

Native Vegetation Clearing Permit Application – Menzies Bypass to Yunndaga Rail Siding

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EXECUTIVE SUMMARY

Juno Minerals Limited's (Juno) Mt Mason Direct Shipping Ore (DSO) Hematite Project is located approximately 110km northwest of Menzies. The Project mine product will be hauled by road trains from the site to Yunndaga Rail Siding near Menzies, then loaded on to trains for rail to a port facility for export via shipping.

The Project will contribute positively to the economy of the region through engagement of services for the construction of the proposed haul road and siding, and for ongoing maintenance of the haul road and siding for the duration of the Project.

This Native Vegetation Clearing Permit (NVCP) relates to the Yunndaga Rail Siding Project (the Project), inclusive of the haulage of ore from the Menzies-Sandstone Road to the Siding and is currently an approved development through the Yunndaga Mining Proposal (Registration ID: 46035) received 31 July 2014.

An application to amend the previously granted Clearing Permit for Jupiter Mines Yunndaga Siding Project (CPS 5765/2) was issued on 17 July 2015 but has now lapsed resulting in this new application.

The total area of land proposed to be cleared is approximately 70 ha.

Tenement No.	Description of Mining Disturbances	Proposed Disturbance (ha)
G29/21	Rail Siding	41.00
G29/21	Servicing Area/Equipment Area	3.65
G29/21	Stockpiles	1.08
G29/21	Dam	0.39
L29/116	Haul Road and Rail Siding	6.60
L29/117	Haul Road	13.48
L29/123	Haul Road	3.29
TOTAL Area of Disturbance		69.49

The Project area has been significantly disturbed for historic mining operations and it is expected that the proposed clearing will have no environmental impact.

An assessment of the Project against the Clearing Principles for native vegetation under Schedule 5 of the *Environmental Protection Act 1986* suggests the Project is unlikely to be at variance with any of the ten Clearing Principles.

An evaluation of the Project against the Offset Guidelines suggests the Project has "Residual impacts that are not significant" and no offsets are required.

All studies and surveys in support of this NVCP application have been carried out by suitably qualified persons using methodologies consistent with the EPA's standards, policies and guidance.

1 INTRODUCTION

Juno Minerals Limited's (Juno) Mt Mason Direct Shipping Ore (DSO) Hematite Project is located approximately 110km northwest of Menzies. The product will be hauled by road trains from the site to Yundaga Rail Siding, then loaded on to trains for rail to a port facility for export via shipping.

This Native Vegetation Clearing Permit (NVCP) relates to the Yundaga Rail Siding and the haulage of ore from the Menzies-Sandstone Road to the Siding (the Project) (Figure 1).

The Project is 100% owned and managed by Juno.

1.1 Purpose of this Report

This report has been prepared in support of the following application for the development of the Yundaga Rail Siding and associated infrastructure, to the Native Vegetation Branch of Department of Mines, Industry Regulation and Safety (DMIRS):

- NVCP – Purpose Permit application in accordance with Section 51E of the *Environmental Protection Act 1986* (EP Act) and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*.

The scope of this NVCP application covers clearing activities relating to transport of ore from the Menzies-Sandstone Road intersection to the Yundaga Rail Siding and the development of the Siding. The report includes details of the Project associated with the clearing of native vegetation.

Approvals, including a separate NVCP for the mine site and selected export option, will be sought separately from relevant authorities.

1.2 Contact Details

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ABN: 94 645 778 892

1.3 Land Tenure

The tenement details relevant to the Project as held by Juno are summarised in Table 1.

Table 1: Tenement Details for the Project

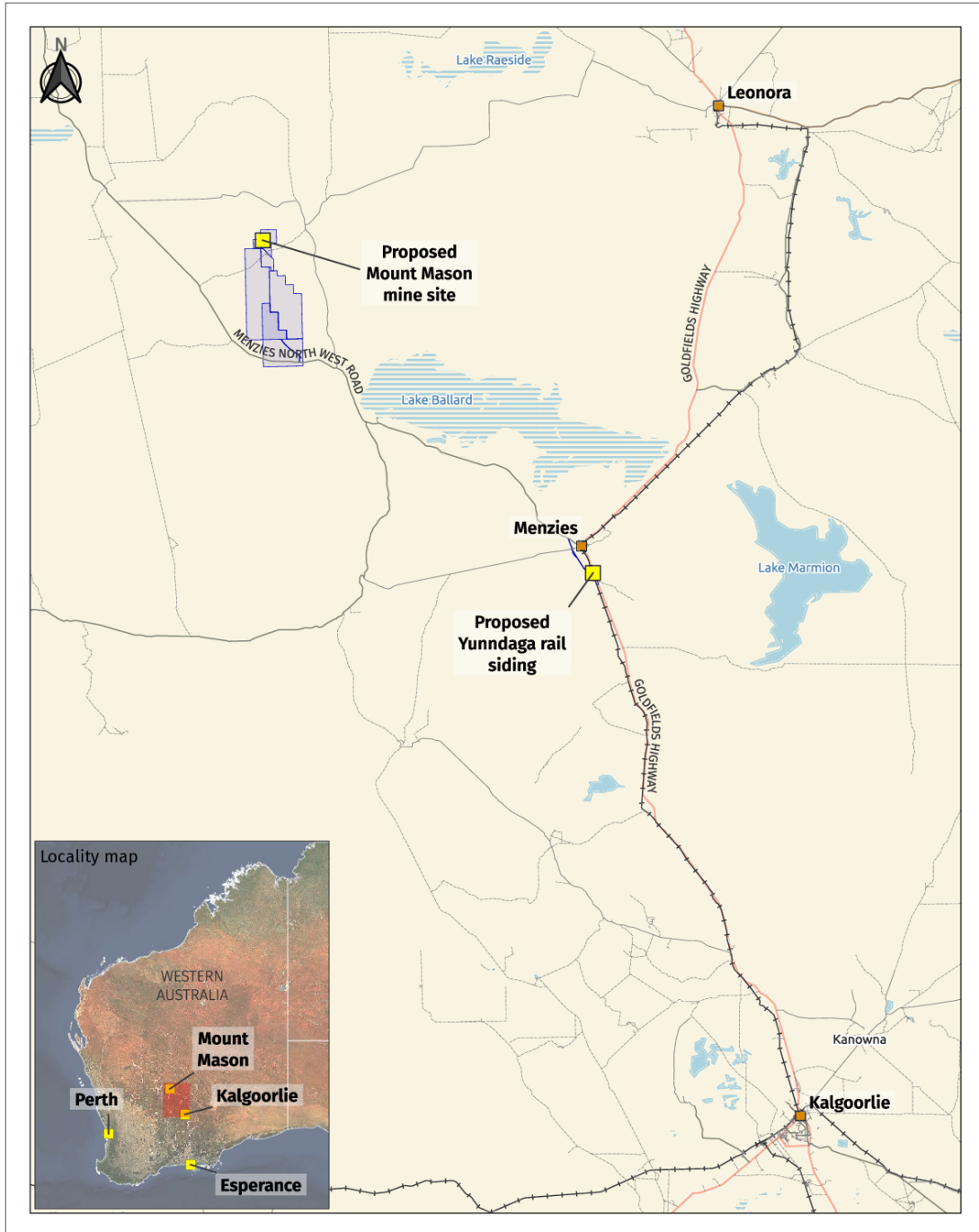
Tenement	Area (ha)	Status	Date of Grant	Date of Expiry
G29/21	95	Granted	23/03/2010	22/03/2031
L29/116	25.48	Granted	1/03/2013	1/02/2034
L29/117	90.14	Granted	12/07/2012	12/06/2033
L29/123	23.13	Granted	26/03/2013	25/03/2034
Total Area	233.75			

1.4 Existing Facilities

The Project area is located within the Shire of Menzies. Yunndaga was previously a Goldfields townsite in the mid 1890's (Landgate, 2013). The townsite and train station was abandoned with no infrastructure remaining apart from the Leonora to Kalgoorlie rail line which is managed and maintained by Arc Infrastructure. While the Project area now predominantly comprises reserved Crown land, a small portion in the north of the Project area extends into the Adelong lease.

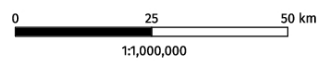
The following existing facilities will be utilised for the Project:

- Rail track; and
- Access and haul roads.



Legend
 Juno tenements

Figure 1
 Mount Mason and Yundaga Rail Siding
 Regional Location



Base map and data from OpenStreetMap and OpenStreetMap Foundation
 Base imagery: Copernicus Sentinel data 2021, processed by ESA. Capture date 19 June 2021.

CRS: GDA94 / MGA zone 51
 Produced 14/07/2021
 ©Juno Minerals
 21-032-01

Figure 1: Regional Location

2 PROJECT DESCRIPTION

2.1 Location

The Project is situated in the Shire of Menzies, in the Goldfields district approximately 6km south of Menzies, which is located approximately 120km north of Kalgoorlie, Western Australia (WA) (Figure 1). Land use in the area is predominantly pastoral, although exploration and mining activities occur in the vicinity of the Project area.

2.2 Project Characteristics

The Project will initially involve mining 1MT per annum of high-grade hematite ore over a period of 5 years (at a nominal mining rate of 1Mtpa with an occasional maximum mining rate of up to 2Mtpa). There is also potential for the mine life to be extended beyond 5 years.

Juno intends to transport iron ore along the Menzies-Sandstone Road to Yunndaga Rail Siding south of the town of Menzies, from where it will be taken by rail to a port facility for export via shipping. This haulage route will include a new access road linking the Menzies-Sandstone Road with Yunndaga Rail Siding that will bypass the town of Menzies (Proposed Haul Road).

The Project will contribute positively to the economy of the region through engagement of services for the construction of the proposed haul road and siding, and for ongoing maintenance of the haul road and siding for the duration of the Project.

Key Project components include:

- Haul road from Menzies-Sandstone Road to Yunndaga Rail Siding;
- Access roads;
- Rail siding and tracks;
- Administration buildings and amenities, including shower and ablutions (septic tank);
- Ore stockpiles;
- Potable water tank;
- Secure machinery storage;
- Hardstand;
- HV Lube maintenance facility;
- Oily water separator; and
- V-cut drainage channels.

The Project clearing footprint will be approximately 66ha within the proposed clearing envelope (Table 2, Figure 2 and Figure 3). However, much of the footprint has already been disturbed by previous activities.

Table 2: Project Footprint

Tenement No.	Description of Mining Disturbances	Proposed Disturbance (ha)
G29/21	Rail Siding	41.00
G29/21	Servicing Area/Equipment Area	3.65
G29/21	Stockpiles	1.08

Tenement No.	Description of Mining Disturbances	Proposed Disturbance (ha)
G29/21	Dam	0.39
L29/116	Haul Road and Rail Siding	6.60
L29/117	Haul Road	13.48
L29/123	Haul Road	3.29
	TOTAL Area of Disturbance	69.49

2.3 Clearing Methods

Vegetation clearing will be undertaken in accordance with the Juno Land Development and Clearing Procedure (Appendix A), using conventional earth moving equipment typical of civil works and mining programs.

Clearing will be most effectively undertaken using bulldozers. The following clearing methodology will apply:

- Significant vegetation (e.g. large trees) shall be avoided and natural clearings will be favoured wherever possible to minimise damage to vegetation;
- Machinery blades shall be set above ground level to minimise disturbance to topsoil and rootstock as well as to reduce erosion when clearing;
- Vegetation and topsoil stockpiles shall be located away from drainage lines and access tracks; and
- Topsoil (top 50mm) will be stripped and stockpiled separately for use in rehabilitation.

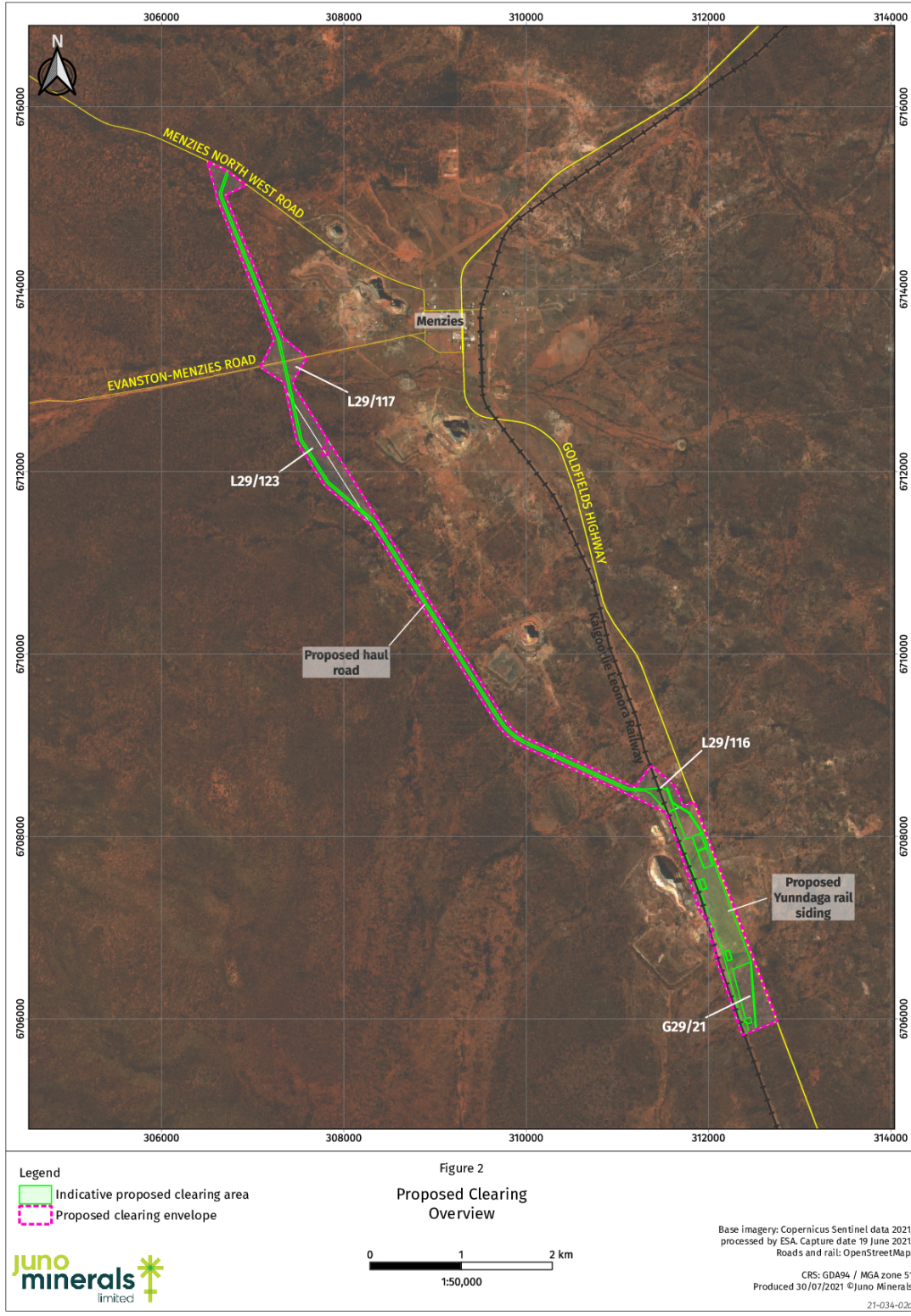


Figure 2: Proposed Clearing - Overview

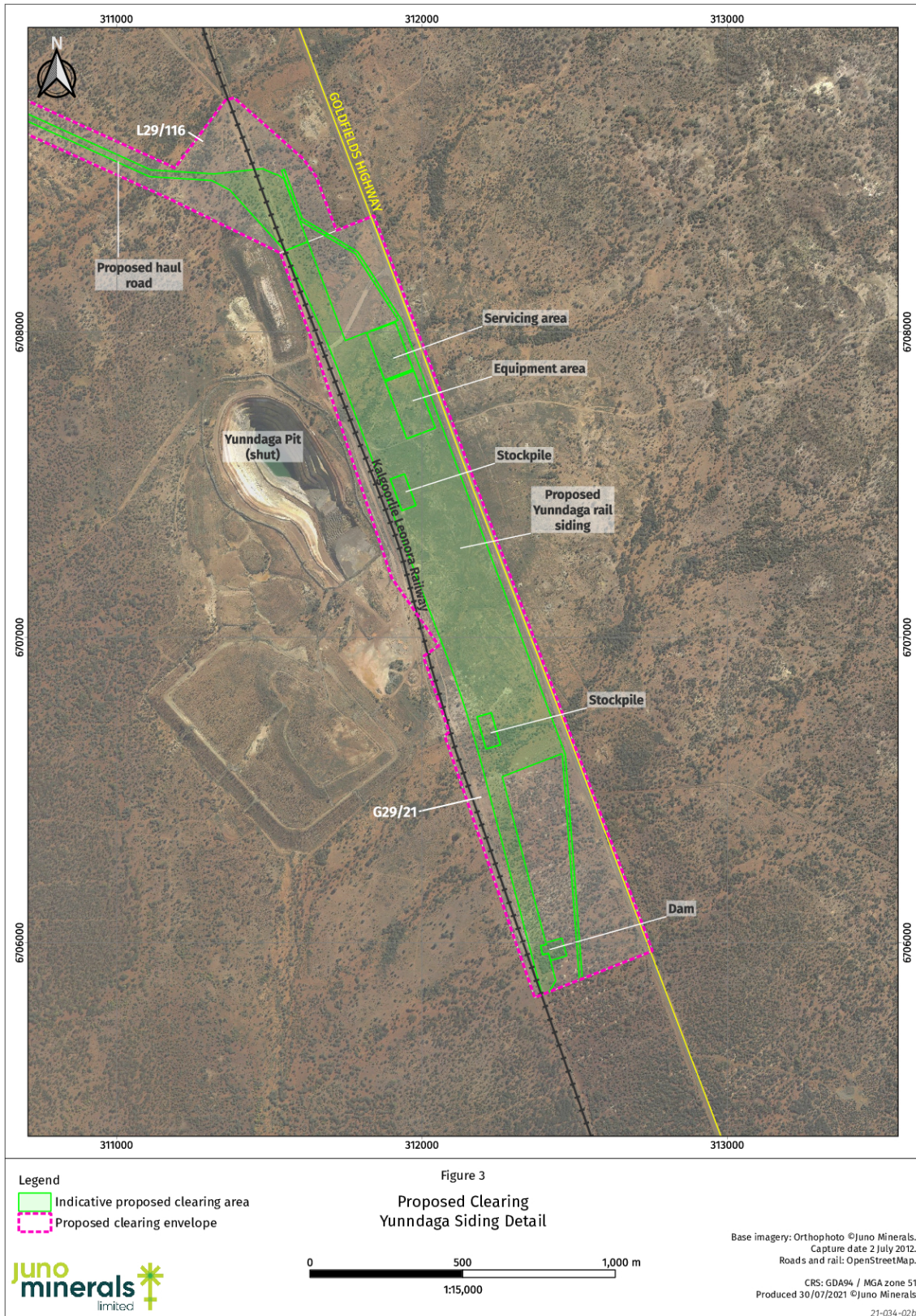


Figure 3: Proposed Clearing - Main Project Area

3 SITE OVERVIEW

3.1 Regional Setting

3.1.1 Biogeography

The Project is within the Murchison bioregion, defined by the Interim Biogeographic Regionalisation for Australia (IBRA) classification system (Outback Ecology Services, 2013). The subregion is described as: “The northern parts of the 'Southern Cross' and 'Eastern Goldfields' terrain of the Yilgarn Craton” (Cowan, Graham & McKenzie, 2001). It is characterised by:

- Internal drainage patterns;
- Extensive areas of elevated red desert sandplains with minimal dune development;
- Salt lake systems associated with the occluded Paleodrainage system;
- Broad plains of red-brown soils and breakaway complexes as well as red sandplains;
- Vegetation is dominated by Mulga Woodlands often rich in ephemerals; hummock grasslands, saltbush shrublands and Halosarcia shrublands; and
- Arid climate, with mainly winter rainfall (200 mm).

3.1.2 Land Systems & Landforms

The Western Australian Department of Agriculture completed a regional survey of land systems occurring within the Murchison to develop a comprehensive description of biophysical resources and to provide an assessment of the condition of the soils and the vegetation of the north-eastern Goldfields (Pringle et al, 1994).

The Project area contains five land systems (Western Botanical, 2021): Moriarty, Bunyip, Rainbow, Yowie, and Graves, of which the Moriarty land system occupies the majority of the area (Table 3). The Moriarty Land System is characterised by low greenstone rises and stony plains, supporting chenopod shrublands with patchy eucalypt overstorey.

The geomorphology of the Moriarty Land System is characterized by low rises to 20m relief, locally with ferruginous duricrust, gently undulating lower plains with pebble mantles and level to very gently inclined alluvial plains; poorly defined, sparse drainage patterns. Slopes of low rises without protective stone mantles, alluvial plains and narrow drainage tracks are moderately susceptible to soil erosion, particularly if perennial shrub cover is substantially reduced or the soil surface is disturbed. The vegetation of this land is highly preferred for grazing by introduced and native animals, rendering it susceptible to overgrazing and consequent degradation (Pringle et al, 1994).

Table 3: Land Systems within the Project Area

Land System	Description
Moriarty	Low rises and very gently undulating stony plains typically consisting of shallow red clayey sands composed of limonite, greenstone and colluvium supporting <i>Eucalyptus</i> and <i>Acacia</i> shrubland and woodland.

Land System	Description
Yowie	A relatively large land system characterised by low sandy plains typically consisting of relatively deep (compared with the surrounding land systems) red clayey sands supporting acacia shrubland and woodland. Contains negligible drainage features.
Bunyip	Plains of saline alluvium typically consisting of self-mulching cracking clays transitioning into calcareous loams on margins. Contains wide drainage tracts receiving run-on from greenstone hills.
Rainbow	Level to very gently inclined low alluvial hardpan plains typically consisting of shallow red earth soils supporting mulga shrubland. Typically occurs between salt lakes and erosional surfaces and contains broad unincised drainage lines.
Graves	Eucalypt woodlands with prominent saltbush and bluebush on deeply weathered, low rounded Archaean basalt and greenstone hills and rises, very gently inclined footslopes with pebble mantles and narrow alluvial tracts receiving tributary flow off higher units. Relief up to 40m.

3.2 Climate

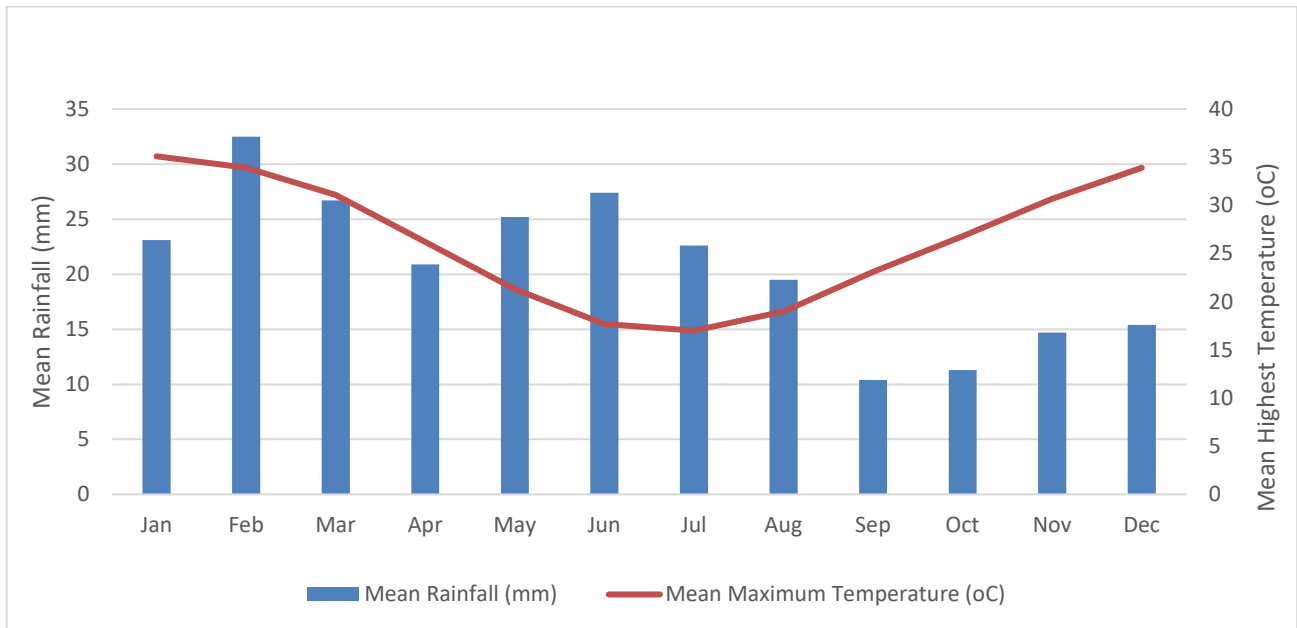
Climate statistics for the Yunddaga area were recorded at the Menzies weather station (BOM Site No.012052¹) (Bureau of Meteorology, 2021). The station is located approximately 7km north of the Yunddaga Rail Siding area.

Historical records from 1898 to 2019¹ show the annual average rainfall for the area to be approximately 250mm, with most of the rainfall occurring between the months of January and August. February receives the most rainfall with an annual average of 32mm and September the least, with an annual average of 10mm.

Temperature records from 1898 to 1996¹ indicate the highest temperatures are experienced between November and February, with the average maximum temperature reaching 35.1°C in January. The lowest temperatures are experienced between May and September, with the lowest average temperature falling to 5.3°C in July (Bureau of Meteorology, 2021) (Figure 4).

The average annual evaporation rate exceeds the average rainfall for every month of the year with an annual average evaporation rate of approximately 2800mm and annual average rainfall of 250mm (Bureau of Meteorology, 2021).

¹ ¹ Data on the BOM website was only available from 1898-1996 for temperature and 1898-2019 for rainfall.



Source: Bureau of Meteorology (2021).

Figure 4: Climate Statistics (1896–2019)

3.3 Geology and Soils

3.3.1 Regional Geology

Murchison Province is spread across the northern third of the Yilgarn Craton. The underlying rocks are predominantly Archaean even-grained porphyritic granitic rocks. These are intruded by quartz veins and dolerite dykes. Throughout the Craton are areas of Archaean migmatite and gneiss. These rocks are especially common along the western margin, as well as in the northwest where the Narryer Terrane and Yarlalweelor Gneiss Complex are located. The latter consists of migmatite, gneiss, schist and quartzite (Tille, 2006).

Areas of gneiss are associated with Archaean greenstone belts which are prominent. These belts have a northwest trend and become more common to the east. They contain a mixture of metamorphosed mafic to ultra-mafic volcanic rocks (including basalt, amphibolite, dolerite and gabbro), felsic volcanic rocks and metasedimentary rocks (including cherts and banded iron formations) (Tille, 2006).

3.3.2 Project Geology

Geology of the Yunndaga Siding area is dominated by sandplain with lateritic pisolites, gabbros, sedimentary rocks with felsic and mafic schists and laterites with silcrete caps (Western Botanical, 2021).

3.3.3 Soils

The Project is located in the Kambalda soil-landscape zone of Kalgoorlie Province. The Kambalda Zone is located in the south-eastern Goldfields between Menzies, Norseman and the Fraser Range. It is dominated by flat to undulating plains (with hills, ranges, some salt lakes and stony plains) on greenstone

and granitic rocks of the Yilgarn Craton. Calcareous and red loamy earths with Salt lake soils, some Red-brown hardpan shallow loams and Red sandy duplexes are present (Tille, 2006).

The Project area is not within a known acid sulfate soil risk area.

3.4 Hydrology and Hydrogeology

3.4.1 Hydrology

Observations from surveys in the region indicate that significant creek systems drain from topographical highlands (greenstone belts) to areas of topographical low relief (sandplains and playa lakes). All major creeks are ephemeral in nature and experience a degree of flow as a response to major rainfall events. Less defined drainage lines are typified within sandplain areas. Sheet flow is likely to occur under major rainfall events given poor creek definition and the relatively uniform gradient that exists. Runoff from outcrops of bedrock may also collect in gnamma holes or rock holes and soaks with water holes often occur next to rock outcrops, forming significant mechanisms of groundwater recharge in the region (Coffey, 2010).

3.4.2 Hydrogeology

A general assessment of the regional distribution of playa lakes from the hydrogeological map of Western Australia (WA) suggests that the drainage systems of the region comprise broad, structurally confined, sub parallel features with a suggested drainage direction in a south easterly direction for systems north of the township of Kalgoorlie and an easterly direction for systems south of Kalgoorlie. The Playa lake systems mark the courses of palaeorivers that ceased to flow when the climate became arid during the Tertiary period. These palaeorivers are regionally referred to as palaeodrainages and tend to discharge into the large playa lakes that exist throughout the area (Coffey, 2010).

The Project lies within the Goldfields Groundwater Proclamation Area under the *Rights in Water and Irrigation Act 1914* (RIWI Act).

3.5 Vegetation and Flora

3.5.1 Vegetation and Flora Surveys

The following flora and vegetation surveys have been undertaken for the Project:

- Reconnaissance survey and gap analysis, April 2021, targeted at orebody and infrastructure areas (Western Botanical, 2021) (Appendix B);
- Level 1 Flora and Fauna Assessment Menzies Bypass and Yunndaga Rail Siding (Outback Ecology Services, 2013) (Appendix C)
- Level 1 flora and vegetation survey of the rail siding, G29/21 (Paul Armstrong and Associates, 2011);
- Level 1 flora and vegetation survey of the proposed Menzies Bypass Haul Road (NVS, 2012); and

Surveys were undertaken in accordance with:

- Environmental Protection Authority (EPA) *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016) (2021 survey only);
- Environmental Protection Authority (EPA) Position Statement No. 3 *Terrestrial Biological Surveys as an Element of Biodiversity Protection* (Environmental Protection Authority, 2002); and
- EPA Guidance Statement No. 51 *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (Environmental Protection Authority, 2004a).

The Final Report, Review of Flora and Vegetation of the Mt Mason and Yundaga Siding Study Areas (Western Botanical, 2021) took into account 2021 and historical flora surveys and has been submitted to IBSA (Ref: IBSA-2021-0303).

3.5.2 Vegetation and Flora

The Project lies within the East Murchison subregion of Western Australia (Outback Ecology Services, 2013). The subregion generally consists of elevated red desert sandplains with minimal dune development and internal drainage, through broad plains of red-brown soils, red sandplains and breakaway complexes (Outback Ecology Services, 2013).

The Project lies within the Barlee Botanical District, as defined by Beard (1975) and contains vegetation associations described in Table 4.

Table 4: Extent and Representation of Vegetation Associations at a Regional Scale

Vegetation Association	Unit Description	Hectares in Study Area	Pre European Extent in WA	Pre European Extent in East Murchison Subregion	% Remaining in East Murchison Subregion	% Reserved in DPaW Managed Lands
18	Low woodland; mulga (<i>Acacia aneura</i>)	72.2	19,892,304.8	10,269,895.8	100	5.12
251	Low woodland; mulga & <i>Allocasuarina cristata</i>	175.6	1,295,103.3	1,174,259.12	100	8.97
20	Low woodland; mulga mixed with <i>Allocasuarina cristata</i> & <i>Eucalyptus sp.</i>	5.3	173,096.2	58,012	100	14.98

Source: Outback Ecology Services (2013).

The 2021 field survey by Western Botanical identified eight vegetation associations at the NVIS Level V. These vegetation associations were dominated by Mulga and other *Acacia sp.*, as well as *Eucalyptus sp.* and one *Chenopod* shrubland association. The NVIS associations are described further in Appendix B.

The 2013 desktop study found a total of 114 plant taxa having the potential to occur within the Project Area. The 2021 field survey recorded sixty-eight species (including two weed species).

The Project area was described as highly disturbed, relating to historical use for vehicle transport corridors and stock watering (Outback Ecology Services, 2013).

3.5.3 Threatened and Priority Ecological Communities

No Federally or State Listed Threatened Ecological Communities (TEC) or Priority Ecological Communities (PEC) have been identified within the Project area. The nearest PEC, the Bulga Downs-Perinvale-Walling vegetation complex, is located approximately 55km west of the Project area (Western Botanical, 2021).

3.5.4 Conservation Significant Flora

Database searches have identified 37 flora species of conservation significance with the 'potential to occur' in the Project Area. However, no Priority or Threatened Flora have been recorded during any of the field surveys (Western Botanical, 2021). Given the degree of disturbance, it is unlikely that any of the species identified during the database searches are present within the Project area (Outback Ecology Services, 2013).

3.5.5 Vegetation Condition

The vegetation condition ranged from "Degraded" to "Very Good" on the Keighery (1994) scale. The areas of "Very Good" condition were associated with the north of the Project area, while the "Degraded" areas were associated with existing disturbance in the south of the Project area and existing transport corridors. Almost 65% of the Project area was determined to be "Degraded" and only 3% determined "Very good" (Outback Ecology Services, 2013).

The presence of stock and other grazing herbivores has had a significant effect on the types and species of vegetation present throughout the Project area, with the majority of palatable species either being 'grazed out' or with distinct browse-lines. Some parts of the Project area are degraded as a result of mining activity, both recent and historical.

3.5.6 Introduced Flora Species

Due to the highly disturbed nature of the Project area and proximity to the town of Menzies, the degree of infestation by introduced species is high, with 17 introduced species (primarily grasses *Cenchrus ciliaris*, *Pentameris airoides* and *Carrichtera annua*) identified in the 2013 field investigations. None of the introduced species recorded were classified by the Department of Agriculture and Food as a Declared Plant for the Menzies municipal district (Outback Ecology Services, 2013).

Further introduced species were identified within 100m of the Project area, adjacent to the rail corridor near the abandoned Princess Mary mine. These were *Asphodelus fistulosus* (Onion Weed), *Centaurea melitensis* (Maltese Cockspur) and *Opuntia* sp. (Prickly Pear) (Outback Ecology Services, 2013). *Opuntia* species (Prickly Pears) are listed as Weeds of National Significance.

The 2021 survey identified an additional two species representing Declared Pests as having been reported within or adjacent to the Yunndaga Rail Siding: *Carthamus lanatus* (Saffron Thistle) and *Heliotropium europaeum* (Common Heliotrope). (Western Botanical, 2021).

The highest frequency and cover of introduced species occur on or adjacent to existing disturbance, which included the Sandstone Road in the north, the Evanston Road, which bisects the Project Area west of Menzies, the rail corridor which partitions the south-eastern portion of the Project Area and the abandoned

Princess Mary mine to the south of the Project Area. In the case of the road and rail corridors, the populations of introduced flora species rarely occurred more than 10m away from existing disturbance.

3.6 Fauna

3.6.1 Fauna Surveys

Fauna surveys completed for the Yundaga Project area include:

- Targeted Fauna Survey June 2021 for Malleefowl, Long-tailed Dunnart, Night Parrot and the Arid Bronze Azure Butterfly, and
- Level 1 Flora and Fauna Assessment – Menzies Bypass and Yundaga Rail Siding (Outback Ecology Services, 2013).

The 2021 Targeted Fauna Survey was completed in accordance with the following EPA, DBCA and DAWE requirements for the environmental surveying and reporting of fauna surveys in WA, where relevant and practical, and as documented in:

- EPA Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA 2020);
- Interim Guideline for preliminary surveys of Night Parrot (*Pezoporus occidentalis*) in Western Australia (WA Department of Parks and Wildlife [DPaW] 2017);
- Survey Guidelines for Australia's Threatened Birds. EPBC Act survey guidelines 6.2 (2010) (DSEWPaC);
- National Recovery Plan for Malleefowl (*Leipoa ocellata*), Department for Environment and Heritage (Benshemesh 2007); and
- Guideline for the survey of arid bronze azure butterfly (ABAB) in Western Australia (DBCA 2020).

The 2013 survey was undertaken in accordance with:

- Environmental Protection Authority (EPA) Position Statement No. 3 Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA, 2002)
- EPA Guidance Statement No. 56 *Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (EPA, 2004b).

A desktop study and literature review were conducted to generate a list of terrestrial fauna species with 'the potential to occur' in the Project Area (Outback Ecology Services, 2013).

3.6.2 Fauna Habitats

In the Yundaga Siding and proposed haul road area three broad fauna habitat types were identified (Western Ecological, 2021):

- Mulga Shrubland – occurs in a variety of landscape positions i.e., small rocky hills and rises, in drainage channels and floodplains, and on flats (noting that much of this section of the project area displays little relief in elevation);
- Scattered Low Shrubland – this habitat consists of chenopods, other low shrubs and Buffel Grass

- Eucalypt Open woodland – scattered *Eucalyptus lesouefii* (suspected) with little midstorey (mixed shrubs) and understorey in relatively flat areas.

These three habitat types are widespread and common in areas adjacent to the Project area and, more broadly, across the region.

3.6.3 Conservation Significant Fauna

Table 5 lists that vertebrate species of conservation significance that have been identified as potentially occurring in the Project area (Outback Ecology Services, 2013) (Western Botanical, 2021). Seven of the conservation significant species ‘possibly’ occur, one species (the Malleefowl) is ‘likely’ to occur, and one species (the Rainbow Bee-eater) is ‘very likely’ to occur (Outback Ecology Services, 2013).

Field investigations recorded 22 species, including 5 mammals, 15 birds and 2 reptiles (Outback Ecology Services, 2013).

Twenty-one invertebrate species of conservation significance were identified from database searches (with a 100km radius) as potentially occurring in the Project Area (Landgate, 2013) including:

- Twenty Short Range Endemic (SRE) invertebrate species (including 13 mygalomorph spiders, 4 millipedes and 3 pseudoscorpions); and
- One species of butterfly listed by DPaW as Priority 1.

Outback Ecology Services (2013) found that none of the species located during the field investigations were of conservation significance. Further to this, no vertebrate species of conservation significance listed in database searches were encountered during field investigations (Outback Ecology Services, 2013). No amphibians or invertebrate species of conservation significance were noted (Outback Ecology Services, 2013).

Table 5: Presence of Conservation Significant Fauna

Common Name Scientific Name	Likelihood of Occurrence	Conservation Status		
		EPBC	WC Act	DPaW
Mammals				
Chuditch <i>Dasyurus geoffroii</i>	Unlikely	Vulnerable	Schedule 1	
Long-tailed Dunnart <i>Sminthopsis longicaudata</i>	Unlikely			Priority 4
Reptiles				
Woma <i>Aspidites ramsayi</i>	Possible		Schedule 4	
Common Slender Blue-tongue <i>Cyclodomorphus branchialis</i>	Unlikely	Vulnerable		
Birds				
Slender-billed Thornbill <i>Acanthiza iredalei iredalei</i>	Unlikely	Vulnerable		
Bush Stone-curlew <i>Burhinus grallarius</i>	Possible			Priority 4

Common Name Scientific Name	Likelihood of Occurrence	Conservation Status		
		EPBC	WC Act	DPaW
Shy Heathwren (western) <i>Hylacola cauta whitlocki</i>	Possible			Priority 4
Crested Bellbird <i>Oreoica gutturalis</i> subsp. <i>gutturalis</i>	Possible			Priority 4
Major Mitchell's Cockatoo <i>Lophochroa leadbeateri</i>	Possible		Schedule 4	
Peregrine Falcon <i>Falco peregrinus</i>	Likely		Schedule 4	
Australian Bustard <i>Ardeotis australis</i>	Possible			Priority 4
Hooded Plover <i>Thinornis rubricollis</i>	Unlikely			Priority 4
White-browed Babbler <i>Pomatostomus superciliosus ashbyi</i>	Possible ²			Priority 4
Malleefowl <i>Leipoa ocellata</i>	Likely	Vulnerable Migratory	Schedule 1	
Common Sandpiper <i>Actitis hypoleucos</i>	Unlikely	Migratory	Schedule 3	
Fork-tailed Swift <i>Apus pacificus</i>	Unlikely	Migratory	Schedule 3	
Cattle Egret <i>Ardea ibis</i>	Unlikely	Migratory	Schedule 3	
Eastern Great Egret <i>Ardea modesta</i>	Unlikely	Migratory	Schedule 3	
Sharp-tailed Sandpiper <i>Calidris acuminata</i>	Unlikely	Migratory	Schedule 3	
Red Knot <i>Calidris canutus</i>	Unlikely	Migratory	Schedule 3	
Oriental Plover <i>Charadrius veredus</i>	Unlikely	Migratory	Schedule 3	
Rainbow Bee-eater <i>Merops ornatus</i>	Very likely	Migratory	Schedule 3	
Pacific Golden Plover <i>Pluvialis fulva</i>	Unlikely	Migratory	Schedule 3	
Wood Sandpiper <i>Tringa glareola</i>	Unlikely	Migratory	Schedule 3	
Common Greenshank <i>Tringa nebularia</i>	Unlikely	Migratory	Schedule 3	

Source: Outback Ecology Services (2013).

No records of Malleefowl, Malleefowl mounds or tracks were recorded in the 2021 Targeted Fauna Survey. The habitat has been extensively disturbed for historic mining activity and is now deemed unsuitable for Malleefowl as it has limited canopy cover in many areas and lacks a diverse shrub layer throughout much of the project area (Western Botanical, 2021).

In addition, 'the Project area contains only marginal suitable habitat of mallee shrubland and mulga woodland on heavy loam soils' and around 65% of the vegetation is classified as 'Degraded' (Outback Ecology Services, 2013). Juno therefore considers that the potential impact from the Project on Malleefowl is insignificant.

None of the habitats are suitable for Night Parrots as there are no areas with large spinifex (*Triodia*) hummocks, and there are also no rocky ridges with boulders that is preferred habitat for the Long-tailed Dunnart (Western Botanical, 2021).

There is only limited potential habitat for the Arid Bronze Azure Butterfly in the Project area, and it is considered unlikely to be present (Western Botanical, 2021).

3.6.4 Introduced Fauna Species

Three introduced fauna species have been found during field investigations, the dog/dingo (*Canis lupus*), rabbit (*Oryctolagus cuniculus*), and European Cattle (*Bos taurus*) (Outback Ecology Services, 2013).

3.7 Biodiversity

Due to most of the Project area being previously disturbed for historic mining purposes, the absence of any Malleefowl in recent field surveys, and the absence of appropriate habitat for the Arid Azure Bronze Butterfly, the Night Parrot and the Lon-tailed Dunnart (Western Botanical, 2021), the relevance of the Project area for biodiversity is considered by Juno to be low.

There are no TECs or PECs in the vicinity of the project and no Declared Rare Flora or Priority Fauna species.

The Project has not been referred for assessment under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) as it is not likely to have significant impact on a matter of national environmental significance, nor significant impact on the environment in general.

4 ENVIRONMENTAL IMPACTS MANAGEMENT

4.1 Water

4.1.1 *Potential Impacts*

No groundwater impacts as a result of additional extraction are likely for this Project. Water will be trucked to the site; therefore no groundwater bores will be needed. A 20kL capacity potable water tank will be used for potable water requirements (drinking, showering, safety deluge showers, etc.). It is estimated that 1.0kL of raw water per day will be required during operation for dust suppression and 0.3kL for potable water use.

The risk of groundwater contamination from the Project is considered to be minimal. There will be no mining or ground penetrating activities and no proposed bores at the rail siding or along the haul route, reducing direct access to and exposure of groundwater. With pathways to groundwater reduced, a very minimal risk exists from large volume spills infiltrating soil. This is considered a minimal risk, as no large volumes of fuel or hydrocarbons will be stored at the rail siding. All service truck refuelling and major servicing will take place at Mount Mason mine or at a strategic location along the Menzies to Esperance railway and risks to groundwater will be managed according to actions and mitigation measures employed at the mine site.

Approximately 21% of the Study Area comprises Drainage Depression habitat. Changes in the timing, quantity, quality or distribution of water within this habitat may adversely affect the fauna and flora assemblages that may be dependent upon them. However, much of this habitat is classified as “degraded” (Outback Ecology Services, 2013).

4.1.2 *Management Strategies*

The main mechanisms for reducing potential impact to surface water and groundwater include:

- Where practicable retain vegetation between Project components during construction to reduce erosion;
- Maintain existing drainage patterns as far as practicable;
- Ensure there is no release of surface water during construction and operation that contains sediment levels which may impact on downstream ecosystems;
- Manage the treatment of sewage and the disposal of effluent in accordance with the Department of Water and Environmental Regulation’s (DWER) requirements under Part V of the EP Act;
- Cleared vegetation and topsoil will be stockpiled away from watercourses and in discrete stockpiles to avoid any interference to surface flows;
- The area of the rail siding will be generally sloping at 1 in 500 (0.2%) which is close to level (this is flatter than a minimum water flow gradient 1 in 100 (1%));
- A cut-off drain and bund will be created around the hardstand area to capture and 1 in 25-year rainfall event runoff from the mobile plant operating area and this storm-water will be directed to a storm-water sediment basin for capture and treatment if required;
- Any excessive spilled hydrocarbons picked up by the water will be extracted using an oily water separator in series with an adequately sized sediment sump;

- Sheet flow water moving around the area during one of these storms will be diverted away from the rail siding so that mixing of normal regional floodwaters and site runoff is avoided;
- Any storage of fuels, oils or grease at the Project will be kept to minimum volumes and will be bunded/contained to minimise the risk to the environment;
- Service trucks will be fitted with spill response equipment;
- No major servicing will be conducted at Yunndaga; these activities will be conducted off Project;
- Locomotives will not be fuelled or serviced at Yunndaga, this will take place at major rail stations or along the rail route to the nominated Port for export;
- If any bores are required to be installed in any area of the Project, the required approvals and licenses will be sought from the DWER prior to construction;
- The procedures for managing environmental incidents will be communicated to all operational staff and contractors as part of the Juno induction process; and
- All personnel and contractors will undergo appropriate training and inductions to inform them of requirements relevant to their roles to prevent and manage surface water and groundwater impacts.

4.2 Vegetation Degradation

4.2.1 *Potential Impacts*

Potential impacts to vegetation and flora in the Project area are primarily related to land clearing. No conservation significant flora or floral communities have been recorded in the Project area during studies and the area is described as highly disturbed. Therefore, the potential impacts to flora from land clearing are considered to be minor.

The development and operation of the Project may potentially generate localised dust emissions due to general traffic and earth moving activities. Dust emissions may have a localised impact on surrounding vegetation where high levels of dust can be associated with a reduction in plant growth resulting in the degradation of the overall ecosystem and the increased risk of disease in plants.

4.2.2 *Management Strategies*

Juno will undertake the following actions to reduce the direct and indirect impacts on vegetation:

- Design the Project layout to minimise clearing;
- Ensure proposed clearing areas are clearly demarcated and communicated to operators and contractors involved in clearing;
- Directly place cleared vegetation on rehabilitation areas or mulch and stockpile for use during later rehabilitation;
- Remove topsoil (top 50mm) and place directly on rehabilitation areas, or stockpile for use during future rehabilitation;
- Monitor clearing activities, recording actual disturbance footprints;
- Undertaking post-clearing inspections to verify appropriate areas have been cleared;
- Implement progressive rehabilitation of the Project area including access tracks or roads that are no longer required;
- Restrict the use of vehicles to established access roads and tracks;

- All disturbed and rehabilitated areas will be checked for weeds (particularly after rainfall events);
- Treat weed infested areas and implement appropriate weed hygiene procedures;
- Educate employees of the impacts of their activities on the native flora and vegetation through an Environmental Induction programme; and
- Implement adequate dust suppression measures during construction and operation to reduce the effects of dust on vegetation.

4.3 Land Degradation

4.3.1 Potential Impacts

Unmanaged, the clearing of vegetation has the potential to result in land degradation, including soil erosion, water-logging and flooding. Vegetation cover across the Project area is not dense, with the exception of a few areas of specific vegetation types, and it is unlikely there will be widespread degradation.

The land clearing required for establishment of the Project is defined in Table 2. Total clearing over the Project will be approximately 70ha.

4.3.2 Management Strategies

Measures to address land degradation in accordance with Juno's Land Development and Clearing Strategy relate to:

- Baseline data collation through comprehensive field surveys to identify potential constraints and sensitive areas;
- Implementation of an integrated mine planning process with environment department;
- Definition of clearing boundaries via spatially accurate GIS systems and field pegging and delineation;
- Verification of clearing boundaries prior to and following clearing; and
- Submission of a Clearing Permit application to the Native Vegetation Branch of DMIRS in accordance with the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*.

Juno will undertake the following actions to minimise the risk of land degradation:

- Careful site planning to avoid and minimise impacts from required clearing of flora and vegetation;
- Areas of vegetation between Project components will be retained to reduce scouring and soil erosion, wherever possible;
- Prior to commencement of works, areas to be disturbed will be clearly demarcated in the field to minimise disturbance and 'no-go' areas will be flagged;
- Post-clearing inspections will be undertaken to verify appropriate areas have been cleared;
- Topsoil and vegetation from all clearance activity will be separately stockpiled in dedicated stockpile areas;
- Where practicable, for any temporary clearance required, raised blade disturbance will be conducted to minimise vegetation removal;

- Weed dispersal will be controlled through establishment of weed hygiene inspection and cleaning procedures;
- All disturbed and rehabilitated areas will be checked for weeds (particularly after rainfall events) and infested areas will be treated on an as needs basis;
- Rehabilitation will be undertaken as soon as practicable after land disturbance with the implementation of a progressive rehabilitation program; and
- Personnel will be provided with training to assist in their general awareness and understanding of the importance of minimising vegetation clearing and disturbance.

5 REHABILITATION

The objective of the rehabilitation program for the Project is to rehabilitate the affected areas to ensure that soil erosion and subsequent sedimentation is minimised and endemic plant species are re-established. It is anticipated that the rehabilitation program will result in the establishment of a self-sustaining vegetation complex into which local fauna will be able to return.

To facilitate the closure process, the Completion Criteria derived for Juno from the post-closure land use, closure objectives and closure design criteria have been broken down into several phases as shown below (Table 6 (Bluetongue Environmental, 2013)):

- Site-Wide Safety and Compliance Completion Criteria;
- Phase 1 – Closure and Rehabilitating Planning;
- Phase 2 – Landform Construction and Rehabilitation Implementation;
- Phase 3 – Ecosystem Establishment and Monitoring; and
- Phase 4 – Land Management and Relinquishment.

Rehabilitation of the Project area will be guided by the following principles:

- Ensure that vegetation clearing is kept to the minimum;
- Minimise soil erosion;
- Revegetation research and trials;
- Collect and correctly stockpile vegetative material and topsoil, where available, for later use at selected sites;
- Progressively rehabilitate completed areas to designated post-operational land use as soon as practicable;
- Where appropriate, only using local native plant species on selected areas of the project site; and
- Rehabilitation performance monitoring and improvement/refinement.

Rehabilitation and decommissioning of the project will involve:

- All infrastructure will be removed on final closure;
- All hazardous materials to be removed from site;
- In accordance with the *Contaminated Sites Act 2003* appropriate assessments will be undertaken to identify, assess and manage any contamination associated with these sites;
- Surfaces will be re-contoured to facilitate free draining of surface runoff;
- Re-spreading of stockpiled topsoil to a depth of 0.1–0.3m in areas designated for revegetation and then covering with stockpiled vegetation; and
- Where revegetation is prescribed, deep ripping of disturbed areas on the contour and seeding with local provenance native seed.

As required by tenement conditions, Juno will report on the status of the rehabilitation and results of any monitoring undertaken at site to DMIRS and DWER through the Project Annual Environment Report (AER).

The Closure Criteria will be monitored post-closure and will cover the areas shown in Table 7 (Bluetongue Environmental, 2013).

Table 6: Application of Closure Objectives across Closure Phases

Applicable Closure Phase					
Aspect	Safety and Compliance	Rehabilitation			
		Phase 1	Phase 2	Phase 3	Phase 4
Compliance					
Safety and Health					
Decommissioning, Demolition and Disposal					
Stakeholders and Community					
Post Mining Land Use					
Visual Amenity					
Structural Stability					
Topography and Drainage					
Managing Wastes					
Final Surface Characteristics					
Vegetation					
Fauna Habitat					
Long-term Sustainability					
Access and Land Management					

6 CONSULTATION

Juno has undertaken consultation with a range of stakeholders (Table 7) and will continue consultation throughout all stages of the Project.

Table 7: Project Stakeholder Consultation

Stakeholder Group	Date	Stakeholder Contact	Issues Discussed	Outcomes
NATIVE TITLE				
Wongatha Indigenous Group	November 2019	Ron Harrington	Invitation to attend public presentation evening in Kalgoorlie and/or meet to discuss current care and maintenance status of Project and confirm end land use strategy as proposed in approved MCP	After Jupiter followed up invitation via email and phone, the stakeholder reverted and queried the update. Jupiter advised it was conducting an analysis to assess economic viability and possible development date and would advise him if any change to the Project development status was likely. It was reiterated that although it was likely to be some time away and subject to potential changes in stakeholder preferences, Jupiter was still committed to the same end land use and associated closure criteria for removal of infrastructure and rehabilitation to pastoral and grazing which he endorsed.
Goldfields Land and Sea Council*	2019	Office of GLSC	Invitation to attend public presentation evening in Kalgoorlie and/or meet to discuss current care and maintenance status of Project and confirm end land use strategy as proposed in approved MCP	GLSC Now not recognized as Goldfields representative body for native title. Jupiter propose to engage with Native Titles Services group subject to confirmation of representative status.
Wongatha Indigenous Group	June 2012 to March 2013	Ron Harrington Smith and Aubrey Lynch	Numerous discussions regarding survey logistics and also potential employment opportunities. Wongatha have no objection to the Project if ongoing relationship to manage heritage, but no Section 18 required for avoidance of sites.	Heritage Survey Reports. No Section 18 required due to avoidance of all sites Commitment to continued consultation and Project updates.
Wutha Indigenous Group	June 2012 to	Greg Stubbs and	Numerous discussions regarding survey logistics and	Heritage Agreement.

Stakeholder Group	Date	Stakeholder Contact	Issues Discussed	Outcomes
	February 2013	Ron Harrington Smith	also potential employment opportunities. Wongatha have no objection to the Project Projects if ongoing relationship to manage heritage but no Section 18 required for avoidance of sites. Also discussion regarding access to northern water tenements as relates to active Native Title Claim.	Heritage Survey Reports No Section 18 required due to avoidance of all sites Commitment to continued consultation and Project updates
Goldfields Land and Sea Council*	11 September 2012	Daniel Jacobs	Discussion regarding potential new Native Title Claim – Lungkatharra – which would affect the Yundaga portion of the Project area. The Lungkatharra Claim is a few months off being formed. However, the Wongatha Native Title Claimants make up a large portion of the claim, so the main representatives are already being consulted with on a regular basis.	Confirmation that Juno is consulting with the appropriate people and that the upcoming survey can be conducted by the Wongatha representatives in the interim while the Native Title Claim is being developed.
PASTORALISTS				
Perrinvale Station	October 2019	Andrew Farson	Personal invitation to meet and discuss current care and maintenance status of Project and confirm end land use strategy as proposed in approved MCP	Meeting confirmed status as new lease owner management representative. Responsible agency remains Pastoral Lands Board. Discussed opportunities for post mine rehabilitation with native vegetation conducive to stock feed consumption.
Walling Rock Station	October 2019	Keith Mader	Personal invitation to meet and discuss current care and maintenance status of Project and confirm end land use strategy as proposed in approved MCP	Meeting at residence. Discussed current Project status and status of surrounding station leases. Still keen to pursue employment or contractor opportunities.
Riverina Station	October 2019	Andrew Farson	Personal invitation to meet and discuss current care and maintenance status of Project and confirm end land use strategy as proposed in approved MCP	Meeting confirmed status as new lease owner management representative. Responsible agency remains Pastoral Lands Board. Discussed potential residential site development at northern end of Riverina lease and also potential station residence access road.
Sturt Meadows	October 2019	Paul Axford	Personal invitation to meet and discuss current care and maintenance status of Project and confirm end land use strategy as proposed in approved MCP	Meeting conducted. Advised signatory status to management of land for carbon credit program. No changes requested of Jupiter in respect to proposed end- land use criteria.
Morapai Station	November 2019	Greg Stubbs	Invitation to attend public presentation evening in Kalgoorlie and/or meet to discuss current care and maintenance status of Project and confirm end land use strategy as proposed in approved MCP	As above with regards to Wongatha Group

Stakeholder Group	Date	Stakeholder Contact	Issues Discussed	Outcomes
Norilsk Nickel Cawse Pty Ltd	November 2019	Corporate	No interim consultation required access agreement still current	Ongoing access agreement still in place
REGULATORS				
DMIRS - Mines Safety Directorate and Safety Regulation Group (Kalgoorlie)	29 July 2021	David Muller, Team Leader - Inspector of Mines and Clay Wittchen, Inspector of Mines	A Project overview, discussions and requirements on submission of Juno's Project Management Plan, PMP	Highlighted what is important, addressing all the required aspects very important, very supportive of the Project, 30 working days turn around on the PMP, but in reality have been less than that.
DMIRS - Resource Industries, Regulatory Services	16 July 2021	Richard Smetana	Confirmation of NVCP - Purpose Permit approach, clarification on rehabilitation/regrowth inclusion etc.	Confirmation NVCP approach and requirement to include rehabilitated and regrowth areas in the total areas.
Department of Water and Environmental Regulation (DWER)	2 July 2021	Carmen Standing Shanuka Palamure	Scoping meeting for Mount Mason Works Approval Application. Discussed Project characteristics, existing approvals, and emissions, discharges and waste.	Confirmation of Work Approval Application requirements for the Project
Department of Mines, Industry Regulation and Safety (DMIRS)	8 June 2021	Damien Montague Richard Smetana	Email of 3 June Scoping Meeting presentation, confirmation of low impact Project and no changes required to Mining Proposal, Project Management Plan, or Mine Closure Plan. Conditional approval strategy for NVCP	NVCP conditional approval to include a clearing exclusion zone for <i>Drosera</i> sp. pending August/September targeted botanical survey to confirm range, map vegetation types at Yunndaga, and review of potential locations and risks associated with the Azure Bronze Butterfly (<i>E. salubris</i>) habitat.
Department of Mines, Industry Regulation and Safety (DMIRS)	3 June 2021	Damien Montague Richard Smetana	Scoping meeting to discuss existing approved Mining Proposals (including for Yanndaga siding), Mine Closure Plan and Project Management Plan, and resubmission of NVCP applications, including biological survey requirements	Confirmation on status of existing Mining Act approvals, and approach to be taken for NVCP (i.e. approval to clear non- <i>Drosera</i> sp. habitat subject to a condition regarding completion of spring targeted biological surveys)
Department of Mines, Industry Regulation and Safety (DMIRS)	June 2021	Matt Cann	Discussion regarding the Mine Closure Plan assessment status and Mining Proposal	Advice provided that MCP Reg ID 83817 is 'pending' assessment subject to DMIRS resources, and as long as the Project is developed in line with existing approvals then no further approvals would be required
Former Department of Indigenous Affairs	As at November 2019	Department of Premier and Cabinet	No interim consultation regarding native title undertaken to date	No change in native title claimants.

Stakeholder Group	Date	Stakeholder Contact	Issues Discussed	Outcomes
Department of the Environment and Energy	October 2019	Kahli Beisser	Advice in respect of care and maintenance status of Project seeking confirmation that applicable conditions prevail.	Confirmed that Jupiter is cognisant of conditions in respect of EPBC assessment and will implement in accordance with advice.
Department of Mines Industry Regulation and Safety	September 2019	Matt Cann	Discussion regarding MCP update content requirements	Advice given in respect of update in accordance with 2015 MCP Guidelines noting no material changes to MCP under care and maintenance conditions. Include reference to timeline approach to closure obligations. Reference to WABSI framework acknowledged and noted in 2019 MCP submission.
Department of Mines, Industry Regulation and Safety (Kalgoorlie Branch)	May 2019	Matt Cann	Initial consultation regarding requirements for MCP update to address MCP REG ID: 75964 – Mount Mason Project and Yunndaga Siding – Refusal of Mine Closure Plan During Assessment	Submission of revised plan by November 30 in accordance with MCP Guidelines.
Department of Water and Environmental Regulation	Feb 2018	Andrew Naskos	Application of extension of water licence.	Water licence extension granted: GWL 174647(3)
Department of Environment and Conservation	28 June 2013	Various Representatives	Final Mount Mason Mining Proposal presentation 28th June 2013	Discussed status of PEC and agreed to provide advice for submission.
Department of Mines and Petroleum	28 June 2013	Various Representatives	Final Mount Mason Mining Proposal presentation 28th June 2013	No issues arising
Department of Sustainability, Environment, Water, Population and Communities	25 March 2013	Con Voutas	Mount Mason presentation and submission of EPBC referral document, including Malleefowl Management Plan	Likely not Controlled Action, possibly in a prescribed manner after some mapping amendments to include an age on mounds –and try to achieve a 50 m buffer for inactive mounds <20 years old along with 250 m buffer for active mounds (unless suitable justification).
Department of Mines and Petroleum	19 December 2012	Nick Galton-Fenzi	Presentation: Draft Mount Mason Mining Proposal.	Query regarding water monitoring being undertaken for baselines level, confirmed that Juno have a groundwater monitoring program in place.
Department of Mine, Industry Regulation and Safety	25 October 2012	Julie Futter/ Neville Hauge	Presentation: Project update on exploration activities to date.	Commitment to provide Project updates and potentially site visit in the future

Stakeholder Group	Date	Stakeholder Contact	Issues Discussed	Outcomes
Department of Sustainability, Environment, Water, Population and Communities	21 March 2012	Nicole Matthews	Project update and more detailed discussion related to the EPBC Act approval process.	Mount Mason to be referred, although unlikely to be considered a Controlled Action.
Department of Sustainability, Environment, Water, Population and Communities	3 February 2012	Nicole Matthews (Perth), Mark Hill (Canberra)	Project background/initial determination of whether referral under the EPBC Act required.	Potential impact appears manageable, so unlike to be a controlled action, but advised to refer.
Department of Indigenous Affairs	25 January 2012	Simon Keanon	Project update. DIA suggested consultation with Goldfields Land and Sea Council	Confirmation that the correct heritage groups are being consulted.
NON-GOVERNMENT ORGANISATION				
Malleefowl Preservation Group (now the Malleefowl Recovery Group)	October 2019	Susanne Dennings	No interim consultation undertaken to date	Invitation to personal meeting extended and pending.
Malleefowl Preservation Group	June 2012 to April 2013	Susanne Dennings	Project background/updates and discussion relating to potential involvement/scoping for Malleefowl surveys. Also, numerous discussions regarding setting up a sponsorship/financial contribution towards Lotterywest grant funded CEO position.	An agreement has been made, with the first payment of \$20,000 presented in April 2013 – with commitment to ongoing contribution (subject to Project status)
INFRASTRUCTURE PROVIDERS				
Shire of Menzies	29 July 2021	Greg Dwyer, President and Brian Joiner, CEO	Addressed the full Menzies Shire Council on the Project, plus discussed the possibility of utilising the Menzies rail siding as an interim measure to load out DSO as a potential (less preferred) option.	Highly supportive of the Project and want to see it go ahead this time around. The Menzies siding is as a backup option if the other rail siding options don't crystallize albeit low probability. If Menzies is the only option, then would facilitate it, if this came to eventuate, then community engagement would only commence then.

Stakeholder Group	Date	Stakeholder Contact	Issues Discussed	Outcomes
Shire of Menzies	14 July 2021	Greg Dwyer, President and Brian Joiner, CEO	The possibility to utilize the Menzies Rail Siding as an interim bulk DSO loadout location.	Positive discussions, would prefer routes that avoided coming through the center of town, offered up a southern access possibility. What benefits will be in it for the town? Greg Durack invited to present to full Shire Council on 29 July.
Shire of Menzies	4 March 2021	Brian Joiner, CEO	Juno introduction and outline of the required use of Shire Roads, and the new planned Menzies bypass to Yunddaga	Appreciated the outline, Shire Roads OK to use, but the basis is that you damage you fix. Happy to assist Juno to progress its Project
Shire of Menzies	October 2019	Greg Dwyer (Shire President), Peter Money (CEO). Jill Dwyer (Councillor)	Presentation Project update and discussion regarding Project development issues and timeline and discussion regarding mine closure and end land use objectives, particularly for haul road and Yunddaga Siding infrastructure.	Discussion confirmed previous arrangements where final land use objectives will be determined during life of Project and finalised in consultation with Shire closer to the conclusion of the mining phase.
Arc Infrastructure	Ongoing regular liaison during 2019	Murray Cook, Paul Larsen, Nathan Speed.	Project development update and commercial in confidence discussions regarding costing and availability of rail services.	Commercial in Confidence-ground rail services
Southern Ports	Ongoing regular liaison 2018 to 2019	Jared Brotherston, Scott Bates	Project development update and commercial in confidence discussions regarding costing and availability of port services.	Commercial in Confidence-port storage and shipping services.
Various Yilgarn iron ore explorers/producers	2013-2017	Various	Continuous discussions with Yilgarn iron ore explorers or producers to consolidate infrastructure to reduce footprint and achieve cost synergies.	Discussions ongoing, no agreements in place yet.
Shire of Menzies	April 2014	Shire President, Gregory Dwyer / Council Meeting	Presentation to confirm road use agreement and any secondary approvals/licensed required for Mount Mason Project.	Agreement in principle.

Stakeholder Group	Date	Stakeholder Contact	Issues Discussed	Outcomes
Shire of Menzies	28 June 2013	Shire President, Gregory Dwyer / Council Meeting	Presentation by Juno giving Project Project update and Mount Mason Mining proposal including discussion of Menzies – Sandstone Shire Road usage for traffic haul to proposed Yunndaga Siding, and development of Yunndaga Siding train loading facility	No issues with Mount Mason Mining Proposal raised. Agreed to further discuss the Shire road transport requirements and specifically the upgrade proposal in respect of the Shires new 4 km section of bitumen road proposed for the Lake Ballard / Snake Hill Road intersections during 2013/2014 financial year. Yunndaga Siding to be the subject of a separate technical discussion with Shire staff prior to submission of separate Mining Proposal.
Shire of Menzies	18 July 2013	Shire CEO	Presentation / discussion Yunndaga Siding Mining Proposal.	Proposed meeting.
Shire of Menzies	22 October 2012	Shire President, Gregory Dwyer / Council Meeting	Presentation by Jupiter giving Project update and discussion regarding issues, progress and challenges – particularly transportation to port and related port access.	Initial meeting with new staff members and commitment to Project update in future.
Brookfield Rail	7 September 2012	Laura Adair	Preliminary enquiry and request response to queries regarding proposed rail crossing at Menzies 52.	Referred to Aurizon for above-ground rail services.
Shire of Menzies	July 2012	Shire Technical Staff	Detailed design, standard, maintenance and construction of transport route, Menzies-Sandstone Road to Yunndaga.	Agreement to construct Network 10 standard gravel road. Maintenance arrangements to be confirmed with Shire Roads agreement.

** As of 1 July 2019, the Goldfields Land and Sea Council are no longer funded as a Native Title Service Provider and as such no longer provide this service*

7 ASSESSMENT AGAINST CLEARING PRINCIPLES

An assessment of the Project against the clearing principles under Schedule 5 of the EP Act follows.

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

The Project is not likely to be at variance to this Principle.

The Project does not occur within any of the Biodiversity Hotspots as identified by the Threatened Species Scientific Committee for the Australian Government.

There are no Threatened Ecological Communities (TEC) or Priority Ecological Communities (PEC) within, nor in the vicinity of, the Project Area.

There are no Declared Rare Flora or Priority species within the Project area.

The presence of stock and other grazing herbivores has had a significant effect on the types and species of vegetation present throughout the Project area, with the majority of palatable species either being 'grazed out' or with distinct browse-lines. Some parts of the Project area are degraded as a result of mining activity, both recent and historical.

The area is not within a Bush Forever Site or an ecological link or corridor.

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

The Project is not likely to be at variance to this Principle.

In the Yunndaga Siding and proposed haul road area three broad fauna habitat types were identified, Mulga Shrubland, Scattered Low Shrubland, and Eucalypt Open woodland. These three habitat types are widespread and common in areas adjacent to the Project area and, more broadly, across the region (Western Ecological, 2021).

No Malleefowl, Malleefowl mounds or tracks were recorded during the 2021 Targeted Fauna Survey of the Project area. The habitat has been extensively disturbed for historic mining activity and is now deemed unsuitable for Malleefowl as it has limited canopy cover in many areas and lacks a diverse shrub layer throughout much of the project area (Western Botanical, 2021).

None of the habitats are suitable for Night Parrots as there are no areas with large spinifex (*Triodia*) hummocks, and there are also no rocky ridges with boulders that is preferred habitat for the Long-tailed Dunnart (Western Botanical, 2021).

There is only limited potential habitat for the Arid Bronze Azure Butterfly in the Project area, and it is considered unlikely to be present (Western Botanical, 2021).

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

The Project is not likely to be at variance to this Principle.

No plant taxa located in the Project area are gazetted as Declared Rare Flora (DRF) pursuant to Subsection 2 of Section 23F of the WC Act or listed as Threatened pursuant to Schedule 1 of the EPBC Act. Nor are there any Priority flora.

Database searches identified 37 flora species of conservation significance with the potential to occur in the Project area; however, field investigations did not encounter any of these species. Given the degree of disturbance, it is unlikely that any of the species identified during the database searches are present within the Project area.

- 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.**

The Project is not likely to be at variance to this Principle.

The vegetation communities within the Project area are not considered to be analogous to any Threatened Ecological Communities (TEC) or Priority Ecological Communities (PEC).

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

The Project is not likely to be at variance to this Principle.

The Project lies within the Barlee Botanical District, as defined by Beard (Beard, 1990) and contains the vegetation associations described in Table 8. A summary of the current extent and representation of these associations in the proposed clearing is presented in the table below. At a regional scale (Western Australia) the proposed disturbance for the Project represents <0.01% of any of the four vegetation groups present.

Vegetation Association 18 is listed to be a medium reservation priority in the biodiversity audit of the Eastern Goldfields subregion, whereas vegetation associations 20 and 251 were listed as low (Cowan, Graham, & McKenzie, 2001).

Table 8: Beard Vegetation Associations in the Project Area

Vegetation Association	Unit Description	Pre European Extent in East Murchison subregion	% Remaining in East Murchison subregion	Yunndaga proposed clearing (ha)	Clearing as % of Current Extent within East Murchison subregion
18	Low woodland; mulga (<i>Acacia aneura</i>)	10,269,895.8	100	8.6	0.0001
251	Low woodland; mulga & <i>Allocasuarina cristata</i>	1,174,259.12	100	59.4	0.005
20	Low woodland; mulga mixed with <i>Allocasuarina cristata</i> & <i>Eucalyptus sp.</i>	58,012	100	1.5	0.0026

Amended from Outback Ecology Services (2013).

The Project is not within a 'constrained area' with regards to urban development, and the degree of fragmentation of the vegetation across the landscape is extremely low.

The Project area was described as highly disturbed, relating to historical use for vehicle transport corridors and stock watering (Outback Ecology Services, 2013).

- 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 Project is not likely to be at variance with the Principle.

There are no lakes, rivers or other significant water bodies within the Project area.

Approximately 21% of the Study Area comprises Drainage Depression habitat. Changes in the timing, quantity, quality or distribution of water within this habitat may adversely affect the fauna and flora assemblages that may be dependent upon them. However, much of this habitat is classified as “degraded” (Outback Ecology Services, 2013), and it is unlikely the Project will have any significant impact on water quantity, quality etc.

In addition, given the highly disturbed environment - almost 65% of the Project area was determined to be “Degraded” and only 3% determined “Very good” (Outback Ecology Services, 2013) – it is unlikely that there will be a significant impact on the Drainage Depression habitat.

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

The Project is not likely to be at variance with the Principle.

The Project area contains four land systems: Moriarty, Bunyip, Rainbow and Yowie, of which the Moriarty land system occupies the majority of the area. The Moriarty Land System is characterised by low greenstone rises and stony plains, supporting chenopod shrublands with patchy eucalypt overstorey.

It is not considered likely that the clearing of the vegetation will cause appreciable land degradation, given the current degraded condition of the existing environment. Juno commits to maintaining existing drainage paths where possible and will mitigate erosion through appropriate management measures, as detailed in Section 4 of this report and in the Mining Proposal.

- 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.**

The Project is not likely to be at variance with the Principle.

The Project area does not lie within any conservation areas or DPaW managed lands. The nearest conservation reserves to the project are:

- Goongarrie National Park – approximately 40 km south southeast;
- Clear and Muddy Lakes Nature Reserve – approximately 75 km south; and
- Mount Manning Range Nature Reserve – approximately 100 km west.

The Project area is not located within an Environmentally Sensitive Area as declared in Environmental Protection (Environmentally Sensitive Areas) Notice 2005, Government Gazette No. 55.

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

The Project is not likely to be at variance with the Principle.

The Project area is not located within a Public Drinking Water Source Area (PDSWA) and there are no significant watercourses or wetlands within the application area. The Priority 1 Menzies Water Reserve lies approximately 1km north of the Yunndaga Siding, however it is unlikely the Project will impact on this area.

There are a number of ephemeral drainage lines that run through the area; however, the average evaporation rate exceeds the average rainfall for every month of the year, and during normal rainfall events the proposed clearing would be unlikely to cause deterioration in the quality of surface water. Substantial rainfall events may create surface sheet flow, but these events will be managed through the implementation of appropriate mitigation measures, as detailed in Section 4 of this report and in the Mining Proposal.

The proposed clearing is not likely to cause salinity levels in groundwater to increase.

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

The Project is not likely to be at variance with the Principle.

The average annual evaporation rate exceeds the average rainfall for every month of the year with an annual average evaporation rate of approximately 2800mm and annual average rainfall of 251mm (Bureau of Meteorology, 2021). During normal seasonal rains there is limited surface flow and the proposed clearing is not likely to cause or increase the incidence or intensity of flooding. The existing environment is “degraded” and additional clearing levels will be low.

8 PLANNING INSTRUMENTS AND OTHER RELEVANT MATTERS

8.1 Planning Instruments

8.1.1 National Recovery Plan for Malleefowl *Leipoa ocellata*

Nationally, the Malleefowl is listed as Vulnerable under the Environment Protection and Biodiversity Conservation (EPBC) Act 1999. In Western Australia it is listed as Fauna that is rare or is likely to become extinct under Schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice 2005. In addition to the national and state listings, Malleefowl qualify as Vulnerable by international criteria for threatened species (IUCN 2001, criteria VU A1c,e and A2b,c,e).

Further declines are expected because many remaining populations are small and isolated; are threatened by introduced competitors and predators; and are subject to recurrent catastrophic events that severely threaten habitat quality and the viability of populations.

The 2021 Targeted Fauna Survey did not record any Malleefowl, Malleefowl mounds nor tracks in the Project area.

Clearing for the Project will be limited to that required for the safe operation of the Project and active Malleefowl mounds should they occur in the future will be avoided. Fox populations will be managed through ensuring the Project does not impact (e.g. no feeding of foxes and prevention of access to food waste within Juno managed Project areas). Warning signs and speed limits will be implemented to minimise any mortality on roads and tracks within control of the Project.

The Project is not in conflict with any of the objectives of the National Recovery Plan.

8.1.2 Shire of Menzies Local Planning Strategy

The Shire of Menzies Local Planning Strategy is a high-level strategic document that in accordance with the *Planning and Development (Local Planning Schemes) Regulations 2015* sets out the long-term planning directions for the local government, applies state or regional planning policy that is relevant to the strategy, and provides the rationale for any zoning or classification of land under the local planning scheme.

The overarching objectives for the Shire include:

- Land development: adequate land for commercial, industrial and residential purposes;
- Increased capacity and diversity of housing choice: appropriate residential zoning and density to allow diverse residential development opportunities that address affordable housing demand, and for aged persons;
- Facilitate commercial and industrial growth: develop partnerships with the mining industry for business and employment opportunities to assist with population retention. Respond to changes to the pastoral industry and provide for value-add opportunities where appropriate;
- Tourism opportunities: support Menzies as a place to visit through capacity building in events, arts, walk ways and cultural experiences;
- Preservation of Aboriginal culture and heritage: working with Menzies Aboriginal Corporation and the Tjuntjuntjara community;
- Provision of adequate health and emergency services: provision of aged care services and accommodation, and appropriate services and facilities for people with disabilities;

- Heritage preservation and protection of the built environment: a built environment that protects and restores buildings of historical value in Menzies, Kookynie and Goongarrie; and
- Sustainability through regional and government partnerships: informed resource decisions for the community good.

The Project is not likely to conflict with any of the objectives of the Shire of Menzies Local Planning Strategy.

8.2 Other Relevant Matters

8.2.1 Land Use Impacts

8.2.1.1 Pastoral

Consultation has been ongoing with relevant Pastoralists in regards to the associated Mount Mason Project (Section 6). Fencing will be maintained to prevent impacts on livestock, and access to pastoral tracks will be maintained.

There is not expected to be any significant impact on pastoral land use from this Project.

8.2.1.2 Heritage

Jupiter initially consulted with the Goldfields Land and Sea Council (GLSC) regarding the Project, and was referred to both Wongatha and Wutha Native Title Claimant Groups for heritage assessments and the ongoing consultation process.

The following survey has been completed for the Project area:

- Jupiter Mining Ltd Yunndaga Ethno Survey report – Addendum August 2013 Wutha NTC.

There is a Ceremonial, Mythological Aboriginal Heritage Place (ID 17168) located approximately 120m to the east of the Yunndaga Siding rail line.

Juno will avoid impacting on any Aboriginal Heritage sites. Should there be any risk of impact on a site Juno will consult with the Wongatha and Wutha Groups where relevant, and follow all requirements of the *Aboriginal Heritage Act 1972*.

8.2.1.3 Ground Water Proclamation

The Project lies within the Goldfields Groundwater Proclamation Area under the *Rights in Water and Irrigation Act 1914* (RIWI Act). As the Project area is predominantly already cleared or disturbed it is very unlikely clearing associated with this Project will impact on the groundwater.

8.2.2 Previous Decisions

The Project was previously granted a permit and extension to clear native vegetation (CPS 5765/2) under s.51M of the *Environmental Protection Act 1986* on 24 September 2015 (Appendix D). Due to the approved clearing not being undertaken within the required timeframe of the permit, and a change in ownership from Jupiter to Juno, the Project was advised that a new permit would be required.

The proposed location and size of the area of clearing for this current NVCP application does not differ from that which was previously approved for clearing.

8.2.3 Legislative Requirements

The Project does not require any other approval under the EP Act, *Rights in Water and Irrigation Act 1914*, or the *Aboriginal Heritage Act 1972*.

8.2.4 Necessity

The proposed native vegetation clearing for the Project follows the impact mitigation sequence, as shown in Table 9.

Table 9: Native Vegetation Clearing Impact Mitigation

Mitigation Sequence	
Avoid	Product is proposed to be hauled via existing roads where possible. Only the access road and the Yunndaga Rail Siding are proposed to be cleared.
Minimise	The area of land to be cleared for the Project has been limited to that necessary for the safe construction and operation of the haul road and siding.
Rehabilitate	On completion of the Project the haul road and siding will be rehabilitated (refer to section 5);
Offset	The Project has not been determined to require any offset (refer to section 9).

8.2.5 Environmental Protection Policies

There is no Environmental Protection Policy (EPP) relevant to this Project.

8.2.6 Agreements to Reserve, Conservation Covenants and Soil Conservation Notices

The Project area is not land subject to an agreement to reserve, a conservation covenant, nor a soil conservation notice under the *Soil and Land Conservation Act 1945*.

9 OFFSETS

Under Part V Division 2 (Clearing of native vegetation) of the EP Act, a native vegetation clearing permit may be subject to a condition requiring an offset to “establish and maintain vegetation on land other than land cleared under the [clearing] permit in order to offset the loss of the cleared vegetation or make monetary contributions to a fund maintained for the purpose of establishing or maintaining vegetation”.

In accordance with the Residual Impact Significance Model (Figure 3 of the DWER WA Environmental Offsets Guidelines 2014), environmental offsets are only to be applied where the residual impacts of a project are determined to be significant, after avoidance, minimisation and rehabilitation have been pursued.

In general, significant residual impacts include those that affect rare and endangered plants and animals (such as declared rare flora and threatened species that are protected by statute), areas within the formal conservation reserve system, important environmental systems and species that are protected under international agreements (such as Ramsar listed wetlands) and areas that are already defined as being critically impacted in a cumulative context. Impacts may also be significant if, for example, they could cause plants or animals to become rare or endangered, or they affect vegetation which provides important ecological functions.

Assessment of this Project against the Residual Impact Significance Model suggests that the residual impacts are not significant, and no environmental offsets are required.

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APPENDICES

Appendix A: Juno Land Development and Clearing Procedure

Land Disturbance and Clearing Procedure

August 2021

VERSION CONTROL	Doc ID: JM 001	Doc Title:	Land Disturbance and Clearing Procedure		
V3	Final	JP	GO & GK	GD	06/08/21
V2	Final Draft	JP	GO & GK	GD	30/7/2021
V1	Draft	JP	GO & GK	GD	08/06/21
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FINAL DRAFT

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1 PURPOSE

The purpose of this procedure is to:

- Manage the potential impacts of land disturbance and clearing on vegetation and fauna;
- Minimising impact to:
 - Malleefowl (*Leipoa ocellata*) which is listed as 'vulnerable' under the Environmental Protection and Biodiversity Conservation Act (Cth) and 'rare and likely to become extinct' under the *Biodiversity Conservation Regulations 2018 (WA)*; and
 - *Drosera eremaea* which is listed as a Priority 1 species.
- Ensure compliance with legislative requirements.

2 SCOPE

This procedure applies to all Juno Minerals Limited ('Juno') land clearing or vegetation disturbance activities. This includes contractors undertaking land disturbance or clearing on Juno's behalf.

3 RELEVANT LEGISLATION AND JUNO COMMITMENTS

- *Environmental Protection Act 1986*;
- *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*;
- *Biodiversity Conservation Regulations 2018 (WA)*;
- *Environmental Protection and Biodiversity Act 1999 (Cth)*;
- *Aboriginal Heritage Act 1972*;
- EPBC Decision on Referral (EPBC Ref: as issued and current);
- Native Vegetation Clearing Permits as issued by DMIRS and current Jupiter Central Yilgarn Iron Project - Malleefowl Management Plan (current version).

4 RESPONSIBILITIES

Resident Manager:

- Ensure persons undertaking any land disturbance or clearing activities are aware of the requirements of this procedure prior to commencing works;
- Ensure appropriate supervision of land disturbance and clearing activities is provided; and
- Ensure no impact to any environmental significant areas (Malleefowl mounds, populations of *Drosera eremaea*, or Aboriginal Heritage Site).
- Ensure consultation with relevant stakeholders has been conducted where required.

Environmental Officer:

- Assess Juno Ground or Vegetation Disturbance Permits (GVDP) to ensure the area requested to be cleared/disturbed has been authorised and meets the requirements under the relevant Department of Mines, Industry Regulation and Safety native vegetation clearing permit (CPS 5765/2 or CPS 5764/2).
- Determine if a Department of Parks and Wildlife (DPaW) Licence to Take flora is required for the disturbance/clearing.
- Determine any 'No-go' areas with regards to:
 - Active Malleefowl mounds or mounds that are inactive <20yrs to be retained (ensure appropriate approved buffer),
 - *Drosera eremaea* plants or populations, and
 - Aboriginal Heritage Sites.
- Ensure a pre-clearing survey is completed (no earlier than 1 week prior to the commencement of ground disturbance) in the field by an appropriately qualified and Juno authorised person to identify any previously unrecorded active Malleefowl mounds, or a change in status of an old Malleefowl mound.
- Audit/inspect land disturbance and clearing activities to ensure they are being performed in accordance with this procedure.
- Ensure that soil stockpiles are numerically identified and the date/s of stripping recorded on a site Topsoil and Overburden GIS register.
- Ensuring any non-conformance with the procedure is reported, investigated and any potential impact mitigated.
- Ensure areas cleared/disturbed are accurately surveyed, recorded and reported as required by legislative requirements (e.g. Annual Environmental Report, Mine Rehabilitation Fund Report).
- Ensure consultations with relevant stakeholders are documented/recorded where required and the Juno Stakeholder Consultation Register is updated.

Field Surveyor:

- Ensure survey, ground truthing and flagging all ground clearing/disturbance areas in accordance with the issued Juno Ground or Vegetation Disturbance Permits (GVDP); and
- Ensure Environmentally Sensitive Areas and Heritage Sites are clearly demarcated as 'No-go' areas in the field.

Site Supervisor:

- Ensure all clearing boundaries and 'No-go' Areas are clearly demarcated in the field prior to disturbance/clearing commencing;
- Provide all Earthworks Machinery Operators with an 'orientation' of the area to be cleared ensuring they are familiar with the clearing area boundaries and any 'No-go' areas;
- Provide supervision during disturbance/clearing to ensure activities comply with all legislative requirements and the requirements of this procedure.

Earthworks Machinery Operator:

- Ensure ground disturbance or clearing is conducted in accordance with all approvals, permits and this procedure.
- Ensure they have sighted all relevant approvals/permits and are satisfied they are complying with an approved GVDP prior to the commencement of any land and vegetation disturbance (refer to the relevant Juno Ground or Vegetation Disturbance Permits (GVDP));
- Clear/disturb only within the approved, demarcated areas (this includes not driving/parking on vegetation outside the approved area) as defined by the GVDP;
- Ensure a GPS record is obtained that records clearing activity during the works (preferably equipment based), and provide the Juno Environmental Officer with the GIS polygon/shape file after clearing; and
- If in doubt, STOP Work, and seek assistance to clarify clearing or 'No-go' Area requirements before proceeding with any land disturbance/clearing activities.

Database Manager:

- Maintain GIS environmental impact assessment layers (shape files) including the Threatened Flora, Threatened Fauna, Baseline Surveys and Archaeological or Potential Sites, and Archaeological sites, and 'No-go' buffer layers;
- Maintain data on cleared/disturbed areas as provided by the persons undertaking the disturbance/clearing.

5 PROCEDURE

5.1 Planning and Requesting Authorisation to Clear

For long term project planning purposes, a project Ground or Vegetation Disturbance 5 year plan should be developed which takes into account the potential for seasonal nesting in used and unused Malleefowl mounds.

As Malleefowl nesting activity occurs during July to March, clearing planning and initial surveying for disturbance should ideally be conducted up to 9 months preceding the required clearing disturbance, with clearing taking place in April to June.

At the time of disturbance, the person requesting clearing/disturbance is then required to complete a Juno Ground or Vegetation Disturbance Permit (GVDP) request form (Appendix) and provide the Environmental Officer with all maps, shape files of all proposed disturbance areas, the method of clearing, the method of topsoil removal and stockpiles.

GVDP request forms need to be submitted to the site Environmental Officer at least 7 working days in advance of the proposed disturbance/clearing to allow sufficient time to ensure an assessment can be completed and all legislative requirements/notifications of relevant Government agencies can be met in consultation with relevant Government agencies.

When requesting a GVDP the following are required to be considered:

- Previously disturbed or cleared areas are to be used as a preference over disturbing/clearing new areas.
- The area to be cleared shall be kept as the minimum area required for the safe installation and operation of plant/equipment and associated activities;
- 'Active' Malleefowl mounds are to be avoided and 'inactive' mounds to be retained (ensure appropriate approved buffers), unless otherwise approved under the current EPBC 'action';
- *Drosera eremaea* plants and populations are to be avoided (with a 10m buffer);
- Aboriginal Heritage Sites are to be avoided (minimum 10m buffer); and
- Locations for topsoil stockpiles are to be identified with the assistance of the Environmental Officer (locations must not be impacted by vehicle traffic, surface water flow, weeds etc).

No ground or vegetation disturbing activities may commence without an authorised GVDP.

5.2 Assessment of Request to Clear

Upon receiving the request for a Juno Ground or Vegetation Disturbance Permit (GVDP), the Environmental Officer is required to conduct a desktop assessment to:

- Ensure the proposed clearing/disturbance area is authorised under a current DMIRS Clearing Permit.
- Identify any Declared Rare or Protected Flora and Fauna (DRF, Priority 1 etc) as gazetted under the *Biodiversity Conservation Act 2016 (WA)* or under the *Environmental Protection and Biodiversity Act 1999 (Cth)*;
- Ensure that if any Priority flora species are required to be removed, authorisation is obtained from the relevant Government Department (e.g. DPaW for a Licence to Take Flora);
- Identify any 'active' Malleefowl mounds (to be avoided with a 250m buffer);
- Identify any 'inactive' mounds to be retained (with approved buffer). Note that some 'inactive' mounds have been approved for clearing under EPBC referral decision; and
- Identify any Aboriginal or European Heritage or Cultural sites (to be avoided with a minimum 10m buffer for artifact scatters; additional buffer requirements for other types of sites as per Juno agreements with Traditional Owners).

Clearing should only be approved after reasonable access alternatives have been considered as not practicable.

The Environmental Officer is also responsible for ensuring the planned land disturbance/clearing has been discussed with relevant stakeholders who may be impacted by, or have a vested interest in, the activities.

This may include:

- Communities living in close proximity to the area or work that may be impacted by noise, dust, vibration or visual amenity.
- Pastoralists, particularly where there are impacts in relation to stock watering areas, fences, gates or other property infrastructure.
- Traditional Owners or Native Title parties who have a registered cultural or legal interest in the area.

The Environmental Officer is responsible for documenting and recording the consultation with relevant stakeholders and ensuring the updating of the Juno Stakeholder Consultation Register .

Any complaints from stakeholders are to be reported to the Resident Manager or Environmental Manager and work suspended until approval to continue has been given.

Once the desktop assessment has been completed, and all external approvals have been received, the Environmental Officer is to complete a Juno GVDP and forward a copy to the Manager (or authorised delegate) of the person requesting clearing/disturbance for countersigning.

A copy shall also be kept, scanned and filed, by the Environmental Officer.

5.3 Ground Truthing and Demarcation

5.3.1 Pre-clearing Malleefowl Mound Survey

A pre-clearing survey must be completed (no earlier than 7 working days prior to the commencement of ground disturbance) in the field by an appropriately qualified and Juno authorised person to identify any previously unrecorded 'active' Malleefowl mounds, or a change in the status of an old 'inactive' Malleefowl mound to 'active'.

The results of the survey are to be entered into the relevant section of the GVDP and signed off by the person who completed the survey.

GPS coordinates of any new/status changed 'active' mounds are to be added to the database, and appropriate clearing control measures are to be in place to protect the 'active' mound(s).

5.3.2 Demarcation of Clearing Area

The authorised area to be disturbed/cleared (as outlined in the GVDP) is to be clearly pegged and demarked/flagged by Field Assistants using the following materials/methods:

Clearing boundary (Figure 1):

- Fluorescent pink flagging tape to be used;
- Tape is to be placed at head height; and

- Consecutive pieces of flagging tape are to be spaced close enough together such that the next tape is visible at all times as the area is cleared.

'No-go' Areas:

- Red and yellow striped flagging tape to be used;
- Demarcation for the 'No-go' Area must include:
 - Approved buffer around 'active' Malleefowl mounds and around 'inactive' <20yrs Malleefowl mounds,
 - 10m buffer around *Drosera eremaea*, and
 - 10m buffer for Aboriginal artefact scatter site (buffer size to be identified for other types of sites in consultation with Traditional Owners (e.g. for ceremonial or mythological sites).
- Tape is to be placed at head height; and
- Consecutive pieces of flagging tape are to be spaced close enough together such that the next tape is visible at all times as the adjacent approved clearing area is cleared.



Figure 1: Land Disturbance/Clearing Boundary Demarcation

5.4 Land Disturbance and Clearing

5.4.1 Pre-clearing Orientation

The site Environmental Officer is to:

- Provide the Earthworks Machinery Operator(s) and the Land Disturbance/Clearing/Site Supervisor with a copy of the signed Juno GVDP, which must include all approved Clearing Maps;
- Go through the disturbance/clearing requirements with the Earthworks Machinery Operator(s) and the Land Disturbance/Clearing/Site Supervisor prior to land disturbance/clearing commencing to ensure they are aware of the approved clearing boundaries and any 'No-go' Areas; and
- Ensure the approved clearing area polygon/shapefile and any 'No-go' Area polygons/shapefiles are provided to the Earthworks Machinery Operator and has been uploaded into the GPS on the machinery (where installed) or to a portable GPS carried by the Operator.

Once explained and agreed the Earthworks Machinery Operator must sign off on all approved Clearing Maps signalling that they are aware of the required clearing area, 'No-go' areas, and any other conditions of clearing.

Disturbance/clearing activities must NOT commence until the Pre-clearing Orientation is completed with the Earthworks Machinery Operator(s) and the Land Disturbance/Clearing/Site Supervisor and the authorised GVDP has been signed by the Earthworks Machinery Operator.

5.4.2 Clearing Methodology

A daily pre-earthmoving visual assessment should be undertaken by the Land Disturbance/Clearing/Site Supervisor and the Earthworks Machinery Operator prior to commencement of clearing activity to ensure the below clearing methodology is understood and implemented:

- Disturbance/clearing shall be kept to a minimum within the approved clearing area.
- All clearing is to avoid environmentally sensitive areas i.e. there is to be no clearing within 200m from known Mallee fowl mounds or 50m away from known Drosera eremaea populations.
- Significant vegetation e.g. large trees are to be avoided, and is to favour natural clearings wherever possible to minimise damage to vegetation.
- Machinery blades shall be set above ground level to minimise disturbance to topsoil and rootstock and to reduce erosion when clearing.
- All clearing shall progress in a slow, systematic manner in order to not confuse or trap evacuating fauna.
- Fauna must be looked out for during clearing. Reptiles can be slow moving, so if fauna is sighted, all machinery is to stop to allow safe egress from the work area.

5.4.3 Access tracks

- Access tracks, unless otherwise determined, should be as straight as practicable to minimise clearing.
- Avoid tight bends, proximity to trees and boggy areas when planning access tracks.
- Where possible low rise (<0.5m) vegetation i.e. grasses/shrubs etc. should be rolled rather than cleared.
- Taller vegetation requiring stripping shall be stockpiled on cleared ground for use in rehabilitation (i.e. not to be stockpiled on existing native vegetation as it will damage it).
- If overhanging branches (less than 5m high) need to be removed for access they should be removed in a manner that does not damage the remainder of the tree.
- The creation of windrows which have the potential to block or channel water flow along tracks causing erosion will be avoided.
- Grading of tracks should be minimised and only performed on excessively rough tracks. Where grading is necessary, the risk of erosion can be minimised by breaking windrows to allow drainage, with cambering of tracks to channel overland flow and avoiding deep cutting into the soil profile. Any damage caused during wet conditions is to be repaired when the ground has dried out.
- Vehicles must drive on existing roads i.e. no short cuts or deviations from the tracks will be tolerated. Off road access is prohibited unless in an emergency i.e. bush fire.
- During wet and boggy conditions all vehicle movement will be kept to a minimum.
- Width of access tracks to be confined to 3.5 m – 4 m.
- Discharge of water until the appropriate and approved containment facilities have been implemented or the water quality is tested and deemed acceptable for discharge.

5.4.4 Topsoil and vegetation management

- Topsoil (top 50mm), as distinct from overburden (50 – 300mm), is to be stripped from clearing areas for use in rehabilitation. If 50mm is not available to be stripped (due to skeletal soils) the Earthworks Machinery Operator(s) shall strip as much topsoil as possible and place it on a demarcated topsoil stockpile.
- Stockpiles shall be numerically identified and the date/s of stripping recorded on a Site Topsoil and Overburden GIS Register, to be maintained by the Environmental Officer.
- Topsoil removal should be planned to be stripped in dry conditions and multiple handling of topsoil should be avoided.
- Vegetation and topsoil stockpiles are to be placed in the locations approved in the GVDP (e.g. away from drainage lines and access tracks etc.)

5.4.5 Post-clearing and Sign-off

- After the area has been cleared, and prior to the Earthworks Machinery Operator moving from the area, the Land Disturbance/Clearing Supervisor and the Environmental Officer shall inspect the cleared area to ensure all clearing requirements have been met and sign off on the completed works (i.e. sign the GVDP).
- Where the requirements have NOT been conducted in accordance with this procedure and /or there is variance in the area cleared, an Environmental Incident Form is to be raised and processed as expediently as practicable to determine if remedial works are required prior to movement of the earthmoving machinery and/ or other actions are required e.g. re-instruction of Operator.
- The Earthworks Machinery Operator shall provide the GIS polygon/shapefile of the cleared area to the Database Manager for uploading into the database

5.5 Reporting

The Environmental Officer shall ensure that survey confirmation occurs for all ground disturbance & clearing activities, and the data is made available for reporting in the Project Annual Environmental Report (AER) and Mine Rehabilitation Fund Report as submitted to DMIRS.

<input type="checkbox"/> Mound(s) is outside clearing area but there is inadequate buffer area outside the clearing area,	<input type="checkbox"/> A reduced buffer area has been approved (EPBC) - clearing may proceed to the reduced buffer area. <input type="checkbox"/> No approved reduced buffer (EPBC) - clearing may not commence inside the buffer area(s) until April-June outside the nesting and incubation period. <input type="checkbox"/> No approved reduced buffer (EPBC) and clearing cannot be practicably delayed – Contact appropriate Regulatory Authorities for advice on management requirements to enable clearing to proceed.
<input type="checkbox"/> Mound(s) and buffer area(s) is inside the approved clearing area	Contact appropriate Regulatory Authorities for advice on management requirements.

PART D: PLANNING CONTROLS <i>(Site Environmental Officer to Complete)</i>	Yes	N/A
Disturbance >250m from known 'active' Malleefowl mounds (unless otherwise approved)?		
Disturbance >50m from a known 'inactive <20years to be retained' Malleefowl mounds?		
Disturbance >10m from known <i>Drosera eremaea</i> plants and/or populations?		
Disturbance >10m outside of Aboriginal or European cultural heritage sites?		
Topsoil stockpile locations have been identified (and are suitable)?		

PART E: PRE-START WORK CONTROLS <i>(Site Environmental Coordinator to complete with Land Disturbance/Clearing Supervisor)</i>	Yes	N/A
Disturbance Area Surveyed and clearly demarcated with correct tape?		
'No-go' Areas clearly demarcated with correct tape (and with the correct buffer requirements)?		
Weed Hygiene Certificate received for all Ground Engaging Machinery?		
Job Hazard Analysis (JHA)/Risk Assessment Prepared / Approved? <i>(ensure fire and emergency response is included)</i>		
Clearing Maps approved by all signatories?		

PART F: PERMIT APPROVAL		
Land Disturbance/Clearing/Site Supervisor	..... I confirm that that all ground disturbing activities will be undertaken strictly in accordance this Permit	..... date
Site Environmental Officer	..... I confirm that that all ground disturbing activities will be undertaken strictly in accordance this Permit	..... date
Environmental Manager	..... Authorisation is given to proceed with the Permit Application under the conditions prescribed on this Permit	..... date

PART G: PRE-START EARTHWORKS MACHINERY OPERATOR CONTROLS <i>(Site Environmental Officer to complete with the Earthworks Machinery Operator(s))</i>	Yes	N/A
Copy of this GVDP (and associated Clearing Maps) provided to the Earthworks Machinery Operator(s)?		
In field 'orientation' provided to the Earthworks Machinery Operator(s)?		
Earthworks Machinery Operator (sign off)	..... Earthworks Machinery Operator	..... date
Earthworks Machinery Operator (sign off)	..... Earthworks Machinery Operator	..... date
Earthworks Machinery Operator (sign off)	..... Earthworks Machinery Operator	..... date

PART H: POST DISTURBANCE CONTROLS		
Post Disturbance Inspection Completed	..... Site Environmental Officer	.....date
Post Disturbance Survey Completed (Including topsoil stockpile locations)	..... Surveyor or alternative	.....date
Disturbance Register Updated	..... Environmental Manager	.....date
Total Area Disturbed (ha):	Veg Clearing (ha):	Pre-Disturbed (ha):

FINAL DRAFT

Appendix B: Final Report, Review of Flora and Vegetation of the Mount Mason and Yunndaga Study Areas (July 2021)



**Western
Botanical**

Final Report, Review of Flora and Vegetation of the Mount Mason
and Yunndaga Study Areas
July 2021

Prepared for: Juno Minerals Pty Ltd

Report Ref: WB962



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Report No: WB962

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This report has been designed for double-sided printing

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1. Executive Summary

Juno Minerals Pty Ltd (Juno) hold the Mount Mason hematite project, located approximately 12km NW from the Mount Ida magnetite project, 96 km south-west of Leonora and 90 km north-west of Menzies, Western Australia. The project also includes planned development of a rail siding at Yunndaga Siding, at the Menzies townsite.

The Mount Mason and Yunndaga Siding project received development approval by the Department of Mining and Petroleum Resources in July 2014. Jupiter Mines Pty Ltd was granted a Clearing Permit (CP) 5765/2 on 24/9/2015 with an expiry date of 30/11/2018. The tenements were subsequently transferred to Juno Minerals Pty Ltd. Given the former CP has expired, a new Clearing Permit meeting the current Department of Mines, Industry Regulation and Safety (DMIRS) regulations and Environmental Protection Authority (EPA, 2016) Guidance is required.

In order to further the project, Juno engaged Western Botanical to review the existing information on the flora and vegetation of the Mt Mason and Yunndaga Study Areas, identify any gaps that may exist, and to develop and implement a works program to address the gaps, meeting the current EPA Guidance requirements.

A desktop review confirmed previous works and identified a range of significant flora known within and nearby both Study Areas (Western Botanical 2021a). A reconnoitre survey of both the Mount Mason and Yunndaga Study Areas was implemented in mid April 2021 where previous consultant's reports and mapping were referred to in reviewing the flora, vegetation and significant flora of the Study Areas. This review identified some gaps that were required to bring the project into compliance with EPA Guidance 2016 requirements (Western Botanical 2021b).

As current studies of flora and vegetation for the Mount Mason and Yunndaga Siding Study Areas have not been completed and revised data is not available, it is premature to attempt to assess the entire project against the EPA's 10 Clearing Principles. However, the following can be stated for each site:

Mount Mason Study Area

- A six day vegetation mapping exercise was undertaken in April 2021, focusing on the orebody and infrastructure areas with one of these spent on the haul road alignment.
- The Mount Mason Study Area has relatively simple flora with moderate diversity for the region and reflecting that of similar landforms in the region. Vegetation is in Pristine Condition outside areas of previous direct disturbance. Inclusive of tracks and rehabilitated drill pads, the entire Study Area would be considered in Excellent Condition. Rehabilitation of previous exploration areas has progressed well.
- The works presented in Native Vegetation Solutions (2012 and 2013), while limited to Disturbance Footprints with minimal buffers, is valuable and mostly accurate with only

minor amendments to species identifications and no additional Priority Flora have been noted within proposed those Disturbance Footprints previously surveyed.

- Targeted Surveys for Priority Flora recognised at that time had not been implemented in the Native Vegetation Solutions (2012 and 2013) works.
- The Mount Mason Study Area supports three Priority Flora: *Drosera eremaea* P1 (inclusive of *Drosera* aff. *eremaea*), *Calytrix hislopilii* P3, *Philothea brevifolia* subsp. *deserti* P3. Of these:
 - *Calytrix hislopilii* P3, *Philothea brevifolia* subsp. *deserti* P3 populations lie well outside area of proposed development.
 - *Drosera eremaea* P1 is known within and in close proximity to the proposed disturbance footprint within the orebody area.
 - One record of *Drosera* aff. *eremaea* is known within the Exploration Camp area. Based on the regional distribution of similar species, this is likely to be *D. eremaea* P1, however, the accuracy of the position mapped has not been verified.
 - One record of *Hysterobaeckea longipes* is noted adjacent to the Haul Road alignment approximately 7.75km south of the Mt Mason orebody area. This represents a 350 km eastwards disjunct occurrence. An error in the locational information accompanying this specimen is suspected.
- The northern portion of the Mount Mason Study Area, inclusive of the orebody area and part of the haul road, lies within the Perrinvale/Walling vegetation assemblages (banded ironstone formation) Priority 1 Priority Ecological Community.
- Other areas of proposed development (haul road, proposed explosives magazine, access road from the Mt Ida road) are not known to support any species with conservation listing. Given the landforms, soil and vegetation associations present in these areas, no Priority Flora are known, nor are they expected to occur, within proposed development footprints outside the orebody area and the northern portion of the haul road alignment. Similarly, pending verification of the *Drosera* aff. *eremaea* record, no significant flora are expected at the Exploration Camp area.

Yunndaga Siding Study Area

- Only a brief 1 day on-site reconnaissance was undertaken in April 2021.
- The Yunndaga Siding Study Area is reported in Paul Armstrong & Associates (2012) and Outback Ecology Services (OES) (2013). Vegetation Mapping presented within these documents was found to be inaccurate and requires major revision.

- Flora identifications presented within OES (2013) are considered largely accurate and the weed mapping is likely similarly of high value.
- The Yunndaga Rail Siding Study Area includes many areas of historical disturbance, numerous weed species (including Opuntoid cacti, Weeds of National Significance)
- No Priority or Threatened Flora are noted, nor are they expected, at the Yunndaga Siding Study Area.
- No Priority Ecological Communities or Threatened Ecological Communities are known within or adjacent to the Yunndaga Siding Study Area.

2. Introduction

Juno Minerals Pty Ltd (Juno) hold the Mount Mason hematite project, located approximately 12km NW from the Mount Ida magnetite project, 96 km south-west of Leonora and 90 km north-west of Menzies, Western Australia. The project also includes planned development of a rail siding at Yunndaga Siding, at the Menzies townsite. The project lies near the south-western margin of the Eastern Murchison (MUR01) biogeographic subregion which is dominated by Mulga woodlands on stony hills and hardpan plains, *Acacia* shrublands on yellow sandplains, Spinifex hummocked grasslands on orange sandplains and Chenopod plains on saline margins of salt lakes.

The Mount Mason and Yunndaga Siding project received development approval by the Department of Mining and Petroleum Resources in July 2014. Jupiter Mines Pty Ltd was granted a Clearing Permit (CP) 5765/2 on 24/9/2015 with an expiry date of 30/11/2018. The tenements were subsequently transferred to Juno Minerals Pty Ltd. Given the former CP has expired, a new Clearing Permit meeting the current Department of Mines, Industry Regulation and Safety (DMIRS) regulations and Environmental Protection Authority (EPA, 2016) Guidance is required.

In order to further the project, Juno engaged Western Botanical to review the existing information on the flora and vegetation of the Mt Mason and Yunndaga Study Areas, identify any gaps that may exist and to develop and implement a works program to address the gaps, meeting the current EPA Guidance requirements.

A reconnoitre survey of both the Mount Mason and Yunndaga Study Areas was implemented in mid-April 2020 where previous consultant's reports and mapping were referred to in reviewing the flora, vegetation and significant flora of the Study Areas. This review identified the following matters:

- The previous flora and vegetation assessments at both sites were limited to the proposed disturbance footprints at both sites with minimal (approximately 100m) buffers around planned development.
- Previous Detailed level survey vegetation mapping and flora assessments at Mount Mason were reasonably accurate, however, previous Reconnoitre level survey for the Yunndaga Siding site was inaccurate.
- Neither dataset was compliant with current EPA Guidance requirements, specifically requiring (i) a minimum 500m buffer around infrastructure, (ii) adequate quadrat representation to validate vegetation mapping, and (iii) targeted surveys for conservation-significant flora.
- Minor amendments to flora nomenclature and conservation status updates were required.

- While records of a few Priority Flora had been reported, Targeted Surveys within and adjacent to the Mount Mason Study Area for conservation-listed significant species had not been implemented. Targeted Survey within the former limited Yunndaga Siding Study Area had been conducted.
- No Threatened Flora were known, nor were expected, within or nearby the two Study Areas.

2.1. Project Background

2.2. Previous Surveys

The following reports provided by Juno Minerals (as Jupiter Mines), assessing the flora and vegetation of tenements now held by Juno Minerals were reviewed in the course of this desktop assessment. These should be read in conjunction with report as provide results of previous surveys within proposed disturbance envelopes at both Mount Mason and Yunndaga Siding.

Mount Mason Study Area

- P.G. Armstrong & Associates (2008) Vegetation Survey and Rare Flora Search of the Mt Mason and Mt Ida Exploration Project May-Sept 2007. Consultant's report to Jupiter Mines Ltd and Hardrock Mining.
- Native Vegetation Solutions (2012) Level 2 Flora and Vegetation Survey. Consultant's report to Jupiter Mines Ltd.
- Native Vegetation Solutions (2013) Level 1 Flora and Vegetation Survey of the Proposed Mount Mason Haul Road (M29/414, M29/408, G29/22, G29/23, L29/79, L29/100). Consultant's report to Jupiter Mines Ltd.

Yunndaga Siding Study Area

- Paul Armstrong & Associates (2012) Vegetation Survey and Rare Flora Search at the Menzies Railhead for Mt Mason Project, Conducted June 2011. Consultant's report to Jupiter Mines Ltd.
- Outback Ecology Services (2013) Level 1 Flora and Fauna Assessment Menzies Bypass and Yunndaga Rail Siding. Consultant's report to Jupiter Mines Ltd.

In order to gain some contextual information, three reports dealing with the flora and vegetation of adjacent Banded Ironstone Formation (BIF) ranges west and north-west of the Study Area were reviewed (Western Botanical 2010, 2011a, 2011b). Additional information on *Hibiscus* sp. Perrinvale Station (J. Warden & E. Ager WB 10581) P1 was taken from Western Botanical 2019.

2.3. Current Survey

The current study was scoped as a Reconnaissance Survey and gap analysis for the Mount Mason and Yunndaga Siding Study Areas with a view to recommending and implementing supplementary assessments in 2021 as required to bring the current works in line with EPA Guidance (2016) requirements. Vegetation mapping was to be extended to the limits of the 500m buffer now applied at both Study Areas.

2.4. Physical Environment

2.4.1. Climate

Long term climatological information is presented in Native Vegetation Solutions (2013) and is not reproduced here.

Rainfall prior to the April 2021 Reconnaissance Survey included a 35mm in one day in mid February 2021 from a decaying tropical low. Monthly totals of 3.4mm in January, 60.2mm in February, 39.6mm in March and 7.2mm to mid April 2021 were recorded at Walling Rock (BOM Station 12318) (Bureau of Meteorology). The response in vegetation observed in the April 2021 Reconnaissance Survey was that vegetation had been sustained over summer as foliage was healthy and leaves extended (plants not aestivating) but that insufficient rainfall had occurred to stimulate germination of annuals except in low lying moisture gaining sites with clayey soils and few species were in flower.

2.4.2. Geology

Geology of the Mount Mason Study Area is relatively simple with the orebody area laying within Metamorphosed banded iron formation and chert strike aligned NNW-SSE with metabasalt dominating on the eastern side of the BIF ridge and granites on the western side, Figure 1.

Geology of the Yunndaga Siding Study Area is far more complex but is dominated by sandplain with lateritic pisolites, gabbros, sedimentary rocks with felsic and mafic schists and laterites with silcrete caps, Figure 2.

Figure 1. Geology of the Mt Mason Study Area

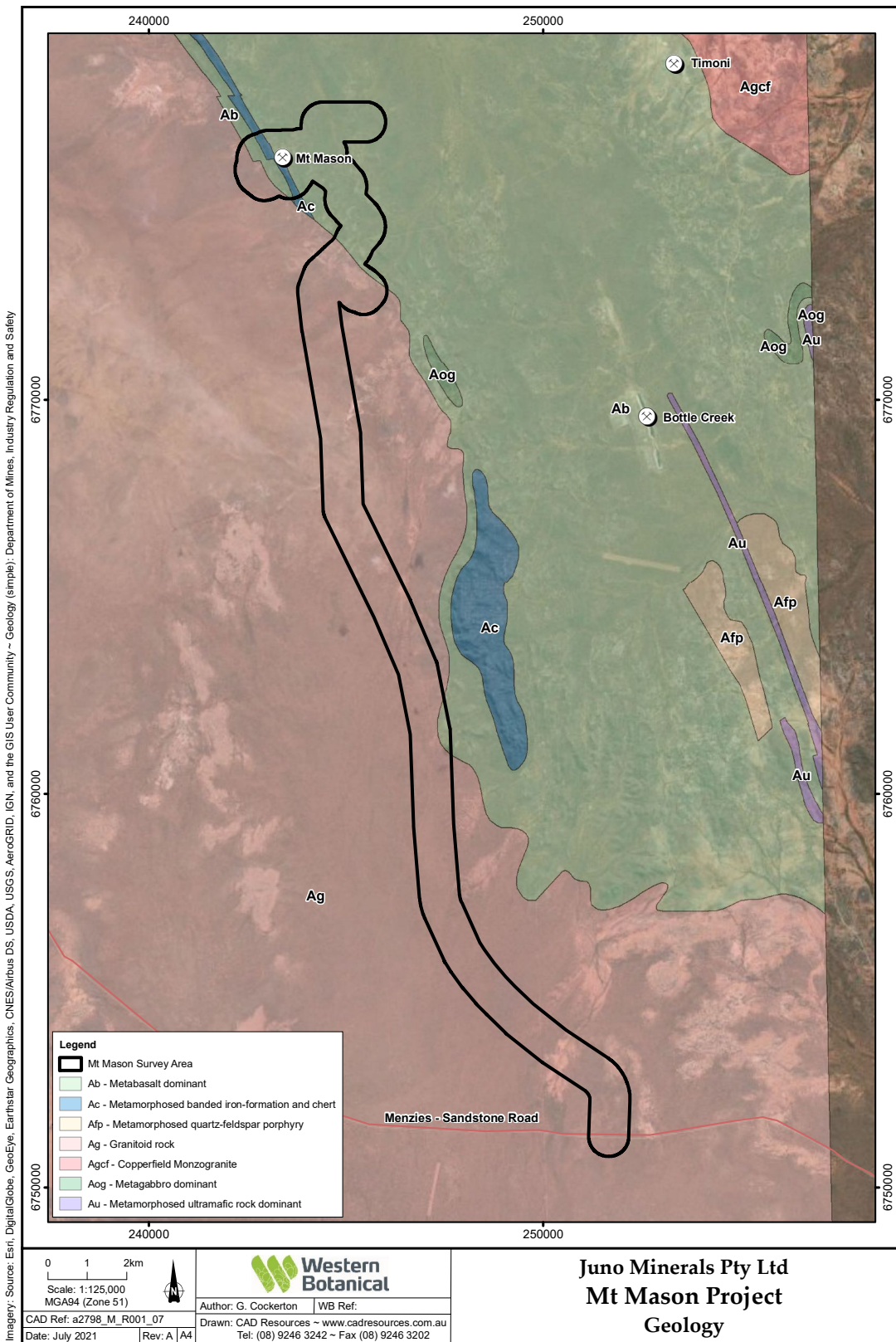
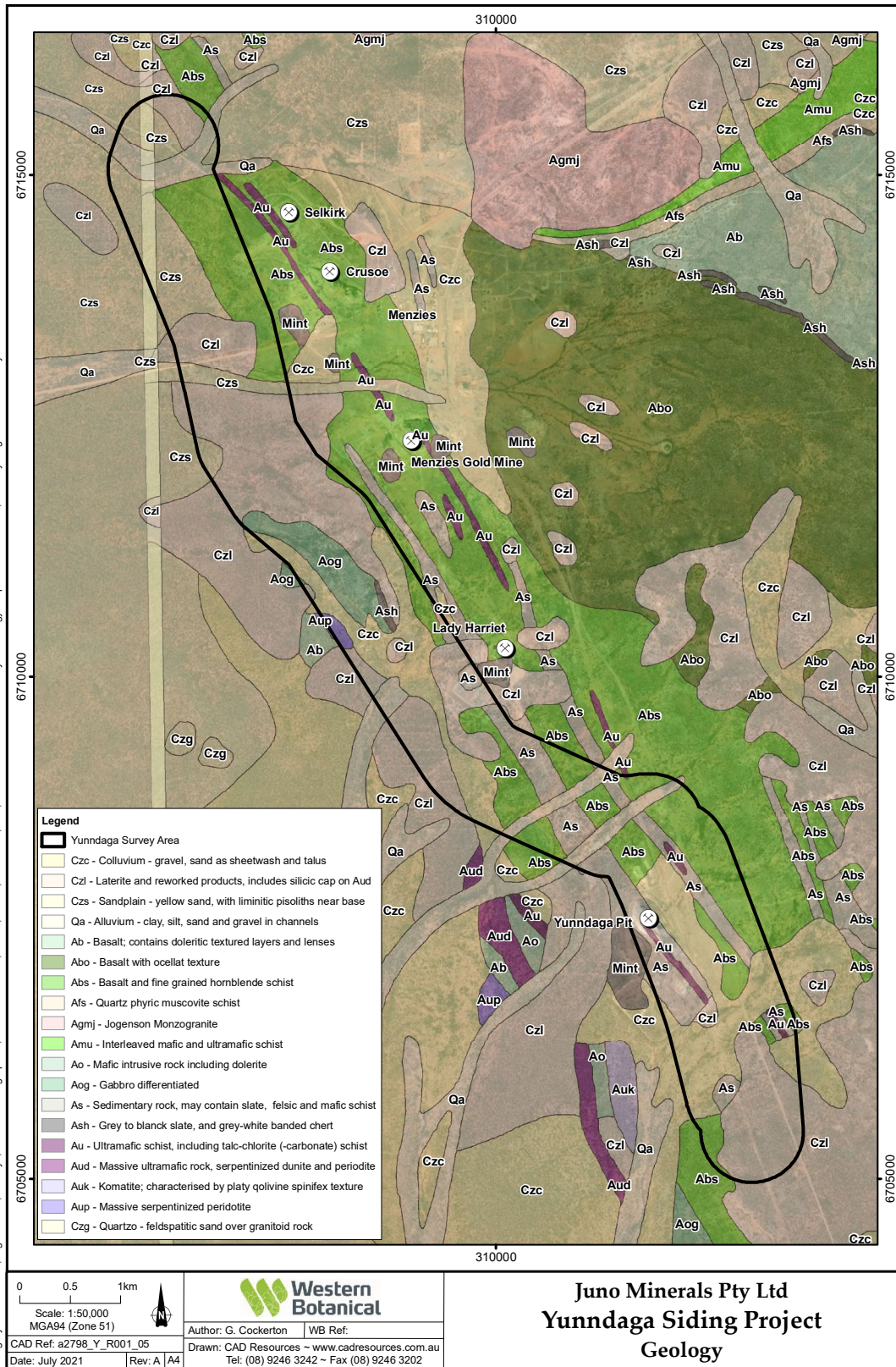


Figure 2. Geology of the Yunndaga Siding Study Area



2.5. Biological Environment

2.5.1. Interim Biogeographic Regionalisation of Australia

The setting of the Study Area within the IBRA regions is presented Native Vegetation Solutions (2012 and 2013) and is not reproduced here.

2.5.2. Land Systems

Land Systems of the Mt Mason Study Area are presented in Table 1.

Table 1. Land Systems of the Mt Mason Study Area

Land System Name	Characteristics
Rainbow	Hardpan plains supporting Mulga on alluvial plains subject to sheet flow; frequently with fine ironstone gravel mantles, and sparse, generally narrow and unincised concentrated drainage tracts.
Bevon	Irregular low hills supporting Mulga and Low shrubs on ?Tertiary limonite, minor Archaean greenstone and banded iron formation, extensive Quaternary colluvium and restricted areas of Quaternary alluvium and eluvium.
Brooking	Mulga shrublands, occasional minor halophytic shrublands on Archaean banded iron formation, locally quartzite, slate, shale and greywacke, with Quaternary colluvium and minor alluvium.
Waguin	<i>Acacia</i> shrublands and minor halophytic shrublands on very low breakaways (relief usually less than 4 m) with short footslopes above erosional plains and minor alluvial plains. This system usually occurs within large areas of sandplain, often occurring in parallel series.
Marmion	Gently undulating sandplains with mixed shrublands and hummock grasslands on Gently undulating sandplains with surface drainage features confined to areas fringing occasional exposures of granite.
Sherwood	Mulga shrublands, occasional minor halophytic shrublands on low breakaways (5 to 20 m relief), with pallid zone upper footslopes, depositional lower footslopes; extensive, level to gently undulating plains with pebble mantles; and lower alluvial plains and drainage floors receiving concentrated flow. Occasional low hills and tors.

Land System Name	Characteristics
Yowie	Mulga and Bowgada shrublands and patchy wanderrie grasslands on Quaternary sand and minor cemented alluvium.

Land Systems of the Yunddaga Study Area are presented in Table 2.

Table 2. Land Systems of the Yunddaga Study Area

Land System Name	Characteristics
Bunyip	Hardpan plains supporting Mulga on alluvial plains subject to sheet flow; frequently with fine ironstone gravel mantles, and sparse, generally narrow and unincised concentrated drainage tracts.
Moriarty	Chenopod Shrublands with patchy occurrences of eucalypts on low rises to 20 m relief, locally with ferruginous duricrust, gently undulating lower plains with pebble mantles and level to very gently inclined alluvial plains; poorly defined, sparse drainage patterns.
Yowie	Mulga and Bowgada shrublands and patchy wanderrie grasslands on Quaternary sand and minor cemented alluvium.
Rainbow	Hardpan plains supporting Mulga on alluvial plains subject to sheet flow; frequently with fine ironstone gravel mantles, and sparse, generally narrow and unincised concentrated drainage tracts.
Graves	Eucalypt woodlands with prominent saltbush and bluebush on deeply weathered, low rounded Archaean basalt and greenstone hills and rises, very gently inclined footslopes with pebble mantles and narrow alluvial tracts receiving tributary flow off higher units. Relief up to 40 m.

Figure 3. Land Systems of the Mount Mason Study Area

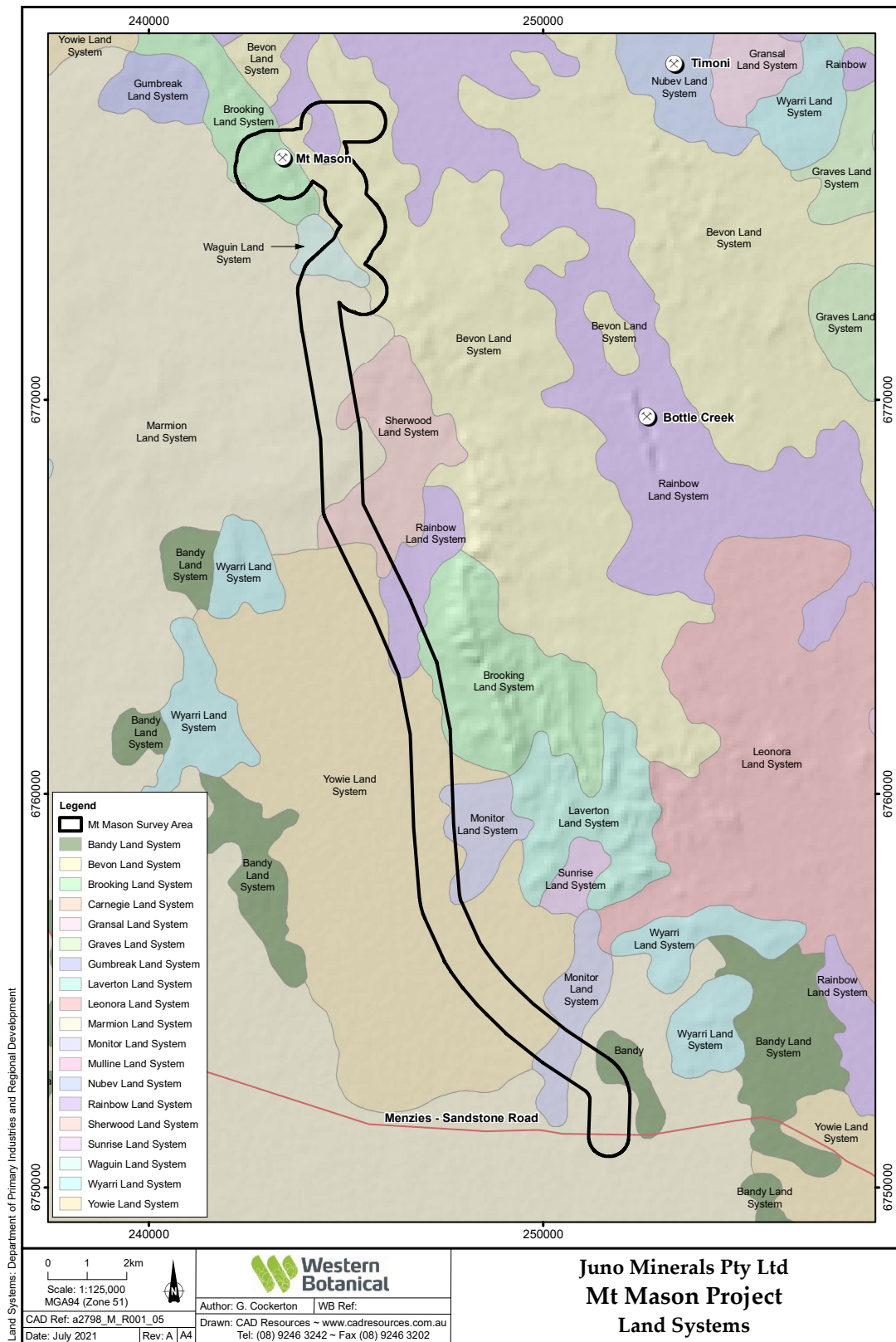
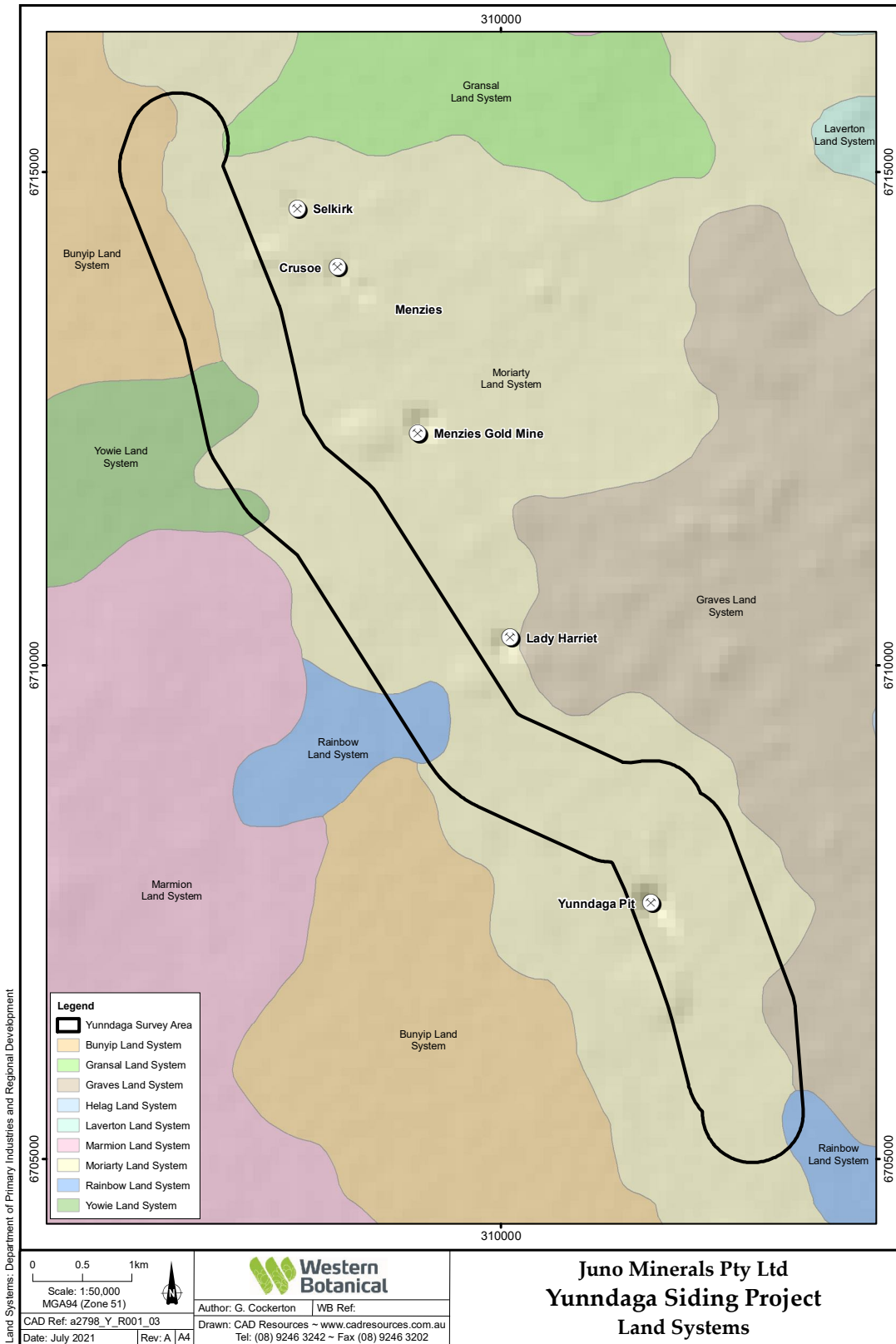


Figure 4. Land Systems of the Yunndaga Siding Study Area



2.5.3. Beard Pre-European Vegetation

The setting of the Study Area within Beard's Pre-European vegetation mapping is presented Native Vegetation Solutions (2012 and 2013) and is not reproduced here.

2.6. Site location map



The location of the two Study Areas is presented in greater detail in Figure 6 and Figure 7.

3. Methods

3.1. Desktop Assessment

This report incorporates the findings of a Desktop Assessment undertaken prior to field the April 2021 works as reported in Western Botanical (2021).

A query of the Department of Biodiversity, Conservation and Attractions' (DBCA's) Threatened and Priority Flora (TPFL) and WA Herbarium (WAHERB) databases (15-1120FL) and the Threatened and Priority Ecological Communities (TEC/PEC) databases (41-1020EC) was undertaken and the results analysed for likelihood of occurrence of conservation significant flora species within the Study Area.

The Department of Agriculture, Water and Environment's Protected Matters Search Tool was used to identify any Federally listed species or Threatened Ecological Communities within or nearby the Study Area.

Reports supplied by Juno are summarised in Table 3.

Table 3. Previous Consultant's Reports Reviewed

Reference	Brief Description
Mount Mason Study Area	
P.G. Armstrong & Associates (2008) Vegetation Survey and Rare Flora Search of the Mt Mason and Mt Ida Exploration Project May-Sept 2007. Consultant's report to Jupiter Mines Ltd and Hardrock Mining.	Level 1 Reconnaissance and Targeted Survey of Orebody Area
Native Vegetation Solutions (2012) Level 2 Flora and Vegetation Survey. Consultant's report to Jupiter Mines Ltd.	Level 2 Detailed Survey of Orebody Areas (lacking Targeted Survey component)
Native Vegetation Solutions (2013) Level 1 Flora and Vegetation Survey of the Proposed Mount Mason Haul Road (M29/414, M29/408, G29/22, G29/23, L29/79, L29/100). Consultant's report to Jupiter Mines Ltd.	Level 1 Targeted Survey of Proposed Haul Road from Orebody Areas to Menzies
Yunndaga Siding Study Area	
Paul Armstrong & Associates (2012) Vegetation Survey and Rare Flora Search at the Menzies Railhead for Mt Mason Project, Conducted June 2011. Consultant's report to Jupiter Mines Ltd.	Level 1 Reconnaissance and Targeted Survey of Rail Siding and associated Laydown Areas
Outback Ecology Services (2013) Level 1 Flora and Fauna Assessment Menzies Bypass and Yunndaga Rail Siding. Consultant's report to Jupiter Mines Ltd.	Level 1 Targeted Flora and Fauna Assessment of Proposed Haulage Route Bypass, Rail Siding and associated Laydown Areas; includes review of all reports to date

Relevant reports prepared by Western Botanical on adjacent BIF ranges were reviewed and information added to that presented in the DBCA databases.

3.2. Field Survey

The current Reconnaissance field survey was undertaken by two botanist and one field assistant over the period 14th to 22nd April 2021. Survey involved utilising vegetation mapping prepared by previous consultants which were either validated or amended in the field.

- In a six day period, vegetation mapping was extended beyond previous mapping limits, to a buffer of 500m around all planned infrastructure at Mount Mason and the proposed haul road to the Menzies – Sandstone Road. Not all areas within the expanded buffer were able to be assessed in the timeframe available and completion of mapping will be required at a later date.
- A one day reconnaissance review of vegetation was undertaken at Yundaga when significant inaccuracies were observed, indicating that a complete revision of mapping at this site was required to be undertaken at a later date.

At both sites, the following was undertaken:

- Vegetation was assessed on foot at sites representative of homogeneous reflectance as shown on (i) laminated colour satellite imagery field maps at 1:10,000 scale and (ii) on Google Earth imagery on laptops. Field maps were annotated with vegetation types and boundaries drawn where this could be done reasonably confidently.
- Vegetation descriptions inclusive of species present, landform, soil and any significant flora were documented at representative sites.
- All flora encountered was recorded and reference specimens of most species were taken for compilation of a field herbarium, future reference and to meet license conditions.

3.3. Flora Specimen Identification

Specimens of flora were confirmed using resources at Western Botanical, the WA Herbarium's Reference Herbarium and Research Collection where required, and on-line resources. Where full identification could not be achieved, specimens were marked for recollection at a later date.

3.4. Significant Flora

Specimens of significant flora were added to the Western Botanical Specimen Database and have been prepared for vouchering at the WA Herbarium.

3.5. Weeds

Weed species were recorded in a similar fashion to native flora and specimens retained for verification of identification and vouchering at the WA Herbarium as required.

3.6. Vegetation Condition

Vegetation Condition was scored utilising the Vegetation Condition Scale presented in EPA Guidance (2016), Appendix 1.

4. Results and Discussion

4.1. Desktop Assessment – adapted from Western Botanical (2021a)

4.1.1. Flora and Vegetation

The flora of the tenements is likely to reflect that of the eastern Murchison Biogeographic region more-so than that of the north-eastern Coolgardie biogeographic region to the south. The flora of the BIF ranges is expected to be dominated by Mulga (*Acacia aneura* and its allies), *Acacia quadrimarginea* (Granite Mulga), and a range of *Thryptomene*, *Prostanthera* and *Eremophila* species in the mid-shrub stratum and grasses in the lower stratum likely dominated by *Eragrostis*, *Enneapogon* and *Aristida* species. Sandplains are likely to support *Acacia* shrublands over *Triodia basedowii* hummocked Spinifex Grasslands with occasional emergent eucalypts in a mature state and a wide range of relatively short-lived shrubs in a recent post-fire state.

The flora recorded was typical for the landscapes intercepted in the southern portion of the Murchison biogeographic region. While no significant range extensions were reported, one species, *Hysterobaeckea longipes*, is part of a complex and its occurrence within the Study Area represents a disjunct occurrence from the main range of the species. An error in plotting the location of this species is suspected.

4.1.2. Conservation-Significant Flora

The review of publicly available DBCA databases (15-1120FL) returned sixty one species with conservation significance with records in a 20km radius of a centroid within the Study Area,

Table 5 and Figure 5. Within this, ten Priority 1, 11 Priority 2, 27 Priority 3 and nine Priority 4 species were returned. The list also returned four species listed as Threatened Flora in Western Australia. No Federally EPBC Listed Threatened Flora are known within or in the immediate vicinity of the Study Area.

Of the four Threatened Flora species returned:

- *Eucalyptus crucis* subsp. *crucis* is a granite rock endemic and is known from several populations considerably south of the Study Area and is considered unlikely to occur within the Study Area.
- *Myriophyllum lapidicola* is an aquatic annual herb known from granite outcrops in the eastern Avon Wheatbelt and is unlikely to occur in the Study Area.
- *Ricinocarpos brevis* is a Banded Ironstone Formation (BIF) endemic known within reasonable proximity to the Study Area with populations at the Windarling Range, Johnson Range and Perrinvale Station. This species and suitable potential habitat has been extensively surveyed in the region by Western Botanical and is therefore considered unlikely to occur within the Study Area.

- *Seringia exastia* is listed as a Threatened Flora taxon due to a recent (2020) revision of taxonomy of species but is widespread within central and northern Western Australia and will be removed from the Threatened Flora List following a pending meeting of the Threatened Species Scientific Committee (pers. comm. Melanie Smith, DBCA).

Of the 57 Priority Flora returned:

Twenty-six Priority Flora species are considered Unlikely to occur within the Study Area due to either (i) their known ranges being at considerable distance from the Study Area, and/or (ii) the habitats which they occupy are considered unlikely to occur within the Study Area. These species can be discounted from further consideration.

- Of these, two are database errors:
 - *Acacia effusa* P3 has a Pilbara distribution. The one point on ex-Cashmere Downs (PERTH 07737742), is likely either a taxonomic or data entry error at WAHERB and has since been reviewed (B. Maslin pers. comm.).
 - *Eremophila dendritica* P2 has a western Nullarbor distribution and its inclusion in the database search results is in error and has since been reviewed by WAHERB.
- Twenty-nine Priority Flora species are considered as Possibly occurring within the Study Area, either due to (i) close proximity of known populations to the Study Area and/or (ii) habitats supporting the species are known to, or are likely to, occur within the Study Area.
 - Of these, the newly recognised *Hibiscus* sp. Perrinvale Station (J. Warden & E. Ager WB 10581) P1 is likely to occur on the upper to lower slopes of the BIF ranges and associated duricrust outcrops within the Study Area. Given its discovery in the region in 2019 by Western Botanical, it is unlikely to have been surveyed in previous botanical assessments within tenements. It is a cryptic species and is difficult to assess in seasons outside those with favourable rainfall.
- Five Priority species have records plotted within tenements: *Calotis* sp. Perrinvale Station (R.J. Cranfield 7096) P3, *Chrysocephalum apiculatum* subsp. *norsemanense* P3, *Drosera eremaea* P1, *Philothea deserti* subsp. *brevifolia* P3 and *Pterostylis virens* P3. Of these:
 - *Chrysocephalum apiculatum* subsp. *norsemanense* P3 and *Philothea deserti* subsp. *brevifolia* P3 are species found on gravely sandplains with *Acacia* shrublands and *Triodia* hummocked grassland (Spinifex). Both species are fire responsive, being particularly abundant after fire and numbers diminish as vegetation matures. The location of *Chrysocephalum apiculatum* subsp. *norsemanense* P3 may not be accurately plotted.
 - *Calotis* sp. Perrinvale Station (R.J. Cranfield 7096) P3 is found in non-saline red-brown loamy to clayey soils, often under *Eucalyptus ravidia*, *E. salubris* (Gimlet) or *E. salmonophloia* (Salmon Gum) trees in winter wet depressions. The location of this site may not be accurately plotted.

- The small perennial geophyte *Drosera eremaea* P1 (and *Drosera* aff. *eremaea*) is known on mid slopes of BIF ranges, creeklines in granitoid landforms and most records on site are considered accurately plotted.
- The small perennial geophyte *Pterostylis virens* P3 are associated with shallow sandy deposits on and around granite outcrops. Locations of these are plotted using GPS and are likely accurate.

A correlation of Priority Flora records plotted with Tenements is presented in Table 4 and an assessment of the likelihood of Conservation-Significant Flora occurring within the Study Areas is presented in Table 5.

Table 4. Correlation of Priority Flora with Known Occurrences Within Tenements

Taxon	Cons Code	Presence within Tenements	Grid	Easting	Northing	Comment
Calotis sp. Perrinvale Station (R.J. Cranfield 7096)	P3	Present on L 29/100	51J	240635	6770606	Positional error suspected
Chrysocephalum apiculatum subsp. norsemanense	P3	Present on L 29/079	51J	247490	6754123	Positional error suspected
Drosera eremaea	P1	Present on M 29/408	51J	243320	6776133	Within and adjacent to disturbance footprints
Philotheca deserti subsp. brevifolia	P3	Present on L 29/100	51J	247490	6754123	Outside proposed disturbance envelopes
Pterostylis virens	P3	Present on L 29/078	51J	255611	6751867	Outside proposed disturbance envelopes

Distributions of Priority Flora known within and adjacent to the Study Area are presented in Figure 5, Figure 6 and Figure 7.

Table 5. Analysis of Conservation Significant Flora Known in the Region

Taxon	Cons_Code	TPFL	WAHERB	WB	Habitat	Likelihood	Comment
<i>Acacia effusa</i>	P3		1		Ironstone Hills	Unlikely	Acacia effusa P3 has a Pilbara distribution. The one point on ex-Cashmere Downs (PERTH 07737742), is likely either a taxonomic or data entry error at WAHERB and is being reviewed (B. Maslin pers. comm.).
<i>Acacia subrigida</i>	P2		1		Sandplains	Possible	Widespread, poorly collected
<i>Aluta teres</i>	P1	1	1		Sandplains	Possible	Known nearby Study Area, Cashmere Downs, Bulga Downs, Ida Valley, dependant on suitable habitat
<i>Banksia arborea</i>	P4	1	1		Ironstone Hills	Unlikely	Known from BIF ranges west of tenements, different vegetation association to that within Study Area
<i>Beyeria lapidicola</i>	P1	1	1		Ironstone Hills	Possible	Known nearby Study Area, Mount Richardson, dependant on suitable habitat
<i>Calandrinia kalanniensis</i>	P2		1		Granite outcrops	Unlikely	Main distribution significantly south-west of Study Area
<i>Calandrinia quartzitica</i>	P1		1		Quartz outcrops	Possible	Known from quartz outcrops near slat lakes east of Study Area
<i>Calandrinia</i> sp. Menzies (F. Hort et al. FH 4100)	P3		1		Red loamy plains	Possible	Known nearby Study Area, dependant on suitable habitat
<i>Calotis</i> sp. Perrinvale Station (R.J. Cranfield 7096)	P3		1		Red loamy plains	Known within tenements	Present on L 29/100 though positional error suspected
<i>Calytrix hislopii</i>	P3		1		Lateritic breakaways	Possible	Known from north of tenements
<i>Calytrix praecipua</i>	P3		1		Archaean granite breakaways	Unlikely	Main distribution significantly east and north of Study Area
<i>Chrysocephalum apiculatum</i> subsp. <i>norsemanense</i>	P3		1		Sandplains	Known within tenements	Present on L 29/079 though positional error suspected

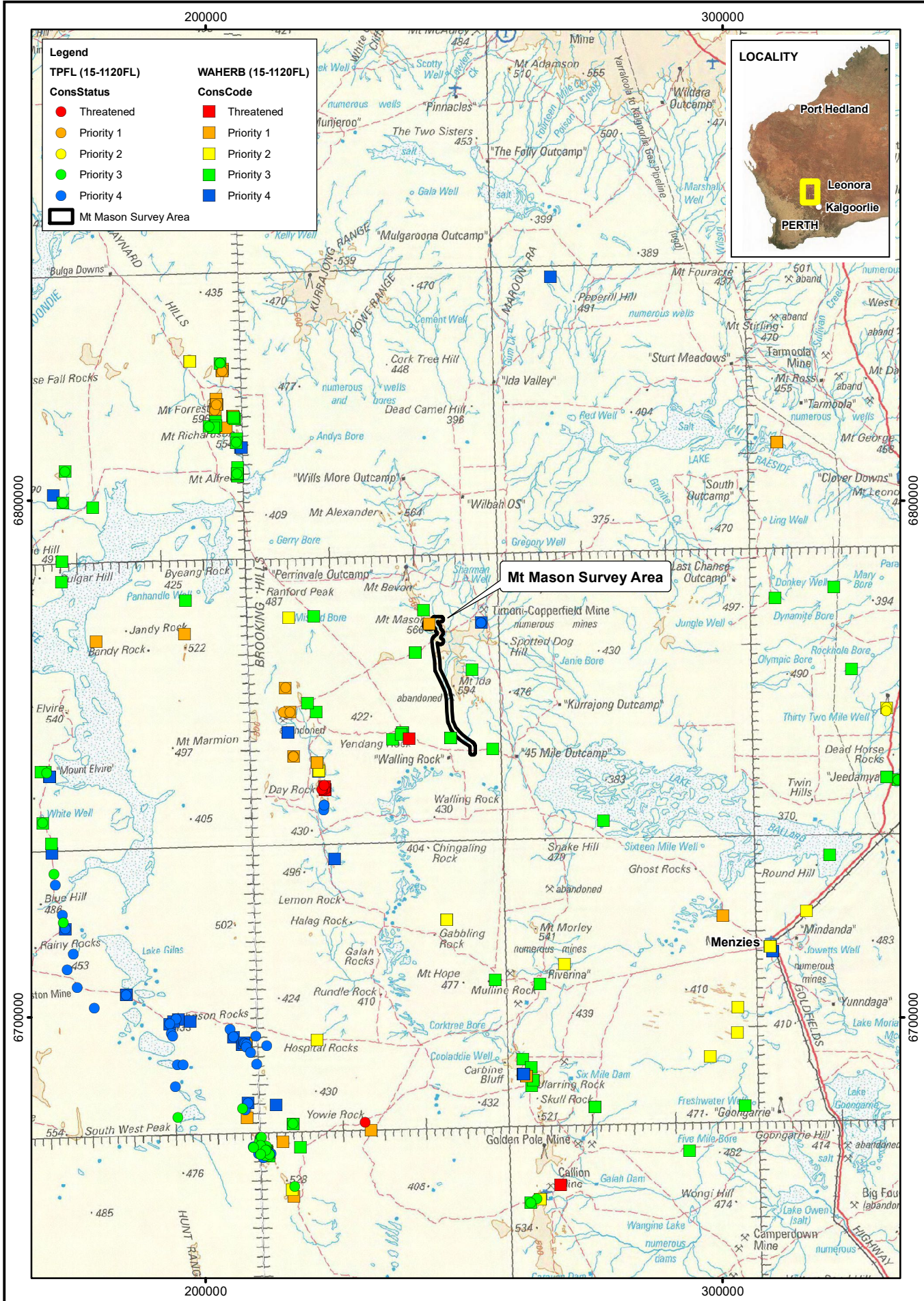
Taxon	Cons Code	TPFL	WAHERB	WB	Habitat	Likelihood	Comment
<i>Drosera eremaea</i>	P1		1		Granite outcrops, BIF ranges	Known within tenements	Present on M 29/408, within orebody and adjacent to haul road areas
<i>Eremophila dendritica</i>	P2	1			Stony plains	Unlikely	Database positional error
<i>Eremophila mirabilis</i>	P2	1	1		Archaean granite breakaways	Unlikely	Main distribution significantly east of Study Area
<i>Eremophila veronica</i>	P3		1		Lateritic breakaways	Unlikely	Main distribution significantly south of Study Area
<i>Eucalyptus crucis</i> subsp. <i>crucis</i>	T		1		Granite outcrops	Unlikely	Well surveyed, granite rock endemic, main distribution significantly south of Study Area
<i>Eucalyptus educta</i>	P2		1		Granite outcrops	Possible	Main distribution significantly south-west of Study Area
<i>Eucalyptus formanii</i>	P4	1	1		Sandplains	Possible	Main distribution west of the Study Area
<i>Eucalyptus jutsonii</i> subsp. <i>jutsonii</i>	P4		1		Sandplains and sand dunes	Unlikely	Main distribution significantly south-east of Study Area
<i>Euryomyrtus recurva</i>	P3	1	1		Sandplains, gravelly soils	Unlikely	Main distribution significantly west of Study Area
<i>Eutaxia nanophylla</i>	P3		1		Red loamy plains	Unlikely	Main distribution significantly south of Study Area
<i>Eutaxia rubricarina</i>	P3		1		Red loamy plains	Unlikely	Main distribution significantly south-west of Study Area
<i>Goodenia berringbinensis</i>	P4		1		Red loamy plains, water courses	Possible	Main distribution significantly north-west of Study Area
<i>Grevillea erectiloba</i>	P4	1	1		Red loamy plains	Possible	Main distribution significantly south-west of Study Area, positional error of record near Menzies is highly likely
<i>Grevillea georgeana</i>	P3	1	1		Ironstone Hills, laterite gravel rises	Possible	Main distribution significantly south-west of Study Area
<i>Grevillea inconspicua</i>	P4		1		Red loams over subcropping greenstone	Possible	Main distribution significantly north-east of Study Area
<i>Grevillea secunda</i>	P4		1		Sandplains and sand dunes	Possible	Main distribution significantly south-east of Study Area
<i>Grevillea</i> sp. Yerilgee Hills (T. Laslett TL 025)	P1		1		Sandplains	Unlikely	Main distribution significantly south of Study Area

Taxon	Cons_Code	TPFL	WAHERB	WB	Habitat	Likelihood	Comment
<i>Grevillea subterlineata</i>	P3		1		Gravelly sand	Unlikely	Highly disjunct distribution, significantly south and north-west of the Study Area
<i>Hemigenia exilis</i>	P4	1	1		Duricrust outcrops	Possible	Main distribution north-west of the Study Area
<i>Hibbertia lepidocalyx</i> subsp. <i>tuberculata</i>	P3	1	1		Ironstone Hills	Unlikely	Main distribution significantly south of Study Area
<i>Hibiscus krichauffianus</i>	P3		1		Red loamy plains, stony hills	Possible	Widely distributed, poorly collected
<i>Hibiscus</i> sp. Perrinvale Station (J. Warden & E. Ager WB 10581)	P3		1	1	Ironstone Hills	Possible	Widely distributed, poorly collected, a BIF and duricrust remnant Endemic
<i>Homalocalyx grandiflorus</i>	P3		1		Sandplains	Possible	Main distribution significantly south of Study Area
<i>Hyalosperma stoveae</i>	P2		1		Sandplains	Possible	Main distribution significantly west of Study Area
<i>Hysterobaeckea ochropetala</i> subsp. <i>cometes</i>	P3		1		Sandplains	Unlikely	Main distribution significantly south of Study Area, positional error of record near Menzies is highly likely
<i>Jacksonia lanicarpa</i>	P1	1	1		Sandplains	Possible	Known nearby Study Area, dependent on suitable habitat
<i>Labichea eremaea</i>	P3	1	1		Sandplains	Possible	Known nearby Study Area, dependent on suitable habitat
<i>Malleostemon</i> sp. Adelong (G.J. Keighery 11825)	P2		1		Sandplains and sand dunes	Possible	Known nearby Study Area, dependent on suitable habitat
<i>Menkea draboides</i>	P3		1		Red sand, loam, granite rocks	Possible	Known nearby Study Area, dependent on suitable habitat
<i>Micromyrtus serrulata</i>	P3	1	1		Sandy clayey soils over granite	Possible	Known nearby Study Area, dependent on suitable habitat
<i>Mirbelia ferricola</i>	P3	1	1		Ironstone Hills	Possible	Main distribution significantly south of Study Area
<i>Myriophyllum lapidicola</i>	T	1			Granite outcrops	Unlikely	An annual growing in rock pools on granite outcrops

Taxon	Cons Code	TPFL	WAHERB	WB	Habitat	Likelihood	Comment
<i>Newcastelia insignis</i>	P2		1		Sandplains	Possible	Known nearby Study Area, dependent on suitable habitat. positional error of record near Menzies is highly likely
<i>Notisia intonsa</i>	P3		1		Red clay, winter wet depressions	Possible	Main distribution significantly south of Study Area, dependent on suitable habitat
<i>Phebalium</i> sp. Yerilgee Sandplain (J. Jackson 223)	P2		1		Sandplains	Unlikely	Main distribution significantly south of Study Area
<i>Philotheca coateana</i>	P3	1	1		Sandplains	Possible	Known nearby Study Area, dependent on suitable habitat
<i>Philotheca deserti</i> subsp. <i>brevifolia</i>	P3	1	1		Sandplains	Known within tenements	Present on L 29/079, outside proposed disturbance envelopes
<i>Phyllanthus baeckeoides</i>	P3	1	1		Drainage lines associated with BIF Ranges	Possible	Known in region nearby Study Area, dependent on suitable habitat
<i>Pterostylis elegantissima</i>	P1		1		Winter wet clay soil	Unlikely	Known distribution significantly south-east of Study Area
<i>Pterostylis virens</i>	P3		1		Granite outcrops	Known within tenements	Present on L 29/078, , outside proposed disturbance envelopes
<i>Pterostylis xerampelina</i>	P1		1		Granite outcrops	Unlikely	Main distribution significantly south of Study Area, dependent on suitable habitat
<i>Ricinocarpos brevis</i>	T	1	1		Ironstone Hills	Unlikely	Has been extensively surveyed
<i>Seringia exastia</i>	T*		1		Sandplains	Probable	Known nearby, Listed as Threatened due to technicality, abundant and widespread species
<i>Tecticornia mellarium</i>	P1		1		Salt lake margins	Possible	Suitable habitat may be present on L29/081
<i>Thryptomene eremaea</i>	P2		1		Sandplains	Unlikely	Main distribution significantly south-east of Study Area, dependent on suitable habitat, positional error of record near Menzies is highly likely.
<i>Thryptomene</i> sp. Leinster (B.J. Lepschi & L.A. Craven 4362)	P3		1		Archaean granite breakaways	Unlikely	Main distribution significantly east of Study Area, close to <i>Thryptomene decussata</i>

Taxon	Cons_Code	TPFL	WAHERB	WB	Habitat	Likelihood	Comment
Thysanotus brachyantherus	P2		1		Limestone	Unlikely	Main distribution significantly south of Study Area
Thysanotus sp. Ennuin (N. Gibson & M. Lyons 2665)	P1		1		Loamy soils, winter wet depressions	Unlikely	Main distribution significantly south-west of Study Area
Wurmbea murchisoniana	P4		1		Granite rocks, wet depressions	Unlikely	Widespread, poorly collected, main distribution significantly west of Study Area

Figure 5. Species With Conservation Significance Returned in DBCA Database Query 15-1120FL.



Legend

TPFL (15-1120FL)

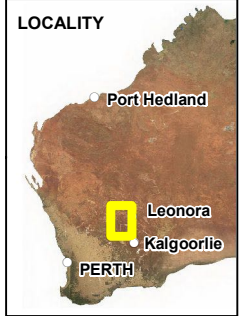
ConsStatus

- Threatened
- Priority 1
- Priority 2
- Priority 3
- Priority 4
- ▭ Mt Mason Survey Area

WAHERB (15-1120FL)

ConsCode

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



Ref. Flora (Department of Biodiversity, Conservation and Attractions)

0 10 20km

Scale: 1:1,000,000
MGA94 (Zone 51)

CAD Ref: a2798_M_R001_01
Date: July 2021

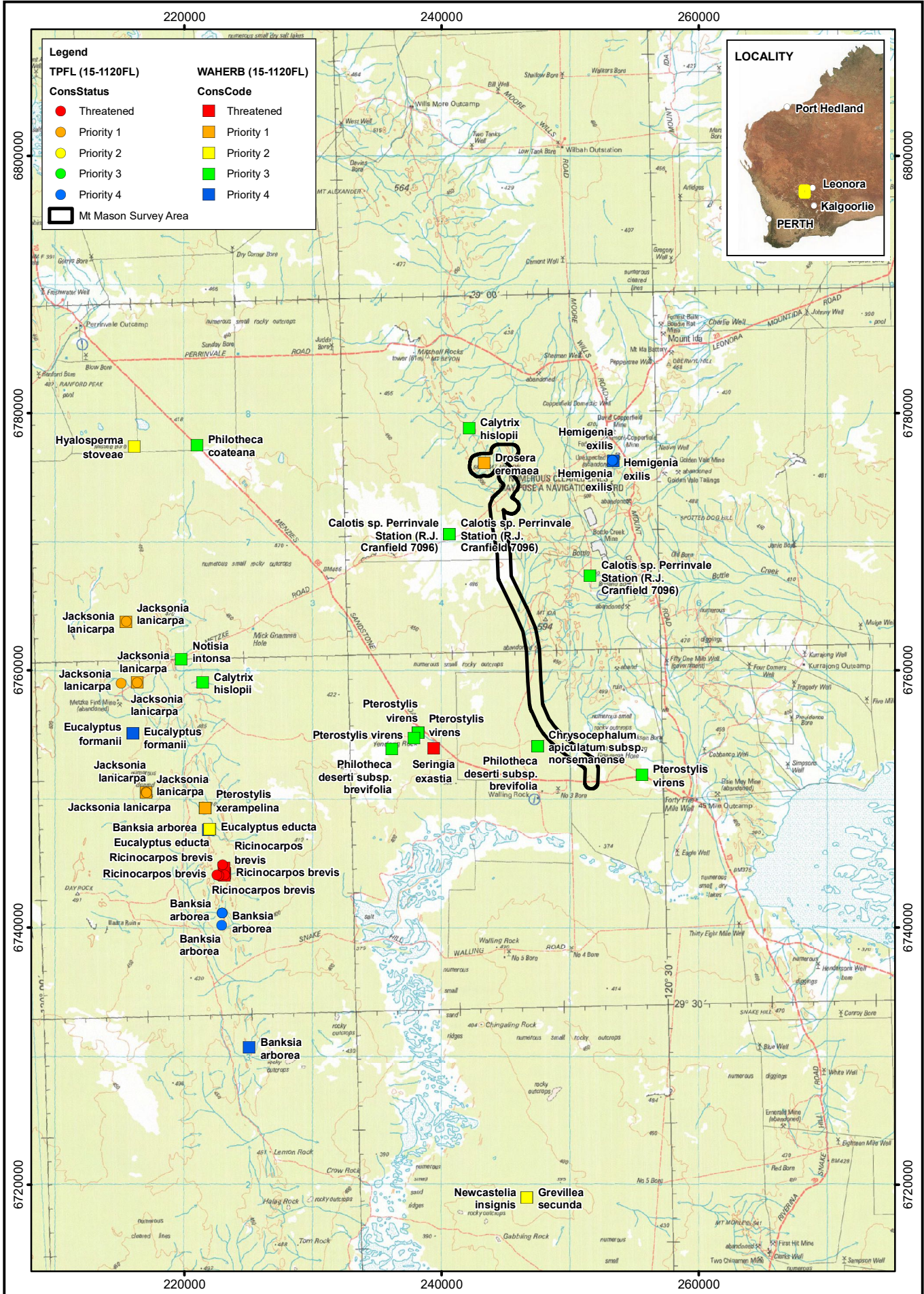
Rev: A | A4

Author: G. Cockerton | WB Ref:

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

Juno Minerals Pty Ltd
Mt Mason Project
DBCA Flora Search Results

Figure 6. Species With Conservation Significance Within and in Close Proximity to the Mount Mason Study Area



Ref. Flora (Department of Biodiversity, Conservation and Attractions)

0 4 8km
 Scale: 1:400,000
 MGA94 (Zone 51)

CAD Ref: a2798_M_R001_02
 Date: July 2021

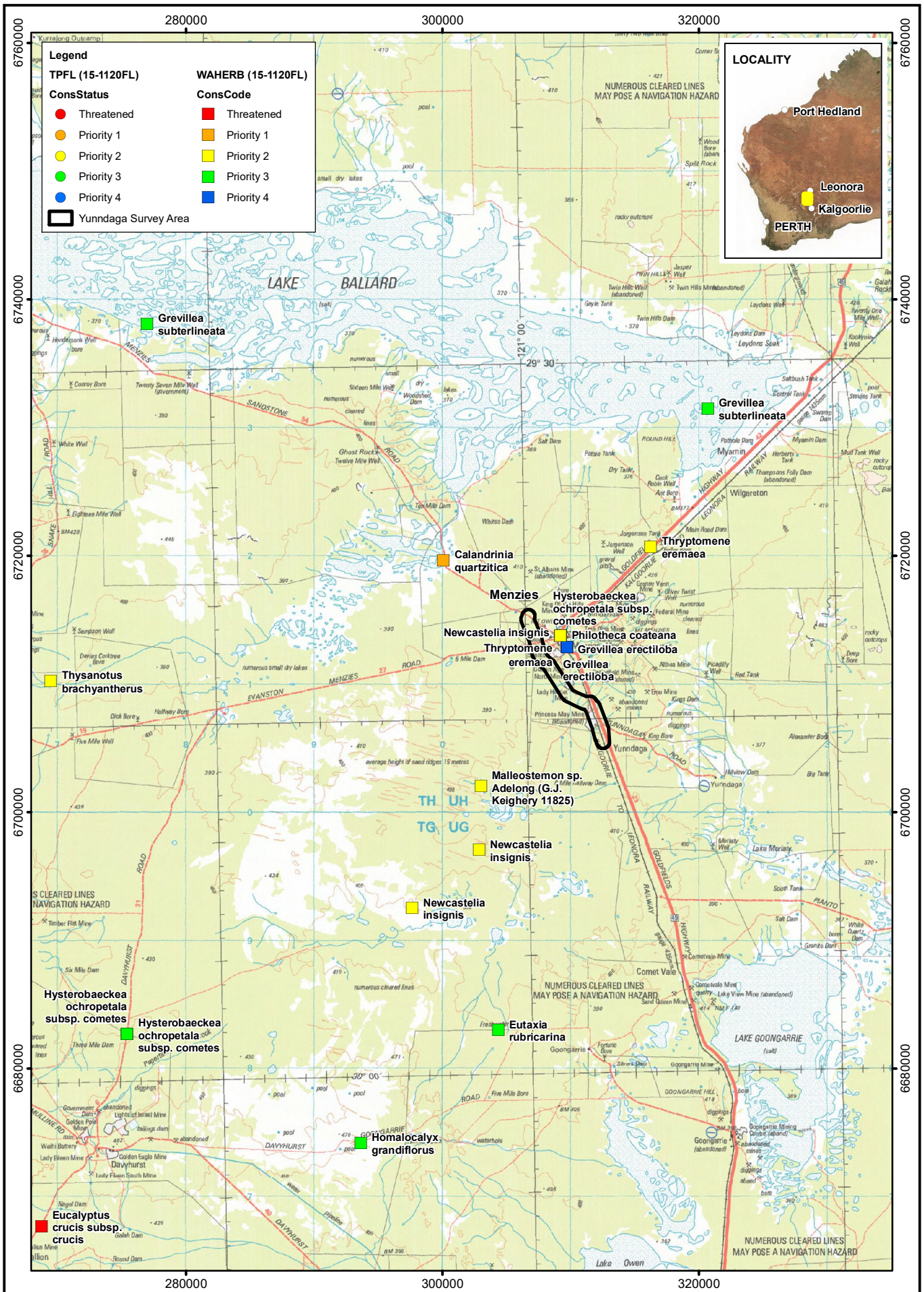
Rev: A | A4

Western Botanical

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

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Mt Mason Project
DBCAs Flora Search Results

Figure 7. Species With Conservation Significance Near Yundaga Siding



Ref. Flora (Department of Biodiversity, Conservation and Attractions)

0 4 8km
 Scale: 1:400,000
 MGA94 (Zone 51)

Western Botanical
 Author: G. Cockerton WB Ref:
 CAD Ref: a2798_Y_R001_02 Drawn: CAD Resources ~ www.cadresources.com.au
 Date: July 2021 Rev: A | A4 Tel: (08) 9246 3242 ~ Fax (08) 9246 3202

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Yundaga Siding Project
DBCA Flora Search Results

A review of relevant Western Botanical reports for sites with similar landforms and geology to those of the Study Area within a 100km radius of the Study Area was also undertaken, Figure 8, Table 3. Western Botanical reports for the Brooking Hills (Western Botanical 2010), Mt Richardson (Western Botanical 2011a) and Churchill Polygon (Western Botanical 2011b) were reviewed. Species with conservation significance reported within WB reports or subsequently recognised at each Adjacent Study Site are presented in Table 7.

Figure 8. Adjacent Study Sites Assessed by Western Botanical



Table 6. Relevant WB Adjacent Study Site Reports Reviewed

Site	Distance and Direction from Study Area	Landforms, Geology	Indicative Coordinate		
Brooking Hills	55 km NW	BIF, debris slopes, outwash plains	51J	208100	6788700
Churchill Polygon	55km WNW	BIF, debris slopes, outwash plains, drainage systems	50J	782000	6780000
Mt Richardson	74km NW	BIF, debris slopes, outwash plains, sandplains	50J	790000	6816000

Table 7. Conservation-Significant Species Correlation with WB Adjacent Study Sites

	Brooking Hills	Churchill Polygon	Mt Richardson
Aluta teres P1		1	
Beyeria lapidicola P1			1
Calytrix creswellii P3			1
Calytrix verruculosa P3			1
Hibiscus sp. Perrinvale Station P1 ¹		1	
Philothea coateana P3		1	
Phyllanthus baeckeoides P3			1
Drosera sp. in the <i>D. macrantha</i> ² – <i>D. eremaea</i> complex	1		1

While species with conservation significance recorded at these sites are useful in developing a regional context for some species, the sites covered by Western Botanical previous surveys do not overlap the current Study Area and are at somewhat (55 to 74 km) disjunct. No species with Conservation Significance were recorded at the Brooking Hills while the Churchill Polygon supports three Priority species and Mt Richardson supports four taxa with conservation significance. There is no overlap in the Priority species present at the two sites.

Drosera sp. in the *macrantha* – *D. eremaea* complex (noted then as *Drosera macrantha* subsp. *macrantha*) were recorded at the Brooking Hills and Mt Richardson sites. These may in fact reflect *Drosera eremaea*.

¹ *Hibiscus* sp. Perrinvale was recognised after the WB report was produced.

² Reported as *Drosera macrantha* subsp. *macrantha*

At Mt Richardson, *Calytrix uncinata* recorded (Western Botanical 2011a) and reported as Priority 4 has subsequently been removed from the Priority Flora list and *Calytrix* sp. Triangles (J. Warden & E. Ager WB19712) reported was subsequently identified as *Calytrix erosipetala* which has also recently been removed from the Priority Flora list.

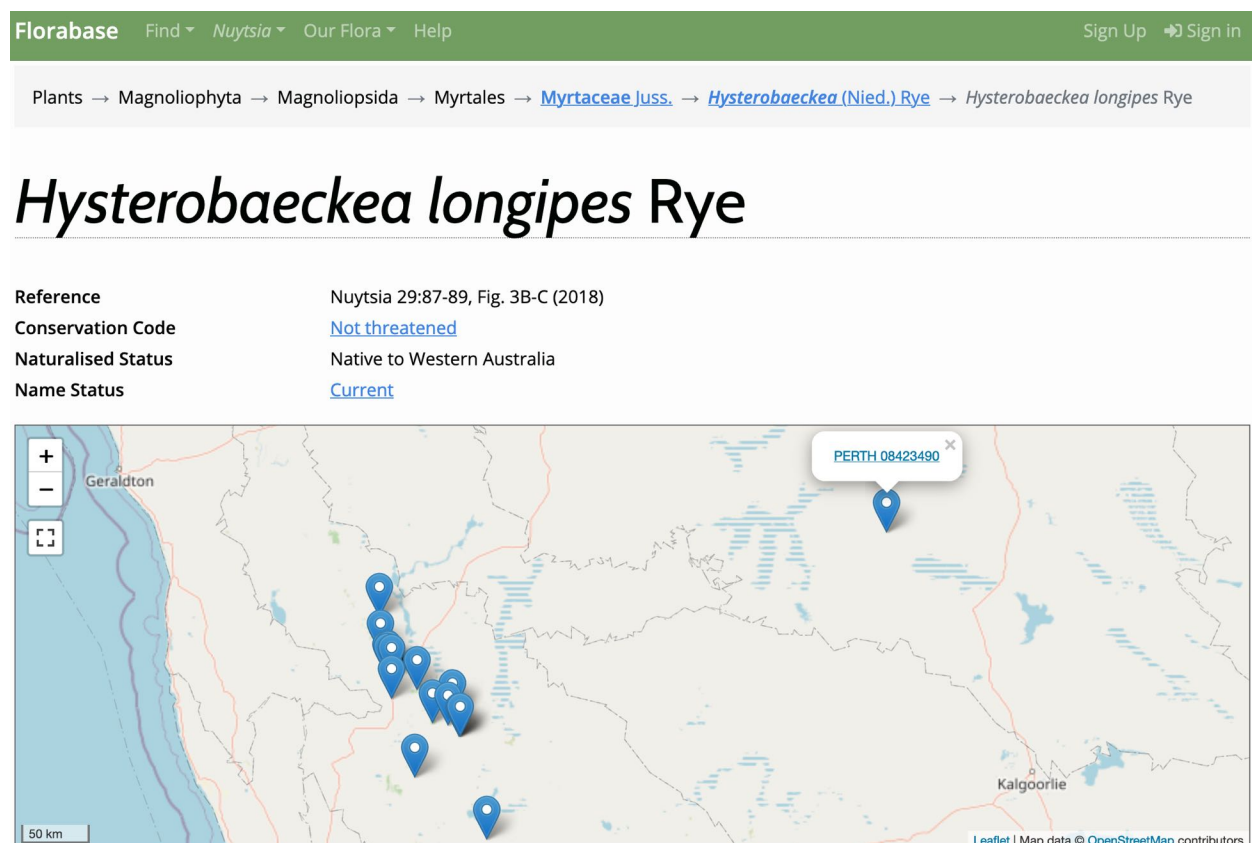
At the Churchill Polygon, *Hibiscus* sp. Perrinvale Station was recognised as a new species following surveys east of Leonora (Western Botanical, 2019) and was listed as Priority 1 by DBCA in 2019.

4.1.3. Disjunct Occurrences and Range Extensions

No significant range extensions were reported in previous consultant's reports.

One species, reported in Native Vegetation Solutions (2013) as *Baeckea* sp. Wubin, now *Hysterobaeckea longipes*, represents a disjunct occurrence of this species, some 375 km east of its known range in the northern Avon Wheatbelt west of Mongers Lake, north of Wubin, Figure 9. While no voucher from the Mt Mason project area is reported, a specimen of the species from within the proposed haul road alignment is vouchered (PERTH 8423490, P. Knapton 47, 9/4/2018). The identification of this specimen has been reviewed and is not in doubt (Dr. Barbara Rye, pers. comm.). However, the location information is queried as the associated species noted with the specimen do not occur within the Mt Mason Study Area. It is suggested that the location notes accompanying the specimen and the coordinate given are inaccurate, Figure 9.

Figure 9. *Hysterobaeckea longipes* records in WA



4.1.4. Species Not Fully Identified

Previous reports on flora and vegetation of tenements held by Jupiter Mines also reported the following species which have not been fully identified, Table 8. While these have not been fully identified due to unavailability of suitable material following survey, the majority of these may not represent species with conservation significance, however, some require review.

Table 8. Species Previously Reported but Not Fully Identified

Species	P.G. Armstrong & Associates (2008)	Native Vegetation Solutions (2012)	Paul Armstrong & Associates (2012)	Native Vegetation Solutions (2013)	Outback Ecology Services (2013)	Issue
Corchorus sp.	1					No Corchorus in this region, specimen not vouchered at WAHERB
Liliaceae sp.	1					Not vouchered at WAHERB
Poaceae (Poa) sp. PA07/506	1					Not vouchered at WAHERB
Drosera sp. (P.G. Armstrong 07/545)	1					Specimen at WAHERB (PERTH 07801823)
Apocynaceae sp.		1				Not vouchered at WAHERB
Corchorus sp.		1				No Corchorus known in the region. Not vouchered at WAHERB
Eucalyptus sp. (sterile)		1				Not vouchered at WAHERB
Podolepis sp. (ATQ14-6)				1		Not vouchered at WAHERB
Eucalyptus sp. (sterile)				1		Not vouchered at WAHERB
Goodenia sp.				1		Not vouchered at WAHERB
Myrtaceae sp. #3 (ATQ120-7)				1		Not vouchered at WAHERB
Unknown sp. (unknown family).				1		Not vouchered at WAHERB
Haloragis sp.				1		Not vouchered at WAHERB
Eucalyptus sp.				1		Not vouchered at WAHERB
Alectryon oleifolius				1		Not vouchered at WAHERB, NO SUBSP noted, likely subsp. canescens

Species	P.G. Armstrong & Associates (2008)	Native Vegetation Solutions (2012)	Paul Armstrong & Associates (2012)	Native Vegetation Solutions (2013)	Outback Ecology Services (2013)	Issue
Frankenia sp.				1		Not vouchered at WAHERB
Sclerolaena sp.				1		Not vouchered at WAHERB
Psyrax sp.,				1		Not vouchered at WAHERB
Calandrinia sp.				1		Not vouchered at WAHERB
Sida sp.				1		Not vouchered at WAHERB
Hibiscus sp.				1		Not vouchered at WAHERB
Eremophila sp. YUNGVEG06				1		Missing from Species List
Abutilon sp. YUNGVEG10				1		Missing from Sp. List
Acacia sp. YUNGVEG21				1		Missing from Sp. List

Given the high endemism of flora of the BIF ranges in the region, there is some risk that one or more of these species may represent species with either taxonomic or conservation significance. In particular, the *Corchorus* sp. and *Hibiscus* sp. reported should be addressed in future targeted surveys.

4.1.5. Possible Mis-identifications of Flora

Four species previously reported represent possibly mis-identifications of flora, Table 9. None of these have conservation significance.

Table 9. Potential Misidentifications of Flora within Previous Consultants' Reports

Species Reported	Likely Correct Corrected Identification	P.G. Armstrong & Associates (2008)	Native Vegetation Solutions (2012)	Paul Armstrong & Associates (2012)	Native Vegetation Solutions (2013)	Outback Ecology Services (2013)
<i>Acacia ramulosa</i>	<i>Acacia cockertoniana</i> (BIF endemic)	1				
<i>Minuria cunninghamii</i>	<i>Olearia humilis</i> (Occurs on BIF and Laterite)	1				
<i>Eucalyptus lesouefii</i>	<i>Eucalyptus lesouefii</i> pruinose adult leaf form (G & S Cockerton WB40262) – newly recognised species, widespread	1				
<i>Solanum hystrix</i> (Weed)	<i>Solanum hoplopetalum</i> (a native species)					1

The possible misidentification of *Acacia cockertoniana* and *Olearia humilis* in PG Armstrong & Associates (2008) is corrected in Native Vegetation Solutions (2012). *Eucalyptus lesouefii* pruinose adult leaf form (G & S Cockerton WB40262) is a recently recognized species (mid 2020) which is widespread in the northern portion of the range of *E. lesouefii* (Malcolm French, pers. comm.) and not considered to warrant conservation listing. It is also common for *Solanum hoplopetalum* (a native species) to be misidentified as *Solanum hystrix* (a weed) and *S. hoplopetalum* is common and widespread in the region.

4.1.6. Declared Pests

Three species representing Declared Pests have been reported within or adjacent to the Yundaga Rail Siding: *Carthamnus lanatus* (Saffron Thistle), *Opuntia* sp. (Prickly Pear) and *Heliotropium europaeum* (Common Heliotrope). These and other weed species should be addressed in any development proposal at this site.

4.1.7. Weeds of National Significance (WONS)

Opuntia species (Prickly Pears) are listed as Weeds of National Significance (WONS). Notes on control of Prickly Pear are presented in Appendix 5. Opuntoid cacti were previously recorded near the Yundaga Study Area.

4.1.8. Threatened and Priority Ecological Communities

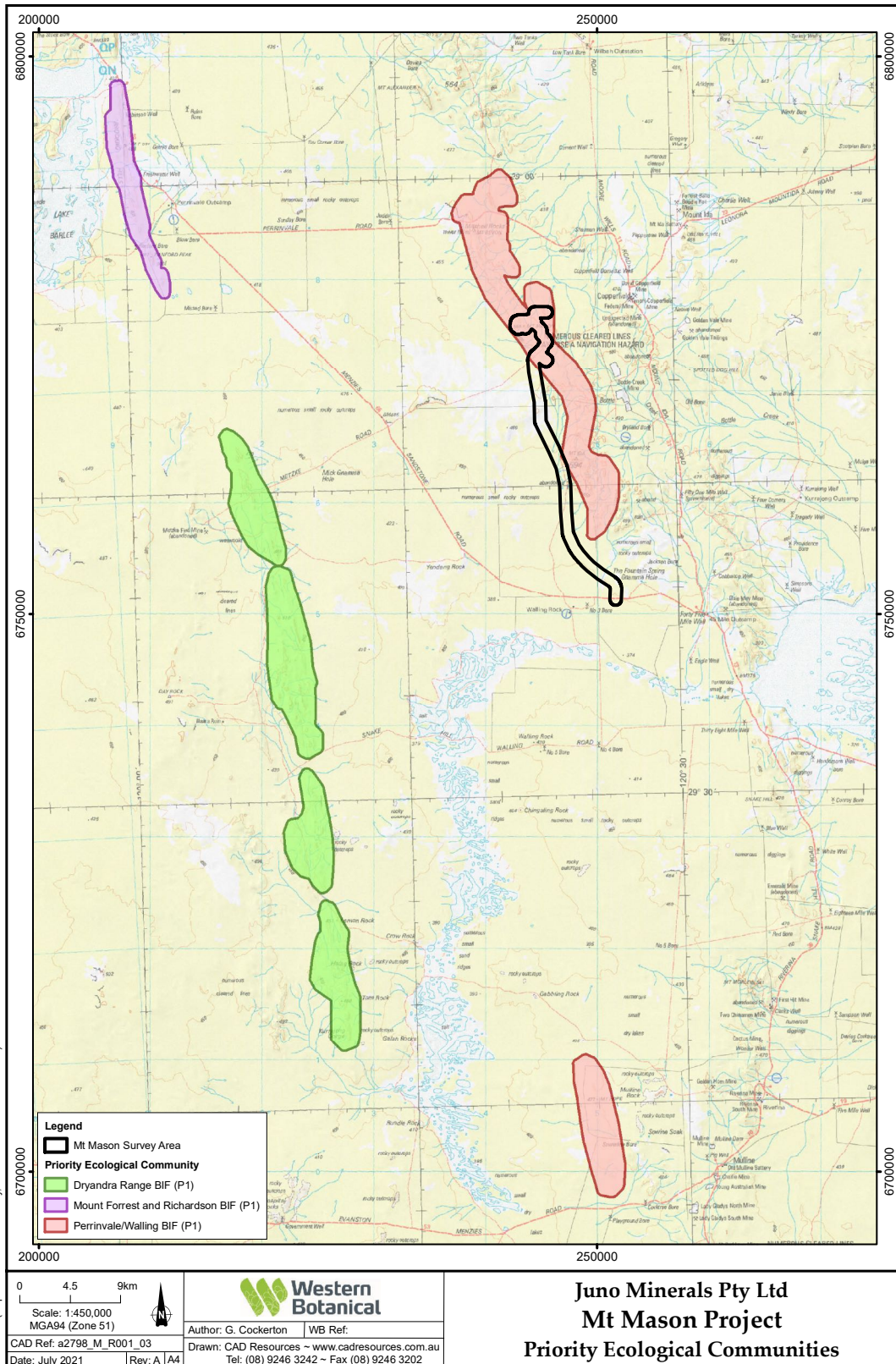
No Federally or State Listed Threatened Ecological Communities were identified within the Study Area.

The orebody areas and northern parts of the proposed haul road and the camp area all lie within the Perrinvale/Walling vegetation assemblages (banded ironstone formation) Priority 1 Priority Ecological Community. Tenements held by Juno Minerals are located within the central and southern parts of this PEC, Figure 10.

It is expected, upon evaluation, that some vegetation associations of the Study Area may be regionally restricted, particularly those associated with the geology of the BIF ranges and associated laterite caps and the erosion products from these ranges. These will most likely be widespread within similar landforms of the Mt Mason / Mt Ida area.

It is not expected that vegetation associations associated with (i) Archaean granite breakaways, (ii) aeolian sandplains or (iii) broad drainage tracts would be considered to fall within the definition of the PEC.

Figure 10. Priority Ecological Communities of the Region



4.2. Field Survey – Mt Mason

4.2.1. Landforms

The Mt Mason Study Area includes the following landforms.

- Low banded ironstone formation (haematite) hills (two to three parallel series) of moderate relief, estimated at 20 to 75m above the surrounding plains, with moderate outcrop and small areas of tallus slopes;
- Colluvial slopes with laterite gravel, angular BIF colluvium and minor outcrop;
- Lower slopes with lateritic gravely and sandy lateritic gravely textures, colluvium and alluvium;
- Small, disjunct low rises of weathered ferruginous duricrust;
- Subcropping weathered, fractured basalt and gabbro with associated calcrete concretion;
- Aeolian yellow sandplain west of the orebody area;
- Aeolian orange sandplain on top of weathered Archaean granite plateaux;
- Weathered Archaean granite plateaux, low breakaway cliffs of 2 to 5m relief, kaolinitic footslopes and associated saline plains with coarse silty sand soils; and
- Narrow to broad drainage lines, extensive alluvial floodplains and areas subject to sheet flow, often with a mantle of shallow red silty sand.

4.2.2. Vegetation Mapping

Field survey at Mt Mason to date has recognised thirty four vegetation associations at the NVIS Level V *Association* where three dominant species in each stratum is used to define vegetation associations. Of these:

- 23 are Mulga Woodlands, ranging from tops of BIF ridges to low lying drainage tracts;
- 1 is a *Casuarina* Woodland on outcropping calcrete over basalt;
- 5 are *Eucalyptus* woodlands with either calcrete influenced soils or on clay;
- 1 represents a tall *Allocasuarina* shrubland on duricrust outcrop; and
- 4 represent low shrublands with emergent *Acacia* on Archaean granite plateaux or duricrust outcrops.

These are summarised in Table 10.

Table 10. Draft Vegetation Associations of the Mount Mason Study Area

Structural Formation	Vegetation Association Code	Vegetation Association Name
Acacia (Mulga) Woodlands	A1	Mulgas over Acacia cockertoniana A. quadrimarginea
Acacia (Mulga) Woodlands	A1.1	Acacia quadrimarginea, A. incurvaneura, A. mulganeura, A. caesaneura (narrow phyllode form) over Prostanthera althoferi subsp. althoferi, Hibbertia arcuata, Olearia humilis on BIF Ridge tops
Acacia (Mulga) Woodlands	A1.2	Acacia cockertoniana, A. mulganeura over Thryptomene decussata Shrubland
Acacia (Mulga) Woodlands	A2	Acacia incurvaneura over Philotheca brucei
Acacia (Mulga) Woodlands	A3	Mulga over Prostanthera althoferi subsp. althoferi, Olearia humilis, Eremophila forrestii subsp. forrestii
Acacia (Mulga) Woodlands	A4	Mulga over Acacia ramulosa subsp. ramulosa over Eremophila forrestii
Acacia (Mulga) Woodlands	A4	Acacia incurvaneura, A. cockertoniana, A. ramulosa, Eremophila forrestii subsp. forrestii
Acacia (Mulga) Woodlands	A4	Acacia incurvaneura, A. cockertoniana, A. ramulosa, Eremophila forrestii subsp. forrestii
Acacia (Mulga) Woodlands	A6	Acacia sibirica shrubland
Acacia (Mulga) Woodlands	A6	Acacia sibirica, A. ramulosa subsp. ramulosa shrubland
Acacia (Mulga) Woodlands	A7	Acacia sibirica over Dodonaea lobulata
Acacia (Mulga) Woodlands	A9	Acacia sibirica over Ptilotus obovatus (Upright form, G Cockerton et. al. 15206)
Acacia (Mulga) Woodlands	A10	Mulga, Acacia effusifolia, Eremophila forrestii subsp. forrestii
Acacia (Mulga) Woodlands	A11	Mulga over Acacia cockertoniana over Philotheca brucei
Acacia (Mulga) Woodlands	A12	Acacia incurvaneura over Acacia ramulosa subsp. ramulosa
Acacia (Mulga) Woodlands	A14	Acacia quadrimarginea, Acacia ramulosa subsp. ramulosa over Thryptomene costata
Acacia (Mulga) Woodlands	A15	Acacia quadrimarginea on granite outcrop
Acacia (Mulga) Woodlands	A16	Acacia incurvaneura, A. mulganeura, A. caesaneura over Eremophila forrestii
Acacia (Mulga) Woodlands	A17	Callitris columellaris, Acacia ramulosa subsp. ramulosa, Eucalyptus leptopoda subsp. leptopoda
Acacia (Mulga) Woodlands	A18	Acacia incurvaneura, A. ramulosa subsp. ramulosa, A. tetragonophylla, A. mulganeura over Ptilotus obovatus (typical Goldfields form)
Acacia (Mulga) Woodlands	A19	Acacia cockertoniana over Eremophila forrestii subsp. forrestii
Acacia (Mulga) Woodlands	BRX-P	Granite Breakaway with Acacia cockertoniana, A. ramulosa subsp. ramulosa, Calytrix desolata
Acacia (Mulga) Woodlands	DRMS	Drainage line Mulga Shrubland
Acacia Shrubland with Mallees	A13	Acacia effusifolia with emergent Mallees
Casuarina woodland	C1	Casuarina pauper over Ptilotus obovatus (Upright form, G Cockerton et. al. 15206)
Eucalypt woodlands	E1	Eucalyptus lesouefii Woodland over Eremophila pantonii shrubland
Eucalypt woodlands	E2	Eucalyptus salubris woodland

Structural Formation	Vegetation Association Code	Vegetation Association Name
Eucalypt woodlands	E3	Eucalyptus oleosa over Acacia incurvaneura and Acacia cockertoniana
Eucalypt woodlands	E4	Eucalyptus oleosa, Acacia incurvaneura, Acacia tetragonophylla
Eucalypt woodlands	E5	Eucalyptus sp. (mallee) over Acacia ramulosa, A. hemiteles, Senna artemisioides subsp. filifolia
Low Shrublands	S1	Hibbertia arcuata, Myrtaceae sp. Shrubland on Duricrust outcrop
Low Shrublands	S2	Acacia cockertoniana over Thryptomene decussata
Low Shrublands	S4	Calytrix hislopii P3, Calytrix desolata Shrubland with emergent Acacia cockertoniana on Duricrust outcrop
Low Shrublands	S5	Frankenia sp. Shrubland on saline plains
Tall Shrublands	S3	Allocasuarina acutivalvis, A. cockertoniana, A. quadrimarginea Tall Shrubland (lacking Calytrix) on Duricrust outcrop

Clearer definition of these vegetation associations will be available following the completion of vegetation assessment at a later date where data from quadrats and subsequent statistical validation will be presented.

A draft vegetation map is presented in

Appendix 2. Areas for which vegetation association information is lacking have been left blank and will need to be addressed at a later date.

4.2.3. Flora

The majority (82%) of flora apparent on site were confidently identified in the field. The total species count for the April survey was 135 species, of which 24 (18%) are earmarked for re-collection with flowers / fruits to enable identification to species level.

The majority of these are well known and widespread in the region and are not considered significant species. Two species encountered were confirmed as Priority Flora: *Calytrix hislopii* P3 and *Philothea deserti* subsp. *brevifolia* P3.

A systematic Species List for the Mt Mason Study Area as recorded in April 2021 is presented in Appendix 3.

4.2.4. Significant Flora

Significant flora of the Study Area include conservation listed species, potentially novel taxa, records representing significant range extensions. Cumulatively, six significant flora are known within the Study Area:

- *Drosera eremaea* P1 – found on mid slopes of the BIF Range with one record of *Drosera* aff. *eremaea* P1 (PERTH 8600074) near the existing mine camp, both within and outside potential disturbance footprints.
- *Calytrix hislopii* P3 – found on low duricrust outcrops on low rises east of the orebody area, outside disturbance footprints.
- *Philothea deserti* subsp. *brevifolia* P3 – found on gravelly sandplains west of the proposed camp and haul road alignment, outside disturbance footprints.
- *Hysterobaeckea longipes* (PERTH 8423490), pending review of taxonomy and distribution within the Study Area – associated with Mulga woodlands within the haul road alignment.
- *Pterostylis virens* P3 – associated with granitoid landforms, outside disturbance footprints.
- *Corchorus* sp. reported by Native Vegetation Solutions (2012) – associated with the western flank of the BIF ridge within the orebody area - pending review of taxonomy and distribution within the Study Area as discussed above.

Locations of records of these combined datasets of Priority species are presented in Figure 11 and Figure 12. Locations of Priority Flora recorded during the April 2021 survey are presented on the draft vegetation maps for Mount Mason on maps 1, 2 and 3 in

Appendix 2.

Of these six species, *Drosera eremaea* P1 poses a management challenge as it has not yet been fully surveyed within the Study Area, a record lies within the proposed disturbance footprint and the species is poorly known regionally. The management of *Drosera eremaea* has been robustly discussed with Juno Minerals management with the following strategy proposed to manage the impacts to this species:

Hibiscus sp. Perrinvale Station (P1) was not observed, however, the dry seasonal conditions in April 2021 would not have been conducive to this species being readily recognised if it was present.

Figure 11. Overview of Locations of Significant Flora within and Adjacent to the Mt Mason Study Area.

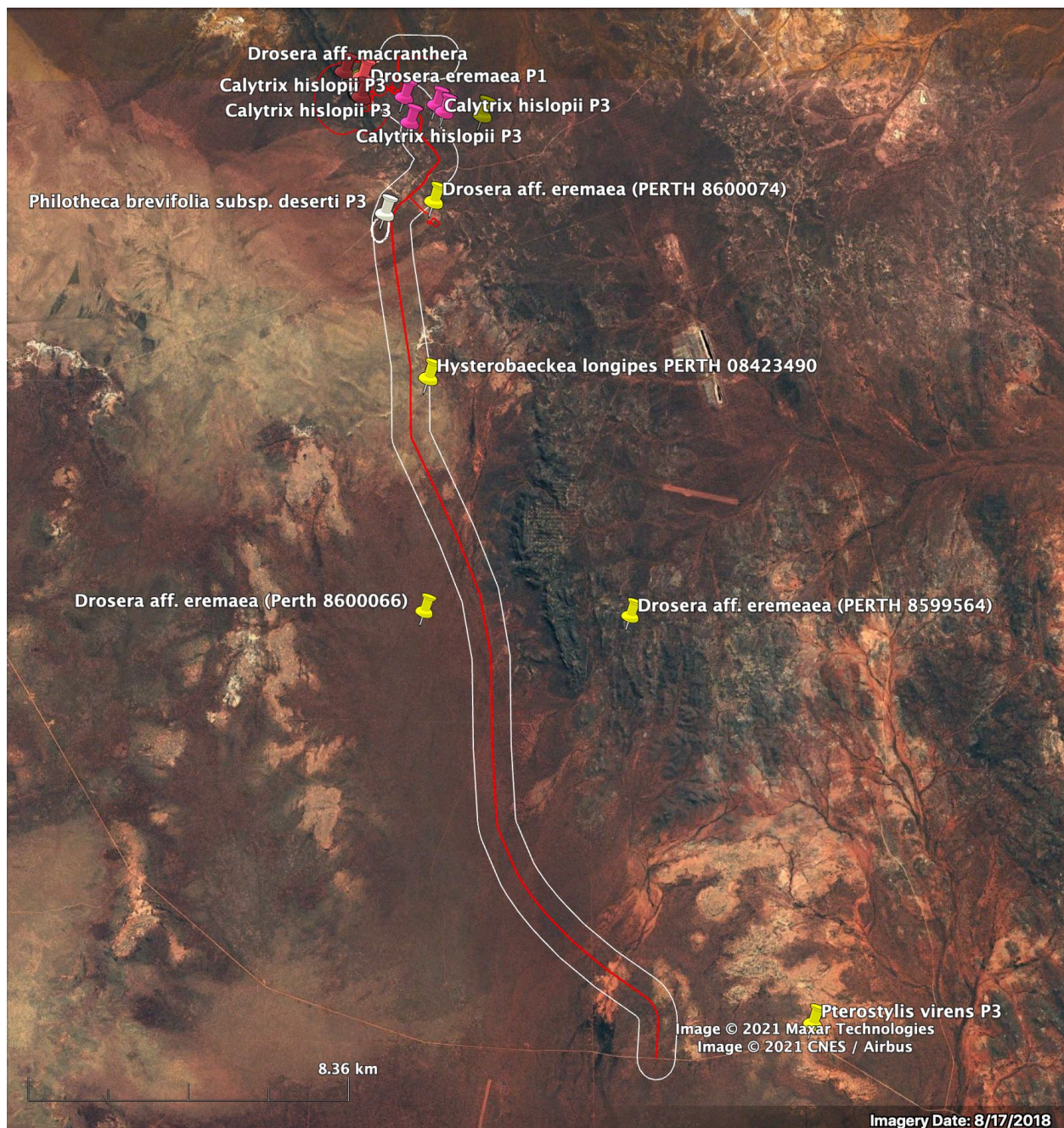
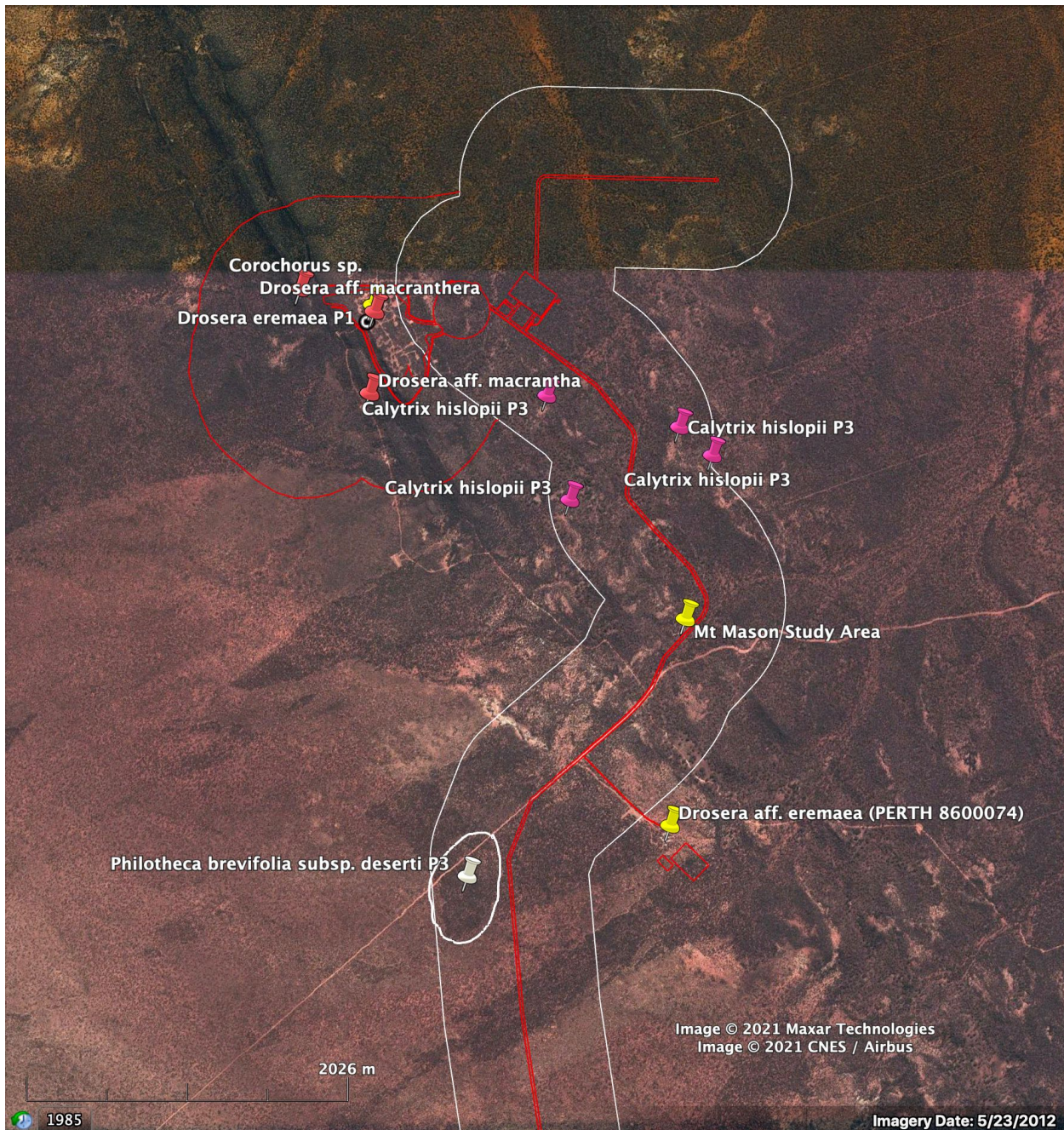


Figure 12. Enlargement of the orebody and Camp Area showing Significant Flora

4.2.5. Weeds

No weeds were recorded at the Mt Mason Study Area in April 2021 and few are expected.

4.2.6. Vegetation Condition

Vegetation Condition excluding areas that have been previously cleared for Pastoral management and or mining exploration are considered to be in Pristine Condition and displaying normal

characteristics for the prevailing seasonal conditions. While not specifically assessed, areas previously cleared for exploration have been rehabilitated and casual observations indicated excellent recruitment of a wide range of local native species of representing all strata of the surrounding vegetation. Inclusive of tracks and rehabilitated drill pads, the entire Study Area would be considered in Excellent Condition.

4.3. Field Survey – Yunndaga Siding

The single day spent at the Yunndaga Siding area in April 2021 was inadequate to gather more than a cursory overview of the vegetation and flora of the site. It was sufficient though to identify that the previous vegetation mapping of the siding area near the existing railway line was inadequate and needed to be redefined. With only partial coverage of this Study Area, eight vegetation associations were observed and described, Table 11.

Table 11. Vegetation Associations of the Yunndaga Siding Study Area (incomplete)

Veg Code	Description
YA1	Acacia aptaneura 7m, A. craspedocarpa 2.5m, PFC 10 to 15% over A. ramulosa 2m, PFC 5 to 8% on gently inclined alluvial washplain on clayey hard setting sand.
YA2	Acacia sibirica 3 to 5m, occasional Casuarina pauper 3 to 5m, PFC 5% over Acacia sibirica 2m, Senna artemisioides subsp. filifolia 1.7m, Eremophila pantonii 1.8m, PFC 10 to 15% over scattered Atriplex bunburyana 0.5m, Ptilotus obovatus (typical Goldfields form) 0.5m, PFC 2%. Soil is a hard setting sandy clay, relatively level, overlying carbonate and basalt rocks (observed in costene), can have discontinuous weathered granite and quartz stony mantle.
YA3	Acacia sibirica 3 to 5m, PFC 5% over very scattered Scaevola spinescens (Narrow leaf, spiny form) 1.5m, occasional Maireana sedifolia 1m, Dodonaea lobulata 1m, Dodonaea rigida 1m, Eremophila latrobei subsp. latrobei 1.5m, Ptilotus obovatus (typical Goldfields form) 0.5m, PFC 2%. Site represents a gentle slope and has a continuous sub-rounded ironstone pisolithic gravel over a red silty sand over calcrete.
YA4	Eucalyptus oleosa 12m, PFC 5% over Acacia sibirica 3 to 6m, PFC 5 to 10% over Senna artemisioides subsp. filifolia 1.5m, Scaevola spinescens (narrow leaf, spiny form) 1m, PFC 2 to 5% over Ptilotus obovatus (typical Goldfields form) 0.5m, PFC 1 to 5% and annual grasses. Soil is firm clayey sand. A drainage area with the region south of the Menzies - Evanston Rd having been affected by surface drainage interruption.
YA5	Mulga shrubland on hardpan plain. A. caesaneura 2 to 6m, A. aneura 2 to 6m, occasional Dodonaea rigida 1.5m, Scaevola spinescens (narrow leaf, spiny form) 1.5m, PFC 1 to 2%. An area subject to sheet flow and which support a wide range of annuals in appropriate season.
YE1	Eucalyptus cylindrica 8 to 10m, Casuarina pauper 8m, PFC 10 to 15% over Dodonaea viscosa subsp. angustissima 1.8m, Senna artemisioides subsp. filifolia 1.5m, PFC 15 to 20%. Soil is a red-brown silty sand, hard setting.

Veg Code	Description
YE2	Eucalyptus oleosa 12m, E. concinna 8m, PFC 5% over Acacia sibirica 3 to 6m, PFC 5 to 10% over Senna artemisioides subsp. filifolia 1.5m, Scaevola spinescens (narrow leaf, spiny form) 1m, PFC 2 to 5%. Soil is firm clayey sand.
YS1	Chenopod shrubland with emergent Eremophila longifolia and Casuarina pauper. Maireana sedifolia, M. pyramidata 1.2m, PFC 5% with Ptilotus obovatus (typical Goldfields form) 0.4m, annual grasses on calcrete plain with a thin veneer of fine sandy clay soil

The vegetation associations at Yundaga Siding are not considered directly comparable with those at Mount Mason.

Sixty eight species were recorded, including two weed species. No priority Flora were recorded and, based on the Desktop Assessment, no Conservation-Significant Flora are expected at Yundaga Siding. A draft systematic species list observed in April 2021 for the Yundaga Siding area is presented in Appendix 4.

4.4. Statistical Analysis of Vegetation Associations

Not applicable at this stage.

5. Assessment Against the 10 Clearing Principles

As current studies of flora and vegetation for the Mount Mason and Yunndaga Siding Study Areas have not been completed and revised data is not available, it is premature to attempt to assess the project against the EPA's 10 Clearing Principles. However, the following can be stated for each site:

Mount Mason Study Area

- The Mount Mason Study Area has relatively simple flora with moderate diversity for the region and reflecting that of similar landforms in the region. Vegetation is in Pristine Condition outside areas of direct disturbance.
- The works presented in Native Vegetation Solutions (NVS) (2012), while limited to Disturbance Footprints with minimal buffers, is valuable and mostly accurate with only minor amendments to species identifications and no additional Priority Flora have been noted within proposed Disturbance Footprints.
- Targeted Surveys for Priority Flora had not been implemented in the NVS (2012) works.
- The Mount Mason Study Area supports three Priority Flora: (*Drosera eremaea* P1, *Calytrix hislopii* P3, *Philothea brevifolia* subsp. *deserti* P3). Of these:
 - *Calytrix hislopii* P3, *Philothea brevifolia* subsp. *deserti* P3 populations lie well outside area of proposed development.
 - *Drosera eremaea* P1 is known within and in close proximity to the proposed disturbance footprint within the orebody area.
 - One record of *Drosera* aff. *eremaea* is known within the Exploration Camp area. Based on the regional distribution of similar species, this is likely to be *D. eremaea* P1.
 - One record of *Hysterobaeckea longipes* is noted adjacent to the Haul Road alignment approximately 7.75km south of the Mt Mason orebody area. This represents a 350 km disjunct occurrence. A misidentification of this specimen is suspected and a review of this specimen has been instigated.
- Other areas of proposed development (haul road, proposed explosives magazine, access road from the Mt Ida road) are not known to support any species with conservation listing. Given the landforms, soil and vegetation associations present in these areas, no Priority Flora are known, nor are they expected to occur, within proposed development footprints outside the orebody area.

Yunndaga Siding Study Area

- The Yunndaga Siding Study Area is reported in Paul Armstrong & Associates (2012) and Outback Ecology Services (OES) (2013). Vegetation Mapping presented within these documents was found to be inaccurate and requiring major revision.
- Flora identifications presented within OES (2013) are considered largely accurate and the weed mapping is likely similarly of high value.
- No Priority or Threatened Flora are noted, nor are they expected, at the Yunndaga Siding Study Area.

6. Limitations

6.1. Desktop Assessment

Substantial information in the form of previous consultant's reports was available on the flora, vegetation and conservation significant flora of the Study Areas. Information gathered from Western Botanical reports covering adjacent BIF ranges was assimilated where appropriate. Publicly available data from the DBCA and DAWE were incorporated in the desktop review.

Few specimens from any of the previous flora surveys appear to have been vouchered at the WA Herbarium, meaning queries on the identification of some taxa that appear to be anomalous records could not be verified.

6.2. Field Assessment – Autumn 2021 Works

Limitation	Discussion
Available sources of contextual information	Reasonable contextual information was available for the Mount Mason and Yundaga Siding Study Areas. Previous Consultant's reports and publicly available data was useful in preparing for field operations in Autumn 2021. This is not a Limitation for the proposal
The Scope of the survey	The survey was scoped as a Reconnoitre, Gap Analysis and extrapolation of Vegetation Mapping to bring the project in-line with EPA Guidance 2016 requirements. This has not allowed for detailed assessment of vegetation throughout the expanded Study Area and therefore is a Limitation for the proposal.
Proportion of flora collected and identified	Perennial flora of the Mount Mason has been reasonably well addressed in April 2021 though 19 specimens of perennials require verification following collection of adequate at a later date. Annuals have not been adequately reviewed. This is a Limitation for the Mount Mason Study Area. Only a small proportion of the Yundaga Siding flora has been reassessed in April 2021. This is a Limitation for the Yundaga Siding Study Area

Limitation	Discussion
Completeness and further work which may be needed	<p>Mount Mason While previous botanical assessments have been conducted at Mt Mason, the areas assessed do not comply with EPA Guidance 2016 requirements. The Gap Analysis at the Mount Mason Study Area identified the following are required:</p> <ul style="list-style-type: none"> • Finalisation of vegetation mapping within the 500m buffer around proposed Development Envelopes. • Establishment of additional quadrats for adequate representation and subsequent statistical analysis of data. • Finalisation of flora collections and identifications of some species within the Study Area and Development Envelopes. • Targeted survey for <i>Drosera eremaea</i> P1 within the Study Area inclusive of the deposit area, northern part of the haul road and camp area following suitable winter seasonal rainfall. <p>This is a Limitation for the proposal.</p> <p>Yunndaga Siding While previous botanical assessments have been conducted at the Yunndaga Siding Study Area, the areas assessed do not comply with EPA Guidance 2016 requirements. The Gap Analysis at the Yunndaga Siding Study Area identified the following are required:</p> <ul style="list-style-type: none"> • Mapping the vegetation at NVIS Level 5 <i>Association</i> level of detail throughout the Study Area. • Establishment of quadrats for adequate representation and subsequent statistical analysis of data. • Finalisation of flora collections and identifications of some species within the Study Area and Development Envelopes. <p>This is a Limitation for the proposal.</p>
Mapping reliability	<p>Mount Mason Though vegetation mapping has not been completed, pending some gaps being addressed, quadrat establishment and scoring and subsequent statistical validation, the descriptions and boundaries of communities are considered sufficiently accurate to define the Vegetation Associations of the Study Area. Full descriptions have not been reported in this document, pending finalisation of the points above. This is a Limitation for the proposal.</p> <p>Yunndaga Siding The Autumn 2021 review of previous vegetation mapping at Yunndaga Siding was found to be inaccurate is requiring revision. This is a Limitation for the proposal.</p>

Limitation	Discussion
Timing: weather, season	<p>The Autumn 2021 surveys at both Mount Mason and Yunndaga Siding Study Areas were undertaken under dry seasonal conditions. This allowed most perennial species to be accurately identified, though some gaps remain at the Mt Mason site where flowering material is required to confidently identify 19 perennial species.</p> <p>The Autumn 2021 survey did not allow for annuals or geophytes to be addressed.</p> <p>Similarly, the review of <i>Drosera eremaea</i> P1 within the orebody and mine camp areas at Mount Mason could not be reassessed, verified or discounted due to dry seasonal conditions.</p> <p>This is a Limitation for the proposal.</p>
Disturbances	<p>Disturbances at Mount Mason were limited to previously rehabilitated exploration areas and to currently serviceable tracks.</p> <p>This is not a Limitation for the proposal.</p> <p>The Yunndaga Siding Study Area includes many areas that have been historically disturbed. While this has had an impact on the quality of vegetation, particularly around previous mining activities and infrastructure, and numerous weeds are known to be present, vegetation and flora of this Study Area can still be adequately assessed. The review of vegetation and flora at Yunndaga Siding is yet to be undertaken.</p> <p>This is not a Limitation for the proposal.</p>
Intensity	<p>Mount Mason</p> <p>While vegetation mapping within the Mount Mason Study Area inclusive of a 500m buffer around planned Development Envelopes has been implemented at adequate intensity to define communities and map approximate boundaries, the establishment of representative quadrats has not been implemented at adequate intensity to comply with EPA Guidance (2016) requirements.</p> <p>Targeted Surveys for <i>Drosera eremaea</i> P1 have not yet been undertaken under favourable seasonal conditions.</p> <p>This is a Limitation for the proposal.</p> <p>Yunndaga Siding</p> <p>Studies complying with EPA Guidance (2016) have not yet been undertaken at Yunndaga Siding. Previous vegetation mapping needs revision and adequate quadrat representation within the Study Area is yet to be implemented.</p> <p>This is a Limitation for the proposal</p>
Resources	<p>Adequate resources were available for the Autumn 2021 assessment at the Mount Mason Study Area, however, inadequate time was available to map the revise the vegetation mapping at the Yunndaga Siding site.</p> <p>This is a Limitation for the proposal</p>

Limitation	Discussion
Access	<p>Mount Mason Access within the Mount Mason orebody and infrastructure areas was readily available. Access within the proposed Haul Road was limited and allowed only limited access to the central and southern portions. However, both these regions have relatively uniform vegetation communities as demonstrated on aerial photography and satellite imagery of the area and the limited access here is not considered a material limitation to the vegetation mapping of these areas. This is a minor Limitation for vegetation mapping within the Study Area.</p> <p>Yunndaga Siding Good access is available at Yunndaga Siding. This is not a limitation for the proposal</p>
Experience levels	<p>Geoff Cockerton, Principal Botanist, has 30 years experience in assessment of flora and vegetation in the Murchison biogeographic region of Western Australia, and specifically over 16 years assessing the flora and vegetation of the Banded Ironstone formation ranges of the Yilgarn region. Jonathan Warden, Senior Botanist, has 13 years experience in assessing flora and vegetation of similar landscape to those at Mount Mason and Yunndaga Siding. Jason Paterson has 2 years experience in flora survey and has worked on several projects in the Menzies region in this timeframe. Experience levels of Senior botanists is not considered a limitation for this project.</p>

7. List of Participants

Staff Member	Field Surveys	Specimen Identification	Data Analysis	Report Preparation
Geoff Cockerton B.Sc. (Biology) Flora Taking (Biological Assessment) License No. – FB62000046	1	1	1	1
Jason Paterson B.Sc. Hons (Environmental Science) Flora Taking (Biological Assessment) License No. – FB62000299	1	1		
Steven Cockerton Flora Taking (Biological Assessment) License No. –FB62000300	1			
Jonathan Warden Flora Taking (Biological Assessment) License No. – FB6200044		1		

8. Acknowledgements

- Mr. Malcolm French is thanked for his comments on *Eucalyptus lesouefii* pruinose adult leaf form (G & S Cockerton WB40262).
- Dr Barbara Rye, WA Herbarium, for review of specimen of *Hysterobaeckea longipes* reportedly collected near Mt Mason.

9. Bibliography

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Appendix 1. EPA Vegetation Condition Scale

















Table 2: Vegetation Condition Scale (adapted from Keighery 1994 and Trudgen 1988)

Vegetation Condition	South West and Interzone Botanical Provinces	Eremaean and Northern Botanical Provinces
Pristine	Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement.	
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. Damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.	Pristine or nearly so, no obvious signs of damage caused by human activities since European settlement.
Very Good	Vegetation structure altered, obvious signs of disturbance. Disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.	Some relatively slight signs of damage caused by human activities since European settlement. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds, or occasional vehicle tracks.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.	More obvious signs of damage caused by human activity since European settlement, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or slightly aggressive weeds.
Poor		Still retains basic vegetation structure or ability to regenerate it after very obvious impacts of human activities since European settlement, such as grazing, partial clearing, frequent fires or aggressive weeds.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.	Severely impacted by grazing, very frequent fires, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species present including very aggressive species.
Completely Degraded	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 comprising weed or crop species with isolated native trees and shrubs.	Areas that are completely or almost completely without native species in the structure of their vegetation; i.e. areas that are cleared or 'parkland cleared' with their flora comprising weed or crop species with isolated native trees or shrubs.



Appendix 2. Draft Vegetation Map for the Mount Mason Study Area

Legend

Acacia (Mulga) Woodlands

-  A1 - Acacia quadrimarginea, A. incurvaneura, A. mulganeura, A. caesaneura (narrow phyllode form) over Prostanthera althoferi subsp. althoferi, Hibbertia arcuata, Olearia humilis, may contain Thryptomene decussata, on BIF Ridge tops
-  A2 - Acacia incurvaneura over Philotheca brucei
-  A3 - Mulga over Prostanthera althoferi subsp. althoferi, Olearia humilis, Eremophila forrestii subsp. forrestii
-  A4 - Acacia incurvaneura, A. cockertoniana, A. ramulosa, Eremophila forrestii subsp. forrestii
-  A6 - Acacia sibirica, A. ramulosa subsp. ramulosa shrubland
-  A7 - Acacia sibirica over Dodonaea lobulata
-  A9 - Acacia sibirica over Ptilotus obovatus (upright form)
-  A10 - Mulga, Acacia effusifolia, Eremophila forrestii subsp. forrestii
-  A11 - Mulga over Acacia cockertoniana over Philotheca brucei
-  A12 - Acacia incurvaneura over Acacia ramulosa subsp. ramulosa
-  A14 - Acacia quadrimarginea, Acacia ramulosa subsp. ramulosa over Thryptomene costata
-  A15 - Acacia quadrimarginea on granite outcrop
-  A17 - Callitris columellaris, Acacia ramulosa subsp. ramulosa, Eucalyptus leptopoda subsp. leptopoda
-  A18 - Acacia incurvaneura, A. ramulosa subsp. ramulosa, A. tetragonophylla, A. mulganeura over Ptilotus obovatus (typical Goldfields form)
-  A19 - Acacia cockertoniana over Eremophila forrestii subsp. forrestii
-  DRMS - Drainage line Mulga Shrubland






Acacia Shrubland with Mallees

-  A13 - Acacia effusifolia with emergent Mallees
-  A13 (Recent Fire) - Acacia effusifolia with emergent Mallees





Casuarina woodland

-  C1 - Casuarina pauper over Ptilotus obovatus (Upright form)


Eucalypt woodlands

-  E1 - Eucalyptus lesouefii (pruinose leaf form) Woodland over Eremophila pantonii shrubland
-  E2 - Eucalyptus salubris woodland
-  E3 - Eucalyptus oleosa over Acacia incurvaneura and Acacia cockertoniana
-  E4 - Eucalyptus oleosa, Acacia incurvaneura, Acacia tetragonophylla
-  E5 - Eucalyptus spp. (mallee) over Acacia ramulosa, A. hemiteles, Senna artemisioides subsp. filifolia


Low Shrublands

-  S1 - Hibbertia arcuata, Myrtaceae sp. Shrubland on Duricrust outcrop
-  S2 - Acacia cockertoniana over Thryptomene decussata
-  S4 - Calytrix hislopilii P3, Calytrix ?desolata Shrubland with emergent Acacia cockertoniana on Duricrust outcrop
-  S5 - Frankenia sp. Shrubland on saline plains

Tall Shrublands

-  S3 - Allocasuarina acutivalvis, A. cockertoniana, A. quadrimarginea (lacking Calytrix) on Duricrust outcrop

Other

-  D - Disturbed



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Mt Mason Project
Vegetation Legend

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6777000

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6776000

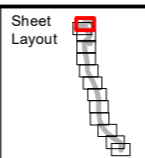
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Image Source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Legend
 Survey Area
Calytrix hislopilii





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 Date: Jul 2021 | Rev: A | A3

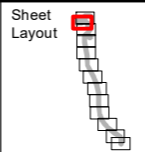


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Vegetation: Sheet 1 of 13



Legend
 Survey Area
 *Calytrix hislopii*



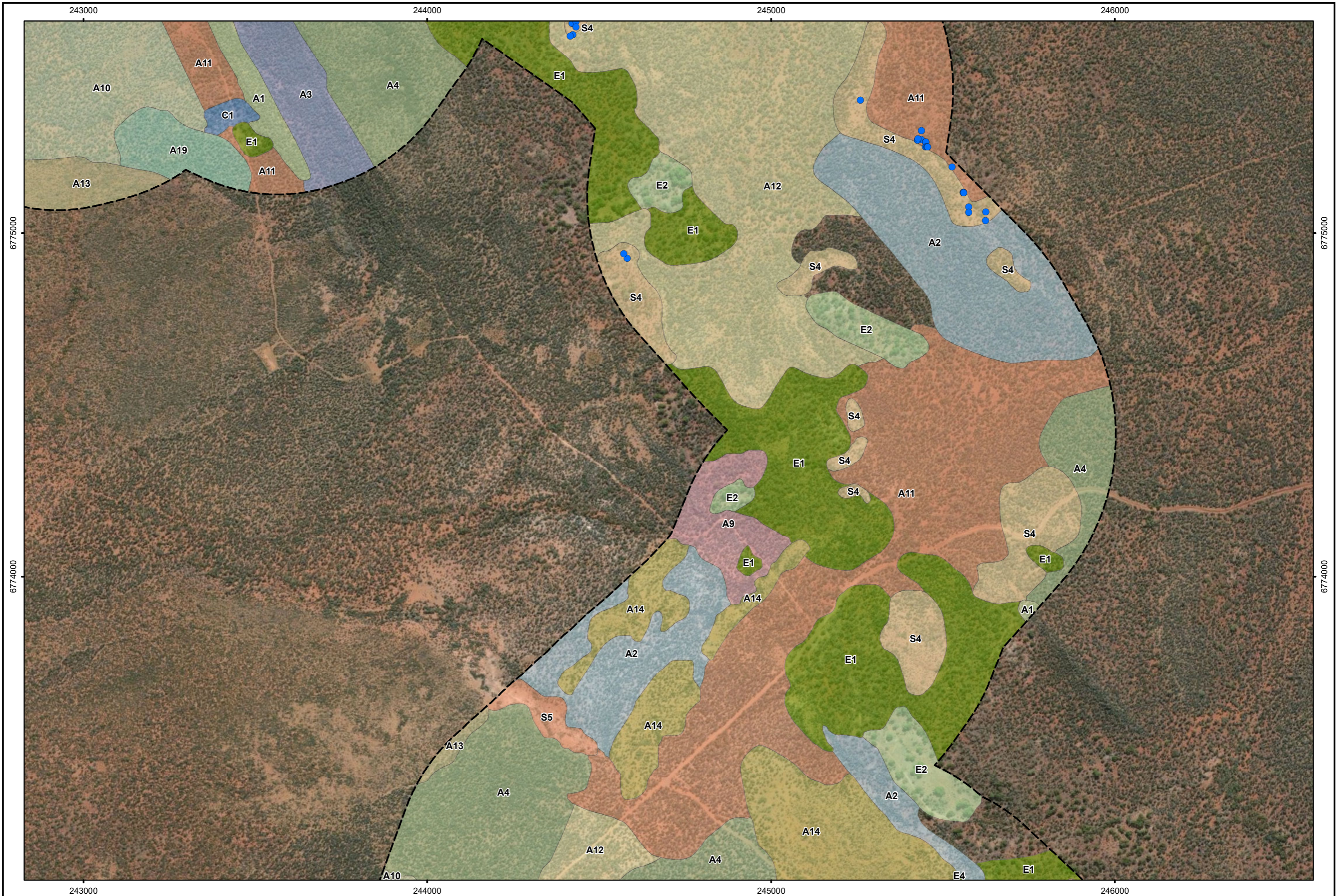
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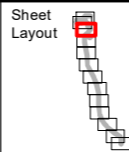
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Vegetation: Sheet 2 of 13

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Legend
 Survey Area
Calytrix hislopia



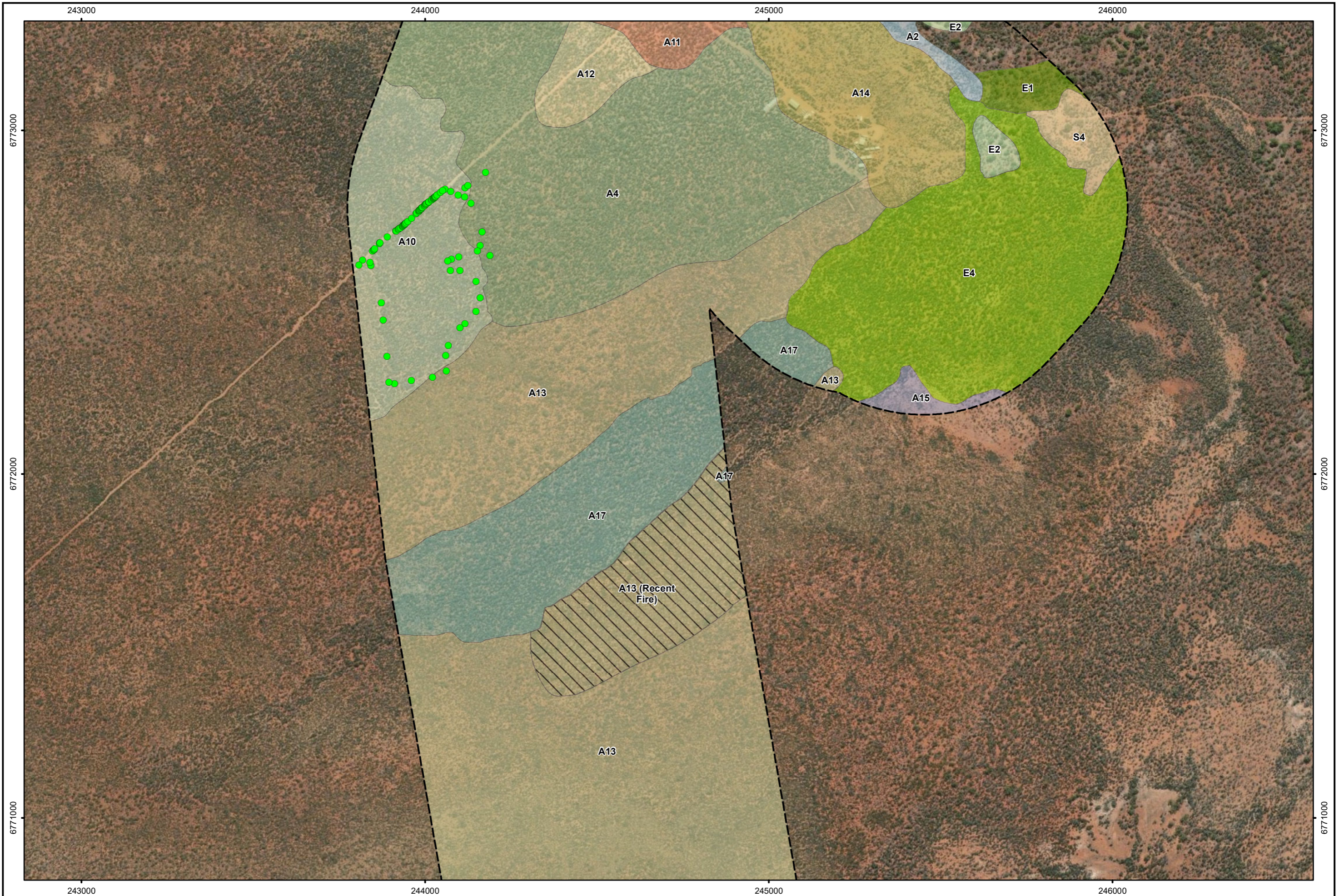
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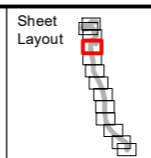
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Vegetation: Sheet 3 of 13

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Legend
 [Dashed Line] Survey Area
 [Green Dot] *Philotheca deserti* subsp. *brevifolia*



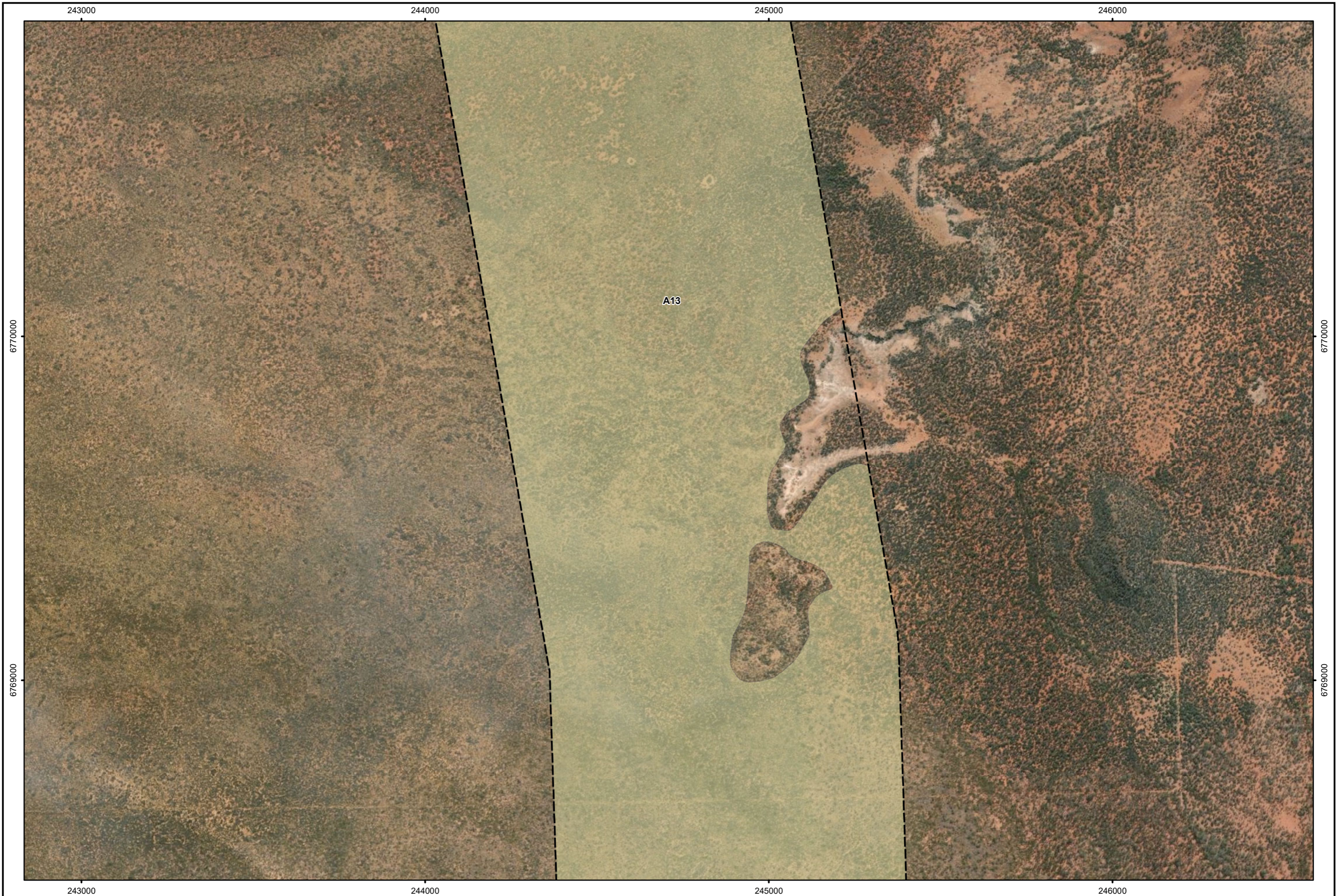
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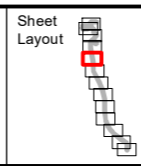
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Legend
 Survey Area



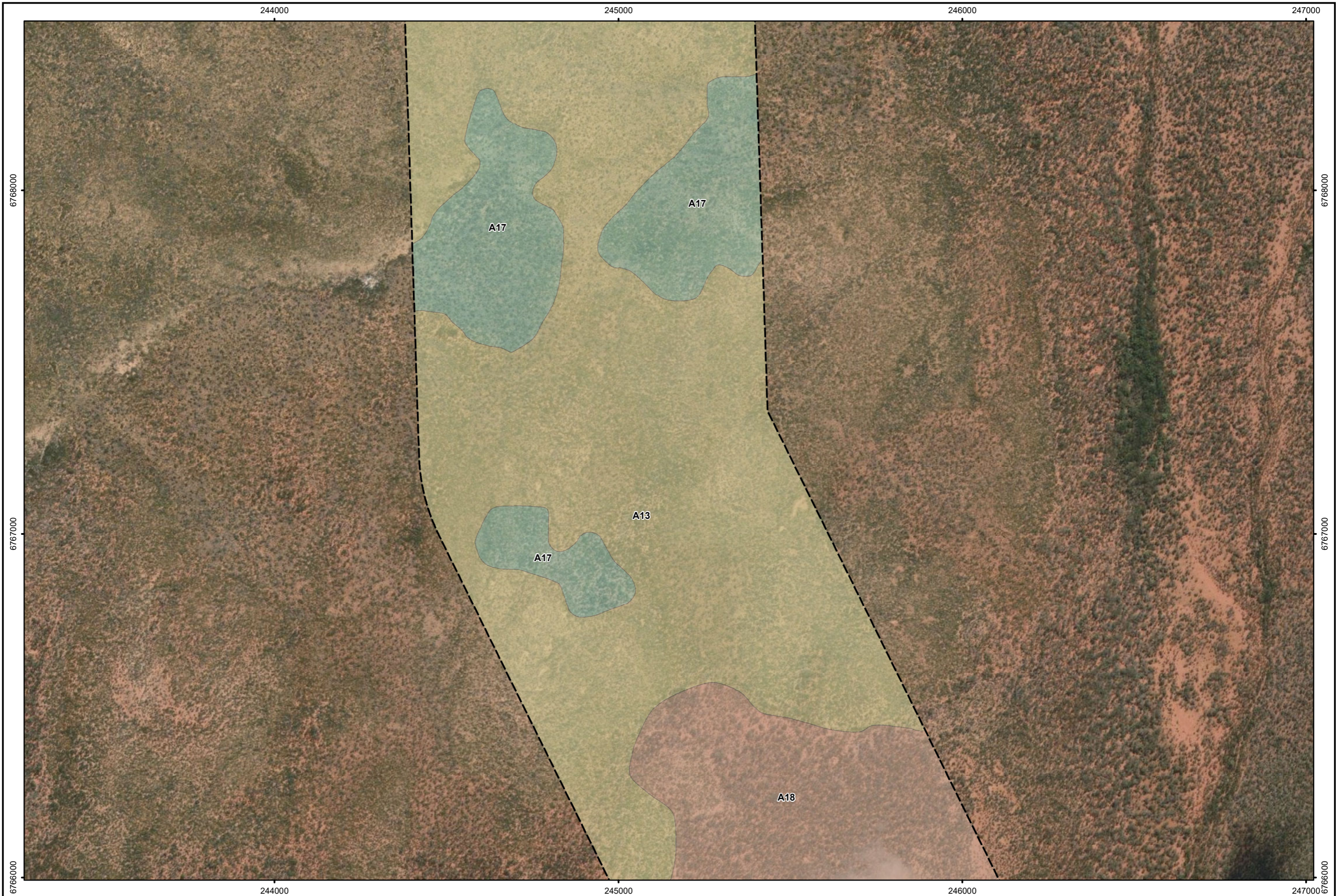
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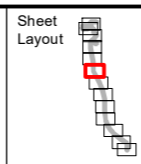
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Vegetation: Sheet 5 of 13

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Legend
 Survey Area



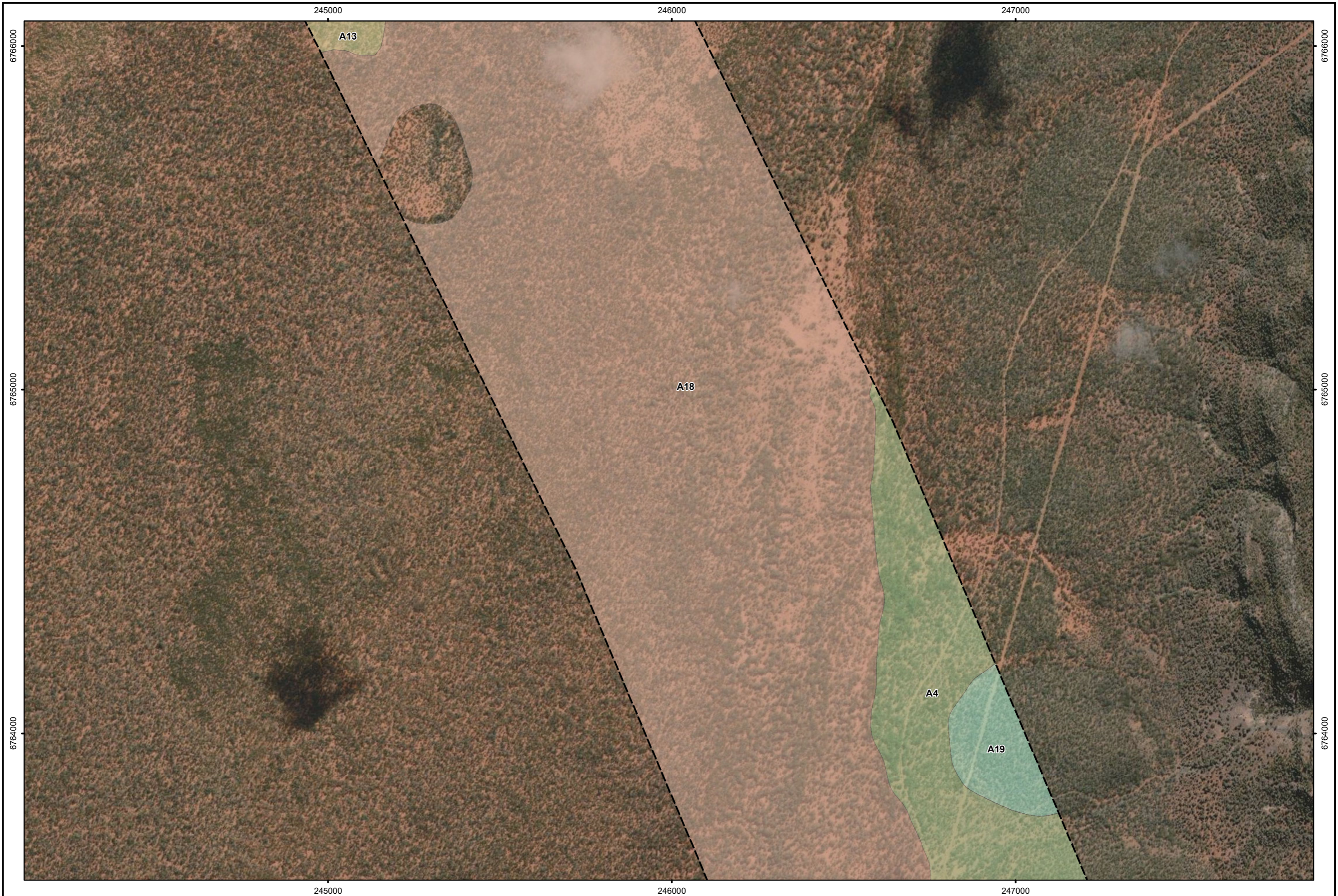
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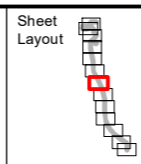
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Vegetation: Sheet 6 of 13

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Legend
 Survey Area



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Vegetation: Sheet 7 of 13

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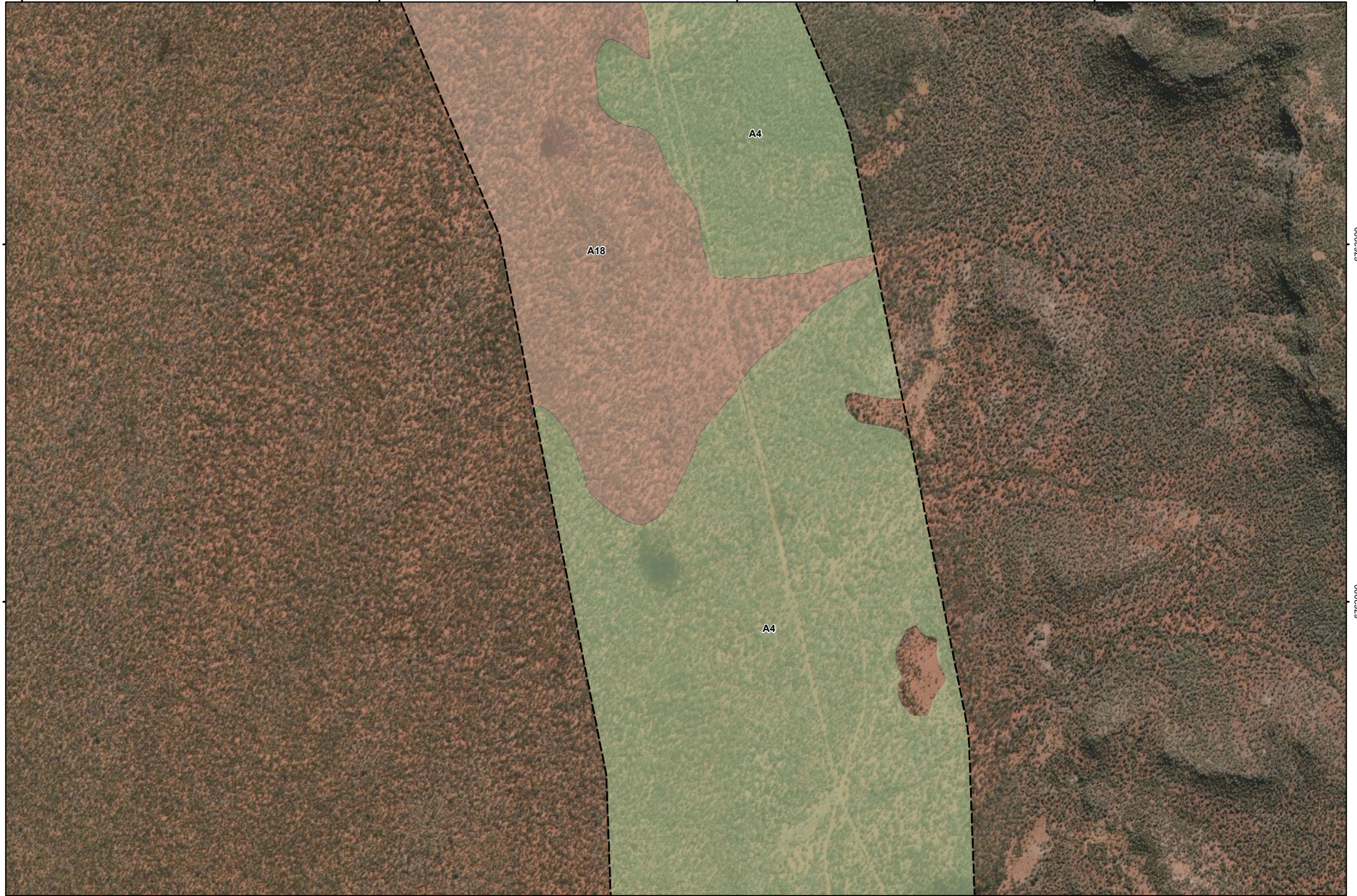
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


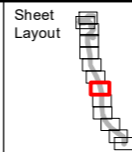
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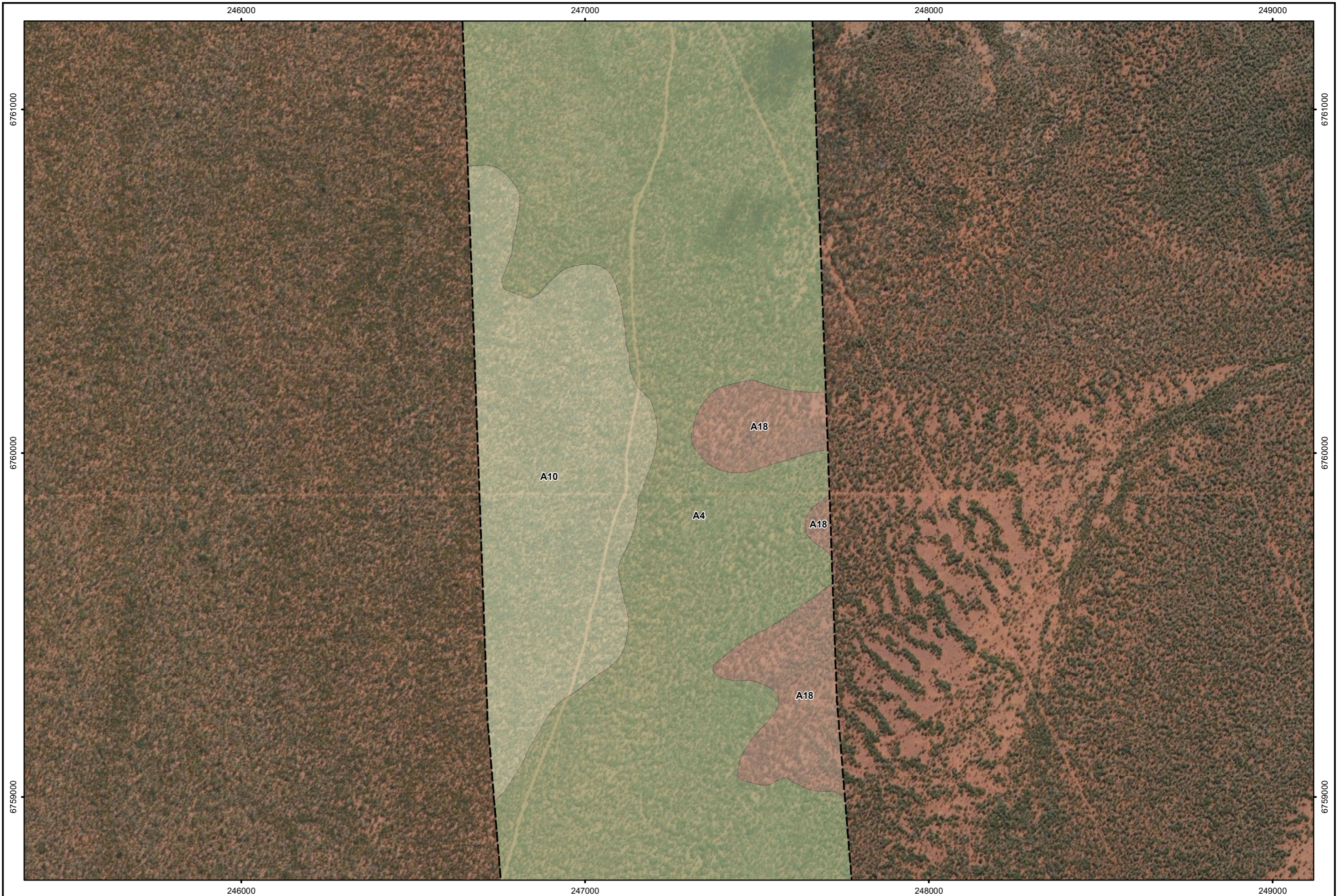



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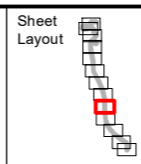
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Vegetation: Sheet 8 of 13

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 Survey Area



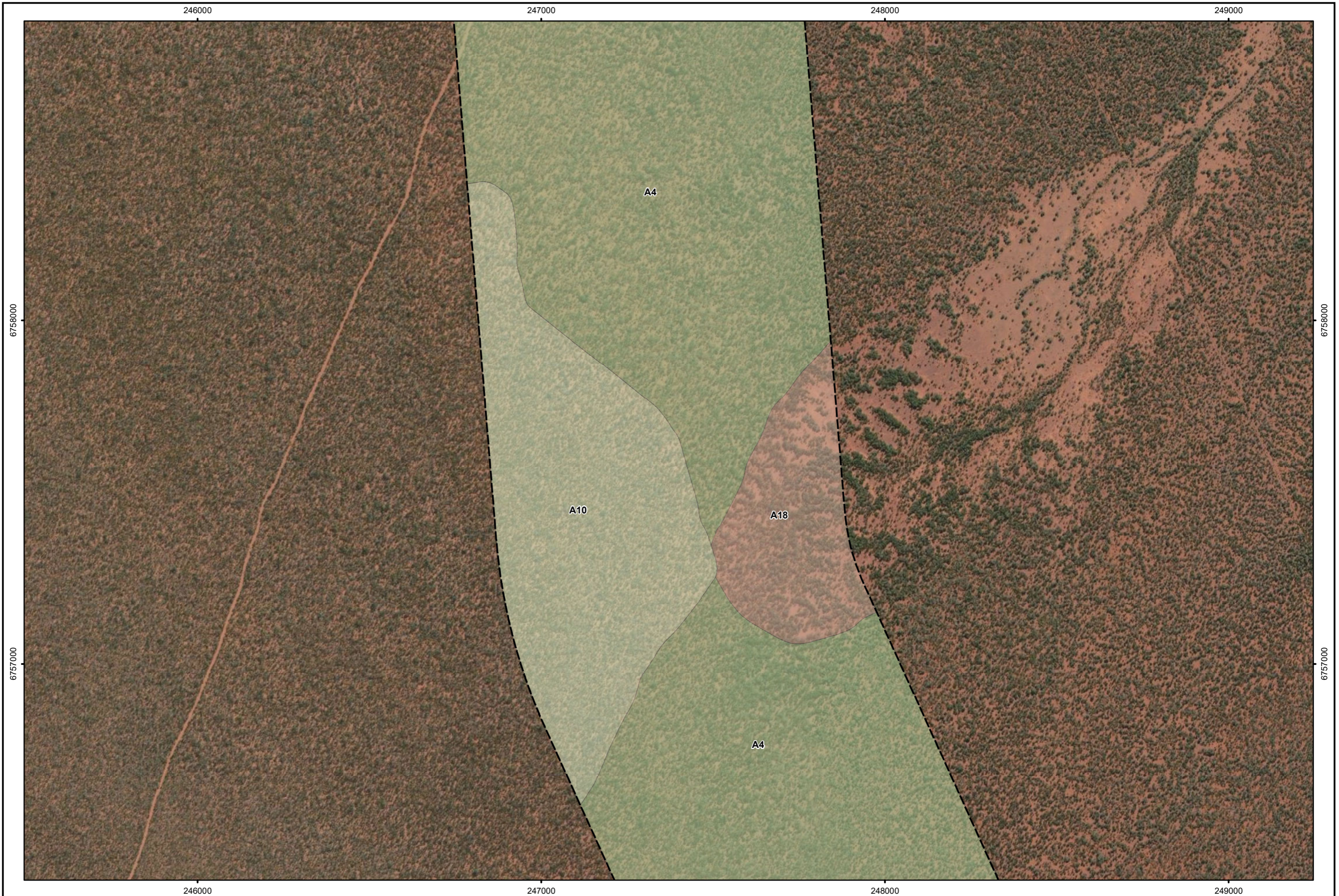
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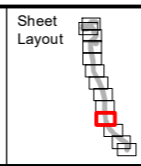
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Vegetation: Sheet 9 of 13

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Legend
 Survey Area



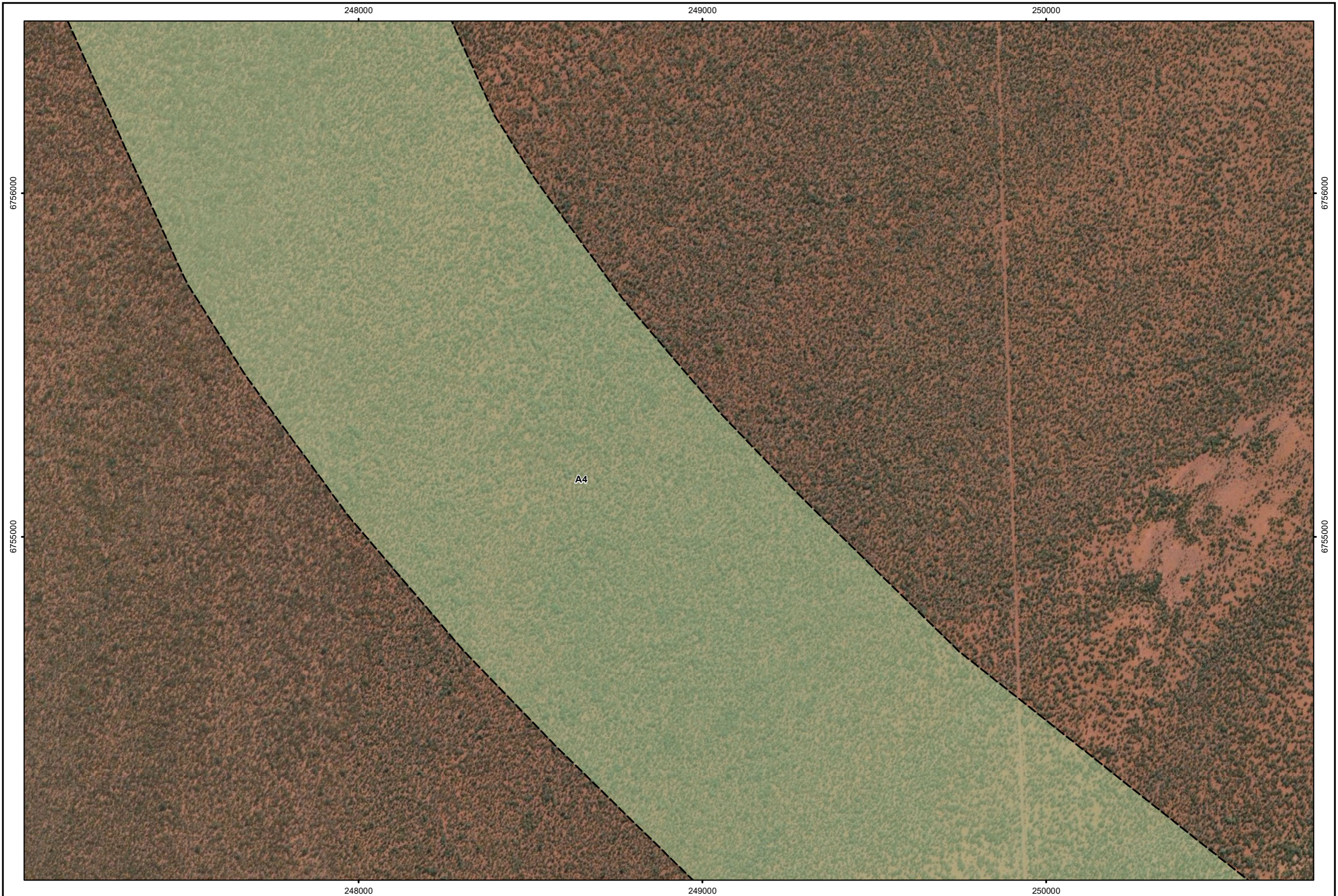
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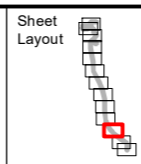
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Mt Mason Project
Vegetation: Sheet 10 of 13

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



Legend
[Dashed Box] Survey Area



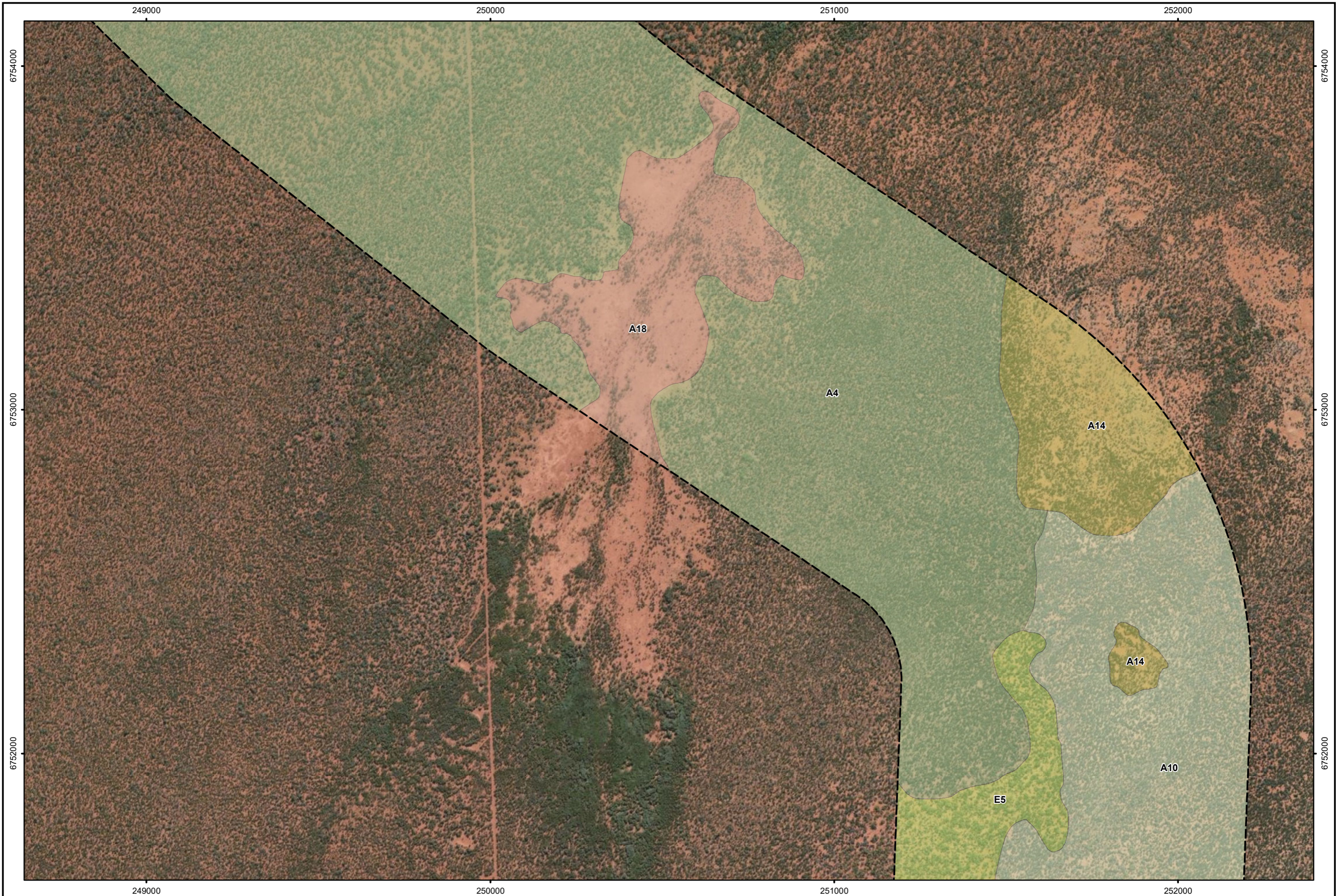
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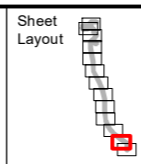
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Mt Mason Project
Vegetation: Sheet 11 of 13

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



Legend
 Survey Area



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 Scale: 1:10,000
 MGA94 (Zone 50)
 CAD Ref: a2798_M_R001_08
 Date: Jul 2021 | Rev: A | A3



Author: G. Cockerton | WB Ref:
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Mt Mason Project
Vegetation: Sheet 12 of 13

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251000

252000

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6752000

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6751000

6751000

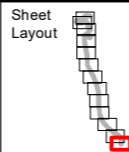
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251000

252000

253000

Legend
Survey Area



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Date: Jul 2021 | Rev: A | A3



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Mt Mason Project
Vegetation: Sheet 13 of 13

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



Appendix 3. Interim Systematic Species List for the Mount Mason Study Area

Family	Taxon	Recollection Required ?
Amaranthaceae	<i>Ptilotus obovatus</i> (typical Goldfields form)	
Amaranthaceae	<i>Ptilotus obovatus</i> (upright calcrete form)	
Amaranthaceae	<i>Ptilotus polystachyus</i>	
Amaranthaceae	<i>Ptilotus</i> ? <i>aervoides</i> / <i>roei</i>	Recol
Apocynaceae	<i>Alyxia buxifolia</i>	
Apocynaceae	<i>Marsdenia australis</i>	
Asteraceae	? <i>Pluchea dentex</i>	Recol
Asteraceae	<i>Chrysocephalum puteale</i>	
Asteraceae	<i>Olearia humilis</i>	
Asteraceae	<i>Olearia muelleri</i>	
Caryophyllaceae	Indet.	Recol
Casuarinaceae	<i>Allocasuarina acutivalvis</i> subsp. <i>acutivalvis</i>	
Casuarinaceae	<i>Casuarina pauper</i>	
Chenopodiaceae	<i>Atriplex bunburyana</i>	
Chenopodiaceae	<i>Maireana</i> ? <i>radiata</i>	Recol
Chenopodiaceae	<i>Maireana georgei</i>	
Chenopodiaceae	<i>Maireana glomerifolia</i>	
Chenopodiaceae	<i>Maireana pyramidata</i>	
Chenopodiaceae	<i>Maireana sedifolia</i>	
Chenopodiaceae	<i>Maireana triptera</i>	
Chenopodiaceae	<i>Maireana</i> sp. BRX-FOL	Recol
Chenopodiaceae	<i>Rhagodia drummondii</i>	
Chenopodiaceae	<i>Rhagodia ermaea</i>	
Dilleniaceae	<i>Hibbertia</i> ? <i>exasperata</i> (lignotuberous)	Recol
Dilleniaceae	<i>Hibbertia arcuata</i>	
Euphorbiaceae	<i>Ptilotus drummondii</i>	
Euphorbiaceae	<i>Euphorbia drummondii</i>	
Euphorbiaceae	<i>Phyllanthus erwinii</i>	
Fabaceae	<i>Acacia aneura</i> sens. str.	
Fabaceae	<i>Acacia burkittii</i>	
Fabaceae	<i>Acacia caesaneura</i> (narrow phyllode form)	
Fabaceae	<i>Acacia caesaneura</i> (typical phyllode form)	
Fabaceae	<i>Acacia cockertoniana</i>	
Fabaceae	<i>Acacia colletioides</i>	
Fabaceae	<i>Acacia craspedocarpa</i>	
Fabaceae	<i>Acacia effusifolia</i>	
Fabaceae	<i>Acacia incurvaneura</i>	
Fabaceae	<i>Acacia kempeana</i>	
Fabaceae	<i>Acacia mulganeura</i>	
Fabaceae	<i>Acacia murrayana</i> sens. str.	
Fabaceae	<i>Acacia quadrimarginea</i>	
Fabaceae	<i>Acacia ramulosa</i> subsp. <i>ramulosa</i>	
Fabaceae	<i>Acacia rhodophloia</i>	
Fabaceae	<i>Acacia sibirica</i>	

Family	Taxon	Recollection Required ?
Fabaceae	Acacia aff. rigens	Recol
Fabaceae	Acacia tetragonophylla	
Fabaceae	Acacia aff. rigens	Recol
Fabaceae	Mirbelia sp. Indet	Recol
Fabaceae	Senna aff. manicula	Recol
Fabaceae	Senna artemisioides subsp. filifolia	
Fabaceae	Senna sp. Meekatharra (E. Bailey 1-26)	
Frankeniaceae	Frankenia sp. Indet	Recol
Goodeniaceae	Scaevola spinescens (non-spiny, broad leaf form)	
Goodeniaceae	Scaevola spinescens (spiny, narrow leaf form)	
Haloragaceae	Haloragis odontocarpa	
Haloragaceae	Haloragis trigonocarpa	
Lamiaceae	Prostanthera althoferi subsp. althoferi	
Lamiaceae	Microcorys sp. Mt Gibson (SJ Patrick 2098)	
Lamiaceae	Teucrium teucriflora	
Loranthaceae	Amyema banksii (on Grevillea ?nematophylla)	
Loranthaceae	Amyema benthamii (on Brachychiton gregorii)	
Loranthaceae	Amyema miquellii (on Eucalyptus oleosa)	
Malvaceae	Abutilon sp.	Recol
Malvaceae	Abutilon cryptopetalum	
Malvaceae	Abutilon otocarpum subsp. prostratum	
Malvaceae	Brachychiton gregorii	
Malvaceae	Sida aff. calyxhymenia	Recol
Malvaceae	Sida ectogamma	
Malvaceae	Sida sp. dark green fruits ((S. van Leeuwen 2260)	
Malvaceae	Sida sp. golden calyces pubescent (GJ Leach 1966)	
Myrtaceae	Myrtaceae sp. (BRX-P)	Recol
Myrtaceae	Myrtaceae sp. (with A. effusifolia 19/4/21)	Recol
Myrtaceae	Myrtaceae sp. (with A. effusifolia 19/4/21)	Recol
Myrtaceae	Calytrix hislopii PRIORITY 3	
Myrtaceae	Calytrix desolata	Recol
Myrtaceae	Eucalyptus ewartiana	
Myrtaceae	Eucalyptus leptopoda subsp. elevata	
Myrtaceae	Eucalyptus lesouefii (pruinose adult leaf form) (G & S Cockerton WB40262)	
Myrtaceae	Eucalyptus oleosa subsp. ?	
Myrtaceae	Eucalyptus salubris	
Myrtaceae	Eucalyptus sp. Indet.	Recol
Myrtaceae	Euryomyrtus patrickiae	
Myrtaceae	Melaleuca leiocarpa (sandplain form)	
Myrtaceae	Micromyrtus chrysodema P1 / flaviflora	Recol
Myrtaceae	Myrtaceae sp. Indet	Recol
Myrtaceae	Myrtaceae sp. Indet	Recol
Myrtaceae	Myrtaceae sp. Indet	Recol
Myrtaceae	Thryptomene costata	
Myrtaceae	Thryptomene decussata	
Pittosporaceae	Bursaria occidentalis	
Poaceae	Neurachne minor	

Family	Taxon	Recollection Required ?
Poaceae	<i>Aristida contorta</i>	
Poaceae	<i>Austrostipa</i> sp. Indet	Recol
Poaceae	<i>Austrostipa elegantissima</i>	
Poaceae	<i>Austrostipa</i> sp.	
Poaceae	<i>Enneapogon caeruleus</i>	
Poaceae	<i>Eragrostis eriopoda</i>	
Poaceae	<i>Eriachne helmsii</i>	
Poaceae	<i>Eriachne pulchella</i> subsp. <i>pulchella</i>	
Poaceae	<i>Eriachne mucronata</i> Desert form <i>glabrous</i> (WB40048)	
Poaceae	<i>Paspalidium basicladum</i>	
Poaceae	<i>Triodia rigidissima</i>	Recol
Portulacaceae	<i>Calandrinia</i> sp. Indet.	Recol
Portulacaceae	<i>Portulaca intraterranea</i>	Recol
Proteaceae	<i>Grevillea extorris</i>	
Proteaceae	<i>Grevillea nematophylla</i>	
Proteaceae	<i>Grevillea sarissa</i> subsp. <i>sarissa</i>	
Proteaceae	<i>Hakea arida</i> subsp., <i>arida</i>	
Proteaceae	<i>Hakea lorea</i> subsp. <i>Lorea</i>	
Rhamnaceae	<i>Cryptandra connata</i>	
Rubiaceae	<i>Psydrax latifolia</i>	
Rubiaceae	<i>Psydrax suaveolens</i>	
Rubiaceae	<i>Solanum cleistogamum</i>	
Rubiaceae	<i>Solanum lasiophyllum</i>	
Rutaceae	<i>Phebalium filifolium</i>	
Rutaceae	<i>Philotheca brucei</i> subsp. <i>brucei</i>	
Rutaceae	<i>Philotheca deserti</i> subsp. <i>brevifolia</i> PRIORITY 3	
Sapindaceae	<i>Dodonaea lobulata</i>	
Sapindaceae	<i>Dodonaea petiolaris</i>	
Sapindaceae	<i>Dodonaea rigida</i>	
Sapindaceae	<i>Dodonaea viscosa</i> subsp. <i>spatulata</i>	
Scrophulariaceae	<i>Eremophila forrestii</i> subsp. <i>forrestii</i>	
Scrophulariaceae	<i>Eremophila granitica</i>	Recol
Scrophulariaceae	<i>Eremophila georgei</i>	
Scrophulariaceae	<i>Eremophila latrobei</i> subsp. <i>latrobei</i>	
Scrophulariaceae	<i>Eremophila longifolia</i> (green leaf form)	
Scrophulariaceae	<i>Eremophila oldfieldii</i> subsp. <i>angustifolia</i>	
Scrophulariaceae	<i>Eremophila pantonii</i>	
Scrophulariaceae	<i>Eremophila platycalyx</i> subsp. <i>granites</i> (DJ Edinger & G Marsh DJE4788)	
Solanaceae	<i>Nicotiana</i> sp.	Recol
Solanaceae	<i>Solanum ferocissimum</i>	
Stylidiaceae	<i>Stylidium longibracteatum</i>	
Thymelaeaceae	<i>Pimelea microcephala</i>	
Thymelaeaceae	<i>Pimelea</i> sp. Indet	Recol
Zygophyllaceae	<i>Tribulus asterocarpus</i>	

Appendix 4. Interim Systematic Species List for the Yunndaga Siding Study Area, recorded April 2021.

Family	Genus	Species
Amaranthaceae	Ptilotus	obovatus (typical Goldfields form)
Apocynaceae	Alyxia	buxifolia
Apocynaceae	Marsdenia	australis
Asteraceae	Olearia	muelleri
Chenopodiaceae	Atriplex	bunburyana
Chenopodiaceae	Enchylaena	lanata
Chenopodiaceae	Maireana	georgei
Chenopodiaceae	Maireana	pyramidata
Chenopodiaceae	Maireana	sedifolia
Chenopodiaceae	Rhagodia	drummondii
Chenopodiaceae	Rhagodia	preissii
Chenopodiaceae	Salsola	tragus
Euphorbiaceae	Euphorbia	drummondii
Euphorbiaceae	Phyllanthus	irwini
Fabaceae	Acacia	aneura sens. str.
Fabaceae	Acacia	aptaneura
Fabaceae	Acacia	burkittii
Fabaceae	Acacia	caesaneura
Fabaceae	Acacia	craspedocarpa
Fabaceae	Acacia	effusifolia
Fabaceae	Acacia	hemiteles
Fabaceae	Acacia	incurvaneura
Fabaceae	Acacia	ligulata
Fabaceae	Acacia	murrayana
Fabaceae	Acacia	oswaldii
Fabaceae	Acacia	ramulosa subsp. ramulosa
Fabaceae	Acacia	sibirica
Fabaceae	Acacia	tetragonophylla
Fabaceae	Casuarina	pauper
Fabaceae	Senna	artemisioides subsp. filifolia
Fabaceae	Senna	artemisioides subsp. artemisioides
Goodeniaceae	Scaevola	spinescens (broad leaf, non-spiny form)
Goodeniaceae	Scaevola	spinescens (narrow leaf, spiny form)
Haloragaceae	Haloragis	odontocarpa
Lamiaceae	Salvia	verbenaca (Wild Sage) *
Loranthaceae	Amyema	Fitzgeraldii (on Mulga)
Loranthaceae	Lysiana	casuarinae (on Acacia sibirica)

Family	Genus	Species
Malvaceae	? Sida	calyxhymenia
Malvaceae	Abutilon	otocarpum subsp. prostratum
Malvaceae	Sida	ectogamma
Myrtaceae	Eucalyptus	? concinna / cylindrica
Myrtaceae	Eucalyptus	oleosa
Poaceae	Cenchrus	ciliaris (Buffel Grass) *
Poaceae	Chloris	truncata
Poaceae	Enneapogon	avenaceus
Poaceae	Enneapogon	caerulescens
Poaceae	Paspalidium	sp. Indet.
Proteaceae	Grevillea	?berryana / nematophylla
Proteaceae	Hakea	lorea subsp. lorea
Proteaceae	Hakea	preissii
Pteridaceae	Cheilanthes	sieberi subsp. sieberi
Rubiaceae	Alectryon	oleifolius subsp. canescens
Rubiaceae	Psydrax	suaveolens
Santalaceae	Santalum	spicatum
Sapindaceae	Dodonaea	lobulata
Sapindaceae	Dodonaea	rigida
Sapindaceae	Dodonaea	viscosa subsp. angustissima
Scrophulariaceae	Eremophila	alternifolia
Scrophulariaceae	Eremophila	georgei
Scrophulariaceae	Eremophila	latrobei subsp. latrobei
Scrophulariaceae	Eremophila	longifolia (green leaf form)
Scrophulariaceae	Eremophila	decipiens subsp. decipiens
Scrophulariaceae	Eremophila	pantonii
Solanaceae	Solanum	lasiophyllum
Solanaceae	Solanum	nummularium
Thymelaeaceae	Pimelea	microcephala

Appendix 5. Management of Opuntoid Cacti

Taken from Atlas of Living Australia: <https://profiles.ala.org.au/opus/weeds-australia/profile/Opuntia%20spp.>

Best practice management

When controlling *Opuntia* Prickly Pear species, an integrated weed management approach is usually desirable especially for larger infestations.

Chemical control: While several herbicides are recommended for managing Prickly Pears, chemical control is not always effective, as many species occur on rocky slopes, and infested areas must be checked and resprayed over several years if necessary (Parsons & Cuthbertson 2001). Methods used are:

- Foliar spray covering all pads
- Stem injection (includes drill and fill method on every 2-3 pads)
- Basal bark and cut stump (not normally used or considered best practice).

However, plants are extremely hardy and follow up and monitoring may be required for 1-2 years to ensure plant do not re-sprout. Registered herbicides, techniques and on-label instruction should always be followed in your state or territory. A variety of herbicides (chemicals) are known to be effective. Please see Sheehan & Potter (2017) for an overview. Also see the Australian Pesticides and Veterinary Medicines Authority for chemical information <http://www.apvma.gov.au>. Permits from state or territory Environment Protection Authorities may be required if herbicides are to be sprayed on riverbanks.

Non-chemical control: Physical control: Physical control either by manual (hand) or mechanical (machine) removal can be feasible and cost-effective for all species of *Opuntia* (Prickly Pears).

Manual (hand) removal appears to be one of the most effective control methods for scattered and small infestations (Sheehan & Potter 2017). However, the spines make manual removal of these species difficult (Parsons & Cuthbertson 2001). Using tools and avoiding spines and glochids is a top health and safety concern when working with Prickly Pears. Personal Protective Equipment (PPE) must (should) be worn, and tools used that eliminate or significantly reducing handling of plants with spines and glochids used.

Mechanical (machine removal) is useful for large dense impenetrable stands (Sheehan & Potter 2017). This method is useful for removing bio-mass and increases accessibility for other follow-up control methods. Machine removal with front end loaders causes high levels of disturbance and will require planning and long-term follow-up using an integrated weed management techniques for cacti and other weeds that could colonise the area. Normally mechanical control should be carried out when conditions are dry to avoid damaging soil reducing soil disturbance, reducing likely spread of plants. However, caution should be employed as some species have glochids that are airborne and are more likely to dislodge and injure workers with PPE like masks or respirators worn with eye protection

Disposal: Care must also be taken to remove and properly dispose of plants parts. Pads, flowers, fruits and even small sections of stems if left on the soil surface can produce roots and grow into a new plant. If one large plant is uprooted, broken up, and left on the soil surface, each pad will take root and form a new plant. Where one plant was present there would now be many plants.

The root system must also be dug out to prevent regrowth (Parsons & Cuthbertson 2001). Plant can be buried at a depth of 1 metre on or off site. Burning plants (all vegetative, flowering and fruiting parts) with other dry materials for plants that have dried out over summer can also be used to kill plants. However, you should consult your local fire service for advice and permissions.



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Appendix C: Level 1 Flora and Fauna Assessment – Menzies Bypass and Yunndaga Rail Siding (Outback Ecological Services, 2013)

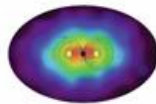


Jupiter Mines Limited

Central Yilgarn Iron Project

Level 1 Flora and Fauna Assessment –
Menzies Bypass and Yunndaga Rail
Siding

June 2013



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Executive Summary

Jupiter Mines Limited propose to construct a haulage route to bypass the town of Menzies in the Murchison region of Western Australia. To evaluate the environmental impact of any development, Jupiter Mines Limited commissioned Outback Ecology to undertake a review of previous fauna and flora work and conduct a Level 1 Flora and Fauna Assessment (Assessment) of the proposed haulage route option (the Study Area).

The primary objective of the Assessment was to determine the environmental value of areas proposed to be cleared for the haul route. Specific objectives were to:

- undertake a comprehensive desktop study to inventory the flora, vegetation and terrestrial fauna species identified within the Study Area, or likely to occur within the Study Area;
- provide a description of vertebrate fauna habitats, terrestrial fauna habitats and any sensitive habitats expected to occur within the Study Area;
- identify any conservation significant flora within the Study Area;
- provide a description and map vegetation associations within the Study Area;
- verify the results of the desktop study and map broad fauna habitats present within the Study Area;
- assess the likelihood of habitat within the Study Area to support conservation significant fauna species;
- conduct targeted surveys for fauna species of conservation significance; and
- identify the potential impacts of the Project on the flora, vegetation, fauna assemblages and habitat in the area.

A total of 114 plant taxa were recorded with the dominant families being Chenopodiaceae, Fabaceae, Poaceae and Scrophulariaceae. Most communities comprised Mulga or Mallee upperstoreys with mixed shrubland mid-storeys. Six broad vegetation associations were described and mapped:

- Tall Shrubland on Stony Plains;
- Open Shrubland on Stony or Rocky Rises;
- Tall Shrubland Sandplains;
- Mallee Drainage and Sandplains;
- Mulga Drainage and Sandplains; and
- Shrubland Drainage and Sandplains.

The most common vegetation was the Tall Shrubland on Stony Plains which was usually interspersed by alternating combinations of the other five associations.

The Study Area was highly disturbed, particularly in the southern areas, around historic stock watering points and adjacent to various transport corridors. Seventeen species of introduced species were identified, the most common and widespread being the grasses **Cenchrus ciliaris* and **Pentameris airoides*, as well as **Carrichtera annua* (Ward's Weed). None of the introduced species were 'Declared' in the Menzies municipal district, although **Heliotropium europaeum* (present near

the Princess Mary Pit) is Declared elsewhere in the State. **Carthamus lanatus* (Saffron Thistle), a P4 Declared Plant in the Menzies district (and a P1 species Statewide), was identified by Paul Armstrong and Associates (2012) in the southern portion of the Study Area, which was not traversed by Outback Ecology during the May 2013 assessment.

Four Priority Ecological Communities (PECs) and 37 flora species of conservation significance were identified as potentially within the Study Area, however none were recorded during the field assessment. The Study Area contained suitable habitat types for some of these PECs and flora of conservation significance, however given the degree of disturbance; it was unlikely to support them.

Five broad fauna habitats were identified within the Study Area, none of which were considered significant:

- Drainage Depression;
- Open Mallee/Shrubland on Red Loam;
- Open Mallee/Shrubland on Stony Low Rises;
- Open Mulga Woodland on Sandplain; and
- Open Mulga Woodland on Stony Red Loam.

The desktop study identified 25 vertebrate fauna species of conservation significance that are likely to occur, or possibly occur within the Study Area. The likelihood of each of these species occurring in the Study Area was determined based on habitat assessments performed during the field survey, reported data on species distributions and habitat from previous surveys in the wider region, and published knowledge on the biology of individual species. Briefly, these fauna consist of:

- seven species listed as Threatened under the *Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act)* and/or *Wildlife Conservation Act 1950 (WC Act)*;
- seven species recognized by the Department of Environment and Conservation (DEC) as Priority fauna; and
- 12 species listed as Migratory under the *EPBC Act* and *WC Act* (including one species also listed as Threatened under the *EPBC Act* and/or *WC Act*).

The likelihood of each of the 21 invertebrate species of conservation significance identified by the desktop study as potentially occurring within the Study Area was also determined, based on habitat assessments performed during the field survey and reported data on species distributions and habitat from previous surveys in the wider region. Briefly, these fauna consist of:

- 20 species of SRE invertebrate species (including 13 mygalomorph spiders, four millipedes and three pseudoscorpions); and
- one species of butterfly listed by the DEC as Priority 1.

A total of 294 terrestrial vertebrate species and 21 terrestrial invertebrate species were identified by the desktop study as potentially occurring within the Study Area. The field survey recorded 22 species, including five mammals (two native), 15 birds and two reptiles. None of these species were

of conservation significance. No amphibians or invertebrate species of conservation significance were recorded during the field survey.

The clearing of vegetation during road construction represents the greatest potential impact of the Project on fauna habitat and assemblages. Other potential impacts include the direct loss of individuals during land clearing and ongoing use of the new road, as well as changes in the hydrology of the Study Area and surrounding area resulting from interruption to natural water flow. Although no conservation significant flora and fauna were recorded within the Study Area, if any were present it is likely that they would not be solely reliant on habitat within the Study Area, and the regional impacts of the Project on any species of conservation significance are likely to be negligible.

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1. INTRODUCTION

1.1. Project Background and Location

The Menzies Bypass (the Study Area), which is part of Jupiter Mines Limited (Jupiter) Central Yilgarn Iron Project, is located adjacent to the town of Menzies in the Murchison bioregion of Western Australia (WA), approximately 560 kilometres (km) east-northeast of Perth (**Figure 1**). The Study Area encompasses 253 hectares (ha) of land comprising a proposed haulage option to bypass Menzies (**Figure 2**). In May 2013, Jupiter commissioned Outback Ecology to undertake a desktop review and a Level 1 flora and fauna assessment to gather background biological information on the flora and vegetation, fauna, fauna assemblages and habitat within the Study Area.

1.2. Report Scope and Objectives

This report documents the results of a Level 1 flora and fauna assessment of the Study Area, comprising a desktop review and reconnaissance survey. The assessment was designed and conducted in accordance with Western Australian (WA) Department of Environment and Conservation (DEC) and WA Environmental Protection Authority (EPA) guidelines (EPA and DEC 2010, EPA 2002, EPA 2004, EPA 2009). The objectives were to:

- undertake a comprehensive desktop study to develop an inventory of flora, vegetation and terrestrial fauna species identified within the Study Area, or likely to occur within the Study Area;
- provide a description of vertebrate fauna habitats, terrestrial fauna habitats and any sensitive habitats expected to occur within the Study Area;
- identify any conservation significant flora and vegetation that occurs within the Study Area;
- provide a description and map vegetation associations that occur within the Study Area;
- verify the results of the desktop study and map broad fauna habitats present within the Study Area;
- assess the likelihood of habitat within the Study Area to support conservation significant fauna species;
- conduct targeted surveys for fauna species of conservation significance; and
- identify the potential impacts of the Project on the flora, fauna assemblages and habitat in the area.

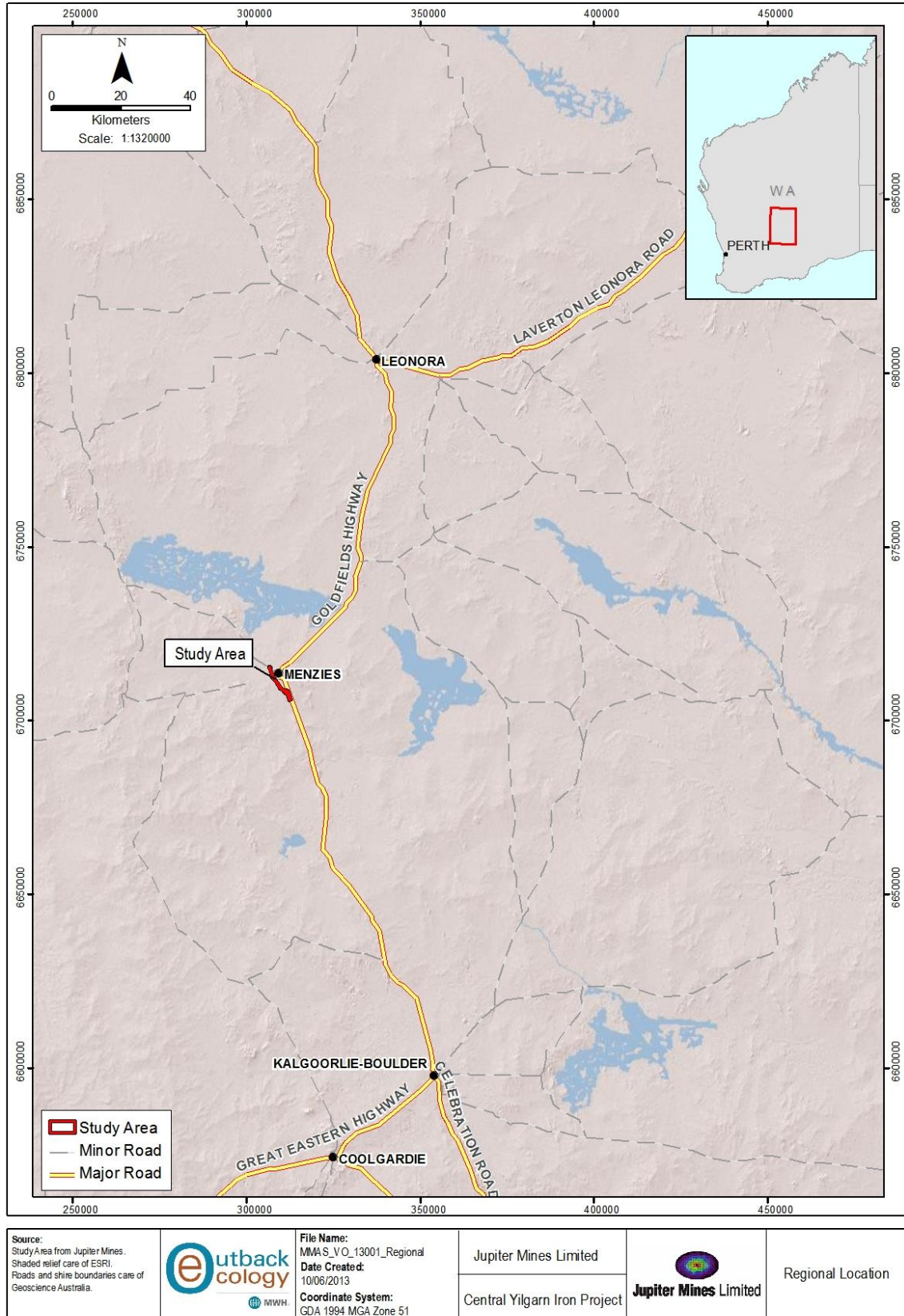


Figure 1: Regional location of the Menzies Bypass Study Area



Figure 2: Layout of the Menzies Bypass Study Area

2. EXISTING ENVIRONMENT

2.1. Climate

The East Murchison sub-bioregion, which encompasses the Study Area, experiences an arid climate with mainly winter rainfall (Cowan 2001). The Bureau of Meteorology (BOM) weather station at the town of Menzies, located within two kilometres of the Study Area, provides comprehensive climate information of direct relevance to the Study Area (**Figure 3**). Mean maximum temperatures at Menzies range from 17.0 °C in July to 35.1 °C in January, and peak temperatures are recorded from November to March. Mean minimum temperatures in winter months range from 5.3 to 6.7 °C. Rainfall at Menzies was highly variable over the previous five years (**Figure 4**); however, on average, the town receives 249.6 mm and 32 rain days per year (BOM 2012). Rainfall is generally unreliable across the Murchison bioregion and while many parts received consecutive years of above average rainfall in the mid to late 1990s, recent years have resulted in many areas, particularly to the west and to the south of where the Study Area lies, declared drought-affected (Australian Government 2012b).

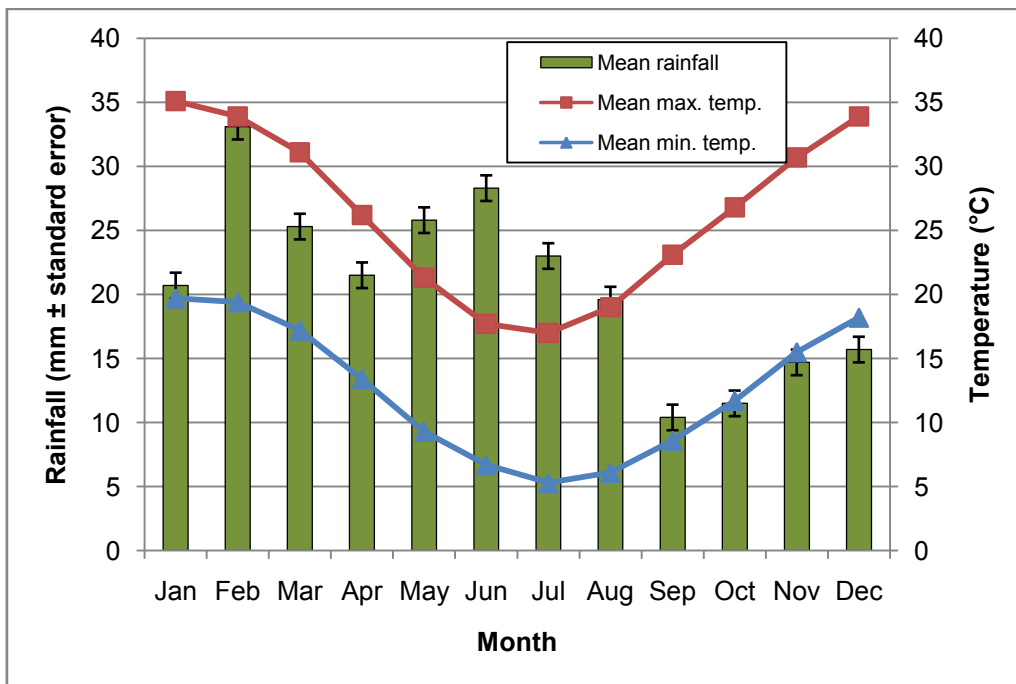


Figure 3: Climate data for Menzies

Source data: BOM (2012), weather station 012052, 1896-2012

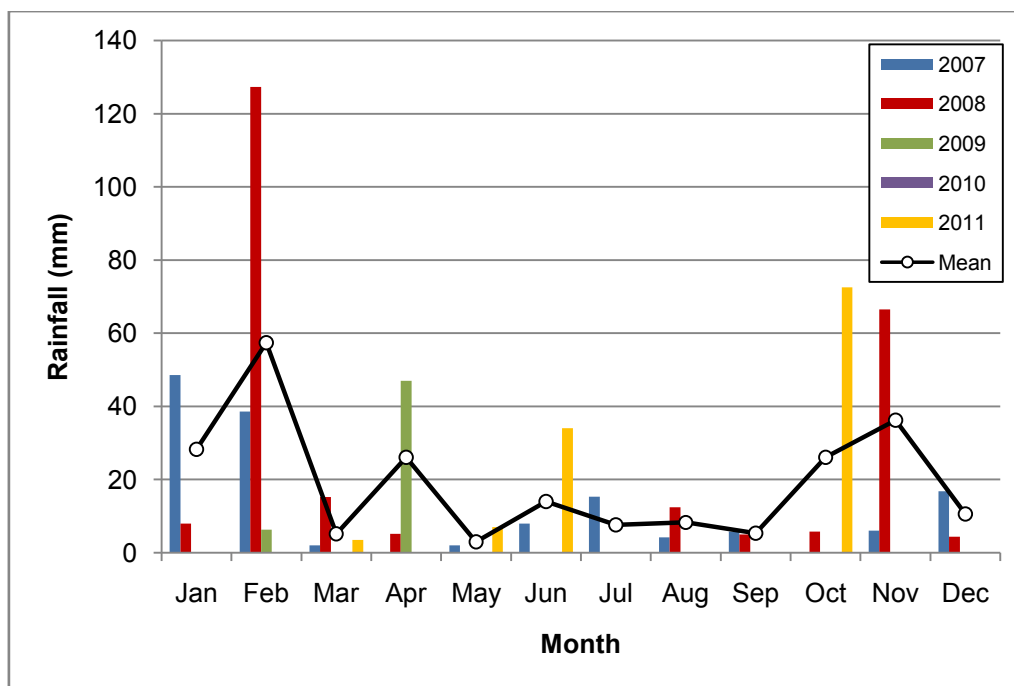


Figure 4: Monthly rainfall for Menzies

Source data: BOM (2012), weather station 012052, 1896-2012. No data was available for 2010.

2.2. Biogeographic Region

The Study Area lies within the Murchison bioregion, as defined by the Interim Biogeographic Regionalisation for Australia (IBRA) classification system (DSEWPaC 2012a) (**Figure 5**). The Murchison bioregion covers 28,120,000 hectares of land that is predominantly used for mining and grazing (ANRA 2009b). It encompasses the transitional zone between Eucalypt dominated southwest Australia and Mulga/Spinifex dominated central Australia, with vegetation closely associated with geology, soils and climate (ANRA 2009b, Morton *et al.* 1995). Areas of outcropping rock with skeletal soils support Mulga low woodlands. Hummock grassland occurs predominately on calcareous soils, with samphire (*Tecticornia* spp.) low shrubland common to areas of saline alluvium. Red sand plains in the east of the bioregion support Mallee-Mulga parkland over hummock grassland.

The Murchison bioregion also contains several large ephemeral wetlands, providing refuge for waterbirds. While overgrazing has had the greatest impact on the condition of the bioregion, the effects of soil erosion, weeds, feral animals and mining are also notable (ANRA 2009b).

The Murchison bioregion comprises two sub-bioregions: the Murchison 1 (MUR1 – East Murchison) sub-bioregion, and the Murchison 2 (MUR2 – Western Murchison) sub-bioregion. The Study Area lies within the East Murchison sub-bioregion, approximately 50 km north of the Coolgardie bioregion (**Figure 5**). The East Murchison sub-bioregion largely consists of extensive areas of elevated red desert sandplains with minimal dune development and internal drainage, though broad plains of red-brown soils, red sandplains and breakaway complexes are also widespread (ANRA 2009a). Vegetation includes Mulga woodlands, hummock grasslands, saltbush shrublands and *Halosarcia* shrublands (Cowan 2001). Salt lake systems occur throughout and one in particular, Lake Barlee,

approximately 120 km west northwest of the Study Area, is considered an important breeding site for a number of waterbirds, particularly the Banded Stilt (*Cladorhynchus leucocephalus*) (Cowan 2001). Lake Barlee, Lake Ballard and Lake Marmion (both within 30 km of the Study Area) are wetlands of national significance (DSEWPaC 2011). Rare fauna known to occur within the sub-bioregion include the Great Desert Skink (*Egernia kintorei*), Princess Parrot (*Polytelis alexandrae*) and the Brush-tailed Mulgara (*Dasyercus blythi*), and one species of vertebrate, the Yellow-bellied Black Snake (*Pseudechis butleri*), is endemic to the sub-bioregion (Cowan 2001).

2.3. Beard's Vegetation Mapping

The Study area is located within the Barlee Botanical District as defined by Beard (1975). Beard (1975) further divided the botanical district into physiographic (physical geography) units (also called vegetation supergroups) in which he mapped Vegetation Associations. Three Beard's vegetation association; 18, 20 and 251 occur within the Study Area (**Table 1**).

Table 1: Beard Vegetation Associations that occur within the Study Area

Vegetation Association	Unit Description	Area in Study Area (ha)	Portion of the Study Area (%)	Pre European Vegetation Extent (%)	Priority
18	Low woodland; mulga (<i>Acacia aneura</i>)	72.2	28.5	100	Medium
251	Low woodland; mulga & <i>Allocasuarina cristata</i>	175.6	69.4	100	Low
20	Low woodland; mulga mixed with <i>Allocasuarina cristata</i> & <i>Eucalyptus</i> sp.	5.3	2.1	100	Low

2.4. Land Systems

Regional surveys conducted by the WA Department of Agriculture and Food have contributed to a comprehensive description of biophysical resources present within WA, and the condition of these resources with respect to the impact of pastoralisation (Payne *et al.* 1998). This information, based on landforms, soils, vegetation, geology and geomorphology has been used to classify and map the land systems of the north-eastern Goldfields, including the Study Area. An assessment of these land systems provides an indication of the occurrence and distribution of flora, vegetation and fauna present within and surrounding the Study Area. The Study Area contains four land systems: Moriarty, Bunyip, Rainbow and Yowie (**Table 2**). Of these, the Moriarty land system occupies the majority of the Study Area (**Figure 6**).

Table 2: Land systems within and surrounding the Study Area

Land system	Description	Area within Study Area (ha)	Proportion of Study Area (%)
Moriarty	Low rises and very gently undulating stony plains typically consisting of shallow red clayey sands composed of limonite, greenstone and colluvium supporting <i>Eucalyptus</i> and <i>Acacia</i> shrubland and woodland.	245	96.8
Yowie	A relatively large land system characterised by low sandy plains typically consisting of relatively deep (compared with the surrounding land systems) red clayey sands supporting acacia shrubland and woodland. Contains negligible drainage features.	4	1.6
Bunyip	Plains of saline alluvium typically consisting of self-mulching cracking clays transitioning into calcareous loams on margins. Contains wide drainage tracts receiving run-on from greenstone hills.	2	>1
Rainbow	Level to very gently inclined low alluvial hardpan plains typically consisting of shallow red earth soils supporting mulga shrubland. Typically occurs between salt lakes and erosional surfaces and contains broad unincised drainage lines.	2	>1
Total		253	100

Source: Payne *et al.* (1998)



Figure 5: Location of the Study Area within the Murchison bioregion

2.5. Land Use

The majority of land within the Murchison bioregion comprises pastoral leases (83%). Mining and indigenous ownership comprise 22% and 6% of this pastoral lease land, respectively. Many pastoral leases are no longer considered viable for pastoral enterprises and their use for mining purposes is increasing (Australian Government 2012b). Conservation estate encompasses 6.7% of the bioregion and includes one national park (Goongarrie National Park), six nature reserves, one timber reserve and five areas of Unallocated Crown Land (ANRA 2009a, Australian Government 2012b). Pastoral activity and feral herbivores, particularly goats, are key threats to biodiversity within the bioregion and the impact of wild dogs is also thought to have increased in recent years (Australian Government 2012b). Together with land use competition, lack of biodiversity information and lack of financial investment, these threats form a barrier to the effective conservation of the 60 ecosystems or vegetation associations that have been identified as high priority to reserve but which are not represented in the conservation estate (ANRA 2009a).

The Study Area is located within the Shire of Menzies. While predominantly comprising reserved Crown land, a small portion of the Study Area extends into the Adelong pastoral lease (**Figure 7**). The area surrounding that of the Study Area is primarily reserved Crown Land, owing to the close proximity of the town of Menzies, whilst the broader surrounds consist primarily of pastoral lease. The closest conservation reserve is Goongarrie National Park (approximately 39 km to the south-southeast), which contains many important Aboriginal sites and is recognized as a transition zone between semi-arid adapted eucalypt woodlands and arid-adapted mulga woodlands. Other conservation estates within 150 km of the Study Area include Clear and Muddy Lakes Nature Reserve (75km south), Rowles Lagoon Conservation Park (78 km south), Mount Manning Range Nature Reserve (100 km west), Mount Manning Range Conservation Park (130 km west) and Goldfields Woodlands Conservation Park (150 km south).

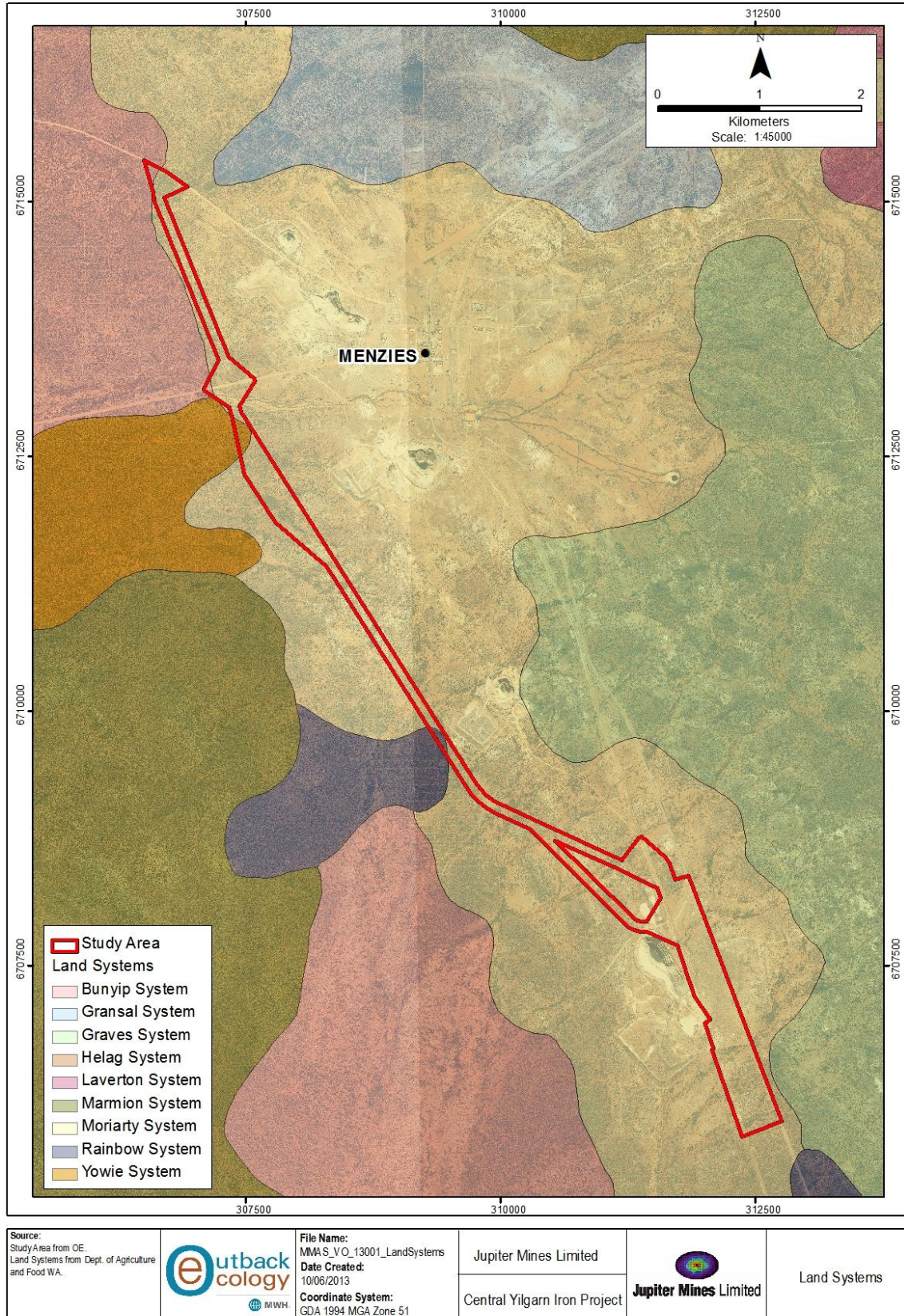


Figure 6: Land systems within and surrounding the Menzies Bypass Study Area

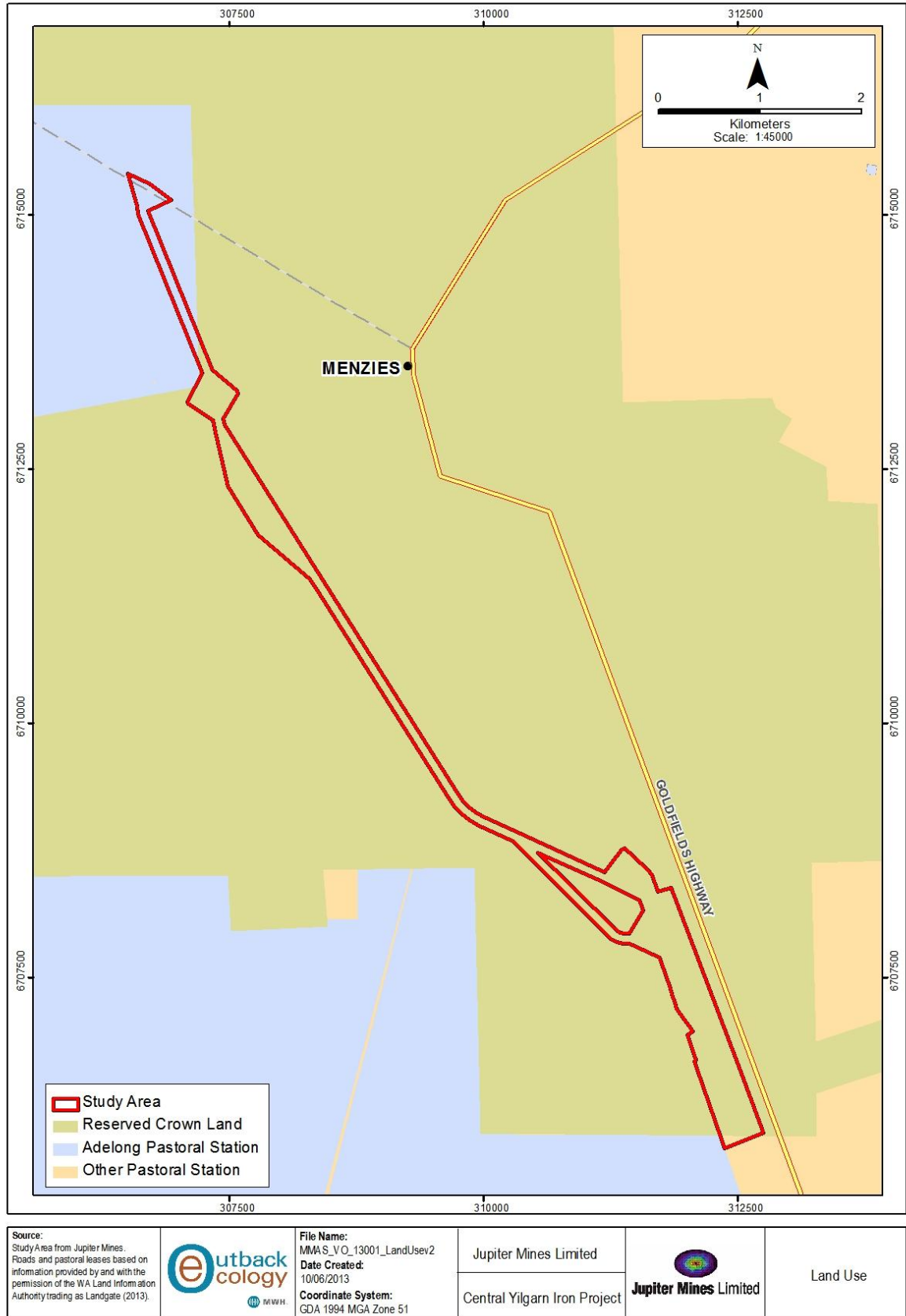


Figure 7: Land use within and surrounding the Menzies Bypass Study Area

3. DESKTOP STUDY

3.1. Flora

The database searches for two recently completed flora surveys within the Study Area were used in this assessment. These were:

- Vegetation Survey and Rare Flora Search at The Menzies Railhead For Mt Mason Project, by Paul Armstong and Associates (May 2012). The Study Area used in this survey (**Figure 8**) remains current and represents the southern 2.5 km (approx 92 ha) of the Study Area for this survey. Vegetation mapping and on-ground assessments were not repeated for the Flora components during this assessment.
- Level 1 Flora and Vegetation Survey of the Proposed Menzies Bypass Haul Road, prepared by Native Vegetation Solutions (NVS) (2012). The Study Area used during this survey (**Figure 8**) has since been reviewed. The northern 2.5 km of the Study Area (approx 35 ha) remain the same for this assessment, but the Study Area now extends approximately seven kilometres further south.

3.1.1. Database Searches

The following database searches have recently been conducted for parts of the Study Area:

- Paul Armstrong and Associates (2012)
 - DEC Threatened Flora database, within a 40 km rectangle around the Study Area.
 - DEC Threatened Ecological Community database, with a search area extending at least 70 km from the Study Area.
- Native Vegetation Solutions (2012)
 - EPBC Protected Matters Database
 - DEC Threatened Flora database within a 50 km radius of the Study Area
 - DEC Threatened Ecological Community database (presumably also within a 50 km radius of the Study Area)

3.1.1.1. Conservation Significant Flora

A total of 37 conservation significant species were identified by either the Paul Armstrong and Associates (2012) or NVS (2012) database searches (**Table 2**). The species varied slightly between the two searches due to the difference in the location and extent of the surveyed areas.

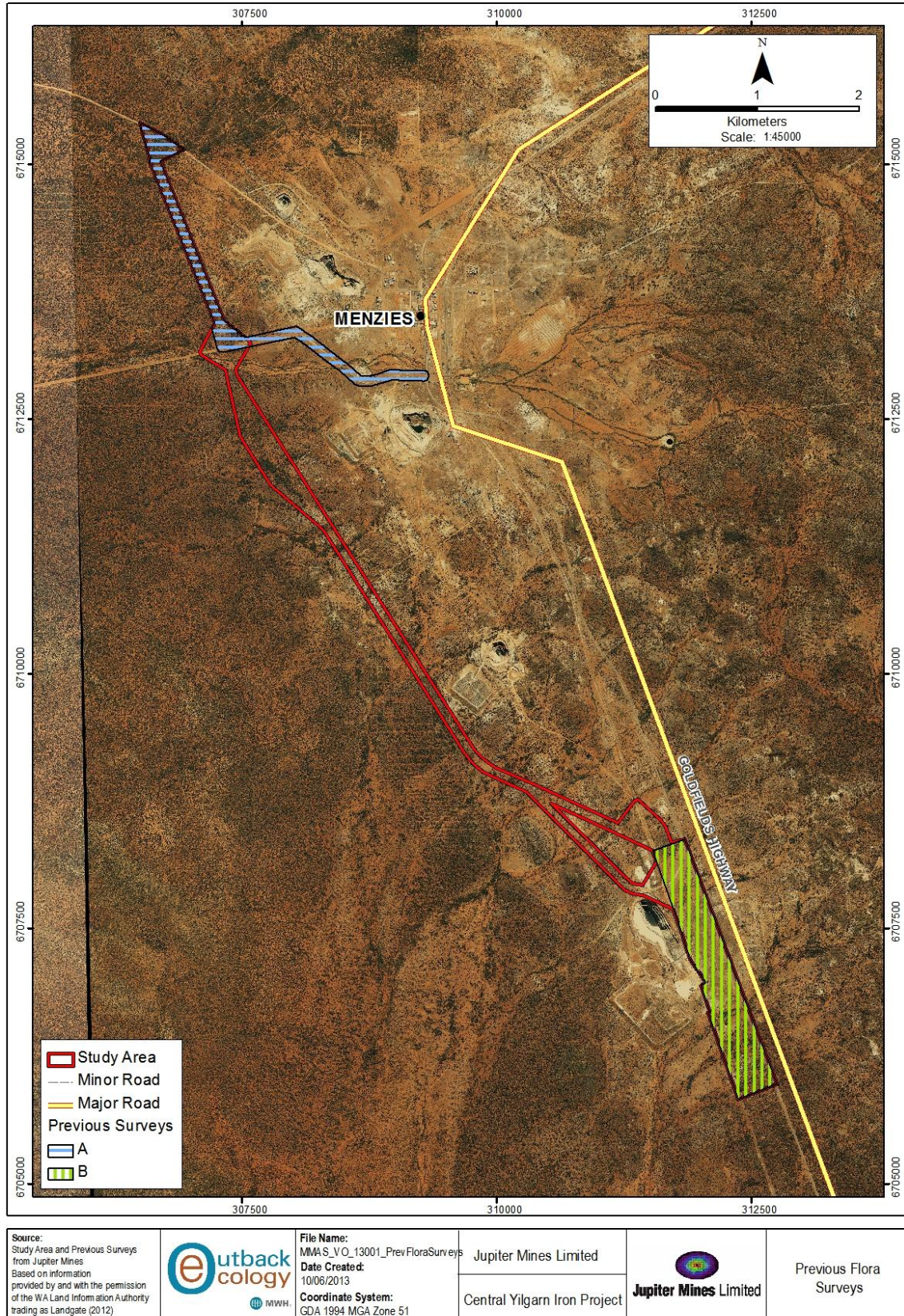


Figure 8: Location of previous flora surveys undertaken near the Menzies Bypass Study Area

Table 3: Conservation significant flora identified during database searches

Species	Priority Status	Paul Armstrong and Associates (2012)	Native Vegetation Solutions (2012)
<i>Acacia eremophila</i> var. <i>variabilis</i>	P3	X	X
<i>Alyxia tetanifolia</i>	P3	X	X
<i>Anacampeseros</i> sp. Eremaean (F. Hort, J. Hort & J. Shanks 3248)	P1	X	
<i>Atriplex lindleyi</i> subsp. <i>conduplicata</i>	P3		X
<i>Banksia arborea</i>	P4	X	
<i>Calytrix creswellii</i>	P3		X
<i>Calytrix praecipua</i>	P3	X	X
<i>Elatine macrocalyx</i>	P3	X	X
<i>Eleocharis papillosa</i>	P3	X	X
<i>Eremophila mirabilis</i>	P2	X	X
<i>Eucalyptus jutsonii</i>	P2	X	X
<i>Eucalyptus jutsonii</i> subsp. <i>jutsonii</i>	P4	X	X
<i>Euryomyrtus leptospermoides</i>	P3	X	X
<i>Eutaxia nanophylla</i>	P3		X
<i>Gnephosis intonsa</i>	P1	X	
<i>Gompholobium cinereum</i>	P3		X
<i>Grevillea erectiloba</i>	P4	X	X
<i>Grevillea secunda</i>	P4	X	
<i>Grevillea subterlineata</i>	P3	X	
<i>Gunniopsis propinqua</i>	P3	X	X
<i>Hakea rigida</i>	P2		X
<i>Hemigenia exilis</i>	P4	X	
<i>Homalocalyx grandiflorus</i>	P3	X	X
<i>Malleostemon</i> sp. Adelong (G.J. Keighery 11825)	P2	X	X
<i>Micromyrtus serrulata</i>	P3	X	X
<i>Newcastelia insignis</i>	P2	X	X
<i>Persoonia leucopogon</i>	P1	X	X
<i>Phebalium appressum</i>	P1		X
<i>Philothea coateana</i>	P3	X	X
<i>Philothea deserti</i> subsp. <i>brevifolia</i>	P1	X	X
<i>Ptilotus chortophytus</i>	P1	X	X
<i>Ricinocarpus brevis</i>	T	X	
<i>Rhagodia</i> sp. Yeelirrie Station (K.A. Shepherd <i>et al.</i> KS 1396)	P1		X
<i>Sowerbaea multicaulis</i>	P4	X	X
<i>Spartothamnella</i> sp. Helena & Aurora Range (P.G. Armstrong 155-109)	P3	X	
<i>Thryptomene eremaea</i>	P2	X	X
<i>Thysanotus brachyantherus</i>	P2	X	X

The DEC Threatened Flora database search conducted by Paul Armstrong and Associates (2012) identified 31 conservation significant taxa. Of them:

- One was considered threatened (*Ricinocarpus brevis*) and is classified under the *EPBC Act* as Endangered. The nearest known population was 100 km to the north west of the Study Area.
- 30 were classified as Priority Flora and included six Priority 1, six Priority 2, twelve Priority 3 and six Priority 4 species.

None of the species identified have records occurring within the Study Area. The NVS (2012) database search, which identified up to 29 conservation significant taxa, also indicated that no known locations of Priority Flora occur within the Study Area. Of the taxa identified by the Paul Armstrong and Associates (2012) database search, only 12 had location records within 20 km of the Study Area (Table 4).

Table 4: Conservation significant flora identified during the Paul Armstrong and Associates (2012) database searches as having locations within 20 km of the Study Area

Species Name	Conservation Significance	Description	Habitat
<i>Eleocharis papillosa</i>	Vulnerable	Sedge, typically less than 10 cm high	Ephemeral wetlands, predominantly freshwater and semi-saline swamps
<i>Persoonia leucopogon</i>	P1	Erect or decumbent shrub, 0.3-0.6 m high	Yellow sand or sandy clay
<i>Newcastelia insignis</i>	P2	Much-branched shrub, 0.3-0.9(-1.5) m high	Red or yellow sandy soils.
<i>Thryptomene eremaea</i>	P2	Erect open shrub, 0.5-1.5 m high	Red or yellow sandplains
Malleostemon sp. Adelong (G.J. Keighery 11825)	P2	Spreading shrub, 0.1-0.3 m high	Red sand sandplains.
<i>Acacia eremophila</i> var. <i>variabilis</i>	P3	Shrub, 1-1.6 m high.	Sandy or sandy loam substrate
<i>Homalocalyx grandiflorus</i>	P3	Spreading shrub, 0.2-0.5(-2) m high	Yellow sand sandplains.
<i>Philotheca coateana</i>	P3	Shrub, 0.3-0.5 m high	Red sand sandplains.
<i>Elatine macrocalyx</i>	P3	Herb, sepals 2-3mm long	Shallow sands over clay. Margins of playa lakes and clay pans.
<i>Eucalyptus jutsonii jutsonii</i>	P4	Mallee, 4-7 m high	Red to pale orange deep sands. Undulating areas and on dunes.
<i>Grevillea erectiloba</i>	P4	Shrub, 1-3 m high	Gravelly loam. Lateritic ridges.
<i>Sowerbaea multicaulis</i>	P4	Herb, 0.075-0.25 m high	Yellow-brown sandplains

The nearest records of Priority species (and the only to occur within 10 km) recorded in the Paul Armstrong and Associates Study Area were *Grevillea arectiloba* (located 4.8 km to the north-north-west), and *Thryptomene eremaea* (located 6.0 km north-north-west of the Study Area). The same two species were also listed in the NVS (2012) DEC database search, and due to the northern location of this Study Area, they were much closer in proximity. One of them, presumably *Thryptomene eremaea*, occurred within 420 m of the NVS (2012) Study Area.

While most of the species identified during the Paul Armstrong and Associates (2012) DEC database search were perennial shrubs or trees, five annual species were also listed. Of them, *Gnephosis intonsa* and *Ptilotus chortophytus*, were thought to have corresponding habitat types (red/brown clays and stony saline loam) within the Study Area, but may be undetectable during on-ground assessments, based on preceding rainfall conditions.

3.1.1.2. TEC and PEC

The TEC database search conducted by Paul Armstrong and Associates (2012) identified no TECs and four PECs:

- Banded Ironstone Hills with *Dryandra arborea*;
- Bulga Downs-Perinvale-Walling vegetation complexes (banded ironstone formation);
- Finnerty Range vegetation complexes (banded ironstone formation); and
- Lake Giles vegetation complexes (banded ironstone formation).

The closest of these was Bulga Downs-Perinvale-Walling vegetation complexes (banded ironstone formation) located approximately 55 km west of the Study Area.

A further eight PECs were identified within the DEC buffer to the west of the Study Area (Paul Armstrong and Associates 2012). The NVS (2012) TEC database search confirmed that there were no TECs or PECs occurring within the Study Area.

3.1.2. Literature Review

The Paul Armstrong and Associates (2011) and the Native Vegetation Solutions (2012) reports were reviewed, the results of which were collated to generate inventories of flora and vegetation, particularly those of conservation significance known to occur in the vicinity of the Study Area (**Table 5**).

Table 5: Summary of findings from previous flora surveys surrounding the Study Area

Figure 8 code	Reference	Study details	Proximity to Study Area	Vegetation Associations Present	Species of conservation significance	Introduced Species	Relevant notes
A	NVS (2012)	<p><u>Project:</u> Central Yilgarn Iron Project</p> <p><u>Client:</u> Jupiter Mines Limited</p> <p><u>Type:</u> Level 1 survey</p> <p><u>Date:</u> February 2012</p>	Northern portion of the Study Area	<ul style="list-style-type: none"> Mulga woodland with emergent <i>Eucalyptus oleosa</i> <i>Acacia sibirica</i> shrubland over mixed shrubs Open shrubland 	No species of conservation significance were recorded.	<p>Fourteen introduced weed species were recorded:</p> <ul style="list-style-type: none"> <i>Asphodelus fistulosus</i> <i>Acetosa vesicaria</i> <i>Brassica tournefortii</i> <i>Carrichtera annua</i> <i>Cenchrus ciliaris</i> <i>Centaurea melitensis</i>, <i>Daucus carota</i> <i>Lysimachia arvensis</i> <i>Medicago laciniata</i> var. <i>laciniata</i>, <i>Pentaschistis airoides</i> subsp. <i>airoides</i>, <i>Salvia verbenaca</i> <i>Schinus molle</i> var. <i>areira</i> <i>Sisymbrium erysimoides</i> <i>Solanum hystrix</i> 	The condition of vegetation was determined to be "Very Good", with areas where there were existing roads and tracks classified as "Good" or "Degraded" due to grazing and historic disturbances.
B	Paul Armstrong and Associates (2012)	<p><u>Project:</u> Central Yilgarn Iron Project</p> <p><u>Client:</u> Jupiter Mines Limited</p> <p><u>Type:</u> Level1 survey</p> <p><u>Date:</u> June 2012</p>	Southern portion of the Study Area	<ul style="list-style-type: none"> Mulga Thicket Mulga Open Scrub Drainage Lines Mulga on Stony Hills Regrowth 	No species of conservation significance were recorded.	<p>Eight introduced weed species were recorded::</p> <ul style="list-style-type: none"> <i>Carrichtera annua</i> <i>Carthamus lanatus</i> <i>Cenchrus ciliaris</i> <i>Citrullus lanatus</i> <i>Cucumis myriocarpus</i> <i>Cynodon dactylon</i> <i>Salvia verbenaca</i> <p><i>Carmathus lanatus</i> is a declared plant in Western Australia</p>	<p>The condition of most of the vegetation was "Good", although significant portions were "Degraded" to "Completely Degraded".</p> <p>The majority of the Study Area was classified as 'Regrowth', indicating significant prior disturbance.</p> <p>Two annual PF species, <i>Gnephosis intonsa</i> and <i>Ptilotus chortophytus</i>, have the potential to occur within the Study Area, but were unlikely to have been recorded due to preceding rainfall conditions.</p>

3.2. Fauna

To place the survey within a broader context, database searches and a literature review were performed prior to the fauna survey. Database searches (**Section 3.2.1**) were conducted to generate lists of terrestrial fauna species potentially occurring within the Study Area, whilst a literature review (**Section 3.2.2**) was conducted to generate lists of terrestrial fauna species known to occur within or near the Study Area, based on data from previous surveys.

3.2.1. Database Searches

Five database searches were undertaken as part of this assessment. For each search, the Study Area was defined as a central point with coordinates 309064 mE 6710939 mN (WGS 1984, UTM 52J). The databases and search areas used were:

- the Threatened and Priority Fauna Database (DEC 2012c), with a circular search area with a radius of 100 km surrounding the central point;
- the Birddata Custom Atlas Bird List (Birdlife Australia 2012), with a circular search area with a radius of 100 km surrounding the central point;
- the NatureMap database (DEC 2012a), with a circular search area with a radius of 40 km surrounding the central point;
- the Protected Matters Search Tool (DSEWPaC 2012b), with a search area consisting of a box surrounding the central point and delineated by the coordinates (clockwise, from the north-west corner) 209064 mE 6810939 mN, 409064 mE 6810939 mN, 409064 mE 6610939 mN, 209064 mE 6610939 mN; and
- the WA Museum (WAM) Arachnid, Diplopod and terrestrial Mollusc Collection Database (WAM 2012), with a circular search area with a radius of 100 km surrounding the central point.

It should be noted that at present WAM is only able to conduct database searches for SRE spiders, scorpions, pseudoscorpions and millipedes; snails or slaters are not included in this search.

3.2.1.1. Vertebrate Fauna

The database searches reported 226 species of native terrestrial vertebrate fauna (**Table 6; Appendix A**), 23 of which are of conservation significance (see **Appendix B** for full definitions of conservation status):

- the Slender-billed Thornbill (western) (*Acanthiza iredalei iredalei*), which is listed as Vulnerable (EPBC Act);
- the Malleefowl (*Leipoa ocellata*), which is listed as Vulnerable (EPBC Act), Schedule 1 (WC Act) and Migratory (EPBC Act);
- the Chuditch (*Dasyurus geoffroii*), which is listed as Vulnerable (EPBC Act) and Schedule 1 (WC Act);
- the Peregrine Falcon (*Falco peregrines*) and Woma (*Aspidites ramsayi*), which are listed as Schedule 4 (WC Act);

- the Australian Bustard (*Ardeotis australis*), Bush Stone-curlew (*Burhinus grallarius*), Shy Heathwren (western) (*Hylacola cauta whitlocki*), Crested Bellbird (southern) (*Oreoica gutturalis gutturalis*), White-browed Babbler (western wheatbelt) (*Pomastomus superciliosus ashbyi*), Hooded Plover (*Thinornis rubricollis*) and Long-tailed Dunnart (*Sminthopsis longicauda*), which are listed as Priority 4 (DEC Priority Fauna List); and
- 11 species of bird that are listed as Migratory (EPBC Act) and Schedule 3 (WC Act), being protected under international agreements (see **Appendix A** for the full list).

3.2.1.2. Invertebrate Fauna

The database searches reported 16 species of terrestrial invertebrate fauna of conservation significance, including 15 species of terrestrial SRE fauna, and one species of butterfly listed as Priority 1 under the DEC Priority Fauna List (**Table 20**).

3.2.2. Literature Review

The literature review identified eight previous fauna surveys undertaken near the Study Area and an SRE terrestrial fauna gap analysis report (**Table 7**; **Figure 9**), the results of which were collated to generate inventories of terrestrial vertebrate fauna and invertebrate fauna of conservation significance known to occur in the vicinity of the Study Area.

3.2.2.1. Vertebrate Fauna

Previous surveys considered in the literature review reported a total of 252 species of native terrestrial vertebrate fauna (**Table 6**; **Appendix A**), 13 of which are of conservation significance. Two of these species of conservation significance were not previously identified during the database searches (see **Section 3.2.1**):

- the Common Slender Blue-tongue (*Cyclodomorphus branchialis*), which is listed as Schedule 1 (WC Act); and
- the Major Mitchell's Cockatoo (*Lophochroa leadbeateri*), which is listed as Schedule 4 (WC Act).

3.2.2.2. Invertebrate Fauna

The previous surveys and report considered in the literature review reported a total of 17 species of terrestrial invertebrate fauna of conservation significance, five of which were not identified by the database searches as potentially occurring within the Study Area (**Table 20**).

Table 6: Terrestrial vertebrate species richness from previous surveys and database searches(see **Appendix A** and/or **Table 7** for a key to literature review and database search letter codes)

Fauna	This study	Literature review									Database searches					Total
		A	B	C	D	E	F	G	H	Total	I	J	K	L	Total	
Native mammals	2	12	9	10	9	11	10	10	21	29	2	0	20	0	22	31
Introduced mammals	3	2	1	3	1	7	5	4	7	9	0	0	1	4	4	9
Birds	15	65	34	60	34	51	57	56	111	137	14	119	80	7	139	158
Reptiles	2	26	13	33	12	26	21	40	52	83	1	0	61	0	61	91
Amphibians	0	2	0	0	0	2	0	0	0	3	0	0	4	0	4	5
Total native vertebrate fauna	19	105	56	103	55	90	88	106	184	252	17	119	165	7	226	285
Total vertebrate fauna	22	107	57	106	56	97	93	110	191	261	17	119	166	11	230	294

Table 7: Summary of findings from previous fauna surveys surrounding the Study Area

Figure 8 code	Reference	Study details	Proximity to Study Area	Methods	Habitats	Fauna recorded	Species of conservation significance	Relevant notes
A	Keith Lindbeck and Associates (in prep)	<p><u>Project:</u> Central Yilgarn Iron Project – Mt Ida</p> <p><u>Client:</u> Jupiter Mines Limited</p> <p><u>Type:</u> Level 2 survey</p> <p><u>Date:</u> September-October 2011 (Phase 1) and March-April 2012 (Phase 2)</p>	Approx. 70 km northwest	<ul style="list-style-type: none"> • Trapping (11,851 trap nights across 21 sites) • AnaBat recordings • Avifauna surveys • Spotlighting • Invertebrate sampling • Opportunistic observations 	<ul style="list-style-type: none"> • Mulga Scrub Communities • <i>Eucalyptus</i> Low Woodland • <i>Casuarina pauper</i> Communities • Low Myrtaceous Shrubland • <i>Eremophila pantonii</i> Low Scrub Communities • Banded Ironstone 	<p>107 species of terrestrial vertebrate fauna:</p> <ul style="list-style-type: none"> • 14 mammal (12 native) • 65 bird • 26 reptile • 2 amphibian 	<p><u>Threatened</u></p> <ul style="list-style-type: none"> • Malleefowl (EPBC Act – VU, M; WC Act – S1) <p><u>Priority</u></p> <ul style="list-style-type: none"> • Crested Bellbird (southern) (DEC – Priority 4) • White-browed Babbler (western wheatbelt) (DEC – Priority 4) • Long-tailed Dunnart (DEC – Priority 4) <p><u>Migratory</u></p> <ul style="list-style-type: none"> • Rainbow Bee-eater (EPBC Act – M; WC Act – S3) 	No significant fauna habitats were identified; however, more captures were recorded in Mulga Scrub Communities than other habitat types.
B	Keith Lindbeck and Associates (2012)	<p><u>Project:</u> Central Yilgarn Iron Project – Mt Mason</p> <p><u>Client:</u> Jupiter Mines Limited</p> <p><u>Type:</u> Level 2 survey</p> <p><u>Date:</u> August-September 2011 (Phase 1) and March 2012 (Phase 2)</p>	Approx. 90 km northwest	<ul style="list-style-type: none"> • Trapping (4,613 trap nights across ten sites) • AnaBat recordings • Avifauna surveys • Spotlighting • Invertebrate sampling • Opportunistic observations 	<ul style="list-style-type: none"> • Mulga Shrubland 	<p>57 species of terrestrial vertebrate fauna:</p> <ul style="list-style-type: none"> • 10 mammal (9 native) • 34 bird • 13 reptile 	<p><u>Priority</u></p> <ul style="list-style-type: none"> • Crested Bellbird (southern) (DEC – Priority 4) • White-browed Babbler (western wheatbelt) (DEC – Priority 4) • Long-tailed Dunnart (DEC – Priority 4) 	No significant fauna habitats were identified.
C	Ninox Wildlife Consulting (2012)	<p><u>Project:</u> Ularring Hematite Project – Snark Area</p> <p><u>Client:</u> Macarthur Minerals Limited</p> <p><u>Type:</u> Level 2 survey</p> <p><u>Date:</u> October 2011</p>	Approx. 100 km west	<ul style="list-style-type: none"> • Trapping (3,883 trap nights across 11 sites) • AnaBat recordings • Avifauna surveys • Area searches • Assessments of previously identified Malleefowl mounds • Opportunistic observations 	<ul style="list-style-type: none"> • Eucalypt woodlands along drainage lines • Black Oak woodlands on calcrete • <i>Acacia</i> low woodlands/shrublands (Mulga) on sandy clay loams • Sandplain shrubland on loamy sand • Banded Ironstone Ridges 	<p>106 species of terrestrial vertebrate fauna:</p> <ul style="list-style-type: none"> • 13 mammal (10 native) • 60 bird • 33 reptile 	<p><u>Threatened</u></p> <ul style="list-style-type: none"> • Malleefowl (EPBC Act – VU, M; WC Act – S1) <p><u>Priority</u></p> <ul style="list-style-type: none"> • Crested Bellbird (southern) (DEC – Priority 4) <p><u>Migratory</u></p> <ul style="list-style-type: none"> • Rainbow Bee-eater (EPBC Act – M; WC Act – S3) 	These surveys represent autumn (Survey C) and spring (Survey D) studies of the same sites. Survey C recorded fresh tracks of Malleefowl. Neither survey identified significant habitat for species of conservation significance; however, it was noted that some fauna are restricted to Banded Ironstone Formations.
D	KLA (2011)	<p><u>Project:</u> Snark Project</p> <p><u>Client:</u> Macarthur Minerals Limited</p> <p><u>Type:</u> Level 2 survey</p> <p><u>Date:</u> May 2011</p>	Approx. 100 km west	<ul style="list-style-type: none"> • Trapping (2840 trap nights across 11 sites) • AnaBat recordings • Avifauna surveys • Area searches • Opportunistic observations 	<ul style="list-style-type: none"> • Salt lake systems • Banded Ironstone Ridges 	<p>56 species of terrestrial vertebrate fauna:</p> <ul style="list-style-type: none"> • 10 mammal (9 native) • 34 bird • 12 reptile 	<p><u>Priority</u></p> <ul style="list-style-type: none"> • Crested Bellbird (southern) (DEC – Priority 4) 	

Figure 8 code	Reference	Study details	Proximity to Study Area	Methods	Habitats	Fauna recorded	Species of conservation significance	Relevant notes
E	Biota (2011)	<p><u>Project:</u> Koolyanobbing Iron Ore Project – Deception Deposit</p> <p><u>Client:</u> Cliffs Asia Pacific Iron Ore Proprietary Limited</p> <p><u>Type:</u> Level 2 survey</p> <p><u>Date:</u> May (Phase 1) and November-December (Phase 2) 2010</p>	Approx. 165 km west	<ul style="list-style-type: none"> • Trapping (2,803 trap nights across 11 sites) • AnaBat recordings • Harp traps for bats • Avifauna surveys • Area searches • Spotlighting • Opportunistic observations 	<ul style="list-style-type: none"> • Plains supporting shrubland on loam • Plains supporting shrubland on yellow sand • Plains supporting woodland on loam • Rocky slope of deposit with Mallee and/or shrubs • Granite outcropping 	<p>97 species of terrestrial vertebrate fauna:</p> <ul style="list-style-type: none"> • 18 mammal (11 native) • 51 bird • 26 reptile • 2 amphibian 	<p><u>Threatened</u></p> <ul style="list-style-type: none"> • Malleefowl (EPBC Act – VU, M; WC Act – S1) <p><u>Priority</u></p> <ul style="list-style-type: none"> • Crested Bellbird (southern) (DEC – Priority 4) • White-browed Babbler (western wheatbelt) (DEC – Priority 4) <p><u>Migratory</u></p> <ul style="list-style-type: none"> • Rainbow Bee-eater (EPBC Act – M; WC Act – S3) 	
F	Ninox Wildlife Consulting (2009)	<p><u>Project:</u> Yilgarn Iron Ore Project – Carina Prospect</p> <p><u>Client:</u> Polaris Metals NL</p> <p><u>Type:</u> Level 2 survey</p> <p><u>Date:</u> June (Phase 1) and October-November (Phase 2) 2008</p>	Approx. 130 km southwest	<ul style="list-style-type: none"> • Trapping (1728 trap nights across six sites) • AnaBat recordings • Targeted SRE invertebrate searches • Avifauna surveys • Area searches • Opportunistic observations 	<ul style="list-style-type: none"> • Open Low Woodland on red to yellow sandy clay flats • Woodland on flat red clay soils • Scrub on red-brown clay upper slopes and ridges with ironstone outcropping • Open Woodland on red-brown clay to sandy clay on flats with scattered ironstone pebbles • Woodland on red-brown sandy clay flats with scattered ironstone and quartz pebbles 	<p>93 species of terrestrial vertebrate fauna:</p> <ul style="list-style-type: none"> • 15 mammal (10 native) • 57 bird • 21 reptile 	<p><u>Threatened</u></p> <ul style="list-style-type: none"> • Major Mitchell's Cockatoo (WC Act – S4) <p><u>Priority</u></p> <ul style="list-style-type: none"> • Australian Bustard (DEC – Priority 4) <p><u>Migratory</u></p> <ul style="list-style-type: none"> • Rainbow Bee-eater (EPBC Act – M; WC Act – S3) 	
G	Outback Ecology (2009)	<p><u>Project:</u> Randalls Gold Project</p> <p><u>Client:</u> Integra Mining Limited</p> <p><u>Type:</u> Level 2 survey and Level 1 survey of a Priority 3 Priority Ecological Community (comprising targeted Malleefowl survey and SRE invertebrate habitat assessment)</p> <p><u>Date:</u> November 2008</p>	Approx. 175 km southeast	<ul style="list-style-type: none"> • Trapping (2,184 trap nights across six sites) • AnaBat recordings • Avifauna surveys • Area searches • Spotlighting • Opportunistic observations • Targeted SRE invertebrate habitat searches • Targeted Malleefowl searches 	<ul style="list-style-type: none"> • Chenopod shrubland on river flat • Mallee woodland on greenstone hill • Mallee woodland over Spinifex • Blackbutt over open shrubland • Salmon Gum woodland over open scrub • Open Mallee woodland over saltbush 	<p>110 species of terrestrial vertebrate fauna:</p> <ul style="list-style-type: none"> • 14 mammal (10 native) • 56 bird • 40 reptile 	<p><u>Threatened</u></p> <ul style="list-style-type: none"> • Major Mitchell's Cockatoo (WC Act – S4) <p><u>Migratory</u></p> <ul style="list-style-type: none"> • Rainbow Bee-eater (EPBC Act – M; WC Act – S3) • Wood Sandpiper (EPBC Act – M; WC Act – S3) • Common Greenshank (EPBC Act – M; WC Act – S3) 	This survey recorded the Western Rosella (Mallee), which at the time was of conservation significance; however, this species is no longer considered threatened.

Figure 8 code	Reference	Study details	Proximity to Study Area	Methods	Habitats	Fauna recorded	Species of conservation significance	Relevant notes
H	Burbidge <i>et al.</i> (1995)	<p><u>Project:</u> Biological survey of the Eastern Goldfields – Barlee-Menzies Study Area</p> <p><u>Client:</u> Western Australian Museum</p> <p><u>Type:</u> Biological survey (comprising assessments of the physical environment, vegetation and flora and vertebrate fauna)</p> <p><u>Date:</u> Three site visits: July-August 1979, September 1980 and March 1981</p>	Between approx. 25 and 225 km west	<ul style="list-style-type: none"> • Trapping (ten sites) • Avifauna surveys • Area searches • Spotlighting • Mist-netting • Opportunistic observations 	<ul style="list-style-type: none"> • Broad valleys • Salt lake Features • Sandplains • Banded Ironstone Hills • Undulating Plain • Granite Exposures 	<p>191 species of terrestrial vertebrate fauna:</p> <ul style="list-style-type: none"> • 28 mammal (21 native) • 111 bird • 52 reptile 	<p><u>Threatened</u></p> <ul style="list-style-type: none"> • Malleefowl (EPBC Act – VU, M; WC Act – S1) • Slender-billed Thornbill (western) (EPBC Act – VU) • Common Slender Blue-tongue (WC Act – S1) • Peregrine Falcon (WC Act – S4) <p><u>Priority</u></p> <ul style="list-style-type: none"> • Hooded Plover (DEC – Priority 4) <p><u>Migratory</u></p> <ul style="list-style-type: none"> • Rainbow Bee-eater (EPBC Act – M; WC Act – S3) 	This survey is part of a comprehensive series of biological surveys covering the Eastern Goldfield's region Western Australia and published by the Western Australian Museum.
n/a	Outback Ecology (in prep)	<p><u>Project:</u> Central Yilgarn Iron Project</p> <p><u>Client:</u> Jupiter Mines Limited</p> <p><u>Type:</u> Terrestrial SRE Invertebrate Fauna Gap Analysis</p> <p><u>Date:</u> November 2012</p>	This report comprises a review of previous invertebrate survey work associated with the Mt Ida and Mt Mason projects, including KLA (2012, in prep) and Outback Ecology (2011), which covered study areas located between approximately 70 and 90 km northwest of the Study Area. This review summarises the findings of these previous surveys with up-to-date taxonomy and conservation status information.	n/a	n/a	17 species of SRE invertebrate fauna (see Table 20)		

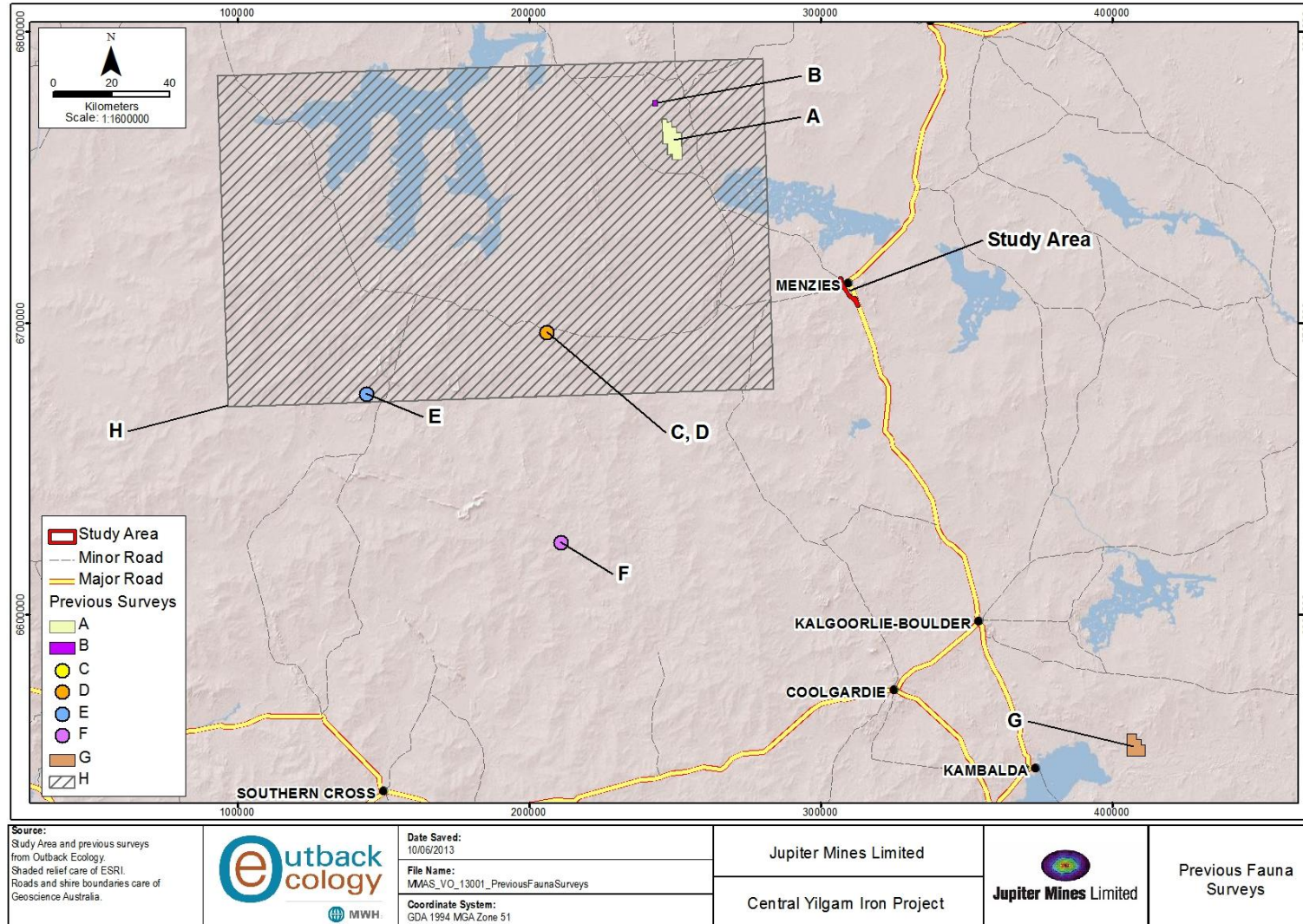


Figure 9: Location of previous fauna surveys undertaken near the Study Area

4. FIELD SURVEY METHODOLOGY

4.1. Survey Timing and Weather

Two field trips were conducted during this assessment; a level 1 fauna assessment of the Study Area on the 9 November 2012 and a level 1 flora assessment between the 22 and 23 May 2013. Limited rainfall was received at Menzies prior to the field season. It should be noted that both January and March 2013 experienced rainfall that exceeded the long-term average by over four times for those months (**Figure 10**).

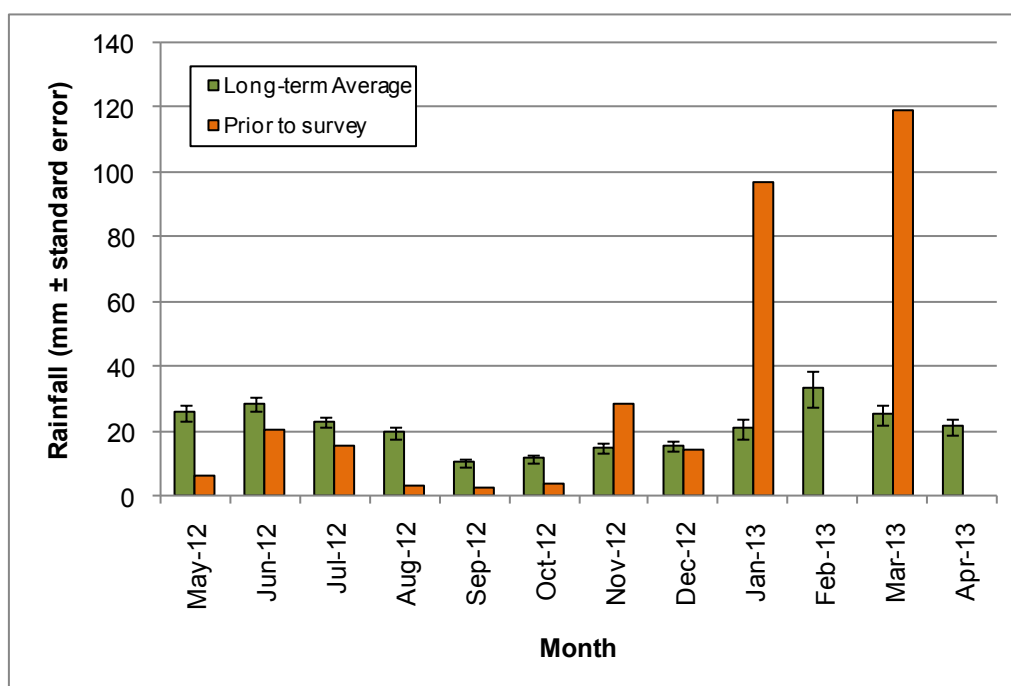


Figure 10: Rainfall at Menzies prior to the Survey*, compared with the long term average

Source data: BOM (2012), 1896-2012

*Rainfall statistics for January-April 2013 are incomplete and therefore may not reflect total rainfall for those months

4.2. Flora

4.2.1. Vegetation Associations

Broad vegetation associations within the Study Area, based on soil types, topography and species were identified in the field. Representative areas were chosen and relevés were used to describe the associations present. A relevé is a description of a homogenous stand of vegetation without the boundaries imposed by a quadrat, the results of which are not used in statistical analysis. Relevés allow for the dominant species and unique features of a site to be captured quickly, allowing for more accurate representation of the vegetation to be mapped and anomalies across the site to be captured.

For each relevé the following information was recorded:

- GPS location (recorded in GDA94 UTM 51J)
- Photograph of the vegetation
- Soil type and presence of outcropping
- Vegetation community condition

- Dominant or key species listed and cover estimated
- Vegetation description
- Disturbance level and description

Prior to the survey, vegetation units were identified as far as practicable on aerial photographs of the Study area in conjunction with information collected in the desktop review. Relevé data and field observations were used to refine vegetation association mapping boundaries. Vegetation units were described using a vegetation classification based on height and estimated cover as described by Keighery (1994). Vegetation condition was defined using the Keighery Scale (Keighery 1994).

4.2.2. Conservation Significant Flora

The Study Area was systematically searched on-foot for flora of conservation significance. Tracks were recorded using a handheld GPS unit and used to ensure that as much ground as possible was covered within the Study area.

The total traverse length within the Study Area was approximately 35 km, along which 22 vegetation relevés were recorded (**Figure 11**). The area previously surveyed and mapped by Paul Armstrong and Associates (2012) was not re-assessed during this assessment, and the vegetation association descriptions used by Paul Armstrong and Associates (2012) and Outback Ecology (2013) vary slightly.

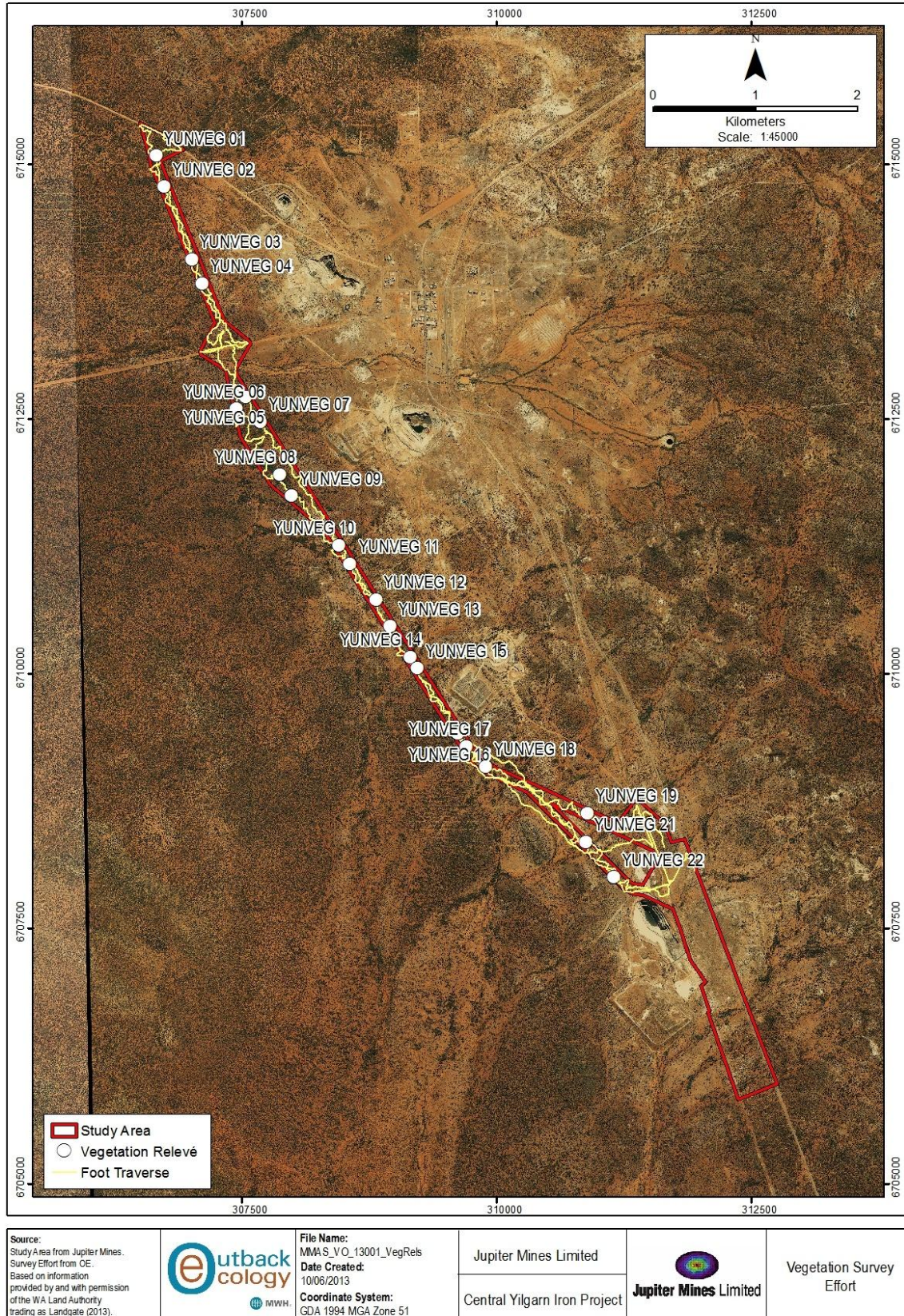


Figure 11: On-foot traverses of the Study Area showing locations of relevés

4.3. Fauna

4.3.1. Habitat Assessment

Broad habitat types within the Study Area were identified in the field and representative areas were chosen for habitat assessments. The purpose of the habitat assessments was to characterise the quality and complexity of habitat provided for fauna, with a focus on species of conservation significance. The following parameters were considered:

- landscape and soil features;
- presence or absence of logs or other habitat structures;
- vegetation cover, condition and species composition;
- estimate of leaf litter cover percentage and type;
- presence or absence of water; and
- type and level of disturbance.

A total of five habitat assessments were conducted within the Study Area (**Appendix C**). Habitat information gathered during the field survey was subsequently used in conjunction with aerial imagery and topographic maps to produce habitat maps for the Study Area.

4.3.2. Habitat Searches and Opportunistic Observations

To develop an inventory of fauna species occurring within the Study Area, including all terrestrial vertebrate and invertebrate species of conservation significance, searches were conducted across the Study Area, ensuring all broad fauna habitat types identified (see **Section 4.3.1**) received adequate coverage. Searches involved:

- observation and documentation of fauna seen or heard, or whose presence was inferred from tracks, scats or burrows;
- active hand-searching for cryptic species by overturning logs and stones, and searching beneath leaf litter and the bark of dead trees; and
- targeted searches of microhabitats likely to support species of conservation significance.

5. RESULTS AND DISCUSSION

5.1. Flora

5.1.1. Flora Composition

A total of 114 taxa (including subspecies and variants) from 32 families and 63 genera were recorded from within the Study area during the May 2013 survey (**Appendix D**). The most frequently occurring families within the Study area were Chenopodiaceae (18 species), Fabaceae (18 species), Poaceae (12 species) and Scrophulariaceae (12 species), together comprising 53% of species identified. This is a dominant floristic composition typical of the Murchison bioregion (Desmond *et al.* 2001) and similar to what had been recorded during the Paul Armstrong and Associates (2012) and Native Vegetation Solutions (2012) surveys. A number of specimens could not be positively identified due to inadequate flowering or fruiting material and are denoted by a “sp” in **Appendix D**.

5.1.2. Conservation Significant Flora

No Threatened Flora species as listed under the *EPBC Act 1999*, or Threatened Flora species listed under the *Wildlife Conservation Act 1950 (WA)* were recorded within the Study area. No Priority flora species were recorded in the Study Area. Given the degree of disturbance, it is unlikely that any of the species identified during the database searches were present within the Study Area. It is possible, however, that preceding rainfall conditions, may have limited the expression of some rainfall-dependent or annual species.



5.1.3. Introduced Species




Due to the highly disturbed nature of the Study Area, and close proximity to the town of Menzies, the degree of infestation by introduced species was high, with 17 species identified within the Study Area (**Table 8, Figure 12**). This included five species not recorded by previous surveys in the area (Paul Armstrong and Associates (2012), Native Vegetation Solutions (2012)). It should be noted, however that some of these species are ‘tolerated’ by regulating bodies and not all of them should be considered ‘weeds’. None of the introduced species recorded were classified by the Department of Agriculture and Food as a Declared Plant for the Menzies municipal district, although *Heliotropium europaeum* is Declared (P1, P3, P4) in areas further south and in the south-western districts of Western Australia.




Three further introduced species were identified within 100 m of the Study Area, adjacent to the rail corridor near the abandoned Princess Mary Mine. These were **Asphodelus fistulosus* (Onion Weed), **Centaurea melitensis* (Maltese Cockspur) and **Opuntia* sp. (Prickly Pear), the latter of which is a Declared Plant in Western Australia.




There is the possibility that some of the annual introduced species identified by Native Vegetation Solutions (2012), such as **Brassica tournefortii* (Wild Turnip), **Daucus carota* (Wild Carrot) and **Medicago laciniata* var. *laciniata* (Cutleaf Medic) could also occur within the Study Area, but may not have present during the May 2013 field assessment due to the lack of adequate rainfall preceding the survey.




Table 8: Introduced flora species recorded within the Study Area during the May 2013 survey

Species	Occurrence	Reference Photograph#
* <i>Acetosa vesicaria</i> (Ruby Dock)	Colonisation of rocky areas including adjacent roads and rail corridor. Also present among historic mine workings, distant from regular traffic. As an annual species, it is likely to be more widespread in the area than recorded during the May 2013 survey.	
* <i>Agave Americana</i> (Century Plant)	Single plant observed towards the south of the Study Area near the northern edge of the abandoned Princess Mary Pit	
* <i>Carrichtera annua</i> (Ward's Weed)	Most prevalent in roadside drains and along edges of corridors. Some associated with prospecting disturbance and stock watering points distant from regularly trafficked areas.	No photograph

Species	Occurrence	Reference Photograph#
<p>*<i>Cenchrus ciliaris</i> (Buffel Grass)</p>	<p>Present throughout in low lying areas including areas distant from regular traffic. Most prevalent along the Evanston Road, the rail corridor, the Sandstone Road and in southern sections of the Study Area (near the Princess Mary mine). Also associated with historic workings and drainage lines.</p>	 <p><i>Cenchrus ciliaris</i> Photos: G.F. Craig, R. & M. Long & L. Wallis</p>
<p>*<i>Citrullus lanatus</i> (Pie Melon)</p>	<p>Only observed along Evanston Road verges</p>	 <p><i>Citrullus lanatus</i> Photos: R. Randall & J. Dodd</p>
<p>*<i>Cucumis myriocarpus</i> (Paddy Melon)</p>	<p>Observed along the Sandstone Road and Evanston Road road verges and in associated drains.</p>	

Species	Occurrence	Reference Photograph#
<p>*<i>Cynodon dactylon</i> (Couch)</p>	<p>Present along road verges, particularly the Evanston Road.</p>	 <p><i>Cynodon dactylon</i> Photo: L. Fontanini</p>
<p>*<i>Heliotropium europaeum</i> (Heliotrope)</p>	<p>Small population near abandoned water near northern edge of Princess Mary Pit.</p>	
<p>*<i>Nerium oleander</i> (Oleander)</p>	<p>Single individual observed in southern part of Study Area near abandoned water and Pit.</p>	

Species	Occurrence	Reference Photograph#
<p><i>*Pentameris airoides</i> (False Hair Grass)</p>	<p>Most prevalent in southern areas of Study Area including along rail corridor. Occurrences also in creek lines and run-on flats in centre of Study Area usually in close proximity to historic workings.</p>	
<p><i>*Salvia verbenaca</i> (Wild Sage)</p>	<p>Most common along road and rail corridors, and in roadside drains.</p>	<p>No photograph</p>
<p><i>*Schinus molle</i> var. <i>areira</i> (Pepper Tree)</p>	<p>Several individuals in southern section of Study area near abandoned water and Princess Mary Pit.</p>	
<p><i>*Sisymbrium erysimoides</i> (Smooth Mustard)</p>	<p>Observed in southern parts of Study Area and along rail corridor.</p>	<p>No photograph</p>
<p><i>*Solanum nigrum</i> (Blackberry Nightshade)</p>	<p>Single individual observed in south of Study Area, near the abandoned water north of the Princess Mary Pit</p>	

Species	Occurrence	Reference Photograph#
<p><i>*Solanum hystrix</i> (Afghan Thistle)</p>	<p>Largest presence was along Evanston Road verge drains, but was also present along Sandstone Road and near southern areas of Study area. One small population on small patch of disturbance distant from regularly trafficked areas.</p>	
<p><i>*Sonchus oleraceus</i> (Common Sowthistle)</p>	<p>Observed along road and rail corridors and occasionally in historic workings further away from regularly trafficked areas.</p>	
<p><i>*Tribulus terrestris</i> (Caltrop)</p>	<p>Large desiccated mats in areas south of the Sandstone Road, adjacent stock watering points and in southern sections of the Study Area.</p>	 <p><i>Tribulus terrestris</i></p> <p>Photos: S.M. Armstrong, J. Dodd & R. Knox</p>

#Photographs taken by A. Friedel or courtesy of the DEC FloraBase

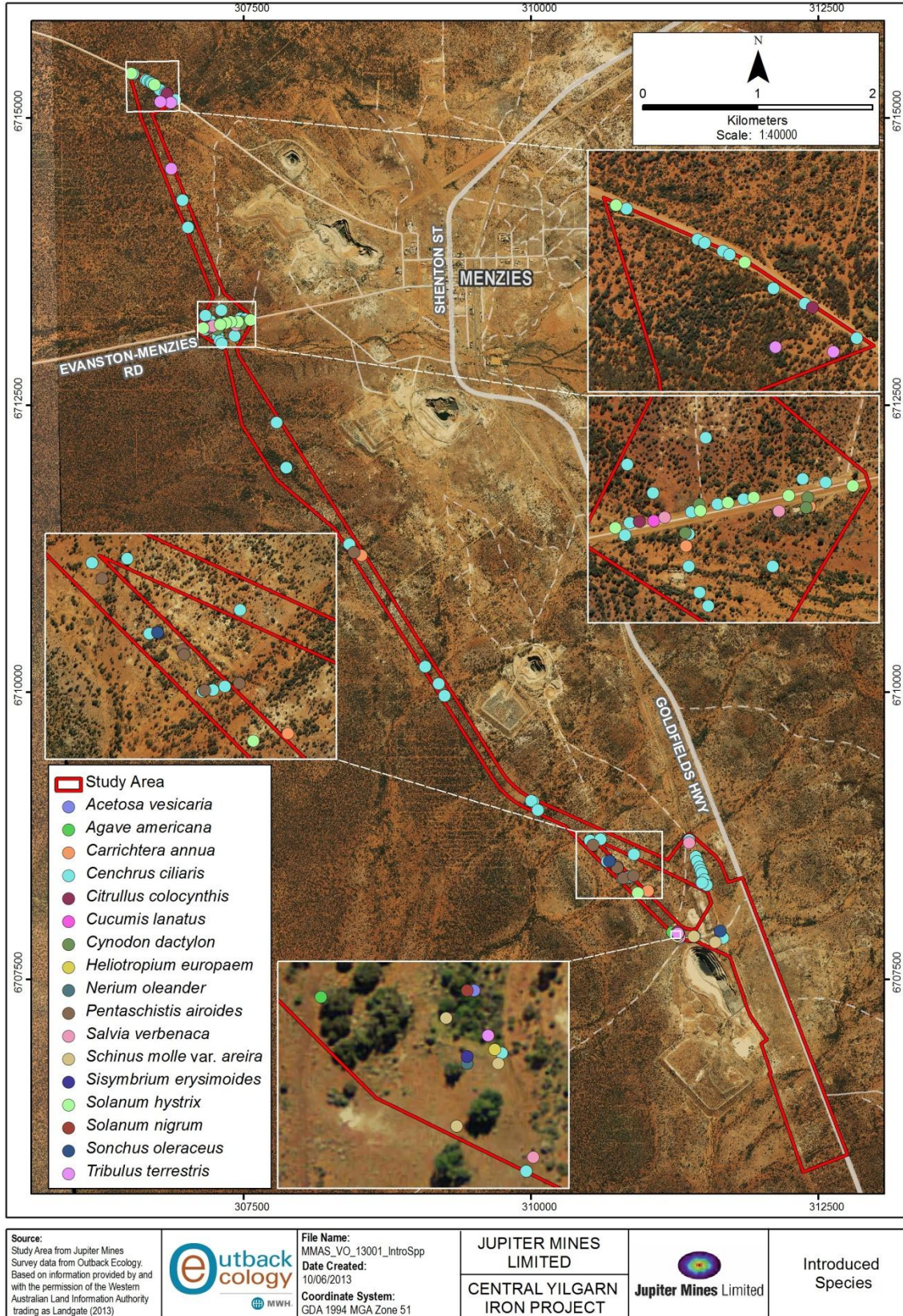


Figure 12: Study Area showing occurrences of introduced species

The highest frequency and cover of introduced species occurred on or adjacent to existing disturbance, which included the Sandstone Road in the north, the Evanston Road, which bisect the Study Area west of Menzies, the rail corridor which partitions the south-eastern portion of the Study Area, and the abandoned Princess Mary Mine to the south of the Study Area. In the case of the road and rail corridors, the populations of introduced flora species rarely occurred more than 10 m away from existing disturbance.

Five species (**Agave americana*, **Heliotropium europaeum*, **Nerium oleander*, **Schinus molle* var. *areira* and **Solanum nigrum*) were present only within 100 m of a presumably, former stock watering point or outstation adjacent to the northern edge of the Princess Mary Pit. Many of the other introduced species were also recorded in their highest frequency near this location. The remains of a dead date palm (**Phoenix dactylifera*) were rooted within an old tank foundation in this area.







The most widespread and common species encountered was **Cenchrus ciliaris* (Buffel Grass), which occurred mostly in areas prone to the collection of water, such as road verges and run-on flats and watercourses in parts of the Study Area distant from recent disturbance. A number of other species including **Carrichtera annua* (Wards Weed) and **Pentameris airoides* (False Hair Grass) were frequently observed away from regularly trafficked areas and are expected to have been transported by off-road vehicle or stock movements. Some were observed colonising historic mine workings and associated disturbance (abandoned shafts, mullock heaps and prospecting pads). The potential for spread and further infestation of these species is considered moderate, but at the time of monitoring they did not appear to be significantly impacting remnant native vegetation.

5.1.4. Vegetation Associations

The vegetation present within the Study Area comprised mostly of mixed-Acacia and occasional Mallee or Black-Oak dominated upper storey and mixed shrubland lower stratum comprising species of *Acacia*, *Atriplex*, *Eremophila*, *Maireana*, *Ptilotus*, *Senna*, *Sida* and *Solanum*. The largest difference between the associations described was whether they represented run-off (water-shedding) environments or run-on (drainage) environments. The other determining factor was the amount and type of stones or rock within the surface medium, which comprised typically of red loams with occasional more-sandy or more-clayey components. A total of six vegetation associations were described and mapped (**Table 9**, **Figure 13**). Three of them represent various drainage areas (dominated by either Mulga, Mallee or chenopod shrubs), and the other three run-off areas (with either fine or coarse rocky material or sandy substrate). In total, information was collected from 22 relevé sites (**Appendix E**), with each vegetation association being represented by between one and seven relevés.

The south-eastern portion of the Study Area (92 ha) that was surveyed by Paul Armstong and Associates (2012) was not remapped as part of the May 2013 assessment. Paul Armstong and Associates (2012) identified five slightly different vegetation associations; regrowth, mulga, open mulga, mulga on rocky hill and drainage lines. The resulting figures are provided in **Appendix F**.

Table 9: Vegetation Association Descriptions

Association Description	Soil Type	Dominant structure/composition	Relevé Condition	Representative Photograph
Tall Shrubland on Stony Plains	Stony red loam	Open Tall Woodland of <i>Acacia incurvaneura</i> and/or <i>Acacia caesaneura</i> with occasional <i>Casuarina pauper</i> emergents over open Tall Shrubland of <i>Acacia mulganeura</i> and other mixed <i>Acacia</i> shrubs over Open Shrubland of <i>Dodonea</i> , <i>Eremophila</i> , <i>Scaevola</i> and <i>Senna</i> species over mixed Chenopod Shrubland with <i>Ptilotus obovatus</i> and <i>Solanum lasiophyllum</i> .	6 Good 1 Degraded	
Open Shrubland on Stony or Rocky Rises	Stony or rocky sandy loam	Tall Open Shrubland of <i>Acacia caesaneura</i> and <i>Acacia mulganera</i> with or without <i>Casuarina pauper</i> and <i>Eucalyptus</i> spp. emergents over Open Shrubland of <i>Dodonea lobulata</i> , <i>Eremophila</i> spp., <i>Scaevola spinescens</i> <i>Senna artemisioides</i> subsp. <i>filifolia</i> , and <i>Sida</i> spp. over Low Shrubland of <i>Maireana trichoptera</i> and <i>Ptilotus obovatus</i> .	3 Good	
Tall Shrubland Sandplains	Sandy red loam	Tall shrubland comprising <i>Acacia burkittii</i> , <i>A. craspedocarpa</i> , <i>A. mulganeura</i> and <i>A. sibirica</i> with <i>Casuarina pauper</i> emergents over Open Shrubland of <i>Senna artemisioides</i> subsp. <i>filifolia</i> and <i>Dodonea lobulata</i> over Low Shrubland of <i>Ptilotus obovatus</i> and <i>Sclerolaena diacantha</i>	1 Very Good	
Mallee Drainage and Sandplains	Sandy red clay loam	Open Woodland of <i>Eucalyptus oleosa</i> and <i>Casuarina pauper</i> with or without interspersing <i>Acacia incurvaneura</i> over Tall Shrubland of <i>Acacia hemiteles</i> , <i>A. ligulata</i> , <i>Eremophila scoparia</i> and <i>Senna artemisioides</i> subsp. <i>filifolia</i> over sparse Low Shrubland of <i>Atriplex bunburyana</i> , <i>Maireana georgei</i> , <i>Ptilotus obovatus</i> and <i>Sclerolaena diacantha</i> .	1 Good 2 Degraded	
Mulga Drainage and Sandplains	Sandy red clay loam	Closed or Open Tall Woodland comprising <i>Acacia incurvaneura</i> and/or <i>Acacia caesaneura</i> with occasional <i>Eucalyptus oleosa</i> and <i>Casuarina pauper</i> over Sparse Tall <i>Acacia</i> Shrubland over Open Shrubland of <i>Enchylaena tomentosa</i> , <i>Ptilotus obovatus</i> , <i>Scaevola spinescens</i> , <i>Sida</i> spp. and <i>Solanum lasiophyllum</i> over occasional concentrated Herblands of <i>Abutilon</i> sp. <i>Cheilanthes sieberi</i> and <i>Euphorbia drummondii</i>	1 Very Good 4 Good	
Shrubland Drainage and Sandplains	Sandy red clay loam	Sparse Tall Shrubland of <i>Acacia tetragonophylla</i> and <i>Eremophila longifolia</i> over Open Shrubland of <i>Senna artemisioides</i> subsp. <i>filifolia</i> , and mixed chenopods including <i>Atriplex bunburyana</i> , <i>Maireana sedifolia</i> and <i>M. triptera</i> over Low Shrubland of <i>Sclerolaena diacantha</i> and <i>Solanum lasiophyllum</i> , over Sparse Grassland.	2 Good 1 Degraded	

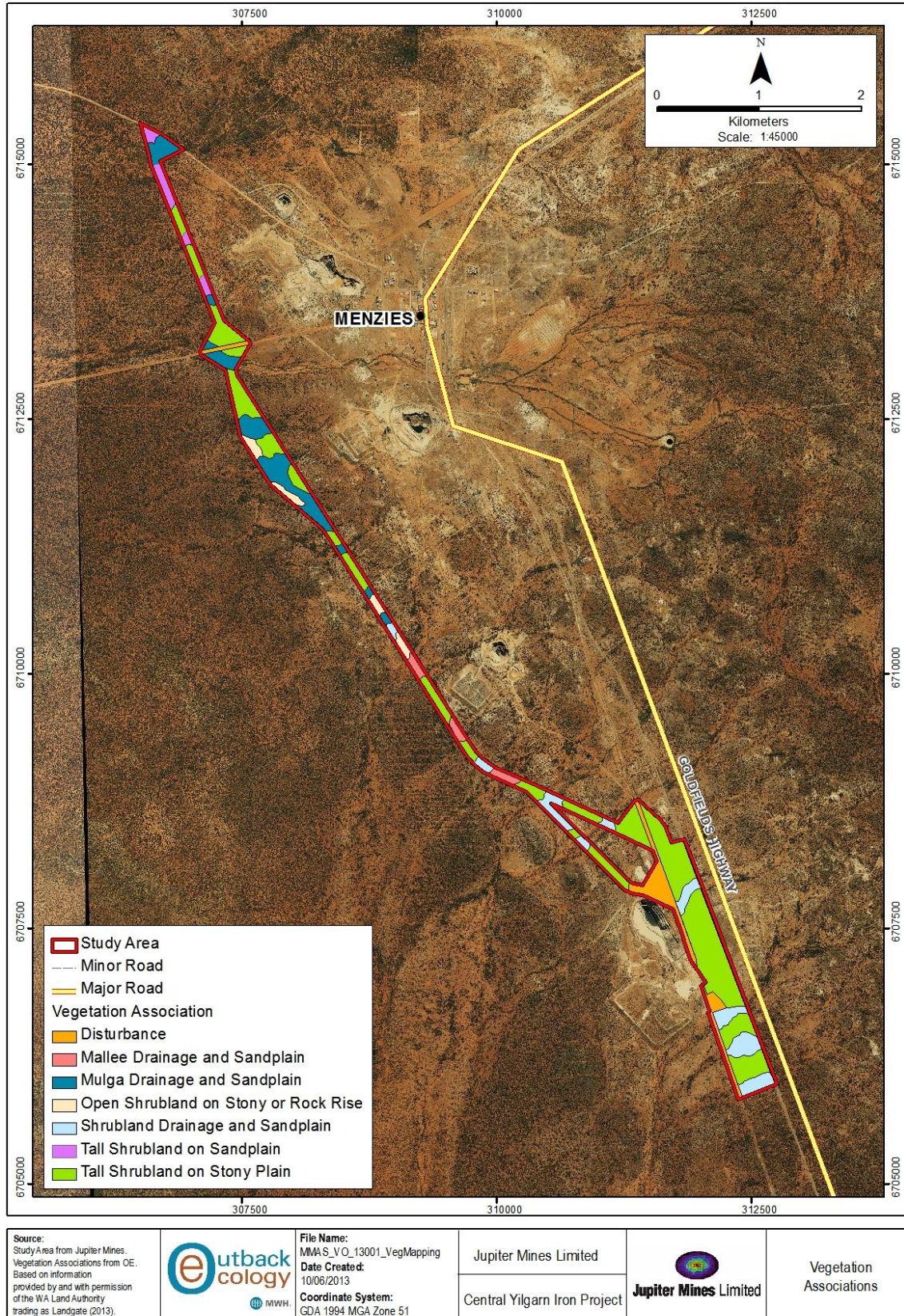


Figure 13: Study Area showing vegetation associations in the Study Area (May 2013)

The association that covered the largest proportion of the Study Area was the Tall Shrubland on Stony Plains (**Table 10**). While mallee (primarily *Eucalyptus oleosa*) was present throughout, the Mallee Drainage and Sandplains association was largely confined to the central areas of the Study Area. The Tall Shrubland Sandplain association was generally confined to areas north of the Evanston Road. This drainage association tended to be in poorer condition due to the disturbances caused by the more regular and rapid flow of water, concentration of stock and other grazing herbivore activity and the absence of a stabilising stony surface. The surface crust integrity of these areas was generally poor and there was a propensity for erosion. These association areas would be considered most 'at risk' by the proposed haul road Project.

Table 10: Vegetation Association Proportions

Association	Area (ha)	Proportion of Study Area (%)
Tall Shrubland on Stony Plains	132.9	52.1
Open Shrubland on Stony or Rocky Rises	9.4	3.7
Tall Shrubland on Sandplain	9.6	3.8
Mallee Drainage and Sandplains	7.4	2.9
Mulga Drainage and Sandplains	35.7	14.0
Shrubland Drainage and Sandplains	30.2	11.9
Disturbed	29.7	11.6
Total:	254.9	100

5.1.5. Beard Vegetation Associations

The current extant of all vegetation associations within the Study area exceed 99% (Beard 1975) (**Table 11**). It is important to note that "Vegetation Associations" may contain complexes or groupings of different floristic communities of which more detailed representation and reservation is not known. The condition of the vegetation throughout the extent of each vegetation complex is also not taken into consideration in these reported figures.

Vegetation Associations 18 listed as of medium reservation priority in the biodiversity audit of the Eastern Goldfields subregion, where as vegetation association 20 and 251 were listed as low (Cowan 2001). However only 5.12% of association 18, 14.98% of association 20 and 8.97% of association 251 are reserved in DEC managed lands in the Eastern Murchison sub-bioregion.

Table 11: Beard Association Remaining in the Sub-bioregion

Beard Vegetation Association	Pre-European extent (ha) in WA	Study area (ha)	Eastern Murchison Sub-bioregion		
			Area (ha)	Percentage of pre-European extent still extant (2009)	Percentage of removed pre-European extent
18	19,892,304.8	72.2 (28.5%)	10,269,895.8	100	0.0007
20	1,295,103.3	175.6 (69.4%)	1,174,259.12	100	0.015
251	173,096.2	5.3 (2.1%)	58,012.00	100	0.0091

5.1.6. Conservation Significance of Vegetation in the Study Area

None of the vegetation associations recorded within the Study Area were analogous to described PECs. No banded ironstone habitat, likely to support regional PEC vegetation associations was recorded in the Study Area.

5.1.7. Vegetation Condition

The Study Area was generally highly disturbed due to its close proximity to Menzies. Among the disturbances were numerous light vehicle tracks and the larger transport corridors of the Sandstone Road, Evanston Road, Goldfields Highway and northern railway. Mining in various degrees has had a large impact on the Study Area. Infrastructure associated with the abandoned Princess Mary mine; including a waste rock landform and open pit are located in the south of the Study Area. Evidence of prospecting and historic mine workings including shafts and mullock heaps were also present throughout, as well as evidence of more recent clearing and prospecting. As a result of past (and current) activity, refuse, bottle dumps and scrap metal were also present throughout the Study Area. Historically, significant amounts of timber had been cut in the Study Area, particularly in the southern parts, with low levels of recovery at the time of assessment.

The presence of stock (rogue or otherwise) and other grazing herbivores has had a significant effect on the types and species of vegetation present throughout the Study area, with the majority of palatable species either being 'grazed out' or with distinct browselines. A dam near the centre of the Study Area provided the nearest available surface water at the time of assessment. The removal of vegetation in this area had caused numerous erosion channels and transport of sediment. Some recovery had occurred around a former watering point or outstation near the northern rim of the

Princess Mary Pit, but this also included the proliferation of weed species introduced to the area, particularly along erosion or drainage features.

Vegetation condition ranged from 'Degraded' to 'Very Good' based on the Keighery (1994) scale (**Table 10, Figure 14**). The only area classified as 'Very Good' occurred to the north of the Study Area between the Evanston and Sandstone Roads. The 'Degraded' areas were associated with transport corridors as well as the southern disturbance area.

Table 12: Vegetation Condition Proportion

Condition Score	Condition Score Description (Keighery 1994)	Area (ha)	Proportion of Study Area (%)
Pristine	Pristine or nearly so, no obvious signs of disturbance	0	0
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are nonaggressive species. For example damage to trees caused by fire, the presence of nonaggressive weeds and occasional vehicle tracks.	0	0
Very Good	Vegetation structure altered obvious signs of disturbance. For example disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.	7.9	3.1
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbance. Retains basic vegetation structure or ability to regenerate to it. For example disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.	80.9	32
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.	164.2	64.9
Completely Degraded	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 composing weed or crop species with isolated native trees or shrubs.	0	0
Total		253	100

The south-eastern portion of the Study Area (92 ha) previously surveyed by Paul Armstong and Associates (2012) was not remapped as part of the May 2013 assessment. The majority of this area was described as 'Degraded'. The Paul Armstrong and Associates (2012) figures are provided in **Appendix F**.

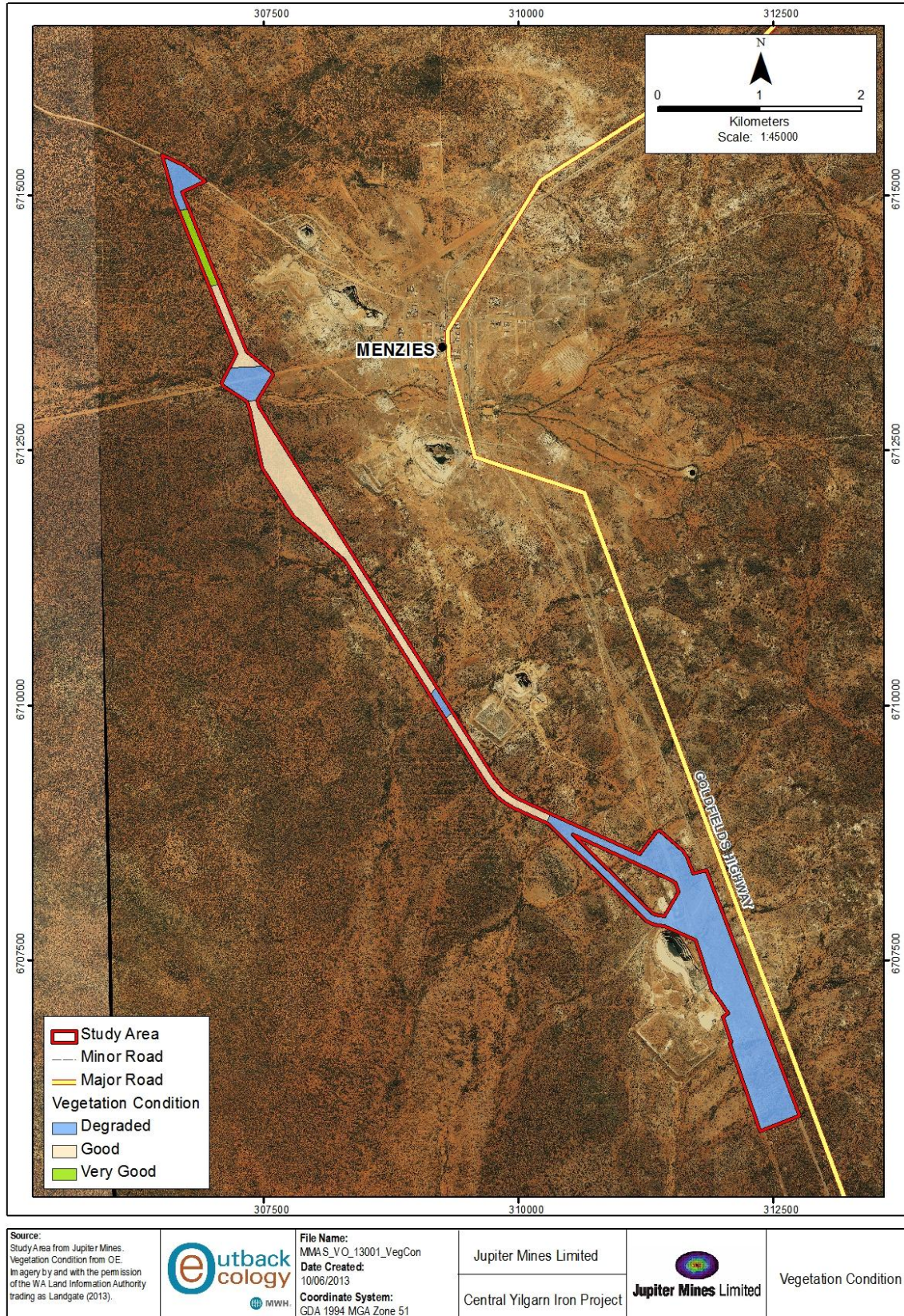


Figure 14: Study Area showing vegetation condition mapping (May 2013)

5.2. Fauna

5.2.1. Fauna Habitats

Five broad fauna habitat types were identified within the Study Area, none of which were considered significant fauna habitat (**Table 13; Figure 15**). Drainage Depression and Open Mulga Woodland on Stony Red Loam were the two most dominant habitat types, together encompassing 84% of the Study Area (**Table 13; Table 14**).

Table 13: Broad fauna habitats within the Study Area

Broad habitat type	Size within Study Area (hectares)	Proportion of Study Area (%)
Drainage Depression	53.8	21.3
Open Mallee/Shrubland on Red Loam	5.4	2.1
Open Mallee/Shrubland on Stony Low Rises	4.0	1.6
Open Mulga Woodland on Sandplain	4.7	1.9
Open Mulga Woodland on Stony Red Loam	158.0	62.5
Total ¹	253	89.4

¹The Study Area includes 27.7 ha of disturbance, which was not classified as a habitat type; consequently, sizes do not sum to the total area of the Study Area and the proportions do not sum to 100%.

While most of the Study Area was in moderate condition, some parts were degraded as a result of mining activity, both recent and historical. Vegetation is likely still recovering from grazing and cutting of trees associated with gold mining activities in the early 1900s, which would have reduced vegetation density and the number of large, old trees. Several abandoned mine shafts were observed within the Study Area (**Plate 1**). These represent a hazard to fauna and people, as individuals that fall into the shafts may become trapped; however, they may also provide habitat for bats, which are known to inhabit old shafts when roosting (Churchill 2008, Duncan *et al.* 1999). Rubbish was scattered throughout the Study Area.



Plate 1: Abandoned mine shaft within the Study Area

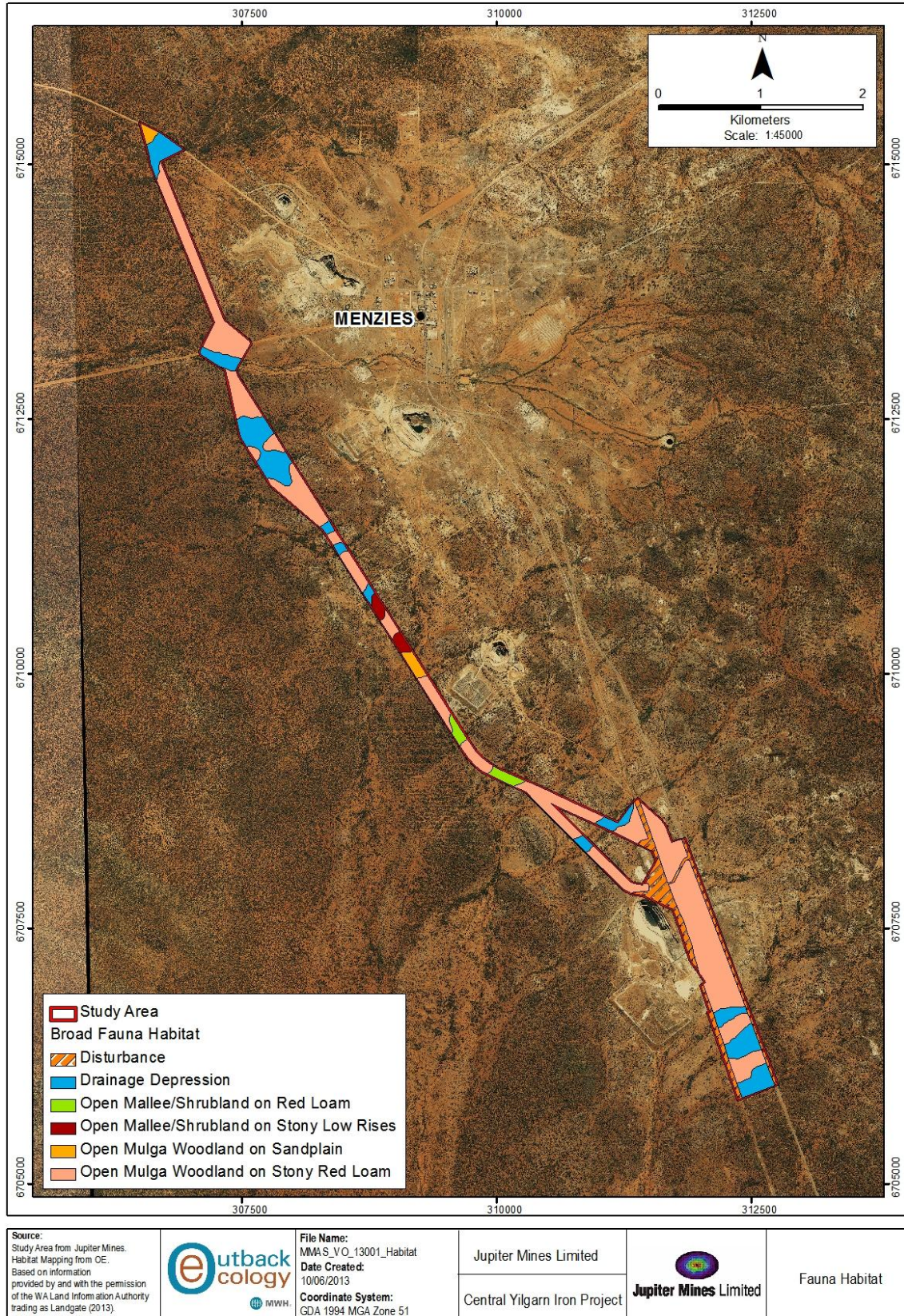


Figure 15: Broad fauna habitats within the Study Area

Table 14: Habitat assessment summary for the dominant broad fauna habitat types

Fauna habitat	Reference	Vegetation features			Physical features
		Upper stratum	Middle stratum	Lower stratum	
Drainage Depression	Plate 2	Acacia spp. up to 6 m high with up to 70 % cover	Acacia sp., Scaevola sp. and Atriplex sp. up to 3.5 m with up to 60% cover	Eragrostis sp. and Ptilotus sp. up to 0.5 m with up to 30% cover	Light-red to red sandy loam with no exposed bedrock. Some areas lightly stony. Landform typically flat and low-lying
		Other comments: Evidence of introduced species (cattle tracks, grazing, rabbit burrows and latrines). Prone to waterlogging and flooding. No evidence human disturbance or weeds, and long unburnt. Occasional large trees (>20 cm DBH) in some areas and coarse woody debris common.			
Open Mulga Woodland on Stony Red Loam	Plate 3	Acacia spp. up to 6 m high with up to 15 % cover	Acacia spp. up to 2.5 m high with up to 10 % cover	Ptilotus sp. up to 0.6 m high with up to 2% cover	Red, sandy loam with no exposed bedrock but loose stones throughout. Landform typically flat.
		Other comments: Some evidence of introduced species (grazing, rabbit burrows and latrines). No evidence of water impacts, human disturbance or weeds, and long unburnt. No large trees (>20 cm DBH) but occasional coarse woody debris.			



Plate 2: Drainage Depression



Plate 3: Open Mulga Woodland on Stony Red Loam

5.2.2. Fauna Recorded

A total of 294 terrestrial vertebrate species – 40 mammals (31 of which are native), 158 birds, 91 reptiles and five amphibians – were identified by the database searches and the literature review as potentially occurring within the Study Area (**Table 6; Appendix A**). This survey recorded 22 terrestrial vertebrate species, including five mammals (two of which are native), 15 birds and two reptiles.

Lower species richness was recorded by this survey compared with previous surveys considered by the literature review in the region. This is because the previous surveys encompassed habitat features that were not present within the Study Area (eg ironstone ridges, granite outcropping, salt lake systems). It is also because they incorporated sampling techniques that are more intensive than those used during this survey (eg trapping over multiple days, use of Anabat bat echolocation recorders and spotlighting).

All 22 species recorded during this survey were identified by the literature review or database searches as potentially occurring in the Study Area. The field survey therefore recorded approximately 7% of the total number of species identified by the literature review and database searches as potentially occurring within the Study Area.

5.2.2.1. Mammals

Five species of mammal were recorded during the field survey – one macropod, one monotreme and three introduced species – none of which are of conservation significance (**Table 15**). The majority of mammals were observed indirectly via tracks, scats and diggings.

Table 15: Mammal species recorded within the Study Area during the field survey

Common name	Species name
Common Wallaroo	<i>Macropus robustus</i>
Short-beaked Echidna	<i>Tachyglossus aculeatus</i>
Dog/Dingo	<i>Canis lupus</i>
Rabbit	<i>Oryctolagus cuniculus</i>
European Cattle	<i>Bos taurus</i>

5.2.2.2. Birds

Seventeen species of bird were recorded during the field survey, none of which are of conservation significance (**Table 16**). All birds were either heard or seen, except the Emu, of which scats were observed.

Table 16: Bird species recorded within the Study Area during the field survey

Common name	Species name
Spiny-cheeked Honeyeater	<i>Acanthagenys rufogularis</i>
Inland Thornbill	<i>Acanthiza apicalis</i>
Chestnut-rumped Thornbill	<i>Acanthiza uropygialis</i>
Grey Shrike-thrush	<i>Colluricincla harmonica</i>
Little Crow	<i>Corvus bennetti</i>
Emu	<i>Dromaius novaehollandiae</i>
Singing Honeyeater	<i>Lichenostomus virescens</i>
Brown Honeyeater	<i>Lichmera indistincta</i>
Splendid Fairy-wren	<i>Malurus splendens</i>
Rufous Whistler	<i>Pachycephala rufiventris</i>
Red-capped Robin	<i>Petroica goodenovii</i>
Tawny Frogmouth	<i>Podargus strigoides</i>
White-browed Babbler	<i>Pomatostomus superciliosus</i>
White-fronted Honeyeater	<i>Purnella albifrons</i>
Grey Fantail	<i>Rhipidura albiscapa</i>
Weebill	<i>Smicronis brevirostris</i>
Grey Currawong	<i>Strepera versicolor</i>

5.2.2.3. Reptiles

Two species of reptile were seen during the field survey – the Mulga Dragon (*Caimanops amphiboluroides*) and the Three-lined Knob-tail gecko (*Nephrurus levis*) – neither of which are of conservation significance.

5.2.2.4. Amphibians

No species of amphibian were recorded during the field survey.

5.2.2.5. Invertebrate Fauna

No species of invertebrate fauna of conservation significance were recorded during the field survey.

5.2.3. Vertebrate Fauna of Conservation Significance

While no species of conservation significance were recorded during the field survey, the literature review and database searches identified 25 terrestrial vertebrate species of conservation significance that potentially occur within the Study Area (**Appendix A**). Of these:

- seven species are listed as Threatened under the EPBC Act and/or WC Act (**Section 5.2.3.1**);
- seven species are recognized by DEC as Priority fauna (**Section 5.3.2**); and

- twelve species (including one species also listed under the EPBC Act and/or WC Act) are listed as Migratory under the EPBC Act, being subject to international agreements such as the Japan-Australia Migratory Bird Agreement (JAMBA), the China- Australia Migratory Bird Agreement (CAMBA), the Republic of Korea Australia Migratory Bird Agreement (ROKAMBA) and the Bonn Convention (The Convention on the Conservation of Migratory Species of Wild Animals) (**Section 5.2.3.3**).

In **Sections 5.2.3.1** to **Section 5.2.3.3**, the likelihood of each of these species of conservation significance occurring in the Study Area has been assessed and ranked. The rankings were assigned using the following definitions:

Confirmed – the presence of the species in the Study Area has been recorded unambiguously during the last ten years (ie during recent surveys of the Study Area or from recent records obtained via database searches);

Very likely – the Study Area lies within the known distribution of the species and contains suitable habitat(s), plus the species generally occurs in suitable habitat and has been recorded nearby within the last 20 years;

Likely – the Study Area lies within the known distribution of the species and the species has been recorded nearby within the last 20 years; however, either:

- a. the Study Area contains only a small area of suitable habitat, or habitat that is only marginally suitable; or
- b. the species is generally rare and patchily distributed in suitable habitat;

Possible – there is an outside chance of occurrence, because:

- a. the Study Area is just outside the known distribution of the species, but it does contain suitable and sufficient habitat (the species may be common, rare, or patchily distributed); or
- b. the Study Area lies within the known distribution of the species, but the species is very rare and/or patchily distributed; or
- c. the Study Area lies on the edge of, or within, the known distribution and has suitable habitat, but the species has not been recorded in the area for over 20 years; or

Unlikely – the Study Area lies outside the known distribution of the species, the Study Area does not contain suitable habitat, and the species has not been recorded in the area for over 20 years.

For each conservation significant species identified by the literature review and database searches as potentially occurring within the Study Area, justification for why a particular rank was assigned is given and additional species information is provided for those species that could Possibly occur or are Likely, Very Likely or Confirmed as occurring within the Study Area.

Of the 25 terrestrial vertebrate species of conservation significance that potentially occur within the Study Area, the likelihood of 15 species occurring within the Study Area was considered Unlikely, seven Possible, two Likely and one Very Likely.

5.2.3.1. Threatened Fauna

Legislation has been developed at a Commonwealth (EPBC Act) and State (WC Act) level to protect fauna species that have been formally recognised as rare, threatened with extinction or having high conservation value. For the full definitions of conservation significance under these Acts, see **Appendix B**. The database searches and literature review identified seven Threatened species that potentially occur within the Study Area, none of which were recorded during the field survey (**Table 17**).

Table 17: Threatened vertebrate fauna potentially occurring within the Study Area

Common name (species name)	Conservation status		Number of		Likelihood of occurrence
	EPBC ¹	In WA ²	Surveys	Databases	
Malleefowl (<i>Leipoa ocellata</i>)	VU, M	S1	4	4	Likely
<p>Reason for likelihood rank: The Study Area lies within the known distribution of the Malleefowl and the species has been recorded as close as 3 km from the Study Area (DEC 2012b) but the Study area contains only marginally suitable habitat of mallee shrubland and mulga woodland on heavy loam soils.</p> <p>Species information: <u>Distribution/habitat:</u> The Malleefowl occurs in isolated patches across southern Australia, inhabiting scrublands, Eucalypt woodland and coastal heaths (Pizzey and Knight 2007). <u>Biology/ecology:</u> Females lay eggs in a large mound of earth and vegetation prepared and maintained by a male (Johnstone and Storr 1998). The species has been known to feed on <i>Acacia</i> and wheat seeds. <u>Threats:</u> The major threat to the Malleefowl is past clearing for agriculture, which has reduced available habitat, and predation by feral cats may have a significant impact in some habitats (Garrett <i>et al.</i> 2011)</p>					
Chuditch (<i>Dasyurus geoffroii</i>)	VU	S1	0	2	Unlikely
<p>Reason for likelihood rank: The Study Area lies outside the known distribution of the Chuditch (Menkhorst and Knight 2010, Van Dyck and Strahan 2008). In 2008, a single record for the species (tracks) was recorded approximately 30 km south of the Study Area on Goongarrie Station (DEC 2012b). The reliability of this record is unknown.</p> <p>Species information: <u>Distribution/habitat:</u> The Chuditch is restricted to wet and dry sclerophyll forest, and mallee remnants, in southwest Western Australia (Menkhorst and Knight 2004). <u>Biology/ecology:</u> The Chuditch is typically active during the night, feeding on insects and small vertebrates and finding cover during the day in burrows or hollow logs (Van Dyck and Strahan 2008). <u>Threats:</u> The Chuditch's range has contracted dramatically since European settlement and the species is currently threatened by habitat destruction and predation by foxes (Van Dyck and Strahan 2008).</p>					
Slender-billed Thornbill (western) (<i>Acanthiza iredalei iredalei</i>)	VU		1	2	Unlikely
<p>Reason for likelihood rank: The Study Area lies on the edge of the known distribution of the Slender-billed Thornbill (western) and contains very marginally suitable habitat of mulga woodland (the species prefers saltbush and samphire flats) (Morcombe 2003, Pizzey and Knight 2007), and the species has not been recorded nearby: a 2003 record approximately 160 km west of the Study Area is the closest published record (DEC 2012b).</p>					
Common Slender Blue-tongue (<i>Cyclodomorphus branchialis</i>)	VU		1	0	Unlikely
<p>Reason for likelihood rank: The Study Area lies well outside the known distribution of the Common Slender Blue-tongue and contains marginally suitable habitat of semi-arid shrubland (Wilson and Swan 2010). The database searches did not record the species and the closest published record of</p>					

Common name (species name)	Conservation status		Number of		Likelihood of occurrence
	EPBC ¹	In WA ²	Surveys	Databases	
the species is from 140 km west of the Study Area (DEC 2012b).					
Peregrine Falcon (<i>Falco peregrinus</i>)		S4	1	2	Likely
<p>Reason for likelihood rank: The Study Area lies within the known distribution of the Peregrine Falcon (the species can be found in a variety of habitats throughout Australia) (Pizzey and Knight 2007) and in 2002 the species was recorded approximately 50 km from the Study Area (Birdlife Australia 2012, DEC 2012b). However, the species is generally rare or uncommon within its range. It is unlikely that the species would use the Study Area for nesting.</p> <p>Species information: <u>Distribution/habitat:</u> In arid Australia, Peregrine Falcons are sparsely distributed and closely associated with waterholes, range and gorge environments, although they do range widely over riverine and Acacia woodland habitats when hunting (Garnett and Crowley 2000). <u>Biology/ecology:</u> The Peregrine Falcon is an aerial carnivore, which in the Australian arid zone nests on inland cliffs, in tree hollows and in steep-sided rocky outcrops near water (Pizzey and Knight 2007). The species has a home range of approximately 20 to 30 km².</p>					
Major Mitchell's Cockatoo (<i>Lophochroa leadbeateri</i>)		S4	2	0	Possible
<p>Reason for likelihood rank: The Study Area lies within the known distribution of the Major Mitchell's Cockatoo and contains marginally suitable habitat of mallee shrubland and mulga woodland (the species prefers more wooded habitat near watercourses) (Pizzey and Knight 2007). While the database searches did not record the species, previous surveys recorded the species approximately 130 km (Ninox Wildlife Consulting 2009) and 175 km (Outback Ecology 2009) from the Study Area.</p> <p>Species information: <u>Distribution/habitat:</u> The Major Mitchell's Cockatoo is widespread but unevenly distributed across arid Australia, inhabiting lightly wooded country near water and tall eucalypts, which are relied upon for hollows (Johnstone and Storr 1998). <u>Biology/ecology:</u> The Major Mitchell's Cockatoo nests in hollows of mature eucalypts and feeds predominantly on seeds, but also the roots, flowers and fruit of some plant species (Johnstone and Storr 1998). <u>Threats:</u> The species is threatened by loss of hollow-bearing trees, and also by competition for hollows with Galahs (Garnett <i>et al.</i> 2011)</p>					
Woma (<i>Aspidites ramsayi</i>)		S4	0	2	Possible
<p>Reason for likelihood rank: The Study Area lies within the known distribution of the Woma and contains suitable habitat of woodland and shrubland (Wilson and Swan 2010). The species was recorded less than 3 km from the Study Area in 1966, and approximately 110 km from the Study Area in 1992 (DEC 2012b); however, there have been no other published records of the species nearby and none of the previous surveys considered in the literature review recorded the species. Therefore if the species persists in the area, it is likely to be rare or patchily distributed.</p> <p>Species information: <u>Distribution/habitat:</u> The Woma occurs across central Australia and the southwest inhabiting woodlands, heaths and shrublands, often with spinifex (Wilson and Swan 2010). <u>Threats:</u> While populations within central Australia are likely secure, it is the southwestern populations that appear to be declining, threatened by land clearing and predation by introduced animals (Storr <i>et al.</i> 2002, Wilson and Swan 2010).</p>					

¹Status under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* – VU (Vulnerable), M (Migratory). ²Status under the Western Australian Wildlife Conservation Act 1950 – S1 (Schedule 1 – Rare or likely to become extinct), S4 (Schedule 4 – Specially protected); See Appendix B for full definitions of conservation status

5.2.3.2. Priority Fauna

The WA DEC recognises several species that are not listed under the WC Act or the EPBC Act but for which there is some conservation concern, and has produced a supplementary list of Priority Fauna. For the full definitions of Priority Fauna rankings, see **Appendix B**. The database searches and literature review identified seven species of Priority Fauna that potentially occur within the Study Area, none of which were recorded during the field survey (**Table 18**).

Table 18: DEC Priority vertebrate fauna potentially occurring within the Study Area

Common name (species name)	Conservation status		Number of		Likelihood of occurrence
	EPBC	In WA ¹	Surveys	Databases	
Australian Bustard (<i>Ardeotis australis</i>)		P4	1	1	Possible
<p>Reason for likelihood rank: The Study Area lies within the known distribution of the Australian Bustard and contains suitable habitat of scrubland and woodland (Pizzey and Knight 2007); however, the species has not been recorded nearby. The closest published record is from 1999, 75 km south (DEC 2012b). Ninox Wildlife Consulting (2009) recorded the species approximately 130 km southwest of the Study Area.</p> <p>Species information: <u>Distribution/habitat:</u> The Australian Bustard occurs over much of Western Australia, with the exception of the more heavily wooded southern portions of the state (Johnstone and Storr 1998). The species also occurs in eastern Australia and New Guinea. The Australian Bustard inhabits open dry woodlands of Mulga, arid shrublands and tussock grasslands supporting spinifex species (Johnstone and Storr 1998, Morcombe 2003), along with grasslands and drainage areas particularly after a series of years of above average rainfall (Johnstone and Storr 1998). <u>Biology/ecology:</u> Generally, this species is considered scarce to common depending on season and habitat. It has an omnivorous diet but appears to have some preference for grasshoppers and is often attracted to recently burnt areas (Marchant and Higgins 1993).</p>					
Bush Stone-curlew (<i>Burhinus grallarius</i>)		P4	0	1	Possible
<p>Reason for likelihood rank: The Study Area contains suitable habitat of open woodland and sandplain with mallee (Pizzey and Knight 2007); however, it lies just outside the known distribution of the Bush Stone-curlew (Pizzey and Knight 2007). The species was not recorded by any of the surveys considered in the literature review and the closest published record of the Bush Stone-curlew is from 2004, 50 km northwest of the Study Area (DEC 2012b).</p> <p>Species information: <u>Distribution/habitat:</u> The Bush Stone-curlew is found in a range of habitats including open woodland, dry water courses with branches, leaf litter and sparse grass (Pizzey and Knight 2007). <u>Biology/ecology:</u> The Bush Stone-curlew constructs nests consisting of a slight depression on the ground or at the foot of or trees (Johnstone and Storr 1998). <u>Threats:</u> In areas where foxes occur, the Bush Stone-curlew has suffered substantial declines, due to predation of it (Johnstone and Storr 1998).</p>					
Shy Heathwren (western) (<i>Hylacola cauta whitlocki</i>)		P4	0	1	Possible
<p>Reason for likelihood rank: The Study Area lies on the edge of the known distribution of the Shy Heathwren (western) and contains suitable habitat of mallee (Pizzey and Knight 2007); however, the only one database search provided a record, which was from 2008, 45 km southwest of the Study Area.</p> <p>Species information: <u>Distribution/habitat:</u> The Shy Heathwren occurs in the semi-arid interior of south-western Australia, inhabiting shrubland and scrubs on sandy soils (Johnstone and Storr 2004). <u>Biology/ecology:</u> The Shy Heathwren constructs domed nests in depressions on the ground or in the base of shrubs, often</p>					

Common name (species name)	Conservation status		Number of		Likelihood of occurrence
	EPBC	In WA ¹	Surveys	Databases	
among fallen branches or debris. The species mainly forages on the ground for insects (Johnstone and Storr 2004).					
Crested Bellbird (southern) (<i>Oreoica gutturalis gutturalis</i>)		P4	5	0	Possible
<p>Reason for likelihood rank: The Crested Bellbird (southern) is one of two subspecies known to occur in Western Australia, the other being <i>Oreoica gutturalis pallescens</i>, which is not of conservation significance. These subspecies do not have discrete ranges; rather, a broad zone of hybridization occurs (Australian Government 2012a). As the Study Area lies within this zone, individuals of the Crested Bellbird (southern) can be difficult to distinguish from individuals that are not of this subspecies. Out of eight previous surveys that recorded the Crested Bellbird near the Study Area: five attributed records to the Crested Bellbird (southern); two identified individuals to species-level only, with no indication of conservation significance, and; one noted that it was difficult to determine with certainty whether or not individuals were of the Crested Bellbird (southern). Notably, the Study Area is located just outside the known distribution of the Crested Bellbird (southern) and contains marginally suitable habitat of woodland and mallee shrubland (the species also occurs in <i>Triodia</i> hummock grassland, saltbush and heath) (Morcombe 2003). Consequently, it is likely that any records of Crested Bellbird in the close vicinity of the Study Area are not the Crested Bellbird (southern); however, because of the close proximity of the Study Area to the known distribution of the species, it remains possible that individuals of the Crested Bellbird (southern) could be observed near the Study Area.</p> <p>Species information:</p> <p><u>Distribution/habitat:</u> The Crested Bellbird (southern) historically occurred across southern Australia, but its range has contracted towards the inland in south-western Australia. Populations also occur in inland areas of south-eastern Australia (Australian Government 2012a). The species inhabits the shrub layer of Eucalypt woodlands, as well as mallee, Acacia shrubland, hummock grassland, saltbush and heath (Australian Government 2012a).</p> <p><u>Biology/ecology:</u> The Crested Bellbird (southern) constructs cup nests and feeds on a variety of insects and seeds (Australian Government 2012a).</p> <p><u>Threats:</u> In Western Australia, the Crested Bellbird (southern) is threatened by clearing and is particularly sensitive to fragmentation (Australian Government 2012a).</p>					
White-browed Babbler (western wheatbelt) (<i>Pomatostomus superciliosus ashbyi</i>)		P4	3	0	Possible
<p>Reason for likelihood rank: The White-browed Babbler (western wheatbelt) is one of two subspecies known to occur in Western Australia, the other being <i>Pomatostomus superciliosus superciliosus</i>, which is not of conservation significance. These subspecies do not have discrete ranges; rather, a zone of intergradations occurs (Australian Government 2012c). As the Study Area lies within this zone, individuals of the White-browed Babbler (western wheatbelt) can be difficult to distinguish from individuals that are not of this subspecies. Out of seven previous surveys that recorded the White-browed Babbler near the Study Area, three attributed records to the White-browed Babbler (western wheatbelt), whereas the remaining surveys identified individuals to species-level only, with no indication of conservation significance. Notably, the Study Area is located outside the known distribution of the White-browed Babbler (western wheatbelt). It is likely that any records of White-browed Babbler in the close vicinity of the Study Area are not the White-browed Babbler (western wheatbelt); however, because of the close proximity of the Study Area to the known distribution of the species and the fact that the Study Area contains suitable habitat of woodland and mallee, it remains possible that individuals of the White-browed Babbler (western wheatbelt) could be observed near the Study Area. It should be noted that this field survey recorded the White-browed Babbler, but individuals were not deemed to be the White-browed Babbler (western wheatbelt).</p>					

Common name (species name)	Conservation status		Number of		Likelihood of occurrence
	EPBC	In WA ¹	Surveys	Databases	
Species information:					
<u>Distribution/habitat:</u> The White-browed Babbler (western wheatbelt) occurs in south-western Western Australia, inhabiting Eucalypt forests and woodlands (Australian Government 2012c).					
<u>Biology/ecology:</u> The White-browed Babbler (western wheatbelt) constructs bulky domed nests and forages on or near the ground for insects and seeds (Australian Government 2012c).					
<u>Threats:</u> The White-browed Babbler (western wheatbelt) is threatened by clearing for agriculture (Australian Government 2012c).					
Hooded Plover (<i>Thinornis rubricollis</i>)		P4	1	2	Unlikely
Reason for likelihood rank: The Study Area lies within the known distribution of the Hooded Plover but does not contain suitable habitat (Pizzey and Knight 2007). The species is typically coastal but in Western Australia can also be found at inland salt lakes such as those near the Study Area eg Lake Ballard and Lake Barlee.					
Long-tailed Dunnart (<i>Sminthopsis longicaudata</i>)		P4	2	1	Unlikely
Reason for likelihood rank: The Study Area lies outside the known distribution of the Long-tailed Dunnart and contains unsuitable habitat (the species prefers rocky country further north) (Van Dyck and Strahan 2008). The two surveys that recorded the species captured individuals approximately 75 km northwest of the Study Area (KLA 2012, in prep) and the species is not known to occur further south (DEC 2012b).					

¹Status under the DEC Priority Fauna List – P4 (Priority 4). See Appendix B for full definitions of conservation status

5.2.3.3. Migratory Birds

Many species of migratory bird are listed under the EPBC Act, the WC Act and international agreements including the Japan-Australia Migratory Bird Agreement, the China-Australia Migratory Bird Agreement, Republic of Korea Australia Migratory Bird Agreement and the Bonn Convention (The Convention on the Conservation of Migratory Species of Wild Animals).

The database searches and literature review identified 12 listed Migratory species that potentially occur within the Study Area and its surrounds (ie within 100 km of Study Area), none of which were recorded during the field survey (**Table 19**). Broadly speaking, the occurrence of migratory waterbirds in arid Australia is highly sporadic and many species are only likely to be present in favourable seasons when water is plentiful (Halse *et al.* 1998, Kingsford and Norman 2002, Kingsford *et al.* 2010). The database searches and literature review identified a large number of migratory waterbirds as potentially occurring within the Study Area because they encompassed salt lake habitat associated with nearby lakes such as Lake Barlee and Lake Ballard. As no major wetlands or natural water bodies were found within the Study Area, the occurrence of most migratory waterbirds within the Study Area would be occasional only, and they are unlikely to be dependent on the habitats present.

Table 19: Migratory birds potentially occurring within the Study Area

Common name (species name)	Conservation status		Number of		Likelihood of occurrence
	EPBC ¹	In WA ²	Surveys	Databases	
Common Sandpiper (<i>Actitis hypoleucos</i>)	M	S3	0	1	Unlikely
Reason for likelihood rank: The Study Area lies within the known distribution of the Common Sandpiper; however, in inland Western Australia, the species is restricted to wetlands, which do not occur within the Study Area (Morcombe 2003).					
Fork-tailed Swift (<i>Apus pacificus</i>)	M	S3	0	1	Unlikely
Reason for likelihood rank: The Fork-tailed Swift breeds in Asia but visits Australia in the summer when it can be seen flying all over the country (Pizzey and Knight 2007); however, the Study Area is unlikely to be a valuable foraging or roosting site for the species.					
Cattle Egret (<i>Ardea ibis</i>)	M	S3	0	1	Unlikely
Reason for likelihood rank: The Study Area lies within the known distribution of the Cattle Egret; however, in inland Western Australia, the species is restricted to wetlands and flooded pastures, which do not occur within the Study Area (Morcombe 2003).					
Eastern Great Egret (<i>Ardea modesta</i>)	M	S3	0	2	Unlikely
Reason for likelihood rank: The Study Area lies within the known distribution of the Eastern Great Egret; however, in inland Western Australia, the species is restricted to wetlands and dams, which do not occur within the Study Area (Morcombe 2003).					
Sharp-tailed Sandpiper (<i>Calidris acuminata</i>)	M	S3	0	1	Unlikely
Reason for likelihood rank: The Study Area lies within the known distribution of the Sharp-tailed Sandpiper; however, in inland Western Australia, the species is restricted to wetlands, irrigated pastures and saltfields, which do not occur within the Study Area (Pizzey and Knight 2007).					
Red Knot (<i>Calidris canutus</i>)	M	S3	0	1	Unlikely
Reason for likelihood rank: The Study Area lies outside the known distribution of the Red Knot and does not contain suitable habitat (Pizzey and Knight 2007).					
Oriental Plover (<i>Charadrius veredus</i>)	M	S3	0	1	Unlikely
Reason for likelihood rank: The Study Area lies outside the known distribution of the Oriental Plover and does not contain suitable habitat (Pizzey and Knight 2007).					
Malleefowl (<i>Leipoa ocellata</i>)	VU, M	S1	4	4	Likely
See Section 5.2.3.1 for reason for likelihood rank and species information					
Rainbow Bee-eater (<i>Merops ornatus</i>)	M	S3	6	4	Very Likely
Reason for likelihood rank: The Study Area lies within the known distribution of the Rainbow Bee-eater and contains suitable habitat of woodlands with sandy, loamy soil, plus the species has been recorded numerous times nearby.					
Pacific Golden Plover (<i>Pluvialis fulva</i>)	M	S3	0	1	Unlikely
Reason for likelihood rank: The Study Area lies outside the known distribution of the Oriental Plover and does not contain suitable habitat (Pizzey and Knight 2007).					
Wood Sandpiper (<i>Tringa glareola</i>)	M	S3	1	1	Unlikely

Reason for likelihood rank: The Study Area lies within the known distribution of the Wood Sandpiper; however, in inland Western Australia, the species is restricted to wetlands and sewage ponds, which do not occur within the Study Area (Pizzey and Knight 2007). The one survey that recorded the species observed individuals around Lake Lefroy, approximately 175 km southeast of the Study Area (Outback Ecology 2009).

Common Greenshank (<i>Tringa nebularia</i>)	M	S3	1	1	Unlikely
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Reason for likelihood rank: The Study Area lies within the known distribution of the Common Greenshank; however, in inland Western Australia, the species is restricted to wetlands, lakes and sewage ponds, which do not occur within the Study Area (Pizzey and Knight 2007). The one survey that recorded the species observed individuals around Lake Lefroy, approximately 175 km south of the Study Area (Outback Ecology 2009).

¹Status under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* – VU (Vulnerable), M (Migratory). ²Status under the Western Australian Wildlife Conservation Act 1950 – S1 (Schedule 1 – Rare or likely to become extinct), S3 (Schedule 3 - Migratory birds). See Appendix B for full definitions of conservation status

5.2.4. Invertebrate Fauna of Conservation Significance

A total of 21 terrestrial invertebrate species of conservation significance was identified by the database searches and literature review as potentially occurring within the Study Area (**Table 20**). Of these, 17 and four species were considered to exhibit low and medium potential to occur within the Study Area, respectively (**Table 20**). No species of invertebrate fauna of conservation significance were recorded during the field survey.

Table 20: Terrestrial invertebrate species of conservation significance potentially occurring within the Study Area

Scientific name	Group	Information source			Potential to occur in Study Area	Reason for potential category	
		DEC (2012c)	WAM (2012)	Outback Ecology (in prep)		Previous records within 100 km of Study Area	Occurrence of habitat within Study Area
<i>'Eucanippe' MYG231</i>	Mygalomorph Spider		X	X	Low	Species is represented by a single specimen collected approximately 88 km northwest of the Study Area	Species is known from Elevated banded Ironstone (BIF) range, which does not occur within the Study Area
<i>Aganippe 'MYG224'</i>			X	X	Low	Species is represented by five specimens collected approximately 86 km northwest of the Study Area	Species is known from Elevated banded Ironstone (BIF) range, which does not occur within the Study Area
<i>Aganippe 'MYG238'</i>				X	Low	Nil – the closest record is from approximately 150 km northwest of the Study Area	Species is known from sandplain ² , which occurs within the Study Area
<i>Aganippe 'MYG244'</i>			X		Low	Species is represented by a single specimen collected approximately 78 km south of the Study Area	Species was recorded adjacent to Clear lake within Rowles Lagoon Nature Reserve and similar habitat does not occur within the study Area
<i>Aganippe 'MYG256'</i>				X	Low	Species is represented by a single specimen collected approximately 75 km northwest of the Study Area	Species is known from Eucalypt woodland, which occurs within the Study Area
<i>Eucyrtops 'MYG150'</i>				X	Low	Species is represented by one specimen collected approximately 76 km northwest of the Study Area. Other nearby records include one specimen collected approximately 172 km west, and five collected approximately 375 km west	Species is known from Elevated banded Ironstone (BIF) range and adjacent sandplains and similar habitat does not occur within the study Area
<i>Eucyrtops eremaea</i>			X	X	Low	Species is represented by two specimens collected approximately 77 km northwest of the Study Area. Other nearby records include two specimens collected approximately 114 km northeast	Species is known from Ironstone hills and Stony plains ² , and stony soils occur in the region of the Study Area
<i>Aname 'MYG251'</i>			X	X	Low	Species is represented by a single specimen collected approximately 77 km northwest of the Study Area	Species is known from Plains ² , which occur in the region of the Study Area
<i>Kwonkan goongariensis</i>			X	X	Medium	Species is represented by four specimens, including two collected approximately 27 km south of the Study Area and two collected approximately 38 and 73 km northeast	Species is known from Mulga Plain ² , which occur within the Study Area
<i>Missulena 'MYG226'</i>			X	X	Low	Species is represented by a single specimen collected approximately 76 km northwest of the Study Area	Species is known from Ironstone hills, which do not occur within the Study Area
<i>Synothele goongarrie</i>			X	X	Medium	Species is represented by a single specimen collected approximately 21 km south of the Study Area	Species is known from Mulga Plain ² , which occur within the Study Area
<i>Synothele 'MY236'</i>				X	Low	Nil – the closest record is from approximately 147 km northwest of the Study Area	Species is known from Elevated banded Ironstone (BIF) range ² , which does not occur within the Study Area
<i>Idiommata blackwalli?</i>				X	Low	Species is represented by a single specimen collected approximately 75 km northwest of the Study Area	Species is known from Eucalypt woodland, which occurs within the Study Area
<i>'PSEAAC' 'PSE029'</i>	Pseudoscorpion		X	X	Low	Species is represented by five specimens collected approximately 75 km northwest of the Study Area	Species is known from Acacia shrubland, which occurs within the Study Area
<i>Conicochernes 'PSE024'</i>			X	X	Medium	Species is represented by 14 specimens collected between approximately 50 and 82 km southwest of the Study Area	Species is known from Mulga Plain ² , which occur within the Study Area
<i>Synsphyronus 'PSE025'</i>			X		Low	Species is represented by two specimens collected approximately 85 km southwest of the Study Area	Species is known from a possible claypan area and similar habitat does not occur within the study Area
<i>Antichiropus 'credo'</i>	Millipede		X	X	Medium	Species is represented by two specimens collected approximately 44 and 75 km southwest of the Study Area	Species is known from Mulga Plain ² , which occur within the Study Area
<i>Antichiropus 'Mt Gibson 1'</i>			X	X	Low	Nil – nearby records include 46 specimens collected between approximately 105 and 370 km west of the Study Area.	Species is known from Elevated banded Ironstone (BIF) range ² , which does not occur within the Study Area
<i>Antichiropus 'Mt Ida'</i>			X	X	Low	Species is represented by a single specimen collected approximately 73 km northwest of the Study Area	Species is known from Elevated banded Ironstone (BIF) range ² , which does not occur within the Study Area
<i>Atelomastix bamfordi</i>				X	Low	Nil – nearby records include 121 specimens collected between approximately 158 and 247 km west-southwest of the Study Area	Species is known from Elevated banded Ironstone (BIF) range ² , which does not occur within the Study Area
<i>Jalmenus aridus</i> ¹	Butterfly	X			Low	Nil – the species is known from only one location, which is approximately 125 km south of the Study Area	-

¹ Listed under the DEC Priority Species List (Priority 1); all other species are SRE fauna; ²These habitats have been rationalized based on aerial imagery – ground-truthing would be required for confirmation

5.3. Limitations and Constraints

There are a number of possible limitations and constraints that can impinge on the adequacy of flora, vegetation and fauna assessments (EPA 2004)(EPA 2004). These are discussed below, with respect to this Study (**Table 21**). All flora, vegetation and fauna surveys are limited to some degree by time and seasonal factors, and ideally multiple surveys of an area would be undertaken over a number of years and within a number of different seasons.

Table 21: Potential limitations and constraints of this assessment

Factor	Constraint (Yes or No)	Comments
Competency and experience of consultants	No	Survey team members were flora and fauna specialists employed by Outback Ecology. All team members possessed relevant post-graduate qualifications and have previous experience undertaking flora or fauna surveys of this nature in Western Australia.
Scope	No	The scope was clearly defined and realistically achievable. All flora and fauna groups were surveyed using standardised and well-established techniques, and previous survey work local to and in the wider region of the Study Area was reviewed.
Proportion of fauna identified	No	This survey recorded 7% of the fauna species identified as potentially occurring in the Study area from database searches and a literature review Area. The total of 22 species recorded during the field survey was consistent with what might be expected from a one-day field survey.
Proportion of flora identified	No	An inventory of flora species was recorded during the traverse of the Study Area. The on-foot traverse was designed to cover the as much ground as possible within the Study Area and no part of the Study Area was more than 100 m from the traverse. Numerous species were unidentifiable due to their age or absence of diagnostic characteristics. While some species were only identified to a Genus level, this was not thought to include any of the conservation significant flora species identified by the database searches. It is possible that some annual species were not recorded during the field assessment due to a lack of adequate rainfall preceding the survey.
Information sources	No	The region around the Study Area is well-surveyed due to a history of mining operations and the results of previous biological surveys relevant to the Study area were readily accessible.
Proportion of task achieved, and further work which might be needed	No	All planned survey works were conducted according to scope, and the conservation value of flora and fauna within the Study Area has been demonstrated by this study. It is possible that undetected species occur within the Study Area, some of which may be of conservation significance, and further studies at other times of the year may verify this.
Timing / weather / season / cycle	No	This report details the results of a survey conducted within the Study Area in November 2012 and May 2013, which is appropriate timing when regional rainfall patterns are considered.
Disturbances	No	While some anthropogenic disturbance (eg rubbish and mineshafts) was present within the Study Area, the field survey was not hindered by disturbance.
Intensity	No	A one-day field survey was conducted and 45 person-hours were spent searching the Study Area for fauna and habitats. A one-day field survey was conducted and 24 person-hours were spent searching the Study Area for flora and vegetation communities. This intensity is considered adequate given the scale of the proposed impacts.

Factor	Constraint (Yes or No)	Comments
Completeness	No	The survey was completed according scope.
Resources	No	Resources were adequate to carry out the survey satisfactorily, and the survey participants were competent in identification of species present
Remoteness / access problems	No	Access to all of the Study Area was good and adequate survey coverage was achieved.
Availability of contextual information	No	Regional information was available from numerous sources (eg ANRA 2009a, ANRA 2009b, Australian Government 2012b, Birdlife Australia 2012, Cowan 2001, DEC 2012a, DEC 2012c, DSEWPaC 2012b)

6. POTENTIAL IMPACTS

The primary objectives of this section are to describe the relevant threatening processes associated with the proposed Project (**Section 6.1**), and to examine the likely impact of these threatening processes on vegetation associations (**Section 6.2**), conservation significant flora (**Section 6.3**), fauna habitat (**Section 6.4**) and fauna assemblages (**Section 6.5**).

6.1. Threatening Processes

While some parts of the Murchison bioregion are in good condition, others are severely degraded from intensive pastoral use. Processes threatening the bioregion include feral predators, weeds, mining, tourism, grazing and habitat damage by introduced herbivores (ANRA 2009a, ANRA 2009b). Additional threatening processes associated with Project activities within the Study Area include direct impacts (such as habitat clearing/modification and fire) and indirect impacts (such as altered hydrology, noise and vibration, light, dust, introduced flora and introduced fauna) and these are discussed in further detail below.

6.1.1. Habitat Clearing and Modification

Development of the Project will result in the removal of habitat via land clearance and road construction. Land clearing is a necessary part of the Project development and represents the most direct impact on fauna habitat and assemblages present within the Study Area. Land clearance will result in increased edge effects, habitat contraction and potentially fragmentation of habitat within the Study Area. Clearing of vegetation can sometimes be conducted in a manner that minimises impact on vertebrate fauna by considering the timing of clearance activities, progressively clearing over time to allow animals to disperse to other suitable areas, and by retaining corridors or linkages so that individuals can move between remaining habitat patches.

6.1.2. Fire

Project development and ongoing use of the new road may alter the fire regime of the Study Area through the introduction of unplanned fire resulting from vehicle movements. Fire may impact fauna via direct contact between fire and fauna, or indirectly by long-term habitat modification brought about by inappropriate fire frequency and intensity. The value of many habitats to fauna lies in the mosaic of ages-since-fire that exist in those habitats as a result of traditional land management practices and/or natural fire regimes (Parr and Andersen 2006, Southgate *et al.* 2007, Woinarski 1999). Introduction of too frequent, hot or extensive fires can eliminate this mosaic, and reduce the capacity of these habitats to support diverse vertebrate and invertebrate fauna. The impact of inappropriate fire regimes may be reduced through the implementation of an appropriate fire management plan.

6.1.3. Altered Hydrology

Project development may alter the surface water hydrology within the Study Area. Availability of water and nutrients is the primary structuring force in arid and semi-arid environments (James *et al.* 1995). A system of salt lakes and other water bodies occurs in the region of the Study Area, providing key resources to a diversity of fauna, particularly waterbirds. Alterations to surface hydrology may affect the quality and/or distribution of water in the region and reduce the availability of

suitable habitat for water-dependent fauna. Approximately 21% of the Study Area comprises Drainage Depression habitat. Changes in the timing, quantity, quality or distribution of water within this habitat may adversely affect the fauna assemblages that may be dependent upon them, and efforts should be made to minimize the impact of the Project on the natural flow of water through the Study Area.

6.1.4. Noise and Vibration

Project development is likely to generate noise and vibration due to the general operation of machinery and vehicles, as well as the general presence of people. Noise and vibration from vehicles using the new road will continue into the future. The adverse effects of noise on vertebrate fauna have been well studied and responses vary depending on the species and on the age and sex of the individual animal (Larkin *et al.* 1996, Radle 2007). General responses to noise across a wide variety of vertebrate species range from interruptions in feeding and resting behaviour to complete abandonment of an area. Noise may lead to reduced population densities in small mammals, nest failure and decreased population densities in birds (Slabbekoorn and Ripmeester 2008), and abandoning of roost sites and a reduced hunting efficiency in bats due to disturbance of their echolocation system. Constant levels of noise also affect species communication via acoustic interference (Parris and Schneider 2009). Species that may be especially at risk of disturbed communication are those that use calls to communicate over larger distances such as the conservation significant Bush Stone-curlew (*Burhinus grallarius*), which possibly occurs within the Study Area.

6.1.5. Light

The Project may result in an increase in exposure of fauna to artificial light from construction and haulage activities, should these activities occur during the night. Artificial light could have detrimental effects on resident fauna species as it may interfere with biological and behavioural activities that are governed by the length of day or photoperiod, including reproduction, dormancy, foraging and migration (Bradshaw and Holzapfel 2007, Le Corre *et al.* 2002, Rich and Longcore 2006). For example, nocturnal mice exposed to artificial light have been observed to exploit fewer food patches compared to mice exposed to areas of less light (Bird *et al.* 2004), while nocturnal frogs exposed to artificial light have been known to suspend normal feeding and reproductive behaviour (Harder 2002). Light pollution has also been shown to interfere with timing of songbird choruses, potentially leading to reduction in breeding success or survival (Miller 2006). It is likely that excessive light can also alter the natural foraging behaviour of bats (Stone *et al.* 2009).

6.1.6. Dust

During any construction work, Project development may cause an increase in dust pollution resulting from earthworks, the general traffic activities of light and heavy vehicles and machinery, and the clearing of covering vegetation. Dust pollution may interfere with plant metabolic processes and high levels may reduce plant growth, resulting in the degradation of the overall ecosystem and the increased risk of disease in plants. In turn, this may impact the quality of fauna habitats and assemblages within the Project area due to reduction in food resource and shelter availability. During

construction work, and following if necessary, adequate dust suppression measures should be implemented to reduce the effects of dust on vegetation and hence fauna habitats and assemblages.

6.1.7. Introduced Flora

Environmental weeds may be brought in during construction and operation of the haul road. Weed invasion is widely recognised as having a negative impact on vertebrate fauna species as it can fundamentally alter the composition and structure of native vegetation communities (Cowie and Werner 1993, Gordon 1998). Invasion by non-native species typically results in declines in native plant species richness, but the response of fauna may be more complicated with individual invasions potentially resulting in increase, decrease or no-change scenarios for different assemblages (Grice 2006). For example, even at low densities, Buffel Grass (*Cenchrus ciliaris*) has been seen to affect the composition of ground vegetation, birds and ant fauna, leading to declines in some species (Binks *et al.* 2005, Smyth *et al.* 2009).

6.1.8. Introduced Fauna

Introduced fauna (both herbivorous and predatory) cause fundamental changes to ecosystems, and have led to the decline and extinction of many species in Australia (Abbott 2002, Burbidge and McKenzie 1989, Ford *et al.* 2001, Short and Smith 1994). Predation by the Red Fox and predation by the Feral Cat are listed as key threatening processes to native fauna under the EPBC Act. Introduced herbivores have been responsible for the widespread degradation of much of semi-arid Australia due to overgrazing (Morton 1990). Such habitat degradation can potentially impact both vertebrate and invertebrate fauna. Development of the Project may provide additional resources or habitat that attract and support a greater abundance of feral animals in the area, which in turn may adversely impact on populations of native fauna.

6.2. Impacts on Flora

In addition to the notes provided above, the largest potential impact on Flora as a result of the Project will be the change in surface hydrology. Road construction can have a significant impact on cross-surface flow of resources, creating water deficits and surpluses in some areas. Where impacted, this can cause water-sensitive species to 'drown' and water-dependent species to 'starve'. Roadside verges and drains also provide suitable habitat for the proliferation of many of the introduced species identified in this survey and it is expected that some of them will be spread along the road by vehicle traffic. Large populations of these species could impact surrounding native communities in areas where weed infestation is currently low. Dust is a lesser impact, but it is expected that dust-sensitive species will undergo a reduction in health following the construction of the road.

6.3. Impacts on Fauna Habitats

Vertebrate fauna habitat loss as a direct result of land clearing and earthworks for the development of the Project is considered the primary impact on terrestrial vertebrate fauna. Loss of habitat is listed as a key threatening process under the EPBC Act. It is likely that sedentary fauna currently residing within areas to be cleared would be lost and more mobile fauna would be displaced. It is

recommended that the total area of land cleared for road construction and/or utilised as a storage site of construction materials and equipment is minimised as far as practically possible.

6.4. Impacts on Fauna Assemblages

Land clearance is likely to result in the direct loss of individuals during initial clearance activities. Faunal assemblages most likely impacted by the Project are those dependent on specific habitats or those with restricted ranges. As the habitats within the Study Area are well-represented in the surrounding region, land clearance is not likely to have substantial impacts on fauna populations at a regional scale. Impacts to fauna assemblages during road construction may be reduced by considering the timing of land clearing activities and other proposed developmental works. Ongoing use of the new road will also likely result in fauna fatalities through road kill and at greatest risk are fauna that utilise road surfaces as a heat source (ie reptiles), fauna that are wide-ranging (e.g. kangaroos), and scavengers that feed on road kill (eg Wedge-tailed Eagles).

7. CONCLUSIONS

This report documents the findings of a Level 1 Flora and Fauna Assessment of the Study Area, which comprises a proposed haulage route. This assessment consists of a desktop study and a flora and terrestrial fauna reconnaissance survey.

7.1. Flora

The Study Area assessed for flora in May 2013 did not include the ~90 ha portion already surveyed by Paul Armstrong and Associates (2012), which has been reported on separately. Six broad vegetation associations occur within the 2013 Study Area, comprising Tall Shrubland on Stony Plains, Open Shrubland on Stony or Rocky Rises, Tall Shrubland Sandplains, Mallee Drainage, Mulga Drainage and Shrubland Drainage on Sandplains. Of them the Tall Shrubland on Stony Plains association occupied the largest proportion of the Study Area (52 %), and was typically interspersed by either of the three types associated with drainage or run-on flats. The Tall Shrubland Sandplains type was more common in northern sections, and was without the stony surface nature which partly characterised the Tall Shrubland on Stony Plains association.

The majority of the Study Area was highly disturbed, with 65 % considered to be 'Degraded' in condition. Among the disturbances present were the impact of stock and other introduced grazing herbivores, historic mine workings and refuse dumps, and the transport corridors of the Sandstone Road, Evanston Road, the Goldfields Highway and the northern railway, in addition to numerous and largely 'ad-hoc' light vehicle tracks throughout the Study Area. Evidence of more recent mining activity included the abandoned Princess Mary Pit in the south, occasional drill-holes, and dozer tracks and clearances made for the purposes of prospecting. In general, the northern areas of the Study Area were considered to be in better condition than the southern areas.

Seventeen introduced plant species were recorded (with several others in close proximity), but most were confined to areas of existing disturbance. The most widespread was *Cenchrus ciliaris* (Buffel Grass) which occurred along the transport corridors and as small populations in areas subject to drainage and inundation throughout the Study Area. *Carrichtera annua* (Wards Weed) and *Pentaschistis airoides* (False Hair Grass) were also regularly observed in areas distant from regularly trafficked areas, although *Solaunum hystrix* (Afghan Thistle) and *Tribulus terrestris* (Caltrop) were also observed in lower frequency. *Carmanthus lanatus* (Saffron Thistle), a P4 Declared Plant in the Menzies area (and P1 in the whole-of-State), was identified by Paul Armstrong and Associates (2012), but was not included within the Study Area traversed in May 2013. *Heliotropium europaeum*, however, was present near the northern rim of the Princess Mary Pit, and while not Declared in the Menzies District, it is a Declared Species elsewhere in Western Australia (towards the south-west).

Overall 114 taxa were identified, with the dominant families being Chenopodaceae, Fabaceae, Poaceae and Scrophulariaceae. No areas of TEC or PEC were identified, and none of the 37 flora of conservation significance from the database searches were recorded. Given the degree of disturbance within the Study Area, there is a low potential for any annual Priority flora that may not have been expressed during the field-assessment to be present.

7.2. Fauna

Five broad terrestrial vertebrate fauna habitats occur within the Study Area, comprising Drainage Depression, Open Mallee/Shrubland on Red Loam; Open Mallee/Shrubland on Stony Low Rises; Open Mulga Woodland on Sandplain; and Open Mulga Woodland on Stony Red Loam. These fauna habitats are congruent with those known to occur elsewhere in the Murchison bioregion and are not considered to be of particular significance.

A total of 25 terrestrial vertebrate fauna species of conservation significance were identified by the desktop study as potentially occurring within the Study Area. Of these, none were confirmed as occurring within the Study Area and only three species were considered Likely or Very Likely to occur: the Malleefowl (*Leipoa ocellata*), the Peregrine Falcon (*Falco peregrinus*) and the Rainbow Bee-eater (*Merops ornatus*). The desktop study identified a substantial number of species as potentially occurring in the Study Area (294 vertebrate species), however it incorporated species records obtained from search areas and previous surveys that encompassed a greater diversity of habitats than were present within the Study Area. Consequently, many species recorded by the desktop study are unlikely to occur in the Study Area.

A total of 21 terrestrial invertebrate species of conservation significance were identified by the desktop study as potentially occurring within the Study Area. Of these, none were confirmed as occurring within the Study Area and only four species were considered to have a moderate chance of occurring within the Study Area, including two mygalomorph spiders (*Kwonkan goongarriensis* and *Synothele goongarrie*), one pseudoscorpion (*Conicochernes 'PSE024'*) and one millipede (*Antichiropus 'credo'*).

Of the potential impacts of the Project on native flora and fauna, the clearing of vegetation during road construction is likely to have the greatest impact on fauna habitat and assemblages. Other potential impacts include the direct loss of individuals during land clearing and ongoing use of the new road, as well as changes in the hydrology of the Study Area and surrounding area resulting from interruption to natural water flow. Of the flora and fauna of conservation significance that may occur within the Study Area, none are likely to be solely reliant on habitat patches within the Study Area, and the regional impacts of the Project on species of conservation significance are likely to be negligible.

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Appendix A**Terrestrial Vertebrate Fauna Recorded Within and Surrounding the Yundaga Study Area**

This Appendix contains a species list comprising all vertebrate fauna recorded during the field survey, literature review and database searches

Legend**Abbreviations and symbols**

- * Introduced species.
- X Recorded during a field survey, or as part of a database or regional information search.

EPBC Act – Entries in this column indicate the status of each species under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) (EPBC Act): CR, Critically Endangered; E, Endangered; VU, Vulnerable; and M, Migratory. If a cell is empty, the species is not listed as Threatened under the EPBC Act.

In WA – Entries in this column indicate the status of each species in Western Australia. If a species is listed as Threatened under Schedule 1, 3 or 4 of the *Wildlife Conservation Act 1950* (WA) (WC Act), the Schedule on which it is listed is provided: S1, Schedule 1, Fauna that is rare or is likely to become extinct; S3, Schedule 3, Migratory birds protected under an international agreement; and S4, Schedule 4, Other specially protected fauna. Species not listed under the WC Act may be listed on the Department of Environment and Conservation's list of Priority Fauna. In these cases, their rankings are provided: P1, Priority 1; P2, Priority 2; P3, Priority 3; and P4, Priority 4.

Vertebrate surveys considered in literature review

- A** Level 2 survey for the Mt Ida Project (KLA in prep)
- B** Level 2 survey for the Mt Mason Project (KLA 2012)
- C** Level 2 survey for the Snark Project (Ninox Wildlife Consulting 2012)
- D** Level 2 survey for the Snark Project (KLA 2011)
- E** Level 2 survey for the Deception Deposit Project (Biota 2011)
- F** Level 2 survey for the Carina Prospect (Ninox Wildlife Consulting 2009)
- G** Level 2 survey for the Randalls Gold Project (Outback Ecology 2009)
- H** Biological survey of the Eastern Goldfields (Burbidge *et al.* 1995)

Database searches

- I** Threatened and Priority Fauna Database (DEC 2012c)
- J** Birdata Custom Atlas Bird List (Birdlife Australia 2012)
- K** NatureMap Database (DEC 2012a)
- L** Protected Matters Search Tool (DSEWPaC 2012b)

Species name	Common name	Conservation status		This survey	Literature review								Database searches				
		EPBC Act	In WA		A	B	C	D	E	F	G	H	I	J	K	L	
MAMMALS																	
BOVIDAE																	
<i>Bos taurus</i> *	European Cattle			X					X								
<i>Capra hircus</i> *	Goat								X		X	X					X
<i>Ovis aries</i> *	Domestic Sheep										X	X					
BURRAMYIDAE																	
<i>Cercartetus concinnus</i>	Western Pygmy-possum						X			X							
CAMELIDAE																	
<i>Camelus dromedarius</i> *	Dromedary						X			X							
CANIDAE																	
<i>Canis lupus</i> *	Dingo/Dog			X					X	X		X					
<i>Vulpes vulpes</i> *	Fox								X	X	X	X					X
DASYURIDAE																	
<i>Dasyurus geoffroii</i>	Chuditch	VU	S1										X			X	
<i>Ningau ridei</i>	Wongai Ningau				X							X				X	
<i>Ningau yvonneae</i>	Southern Ningau								X	X	X	X				X	
<i>Pseudantechinus macdonnellensis</i>	Fat-tailed False Antechinus						X										
<i>Pseudantechinus woolleyae</i>	Woolley's Pseudantechinus				X	X											
<i>Sminthopsis crassicaudata</i>	Fat-tailed Dunnart										X	X				X	
<i>Sminthopsis dolichura</i>	Little Long-tailed Dunnart				X	X		X	X	X		X				X	
<i>Sminthopsis gilberti</i>	Gilbert's Dunnart															X	
<i>Sminthopsis hirtipes</i>	Hairy-footed Dunnart				X							X				X	
<i>Sminthopsis longicaudata</i>	Long-tailed Dunnart		P4		X	X							X				
<i>Sminthopsis macroura</i>	Stripe-faced Dunnart								X								
FELIDAE																	
<i>Felis catus</i> *	Cat								X			X					X
LEPORIDAE																	
<i>Oryctolagus cuniculus</i> *	Rabbit			X	X		X		X	X	X	X					X
MACROPODIDAE																	
<i>Macropus fuliginosus</i>	Western Grey Kangaroo								X		X	X					
<i>Macropus robustus</i>	Common Wallaroo			X			X		X		X	X				X	
<i>Macropus rufus</i>	Red Kangaroo									X		X					

Species name	Common name	Conservation status		This survey	Literature review								Database searches			
		EPBC Act	In WA		A	B	C	D	E	F	G	H	I	J	K	L
MOLOSSIDAE																
<i>Austronomus australis</i>	White-striped Freetail-bat				X	X	X	X	X	X	X	X				X
<i>Mormopterus planiceps</i>	Little Mastiff-bat										X	X				X
MURIDAE																
<i>Mus musculus*</i>	House Mouse				X	X	X	X	X	X		X				X
<i>Notomys alexis</i>	Spinifex Hopping-mouse				X	X	X	X	X			X				X
<i>Notomys mitchellii</i>	Mitchell's Hopping-mouse						X	X								X
<i>Pseudomys albocinereus</i>	Ash-grey Mouse											X				X
<i>Pseudomys bolami</i>	Bolam's Mouse						X		X		X	X				X
<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse				X	X	X	X				X				X
TACHYGLOSSIDAE																
<i>Tachyglossus aculeatus</i>	Short-beaked Echidna			X	X		X				X	X				X
VESPERTILIONIDAE																
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat				X	X	X	X	X	X	X	X				X
<i>Chalinolobus morio</i>	Chocolate Wattled Bat							X	X	X	X					
<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat											X				X
<i>Nyctophilus major</i>	Western Long-eared Bat											X				
<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat				X	X			X	X		X				X
<i>Vespadelus baverstocki</i>	Inland Forest Bat							X		X		X				X
<i>Vespadelus finlaysoni</i>	Inland Cave Bat				X	X	X									
<i>Vespadelus regulus</i>	Southern Forest Bat									X		X				
BIRDS																
ACANTHIZIDAE																
<i>Acanthiza apicalis</i>	Inland Thornbill			X	X	X	X	X		X	X	X			X	X
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill				X	X		X	X	X		X		X	X	
<i>Acanthiza iredalei iredalei</i>	Slender-billed Thornbill (western)	VU										X		X		X
<i>Acanthiza robustirostris</i>	Slaty-backed Thornbill				X	X			X		X			X	X	
<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill			X	X		X	X	X	X	X	X		X	X	
<i>Aphelocephala leucopsis</i>	Southern Whiteface				X			X	X	X		X		X	X	
<i>Calamanthus campestris</i>	Rufous Fieldwren					X										
<i>Gerygone fusca</i>	Western Gerygone							X				X		X	X	
<i>Hylacola cauta whitlocki</i>	Shy Heathwren (western ssp)		P4											X		

Species name	Common name	Conservation status		This survey	Literature review								Database searches			
		EPBC Act	In WA		A	B	C	D	E	F	G	H	I	J	K	L
<i>Pyrholaemus brunneus</i>	Redthroat				X	X	X	X	X	X		X		X	X	
<i>Sericornis magnirostra</i>	Large-billed Scrubwren										X					
<i>Smicronis brevirostris</i>	Weebill			X	X	X	X	X	X	X	X			X	X	
<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk				X						X	X		X	X	
ACCIPITRIDAE																
<i>Accipiter fasciatus</i>	Brown Goshawk						X			X		X		X	X	
<i>Aquila audax</i>	Wedge-tailed Eagle				X				X	X	X	X		X	X	
<i>Circus approximans</i>	Swamp Harrier													X		
<i>Circus assimilis</i>	Spotted Harrier											X				
<i>Elanus axillaris</i>	Black-shouldered Kite													X		
<i>Haliastur sphenurus</i>	Whistling Kite										X	X		X		
<i>Hamirostra melanosternon</i>	Black-breasted Buzzard											X		X		
<i>Hieraaetus morphnoides</i>	Little Eagle											X		X		
<i>Lophoictinia isura</i>	Square-tailed Kite											X		X		
<i>Milvus migrans</i>	Black Kite													X		
AEGOTHELIDAE																
<i>Aegotheles cristatus</i>	Australian Owlet-nightjar				X	X						X		X		
ANATIDAE																
<i>Anas gracilis</i>	Grey Teal											X		X	X	
<i>Anas superciliosa</i>	Pacific Black Duck				X							X		X	X	
<i>Aythya australis</i>	Hardhead											X				
<i>Biziura lobata</i>	Musk Duck														X	
<i>Chenonetta jubata</i>	Australian Wood Duck											X			X	
<i>Cygnus atratus</i>	Black Swan										X	X				
<i>Malacorhynchus membranaceus</i>	Pink-eared Duck											X		X	X	
<i>Tadorna tadornoides</i>	Australian Shelduck										X	X		X	X	
APODIDAE																
<i>Apus pacificus</i>	Fork-tailed Swift	M	S3													X
<i>Ardea ibis</i>	Cattle Egret	M	S3													X
<i>Ardea modesta</i>	Eastern Great Egret	M	S3										X			X
<i>Ardea pacifica</i>	White-necked Heron											X		X	X	
<i>Egretta novaehollandiae</i>	White-faced Heron											X		X		

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ARTAMIDAE																	
<i>Artamus cinereus</i>	Black-faced Woodswallow				X							X		X	X		
<i>Artamus cyanopterus</i>	Dusky Woodswallow									X	X	X		X			
<i>Artamus minor</i>	Little Woodswallow				X		X			X		X		X			
<i>Artamus personatus</i>	Masked Woodswallow				X		X			X		X		X	X		
<i>Cracticus nigrogularis</i>	Pied Butcherbird				X	X		X	X	X	X	X		X	X		
<i>Cracticus tibicen</i>	Australian Magpie				X				X	X	X	X		X	X		
<i>Cracticus torquatus</i>	Grey Butcherbird				X		X		X	X		X		X	X		
<i>Strepera versicolor</i>	Grey Currawong			X	X	X	X	X	X	X	X	X		X	X		
BURHINIDAE																	
<i>Burhinus grallarius</i>	Bush Stone-curlew		P4										X				
CACATUIDAE																	
<i>Calyptorhynchus banksii</i>	Red-tailed Black-Cockatoo								X								
<i>Eolophus roseicapillus</i>	Galah				X	X	X		X	X	X	X		X			
<i>Lophochroa leadbeateri</i>	Major Mitchell's Cockatoo		S4							X	X						
<i>Nymphicus hollandicus</i>	Cockatiel				X	X	X					X		X	X		
CAMPEPHAGIDAE																	
<i>Coracina maxima</i>	Ground Cuckoo-shrike									X		X		X	X		
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike				X	X	X	X	X	X	X	X		X	X		
<i>Lalage sueurii</i>	White-winged Triller				X		X	X		X		X		X			
CASUARIIDAE																	
<i>Dromaius novaehollandiae</i>	Emu			X	X					X	X	X		X	X		
CHARADRIIDAE																	
<i>Charadrius australis</i>	Inland Dotterel										X						
<i>Charadrius ruficapillus</i>	Red-capped Plover										X	X		X	X		
<i>Charadrius veredus</i>	Oriental Plover	M	S3														X
<i>Euseyornis melanops</i>	Black-fronted Dotterel										X	X		X			
<i>Erythrogonys cinctus</i>	Red-kneed Dotterel										X	X					
<i>Pluvialis fulva</i>	Pacific Golden Plover	M	S3										X				
<i>Thinornis rubricollis</i>	Hooded Plover		P4									X	X		X		
<i>Vanellus tricolor</i>	Banded Lapwing											X		X			
CLIMACTERIDAE																	

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<i>Climacteris affinis</i>	White-browed Treecreeper				X		X	X	X			X		X	X	
<i>Climacteris rufa</i>	Rufous Treecreeper						X	X	X	X		X		X		
COLUMBIDAE																
<i>Geopelia cuneata</i>	Diamond Dove						X									
<i>Ocyphaps lophotes</i>	Crested Pigeon				X						X		X	X		
<i>Phaps chalcoptera</i>	Common Bronzewing				X	X	X		X	X		X		X	X	
CORVIDAE																
<i>Corvus bennetti</i>	Little Crow			X	X	X		X	X			X		X	X	
<i>Corvus coronoides</i>	Australian Raven							X	X	X				X	X	
<i>Corvus orru</i>	Torresian Crow				X	X	X			X				X	X	
CUCULIDAE																
<i>Cacomantis pallidus</i>	Pallid Cuckoo				X	X	X	X		X		X		X		
<i>Chalcites basalis</i>	Horsfield's Bronze-Cuckoo				X	X	X		X	X	X	X		X		
<i>Chalcites osculans</i>	Black-eared Cuckoo				X	X	X		X					X	X	
ESTRILDIDAE																
<i>Taeniopygia guttata</i>	Zebra Finch				X		X	X	X	X		X		X	X	
EUROSTOPODIDAE																
<i>Eurostopodus argus</i>	Spotted Nightjar				X				X			X		X		
FALCONIDAE																
<i>Falco berigora</i>	Brown Falcon				X		X			X	X	X		X	X	
<i>Falco cenchroides</i>	Nankeen Kestrel				X				X		X	X		X	X	
<i>Falco longipennis</i>	Australian Hobby											X		X	X	
<i>Falco peregrinus</i>	Peregrine Falcon			S4								X	X	X		
HALCYONIDAE																
<i>Todiramphus pyrrhopygius</i>	Red-backed Kingfisher						X			X		X		X		
<i>Todiramphus sanctus</i>	Sacred Kingfisher										X					
HIRUNDINIDAE																
<i>Cheramoeca leucosterna</i>	White-backed Swallow				X									X		
<i>Hirundo neoxena</i>	Welcome Swallow				X						X	X		X	X	
<i>Petrochelidon ariel</i>	Fairy Martin											X		X		
<i>Petrochelidon nigricans</i>	Tree Martin							X	X	X	X			X		
LARIDAE																

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<i>Chroicocephalus novaehollandiae</i>	Silver Gull											X				
MALURIDAE																
<i>Malurus lamberti</i>	Variiegated Fairy-wren							X	X	X		X				
<i>Malurus leucopterus</i>	White-winged Fairy-wren										X	X		X	X	
<i>Malurus pulcherrimus</i>	Blue-breasted Fairy-wren													X		
<i>Malurus splendens</i>	Splendid Fairy-wren			X	X	X	X	X	X	X		X		X	X	
MEGALURIDAE																
<i>Cincloramphus cruralis</i>	Brown Songlark										X	X				
<i>Cincloramphus mathewsi</i>	Rufous Songlark						X					X			X	
MEGAPODIIDAE																
<i>Leipoa ocellata</i>	Malleefowl	VU, M	S1		X		X		X			X	X	X	X	X
MELIPHAGIDAE																
<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater			X	X	X	X	X	X	X	X	X		X	X	
<i>Anthochaera carunculata</i>	Red Wattlebird				X	X	X			X	X	X		X	X	
<i>Certhionyx variegatus</i>	Pied Honeyeater						X					X		X	X	
<i>Epthianura albifrons</i>	White-fronted Chat										X	X		X	X	
<i>Epthianura aurifrons</i>	Orange Chat													X	X	
<i>Epthianura tricolor</i>	Crimson Chat					X	X					X		X	X	
<i>Lichenostomus leucotis</i>	White-eared Honeyeater				X		X	X	X	X		X		X	X	
<i>Lichenostomus ornatus</i>	Yellow-plumed Honeyeater									X	X	X		X	X	
<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater													X		
<i>Lichenostomus plumulus</i>	Grey-fronted Honeyeater									X		X		X		
<i>Lichenostomus virescens</i>	Singing Honeyeater			X	X	X	X	X	X	X	X	X		X	X	
<i>Lichmera indistincta</i>	Brown Honeyeater			X			X	X	X	X	X	X		X	X	
<i>Manorina flavigula</i>	Yellow-throated Miner				X	X	X		X	X	X	X		X	X	
<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater				X		X		X	X	X	X		X	X	
<i>Purnella albifrons</i>	White-fronted Honeyeater			X	X		X			X		X		X		
<i>Sugomel niger</i>	Black Honeyeater						X				X	X		X		
MEROPIIDAE																
<i>Merops ornatus</i>	Rainbow Bee-eater	M	S3		X		X		X	X	X	X	X	X	X	X
MONARCHIDAE																
<i>Grallina cyanoleuca</i>	Magpie-lark				X						X	X		X	X	

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MOTACILLIDAE																	
<i>Anthus novaeseelandiae</i>	Australasian Pipit				X						X	X		X			
NECTARINIIDAE																	
<i>Dicaeum hirundinaceum</i>	Mistletoebird				X		X		X			X		X	X		
NEOSITTIDAE																	
<i>Daphoenositta chrysoptera</i>	Varied Sittella				X		X	X	X		X	X		X	X		
OTIDIDAE																	
<i>Ardeotis australis</i>	Australian Bustard		P4							X			X				
PACHYCEPHALIDAE																	
<i>Colluricincla harmonica</i>	Grey Shrike-thrush			X	X	X	X	X	X	X	X	X		X	X		
<i>Oreoica gutturalis</i>	Crested Bellbird	See note below table ¹															
<i>Pachycephala inornata</i>	Gilbert's Whistler						X	X		X		X		X			
<i>Pachycephala pectoralis</i>	Golden Whistler													X	X		
<i>Pachycephala rufiventris</i>	Rufous Whistler			X	X	X	X	X	X	X	X	X		X	X		
PARDALOTIDAE																	
<i>Pardalotus striatus</i>	Striated Pardalote				X		X	X	X	X	X	X		X	X		
PETROICIDAE																	
<i>Drymodes brunneopygia</i>	Southern Scrub-robin						X							X			
<i>Eopsaltria griseogularis</i>	Western Yellow Robin						X		X					X			
<i>Melanodryas cucullata</i>	Hooded Robin				X			X	X			X		X			
<i>Microeca fascinans</i>	Jacky Winter						X			X		X		X	X		
<i>Petroica goodenovii</i>	Red-capped Robin				X	X	X	X	X	X	X	X		X	X		
PHASIANIDAE																	
<i>Coturnix pectoralis</i>	Stubble Quail															X	
PODARGIDAE																	
<i>Podargus strigoides</i>	Tawny Frogmouth						X		X		X	X		X			
PODICIPEDIDAE																	
<i>Poliiocephalus poliocephalus</i>	Hoary-headed Grebe											X			X		
POMATOSTOMIDAE																	
<i>Pomatostomus superciliosus</i>	White-browed Babbler	See note below table ²															
PSITTACIDAE																	
<i>Barnardius zonarius</i>	Australian Ringneck				X	X	X	X	X	X	X	X		X			

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<i>Glossopsitta porphyrocephala</i>	Purple-crowned Lorikeet						X			X			X	X		
<i>Melopsittacus undulatus</i>	Budgerigar				X	X	X					X	X			
<i>Neophema elegans</i>	Elegant Parrot							X								
<i>Neophema splendida</i>	Scarlet-chested Parrot										X		X			
<i>Neopsephotus bourkii</i>	Bourke's Parrot					X					X		X			
<i>Platycercus icterotis</i>	Western Rosella										X					
<i>Polytelis anthopeplus</i>	Regent Parrot									X	X		X	X		
<i>Psephotus varius</i>	Mulga Parrot				X		X	X	X		X	X	X			
PSOPHODIDAE																
<i>Cinclosoma castaneothorax</i>	Chestnut-breasted Quail-thrush				X		X		X	X			X	X		
<i>Cinclosoma castanotum</i>	Chestnut Quail-thrush						X				X		X	X		
<i>Psophodes occidentalis</i>	Chiming Wedgebill												X			
PTILONORHYNCHIDAE																
<i>Ptilonorhynchus guttatus</i>	Western Bowerbird				X	X							X			
RALLIDAE																
<i>Fulica atra</i>	Eurasian Coot										X					
<i>Tribonyx ventralis</i>	Black-tailed Native-hen												X			
RECURVIROSTRIDAE																
<i>Cladorhynchus leucocephalus</i>	Banded Stilt											X		X		
<i>Himantopus himantopus</i>	Black-winged Stilt											X				
<i>Recurvirostra novaehollandiae</i>	Red-necked Avocet											X		X		
RHIPIDURIDAE																
<i>Rhipidura albiscapa</i>	Grey Fantail			X			X		X			X	X	X		
<i>Rhipidura fuliginosa</i>	New Zealand Fantail				X	X		X		X						
<i>Rhipidura leucophrys</i>	Willie Wagtail				X		X		X	X	X	X	X	X		
SCOLOPACIDAE																
<i>Actitis hypoleucos</i>	Common Sandpiper	M	S3										X			
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	M	S3										X			
<i>Calidris canutus</i>	Red Knot	M	S3										X			
<i>Tringa glareola</i>	Wood Sandpiper	M	S3								X		X			
<i>Tringa nebularia</i>	Common Greenshank	M	S3								X		X			
STRIGIDAE																

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		EPBC Act	In WA		A	B	C	D	E	F	G	H	I	J	K	L
<i>Ninox novaeseelandiae</i>	Southern Boobook Owl											X		X		
TURNICIDAE																
<i>Turnix velox</i>	Little Button-quail							X				X		X		
REPTILES																
AGAMIDAE																
<i>Caimanops amphiboluroides</i>	Mulga Dragon			X	X	X	X	X								
<i>Ctenophorus caudicinctus</i>	Ring-tailed Dragon										X					
<i>Ctenophorus cristatus</i>	Crested Dragon									X	X	X			X	
<i>Ctenophorus fordi</i>	Mallee Military Dragon										X	X			X	
<i>Ctenophorus isolepis</i>	Central Military Dragon											X				
<i>Ctenophorus maculatus</i>	Spotted Military Dragon										X					
<i>Ctenophorus ornatus</i>	Ornate Dragon							X				X				
<i>Ctenophorus reticulatus</i>	Western Netted Dragon				X		X	X	X		X	X			X	
<i>Ctenophorus salinarum</i>	Claypan Dragon											X			X	
<i>Ctenophorus scutulatus</i>	Lozenge-marked Dragon				X	X	X	X				X			X	
<i>Moloch horridus</i>	Thorny Devil								X	X		X			X	
<i>Pogona minor minor</i>	Dwarf Bearded Dragon				X	X	X	X		X	X	X			X	
ELAPIDAE																
<i>Brachyuropsis semifasciatus</i>	Southern Shovel-nosed Snake						X		X	X	X					
<i>Demansia psammophis</i>	Yellow-faced Whip Snake				X				X			X			X	
<i>Furina ornata</i>	Orange-naped Snake										X				X	
<i>Neelaps bimaculatus</i>	Black-naped Snake									X		X			X	
<i>Parasuta gouldii</i>	Gould's Hooded Snake									X						
<i>Parasuta monachus</i>	Monk Snake						X		X	X		X			X	
<i>Pseudechis australis</i>	King Brown Snake										X				X	
<i>Pseudechis butleri</i>	Spotted Mulga Snake				X											
<i>Pseudonaja modesta</i>	Ringed Brown Snake				X							X			X	
<i>Pseudonaja nuchalis</i>	Western Brown Snake											X			X	
<i>Simoselaps bertholdi</i>	Jan's Banded Snake						X				X	X				
<i>Suta fasciata</i>	Rosen's Snake						X								X	
GEKKONIDAE																
<i>Diplodactylus granariensis</i>	Wheat-belt Stone Gecko						X		X	X	X	X			X	

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<i>Diplodactylus pulcher</i>	Fine-faced Gecko				X	X	X	X	X	X	X	X			X	
<i>Diplodactylus vittatus</i>	Wood Gecko											X				
<i>Gehyra purpurascens</i>	Purplish Dtella						X				X	X			X	
<i>Gehyra variegata</i>	Tree Dtella				X	X	X		X	X	X	X			X	
<i>Heteronotia binoei</i>	Bynoe's Gecko				X	X	X		X		X	X			X	
<i>Lucasium maini</i>	Main's Ground Gecko								X	X	X				X	
<i>Lucasium stenodactylum</i>	Crowned Gecko							X								
<i>Nephrurus laevis</i>	Smooth Knob-tail										X				X	
<i>Nephrurus levis</i>	Three-lined Knob-tail			X	X											
<i>Nephrurus vertebralis</i>	Midline Knob-tail				X							X			X	
<i>Oedura reticulata</i>	Reticulated Velvet Gecko									X	X	X				
<i>Rhynchoedura ornata</i>	Beaked Gecko								X		X	X			X	
<i>Strophurus assimilis</i>	Goldfields Spiny-tailed Gecko					X					X	X			X	
<i>Strophurus elderi</i>	Jewelled Gecko										X	X			X	
<i>Strophurus intermedius</i>	Eastern Spiny-tailed Gecko											X				
<i>Strophurus strophurus</i>	Western Spiny-tailed Gecko				X										X	
<i>Strophurus wellingtonae</i>	Western Shield Spiny-tailed Gecko														X	
<i>Underwoodisaurus milii</i>	Thick-tailed Gecko						X			X	X	X			X	
PYGOPODIDAE																
<i>Delma australis</i>	Marble-faced Delma								X	X	X				X	
<i>Delma butleri</i>	Unbanded Delma											X			X	
<i>Lialis burtonis</i>	Burton's Snake-lizard										X	X			X	
<i>Pygopus nigriceps</i>	Hooded Scaly-foot						X		X						X	
PYTHONIDAE																
<i>Antaresia stimsoni</i>	Stimson's Python				X				X							
<i>Aspidites ramsayi</i>	Woma		S4										X		X	
SCINCIDAE																
<i>Cryptoblepharus australis</i>															X	
<i>Cryptoblepharus buchananii</i>															X	
<i>Cryptoblepharus plagioccephalus</i>	Callose-palmed Shinning-skink				X		X	X			X	X			X	
<i>Ctenotus atlas</i>	Southern Mallee Ctenotus								X		X	X			X	
<i>Ctenotus brooksi</i>	Wedgesnout Ctenotus														X	

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<i>Ctenotus grandis</i>	Grand Ctenotus							X									
<i>Ctenotus leae</i>	Orange-tailed Finesnout Ctenotus															X	
<i>Ctenotus leonhardii</i>	Leonhardi's Ctenotus				X	X		X				X				X	
<i>Ctenotus mimetes</i>	Checker-sided Ctenotus				X			X				X					
<i>Ctenotus schomburgkii</i>	Barred Wedgesnout Ctenotus				X	X	X	X	X		X	X				X	
<i>Ctenotus uber</i>	Spotted Ctenotus						X		X		X	X				X	
<i>Ctenotus xenopleura</i>	Wide-striped Ctenotus											X				X	
<i>Cyclodomorphus branchialis</i>	Common Slender Blue-tongue		S1									X					
<i>Cyclodomorphus melanops</i>	Spinifex Slender Blue-tongue									X						X	
<i>Egernia depressa</i>	Pygmy Spiny-tailed Skink				X	X			X			X				X	
<i>Egernia formosa</i>	Goldfields Crevice-skink						X			X		X				X	
<i>Egernia richardi</i>	Bright Crevice-skink										X						
<i>Eremiascincus richardsonii</i>	Broad-banded Sand-swimmer				X							X				X	
<i>Hemiergis initialis</i>	Southwestern Earless Skink						X		X			X					
<i>Hemiergis millewae</i>	Triodia Earless Skink											X					
<i>Lerista kingi</i>							X									X	
<i>Lerista macropisthopus</i>	Unpatterned Robust Slider								X			X				X	
<i>Lerista muelleri</i>	Wood Mulch-slider										X	X					
<i>Lerista picturata</i>	Southern Robust Slider										X					X	
<i>Lerista tridactyla</i>	Dark-backed Mulch Slider										X						
<i>Liopholis inornata</i>	Desert Skink						X		X		X	X					
<i>Lokisaurus rhodonoides</i> ³							X		X								
<i>Menetia greyii</i>	Common Dwarf Skink				X	X	X	X	X	X	X	X				X	
<i>Morethia butleri</i>	Woodland Morethia Skink				X		X			X	X	X				X	
<i>Tiliqua occipitalis</i>	Western Blue-tongue															X	
<i>Tiliqua rugosa</i>	Shingle-back										X						
<i>Tiliqua scincoides</i>	Eastern Blue-tongue						X										
TYPHLOPIDAE																	
<i>Ramphotyphlops australis</i>	Southern Blind Snake									X	X						
<i>Ramphotyphlops bicolor</i>							X			X						X	
<i>Ramphotyphlops bituberculatus</i>	Prong-snouted Blind Snake				X		X		X		X					X	
<i>Ramphotyphlops hamatus</i>	Pale-headed Blind Snake						X				X	X					

Species name	Common name	Conservation status		This survey	Literature review								Database searches				
		EPBC Act	In WA		A	B	C	D	E	F	G	H	I	J	K	L	
<i>Ramphotyphlops waitii</i>	Beaked Blind Snake															X	
VARANIDAE																	
<i>Varanus caudolineatus</i>	Stripe-tailed Monitor				X	X	X					X				X	
<i>Varanus giganteus</i>	Perentie						X									X	
<i>Varanus gouldii</i>	Gould's Goanna						X				X	X				X	
<i>Varanus panoptes</i>	Yellow-spotted Monitor				X	X			X								
<i>Varanus tristis</i>	Black-headed Monitor				X		X			X		X				X	
AMPHIBIANS																	
LIMNODYNASTIDAE																	
<i>Heleioporus albopunctatus</i>	Western Spotted Frog								X								
<i>Neobatrachus kunapalari</i>	Kunapalari Frog															X	
<i>Neobatrachus sutor</i>	Shoemaker Frog				X											X	
<i>Neobatrachus wilsmorei</i>	Goldfields Bullfrog															X	
MYOBATRACHIDAE																	
<i>Pseudophryne occidentalis</i>	Orange-crowned Toadlet				X				X							X	

¹ The Crested Bellbird was recorded by previous surveys A, B, C, D, E, F, G and H; and by database searches J and K. The species was not observed during this survey. Surveys A, B, C, D and E recorded individuals as the Crested Bellbird (southern) (*Oreoica gutturalis gutturalis*), which is listed as Priority 4 under the DEC Priority Fauna Species List. The remaining surveys and database searches did not identify individuals as the Crested Bellbird (southern), but instead identified the species to species-level only with no indication of conservation significance. See **Table 18** for a further discussion about White-browed Babbler taxonomy and occurrence within the Study Area.

² The White-browed Babbler was recorded by this field survey, as well as previous surveys A, B, C, D, E, F and H; and by database searches J and K. Surveys A, B, and E recorded individuals as the White-browed Babbler (western wheatbelt) (*Pomatostomus superciliosus ashbyi*), which is listed as Priority 4 under the DEC Priority Fauna Species List. The remaining surveys and database searches did not identify individuals as the White-browed Babbler (western wheatbelt), but instead identified the species to species-level only with no indication of conservation significance. See **Table 18** for a further discussion about White-browed Babbler taxonomy and occurrence within the Study Area.

³ Previously known as *Lerista rhodonoides* (Wells 2012).

Appendix B

Definitions of Codes and Terms Used to Describe Fauna of Conservation Significance

Fauna may be accorded legislative protection by being listed under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwth) (EPBC Act) and/or the *Wildlife Conservation Act 1950* (WA) (WC Act), or by being listed on the WA Department of Environment and Conservation's *Priority Species List*. This Appendix presents a summary of the different rankings and listings used to describe conservation status. Some categories, such as 'extinct', 'extinct in the wild' and 'conservation dependent' (EPBC Act) are not presented here, as the table includes only the information needed to fully understand the codes presented in the preceding report. Refer to the relevant legislation for a full description of all codes in use, as well as their associated criteria.

Definitions of Codes and Terms Used to Describe Conservation Significance Status

Status	Code	Description
Categories used under the EPBC Act		
Critically Endangered	CR	Fauna that is considered to be facing an extremely high risk of extinction in the wild in the immediate future
Endangered	EN	Fauna that is considered to be facing a very high risk of extinction in the wild in the near future
Vulnerable	VU	Fauna that is considered to be facing a high risk of extinction in the wild in the medium-term future
Migratory	M	Species that migrate to, over and within Australia and its external territories.
Schedules used under the WC Act		
Schedule 1	S1	Fauna that is rare or likely to become extinct. Threatened fauna listed under Schedule 1 of the WC Act are further ranked by the DEC, according to the level of threat facing each species. The ranks are CR, EN and VU.
	CR	Critically endangered: considered to be facing an extremely high risk of extinction in the wild
	EN	Endangered: considered to be facing a very high risk of extinction in the wild
	VU	Vulnerable: considered to be facing a high risk of extinction in the wild
Schedule 2	S2	Fauna that is presumed to be extinct
Schedule 3	S3	Birds that are subject to an agreement between the governments of Australia and Japan relating to the protection of migratory birds
Schedule 4	S4	Fauna that is in need of special protection, other than for reasons mentioned above
DEC Priority Fauna Lists		
Priority 1	P1	Taxa with few, poorly known populations on threatened lands. These are known from few specimens or sight records from one or a few localities on lands not managed for conservation, eg agricultural or pastoral lands, urban areas, active mineral leases. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.
Priority 2	P2	Taxa with few, poorly known populations on conservation lands. These are known from few specimens or sight records from one or a few localities on lands not under immediate threat of habitat destruction or degradation, eg national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.
Priority 3	P3	Taxa with several, poorly known populations, some on conservation lands. These are known from few specimens or sight records from several localities, some of which are on lands not under immediate threat of habitat destruction or degradation. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.
Priority 4	P4	Taxa in need of monitoring. These 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. These taxa are usually represented on conservation lands.
Priority 5	P5	Taxa in need of monitoring. These are not considered threatened but are subject to a specific conservation programme, the cessation of which would result in the species becoming threatened within five years.

Appendix C
Raw Data from Habitat Assessments

This Appendix contains the raw data obtained from habitat assessments conducted during this survey.

Study Area: Yunndaga
Site Name: YUNHAB01
Habitat Type: Open Mulga Woodland on Stony Red Loam
Assessment Date: 9/11/12

Coordinates (WGS84 UTM 52K):
 Transect start point: 307672 E, 6712465 N

Vegetation:

Stratum	Height		Percent cover		Growth Form	Dom spp.
	min (m)	max (m)	min (%)	max (%)		
Upper	4	5	10	15	tree/shrub	<i>Acacia aneura</i> , <i>Acacia</i> sp.
Middle	1.5	2.5	5	10	shrub	<i>Acacia tetragonophylla</i> , <i>Acacia</i> sp.
Ground	0.3	0.6	1	2	shrub	<i>Ptilotus</i> sp.

Ground Cover (percent):

Bare soil	Litter	Perennial	Annuals
97	2	0	1

Soils: Type: stony, sandy loam
Colour: red
Exposed bedrock: none

Coarse Surface Particles:
% cover over transect: >60
% cover on ground: >50
CSP sizes: 2-60mm

Water Impacts:
Waterlogging: none
Inundation: none
Flooding: none

Fire impacts: long unburnt

Other Impacts:

Erosion: none
Human disturbance: none
Introduced species: grazing, rabbit burrows and latrines
Weeds: none

Other Environmental Variables:

Slope: level
Aspect: n/a
Landform: plain
Large trees (>20cm DBH): none
Visible hollows: none
Coarse woody debris: occasional



Study Area: Yunndaga
Site Name: YUNHAB02
Habitat Type: Drainage Depression
Assessment Date: 9/11/12

Coordinates (WGS84 UTM 52K):
 Transect start point: 307510 E, 6712748 N

Vegetation:

Stratum	Height		Percent cover		Growth Form	Dom spp.
	min (m)	max (m)	min (%)	max (%)		
Upper	5	6	40	60	tree	<i>Acacia</i> spp.
Middle	1.2	2	10	20	shrub	<i>Acacia</i> sp., <i>Scaevola</i> sp.
Ground	0	0.2	10	15	herb/grass	<i>Eragrostis</i> sp.

Ground Cover (percent):

Bare soil	Litter	Perennial	Annuals
50	25	10	15

Soils: Type: sandy loam
Colour: red
Exposed bedrock: none

Coarse Surface Particles:
% cover over transect: 30-60
% cover on ground: 10-50
CSP sizes: 2-60 mm

Water Impacts:
Waterlogging: prone
Inundation: not prone
Flooding: prone

Fire impacts: long unburnt

Other Impacts:

Erosion: none
Human disturbance: none
Introduced species: grazing, rabbit burrows and latrines
Weeds: none

Other Environmental Variables:

Slope: level
Aspect: n/a
Landform: drainage depression
Large trees (>20cm DBH): occasional
Visible hollows: none
Coarse woody debris: common



Study Area: Yunndaga
Site Name: YUNHAB03
Habitat Type: Drainage Depression
Assessment Date: 9/11/12

Coordinates (WGS84 UTM 52K):
 Transect start point: 308473 E, 6711236 N

Vegetation:

Stratum	Height		Percent cover		Growth Form	Dom spp.
	min (m)	max (m)	min (%)	max (%)		
Upper	5	6	60	70	tree	<i>Acacia</i> sp.
Middle	2	2.5	0	5	shrub	<i>Acacia</i> sp.
Ground	0	0.5	10	30	herb/grass	<i>Ptilotus</i> sp., herbs

Ground Cover (percent):

Bare soil	Litter	Perennial	Annuals
40	40	0	20

Soils: Type: sandy loam
Colour: light red
Exposed bedrock: none

Coarse Surface Particles: none

Water Impacts:
Waterlogging: prone
Inundation: not prone
Flooding: prone

Fire impacts: long unburnt

Other Impacts:

Erosion: slightly disturbed
Human disturbance: none
Introduced species: grazing, old cattle tracks
Weeds: none

Other Environmental Variables:

Slope: level
Aspect: n/a
Landform: drainage depression
Large trees (>20cm DBH): none
Visible hollows: none
Coarse woody debris: common



Study Area: Yunndaga
Site Name: YUNHAB04
Habitat Type: Open Mallee Shrubland on Stony Low Rises
Assessment Date: 9/11/12

Coordinates (WGS84 UTM 52K):
 Transect start point: 308837 E, 6710733 N

Vegetation:

Stratum	Height		Percent cover		Growth Form	Dom spp.
	min (m)	max (m)	min (%)	max (%)		
Upper	5	8	5	5	mallee/tree	<i>Eucalyptus</i> sp., <i>Casuarina</i> sp., <i>Acacia</i> sp.
Middle	0.5	1.5	5	10	shrub	<i>Eremophila</i> sp., <i>Scaevola</i> sp., <i>Santalum</i> sp.
Ground	0.2	0.5	0	5	shrub	mixed shrubs

Ground Cover (percent):

Bare soil	Litter	Perennial	Annuals
90	10	0	0

Soils: Type: sandy clay loam
Colour: red
Exposed bedrock: none

Coarse Surface Particles: quartz
% cover over transect: >60
% cover on ground: >50
CSP sizes: 6-200mm

Water Impacts:
Waterlogging: none
Inundation: none
Flooding: none

Fire impacts: long unburnt

Other Impacts:

Erosion: none
Human disturbance: exploration works
Introduced species: some grazing
Weeds: none

Other Environmental Variables:

Slope: gentle
Aspect: varied
Landform: low ridge
Large trees (>20cm DBH): occasional
Visible hollows: none
Coarse woody debris: none



Study Area: Yunndaga
Site Name: YUNHAB05
Habitat Type: Open Mulga Woodland on Sandplain
Assessment Date: 9/11/12

Coordinates (WGS84 UTM 52K):
 Transect start point: 309139 E, 6710149 N

Vegetation:

Stratum	Height		Percent cover		Growth Form	Dom spp.
	min (m)	max (m)	min (%)	max (%)		
Upper	6	8	5	5	mallee	<i>Eucalyptus</i> sp., <i>Acacia</i> sp.
Middle	1.5	2.5	5	10	shrub	<i>Eremophila</i> sp., <i>Acacia</i> sp.
Ground	2	0.7	5	10	shrub	Chenopod (<i>Maireana</i>), <i>Senna artemoides</i>

Ground Cover (percent):

Bare soil	Litter	Perennial	Annuals
80	5	15	0

Soils: Type: sandy clay loam
Colour: red
Exposed bedrock: none

Coarse Surface Particles:
% cover over transect: 30-60
% cover on ground: <10
CSP sizes: 2-60mm

Water Impacts:
Waterlogging: none
Inundation: none
Flooding: none

Fire impacts: long unburnt

Other Impacts:

Erosion: none
Human disturbance: some drainage works
Introduced species: none
Weeds: none

Other Environmental Variables:

Slope: level
Aspect: n/a
Landform: plain
Large trees (>20cm DBH): occasional
Visible hollows: none
Coarse woody debris: occasional



Study Area: Yunndaga
Site Name: YUNHAB06
Habitat Type: Open Mulga Woodland on Stony Red Loam
Assessment Date: 9/11/12

Coordinates (WGS84 UTM 52K):
 Transect start point: 306858 E, 6714466 N

Vegetation:

Stratum	Height		Percent cover		Growth Form	Dom spp.
	min (m)	max (m)	min (%)	max (%)		
Upper	4	6	5	5	tree	<i>Casuarina</i> sp., <i>Acacia</i> sp.
Middle	1	2	0	5	shrub	<i>Senna artemoides</i>
Ground	0.2	0.3	0	2	herb/annual	<i>Ptilotus</i> sp.

Ground Cover (percent):

Bare soil	Litter	Perennial	Annuals
95	3	0	2

Soils: Type: sandy loam
Colour: red
Exposed bedrock: none

Coarse Surface Particles:
% cover over transect: >60
% cover on ground: 10-50
CSP sizes: 2-60mm

Water Impacts:
Waterlogging: none
Inundation: none
Flooding: none

Fire impacts: long unburnt

Other Impacts:

Erosion: none
Human disturbance: none
Introduced species: some grazing
Weeds: none

Other Environmental Variables:

Slope: level
Aspect: n/a
Landform: plain
Large trees (>20cm DBH): none
Visible hollows: none
Coarse woody debris: none



Study Area: Yunndaga
Site Name: YUNHAB07
Habitat Type: Drainage Depression
Assessment Date: 9/11/12

Coordinates (WGS84 UTM 52K):
 Transect start point: 306702 E, 6715114 N

Vegetation:

Stratum	Height		Percent cover		Growth Form	Dom spp.
	min (m)	max (m)	min (%)	max (%)		
Upper	4	6	40	60	tree	<i>Acacia</i> sp.
Middle	2	3.5	4	5	shrub	<i>Atriplex</i> sp.
Ground	0.1	0.2	0	2	grasses	<i>Eragrostis</i> ?

Ground Cover (percent):

Bare soil	Litter	Perennial	Annuals
10	88(thin)	0	2

Soils: Type: sandy loam
Colour: red
Exposed bedrock: none

Coarse Surface Particles: none

Water Impacts:
Waterlogging: none
Inundation: none
Flooding: prone

Fire impacts: long unburnt

Other Impacts:
Erosion: ?
Human disturbance: none
Introduced species: minor grazing
Weeds: none

Other Environmental Variables:
Slope: level
Aspect: n/a
Landform: plain
Large trees (>20cm DBH): none
Visible hollows: none
Coarse woody debris: occasional



Appendix D
Flora Species List

This Appendix contains a list of Flora identified within the Study Area during the May 2013 survey.

Family Code	Family Name	Species Name
29	Pteridaceae	
		<i>Cheilanthes sieberi</i>
128	Asparagaceae	
		* <i>Agave americana</i>
163	Poaceae	
		<i>Aristida contorta</i>
		<i>Austrostipa elegantissima</i>
		<i>Austrostipa nitida</i>
		* <i>Cenchrus ciliaris</i>
		* <i>Cynodon dactylon</i>
		<i>Enneapogon caerulescens</i>
		<i>Enneapogon</i> sp.
		<i>Enteropogon acicularis</i>
		<i>Eragrostis eriopoda</i>
		<i>Eriachne</i> sp.
		<i>Monachather paradoxus</i>
		* <i>Pentameris airoides</i>
175	Proteaceae	
		<i>Grevillea nematophylla</i>
		<i>Hakea lorea</i>
		<i>Hakea preissii</i>
		<i>Hakea recurva</i>
196	Haloragaceae	
		<i>Haloragis</i> sp.
199	Zygophyllaceae	
		* <i>Tribulus terrestris</i>
		<i>Zygophyllum iodocarpum</i>
201	Fabaceae	
		<i>Acacia aneura</i>
		<i>Acacia burkittii</i>
		<i>Acacia caesaneura</i>
		<i>Acacia colletioides</i>
		<i>Acacia coolgardiensis</i>
		<i>Acacia craspedocarpa</i>
		<i>Acacia erinacea</i>
		<i>Acacia hemiteles</i>
		<i>Acacia incurvaneura</i>
		<i>Acacia ligulata</i>
		<i>Acacia mulganeura</i>
		<i>Acacia oswaldii</i>
		<i>Acacia ramulosa</i>
		<i>Acacia tetragonophylla</i>
		<i>Senna artemisioides</i> subsp. <i>filifolia</i>
		<i>Senna artemisioides</i> subsp. <i>sturtii</i>
		<i>Senna artemisioides</i> subsp. <i>x artemisioides</i>
		<i>Senna cardiosperma</i>

Family Code	Family Name	Species Name
217	Casuarinaceae	<i>Casuarina pauper</i>
224	Cucurbitaceae	* <i>Citrullus lanatus</i> * <i>Cucumis myriocarpus</i>
243	Euphorbiaceae	<i>Euphorbia drummondii</i>
274	Geraniaceae	<i>Erodium crinitum</i>
281	Myrtaceae	<i>Eucalyptus oleosa</i> <i>Eucalyptus</i> sp.
298	Anacardiaceae	* <i>Schinus molle</i> var. <i>areira</i>
299	Sapindaceae	<i>Alectryon oleifolius</i> <i>Dodonea lobulata</i> <i>Dodonea rigida</i>
309	Malvaceae	<i>Abutilon</i> sp. <i>Brachychiton gregorii</i> <i>Lawrencia squamata</i> <i>Hibiscus</i> sp. <i>Sida calyxhymenia</i> <i>Sida</i> sp.
338	Santalaceae	<i>Exocarpos aphyllus</i> <i>Santalum spicatum</i>
342	Frankeniaceae	<i>Frankenia</i> sp.
332	Brassicaceae	* <i>Carrichtera annua</i> * <i>Sisymbrium erysimoides</i>
339	Loranthaceae	<i>Amyema fitzgeraldii</i> <i>Amyema preissii</i>
345	Polygonaceae	* <i>Acetosa vesicaria</i>
357	Amaranthaceae	<i>Ptilotus helipteroides</i> <i>Ptilotus nobilis</i> <i>Ptilotus obovatus</i>
358	Chenopodiaceae	<i>Atriplex bunburyana</i> <i>Atriplex nummularia</i>

Family Code	Family Name	Species Name
		<i>Atriplex vesicaria</i>
		<i>Dissocarpus paradoxus</i>
		<i>Dysphania melanocarpa</i>
		<i>Enchylaena tomentosa</i>
		<i>Maireana appressa</i>
		<i>Maireana georgei</i>
		<i>Maireana sedifolia</i>
		<i>Maireana pyramidata</i>
		<i>Maireana tomentosa</i>
		<i>Maireana trichoptera</i>
		<i>Maireana triptera</i>
		<i>Rhagodia eremaea</i>
		<i>Salsola australis</i>
		<i>Sclerolaena diacantha</i>
		<i>Sclerolaena obliquicuspis</i>
		<i>Sclerolaena sp.</i>
374	Portulacaceae	
		<i>Calandrinia sp.</i>
409	Rubiaceae	
		<i>Psydrax sp.</i>
413	Apocynaceae	
		<i>Marsdenia australis</i>
		* <i>Nerium oleander</i>
415	Boraginaceae	
		* <i>Heliotropium europaeum</i>
416	Convolvulaceae	
		<i>Convolvulus remotus</i>
417	Solanaceae	
		* <i>Solanum hystrix</i>
		<i>Solanum lasiophyllum</i>
		* <i>Solanum nigrum</i>
		<i>Solanum nummularium</i>
428	Scrophulariaceae	
		<i>Eremophila caperata</i>
		<i>Eremophila decipiens</i>
		<i>Eremophila exilifolia</i>
		<i>Eremophila georgei</i>
		<i>Eremophila granitica</i>
		<i>Eremophila latrobei</i> subsp. <i>filiformis</i>
		<i>Eremophila longifolia</i>
		<i>Eremophila margarethae</i>
		<i>Eremophila oldfieldii</i>
		<i>Eremophila pantonii</i>
		<i>Eremophila serrulata</i>
		<i>Eremophila scoparia</i>
432	Lamiaceae	

Family Code	Family Name	Species Name
		<i>*Salvia verbenaca</i>
452	Goodeniaceae	<i>Scaevola spinescens</i>
460	Asteraceae	<i>Brahyscome ciliaris</i> <i>Cratystylis subspinescens</i> <i>Olearia muelleri</i> <i>Olearia pimeleoides</i> <i>*Sonchus oleraceus</i>

Appendix E

Raw Vegetation Association Data

This Appendix contains the raw vegetation association data collected during the May 2013 survey.

Yunndaga **Site** YUNVEG01
Described by AF **Date** 23/05/2013 **Type** V
Location WP 151
Coordinates (GDA) 51 J 306661 6715081
Habitat Mulga Drainage and Sandplain
Soil Sandy red clay loam
Vegetation Tall Woodland of *Acacia incurvaneura* with occasional *Eucalyptus oleosa* over Sparse Low Shrubland of *Ptilotus obovatus* and *Enchylaena tomentosa*.
Veg Condition Good



Yunndaga **Site** YUNVEG 02
Described by AF **Date** 23/05/2013 **Type** V
Location WP 152
Coordinates (GDA) 51 J 306738 6714776
Habitat Tall Shrubland Sandplain
Soil Sandy red loam
Vegetation Open Tall Shrubland of *Acacia burkittii*, *Acacia craspedocarpa* and *Acacia mulganeura* with *Casuarina pauper* emergents over Open Shrubland of *Senna artemisioides* subsp. *filifolia* and *Dodonea lobulata* over Low Shrubland of *Ptilotus obovatus* and *Sclerolaena diacantha*
Veg Condition Very Good



SPECIES LIST:

Name	Cover	C Class
<i>Acacia craspedocarpa</i>		<1 %
<i>Acacia incurvaneura</i>		70-100 %
<i>Austrostipa nitida</i>		<1 %
<i>Euphorbia drummondii</i>		<1 %
<i>Enchylaena tomentosa</i>		1-5 %
<i>Enneapogon caeruleus</i>		<1 %
<i>Eucalyptus oleosa</i>		1-5 %
<i>Maireana georgei</i>		<1 %
<i>Ptilotus obovatus</i>		5-10 %
<i>Sclerolaena diacantha</i>		<1 %
<i>Sida</i> sp.		<1 %
<i>Solanum lasiophyllum</i>		<1 %

SPECIES LIST:

Name	Cover	C Class
<i>Acacia burkittii</i>		1-5 %
<i>Acacia craspedocarpa</i>		1-5 %
<i>Acacia incurvaneura</i>		1-5 %
<i>Acacia ligulata</i>		1-5 %
<i>Acacia mulganeura</i>		1-5 %
<i>Austrostipa nitida</i>		<1 %
<i>Casuarina pauper</i>		<1 %
<i>Dodonea lobulata</i>		1-5 %
<i>Psyrax</i> sp.		<1 %
<i>Ptilotus obovatus</i>		1-5 %
<i>Scaevola spinescens</i>		<1 %
<i>Sclerolaena diacantha</i>		1-5 %
<i>Senna artemisioides</i> subsp. <i>filifolia</i>		5-10 %
<i>Solanum lasiophyllum</i>		<1 %

Yunndaga
Described by AF
Location WP 158
Coordinates (GDA) 51 J 307011 6714065
Habitat Mulga Drainage and Sandplains
Soil Sandy red clay loam
Vegetation Open Tall Woodland of *Acacia incurvaneura* over Sparse Tall Shrubland of *Acacia craspedocarpa* and *Acacia tetragonophylla* over Open Shrubland of *Scaevola spinescens* and *Sida* sp. over Low Shrubland of *Solanum lasiophyllum*.
Veg Condition Very Good



Yunndaga
Described by AF
Location WP 162
Coordinates (GDA) 51 J 307117 6713829
Habitat Tall Shrubland on Stony Plains
Soil Stony red loam
Vegetation Open Tall Woodland of *Acacia incurvaneura* over Open Tall Shrubland of *Acacia mulganeura* with occasional *Acacia craspedocarpa* and *Acacia ligulata* over Open Shrubland of *Scaevola spinescens*, *Senna artemisioides* subsp. *filifolia* and *Sida* sp. over Low Shrubland of *Mairena triptera* and *Ptilotus obovatus*.
Veg Condition Good



SPECIES LIST:

Name	Cover	C Class
<i>Acacia caesincurvaneura</i>		50-70 %
<i>Acacia coolgardiensis</i>		1-5 %
<i>Acacia craspedocarpa</i>		1-5 %
<i>Acacia incurvaneura</i>		10-25 %
<i>Acacia tetragonophylla</i>		1-5 %
<i>Austrostipa nitida</i>		<1 %
<i>Enchylaena tomentose</i>		<1 %
<i>Ptilotus obovatus</i>		<1 %
<i>Scaevola spinescens</i>		1-5 %
<i>Senna artemisioides</i> subsp. <i>filifolia</i>		<1 %
<i>Sida</i> sp.		1-5 %
<i>Solanum lasiophyllum</i>		1-5 %

SPECIES LIST:

Name	Cover	C Class
<i>Acacia coolgardiensis</i>		<1 %
<i>Acacia craspedocarpa</i>		1-5 %
<i>Acacia incurvaneura</i>		1-5 %
<i>Acacia ligulata</i>		1-5 %
<i>Acacia mulganeura</i>		5-10 %
<i>Acacia tetragonophylla</i>		<1 %
<i>Eremophila oldfieldii</i>		<1 %
<i>Eremophila</i> sp.		<1 %
<i>Maireana triptera</i>		1-5 %
<i>Ptilotus obovatus</i>		1-5 %
<i>Scaevola spinescens</i>		1-5 %
<i>Senna artemisioides</i> subsp. <i>filifolia</i>		1-5 %
<i>Sida calyxhymentia</i>		<1 %
<i>Sida</i> sp.		1-5 %

Yunndaga

Site YUNVEG 05

Described by AF Date 23/05/2013 Type V

Location WP 188

Coordinates (GDA) 51 J 307540 6712716

Habitat Tall Shrubland on Stony Plains

Soil Stony red loam

Vegetation Sparse Tall Woodland of *Acacia caesaneura* and *Casuarina pauper* over open Tall Shrubland of *Acacia mulganeura* over Open Shrubland of *Dodonea rigida*, *Scaevola spinescens* and *Sida* sp. over Low Shrubland of *Ptilotus obovatus* and *Solanum lasiophyllum*.

Veg Condition Good

**SPECIES LIST:**

Name	Cover	C Class
<i>Acacia caesaneura</i>		5-10 %
<i>Acacia mulganeura</i>		10-25 %
<i>Casuarina pauper</i>		1-5 %
<i>Dodonea rigida</i>		1-5 %
<i>Eremophila oldfieldii</i>		1-5 %
<i>Eremophila</i> sp.		<1 %
<i>Ptilotus obovatus</i>		1-5 %
<i>Scaevola spinescens</i>		1-5 %
<i>Sclerolaena diacantha</i>		<1 %
<i>Sida</i> sp.		1-5 %
<i>Solanum lasiophyllum</i>		1-5 %

Yunndaga

Site YUNVEG 06

Described by AF Date 23/05/2013 Type V

Location WP 230

Coordinates (GDA) 51 J 307448 6712597

Habitat Tall Shrubland on Stony Plains

Soil Stony red loam

Vegetation Tall Open Shrubland of *Acacia mulganeura* with *Acacia incurvaneura* emergents over Sparse Low Shrubland of *Senna artemisioides* subsp. *filifolia* and *Eremophila* spp. over a Sparse Low Shrublandland of *Ptilotus obovatus* and *Sclerolaena diacantha*.

Veg Condition Good

**SPECIES LIST:**

Name	Cover	C Class
<i>Acacia caesaneura</i>		1-5 %
<i>Acacia coolgardiensis</i>		1-5 %
<i>Acacia incurvaneura</i>		1-5 %
<i>Acacia mulganeura</i>		5-10 %
<i>Acacia tetragonophylla</i>		1-5 %
<i>Brachychiton gregorii</i>		<1 %
<i>Enchylaena tomentosa</i>		<1 %
<i>Enneapogon caerulescens</i>		<1 %
<i>Eremophila</i> sp.		<1 %
<i>Ptilotus obovatus</i>		1-5 %
<i>Senna artemisioides</i> subsp. <i>filifolia</i>		1-5 %
<i>Sida</i> sp.		1-5 %
<i>Solanum lasiophyllum</i>		<1 %

Yunndaga

Site YUNVEG 07

Described by AF Date 23/05/2013 Type V

Location WP 192

Coordinates (GDA) 51 J 307687 6712473

Habitat Mulga Drainage and Sandplains

Soil Sandy red clay loam

Vegetation Tall Open Woodland of *Acacia incurvaneura* and *Acacia caesaneura* with emergent *Eucalyptus oleosa* over Open Shrubland of *Dodonea rigida*, *Scaevola spinescens* and *Sida* sp. over a Sparse Low Shrubland of *Ptilotus obovatus*, over Sparse Herbland of *Cheilanthes sieberi* and *Euphorbia drummondii*.

Veg Condition Good

**SPECIES LIST:**

Name	Cover	C Class
<i>Acacia caesaneura</i>		10-25 %
<i>Acacia incurvaneura</i>		10-25 %
<i>Acacia tetragonophylla</i>		<1 %
<i>Austrostipa nitida</i>		<1 %
<i>Cheilanthes sieberi</i>		1-5 %
<i>Dodonea rigida</i>		5-10 %
<i>Eucalyptus oleosa</i>		1-5 %
<i>Euphorbia drummondii</i>		1-5 %
<i>Ptilotus obovatus</i>		1-5 %
<i>Scaevola spinescens</i>		1-5 %
<i>Sida</i> sp.		1-5 %
<i>Solanum lasiophyllum</i>		<1 %

Yunndaga

Site YUNVEG 08

Described by AF Date 23/05/2013 Type V

Location WP 216

Coordinates (GDA) 51 J 307872 6711953

Habitat Mulga Drainage and Sandplains

Soil Sandy red clay loam

Vegetation Tall Open Woodland of *Acacia incurvaneura* and *Acacia mulganeura* over Open Shrubland of *Scaevola spinescens* over Low Shrubland of *Ptilotus obovatus*.

Veg Condition Good

**SPECIES LIST:**

Name	Cover	C Class
<i>Acacia incurvaneura</i>		10-25 %
<i>Acacia mulganeura</i>		25-50 %
<i>Amyema fitzgeraldii</i>		<1 %
<i>Dodonea rigida</i>		<1 %
<i>Enneapogon caeruleus</i>		<1 %
<i>Euphorbia drummondii</i>		<1 %
<i>Enchylaena tomentosa</i>		<1 %
<i>Ptilotus obovatus</i>		1-5 %
<i>Scaevola spinescens</i>		1-5 %
<i>Solanum lasiophyllum</i>		<1 %

Yunndaga

Described by AF
Location WP 215

Coordinates (GDA) 51 J 307988 6711741

Habitat Open Shrubland on Light Stony Rise

Soil Stony red loam

Vegetation Open Tall Shrubland of *Acacia caesaneura* and *Acacia mulganeura* over Open Shrubland of *Dodonea lobulata*, *Scaevola spinescens* and *Sida* sp. over Low Shrubland of *Ptilotus obovatus*.

Veg Condition Good



Site YUNVEG 09

Date 23/05/2013 Type V

Yunndaga

Described by AF
Location WP 042

Coordinates (GDA) 51 J 308453 6711258

Habitat Mulga Drainage and Sandplain

Soil Sandy red clay loam

Vegetation Open Woodland of *Acacia incurvaneura* over Tall Shrubland of *Acacia mulganeura* over Open Shrubland of *Sida* sp. over Low Shrubland of *Enchylaena tomentosa* and *Ptilotus obovatus* over Sparse Herbland of *Abutilon* sp. and *Euphorbia drummondii*.

Veg Condition Good



Site YUNVEG 10

Date 22/05/2013 Type V

SPECIES LIST:

Name	Cover	C Class
<i>Acacia caesaneura</i>		1-5 %
<i>Acacia mulganeura</i>		10-25 %
<i>Dodonea lobulata</i>		1-5 %
<i>Dodonea rigida</i>		<1 %
<i>Eremophila oldfieldii</i>		1-5 %
<i>Ptilotus obovatus</i>		1-5 %
<i>Scaevola spinescens</i>		1-5 %
<i>Sida</i> sp.		1-5 %

SPECIES LIST:

Name	Cover	C Class
<i>Abutilon</i> sp.		1-5 %
<i>Acacia incurvaneura</i>		10-25 %
<i>Acacia mulganeura</i>		75-100 %
<i>Acacia tetragonophylla</i>		1-5 %
<i>Cheilanthes sieberi</i>		<1 %
<i>Enchylaena tomentosa</i>		1-5 %
<i>Enneapogon caeruleus</i>		<1 %
<i>Eremophila oldfieldii</i>		1-5 %
<i>Euphorbia drummondii</i>		1-5 %
<i>Maireana georgei</i>		<1 %
<i>Ptilotus obovatus</i>		5-10 %
<i>Senna cardiosperma</i>		1-5 %
<i>Sida calyxhyemia</i>		1-5 %
<i>Sida</i> sp.		1-5 %

Yunndaga
Described by AF
Location WP 044
Coordinates (GDA) 51 J 308565 6711075
Habitat Open Shrubland on Rocky Rise
Soil Rocky sandy loam
Vegetation Open Tall Shrubland of *Acacia mulganeura* with *Casuarina pauper* emergents over Open Shrubland of *Dodonea lobulata* and *Senna artemisioides* subsp. *filifolia* over Low Shrubland of *Maireana trichoptera* and *Ptilotus obovatus*.
Veg Condition Good



SPECIES LIST:

Name	Cover	C Class
<i>Acacia hemiteles</i>		<1 %
<i>Acacia ramulosa</i>		<1 %
<i>Acacia mulganeura</i>		10-25 %
<i>Casuarina pauper</i>		1-5 %
<i>Dodonea lobulata</i>		1-5 %
<i>Eremophila oldfieldii</i>		1-5 %
<i>Eremophila scoparia</i>		1-5 %
<i>Maireana trichoptera</i>		1-5 %
<i>Ptilotus obovatus</i>		1-5 %
<i>Santalum spicatum</i>		<1 %
<i>Scaevola spinescens</i>		1-5 %
<i>Senna artemisioides</i> subsp. <i>filifolia</i>		1-5 %
<i>Solanum lasiophyllum</i>		<1 %

Yunndaga
Described by AF
Location WP 049
Coordinates (GDA) 51 J 308565 6711075
Habitat Open Shrubland on Rocky Rise
Soil Rocky sandy loam (with quartz)
Vegetation Sparse Woodland of *Eucalyptus oleosa* and *Casuarina pauper* over Open Tall Shrubland of *Acacia mulganeura* over Open Shrubland of *Eremophila pantonii*, and *Scaevola spinescens*.
Veg Condition Good



SPECIES LIST:

Name	Cover	C Class
<i>Acacia erinacea</i>		1-5 %
<i>Acacia mulganeura</i>		1-5 %
<i>Casuarina pauper</i>		<1 %
<i>Eremophila margarethae</i>		<1 %
<i>Eremophila pantonii</i>		10-25 %
<i>Eucalyptus oleosa</i>		1-5 %
<i>Eucalyptus</i> sp.		1-5 %
<i>Exocarpos aphylla</i>		<1 %
<i>Santalum spicatum</i>		1-5 %
<i>Scaevola spinescens</i>		10-25 %
<i>Senna artemisioides</i> subsp. <i>filifolia</i>		<1 %

Yunndaga

Described by AF
Location WP 049

Coordinates (GDA) 51 J 308565 6711075

Habitat Shrubland Drainage and Sandplain

Soil Sandy red clay loam

Vegetation Sparse Tall Shrubland of *Acacia tetragonophylla* and *Eremophila longifolia* with *Casuarina pauper* emergents over Low Shrubland of *Atriplex bunburyana*, *Maireana georgei*, *Maireana triptera*, *Sclerolaena diacantha* and *Solanum lasiophyllum* over Sparse Grassland of *Enneapogon caeruleus*.

Veg Condition Good

**Site YUNVEG 13**

Date 22/05/2013 Type V

Yunndaga

Described by AF
Location WP 57

Coordinates (GDA) 51 J 309157 6710162

Habitat Mallee Drainage and Sandplains

Soil Sandy red clay loam

Vegetation Open Woodland of *Eucalyptus oleosa* and *Casuarina pauper* over Shrubland of *Acacia hemiteles*, *Eremophila scoparia* and *Senna artemisioides* subsp. *filifolia* over Low Shrubland of *Atriplex bunburyana* and *Sclerolaena diacantha*.

Veg Condition Degraded

**Site YUNVEG 14**

Date 22/05/2013 Type V

SPECIES LIST:

Name	Cover	C Class
<i>Acacia hemiteles</i>	<1 %	<1 %
<i>Acacia tetragonophylla</i>	<1 %	<1 %
<i>Atriplex bunburyana</i>	25-50 %	<1 %
<i>Austrostipa nitida</i>	<1 %	<1 %
<i>Casuarina pauper</i>	<1 %	<1 %
<i>Enneapogon caeruleus</i>	1-5 %	<1 %
<i>Eremophila longifolia</i>	<1 %	<1 %
<i>Eremophila scoparia</i>	1-5 %	<1 %
<i>Maireana georgei</i>	1-5 %	<1 %
<i>Maireana triptera</i>	1-5 %	<1 %
<i>Sclerolaena diacantha</i>	1-5 %	<1 %
<i>Sclerolaena obliquicuspis</i>	<1 %	<1 %
<i>Solanum lasiophyllum</i>	1-5 %	<1 %

SPECIES LIST:

Name	Cover	C Class
<i>Acacia colletioides</i>	<1 %	<1 %
<i>Acacia hemiteles</i>	1-5 %	<1 %
<i>Acacia incurvaneura</i>	<1 %	<1 %
<i>Acacia tetragonophylla</i>	<1 %	<1 %
<i>Atriplex bunburyana</i>	1-5 %	<1 %
<i>Casuarina pauper</i>	<1 %	<1 %
<i>Eremophila scoparia</i>	1-5 %	<1 %
<i>Enchylaena tomentosa</i>	<1 %	<1 %
<i>Eucalyptus oleosa</i>	1-5 %	<1 %
<i>Maireana pyramidata</i>	<1 %	<1 %
<i>Ptilotus nobilis</i>	<1 %	<1 %
<i>Ptilotus obovatus</i>	<1 %	<1 %
<i>Rhagodia eremaea</i>	<1 %	<1 %
<i>Sclerolaena diacantha</i>	1-5 %	<1 %
<i>Senna artemisioides</i> subsp. <i>filifolia</i>	1-5 %	<1 %

Yunndaga

Described by AF
Location WP 60

Coordinates (GDA) 51 J 309224 6710052

Habitat Mallee Drainage and Sandplains

Soil Sandy red clay loam

Vegetation Open Woodland of *Acacia incurvaneura* and *Eucalyptus oleosa* over Low Shrubland of *Maireana georgei*, *Ptilotus obovatus* and *Sclerolaena diacantha*.

Veg Condition Degraded

**SPECIES LIST:**

Name	Cover	C Class
<i>Acacia incurvaneura</i>		5-10 %
<i>Acacia mulganeura</i>		<1 %
<i>Atriplex bunburyana</i>		<1 %
<i>Eucalyptus oleosa</i>		1-5 %
<i>Maireana georgei</i>		1-5 %
<i>Ptilotus obovatus</i>		1-5 %
<i>Sclerolaena diacantha</i>		1-5 %
<i>Senna artemisioides</i> subsp. <i>filifolia</i>		<1 %

Site YUNVEG15

Date 22/05/2013 Type V

Yunndaga

Described by AF
Location WP 60

Coordinates (GDA) 51 J 309224 6710052

Habitat Mallee Drainage and Sandplain

Soil Sandy red clay loam

Vegetation Open Woodland of *Acacia incurvaneura* and *Eucalyptus oleosa* over Tall Shrubland of *Acacia ligulata* and *Senna artemisioides* subsp. *filifolia*. over Open Low Shrubland of *Ptilotus obovatus*.

Veg Condition Good

**SPECIES LIST:**

Name	Cover	C Class
<i>Acacia incurvaneura</i>		5-10 %
<i>Acacia ligulata</i>		1-5 %
<i>Acacia mulganeura</i>		<1 %
<i>Atriplex bunburyana</i>		1-5 %
<i>Enchylaena tomentosa</i>		<1 %
<i>Eucalyptus oleosa</i>		5-10 %
<i>Olearia muelleri</i>		1-5 %
<i>Ptilotus obovatus</i>		1-5 %
<i>Scaevola spinescens</i>		1-5 %
<i>Senna artemisioides</i> subsp. <i>filifolia</i>		1-5 %

Site YUNVEG 16

Date 22/05/2013 Type V

Yunndaga

Described by AF
Location WP 64

Coordinates (GDA) 51 J 309707 6709285

Habitat Tall Shrubland on Stony Plains

Soil Stony red loam

Vegetation Open Tall Shrubland of *Acacia mulganeura* with *Acacia incurvaneura* and *Casuarina pauper* emergents over Shrubland of *Acacia hemiteles* over Sparse Low Shrubland of *Ptilotus obovatus* and *Solanum lasiophyllum*.

Veg Condition Good

**Site YUNVEG 17**

Date 22/05/2013 **Type** V

Yunndaga

Described by AF
Location WP 66

Coordinates (GDA) 51 J 309893 6709087

Habitat Shrubland Drainage and Sandplains

Soil Sandy red clay loam

Vegetation Open Shrubland of *Senna artemisioides* subsp. *filifolia* and *Maireana sedifolia* over Low Shrubland of *Maireana trichoptera*, *Sclerolaena diacantha* and *Solanum lasiophyllum* over Grassland of *Aristida contorta* and *Enneapogon caeruleus*.

Veg Condition Good

**Site YUNVEG 18**

Date 22/05/2013 **Type** V

SPECIES LIST:

Name	Cover	C Class
<i>Acacia hemiteles</i>		1-5 %
<i>Acacia incurvaneura</i>		1-5 %
<i>Acacia ramulosa</i>		<1 %
<i>Acacia mulganeura</i>		5-10 %
<i>Acacia tetragonophylla</i>		<1 %
<i>Amyema fitzgeraldii</i>		<1 %
<i>Casuarina pauper</i>		<1 %
<i>Enneapogon caeruleus</i>		1-5 %
<i>Maireana trichoptera</i>		<1 %
<i>Ptilotus obovatus</i>		<1 %
<i>Sclerolaena diacantha</i>		<1 %
<i>Solanum lasiophyllum</i>		<1 %

SPECIES LIST:

Name	Cover	C Class
<i>Aristida contorta</i>		5-10 %
<i>Dissocarpus paradoxus</i>		<1 %
<i>Enneapogon caeruleus</i>		75-100 %
<i>Euphorbia drummondii</i>		1-5 %
<i>Erodium crinatum</i>		<1 %
<i>Maireana sedifolia</i>		1-5 %
<i>Maireana trichoptera</i>		5-10 %
<i>Ptilotus obovatus</i>		<1 %
<i>Sclerolaena diacantha</i>		5-10 %
<i>Senna artemisioides</i> subsp. <i>filifolia</i>		5-10 %
<i>Solanum lasiophyllum</i>		1-5 %
<i>Solanum nummularium</i>		<1 %

Yunndaga

Described by AF
Location WP 76

Coordinates (GDA) 51 J 310894 6708632

Habitat Tall Shrubland on Stony Plains

Soil Stony red loam

Vegetation Open Tall Shrubland of *Acacia mulganeura* with *Casuarina pauper* emergents over Shrubland of *Atriplex nummularia*, *Maireana sedifolia* and *Senna artemisioides* subsp. *filifolia* over Low Shrubland of *Maireana georgei*, *Maireana trichoptera*, *Ptilotus obovatus* and *Solanum lasiophyllum*.

Veg Condition Good

**Site YUNVEG 19**

Date 22/05/2013 Type V

Yunndaga

Described by AF
Location WP 83

Coordinates (GDA) 51 J 311317 6708527

Habitat Tall Shrubland on Stony Plain

Soil Stony red loam

Vegetation Sparse Woodland of *Acacia incurvaneura* and *Casuarina pauper* over Tall Shrubland of *Acacia mulganeura* and *Acacia burkittii* over Shrubland of *Senna artemisioides* subsp. *filifolia* over Low Shrubland of *Maireana georgei*, *Ptilotus obovatus* and *Sclerolaena diacantha*.

Veg Condition Good

**Site YUNVEG 20**

Date 22/05/2013 Type V

SPECIES LIST:

Name	Cover	C Class
<i>Acacia burkittii</i>	<1 %	
<i>Acacia mulganeura</i>	1-5 %	
<i>Atriplex bunburyana</i>	<1 %	
<i>Atriplex nummularia</i>	1-5 %	
<i>Casuarina pauper</i>	<1 %	
<i>Enneapogon caeruleus</i>	<1 %	
<i>Eremophila oldfieldii</i>	1-5 %	
<i>Eremophila scoparia</i>	<1 %	
<i>Maireana georgei</i>	1-5 %	
<i>Maireana sedifolia</i>	1-5 %	
<i>Maireana triptera</i>	<1 %	
<i>Ptilotus obovatus</i>	1-5 %	
<i>Rhagodia eremea</i>	<1 %	
<i>Solanum lasiophyllum</i>	<1 %	

SPECIES LIST:

Name	Cover	C Class
<i>Acacia burkittii</i>	1-5 %	
<i>Acacia incurvaneura</i>	1-5 %	
<i>Acacia mulganeura</i>	1-5 %	
<i>Casuarina pauper</i>	1-5 %	
<i>Enneapogon caeruleus</i>	1-5 %	
<i>Eremophila oldfieldii</i>	<1 %	
<i>Maireana georgei</i>	1-5 %	
<i>Maireana pyramidata</i>	<1 %	
<i>Maireana sedifolia</i>	<1 %	
<i>Ptilotus obovatus</i>	1-5 %	
<i>Scaevola spinescens</i>	<1 %	
<i>Sclerolaena diacantha</i>	1-5 %	
<i>Senna artemisioides</i> subsp. <i>filifolia</i>	1-5 %	

Yunndaga

Described by AF
Location WP 102

Coordinates (GDA) 51 J 310880 6708347

Habitat Drainage Sandplain

Soil Sandy red clay loam

Vegetation Sparse Tall Shrubland of *Acacia mulganeura* with *Casuarina pauper* emergents over Open Shrubland of *Atriplex bunburyana* and *Senna artemisioides* subsp. *filifolia* over Sparse Grassland of *Austrostipa nitida* and *Enneapogon caerulescens*.

Veg Condition Degraded



Site YUNVEG 21

Date 22/05/2013 Type V

Yunndaga

Described by AF
Location WP 109

Coordinates (GDA) 51 J 311154 6708001

Habitat Tall Shrubland on Stony Plains

Soil Stony red loam

Vegetation Tall Shrubland of *Acacia mulganeura* with *Casuarina pauper* emergents over Open Shrubland of *Dodonea lobulata*, *Scaevola spinescens* and *Senna artemisioides* subsp. *filifolia* over Sparse Low Shrubland of *Ptilotus obovatus*.

Veg Condition Degraded



Site YUNVEG22

Date 22/05/2013 Type V

SPECIES LIST:

Name	Cover	C Class
<i>Acacia mulganeura</i>		1-5 %
<i>Acacia</i> sp.		1-5 %
<i>Aristida contorta</i>		<1 %
<i>Atriplex bunburyana</i>		1-5 %
<i>Austrostipa nitida</i>		1-5 %
<i>Casuarina pauper</i>		5-10 %
<i>Enneapogon caerulescens</i>		1-5 %
<i>Maireana georgei</i>		<1 %
<i>Ptilotus nobilis</i>		<1 %
<i>Rhagodia eremaea</i>		<1 %
<i>Senna artemisioides</i> subsp. <i>filifolia</i>		1-5 %

SPECIES LIST:

Name	Cover	C Class
<i>Acacia mulganeura</i>		5-10 %
<i>Casuarina pauper</i>		<1 %
<i>Dodonea lobulata</i>		1-5 %
<i>Enneapogon caerulescens</i>		<1 %
<i>Maireana georgei</i>		<1 %
<i>Marsdenia australis</i>		<1 %
<i>Ptilotus obovatus</i>		1-5 %
<i>Scaevola spinescens</i>		1-5 %
<i>Senna artemisioides</i> subsp. <i>filifolia</i>		1-5 %
<i>Sida calyxhymentia</i>		<1 %
<i>Solanum lasiophyllum</i>		<1 %

Appendix F

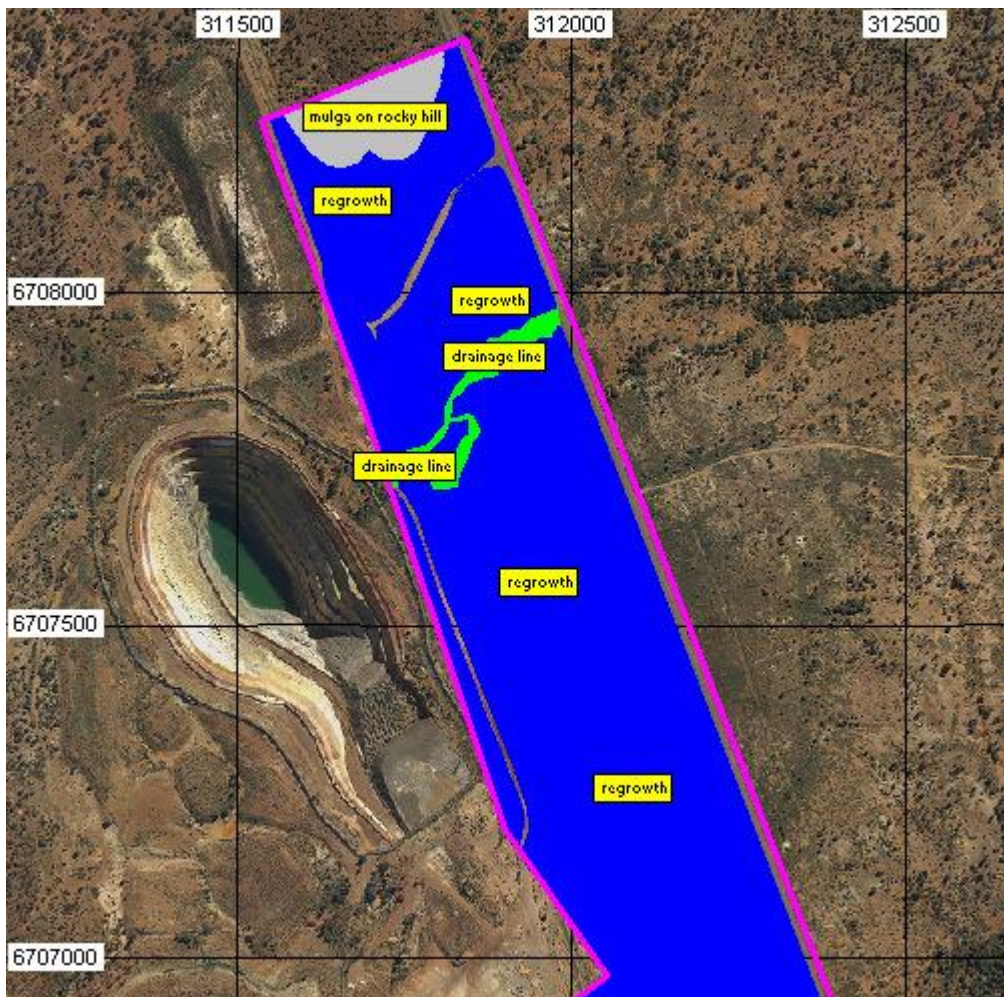
Paul Armstrong and Associates (2012) Vegetation Association and Condition Maps

This Appendix contains the vegetation association and vegetation condition map prepared by Paul Armstrong and Associates (2012) for the south eastern section of the Study Area.

Northern portion of the vegetation association map, as assessed from field observations and aerial photograph interpretation for the RH Project (purple outline). Aerial photograph supplied by Jupiter. Coordinates are UTM in cell 51J using GDA '94.

Key:

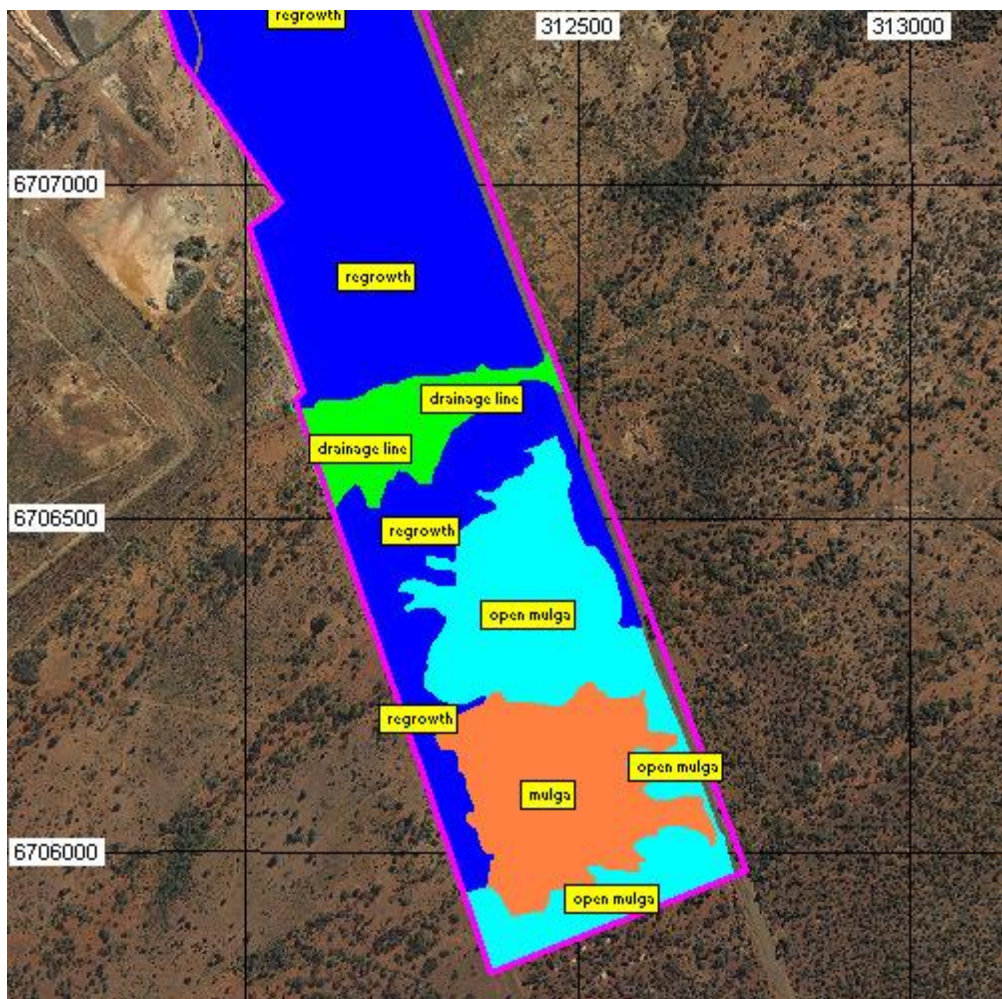
- Dark blue – regrowth
- Green – drainage lines
- Grey – mulga on rocky hill
- Light blue – open mulga
- Orange – mulga



Southern portion of the vegetation association map, as assessed from field observations and aerial photograph interpretation for the RH Project (purple outline). Aerial photograph supplied by Jupiter. Coordinates are UTM in cell 51J using GDA '94.

Key:

- Dark blue – regrowth
- Green – drainage lines
- Grey – mulga on rocky hill
- Light blue – open mulga
- Orange – mulga



Northern portion of the vegetation condition map, as assessed from field observations and aerial photograph interpretation for the RH Project (purple outline). Aerial photograph supplied by Jupiter. Coordinates are UTM in cell 51J using GDA '94.

Key:

Green – Good condition

Olive – Degraded to Completely Degraded

Pink – Completely Degraded



Southern portion of the vegetation condition map, as assessed from field observations and aerial photograph interpretation for the RH Project (purple outline). Aerial photograph supplied by Jupiter. Coordinates are UTM in cell 51J using GDA '94.

Key:

Green – Good condition

Olive – Degraded to Completely Degraded

Pink – Completely Degraded



Appendix D: Historic Native Vegetation Clearing Permit (CPS 5765/2)



Government of **Western Australia**
Department of **Mines and Petroleum**

Our Ref: A2208/201301 / CPS 5765/2
Enquiries: Lesley Polomka Tel: (08) 9222 3313 Fax: (08) 9222 3862
Email: lesley.polomka@dmp.wa.gov.au

Ms Melissa North
Chief Financial Officer
Jupiter Mines Limited
PO Box Z5117
PERTH WA 6000

Dear Ms North

**Permit to Clear Native Vegetation under the *Environmental Protection Act 1986*
Jupiter Mines Limited – Yunndaga Rail Siding Project (CPS 5765/2)
(Amendment to CPS 5765/1)**

Please find enclosed your amended permit to clear native vegetation granted under s.51M of the *Environmental Protection Act 1986*. This authorisation gives you approval to clear, subject to certain terms, conditions or restrictions. A copy of your permit is now available for the public to view, as required by the regulations.

Read your permit carefully. If you do not understand your permit, contact this Department immediately. There are penalties for failing to comply with the requirements of your permit.

**Please note the changes from the previous version of the permit (CPS 5765/1).
The changes relate to the duration of the permit.**

Compliance with the terms, conditions or restrictions of this permit does not absolve the Permit Holder from responsibility for compliance with the requirements of all Commonwealth and State legislation.

If you have any queries regarding this decision, please do not hesitate to contact Lesley Polomka, Senior Environmental Officer, on (08) 9222 3313 or email lesley.polomka@dmp.wa.gov.au.

Yours sincerely

Marnie Leybourne
DIRECTOR OPERATIONS
ENVIRONMENT

Officer with delegated authority under Section 20
of the Environmental Protection Act 1986

24 September 2015

Encs



GOVERNMENT OF
WESTERN AUSTRALIA

CLEARING PERMIT

Granted under section 51E of the Environmental Protection Act 1986

Purpose Permit Number: 5765/2
Duration of Permit: From 9 November 2013 to 30 November 2018
Permit Holder: Jupiter Mines Limited

The Permit Holder is authorised to clear native vegetation subject to the following conditions of this Permit.

PART I - CLEARING AUTHORISED

1. Land on which clearing is to be done

General Purpose Lease 29/21
Miscellaneous Licence 29/116
Miscellaneous Licence 29/117
Miscellaneous Licence 29/123

2. Purpose for which clearing may be done

Clearing for the purpose of mineral production and associated activities.

3. Area of Clearing

The Permit Holder must not clear more than 64 hectares of native vegetation. All clearing must be within the area cross-hatched yellow on attached Plan 5765/2.

4. Application

This Permit allows the Permit Holder to authorise persons, including employees, contractors and agents of the Permit Holder, to clear native vegetation for the purposes of this Permit subject to compliance with the conditions of this Permit and approval from the Permit Holder.

PART II - MANAGEMENT CONDITIONS

5. Weed control

When undertaking any clearing or other activity authorised under this Permit, the Permit Holder must take the following steps to minimise the risk of the introduction and spread of *weeds*:

- (i) clean earth-moving machinery of soil and vegetation prior to entering and leaving the area to be cleared;
- (ii) ensure that no *weed*-affected soil, *mulch*, *fill* or other material is brought into the area to be cleared; and
- (iii) restrict the movement of machines and other vehicles to the limits of the areas to be cleared.

PART III - RECORD KEEPING AND REPORTING

6. Records to be kept

The Permit Holder must maintain the following records for activities done pursuant to this Permit:

In relation to the clearing of native vegetation authorised under this Permit,

- (i) the location where the clearing occurred, recorded using a Global Positioning System (GPS) unit set to Geocentric Datum Australia 1994 (GDA94), expressing the geographical coordinates in Eastings and Northings or decimal degrees;
- (ii) the date that the area was cleared;
- (iii) the size of the area cleared (in hectares); and
- (iv) purpose for which clearing was undertaken.

7. Reporting

- (a) The Permit Holder shall provide a report to the Director Operations, Environment, Department of Mines and Petroleum by 31 October each year for the life of this permit, demonstrating adherence to all conditions of this permit, and setting out the records required under Condition 6 of this permit in relation to clearing carried out between 1 July and 30 June of the previous financial year.
- (b) Prior to 30 November 2018, the Permit Holder must provide to the Director Operations, Environment, Department of Mines and Petroleum a written report of records required under Condition 6 of this Permit where these records have not already been provided under Condition 7(a) of this Permit.

DEFINITIONS

The following meanings are given to terms used in this Permit:

fill means material used to increase the ground level, or fill a hollow;

mulch means the use of organic matter, wood chips or rocks to slow the movement of water across the soil surface and to reduce evaporation;

weed/s means any plant –

- (a) that is a declared pest under section 22 of the *Biosecurity and Agriculture Management Act 2007*; or
- (b) published in a Department of Parks and Wildlife Regional Weed Rankings Summary, regardless of ranking; or
- (c) not indigenous to the area concerned.

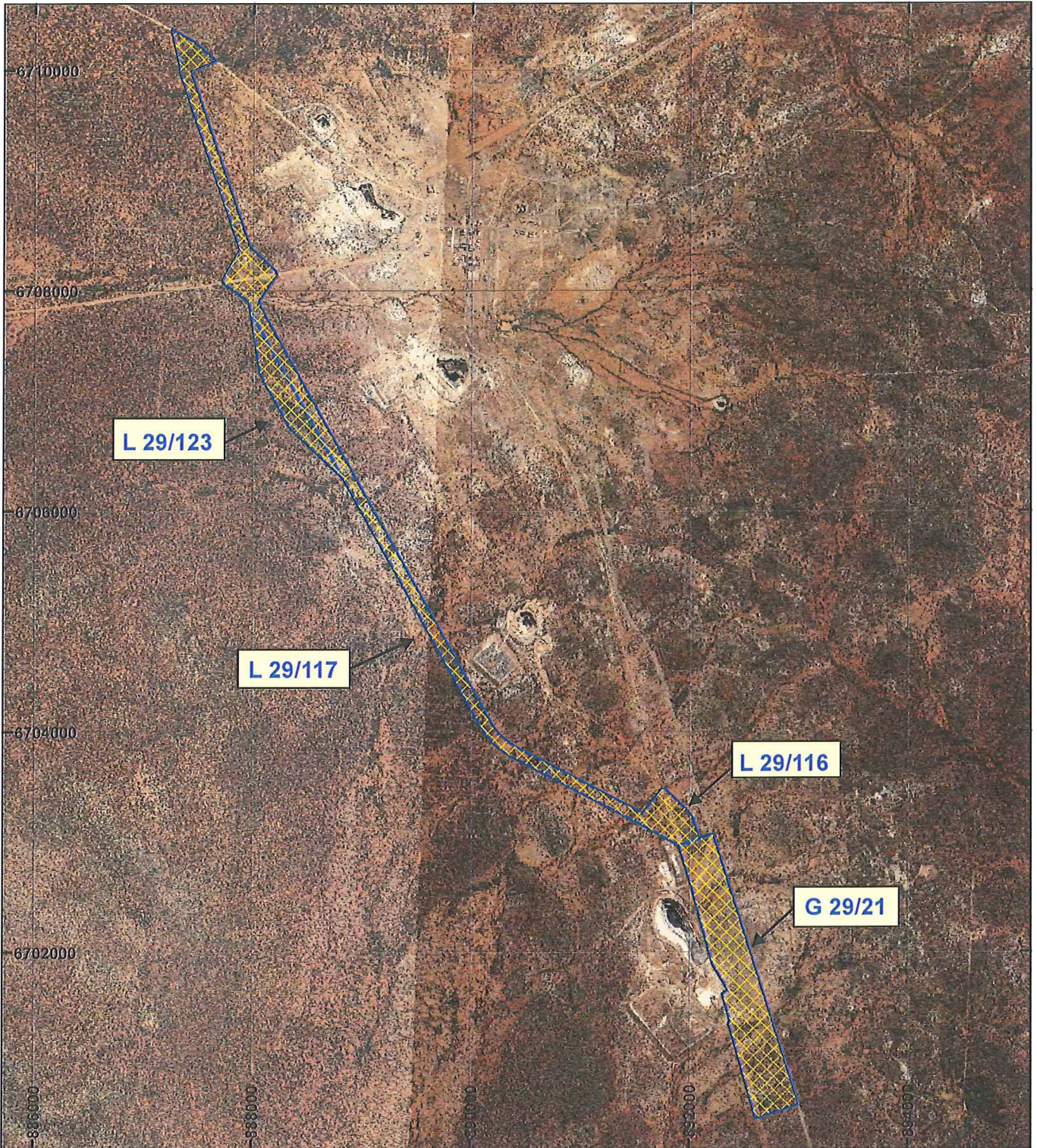


Marnie Leybourne
DIRECTOR OPERATIONS
ENVIRONMENT
DEPARTMENT OF MINES AND PETROLEUM

*Officer with delegated authority under Section 20
of the Environmental Protection Act 1986*

24 September 2015

PLAN 5765/2



LEGEND

Mining Tenements

Clearing Instruments

Areas Approved to Clear

Menzies 3138 Aug 2010 Mosaic
Riverina 3038 Aug 2010 Mosaic



Scale 1:50,000
(Approximate when reproduced at A4)

Geocentric Datum Australia 1994

Note: the data in this map have not been projected. This may result in geometric distortion or measurement inaccuracies.

M. Derby Date 24/9/15

MARNIE LEYBOURNE
Officer with delegated authority under Section 20 of
the Environmental Protection Act 1986

Information derived from this map should be confirmed with the data custodian acknowledged by the agency acronym in the legend.



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