos, there is guidance for the assessment of impact significance.

Table 2-8. Assessment criteria for impacts upon fauna.

Impact Category	Observed Impact
Negligible	Effectively no population decline; at most few individuals impacted and any decline in population size within the normal range of annual variability.
Minor	Population decline temporary (recovery after end of project such as through rehabilitation) or permanent, but < 1% within 15 km radius of centre-point of impact area (or within bioregion if this is smaller). No change in viability or conservation status of taxon.
Moderate	Permanent population decline 1-10% within 15 km radius. No change in viability or conservation status of taxon.
Major	Permanent population decline 10-50% within 15 km radius. No change in viability or conservation status of taxon.
Critical	Taxon decline > 50% (including local extinction) within 15 km and/or change in viability or conservation status of taxon.

2.7 Mapping

As requested, high resolution maps have been provided within the body of this report. GIS files will be required as per client specifications. As per the recommendation of EPA (2020), maps use the GDA94 datum and are projected into the appropriate Map Grid of Australia (MGA94) zone.

3 Fauna values

3.1 Vegetation and Substrate Associations (VSAs)

Vegetation and substrate associations within the project area are a complex mosaic, largely reflecting soil types. Previous surveys in the Mt Marion area provided an understanding of the VSAs considered likely to be present. From this, and observations made during the field investigations, seven major VSAs were identified in relation to fauna in the project area. Six of these were presented in the 2019 review (Metcalf and Bamford 2019), with the descriptions being modified slightly here. The VSAs identified within the project area are:

1. **Mixed Eucalypt woodland over sclerophyll shrubland on undulating hills.** Dominant species vary across the project area, including *Eucalyptus transcontinentalis, E. salmonophloia, E. lesouefii, E. gracilis, E. ravida,* and *E. oleosa.* Equivalent to VSA 1 in Metcalf and Bamford 2019. Occurs in L/M and Hamptons. See **Plate 1**.
2. **Acacia shrubland on slopes with scattered Eucalypts over rocky loam.** Equivalent to VSA 2 in Metcalf and Bamford 2019. Occurs in Hamptons. See **Plate 2.**
3. **Open to closed Eucalypt woodland or Mallee over mixed shrubland on flats.** Dominant Eucalypt species vary across the project area. Equivalent to VSA 3 in Metcalf and Bamford 2019. This VSA covers majority of the project area and occurs in L/M, Hamptons and East. See **Plate 3**.
4. **Mixed Eucalypt woodland over *Melaleuca sheathiana* on gravelly rises.** *Melaleuca sheathiana* thickets and scattered smooth-barked Eucalypts over stony brown loam rises. Equivalent to VSA 4 in Metcalf and Bamford 2019. Occurs in L/M. See **Plate 4**.
5. **Dense Mallee and Eucalypt woodland associated with minor drainage lines.** Dense Mallee over Acacia with scattered Eucalypts over fine red loam in drainage lines. Equivalent to VSA 5 in Metcalf and Bamford 2019. Occurs in L/M and East. See **Plate 5**.
6. **Acacia shrubland on brown loam flats.** Open Acacia shrubland with lack of understorey over stony brown loam flats. Equivalent to VSA 6 in Metcalf and Bamford 2019. Occurs in L/M. See **Plate 6**.
7. **Dense Acacia shrubland on exposed granite.** Acacia shrubland with scattered Eucalypts over mixed shrubland on rocky exposed granite and red loam. Occurs in East. This VSA was not listed in the 2019 review. See **Plate 7**.

VSA mapping is not available as the leases were not traversed completely (in particular, East). It is expected that the remaining areas of the leases are likely to contain the above VSAs and be dominated by VSA 3, which is the most prevalent VSA across previously-surveyed areas in Mt Marion. More detailed and extensive surveys will be required to understand the full extent of VSAs within the project area.

Plate 1. VSA 1: Mixed Eucalypt woodland over sclerophyll shrubland on undulating hills.

Plate 2. VSA 2: Acacia shrubland on rocky rises.

Plate 3. VSA 3: Eucalypt woodland over mixed shrubs on red loam flats.

Plate 4. VSA 4: Mixed Eucalypt woodland over Melaleuca sheathiana on gravelly rises.

Plate 5. VSA 5: Dense Mallee and Eucalypt woodland associated with minor drainage lines.

Plate 6. VSA 6: Acacia shrubland on brown loam flats.

Plate 7. VSA 7: Dense Acacia shrubland on exposed granite.

3.2 Fauna assemblage

3.2.1 Expected vertebrate fauna assemblage

The desktop study identified 288 vertebrate fauna species as potentially occurring in the Mt Marion Lithium Project area (see **Appendix 5**): five frogs, 85 reptiles, 164 birds, 25 native and ten introduced mammals. Of these, 95 species have been recorded during fauna assessments within the project area, including one frog, 12 reptiles, 66 bird species, ten native mammals and six introduced mammals. This list does not include locally extinct species and records of species that may formally have been present are limited. However, based on broad patterns of distribution and habitat, locally extinct species are likely to include the Numbat *Myrmecobius fasciatus*, Brushtail Possum *Trichosurus vulpecula* the Greater Bilby *Macrotis lagotis* and one of the stick-nest rats *Leporillus* sp..

The 2021 survey confirmed the presence of three reptiles, 34 birds, two native mammals and one introduced mammal. The camera trap survey recorded the presence of three reptile, nine bird and three mammal species, with the most abundantly recorded group being birds (number of detections=49), followed by reptiles (number of detections=13) and mammals (number of detections=11). Notable camera trap detections included one incidence of mating Spotted Nightjars, a family of Emus (one adult male and six juveniles), and a feral cat. **Appendix 6** lists all species recorded during 2021 field investigations. Raw camera trap data are presented in **Appendix 7**.

The faunal assemblage expected is typical of the Coolgardie region. Most fauna species recorded or expected to occur in the project area are widespread, but some species may have restricted or habitat limited distributions, and some fauna species expected have declined in the region. The composition of the vertebrate fauna expected to occur and recorded within the project area is presented in **Table 3-1**. The conservation significant fauna species occurring or likely to occur in the project area are discussed in the following section.

Key features of the fauna assemblage expected in the project area are:

- Uniqueness: The assemblage is typical of that found in Goldfields eucalypt woodlands. The project area occurs near the edge of some fauna species' distribution e.g., Blue-breasted Fairy-wren and Western Yellow Robin;
- Completeness: The assemblage of species from the project area is mostly complete, with a portion of the mammal fauna considered locally extinct; and
- Richness: The assemblage contains a high level of richness to be expected in relatively undisturbed intact woodland vegetation.

Table 3-1. Composition of vertebrate fauna assemblage of the project area.

Taxon	Number of species	Total species recorded	Number of species in each status category			
			Resident	Migrant or regular visitor	Irregular visitor	Vagrant
Frogs	5	1	5	-	-	-
Reptiles	85	12	85	-	-	-
Birds	164	66	86	35	7	36
Native Mammals	25	10	22	1	1	-
Introduced Mammals	10	6	5	2	3	-
Total	**288**	**95**	**203**	**38**	**11**	**36**

3.2.2 Vertebrate fauna of conservation significance

Of the 288 species of vertebrate fauna that are expected to occur in the project area, 33 are considered to be of conservation significance (10 CS1, two CS2 and 21 CS3; see **Appendix 1** for descriptions of these CS (conservation significance) levels). A summary of the numbers in each vertebrate class is presented in

Table 3-2. The majority of conservation significant species are expected as residents (13 species), following by vagrants (7 species), regular visitors (7 species) and irregular visitors (6 species). The list of expected conservation significant species, their CS levels, expected status in the project area, and local records are given in

Table 3-3.

A total of ten conservation significant species have been recorded to date, comprising one CS1 and 9 CS3 species (

Table 3-2 and **Appendix 5**). Only one conservation significant species was recorded during 2021 field investigations – the CS3 Copper-backed Quail-thrush, recorded on a camera trap in Hamptons (see **Appendix 7**).

Table 3-2. Summary of conservation significant species expected and recorded in Mt Marion.

Number of species recorded in parenthesis. See **Appendix 1** for full explanation of Conservation Significance (CS) levels: CS1 = listed under WA State and/or Commonwealth legislation; CS2 = listed as Priority by DBCA; CS3 = considered locally significant.

Taxon	Significant Fauna expected (recorded)		
	CS1	CS2	CS3
Frogs	0	0	0
Reptiles	0	0	1
Birds	9 (1)	1	19 (9)
Native Mammals	1	1	1
Introduced Mammals	0	0	0
Total	**10**	**2**	**21**

Table 3-3. Significant fauna species recorded or expected in the Mt Marion Lithium Project area.

Common Name	Latin Name	Conservation Status				Expected status in project area	Local records
BCA		EPBC	BCA	Priority	CS3		
Conservation Significance 1 (CS1)							
Malleefowl	*Leipoa ocellata*	Vul	Vul			Visitor	Mt Marion
Fork-tailed Swift	*Apus pacificus*	Mig	Mig			Irregular visitor	Woolgangie
Hooded Plover	*Thinornis rubricollis*	Mig	Mig			Vagrant	Bulong
Sharp-tailed Sandpiper	*Calidris acuminata*	Mig	Mig			Vagrant	Kambalda West
Curlew Sandpiper	*Calidris ferruginea*	Mig	Mig			Vagrant	Kambalda East
Red-necked Stint	*Calidris ruficollis*	Mig	Mig			Vagrant	Kambalda East
Common Greenshank	*Tringa nebularia*	Mig	Mig			Vagrant	Kambalda East
Wood Sandpiper	*Tringa glareola*	Mig	Mig			Vagrant	Kambalda East
Peregrine Falcon	*Falco peregrinus*		OS			Visitor	St Ives
Chuditch	*Dasyurus geoffroyii*	Vul	Vul			Vagrant to Irregular Visitor	Kalgoorlie
Conservation Significance 2 (CS2)							
Western Rosella (Inland)	*Platycercus icterotis xanthogenys*			4		Irregular Visitor	Kalgoorlie
Central Long-eared Bat	*Nyctophilus major tor*			3		Resident	Coolgardie
Conservation Significance Level 3							
Carpet Python	*Morelia spilota imbricata*				X	Resident	Kalgoorlie
Australian Bustard	*Ardeotis australis*				X	Irregular Visitor	Coolgardie
Bush Stone-curlew	*Burhinus grallarius*				X	Visitor	Jilbadji
Square-tailed Kite	*Lophoictinia isura*				X	Visitor	St Ives
Purple-crowned Lorikeet	*Glossopsitta porphyrocephala*				X	Resident	Mt Marion
Regent Parrot	*Polytelis anthopeplus*				X	Visitor	St Ives

Common Name	Latin Name	Conservation Status				Expected status in project area	Local records
BCA		EPBC	BCA	Priority	CS3		
Scarlet-chested Parrot	*Neophema splendida*				X	Irregular Visitor	St Ives
Major Mitchell's Cockatoo	*Cacatua leadbeateri*				X	Visitor	Coolgardie
Rainbow Bee-eater	*Merops ornatus*				X	Regular Visitor	Mt Marion
White-browed Treecreeper	*Climacteris affinis*				X	Resident	Cannon
Rufous Treecreeper	*Climacteris rufus*				X	Resident	Mt Marion
Blue-breasted Fairy-wren	*Malurus pulcherrimus*				X	Resident	Mt Marion
Purple-gaped Honeyeater	*Lichenostomus cratitius*				X	Resident	Kalgoorlie
Shy Heathwren	*Hylacola cauta whitlocki*				X	Irregular visitor	St Ives
White-browed Babbler	*Pomatostomus superciliosus*				X	Resident	Mt Marion
Copper-backed Quail-thrush	*Cinclosoma clarum*				X	Resident	Mt Marion
Gilbert's Whistler	*Pachycephala inornata*				X	Resident	Mt Marion
Crested Shrike-tit	*Falcunculus frontatus*				X	Resident	Kalgoorlie
Western Yellow Robin	*Eopsaltria griseogularis*				X	Resident	Mt Marion
Southern Scrub-robin	*Drymodes brunneopygia*				X	Irregular Visitor	Mt Marion
Kultarr	*Antechinomys laniger*				X	Resident	Kalgoorlie

See **Appendix 2** for descriptions of conservation status codes. EPBC Act (EPBC) and Biodiversity Conservation Act (BCA): Vul: Vulnerable; End: Endangered; CE: Critically Endangered, Mig: Migratory, OS: Other Specially Protected Fauna; DBCA Priority: P1 – P4 = Priority 1 - 4. CS3: locally significant but not listed.

3.2.3 Conservation significant species accounts

Conservation significant species which may occur in the project area on a regular basis (as regular visitor or resident) are discussed here under CS categories, except for the Chuditch (an irregular visitor to vagrant) which is included on the basis of being a targeted species in the 2021 investigations.

Conservation Significance Level 1

Malleefowl

In Western Australia, Malleefowl occur mainly in scrubs and thickets of Mallee (*Eucalyptus* spp.), Boree (*Melaleuca lanceolata*), Bowgada (*Acacia linophylla*), and other dense, litter-forming shrublands including Mulga (*Acacia aneura*) (Johnstone and Storr 2004). The species' distribution was once larger and less fragmented, but the widespread clearing of suitable habitat, coupled with the degradation of habitat by fire and livestock, and fox predation, has reduced Malleefowl numbers considerably (Johnstone and Storr 2004). It is expected to be a regular visitor to the area, with recent breeding recorded in the Hamptons lease (in the past 1 to 5 years).

The field investigations recorded two Malleefowl mounds, both located within the Hamptons lease (see **Figure 3-1**). Details of these mounds are given in **Table 3-4** with photographs of each mound in **Figure 3-2** and **Figure 3-3**. These mounds are located outside previous survey areas and have not been

recorded in previous BCE surveys. Both mounds are within one km of the closest mound recorded by BCE to the south in 2016 (Bamford et al. 2016; see **Figure 3-4**). It is noted that one of the mounds recorded in the present survey was assessed as being of "Recent" age (1-5 years), though not currently active. All other mounds previously recorded by BCE in the Mt Marion area were classed as Moderately Old (5-20 years), Old (20-100 years), or Very Old (100+ years) (see **Table 3-5**).

No Malleefowl were seen, and there were no signs of Malleefowl presence (e.g. tracks, droppings, feathers). There is potential nesting habitat in the densely-vegetated part of Hamptons which contained the Malleefowl mounds, with little obvious habitat in East and in M (which is mostly drill-pads) and L (**Figure 3-1**).

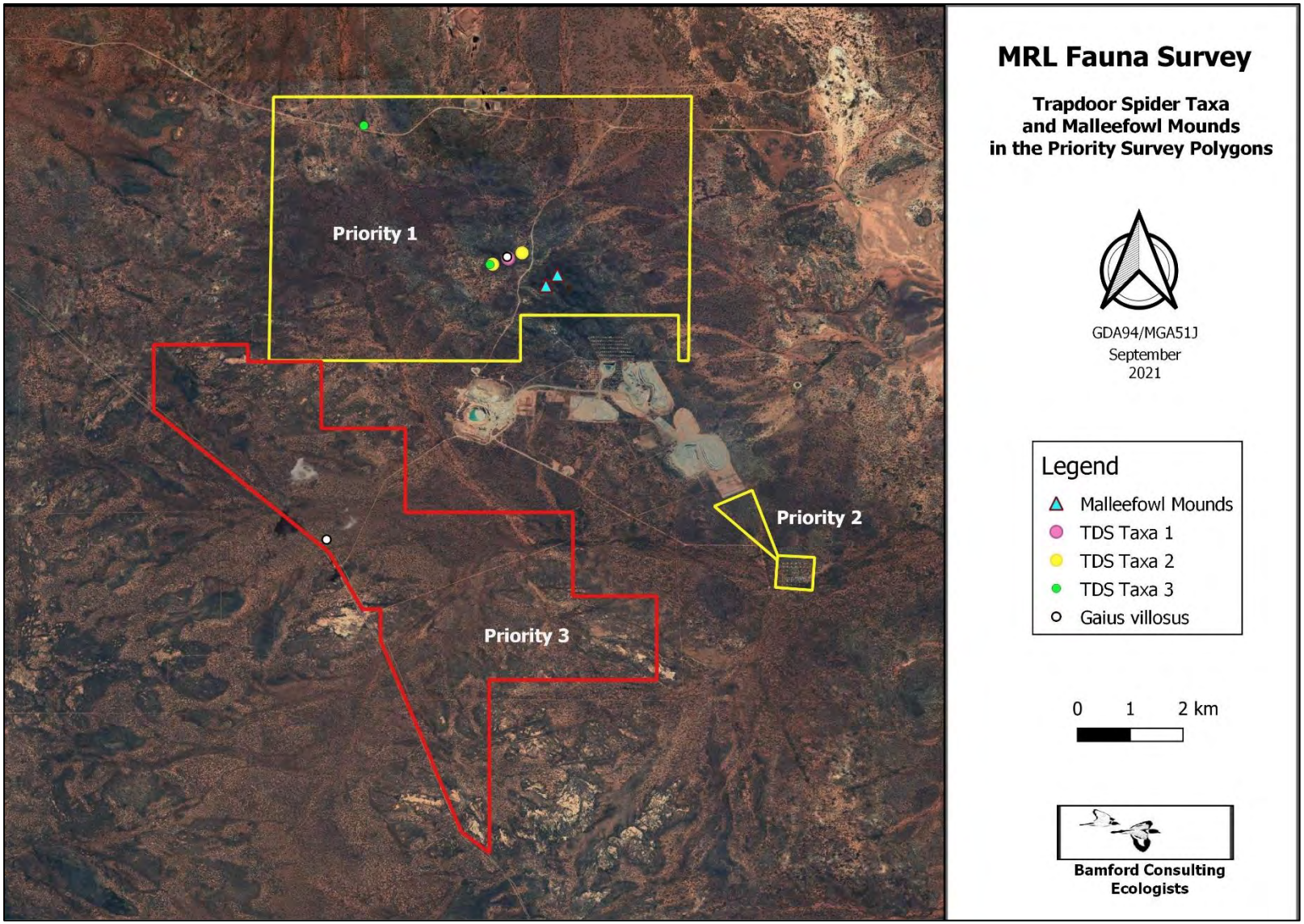


Figure 3-1. Map showing locations of Malleefowl mounds and Trapdoor Spider burrows recorded during 2021 survey.

Table 3-4. Details of Malleefowl mounds recorded in 2021 field investigations.

UTM Zone 51. Mound width (W, metres), height (H, centimetres), depth (D, centimetres) and profile (P) listed. See Methods for explanation of profile and age categories.

Lease	Status	Age (yrs)	W	H	D	Habitat	Easting	Northing	P	Comments
Hamptons	Inactive	Old (20-100)	10	55	25	Lower slopes of acacia shrubland on rocky red loam	351590	6563269	1	Low shrubs growing out of mound edges
Hamptons	Inactive	Recent (1-5)	6	40	65	Adjacent to drainage line in acacia shrubland on rocky loam	351804	6563508	1	Old egg shell fragments, no tracks

Figure 3-2. Malleefowl mound categorised as "Recent" and inactive; recorded in 2021 survey.

Figure 3-3. Mallefowl mound categorised as "Old"; recorded in 2021 survey.

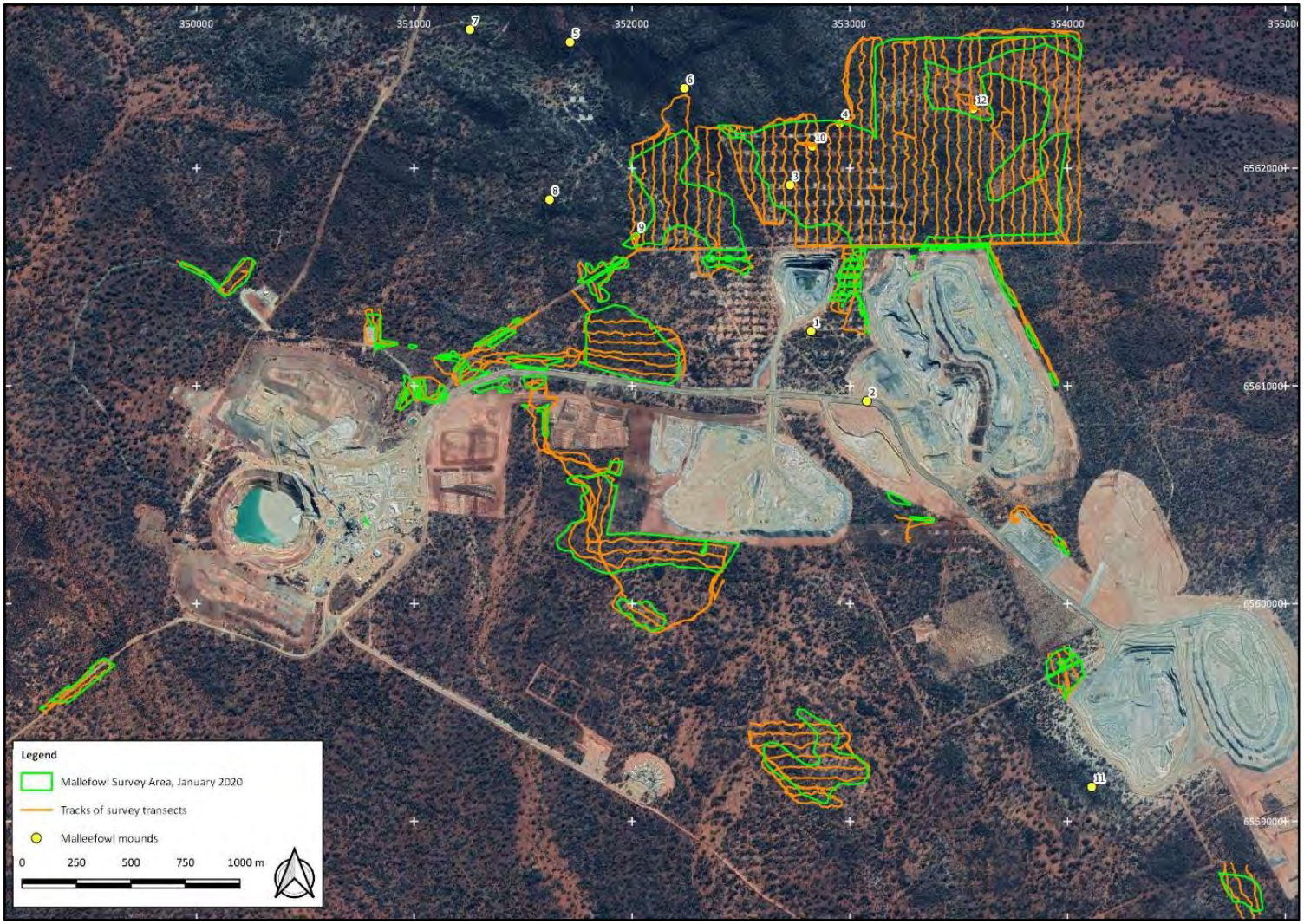


Figure 3-4. Malleefowl mounds recorded in previous BCE surveys across the Mt Marion site (figure taken from Bancroft and Bamford 2020); closest mound (#7) is located <1 km south of mounds recorded in 2021 survey. Details of 2020 mounds are given in Table 3-5.

Table 3-5. Details of Malleefowl mounds recorded in previous surveys across Mt Marion site (taken from Bancroft and Bamford 2020).

	Easting	Northing	Habitat / Vegetation	W	H	D	Age	P	Reference
1	352822	6561252	*Eucalyptus spp.* And *Acacia acuminata* over *Melaleuca* and *Eremophila.*	3	50	-	Very Old	6	Rapallo (2010)
2	353078	6560931	*Allocasuarina* over *Melaleuca pauperiflora* shrubland	4	40	20	Very Old	6	Rapallo (2010)
3	352725	6561923	*Acacia quadrimarginea* over *Allocasuarina* on gravelly/rocky slight	NA	NA	NA	Very Old	NA	BCE (2016b)
4	352953	6562206	*A. quadrimarginea* shrubland, *A. acuminata*, *E. oldfieldi*	7	50	40	Moderately old	1	BCE (2016a)
5	351715	6562579	*A. quadrimarginea* shrubland, *A. acuminata*, *E. lesouefii*	6	30	30	Very Old	1	BCE (2016a)
6	352240	6562367	*Acacia, Allocasuarina, Senna,* Mallee thicket	7	100	50	Old	1	BCE (2016a)
7	351255	6562637	Mallee, *A. quadrimarginea, Dodonea sp, Scavola spinescens*	4	50	20	Old	1	BCE (2016a)
8	351621	6561856	Mallee, Melaleuca thicket	5	10	10	Very Old	1	BCE (2016a)
9	352017	6561688	Mallee, Melaleuca thicket	10	50	0	Very Old	6	BCE (2016a)
10	352828	6562100	*A. quadrimarginea*, *A. acuminata*, *E. oldfieldi, E scoparia*	7	50	0	Very Old	6	BCE (2016a)
11	354110	6559159	*Eucalypt* woodland over open mixed shrubland	4	20	0	Very Old	6	Metcalf and Bamford (2017)
12	353566	6562272	*Acacia* spp. Shrubland	4.5	20	0	Very Old	6	Bancroft and Bamford (2020)

Peregrine Falcon

This species is found in a wide variety of habitats, with its distribution often linked to the abundance of prey. Blakers *et al*. (1984) consider that Australia is one of the strongholds of the species since it has declined in many other parts of the world. It is considered likely to be a regular visitor to the project area, with the possibility that the area is within the range of a resident pair. If a pair is resident, they may nest in an old raven or crow nest in a tall eucalypt.

Chuditch

The Chuditch occurs in Jarrah woodlands, mallee shrublands and heathlands. Its range has contracted drastically since European settlement as a result of feral predation, land clearing and removal of den sites. The project area represents the north-eastern edge of its range, and it is expected as a vagrant in the Mt Marion area.

No Chuditch were recorded on camera traps in the 2021 field investigations. However, suitable habitat for Chuditch exists throughout the project area, and the species is considered likely to occur as a vagrant, more likely in autumn when juveniles and breeding adults are dispersing. The closest records of Chuditch are ~ 200 km southwest of Mt Marion around Mt Holland, with eighteen

individuals recorded in 2016 and ten individuals recorded in 2017, including adults and dispersing juveniles (Western Wildlife 2017). Given the home range of the Chuditch extends up to 15 km^2 for males and 3-4 km^2 for females (DBCA 2017), Mt Marion may be outside the range for this population but within the range of dispersing individuals, hence the expectation that the species may be an irregular visitor or vagrant in the area.

Conservation Significance Level 2

Central Long-eared Bat

Critical habitat for this species would be tree-hollows, most likely in large eucalypts. There is the potential for a resident population in the Mt Marion area.

Conservation Significance Level 3

The CS3 class is more subjective but includes species that have declined extensively across the Wheatbelt and Goldfields due to land clearing, and species that occur at the edge of their range in the region. This makes their presence in the project area significant as populations on the edge of a species' range are often less abundant and more vulnerable to extinction than populations at the centre of the range (Curnutt *et al.* 1996).

Carpet Python

This species is often associated with cover provided by exposed rocks or fallen timber. There is the potential for a resident population in the Mt Marion area.

CS3 birds

There are 15 locally significant birds expected to occur as regular visitor or resident in the Mt Marion area. A number of south-west Australian woodland bird species are recognized as declining (Saunders and Ingram 1995) and are listed in this review under CS3 (see **Table** 3-3). These species have lost considerable areas of habitat throughout the Wheatbelt and adjacent Goldfields as a result of large-scale habitat clearance and the removal of mature Eucalypt trees. Species include Regent Parrot, Southern Scrub-robin, Purple-crowned Lorikeet, Gilbert's Whistler, Rufous Tree-creeper and Purple-gaped Honeyeater. These species generally remain widespread and, in some cases, common in the broader Great Western Woodlands. The retention of these species in their natural abundances is of particular conservation significance as these species are now increasingly absent or rare over much of the Wheatbelt (Duncan *et al.* 2006, Watson *et al.* 2008). Furthermore, some species recorded at Mount Marion are near the limit of their range and are also considered locally significant (and thus listed here as CS3). These include the Blue-breasted Fairy-wren and Western Yellow Robin.

Kultarr

Specific habitat associations for this species are unclear. There is the potential for a resident population in the Mt Marion area.

3.2.4 Invertebrate fauna of conservation significance

Five conservation significant invertebrate species have been recorded in the Coolgardie - Kalgoorlie area from database searches (DBCA 2019, ALA 2021). These are the ABAB (*Ogyris subterrestris petrina*), Inland Hairstreak (*Jalmenus aridus*), the freshwater shrimp *Branchinella denticulate*, the

Coolgardie Shield-backed Trapdoor Spider *Idiosoma* intermedium, and the Central Eastern Wheatbelt Shield-backed Trapdoor Spider *Idiosoma mcnamarai*. In addition, trapdoor spiders are considered likely to occur in the project area. These are discussed under headings below.

Arid Bronze Azure Butterfly

The Arid Bronze Azure Butterfly (ABAB) is listed as critically endangered under the national EPBC Act 1999 and the state Biodiversity Conservation Act 2016. The ABAB is listed due to its low abundance and fragmented distribution, with only two extant subpopulations remaining in Western Australia (one in Wheatbelt and one in Goldfields; DBCA 2020). It is only known from Barbalin Nature Reserve (10 km west of Mukinbudin, in the Wheatbelt), however was formerly known from the Lake Douglas area (12 km south-west of Kalgoorlie and only 15 km north of the Mt Marion Project). At Lake Douglas, the ABAB was recorded from undulating stony rises supporting *Eucalyptus concinna*. While the species has not been recorded in the Lake Douglas area since 1993, it has the potential to persist in the wider area.

All leases contained habitat considered suitable for the ABAB-associated sugar ant (i.e. smooth-barked eucalypts on red loam with disturbance), however, no *Camponotus* ants were found. As the ant has not been recorded in this and multiple previous surveys, while not necessarily absent, the ABAB is considered unlikely to occur in the Mt Marion area. Details of each tree surveyed is given in **Table 3-6** and shown in **Figure 2-1**.

Table 3-6. Details of smooth-barked eucalypts surveyed for ABAB-associated ants

Form	DBH	*C. terebrans*	Easting	Northing	Zone	Priority Area
Tree	300	nil	356037	6556710	51J	2
Mallee	300	nil	356647	6556887	51J	2
Mallee	250	nil	356373	6556756	51J	2
Tree	450	nil	355811	6557636	51J	2
Tree	400	nil	355522	6557938	51J	2
Tree	200	nil	355195	6558324	51J	2
Tree	500	nil	355553	6558753	51J	2
Tree	200	nil	355581	6558623	51J	2
Tree	300	nil	355584	6558352	51J	2
Tree	800	nil	355862	6557677	51J	2
Tree	900	nil	355917	6557528	51J	2
Mallee	150	nil	351206	6563537	51J	1
Tree	600	nil	353048	6566609	51J	1
Tree	200	nil	347517	6566201	51J	1
Mallee	150	nil	347602	6566049	51J	1
Tree	400	nil	347600	6566316	51J	1
Tree	250	nil	347538	6566276	51J	1
Mallee	150	nil	346758	6566899	51J	1
Mallee	200	nil	350594	6557095	51J	3
Tree	250	nil	349674	6556569	51J	3
Mallee	250	nil	349161	6556343	51J	3
Mallee	300	nil	348772	6555303	51J	3
Tree	350	nil	344151	6560616	51J	3
Tree	370	nil	347542	6557804	51J	3

Form	DBH	*C. terebrans*	Easting	Northing	Zone	Priority Area
Mallee	250	nil	347505	6557617	51J	3
Tree	300	nil	350367	6564125	51J	1
Mallee	150	nil	350633	6564390	51J	1
Mallee	150	nil	351174	6564319	51J	1
Tree	300	nil	352369	6563722	51J	1
Tree	300	nil	351969	6564189	51J	1
Tree	200	nil	351600	6564029	51J	1
Tree	150	nil	352220	6565197	51J	1
Tree	500	nil	353046	6564275	51J	1
Tree	200	nil	353313	6563548	51J	1
Mallee	500	nil	354013	6565321	51J	1
Tree	300	nil	350843	6566446	51J	1
Tree	900	nil	349269	6561585	51J	1
Tree	150	nil	355522	6557888	51J	2
Tree	180	nil	355405	6558082	51J	2
Tree	250	nil	355244	6558251	51J	2
Tree	150	nil	355055	6558464	51J	2
Mallee	180	nil	355387	6558352	51J	2
Tree	150	nil	355378	6558190	51J	2
Tree	200	nil	355530	6558140	51J	2
Tree	350	nil	355746	6557850	51J	2
Tree	200	nil	351314	6563570	51J	1
Tree	350	nil	351300	6563579	51J	1
Tree	400	nil	351289	6563559	51J	1
Tree	200	nil	351263	6563558	51J	1
Tree	150	nil	351235	6563559	51J	1
Tree	300	nil	351100	6563978	51J	1
Mallee	150	nil	347525	6566371	51J	1
Tree	200	nil	347488	6566408	51J	1
Tree	300	nil	347374	6566318	51J	1
Tree	200	nil	349149	6556337	51J	3
Mallee	150	nil	348743	6555297	51J	3
Tree	300	nil	344164	6560634	51J	3
Tree	250	nil	344297	6560635	51J	3
Mallee	150	nil	347375	6557711	51J	3
Mallee	150	nil	347405	6557834	51J	3
Tree	200	nil	347419	6557931	51J	3
Tree	200	nil	351569	6564003	51J	1
Tree	150	nil	352199	6565167	51J	1
Tree	300	nil	354001	6565282	51J	1
Tree	350	nil	350845	6566495	51J	1
Tree	350	nil	351557	6565361	51J	1
Tree	850	Nil	349293	6561589	51J	1

Inland Hairstreak

The Inland Hairstreak is listed as Priority 1 by the DBCA. There is limited knowledge of its distribution and biology; it is only known from an area near Kalgoorlie, the larvae feed on leaves and flowers of *Senna nemophila* and *Acacia tetragonophylla*, and the caterpillars are attended to by the ant species *Froggattella kirbii.*

Freshwater shrimp *Branchinella denticulata*

The freshwater shrimp *Branchinella denticulata* is listed as Priority 3 by the DBCA. There is limited information on the species range, population dynamics and threats, but it is considered vulnerable (Inland Water Crustacean Specialist Group, 1996). No suitable waterbodies have been identified within the project area, therefore it is considered unlikely to occur within the project area.

Tree-stem Trapdoor Spider

The Tree-stem Trapdoor Spider *Aganippe castellum* is listed as Priority 4 by DBCA and while not returned from databases, there is some suitable habitat for the species in the general area (typically shrublands on the mid to lower slopes of rocky ridges and the adjacent plains, where it builds a distinctive burrow against eucalypts, Broom-bush, Sheoaks and other shrubs (BCE database)). The nearest records come from Koolyanobbing Range, Bungalbin Hill and Mt Dimer (over 100 km west of Kalgoorlie, DBCA 2019 and BCE records), where the Tree-stem Trapdoor Spider appears to be widespread (BCE database). It was not recorded in the 2021 field investigations and has not been previously recorded in the Mt Marion area. It is considered unlikely to be present in the project area.

Shield-backed Trapdoor Spiders *Idiosoma* spp.

There are two species of Shield-backed Trapdoor Spider *Idiosoma spp.* that may occur within the project area: Coolgardie Shield-backed Trapdoor Spider *Idiosoma intermedium*, listed as P3, recorded in the Goldfields region (DBCA); and Central Eastern Wheatbelt Shield-backed Trapdoor Spider *Idiosoma mcnamarai*, listed as P1, recorded in the Wheatbelt region (DBCA) (ALA 2021). Both species therefore fall under the CS2 category of conservation significance in this report.

The field investigations recorded seven locations of trapdoor spider, with two of these being matriarchial clusters (i.e., a large burrow of the matriarch spider surrounded by multiple smaller burrows of juvenile spiders). All trapdoor spider burrows of interest were located within Hamptons. The locations of these burrows are shown in **Figure 3-1**. Details of each burrow are presented in **Table 3-7** and photographs of burrows shown in **Figure 3-5** to **Figure 3-10**.

Three specimens were collected for identification and all were unidentifiable species of the genus *Idiosoma*, with two juveniles and one adult female identified. It was not possible to know if they were all the same species or not. The precautionary approach was taken and it is considered possible that the collected specimens were individuals of either one or both of the expected priority-listed Shield-backed Trapdoor Spider: the Coolgardie Shield-backed Trapdoor Spider and/or the Central Eastern Wheatbelt Shield-backed Trapdoor Spider. Therefore, it is possible that one or both of these priority-listed species was recorded in the project area.

Table 3-7. Details of trapdoor spider species recorded in 2021 field investigations

Taxa#	Priority Area	Lid Architecture	Habitat	Details	Easting	Northing	Aspect	Photograph
Sp. 1	1	Typical fan with leaves 8mm diameter	High in landscape, mid-slope mallee woodland over open shrubland on rocky red loam.	Matriarchial cluster of 7, Voucher collected. Identified as juvenile *Idiosoma sp.*.	350866	6563858	East	Figure 3-5, Figure 3-6
Sp. 2	1	Typical fan with leaves 7-9mm diameter. Loam used as a 'glue' to keep fan twigs in position. Lid is sand covered.	Lower slope in open eucalypt woodland over open shrubland. Close to disturbance and drainage line.	Matriarchial cluster of 20, Voucher collected. The lid and associated fan is slightly raised (5mm) above ground level. Possibly due to position in landscape where elevation above water runoff is advantageous. Voucher collected. Identified as juvenile *Idiosoma sp.*.	351127	6563985	West	Figure 3-7
Sp. 2	1	As above for Sp. 2	Upper mid-slope in eucalypt woodland over acacia shrubland on stony red loam.	Single burrow found. No voucher collected as corresponded to the lid architecture of previous Sp. 2 taxa.	350573	6563726	South	
Sp. 3	1	Typical fan with acacia phyllodes and leaves. 10mm diameter	Upper mid-slope in eucalypt woodland over acacia shrubland on stony red loam.	Single burrow found. Voucher collected. Identified as female adult *Idiosoma sp.*.	350520	6563719	South	Figure 3-8
Sp. 3	1	As above	Open acacia shrubland on rocky red loam flats	No voucher taken - already specimen of taxa Sp. 3 collected.	348087	6566746	South	
Unidentified spider burrow	1	Large, 15 - 20mm diameter no 'moustache'/fan	Hill top with low acacia shrubland on rocky red loam	No voucher required – too large to be considered a CS species.	350845	6563893	nil	Figure 3-9

Taxa#	Priority Area	Lid Architecture	Habitat	Details	Easting	Northing	Aspect	Photograph
Unidentified spider burrow	3	Large, 15 - 20mm diameter no 'moustache'/fan	Salmon gum woodland on red loam flats	No voucher required – too large to be considered a CS species.	347510	6557615	nil	Figure 3-10

Figure 3-5. Trapdoor Spider burrow Species 1 (specimen collected and identified as *Idiosoma sp.*)

Figure 3-6. Trapdoor Spider burrow Species 1, same burrow with lid closed

Figure 3-7. Trapdoor Spider burrow Species 2 showing matriarchal cluster (specimen collected and identified as *Idiosoma sp.*)

Figure 3-8. Trapdoor Spider burrow Species 3 (specimen collected and identified as *Idiosoma sp.*)

Figure 3-9. Unidentified large spider burrow

Figure 3-10. Unidentified large spider burrow

No additional invertebrate species of listed conservation significance were recorded during the desktop assessment or field investigations. Invertebrates in general are beyond the scope of assessment for environmental impact assessment because the vast amounts of varying species and their taxonomy is so poorly understood, but it is possible to focus on a small range of taxa that are

short-range endemics (SRE). Harvey (2002) notes that the majority of invertebrate species that have been classified as short-range endemics have common life history characteristics such as poor powers of dispersal or confinement to discontinuous habitats. Several groups, therefore, have particularly high instances of short-range endemic species: Gastropoda (snails and slugs), Oligochaeta (earthworms), Onychophora (velvet worms), Araneae (mygalomorph spiders), Schizomida (schizomids; spider-like arachnids), Diplopoda (millipedes), Phreatoicidea (phreatoicidean crustaceans), and Decapoda (freshwater crayfish). Harvey (2002) classes invertebrates as SRE species if they have a distribution of <10,000 km2 and notes that they are often associated with fragmented and/or relictual environments. No other SRE taxa were recorded during the survey and in general the environment is not conducive to the evolution of such species, but this does not rule out the possibility of limited range species in the region.

3.3 Patterns of biodiversity

Investigating patterns of biodiversity can be complex and is beyond the scope of the present assessment and previous fauna assessments conducted across the Mt Marion Lithium Project area. However, the presence of a range of VSAs are factors in patterns of biodiversity. Within the project area, the VSAs are considered to be mostly intact with some historical mining, timber harvesting and grazing disturbance. Fauna that occur in eucalypt woodlands throughout the region are likely to utilise the project area for foraging, transit and/or nesting. Areas of dense thicket are important for species that prefer dense cover such as the Blue-breasted Fairy-wren and Western Yellow Robin. Areas with exposed granite may support a unique suite of species. The presence of large Eucalypts (predominantly Salmon Gums) containing large hollows is likely to influence patterns of distribution of fauna that rely on such hollows for breeding, such as several parrot species and the Rufous Tree-creeper.

3.4 Ecological processes

The nature of the landscape and the fauna assemblage indicate some of the ecological processes that may be important for ecosystem function (see **Appendix** 4 for descriptions and other ecological processes). Key ecological processes affecting the fauna assemblage in the project area are habitat loss, hydrology, feral species and interactions with native species, habitat degradation due to clearing and loss of connectivity.

Local hydrology. There is a paleo-drainage system in the area which drains into Lake Lefroy, south-east of the project area. The generally heavy soils in the area mean that surface and sub-surface water movement can be complex and can affect the distribution of plants.

Feral species and interactions with over-abundant native species. Feral species occur throughout Western Australia and it is expected that the fauna assemblage within the project area has been impacted by feral species (particularly foxes, feral cats and goats), which has resulted in the loss of some mammal and bird species. Rabbits and introduced rodents may cause further degradation to the native vegetation and, in combination with introduced predators (cats, dogs and foxes), reduce the capacity of the area to support native fauna diversity. Over-abundant native species such as the Galah may have suppressed the abundance of species such as Major Mitchell's Cockatoo. A feral cat was recorded on a camera trap in Hamptons in the present survey.

Connectivity and landscape permeability. The project area is part of a much greater area of native vegetation. The eucalypt woodlands in the project area provide connectivity between the surrounding woodlands, with fauna, such as birds and mammals, likely to move across the landscape.

Fire. Fire may rarely be a feature of this landscape, with some of the vegetation too open to carry fire regularly, but thickets are more likely to burn. The fauna is largely adapted to occasional fires but alterations to fire regimes have probably affected the abundance of some species, and thus fire is a factor to consider in understanding impacts.

3.5 Summary of fauna values

The desktop study identified 288 vertebrate fauna species as potentially occurring in the project area: five frogs, 85 reptiles, 164 birds, 25 native and ten introduced mammals. Ninety-five of these species have been recorded during fauna assessments to date, including species recorded in the 2021 field investigations. This total includes one frog, 12 reptiles, 66 bird species, ten native mammals and six introduced mammals. Conservation significant fauna species recorded comprised nine locally significant bird species and mounds of the CS1 Malleefowl.

Fauna values within the study area can be summarised as follows:

Fauna assemblage. Largely intact and rich, and broadly typical of the Coolgardie Bioregion. Some south-western species occur at the eastern edge of their range (Blue-breasted Fairy-wren, Western Yellow Robin) and the assemblage also has elements from adjacent biogeographic zones.

Species of conservation significance. Nineteen significant species likely to occur as residents or regular visitors of the project area. The majority of these are locally significant and are not listed under legislation. Significant species are:

- Malleefowl (CS1) – regular visitor; two mounds were recorded in Hamptons (one recent, one old) and suitable habitat is present mostly in Hamptons;
- Rainbow Bee-eater (CS3) – regular visitor;
- Peregrine Falcon (CS1) – resident or regular visitor;
- Chuditch (CS1) – vagrant; no Chuditch were recorded on camera traps;
- Central Long-eared Bat (CS2) – resident;
- Carpet Python (CS3) – resident;
- Locally significant (CS3) declining woodland birds; nine species recorded including Rainbow Bee-eater, Purple-crowned Lorikeet, Rufous Treecreeper, Blue-breasted Fairy-wren, White-browed Babbler, Copper-backed Quail-thrush, Gilbert's Whistler, Southern Scrub-Robin (irregular visitor) and Western Yellow Robin, and an additional seven species expected as residents or regular visitors including Bush Stone-curlew, Square-tailed Kite, Regent Parrot, Major Mitchell's Cockatoo, White-browed Treecreeper, Purple-gaped Honeyeater and Crested Shrike-tit; and
- Kultarr (CS3) – resident.

A further 13 conservation significant species are expected to occur as vagrants or irregular visitors.

Invertebrate species of conservation significance. No ants with which the ABAB is associated were recorded, although suitable habitat exists across the project area. Three trapdoor spider specimens were identified as species of *Idiosoma*, with the potential for them to represent two CS2 species.

Vegetation and Substrate Associations (VSAs). There were seven VSAs identified. Most of the project area contains intact eucalypt woodland or Mallee over a range of understorey types (ranging from Melaleuca and Acacia thickets, Eremophila shrub lands or sparsely vegetated). There are areas of open Salmon Gum woodland containing mature, hollow-bearing trees and valleys and slopes of the Saddle Hills contain dense Acacia shrub lands. Small areas on the crests of hills contain Casuarina or Melaleuca thickets. All VSAs are considered important for fauna, with large Salmon Gums providing important nesting opportunities for fauna and dense vegetation providing cover and habitat for species such as the Golden Whistler, Western Yellow Robin and Malleefowl. Two VSAs, #5 and #7, are not well represented within the project area. It is expected they will be represented outside of the project area as a similar portion of the landscape.

Patterns of biodiversity. The fauna assessment did not provide adequate data to examine detailed patterns of biodiversity but the presence of a range of VSAs are factors in patterns of biodiversity; fauna that occur in eucalypt woodlands throughout the region are likely to utilise the project area, areas of dense thicket are important for species that prefer dense cover, areas with exposed granite may support a unique suite of species and large, hollow-bearing trees in woodlands may provide important nesting opportunities.

Key ecological processes. Key ecological processes affecting the fauna assemblage in the project area are hydrology, feral species and possibly over-abundant native species.

4 Impact assessment

4.1 Impacting processes

Threatening processes have to be considered in the context of fauna values and the nature of the proposed action and are examined below. Impact categories are defined in **Table 2-8**.

Habitat loss leading to population decline *Minor to Moderate*

For the Coolgardie Bioregion (a Group 2 Bioregion), the EPA (2004) considers a proposal impacting > 50 ha as having a high impact, with the smaller leases in the project area being 50 ha and 67 ha, and Hamptons and East much larger (> 3000 ha). Population decline is inevitable with some habitat loss, but significance depends on proportion of VSA and of populations impacted. Most of the project area contains VSAs that are well represented in the region. The loss of potential breeding areas for Malleefowl is unlikely to impact the local population provided any active nests are protected to ensure breeding success. Large, hollow-bearing Eucalypt trees occur within the project area, support conservation significant fauna and contain breeding or roosting sites (tree hollows) for a range of fauna.

Habitat loss leading to population fragmentation *Negligible to Minor*

Linear landscape features that might be disrupted include drainage lines and to some extent hills, although these are broadly undulating rather than confined. Roads may limit movement of small, terrestrial fauna species.

Local hydrology *Minor (with management)*

There is a paleo-drainage system in the area which drains into Lake Lefroy, south-east of the project area. Surface and sub-surface drainage patterns are likely to be complex due to heavy soils. Alteration of drainage pattern can significantly impact downstream environments, therefore maintaining local hydrology is considered to be of high importance.

Degradation of habitat due to weed invasion *Negligible*

This impact should be Negligible assuming standard hygiene procedures are followed (see recommendations).

Ongoing mortality from operations *Minor (with management)*

The viability of species that occur at low population densities in areas adjacent to the project area may be compromised by ongoing mortality, such as through roadkill. The Malleefowl is of particular concern as it may occur in low densities within and adjacent to the project area (at least around Hamptons) and is highly susceptible to roadkill. The status of the Chuditch in the area is uncertain, but it may be present in low numbers and thus the occasional road death would be a significant impact on this population.

Species interactions *Minor (with management)*

Feral fauna can increase in abundance around human disturbance which may exacerbate localised impacts on other native fauna. Tracks through otherwise intact native vegetation can facilitate access by feral predators. At least one feral cat was active in the project area in 2021. Increases in the abundance of predatory and/or scavenging bird species can adversely impact smaller birds, including some of those listed as CS3. The abundance of some native species can increase around a mine, possibly due to the presence of fresh water (such as for more-aggressive birds) and increased foraging opportunities in cleared areas (such as for kangaroos); this can impact less common native species through competition and displacement.

Altered fire regimes *Negligible*

Impacts from fire arising from the project are anticipated to be Negligible providing management measures are in place.

Disturbance (dust, noise, light) *Minor (with management)*

The level of dust, noise and light from the proposed action is uncertain but impacts would be localised. Minor impact with some management possible.

4.2 Summary of impacts and Recommendations

Impacts upon significant fauna species and key fauna values are summarised in **Table 4-1** and

Table 4-2, and are mostly considered to be Negligible to Minor; this is largely because the project area is small relative to the broad and largely intact landscape. Impact upon some of the less widespread VSAs may be Minor to Moderate because they are limited in extent within the project area and their status in the broader region is uncertain (though they are expected to be represented at a similar portion of the landscape outside the project area); examples of these are VSA 5 (drainage lines) and VSA 7 (Acacia on exposed granite). Recommendations on management measures to mitigate potential impacts are included in **Table 4-1** and

Table 4-2.

Table 4-1. Impact assessment of the significant fauna species expected to occur in the project area.

Common Name	Status	Habitat	Occurrence	Management	Residual Impact
Malleefowl	Vul	Dense shrublands	Potential visitor	Survey for nests prior to clearing. Protect active nests, habitat preservation, roadkill management, monitor local population. Avoid increasing abundance of feral species.	Negligible
Carpet Python	CS3	Woodland tree hollows	Potential Resident	Conserve mature trees. Relocate if encountered during clearing.	Negligible
Peregrine Falcon	OS (Sect 18 of WA BCA)	Woodland tree hollows	Potential Resident	Maintain breeding sites if found (if possible), avoid direct impact on active nests.	Negligible
Major Mitchell's Cockatoo	CS3	Woodland tree hollows	Irregular visitor	Conserve mature trees, maintain breeding sites if found (if possible), avoid direct impact on active nests. Avoid encouraging over-abundant native species (such as the Galah).	Negligible
Central Long-eared Bat	P4	Woodland tree hollows	Potential Resident	Conserve mature trees, maintain breeding sites if found.	Negligible
Rainbow Bee-eater	CS3	Woodland	Regular Migrant	None	Negligible
CS3 Birds	CS3	Woodland	Resident	Habitat preservation / conserve mature trees where possible. Avoid over-abundant native species.	Negligible

Table 4-2. Summary of potential impacts upon key fauna values.

Fauna Value	Nature and Significance of Impact		Recommended Actions
	Potential Impacts	Significance	
Fauna assemblage	Increased mortality; loss of habitat; species interactions.	Minor as impacts very localised in a regional context	• Minimise impact footprint; • Conserve large, mature, hollow-bearing trees where possible; • Ensure landscape permeability is maintained by creating cross-over/underpass points along transport corridors/pipelines; and • Manage feral and over-abundant species
VSAs	Loss of habitat; habitat degradation.	Minor to Moderate – most of the area contains widespread VSAs; some VSAs are restricted within and outside the project area.	• Minimise footprint; • Minimise disturbance to mature Eucalypt trees and areas of dense understorey.
Significant fauna	Ongoing mortality; loss of habitat; species interactions.	Minor as impacts localised but consideration may be needed for Malleefowl if present in adjacent areas.	• Minimise footprint; • Habitat preservation – retain / manage important areas; • Monitor local Malleefowl population if present; • Protect active nests; and • Retain mature, hollow-bearing trees where possible.
Patterns of biodiversity	Loss of habitat	Minor as impacts very localized.	• Minimise footprint; and • Minimise disturbance to mature Eucalypt trees and dense Acacia shrubland areas.
Ecological processes	Increased mortality; habitat degradation	Minor	• Minimise disturbance footprint; • Manage hydrology; and • Feral species management

In addition, several recommendations are made for future surveys when more detail around a clearing footprint is available. These include:

- Malleefowl – conduct targeted systematic surveys for active Malleefowl mounds within and adjacent to the footprint;
- Chuditch – conduct camera trap surveys within and surrounding the footprint.
- ABAB – search for ABAB-associated ants within and surrounding the footprint; and
- Trapdoor Spiders – search for presence of threatened trapdoor spider burrows within and surrounding the footprint.

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6 Appendices

Appendix 1. Explanation of fauna values.

Fauna values are the features of a site and its fauna that contribute to biodiversity, and it is these values that are potentially at threat from a development proposal. Fauna values can be examined under the five headings outlined below. It must be stressed that these values are interdependent and should not be considered equal, but contribute to an understanding of the biodiversity of a site. Understanding fauna values provides opportunities to predict and therefore mitigate impacts.

Assemblage characteristics

Uniqueness. This refers to the combination of species present at a site. For example, a site may support an unusual assemblage that has elements from adjacent biogeographic zones, it may have species present or absent that might be otherwise expected, or it may have an assemblage that is typical of a very large region. For the purposes of impact assessment, an unusual assemblage has greater value for biodiversity than a typical assemblage.

Completeness. An assemblage may be complete (i.e. has all the species that would have been present at the time of European settlement), or it may have lost species due to a variety of factors. Note that a complete assemblage, such as on an island, may have fewer species than an incomplete assemblage (such as in a species-rich but degraded site on the mainland).

Richness. This is a measure of the number of species at a site. At a simple level, a species rich site is more valuable than a species poor site, but value is also determined, for example, by the sorts of species present.

Vegetation and substrate associations (VSAs)

VSAs combine broad vegetation types, the soils or other substrate with which they are associated, and the landform. In the context of fauna assessment, VSAs are the environments that provide habitats for fauna. The term habitat is widely used in this context, but by definition an animal's habitat is the environment that it utilises (Calver *et al.* 2009), not the environment as a whole. Habitat is a function of the animal and its ecology, rather than being a function of the environment. For example, a species may occur in eucalypt canopy or in leaf-litter on sand, and that habitat may be found in only one or in several VSAs. VSAs are not the same as vegetation types since these may not incorporate soil and landform, and recognise floristics to a degree that VSAs do not. Vegetation types may also not recognise minor but often significant (for fauna) structural differences in the environment. VSAs also do not necessarily correspond with soil types, but may reflect some of these elements.

Because VSAs provide the habitat for fauna, they are important in determining assemblage characteristics. For the purposes of impact assessment, VSAs can also provide a surrogate for detailed information on the fauna assemblage. For example, rare, relictual or restricted VSAs should automatically be considered a significant fauna value. Impacts may be significant if the VSA is rare, a large proportion of the VSA is affected and/or the VSA supports significant fauna. The disturbance of even small amounts of habitat in a localised area can have significant impacts to fauna if rare or unusual habitats are disturbed.

VSA assessment was made with reference to the key attributes provided by (EPA 2020):

- soil type and characteristics
- extent and type of ground surfaces and landforms
- height, cover and dominant flora within each vegetation stratum
- presence of specific flora or vegetation of known importance to fauna
- evidence of fire history including, where possible, estimates of time since fire
- evidence and degree of other disturbance or threats, e.g. feral species
- presence of microhabitats and significant habitat features, such as coarse woody debris, rocky
- outcrops, tree hollows, water sources and caves
- evidence of potential to support significant fauna
- function of the habitat as a fauna refuge or part of an ecological linkage.

Patterns of biodiversity across the landscape

This fauna value relates to how the assemblage is organised across the landscape. Generally, the fauna assemblage is not distributed evenly across the landscape or even within one VSA. There may be zones of high biodiversity such as particular environments or ecotones (transitions between VSAs). There may also be zones of low biodiversity. Impacts may be significant if a wide range of species is affected even if most of those species are not significant per se.

Species of conservation significance

Species of conservation significance are of special importance in impact assessment. The conservation status of fauna species in Australia is assessed under Commonwealth and State Acts such as the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the Western Australian *Biodiversity Conservation Act 2016* (BC Act). In addition, the Western Australian Department of Biodiversity, Conservation and Attractions (DBCA) recognises priority levels, while local populations of some species may be significant even if the species as a whole has no formal recognition. Therefore, three broad levels of conservation significance can be recognised and are used for the purposes of this report, and are outlined below. A full description of the conservation significance categories, schedules and priority levels mentioned below is provided in **Appendix 2**.

<u>Conservation Significance (CS) 1: Species listed under State or Commonwealth Acts</u>.

Species listed under the EPBC Act are assigned to categories recommended by the International Union for the Conservation of Nature and Natural Resources (IUCN 2012), or are listed as migratory. Migratory species are recognised under international treaties such as the China Australia Migratory Bird Agreement (CAMBA), the Japan Australia Migratory Bird Agreement (JAMBA), the Republic of South Korea Australia Migratory Bird Agreement (ROKAMBA), and/or the Convention on the Conservation of Migratory Species of Wild Animals (CMS; also referred to as the Bonn Convention). The *Wildlife Conservation Act 1950* uses a series of seven Schedules to classify conservation status that largely reflect the IUCN categories (IUCN 2012).

Conservation Significance (CS) 2: Species listed as Priority by DBCA but not listed under State or Commonwealth Acts.

In Western Australia, DBCA has produced a supplementary list of Priority Fauna, being species that are not considered threatened under the *Wildlife Conservation Act 1950* but for which DBCA feels there is cause for concern.

Conservation Significance (CS) 3: Species not listed under Acts or in publications, but considered of at least local significance because of their pattern of distribution.

This level of significance has no legislative or published recognition and is based on interpretation of distribution information, but is used here as it may have links to preserving biodiversity at the genetic level (EPA 2002). If a population is isolated but a subset of a widespread (common) species, then it may not be recognised as threatened, but may have unique genetic characteristics. Conservation significance is applied to allow for the preservation of genetic richness at a population level, and not just at a species level. Species on the edge of their range, or that are sensitive to impacts such as habitat fragmentation, may also be classed as CS3, as may colonies of waterbirds. The Western Australian Department of Environmental Protection, now DBCA, used this sort of interpretation to identify significant bird species in the Perth metropolitan area as part of the Perth Bushplan (DEP 2000).

Marine-listed species

Some conservation significant species may also be listed as 'Marine' under the EPBC Act. This listing protects these species in 'Commonwealth areas' which include "marine areas beyond the coastal waters of each State and the Northern Territory, and includes all of Australia's Exclusive Economic Zone (EEZ)" (DAWE 2020b). The EEZ extends to 200 nautical miles (approximately 350 kilometres) from the coast (DAWE 2020b). This may mean that the 'Marine' listing does not apply to the project/survey area (depending on its location). Therefore, when a species is otherwise protected (under the EPBC Act or BC Act) or priority-listed (by the DBCA) then the Marine listing is also noted but it does not have site-specific relevance. In cases where a species is solely Marine-listed (for a list see DAWE 2020a) and a project/survey area is not within a Commonwealth area then it is treated like all other fauna.

Invertebrates

Invertebrate species considered to be short range endemics (SREs) also fall within the CS3 category, as they have no legislative or published recognition and their significance is based on interpretation of distribution information. Harvey (2002) notes that the majority of species that have been classified as short-range endemics have common life history characteristics such as poor powers of dispersal or confinement to discontinuous habitats. Several groups, therefore, have particularly high instances of short-range endemic species: Gastropoda (snails and slugs), Oligochaeta (earthworms), Onychophora (velvet worms), Araneae (mygalomorph spiders), Pseudoscorpionida (pseudoscorpions), Schizomida (schizomids), Diplopoda (millipedes), Phreatoicidea (phreatoicidean crustaceans), and Decapoda (freshwater crayfish). The poor understanding of the taxonomy of many of the short-range endemic species hinders their conservation (Harvey 2002).

Introduced species

In addition to these conservation levels, species that have been introduced (INT) are indicated throughout the report. Introduced species may be important to the native fauna assemblage through effects by predation and/or competition.

Ecological processes upon which the fauna depend

These are the processes that affect and maintain fauna populations in an area and as such are very complex; for example, populations are maintained through the dynamic of mortality, survival and recruitment being more or less in balance, and these are affected by a myriad of factors. The dynamics of fauna populations in a project may be affected by processes such as fire regime, landscape patterns (such as fragmentation and/or linkage), the presence of feral species and hydrology. Impacts may be significant if processes are altered such that fauna populations are adversely affected, resulting in declines and even localised loss of species. Threatening processes as outlined in **Appendix 3** are effectively the ecological processes that can be altered to result in impacts upon fauna.

Appendix 2. Categories used in the assessment of conservation status.

IUCN (International Union for the Conservation of Nature) categories, as outlined by IUCN (2012), and as used for the *Environment Protection and Biodiversity Conservation Act 1999* and the Western Australian *Biodiversity Conservation Act 2016*.

Extinct	Taxa not definitely located in the wild during the past 50 years.
Extinct in the Wild (Ex)	Taxa known to survive only in captivity.
Critically Endangered (CR)	Taxa facing an extremely high risk of extinction in the wild in the immediate future.
Endangered (E)	Taxa facing a very high risk of extinction in the wild in the near future.
Vulnerable (V)	Taxa facing a high risk of extinction in the wild in the medium-term future.
Near Threatened	Taxa that risk becoming Vulnerable in the wild.
Conservation Dependent	Taxa whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent taxon would be classed as Vulnerable or more severely threatened.
Data Deficient (Insufficiently Known)	Taxa suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information.
Least Concern.	Taxa that are not Threatened.

Schedules used in the WA *Biodiversity Conservation Act 2016*

Schedule 1 (S1)	Critically Endangered fauna.
Schedule 2 (S2)	Endangered fauna
Schedule 3 (S3)	Vulnerable Migratory species listed under international treaties.
Schedule 4 (S4)	Presumed extinct fauna
Schedule 5 (S5)	Migratory birds under international agreement
Schedule 6 (S6)	Conservation dependant fauna
Schedule 7 (S7)	Other specially protected fauna

WA DBCA Priority species (species not listed under the *WA Biodiversity Conservation Act 2016*, but for which there is some concern).

Priority 1 (P1)	Taxa with few, poorly known populations on threatened lands.
Priority 2 (P2)	Taxa with few, poorly known populations on conservation lands; or taxa with several, poorly known populations not on conservation lands.
Priority 3 (P3)	Taxa with several, poorly known populations, some on conservation lands.
Priority 4. (P4)	Taxa in need of monitoring. Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change.
Priority 5 (P5)	Taxa in need of monitoring. Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years (IUCN Conservation Dependent).

Appendix 3. Explanation of threatening processes.

Potential impacts of proposed developments upon fauna values can be related to threatening processes. This is recognised in the literature and under the EPBC Act, in which threatening processes are listed (see **Appendix 4**). Processes that may impact fauna values are discussed below. Rather than being independent of one another, processes are complex and often interrelated. They are the mechanisms by which fauna can be affected by development. Impacts may be significant if large numbers of species or large proportions of populations are affected.

Note that the terms direct and indirect impacts are used by the DotE (2013), DSEWPaC (2013) and EPA (2016a), but there is some inconsistency in how these are defined. The federal guidance does not define direct impact but has a very broad definition of indirect, and makes the statement (DotE 2013) '*Consideration should be given to all adverse impacts that could reasonably be predicted to follow from the action, whether these impacts are within the control of the person proposing to take the action or not. Indirect impacts will be relevant where they are sufficiently close to the proposed action to be said to be a consequence of the action, and they can reasonably be imputed to be within the contemplation of the person proposing to take the action*.' Indirect impacts therefore can even include what the DotE (2013) calls facilitated impacts, which are the result of third party actions triggered by the primary action. In contrast, the EPA (2016a) defines direct impacts to '*include the removal, fragmentation or modification of habitat, and mortality or displacement of individuals or populations.*' This document then lists as indirect impacts what in many cases are the consequences of the removal, fragmentation or modification of habitat. For example, '*disruption of the dispersal of individuals required to colonise new areas inhibiting maintenance of genetic diversity between populations'* is a consequence of habitat fragmentation. Impacts of light, noise and even roadkill are defined as indirect but they are clearly the result of the action and in control of the person taking the action. Roadkill is as direct a form of mortality as can be observed, but it is considered as an indirect impact in the context of a development presumably because it is not directly linked to land clearing. The EPA (2016a) makes a strong distinction between removal of vegetation (direct impact) and the consequences of such clearing and other aspects of a development (indirect impacts). It is not obvious how this distinction between direct and indirect impacts is helpful in the EIA process, as the key aim is to ensure that all impacts that result from a project are addressed in this assessment process. Interestingly, Gleeson and Gleeson (2012), in a major review of impacts of development on wildlife, do not use the terms direct or indirect. In the following outlines of threatening processes that can cause impacts, the emphasis is upon interpreting how a threatening process will cause an impact. For example, loss of habitat (threatening process) can lead to population decline and to population fragmentation, which are two distinct impacts, with population decline considered a direct impact and fragmentation an indirect impact by the EPA (2016a).

Loss of habitat affecting population survival

Clearing for a development can lead to habitat loss for a species with a consequent decline in population size. This may be significant if the smaller population has reduced viability. Conservation significant species or species that already occur at low densities may be particularly sensitive to habitat loss affecting population survival.

Loss of habitat leading to population fragmentation

Loss of habitat can affect population movements by limiting movement of individuals throughout the landscape as a result of fragmentation (Soule *et al.* 2004, Gleeson and Gleeson 2012). Obstructions associated with the development, such as roads, pipes and drainage channels, may also affect movement of small, terrestrial species. Fragmented populations may not be sustainable and may be sensitive to effects such as reduced gene flow.

Degradation of habitat due to weed invasion leading to population decline

Weed invasion, such as through introduction by human boots or vehicle tyres, can occur as a result of development and if this alters habitat quality, can lead to effects similar to habitat loss.

Increased mortality

Increased mortality can occur during project operations; for example from roadkill, animals striking infrastructure and entrapment in trenches. Roadkill as a cause of population decline has been documented for several medium-sized mammals in eastern Australia (Dufty 1989, Jones 2000). Increased mortality due to roadkill is often more prevalent in habitats that have been fragmented (Scheick and Jones 1999, Clevenger and Waltho 2000, Jackson and Griffin 2000).

Increased mortality of common species during development is unavoidable and may not be significant for a population. However, the cumulative impacts of increased mortality of conservation significant species or species that already occur at low densities may have a significant impact on the population.

Species interactions, including predation and competition

Changes in species interactions often occur with development. Introduced species, including the feral Cat, Red Fox and Rabbit may have adverse impacts upon native species and development can alter their abundance. In particular, some mammal species are very sensitive to introduced predators and the decline of many mammals in Australia has been linked to predation by the Red Fox, and to a lesser extent the feral Cat (Burbidge and McKenzie 1989). Introduced grazing species, such as the Rabbit, Goat, Camel and domestic livestock, can also degrade habitats and deplete vegetation that may be a food source for other species.

Changes in the abundance of some native species at the expense of others, due to the provision of fresh watering points, can also be a concern. Harrington (2002) found the presence of artificial fresh waterpoints in the semi-arid mallee rangelands to influence the abundance and distribution of certain bird species. Common, water-dependent birds were found to out-compete some less common, water-independent species. Similarly, Read *et al.* (2015) found a decline in some bird species but an increase in others in the vicinity of active mines and concluded this was due to the mine attracting large and aggressive species that displaced other species. Over-abundant native herbivores, such as kangaroos, can also adversely affect less abundant native species through competition and displacement.

Hydroecology

Interruptions of hydroecological processes can have major effects because they underpin primary production in ecosystems and there are specific, generally rare habitats that are hydrology-dependent. Fauna may be impacted by potential changes to groundwater level and chemistry and

altered flow regime. These changes may alter vegetation across large areas and may lead to habitat degradation or loss. Impacts upon fauna can be widespread and major.

Changes to flow regime across the landscape may alter vegetation and may lead to habitat degradation or loss, affecting fauna. For example, Mulga has a shallow root system and relies on surface sheet flow during flood events. If surface sheet flow is impeded, Mulga can die (Kofoed 1998), which may impact on a range of fauna associated with this vegetation type.

Fire

The role of fire in the Australian environment and its importance to vertebrate fauna has been widely acknowledged (Gill *et al.* 1981; Fox 1982; Letnic *et al.* 2004). It is also one of the factors that has contributed to the decline and local extinction of some mammal and bird species (Burbidge and McKenzie 1989). Fire is a natural feature of the environment but frequent, extensive fires may adversely impact some fauna, particularly mammals and short-range endemic species. Changes in fire regime, whether to more frequent or less frequent fires, may be significant to some fauna. Impacts of severe fire may be devastating to species already occurring at low densities or to species requiring long unburnt habitats to survive. In terms of conservation management, it is not fire *per se* but the fire regime that is important, with evidence that infrequent, extensive and intense fires adversely affect biodiversity, whereas frequent fires that cover small areas and are variable in both season and intensity can enhance biodiversity. Fire management may be considered the responsibility of managers of large tracts of land, including managers of mining tenements.

Dust, light, noise and vibration

Impacts of dust, light, noise and vibration upon fauna are difficult to predict. Some studies have demonstrated the impact of artificial night lighting on fauna, with lighting affecting fauna behaviour more than noise (Rich and Longcore 2006). Effects can include impacts on predator-prey interactions, changes to mating and nesting behaviour, and increased competition and predation within and between invertebrates, frogs, birds and mammals.

The death of very large numbers of insects has been observed around some remote mine sites and attracts other fauna, notably native and introduced predators (M. Bamford pers. obs). The abundance of some insects can decline due to mortality around lights, although this has previously been recorded in fragmented landscapes where populations are already under stress (Rich and Longcore 2006). Artificial night lighting may also lead to disorientation of migratory birds. Aquatic habitats and open habitats such as grasslands and dunes may be vulnerable to light spill.

Appendix 4. Ecological and threatening processes identified under legislation and in the literature.

Ecological processes are processes that maintain ecosystems and biodiversity. They are important for the assessment of impacts of development proposals, because ecological processes make ecosystems sensitive to change. The issue of ecological processes, impacts and conservation of biodiversity has an extensive literature. Following are examples of the sorts of ecological processes that need to be considered.

Ecological processes relevant to the conservation of biodiversity in Australia (Soule *et al.* 2004):

- Critical species interactions (highly interactive species);
- Long distance biological movement;
- Disturbance at local and regional scales;
- Global climate change;
- Hydroecology;
- Coastal zone fluxes;
- Spatially-dependent evolutionary processes (range expansion and gene flow); and
- Geographic and temporal variation of plant productivity across Australia.

Threatening processes (EPBC Act)

Under the EPBC Act, a key threatening process is an ecological interaction that threatens or may threaten the survival, abundance or evolutionary development of a threatened species or ecological community. There are currently 20 key threatening processes listed by the federal Department of the Environment (DotE 2014):

- Competition and land degradation by rabbits.
- Competition and land degradation by unmanaged goats.
- Dieback caused by the root-rot fungus (*Phytophthora cinnamomi*).
- Incidental catch (bycatch) of Sea Turtle during coastal otter-trawling operations within Australian waters north of 28 degrees South.
- Incidental catch (or bycatch) of seabirds during oceanic longline fishing operations.
- Infection of amphibians with chytrid fungus resulting in chytridiomycosis.
- Injury and fatality to vertebrate marine life caused by ingestion of, or entanglement in, harmful marine debris.
- Invasion of northern Australia by Gamba Grass and other introduced grasses.
- Land clearance.
- Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants.
- Loss of biodiversity and ecosystem integrity following invasion by the Yellow Crazy Ant (*Anoplolepis gracilipes*) on Christmas Island, Indian Ocean.
- Loss of climatic habitat caused by anthropogenic emissions of greenhouse gases.
- Novel biota and their impact on biodiversity.
- Predation by European red fox.
- Predation by exotic rats on Australian offshore islands of less than 1000 km^2 (100,000 ha).
- Predation by feral cats.
- Predation, Habitat Degradation, Competition and Disease Transmission by Feral Pigs.
- Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species.
- The biological effects, including lethal toxic ingestion, caused by Cane Toads (*Bufo marinus*).
- The reduction in the biodiversity of Australian native fauna and flora due to the red imported fire ant, *Solenopsis invicta* (fire ant).

General processes that threaten biodiversity across Australia (The National Land and Water Resources Audit):

- Vegetation clearing;
- Increasing fragmentation, loss of remnants and lack of recruitment;
- Firewood collection;
- Grazing pressure;
- Feral animals;
- Exotic weeds;
- Changed fire regimes;
- Pathogens;
- Changed hydrology—dryland salinity and salt water intrusion;
- Changed hydrology— such as altered flow regimes affecting riparian vegetation; and
- Pollution.

In addition to the above processes, the federal Department of Agriculture, Water and the Environment (DAWE) produced Significant Impact Guidelines that provide criteria for the assessment of the significance of impacts. These criteria provide a framework for the assessment of significant impacts. The criteria are listed below.

- Will the proposed action lead to a long-term decrease in the size of a population?
- Will the proposed action reduce the area of occupancy of the species?
- Will the proposed action fragment an existing population?
- Will the proposed action adversely affect habitat critical to the survival of a species?
- Will the proposed action disrupt the breeding cycle of a population?
- Will the proposed action modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?
- Will the proposed action result in introducing invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat?
- Will the proposed action introduce disease that may cause the species to decline?
- Will the proposed action interfere with the recovery of the species?

Appendix 5 Fauna expected to occur in the project area.

These lists are derived from the results of database and literature searches and from previous field surveys conducted in the Kalgoorlie region. These are:

- Species listed under fauna databases – NatureMap (DBCA 2019), Birdata (BirdLife Australia 2019), Atlas of Living Australia (ALA 2019) or EPBC Protected Matters Search (DEE 2019), or from the literature;
- Local records (BCE database) and fauna recorded during previous BCE fauna assessments in the local area:
- Species previously recorded at Mt Marion by BCE (2012) or Rapallo (2010);
- Alacer Gold Level 1 Fauna surveys (conducted by BCE during 2012 at the South Kalgoorlie operations) listed under "A" (see BCE, 2012a, b, c, d).
- Level 1 Fauna survey of Excelsior Gold's Bardoc Project (listed under "B", BCE, 2012e).
- Level 1 Fauna survey of the Metals X Cannon Project (listed under "C", see BCE 2015);
- Level 1 Fauna survey of the Metals X Gunge West Project (listed under "G", BCE 20126);
- Level 1 Fauna survey at Red Hill, Kambalda (listed under "K", BCE 2015);
- Level 2 Fauna survey conducted by BCE at St Ives, Lake Lefroy (Si);
- Fauna recorded during a previous Mount Marion BCE survey (listed under "BCE", 2016)
- Fauna recorded during a BCE survey of M15/717, within the Mt Marion area (listed under "BCE", 2017a);
- Fauna recorded during the BCE survey of the Stage 1 borefields pipeline corridor listed under "BCE", 2017b);
- Fauna recorded during the BCE survey of the Woolibar Stage 2, borefields pipeline corridor (listed under "BCE", 2018);
- Note conservation significant fauna are listed under CS;
- Species recorded opportunistically outside the survey, but within the region, are listed under "R";
- Species recorded indirectly by prints, nests, bones etc and listed under "S";
- Species recorded breeding within the area are listed under "X^B";
- Species recorded or expected from the region, but not the specific study area are listed as "-"; and
- Species recorded using motion-sensitive cameras are listed as "C".

Table 6-1. Frogs recorded or expected to occur in the Mt Marion area.

FROGS	CS	Outside Areas	Mt Marion surveys						
			Rapallo 2010	BCE					
				2012	2016	2017a	2017b	2018	2021
Limnodynastidae (burrowing frogs)									
Kunapalari Frog *Neobatrachus kunapalari*		SI, B			X				
Humming Frog *Neobatrachus pelobatoides*									
Shoemaker Frog *Neobatrachus sutor*									
Goldfields Bull Frog *Neobatrachus wilsmorei*									
Myobatrachidae (ground-frogs)									
Western Toadlet *Pseudophryne occidentalis*		SI, B							
Total Number of Species Expected: 5 Total Number of Species Recorded from the Mt Marion Lithium Project Area: 1		2	0	0	1	0	0	0	0

Table 6-2. Reptiles recorded or expected to occur in the Mt Marion area.

REPTILES	CS	Outside Areas	Mt Marion surveys						
			Rapallo 2010	BCE					
				2012	2016	2017a	2017b	2018	2021
CARPHODACTYLIDAE									
Pale Knob-tailed Gecko *Nephrurus laevissimus*		SI							
Midline Knob-tail *Nephrurus vertebralis*									
Barking Gecko *Underwoodisaurus milii*		SI, B, A, K			X				
DIPLODACTYLIDAE									
Clawless Gecko *Crenadactylus ocellatus*		SI							
Western Stone Gecko *Diplodactylus granariensis*		SI, K			X				

REPTILES		CS	Outside Areas	Mt Marion surveys						
				Rapallo	BCE					
				2010	2012	2016	2017a	2017b	2018	2021
Beautiful Gecko	*Diplodactylus pulcher*		SI, K							
Reticulated Velvet Gecko	*Hesperoedura reticulata*		SI			X				
Beaded Gecko	*Lucasium damaeum*									
Main's Ground Gecko	*Lucasium maini*		SI, K							
Beaked Gecko	*Rhynchoedura ornata*					X				
Thorn -tailed Gecko	*Strophurus assimilis*		SI							
Jewelled Gecko	*Strophurus elderi*		SI							
Ring-tailed Gecko	*Strophurus strophurus*									
GEKKONIDAE										
Marbled Gecko	*Christinus marmoratus*		SI							
Purplish Dtella	*Gehyra purpurascens*		SI							
Tree Dtella	*Gehyra variegata*		SI, A, K, G	X		X				
Bynoe's Gecko	*Heteronotia binoei*		SI, B, A, K	X		X				
PYGOPODIDAE										
Marble-faced Delma	*Delma australis*		SI							
Unbanded Dema	*Delma butleri*		SI							
Fraser's Delma	*Delma fraseri*		SI							
Burton's Legless-Lizard	*Lialis burtonis*		SI							
Common Scaly-foot	*Pygopus lepidopodus*		SI							
Western Scaly-foot	*Pygopus nigriceps*									
AGAMIDAE										
Crested Dragon	*Ctenophorus cristatus*		SI, A, K	X	X	X				
Mallee Dragon	*Ctenophorus fordi*		SI							
Western Netted Dragon	*Ctenophorus reticulatus*		SI, A							
Claypan Dragon	*Ctenophorus salinarum*		SI, K							
Lozenge-marked Dragon	*Ctenophorus scutulatus*		SI, B							
Mulga Dragon	*Diporiphora amphiboluroides*									
Thorny Devil	*Moloch horridus*		SI, K							
Bearded Dragon	*Pogona minor*		SI							
Pebble Dragon	*Tympanocryptis pseudopsephos*		SI, C							
SCINCIDAE										
A skink	*Cryptoblepharus australis*									
A skink	*Cryptoblepharus buchananii*		SI	X						
Southern Mallee Skink	*Ctenotus atlas*		SI							
Leonhardi's Ctenotus	*Ctenotus leonhardii*		SI							
Barred Wedge-snouted Ctenotus	*Ctenotus schomburgkii*		SI							
Rock Ctenotus	*Ctenotus severus*									
Spotted Ctenotus	*Ctenotus uber*		SI, A							
Spinifex Slender Blue-tongue	*Cyclodomorphus melanops*		SI							
Pygmy Spiny-tailed Skink	*Egernia depressa*		B, A							
Goldfields Crevice Skink	*Egernia formosa*		SI, B, A		X	X				
Woodland Crevice Skink	*Egernia richardi*									
Broad-banded Sandswimmer	*Eremiascincus richardsonii*		SI							
Southern Five-toed Mulch Skink	*Hemiergis initialis*		SI							
Four-toed Mulch Skink	*Hemiergis peronii*									
South-west Four-toed Lerista	*Lerista distinguenda*		SI							
King's Lerista	*Lerista kingi*									
Robust Lerista	*Lerista macropisthopus*									
Goldfields Robust Lerista	*Lerista picturata*		SI							
Common Mulch Lerista	*Lerista timda*									
Desert Skink	*Liopholis inornata*		SI							
Bull-headed Skink	*Liopholis multiscutata*		SI							
Night Skink	*Liopholis striata*									
Common Dwarf Skink	*Menetia greyii*		SI							
Saltbush Flecked Skink	*Morethia adelaidensis*		SI							
Woodland Dark Fleck Skink	*Morethia butleri*		SI							
Woodland Flecked Skink	*Morethia obscura*		SI							
Western Blue-tongue	*Tiliqua occipitalis*		SI							
Bobtail	*Tiliqua rugosa*		SI, A, C, K, G							C
VARANIDAE										
Pygmy Mulga Monitor	*Varanus caudolineatus*									
Bungarra or Sand Monitor	*Varanus gouldii*		SI, B, A, C, K		X	X				C
Racehorse Monitor	*Varanus tristis tristis*		A							C

REPTILES		CS	Outside Areas	Mt Marion surveys						
				Rapallo	BCE					
				2010	2012	2016	2017a	2017b	2018	2021
TYPHLOPIDAE										
Southern Blind Snake	*Anilios australis*		SI							
Dark-spined Blind Snake	*Anilios bicolor*		SI							
Prong-snouted Blind Snake	*Anilios bituberculatus*		SI							
Hook-Snouted Blind Snake	*Anilios hamatus*									
Common Beaked Blind Snake	*Anilios waitii*									
BOIDAE										
Stimson's Python	*Antaresia stimsoni*									
Carpet Python	*Morelia spilota imbricata*	3	SI							
ELAPIDAE										
Desert Death Adder	*Acanthophis pyrrhus*									
Narrow-banded Shovel-nosed Snake	*Brachyurophis fasciolata*		SI							
Southern Shovel-nosed Snake	*Brachyurophis semifasciata*		SI							
Yellow-faced Whipsnake	*Demansia psammophis*		SI							
Bardick	*Echiopsis curta*									
Moon Snake	*Furina ornata*									
Black-naped Snake	*Neelaps bimaculatus*									
Gould's Snake	*Parasuta gouldii*		SI							
Monk Snake	*Parasuta monachus*		SI							
Black-backed Hooded Snake	*Parasuta nigriceps*									
Mulga Snake	*Pseudechis australis*		SI							
Ringed Brown Snake	*Pseudonaja modesta*		SI							
Western Brown Snake	*Pseudonaja mengdeni*		SI, K							
Jan's Banded Snake	*Simoselaps bertholdi*		SI							
Rosen's Snake	*Suta fasciata*									
Total Number of Species Expected: 85 **Total Recorded from the Mt Marion Lithium Project Area: 12**			**59**	**4**	**3**	**9**	**0**	**0**	**0**	**3**

Table 6-3. Birds recorded or expected to occur in the Mt Marion area.

Birds		CS	Outside Areas	Mt Marion surveys						
				Rapallo	BCE					
				2010	2012	2016	2017a	2017b	2018	2021
CASUARIIDAE										
Emu	*Dromaius novaehollandiae*		SI,B,A, G,C		X	X	S	X[B]	X	X, C
ANATIDAE										
Pink-eared Duck	*Malacorhynchus membranaceus*		A				-	-	-	
Black Swan	*Cygnus atratus*		A				-	-	-	
Australian Shelduck	*Tadorna tadornoides*		A				-	-	-	
Hardhead	*Aythya australis*						-	-	-	
Australasian Shoveler	*Spatula rhynchotis*						-	-	-	
Australian Wood Duck	*Chenonetta jubata*		A				-	-	-	
Pacific Black Duck	*Anas superciliosa*		A				-	-	-	
Grey Teal	*Anas gracilis*						-	-	-	
Chestnut Teal	*Anas castanea*						-	-	-	
Freckled Duck	*Stictonetta naevosa*						-	-	-	
Musk Duck	*Biziura lobata*						-	-	-	
MEGAPODIIDAE										
Malleefowl	*Leipoa ocellata*	1	SI,A,K, G,C	X		X	S		S	S
PHASIANIDAE										
Stubble Quail	*Coturnix pectoralis*								-	
PODICIPEDIDAE										
Australasian Grebe	*Tachybaptus novaehollandiae*		B,A				-	-	-	
Hoary-headed Grebe	*Poliocephalus poliocephalus*						-	-	-	
COLUMBIDAE										
Common Bronzewing	*Phaps chalcoptera*		SI,B,K, G,C	X		X		X	X	C
Crested Pigeon	*Ocyphaps lophotes*		SI,B,A, K,C							
Diamond Dove	*Geopelia cuneata*		A							
CUCULIDAE										
Horsfield's Bronze-Cuckoo	*Chalcites basalis*		SI,A,K, C							X
Black-eared Cuckoo	*Chalcites osculans*		K,C			X				
Fan-tailed Cuckoo	*Cacomantis flabelliformis*									
Pallid Cuckoo	*Heteroscenes pallidus*			X						
OTIDIDAE										
Australian Bustard	*Ardeotis australis*	3								
PODARGIDAE										
Tawny Frogmouth	*Podargus strigoides*		B,A,G, C		X	X				
EUROSTOPODIDAE										
Spotted Nightjar	*Eurostopodus argus*					X				C
AEGOTHELIDAE										
Australian Owlet-nightjar	*Aegotheles cristatus*		SI,K		X					
APODIDAE										
Fork-tailed Swift	*Apus pacificus*	1								
RALLIDAE										
Buff-banded Rail	*Hypotaenidia philippensis*						-	-	-	
Australian Spotted Crake	*Porzana fluminea*		A				-	-	-	
Baillon's Crake	*Zapornia pusilla*						-	-	-	
Spotless Crake	*Zapornia tabuensis*						-	-	-	
Black-tailed Native-hen	*Tribonyx ventralis*						-			
Eurasian Coot	*Fulica atra*						-	-	-	
BURHINIDAE										
Bush Stone-curlew	*Burhinus grallarius*	3								
RECURVIROSTRIDAE										
Red-necked Avocet	*Recurvirostra novaehollandiae*						-	-	-	
Pied (Black-winged) Stilt	*Himantopus leucocephalus*		A				-	-	-	
Banded Stilt	*Cladorhynchus leucocephalus*		A				-	-	-	
CHARADRIIDAE										
Red-capped Plover	*Charadrius ruficapillus*						-	-	-	
Hooded Plover	*Thinornis rubricollis*	2					-	-	-	
Black-fronted Dotterel	*Elseyornis melanops*		A				-	-	-	

Birds		CS	Outside Areas	Mt Marion surveys						
				Rapallo	BCE					
				2010	2012	2016	2017a	2017b	2018	2021
Banded Lapwing	*Vanellus tricolor*									
Red-kneed Dotterel	*Erythrogonys cinctus*						-	-	-	
Inland Dotterel	*Charadrius australis*									
SCOLOPACIDAE										
Sharp-tailed Sandpiper	*Calidris acuminata*	1					-	-	-	
Curlew Sandpiper	*Calidris ferruginea*	1					-	-	-	
Red-necked Stint	*Calidris ruficollis*	1					-	-	-	
Common Greenshank	*Tringa nebularia*	1					-	-	-	
Wood Sandpiper	*Tringa glareola*	1					-	-	-	
TURNICIDAE										
Little Button-quail	*Turnix velox*		A			R				
ARDEIDAE										
White-necked Heron	*Ardea pacifica*						-	-	-	
Eastern Great Egret	*Ardea alba*						-	-	-	
White-faced Heron	*Egretta novaehollandiae*		B,A				-	-	-	
PLATALEIDAE										
Straw-necked Ibis	*Threskiornis spinicollis*						-	-	-	
Yellow-billed Spoonbill	*Platalea flavipes*						-	-	-	
ANHINGIDAE										
Little Pied Cormorant	*Microcarbo melanoleucos*						-	-	-	
Little Black Cormorant	*Phalacrocorax sulcirostris*						-	-	-	
ACCIPITRIDAE										
Black-shouldered Kite	*Elanus axillaris*									
Black-breasted Buzzard	*Hamirostra melanosternon*									
Square-tailed Kite	*Lophoictinia isura*	3								
Wedge-tailed Eagle	*Aquila audax*		SI,B,A, G,C							X
Little Eagle	*Hieraaetus morphnoides*		K							
Spotted Harrier	*Circus assimilis*									X
Brown Goshawk	*Accipiter fasciatus*		SI,B,C							X
Collared Sparrowhawk	*Accipiter cirrocephalus*									
Whistling Kite	*Haliastur sphenurus*									X
Black Kite	*Milvus migrans*									
TYTONIDAE										
Eastern Barn Owl	*Tyto alba delicatula*									
STRIGIDAE										
Southern Boobook	*Ninox boobook*									
MEROPIDAE										
Rainbow Bee-eater	*Merops ornatus*	3	SI,A,K		X	X				
HALCYONIDAE										
Sacred Kingfisher	*Todiramphus sanctus*		A							
Red-backed Kingfisher	*Todiramphus pyrrhopygius*				X					
FALCONIDAE										
Nankeen Kestrel	*Falco cenchroides*		B,K							
Australian Hobby	*Falco longipennis*									
Brown Falcon	*Falco berigora*		SI,B,A, K,C	X		X		X		
Peregrine Falcon	*Falco peregrinus*	1								
CACATUIDAE										
Cockatiel	*Nymphicus hollandicus*									
Galah	*Eolophus roseicapillus*		K							
Major Mitchell's Cockatoo	*Lophochroa leadbeateri*	3								
Little Corella	*Cacatua sanguinea*									
PSITTACIDAE										
Regent Parrot	*Polytelis anthopeplus*	3	SI							
Mulga Parrot	*Psephotus varius*		SI,B,G, C			X	X	X		
Western Rosella (inland)	*Platycercus icterotis xanthogenys*	2								
Australian Ringneck	*Barnardius zonarius*		SI,B,A, K,G,C	X	X	X	X		X	X, C
Scarlet-chested Parrot	*Neophema splendida*	3	SI							
Purple-crowned Lorikeet	*Glossopsitta porphyrocephala*	3	SI, B, K, G, C	X	X	X	X	X	X	
Budgerigar	*Melopsittacus undulatus*		SI,K							
CLIMACTERIDAE										

Birds		CS	Outside Areas	Mt Marion surveys						
				Rapallo	BCE					
				2010	2012	2016	2017a	2017b	2018	2021
White-browed Treecreeper	*Climacteris affinis*	3	C							
Rufous Treecreeper	*Climacteris rufa*	3	SI,C		X	X	X		X	
MALURIDAE										
Blue-breasted Fairy-wren	*Malurus pulcherrimus*	3	A,K,G		X	X	X	X	X	
Variegated Fairy-wren	*Malurus lamberti*									X
Splendid Fairy-wren	*Malurus splendens*		B,A,C							
White-winged Fairy-wren	*Malurus leucopterus*		SI,B,A, K							
MELIPHAGIDAE										
Black Honeyeater	*Sugomel niger*									
Brown Honeyeater	*Lichmera indistincta*		SI,B,A, K,G,C	X	X	X				X
White-cheeked Honeyeater	*Phylidonyris niger*									
White-eared Honeyeater	*Nesoptilotus leucotis*		B,A,K, G,C	X	X	X	X	X		X
Brown-headed Honeyeater	*Melithreptus brevirostris*		SI,B,A, K,G,C	X	X	X	X	X		X
Pied Honeyeater	*Certhionyx variegatus*									
Crimson Chat	*Epthianura tricolor*									
Orange Chat	*Epthianura aurifrons*									
White-fronted Cat	*Epthianura albifrons*		A							
Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*		SI,B,A, K,C		X	X	X	X	X	
Red Wattlebird	*Anthochaera carunculata*		SI,B,A, K,G,C	X	X	X	X	X	X	X
Singing Honeyeater	*Gavicalis virescens*		SI,B,A, K,G,C		X					X
Yellow-plumed Honeyeater	*Ptilotula ornatus*		SI,B,A, K,G,C	X	X	X	X	X	X	
Grey-fronted Honeyeater	*Ptilotula plumula*		B							
White-fronted Honeyeater	*Purnella albifrons*		SI,B,A, K,C	X	X	X	X	X		
Purple-gaped Honeyeater	*Lichenostomus cratitius*	3								
Yellow-throated Miner	*Manorina flavigula*		SI,B,A, K,C	X	X	X	X	X	X	X, C
PARDALOTIDAE										
Spotted Pardalote	*Pardalotus punctatus*				X					
Striated Pardalote	*Pardalotus striatus*		SI,B,A, K,G,C		X	X	X	X		X
ACANTHIZIDAE										
Western Gerygone	*Gerygone fusca*							X		
Weebill	*Smicrornis brevirostris*		SI,B,A, K,G,C	X	X	X	X	X	X	
Redthroat	*Pyrrholaemus brunneus*		SI,B,A, K,G,C	X	X	X				
Shy Heathwren	*Calamanthus cauta whitlocki*	3	SI							
Rufous Fieldwren	*Calamanthus campestris*									
White-browed Scrubwren	*Sericornis frontalis*									
Southern Whiteface	*Aphelocephala leucopsis*		C							
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*		B,A,K, C	X		X				
Inland Thornbill	*Acanthiza apicalis*		SI,B,A, K,G,C	X	X	X	X		X	
Slaty-backed Thornbill	*Acanthiza robustirostris*		K							
Slender billed Thornbill	*Acanthiza iredalei*									
Chestnut-rumped Thornbill	*Acanthiza uropygialis*		SI,B,A, K,G,C	X	X	X	X			X
POMATOSTOMIDAE										
White-browed Babbler	*Pomatostomus superciliosus*	3	B,A,K, G,C	X	X	X	X	X		X
NEOSITTIDAE										
Varied Sittella	*Daphoenositta chrysoptera*		SI,B,A, K,G,C		X	X				
CAMPEPHAGIDAE										
Ground Cuckoo-shrike	*Coracina maxima*									

Birds		CS	Outside Areas	Mt Marion surveys						
				Rapallo	BCE					
				2010	2012	2016	2017a	2017b	2018	2021
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*		SI,B,A, K,C	X	X	X	X	X		X
White-winged Triller	*Lalage tricolor*									
PSOPHODIDAE										
Copper-backed Quail-thrush	*Cinclosoma clarum*	3	A,K,G, C	X	X	X	X	X[B]		X, C
PACHYCEPHALIDAE										
Gilbert's Whistler	*Pachycephala inornata*	3	B,A,K, C		X	X				
Rufous Whistler	*Pachycephala rufiventris*		B,A,K, G,C			X				X
Golden Whistler	*Pachycephala pectoralis*			X		X				X
Grey Shrike-thrush	*Colluricincla harmonica*		SI,B,A, K,G,C	X	X	X		X	X	X
FALCUNCULIDAE										
Crested Shrike-tit	*Falcunculus frontatus*	3								
OREOICIDAE										
Crested Bellbird	*Oreoica gutturalis*		SI,B,A, K,G,C		X	X	X	X	X	X
ARTAMIDAE										
Grey Currawong	*Strepera versicolor*		SI,B,A, K,G,C		X	X	X	X		X, C
Australian Magpie	*Gymnorhina tibicen*		SI,B,A, K,C							X
Pied Butcherbird	*Cracticus nigrogularis*		A,G,C		X				X	X
Grey Butcherbird	*Cracticus torquatus*		SI,B,A, K,G,C		X	X	X			
Masked Woodswallow	*Artamus personatus*		SI,A,K							X
Dusky Woodswallow	*Artamus cyanopterus*		SI,G,C		X	X	X	X	X	X
Black-faced Woodswallow	*Artamus cinereus*		B,K		X					
Little Woodswallow	*Artamus minor*									
RHIPIDURIDAE										
Willie Wagtail	*Rhipidura leucophrys*		SI,B,A, K,G,C	X	X	X		X	X	X, C
Grey Fantail	*Rhipidura fuliginosa*						X			
CORVIDAE										
Torresian Crow	*Corvus orru*			X						
Australian Raven	*Corvus coronoides*		SI,B,A, K,G,C		X	X	X			X, C
MONARCHIDAE										
Magpie-lark	*Grallina cyanoleuca*		A							X
PETROICIDAE										
Red-capped Robin	*Petroica goodenovii*		SI,B,A, K,C		X					
Jacky Winter	*Microeca fascinans*		B,A,G, C	X	X	X	X	X		X
Southern Scrub-robin	*Drymodes brunneopygia*	3				R				
Western Yellow Robin	*Eopsaltria griseogularis*	3	A,K,G, C	X		X	X	X		
Hooded Robin	*Melanodryas cucullata*									
NECTARINIIDAE										
Mistletoebird	*Dicaeum hirundinaceum*		SI,B,A, K,C	X		X				
ESTRILDIDAE										
Zebra Finch	*Taeniopygia guttata*									
MOTACILLIDAE										
Australasian Pipit	*Anthus novaeseelandiae*		SI,A,K							
HIRUNDINIDAE										
White-backed Swallow	*Cheramoeca leucosterna*		SI,A,K, G							
Fairy Martin	*Petrochelidon ariel*		A							
Tree Martin	*Petrochelidon nigricans*		SI,A,K, G,C		X	X		X		
Welcome Swallow	*Hirundo neoxena*		A,K,G		X	X		X		
ZOSTEROPIDAE										

Birds		CS	Outside Areas	Mt Marion surveys						
				Rapallo	BCE					
				2010	2012	2016	2017a	2017b	2018	2021
Silvereye	*Zosterops lateralis*		SI,A							
MEGALURIDAE										
Rufous Songlark	*Cincloramphus mathewsi*									
Brown Songlark	*Cincloramphus cruralis*									
Total Number of Species Expected for Region: 164										
Total number of species recorded from the Mt Marion Lithium Project Area: 66			**50**	**32**	**43**	**48**	**30**	**29**	**20**	**34**

Table 6-4. Mammals recorded or expected to occur in the Mt Marion area.

MAMMALS		CS	Outside Areas	Mt Marion Surveys						
				Rapallo 2010	BCE					
					2012	2016	2017a	2017b	2018	2021
Tachyglossidae										
Echidna	*Tachyglossus aculeatus*		SI,A,B,C,K,G		X	X		X	X	
Dasyuridae										
Chuditch	*Dasyurus geoffroii*									
Ride's Ningaui	*Ningaui ridei*		SI							
Mallee Ningaui	*Ningaui yvonneae*		SI							
Kultarr	*Antechinomys laniger*	CS3								
Fat-tailed Dunnart	*Sminthopsis crassicaudata*		SI							
Little Long-tailed Dunnart	*Sminthopsis dolichura*		SI,G							C
Gilbert's Dunnart	*Sminthopsis gilberti*									
Burramyidae										
Western Pygmy-possum	*Cercartetus concinnus*		SI							
Macropodidae										
Western Grey Kangaroo	*Macropus fuliginosus*		SI,A,B,C,K,G		X	X	X	X	C	C
Euro	*Macropus robustus*		SI,K,G	X		X				
Red Kangaroo	*Macropus rufus*		SI							
Molossidae										
Inland Freetail Bat	*Mormopterus petersi*		SI,A							
Southern Freetail Bat	*Mormopterus kitcheneri*				X					
White-striped Freetail Bat	*Austronomus australis*		SI,A		X					
Vespertilionidae										
Gould's Wattled Bat	*Chalinolobus gouldii*		SI,A		X					
Chocolate Wattled Bat	*Chalinolobus morio*		A		X					
Lesser Long-eared Bat	*Nyctophilus geoffroyi*									
Greater Long-eared Bat	*Nyctophilus major tor*	CS2								
Inland Broad-nosed Bat	*Scotorepens balstoni*		A							
Southern Forest Bat	*Vespadelus regulus*		A		X					
Inland Forest Bat	*Vespadelus baverstocki*		A		X					
Muridae										
Mitchell's Hopping Mouse	*Notomys mitchelli*		SI,K							
Bolam's Mouse	*Pseudomys bolami*		SI							
Sandy Inland Mouse	*Pseudomys hermannsburgensis*		SI							
INTRODUCED MAMMALS										
Dingo	*Canis lupus*		SI,A	X						
European Red Fox	*Vulpes vulpes*		A,B,G	X						
Feral Cat	*Felis catus*		SI,B,K,G			X			C	C
Rabbit	*Oryctolagus cuniculus*		SI,A,B,C,K,G		X	X	X	X	X	
House Mouse	*Mus musculus*		SI,A							
Goat	*Capra hircus*		A,B,C,K,G		X	X				

MAMMALS		CS	Outside Areas	Mt Marion Surveys						
				Rapallo 2010	BCE					
					2012	2016	2017a	2017b	2018	2021
Horse	*Equus caballus*		K							
Dromedary Camel	*Camelus dromedarius*									
Cattle	*Bos taurus*		A		X					
Sheep	*Ovis aries*									
Total Number of Native Species Expected (Recorded) from the Mt Marion Project Area: 25 (10)			**19**	**1**	**8**	**3**	**1**	**2**	**2**	**2**
Total Number of Introduced Species Expected (Recorded) from the Mt Marion Project Area: 10 (6)			**8**	**2**	**3**	**3**	**1**	**1**	**2**	**1**

Appendix 6. Species recorded in the 2021 field investigations.

Species	Visual/aural	Camera Trap
Racehorse Monitor		x
Bungarra		x
Bobtail		x
Australia Raven	x	x
Australian Magpie	x	
Australian Ringneck	x	x
Black-faced Cuckoo-shrike	x	
Brown Goshawk	x	
Brown Honeyeater	x	
Brown-headed Honeyeater	x	
Copper-backed Quail-thrush	x	x
Chestnut-rumped Thornbill	x	
Common Bronzewing		x
Crested Bellbird	x	
Dusky Woodswallow	x	
Emu	x	x
Golden Whistler	x	
Grey Currawong	x	x
Grey Shrike-thrush	x	
Jacky Winter	x	
Masked Woodswallow	x	
Mudlark	x	
Pied Butcherbird	x	
Red Wattlebird	x	
Rufous Whistler	x	
Horsfield's Bronze-Cuckoo	x	
Singing Honeyeater	x	
Spotted Harrier	x	
Spotted Nightjar		x
Striated Pardalote	x	
Variegated Fairy wren	x	
Wedge-tailed Eagle	x	
Whistling Kite	x	
White-browed Babbler	x	
White-eared Honeyeater	x	
Willie Wagtail	x	x
Yellow-throated Miner	x	x
Little Long-tailed Dunnart		x
Grey Kangaroo		x
Feral cat		x

Appendix 7. Raw data of 2021 camera trap survey.

Detection	Camera	Priority Area	Date	Time	Count	Common name	Scientific name	Type	Notes
1	BCE05	2	5/10/21	11:22:15	1	Common Bronzewing	*Phaps chalcoptera*	Bird	
2	BCE05	2	6/10/21	6:19:16	1	Common Bronzewing	*Phaps chalcoptera*	Bird	
3	BCE05	2	7/10/21	6:40:49	1	Emu	*Dromaius novaehallandiae*	Bird	Juvenile
4	BCE05	2	11/9/21	5:54:18	1	Raven	*Corvus coronoides*	Bird	Eating ants on bait tube
5	BCE05	2	12/9/21	12:21:36	1	Raven	*Corvus coronoides*	Bird	Eating ants on bait tube
6	BCE05	2	13/9/21	5:46:09	1	Raven	*Corvus coronoides*	Bird	Eating ants on bait tube
7	BCE05	2	13/9/21	12:36:59	1	Raven	*Corvus coronoides*	Bird	Eating ants on bait tube
8	BCE05	2	14/9/21	5:37:29	1	Raven	*Corvus coronoides*	Bird	Eating ants on bait tube
9	BCE05	2	16/9/21	13:44:50	1	Raven	*Corvus coronoides*	Bird	Eating ants on bait tube
10	BCE05	2	18/9/21	10:10:59	1	Raven	*Corvus coronoides*	Bird	Eating ants on bait tube
11	BCE05	2	30/9/21	5:42:29	1	Raven	*Corvus coronoides*	Bird	Eating ants on bait tube
12	BCE05	2	13/10/21	15:29:13	1	Willy Wagtail	*Rhipidura leucophrys*	Bird	
13	BCE05	2	19/9/21	11:37:59	1	Bobtail	*Tiliqua rugosa*	Reptile	
14	BCE06	1	8/10/21	21:33:38	1	Feral cat	*Felis catus*	Mammal	
15	BCE06	1	17/9/21	12:30:55	1	Sminthopsis dolichura	*Little Long-tailed Dunnart*	Mammal	
16	BCE06	1	27/9/21	19:32:04	1	Sminthopsis dolichura	*Little Long-tailed Dunnart*	Mammal	
17	BCE06	1	9/10/21	1:35:50	1	Sminthopsis dolichura	*Little Long-tailed Dunnart*	Mammal	
18	BCE06	1	13/10/21	19:17:42	1	Sminthopsis dolichura	*Little Long-tailed Dunnart*	Mammal	
19	BCE06	1	22/9/21	13:42:40	1	Gould's Goanna	*Varanus gouldii*	Reptile	
20	BCE06	1	24/9/21	10:57:40	1	Gould's Goanna	*Varanus gouldii*	Reptile	
21	BCE06	1	30/9/21	15:28:00	1	Gould's Goanna	*Varanus gouldii*	Reptile	
22	BCE06	1	13/10/21	10:36:38	1	Gould's Goanna	*Varanus gouldii*	Reptile	
23	BCE11	1	30/9/21	9:27:46	1	Currawong	*Strepera versicolor*	Bird	
24	BCE11	1	12/9/21	9:20:08	1	Grey Kangaroo	*Macropus fuliginosus*	Mammal	

Detection	Camera	Priority Area	Date	Time	Count	Common name	Scientific name	Type	Notes
25	BCE11	1	23/9/21	16:54:45	1	Grey Kangaroo	*Macropus fuliginosus*	Mammal	
26	BCE11	1	14/9/21	18:56:57	1	Sminthopsis dolichura	*Little Long-tailed Dunnart*	Mammal	
27	BCE11	1	16/9/21	23:36:09	1	Sminthopsis dolichura	*Little Long-tailed Dunnart*	Mammal	
28	BCE11	1	30/9/21	0:00:32	1	Sminthopsis dolichura	*Little Long-tailed Dunnart*	Mammal	
29	BCE13	1	16/10/21	10:46:38	1	Currawong	*Strepera versicolor*	Bird	
30	BCE30	3	18/9/21	11:47:13	1	Australian Ringneck	*Barnardius zonarius*	Bird	
31	BCE30	3	13/9/21	17:21:31	1	Common Bronzewing	*Phaps chalcoptera*	Bird	
32	BCE30	3	14/9/21	17:49:13	2	Common Bronzewing	*Phaps chalcoptera*	Bird	
33	BCE30	3	15/9/21	17:46:06	1	Common Bronzewing	*Phaps chalcoptera*	Bird	
34	BCE30	3	10/10/21	17:24:04	1	Common Bronzewing	*Phaps chalcoptera*	Bird	
35	BCE30	3	16/9/21	6:10:17	1	Currawong	*Strepera versicolor*	Bird	
36	BCE30	3	23/9/21	12:03:27	1	Currawong	*Strepera versicolor*	Bird	
37	BCE30	3	16/9/21	0:36:39	1	Emu	*Dromaius novaehallandiae*	Bird	
38	BCE30	3	18/9/21	10:47:37	2	Emu	*Dromaius novaehallandiae*	Bird	1 Juv 1 adult
39	BCE30	3	19/9/21	16:04:09	1	Emu	*Dromaius novaehallandiae*	Bird	
40	BCE30	3	20/9/21	7:41:11	7	Emu	*Dromaius novaehallandiae*	Bird	6 Juv 1 adult
41	BCE30	3	20/9/21	14:43:03	5	Emu	*Dromaius novaehallandiae*	Bird	4 Juv 1 adult
42	BCE30	3	21/9/21	13:24:34	1	Emu	*Dromaius novaehallandiae*	Bird	
43	BCE30	3	21/9/21	15:19:56	2	Emu	*Dromaius novaehallandiae*	Bird	2 Adults
44	BCE30	3	27/9/21	7:18:09	2	Emu	*Dromaius novaehallandiae*	Bird	
45	BCE30	3	3/10/21	12:00:43	1	Emu	*Dromaius novaehallandiae*	Bird	
46	BCE30	3	7/10/21	10:38:40	1	Emu	*Dromaius novaehallandiae*	Bird	
47	BCE30	3	8/10/21	7:22:17	1	Emu	*Dromaius novaehallandiae*	Bird	
48	BCE30	3	8/10/21	10:59:19	1	Emu	*Dromaius novaehallandiae*	Bird	
49	BCE30	3	9/10/21	14:49:20	1	Emu	*Dromaius novaehallandiae*	Bird	

Detection	Camera	Priority Area	Date	Time	Count	Common name	Scientific name	Type	Notes
50	BCE30	3	9/10/21	16:32:05	2	Emu	*Dromaius novaehallandiae*	Bird	
51	BCE30	3	11/10/21	13:46:20	1	Emu	*Dromaius novaehallandiae*	Bird	
52	BCE31	1	16/9/21	11:56:45	1	Bobtail	*Tiliqua rugosa*	Reptile	
53	BCE32	1	18/9/21	9:11:19	1	Copper-backed Quail-thrush	*Cinclosoma clarum*	Bird	
54	BCE32	1	15/9/21	2:11:09	1	Spotted Nightjar	*Eurostopodus argus*	Bird	
55	BCE32	1	17/9/21	23:01:27	1	Spotted Nightjar	*Eurostopodus argus*	Bird	
56	BCE32	1	19/9/21	0:00:06	1	Spotted Nightjar	*Eurostopodus argus*	Bird	
57	BCE32	1	20/9/21	22:03:06	1	Spotted Nightjar	*Eurostopodus argus*	Bird	
58	BCE32	1	2/10/21	4:56:43	1	Spotted Nightjar	*Eurostopodus argus*	Bird	
59	BCE32	1	3/10/21	20:08:49	1	Spotted Nightjar	*Eurostopodus argus*	Bird	
60	BCE32	1	4/10/21	12:20:12	2	Spotted Nightjar	*Eurostopodus argus*	Bird	Mating
61	BCE32	1	5/10/21	1:21:07	1	Spotted Nightjar	*Eurostopodus argus*	Bird	
62	BCE32	1	13/10/21	0:39:51	1	Spotted Nightjar	*Eurostopodus argus*	Bird	
63	BCE32	1	13/10/21	0:39:51	1	Spotted Nightjar	*Eurostopodus argus*	Bird	
64	BCE32	1	17/10/21	4:42:40	1	Spotted Nightjar	*Eurostopodus argus*	Bird	
65	BCE32	1	15/10/21	2:53:53	1	Little Long-tailed Dunnart	*Sminthopsis dolichura*	Mammal	
66	BCE32	1	21/9/21	11:18:49	1	Gould's Goanna	*Varanus gouldii*	Reptile	
67	BCE33	1	27/9/21	19:56:29	1	Grey Kangaroo	*Macropus fuliginosus*	Mammal	
68	BCE33	1	24/9/21	21:31:58	1	Little Long-tailed Dunnart	*Sminthopsis dolichura*	Mammal	
69	BCE33	1	14/9/21	14:37:31	1	Bobtail	*Tiliqua rugosa*	Reptile	
70	BCE34	3	24/9/21	8:18:35	1	Yellow-throated Miner	*Manorina flavigula*	Bird	
71	BCE34	3	5/10/21	9:22:12	1	Black-headed Monitor	*Varanus tristis*	Reptile	
72	BCE34	3	5/10/21	9:22:12	1	Gould's Goanna	*Varanus gouldii*	Reptile	
73	BCE34	3	6/10/21	9:22:12	1	Gould's Goanna	*Varanus gouldii*	Reptile	

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Appendix C Certificate of Title

WESTERN AUSTRALIA

REGISTER NUMBER		
105/DP40396		
DUPLICATE EDITION	DATE DUPLICATE ISSUED	
2	14/1/2019	

VOLUME	FOLIO
2668	420

RECORD OF CERTIFICATE OF TITLE

UNDER THE TRANSFER OF LAND ACT 1893

The person described in the first schedule is the registered proprietor of an estate in fee simple in the land described below subject to the reservations, conditions and depth limit contained in the original grant (if a grant issued) and to the limitations, interests, encumbrances and notifications shown in the second schedule.

REGISTRAR OF TITLES

LAND DESCRIPTION:

[redacted]

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

[redacted]ITED OF 1 388 HAY STREET SUBIACO WA 6008
(AN O024589) REGISTERED 7/11/2018

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)

1. G277418 EASEMENT TO WESTERN MINING CORPORATION LTD FOR PIPELINE PURPOSES AND SEE DEPOSITED PLAN 219047 REGISTERED 12/9/1996.
   G999952 NOTIFICATION. THE GRANTEES OF EASEMENT G277418 ARE NOW SOUTHERN CROSS PIPELINES AUSTRALIA PTY LTD. PURSUANT TO S20(5) OF THE PETROLEUM PIPELINES ACT 1969 LODGED 12/1/1999.
2. *K253963 CAVEAT BY DIORO EXPLORATION NL LODGED 2/7/2007.
3. *K434327 CAVEAT BY LODESTAR MINERALS LTD LODGED 5/12/2007.
4. *N075712 CAVEAT BY REED INDUSTRIAL MINERALS PTY LTD LODGED 28/7/2015.

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.
* Any entries preceded by an asterisk may not appear on the current edition of the duplicate certificate of title.
Lot as described in the land description may be a lot or location.

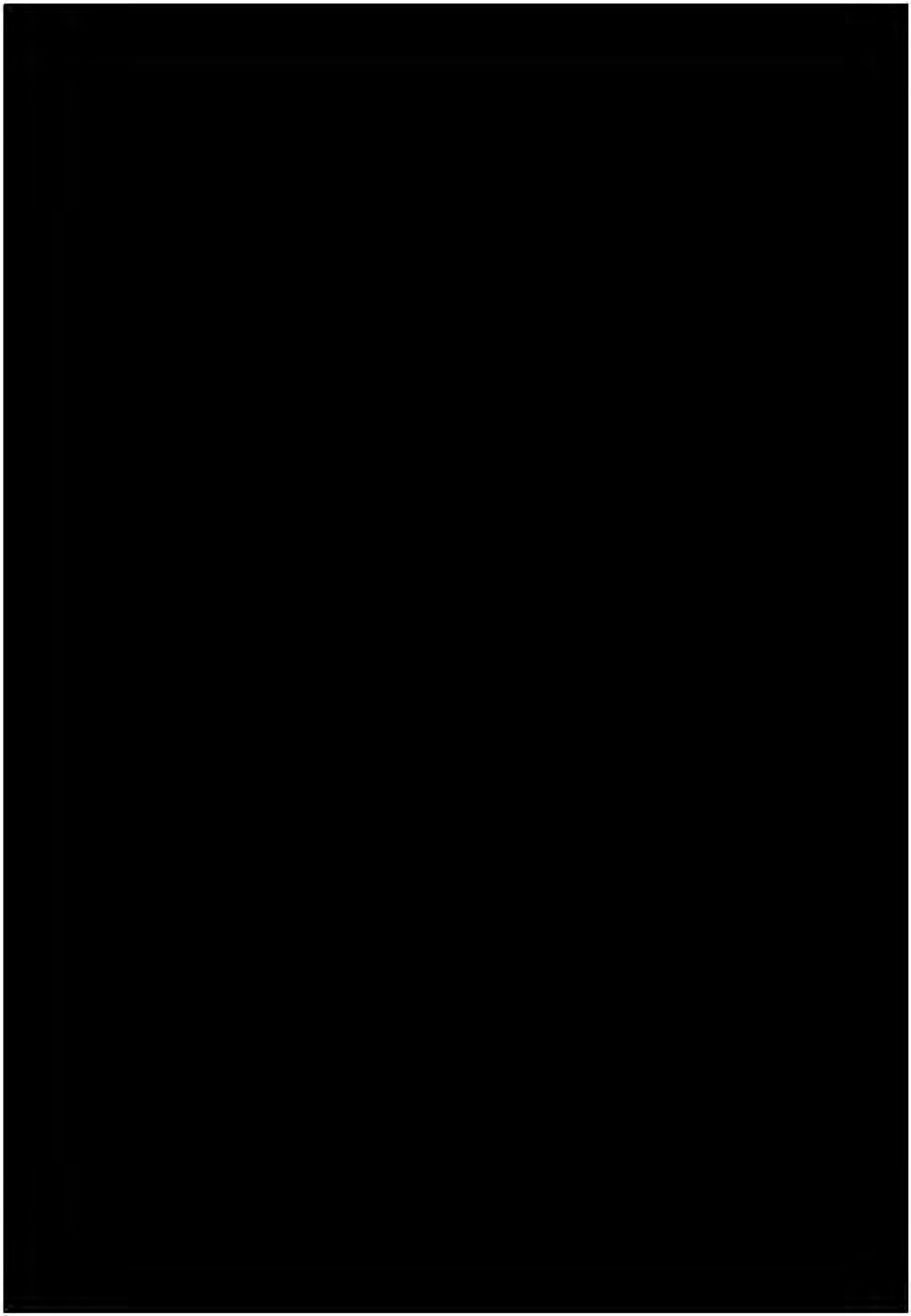
----------END OF CERTIFICATE OF TITLE----------

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land

[redacted]

Appendix D Authority To Access



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