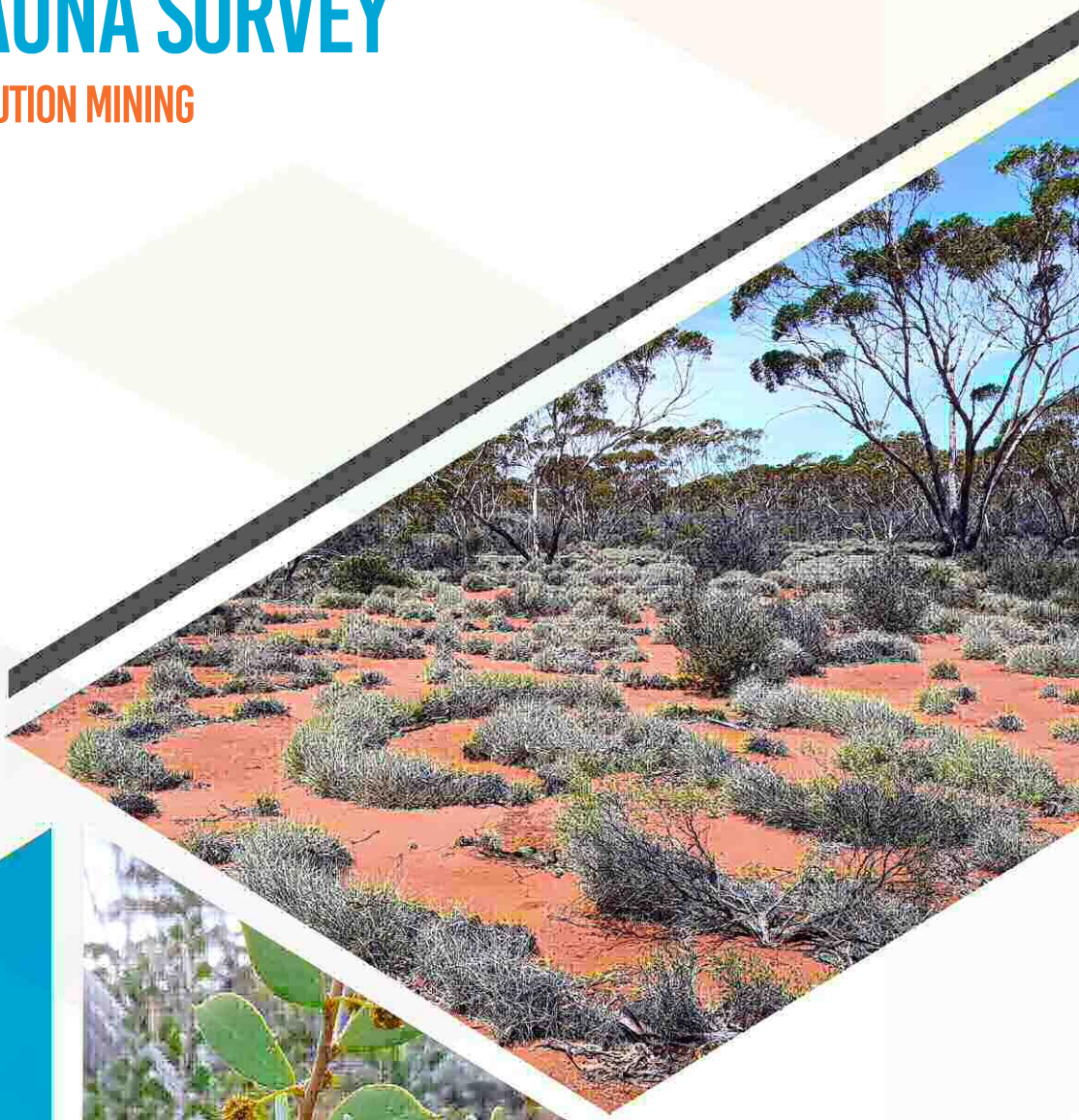
Appendix L: Supporting Biodiversity Survey (Reconnaissance Flora & Level 1 Fauna Survey)

RAYJAX & CASTLE HILL RECONNAISSANCE FLORA & LEVEL 1 FAUNA SURVEY

PREPARED FOR: EVOLUTION MINING



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Report Details			
Project Description:	Rayjax & Castle Hill Reconnaissance Flora & Level 1 Fauna Survey		
Prepared For:	Evolution mining		
Project ID:	1927		
Version History	Author	Reviewer	Date of Issue
Version 1	Carmel Forrester (Flora) Astrid Heidrich (Fauna)	Dr Cam Mounsey	19-Sep-19

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EXECUTIVE SUMMARY

Evolution Mining are exploring options to mine at various locations within the Mungari Gold Project tenements, located 600 km east of Perth and 20 km west of Kalgoorlie in the Goldfields region of Western Australia. Spectrum Ecology was engaged to complete a Reconnaissance flora and vegetation survey and Level 1 fauna survey at:

- Castle Hill mine and Haul Road (Castle Hill study area),
- Rayjax mine and Haul Road (Rayjax study area),
- Burgundy to Cutters Ridge Haul Road, and
- Tailings Storage Facility (TSF).

Throughout this report, these areas may also be referred to as 'study areas'. In addition, a desktop Subterranean Fauna survey was completed in corporation with Bennelongia Environmental Consultants at the above study areas, along with the Cutters Ridge mine and Haul Road.

Flora

113 taxa from 28 families and 49 genera were recorded during the survey, one of which was an introduced taxon; **Erodium cicutarium*.

No Threatened flora taxa were recorded in the study areas during the current assessment or considered likely to occur. Three significant flora taxa were identified in the study area during the current survey or during the desktop assessment:

- Priority 1: *Calandrinia lefroyensis/quartzitica, Eremophila praecox* (desktop); and
- Priority 3: *Allocasuarina eriochlamys* subsp. *grossa* (current survey) (outside study area).

An additional three significant flora were assigned a high likelihood of occurrence within the study areas, but not identified during the field survey:

- Priority 3: *Austrostipa blackii*;
- Priority 4: *Eucalyptus jutsonii subsp. jutsonii*; and
- Species of Interest: *Calandrinia* sp. Gypsum (F. Obbens & L. Hancock FO 10/14).

One of these taxa was considered to have high significance at a regional scale if impacted at the study area: *Calandrinia lefroyensis/quartzitica* (Priority 1).

Two of these taxa were considered to have high significance at a local scale if impacted at the study area including: *Calandrinia lefroyensis/quartzitica* (Priority 1), and *Calandrinia* sp. Gypsum (species of interest). These taxa have relatively few records in the local area.

Vegetation

Eleven vegetation types, mostly dominated by Eucalyptus species, were described throughout the study areas occurring on flat plains, claypans or lake beds, minor drainage lines, simple slopes, and minor floodplains. An assessment of vegetation condition (as per EPA 2016b), showed the majority of vegetation within the study areas was in Pristine (42.5%) or Excellent (52.3%) condition with few disturbances noted. A small area was mapped as Good (5.1%) and was characterised by quarries or mining activities.

No vegetation types in the study areas were considered to represent a Threatened Ecological Community (TEC) or Priority Ecological Community (PEC), or have a high degree of historical impact, or provide a function to maintain ecological integrity of a significant ecosystem.

Eight of the vegetation types were considered significant due to either providing refuge to significant species or being restricted within the study areas. Of these, three were considered to have high significance at a local scale, if impacted at the study area:

ii: *Tecticornia halocnemoides* ssp. *halocnemoides*, *T. indica* ssp. *indica* and *T. chartacea* low open chenopod shrubland;

v: *Casuarina pauper* low isolated trees over *Melaleuca laterifora* mid open shrubland over *Frankenia setosa* and *Atriplex stipitata* low open shrubland; and

vii: *Eucalyptus griffithsii* low woodland over *Senna artemisioides* and *Eremophila ionantha* mid sparse shrubland over *Acacia hemiteles* and *Grevillea acuaria* low sparse shrubland.

Type vii is possibly restricted in the region and was considered to have high significance at a regional scale if impacted at the study area.

Fauna

Eight survey sites were established at each of the Castle Hill and Rayjax study areas, seven survey sites at Burgundy to Cutters Ridge Haul Road, and 14 survey sites were established at the TSF Area.

A total of four fauna habitat types were recorded from the study area: Disturbed Eucalypt Woodland, Gentle Hillslope with Eucalypt Woodland, Minor Drainage Line, and Open Eucalypt Woodland over Open Tall Shrubs. At the Rayjax study area two fauna habitats were recorded: Mixed Eucalypt Woodland and Gentle Hillslope with Eucalypt Woodland. At the Burgundy to Cutters Ridge Haul Road four fauna habitat types were recorded: Gentle Hillslope with Eucalypt Woodland, Mixed Eucalypt Woodland, Minor Drainage Line, and Floodplain. A total of four fauna habitat types were recorded from the study area: Eucalypt Woodland over Open Shrubland, Mixed Dense Shrubland, Claypan and Saltbush Shrubland. In addition, some areas were already cleared which do not represent a habitat type as such.

A total of 11 vertebrate fauna species and 13 potential SRE invertebrate fauna species were recorded during the survey at the Castle Hill study area. A total of eight vertebrate fauna species and nine potential SRE invertebrate fauna species were recorded from the Rayjax study area. Fifteen vertebrate fauna species and 11 potential SRE invertebrate fauna taxa were recorded from the Burgundy to Cutters Ridge Haul Road. A total of 13 vertebrate fauna species and five potential SRE invertebrate fauna taxa were recorded during the survey at the TSF area.

No conservation significant fauna was recorded during the survey at the study areas.

The desktop Subterranean Fauna survey identified seven species of stygofauna and 11 species of troglofauna potentially occurring in the area. However, no PEC calcrete aquifers or other highly prospective stygofauna or troglofauna habitats occur close to the study areas.

1. INTRODUCTION

1.1. Project Background

Evolution Mining is a gold mining company with multiple projects across Australia. The Rayjax and Castle Hill Project Area is a proposed project situated 20-30 km north and west (respectively) of regional towns Coolgardie and Kalgoorlie, in Western Australia, and approximately 530 km east of Perth.

Spectrum Ecology was commissioned to undertake a Reconnaissance Flora and Vegetation Assessment, and Level 1 Fauna Assessment of various locations at the Rayjax and Castle Hill Project Area (1378 ha), and includes Castle Hill (451.7 ha), Rayjax (146.9 ha), Burgundy to Cutters Ridge Haul Road (354.2 ha) and Tailings Storage Facility (TSF; 425.5 ha). The study areas include Open Pits, Tailings Storage Facility (TSF), Haul Roads, and their associated infrastructure (Map 1.1). Some sections in and around the study areas have had recent flora and fauna studies completed (within 5 years). Known previous studies are listed in Section 1.8.

The objectives of the Reconnaissance flora and vegetation assessment and Level 1 fauna assessment are:

- To verify the information obtained from the desktop study and characterise the flora, vegetation, fauna and fauna habitats present; and
- To clarify whether the study area may potentially support any significant flora, vegetation, fauna or fauna habitats.

1.2. Legislation and Guidance

Flora and fauna in Western Australia are protected by various legislation, including:

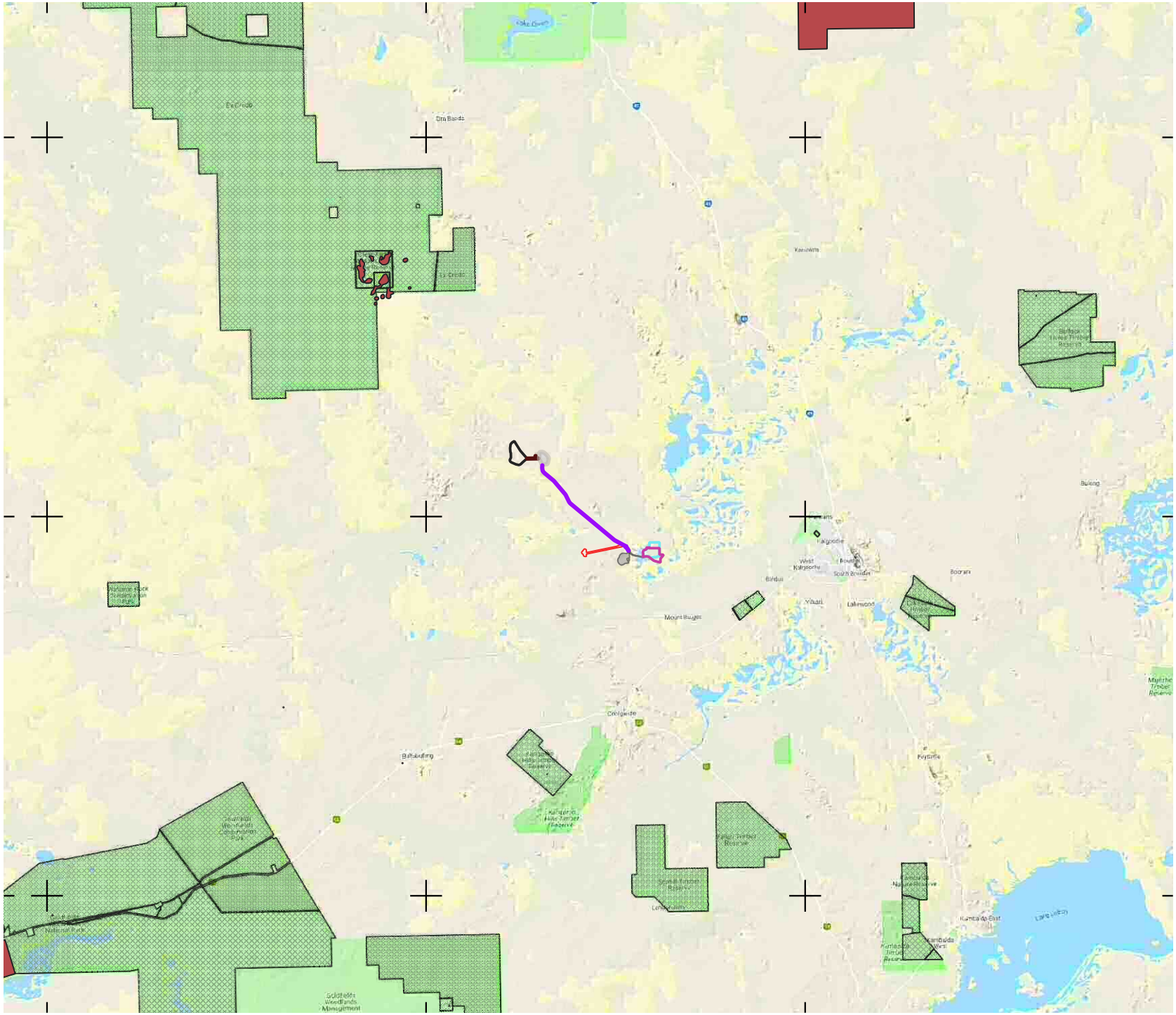
- Biodiversity Conservation Act 2016 (BC Act), which replaced the Wildlife Conservation Act 1950 (WC Act) as of 1 January 2019 (Government of Western Australia, 2016);
- Wildlife Conservation Act 1950;
- Environmental Protection Act 1986 (EP Act); and
- Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act) (Department of the Environment and Energy, 2016 [DotEE]).

The surveys are compliant with Reconnaissance flora and vegetation survey guidelines and Level 1 fauna survey guidelines, as outlined in:

- EPA Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment (Environmental Protection Authority, 2016b [EPA]);
- EPA Technical Guidance: Terrestrial Fauna Surveys (EPA 2016e); and
- EPA Technical Guidance: Sampling Methods for Terrestrial Vertebrate Fauna (EPA 2016d).

This assessment is also consistent with the following guidelines:

- EPA Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA 2002);
- EPA Environmental Factor Guideline: Flora and Vegetation (EPA 2016a);
- National Vegetation Information System (NVIS) Australian Vegetation Attribute Manual (ESCAVI, 2003);
- EPA Guidance Statement No. 56: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia (EPA 2004); and
- EPA & DEC Technical Guide: Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA and DEC, 2016)



Legend

Conservation Estate

Environmentally Sensitive Area

Study Area

- Rajax Mine & Haul Road
- Burgundy to Cutters Ridge Haul Road
- Castle Hill Haul Road
- Castle Hill Mine
- Burgundy Mine (not included in current survey)
- Cutters Ridge Mine
- TSF 3&4
- TSF3 Area

N

10 0 10

Scale 1:700000 @ A4

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

Author: AH Approved: DC Date: 13-09-2019

Location of the Study Areas

Rayjax to Castle Hill

Map 1.1

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Evolution Mining

1.3. Bioregion and Climate

The Interim Biogeographic Regionalisation for Australia (IBRA) classifies Australia into regions based on dominant landscape, climate, lithology, geology, landform and vegetation (Thackway and Cresswell, 1995). The study area is situated in the Coolgardie IBRA region; a large region which forms an interzone between the Mediterranean climate of the south-west and the arid inland of Western Australia. The Coolgardie bioregion is characterised by granite outcrops, low greenstone hills, laterite uplands, broad plains and numerous salt lakes. The climate of the Coolgardie bioregion is classified as arid to semi-arid, warm Mediterranean, with 250 to 300 mm of mainly winter rainfall, annually (McKenzie, May and McKenna, 2003).

The Coolgardie region is divided into three sub-regions: Southern Cross, Eastern Goldfield and Mardabilla. The study area is located within the Eastern Goldfield sub-region (Figure 1.1), which is characterised by subdued relief of gently undulating plains, interrupted in the west by low hills and ridges of greenstones and in the east with granulites. Calcareous earths are the dominant soil group and a series of salt lakes occur in the west that are remnants of an ancient drainage line (Cowen, 2001).

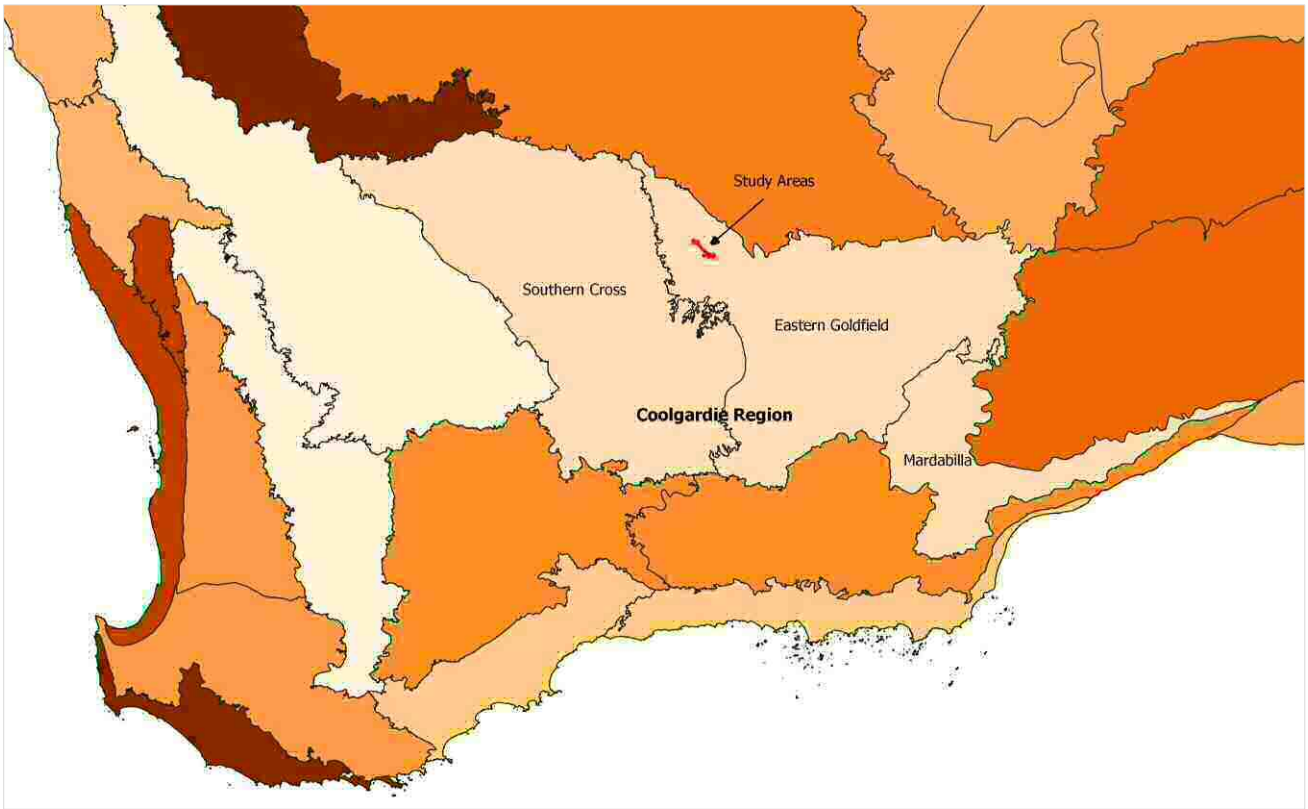

Figure 1.1: IBRA Classification of the Study Areas

1.4. Disturbance History

The dominant current and historical land uses and their associated disturbances across the Coolgardie region include: unallocated crown land (low impact recreational disturbance), pastoral leases (disturbance from grazing by sheep and cattle), and mining leases (disturbance of relatively small areas with high impact, drill lines etc.). Logging for fuel was previously conducted in the region from 1890 to 1950 but these areas are now regenerating (Cowen, 2001).

1.5. Geology

The geology of Western Australia has been mapped at a scale of 1:250,000 (DMIR 2019). Nine units have been mapped within the Castle Hill study area, four units have been mapped within the Rayjax study area, eight units are mapped from the Burgundy to Cutters Ridge Haul Road, and three units are mapped from the TSF area. These are listed in Table 1.1 and mapped in Map 1.2. None of the geological units mapped at the study area have more than 1.6% of their total extents mapped within.

Table 1.1: Geological Units of the Study Area (1:250,000)

Code	Description	Area in Study Area (ha)	% of Study Area	Area in WA (ha)	% of WA Extent
Castle Hill					
Ab	Basalt, includes doleritic layers and lenses	120.9	26.7	35,647.9	0.3
Abm	Komatiitic basalt, includes variolitic basalt and basalt with relic (pyroxene) spinifex texture	1.1	0.2	9,098.6	<0.1
Agbl	Bali monzogranite: porphyritic, with biotite	1.3	0.3	3,752.3	<0.1
Agkn	Kintore tonalite: equigranular, with biotite	2.8	0.6	177.6	1.6
Ao	Medium- and corse-grained mafic rocks; mainly gabbro and dolerite	47.4	10.5	4,991.1	0.9
Au	Ultramafic rocks; includes tremolite(-chlorite) and talc-chlorite(-carbonate) schists	34.8	7.7	3,702.6	0.9
Auk	Komatiite with relict olivine spinifex texture	68.1	15.1	26,737.3	0.2
Czc	Colluvium - gravel, sand, and silt as sheetwash or talus	10.6	2.4	444,247.0	<0.1
Czl	Laterite and reworked products	164.47	36.43	138,961.6	0.1
Rajax					
Abm	Komatiitic basalt, includes variolitic basalt and basalt with relic (pyroxene) spinifex texture	9.3	6.4	9,098.6	0.1
Ao	Medium- and corse-grained mafic rocks; mainly gabbro and dolerite	33.3	22.7	4,991.1	0.7
Auk	Komatiite with relict olivine spinifex texture	56.7	38.6	26,737.3	0.2

Code	Description	Area in Study Area (ha)	% of Study Area	Area in WA (ha)	% of WA Extent
Czc	Colluvium - gravel, sand, and silt as sheetwash or talus	47.6	32.4	444,247.0	<0.1
Burgundy to Cutters Ridge Haul Road					
Abm	Komatiitic basalt, includes variolitic basalt and basalt with relic (pyroxene) spinifex texture	15.3	4.3	9,098.6	0.2
Afv	Felsic volcanic and volcaniclastic rocks	18.3	5.2	13,552.4	0.1
Aogw	Powder sill: gabbro and quartz gabbro	19.7	5.6	2,843.3	0.7
As	Pelitic and psammitic sedimentary rocks; includes conglomerate, chert and felsic volcaniclastic rocks	14.5	4.1	5,880.2	0.3
Czc	Colluvium - gravel, sand, and silt as sheetwash or talus	243.1	68.6	444,247.0	0.1
Czl	Laterite and reworked products	19.9	5.6	138,961.6	<0.1
Cztd	Sand, silt, and gypsum in stabilized dunes adjacent to playas	4.2	1.2	69,707.9	<0.1
Qa	Alluvium - clay, silt, sand, and gravel in channels	19.1	5.4	72,917.0	<0.1
TSF					
Afv	Felsic volcanic and volcaniclastic rocks	0.1	<0.1	13,552.4	0.0
Cztd	Sand, silt, and gypsum in stabilized dunes adjacent to playas	392.9	92.3	69,707.9	0.6
Czts	Evaporite interbedded with clay and sand in playas	32.5	7.6	25,568.2	0.1

Legend

Geological Units (1:250,000)

- Ab
- Abm
- Afv
- Agbl
- Agkn
- Ao
- Aogw
- As
- Au
- Auk
- Czc
- Czl
- Cztd
- Czts
- Qa

Study Areas

- Burgundy & Cutters Ridge
- Burgundy to Cutters Ridge Haul Road
- Castle Hill Haul Road
- Castle Hill Mine
- Rajax Mine & Haul Road
- TSF 3 & 4

N

Scale 1:100000

1 0 1 2 km

@ A4

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

Author: AH Approved: DC Date: 18-09-2019

Geological Mapping of the Study Areas

Rayjax to Castle Hill

Map 1.2

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1.6. Vegetation

Pre-European vegetation mapping was originally undertaken by Beard at various scales across the state and has since been updated to be consistent with the National Vegetation Information System (NVIS) descriptions at a scale of 1:250,000 (Department of Primary Industry and Regional Development, 2019).

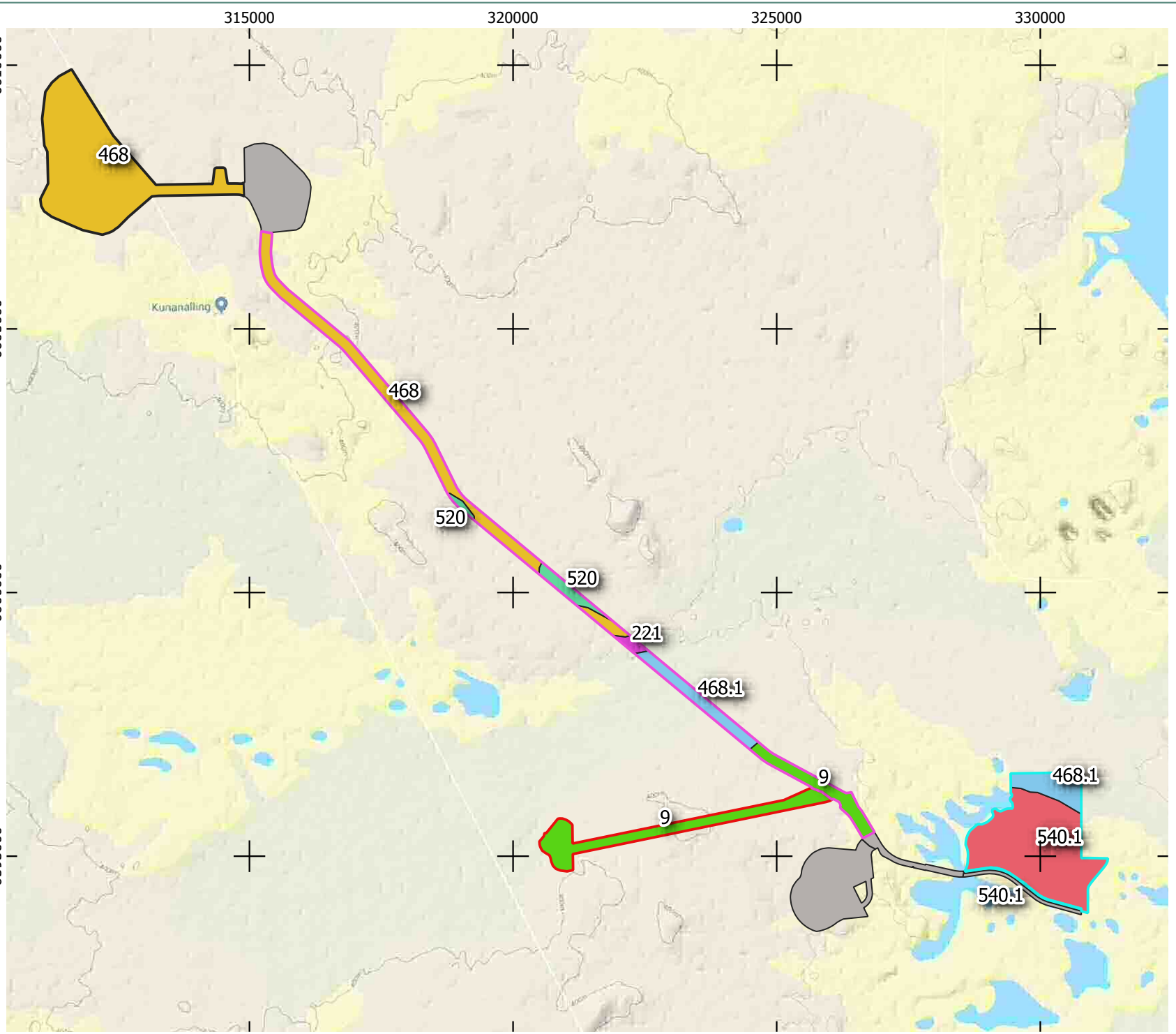
One unit (468) has been mapped within the Castle Hill study area, one unit (9) has been mapped in the Rayjax study area, five units (9, 221, 468, 468.1, 520) have been mapped within the Burgundy to Cutters Ridge study area, and two units (468.1, 540.1) have been mapped inside the TSF Area. The units are listed in Table 1.2 and shown in Map 1.3. State-wide vegetation statistics are available for these units which list pre-European extent, current extent, area in DBCA managed lands etc., and is a useful tool to determine if a vegetation unit is rare or otherwise significant (Government of Western Australia, 2019).

There are 179 Beard vegetation units within the Coolgardie Bioregion, six of which are mapped within the study areas. The majority of the six Beard vegetation units recorded at the study areas are widespread across Western Australia. The least widespread units; 520 (30,988 ha), 540.1 (49,482 ha), and 221 (52,086 ha) are associated with habitats that are restricted in the study areas including salt lakes and drainage channels.

Table 1.2: Vegetation Associations Mapped Within the Study Areas

Sub-association	NVIS Level V Vegetation Description	Area in Study Area (ha)	% of Study Area	Pre-European Whole State (ha)	Current Extent State (ha)	% Remaining	% of Current Extent in DBCA Land
Castle Hill							
468	*Eucalyptus salmonophloia, E. dundasii* mid woodland over isolated shrubs and isolated ground species	451.7	100.0	442,147	438,249	99.1	30.4
Rayjax							
9	*Eucalyptus torquata, E. lesouefii, E. clelandiorum* (syn: *clelandii*) low woodland over *Eremophila scoparia, E. glabra, E. oldfieldii* tall sparse heathland and sparse chenopod shrubland over isolated ground species	146.9	100.0	240,509	235,161	97.8	8.1
Burgundy to Cutters Ridge Haul Road							
9	As above	64.46	18.2	240,509	235,161	97.8	8.1
221	Isolated trees and isolated shrubs over *Atriplex* sp. low open shrubland and open chenopod shrubland	10.04	2.8	55,627	52,086	93.7	20.4
468	As above	188.23	53.2	442,147	438,249	99.1	30.4
468.1 - mosaic	*Eucalyptus lesouefii, E. salmonophloia, E. transcontentalis* tall woodland, over *Eremophila scoparia, E. alternifolia, E. decipiens* tall open shrubland	58.46	16.5	66,475	62,253	93.7	2.1
520	Isolated trees over *Acacia quadrimarginea* tall shrubland over isolated ground species	32.98	9.3	31,514	30,988	98.3	53.5
TSF area							
540.1	*Casuarina cristata* subsp *cristata, Myoporum platycarpum, Callitris columellaris* low open woodland over *Eremophila miniata, Grevillea sarissa* tall sparse shrubland over *Atriplex*	363.10	85.3	51,663	49,482	95.8	0

Sub-association	NVIS Level V Vegetation Description	Area in Study Area (ha)	% of Study Area	Pre-European Whole State (ha)	Current Extent State (ha)	% Remaining	% of Current Extent in DBCA Land
	hymenotheca low open shrubland and low open chenopod shrubland						
468.1 - mosaic	As above	62.41	14.7	66,475	62,253	93.7	2.1



Legend

Pre-European Vegetation units

- 9
- 221
- 468
- 468.1
- 520
- 540.1

Study Areas

- Burgundy & Cutters Ridge
- Burgundy to Cutters Ridge Haul Road
- Castle Hill study area
- Cutters Ridge
- Rajax Mine study area
- TSF 3 & 4

N

1 0 1 2 km

Scale 1:100000 @ A4

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

Author: AH Approved: DC Date: 18-09-2019

Pre-European Vegetation Mapping of the Study Areas

Rayjax to Castle Hill

Map 1.3

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1.7. Conservation Estate and Environmentally Sensitive Areas

Searching the Collaborative Australian Protected Area Database (CAPAD), several small state protected areas and two commonwealth protected areas were found located within 60km of the study area. These protected areas and their approximate distance from the study area are listed in Table 1.3.

Table 1.3: Protected Areas within the Vicinity of the Study Area

Reserve Name (Protected Area ID)	Relevant to the Study Area		Comment (Jurisdiction/Size)
	Distance	Direction	
5(1)(g) Reserves			
Kangaroo Hills (5(1)(g)) (WA_19211)	25 km	South	Western Australia, 3120 (ha)
Lakeside Timber (5(1)(g)) (WA_19215)	37 km	East	Western Australia, 2390 (ha)
Scahill (5(1)(g)) (WA_19621)	35 km	South	Western Australia, 6915 (ha)
5(1)(h) Reserves			
Kalgoorlie Arboretum (5(1)(h)) (WA_23840)	25 km	East	Western Australia, 26 (ha)
Yallari Timber (5(1)(h)) (WA_19212)	35 km	South	Western Australia, 6077 (ha)
Nature Reserves			
Clear and Muddy Lakes (WA_07634)	27 km	North West	Western Australia, 1926 (ha), Within Credo National Reserve
Kurrawang (WA_35453)	15 km	East	Western Australia, 635 (ha),
Conservation Parks			
Goldfields Woodlands (WA_46127)	57 km	South West	Western Australia, 34,408 (ha)
Rowels Lagoon (WA_04274)	27 km	North West	Western Australia, 404 (ha), Within Credo National Reserve, Nationally Important Wetland.
Wallaroo Rock (WA_27655)	58 km	West	Western Australia, 1214 (ha)
National Reserve/Parks			
Credo National Reserve (CWTH_N7121)	20 km	North West	Commonwealth, 202, 000 (ha)
Goldfields Woodlands (WA_46126)	57 km	South West	Western Australia, 646,000 (ha)

There are no Conservation Estates or Environmentally Sensitive Areas found within the study areas. The closest is the Credo National Reserve, 20 km to the north-west of the study areas. Conservation Estate and ESAs within the vicinity are mapped in Map 1.1.

1.8. Database Searches

1.8.1. Flora and Vegetation Database Searches

A desktop review of all relevant and available flora and vegetation data sources was undertaken prior to the field survey to assess the flora and vegetation likely to occur in the study area. The Database searches include:

- Department of Biodiversity, Conservation and Attractions (DBCA) Threatened and Priority Flora database search (DBCA ref.: 08-0819FL, 50km buffer);
- DBCA Threatened Ecological Communities (TEC) and Priority Ecological Communities (PEC) database search (DBCA ref.: 1927, 50km buffer);
- DBCA and WA Museum NatureMap online database (20 km and 40 km radius);
- EPBC Protected Matters search tool (40 km buffer);
- Index of Biodiversity Surveys and Assessments (IBSA) Database; and
- Previous survey reports supplied by the client.

DBCA database searches worked from a polygon that encompassed all components of the study areas (see Table 1.4). DBCA searched within a 50 km buffer the polygon. The NatureMap searches worked from a central point in the study areas with a 20 km and 40 km buffer. Relevant results from the database searches are summarised in Table 1.4 and mapped on Map 1.4.

Table 1.4: Summary of Database Searches Undertaken for the Assessment

Source	Custodian	Comments
Threatened and Priority Flora (TPFL)	DBCA	Polygon plus 50km buffer. 204 Conservation Significant Flora records found.
Western Australian Herbarium (WAHerb)	DBCA	Polygon plus 50km buffer. 31 Conservation Significant Flora records found
Threatened and Priority Ecological Communities (TPEC)	DBCA	Polygon plus 50km buffer. No Conservation Significant Vegetation
NatureMap	DPAW^ / WAM^^	Central point, radial buffer of 20 km and 40 km. Searches returned, respectively, 5 and 50 Conservation Significant flora species.
Protected Matters	EPBC	Central point with 40km buffer. Three Endangered plants may have habits occur in the area, but are not known from this area. One Nationally Important Wetland (Rowels Lagoon) occurs within the vicinity of the study area.
Index of Biodiversity Surveys and Assessments (IBSA)	DBCA	N/A
Botanica Consulting, 2014, Level 2 Flora & Vegetation Survey for the Burgundy Project	Evolution Mining	Previous botanical survey in the vicinity of the current Rayjax & Castle Hill Study Area. No Conservation Significant Flora Recorded.
Phoenix Environmental Science, 2018, Flora and Vegetation Survey for the Cutter's Ridge Project	Evolution Mining	Previous Survey within current Rayjax & Castle Hill Study Area. Five Conservation Significant Flora recorded.
Native Vegetation Solutions, 2013 - 2019, Vegetation Monitoring Impact Study of the Mungari Tailings Storage Facility.	Evolution Mining	Previous Survey within current Rayjax & Castle Hill Study Area. No Priority Flora recorded.

^ Department of Parks and Wildlife. ^^ Western Australian Museum

An assessment of each significant species or community identified in the above data searches was completed with the following information provided:

- Conservation status (EPBC Act, WC Act, DBCA listing);
- Description of species habitat requirements and presence of this habitat within the study area;
- Summary of relevant records including source of record (DBCA, previous report etc.) and accuracy of the record location; and
- Likelihood of occurrence criteria assigned and justification of likelihood of occurrence that considers known habitats, survey effort etc. The likelihood of occurrence will be determined based on the criteria outlined in Table 1.5.

Table 1.5: Likelihood of Occurrence Criteria – Flora and Vegetation

Likelihood	Criteria
Recorded	Species or community recorded within study area
High	Species or community recorded in close proximity to study area and suitable habitat occurs in the study area
Medium	Species or community recorded outside the study area but within 20°km suitable habitat occurs in the study area.
Low	Species or community rarely or not recorded within 20°km of the study area. Suitable habitat does not occur within or in close proximity to the study area.

1.8.1.1. Flora

Sixty-two significant taxa were identified during the flora database searches and these are summarised in Table 1.6. A full list of likelihood of occurrence is provided in Appendix A. Records are mapped in Map 1.4. Coordinates of mapped records are available upon request.

Table 1.6: Significant Flora Recorded from Database Searches

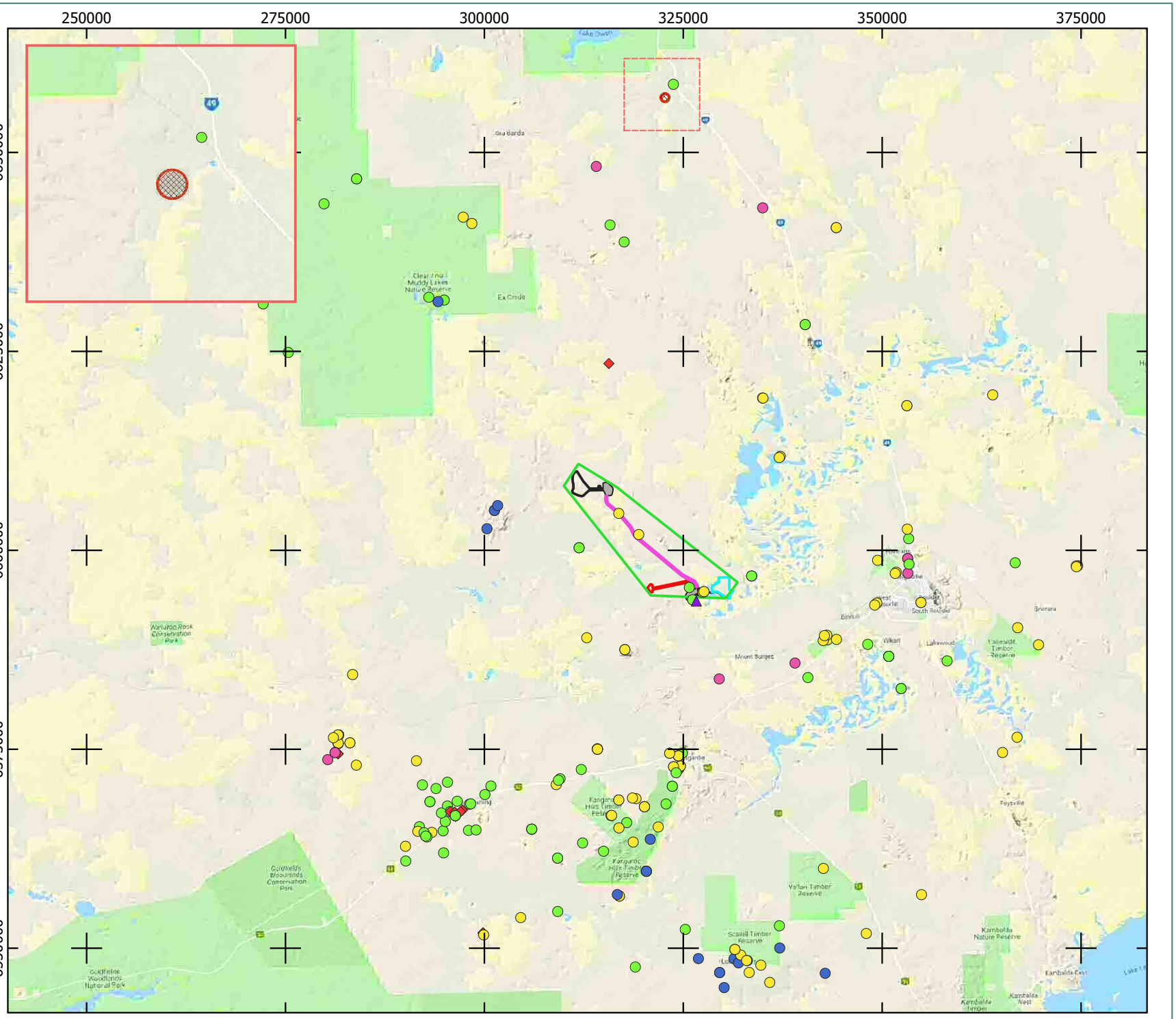
Likelihood	Status	Species
Recorded	Priority 1	*Calandrinia* sp ?*lefroyensis/quartzitica, Eremophila praecox*
	Priority 3	*Allocasuarina eriochlamys* subsp. *grossa*
High	Priority 3	*Austrostipa blackii*
	SOI^	*Calandrinia* sp. Gypsum (F. Obbens & L. Hancock FO 10/14)
	Priority 4	*Eucalyptus jutsonii* subsp. *jutsonii*
Medium	Threatened	*Conostylis lepidospermoides, Gastrolobium graniticum*
	Priority 1	*Acacia websteri, Rhodanthe uniflora, Thryptomene* sp. *Londonderry* (R.H. Kuchel 1763)
	Priority 2	*Elachanthus pusillus*
	Priority 3	*Chrysocephalum apiculatum* subsp. *norsemanense, Notisia intonsa, Phlegmatospermum eremaeum*
	Priority 4	*Eremophila caerulea* subsp. *merrallii*
Low	Priority 1	*Acacia coatesii, Acacia epedunculata, Acacia sclerophylla* var. *teretiuscula, Austrostipa* sp. *Carlingup Road* (S. Kern & R. Jasper LCH 18459), *Dampiera plumosa, Eremophila xantholaema, Eucalyptus websteriana* subsp. *norsemanica, Lepidosperma* sp. *Parker Range* (N. Gibson & M. Lyons 2094), *Melichrus* sp. *Coolgardie* (K.R. Newbey 8698), *Phebalium appressum, Philotheca pachyphylla, Ptilotus chortophytus, Ptilotus procumbens, Ricinocarpos sp. Eastern Goldfields* (A. Williams 3), *Thryptomene* sp. *Coolgardie* (E. Kelso s.n. 1902), *Xanthoparmelia subbarbatica*
	Priority 2	*Austrostipa* sp. *Dowerin* (G. Wiehl F 8004), *Eucalyptus educta, Goodenia salina, Hakea rigida, Lepidium merrallii, Phebalium clavatum, Rumex crystallinus*
	Priority 3	*Acacia crenulata, Acacia cylindrica, Alyxia tetanifolia, Angianthus prostratus, Atriplex lindleyi* subsp. *conduplicata, Calytrix creswellii, Cyathostemon verrucosus, Diocirea acutifolia, Diocirea microphylla, Eleocharis papillosa, Eremophila veronica, Gompholobium cinereum, Grevillea georgeana, Hysterobaeckea ochropetala* subsp. *cometes, Isolepis australiensis, Lepidium*

Likelihood	Status	Species
		fasciculatum, Melaleuca coccinea, Rinzia triplex, Styphelia sp. Bullfinch (M. Hislop 3574), *Xanthoparmelia dayiana*
	Priority 4	*Eucalyptus* x *brachyphylla, Frankenia glomerata, Myriophyllum petraeum*

^ = species of interest

1.8.1.2. Vegetation

One Priority 3 PEC was recorded as occurring within 49 km north of the study area: Emu Land System. The threat to this PEC is listed as 'over grazing' (DBCA 2017). The location and extent of this PEC is mapped on Map 1.4. The Emu land system is described as fresh or brackish ephemeral lakes and swamps; Lignum, Canegrass and Paperbark shrublands. No TECs were mapped in the vicinity of the study areas.



Legend

Database Search Area

PEC database search results

Study Areas

Burgundy Mine & Cutters Ridge

Burgundy to Cutters Ridge Haul Road

Castle Hill study area

Rajax Mine study area

TSF 3 & 4

Significant Flora

Threatened

Priority 1

Priority 2

Priority 3

Priority 4

SOI

N

Scale 1:650000

5 0 5 km

@ A4

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

Author: AH Approved: DC Date: 25-09-2019

Significant Flora and PECs Recorded from the Database Searches

Rayjax to Castle Hill

Map 1.4

Prepared for
Evolution Mining

1.8.2. Fauna Database Searches

A desktop review of all relevant and available vertebrate fauna data sources was undertaken prior to the field survey. The following data sources were searched to assess the vertebrate fauna species likely to occur in the study area:

- DBCA Threatened and Priority Fauna database search (DBCA ref.: FAUNA#6050, 50 km buffer);
- DBCA and WA Museum NatureMap online database (40 km radius);
- EPBC Protected Matters search tool (40km radius); and
- Previous survey reports supplied by the client.

Details of each database search and previous survey report are summarised in Table 1.7.

Table 1.7: Details of Fauna Desktop Assessment

Data Source	Custodian	Details
Commonwealth Protected Matter Search Tool (PMST)	Department of the Environment and Energy (DoEE)	Date: 30/8/19 Buffer: 50 km
NatureMap	Department of Parks and Wildlife / Western Australian Museum	Date: 17/7/19 Buffer: 40 km Centre Point: 121°06'24"E 30°43'54"S
DBCA Threatened Database Search	Department of Biodiversity Conservation and Attraction	Date: 1/8/19 Details: Polygon plus 50 km
Western Australian Museum	Arachnida & Myriapoda Database	Search Area: NW corner -30.236° 120.609° SE corner -31.128° 121.67°
	Crustacea Database	
	Mollusc Database	
Phoenix (2019) Mungari Gold Operations Cutters Ridge	Evolution Mining Ltd	Level 1 Fauna survey at Cutters Ridge
Harewood (2014a) Burgundy Project Area	Phoenix Gold Ltd	Level 1 Fauna survey at Burgundy Project
Harewood (2014b) Burgundy Project Area (Mining Lease 16/199, 16/200, 16/527)	Phoenix Gold Ltd	Targeted Malleefowl survey at Burgundy Project
Terrestrial Ecosystem (2016) Mungari Tailing Storage Facility Cell 3	Native Vegetation Solutions	Level 1 Fauna survey at TSF Cell 3

A preliminary assessment of each significant species identified in the above database searches was completed prior to undertaking the field survey, with the following information provided:

- Conservation status (EPBC Act, WC Act, DBCA listing);
- Description of species habitat requirements and presence of this habitat within the study area;
- Summary of relevant records including source of record (DBCA, previous report etc.) and accuracy of the record location; and
- Likelihood of occurrence criteria assigned and justification of likelihood of occurrence that considers known habitats, survey effort etc. The likelihood of occurrence was determined based on the criteria outlined in Table 1.8.

Table 1.8: Likelihood of Occurrence Criteria – Vertebrate Fauna

Likelihood	Criteria
Recorded	Species recorded in the study area in the previous ten years.
High	Species recorded within or in close proximity to study area within 20 years. Suitable habitat occurs in the study area
Medium	Species recorded within or in close proximity to study area within 20 years. Species recorded outside the study area but within 50°km. Suitable habitat occurs in the study area.
Low	Species or community rarely or not recorded within 20°km of the study area. Suitable habitat does not occur within or in close proximity to the study area.
Very Low	Species not recorded within 50° km despite multiple recent surveys. Suitable habitat does not occur within the study area. Species considered locally extinct.

The results of the literature review identified fauna species that are listed under the current legislative framework. Three conservation lists have been developed at Commonwealth (EPBC Act) and State level (BC/WC Act and DBCA priority list).

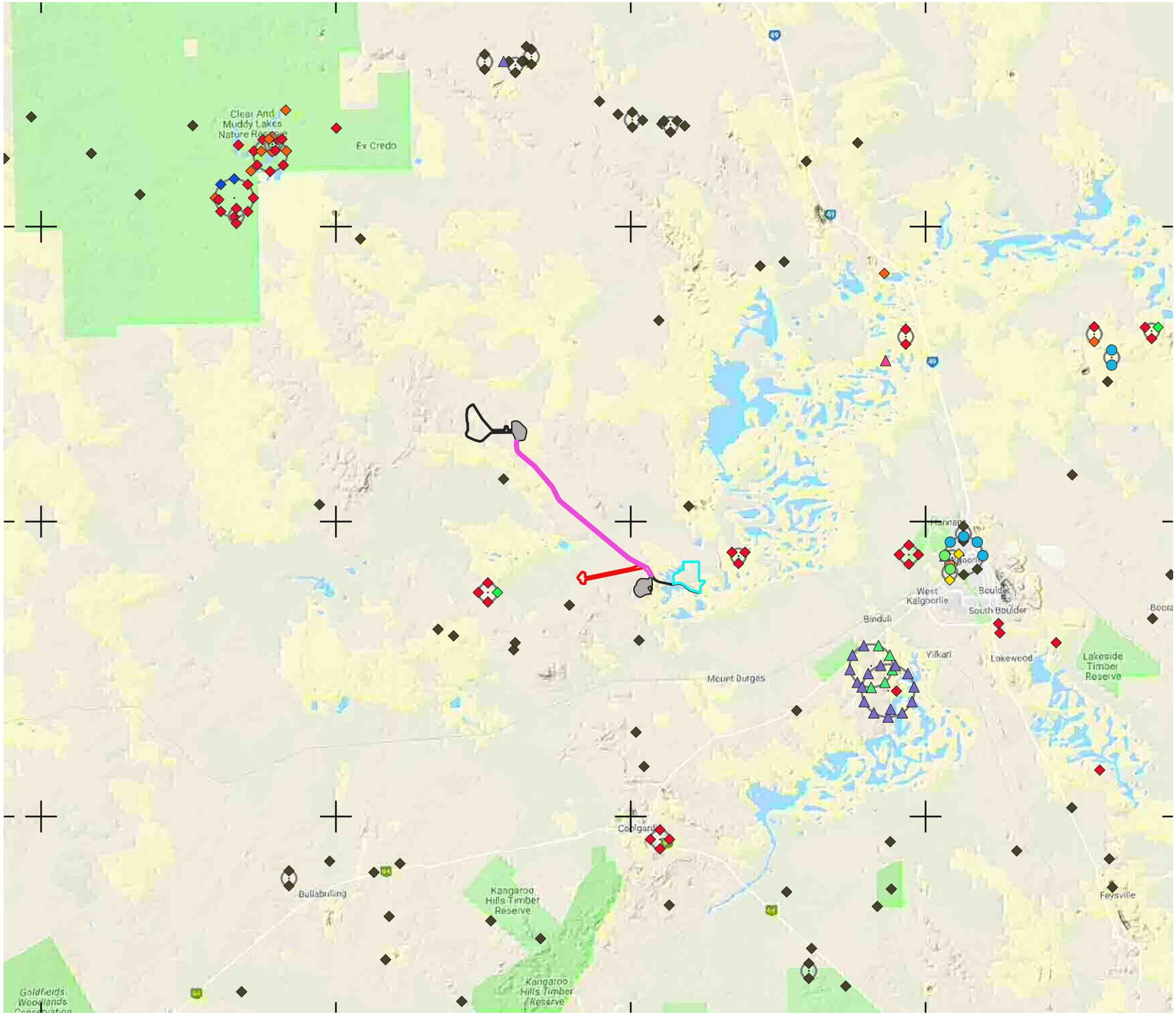
The literature review includes 24 conservation significant fauna species recorded from within the wider region. These are listed in Table 1.9 and mapped on Map 1.5. Survey techniques were tailored to those conservation significant species potentially occurring within the study area. Suitable habitat for each species was assessed and mapped across the extent of the study areas.

Table 1.9: Significant Fauna Recorded from the Database Searches

Likelihood of Occurrence	Fauna Taxa	Conservation Status			Database Record
		EPBC Act	BC Act	DBCA	
Mammals					
Low	Numbat (*Myrmecobius fasciatus*)	EN	EN	EN	NatureMap, PMST, DBCA
	Greater Bilby *(Macrotis lagotis)*	VU	VU	VU	NatureMap, PMST, DBCA
	Chuditch (*Dasyurus geoffroii*)	VU	VU	VU	PMST
	Western False Pipistrelle (*Falsistrellus mackenziei*)	-	-	P4	DBCA
Birds					
High	Malleefowl *(Leiopa ocellata)*	VU	VU	-	NatureMap, PMST
Medium	Carnaby's Cockatoo *(Calyptorhynchus latirostris)*	EN	EN	-	NatureMap, DBCA
	Peregrine Falcon (*Falco peregrinus*)	-	OS	-	NatureMap, DBCA
Low	Curlew Sandpiper *(Calidris ferruginea)*	CR	CR	-	NatureMap, PMST
	Night Parrot (*Pezoporus occidentalis*)	EN	EN	-	PMST
	Fork-tailed Swift (*Apus pacificus*)	M	M	-	PMST
	Common Sandpiper (*Actitis hypoleucos*)	M	M		NatureMap, PMST, DBCA
	Common Greenshank (*Tringa nebularia*)				NatureMap, PMST, DBCA
	Sharp-tailed Sandpiper (*Calidris acuminata*)				NatureMap, DBCA
	Wood Sandpiper (*Tringa glareola*)				NatureMap, DBCA
	Ruddy Turnstone (*Arenaria interpres*)				DBCA
	Red-necked Stint (*Calidris ruficollis*)				NatureMap, DBCA

Likelihood of Occurrence	Fauna Taxa	Conservation Status			Database Record
		EPBC Act	BC Act	DBCA	
	Glossy Ibis (*Plegadis falcinellus)*				DBCA
	Sanderling (*Calidris alba)*				DBCA
	Grey-tailed Tattler (*Tringa brevipes*)				NatureMap, DBCA
	Oriental Plover (*Charadrius veredus*)				NatureMap, DBCA
	Hooded Plover (*Thinornis rubicollis*)	-	-	P4	NatureMap, DBCA
	Blue-billed Duck (*Oxyura australis*)	-	-	P4	NatureMap, DBCA
Birds					
Medium	Arid Bronze Azure Butterfly *(Ogyris subterrestris petrina)*	CR	CR	-	NatureMap, DBCA
	Inland Hairstreak (*Jalmenus aridus*)	-	-	P1	NatureMap, DBCA

Following the survey, this preliminary list of significant fauna species was then re-assessed based on the findings during the survey.



Legend

Study Areas

- Burgundy Mine & Cutters Ridge
- Burgundy to Cutters Ridge Haul Road
- Castle Hill study area
- Rajax Mine study area
- TSF 3 & 4

Database Search results

- Mammal - EN
- Mammal - VU
- Mammal - P4
- Bird - CR & IA
- Bird - EN
- Bird - VU
- Bird - IA
- Bird - OS
- Bird - P4
- Invert - CR
- Invert - P1
- Invert - P3

N

5 0 5 km

Scale 1:450000 @ A4

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

Author: AH Approved: DC Date: 25-09-2019

Significant Fauna Recorded from the Database Searches

Rayjax to Castle Hill

Map 1.5

Prepared for Evolution Mining

1.8.3. SRE Species Status and Database Searches

The SRE status of taxa collected is based on categories which were developed by the Western Australian Museum (WAM; Table 1.10). The categories are used by taxonomists and consultants in order to describe the SRE status of taxa collected from the study area. The classifications listed in Table 1.10 are based on known information of the species group such as distribution, representation of records in collections, and distinct morphological features. Information gaps lead to classing taxa as potential SREs which is a requirement under the precautionary principle.

Table 1.10: Western Australian Museum SRE categories (2013)

Distribution	Taxonomic Certainty	Taxonomic Uncertainty
Distribution <10,000km^2	• Known distribution of <10,000km^2 • Taxonomy is well known • Group is well represented in collections and /or via comprehensive sampling Confirmed SRE	• Patchy sampling has resulted in incomplete knowledge of the geographic distribution of the group • There is incomplete taxonomic knowledge • The group is not well represented in collections This category is most applicable to situations where there are gaps in knowledge of the taxon Potential SRE
Distribution >10,000km^2	• Known distribution of >10,000km2 • Taxonomy is well known • Group is well represented in collections and /or via comprehensive sampling Widespread (not SRE)	

The database searches returned 11 spiders from four families, five millipedes from one family, one isopod, two butterflies from one family, two pseudoscorpions from two families, one scorpion, and three snails from three families (Table 1.9). The two butterflies are significant and one is listed under the EPBC Act/BC Act (*Ogyris subterrestris petrina*) and one as a Priority 1 by the DBCA (*Jalmenus aridus*). They were also returned from the database searches described in section 1.8.2. Of the remaining 23 SRE invertebrate species, 12 are potential SRE species and 11 are confirmed SRE species (Table 1.9).

Table 1.11: Significant Fauna Recorded During the Database Searches

Order/Family	Fauna Taxa	Closest Record Location	SRE Category
Araneae (Spiders)			
Actinopodidae	*Missulena harewoodi*	20km E of Kalgoorlie	Potential
Barychelidae	*Idiommata* 'kalgoorlie'	12km E of Kalgoorlie	Potential
Ctenizidae	*Conothele* 'MYG549'	Rowles	Confirmed
	Conothele 'MYG554'	14km of Kalgoorlie, Ora Banda	Confirmed
Idiopidae	*Idiosoma* 'MYG244'	Rowles Lagoon NR	Confirmed
	Idiosoma `kalgoorie'	20km E of Kalgoorlie	Potential
	Idiosoma `goldfields sp. group`	Kalgoorlie	Potential
	Proshermacha 'MYG435'	Credo Station	Potential
	Proshermacha 'MYG345'	Credo Station	Potential
	Proshermacha 'MYG441'	Credo Station	Potential
	Teyl 'MYG412'	Credo Station	Potential
Diplopoda (Millipedes)			
Paradoxosomatidae	*Antichiropus* 'broad arrows'	23km E of Kalgoorlie	Confirmed

Order/Family	Fauna Taxa	Closest Record Location	SRE Category
	Antichiropus 'DIP065'	Binduli	Confirmed
	Antichiropus 'DIP067'	23km E of Kalgoorlie	Confirmed
	Antichiropus 'kalgoorlie'	Binduli	Confirmed
	Antichiropus nadinae	Credo Station	Confirmed
Crustaceaa			
Armadillidae	*Buddelundia frontosa*	Binduli, Helena Aurora Range	Potential
Lepidoptera (Butterflies and Moths)			
Lycaenidae	*Jalmenus aridus*	Lake Douglas (1980-1990)	Possible / DBCA Priority 1
	Ogyris subterrestris petrina	Lake Douglas (1986)	Confirmed / EPBC Vulnerable
Pseudoscorpiones (Pseudoscorpions)			
Chthonioidea	Austrochthonius `sp. indet. or sp. nov?`	Binduli	Potential
Garypoidea	*Synsphyronus* `PSE025`	Credo Station	Potential
Scorpiones (Scorpions)			
Buthidae	Isometroides `n. sp.`	Credo Station	Potential
Gastropoda (Snails)			
Cameinidae	*Sinumelon* cf. *jimberlanensis*	35km SE of Coolgardie, Dundas Rock, Norseman	Confirmed
Pupillidae	*Pupilla* cf. *ficulnea*	Credo Station	Confirmed
Succineidae	*Succinea aridicola*	Boulder	Confirmed

2. METHODOLOGY

2.1. Field Survey Timing

The survey was undertaken from 19 - 25 August 2019 by two Spectrum personnel; Senior Zoologist, Astrid Heidrich and Botanist, Carmel Forrester (12 person days).

To characterise the prevailing conditions of the survey, monthly rainfall data was sourced from the nearest Bureau of Meteorology (BOM) station (Kalgoorlie-Boulder Airport BOM station # 12038), for the 12 months prior to the survey and compared to the sum of the long-term median rainfall (1939-2019). This is displayed in Figure 2.1.

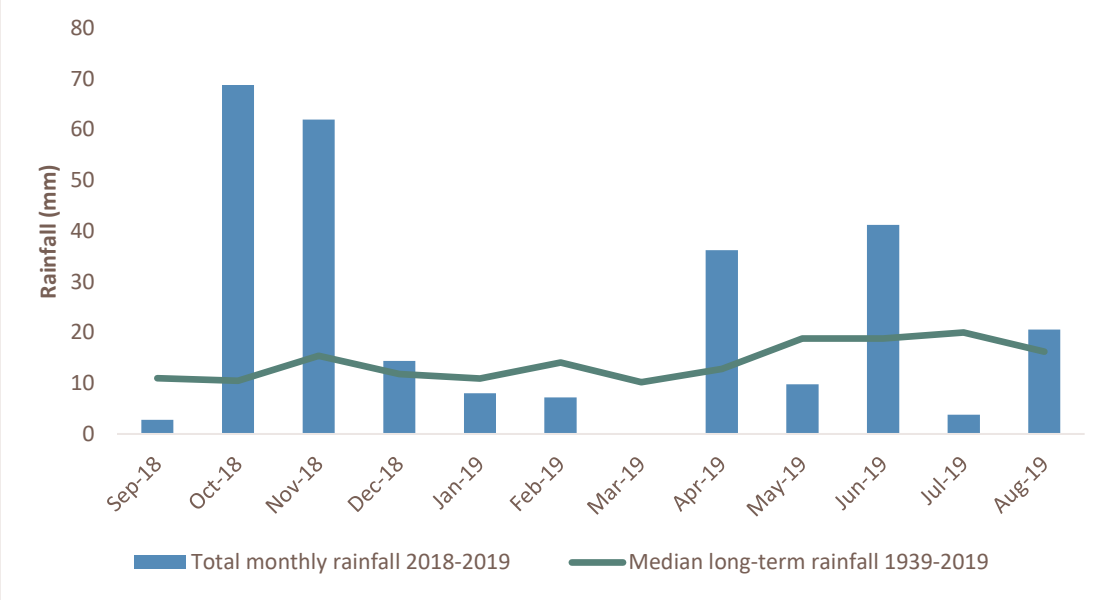


Figure 2.1: Rainfall 12 Months Preceding the Survey at Kalgoorlie-Boulder Airport Weather Station

The following rainfall was recorded at the Kalgoorlie-Boulder Airport BOM station (Bureau of Meteorology, 2019):

- In the 12 months preceding the 2019 field survey (September 2018 to August 2019), 275mm of rainfall was recorded, which is 104 mm higher than the sum of the long-term annual median of 171 mm; and
- In the three-month period prior to the survey (June- August 2019), 66 mm of rainfall was recorded, which is 11 mm higher than the sum of the long-term annual median for the same three months (55 mm).

The survey was undertaken following a period of above median rainfall, and growth conditions for the survey were likely to have been optimal. The Coolgardie Bioregion is considered part of the Interzone Botanical province where recommendations are to conduct flora and vegetation surveys are in Spring, from September to November (EPA, 2016). The field survey timing was conducted outside of EPA recommended timing, however there was above average rainfall and many species were flowering/fruiting during the assessment and it is unlikely to have affected the results of the assessment.

2.2. Project Team and Licences

Spectrum Ecology staff involved with this assessment are listed in Table 2.1, along with their role, years of experience and relevant licences.

Table 2.1: Project Team and Licences

Staff	Role	Years of Experience	Licences
Carmel Forrester	Botanist	5 years	FB82 000 134
Astrid Heidrich	Zoologist	11 years	BA27 000 104

2.3. Reconnaissance Flora and Vegetation Assessment

2.3.1. Field Methodology and Sampling Effort

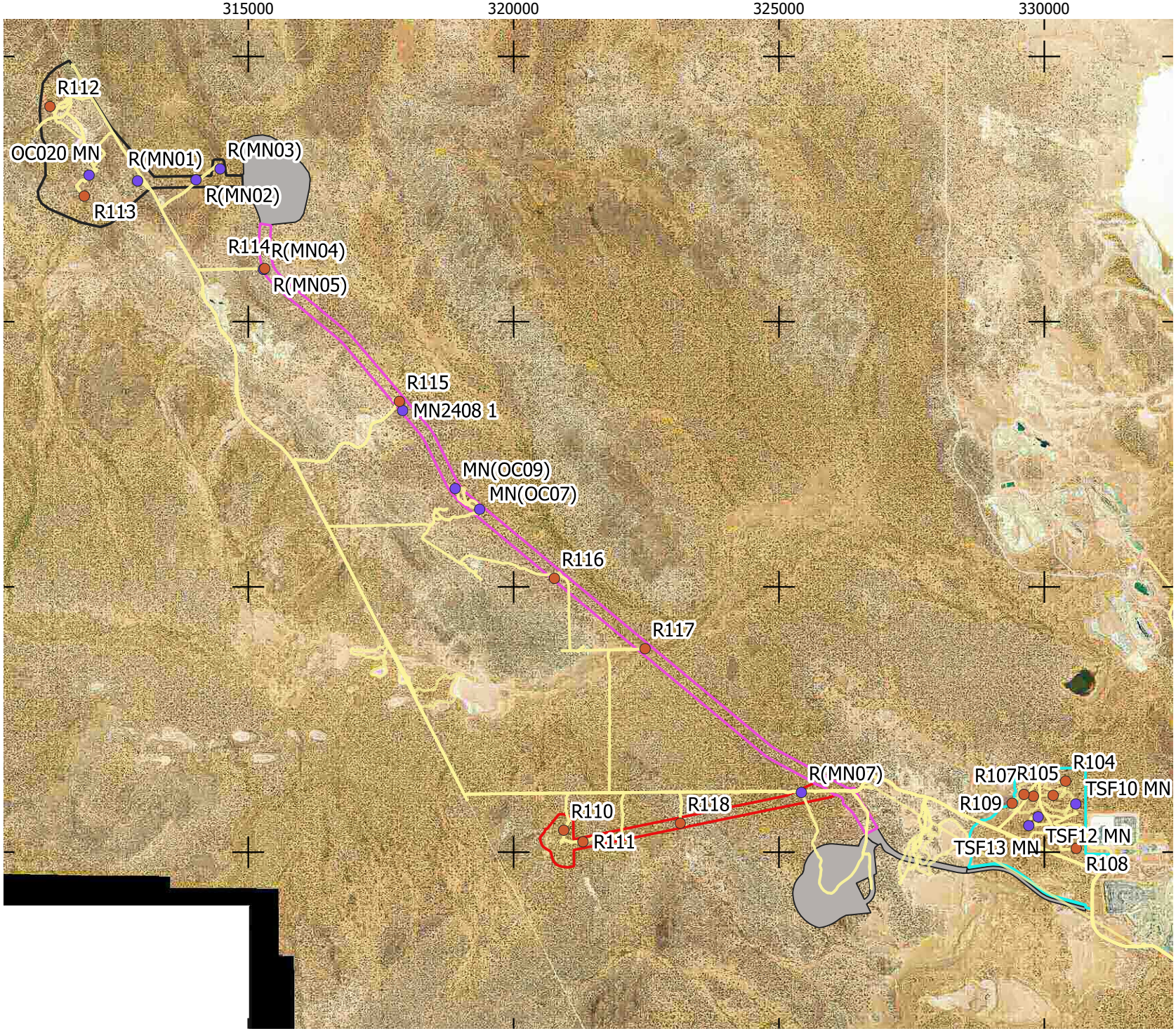
A Reconnaissance level flora and vegetation assessment was conducted at the study areas. This was considered appropriate as it is the preliminary investigation into environmental values of the study area and some of the study areas and surrounding areas have been previously assessed at a detailed flora and vegetation level (Burgundy Mine, Cutters Ridge Mine and TSF area).

A combination of relevés, traverses and opportunistic sampling is appropriate for reconnaissance level surveys as stipulated in the guidance statement (EPA, 2015) and these survey techniques are described in Table 2.2. Comprehensive relevé data collection information is included in Appendix B. Information on vegetation mapping was collected at selected sites and also opportunistically whilst traveling through the study areas. During the survey, 15 relevés were sampled within the study area including two relevés and four mapping sites at Castle Hill, three relevés and one mapping site in Rayjax, four relevés and five mapping sites in Burgundy to Cutters Ridge Haul Road, and six relevés and three mapping sites in the TSF area (site information is described in Appendix C). Relevés, mapping sites, traverses and vehicle tracks are mapped in Map 2.1.

Table 2.2: Reconnaissance Flora and Vegetation Assessment Survey Techniques

Survey Technique	Description
Relevés	Relevés are a low intensity survey technique for gathering information for low-intensity flora and vegetation surveys. Information collected at each relevé includes: • Site code, date, location, botanist; • A photograph; • Vegetation condition and disturbances (including fire); • Landform including; slope, soil, rock type, aspect; and • Flora and vegetation information; dominant cover, structure and species count where necessary.
Traverses	A traverse is an unmarked route along which data is collected. Traverses are useful for identifying the boundaries and characteristics of vegetation types, selecting sites for detailed survey, and targeting significant flora or vegetation. Information recorded along a traverse is as for the relevé, with the addition of noting vegetation changes and relationships between vegetation and substrate.
Opportunistic Sampling	Flora and vegetation not recorded through other sampling methods was opportunistically sampled as encountered in the study area. Opportunistic sampling also included recording locations of significant, introduced (weed) and unknown species.
Targeted Sampling	Areas likely to support significant flora or vegetation were targeted during the survey. Including areas with existing records of significant flora (see Section 1.8.1). Areas were selected based on existing records from database searches, geology, vegetation mapping and known Environmentally Sensitive Areas. Where possible, unusual and restricted geological features within the study area were sampled.

	When potentially significant flora were encountered during the survey, sufficient information was recorded to complete a Threatened and Priority Flora Report Form (TPRF).



Legend

Relevés and Mapping Note sites

- Notes
- Releve
- Survey Track files

Study Areas

- Burgundy and Cutters Ridge
- Burgundy to Cutters Ridge Haul Road
- Castle Hill study area
- Rajax study area
- TSF 3 & 4

N

Scale 1:100000

1 0 1 2 km

@ A4

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

Author: AH Approved: DC Date: 25-09-2019

Flora and Vegetation – Sampling Effort at the Study Areas

Rayjax to Castle Hill

Map 2.1

Prepared for
Evolution Mining

2.3.2. Data for the Index of Biodiversity Survey's for Assessments (IBSA)

The Environmental Protection Authority has given instruction that all biological surveys collecting data on biodiversity submit the report and associated raw data to IBSA as an IBSA data package.

All survey data for the study areas has been provided electronically with this report to comply with IBSA data package standards.

2.3.3. Vegetation and Condition Mapping

The data collected from relevés, traverses, as well as general field notes, observations and aerial photography were used to map the vegetation across the study areas. Vegetation was classified structurally based on the dominant species. The vegetation classification is consistent with NVIS Level V – association vegetation descriptions (referred to as a 'vegetation unit' for the local scale in this report). This level of description provides information on the dominant growth form, height and cover for up to three species for each of the upper, mid and ground strata (ESCAVI, 2003).

Vegetation condition was recorded at relevés and where areas of different vegetation condition were observed from both ground truthing and aerial imagery. The vegetation condition was mapped across the study area at the same scale as the vegetation mapping. Vegetation condition ratings follow the scale recommended for the interzone botanical province (EPA 2016b), summarised in Table 2.3.

Table 2.3: Vegetation Condition Scale and Criteria

Vegetation Condition	Disturbance Criteria
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. Damage to trees caused by fire, the presence of non-aggressive wees and occasional vehicle tracks.
Very Good	Vegetation structure altered with obvious signs of disturbance. Disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback logging and/or grazing.
Good	Vegetation structure significantly altered by 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.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration bit 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.
Completely Degraded	The structure of the vegetation is no longer intact, that eh 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.

2.3.4. Nomenclature, Specimen Identification and Lodgement

Flora nomenclature used in this report is consistent with the Western Australian Herbarium's plant census, provided on FloraBase (Western Australian Herbarium, 2019) and is current at the time of report preparation.

Flora specimens were collected of any suspected or known significant flora and to confirm species recorded during the relevés for vegetation mapping. Specimens were identified using the appropriate taxonomic keys and where required, relevant taxonomic experts at the Western Australian Herbarium.

Specimens are vouchered with the Western Australian Herbarium as per guidance; when they represent new populations of threatened or priority flora, new occurrences of TECs or PECs, individuals that have atypical characteristics, or bioregional range extensions.

2.3.5. Significant Flora and Vegetation Definitions

Flora and vegetation can be considered significant for a range of reasons.

Significant flora can include:

- Being identified as threatened (state listed WC Act and/or nationally listed EPBC Act);
- Being identified as priority species: Priority 1 to 4 (DPaW, 2017);
- Locally endemic or association with a restricted habitat type (e.g. surface water or groundwater dependant ecosystems);
- New species or anomalous features that indicate a potential new species;
- Representative of the range of a species (particularly, at the extremes of range recently discovered range extensions, or isolated outliers of the main range);
- Unusual species, including restricted subspecies, varieties or naturally occurring hybrids; and
- Relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

Significant vegetation can include:

- Identified as Threatened Ecological Community (TEC) (state listed WC Act and/or nationally listed EPBC Act);
- Priority Ecological Community (PEC) (DBCA 2017);
- Restricted distribution;
- Degree of historical impact from threatening processes;
- A role as a refuge; and
- Providing an important function required to maintain ecological integrity of a significant ecosystem.

2.3.6. Limitations and Constraints

Survey specific limitations and constraints for the flora and vegetation reconnaissance assessment for the study areas are discussed in Table 2.4.

Table 2.4: Study Limitations and Constraints – Flora

Limitation	Comment
Availability of contextual information at a regional and local scale.	There are no vegetation surveys or datasets available for contextual information to compare Level V vegetation associations at a regional scale. Beard mapping has been used, however this mapping is conducted at a coarse scale (1:250,000) and can only provide an approximate comparison.
Competency/experience of the team carrying out the survey, including experience in the bioregion surveyed.	Botanist Carmel Forrester has 5 years' experience in conducting botanical surveys throughout Western Australia, including experience within the Interzone Botanical Province.
Proportion of flora recorded and/or collected, any identification issues.	Only suspected or known significant and introduced flora, and flora that was part of vegetation communities were collected which is acceptable for a reconnaissance level survey. One *Tecticornia* specimen could not be identified to species level. Plants were identified by taxonomist Udani Sirisena who has botanical and taxonomic experience throughout Western Australia. Where there were complexities specialist taxonomists at the Western Australian herbarium were consulted.

Limitation	Comment
Was the appropriate area fully surveyed (effort and extent).	Prior to the field survey, relevés were selected to represent the diversity of vegetation and geology present at the study area. This was sufficient to map and classify the vegetation of the study area for a reconnaissance level survey. Previous records of priority flora and areas considered potential habitat were targeted where possible. Some areas could not be accessed in the southern area.
Access restrictions within the survey area.	Access was limited in the southern areas.
Survey timing, rainfall, season of survey.	The field survey timing was slightly outside of the appropriate season for a flora and vegetation survey conducted in the Interzone Botanical Province. However, there was higher than average rainfall at the study areas prior to the field survey and this is not considered to have affected the survey results. Survey timing was outside the recommended season for *Calandrinia lefroyensis/quartzitica* which was targeted during a separate assessment and this species will be targeted during an additional survey in October 2019. There was a partial timing constraint due to site HSE requirements; however, the study areas have been adequately assessed at a Reconnaissance level.
Disturbance that may have affected the results of survey such as fire, flood or clearing.	No disturbances were recorded at the study area that have affected the results of the survey. No areas were recently burnt or cleared within the study area.

2.4. Level 1 Fauna Assessment

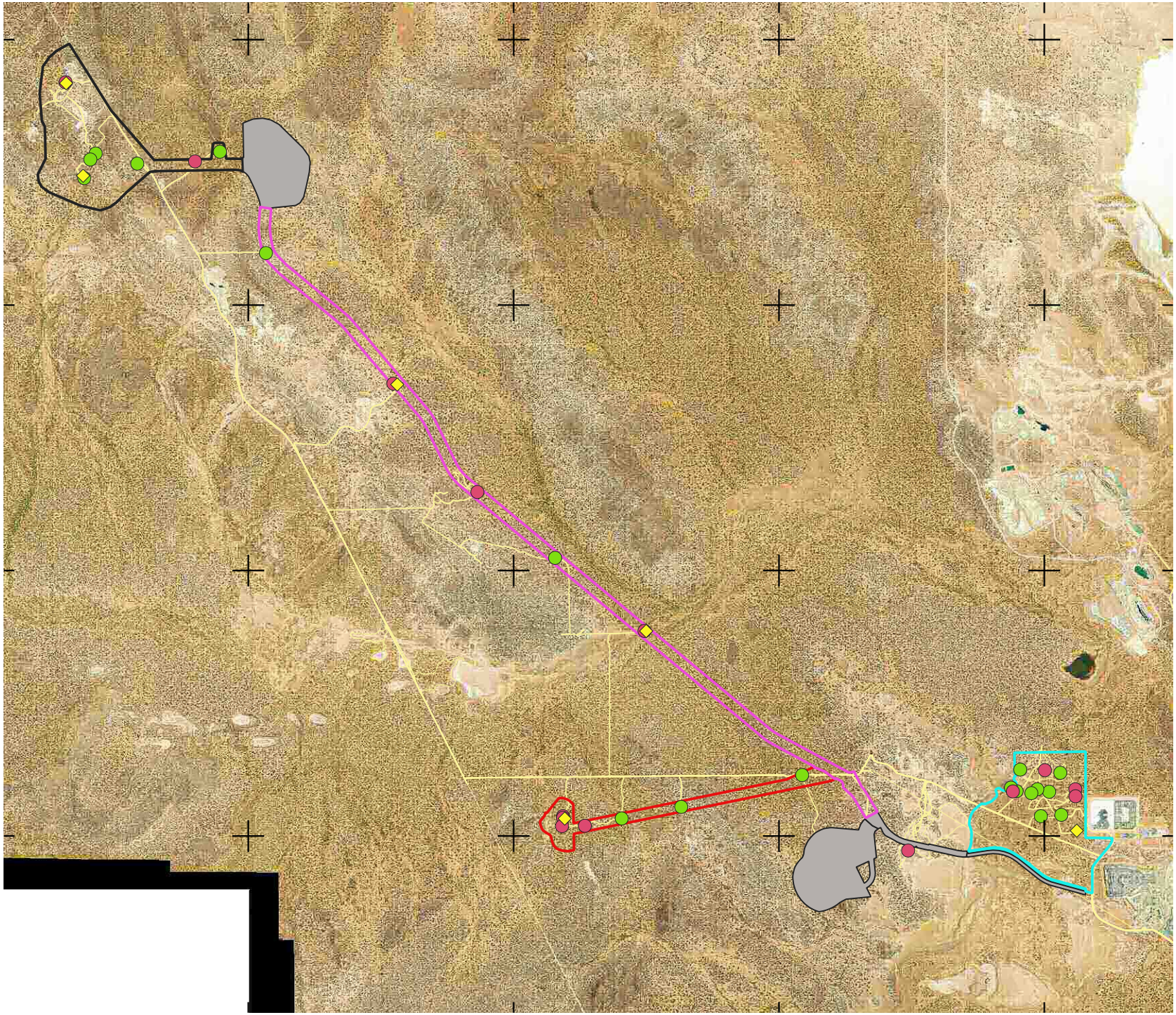
2.4.1. Field Methodology

The terrestrial vertebrate fauna survey was carried out in accordance with Technical Guidance: Terrestrial Fauna Surveys (EPA 2016e), Technical Guidance: Sampling of short range endemic invertebrate fauna (EPA 2016c) and Technical Guidance: Sampling Methods for Terrestrial Vertebrate Fauna (EPA 2016d). The guidance suggests selective low-intensity sampling of fauna and fauna habitats to verify the accuracy of the desktop assessment. The approach of a Level 1 fauna survey was used to describe and map the vertebrate fauna habitats across the study area and complete active searches to describe the vertebrate fauna assemblages of the study area, particularly any significant fauna identified as likely to be present.

A total of eight survey sites were established at Castle Hill and Haul Road, eight survey sites were established at Rayjax and Haul Road, seven survey sites were installed at Burgundy to Cutters Ridge Haul Road and 14 survey sites were established at the TSF Area (Map 2.2). A variety of survey techniques was used for fauna as outlined in Table 2.5. All survey data has been provided electronically with this report as an IBSA data package.

Table 2.5: Fauna Survey Techniques

Fauna	Survey Technique
Mammals	Direct sightings and indirect evidence such as tracks, scats and diggings were recorded across the study area.
Birds	Direct sightings and calls, as well as indirect evidence such as feathers, pellets and nests were recorded across the study area. Search effort was focused to Malleefowl in areas potentially suitable for those species.
Reptiles & Amphibians	Direct sightings and indirect evidence such as calls, tracks, diggings and skins were recorded across the study area and targeted searches were undertaken in areas with suitable habitat.
Invertebrate Fauna	Foraging methods included raking in leaf litter, and searching under bark, under shrubs and moist soil. Leaf litter collections were also made from selected sites and samples placed under Tullgren funnels in the laboratory.



Legend

Study Areas

- Burgundy Mine
- Burgundy to Cutters Ridge Haul Road
- Castle Hill study area
- Cutters Ridge
- Rajax Mine study area
- TSF 3 & 4

Fauna Sites Locations

- Active Search
- Habitat Assessment
- Leaf litter collection
- Survey Track files

N

1 0 1 2 km

Scale 1:100000 @ A4

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

Author: AH Approved: DC Date: 18-09-2019

Fauna – Sampling Effort at the Study Areas

Rayjax to Castle Hill

Map 2.2

Prepared for
Evolution Mining

2.4.2. Fauna Habitat Mapping

Fauna habitat mapping identifies areas of vegetation and land features that are distinguishable from other areas. Typically, each fauna habitat supports a characteristic fauna assemblage that is adapted to the features of the fauna habitat. Fauna habitat types are identified and mapped based on the following information:

- General vegetation type (Shepherd, Beeston and Hopkins, 2001);
- Vegetation Types mapped within the study area;
- Vegetation structure;
- Landforms;
- Geological units;
- Soil substrate;
- Aerial imagery;
- Fauna assemblage; and
- Field observations.

The fauna habitat was recorded at each survey sites and also opportunistically during traversing by foot and travelling between sites.

2.4.3. Nomenclature and Taxonomy

Nomenclature for mammals, reptiles and amphibians followed the Western Australian Museum Checklist of the Vertebrates of Western Australia. Taxonomy of birds followed Christidis and Boles (2008). Fauna species identifications were completed based on information provided in references listed in Table 2.6.

Table 2.6: References Used for Identification of Fauna Species

Fauna	Survey Technique
Mammals	Churchill (2009), Menkhorst and Knight (2001), Van Dyck and Strahan (2008)
Birds	Simpson and Day (2004)
Reptiles & Amphibians	Wilson and Swan (2017), Cogger (2014), Tyler and Doughty (2009)

2.4.4. Conservation Significant Fauna

During the field survey, the preliminary assessment of the likelihood of conservation significant fauna species occurring within the study area was reviewed and amended (see Section 1.8.2). The assessment included the following:

- Suitable fauna habitats recorded from the study area;
- Distribution of previously recorded conservation significant species;
- Frequency of occurrence of conservation significant species in the region;
- Temporal distribution of conservation significant species; and
- Accuracy of record locations, date and source of record (level of reliability).

The likelihood of occurrence of each conservation significant species listed by the database searches was determined based on the criteria outlined in Table 1.8.

2.4.5. Limitations and Constraints

Survey specific limitations and constraints for the level 1 fauna assessment conducted at the study areas are discussed in Table 2.7.

Table 2.7: Limitations and Constraints – Fauna

Limitation	Constraint	Comment
Competency/experience of the consultant carrying out the survey.	No	Fauna survey staff had relevant experience surveying the south-west and interior regions of Western Australia.
Scope (what faunal groups were sampled and were some sampling methods not able to be employed because of constraints such as weather conditions).	No	Sampling techniques were adequate surveying the study area. All fauna groups were sampled. No constraints were experienced completing the survey.
Proportion of fauna identified, recorded and/or collected.	No	All vertebrate fauna species encountered were identified in the field. Level 1 survey methods do not require the identification of all fauna species present within the study area.
Sources of information.	No	There is a number of surveys previously completed partially inside the study areas and the surroundings. Database searches have captured a relatively large number of species from the area and provide an adequate level of information.
The proportion of the task achieved and further work which might be needed.	No	All components of a level 1 fauna survey were completed.
Timing/weather/season/cycle.	Partially	Low overnight temperatures limited the activity level of vertebrate fauna species, in particular reptile species. This was reflected in a relatively low count of reptile species recorded during the survey. However, the assessment of fauna habitats and recording of secondary evidence of fauna species was not compromised. All dominant fauna groups and assemblages were recorded.
Disturbances (e.g. fire, flood, accidental human intervention) which affected results of survey.	No	No disturbances were recorded during the survey.
Intensity (in retrospect, was the intensity adequate).	No	A level 1 survey was adequate to identify faunal assemblages and fauna habitat present within the study areas. Targeted searches for significant fauna species were not completed across all sections of the study area and are recommended.
Completeness (was the relevant area fully surveyed.	No	All representative habitat types were surveyed for habitats and faunal assemblage.
Resources (degree of expertise available in animal identification to taxon level).	No	Resources available were adequate and did not compromise the outcome of the survey.
Remoteness and/or access problems.	No	Some access restrictions were experienced within the study areas and some remote areas were not accessed; however, level 1 fauna sampling was completed at representative habitats.
Availability of contextual (e.g. biogeographic) information on the region.	No	Background information about the region was available and sufficient.

3. RESULTS

3.1. Flora

A total of 113 taxa from 28 families and 49 genera were recorded during the survey and these are listed in Appendix D. Of these, one was an introduced species; **Erodium cicutarium*. No Threatened flora taxa were recorded. Significant and introduced flora information is detailed for each project area below. Another species, Priority 3; *Allocasuarina eriochlamys* subsp. *grossa* was recorded from outside the study areas.

3.1.1. Castle Hill

No Threatened, Priority, or other significant flora taxa were recorded at the Castle Hill study area. No introduced flora species were recorded.

3.1.2. Rayjax

No Threatened, Priority, or other significant flora taxa were recorded at the Rayjax study area. No introduced flora species were recorded.

3.1.3. Burgundy to Cutters Ridge Haul Road

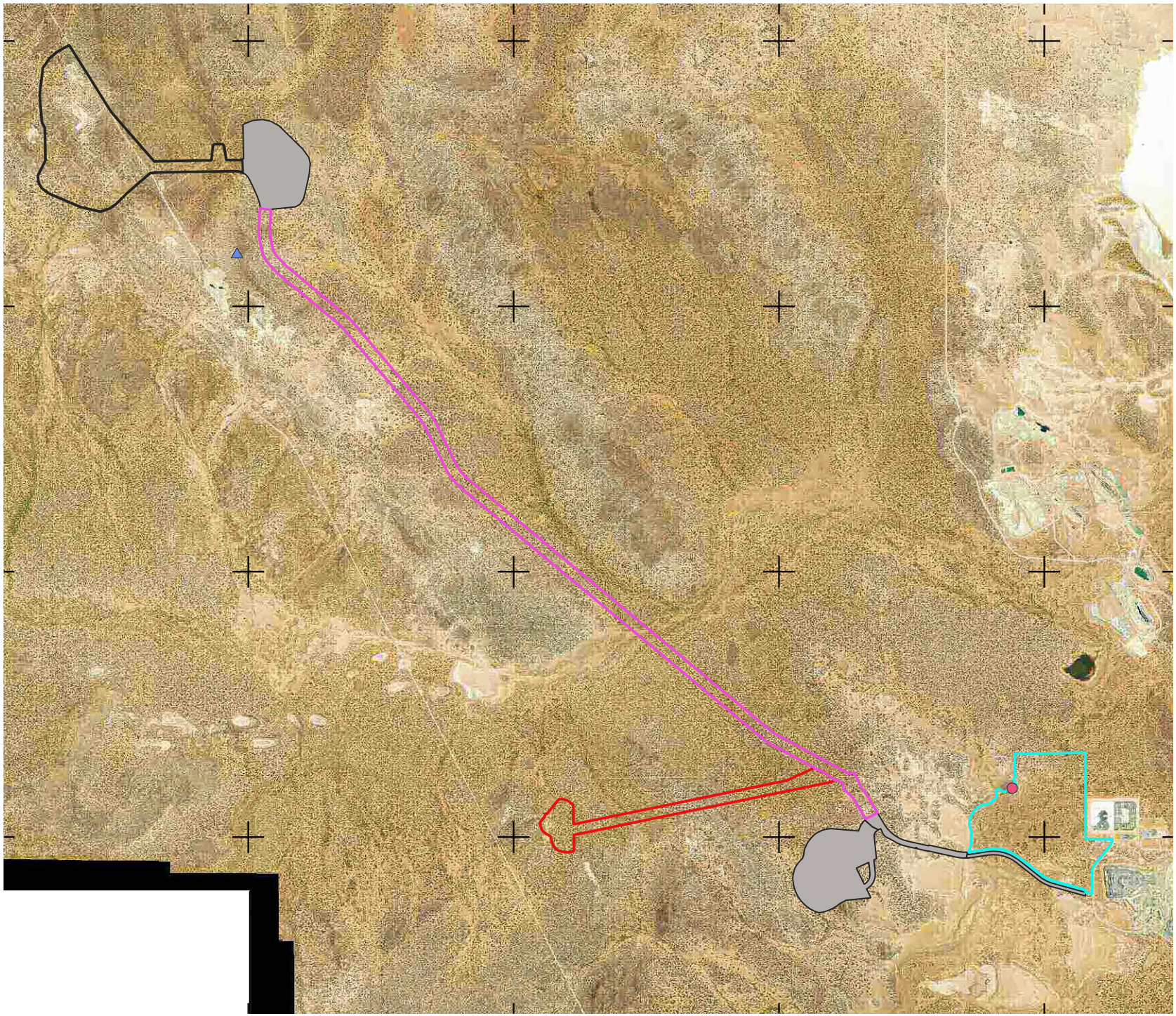
One Priority 3 species, *Allocasuarina eriochlamys* subsp. *grossa* (Figure 3.1) was opportunistically recorded at one location, 480 m west of the Burgundy to Cutters Ridge Haul Road study area. It was recorded on a lateritic outcrop and the population formed the dominant tall shrub stratum (10% cover). The location is mapped on Map 3.1 and coordinates have been provided electronically. No Threatened or other significant flora taxa were recorded from inside the Burgundy to Cutters Ridge Haul Road study area. There were no introduced flora species recorded.

Figure 3.1 : *Allocasuarina eriochlamys* subsp. grossa

3.1.4. TSF

No Threatened, Priority or other significant flora taxa were recorded at the TSF study area.

One environmental weed species was recorded at R109: **Erodium cicutarium*, approximately 20 m outside the TSF study area. This was recorded at one location (0.1% cover), and the location is shown on Map 3.1.



Legend

Study Area

- Burgundy & Cutters Ridge
- Burgundy to Cutters Ridge Haul Road
- Castle Hill study area
- Rajax Mine study area
- TSF 3 & 4

Significant and Introduced Flora

- Allocasuarina eriochlamys
- Erodium cicutarium

N

Scale 1:100000 @ A4

1 0 1 2 km

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

Author: AH Approved: DC Date: 26-09-2019

Significant and Introduced Flora Recorded at the Study Areas

Rayjax to Castle Hill

Map 3.1

Prepared for
Evolution Mining

3.2. Vegetation

There were eleven vegetation types described throughout the study areas occurring on flat plains, claypans, minor drainage lines, simple slopes, and minor floodplains:

i: *Eucalyptus campaspe* and *E. salmonophloia* mid open woodland over *Atriplex nummularia* ssp. *spathulata* and *Eremophila interstans* ssp. *interstans* mid sparse shrubland over *Atriplex vesicaria* low sparse shrubland;

ii: *Tecticornia halocnemoides* ssp. *halocnemoides*, *T. indica* ssp. *indica* and *T. chartacea* low open chenopod shrubland;

iii: *Eucalyptus yilgarnensis*, *E. salubris* and *E. clelandiorum* mid woodland over *Eremophila scoparia*, *Senna artemisiodes* ssp. *filifolia* mid open shrubland over *Ptilotus obovatus* low isolated shrubs;

iv: *Eucalyptus salubris*, *E. clelandiorum* (+/-*E. salmonophloia*) mid open woodland over *Eremophila scoparia* and *Senna artemisiodes* ssp. *filifolia* mid open shrubland over *Atriplex* sp. and *Olearia muelleri* low open shrubland;

v: *Casuarina pauper* low isolated trees over *Melaleuca laterifora* mid open shrubland over *Frankenia setosa* and *Atriplex stipitata* low open shrubland;

vi: *Eucalyptus moderata*, *Eucalyptus oleosa* and *E. torquata* tall mallee woodland over *Eremophila pustulata* and *Eremophila interstans* ssp. *interstans* tall sparse shrubland over *Acacia erinacea*, *Senna artimisioides* ssp. f*ilifolia*, and *Atriplex vesicaria* low sparse shrubland;

vii: *Eucalyptus griffithsii* low woodland over *Senna artemisioides* and *Eremophila ionantha* mid sparse shrubland over *Acacia hemiteles* and *Grevillea acuaria* low sparse shrubland;

viii: *Eucalyptus griffithsii* low woodland over *Eremophila scoparia*, *E. interstans* ssp. *virgata* and *Acacia hemiteles* mid to tall open shrubland;

ix: *Eucalyptus clelandiorum* tall mallee woodland over *Eremophila scoparia*, *Acacia burkittii* and *Atriplex nummularia* ssp. *spathulata* low sparse shrubland;

x: *Eucalyptus griffithsii* low isolated trees over *Acacia burkittii*, *Eremophila scoparia* and *Atriplex nummularia* ssp. *spathulata* mid to tall open shrubland; and

xi: *Duma florulenta* mid sparse shrubland.

Table 3.1 outlines each of the vegetation types and details which type was present in each study area. Vegetation is described for each study area in the sections overleaf.

Table 3.1: Vegetation Types Recorded at the Study Areas

Unit	Description	Landform, Soil & Geology	Sites	Area (ha)					Representative Photograph
				Castle Hill	Rayjax	Haul Road	TSF	Total	
i	*Eucalyptus campaspe* and *E. salmonophloia* mid open woodland over *Atriplex nummularia* ssp. *spathulata* and *Eremophila interstans* ssp. *interstans* mid sparse shrubland over *Atriplex vesicaria* low sparse shrubland	Flat Plain Red Sand; Clay	R112	130.97	-	-	-	130.97	
ii	*Tecticornia halocnemoides* ssp. *halocnemoides*, *T. indica* ssp. *indica* and *T. chartacea* low open chenopod shrubland	Flat Claypan Red Cracking Clay	R107	-	-	-	24.90	24.90	
iii	*Eucalyptus yilgarnensis*, *E. salubris* and *E. clelandiorum* mid woodland over *Eremophila scoparia*, *Senna artemisiodes* ssp. *filifolia* mid open shrubland over *Ptilotus obovatus* low isolated shrubs	Flat Plain Red Sand; Clay	R108 TSF13 MN	-	-	-	9.50	9.50	

Unit	Description	Landform, Soil & Geology	Sites	Area (ha)					Representative Photograph
				Castle Hill	Rayjax	Haul Road	TSF	Total	
iv	*Eucalyptus salubris*, *E. clelandiorum* (+/-*E. salmonophloia*) mid open woodland over *Eremophila scoparia* and *Senna artemisiodes* ssp. *filifolia* mid open shrubland over *Atriplex* sp. and *Olearia muelleri* low open shrubland ^Priority species found within this vegetation type	Flat Plain Red Sand; Clay	R104 TSF10 MN TSF12 MN R110 R111 MN04 R115 R114 R115 R116	5.76	131.70	344.40	96.25	578.11	
v	*Casuarina pauper* low isolated trees over *Melaleuca lateriflora* mid open shrubland over *Frankenia setosa* and *Atriplex stipitata* low open shrubland	Minor Floodplain Red Sand; Clay	R105 R106	-	-	-	292.40	292.40	
vi	*Eucalyptus moderata*, *Eucalyptus oleosa* and *E. torquata* tall mallee woodland over *Eremophila pustulata* and *Eremophila interstans* ssp. *interstans* tall sparse shrubland over *Acacia erinacea*, *Senna artimisioides* ssp. *filifolia*, and *Atriplex vesicaria* low sparse shrubland	Simple Slope Red Brown Sand; Clay	R118	-	15.19	-	-	15.19	

Unit	Description	Area (ha)						Representative Photograph
		Landform, Soil & Geology	Sites	Castle Hill	Rayjax	Haul Road	TSF	Total	
vii	*Eucalyptus griffithsii* low woodland over *Senna artemisioides* and *Eremophila ionantha* mid sparse shrubland over *Acacia hemiteles* and *Grevillea acuaria* low sparse shrubland	Flat Minor Drainage Red Orange Sand; Clay	R117	-	-	9.78	-	9.78	
viii	*Eucalyptus griffithsii* low woodland over *Eremophila scoparia, E. interstans* ssp. *virgata* and *Acacia hemiteles* mid to tall open shrubland	Flat Plain Red Sand; Clay	R(MN03)	15.24	-	-	-	15.24	
ix	*Eucalyptus clelandiorum* tall mallee woodland over *Eremophila scoparia, Acacia burkittii* and *Atriplex nummularia* ssp. *spathulata* low sparse shrubland	Minor Floodplain Red Sand; Clay	R113	98.00	-	-	-	98.00	

Unit	Description	Landform, Soil & Geology	Sites	Area (ha)					Representative Photograph
				Castle Hill	Rayjax	Haul Road	TSF	Total	
x	*Eucalyptus griffithsii* low isolated trees over *Acacia burkittii*, *Eremophila scoparia* and *Atriplex nummularia* ssp. *spathulata* mid to tall open shrubland	Flat Minor Drainage Red Sand; Clay	R(MN01) R(MN02) OC020 MN	202.80	-	-	-	202.80	
xi	*Duma florulenta* mid sparse shrubland * Weed species found within this vegetation type	Flat Claypan Light Orange Claypan	R109	-	-	-	1.23	1.23	

3.2.1. Castle Hill

Five vegetation types (i, iv, viii, ix and x) were described for the Castle Hill study area derived from flat plains, flat minor drainage and floodplains (see Table 3.1 and Map 3.2).

i: *Eucalyptus campaspe* and *E. salmonophloia* mid open woodland over *Atriplex nummularia* ssp. *spathulata* and *Eremophila interstans* ssp. *interstans* mid sparse shrubland over *Atriplex vesicaria* low sparse shrubland;

iv: *Eucalyptus salubris*, *E. clelandiorum* (+/-*E. salmonophloia*) mid open woodland over *Eremophila scoparia* and *Senna artemisiodes* ssp. *filifolia* mid open shrubland over *Atriplex* sp. and *Olearia muelleri* low open shrubland;

viii: *Eucalyptus griffithsii* low woodland over *Eremophila scoparia*, *E. interstans* ssp. *virgata* and *Acacia hemiteles* mid to tall open shrubland;

ix: *Eucalyptus clelandiorum* tall mallee woodland over *Eremophila scoparia*, *Acacia burkittii* and *Atriplex nummularia* ssp. *spathulata* low sparse shrubland; and

x: *Eucalyptus griffithsii* low isolated trees over *Acacia burkittii*, *Eremophila scoparia* and *Atriplex nummularia* ssp. *spathulata* mid to tall open shrubland.

3.2.1.1. Significant Vegetation

There were no vegetation types that were identified as a TEC/PEC, or significant due to historical impact from threatening processes, or provide a function to maintain ecological integrity of a significant ecosystem.

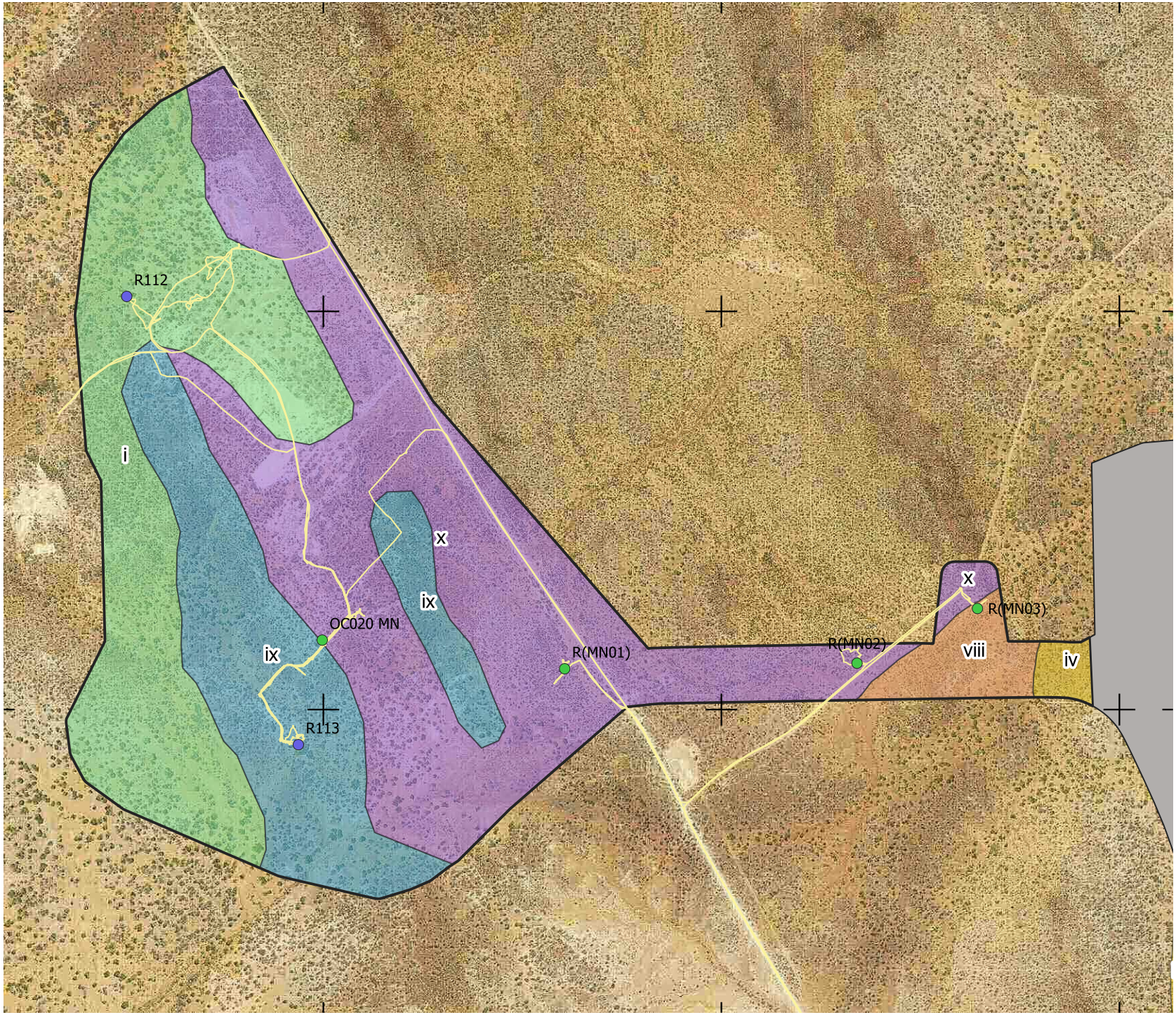
Vegetation type iv is the known habitat for Priority 1 species *Eremophila praecox* and is therefore considered significant as it plays a role in refugee. Vegetation type viii is restricted to a minor drainage channel in the Castle Hill study area and therefore considered significant.

3.2.1.2. Vegetation Condition

Vegetation condition at the Castle Hill study area is presented in Table 3.2 and mapped in Map 3.2. This study area had areas of substantial clearing (9.9%) and the presence of an old mine in the northern section where the vegetation structure was significantly altered. The eastern and southern parts of the study area were disturbed with vehicle tracks and partial clearing, however the vegetation structure remained mostly intact. A small area (7.3%) in the north-west appeared undisturbed. This study area is the location of the decommissioned Castle Hill mine and disturbances can be attributed to this.

Table 3.2: Vegetation Condition at the Castle Hill Study Area

Vegetation Condition	Area (ha)	% of Study Area	Disturbance Details
Pristine	33.0	7.3	Pristine or nearly so, no obvious signs of disturbance, occasionally some presence of old tracks.
Excellent	374.1	82.8	Vegetation structure intact, disturbance affecting individual species. Clearing for drill pads, lines and vehicle tracks.
Good	44.6	9.9	Vegetation structure completely altered for quarry and significantly altered by obvious signs of drilling and mine activity. Retains basic vegetation structure or ability to regenerate it.



Legend

Study Areas

- Burgundy Mine & Cutters Ridge
- Burgundy & Cutters Ridge

Vegetation Units

- i
- ii
- iii
- iv
- v
- vi
- vii
- viii
- ix
- x
- xi

N

Scale 1:20000 | 0.25 | 0 | 0.25 km | @ A4

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

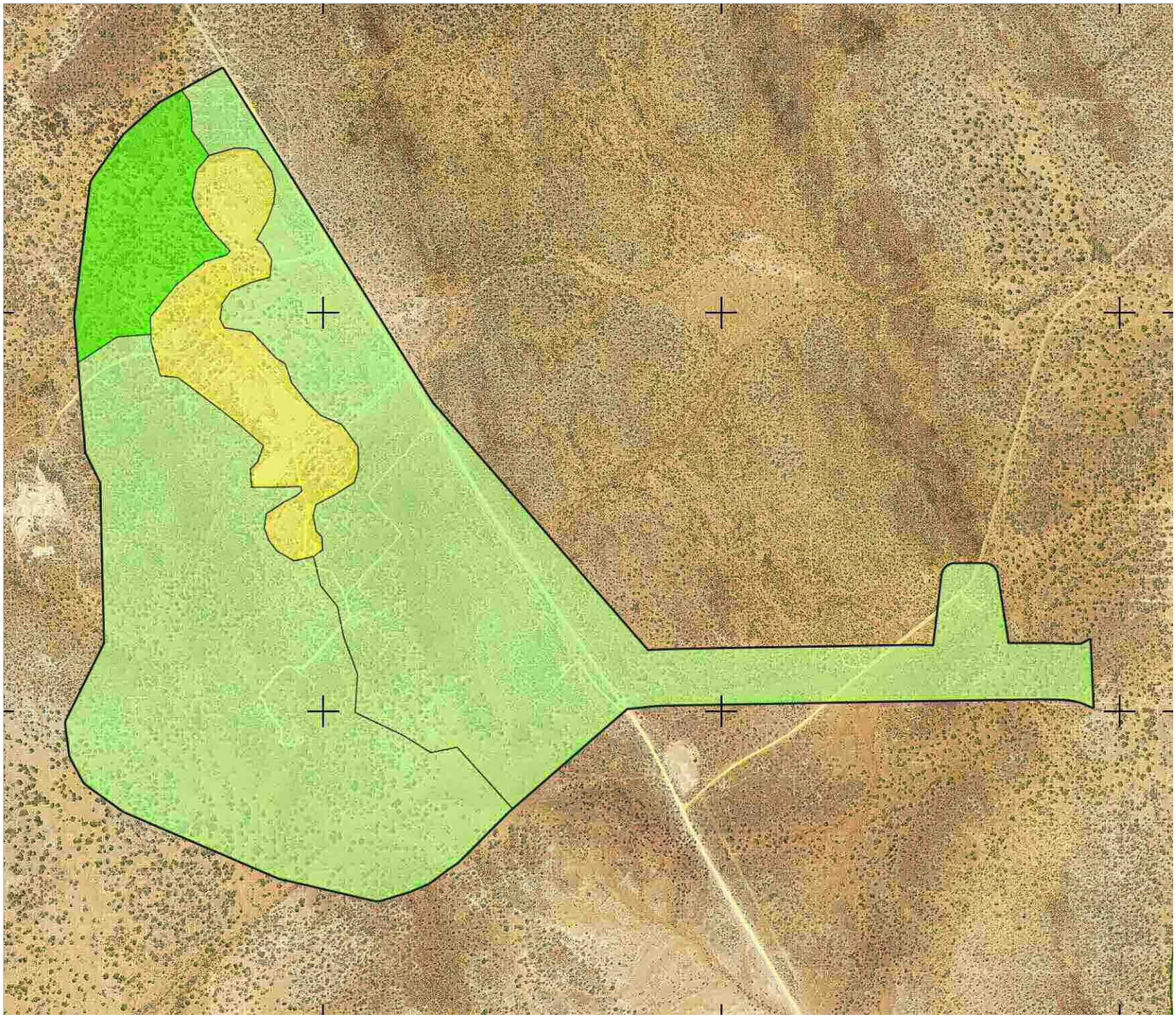
Author: AH Approved: DC Date: 25-09-2019

Vegetation Types Mapped at Castle Hill Study Area

Rayjax to Castle Hill

Map 3.2

Prepared for
Evolution Mining



Legend

Study Area

- Castle Hill study area

Vegetation Condition Mapping

- Pristine
- Excellent
- Good

N

0.25 0 0.25 km

Scale 1:20000 @ A4

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

Author: AH Approved: DC Date: 20-09-2019

Vegetation Condition Mapped at the Castle Hill Study Area

Rayjax to Castle Hill

Map 3.3

Prepared for
Evolution Mining

3.2.2. Rayjax

Two vegetation types (iv and vi) were described for the Rayjax study area and were derived from flat plains, flat minor drainage and floodplains (Map 3.4).

iv: *Eucalyptus salubris*, *E. clelandiorum* (+/-*E. salmonophloia*) mid open woodland over *Eremophila scoparia* and *Senna artemisiodes* ssp. *filifolia* mid open shrubland over *Atriplex* sp. and *Olearia muelleri* low open shrubland; and

vi: *Eucalyptus moderata*, *Eucalyptus oleosa* and *E. torquata* tall mallee woodland over *Eremophila pustulata* and *Eremophila interstans* ssp. *interstans* tall sparse shrubland over *Acacia erinacea*, *Senna artimisioides* ssp. *filifolia*, and *Atriplex vesicaria* low sparse shrubland.

3.2.2.1. Significant Vegetation

There were no vegetation types that were identified as a TEC/PEC or significant due to historical impact from threatening processes, or provide a function to maintain ecological integrity of a significant ecosystem.

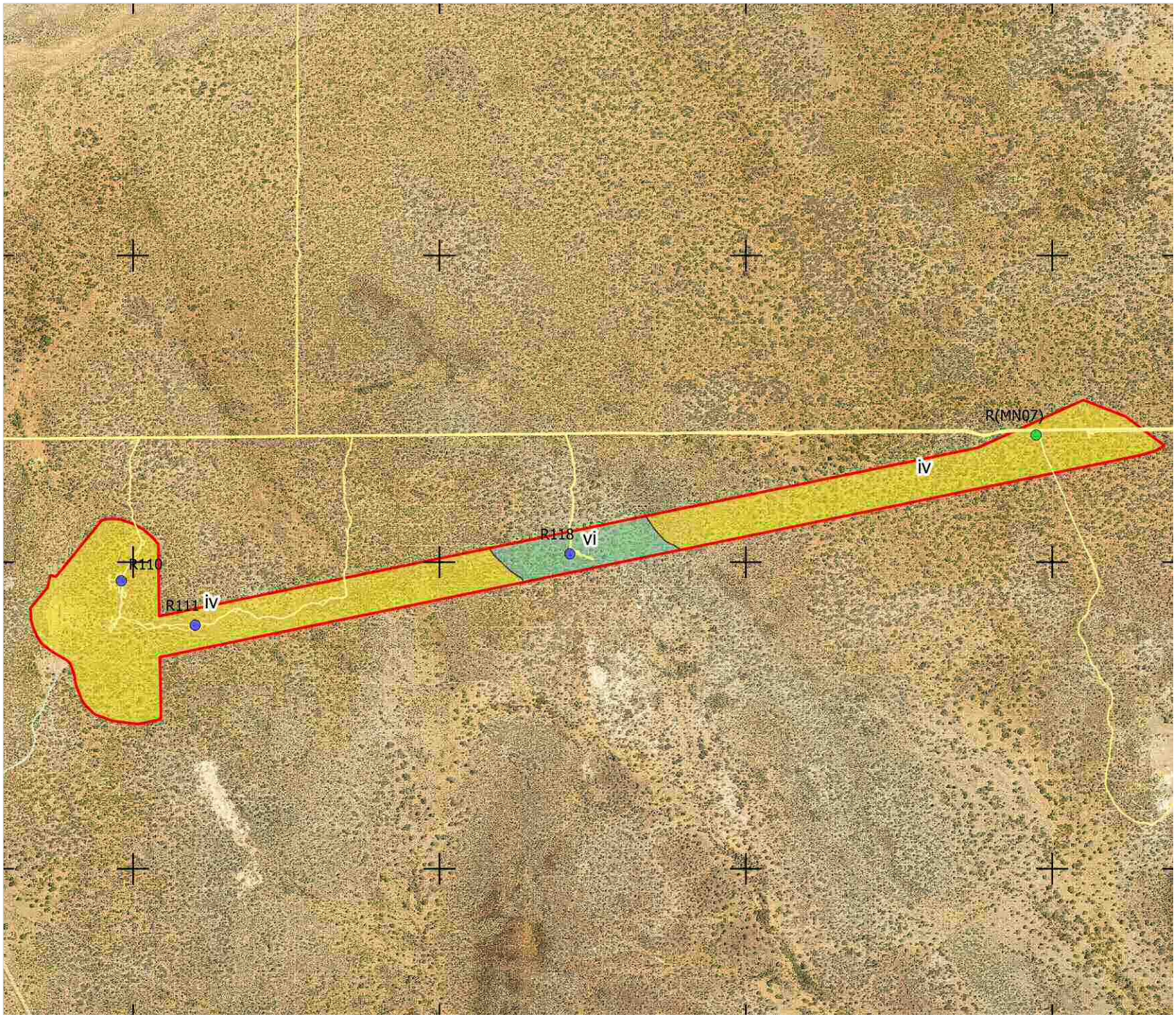
Vegetation type iv is the known habitat for Priority 1 species *Eremophila praecox* and is therefore considered significant as it plays a role in refugee. Vegetation type vi is restricted to a minor drainage channel in the Rayjax study area and therefore considered significant.

3.2.2.2. Vegetation Condition

Vegetation condition in the Rayjax study area is presented in Table 3.3 and mapped in Map 3.5. The Rayjax study area had minor clearing at the western extent (2.6%) where the vegetation structure was significantly altered. Some parts of the study area were disturbed with vehicle tracks, however the vegetation structure remained intact. A large portion (31.1%) appeared undisturbed.

Table 3.3: Vegetation Condition at the Rayjax Study Area

Vegetation Condition	Area (ha)	% of Study Area	Disturbance Details
Pristine	45.8	31.1	Pristine or nearly so, no obvious signs of disturbance, or weeds.
Excellent	97.3	66.2	Vegetation structure intact, disturbance affecting individual species. Clearing for drill vehicle tracks present.
Good	3.9	2.6	Vegetation structure altered for mine activity. Retains basic vegetation structure or ability to regenerate it.



Legend

Study Areas
- Rajax Mine study area
- Burgundy & Cutters Ridge

Vegetation Units
- iv
- vi

Releves and Mapping Sites
- Notes
- Releve
- Tracks and traverses

N

0.25 0 0.25 km

Scale 1:26000 @ A4

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

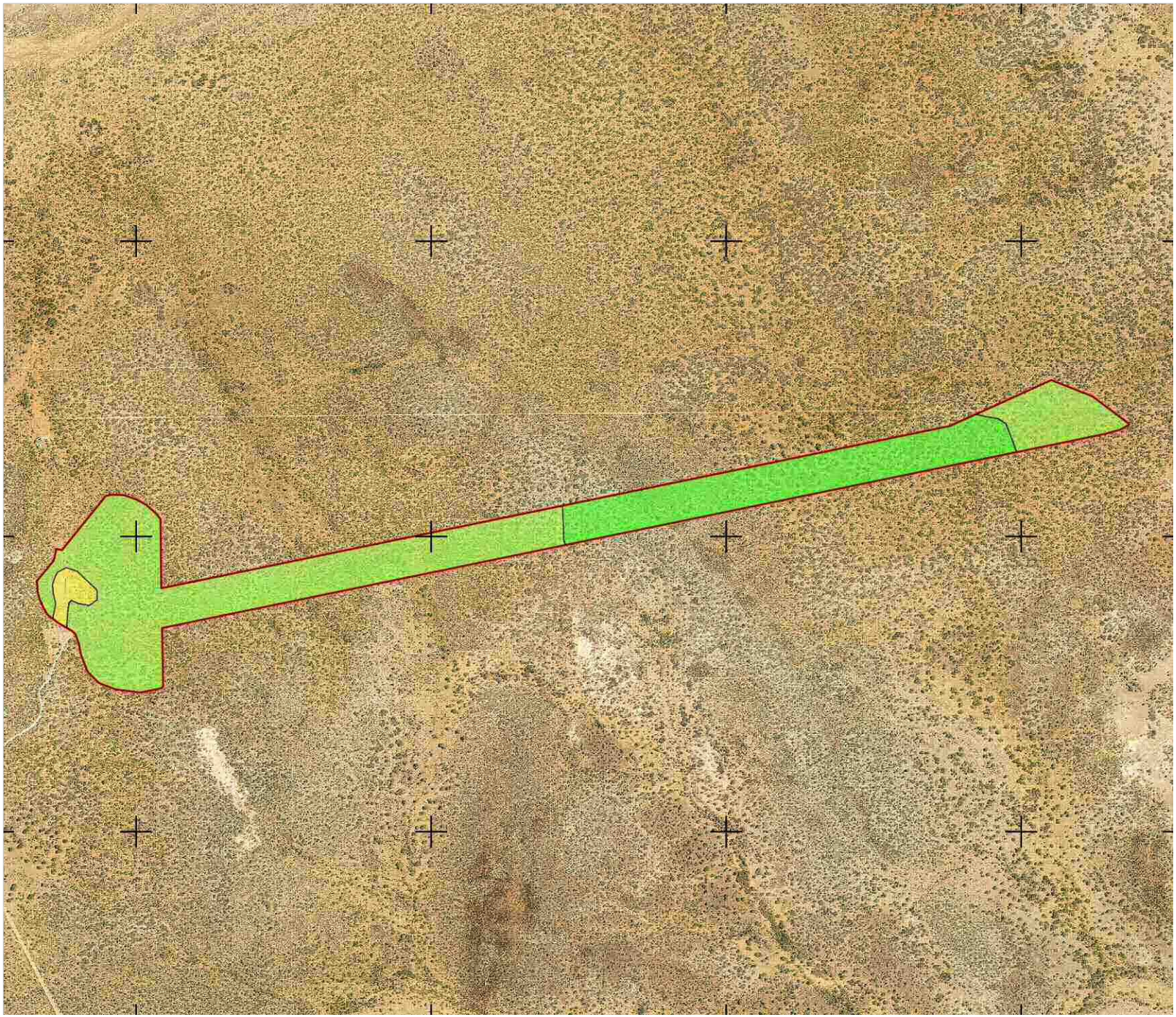
Author: AH Approved: DC Date: 25-09-2019

Vegetation Types Mapped at Rayjax Study Area

Rayjax to Castle Hill

Map 3.4

Prepared for
Evolution Mining



Legend

Study Area

- Rajax Mine study area

Vegetatoin Condition Mapping

- Pristine
- Excellent
- Good

N

0.25 0 0.25 km

Scale 1:27000 @ A4

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

Author: AH Approved: DC Date: 20-09-2019

Vegetation Condition Mapped at the Rayjax Study Area

Rayjax to Castle Hill

Map 3.5

Prepared for
Evolution Mining

3.2.3. Burgundy to Cutters Ridge Haul Road

Two vegetation types (iv, vii) were described for the Burgundy to Cutters Ridge study area and were derived from flat plains, and flat minor drainage (Map 3.6).

iv: *Eucalyptus salubris*, *E. clelandiorum* (+/-*E. salmonophloia*) mid open woodland over *Eremophila scoparia* and *Senna artemisiodes* ssp. *filifolia* mid open shrubland over *Atriplex* sp. and *Olearia muelleri* low open shrubland; and

vii: *Eucalyptus griffithsii* low woodland over *Senna artemisioides* and *Eremophila ionantha* mid sparse shrubland over *Acacia hemiteles* and *Grevillea acuaria* low sparse shrubland.

3.2.3.1. Significant Vegetation

There were no vegetation types that were identified as a TEC/PEC or significant due to historical impact from threatening processes, or provide a function to maintain ecological integrity of a significant ecosystem.

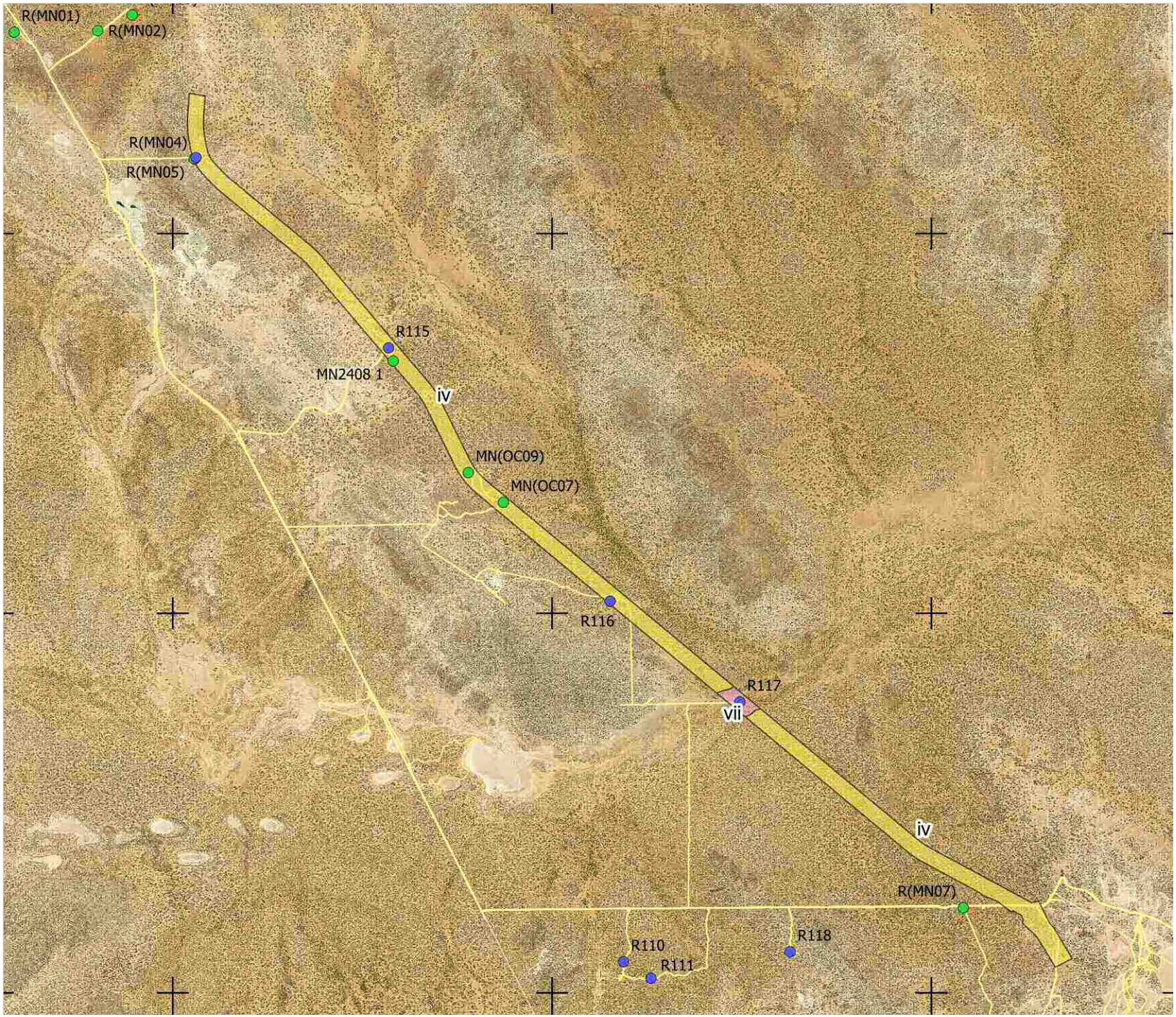
Vegetation type iv is the known habitat for Priority 1 species, *Eremophila praecox*, and is therefore considered significant as it plays a role in refugee. Vegetation type vii is restricted to a minor drainage channel in the Haul Road study area and therefore considered significant.

3.2.3.2. Vegetation Condition

Vegetation condition in the Burgundy to Cutters Ridge Haul Road study area is presented in Table 3.4 and mapped in Map 3.7. This study area was mostly assessed as Pristine with no obvious signs of disturbance. A small percentage in the south had areas disturbed with vehicle tracks, however the vegetation structure remained intact.

Table 3.4: Vegetation Condition at the Burgundy to Cutters Ridge Haul Road Study Area

Vegetation Condition	Area (ha)	% of Study Area	Disturbance Details
Pristine	326.6	92.2	Pristine or nearly so, no obvious signs of disturbance, or weeds.
Excellent	27.6	7.8	Vegetation structure intact, disturbance affecting individual species. Clearing for vehicle tracks present.



Legend

Study Areas

- Burgundy Mine & Cutters Ridge
- Rajax Mine study area
- Burgundy to Cutters Ridge Haul Road
- Burgundy & Cutters Ridge

Vegetation Units

- iv
- vii

Releves and Mapping Sites

- Notes
- Releve
- Tracks and traverses

N

Scale 1:70000 (0.5 0 0.5 1 km) @ A4

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

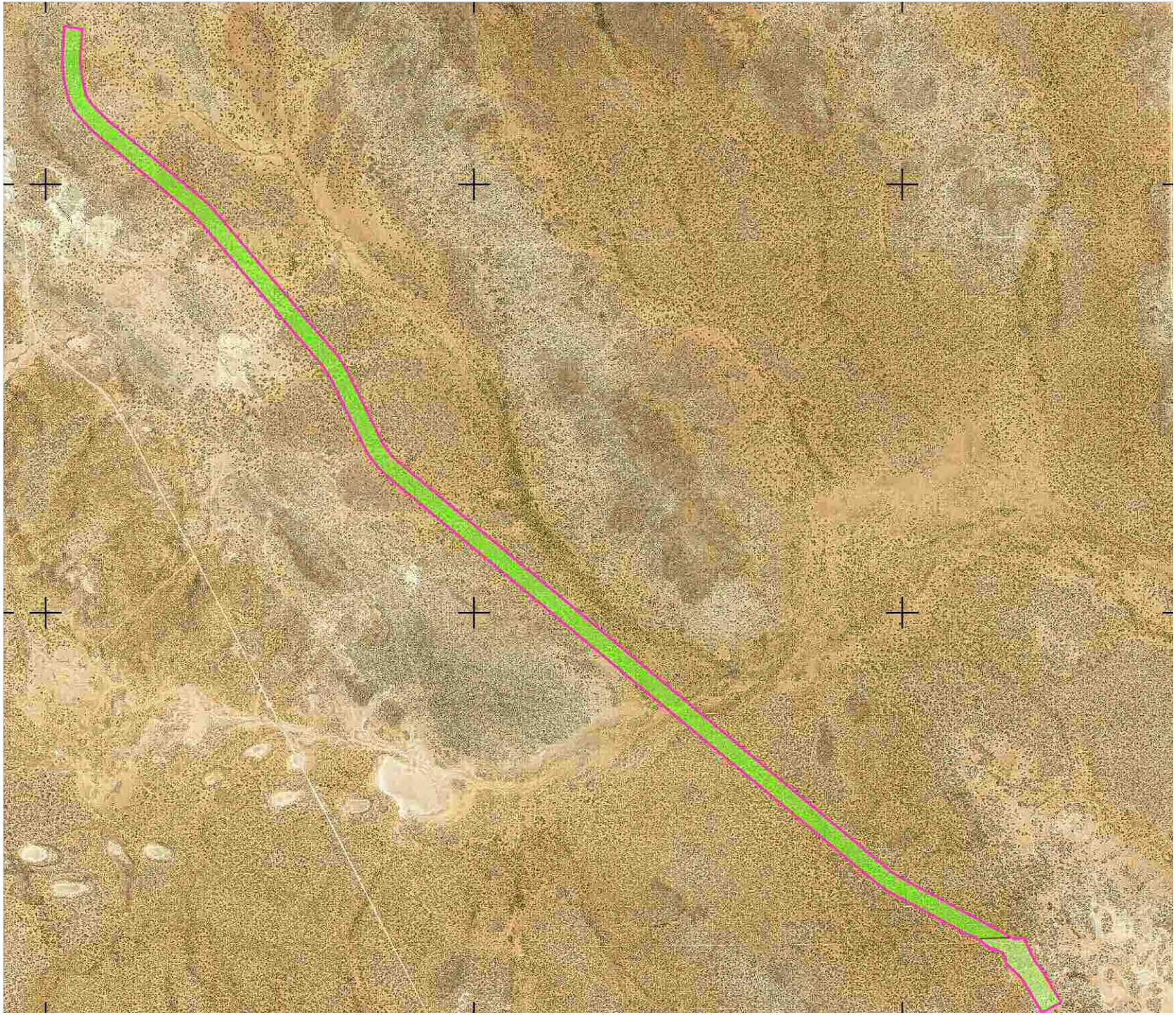
Author: AH Approved: DC Date: 25-09-2019

Vegetation Types Mapped at Burgundy to Cutters Ridge Haul Road Study Area

Rayjax to Castle Hill

Prepared for
Evolution Mining

Map
3.6



Legend

Study Area

- Burgundy to Cutters Ridge Haul Road

Vegetation Condition Mapping

- Pristine
- Excellent

N

0.5 0 0.5 km

Scale 1:62000 @ A4

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

Author: AH Approved: DC Date: 20-09-2019

Vegetation Condition Mapped at Burgundy to Cutters Ridge Haul Road

Rayjax to Castle Hill

Map 3.7

Prepared for
Evolution Mining

3.2.4. TSF

Five vegetation types (ii, iii, iv, v and xi) were described for the TSF study area and were derived from flat plains, claypans and minor floodplains (see Table 3.1 and Map 3.8).

ii: *Tecticornia halocnemoides* ssp. *halocnemoides*, *T. indica* ssp. *indica* and *T. chartacea* low open chenopod shrubland;

iii: *Eucalyptus yilgarnensis*, *E. salubris* and *E. clelandiorum* mid woodland over *Eremophila scoparia*, *Senna artemisiodes* ssp. *filifolia* mid open shrubland over *Ptilotus obovatus* low isolated shrubs;

iv: *Eucalyptus salubris*, *E. clelandiorum* (+/-*E. salmonophloia*) mid open woodland over *Eremophila scoparia* and *Senna artemisiodes* ssp. *filifolia* mid open shrubland over *Atriplex* sp. and *Olearia muelleri* low open shrubland;

v: *Casuarina pauper* low isolated trees over *Melaleuca laterifora* mid open shrubland over *Frankenia setosa* and *Atriplex stipitata* low open shrubland; and

xi: *Duma florulenta* mid sparse shrubland.

3.2.4.1. Significant Vegetation

There were no vegetation types that were identified as a TEC/PEC or significant due to historical impact from threatening processes, or provide a function to maintain ecological integrity of a significant ecosystem.

Vegetation type iv is the known habitat for Priority 1 species, *Eremophila praecox*, and is therefore considered significant as it plays a role in refuge.

Vegetation types ii and v are known habitat for the Priority 1 species, *Calandrinia lefroyensis*/*C. quartzitica* (taxonomy undetermined), as well as the taxonomically complex and often undescribed *Tecticornia* species and are therefore considered significant as it plays a role in refuge. Vegetation type ii also contains the taxonomically complex and often undescribed *Tecticornia* species and also is considered significant as it plays a role in refuge.

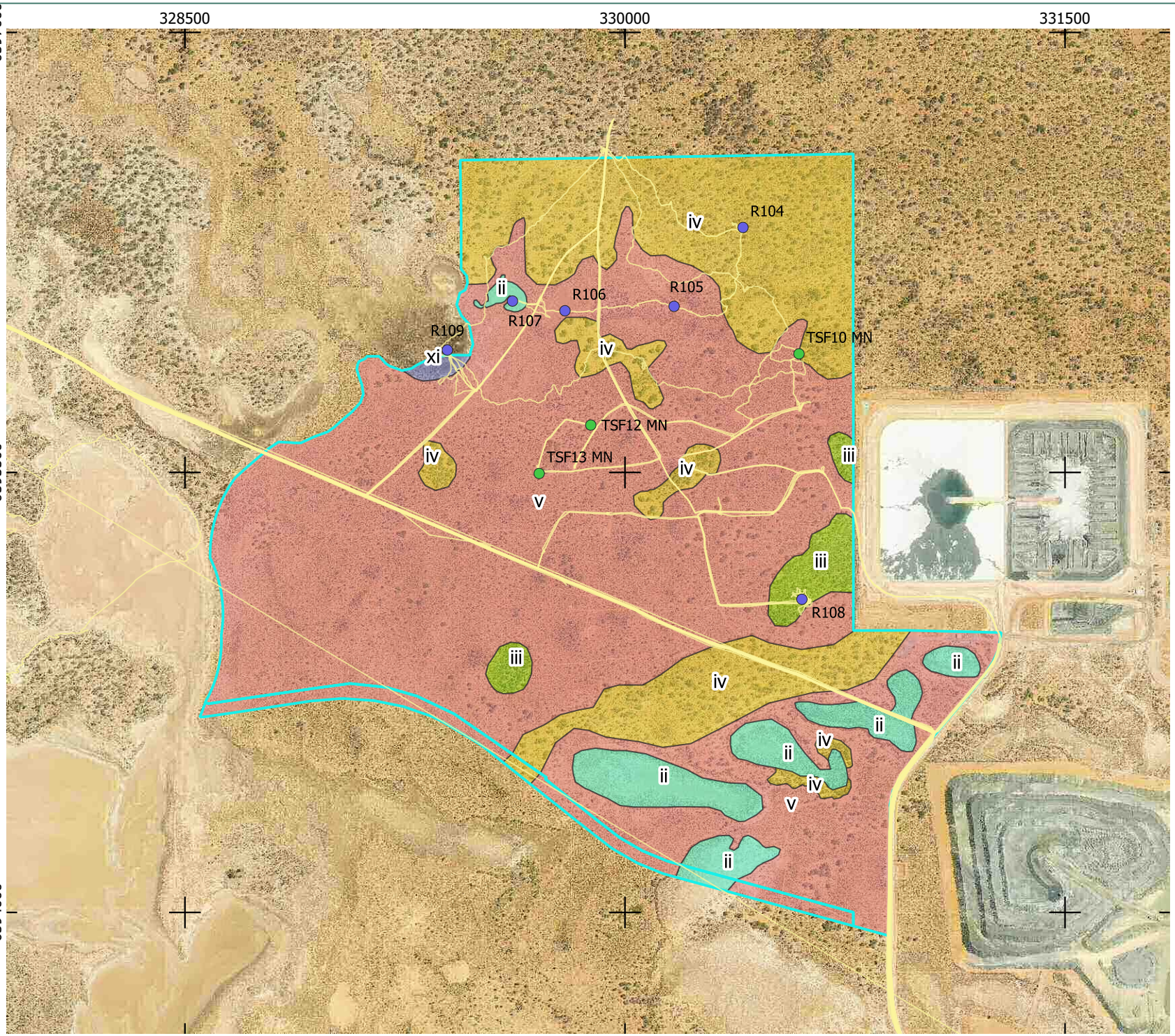
Vegetation types ii, iii and xi are restricted to areas associated with salt lakes in the TSF study area and therefore considered significant.

3.2.4.2. Vegetation Condition

Vegetation condition in the TSF study area is presented in Table 3.5 and mapped in Map 3.9. This study area was disturbed throughout with vehicle tracks and partial clearing for drill pads, however the vegetation structure remained mostly intact. This study area is in close proximity to the existing TSF and active mining Haul Road and the disturbances can be attributed to this.

Table 3.5: Vegetation Condition at the TSF Study Area

Vegetation Condition	Area (ha)	% of Study Area	Disturbance Details
Excellent	425.5	100.0	Vegetation structure intact, disturbance affecting individual species. Clearing for drill pads, lines and vehicle tracks.



Legend

Study Areas

- Burgundy Mine & Cutters Ridge
- Rajax Mine study area
- Burgundy to Cutters Ridge Haul Road
- Burgundy & Cutters Ridge

Vegetation Units

- ii
- iii
- iv
- v
- xi

Releves and Mapping Sites

- Notes
- Releve
- Tracks and traverses

N

0.25 0 0.25 km

Scale 1:18000 @ A4

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

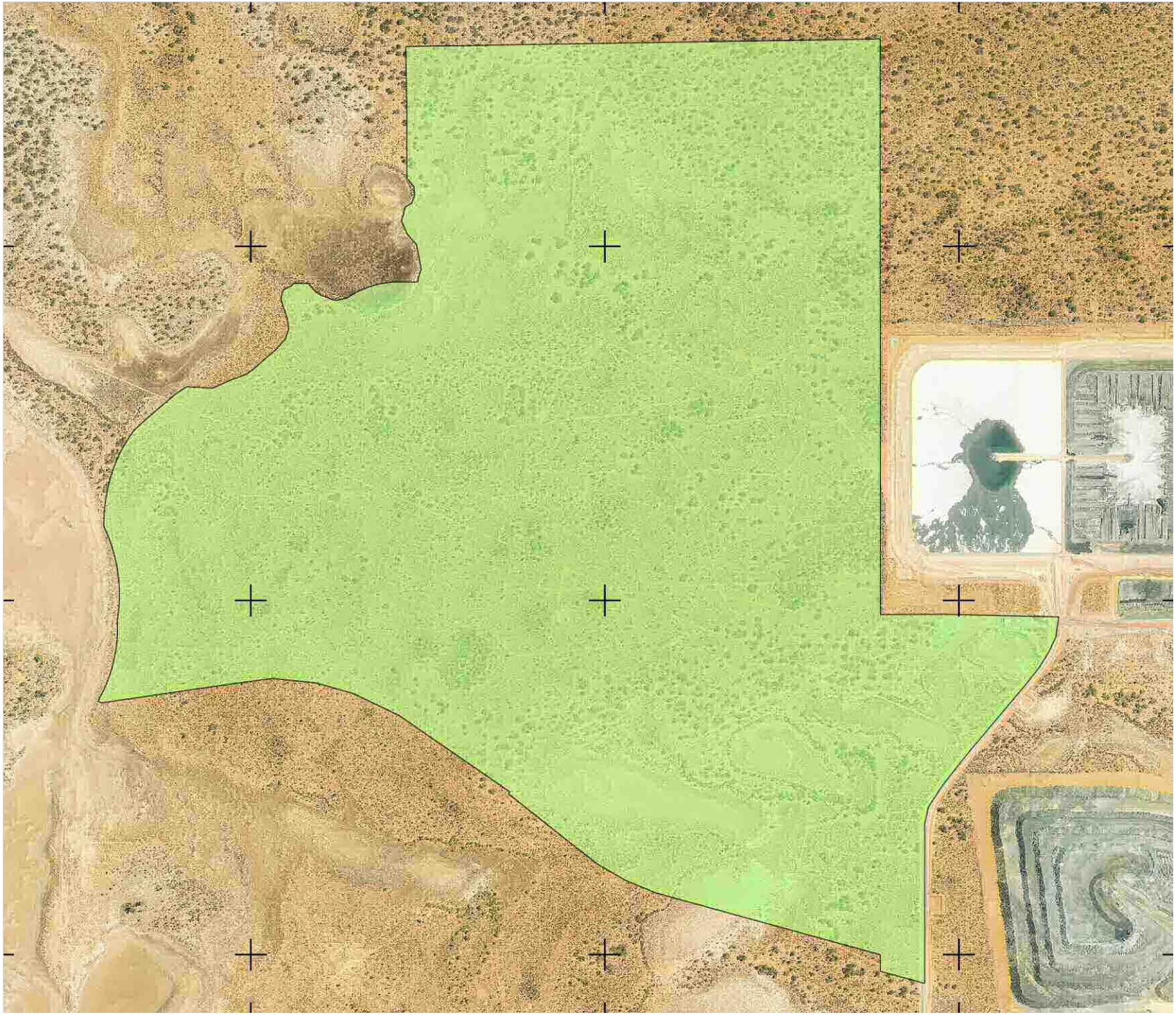
Author: AH Approved: DC Date: 25-09-2019

Vegetation Types Mapped at the TSF Study Area

Rayjax to Castle Hill

Map 3.8

Prepared for
Evolution Mining



Legend

Study Area

TSF 3 & 4

Vegetation Condition Mapping

Excellent

N

0.2 0 0.2 km

Scale 1:15000 @ A4

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

Author: AH Approved: DC Date: 20-09-2019

Vegtation Condition Mapped at the TSF Area

Rayjax to Castle Hill

Map

Prepared for
Evolution Mining

3.9

3.3. Fauna Habitat

3.3.1. Castle Hill

A total of four fauna habitat types were recorded from the Castle Hill study area. Their extent is listed in Table 3.6 and shown in Map 3.10, and their details are described in the sections below.

Table 3.6: Fauna Habitat Types at the Castle Hill Study Area

Habitat Type	Extent (ha)	% of Study Area	Associated Vegetation Type
Disturbed Eucalypt Woodland	94.4	20.9	Veg type i & x
Gentle Hillslope with Eucalypt Woodland	325.4	72.0	Veg type i, iv, vii, ix & x
Minor Drainage Line	25.9	5.7	Veg type i, vii, ix & x
Open Eucalypt Woodland over Open Tall Shrubs	6.0	1.3	Veg type x

3.3.1.1. Disturbed Eucalypt Woodland over Open Shrubland

The Disturbed Eucalypt Woodland over Open Shrubland was recorded from the northern area of the Castle Hill Mine study area. It covered 94.4 ha which represents 20.9% of the study area (Map 3.10). It was dominated by open eucalypt trees (*Eucalypt campaspe* and E. *salmonophloia*) over a low open shrub layer of *Eremophila interstants* over *Atriplex nummularia* and *Atriplex vesicaria* (Figure 3.2). Leaf litter was plentiful under trees and shrub thickets with some wood litter present. The substrate consisted of loamy clay with a slightly rocky mantle of small pebbles. The habitat type was intersected by previously cleared and disturbed areas which reduces the suitability for fauna due to fragmentation of the habitats. Some areas were rehabilitated.

Figure 3.2: Disturbed Woodland over Open Shrubland Habitat

3.3.1.2. Gentle Hillslope with Eucalypt Woodland

Gentle Hillslope with Open Eucalypt Woodland was the most commonly recorded habitat type from within the Castle Hill study area (Map 3.10). It covered 325.4 ha which represents 72.0% of the study area. It was characterised by rolling hills and hillslopes with an open layer of eucalypt trees *of Eucalyptus campaspe*, *E. griffithsii* and *E. salmonophloia*, and scattered *Casuraina obesa*. The understorey was typically sparse to

moderate and consisted of an open shrublayer of mixed lower shrubs of *Eremophila interstants*, *E. scoparia*, *E. interstans*, *Acacia hemiteles* over *Atriplex nummularia* and *A. vesicaria* (Figure 3.3). The substrate varied between loamy clay without pebbles to a heavier mantle of rocks and pebbles. Woodlitter and leaf litter was present under trees.

Figure 3.3: Gentle Hillslope with Eucalypt Woodland Habitat

3.3.1.3. Minor Drainage Line

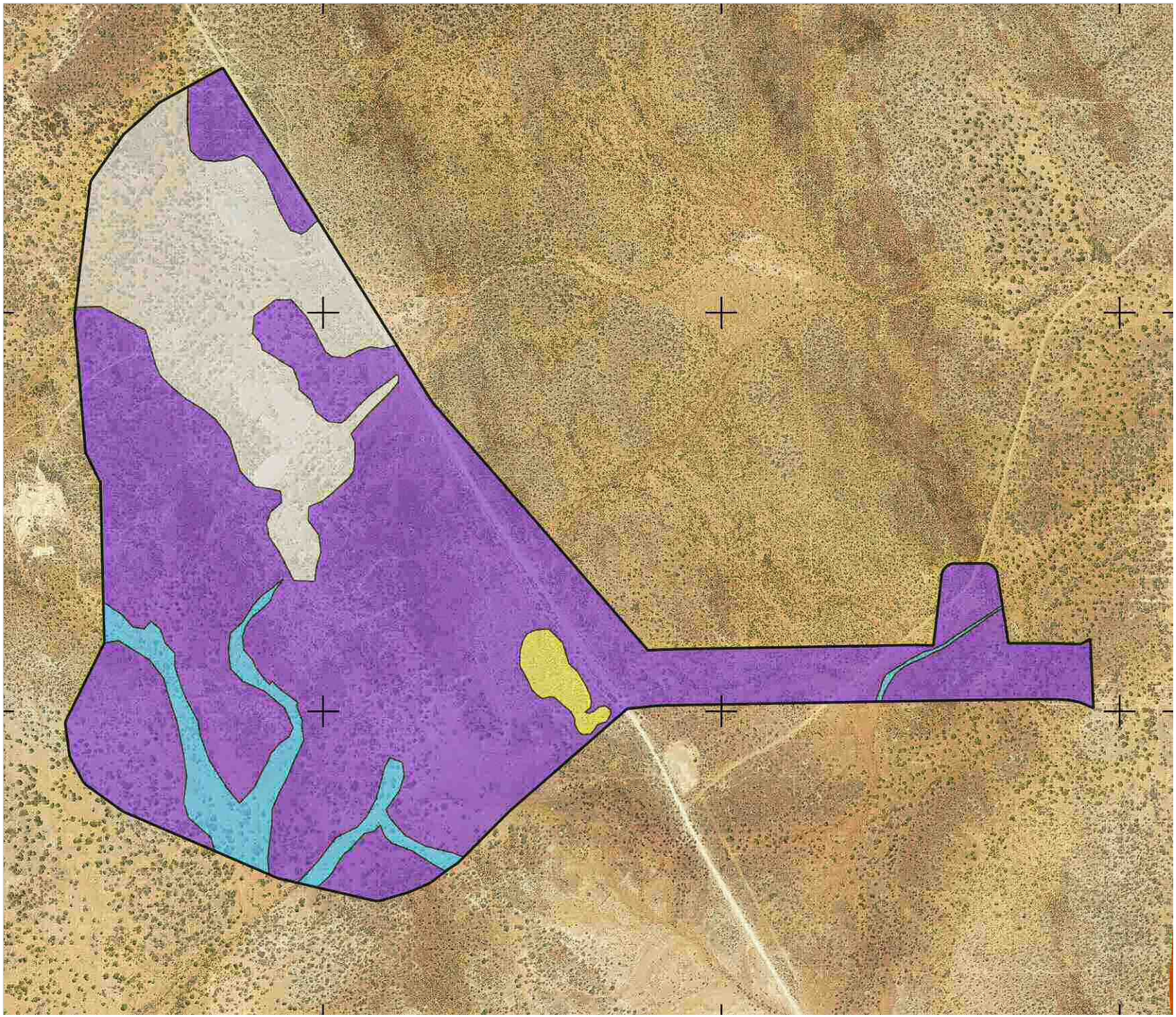
The Minor Drainage Line habitat was recorded from the south-west of the Castle Hill Mine and in the middle of the Haul Road (Map 3.10). It covered 25.9 ha which represents 5.7% of the study area. It is dominated by a very open vegetation layer comprising of fringing *Eucalyptus clelandiorum* over low open shrubs of *Eremophila scoparia*, *Acacia burkitti*, *Acacia tetragonophylla*, and *Atriplex nummularia* (Figure 3.4) Leaf litter was limited to underneath trees along the fringe of the Drainage Line. The substrate consisted of heavy clay with very few rocks.

Figure 3.4: Minor Drainage Line Habitat

3.3.1.4. Open Eucalypt Woodland over Tall Open Shrubs

This habitat type was recorded from the south-east of the Castle Hill Mine study area. It covered 6.0 ha which represent 1.3% of the Castle Hill study area (Map 3.10). The vegetation was dominated by scattered eucalypt trees of *Eucalyptus griffithsii* over an open to moderate layer of tall shrubs (*Acacia burkittii*). There was a lack of lower shrubs, grasses and other ground cover (Figure 3.5). The substrate comprised of heavy clay. Leaf litter was accumulated underneath trees and shrubs. The substrate comprised of heavy clay without rocks or pebbles. Wood litter was very sparse whereas leaf litter was present underneath the shrubs.

Figure 3.5: Open Eucalypt Woodland over Tall Open Shrubs Habitat



Legend

Study Area

- Castle Hill study area

Fauna Habitat Types

- Disturbed Eucalypt Woodland over Open Shrubland
- Gentle Hillslope with Eucalypt Woodland
- Minor Drainage Line
- Open Eucalypt Woodland over Open Tall Shrubs

N

0.25 0 0.25 km

Scale 1:20000 @ A4

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

Author: AH Approved: DC Date: 20-09-2019

Fauna Habitat Types at Castle Hill Study Area

Rayjax to Castle Hill

Map

Prepared for
Evolution Mining

3.10

3.3.2. Rayjax

Two fauna habitats were recorded from the Rayjax study area. Their extent is listed in Table 3.7 and shown in Map 3.11, and their details are described in the sections below.

Table 3.7: Fauna Habitat Types at the Rayjax Study Area

Habitat Type	Extent (ha)	% of Study Area	Associated Vegetation Type
Mixed Eucalypt Woodland	141.9	96.6	Veg type iv
Gentle Hillslope with Eucalypt Woodland	5.0	3.4	Veg type vi

3.3.2.1. Mixed Eucalypt Woodland

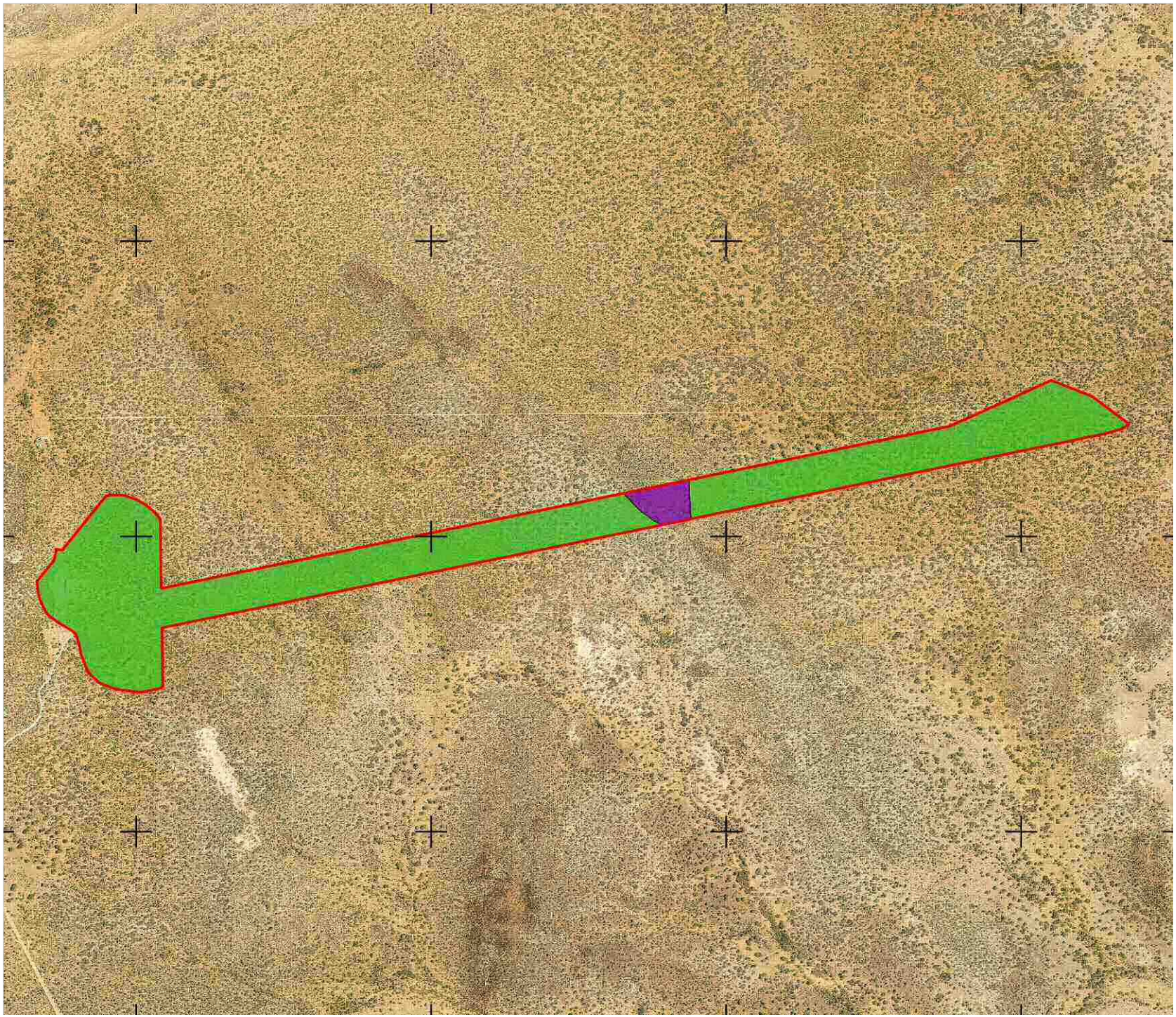
The Mixed Eucalypt Woodland was the most dominant habitat type throughout the Rayjax study area (Map 3.11). It covered 141.9 ha which represents 96.6% of the study area. The habitat type is characterised by a predominantly flat landscape. The vegetation comprised of a moderately open to dense woodland of *Eucalyptus salubris*, *E. clelandiorum* and *E. salmonophloia* over an open layer of mixed lower shrubs of *Eremophila scoparia*, *Senna artemisiodes*, *Atriplex* sp. and *Olearia muelleri*. The substrate consisted of brown sandy clay with leaf litter accumulated underneath trees and shrubs (Figure 3.6). Some pebbles (predominantly quartz) were present in some areas.

Figure 3.6: Mixed Eucalypt Woodland Habitat

3.3.2.2. Gentle Hillslope with Eucalypt Woodland

The Gentle Hillslope with Eucalypt Woodland was recorded from one location within the Rayjax Haul Road (Map 3.10). It covered 5.0 ha which represents 3.4% of the study area. a gentle hillslope dominated by a moderately open to dense woodland of *Eucalyptus moderata*, *E. oleosa* and *E. torquata* over an open layer of mixed lower shrubs of *Eremophila pustulata* E. *interstans*, *Acacia erinacea*, *Senna artimisioides*, *Atriplex vesicaria* and *Cratystylis conocephala*. (Figure 3.7). The substrate consisted of clay with some pebbles and plenty of leaf litter and moderate wood litter.

Figure 3.7: Gentle Hillslope with Eucalypt Woodland Habitat



Legend

Study Area

- Rajax Mine study area

Fauna Habitat Types

- Gentle Hillslope with Eucalypt Woodland
- Mixed Eucalypt Woodland

N

0.25 0 0.25 km

Scale 1:27000 @ A4

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

Author: AH Approved: DC Date: 20-09-2019

Fauna Habitat Types Rayjax Study Area

Rayjax to Castle Hill

Map 3.11

Prepared for Evolution Mining

3.3.3. Burgundy to Cutters Ridge Haul Road

A total of four fauna habitat types were recorded from the Burgundy to Cutters Ridge Haul Road study area. Their extent is listed in Table 3.8 and shown in Map 3.12, and their details are described in the sections below.

Table 3.8: Fauna Habitat Types at Burgundy to Cutters Ridge Haul Road

Habitat Type	Extent (ha)	% of Study Area	Associated Vegetation Type
Gentle Hillslope with Eucalypt Woodland	46.4	13.1	Veg type iv
Mixed Eucalypt Woodland	292.7	82.6	Veg type iv
Minor Drainage Line	6.8	1.9	Veg type iv
Floodplain	8.2	2.3	Veg type vii

3.3.3.1. Gentle Hillslope with Eucalypt Woodland

The Gentle Hillslope with Eucalypt Woodland vegetation type was recorded from the northern section of the Burgundy to Cutters Ridge Haul Road study area (Map 3.12). It intersected the study area from the western areas where it formed considerable hills. This habitat covered 46.4 ha which represents 13.1% of the study area. It was characterised by Gentle Hillslopes which were dominated by moderately open Eucalypt trees, *Eucalyptus moderata*, *E. oleosa* and *E. torquate*), over a moderate layer of *Eremophila pustulata* E. *interstans*, *Acacia erinacea*, *Senna artimisioides*, *Atriplex vesicaria* and *Cratystylis conocephala* (Figure 3.8). The substrate consisted of sandy clay which was dominate by rocks and pebbles in patches.

Figure 3.8: Rocky Hillslope with Eucalypt Woodland Habitat

3.3.3.2. Mixed Eucalypt Woodland

The Mixed Eucalypt Woodland recorded from the Burgundy to Cutters Ridge Haul Road was dominated by tall eucalypt trees which formed denser patches in some sections. It covered 292.7 ha which represents 82.6% of the study area. The vegetation consisted of a moderately open to dense woodland of *Eucalyptus salubris*, *E. clelandiorum* and *E. salmonophloia* over mixed low shrubs of *Eremophila scoparia*, *Senna artemisiodes*, *Atriplex* sp. and *Olearia muelleri* (Figure 3.9). Leaf litter was plentiful and accumulated under the patches of trees, sometimes building a thick layer of dried up leaves in addition to some wood litter.

Figure 3.9: Mixed Eucalypt Woodland Habitat

3.3.3.3. Minor Drainage Line

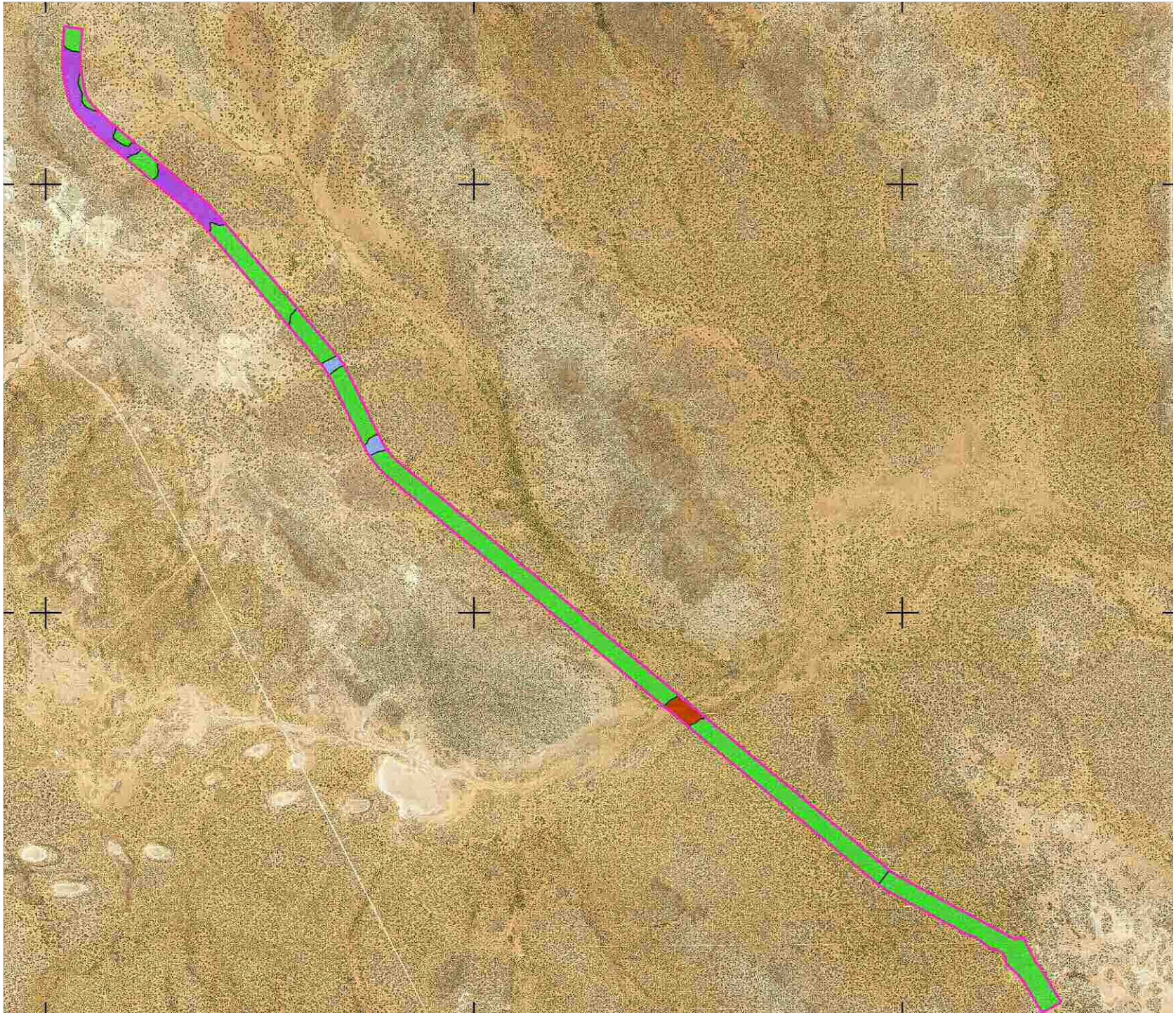
The Minor Drainage Line habitat was recorded from the centre of the Haul Road (Map 3.12). It covered 6.8 ha which represents 1.9% of the study area. It is dominated by a very open vegetation layer comprising of open eucalypt trees (*E. clelandiorum* and *E. salmonophloia)* over low open shrubs of *Eremophila scoparia, Senna artemisiodes*, *Atriplex* sp. and *Olearia muelleri* (Figure 3.10). Leaf litter was limited to trees along the fringe of the Drainage Line. The substrate consisted of heavy clay. Rocks and pebbles were generally lacking. This habitat is characterised by its areas of open or bare vegetation where water runs of after heavy rainfall events.

Figure 3.10: Minor Drainage Line Habitat

3.3.3.4. Floodplain

The floodplain was recorded at one location along the Burgundy to Cutters Ridge Haul Road (Map 3.12), covering 8.2 ha which represents 2.3% of the study area. The vegetation is dominated by scattered *Eucalyptus griffithsii* over an open tall shrubland of *Casuarina obesa* over a mixed lower shrublayer of *Senna artemisioides*, *Eremophila ionantha*, *Acacia hemiteles* and *Grevillea acuaria*, over patches of *Tecticornia halocnemoides* (Samphire) (Figure 3.11). The substrate comprises of firm clay with a thin layer of sand. Leaf litter accumulated under tall trees and shrubs but was otherwise sparse. Wood litter was sparse.

Figure 3.11: Floodplain Habitat



Legend

Study Area

- Burgundy to Cutters Ridge Haul Road

Fauna Habitat Types

- Gentle Hillslope with Eucalypt Woodland
- Minor Drainage Line
- Mixed Eucalypt Woodland
- Floodplain

N

0.5 0 0.5 km

Scale 1:62000 @ A4

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

Author: AH Approved: DC Date: 20-09-2019

Fauna Habitat Types at Burgundy to Cutters Ridge Haul Road

Rayjax to Castle Hill

Map

Prepared for
Evolution Mining

3.12

3.3.4. TSF

A total of four fauna habitat types were recorded from the TSF area. An area of cleared vegetation (1.0 ha) is also present within the north-east area of the TSF Area; however, this does not represent a fauna habitat type as such and has been excluded from the below sections. The extent of each habitat type is listed in Table 3.9 and shown in Map 3.13, and their details are described in the sections below.

Table 3.9: Fauna Habitat Types at the TSF Area

Habitat Type	Extent (ha)	% of Study Area	Associated Vegetation Type
Eucalypt Woodland over Open Shrubland	380.4	89.7	Veg type iii, iv & v
Mixed Dense Shrubland	15.3	3.6	Veg type v
Saltbush Shrubland	28.4	6.7	Veg type ii
Claypan	0.8	0.2	Veg type xi
Cleared	1.0	0.2	-

3.3.4.1. Eucalypt Woodland over Open Shrubland

The Eucalypt Woodland over Open Shrubland was the most dominant habitat type throughout the TSF study area (Map 3.13). It covered 380.4 ha which represents 89.7% of the study area. The vegetation comprised of isolated trees of *Casuarina pauper* and *Melaleuca laterifora* with patches of Eucalypt trees (*Eucalyptus yilgarnensis*, *E. salubris* and *E. clelandiorum*) over an open layer of lower shrubs of *Eremophila scoparia*, *Senna artemisiodes*, *Frankenia setosa* and *Atriplex stipitata* and *Ptilotus obovatus*. The substrate consisted of brown sandy clay with plentiful leaf litter accumulated underneath trees and shrubs (Figure 3.12). Some pebbles (predominantly quartz) were present in some areas.

Figure 3.12: Eucalypt Woodland over Open Shrubland Habitat

3.3.4.2. Mixed Dense Shrubland

The Mixed Dense Shrubland was recorded from patches in the south and middle of the TSF study area (Map 3.13). It covers approximately 15.3 ha which represents 3.6% of the study area. The vegetation comprises of a dense layer of tall and mid shrubs of *Casuarina pauper*, *Melaleuca lateriflora*, *Frankenia setosa* and *Atriplex*

stipitata on sandy clay. Leaf litter is present under large shrubs and trees (Figure 3.13). The substrate was dominated by loamy clay with a slightly sandy cover. Some scattered small rocks or pebbles were only recorded in small patches.

Figure 3.13: Mixed Dense Shrubland Habitat

3.3.4.3. Saltbush Shrubland

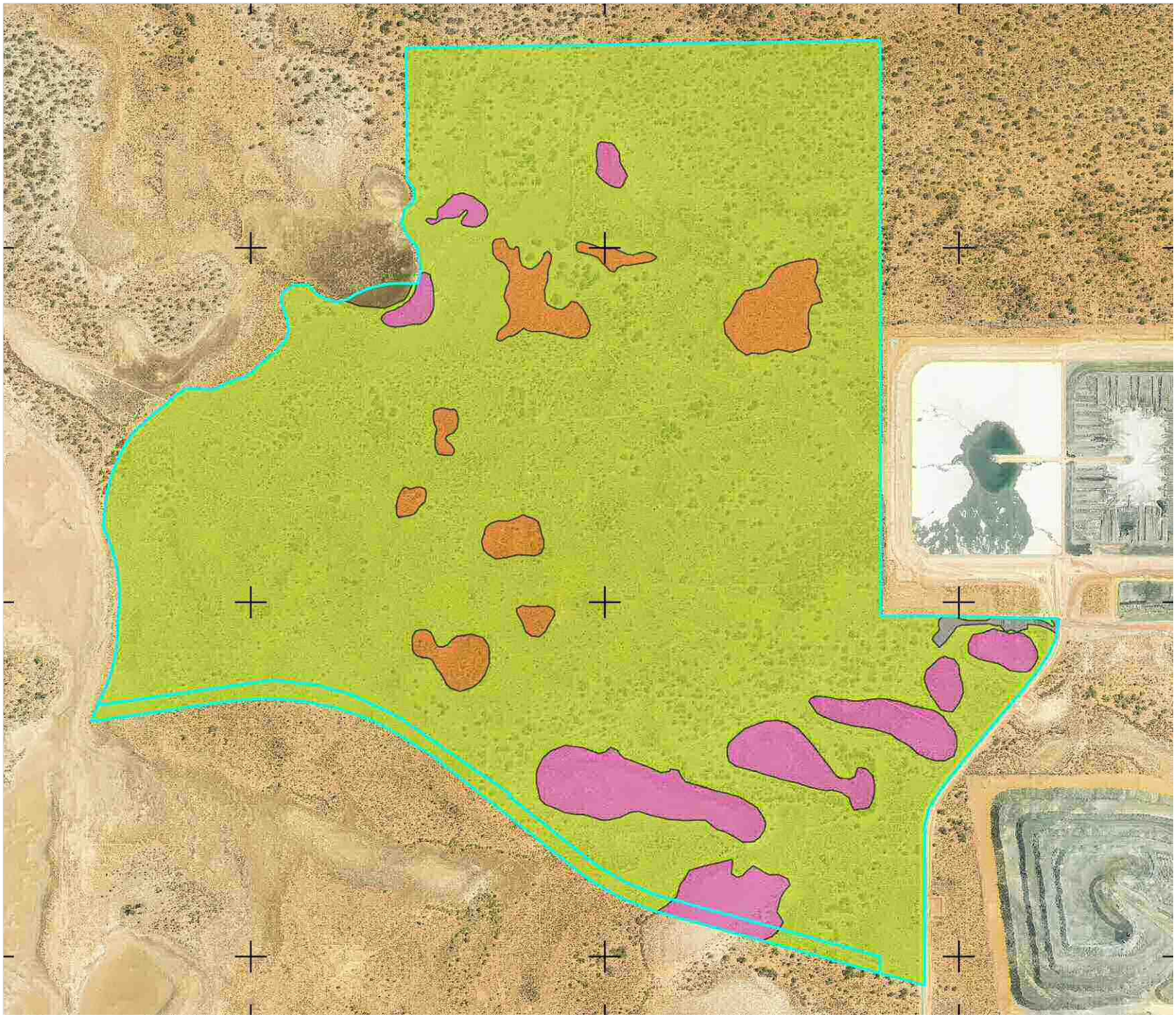
The Saltbush Shrubland habitat was recorded from the north-west and south-east section of the study area (Map 3.13). The Saltbush Shrubland habitat covered 28.4 ha which represents 6.6% of the TSF study area. It is dominated by Samphire shrubs (*Tecticornia halocnemoides*, *T. indica* and *T. chartacea*). The substrate was crusty loamy clay to sandy clay and leaf litter was very limited (Figure 3.14). Wood litter was absent from this habitat.

Figure 3.14: Saltbush Shrubland Habitat

3.3.4.4. Claypan

The Claypan habitat was recorded from the north-west corner of the TSF study area (Map 3.13). It covered 0.8 ha which represents 0.2% of the study area. It is characterised by a relatively uniform vegetation of *Duma florulenta* (Tangled Lignum) shrubs over grasses which were dried during the survey. Leaf litter and wood litter was generally absent (Figure 3.15). Due to the lack of trees and large shrubs, the substrate dries out quickly during the dry season and sun exposure would be high. During the time of the survey, the vegetation was predominantly dried out.

Figure 3.15: Claypan Habitat



Legend

Study Area

- TSF 3 & 4

Fauna Habitat Types

- Claypan
- Cleared
- Eucalypt Woodland over open Shrubland
- Mixed Dense Shrubland
- Saltbush Shrubland

N

0.2 0 0.2 km

Scale 1:15000 @ A4

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

Author: AH Approved: DC Date: 20-09-2019

Fauna Habitat Types at TSF Area

Rayjax to Castle Hill

Map 3.13

Prepared for Evolution Mining

3.4. Vertebrate Fauna

3.4.1. Castle Hill

A total of 11 vertebrate fauna species were recorded during the survey: one native mammal species, one introduced mammal species, and nine bird species (Table 3.10), all of which are widespread species. No species of conservation significance were recorded during the survey (Table 3.10). The introduced Rabbit is widespread in the area and secondary evidence in the form of scats and diggings has been sighted throughout the Castle Hill study area study area. The most commonly recorded bird species was the Purple-crowned Lorikeet which is likely to breed in hollow logs and eucalypt branches.

Table 3.10: Vertebrate Fauna Species Recorded - Castle Hill

Common Name	Scientific Name	Conservation Status	Comments/Details
Mammals			
Western Grey Kangaroo	*Macropus fuliginosus*	-	Scats & tracks
*Rabbit	*Oryctolagus cuniculus*	-	Scats & diggings
Birds			
Purple-crowned Lorikeet	*Parvipsitta porphyrocephala*	-	12 individuals
Striated Pardalote	*Pardalotus striatus*	-	3 individuals
Australian Ringneck	*Platycercus zonarius*	-	4 individuals
Galah	*Cactua roseicapilla*	-	4 individuals
Crested Bellbird	*Oreoica gutturalis*	-	2 individuals
Yellow-plumed Honeyeater	*Ptilotula ornata*	-	1 individual
Weebill	*Smicromis brevirostris*	-	10 individuals
Red Wattlebird	*Anthochaera carunculata*	-	2 individuals
Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*	-	1 individual

*Introduced Species

3.4.2. Rayjax

A total of eight vertebrate fauna species were recorded during the survey: one native mammal species, two introduced mammal species, four bird species, and one reptile (Table 3.10), all of which are widespread species. No species of conservation significance were recorded during the survey (Table 3.10). The Rabbit was recorded across the majority of the study area and surrounding area. The dog was recorded through secondary evidence only (scats). The most commonly recorded bird species was the Purple-crowned Lorikeet which was also recorded from the other study areas. One reptile species was recorded from within the Rayjax study area study area; the Bobtail (*Tiliqua rugosa*). The species is a common reptile across Western Australia (Table 3.10).

Table 3.11: Vertebrate Fauna Species Recorded - Rayjax

Common Name	Scientific Name	Conservation Status	Comments/Details
Mammals			
Western Grey Kangaroo	*Macropus fuliginosus*	-	Scats & tracks
*Rabbit	*Oryctolagus cuniculus*	-	Scats & diggings

Common Name	Scientific Name	Conservation Status	Comments/Details
*Dog	*Canis familiaris*	-	Scats
Birds			
Varied Sittella	*Daphoenositta chrysoptera*	-	3 individuals
Purple-crowned Lorikeet	*Parvipsitta porphyrocephala*	-	10 individuals
Willie Wagtail	*Rhipidura leucophrys*	-	1 individual
Yellow-plumed Honeyeater	*Ptilotula ornata*	-	4 individuals
Reptiles			
Bobtail	*Tiliqua rugosa*	-	remains

*Introduced Species

3.4.3. Burgundy to Cutters Ridge Haul Road

A total of 15 vertebrate fauna species were recorded during the survey: one native mammal species, three introduced mammal species, eight bird species and three reptiles (Table 3.10), all of which are widespread species. No species of conservation significance were recorded during the survey (Table 3.10). The three introduced species, Rabbit, Dog and Cattle, which were recorded through secondary evidence are widespread and commonly recorded in the area.

Table 3.12: Vertebrate Fauna Species Recorded – Burgundy to Cutters Ridge

Common Name	Scientific Name	Conservation Status	Comments/Details
Mammals			
Western Grey Kangaroo	*Macropus fuliginosus*	-	Scats
*Rabbit	*Oryctolagus cuniculus*	-	Scats
*Dog	*Canis familiaris*	-	Scats
*Cattle	*Bos taurus*	-	Scats and tracks
Birds			
Red Wattlebird	*Anthochaera carunculata*	-	2 individuals
Rufous Whistler	*Pachycephala rufiventris*	-	1 individual
Weebill	*Smicromis brevirostris*	-	3 individuals
Striated Pardalote	*Pardalotus striatus*	-	6 individuals
Purple-crowned Lorikeet	*Parvipsitta porphyrocephala*	-	4 individuals
Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*	-	1 individual
Yellow-plumed Honeyeater	*Ptilotula ornata*	-	1 individual
Chestnut Quail-thrush	*Cinclosoma castanotum*	-	1 individual
Reptiles			
Barking Gecko	*Underwoodisaurus milii*	-	1 individual
A skink	*Hemiergis initialis*	-	1 individual
A gecko	*Heteronotia binoei*	-	1 individual

*Introduced Species

3.4.4. TSF

A total of 13 vertebrate fauna species were recorded during the survey: one native mammal species, three introduced mammal species, and nine bird species (Table 3.10), all of which are widespread species. No Conservation Significant fauna species were recorded during the survey (Table 3.10). The three introduced species, Rabbit, Dog and Cattle, are commonly recorded in the area. All three species were recorded through secondary evidence. The Emu (2 individuals) was repeatedly recorded from the main access track in the southern section of the TSF Area. An inactive nest was recorded from outside the study area, and the frequent sightings of the adult individuals indicates that the species is a resident which breeds in the area.

Table 3.13: Vertebrate Fauna Species Recorded – TSF Area

Common Name	Scientific Name	Conservation Status	Comments/Details
Mammals			
Western Grey Kangaroo	*Macropus fuliginosus*	-	2 individuals & scats
*Rabbit	*Oryctolagus cuniculus*	-	Scats and diggings
*Dog	*Canis familiaris*	-	Scats
*Cattle	*Bos taurus*	-	Scats and tracks
Birds			
Emu	*Dromaius novaehollandiae*	-	2 individuals
Crested Bellbird	*Oreoica gutturalis*	-	2 individuals
Weebill	*Smicromis brevirostris*	-	3 individuals
Black-faced Woodswallow	*Artamus cinereus*	-	1 individual
White-winged Fairy-wren	*Malurus leucopterus*	-	Heard
Red Wattlebird	*Anthochaera carunculata*	-	3 individuals
White-eared Honeyeater	*Lichenostomus leucotis*	-	1 individual
White-fronted Honeyeater	*Purnella albifrons*	-	1 individual
Brown Falcon	*Falco berigora*	-	1 individual

*Introduced Species

3.5. Invertebrate SRE Fauna

3.5.1. Castle Hill

During the survey, 13 potential SRE invertebrate fauna taxa were collected from the Castle Hill study area. They consisted of six pseudoscorpions, two isopods, one centipede, three millipedes and one snail (Table 3.14). One of the five pseudoscorpions (*Chernetidae* sp.) and one of the three millipedes (*Unixenus* sp.) could not be identified to species level because the specimens were juveniles, and adult specimens are required for formal identification to species level. It could potentially belong to *Chernetidae* `BPS211` which was recorded from the Rayjax mine (Figure 3.16, Table 3.15).

Two individuals of the snail, *Basedowena* cf. *holoserica* were collected from the Castle Hill Mine and could potentially represent a new species, although resembling *Basedowena holoserica* (Figure 3.16).

Three of the recorded 13 taxa are shown on Figure 3.16: *Beierolpium* 8/4 sp. (C), *Buddelundia* `BIS352` (A), and *Basedowena* cf. *holoserica* (B).

Table 3.14: Recorded SRE Invertebrates – Castle Hill

Order/Family	Taxa	Location	Sampling Type (# of Sites)	Abundance	SRE Category
Pseudoscorpiones					
Garypinidae	*Amblyoplium* `BPS207`	Castle Hill Mine	Leaflitter (1)	1	Potential SRE
Cheiridiidae	*Apocheriridium* `BPS208`	Castle Hill Mine	Leaflitter (2)	4	Potential SRE
Olpiidae	*Beierolpium* 8/4 sp.	Castle Hill Mine	Leaflitter (1)	1	Potential SRE
Chernetidae	*Chernetidae* sp.	Castle Hill Mine	Leaflitter (3)	3	Potential SRE
Geogarypidae	*Geogarypus taylori*	Castle Hill Mine	Leaflitter (1)	1	Potential SRE
Cheliferidae	*Protochelifer* `BPS210`	Castle Hill Mine	Leaflitter (3)	3	Potential SRE
Isopoda					
Armadillidae	*Buddelundia* `BIS350`	Castle Hill & Castle Hill Haul Road	Foraging, Leaflitter (2)	3	Potential SRE
	Buddelundia `BIS352`	Castle Hill Mine	Leaflitter (1)	1	Potential SRE
Chilopoda					
Cryptopidae	*Cryptops* nr *hortensis*	Castle Hill Mine		1	Potential SRE
Diplopoda					
Polyxenidae	*Unixenus* sp.	Castle Hill Mine	Leaflitter (2)	2	Potential SRE
Scutigerellidae	*Hanseniella* `BSYM093`	Castle Hill Mine	Leaflitter (1)	1	Potential SRE
Siphonotidae	*Siphonotidae* `BDI064`	Castle Hill Mine	Leaflitter (4)	5	Potential SRE
Mollusc					
Camaenidae	*Basedowena* cf. *holoserica*	Castle Hill Mine	Foraging, Leaflitter (1)	2	Potential SRE

3.5.2. Rayjax

During the survey, nine potential SRE invertebrate fauna taxa were collected from the Rayjax study area. They consisted of four pseudoscorpions, one isopod, one centipede, three millipedes and one snail (Table 3.15). One of the pseudoscorpions (*Chernetidae* sp.) and one of the millipedes (*Antichiropus* sp., Figure 3.16) could not be identified to species level because the specimens were juveniles, and adult specimens are required for formal identification to species level. The pseudoscorpion could potentially belong to *Chernetidae* `BPS211` which was also recorded from the Rayjax study area (Figure 3.16).

One individual of the snail, *Basedowena* cf. *holoserica* was collected from the Rayjax Mine and could potentially represent a new species, although resembling *Basedowena holoserica* (Figure 3.16).

Six of the recorded nine taxa are shown on Figure 3.16: *Apocheriridium* `BPS209` (F), Chernetidae `BPS211` (H), *Acanthodillo* `BIS353` (G), *Antichiropus* sp. (E), *Phryssonotus novaehollandiae* (I) and *Basedowena* cf. *holoserica* (B).

Table 3.15: Recorded SRE Invertebrates – Rayjax

Order/Family	Taxa	Location	Sampling Type (# of Sites)	Abundance	SRE Category
Pseudoscorpiones					
Cheiridiidae	*Apocheriridium* `BPS208`	Rayjax	Leaflitter (1)	1	Potential SRE
	Apocheriridium `BPS209`	Rayjax	Leaflitter (2)	2	Potential SRE
Chernetidae	Chernetidae sp.	Rayjax	Leaflitter (1)	1	Potential SRE
	Chernetidae `BPS211`	Rayjax	Leaflitter (1)	1	Potential SRE
Isopoda					
Armadillidae	*Acanthodillo* `BIS353`	Rayjax	Leaflitter (1)	1	Potential SRE
Diplopoda					
Paradoxosomatidae	*Antichiropus* sp.	Rayjax	Foraging	1	Potential SRE
Synxenidae	*Phryssonotus novaehollandiae*	Rayjax	Leaflitter (1)	1	Potential SRE
Mollusc					
Camaenidae	*Basedowena* cf. *holoserica*	Rayjax & Rayjax Haul Road	Leaflitter (2)	1	Potential SRE
Pupillidae	*Gastrocopta bannertonensis*	Rayjax	Leaflitter (1)	1	Potential SRE

3.5.3. Burgundy to Cutters Ridge Haul Road

During the survey, 11 potential SRE invertebrate fauna taxa were collected from the Burgundy to Cutters Ridge Haul Road. They consisted of three pseudoscorpions, two isopods, one millipede and five snail (Table 3.16). One of the pseudoscorpions (*Chernetidae* sp.) could not be identified to species level because the specimen was a juvenile, and adult specimens are required for formal identification to species level. The pseudoscorpion could potentially belong to *Nesidiochernes* `BPS212` or Chernetidae `BPS211` which were recorded from the study area and Rayjax mine.

Two individuals of the snail, *Basedowena* cf. *holoserica* was collected from the Burgundy to Cutters Risge Haul Road and could potentially represent a new species, although resembling *Basedowena holoserica* (Figure 3.16).

Three of the recorded 11 taxa are shown on Figure 3.16: *Acanthodillo* `BIS353`(G), *Basedowena* cf. *holoserica* (B) and *Phryssonotus novaehollandiae* (I).

Table 3.16: Recorded SRE Invertebrates – Burgundy to Cutters Ridge Haul Road

Order/Family	Taxa	Location	Sampling Type (# of Sites)	Abundance	SRE Category
Pseudoscorpiones					
Cheiridiidae	*Apocheriridium* `BPS208`	Haul Road	Leaflitter (2)	6	Potential SRE
Chernetidae	Chernetidae sp.	Haul Road	Leaflitter (3)	3	Potential SRE
	Nesidiochernes `BPS212`	Haul Road	Leaflitter (1)	2	Potential SRE

Order/Family	Taxa	Location	Sampling Type (# of Sites)	Abundance	SRE Category
Isopoda					
Armadillidae	*Acanthodillo* `BIS353`	Haul Road	Leaflitter (1)	2	Potential SRE
	Acanthodillo `BIS350`	Haul Road	Foraging, Leaflitter (1)	4	Potential SRE
Polyxenida					
Synxenidae	*Phryssonotus novaehollandiae*	Haul Road	Leaflitter (2)	2	Potential SRE
Mollusc					
Camaenidae	*Basedowena* cf. *holoserica*	Haul Road	Foraging, Leaflitter (1)	2	Potential SRE
Pupillidae	*Gastrocopta bannertonensis*	Haul Road	Leaflitter (1)	1	Potential SRE
	Pupoides adelaidae	Haul Road	Leaflitter (1)	1	Potential SRE
Punctidae	*Westralaoma expicta*	Haul Road	Leaflitter (1)	2	Potential SRE
Succineidae	*Succinae* sp.	Haul Road	Leaflitter (1)	1	Potential SRE

3.5.4. TSF Study Area

During the survey, five potential SRE invertebrate fauna taxa were collected from the TSF Area. They consisted of one pseudoscorpion, one isopod, one geophilomorph and two snail (Table 3.17). One of the pseudoscorpions (*Chernetidae* sp.) could not be identified to species level because the specimen was a juvenile, and adult specimens are required for formal identification to species level. It could potentially belong to the taxa Chernetidae `BPS211` which was recorded from the Rayjax mine (Figure 3.16, Table 3.15)

One individual of the snail, *Basedowena* cf. *holoserica* was collected from the TSF Area and could potentially represent a new species, although resembling *Basedowena holoserica* (Figure 3.16).

The recorded geophilomorph *Sepedonophilus* `BGE043` (D) is shown for reference on Figure 3.16.

Table 3.17: Recorded SRE Invertebrates

Order/Family	Taxa	Location	Sampling Type (# of Sites)	Abundance	SRE Category
Pseudoscorpiones					
Chernetidae	Chernetidae sp.	TSF	Leaflitter (1)	1	Potential SRE
Isopoda					
Armadillidae	*Buddelundia* `BIS350`	TSF	Foraging, Leaflitter (1)	2	Potential SRE
Geophilida					
Chilenophilidae	*Sepedonophilus* `BGE043`	TSF	Foraging	1	Potential SRE
Mollusc					
Camaenidae	*Basedowena* cf. *holoserica*	TSF	Foraging	1	Potential SRE
	Sinumelon kalgum	TSF	Foraging	1	Potential SRE

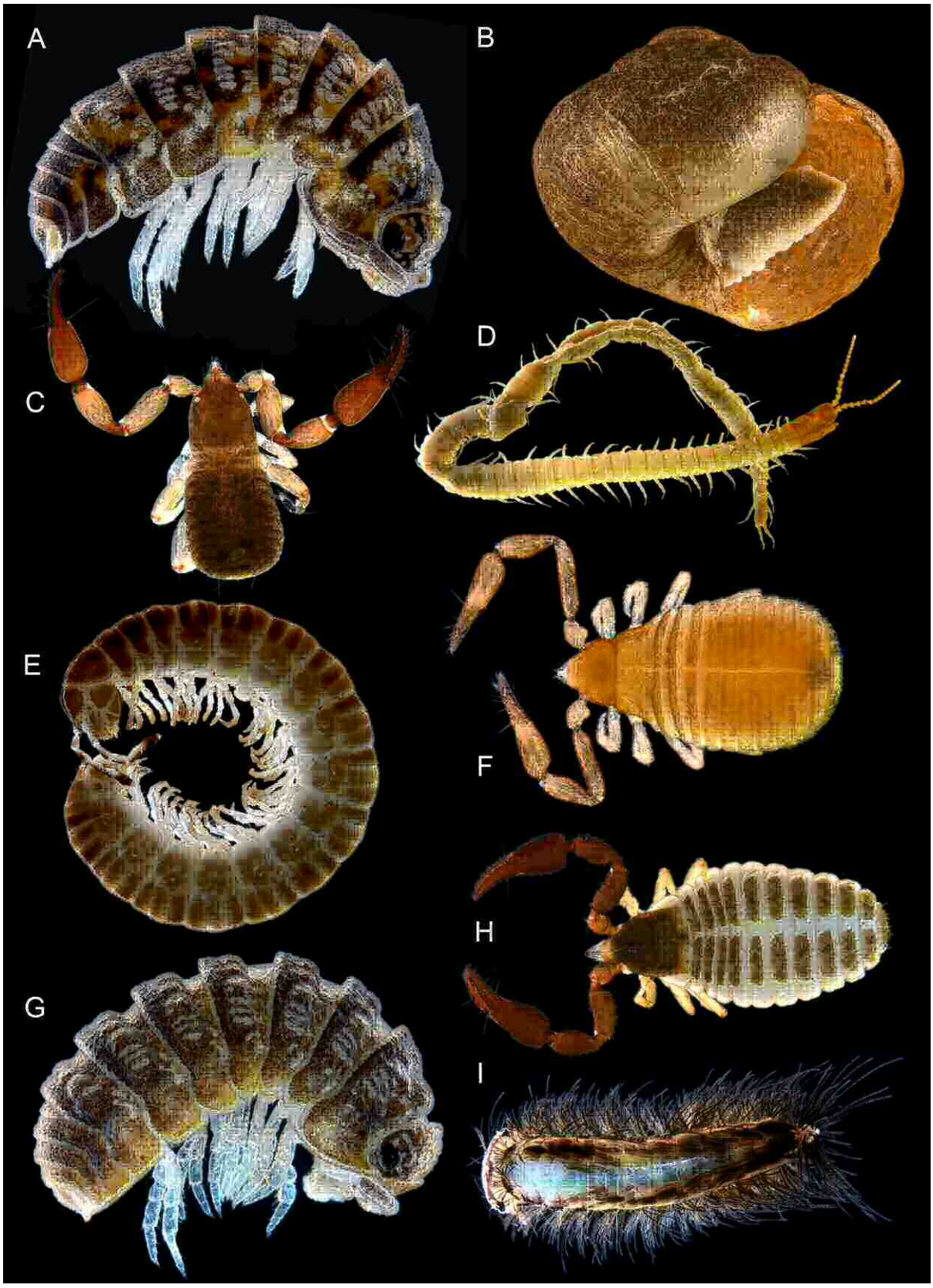
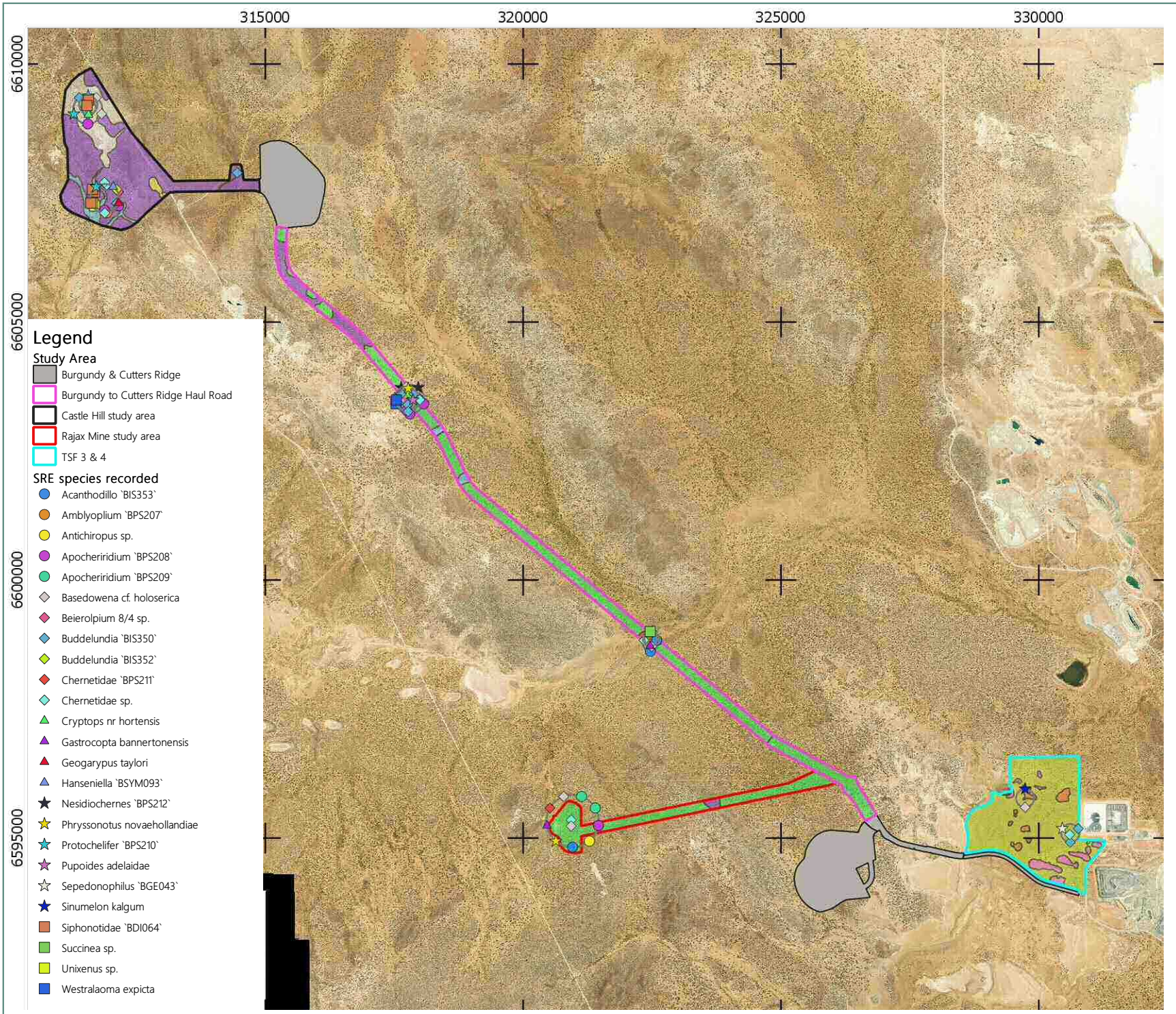


Figure 3.16: Selection of SRE Invertebrate Fauna Species Recorded from the Study Areas

A-Buddelundia `BIS352`; B-Basedowena cf. holoserica; C-Beierolpium 8/4sp.; D-Sepedonophilus `BGE043`; E-Anichiropus sp. F-Apocheridium `BSP209`; G-Acanthodillo `BIS353`; H-Chernetidae `BPS211`; I-Phryssonotus novaehollandiae



N

1 0 1 2 km

Scale 1:100000 @ A4

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

Author: AH Approved: DC Date: 20-09-2019

SRE Species recored during the survey

Rayjax to Castle Hill

Map

Prepared for
Evolution Mining

3.14

4. DISCUSSION

4.1. Flora

4.1.1. Threatened Flora

Two threatened flora taxa were recorded during the database searches: *Conostylis lepidospermoides* (EPBC Act: Endangered, BC Act: Vulnerable) and *Gastrolobium graniticum* (EPBC Act: Endangered, BC Act: Vulnerable). They were both assigned a Medium likelihood of occurrence as they occur within 14 km and 19 km, respectively, and suitable habitat may occur within the study areas which is discussed below for each species.

Conostylis lepidospermoides is known to occur on flat or gently undulating plains in yellow or grey sand over laterite clay, in low heath and sedge communities with other scattered emergent species. The previous record in the region falls on one geological unit (Czc) which is also located within the Castle Hill study area, Rayjax study area and Burgundy to Cutters Ridge Haul Road study area, and therefore potential habitat could occur within these areas.

Gastrolobium graniticum is known to occur on the margins of granite outcrops, especially along drainage lines, on sandy soils in open woodland in association with *Allocasuarina huegeliana*. Previous records fall on five geological units (Qa, Czc, Czl, Agb and As) which also occur within the Castle Hill study area (Czl & Czc), the Rayjax study area (Czc), and the Burgundy to Cutters Ridge Haul Road study area (Czc, QA, As and Czl), and therefore potential habitat could occur within these areas.

4.1.2. Local and Regional Significance

Potential impacts to significant flora recorded at the study areas during the survey and in the desktop assessment are considered at a local and regional scale. Significant flora recorded in the vicinity of the study areas during the database searches, and assigned a high likelihood of occurrence, are also presented in Table 4.1.

Priority flora that are considered to have high significance at a local scale, if impacted at the study area include: *Calandrinia lefroyensis/quartzitica* (Priority 1), and *Calandrinia* sp. Gypsum (F. Obbens & L. Hancock FO 10/14) (SOI) (both recorded during the database searches). An additional three species are considered to have low significance at a local scale: *Eremophila praecox* (P1), *Allocasuarina eriochlamys* sp. *grossa* (P3), and *Eucalyptus jutsonii* subsp. *jutsonii* (P4).

Priority flora that are considered to have high significance at a regional scale, if impacted at the study area include: *Calandrinia lefroyensis/quartzitica* (Priority 1; recorded during the database searches). The remaining five species listed in Table 4.1 have low significance at a regional scale.

Table 4.1: Local and Regional Significance of the Flora of the Study Area

Status & Record	Taxa	Local Significance at the Study Area	Regional Significance at the Study Area	Study Areas
Priority 1				
Desktop	*Calandrinia lefroyensis/ quartzitica*	Uncommon in the local area, only two locations recorded previously – high local significance.	Only known from a small area south of the study area with a range of less than 100 km (*C. lefroyensis*) and common in the Murchison but not recorded in the Coolgardie region before (*C. quartzitica)*, – high regional significance.	Castle Hill: No habitat present Rayjax: No habitat present Haul Road: No habitat present TSF: Previously recorded closeby and habitat present (veg ii)
	Eremophila praecox	Common in the local area, 18 locations within 40 km with one record 350 m east of the Burgundy to Cutters Ridge Haul Road – low local significance.	Known from two areas in the Coolgardie region over a 200 km range – low regional significance.	Castle Hill: Habitat present (veg iv) Rayjax: Habitat present (veg iv) Haul Road: Habitat present/recorded closeby (veg iv) TSF: Habitat present (veg iv)
Priority 3				
Current Survey	*Allocasuarina eriochlamys* subsp. *grossa*	Common in the local area, three locations with numerous records surrounding the study area – low local significance.	Known from many records spanning over 500 km across the Coolgardie and Nullarbor regions – low regional significance.	Castle Hill: No habitat present Rayjax: No habitat present Haul Road: Recorded 450 m west of study area during current survey, no habitat present TSF: No habitat present
Desktop	*Austrostipa blackii*	Uncommon in the local area with two known locations surrounding the study areas – low local significance.	Known from many records spanning over 700 km throughout the Coolgardie, Nullarbor and Yalgoo IBRA regions – low regional significance.	Castle Hill: No habitat present Rayjax: Habitat present (veg vi) Haul Road: No habitat present TSF: No habitat present
Priority 4				
Desktop	*Eucalyptus jutsonii* subsp. *jutsonii*	Common in the local area with known locations surrounding the study areas – low local significance.	Known from many records spanning over 300 km across the Coolgardie and Murchison regions – low regional significance.	Castle Hill: No habitat present Rayjax: No habitat present Haul Road: Habitat present (veg vii) TSF: No habitat present
Species of Interest				

Status & Record	Taxa	Local Significance at the Study Area	Regional Significance at the Study Area	Study Areas
Desktop	*Calandrinia* sp. Gypsum (F. Obbens & L. Hancock FO 10/14)	One known location recorded from the local area and a northerly range extension for the species – high local significance.	Known from many records spanning over 1000 km across the Wheatbelt, Coolgardie, Esperance Plains and Mallee regions – low regional significance.	Castle Hill: No habitat present Rayjax: No habitat present Haul Road: Habitat present (veg vii) TSF: No habitat present

4.2. Vegetation

4.2.1. Vegetation Resembling TEC or PECs

None of the vegetation units recorded resemble the Emu land system PEC, or other known TEC or PECs from the Coolgardie region.

4.2.2. Local and Regional Significance

The local significance of the eight vegetation units considered significant are described in Table 4.2.

Table 4.2: Significant Vegetation Recorded at the Study Areas

Unit	Description	Reason	Study Areas	Locally Significant
ii	*Tecticornia halocnemoides* ssp. *halocnemoides*, *T. indica* ssp. *indica* and *T. chartacea* low open chenopod shrubland	Role as refugee for P1 *Calandrinia lefroyensis/C. quartzitica* and complex *Tecticornia* species	TSF	High – Provides habitat for flora with a high local significance.
iii	*Eucalyptus yilgarnensis*, *E. salubris* and *E. clelandiorum* mid woodland over *Eremophila scoparia*, *Senna artemisiodes* ssp. *filifolia* mid open shrubland over *Ptilotus obovatus* low isolated shrubs	Restricted	TSF	Low – likely to be widespread throughout local area based on Beard
iv	*Eucalyptus salubris*, *E. clelandiorum* (+/-*E. salmonophloia*) mid open woodland over *Eremophila scoparia* and *Senna artemisiodes* ssp. *filifolia* mid open shrubland over *Atriplex* sp. and *Olearia muelleri* low open shrubland	Role as refugee for P1	Castle Hill, Rayjax, Haul Road and TSF	Low – widespread throughout local area
v	*Casuarina pauper* low isolated trees over *Melaleuca lateriflora* mid open shrubland over *Frankenia setosa* and *Atriplex stipitata* low open shrubland	Role as refugee for P1 *Calandrinia lefroyensis/C. quartzitica*	TSF	High – uncommon in local area and provides habitat for flora with a high local significance
vi	*Eucalyptus moderata*, *Eucalyptus oleosa* and *E. torquata* tall mallee woodland over *Eremophila pustulata* and *Eremophila interstans* ssp. *interstans* tall sparse shrubland over *Acacia erinacea*, *Senna artimisioides* ssp. f*ilifolia*, and *Atriplex vesicaria* low sparse shrubland	Restricted	Rayjax	Low – likely to be widespread throughout local area based on Beard
vii	*Eucalyptus griffithsii* low woodland over *Senna artemisioides* and *Eremophila ionantha* mid sparse shrubland over *Acacia hemiteles* and *Grevillea acuaria* low sparse shrubland	Restricted	Haul Road	High – possibly restricted in the local area based on Beard
viii	*Eucalyptus griffithsii* low woodland over *Eremophila scoparia*, *E. interstans* ssp. *virgata* and *Acacia hemiteles* mid to tall open shrubland	Restricted	Castle HIll	Low – likely to be widespread throughout local area based on Beard
xi	*Duma florulenta* mid sparse shrubland	Restricted	TSF	Low – likely to be widespread throughout local area based on Beard

The best available regional vegetation dataset available to assess the regional distribution and significance of the vegetation of the study area is the pre-European vegetation mapping originally undertaken by Beard (Department of Primary Industry and Regional Development, 2019). To assess if any of the vegetation types recorded in the study area are regionally significant, they have been aligned with the pre-European vegetation units as listed in Table 4.3 . The majority of the vegetation types loosely align with a pre-European unit, which indicates that these vegetation types are more widespread throughout the region as they are associated with these larger units.

One vegetation type (vii) geographically aligns with pre-European vegetation unit 221, however the species are not similar. This unit is restricted within the Coolgardie region (11,764 ha) and it is therefore possible that vegetation type vii is also restricted in the region and is therefore considered potentially regionally significant.

Table 4.3: Vegetation Types Mapped at the Study Area and Pre-European Vegetation Units

Unit	NVIS Level IV Vegetation Association	Area in Study Areas (ha)	Current Extent Coolgardie (ha)	Vegetation Types at the Study Area
9	*Eucalyptus torquata, E. lesouefii, E. clelandiorum* (syn: *clelandii*) low woodland over *Eremophila scoparia, E. glabra, E. oldfieldii* tall sparse heathland and sparse chenopod shrubland over isolated ground species	211.4	235,101	iv: *Eucalyptus salubris*, *E. clelandiorum* (+/-*E. salmonophloia*) mid open woodland over *Eremophila scoparia* and *Senna artemisiodes* ssp. *filifolia* mid open shrubland over *Atriplex* sp. and *Olearia muelleri* low open shrubland vi: *Eucalyptus moderata*, *Eucalyptus oleosa* and *E. torquata* tall mallee woodland over *Eremophila pustulata* and *Eremophila interstans* ssp. *interstans* tall sparse shrubland over *Acacia erinacea*, *Senna artimisioides* ssp. *filifolia*, and *Atriplex vesicaria* low sparse shrubland
221	Isolated trees and isolated shrubs over *Atriplex* sp. low open shrubland and open chenopod shrubland	10	11,764	vii: *Eucalyptus griffithsii* low woodland over *Senna artemisioides* and *Eremophila ionantha* mid sparse shrubland over *Acacia hemiteles* and *Grevillea acuaria* low sparse shrubland
468	*Eucalyptus salmonophloia, E. dundasii* mid woodland over isolated shrubs and isolated ground species	639.9	430,756	i: *Eucalyptus campaspe* and *E. salmonophloia* mid open woodland over *Atriplex nummularia* ssp. *spathulata* and *Eremophila interstans* ssp. *interstans* mid sparse shrubland over *Atriplex vesicaria* low sparse shrubland ix: *Eucalyptus clelandiorum* tall mallee woodland over *Eremophila scoparia*, *Acacia burkittii* and *Atriplex nummularia* ssp. *spathulata* low sparse shrubland x: *Eucalyptus griffithsii* low isolated trees over *Acacia burkittii*, *Eremophila scoparia* and *Atriplex nummularia* ssp. *spathulata* mid to tall open shrubland viii: *Eucalyptus griffithsii* low woodland over *Eremophila scoparia*, *E. interstans* ssp. *virgata* and *Acacia hemiteles* mid to tall open shrubland iv: *Eucalyptus salubris*, *E. clelandiorum* (+/-*E. salmonophloia*) mid open woodland over *Eremophila scoparia* and *Senna artemisiodes* ssp. *filifolia* mid open shrubland over *Atriplex* sp. and *Olearia muelleri* low open shrubland
468.1 - mosaic	*Eucalyptus lesouefii, E. salmonophloia, E. transcontentalis* tall woodland, over *Eremophila scoparia, E. alternifolia, E. decipiens* tall open shrubland	120.9	61,727	iv: *Eucalyptus salubris*, *E. clelandiorum* (+/-*E. salmonophloia*) mid open woodland over *Eremophila scoparia* and *Senna artemisiodes* ssp. *filifolia* mid open shrubland over *Atriplex* sp. and *Olearia muelleri* low open shrubland
520	Isolated trees over *Acacia quadrimarginea* tall shrubland over isolated ground species	33.0	30,194	-

Unit	NVIS Level IV Vegetation Association	Area in Study Areas (ha)	Current Extent Coolgardie (ha)	Vegetation Types at the Study Area
540.1	*Casuarina cristata* subsp *cristata, Myoporum platycarpum, Callitris columellaris* low open woodland over *Eremophila miniata, Grevillea sarissa* tall sparse shrubland over *Atriplex hymenotheca* low open shrubland and low open chenopod shrubland	363.1	48,376	v: *Casuarina pauper* low isolated trees over *Melaleuca laterifora* mid open shrubland over *Frankenia setosa* and *Atriplex stipitata* low open shrubland iv: *Eucalyptus salubris*, *E. clelandiorum* (+/-*E. salmonophloia*) mid open woodland over *Eremophila scoparia* and *Senna artemisiodes* ssp. *filifolia* mid open shrubland over *Atriplex* sp. and *Olearia muelleri* low open shrubland ii: *Tecticornia halocnemoides* ssp. *halocnemoides*, *T. indica* ssp. *indica* and *T. chartacea* low open chenopod shrubland iii: *Eucalyptus yilgarnensis*, *E. salubris* and *E. clelandiorum* mid woodland over *Eremophila scoparia, Senna artemisiodes* ssp. *filifolia* mid open shrubland over *Ptilotus obovatus* low isolated shrubs xi: *Duma florulenta* mid sparse shrubland

4.3. Fauna

4.3.1. Fauna Habitats

All habitat types recorded from the survey are commonly recorded in the region and are not restricted to the study areas. In particular the Mixed Eucalypt Woodland and Open Eucalypt Woodland over Open Shrubland habitat types are widespread and have been recorded from other fauna assessments in the wider region (McKenzie *et al.*, 1984; Ecologia 2013; Harewood, 2014a; Botanica Consulting, 2018; Spectrum 2018; Phoenix 2019).

The Gentle Hillslope with Eucalypt Woodland habitat was often associated with smaller hills that extended into adjacent areas and were only marginally covered by the study areas. They have also been recorded from the wider region during previous assessment (Terrestrial Ecosystem, 2016; GHD, 2018; Spectrum Ecology, 2018).

The Mixed Dense Shrubland was recorded from a few smaller patches within the Eucalypt Woodland habitat types. They are common in the area, but are also particularly suitable for the Malleefowl if long unburnt (Benshemesh, 1990). The Mixed Dense Shrubland habitat type is not uncommon as such and has been found during a number of previous surveys in the region (Ecologia 2013; GHD, 2018; Spectrum 2018).

The Minor Drainage Line habitat often intersect surrounding habitat types in a linear manner. Due to the ability to maintain a higher level of moisture under shrubs and trees, or even in the form of surface water, drainage lines represent an important refuge for species that are dependent on suitable microhabitat. These include SRE invertebrate species, which often accumulate along drainage lines, such as the burrowing spider *Idiosoma* `MYG244' or *Idiosoma* 'kalgoorlie' (Harvey, 2002; Rix *et al.*, 2018).

The Claypan, Flooplain and Saltbush Shrubland habitats are typically more restricted habitat types and are generally mapped to occupy smaller areas in comparison to other fauna habitat types such as Eucalypt Woodland dominated habitats (Terrestrial Ecosystem, 2016; Phoenix 2019). However, due to the presence of large salt lakes and clay pans in the Coolgardie region, they are relatively common in the area in particular to the south of the study areas near the TSF Area (McKenzie *et al.*, 1984; Phoenix Environmental Sciences, 2019).

4.3.2. Conservation Significant Fauna

All vertebrate fauna recorded during the survey are commonly recorded in the region. In total, four introduced mammal species, one native mammal, 19 bird species, and four reptiles were recorded. All of them are widespread and are known to occur at the study areas.

The database searches identified four mammal species and eighteen bird species as potentially occurring at the study areas. Of these, three bird species and two invertebrate fauna species have a moderate to high likelihood to occur within the study areas, with the remaining 17 species having a low likelihood to occur. Their details are listed in Table 4.4 and fauna species that has a moderate to high likelihood to occur are discussed in the below sections.

Table 4.4: Summary of Significant Fauna Species That Could Potentially Occur in the Study Area

Likelihood of Occurrence	Species	Conservation Status			Preferred habitats	Previous Records
		EPBC Act	WC/BC Act	DBCA		
Mammals						
Low The species is locally extinct in the region and the species is unlikely to occur.	Numbat *(Myrmecobius fasciatus)*	EN	EN	-	Eucalypt forests and woodlands, dominated by *Eucalyptus marginata*, *E. calophylla* and *E. wandoo*.	One record was made from Kalgoorlie (NatureMap). Two historical records from Kalgoorlie (Threatened Fauna Database).
Low Very limited and only historical records from the surrounding region. The species is known to be locally extinct in the region.	Greater Bilby *(Macrotis lagotis)*	VU	VU	-	Variety of habitats on soft soil including spinifex hummock grassland, acacia shrubland, open woodland and cracking clays.	Six historic records from Kalgoorlie and Kanowna (Threatened Fauna Database). No other records form the vicinity.
Low Although suitable woodland habitat exists within to the study areas, no records have been made in the surrounding area.	Chuditch, Western Quoll *(Dasyurus geoffroii)*	VU	VU	-	Sclerophyll forest, riparian forest, dry woodland, heath and mallee shrubland.	Protected Matter Search Tool (PMST) lists habitat to potentially be present within the study areas. Historical records from within 90 km of the study areas.
Low The study areas are outside the species' distribution. Highly unlikely to occur.	Western False Pipistrelle (*Falsistrellus mackenziei*)	-	-	P4	Sclerophyll forest of Karri, Jarrah and Tuart. Lives in old trees, branches and stumps.	A dead specimen was found in 2013 in Kalgoorlie. The species occurs in coastal regions of the south-west WA. Study areas are outside the species' range and no other records exist in the region.
Birds						
High Numerous records in close proximity of the study areas. Suitable habitat present, in particular at TSF Area and patches within the Rayjax study area.	Malleefowl *(Leipoa ocellata)*	VU	VU	-	Semi-arid and arid habitats. Variety of Mallee woodlands and shrublands.	Over 100 historic and recent records within 40 km of the study areas (DBCA, NatureMap 2019, Phoenix 2018).

Likelihood of Occurrence	Species	Conservation Status			Preferred habitats	Previous Records
		EPBC Act	WC/BC Act	DBCA		
Medium Four recent records (2016-2018) made from Kalgoorlie; however, study areas lie on the edge of the species' current range. Suitable habitat is present throughout the study areas.	Carnaby's Cockatoo *(Calyptorhynchus latirostris)*	EN	EN	-	Breeding in tree hollows of Wandoo, Tuart, Jarrah, York gum, Karri and Marri. Foraging in woodlands, forests, riparian vegetation, heath and *Banksia* woodland as well as introduced species.	Recently recorded from Kalgoorlie. Study areas lie on the north-eastern border of the species' current range.
Medium Recorded from the region of the study areas. Foraging habitat is present, no breeding habitat was recorded from the study areas.	Peregrine Falcon *(Falco peregrinus)*	-	OS	-	Widespread; coastal cliffs, riverine gorges and wooded watercourses.	One record from Credo station (26 km north-west of Castle Hill).
Low No suitable habitat present within the study areas. Records are scares in the region and limited to large inland wetlands.	Curlew Sandpiper *(Calidris ferruginea)*	CR	CR	-	Migratory/waterbird species are typically associated with coastal habitats. These species also inhabit inland ephemeral wetland habitat types when present.	Two records from saltlake habitat east and west of the study areas (Young River Station Lake & Kanowna). No other records in the vicinity.
Low No records in the area and habitat has not been recorded from the regional area. Species listed due to salt lake habitat present within the wider region (~100 km).	Night Parrot *(Pezoporus occidentalis)*	EN	EN	-	Most records from long unburnt *Triodia* grasslands and/or Chenopod shrublands featuring large dense clumps of vegetation.	No confirmed records in the area. Protected Matter Search Tool (PMST) lists habitat to potentially be present within the study areas.
Low The Fork-tailed Swift is highly nomadic and records are rare in the region. Records typically associated with suitable climatic conditions instead of habitat types.	Fork-tailed Swift *(Apus pacificus)*	M	M	-	Nomadic, almost entirely aerial lifestyle over a variety of habitats; associated with storm fronts.	Scattered records in the region but generally rarely recorded (NatureMap 2019).

Likelihood of Occurrence	Species	Conservation Status			Preferred habitats	Previous Records
		EPBC Act	WC/BC Act	DBCA		
Low No suitable habitat present within the study areas. Records are scarse in the region and limited to large inland wetlands.	Common Sandpiper *(Actitis hypoleucos)* Common Greenshank *(Actitis hypoleucos)* Sharp-tailed Sandpiper *(Calidris acuminata)* Wood Sandpiper *(Tringa glareola)* Ruddy Turnstone *(Arenaria interpres)* Red-necked Stint *(Calidris ruficollis)* Glossy Ibis *(Plegadis falcinellus)* Sanderling *(Calidris alba)* Grey-tailed Tattler *(Tringa brevipes)* Oriental Plover *(Charadrius veredrus)*	M	M	-	Migratory/waterbird species are typically associated with coastal habitats. These species also inhabit inland ephemeral wetland habitat types when present.	Several records from Kopai Lake, Rowles Lagoon, Young River Station Lake, Lake Douglas, Hannan Lake, and Kalgoorlie Sewerage Outlet. No other records from outside large lake or lagoon habitat.
Low No suitable habitat is present within the study areas. Two records in the region.	Hooded Plover *(Thinornis rubricollis)*	-	-	P4	Coastal areas and adjacent dunes. Also reefs, coastal lakes, and lagoons.	Two historical records from Arrow Lake from 1980 and 1992 (DBCA threatened fauna database).
Low	Blue-billed Duck *(Oxyura australis)*	-	-	P4	Wetland, inland lakes. Almost entirely aquatic lifestyle, rarely seen on land.	Records from Credo Station from 2015 (DBCA, NatureMap). No other

Likelihood of Occurrence	Species	Conservation Status			Preferred habitats	Previous Records
		EPBC Act	WC/BC Act	DBCA		
No suitable habitat is present within the study areas. Only one record in the region.						records within 100 km of the study area.
Invertebrates						
Medium Only historical records known from Lake Douglas; however, little is known about the species and suitable habitat is present at the study areas.	Arid Bronze Azure Butterfly *(Ogyris subterrestris petrina)*	CR	CR	-	Mallee Woodland and shrubland, hop-bush shrubland, often near flood plains. Associated with the sugar ant (*Camponotus terebrans*) at the base of smooth-barked trees and shrubs.	Known from only two locations, Barbalin NR in the Avon Wheatbelt (recent records) and from Lake Douglas (historical, 1911-1989), approx. 24 km south of the study areas. No other records exist in the area. Suitable habitat is present within study areas.
Medium Few records known to date from Lake Douglas; however, little is known about the species and suitable habitat is present at the study areas.	Inland Hairstreak (*Jalmenus aridus*)	-	-	P1	Larvae feeds on leaves and flowers of *Senna nemophila* and *Acacia tetragonophylla*. Adults remain close to breeding habitat.	Records are restricted to historical sightings in the 80s and 90s from Lake Douglas, approx. 24 km south of the study areas. No other records exist in the area. Suitable habitat is present within study areas.

4.3.2.1. Malleefowl (*Leipoa ocellata*)

Conservation Status: EPBC/BC Act Vulnerable

Distribution, Habitat and Ecology: Once common and widespread across semi-arid southern Australia, Malleefowl have declined severely in the last century, with a 50% decrease in area of occupancy (Benshemesh, 2007). Their current distribution is highly fragmented with a high risk of extinction (Benshemesh, 2007). Malleefowl inhabit habitats consisting of mallee thickets, mulga or other dense litter-forming shrublands as well as dry forest dominated by other eucalypt and acacia species (Johnstone and Storr, 1998; Benshemesh, 2007). They prefer sandy substrate with leaf litter to build their nesting mounds and, therefore the highest breeding density appears to be located in vegetation that is at least 40 years post fire (Woinarski, 1989; Benshemesh, 1990, 1992). They rarely breed in vegetation that has been burnt within the last 15 years.

Occurrence in the Study Areas: The Malleefowl was not recorded during the current survey. The species is known to occur in the region with recent records made from 2009 from 2.6 km west of the study area, also historic records from 1965 from (Figure 4.1). Suitable habitat was recorded from the TSF Area (Dense Shrubland) and from the Rayjax study area (denser patches within the Mixed Eucalypt Woodland). The species was recorded during the survey at Cutters Ridge just south of the Rayjax Haul Road (Phoenix 2019). The species is likely to breed in the region and may forage within the study areas. Suitable habitat provides optimal conditions for breeding and nesting activities as well as foraging with adjacent habitats potentially used for occasional foraging.

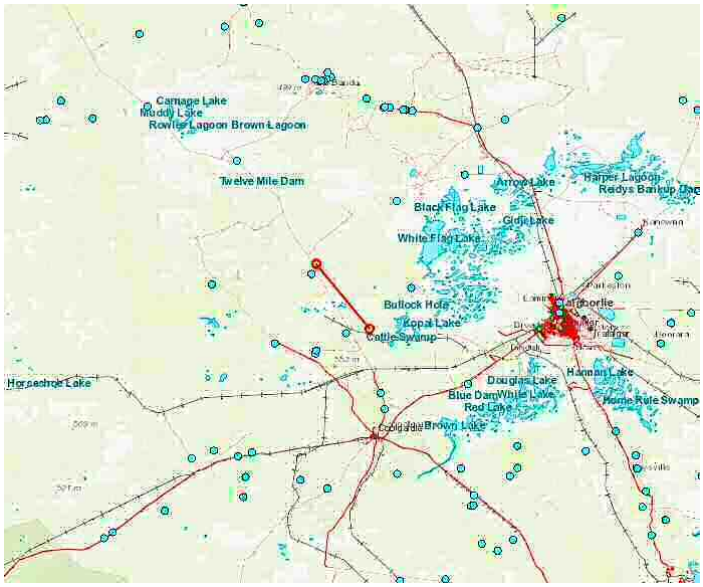


Figure 4.1: Regional Malleefowl Records (NatureMap 2019)

4.3.2.2. Carnaby's Cockatoo (*Calyptorhynchus latirostris*)

Conservation Status: EPBC/BC Act Endangered

Distribution, Habitat and Ecology: The Carnaby's Cockatoo is a woodland specialist. The species feeds on Kwongan heath, *Banksia* spp., *Hakea* spp., *Dryandra* spp., *Grevillea* spp., *Callistemom* spp., Marri, *Erodium* spp., wild radish, pecan nuts, insects as well as a range of fruits (apples etc) (CoA 2017). Roosting and breeding require the presence of large eucalypt trees and typically takes place in forests, woodlands or smaller groups of large trees. Pine plantations also represent an important food resource for Carnaby's Cockatoo with 65% of the Greater Perth-Peel Coastal Plain population recorded utilising the Gnangara Pine Plantation for roosting and foraging (Peck, Barrett and Williams, 2018).

Occurrence in the Study Areas: The Carnaby's Cockatoo has been recorded from Kalgoorlie in 2016 and 2017 (NatureMap, DBCA). However, the study area is outside the current mapped distribution and sightings are very rare in the surrounding (Figure 4.2). Habitat in the study areas and surrounding region provides suitable conditions for foraging, roosting and potential breeding but no actual sites for these activities are known from the region (Figure 4.2). Use of foraging habitat in the area may occur infrequently.

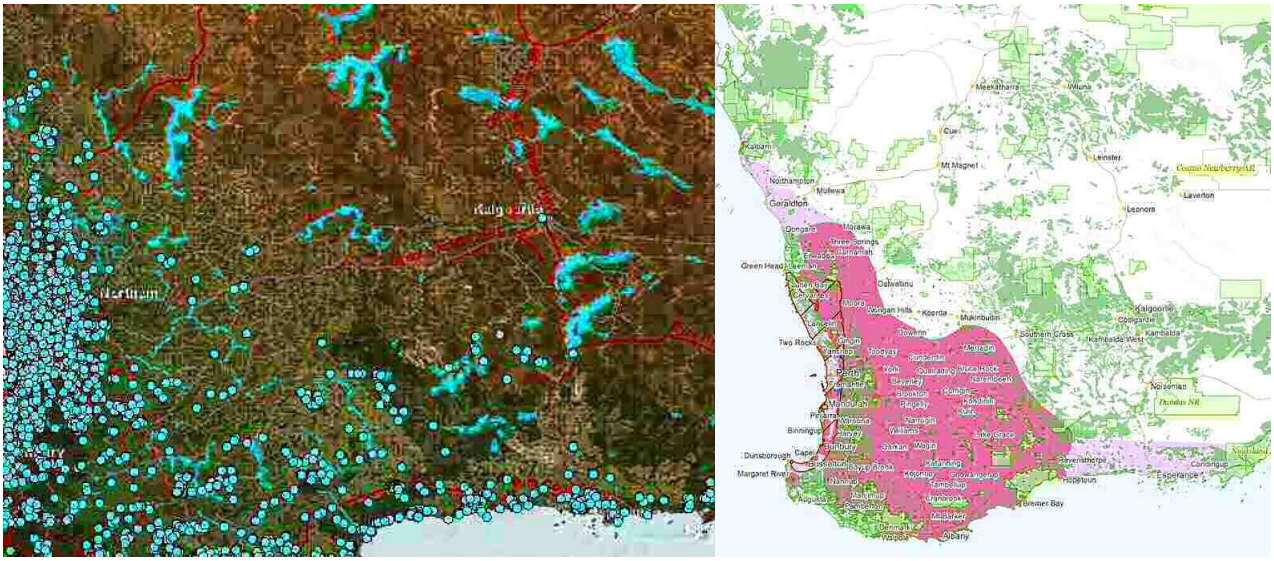


Figure 4.2: Regional Carnaby's Cockatoo Records (left) & Distribution Map (right)

4.3.2.3. Peregrine Falcon (*Falco peregrinus*)

Conservation Status: BC Act Other Specially Protected Fauna

Distribution, Habitat and Ecology: The Peregrine is a nomadic/sedentary bird which is widespread in many parts of Australia and some of its continental islands, but absent from most deserts and the Nullarbor Plain. The species is considered to be moderately common in the Stirling Range, uncommon in the Kimberley, Hamersley and Darling Ranges, and rare or scarce elsewhere (Johnstone and Storr, 1998). The Peregrine Falcon occurs breeds along cliffs, in particular along rivers and ranges, and forages over wooded watercourses and lakes. Peregrine Falcons feed almost entirely on birds, especially parrots and pigeons. They nest primarily on ledges on cliffs, granite outcrops and in quarries, but may also nest in tree hollows around wetlands. Eggs are predominantly laid in September (Johnstone and Storr, 1998).

Occurrence in the Study Areas: The Peregrine Falcon has been recorded from Credo station, approx. 26 km north-west of Castle Hill mine (Figure 4.3). More records exist to the north and north-west of Credo station. Some suitable foraging and hunting ground is present within the study areas; however, the majority of habitats are either too heavily vegetated (woodlands) or lack major drainage lines. The species may overfly the study areas on an occasional basis when travelling between breeding and hunting grounds. No breeding habitat is present within the study areas.

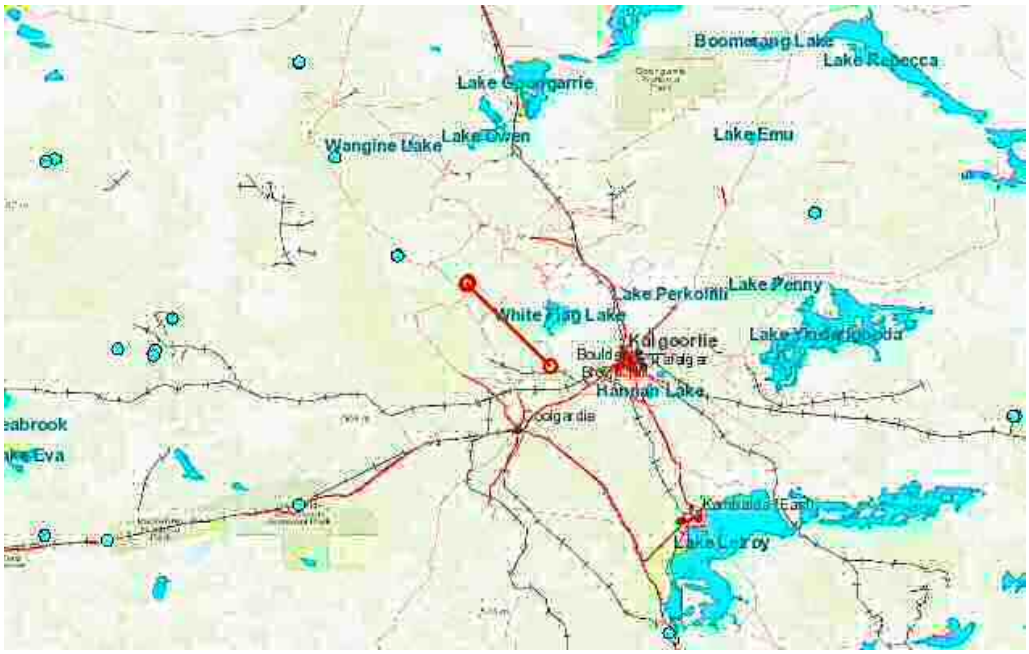


Figure 4.3: Regional Peregrine Falcon Records (NatureMap 2019)

4.3.2.4. Arid Bronze Azure Butterfly (*Ogyris subterrestris petrina*)

Conservation Status: EPBC/BC Act Critically Endangered

Distribution, Habitat and Ecology: To date, little is known about the Arid Bronze Azure Butterfly and all known records are restricted to two locations: Barbalin Nature Reserve, 11 km north-west of Mukinbudin in the central wheatbelt, and Lake Douglas near Kalgoorlie in the Goldfields region. The two locations are 320 km apart (Figure 4.4). The Arid Bronze Azure Butterfly is most likely associated with smooth barked eucalypt trees, such as Gimlet trees *Eucalyptus salubris* and the sugar ant *Camponotus terebrans* (Williams and Williams, 2008; Braby, 2016). The male and female adults have different upper surface, with the male being a plain dark purple with pale bronze margins, whereas the female is similar but with a black and white bar on the costa of each forewing (Williams and Williams, 2008; Braby, 2016). The butterflies have a wing span of about 3.5-4 cm. The eggs are laid in groups of about 40 on the base of mallee gum trees where there is typically an ant nest in the base. The pupa of the butterfly either crawls or will be carried into the ant nest where it is formed. The host ant is suggested to be the pale form of the sugar ant *Camponotus terebrans terebrans* (Williams and Williams, 2008; Braby, 2016).

Occurrence in the Study Areas: The occurrence of the Arid Bronze Azure Butterfly is highly determined by the distribution and abundance of the host ant *C. terebrans*. At the Barbalin site, the host ant has been found to be unicolonial, which means that all nests at Barbalin NR are part of a single 'super colony' (Australian Government, 2019).

In the study areas' surrounding, the Arid Bronze Azure Butterfly has been recorded from Lake Douglas, south-west of the Kalgoorlie. However, the records are all from 1911-1989 and no recent records have been made. There is little known about the species and it's lifestyle can be relatively elusive with small, 3.5-4cm sized adults only emerging between September and March (peak periods in mid-spring and late summer) (Braby, 2016; Australian Government, 2019).The Arid Bronze Azure Butterfly has a moderate likelihood to occur at the study areas based on the presence of potential habitat, the proximity to historic records, the elusive lifestyle and the general lack of knowledge of the species.

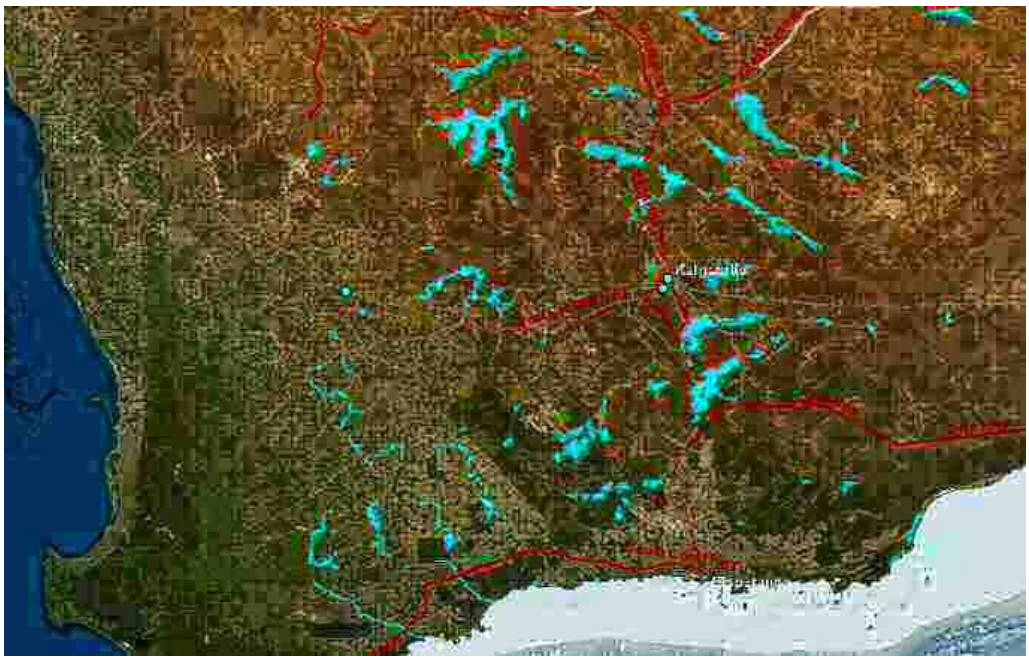


Figure 4.4: Regional Arid Bronze Azure Butterfly Records (NatureMap 2019)

4.3.2.5. Inland Hairstreak (*Jalmenus aridus*)

Conservation Status: DBCA Priority 1

Distribution, Habitat and Ecology: The Inland Hairstreak was originally described from Lake Douglas near Kalgoorlie, however, the species has not been recorded from this location since 1997. Based on the historical records, the larvae of this species is thought to feed on leaves and flowers of young shrubs of *Senna nemophila* and mature trees of *Acacia tetragonophylla*, which grow in shallow gullies with gentle slopes (Braby, 2016). The larvae of the butterfly are attended by the Froglet ant *Froggatella kirbii* (Figure 4.5). The adults are likely to be stay close to the breeding habitats. There are likely two generations per year, although adults are absent in some years (Braby, 2016).

Occurrence in the Study Areas: The Inland Hairstreak has a historic distribution in the close vicinity of the study areas and suitable habitat, in the form of host plants has been recorded from the study areas. Butterflies can be elusive, in particular during years when adults are absent. In general, invertebrate fauna species can be overlooked during survey work, and their distribution and ecology can be relatively unknown for a long time. There are only five records of this species known to date, all of which are from Lake Douglas. The species has not been recorded in WA since 1997 (DBCA 2019, DBCA). This lack of information, uncertainty of its distribution and the application of the Precautionary Principle leads to the conclusion that the species may occur in the study areas, at least on an infrequent basis.

Figure 4.5: Regional Inland Hairstreak Records (NatureMap 2019)

4.3.3. Invertebrate SRE Fauna

A total of 25 potential SRE invertebrate fauna species were recorded from the study area during the survey. Of these, nine pseudoscorpions, one geophilomorph, one centipede, three isopods, five millipedes, and six snails. No arachnids were collected which include mygalomorph spiders and scorpions. The two groups were targeted during foraging but no scorpions or mygalomorph spider burrows were recorded. This is not an unusual observation, with very few invertebrate species recorded during previous surveys (Phoenix 2019) and limited numbers of mygalomorph spiders (11 species) and scorpions (2 species) being returned in the database searches.

There was a moderate number of potential SRE invertebrate species recorded from the study areas which is comparable with records made during previous surveys in the region (Phoenix 2019). Generally, SRE invertebrate species can be difficult to determine due to the uncertainties in determining their distributions. This is often due to the lack of surveys, under-collection of species, lack of taxonomic resolution, and problems in identifying certain life stages. Even when invertebrate species are collected, the majority of them are unknown, undescribed or poorly represented, therefore leaving uncertainties about their status and distribution outside the study areas (Harvey, 2002; Harewood, 2014a).

The taxa currently regarded as `*Antichiropus* sp.' (Diplopoda; Paradoxosomatidae) cannot be fully assessed for SRE status until adults of the millipede (*Antichiropus* sp.) have been collected.

The snail `*Basedowena* cf. *holoserica*' (Mollusc; Camaenidae) was collected from each of the study areas. Based on its differences in morphology, it may represent a new species; however, it resembles *Basedowena holoserica*. Genetic analysis would be required to determine the species and/or if the specimens are unique to what has previously been recorded within the region.

Although limited, the current information for the remaining taxa indicates that there is a reasonable likelihood that they may be range restricted, therefore they are considered Potential SREs as a precaution.

In the absence of firm taxonomic identifications, it is reasonable to use habitats as a surrogate to assess the likelihood of occurrence and potential impacts the development posed to potential SRE invertebrate species. All habitat types recorded from the study areas are not known to be invertebrate fauna hot spots, with the only exception of the Minor Drainage Lines.

Yen and Butcher (1997) list the following threats to SRE invertebrate fauna species include:

- Agriculture and clearing of native vegetation
- Habitat fragmentation
- Grazing and trampling
- Inappropriate fire regimes
- Forestry activities
- Pollution
- Pests and diseases
- Alterations to aquatic ecosystems
- Mineral extraction
- Transport and recreation
- Exotics and introduced taxa
- Direct exploitation
- Long-term environmental changes, including climate change arising from the enhanced Greenhouse Effect.

5. CONCLUSIONS

5.1. Castle Hill

5.1.1. Flora

No Threatened or other significant flora taxa were recorded at the Castle Hill study area during the current assessment. One Priority 1 flora species, *Eremophila praecox*, was given a high likelihood of occurrence at the Castle Hill study area (vegetation type iv).

5.1.2. Vegetation

There were no vegetation types identified as significant due to being considered a TEC or PEC. Vegetation type viii was considered significant because it was restricted in the study area and type iv was considered significant because it provides refugee to a P1 flora species. Neither of these were considered to have high local or regional significance.

5.1.3. Fauna

No conservation significant fauna was recorded from the Castle Hill study area. Thirteen potential SRE taxa were recorded, of which one species, a snail, *Basedowena* cf. *holoserica*, may represent a new species. All habitat types recorded are common in the region and are not restricted to the Castle Hill study area. The Minor Drainage Line habitat may represent the most significant due to the ability to be a refuge for SRE invertebrate species.

5.2. Rayjax

5.2.1. Flora

No Threatened or other significant flora taxa were recorded at the Rayjax study area during the current assessment. One Priority 1 flora species, *Eremophila praecox*, was given a high likelihood of occurrence at the Rayjax study area (vegetation type iv).

5.2.2. Vegetation

There were no vegetation types identified as significant due to being considered a TEC or PEC. Vegetation type vi was considered significant because it was restricted in the study area and type iv was considered significant because it provides refuge to a P1 flora species. Neither of these were considered to have high local or regional significance.

5.2.3. Fauna

No conservation significant fauna was recorded from the Rayjax study area. Nine potential SRE taxa were recorded, of which one species, a snail *Basedowena* cf. *holoserica*, may represent a new species. The millipedes, *Antichiropus* sp., could not be identified to species level due to the specimens being juveniles. All habitat types recorded are common in the region and are not restricted to the Rayjax study area.

5.3. Burgundy to Cutters Ridge Haul Road

5.3.1. Flora

No Threatened flora taxa were recorded during the current assessment or considered likely to occur at the Burgundy to Cutters Ridge Haul Road study area. One Priority 3 taxa, *Allocasuarina eriochlamys* subsp. *grossa*, was recorded from 480 m west of the study area during the current assessment and was assigned a low local and regional significance. One Priority 1 flora species, *Eremophila praecox*, recorded at the Haul Road study area during the desktop assessment and was assigned a low local and regional significance at the study area.

One species of interest was recorded at relevé R116: a specimen of *Eremophila* sp? which could not be fully identified. Coordinates have been provided electronically.

5.3.2. Vegetation

There were no vegetation types identified as significant due to being considered a TEC or PEC. Vegetation type vii was considered significant because it was restricted in the study area and has potential to provide refuge for a P4 flora species (*Eucalyptus jutsonii* subsp. *jutsonii*) and a species of interest (*Calandrinia* sp. Gypsum), and is considered to have high local and regional significance. Type iv was considered significant because it provides refugee to a P1 flora species.

5.3.3. Fauna

No conservation significant fauna was recorded from the Burgundy to Cutters Ridge Haul Road study area. Eleven potential SRE taxa were recorded, of which one species, a snail *Basedowena* cf. *holoserica*, may represent a new species. All habitat types recorded are not restricted to the study area, with the Floodplain and Minor Drainage Line being the more restricted habitat types. The Minor Drainage Line has the highest potential to harbour SRE invertebrate fauna species, whereas the other habitat types do not typically provide suitable microhabitats.

5.4. TSF

5.4.1. Flora

No Threatened or other significant flora taxa were recorded at the TSF study area during the current assessment. Two Priority 1 flora species, *Eremophila praecox* and *Calandrinia lefroyensis/quartzitica* were given a high likelihood of occurrence. *Calandrinia lefroyensis/quartzitica* is considered to have high local and regional significance. One environmental weed species was recorded just outside the TSF study area: **Erodium cicutarium*.

5.4.2. Vegetation

There were no vegetation types identified as significant due to being considered a TEC or PEC. Vegetation types ii, iii and xi were considered significant because they were restricted in the study area, types ii and v provided refugee to the complex *Tecticornia* group and iv was considered significant because it provides refugee to a P1 flora species. Vegetation types ii and v were considered to have a high local significance.

5.4.3. Fauna

No conservation significant fauna was recorded from the TSF study area. Five potential SRE taxa were recorded, of which one species, a snail *Basedowena* cf. *holoserica*, may represent a new species. All habitat types recorded are not restricted to the study area, with the dense shrubland habitat type considered

significant because it provides suitable conditions to the Malleefowl which is likely to be breeding or foraging in the area.

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Appendix A: Likelihood of Occurrence of Significant Flora

Likelihood	Status	Family	Species	Distance from Study Area (km)	Habitat	Source		
						WA Herb	TPFL	Reports Phoenix
Recorded	3	Casuarinaceae	*Allocasuarina eriochlamys subsp. grossa*	1	Red clay and laterite.	2	-	1
Recorded	1	Montiaceae	*Calandrinia sp ?lefroyensis/quartzitica*	<1	Red Sandy ecotone	-	-	2
Recorded	1	Scrophulariaceae	*Eremophila praecox*	<1	Low plain, red-brown sandy loam.	6	10	2
High	SOI	Montiaceae	*Calandrinia sp. Gypsum*	<1	Floodplain with chenopod shrubland on sandy/loamy clay	-	-	1
High	4	Myrtaceae	*Eucalyptus jutsonii subsp. jutsonii*	12	Red sandy soil.	3	-	-
High	3	Poaceae	*Austrostipa blackii*	<1	Basalt or BIF with red-brown deep sandy clay loam soils	1	-	1
Medium	3	Asteraceae	*Chrysocephalum apiculatum subsp. norsemanense*	19	Red sand.	1	-	-
Medium	2	Asteraceae	*Elachanthus pusillus*	22	Unknown	1	-	-
Medium	1	Asteraceae	*Rhodanthe uniflora*	31	Brown earth. Open eucalyptus woodland.	1	-	-
Medium	3	Asteraceae	*Notisia intonsa*	3	Red-brown sandy loam- light clay. Lake shore saline soils	8	2	-
Medium	3	Brassicaceae	*Phlegmatospermum eremaeum*	19	Stony loam.	1		-
Medium	1	Fabaceae	*Acacia websteri*	20	Flat, lateritic soil in red clay sand.	13	5	-
Medium	T	Fabaceae	*Gastrolobium graniticum*	19	Granite rocks in red sand	33	2	-
Medium	T	Haemodoraceae	*Conostylis lepidospermoides*	14	Grey or yellow-brown sand over laterite	1	-	-
Medium	1	Myrtaceae	*Thryptomene sp. Londonderry (R.H. Kuchel 1763)*	19	Orange - brown stony to sandy loams. Sandy flats.	11	-	-
Medium	4	Scrophulariaceae	*Eremophila caerulea subsp. merrallii*	11	Sand, clay or loam. Undulating plains	1	-	-
Low	1	Amaranthaceae	*Ptilotus chortophytus*	22	Quartz outcrop	2	-	-
Low	1	Amaranthaceae	*Ptilotus procumbens*	24	Deep red clay.	1	-	-
Low	3	Apocynaceae	*Alyxia tetanifolia*	18	Sandy clay, loam, concretionary gravel. Drainage lines, near lakes	4	1	-
Low	3	Asteraceae	*Angianthus prostratus*	32	Red loamy soil	3	-	-
Low	3	Brassicaceae	*Lepidium fasciculatum*	23	Dry lake bed. Flat. Soil red loam.	2	-	-
Low	2	Brassicaceae	*Lepidium merrallii*	19	Ridge/slope. Well-drained. Dry brown clay loam over granite. 10-30% of loose rock on soil surface.	1	-	-
Low	3	Chenopodiaceae	*Atriplex lindleyi subsp. conduplicata*	27	By lake.	1	-	-
Low	3	Cyperaceae	*Eleocharis papillosa*	50	Winter wet claypan. Red brown clay loam.	1	-	-
Low	3	Cyperaceae	*Isolepis australiensis*	25	Plain. Seasonally wet red clay soils. Low lying damp area.	1	-	-
Low	1	Cyperaceae	*Lepidosperma sp. Parker Range (N. Gibson & M. Lyons 2094)*	29	Unknown	1	-	-
Low	3	Ericaceae	*Styphelia sp. Bullfinch (M. Hislop 3574)*	36	Red brown loamy clay. Granite rocks with occasional quartz ground cover	2	-	-
Low	1	Ericaceae	*Melichrus sp. Coolgardie (K.R. Newbey 8698)*	36	Yellow sandplain.	3	-	-
Low	1	Euphorbiaceae	*Ricinocarpos sp. Eastern Goldfields (A. Williams 3)*	34	Yellow sand	1	-	-

Likelihood	Status	Family	Species	Distance from Study Area (km)	Habitat	Source		
						WA Herb	TPFL	Reports Phoenix
Low	1	Fabaceae	*Acacia coatesii*	25	Skeletal red loam, Laterite/quartz, green stone ridge. Flat to gentle slope- low rocky hill	5	-	-
Low	3	Fabaceae	*Acacia crenulata*	32	Flat plain with red brown sandy loam - clay loam soil	6	2	-
Low	3	Fabaceae	*Acacia cylindrica*	39	Flat sandplain with very few laterite/quartz fine gravel on deep yellow sandy soil.	1	-	-
Low	1	Fabaceae	*Acacia epedunculata*	42	Yellow sand on sandplain.	8	4	-
Low	1	Fabaceae	*Acacia sclerophylla var. teretiuscula*	30	Clay and loamy soils	1		-
Low	3	Fabaceae	*Gompholobium cinereum*	6	Gentle undulations, yellow sand over laterite.	1	1	-
Low	4	Frankeniaceae	*Frankenia glomerata*	22	Saline depression. White sand.	1	-	-
Low	1	Goodeniaceae	*Dampiera plumosa*	28	Red sandy soils.	1	-	-
Low	2	Goodeniaceae	*Goodenia salina*	25	Flat drainage system. Red sandy clay loam over low gypseous sandy rise.	1	-	-
Low	4	Haloragaceae	*Myriophyllum petraeum*	45	Granitic silty sand. Floor of small ephemeral pool on granite bedrock exposure, water 10-12 cm deep	2	1	-
Low	3	Myrtaceae	*Calytrix creswellii*	44	Flat sandplain of deep yellow sandy soil.	1	-	-
Low	3	Myrtaceae	*Cyathostemon verrucosus*	23	Unknown	1	-	-
Low	2	Myrtaceae	*Eucalyptus educta*	10	Rocky Granite slope and gullies. Brown loam	4	-	-
Low	1	Myrtaceae	*Eucalyptus websteriana subsp. norsemanica*	29	Hill. Rocky, greenstone, metamorphosed basalt.	2	-	-
Low	4	Myrtaceae	*Eucalyptus x brachyphylla*	22	Granite rocks.	1	-	-
Low	3	Myrtaceae	*Hysterobaeckea ochropetala subsp. cometes*	46	Flat plain. Soil red sandy loam.	2	-	-
Low	3	Myrtaceae	*Melaleuca coccinea*	24	Sandy loam over granite. Granite outcrops, sandplain, river valleys	1	-	-
Low	3	Myrtaceae	*Rinzia triplex*	42	Plain. Red-brown Yellow sandy clay loam with lateritic gravel.	3	-	-
Low	1	Myrtaceae	*Thryptomene sp. Coolgardie (E. Kelso s.n. 1902)*	19	Unknown	2	-	-
Low	3	Parmeliaceae	*Xanthoparmelia dayiana*	35	Laterite outcrops. On laterite pebbles.	3	-	-
Low	1	Parmeliaceae	*Xanthoparmelia subbarbatica*	34	Growing on rocks. Ridgetop with greenstone rubble on surface.	1	-	-
Low	1	Poaceae	*Austrostipa sp. Carlingup Road (S. Kern & R. Jasper LCH 18459)*	29	Basalt with red-brown shallow sandy clay soils	3	-	-
Low	2	Poaceae	*Austrostipa sp. Dowerin (G. Wiehl F 8004)*	30	Basalt with red-brown shallow sandy clay loam soils.	2	-	-
Low	2	Polygonaceae	*Rumex crystallinus*	27	Moist soil near water.	1	-	-
Low	3	Proteaceae	*Grevillea georgeana*	23	Top of sand dune. Yellow sand.	1	1	-
Low	2	Proteaceae	*Hakea rigida*	10	Sandy soils, yellow sand	1	-	-
Low	1	Rutaceae	*Philotheca pachyphylla*	36	Sand, red loam, clay loam. Sandplains, hill tops	6	-	-
Low	1	Rutaceae	*Phebalium appressum*	8	Yellow-brown sand-loam. Sandplain	2	-	-

Likelihood	Status	Family	Species	Distance from Study Area (km)	Habitat	Source		
						WA Herb	TPFL	Reports Phoenix
Low	2	Rutaceae	*Phebalium clavatum*	35	Sandplain, red/brown loamy sand over granite.	10	2	-
Low	3	Scrophulariaceae	*Diocirea acutifolia*	42	Flat of red/brown clay loam	1	-	-
Low	3	Scrophulariaceae	*Diocirea microphylla*	34	Plain to gentle slope. Red brown clay loam.	11	-	-
Low	3	Scrophulariaceae	*Eremophila veronica*	21	Stony clay, clay loam. Lateritic breakaways. Party disturbed area/ drainage area	9	-	-
Low	1	Scrophulariaceae	*Eremophila xantholaema*	44	Slope. Brown/red rocky loam/granite.	3	-	-

Appendix B: Relevé/Quadrat Site Data Collection Sheet

Details included in Relevé Sampling

- Site code, date; location;
- Botanist;
- Photograph;
- Vegetation condition (as defined in Table 2.2);
- Disturbances (grazing, weeds, tracks, mounds, litter, erosion, clearing etc.);
- Time since fire (<1 year, 1-2 years, 2-5 years, >5 years); and
- Landform, geology and soils, consistent with the Australian soils and land survey field handbook (National Committee on Soil and Terrain, 2009), including:

  - Flat: plain
  - Flat: valley floor
  - Flat: tidal
  - Slope: lower, mid, upper
  - Slope: cliff
  - Slope: simple
  - Slope: simple dune
  - Hillock
  - Crest: hill
  - Crest: dune
  - Crest: mesa
  - Ridge: hill
  - Ridge: dune
  - Open depression: drainage line
  - Open depression: creek/river
  - Open depression: floodplain
  - Closed depression: Lake edge
  - Closed depression: Swamp edge
  - Drainage line on slope: lower, mid, upper

  - Slope: Level <1°, Very gentle 1°, Gentle 3°, Moderate 10°, Steep 23°, Very steep 37°, Precipitous 60° and Cliff 80°;
  - Aspect: North, South, East, West;
  - Soil: Sand, Clay, Loam, Sandy-clay, Hard-clay, Cracking-clay and Saline;
  - Soil Colour: Dark, Light, Red, Orange, White, Grey, Brown, Black and Yellow;
  - Rock Type: BIF, Calcrete, Creek stones, Dolerite, Granite, Ironstone, Shale, Quartz and Other;
  - Rock Abundance: No rocks, Very few (<2%), Few (2-10%), Common (10-20%), Many (20-50%), Abundant (50-90%) and Continuous (>90%); and
  - Rock Size: Fine gravel (<6 mm), Medium gravel (6-20 mm), Coarse gravel (20-60 mm), Cobbles (60-200 mm), Stones (200-600 mm) and Boulders (>600 mm).
- Dominant species – Crown cover (%) and Height (m); and
- Vegetation structure - NVIS Level V: three dominant species in three strata: upper, middle and ground (ESCAVI, 2003).

Appendix C: Relevé Site Data

Site: R104	Site Type: Releve	Date: 21/8/2019	Botanist: CF
Study area:	TSF		
Landform:	Flat: Plain		
Slope, aspect:	Level <1o		
Soil:	Red Sand; Clay;		
Rocks:	No rocks		
Abundance:			
Size:			
Fire:	>5 years		
Condition:	Excellent		
Notes:	Grazing (low);		
Veg Unit:	iv		
Location:	51J 0330402 6596335		
Vegetation description:			
Eucalyptus salubris and *E. clelandiorum* open mallee woodland over *Eremophila scoparia*, *Senna artemisiodes* ssp. *Filifolia* and *Cratystylis conocephala* open shrubland over *Olearia muelleri* isolated heath shrubs.			

Site: 105	Site Type: Releve	Date: 21/8/2019	Botanist: CF
Study area:	TSF		
Landform:	Flat: Plain		
Slope, aspect:	Level <1o		
Soil:	Red Sand;		
Rocks:	No rocks		
Abundance:			
Size:			
Fire:	>5 years		
Condition:	Excellent		
Notes:	Tracks;		
Veg Unit:	v		
Location:	51J 0330167 6596066		
Vegetation description:			
Melaleuca lateriflora open shrubland			

Site: 106	Site Type: Releve	Date: 21/8/2019	Botanist: CF
Study area:	TSF		
Landform:	Drainage: Floodplain		
Slope, aspect:	Level <1o		
Soil:	Red Sand; Clay;		
Rocks:	No rocks		
Abundance:			
Size:			
Fire:	>5 years		
Condition:	Excellent		
Notes:	Grazing (low);		
Veg Unit:	v		
Location:	51J 0329795 6596051		
Vegetation description:			
Frankenia setosa and *Atriplex stipitata* open heathland			

Site:107	Site Type: Releve	Date: 21/8/2019	Botanist: CF
Study area:	TSF		
Landform:	Drainage: Salt Pan		
Slope, aspect:	Level <1o		
Soil:	Red Cracking Clay;		
Rocks:	No rocks		
Abundance:	-		
Size:	-		
Fire:	>5 years		
Condition:	Excellent		
Notes:	Drainage: Salt Pan		
Veg Unit:	ii		
Location:	51J 0329616 6596084		
Vegetation description			
Tecticornia sp. open chenopod shrubland			

Site:108	Site Type: Releve	Date: 22/08/2019	Botanist: CF
Study area:	TSF		
Landform:	Flat: Plain		
Slope, aspect:	Very Gentle 1o		
Soil:	Red Sand; Clay;		
Rocks:	No rocks		
Abundance:	-		
Size:	-		
Fire:	>5 years		
Condition:	Excellent		
Notes:	Grazing (low); Tracks; Partial clearing;		
Veg Unit:	iii		
Location:	51J 0330603 6595067		
Vegetation description			
Eucalyptus yilgarnensis, *E. salubris* and *E. clelandiorum* mallee woodland over *Eremophila scoparia*, *Senna artemisiodes* ssp. *filifolia* open shrubland over *Ptilotus obovatus* isolated heath shrubs			

Site: 109	Site Type: Releve	Date: 22/08/2019	Botanist: CF
Study area:	TSF		
Landform:	Drainage: Salt Pan		
Slope, aspect:	Level <1o		
Soil:	Light; Orange; Clay		
Rocks:	No rocks		
Abundance:	-		
Size:	-		
Fire:	>5 years		
Condition:	Good		
Notes:	Grazing (low); kangaroo. Many dead mixed herbs.		
Veg Unit:	xi		
Location:	51J 0329394 6595917		
Vegetation description			
Duma florulenta sparse shrubland			

Site: R110	Site Type: Releve	Date: 22/08/2019	Botanist: CF
Study area:	Rayjax		
Landform:	Flat: Plain		
Slope, aspect:	Level <1o		
Soil:	Red Sand; Clay;		
Rocks:	No rocks		
Abundance:	-		
Size:	-		
Fire:	>5 years		
Condition:	Excellent		
Notes:	Grazing (low); some water movement		
Veg Unit:	iv		
Location:	51J 0320942 6595409		
Vegetation description			
Eucalyptus clelandiorum and *E.* (R111-2/R110-1) mallee woodland over *Eremophila scoparia*, *Senna artemisiodes* ssp. *Filifolia* and *Atriplex nummularia* ssp. *spathulata* and *Acacia hemiteles* open shrubland over *Acacia nyssophylla* sparse heathland.			

Site: R111	Site Type: Releve	Date: 22/08/2019	Botanist: CF
Study area:	Rayjax		
Landform:	Flat: Plain		
Slope, aspect:	Level <1o		
Soil:	Red Sand; Clay;		
Rocks:	No rocks		
Abundance:	-		
Size:	-		
Fire:	>5 years		
Condition:	Excellent		
Notes:	-		
Veg Unit:	iv		
Location:	51J 0321304 6595192		
Vegetation description			
Eucalyptus griffithsii and *E.* (R111-2) mallee woodland over *Acacia hemiteles* and *Senna artemisioides* ssp. *Filifolia* open shrubland.			

Site: R118	Site Type: Releve	Date: 24/08/2019	Botanist: CF
Study area:	Rayjax		
Landform:	Hill Slope: Simple		
Slope, aspect:	Gentle 3o		
Soil:	Red Brown sandy Clay		
Rocks:	Ironstone; Quartz		
Abundance:	Abundant 50-90%		
Size:	60-200 mm Cobbles;		
Fire:	>5 years		
Condition:	Very Good		
Notes:	Tracks; Litter		
Veg Unit:	vi		
Location:	51J 0323138 6595541		
Vegetation description			
Eucalyptus moderata open woodland over *E. oleosa* and *E. torquata* mallee woodland over *Eremophila pustulata* and *Eremophila interstans* ssp. *Interstans* sparse shrubland over Acacia erinacea, Senna artimisioides ssp. Filifolia, Atriplex vesicaria, Cratystylis conocephala and *Olearia muelleri* sparse heathland			

Site: MN04	Site Type: Mapping Note	Date: 23/08/2019	Botanist: CF
Study area:	B-C HR		
Landform:	Drainage: Creek/River		
Slope, aspect:	Gentle 3o		
Soil:	Red Sand; Clay;		
Rocks:	Laterite; Quartz		
Abundance:	Very few <2%		
Size:	Pebbles		
Fire:	>5 years		
Condition:	Excellent		
Notes:	-		
Veg Unit:	iv		
Location:	51J 0315281 6605986		
Vegetation description			
Eucalyptus campaspe and *E. salmonophloia* open mallee woodland over *Eremophila interstans* ssp. *Interstans* and *E. scoparia* open shrubland over *Atriplex ?stipitata* and *Ptilotus obovatus* sparse healthland			

Site: MN05	Site Type: Mapping Note	Date: 24/08/2019	Botanist: CF
Study area:	B-C HR		
Landform:	Flat: Plain		
Slope, aspect:	Level <1o		
Soil:	Red Sand; Clay;		
Rocks:	No rocks		
Abundance:	-		
Size:	-		
Fire:	>5 years		
Condition:	Excellent		
Notes:	-		
Veg Unit:	iv		
Location:	51J 0315281 6605986		
Vegetation description			
Eucalyptus clelandiorum and *E. salmonophloia* woodland over *Atriplex nummularia* and *A. vesicaria* sparse heathland.			

Site: R114	Site Type: Releve	Date: 23/08/2019	Botanist: CF
Study area:	B-C HR		
Landform:	Hill Slope: Simple		
Slope, aspect:	Moderate		
Soil:	Red Orange Clay		
Rocks:	Laterite; Quartz		
Abundance:	Continuous >90%		
Size:	<6 mm - Fine Gravel;		
Fire:	>5 years		
Condition:	Excellent		
Notes:	-		
Veg Unit:	iv		
Location:	51J 0315306 6606001		
Vegetation description			
Eucalyptus clelandiorum woodland over *Eremophila intersans* ssp. *Interstans* sparse shrubland over *Atriplex ?stipitata* sparse heathland.			

Site: R115	Site Type: Releve	Date: 24/08/2019	Botanist: CF
Study area:	B-C HR		
Landform:	Flat: Plain		
Slope, aspect:	Level <1o		
Soil:	Red Sand; Clay;		
Rocks:	Ironstone; Quartz		
Abundance:	Common 10-20%		
Size:	<6 mm - Fine Gravel;		
Fire:	>5 years		
Condition:	Excellent		
Notes:	Tracks		
Veg Unit:	iv		
Location:	51J 0317844 6603496		
Vegetation description			
Eucalyptus clelandiorum and *E. salmonophloia* woodland over *E. salubris* open mallee woodland over *Atriplex nummularia* and *A. vesicaria* open heathland.			

Site: R116	Site Type: Releve	Date: 24/08/2019	Botanist: CF
Study area:	B-C HR		
Landform:	Flat: Plain		
Slope, aspect:	Very Gentle		
Soil:	Red Sand; Clay;		
Rocks:	Ironstone; Quartz		
Abundance:	Many 20-50%		
Size:	<6 mm - Fine Gravel;		
Fire:	>5 years		
Condition:	Excellent		
Notes:	Tracks. Vege asat R115		
Veg Unit:	iv		
Location:	51J 0320766 6600159		
Vegetation description			
Eucalyptus salubris and *E. salmonophloia* woodland over *E. torquata* open mallee woodland over *Eremophila scoparia* sparse shrubland over *Cratystylis conocephala*, *Olearia muelleri* and *Atriplex ?stipitata* sparse heathland			

Site: R117	Site Type: Releve	Date: 24/08/2019	Botanist: CF
Study area:	B-C HR		
Landform:	Flat: Plain		
Slope, aspect:	Very Gentle		
Soil:	Red Orange Sand; Clay;		
Rocks:	Ironstone;		
Abundance:	Few 2-10%		
Size:	<6 mm - Fine Gravel;		
Fire:	>5 years		
Condition:	Excellent		
Notes:	-		
Veg Unit:	vii		
Location:	51J 0322475 6598832		
Vegetation description			
Casuarina obesa open woodland over *Eucalyptus griffithsii* mallee woodland over *Senna artemisioides* and *Eremophila ionantha* sparse shrubland over *Acacia hemiteles* and *Grevillea acuaria* sparse healthland			

Site: MN01	Site Type: Mapping Note	Date: 23/08/2019	Botanist: CF
Study area:	C Hill		
Landform:	Flat plain		
Slope, aspect:	Level <1o		
Soil:	Red Clay		
Rocks:	Ironstone;		
Abundance:	Few 2-10%		
Size:	6-20 mm Medium Gravel;		
Fire:	>5 years		
Condition:	Very Good		
Notes:	Tracks;		
Veg Unit:	x		
Location:	51J 0312909 6607653		
Vegetation description			
Acacia burkittii and *Eremophila scoparia* open shrubland.			

Site: MN02	Site Type: Mapping Note	Date: 23/08/2019	Botanist: CF
Study area:	C Hill		
Landform:	Flat: Plain		
Slope, aspect:	Very Gentle		
Soil:	Red Sand; Clay;		
Rocks:	Ironstone;		
Abundance:	Few 2-10%		
Size:	<6 mm - Fine Gravel;		
Fire:	>5 years		
Condition:	Very Good		
Notes:	Tracks. Vege As at MN01		
Veg Unit:	x		
Location:	51J 0314011 6607674		
Vegetation description			
Eucalyptus griffithsii open woodland over *Acacia burkittii* and *Atriplex nummularia* ssp. *spathulata* open shrubland.			

Site: MN03	Site Type: Mapping Note	Date: 23/08/2019	Botanist: CF
Study area:	C Hill		
Landform:	Flat: Plain		
Slope, aspect:	Very Gentle		
Soil:	Red Sand; Clay;		
Rocks:	Ironstone;		
Abundance:	Very few <2%		
Size:	<6 mm - Fine Gravel;		
Fire:	>5 years		
Condition:	Very Good		
Notes:	-		
Veg Unit:	viii		
Location:	51J 0314465 6607880		
Vegetation description			
Eucalyptus griffithsii mallee woodland over *Eremophila scoparia*, *E. interstans* ssp. *Virgata* and *Acacia hemiteles* open shrubland			

Site: OC020 MN	Site Type: Mapping Note	Date: 23/08/2019	Botanist: CF
Study area:	C Hill		
Landform:	Drainage: Drainage line on flat		
Slope, aspect:	Gentle 3o		
Soil:	Red Sand; Clay;		
Rocks:	Granite		
Abundance:	Few 2-10%		
Size:	6-20 mm Medium Gravel;		
Fire:	>5 years		
Condition:	Very Good		
Notes:	Tracks;		
Veg Unit:	x		
Location:	51J 0311995 6607761		
Vegetation description			
Acacia burkittii open shrubland			

Site: R112	Site Type: Releve	Date: 23/08/2019	Botanist: CF
Study area:	C Hill		
Landform:	Flat: Plain		
Slope, aspect:	Very Gentle		
Soil:	Red Sand; Clay;		
Rocks:	Quartz, Ironstone;		
Abundance:	Common 10-20%		
Size:	6-20 mm Medium Gravel;		
Fire:	>5 years		
Condition:	Very Good		
Notes:	Tracks;		
Veg Unit:	i		
Location:	51J 0311258 6609056		
Vegetation description			
Eucalyptus ?capillosa, *E. campaspe* and *E. salmonophloia* open mallee woodland over *Atriplex nummularia* ssp. *spathulata* and *Eremophila interstans* ssp. *Interstans* sparse shrubland over *Atriplex vesicaria* sparse heathland			

Site: R113	Site Type: Releve	Date: 23/08/2019	Botanist: CF
Study area:	C Hill		
Landform:	Drainage: Creek/River		
Slope, aspect:	Moderate 10o		
Soil:	Red Sand; Clay;		
Rocks:	Calcrete; Creek stones		
Abundance:	Many 20-50%		
Size:	60-200 mm Cobbles;		
Fire:	>5 years		
Condition:	Good		
Notes:	Tracks; Partial clearing;		
Veg Unit:	ix		
Location:	51J 0311905 6607367		
Vegetation description			
Eucalyptus clelandiorum mallee woodland over *Eremophila scoparia*, *Acacia burkittii* and *Atriplex nummularia* ssp. *spathulata* sparse shrubland			

Appendix D: Species List - Flora

Family	Species
Aizoaceae	*Disphyma crassifolium*
	Gunniopsis quadrifida
	Sarcozona praecox
	Tetragonia eremaea
Amaranthaceae	?*Ptilotus* sp.
	Ptilotus carlsonii
	Ptilotus exaltatus
	Ptilotus holosericeus
	Ptilotus obovatus
Apocynaceae	*Alyxia buxifolia*
Asteraceae	*Brachyscome ciliaris*
	Centipeda crateriformis
	Cratystylis microphylla
	Cratystylis conocephala
	Olearia muelleri
	Olearia pimeleoides
	Podolepis capillaris
	Senecio glossanthus
	Senecio spanomerus
	Thiseltonia gracillima
Brassicaceae	*Stenopetalum filifolium*
Casuarinaceae	*Allocasuarina eriochlamys* subsp. *grossa* (Priority 3)
	Casuarina ?*obesa*
	Casuarina obesa
	Casuarina pauper
Chenopodiaceae	*Atriplex* ?*stipitata*
	Atriplex nummularia
	Atriplex nummularia subsp. *spathulata*
	Atriplex vesicaria
	Maireana ?*erioclada*
	Maireana ?*georgei*
	Maireana amoena
	Maireana appressa
	Maireana georgei
	Maireana sedifolia
	Maireana trichoptera
	Maireana triptera
	Rhagodia drummondii
	Sclerolaena drummondii
	Sclerolaena eurotioides
	Tecticornia halocnemoides
	Tecticornia sp.
Fabaceae	*Acacia burkittii*
	Acacia erinacea
	Acacia hemiteles
	Acacia inceana subsp. *inceana*
	Acacia jennerae
	Acacia masliniana
	Acacia nyssophylla
	Acacia tetragonophylla
	Alectryon oleifolius subsp. *canescens*
	Jacksonia arida
	Senna artemisioides subsp. *filifolia*
	Senna stowardii
	Swainsona canescens
Frankeniaceae	*Frankenia setosa*
Geraniaceae	**Erodium cicutarium*
Goodeniaceae	*Scaevola spinescens*

Family	Species
	Goodenia berardiana
Haloragaceae	*Haloragis trigonocarpa*
Hemerocallidaceae	*Dianella revoluta var. divaricata*
Lamiaceae	*Westringia rigida*
Loranthaceae	*Amyema miquelii*
Marsileaceae	*Marsilea ?hirsuta*
Montiaceae	*Calandrinia ?hortiorum*
	Calandrinia disperma
	Calandrinia eremaea
	Calandrinia sp.
Myrtaceae	*Eucalyptus ?capillosa*
	Eucalyptus campaspe
	Eucalyptus clelandiorum
	Eucalyptus griffithsii
	Eucalyptus horistes
	Eucalyptus moderata
	Eucalyptus oleosa
	Eucalyptus oleosa subsp. *oleosa*
	Eucalyptus ravida
	Eucalyptus salmonophloia
	Eucalyptus salubris
	Eucalyptus torquata
	Eucalyptus vittata
	Eucalyptus yilgarnensis
	Melaleuca lateriflora
	Melaleuca phoidophylla
Poaceae	*Eragrostis dielsii*
	Lachnagrostis ?filiformis
	Triodia ?scariosa
	Austrostipa scabra
Polygonaceae	*Duma florulenta*
Proteaceae	*Grevillea acuaria*
	Grevillea sarissa subsp. *sarissa*
Santalaceae	*Exocarpos aphyllus*
	Santalum acuminatum
	Santalum spicatum
Sapindaceae	*Dodonaea lobulata*
	Dodonaea viscosa subsp. *angustissima*
Scrophulariaceae	*Eremophila caperata*
	Eremophila interstans subsp. *interstans*
	Eremophila ionantha
	Eremophila miniata
	Eremophila oldfieldii subsp. *angustifolia*
	Eremophila oppositifolia subsp. *angustifolia*
	Eremophila pustulata
	Eremophila scoparia
	Eremophila sp?
	Eremophila decipiens subsp. *decipiens*
	Eremophila glabra subsp. *glabra*
	Eremophila pustulata
	Eremophila interstans subsp. *interstans*
	Eremophila interstans subsp. *virgata*
Solanaceae	*Lycium australe*
Zygophyllaceae	*Roepera glauca*
	Roepera ovata

Appendix E: Subterranean Fauna Desktop Review

Bennelongia Environmental Consultants

Mungari Operations: desktop assessment of subterranean fauna values at Castle Hill, Rayjax and Cutters Ridge

Prepared for:

Spectrum Ecology/Evolution Mining

September 2019

Draft Report

Short-Range Endemics | Subterranean Fauna

Waterbirds | Wetlands

Mungari Operations: desktop assessment of subterranean fauna values at Castle Hill, Rayjax and Cutters Ridge

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Report Number: 377

Report Version	Prepared by	Reviewed by	Submitted to Client	
			Method	Date
Draft	Anton Mittra		Email	16-09-2019
Final				

BEC_RJ-CH-CUT_subterranean fauna desktop_16ix2019.docx

EXECUTIVE SUMMARY

Evolution Mining are exploring options to mine at various locations within the Mungari Operations located approximately 20 km north of Coolgardie in the Goldfields region of Western Australia. The focus areas covered by this report are the proposed mine pits at Castle Hill, Rayjax and Cutters Ridge and the proposed tailings storage facility (TSF) to the east of Cutters Ridge. The focus mine pits and TSF are referred to as the study area. This report presents an appraisal of the potential ecological and conservation values of subterranean fauna in the study area based on desktop review.

There is no highly prospective habitat for subterranean fauna in the study area. The primary limiting factor on the occurrence of subterranean species will be the apparent unavailability of well-developed underground spaces such as coarse interstices, vughs, fractures and caverns. The surficial cover of weathered laterite and saprolite is clayey and more or less devoid of significant subterranean spaces. The underlying rock types are not considered prospective. This is supported by the very limited amounts of water produced during bore drilling and the lack of habitat apparent in drill core photos. The proposed mining areas are all outside the extent of the palaeovalley, further reducing prospectivity. The most prospective area for stygofauna is the TSF, though it is expected that only a depauperate community, at best, would occur and any species present would be highly likely to have a range extending beyond the TSF in palaeovalley sediments. Like the rest of the study area, the TSF has very low prospectivity for troglofauna.

At least seven-species of stygofauna have been recorded within the search area, including a stygal annelid worm, a syncarid and five-species of copepod. All the recorded species are known from single bores within, or immediately adjacent to, the mapped extent of the Rebecca palaeovalley near Lake Goongarrie and were collected are well outside the extent of potential influence from works in the study area. While sampling intensity has been limited in the region, samples that were captured in the review collected very few species, demonstrating the relatively low degree of prospectivity in the search area. No Priority Ecological Community calcrete aquifers or other very prospective stygofauna habitats occur close to the study area.

The desktop revealed records of at least eleven species of troglofauna in the search area including two species of spider (Araneae), three species of centipede (Chilopoda), a millipede (Diplopoda), one species of dipluran, a beetle (Coleoptera), a true bug (Hemiptera) and two species of symphylan. The majority of the troglofauna species were recorded near Lake Goongarrie, some 50 km or more to the north of the study area, predominantly in transported colluvial cover material in the Rebecca palaeovalley. One species was collected 78 km to the east of the study area from low greenstone or ironstone hills. As is the case for stygofauna, the small number of records of troglofauna in the search area in part reflects the small number and very limited coverage of previous samples. However, it is also true that geologies that would typically be considered prospective for troglofauna, such as large calcretes and ironstone ranges are largely absent from the vicinity of the study area and wider search area.

It is apparent that there will be minimal dewatering requirements for the proposed mines and subsequently the magnitude of groundwater drawdown around each pit will presumably be very small. This is in part due to the tight geologies resulting in aquifers being confined to various degrees. Coupled with low levels of habitat prospectivity, a very low level of potential impact to stygofauna is inferred. Due to the general lack of subterranean habitat in the geologies of the study area, it is considered unlikely that troglofauna will occur. (This includes the TSF, which has a very low level of prospectivity for troglofauna.) The level of risk posed by developments in the study area to troglofauna is therefore very low.

No further survey is considered to be required to support mining approvals for the study area in regard to subterranean fauna. It is noted that this assessment does not cover areas or developments outside the current study area, including any water supply options, which should be assessed separately.

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1. INTRODUCTION

Evolution Mining are exploring options to mine at various locations within the Mungari Operations located approximately 20 km north of Coolgardie and 30 km west of Kalgoorlie in the Goldfields region of Western Australia. The focus areas covered by this report are the proposed mine pits at Castle Hill, Rayjax and Cutters Ridge and the proposed tailings storage facility (TSF) to the east of Cutters Ridge. (Figure 1). The focus mine pits and TSF are referred to as the study area.

This report presents an appraisal of the potential ecological and conservation values of subterranean fauna in the study area based on desktop review. The aims of the desktop are:

1. Review available geological and hydrogeological information to assess the prospectivity of habitats in the study area for subterranean fauna.
2. Compile and evaluate records of subterranean fauna within the vicinity of the study area (including listed species and ecological communities), assess ranges of recorded species and incorporate these results into the appraisal of prospectivity.
3. Assess potential impacts to subterranean fauna species based on desktop review.

2. SUBTERRANEAN FAUNA FRAMEWORK

Subterranean fauna includes aquatic stygofauna and air-breathing troglofauna. Both groups characteristically have reduced or absent eyes and are poorly pigmented due to lack of light. Subterranean fauna species in caves have often developed vermiform bodies and elongate sensory structures, though species in tighter, non-cave habitats in the wider landscape do not necessarily share these adaptations. Other typical morphological and physiological adaptations in underground species include wing reduction or loss, increased lifespan, a shift towards K-selection breeding strategy and decreased metabolism (Gibert and Deharveng 2002). Except for a few species of fish, all subterranean fauna species in Western Australia are invertebrates.

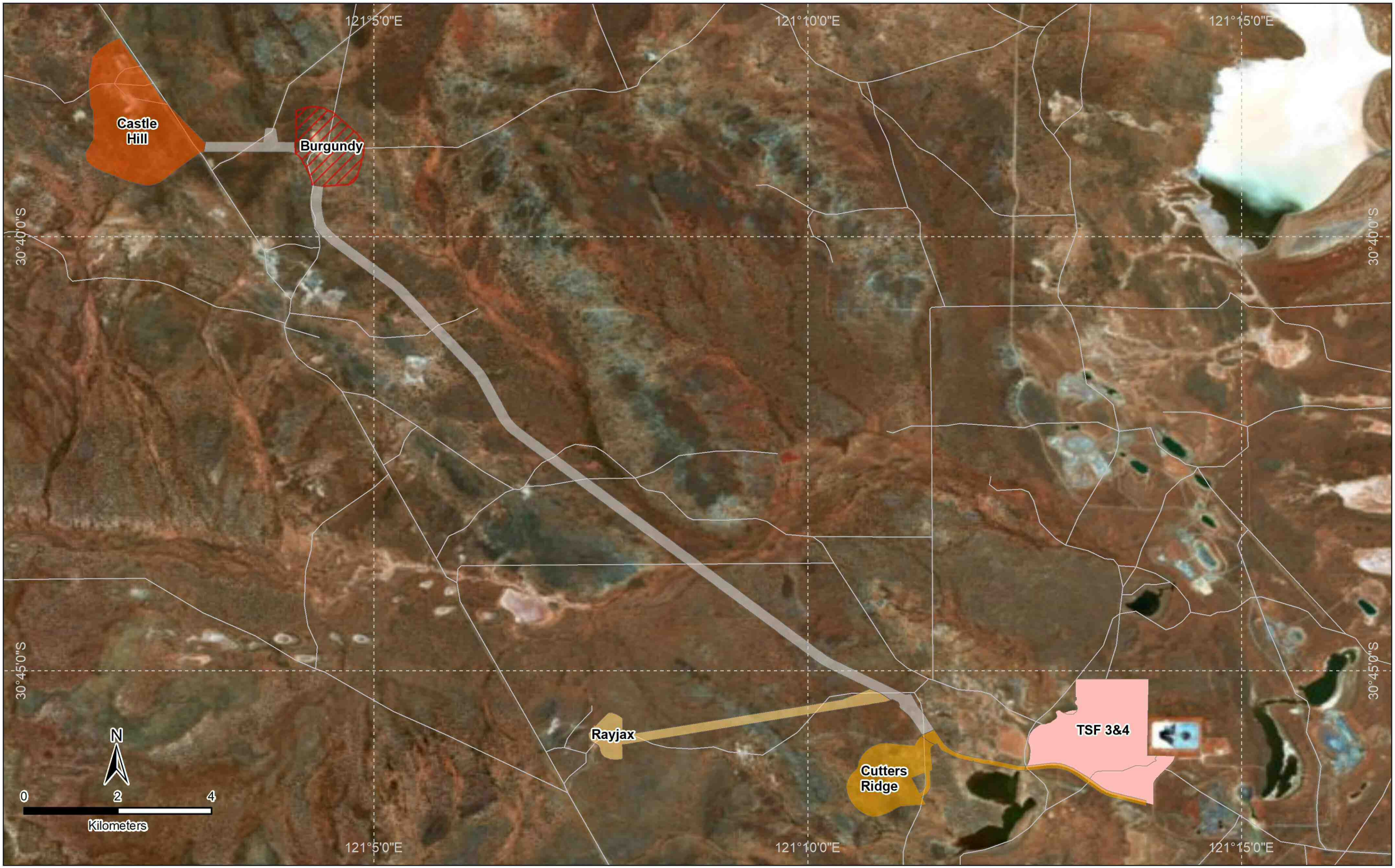
While some subterranean species are obligate inhabitants of groundwater (stygobites) or deep subterranean spaces above the water table (troglobites), others use these habitats only for a proportion of their life cycle (stygophiles and troglophiles). Species with some surface occurrence usually have larger distributions than obligate subterranean species as a result of greater dispersal opportunities.

Although inconspicuous, subterranean fauna contribute markedly to the overall biodiversity of Australia. The Yilgarn, Pilbara and neighbouring regions of Western Australia are recognised as hotspots of subterranean faunal biodiversity, with an estimated 4,000 or more subterranean species likely to occur (Guzik *et al.* 2010), the majority of which remain undescribed. Nearly all subterranean species satisfy Harvey's (2002) criteria for short-range endemism (SRE), namely a total range of less than 10,000 km^2, occurrence in discontinuous or fragmented habitats, slow growth and low fecundity.

Given that species with small ranges are more vulnerable to extinction following habitat degradation than wider ranging species (Ponder and Colgan 2002), it follows that subterranean species are highly susceptible to anthropogenic threats such as groundwater abstraction or excavation. In Western Australia the Environmental Protection Authority (EPA) requires consideration of subterranean fauna as part of environmental impact assessment (EPA 2016a, b).

3. POTENTIAL HABITAT

Troglofauna occupy subterranean spaces, such as alluvial interstices, voids and fissures, while stygofauna inhabit water held by such structures. Stygofauna also occur in the alluvium of hyporheic zones (the confluence of groundwater and surface-water habitats) as well as in groundwater-fed springs. Geology and hydrogeology are significant drivers of the distributions of subterranean species and communities (Eberhard *et al.* 2005; Hose *et al.* 2015; Humphreys 2001). For instance, in arid landscapes, stygofauna are more likely to occur within palaeovalley deposits.



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Author: A. Mittra
Date: 13-09-2019

Legend

- road_lines
- Haul Road
- Cutters Ridge Mine
- Rajax Mine
- Burgundy Mine (not assessed here)
- Castle Hill
- TSF 3&4

Figure 1. Location and layout of the project areas

Highly transmissive geologies tend to support richer and more abundant assemblages of subterranean fauna. For example, clastic alluvial media may host rich assemblages in the interstitial spaces between constituent sand and gravel. Coarse sediments tend to host the richest assemblages while silty or clay-rich substrates are generally not considered prospective (Korbel and Hose 2015). Weathering of consolidated media can also provide inhabitable spaces such as fissures, vughs and caverns. In arid and semi-arid regions, fluctuating groundwater levels and subsequent deposition of carbonate-rich material in palaeochannels has led to the formation of calcrete aquifers that offer habitat similar to karst.

The richest subterranean communities in the Yilgarn are found in palaeovalley calcretes and adjacent alluvial and colluvial units, particularly below the water table, where stygofaunal assemblages are often rich. Survey for troglofauna in the Yilgarn has been very limited when compared to stygofauna though, notably, a rich troglofaunal community was documented in calcrete above the water table around Yeelirrie (45 species, Bennelongia 2015), while 20 species of troglofauna were recorded in calcretes around Lake Way (Outback Ecology 2012). Moderately rich troglofauna communities have also been documented in BIF (Bennelongia 2016) and granite (Bennelongia 2018).

3.1. Local Habitat

A number of sources of information on the physical environment were reviewed to assess habitat prospectivity for subterranean fauna in each component of the study area:

- Geological descriptions in hydrogeology reports (AQ2 2019; Rockwater 2014).
- 100k surficial geology of the Kalgoorlie (3136) map sheet (GSWA 1985) (Figure 2).
- Drill logs for water exploration bores at Rayjax, Cutters Ridge and Burgundy (AQ2 2019). Although the latter is not assessed here, the holes are approximately 200 m from Castle Hill. The locations of the drill holes are shown in Figure 2.
- Photographs of diamond drill cores at Castle Hill, Rayjax and Cutters Ridge (exemplars shown in Plate 1). These were examined to determine the presence of subterranean voids and cavities that could provide potential habitat.
- Mapped distribution of palaeovalleys (Bell *et al.* 2012; Figure 3).

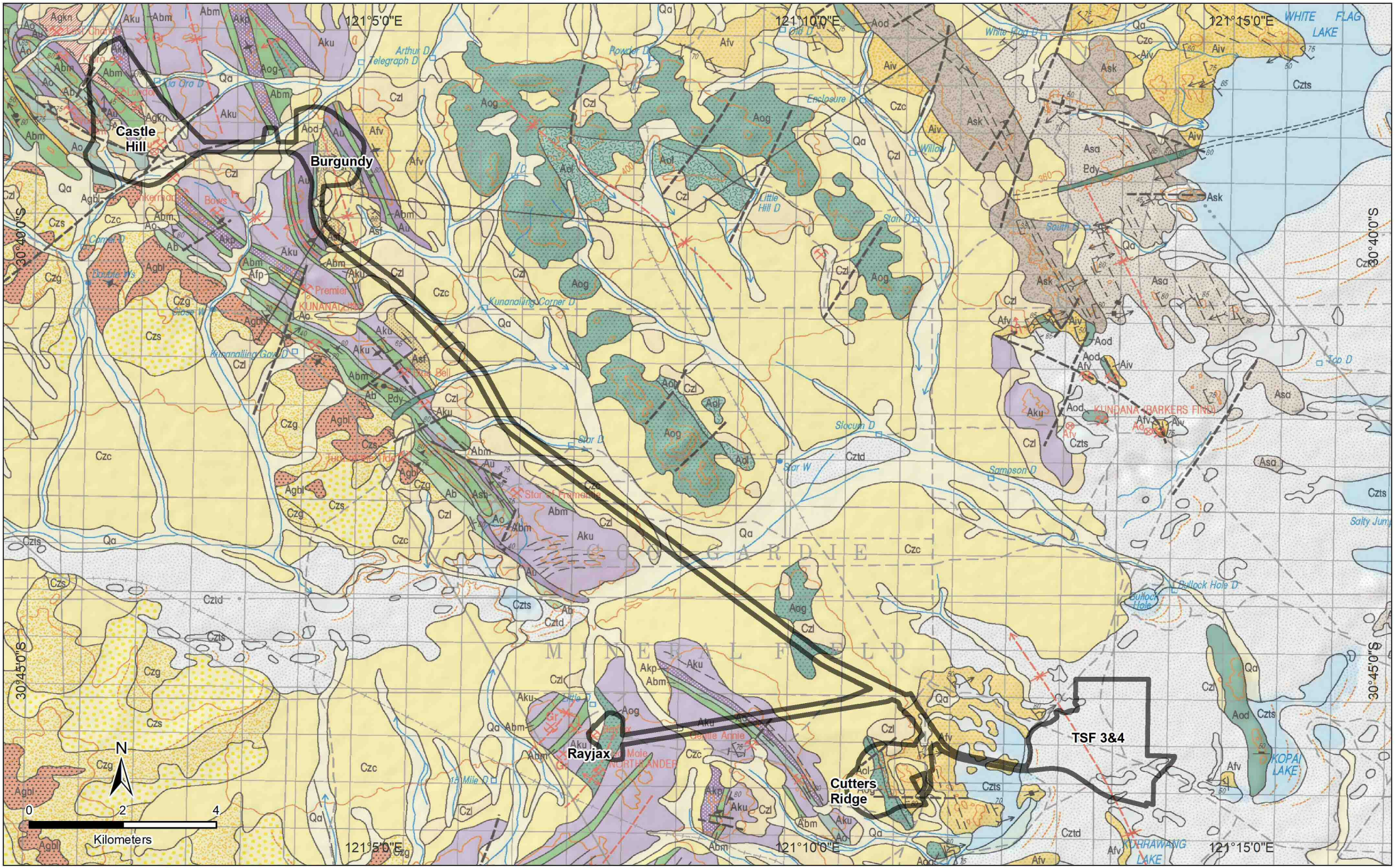
Based on the available logs and mapped surficial geologies, strata above the water table predominantly consist of weathered laterite, saprolite and minor alluvium overlying various mafic and ultramafic rocks.

Unconfined to semi-confined aquifers associated with the transition between weathered and fresh rock, as well as minor confined aquifers associated with fracturing in mineralised zones and quartz veins were observed during water bore drilling in the study area (AQ2 2019). However, minimal groundwater inflows and low levels of permeability were observed, with dewatering requirements likely to relate principally to inflows from surface runoff (AQ2 2019).

3.1.1. Castle Hill

Water bore data is currently not available for Castle Hill, but the geology can be interpreted using 100k mapping (Figure 2) and the single diamond hole provided (Plate 1). Additionally, drill logs for Burgundy (nearby to the east, Figure 1) may be indicative. The geology of Castle Hill consists of various mafic and ultramafic units overlain by weathered saprolite. Some small areas of Quaternary alluvium are also present, corresponding with very minor drainage lines. Significant subterranean spaces appear to be absent and the geologies present are generally not considered prospective for either stygofauna or troglofauna.

Castle Hill, as with the other proposed mine areas, does not occur within a palaeovalley (Figure 3). Based on water bore data from Burgundy, the water table throughout Castle Hill is anticipated to stand at 50 m below ground level (mbgl) or more (based on relief), although there is no information on groundwater quality. However, regardless of water quality, the likely depths to water and the geologies present are likely to be significant limiting factors on the occurrence of stygofauna. It is considered that that the prospectivity for subterranean fauna at Castle Hill is low.



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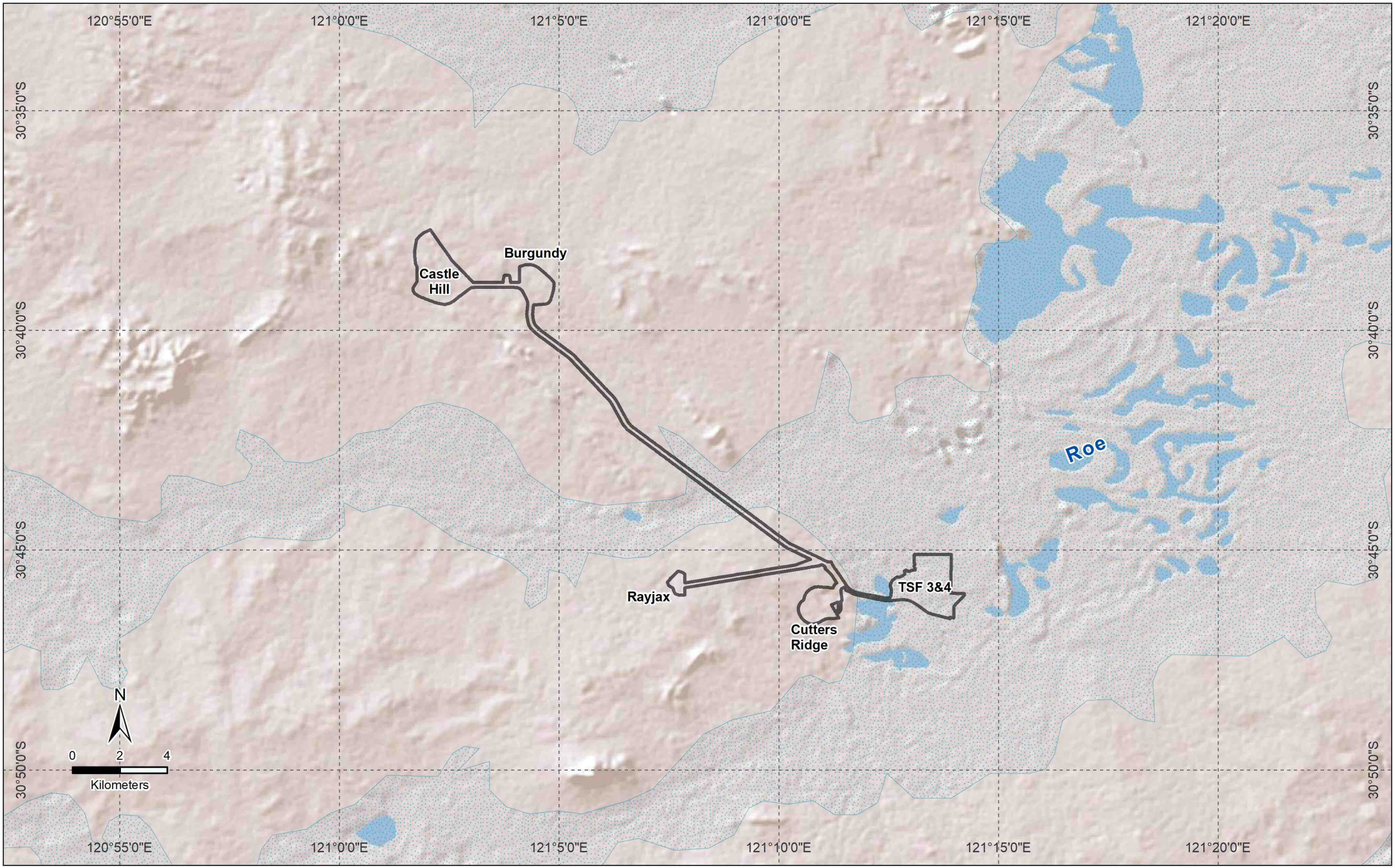
Date: 16-09-2019

Legend

Study area

Drill log

Figure 2. Geology of the Kalgoorlie 3136 map sheet and locations of available drill logs



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Date: 16-09-2019

Legend

Study area | WASANTPalaeoval... | lakes and playas

Figure 3. Distribution of palaeovalleys in the vicinity of the study area

3.1.2. Rayjax

In addition to mapped surficial geology (Figure 2), drill logs from three water bores (AQ2 2019) and a diamond core (Plate 1) provide direct information on the stratigraphy of Rayjax, which predominantly comprises gabbro with some dolerite, porphyry and ultramafics, with a thin (around 11 m) veneer of weathered laterite. There is little to no development of significant subterranean spaces and the geologies present are not typically considered prospective for subterranean fauna.

Depth to the water table, at 19.41 mbgl, is in itself unlikely to be a major limitation on the occurrence of stygofauna, though there is no information on water quality. However, Rayjax is outside the mapped extent of the palaeovalley (Figure 3) and the very low degree of permeability and poor yields of water observed during drilling and airlift testing (AQ2 2019) further suggest a very low level of habitat prospectivity for stygofauna.

3.1.3. Cutters Ridge

The surface geology of Cutters Ridge comprises metamorphosed gabbro and metamorphosed granodiorite flanked by felsic vocanoclastics, colluvium and weathered saprolite and there are also very small pockets of alluvium coinciding with drainage lines (Figure 2). Some thin quartz veins were also encountered within the surficial saprolite (AQ2 2019). As with the deposits above, there is little to no development of significant subterranean spaces and geologies within Cutters Ridge are not typically considered prospective for subterranean fauna. Cutters Ridge occurs outside the palaeovalley (Figure 3) and very little water was encountered during drilling, with flows drying quickly, indicating aquifer confinement. These geological and hydrogeological factors point to low prospectivity for subterranean fauna.

3.1.4. TSF

Drill logs are not available for the TSF, whose geological setting can instead be interpreted through mapped surficial geology. The geology comprises stabilised dunes of sand, silt, gypsum and probably saprolite adjacent to playas within the palaeovalley. Despite being within the palaeovalley, the TSF itself is unlikely to host a more than a depauperate stygal community and is even less likely to host troglofauna. This is primarily due to the lack of subterranean spaces within the very fine-grained geology. For troglofauna, prospectivity is also likely to be limited by shallow depths to the water table, with the caveat that no direct information on groundwater is available for the TSF at present. The geological units within the TSF with the potential to host subterranean fauna appear to be widespread and connected externally, suggesting that any species present would be likely to have ranges larger than the TSF itself.

3.2. Summary of potential habitat

Based on the information available, there is little in the way of prospective habitat for subterranean fauna in the study area. The primary limiting factor on the occurrence of subterranean species will be the apparent unavailability of well-developed underground spaces such as coarse interstices, vughs, fractures and caverns. The surficial cover of weathered laterite and saprolite is clayey and more or less devoid of significant subterranean spaces. The underlying rock types are not considered prospective and this is supported by the very limited amounts of water produced during bore drilling. The proposed mining areas are all outside the extent of the palaeovalley, further reducing prospectivity.

The most prospective area for stygofauna is the TSF, though it is expected that only a depauperate community, at best, would occur and any species present would be highly likely to have a range extending beyond the TSF in palaeovalley sediments. Like the rest of the study area, the TSF has low prospectivity for troglofauna.

Plate 1. Exemplar photographs of diamond drill cores examined to determine the presence of subterranean fauna habitat.
First row – Castle Hill; second row – Rayjax; third row – Cutters Ridge.

4. PREVIOUS RECORDS OF SUBTERRANEAN FAUNA

To further inform the appraisal of the prospectivity of the Project area, records of both stygofauna and troglofauna were compiled from Western Australian Museum (WAM) and Bennelongia databases within a square search area of 2 decimal degrees centred on the approximate centroid of the study area (30.705° S, 121.105° E). Resultant species data were investigated spatially and cross-referenced with other records, including those outside the search area, to determine the distribution of each species relative to the Project. Higher-order identifications were not regarded as distinct species, unless they belonged to taxa that had otherwise not been recorded. The distribution of records of stygofauna and troglofauna identified within the search area are shown in Figure 4 and Figure 5.

4.1. Stygofauna

The desktop revealed records of at least seven-species of stygofauna within the search area, including a stygal annelid worm, a syncarid and five-species of copepod (Table 1). A small number of nematode worms and rotifers have also been collected in the search area in stygofauna samples but, as these groups are typically not assessed due to uncertain degrees of groundwater dependence and poorly resolved taxonomies, these records are not considered further. All the records of stygofauna in the

search area are from the Bennelongia database. (There were no records at the WAM of stygofauna in the search area.)

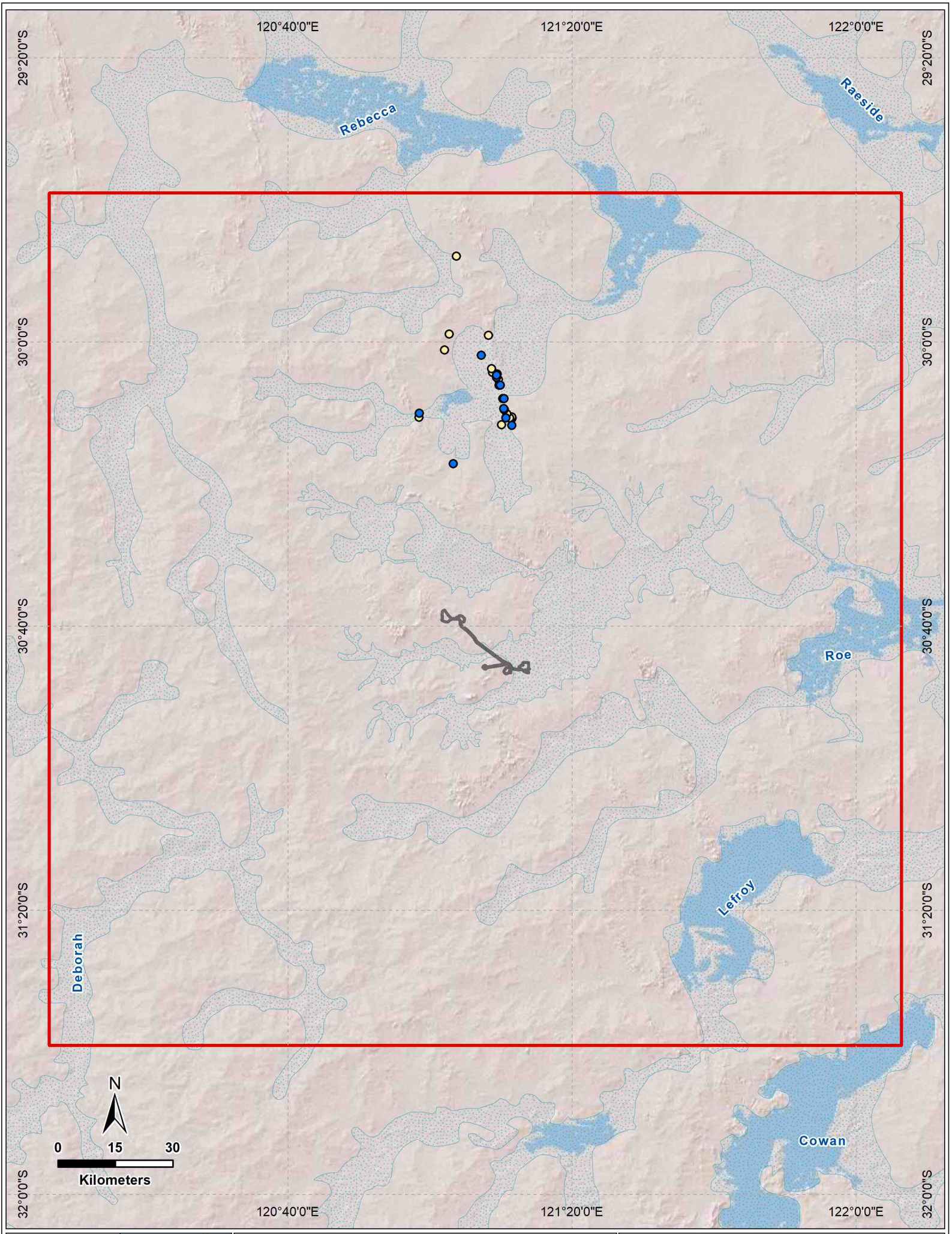
Table 1. Previous records of stygofauna within the search area.
Higher order identifications that may belong to other recorded taxa are denoted with asterisks (*).

Higher Classification	Lowest Identification	Total no. of bores	Comments
Annelida			
Clitellata			
Enchytraeida			
Enchytraeidae	Enchytraeidae `BOL029`	1	Collected 66 km north of the study area.
	Oligochaeta sp.*	1	Higher order identification.
Arthropoda			
Malacostraca			
Syncarida			
Bathynellidae	*Pilbaranella* `BSY178`	1	Collected 68 km north of the study area. Known only from one bore within the Rebecca palaeovalley. Range unknown.
Maxillopoda			
Cyclopoida			
Cyclopidae	*Halicyclops eberhardi* s.l. `BCY062`	1	Collected 38 km north of the study area. Known only from one bore in alluvium adjacent to (and possibly within) the Rebecca palaeovalley. Range unknown.
Harpacticoida			
Ameiridae	*Megastygonitocrella* `BHA247`	1	Collected 51 km north of the study area. Known from a single bore within the Rebecca palaeovalley. Range unknown.
	Stygonitocrella s.l. `BHA245`	1	Collected 38 km north of the study area. Known only from one bore in alluvium adjacent to (and possibly within) the Rebecca palaeovalley. Range unknown.
	Stygonitocrella s.l. `BHA246`	1	Collected 67 km north of the study area. Known from a single bore within the Rebecca palaeovalley. Range unknown.
Miraciidae	*Schizopera* `BHA248`	1	Collected 38 km north of the study area. Known only from one bore in alluvium adjacent to (and possibly within) the Rebecca palaeovalley. Range unknown.

All the recorded species are known from single bores within, or immediately adjacent to, the mapped extent of the Rebecca palaeovalley near Lake Goongarrie (Figure 4). None of the recorded species have been formally described and, combined with the fact that each species is known from a single bore, it is therefore very difficult to predict their likely geographic distributions. However, all the species are well outside the extent of potential influence from works in the study area.

The small number of records of stygofauna species is, at least in part, a result of the limited amount and coverage of stygofauna sampling in the search area (Figure 4, although it is noted that there may be sampling that is not captured by records in the Bennelongia and WAM databases). Nevertheless, samples that were captured in the review collected very few species, demonstrating the relatively low degree of prospectivity in the search area.

A large number of calcrete aquifers in the Goldfields and wider Yilgarn are listed as Priority Ecological Communities (PEC) on the basis that they are known or likely to harbour unique (and often rich) assemblages of stygal communities. None of these PEC calcretes occurs within the search area.



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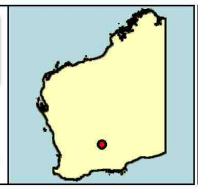
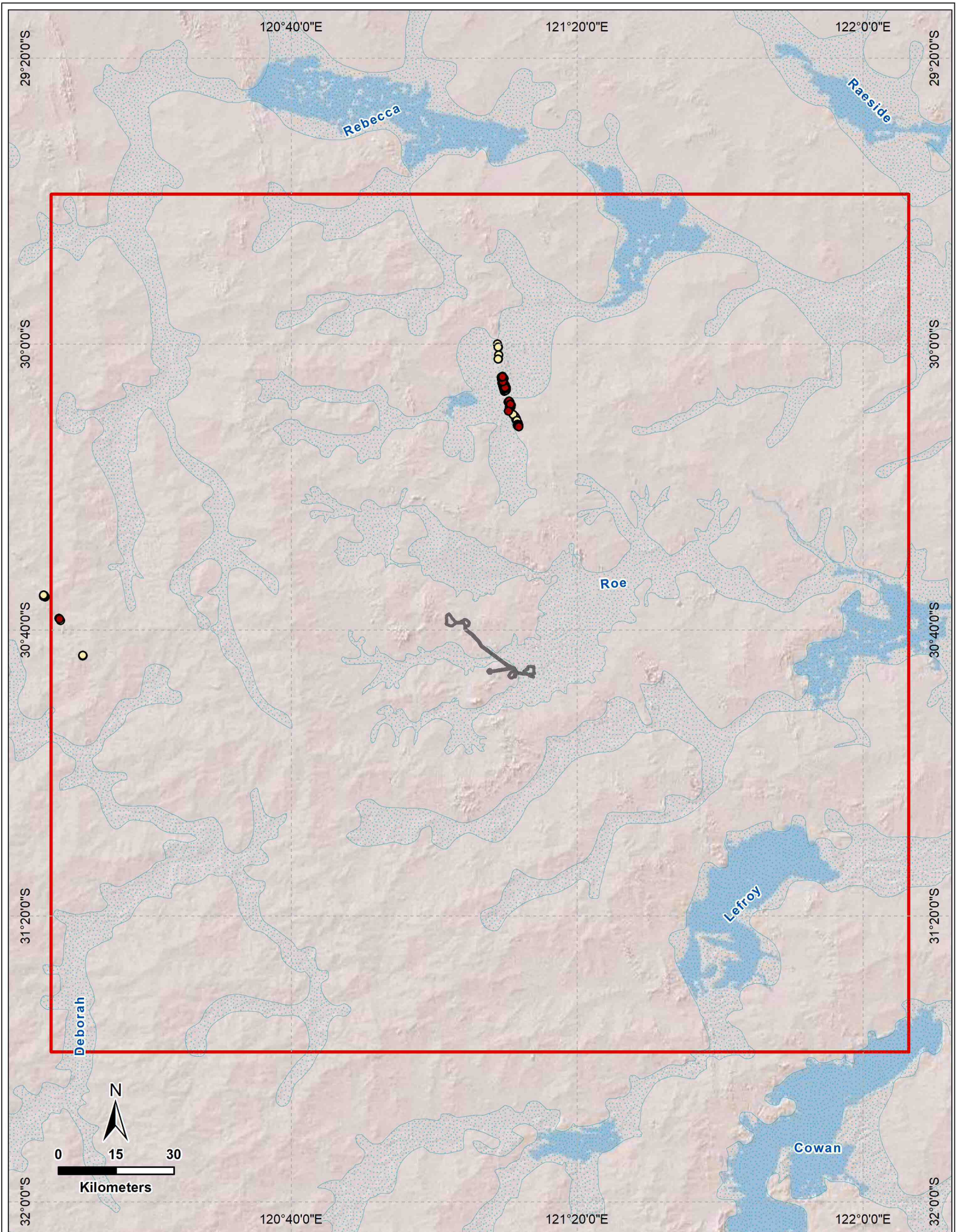
Author: A. Mittra
Date: 02-09-2019



Legend

- Study Area
- Palaeovalley
- 2dd_search_area
- lakes and playas
- Stygofauna sample
- Stygofauna record

Figure 4. Records of stygofauna species within the search area identified through desktop review



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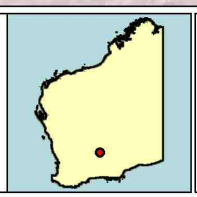

Legend

- Study Area
- Palaeovalley
- 2dd_search_area
- lakes and playas
- Troglofauna sample
- Troglofauna record

Figure 5. Records of troglofauna species within the search area identified through desktop review

4.2. Troglofauna

The desktop revealed records of at least eleven species of troglofauna in the search area including two species of spider (Araneae), three species of centipede (Chilopoda), a millipede (Diplopoda), one species of dipluran, a beetle (Coleoptera), a true bug (Hemiptera) and two species of symphylan (Table 2). All the records came from the Bennelongia database. (There were no records at the WAM of troglofauna in the search area.) The majority of the troglofauna species were recorded near Lake Goongarrie, some 50 km or more to the north of the study area, predominantly in transported colluvial cover material in the Rebecca palaeovalley. One species, the dipluran Japygidae sp., was collected 78 km to the east of the study area from low greenstone or ironstone hills.

As is the case for stygofauna, the small number of records of troglofauna in the search area in part reflects the small number and very limited coverage of previous samples. However, it is also true that geologies that would typically be considered prospective for troglofauna, such as large calcretes and ironstone ranges are largely absent from the vicinity of the study area and wider search area.

Table 2. Previous records of troglofauna within the search area.
Higher order identifications that may belong to other recorded taxa are denoted with asterisks (*).

Higher Classification	Lowest Identification	Total no. of bores	Comments
Arthropoda			
Arachnida			
Araneae			
Oonopidae	*Prethopalpus* `BAR106`	1	Collected 50 km north of the study area. Known from a single bore and collected in transported cover material. Range unknown.
	Prethopalpus `BAR107`	2	Collected from two bores, 50-54 km north of the study area, in transported cover material. Range unknown.
Chilopoda			
Geophilida	Geophilida `BGE040`	1	Collected 56 km north of the study area in transported cover material. Known from a single bore. Range unknown.
	Geophilida `BGE041`	1	Collected 56 km north of the study area in weatehered bedrock. Known from a single bore. Range unknown.
	Geophilida sp.*	1	Higher order identification.
Scolopendrida			
Cryptopidae	*Cryptops* nr *spinipes*	1	Collectected 51 km north of the study area in weathered bedrock. Likely a very widespread species.
Diplopoda			
Polyxenida			
Lophoproctidae	*Lophoturus madecassus*	1	Cosmopolitan species.
Entognatha			
Diplura			
Japygidae	Japygidae sp.	1	Collected 78 km west of the study area, likely in fractured greenstone or ironstone. Range unknown.
Insecta			
Coleoptera			
Carabidae	*Gracilanillus* `BCO186`	1	Collected 54 km north of the study area in transported cover material. Known from a single bore, range unknown.
Hemiptera			
Cixiidae	Cixiidae sp. B02	1	Very widespread morphospecies collected 46 km north of the study area.
Symphyla			
Cephalostigmata			
Scutigerellidae	*Hanseniella* sp.	3	Collected from three bores 49-57 km north of the study area. Not identified to species, range unknown.
	Symphyella `BSYM086`	1	Collected 50 km north of the study area in weathered bedrock. Known from a single bore, range unknown.

5. POTENTIAL IMPACTS

The potential impacts of mining and related operations on subterranean fauna can be broadly divided into primary impacts, namely the impacts causing possible extinction or threat to the persistence of local populations through direct removal of habitat, and secondary impacts that alter or degrade habitat rather than remove it, thereby reducing population densities.

Secondary impacts include pollutants, altered water chemistry, mine blasting and changes to energy and nutrient pathways. Assessing the threat of potential secondary impacts generally requires detailed physicochemical information on the environmental changes expected to occur.

5.1. Stygofauna

The most common factor causing the removal of habitat for stygofauna is drawdown of the watertable, either from mine pit dewatering (if required), or groundwater production in supply borefields. The threat to an individual species will depend on the relationship between its distribution and the spatial and vertical magnitude of drawdown.

It is apparent that there will be minimal dewatering requirements for the proposed mines (AQ2 2019) and subsequently the magnitude of groundwater drawdown around each pit, in terms of both depth and horizontal extent, will presumably be very small. This is in part due to the tight geologies resulting in aquifers being confined to various degrees.

As a result of tight geologies, low permeability and situation outside the palaeovalley, the prospectivity of the study area for stygofauna is generally very low. This is further supported by the small number of species recorded in the region, most of which have been recorded within a palaeovalley (though it is true that sampling intensity has been low). To reiterate, it is considered that very few, if any, stygofauna species will occur within the study area, especially in the mine pit areas at Castle Hill, Rayjax and Cutters Ridge.

The TSF area has a slightly higher, but still low, degree of prospectivity for stygofauna. There is currently limited information on groundwater (depth and quality) in the TSF. However, it is likely that any species present will also occur in the palaeovalley beyond the extent of the TSF.

Overall, the development of open cut pits and the TSF within the study area poses a very low level of risk to stygofauna.

5.2. Troglofauna

The main factor causing the removal of habitat for troglofauna is the excavation of mine pits. As for stygofauna, the level of threat to a troglofauna species depends on its distribution relative to the spatial and vertical extent of excavations. The mine pits in the study area will be small (Figure 1) relative to the median ranges of many troglofauna groups (Halse and Pearson 2014).

Due to the general lack of subterranean habitat in the geologies of the study area, it is considered unlikely that troglofauna will occur. (This includes the TSF, which has a very low level of prospectivity for troglofauna.) The level of risk posed by developments in the study area to troglofauna is therefore very low.

6. CONCLUSIONS

Potential habitats in the study area have low to very low prospectivity for subterranean fauna including both stygofauna and troglofauna. It is considered unlikely that subterranean fauna will occur and, if present, communities will consist of very few species. The low number of records of subterranean fauna species in the vicinity of the study area supports this assessment, though sampling has been limited.

6.1. Recommendations

No further survey is considered to be required to support mining approvals for the study area in regard to subterranean fauna.

It is noted that this assessment does not cover areas or developments outside the current study area, including any water supply options, which should be assessed separately.

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Appendix M: Supporting Biodiversity Survey (Detailed Flora/Vegetation Survey and Basic Fauna Survey)

Rayjax Project
Detailed Flora/ Vegetation Survey and Basic Fauna Survey

Prepared for Evolution Mining Ltd.

January 2021
Version 1

Prepared by:
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Disclaimer

Quality Assurance

An internal quality review process has been implemented to each project task undertaken by BC. Each document and its contents are carefully reviewed by core members of the Consultancy team and signed off at Director Level prior to issue to the client. Draft documents are submitted to the client for comment and acceptance prior to final production.

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Glossary

Acronym	Description
BAM Act	*Biosecurity and Agriculture Management Act 2007*, WA Government.
BC Act	*Biodiversity Conservation Act 2016*, WA Government.
Botanica	Botanica Consulting Pty Ltd.
BoM	Bureau of Meteorology.
DAFWA	Department of Agriculture and Food (now DPIRD), WA Government.
DAWE	Department of the Agriculture, Water and Environment (formerly known as DotEE), Australian Government.
DBCA	Department of Biodiversity, Conservation and Attractions (formerly DPaW), WA Government.
DEC	Department of Environment and Conservation (now DBCA), WA Government.
DER	Department of Environment Regulation (now DWER), WA Government.
DMIRS	Department of Mines, Industry Regulation and Safety (formerly DMP), WA Government
DotEE	Department of the Environment and Energy (now known as DAWE), Australian Government.
DoW	Department of Water (now DWER), WA Government.
DPaW	Department of Parks and Wildlife (now DBCA), WA Government.
DPIRD	Department of Primary Industries and Regional Development, WA Government
DWER	Department of Water and Environmental Regulation (formerly EPA, DER and DoW), WA Government
EP Act	Environmental Protection Act 1986, WA Government.
EP Regulations	Environmental Protection (Clearing of Native Vegetation) Regulations 2004, WA Government.
EPA	Environmental Protection Authority, WA Government.
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*, Australian Government.
ESA	Environmentally Sensitive Area.
Ha	Hectare (10,000 square meters).
IBRA	Interim Biogeographic Regionalization for Australia.
IUCN	International Union for the Conservation of Nature and Natural Resources – commonly known as the World Conservation Union.
JAMBA	*Japan Australia Migratory Bird Agreement 1981.*
Km	Kilometer (1,000 meters).
LGA	Local Government Area
NVIS	National Vegetation Information System.
PEC	Priority Ecological Community.
TEC	Threatened Ecological Community.
WA	Western Australia.
WAHERB	Western Australian Herbarium.
WAM	Western Australian Museum, WA Government.

Executive Summary

Botanica Consulting Pty Ltd (Botanica) was commissioned by Evolution Mining Ltd. (Evolution) to undertake a detailed flora/ vegetation survey and basic fauna survey within the Rayjax Project area (referred to as the 'survey area'). The survey area is 385 ha in extent and is located approximately 30 km west of Kalgoorlie-Boulder, Western Australia. The survey was conducted to support a Native Vegetation Clearing Permit (NVCP) application and Mining Proposal with regards to the further development of the Rayjax Project.

The survey area lies within the Eastern Goldfields (COO3) subregion of the Coolgardie Bioregion, as defined by the Interim Biogeographic Regionalisation of Australia (IBRA).

The Eastern Goldfields subregion (5,102,428 ha) lies on the Yilgarn Craton's Eastern Goldfields Terrain, which is described as gently undulating plains with a subdued relief, interrupted in the west with low hills and ridges of Archaean greenstones and in the east by a horst of Proterozoic basic granulite. The underlying geology is of gneisses and granites eroded into a flat plane covered with tertiary soils and with scattered exposures of bedrock. Calcareous earths are the dominant soil group and cover much of the plains and greenstone areas. A series of large playa lakes in the western half are the remnants of an ancient major drainage line (Cowan 2001).

The vegetation consists of Mallees, Acacia thickets and shrub-heaths on sandplains, with diverse *Eucalyptus* woodlands occurring around salt lakes, on ranges, and in valleys. Salt lake support dwarf shrublands of samphire. Woodlands and *Dodonaea* shrubland occur on basic granulite of the Fraser Range, and the area is rich in endemic Acacias.

The dominant land uses of the Eastern Goldfields subregion includes Unallocated Crown Land (UCL) and Crown reserves and pastoral grazing, with conservation areas and mining leases also present (Cowan, 2001). The survey area is located within the Mt Burges Pastoral Lease.

Prior to the field assessment a literature review was undertaken of previous flora and fauna assessments conducted within the local region. Documents reviewed included:

- Mattiske Consulting (2002). *Flora and Vegetation Survey – Frog's Leg Project Area Supplementary Survey*. Prepared for Mines and Resources Australia, November 2002
- Outback Ecology (2004). *Flora and Vegetation Survey – Frog's Leg Project Targeted Fauna Survey*. Prepared for Mines and Resources Australia Pty. Ltd., January 2004
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In addition to the literature review, searches of the following databases were undertaken to aid in the compilation of a list of significant flora within the survey area:

- DBCA Threatened/ Priority Flora spatial data (DBCA, 2019);
- DBCA NatureMap database (DBCA, 2020); and
- EPBC Protected Matters search tool (DAWE, 2020a).

The NatureMap species search and EPBC Protected Matters search were conducted with a 40 km buffer from the survey area.

The desktop review identified 838 vascular flora species as occurring within 40 km of the survey area, representing 309 genera from 74 families. The most diverse families were Asteraceae (105 species), Fabaceae (105 species) and Myrtaceae (105 species). Significant genera include *Eucalyptus* (56 species), *Acacia* (53 species) and *Eremophila* (38 species). This total includes 83 introduced (weed) species (9.9%).

The desktop review identified 83 introduced flora (weed) species as potentially occurring in the vicinity of the survey area. These species are comprised of 25 families, with the most commonly represented being Asteraceae (14 species), Poaceae (14 species) and Fabaceae (seven species). Of these, nine are listed as a Declared Pest on the Western Australian Organism List (WAOL) under the *Biosecurity and Agriculture Management* (BAM) *Act 2007*, with six also listed as a Weed of National Significance.

The assessment of the DBCA Priority/ Threatened flora data (DBCA, 2019), NatureMap search (DBCA, 2020), Protected Matters searches (DAWE, 2020a) and previous relevant literature identified 50 significant flora species recorded within a 40 km radius of the survey area. These are comprised of three Endangered, 17 Priority 1, eight Priority 2, 18 Priority 3 and four Priority 4 taxa (Appendix 3).

These taxa were assessed for distribution and known habitat to determine their likelihood of occurrence within the survey area. The assessment did not identify any significant flora species as likely to occur in the survey area. Four taxa were assessed as possibly occurring in the survey area, consisting of two Priority 1, two Priority 2 and one Priority 3 taxa.

The Protected Matters search (DAWE, 2020a) did not identify any Threatened Ecological Communities recorded within 40 km of the survey area. Analysis of the Priority Ecological Communities within the Goldfields region (DBCA, 2017) did not identify any significant vegetation assemblages as likely or possibly occurring within the survey area.

A total of 264 terrestrial vertebrate fauna taxa have been recorded within a 40 km radius of the survey area, consisting of 149 bird, 32 mammal, 76 reptile and six amphibian taxa. This total includes nine introduced (feral) species (3.4%)

The NatureMap and EPBC database searches identified 14 feral fauna species from nine families as potentially occurring in the survey area.

The desktop review identified ten terrestrial vertebrate fauna species of conservation significance as previously being recorded in the regional area, consisting of seven Threatened, three migratory or otherwise protected species. In addition, nine migratory wading/shorebird species were assessed collectively due to their similar habitat requirements.

Habitat and distribution data was used to determine the likelihood of occurrence within the survey area. The assessment identified three significant fauna species as potentially occurring in the survey area

There are no vested Conservation Reserves located within the survey area.

There are no DBCA managed lands located within the survey area.

There are no Environmentally Sensitive Areas located within the survey area.

There are no Nationally Important or RAMSAR wetlands located within the survey area.

The closest significant environmental feature is the Kurrawang Nature Reserve, which is DBCA-managed land located approximately 20 km south-east of the survey area. Disturbances within the survey area are unlikely to impact these areas.

Botanica conducted a detailed flora/ vegetation and basic fauna survey from the 28th to 29th October 2020, with the area traversed on foot and ATV by two Botanica staff members; Jennifer Jackson (Senior Botanist, BSc (Honours) Environmental Management) and Matthew Newlands (Environmental Technician).

The field survey identified 65 flora taxa within the survey area. These taxa represented 30 genera across 20 families, with the most diverse genera being *Eremophila* (nine species), *Maireana* (nine species) and *Eucalyptus* (eight species). Dominant families include Chenopodiaceae (13 species), and Fabaceae, Myrtaceae and Scrophulariaceae, all with nine species. No introduced (weed) species were recorded.

No Threatened or Priority flora species were recorded within the survey area.

A total of three broad-scale vegetation communities were identified within the survey area. Vegetation community descriptions and extents were determined from field survey results, aerial imagery interpretation and extrapolation of the communities.

The survey found CLP-EW1 was the most widespread community in the survey area, occupying 308 ha (80%), while CLP-EW2 was the most restricted with 32 ha (8%). CLP-EW1 was the most diverse community, with 48 flora species recorded, and HS-EW1 was the least diverse with 26 flora species.

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

Based on vegetation and associated landforms identified during the flora and vegetation assessment, two broad scale terrestrial fauna habitats were identified as occurring within the survey area. One inactive Malleefowl mound was recorded within the survey area however no evidence of current Malleefowl activity (active mounds, tracks, feathers or bird observations etc.) were observed within the survey area. No evidence of any other significant fauna species were observed during the survey.

Native vegetation within the survey area was rated as ‘good’, which describes obvious signs of damage caused by human activity since European settlement, including impacts to vegetation structure and composition from low levels of grazing, changed fire regimes and/or slightly aggressive weeds. Cleared areas associated with historical mining operations were categorized as completely degraded.

Based on the outcomes from the survey undertaken, Botanica assessed the results of the desktop and field survey with regards to the native vegetation clearing principles listed under Schedule 5 of the EP Act. The assessment found that the proposed vegetation clearing activities is unlikely to be at variance with any of these clearing principles.

1 INTRODUCTION

1.1 Project Description

Botanica Consulting Pty Ltd (Botanica) was commissioned by Evolution Mining Ltd. (Evolution) to undertake a detailed flora/ vegetation survey and basic fauna survey within the Rayjax Project area (referred to as the 'survey area') (Figure 1-1). The survey area is 385 ha in extent and is located approximately 30 km west of Kalgoorlie-Boulder, Western Australia. The survey was conducted to support a Native Vegetation Clearing Permit (NVCP) application and Mining Proposal with regards to the further development of the Rayjax Project.

1.2 Objectives

The flora assessment was conducted in accordance with *Technical Guide - Flora and Vegetation Surveys for Environmental Impact Assessment – December 2016* (EPA, 2016a). The objectives of the assessment were to:

- Conduct a desktop review of available technical reports, relevant databases and spatial data to identify the potential flora and vegetation that may be present;
- Identify significant flora, vegetation/ecological communities potentially occurring in the area;
- Conduct a detailed flora and vegetation survey and targeted searches for populations of significant flora;
- Undertake floristic community mapping to a scale appropriate for the bioregion and described according to the National Vegetation Information System (NVIS) structure and floristics;
- Undertake vegetation condition mapping;
- Review the local and regional significance of flora and vegetation within the survey area;
- Assess the survey area's plant species diversity, density, composition, structure and weed cover, using NVIS classification system for vegetation description; and
- Assess Matters of National Environmental Significance (MNES) and indicate whether potential impacts on MNES as protected under the EPBC Act are likely to require referral to the Commonwealth Department of Agriculture, Water and the Environment (DAWE).

The fauna assessment was conducted in accordance with the requirements for a basic terrestrial fauna survey as defined in *Technical Guidance - Terrestrial Fauna Surveys for Environmental Impact Assessment – June 2020* (EPA, 2020). The objectives of the assessment were to:

- Gather background information on fauna in the survey area (literature review, database and map-based searches);
- Delineate and characterise the faunal assemblages and fauna habitats present in the survey area; and
- Assess the likelihood of significant fauna occurring within the survey area.

Figure 1-1: Regional map of the survey area

2 BIOPHYSICAL ENVIRONMENT

2.1 Regional Environment

The survey area lies within the Eastern Goldfields (COO3) subregion of the Coolgardie Bioregion, as defined by the Interim Biogeographic Regionalisation of Australia (IBRA).

The Eastern Goldfields subregion (5,102,428 ha) lies on the Yilgarn Craton's Eastern Goldfields Terrain, which is described as gently undulating plains with a subdued relief, interrupted in the west with low hills and ridges of Archaean greenstones and in the east by a horst of Proterozoic basic granulite. The underlying geology is of gneisses and granites eroded into a flat plane covered with tertiary soils and with scattered exposures of bedrock. Calcareous earths are the dominant soil group and cover much of the plains and greenstone areas. A series of large playa lakes in the western half are the remnants of an ancient major drainage line (Cowan 2001).

The vegetation consists of Mallees, Acacia thickets and shrub-heaths on sandplains, with diverse *Eucalyptus* woodlands occurring around salt lakes, on ranges, and in valleys. Salt lake support dwarf shrublands of samphire. Woodlands and *Dodonaea* shrubland occur on basic granulite of the Fraser Range, and the area is rich in endemic Acacias.

In accordance with Beard (1990) the survey area is located in the Coolgardie Botanical District of the Southwestern Interzone Province. The landscape is described as gently undulating with occasional ranges of low hills, with sandplains in the western part and some large playa lakes. Soils are principally brown calcareous earths, which overlays the Proterozoic granite and gneiss of the Fraser Range block and Archaean granite, with infolded volcanics and meta-sediments, of the Yilgarn block. Vegetation is predominately *Eucalyptus* woodlands, with slopes and flats containing *E*. *longicornis* alongside *E. salubris* and *E*. *salmonophloia*. Woodland understories range from tall sclerophyll shrubland dominated by *Melaleuca pauperiflora* to soft-leaved saltbush shrubland of *Atriplex vesicaria* and *A*. *nummularia*. Some hill slopes contain mallees of *E*. *livida* or *E*. *loxophleba*, while ironstone ridges are covered in thickets of *Acacia quadrimarginea*, *Allocasuarina acutivalvis* and *A*. *campestris*. Other vegetation assemblages include species-rich scrub-heaths and *Allocasuarina* thickets on sandplains, merging into *Acacia* thickets and Kwongan vegetation to the north.

2.2 Land Use

The dominant land uses of the Eastern Goldfields subregion includes Unallocated Crown Land (UCL) and Crown reserves and pastoral grazing, with conservation areas and mining leases also present (Cowan, 2001). The survey area is located within the Mt Burges Pastoral Lease.

2.3 Soils and Landscape Systems

The survey area lies within the Kalgoorlie Province, located in the southern Goldfields between Paynes Find, Menzies, Southern Cross and Balladonia. The landscape consists of undulating plains (with some sandplains, hills and salt lakes) on the granitic rocks and greenstone of the Yilgarn Craton. Soils range from calcareous loamy earths and red loamy earths with some salt lake soils to red deep sands, yellow sandy earths, shallow loams and loamy duplexes. Vegetation communities are predominately Eucalypt woodlands with some acacia-casuarina thickets, mulga shrublands, halophytic shrublands and spinifex grasslands.

The Kalgoorlie Province is further divided into six soil-landscape zones, with the survey area located in the Norseman Zone (266).

The Norseman zone is located in the southern Goldfields between Koolyanobbing, Menzies, Zanthus (Trans-Australian Railway), Norseman and Lake Hope. The landscape consists of undulating plains and uplands (with some sandplains and salt lakes) on granitic rocks of the Yilgarn Craton. Soils include calcareous loamy earths, yellow sandy and loamy earths, red loamy earths, red deep sands and salt lake soils. Vegetation consists of salmon gum-redwood-merrit-red mallee-gimlet woodland with acacia/casuarina thickets (and some mulga shrublands and spinifex grasslands).

The soil landscape zones are further divided into soil landscape systems, with the survey area located within the Mx43 landscape system (Table 2-1) as shown in Figure 2-1, in accordance with soil landscape system mapping data (Government of Western Australia, 2019).

Table 2-1: Soil Landscape Systems within the survey area

Soil Landscape System	Description	Extent within Survey Area ha (%)
Mx43	Gently undulating valley plains and pediments; some outcrop of basic rock	385 ha (100%)

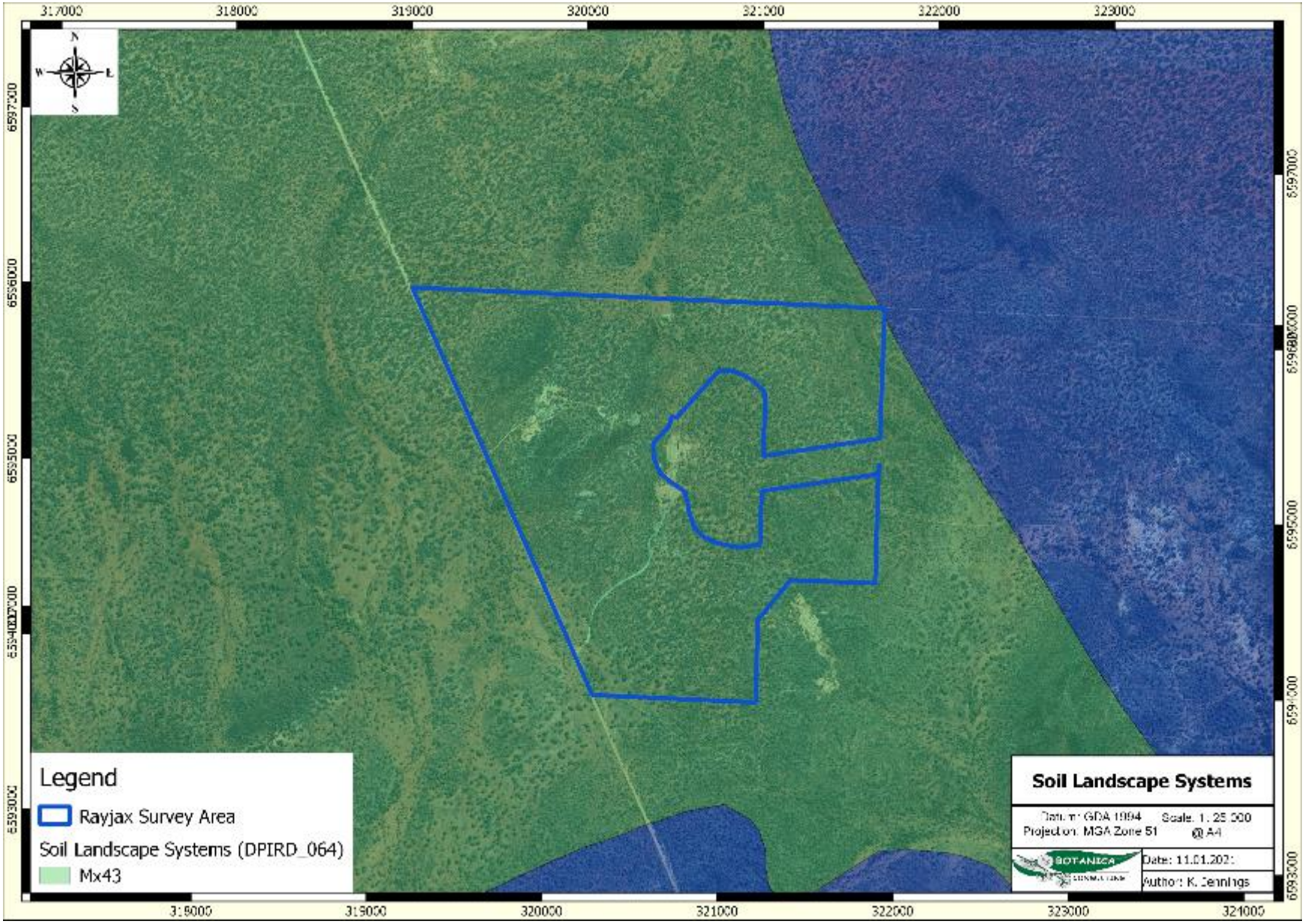


Figure 2-1: Soil Landscape Systems within the survey area

2.4 Regional Vegetation

In accordance with Tille (2006), the vegetation of the Kambalda Zone is typified by the preponderance of stony plains with acacia shrublands and halophytic shrublands, low hills with eucalypt or acacia woodlands with halophytic undershrubs, stony plains with acacia shrublands and alluvial plains with eucalypt woodlands and halophytic undershrubs rangeland. The vegetation of the Norseman zone is differentiated from the Kambalda zone by the presence of sandplains and occasional dunes with spinifex grasslands.

More broadly, the vegetation of the Kalgoorlie Province is described by Tille (2006) as woodlands of redwood (*Eucalyptus transcontinentalis*), red mallee (*E. oleosa*), Dundas blackbutt (*E. dundasii*), merrit (*E. flocktoniae*) and salmon gum (*E. salmonophloia*), found on undulating plains over granite. There are also some hummock grasslands with red mallee over spinifex (*Triodia scariosa*) and thickets of *Acacia*, *Casuarina* and *Melaleuca* spp. Plains on greenstone have woodlands of York gum (*E. loxophleba*), salmon gum and gimlet (*E. salubris*). The valley plains have woodlands of salmon gum, red mallee, Goldfields blackbutt (*E. lesouefii*), gimlet, York gum and morrel (*E. longicornis*). These sometimes have an understorey of saltbush (*Atriplex* spp.), pearl bluebush (*Maireana sedifolia*), sago bluebush (*M. pyramidata*) and *Eremophila* spp. There are areas of spinifex grasslands with red mallee, mallees (e.g. *E. youngiana*) and marble gum (*E. gongylocarpa*). Low woodlands of mulga (*Acacia aneura*) and black sheoak (*Casuarina pauper*) over bluebush and saltbush are also present. Apart from the bare salt lake surfaces, saline valley floors have shrublands of samphire (*Tecticornia* spp.) and *Frankenia* spp. in lower areas, shrublands of saltbush and bluebush on red deep sandy duplexes, and woodlands of salmon gum, merrit, red mallee, gimlet and York gum. *Acacia neurophylla*, *A. beauverdiana* and *A. resinimarginea* thickets grow on gently sloping uplands on granite, with thickets of acacia, casuarina and melaleuca. There are also scrub-heaths and York gum-salmon gum-gimlet woodlands on these uplands. The hilly terrain on greenstone supports woodlands of salmon gum, Goldfields blackbutt, coral gum (*E. torquata*), York gum, gimlet, morrel, Dundas blackbutt and black sheoak. Thickets of granite wattle (*Acacia quadrimarginea*) are also present. The stony plains support scattered woodlands of Goldfields blackbutt, gimlet and salmon gum, along with shrublands of saltbush and bluebush. Sandplains in the west have acacia (*A. coolgardiensis, A. ramulosa, A. aneura, A. burkittii* and *A. tetragonophylla*) shrublands, commonly with patchy native pine (*Callitris glaucophylla C. preissii*) and mallees (*E. leptopoda, E. longicornis* and *E. loxophleba*). Native box (*Bursaria occidentalis*), *Melaleuca uncinata* and *Hakea recurva* may also be present. Hard spinifex (*T. basedowii*) grasslands with mulga, marble gum and mallees (e.g. *E. kingsmillii*) are found on sandplains to the east. The sandy-surfaced plains support acacia, casuarina and melaleuca thickets; woodlands of York gum, cypress pine (*Callitris columellaris*), salmon gum, gimlet and mulga; and shrublands of bowgada (*A. ramulosa*).

2.5 Conservation Values

The Eastern Goldfields subregion contains 16 vegetation associations, predominately open *Eucalyptus* woodlands, that have at least 85 per cent of their total extent in the bioregion (Cowan 2001) The subregion is considered a centre of endemism for Eucalypts in the Goldfields Woodlands region, and is also noted for the diversity of *Acacia* spp. and ephemeral flora communities of the tertiary sandplain shrublands and the valley floors of woodland areas.

The subregion contains one wetland of national importance: Rowles Lagoon System, located approximately 40 km east of the survey area. In addition, there are seven wetlands of subregional importance (Cowan, 2001). Other significant assemblages in the region include plant assemblages of the Fraser Range and the Woodline Hills.

No ecosystems are listed as threatened under WA State legislation occur within the subregion, but 18 communities and vegetation associations are thought to be at risk for a variety of reasons. Grazing from livestock, goats and rabbits and impacts from mining are the main threatening processes in the region, with changed fire regimes, erosion and sedimentation also causing significant impacts.

2.5.1 Great Western Woodlands

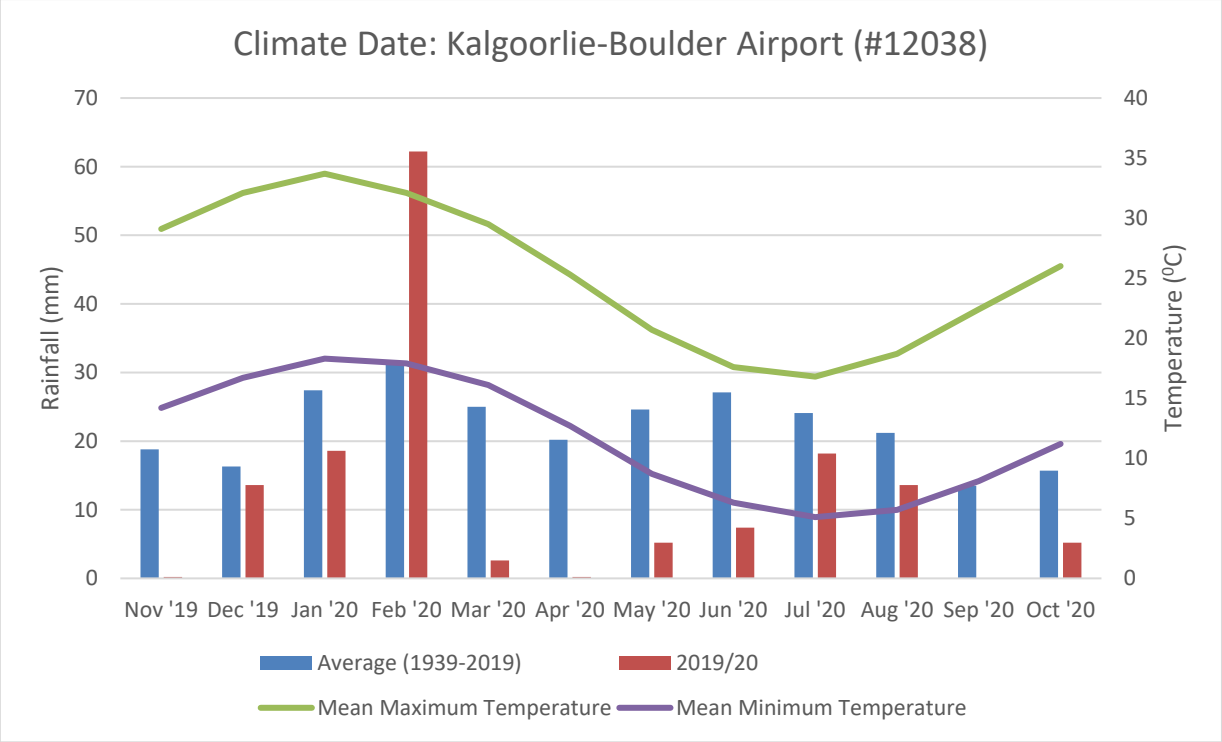
The survey area lies within the Great Western Woodlands, considered by The Wilderness Society of WA to be of global biological and conservation importance as one of the largest and healthiest temperate woodlands on Earth, containing many endemic taxa. The region covers almost 16 million hectares (160,000 square kilometres), from the southern edge of the Western Australian Wheatbelt to the pastoral lands of the Mulga country in the north, the inland deserts to the northeast, and the treeless Nullarbor Plain to the east.

The Great Western Woodlands provides a connection between southwest forests and inland deserts (Gondwana Link) as well as linking the north-west passage to Shark Bay. The majority of the Great Western Woodlands is unallocated crown land (61.1%) with other interests including pastoral leases (20.4%), conservation reserves (15.4%) unallocated crown land, ex pastoral (2%) managed by the Department of Biodiversity, Conservation and Attractions (DBCA) and private land (approximately 1%) (Watson *et. al.,* 2008).

No specific management strategy or formal conservation status applies to the Great Western Woodlands. The Great Western Woodlands currently includes towns, highways, roads, railways, private property, Crown Reserves, agricultural activities and mining tenements.

2.6 Climate

The climate of the Eastern Goldfields subregion is characterised as arid to semi-arid with 200-300 mm of rainfall, sometimes in summer but usually in winter (Cowan 2001). Rainfall data for the Kalgoorlie-Boulder Airport (#12038) weather station, located approximately 30 km east of the survey area, is shown in Graph 2-1 (BoM, 2020). Mean monthly rainfall ranges from 31.6 mm in February to 13.5 mm in September, with a mean annual rainfall of 264.9 mm. The survey was conducted in November 2020, with the preceding months (September and October) being characterised by significantly reduced rainfall. Although climate conditions are not considered optimal for the presence of flowering material and ephemeral species, this is unlikely to be a major survey constraint.



Graph 2-1: Average and recent rainfall and average temperature data (Kalgoorlie-Boulder Airport (#12038)) (BoM, 2020)

2.7 Hydrology

According to the Geoscience Australia database (2015), there are no permanent or ephemeral inland waters or drainage lines within the survey area (Figure 2-2).

Groundwater Dependent Ecosystems (GDE) includes biological assemblages of species such as wetlands or woodlands that use groundwater either opportunistically or as their primary water source. For the purposes of this report, a GDE is defined as any vegetation community that derives part of its water budget from groundwater and must be assumed to have some degree of groundwater dependency. In accordance with the BoM *Atlas of Groundwater Dependent Ecosystems* (BoM, 2020b) database, there are no potential terrestrial or aquatic GDE's within the survey area.

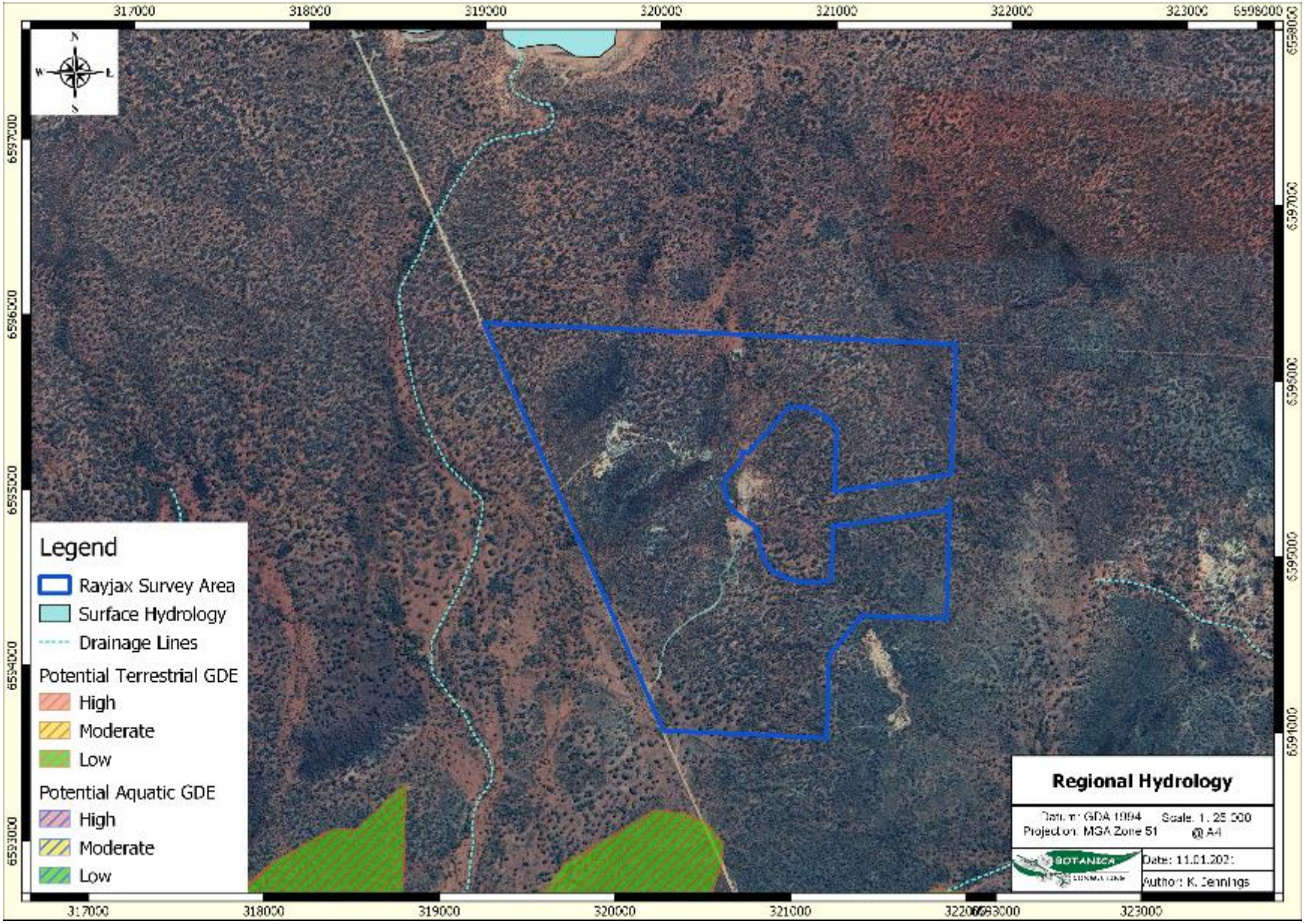


Figure 2-2: Regional hydrology of the survey area

3 SURVEY METHODOLOGY

3.1 Desktop Assessment

Prior to the field assessment a literature review was undertaken of previous flora and fauna assessments conducted within the local region. Documents reviewed included:

- Mattiske Consulting (2002). *Flora and Vegetation Survey – Frog's Leg Project Area Supplementary Survey*. Prepared for Mines and Resources Australia, November 2002
- Outback Ecology (2004). *Flora and Vegetation Survey – Frog's Leg Project Targeted Fauna Survey*. Prepared for Mines and Resources Australia Pty. Ltd., January 2004
- Jim's Seeds, Weeds and Trees (2004). *Flora Survey of the Kunanalling Project*. Prepared for Cazaly Resources Australia, December 2004
- Botanica (2020). *Kundana Reconnaissance Flora/ Vegetation Survey and Basic Fauna Survey.* Prepared for Northern Star Resources Ltd, October 2020

In addition to the literature review, searches of the following databases were undertaken to aid in the compilation of a list of significant flora within the survey area:

- DBCA Threatened/ Priority Flora spatial data (DBCA, 2019);
- DBCA NatureMap database (DBCA, 2020); and
- EPBC Protected Matters search tool (DAWE, 2020a).

The NatureMap species search and EPBC Protected Matters search were conducted with a 40 km buffer from the survey area.

Significant flora and fauna species identified by the desktop review were assessed with regards to their population extent and distribution and preferred habitat to determine their likelihood of occurrence within the survey area.

The assessment categorised flora species as follows:

- Unlikely- Suitable habitat is not expected to occur and/or the survey area is outside the known range of the species.
- Possible- Suitable habitat may be present, and the area is within the known range of the species. This option is also used when there is insufficient information to determine the preferred habitat of a species.
- Likely- Suitable habitat is expected to occur and there are records within 10 km of the survey area.
- Previously Recorded- A record for this species is located within the survey area. Field survey will ground-truth currently occurring individuals and populations.

Fauna species were categorised as follows:

- Would Not Occur: There is no suitable habitat for the species in the survey area and/or there is no documented record of the species in the general area since records have been kept and/or the species is generally accepted as being locally/regionally extinct (supported by a lack of recent records).
    - Locally Extinct: Populations no longer occur within a small part of the species natural range, in this case within 10 or 20km of the survey area. Populations do however persist outside of this area.

    - Regionally Extinct: Populations no longer occur in a large part of the species natural range, in this case within the Goldfields region. Populations do however persist outside of this area.

- Unlikely to Occur: The survey area is outside of the currently documented distribution for the species in question, or no suitable habitat (type, quality and extent) was identified as being present during the field assessment. Individuals of some species may occur occasionally as vagrants/transients especially if suitable habitat is located nearby but the site itself would not support a population or part population of the species.

- Possibly Occurs: Survey area is within the known distribution of the species in question and habitat of at least marginal quality was identified as likely to be present during the field survey and literature review, supported in some cases by recent records being documented in literature from within or near the survey area. In some cases, while a species may be classified as possibly being present at times, habitat may be marginal (e.g. poor quality, fragmented, limited in extent) and therefore the frequency of occurrence and/or population levels may be low.

- Known to Occur: The species in question has been positively identified as being present (for sedentary species) or as using the survey area as habitat for some other purpose (for non-sedentary/mobile species) during field surveys within or near the survey area. This information may have been obtained by direct observation of individuals or by way of secondary evidence (e.g. tracks, foraging debris, scats). In some cases, while a species may be classified as known to occur, habitat may be marginal (e.g. poor quality, fragmented, limited in extent) and therefore the frequency of occurrence and/or population levels may be low.

It should be noted that these lists are based on observations from a broader area than the assessment area (40 km radius) and therefore may include taxa not present. The databases also often include very old records that may be incorrect or in some cases the taxa in question have become locally or regionally extinct. Information from these sources should therefore be taken as indicative only and local knowledge and information also needs to be taken into consideration when determining what actual species may be present within the specific area being investigated.

The conservation significance of flora and fauna taxa was assessed using data from the following sources:

- *Environment Protection and Biodiversity and Conservation* (EPBC) *Act 1999*. Administered by the Australian Government (DAWE);
- *Biodiversity Conservation* (BC) *Act 2016*. Administered by the WA Government (DBCA);
- Red List produced by the Species Survival Commission (SSC) of the World Conservation Union (also known as the IUCN Red List – the acronym derived from its former name of the International Union for Conservation of Nature and Natural Resources). The Red List has no legislative power in Australia but is used as a framework for State and Commonwealth categories and criteria; and
- Priority Flora/ Fauna list. A non-legislative list maintained by DBCA for management purposes (fauna list released April 2019; flora list released December 2018).

The EPBC Act also requires the compilation of a list of migratory species that are recognized under international treaties including the:

- Japan Australia Migratory Bird Agreement 1981 (JAMBA)[1];
- China Australia Migratory Bird Agreement 1998 (CAMBA);
- Republic of Korea-Australia Migratory Bird Agreement 2007 (ROKAMBA); and
- Bonn Convention 1979 (The Convention on the Conservation of Migratory Species of Wild Animals).

Most but not all migratory bird species listed in the annexes to these bilateral agreements are protected in Australia as Matters of National Environmental Significance (MNES) under the EPBC Act. Descriptions of conservation significant species and communities are provided in Appendix 1.

3.2 Field Assessment

Botanica conducted a detailed flora/ vegetation and basic fauna survey from the 28th to 29th October 2020, with the area traversed on foot and ATV by two Botanica staff members; Jennifer Jackson (Senior Botanist, BSc (Honours) Environmental Management) and Matthew Newlands (Environmental Technician).

3.2.1 Vegetation Mapping

Prior to the commencement of field work, aerial photography was inspected and obvious differences in the vegetation assemblages were identified. The different vegetation communities identified were then inspected during the field survey to assess their validity. A handheld GPS unit was used to record the coordinates of the boundaries between vegetation communities. At each sample point, the following information was recorded:

- GPS location;
- Photograph of vegetation;
- Dominant taxa for each stratum (including height and percentage cover of dominant taxa);
- All vascular taxa (including annual taxa);
- Landform classification;
- Vegetation condition rating;
- Collection and documentation of unknown plant specimens; and
- GPS location, photograph and collection of flora of significance if encountered.

Vegetation types were classified by floristic group in accordance with NVIS classifications.

3.2.2 Flora Identification

Unknown specimens collected during the survey were identified by Jim Williams with the aid of samples housed at the Botanica Herbarium and WA Herbarium.

[1] Most but not all species listed under JAMBA are also specially protected under Specially Protected Species of the BC Act.

3.2.3 Sampling Quadrats

A total of 11 quadrats (20m X 20m) were established within the survey area (Figure 3-1).

The quadrats were established by inserting metal pickets in each corner, and measuring the length of the resultant boundaries to verify the quadrats were 20 m x 20 m (square quadrats). Following their establishment and boundary verification, the location of each quadrat was recorded by GPS (Appendix 9) and photographed from the north-west corner of the quadrat (Appendix 10). All vascular plants within the quadrat were recorded (Appendix 10).

This included recording of dominant taxa from the upper, middle and lower stratum, and sampling of all unknown taxa. Unknown taxa were identified using Botanica's own reference herbarium and relevant taxonomical keys. Data on level of disturbance, presence of coarse fragments on surface, topographical position, elevation, aspect, percentage litter, percentage bare ground, percentage surface rock (bedrock and surface deposits), soil types (colour, profile, field texture and surface type), and vegetation structure were collected from each quadrat (Appendix 10). Methods of recording data from these quadrats largely follow those outlined in CSIRO's *Australian Soil and Land Survey Field Handbook* (McDonald *et al.* 1998) and in accordance with current EPA Guidelines (2016).

3.2.4 Targeted Searches

Suitable habitats for significant flora were systematically searched by Botanica staff members to identify and record the locations of Threatened and Priority Flora. Any locations of Threatened and Priority Flora were recorded using a hand-held GPS and a simple plant count (not differentiated between juvenile/mature plants, flowering or non-flowering plants) was conducted.

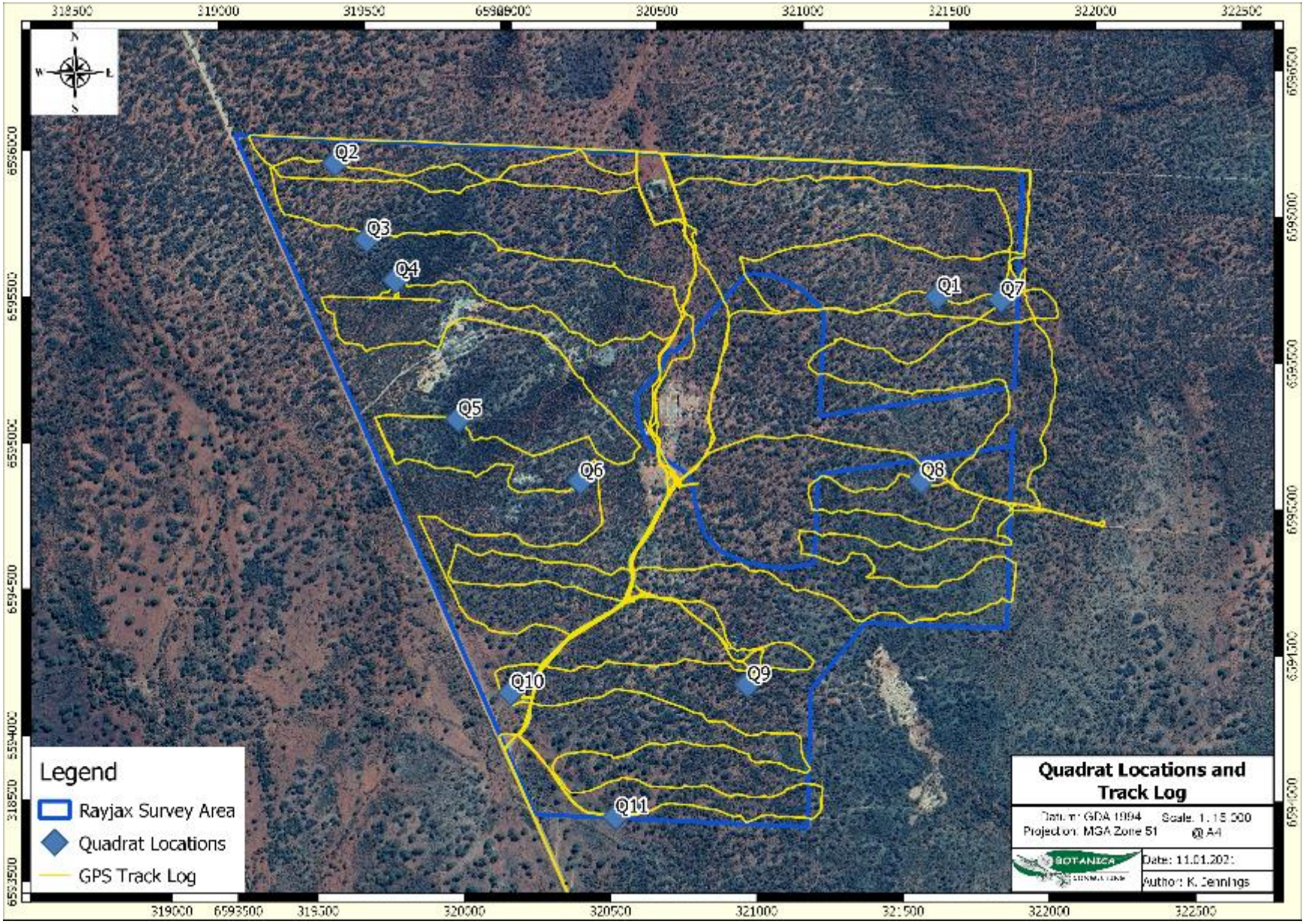


Figure 3-1: Quadrat Locations and GPS track log

3.3 Data Analysis Tools

At the completion of the survey effort, the data obtained was analysed to generate a vegetation map (Figure 4-4) and complete list of flora species (Appendix 5). The statistical program PATN was used to assess species composition of the quadrats (Appendix 11).

3.3.1 PATN Analysis

The PATN software package was used to assess the similarities/ dissimilarities between quadrats based on presence/ absence of species.

No annual species or sterile taxa were recorded within the quadrats. Singleton taxa were included in the analysis. A total of 60 perennial taxa were included in the final analysis.

The analysis produced a quantitative estimate of the relationship between species composition of each quadrat. The classifications were based upon a Bray-Curtis association matrix using a flexible Unweighted Pair Group Arithmetic Mean (UPGMA) method (with a beta value of -0.1) which standardises the data enabling the analysis to be completed. Semi-strong hybrid (SSH) ordination of the quadrat is then undertaken to show spatial relationships between groups and to elucidate possible environmental correlates with the classification.

The analysis also produced a stress value which is a measure of the 'strength' of the analysis (i.e. how well the quadrats are grouped together into the appropriate floristic groups). The lower the stress value the greater the strength of the analysis with a value of less than 0.3 showing that the analysis appropriately grouped quadrats. A stress value greater than 0.3 suggests that the analysis was unable to group quadrats appropriately due to extraneous variables (i.e. other factors influencing differences in floristic groups other than species composition e.g. fire, clearing disturbance etc.).

3.3.2 EstimateS

EstimateS software was used to estimate species richness present using the Chao2 richness estimator. For any number of samples, the estimator uses the existing pattern of species accumulation to estimate the true number of species at a site. The estimators tend to under-estimate species number when sample size is small, hence the estimated number of true species can be seen to increase with sample size. This software was also used to compute Coleman rarefaction curves estimates which were used to calculate species accumulation curves.

3.3.3 Fauna Assessment

Vegetation and landform units identified during the flora assessment have been used to define broad fauna habitat types across the site. This information has been supplemented with observations made during the fauna assessment.

The main aim of the fauna habitat assessment was to determine the likelihood of fauna species of conservation significance utilizing the areas that may be impacted during site development. The habitat information obtained was also used to aid in finalizing the overall potential fauna list.

As part of the desktop literature review, available information on the habitat requirements of the species of conservation significance listed as possibly occurring in the area was researched. During the field survey, the habitats within the study area were assessed and specific elements identified, if present, to determine the likelihood of listed threatened species utilizing the area and its significance to them.

Opportunistic observations of fauna species were made during all field survey work which involved a series of transects across the study area during the day including observations of bird species with binoculars. Secondary evidence of a species presence such as tracks, scats, skeletal remains, foraging evidence or calls were also noted if observed/heard.

3.3.4 Targeted Fauna Survey

Suitable Malleefowl habitat within the survey area was systematically searched on foot and by vehicle by two Botanica staff members to identify and record the locations of any Malleefowl activity (i.e. mounds, footprints and feathers). Any locations/ observations of Malleefowl activity were recorded using a hand-held GPS.

3.3.5 Scientific Licences

Table 3-1: Scientific Licences of Botanica Staff coordinating the flora survey

Licensed staff	Permit Number	Valid Until
Jennifer Jackson	SW019268 (Licence to take flora for scientific purposes)	18/02/2021

3.4 Survey Limitations and Constraints

It is important to note that flora surveys will entail limitations notwithstanding careful planning and design. Potential limitations are listed in Table 3-2.

The conclusions presented in this report are based upon field data and environmental assessments and/or testing carried out over a limited period of time and are therefore merely indicative of the environmental condition of the site at the time of the field assessments. Also, it should be recognised that site conditions can change with time. Information not available at the time of this assessment which may subsequently become available may alter the conclusions presented.

Some species are reported as potentially occurring based on there being suitable habitat (quality and extent) within the survey area or immediately adjacent. The habitat requirements and ecology of many of the species known to occur in the wider area are however often not well understood or documented. It can therefore be difficult to exclude species from the potential list based on a lack of a specific habitats or microhabitats within the survey area. As a consequence of this limitation, the potential species list produced is most likely an overestimation of those species that actually utilise the survey area for some purpose.

In recognition of survey limitations, a precautionary approach has been adopted for this assessment. Any flora and fauna species that would possibly occur within the survey area (or immediately adjacent), as identified through ecological databases, publications, discussions with local experts/residents and the habitat knowledge of the author, has been listed as having the potential to occur.

Table 3-2: Limitations and constraints associated with the survey

Variable	Potential Impact on Survey	Details
Access problems	Not a constraint	The survey was conducted via ATV and on foot. Numerous tracks were located within the survey area, providing ease of access.
Competency/ Experience	Not a constraint	The BC personnel that conducted the survey were regarded as suitably qualified and experienced. **Coordinating Botanist/ Zoologist:** Jennifer Jackson **Data Interpretation:** Kelby Jennings & Lauren Pick
Timing of survey, weather & season	Minor constraint	Fieldwork was undertaken within the EPA's recommended survey period (September - November) for the South-West and Interzone Province. Reduced rainfall was recorded in the preceding months, with no ephemeral species present however this is unlikely to significantly affect the survey results.
Area disturbance	Not a constraint	The area has been disturbed from exploration and mining operations, cattle grazing and other human impacts; however, vegetation was mostly intact and comprised of native vegetation.
Survey Effort/ Extent	Not a constraint	Survey intensity was appropriate for the size/significance of the area with a reconnaissance survey completed to identify vegetation types/fauna habitats and conservation significant species/communities.
Availability of contextual information at a regional and local scale	Not a constraint	Threatened flora database searches provided by the DBCA were used to identify any potential locations of Threatened/Priority taxa. BoM, DWER, DPIRD, DBCA and DAWE databases were reviewed to obtain appropriate regional desktop information on the biophysical environment of the local region. Previous Flora/ Fauna surveys within the local area have been assessed for pertinent information and environmental context of the regional area.
Completeness	Not a constraint	In the opinion of Botanica, the survey area was covered sufficiently in order to identify vegetation assemblages. All observed flora individuals were able to be identified to species level. The vegetation types for this study were based on visual descriptions of locations in the field. The distribution of these vegetation communities/ fauna habitats outside the study area is not known, however vegetation types identified were categorised via comparison to vegetation distributions throughout WA specified in the NVIS Major Vegetation Groups (DotEE, 2017b).

4 RESULTS

4.1 Desktop Assessment

4.1.1 Flora

The desktop review identified 838 vascular flora species as occurring within 40 km of the survey area, representing 309 genera from 74 families. The most diverse families were Asteraceae (105 species), Fabaceae (105 species) and Myrtaceae (105 species). Significant genera include *Eucalyptus* (56 species), *Acacia* (53 species) and *Eremophila* (38 species). This total includes 83 introduced (weed) species (9.9%).

4.1.1.1 Introduced Flora

The desktop review identified 83 introduced flora (weed) species as potentially occurring in the vicinity of the survey area. These species are comprised of 25 families, with the most commonly represented being Asteraceae (14 species), Poaceae (14 species) and Fabaceae (seven species). Of these, nine are listed as a Declared Pest on the Western Australian Organism List (WAOL) under the *Biosecurity and Agriculture Management* (BAM) *Act 2007*, with six also listed as a Weed of National Significance (Table 4-1).

The full list of potential weed species is contained in Appendix 2.

Table 4-1: Potentially occurring Declared Pests and WoNS

Family	Species	Common Name	WAOL Status	Control Category	WONS
Asteraceae	*Xanthium spinosum*	Spiny Cockle burr	Declared Pest - s22(2)	C3 Management, Whole of State	No
Boraginaceae	*Echium plantagineum*	Paterson's Curse	Declared Pest - s22(2)	No Control Category, Whole of State	No
Cactaceae	*Cylindropuntia fulgida* var. *mamillata*	-	Declared Pest - s22(2)	C3 Management, Whole of State	Yes
Cactaceae	*Cylindropuntia imbricata*	-	Declared Pest - s22(2)	C3 Management, Whole of State	Yes
Cactaceae	*Cylindropuntia kleiniae*	-	Declared Pest - s22(2)	C3 Management, Whole of State	Yes
Cactaceae	*Cylindropuntia tunicata*	-	Declared Pest - s22(2)	C3 Management, Whole of State	Yes
Cactaceae	*Opuntia elata*	-	Declared Pest - s22(2)	C3 Management, Whole of State	Yes
Cactaceae	*Opuntia ficus-indica*	-	Declared Pest - s22(2)	C3 Management, Whole of State	Yes
Fabaceae	*Alhagi maurorum*	-	Declared Pest - s22(2)	C3 Management, Whole of State	No

4.1.1.2 Significant Flora

The assessment of the DBCA Priority/ Threatened flora data (DBCA, 2019), NatureMap search (DBCA, 2020), Protected Matters searches (DAWE, 2020a) and previous relevant literature identified 50 significant flora species recorded within a 40 km radius of the survey area. These are comprised of three Endangered, 17 Priority 1, eight Priority 2, 18 Priority 3 and four Priority 4 taxa (Appendix 3).

These taxa were assessed for distribution and known habitat to determine their likelihood of occurrence within the survey area. The assessment did not identify any significant flora species as likely to occur in the survey area. Four taxa were assessed as possibly occurring in the survey area, consisting of two Priority 1, two Priority 2 and one Priority 3 taxa (Table 4-2). The full flora likelihood assessment is listed in Appendix 3. The locations of the DBCA database records are illustrated spatially in Figure 4-1.

Table 4-2: Potentially occurring significant flora species

Species	Rank	Habitat	Comments	Likelihood
Rhodanthe uniflora	P1	Brown earth. Open eucalyptus woodland.	Within species range, habitat may be present.	Possible
Eremophila praecox	P2	Red/brown sandy loam. Undulating plains.	Within known range of species, habitat may be present.	Possible
Eucalyptus educta		Shallow soils. Granite rocks.	Within known range, habitat may be present.	Possible
Notisia intonsa	P3	Red sand, disturbed areas.	Within known range of species, habitat may be present.	Possible

4.1.1.3 Significant Ecological Communities

The Protected Matters search (DAWE, 2020a) did not identify any Threatened Ecological Communities recorded within 40 km of the survey area. Analysis of the Priority Ecological Communities within the Goldfields region (DBCA, 2017) did not identify any significant vegetation assemblages as likely or possibly occurring within the survey area.

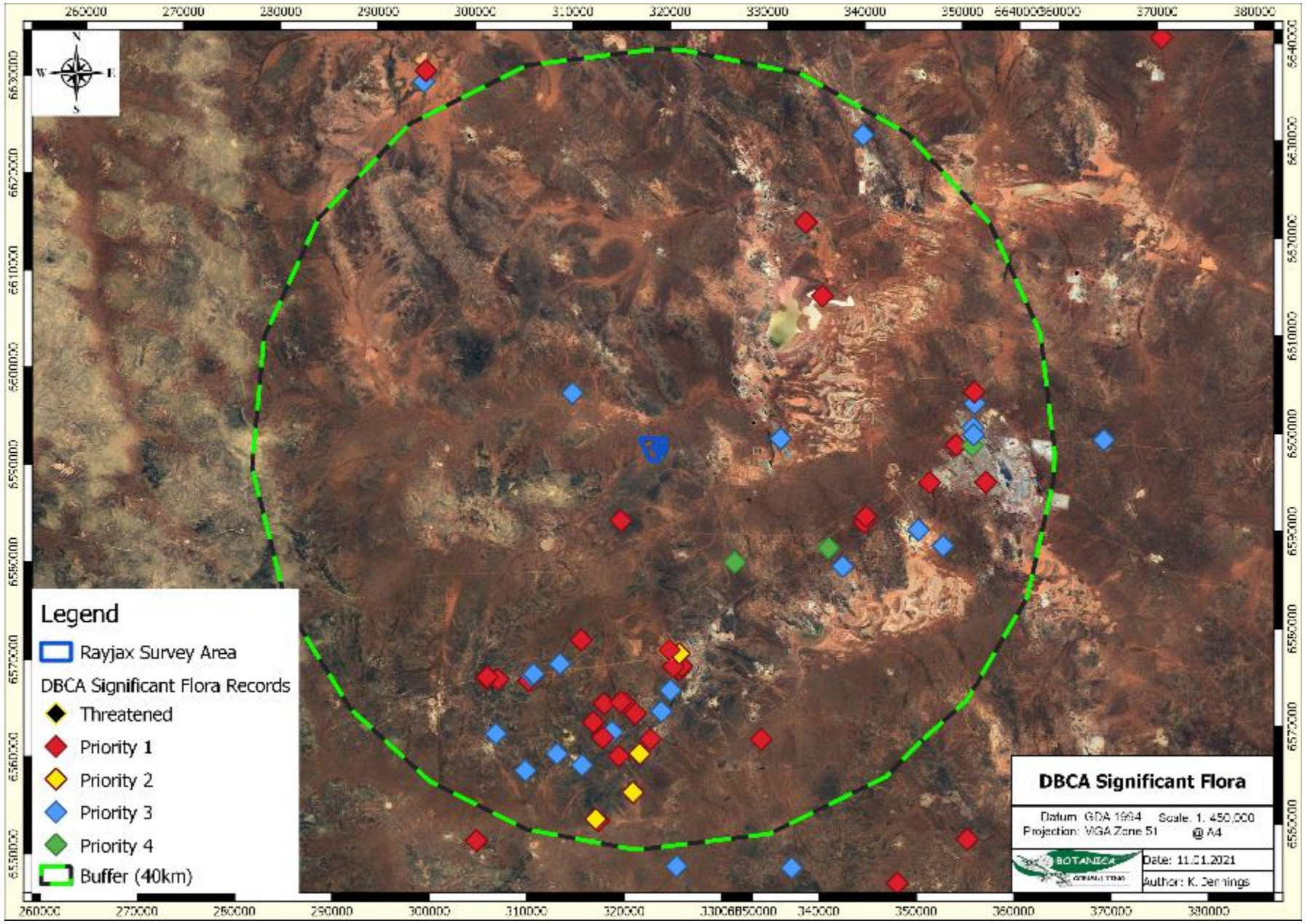


Figure 4-1: DBCA significant flora records

4.1.2 Vegetation Associations

The Pre-European vegetation association spatial mapping dataset (DPIRD, 2018) identifies two vegetation associations as occurring within the survey area (Figure 4-2). The association descriptions and their remaining extent, as specified in the 2018 Statewide Vegetation Statistics (DBCA, 2018) are provided in Table 4-3. Areas retaining less than 30% of their pre-European vegetation extent generally experience exponentially accelerated species loss, while areas with less than 10% are considered “endangered” (EPA, 2000). No vegetation associations within the survey area retain less than 30% of their pre-European extent. Development within the survey area will not significantly reduce the pre-European extent of these vegetation associations.

Table 4-3: Pre-European Vegetation Associations within the survey area

Vegetation Association	Current Extent (ha)	Pre-European extent remaining (%)	% in DBCA managed lands	Floristic Description	Extent within Survey Area ha (%)
Boorabbin 8	81,726.90	99.85	0	Medium woodland; salmon gum & gimlet	28 ha (7%)
Coolgardie 9	95,687.65	96.88	0.5	Medium woodland; coral gum (*Eucalyptus torquata*) & goldfields blackbutt (*E. lesouefii*)	357 ha (93%)

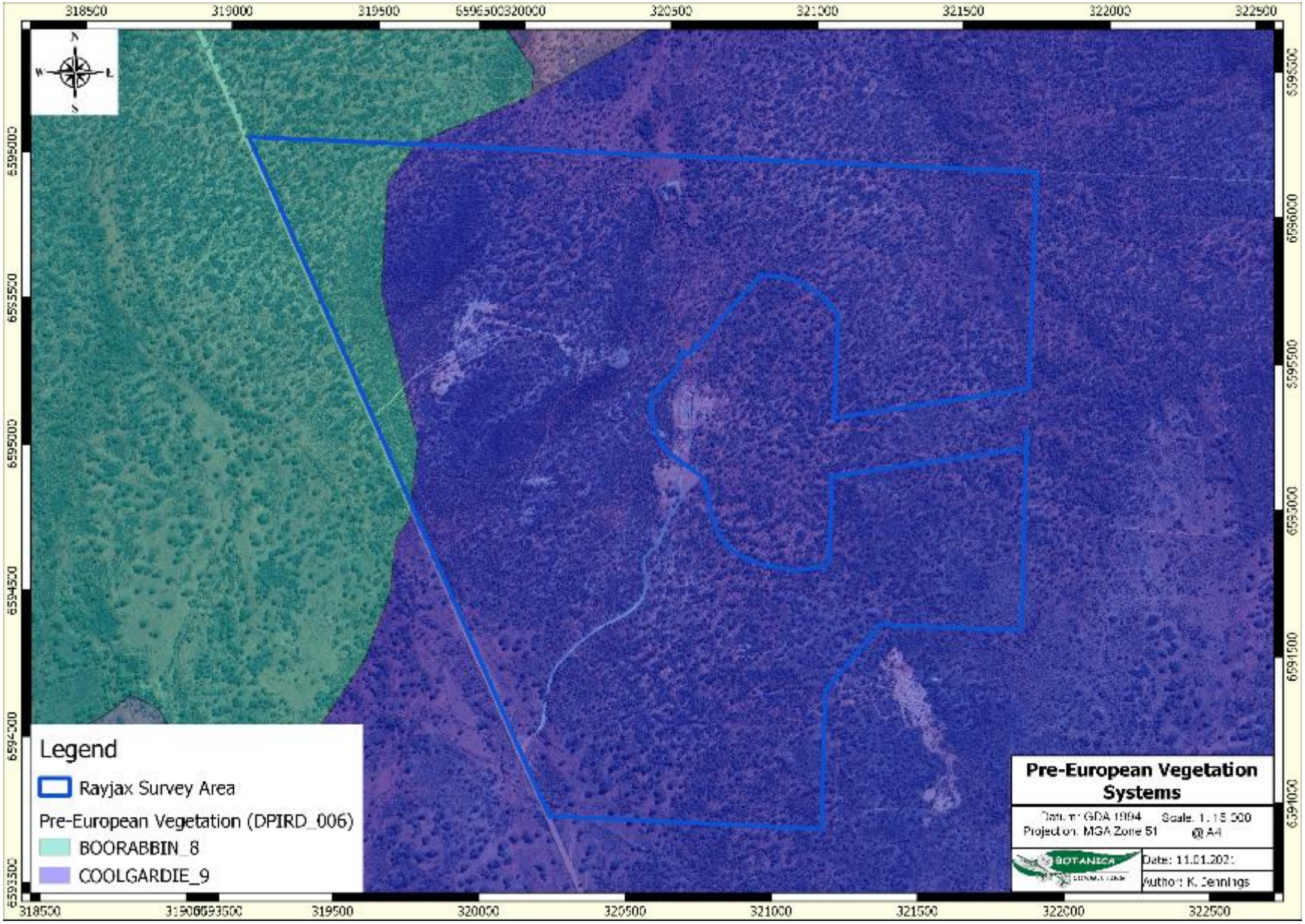


Figure 4-2: Pre-European Vegetation Associations within the survey area

4.1.3 Fauna

According to the results of the NatureMap search (DBCA, 2020), a total of 264 terrestrial vertebrate fauna taxa have been recorded within a 40 km radius of the survey area, consisting of 149 bird, 32 mammal, 76 reptile and six amphibian taxa. This total includes nine introduced (feral) species (3.4%).

4.1.3.1 Introduced (Feral) Fauna

The NatureMap and EPBC database searches identified 14 feral fauna species from nine families as potentially occurring in the survey area (Table 4-4).

Table 4-4: Potentially Occurring Introduced Fauna

Family	Species	Common Name
Bovidae	*Bos taurus*	European Cattle
	Capra hircus	Goat
	Ovis aries	Sheep
Canidae	*Canis lupus familiaris*	Domestic Dog
	Vulpes vulpes	Red Fox
Columbidae	*Columba livia*	Domestic Pigeon
	Streptopelia chinensis	Spotted Turtle-Dove
	Streptopelia senegalensis	Laughing Turtle-Dove
Equidae	*Equus asinus*	Donkey, Ass
	Equus caballus	Horse
Felidae	*Felis catus*	Cat
Gekkonidae	*Hemidactylus frenatus*	Asian House Gecko
Leporidae	*Oryctolagus cuniculus*	Rabbit
Muridae	*Mus musculus*	House Mouse

4.1.3.2 Conservation Significant Fauna

The desktop review identified ten terrestrial vertebrate fauna species of conservation significance as previously being recorded in the regional area, consisting of seven Threatened, three migratory or otherwise protected species. In addition, nine migratory wading/shorebird species were assessed collectively due to their similar habitat requirements. The full fauna likelihood assessment is listed in Appendix 4.

Habitat and distribution data was used to determine the likelihood of occurrence within the survey area. The assessment identified three significant fauna species as potentially occurring in the survey area (Table 4-5).

Table 4-5: Significant fauna species potentially occurring in survey area

Species	Status	Likelihood
Grey Falcon (*Falco hypoleucos*)	T (VU)	Possible
Malleefowl (*Leipoa ocellata*)	T (VU)	Possible
Peregrine Falcon (*Falco peregrinus*)	OS	Possible

4.1.4 Conservation Areas

There are no vested Conservation Reserves located within the survey area.

There are no DBCA managed lands located within the survey area.

There are no Environmentally Sensitive Areas located within the survey area.

There are no Nationally Important or RAMSAR wetlands located within the survey area.

The closest significant environmental feature is the Kurrawang Nature Reserve, which is DBCA-managed land located approximately 20 km south-east of the survey area. Disturbances within the survey area are unlikely to impact these areas. The location of conservation areas in relation to the survey area is provided in Figure 4-3.

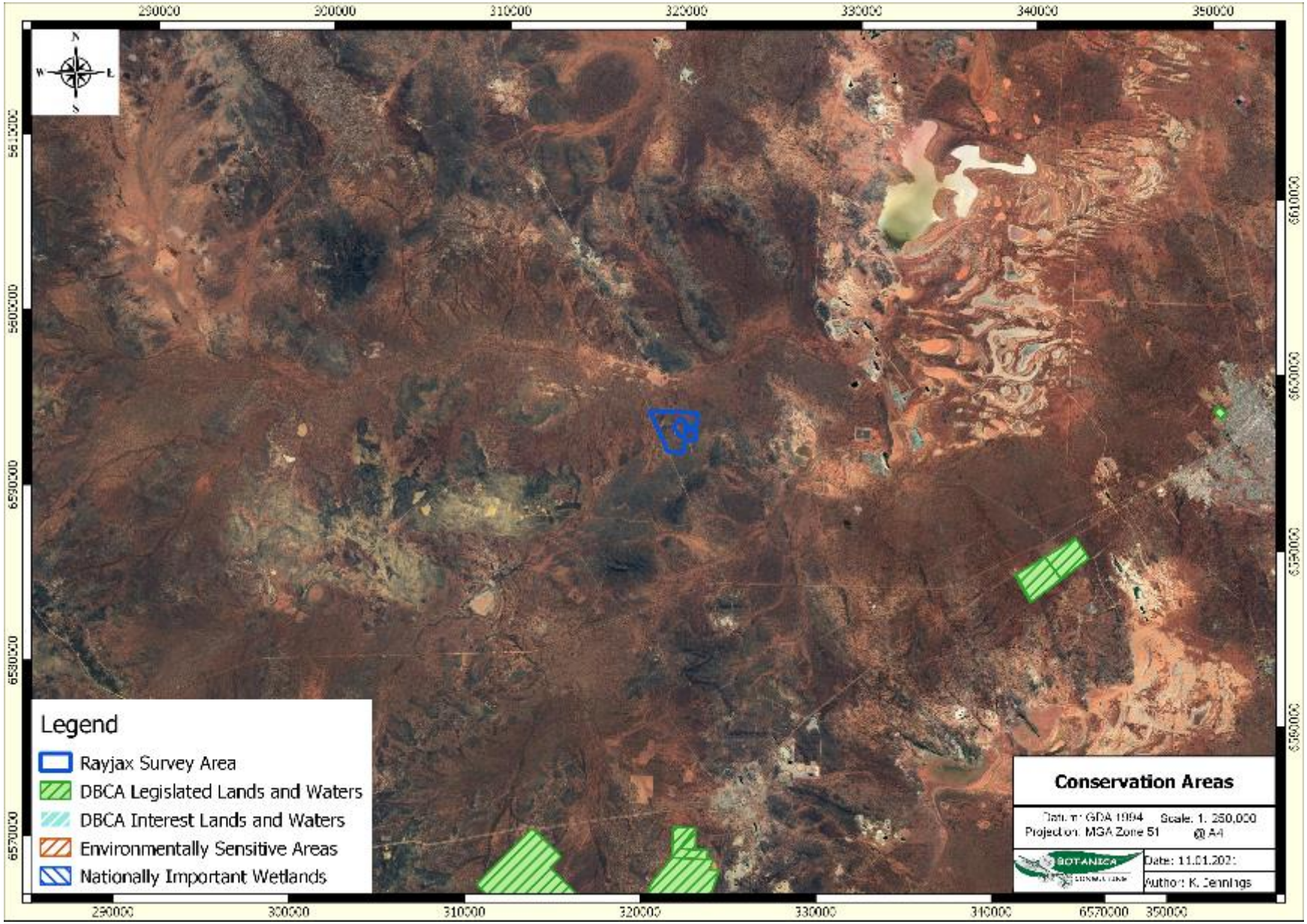


Figure 4-3: Conservation Areas

4.2 Field Assessment

4.2.1 Flora

The field survey identified 65 flora taxa within the survey area. These taxa represented 30 genera across 20 families, with the most diverse genera being *Eremophila* (nine species), *Maireana* (nine species) and *Eucalyptus* (eight species). Dominant families include Chenopodiaceae (13 species), and Fabaceae, Myrtaceae and Scrophulariaceae, all with nine species. No introduced (weed) species were recorded. The full field species inventory is listed in Appendix 5.

4.2.1.1 Introduced Flora

No species of introduced flora were recorded within the survey area.

4.2.1.2 Significant Flora

According to the EPA *Environmental Factor Guideline for Flora and Vegetation* (EPA, 2016b) significant flora includes:

- flora being identified as threatened or priority species;
- locally endemic flora or flora associated with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems);
- new species or anomalous features that indicate a potential new species;
- flora representative of the range of a species (particularly, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range);
- unusual species, including restricted subspecies, varieties or naturally occurring hybrids; and
- flora with relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

No Threatened or Priority flora species or otherwise significant flora (as described above) were recorded within the survey area.

4.2.2 Vegetation Communities

A total of three broad-scale vegetation communities were identified within the survey area. Vegetation community description and extent are listed below in Table 4-6 and illustrated spatially in Figure 4-4. Vegetation community descriptions and extents were determined from field survey results, aerial imagery interpretation and extrapolation of the communities.

The survey found CLP-EW1 was the most widespread community in the survey area, occupying 308 ha (80%), while CLP-EW2 was the most restricted with 32 ha (8%). CLP-EW1 was the most diverse community, with 48 flora species recorded, and HS-EW1 was the least diverse with 26 flora species.

Table 4-6: Vegetation Community Descriptions and Extent

Vegetation Community	Broad Floristic Formation (NVIS III)	Vegetation Description (NVIS V)	Landform	Image
CLP-EW1 308 ha (80%)	*Eucalyptus* open woodland	*Eucalyptus griffithsii* and *E. transcontinentalis* sparse woodland over *Acacia hemiteles* and *Exocarpos aphyllus tall shrubland* over *Scaevola spinescens, Senna artemisioides* subsp. *filifolia, Olearia muelleri* and *Ptilotus obovatus.* var *obovatus* low shrubland.	Clay/loam plain.	
CLP-EW2 32 ha (8%)	*Eucalyptus* open woodland	*Eucalyptus salmonophloia* sparse woodland over *Acacia hemiteles* and *Eremophila scoparia* tall open shrubland over *Atriplex nummularia* and *A. vesicaria* open chenopod shrubland over *Frankenia setosa, Maireana erioclada* and *Olearia muelleri* low open shrubland.	Clay/loam plain.	

Vegetation Community	Broad Floristic Formation (NVIS III)	Vegetation Description (NVIS V)	Landform	Image
HS-EW1 39 ha (10%)	*Eucalyptus* open woodland	*Eucalyptus torquata* and *E. clelandiorum* woodland over *Acacia colletioides, Eremophila interstans* subsp. *interstans* and *Allocasuarina campestris* tall open *shrubland* over *Acacia erinacea, Trymalium myrtillus subsp. myrtillus* and *Westringia rigida* open shrubland *and Triodia scariosa* sparse hummock grassland/ *Olearia muelleri* and *Ptilotus obovatus.* var *obovatus* low sparse shrubland.	Hillslope	
CD 6 ha (2%)	N/A	Completely Degraded (cleared vegetation)	N/A	No image

Figure 4-4: Vegetation Communities

4.2.3 Floristic Composition

PATN analysis was used to determine the similarities or differences between vegetation types identified within the survey area. Appendix 11 provides the dendrogram, two way-table (specifying species group) and ordination graph for all generated from the PATN statistical analysis. A list of the 11 quadrats and their respective floristic groups are provided in Table 4-7 below. The PATN analysis produced a stress value of 0.1526.

Table 4-7: Floristic Groups identified within the survey area and corresponding quadrats

Landform	Major Vegetation Group	Floristic Group	Vegetation Code	Quadrat
Clay-Loam Plain	Eucalypt Woodlands	Sparse woodland of *Eucalyptus griffithsii* and *E. transcontinentalis* over *Acacia hemiteles* shrubland over low mixed shrubland on clay-loam plain.	CLP-EW1	Q1 Q2 Q8 Q9
Clay-Loam Plain	Eucalypt Woodlands	Woodland of *E. salmonophloia* over mixed *Acacia*/*Eremophila* shrubland over low mixed chenopod shrubland on clay-loam plain	CLP-EW2	Q7 Q10 Q11
Hillslope	Eucalypt Woodlands	Low woodland of *E. torquata/ E. clelandiorum* over mixed *Acacia/ Eremophila/Allocasuarina* tall shrubland over hummock grassland/mixed low shrubland on hillslope.	HS-EW1	Q3 Q4 Q5 Q6

The first floristic group comprised of *Eucalyptus griffithsii* and *E. transcontinentalis* woodland quadrats and was mostly characterised by species group A and B (see two-way table provided in Appendix 11) with an average species richness of fifteen taxa per quadrat (ranged from thirteen to sixteen taxa per quadrat).

The second floristic group comprised of *E. salmonophloia* woodland quadrats. This floristic group was mostly characterised by species group A (Appendix 11). This floristic group had an average species richness of fourteen taxa per quadrat (ranged from ten to sixteen taxa per quadrat). As shown in the dendrogram and ordination graph (Appendix 11), floristic groups 1 and 2 were closely associated with each other, with both floristic groups comprised of Eucalypt woodland vegetation on a clay-loam plain.

The third floristic group comprised of *E. torquata* and *E. clelandiorum* woodland quadrats. This floristic group was mostly characterised by species group B (Appendix 11) with an average species richness of fourteen taxa per quadrat (ranged from twelve to seventeen taxa per quadrat).

Results of the PATN analysis supported vegetation delineations made in field, with three distinct floristic groups identified.

4.2.3.1 Species Richness and accumulation estimates

The Chaos 2 richness estimator provided an estimated species richness of 86 species in 30 sample sites (quadrats). Species richness recorded for the 11 quadrats was 60 species which indicates survey intensity was adequate.

A species accumulation curve was created to display the rate of species accumulation. The R^2 value (0.99) suggests that the data "fits" the species accumulation curve shown in Figure 4-5. The rate of species accumulation for the first 10 quadrats ranged from nine to three species per quadrat. The rate of species accumulation between 11-18 quadrats was two species per quadrat. Species accumulation reduced to 1 species per quadrat as quadrat number increased beyond 18 quadrats. Botanica has determined that according to this data a sufficient number of quadrats were established in the survey area to adequately assess the floristic composition of the area.

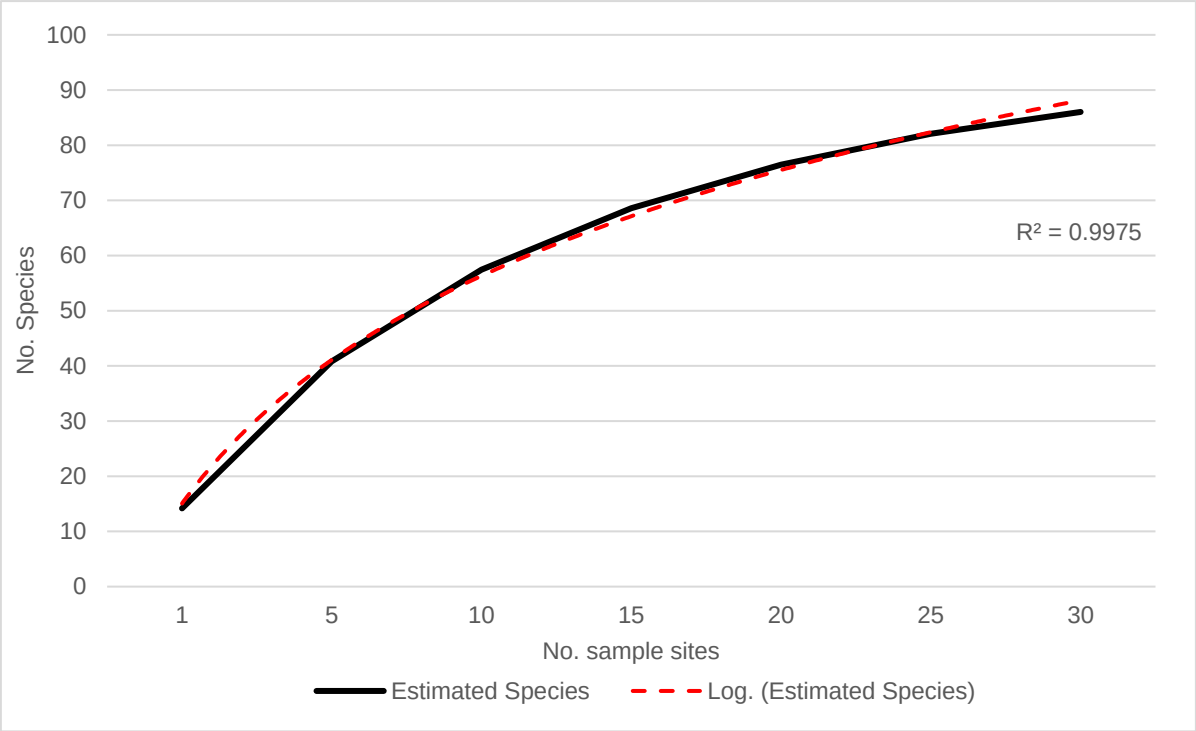


Figure 4-5: Species accumulation curve

4.2.4 Vegetation Condition

Based on the vegetation condition rating scale adapted from Keighery (1994) and Trudgen, (1988), native vegetation within the survey area was rated as 'good' (Table 4-8, Figure 4-6). 'Good' condition depicts more obvious signs of damage caused by human activity since European settlement, including impacts to vegetation structure and composition from low levels of grazing, changed fire regimes and/or slightly aggressive weeds. Cleared areas associated with historical mining operations were categorized as completely degraded.

Table 4-8: Vegetation Condition within the survey area

Condition Rating	Area (ha)	Area (%)
Good	379	98
Completely Degraded	6	2
Total	**385**	**100**

Figure 4-6: Vegetation Condition within the survey area

4.2.5 Significant Vegetation

According to the EPA *Environmental Factor Guideline for Flora and Vegetation* (EPA, 2016b) significant vegetation includes:

- vegetation being identified as threatened or priority ecological communities;
- vegetation with restricted distribution;
- vegetation subject to a high degree of historical impact from threatening processes;
- vegetation which provides a role as a refuge; and
- vegetation providing an important function required to maintain ecological integrity of a significant ecosystem.

No Threatened or Priority Ecological Communities or otherwise significant vegetation (as described above) were identified within the survey area.

4.2.6 Fauna Habitat

Based on vegetation and associated landforms identified during the flora and vegetation assessment, two broad scale terrestrial fauna habitats were identified as occurring within the survey area. Table 4-9 provides a visual representation of this habitat type, and the extent of fauna habitat is shown spatially in Figure 4-7.

Table 4-9: Terrestrial Fauna Habitats within the survey area

Fauna Habitat	Example Image
Eucalyptus woodland on clay-loam plain Area: 340 ha (88%)	
Eucalyptus woodland on hillslope Area: 39 ha (10%)	

Figure 4-7: Terrestrial Fauna Habitats

4.2.7 Significant Fauna

According to the EPA *Environmental Factor Guideline for Terrestrial Fauna* (EPA, 2016c) significant fauna includes:

- Fauna being identified as a threatened or priority species;
- Fauna species with restricted distribution;
- Fauna subject to a high degree of historical impact from threatening processes; and
- Fauna providing an important function required to maintain the ecological integrity of a significant ecosystem.

No significant fauna were observed during the survey. The current status of some species on site and/or in the general area is difficult to determine, however, based on the habitats present and, in some cases, direct observations or recent nearby records, the following species of conservation significance can be regarded as possibly utilising the survey area for some purpose at times, these being:

- **Grey Falcon (*Falco hypoleucos*) - Vulnerable (EPBC Act and BC Act)**
  This species is sparsely recorded throughout inland Australia. Suitable habitat likely to be present but in unlikely to represent critical habitat. Significant impact unlikely.

- **Peregrine Falcon (*Falco peregrinus*) – OS (BC Act)**
  This species potentially utilises some sections of the survey area as part of a much larger home range, though records in this area are uncommon. It is considered unlikely to breed within the survey area. Significant impact unlikely.

- **Malleefowl (*Leipoa ocellata*) - Vulnerable (EPBC Act and BC Act)**
  This species is occasionally recorded in the Eastern Goldfields subregion. An inactive (historical) malleefowl mound was observed within the survey area (Plate 4-1), located within Eucalyptus woodland on hillslope habitat (Figure 4-8). It was estimated that this mound was at least 20 years old and in fact maybe much older than this as they deteriorate slowly. No active malleefowl mounds or other evidence of malleefowl activity (tracks, feathers or bird observations etc.) were observed during the field survey. Available information therefore suggests that a breeding population of this species is unlikely to be present in the survey area, though transient non-breeding individuals may occasionally occur. Significant impact unlikely.

Plate 4-1: Inactive Malleefowl mound (GDA94 Zone 51J 319649 6595768)

It should be noted that while habitats onsite for one or more of the species listed above are considered possibly suitable, some or all may be marginal in extent/quality and therefore the fauna species considered as possibly occurring may in fact only visit the area for short periods as infrequent vagrants.

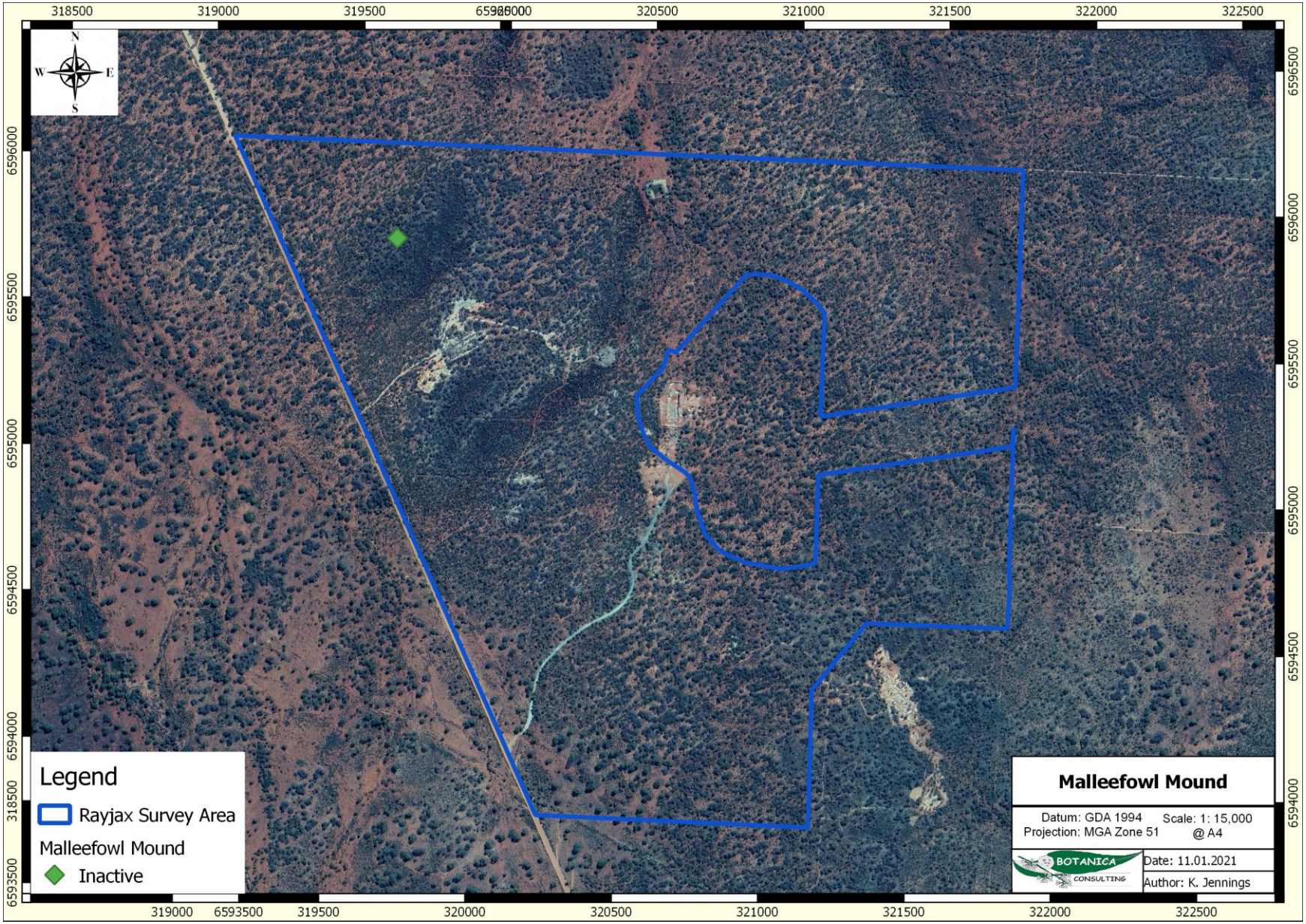


Figure 4-8: Inactive Malleefowl mound location

4.3 Matters of National Environmental Significance

4.3.1 *Environment Protection and Biodiversity Conservation Act 1999*

The EPBC Act protects matters of national environmental significance, and is used by the Commonwealth DAWE to list threatened taxa and ecological communities into categories based on the criteria set out in the Act (www.environment.gov.au/epbc/index.html). The Act provides a national environmental assessment and approval system for proposed developments and enforces strict penalties for unauthorised actions that may affect matters of national environmental significance. Matters of national environmental significance as defined by the Commonwealth EPBC Act include:

- Nationally threatened flora species;
- World heritage properties;
- National heritage places;
- Wetlands of international importance (often called 'Ramsar' wetlands after the international treaty under which such wetlands are listed);
- Nationally threatened ecological communities;
- Commonwealth marine area;
- The Great Barrier Reef Marine Park; and
- Nuclear actions (including uranium mining) a water resource, in relation to coal seam gas development and large coal mining development.

No matters of national environmental significance as defined by the Commonwealth EPBC Act were identified within the survey area.

4.4 Matters of State Environmental Significance

4.4.1 Environmental Protection Act WA 1986

The EP Act provides for the prevention, control and abatement of pollution and environmental harm, for the conservation, preservation, protection, enhancement and management of the environment. The Act is administered by The Department of Water and Environment Regulation (DWER), which is the State Government's environmental regulatory agency.

Under Section 51C of the EP Act and the *Environmental Protection (Clearing of Native Vegetation) Regulations (Regulations) WA 2004* any clearing of native vegetation in Western Australia that is not eligible for exemption under Schedule 6 of the *EP Act 1986* or under the Regulations 2004 requires a clearing permit from the DWER or DMIRS. Under Section 51A of the *EP Act 1986* native vegetation includes aquatic and terrestrial vegetation indigenous to Western Australia, and intentionally planted vegetation declared by regulation to be native vegetation, but not vegetation planted in a plantation or planted with commercial intent. Section 51A of the *EP Act 1986* defines clearing as "the killing or destruction of; the removal of; the severing or ringbarking of trunks or stems of; or the doing of substantial damage to some or all of the native vegetation in an area, including the flooding of land, the burning of vegetation, the grazing of stock or an act or activity that results in the above". Exemptions under Schedule 6 of the EP Act and the EP Regulations do not apply in ESAs as declared under Section 51B of the EP Act or TEC listed under State and Commonwealth legislation.

No evidence of the survey area containing any TEC or Threatened flora or fauna was found during the survey period. The survey area is not located within an ESA.

4.4.2 Biodiversity Conservation Act 2016

This Act is used by the Western Australian DBCA for the conservation and protection of biodiversity and biodiversity components in Western Australia and to promote the ecologically sustainable use of biodiversity components in the State. Taxa are classified as 'Threatened" when their populations are geographically restricted or are threatened by local processes (see following sections for Threatened definitions). Under this Act all native flora and fauna are protected throughout the State. Financial penalties are enforced under this Act if threatened species are collected without an appropriate licence.

Under Section 54(1) of the BC Act, habitat is eligible for listing as critical habitat if:

a) it is critical to the survival of a threatened species or a threatened ecological community; and
b) its listing is otherwise in accordance with the ministerial guidelines.

No threatened species or critical habitat listed under the BC Act were recorded within the survey area.

4.5 Native Vegetation Clearing Principles

Based on the outcomes from the survey undertaken, Botanica assessed the results of the desktop and field survey with regards to the native vegetation clearing principles listed under Schedule 5 of the EP Act (Table 4-10). The assessment found that the proposed vegetation clearing activities are unlikely to be at variance with the clearing principles.

Table 4-10: Assessment against native vegetation clearing principles

Letter	Principle	Assessment	Outcome
Native vegetation should not be cleared if it:			
(a)	comprises a high level of biological diversity.	Vegetation identified within the survey area is not considered to be of high biological diversity and is well represented outside of the survey area. The survey area does not occur within any mapped Priority Ecological Communities (PECs), Threatened Ecological Communities (TECs) or associated buffer zones and does not contain any Banded Ironstone Formations. No Threatened Flora taxa listed under the BC Act and EPBC Act are located within the survey area. No Priority Flora taxa were identified within the survey area.	Clearing is unlikely to be at variance to this principle
(b)	comprises the whole or part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to WA.	No significant fauna were observed within the survey area. The survey area comprises of broad fauna habitats that are typical of those in the wider region. No unique fauna habitats (caves, rocky outcrops/ pools etc.) occur within the survey area. No water bodies (both perennial/ non-perennial) occur within the survey area. One inactive (historic) malleefowl mound was identified within the survey area however no active malleefowl mounds or other evidence of malleefowl activity (tracks, feathers or bird observations etc.)	Clearing is unlikely to be at variance to this principle

Letter	Principle	Assessment	Outcome
Native vegetation should not be cleared if it:			
		were observed during the field survey. Habitat within the survey area is unlikely to constitute critical habitat.	
(c)	includes, or is necessary for the continued existence of rare flora.	No Threatened Flora taxa, pursuant to the BC Act and the EPBC Act were identified within the survey area.	Clearing is not at variance to this principle
(d)	comprises the whole or part of or is necessary for the maintenance of a threatened ecological community (TEC).	No TEC listed under the EPBC Act or by the BC Act occur within the survey area.	Clearing is not at variance to this principle
(e)	is significant as a remnant of native vegetation in an area that has been extensively cleared	All vegetation associations in the survey area retains >96% of their original pre-European vegetation extent.	Clearing is unlikely to be at variance to this principle
(f)	is growing, in, or in association with, an environment associated with a watercourse or wetland	No drainage lines, surface water or other water features were identified within the survey area.	Clearing is unlikely to be at variance to this principle
(g)	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	The survey area and surrounding region has not been extensively cleared. Clearing within the survey area is not considered likely to lead to land degradation issues such as salinity, water logging or acidic soils.	Clearing is unlikely to be at variance to this principle
(h)	Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.	The survey area is not located within or proximate to any conservation areas. Development within the survey area is not expected to impact ay conservation area.	Clearing is unlikely to be at variance to this principle
(i)	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.	No surface water bodies are located within the survey area. Clearing is unlikely to result in significant impacts to groundwater quality.	Clearing is unlikely to be at variance to this principle
(j)	Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding	Rainfall in the Eastern Goldfields subregion has an average rainfall of 200-300mm and an evaporation rate of 2400 mm. Rainfall data for Kalgoorlie-Boulder indicates that rainfall is spread throughout the year and rainfall events are unlikely to result in localised flooding. Clearing within the survey area is not likely to increase the incidence or intensity of flooding within the survey area or surrounds.	Clearing is unlikely to be at variance to this principle

4.6 Conclusions

No Threatened Flora, Fauna or TEC's as listed under the Western Australian BC Act or Commonwealth EPBC Act were identified within the survey area. One inactive (historical) malleefowl mound was observed within the survey area which was estimated to be at least 20 years old. No active malleefowl mounds or other evidence of malleefowl activity (tracks, feathers or bird observations etc.) were observed during the field survey. Available information therefore suggests that a breeding population of this species is unlikely to be present in the survey area, though transient non-breeding individuals may occasionally occur.

No Priority Flora, Fauna or PEC's as listed by DBCA were identified within the survey area. No other significant flora, fauna or vegetation (as described by EPA) was identified within the survey area.

The survey area does not contain any world or national heritage places. There are no wetlands of international importance (Ramsar Wetlands), national importance (ANCA) Wetlands or conservation category wetlands within the survey area. The survey area does not contain any Environmentally Sensitive Areas (ESA) listed under the EP Act. The survey is not located within any proposed or gazetted Conservation Reserves.

The assessment found that the proposed vegetation clearing activities are unlikely to be at variance with the native vegetation clearing principles.

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Appendix 1: Conservation Ratings BC Act and EPBC Act

Definitions of Conservation Significant Species

Code	Category
State categories of threatened and priority species	
Threatened Species (T) Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the Biodiversity Conservation Act 2016 (BC Act).	
CR	**Critically Endangered** Threatened species considered to be "facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for critically endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for critically endangered flora.
EN	**Endangered** Threatened species considered to be "facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for endangered flora.
VU	**Vulnerable** Threatened species considered to be "facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for vulnerable fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for vulnerable flora.
Extinct species Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.	
EX	**Extinct** Species where "*there is no reasonable doubt that the last member of the species has died*", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act). Published as presumed extinct under schedule 4 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for extinct fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for extinct flora.
EW	**Extinct in the Wild** Species that *"is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form*", and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act). Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.
Specially protected species Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection. Species that are listed as threatened species (critically endangered, endangered or vulnerable) or extinct species under the BC Act cannot also be listed as Specially Protected species.	
IA	**International Agreement/ Migratory** Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act). Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the *Convention on the Conservation of Migratory Species of Wild Animals* (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals, that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species.

Code	Category
	Published as migratory birds protected under an international agreement under schedule 5 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.
CD	**Species of special conservation interest** Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act). Published as conservation dependent fauna under schedule 6 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.
OS	**Other specially protected species** Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act). Published as other specially protected fauna under schedule 7 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.
Priority species Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened fauna or flora. Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring. Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.	
P1	**Priority 1: Poorly-known species** Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
P2	**Priority 2: Poorly-known species** Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
P3	**Priority 3: Poorly-known species** Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
P4	**Priority 4: Rare, Near Threatened and other species in need of monitoring** (a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
Commonwealth categories of threatened species	
EX	**Extinct** Taxa where there is no reasonable doubt that the last member of the species has died.
EW	**Extinct in the Wild** Taxa where it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
CR	**Critically Endangered** Taxa that are facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
EN	**Endangered**

Code	Category
	Taxa which are not critically endangered and is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
VU	**Vulnerable** Taxa which are not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
CD	**Conservation Dependent** Taxa which are the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or (b) the following subparagraphs are satisfied: (i) the species is a species of fish; (ii) the species is the focus of a plan of management that provides for actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximised; (iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory; (iv) cessation of the plan of management would adversely affect the conservation status of the species.

Definitions of Conservation Significant Communities

Category Code	Category
State categories of Threatened Ecological Communities (TEC)	
PD	**Presumed Totally Destroyed**
	An ecological community will be listed as Presumed Totally Destroyed if there are no recent records of the community being extant and either of the following applies:
	• records within the last 50 years have not been confirmed despite thorough searches or known likely habitats or;
	• all occurrences recorded within the last 50 years have since been destroyed.
CR	**Critically Endangered**
	An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future, meeting any one of the following criteria:
	The estimated geographic range and distribution has been reduced by at least 90% and is either continuing to decline with total destruction imminent, or is unlikely to be substantially rehabilitated in the immediate future due to modification;
	The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area;
	The ecological community is highly modified with potential of being rehabilitated in the immediate future.
EN	**Endangered**
	An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. The ecological community must meet any one of the following criteria:
	The estimated geographic range and distribution has been reduced by at least 70% and is either continuing to decline with total destruction imminent in the short-term future, or is unlikely to be substantially rehabilitated in the short-term future due to modification;
	The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area;
	The ecological community is highly modified with potential of being rehabilitated in the short-term future.
VU	**Vulnerable**
	An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing high risk of total destruction in the medium to long term future. The ecological community must meet any one of the following criteria:
	The ecological community exists largely as modified occurrences that are likely to be able to be substantially restored or rehabilitated;
	The ecological community may already be modified and would be vulnerable to threatening process, and restricted in range or distribution;

Category Code	Category
	The ecological community may be widespread but has potential to move to a higher threat category due to existing or impending threatening processes.
Commonwealth categories of Threatened Ecological Communities (TEC)	
CE	**Critically Endangered** If, at that time, an ecological community is facing an extremely high risk of extinction in the wild in the immediate future (indicative timeframe being the next 10 years).
EN	**Endangered** If, at that time, an ecological community is not critically endangered but is facing a very high risk of extinction in the wild in the near future (indicative timeframe being the next 20 years).
VU	**Vulnerable** If, at that time, an ecological community is not critically endangered or endangered, but is facing a high risk of extinction in the wild in the medium–term future (indicative timeframe being the next 50 years).
Priority Ecological Communities (PEC)	
P1	**Poorly-known ecological communities**
	Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist.
P2	**Poorly-known ecological communities**
	Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, un-allocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation.
P3	**Poorly known ecological communities**
	Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or:
	Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or;
	Communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing and inappropriate fire regimes.
P4	**Ecological communities that are adequately known, rare but not threatened** or meet criteria for near threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.
P5	**Conservation Dependent ecological communities**
	Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Appendix 2: Potentially Occurring Introduced (Weed) Flora Species

Family	Species	Common Name	WAOL Status	Control Category	WONS
Aizoaceae	*Aizoon pubescens*	-	Permitted - s11	No Control Category	No
Aizoaceae	*Mesembryanthemum crystallinum*	Iceplant	Permitted - s11	No Control Category	No
Aizoaceae	*Mesembryanthemum nodiflorum*	Slender Iceplant	Permitted - s11	No Control Category	No
Amaranthaceae	*Amaranthus viridis*	Green Amaranth	Permitted - s11	No Control Category	No
Anacardiaceae	*Schinus molle* var. *areira*	-	Permitted - s11	No Control Category	No
Apocynaceae	*Asclepias curassavica*	Redhead Cottonbush	Permitted - s11	No Control Category	No
Apocynaceae	*Orbea variegata*	-	Permitted - s11	No Control Category	No
Asparagaceae	*Agave americana*	Century Plant	Permitted - s11	No Control Category	No
Asteraceae	*Arctotheca calendula*	Cape Weed, African Marigold	Permitted - s11	No Control Category	No
Asteraceae	*Carthamus lanatus*	Saffron Thistle	Permitted - s11	No Control Category	No
Asteraceae	*Centaurea melitensis*	Maltese Cockspur, Malta Thistle	Permitted - s11	No Control Category	No
Asteraceae	*Cichorium intybus*	Chicory	Permitted - s11	No Control Category	No
Asteraceae	*Conyza bonariensis*	Flax leaf Fleabane	Permitted - s11	No Control Category	No
Asteraceae	*Conyza sumatrensis*	-	Permitted - s11	No Control Category	No
Asteraceae	*Helianthus annuus*	Sunflower, Common Sunflower	Permitted - s11	No Control Category	No
Asteraceae	*Lactuca serriola forma serriola*	-	Permitted - s11	No Control Category	No
Asteraceae	*Monoculus monstrosus*	-	Permitted - s11	No Control Category	No
Asteraceae	*Oligocarpus calendulaceus*	-	Permitted - s11	No Control Category	No
Asteraceae	*Oncosiphon suffruticosum*	Calomba Daisy	Permitted - s11	No Control Category	No
Asteraceae	*Sonchus oleraceus*	Common Sowthistle	Permitted - s11	No Control Category	No
Asteraceae	*Symphyotrichum squamatum*	Bushy Starwort	Permitted - s11	No Control Category	No
Asteraceae	*Xanthium spinosum*	Spiny Cockleburr	Declared Pest - s22(2)	C3 Management, Whole of State	No
Boraginaceae	*Buglossoides arvensis*	Corn Gromwell	Permitted - s11	No Control Category	No
Boraginaceae	*Echium plantagineum*	Paterson's Curse	Declared Pest - s22(2)	No Control Category, Whole of State	No
Boraginaceae	*Heliotropium europaeum*	Common Heliotrope	Permitted - s11	No Control Category	No
Brassicaceae	*Alyssum linifolium*	Flax-leaf Alyssum	Permitted - s11	No Control Category	No
Brassicaceae	*Brassica tournefortii*	Mediterranean Turnip	Permitted - s11	No Control Category	No
Brassicaceae	*Capsella bursa-pastoris*	Shepherd's Purse	Permitted - s11	No Control Category	No
Brassicaceae	*Carrichtera annua*	Ward's Weed	Permitted - s11	No Control Category	No
Brassicaceae	*Sisymbrium irio*	London Rocket	Permitted - s11	No Control Category	No

Family	Species	Common Name	WAOL Status	Control Category	WONS
Brassicaceae	*Sisymbrium orientale*	Indian Hedge Mustard	Permitted - s11	No Control Category	No
Cactaceae	*Cylindropuntia fulgida* var. *mamillata*	-	Declared Pest - s22(2)	C3 Management, Whole of State	Yes
Cactaceae	*Cylindropuntia imbricata*	-	Declared Pest - s22(2)	C3 Management, Whole of State	Yes
Cactaceae	*Cylindropuntia kleiniae*	-	Declared Pest - s22(2)	C3 Management, Whole of State	Yes
Cactaceae	*Cylindropuntia tunicata*	-	Declared Pest - s22(2)	C3 Management, Whole of State	Yes
Cactaceae	*Opuntia elata*	-	Declared Pest - s22(2)	C3 Management, Whole of State	Yes
Cactaceae	*Opuntia ficus-indica*	-	Declared Pest - s22(2)	C3 Management, Whole of State	Yes
Caryophyllaceae	*Spergularia diandra*	Lesser Sand Spurry	Permitted - s11	No Control Category	No
Chenopodiaceae	*Chenopodium album*	Fat Hen	Permitted - s11	No Control Category	No
Chenopodiaceae	*Chenopodium murale*	Nettle-leaf Goosefoot	Permitted - s11	No Control Category	No
Fabaceae	*Acacia pycnantha*	Golden Wattle	Permitted - s11	No Control Category	No
Fabaceae	*Alhagi maurorum*	-	Declared Pest - s22(2)	C3 Management, Whole of State	No
Fabaceae	*Erythrostemon gilliesii*	-	Permitted - s11	No Control Category	No
Fabaceae	*Medicago laciniata*	Cutleaf Medic	Permitted - s11	No Control Category	No
Fabaceae	*Medicago minima*	Small Burr Medic	Permitted - s11	No Control Category	No
Fabaceae	*Medicago polymorpha*	Burr Medic	Permitted - s11	No Control Category	No
Fabaceae	*Vicia monantha* subsp. *triflora*	-	Permitted - s11	No Control Category	No
Geraniaceae	*Erodium aureum*	-	Permitted - s11	No Control Category	No
Geraniaceae	*Erodium botrys*	Long Storksbill	Permitted - s11	No Control Category	No
Geraniaceae	*Erodium cicutarium*	Common Storksbill	Permitted - s11	No Control Category	No
Lamiaceae	*Marrubium vulgare*	Horehound	Permitted - s11	No Control Category	No
Lamiaceae	*Salvia reflexa*	Mintweed	Permitted - s11	No Control Category	No
Lamiaceae	*Salvia verbenaca*	Wild Sage	Permitted - s11	No Control Category	No
Malvaceae	*Malva parviflora*	Marshmallow	Permitted - s11	No Control Category	No
Oxalidaceae	*Oxalis bowiei*	Bowie Wood Sorrel	Permitted - s11	No Control Category	No
Oxalidaceae	*Oxalis pes-caprae*	Soursob	Permitted - s11	No Control Category	No
Papaveraceae	*Papaver hybridum*	Rough Poppy	Permitted - s11	No Control Category	No
Plumbaginaceae	*Limonium sinuatum*	Perennial Sea Lavender	Permitted - s11	No Control Category	No
Poaceae	*Bromus catharticus*	Prairie Grass	Permitted - s11	No Control Category	No
Poaceae	*Bromus diandrus*	Great Brome	Permitted - s11	No Control Category	No
Poaceae	*Cenchrus ciliaris*	Buffel Grass	Permitted - s11	No Control Category	No
Poaceae	*Ehrharta villosa*	Pyp Grass	Permitted - s11	No Control Category	No
Poaceae	*Eragrostis curvula*	African Lovegrass	Permitted - s11	No Control Category	No

Family	Species	Common Name	WAOL Status	Control Category	WONS
Poaceae	*Hordeum glaucum*	Northern Barley Grass	Permitted - s11	No Control Category	No
Poaceae	*Hordeum leporinum*	Barley Grass	Permitted - s11	No Control Category	No
Poaceae	*Pentameries airoides* subsp. *airoides*	-	Permitted - s11	No Control Category	No
Poaceae	*Phalaris paradoxa*	Paradoxa Grass	Permitted - s11	No Control Category	No
Poaceae	*Rostraria pumila*	-	Permitted - s11	No Control Category	No
Poaceae	*Schismus arabicus*	Araby Grass	Permitted - s11	No Control Category	No
Poaceae	*Schismus barbatus*	Kelch Grass	Permitted - s11	No Control Category	No
Poaceae	*Sorghum halepense*	Johnson Grass	Permitted - s11	No Control Category	No
Poaceae	*Urochloa panicoides*	-	Permitted - s11	No Control Category	No
Polygonaceae	*Polygonum aviculare*	Wireweed	Permitted - s11	No Control Category	No
Polygonaceae	*Rumex vesicarius*	Ruby Dock	Permitted - s11	No Control Category	No
Primulaceae	*Lysimachia arvensis*	Pimpernel	Permitted - s11	No Control Category	No
Solanaceae	*Datura inoxia*	-	Permitted - s11	No Control Category	No
Solanaceae	*Lycium ferocissimum*	African Boxthorn	Permitted - s11	No Control Category	Yes
Solanaceae	*Nicotiana glauca*	Tree Tobacco	Permitted - s11	No Control Category	No
Solanaceae	*Solanum nigrum*	Black Berry Nightshade	Permitted - s11	No Control Category	No
Urticaceae	*Urtica urens*	Small Nettle	Permitted - s11	No Control Category	No
Verbenaceae	*Glandularia aristigera*	-	Permitted - s11	No Control Category	No
Verbenaceae	*Phyla canescens*	-	Permitted - s11	No Control Category	No
Zygophyllaceae	*Tribulus terrestris*	Caltrop	Permitted - s11	No Control Category	No

Appendix 3: Significant Flora Likelihood Assessment

Species	Rank	Habitat	Comments	Likelihood
Conostylis lepidospermoides	T (EN)	Grey or yellow-brown sand over laterite.	Outside known range of species.	Unlikely
Gastrolobium graniticum		Sand, sandy loam, granite. Margins of rock outcrops, along drainage lines.	Outside known range of species.	Unlikely
Thelymitra stellata		Sand, gravel, lateritic loam.	Outside known range of species.	Unlikely
Acacia coatesii	P1	-	Outside known range of species.	Unlikely
Acacia epedunculata		Yellow sand. Sandplains.	Outside known range of species.	Unlikely
Acacia sclerophylla var. *teretiuscula*		Clay & loamy soils.	Outside known range of species.	Unlikely
Acacia websteri		Red sand, clay or loam. Low-lying areas, flats.	At extreme of range, habitat unlikely to be present.	Unlikely
Austrostipa sp. Carlingup Road (S. Kern & R. Jasper LCH 18459)		Rocky basalt hillslopes and crests.	Outside known range of species.	Unlikely
Dampiera plumosa		Red sandy soils.	Outside known range of species.	Unlikely
Eucalyptus websteriana subsp. *norsemanica*		Rocky rises.	Outside known range of species.	Unlikely
Lepidosperma sp. Parker Range (N. Gibson & M. Lyons 2094)		-	Outside known range of species.	Unlikely
Melichrus sp. Coolgardie (K.R. Newbey 8698)		-	Outside known range of species.	Unlikely
Phebalium appressum		Yellow sandplain.	Extreme of known range, habitat unlikely to be present.	Unlikely
Philotheca pachyphylla		Sand, red loam, clay loam. Sandplains, hill tops.	Outside known range of species.	Unlikely
Ptilotus chortophytus		-	Outside known range of species.	Unlikely
Ptilotus procumbens		Red clay.	Outside known range of species.	Unlikely
Ptilotus rigidus		-	At extreme of range.	Unlikely
Rhodanthe uniflora		Brown earth. Open eucalyptus woodland.	Within species range, habitat may be present.	Possible
Thryptomene planiflora		-	Outside known range of species.	Unlikely
Thryptomene sp. Coolgardie (E. Kelso s.n. 1902)		-	Outside known range of species.	Unlikely
Austrostipa sp. Dowerin (G. Wiehl F 8004)	P2	-	Outside known range of species.	Unlikely
Elachanthus pusillus		-	Sparse regional records.	Unlikely
Eremophila praecox		Red/brown sandy loam. Undulating plains.	Within known range of species, habitat may be present.	Possible
Eucalyptus educta		Shallow soils. Granite rocks.	Within known range, habitat may be present.	Possible
Goodenia salina		Low gypseous dunes near salt pans.	Outside known range of species.	Unlikely
Hakea rigida		Sandy soils, yellow sand.	Outside known range of species.	Unlikely
Lepidium merrallii		Clay loam.	Outside known range of species.	Unlikely

Species	Rank	Habitat	Comments	Likelihood
Phebalium clavatum		Sandy soils. Sandplains.	Outside known range of species.	Unlikely
Acacia crenulata	P3	Clay, sandy clay, yellow sand. Rocky rises, granite outcrops, breakaways.	Outside known range of species.	Unlikely
Allocasuarina eriochlamys subsp. *grossa*		Stony loam, laterite clay. Granite outcrops.	Outside known range of species.	Unlikely
Alyxia tetanifolia		Sandy clay, loam, concretionary gravel. Drainage lines, near lakes.	Habitat unlikely to be present.	Unlikely
Angianthus prostratus		Red clay or loamy soils. Saline depressions.	Habitat unlikely to be present.	Unlikely
Atriplex lindleyi subsp. *conduplicata*		Crabhole plains.	Habitat unlikely to be present.	Unlikely
Austrostipa blackii		-	Outside known range of species.	Unlikely
Chrysocephalum apiculatum subsp. *norsemanense*		-	Outside known range of species.	Unlikely
Cyathostemon verrucosus		Slopes of Red Hill, Kambalda	Outside known range of species.	Unlikely
Eremophila veronica		Stony clay, clay loam. Lateritic breakaways.	Outside known range of species.	Unlikely
Gompholobium cinereum		Yellow sand, clayey sand, brown loam, sandy gravel, laterite. Well-drained open sites, slopes, plains, roadsides.	Outside known range of species.	Unlikely
Grevillea georgeana		Stony loam/clay. Ironstone hilltops & slopes.	Outside known range of species.	Unlikely
Isolepis australiensis		Silty sand, sandy clay. Lake margins, pools.	Outside known range of species.	Unlikely
Lepidium fasciculatum		-	Sparse regional records.	Unlikely
Melaleuca coccinea		Sandy loam over granite. Granite outcrops, sandplain, river valleys.	Outside known range of species.	Unlikely
Notisia intonsa		Red sand, disturbed areas.	Within known range of species, habitat may be present.	Possible
Phlegmatospermum eremaeum		Stony loam.	Widespread but sparse records in region.	Unlikely
Rinzia triplex		-	Outside known range of species.	Unlikely
Styphelia saxicola		-	Outside known range of species.	Unlikely
Eremophila caerulea subsp. *merrallii*	P4	Sand, clay or loam. Undulating plains.	Outside known range of species.	Unlikely
Eucalyptus jutsonii subsp. *jutsonii*		Red to pale orange deep sands. Undulating areas and on dunes.	Outside known range of species.	Unlikely
Eucalyptus x brachyphylla		Sandy loam. Granite outcrops.	Outside known range of species.	Unlikely
Frankenia glomerata		White sand.	Outside known range of species.	Unlikely

Appendix 4: Significant Fauna Likelihood Assessment

Species	Conservation Status			Habitat Description	Assessment	Likelihood
	EPBC Act	BC Act	DBCA Priority			
Night Parrot *Pezoporus occidentalis*	EN	CR	-	Most habitat records are of Triodia (Spinifex) grasslands and/or chenopod shrublands in the arid and semi-arid zones, or *Astrebla* spp. (Mitchell grass), shrubby samphire and chenopod associations, scattered trees and shrubs, *Acacia aneura* (Mulga) woodland, treeless areas and bare gibber are associated with sightings of the species. Roosting and nesting sites are consistently reported as within clumps of dense vegetation, primarily old and large Spinifex (*Triodia*) clumps, but sometimes other vegetation types (DAWE, 2020b).	Would not occur. Very marginal habitat.	Would Not Occur
Carnaby's Cockatoo *Calyptorhynchus latirostris*	EN	EN		Carnaby's Cockatoo is endemic to, and widespread in, the south-west of Western Australia. It occurs from the wheatbelt, in areas that receive between 300 and 750 mm of rainfall annually, across to wetter regions in the extreme south-west, including the Swan Coastal Plain and the southern coast. Its range extends from Cape Arid in the south-east to Kalbarri in the north, and inland to Hatter Hill, Gibb Rock, Narembeen, Noongar, Wongan Hills, Nugadong, near Perenjori, Wilroy and Nabawa.	Would Not Occur. No documented records in the region.	Would Not Occur
Grey Falcon *Falco hypoleucos*	VU	VU		The Grey Falcon occurs at low densities across inland Australia. The species frequents timbered lowland plains, particularly acacia shrublands that are crossed by tree-lined water courses. The species has been observed hunting in treeless areas and frequents tussock grassland and open woodland, especially in winter. While breeding Grey Falcons feed almost exclusively on birds. Prey species include doves, pigeons, small parrots and cockatoos and finches, but a variety of other bird prey species has been recorded. Non avian prey recorded by direct observation include small mammals and lizards.	Possibly Occurs. Survey area may form part of larger home range.	Possible
Malleefowl *Leipoa ocellata*	VU	VU	-	Scrublands and woodlands dominated by mallee and wattle species (DAWE, 2020b).	Possibly Occurs. Habitat likely marginal and unsuitable for breeding. Occasional transients only.	Possible
Fork-tailed Swift *Apus pacificus*	MI	MI	-	Low to very high airspace over varied habitat from rainforest to semi desert (Birdlife Australia, 2019).	Unlikely to occur. Very occasional transients only.	Unlikely

Migratory Shorebirds (Various species)	IA/MI	IA/MI	T-P4	Prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline salt lakes inland (DAWE, 2020b).	Habitat would not be present.	Would Not Occur
Grey Wagtail *Motacilla cinerea*	MI	MI	-	Running water in disused quarries, sandy, rocky streams in escarpments and rainforest, sewerage ponds, ploughed fields and airfields (Morecombe 2004).	Would Not Occur. No suitable habitat.	Would Not Occur
Peregrine Falcon *Falco peregrinus*	-	OS	-	The Peregrine Falcon is found in most habitats, from rainforests to the arid zone, and at most altitudes, from the coast to alpine areas. It requires abundant prey and secure nest sites, and prefers coastal and inland cliffs or open woodlands near water, and may even be found nesting on high city buildings (Birdlife Australia, 2018).	Possibly Occurs. Survey area may form part of larger home range but unlikely to breed in area	Possible
Numbat *Myrmecobius fasciatus*	EN	EN		Previously widespread in arid and semi-arid Australia, the species is now restricted to two isolated wild populations in south-west Western Australia and a number of translocations to predator proof locations.	Would Not Occur. No documented records in the region.	Would Not Occur
Chuditch, Western Quoll *Dasyurus geoffroii*	VU	VU		Previously occurred throughout arid and semi-arid Australia but is now restricted to south-west Western Australia. (DAWE, 2020b).	Unlikely to Occur. Considered to be locally extinct.	Unlikely
Bilby *Macrotis lagotis*	VU	VU		In Western Australia, it is mainly restricted to the Gibson Desert, Little Sandy Desert, Great Sandy Desert and parts of the Pilbara and Southern Kimberley.	Would Not Occur. No documented records in the region.	Would Not Occur

Appendix 5: List of species identified within each vegetation type

Family	Species	CLP-EW1	CLP-EW2	HS-EW1
Amaranthaceae	*Ptilotus obovatus.* var *obovatus*	*	*	*
Apocynaceae	*Alyxia buxifolia*	*		
Apocynaceae	*Marsdenia australis*	*		
Asteraceae	*Cratystylis microphylla*	*	*	
	Olearia muelleri	*	*	*
	Olearia pimeleoides	*	*	*
Boraginaceae	*Halgania andromedifolia*	*		
Casuarinaceae	*Allocasuarina campestris*			*
Chenopodiaceae	*Atriplex bunburyana*	*		*
	Atriplex nummularia	*	*	*
	Atriplex vesicaria	*	*	*
	Maireana brevifolia		*	*
	Maireana erioclada	*	*	
	Maireana georgei		*	*
	Maireana pentatropis	*		
	Maireana pyramidata		*	
	Maireana sedifolia	*		
	Maireana tomentosa		*	
	Maireana trichoptera		*	
	Maireana triptera	*	*	*
	Tecticornia disarticulata		*	
Fabaceae	*Acacia burkittii*		*	
	Acacia colletioides	*		*
	Acacia erinacea	*		*
	Acacia hemiteles		*	*
	Acacia jennerae	*		
	Acacia tetragonophylla	*	*	*
	Senna artemisioides subsp*. filifolia*	*	*	*
	Senna cardiosperma	*		
	Senna pleurocarpa var*. angustifolia*	*		
Frankeniaceae	*Frankenia setosa*		*	
Goodeniaceae	*Scaevola spinescens*	*	*	*
Lamiaceae	*Westringia rigida*		*	
Malvaceae	*Abutilon cryptopetalum*	*		
Myrtaceae	*Eucalyptus clelandiorum*	*		
	Eucalyptus griffithsii	*		
	Eucalyptus lesouefii	*		
	Eucalyptus salmonophloia		*	
	Eucalyptus salubris	*		
	Eucalyptus torquata	*		*
	Eucalyptus transcontinentalis	*		
	Eucalyptus yilgarnensis	*		
	Melaleuca pauperiflora	*	*	*
Pittosporaceae	*Pittosporum angustifolium*	*		*
Poaceae	*Austrostipa elegantissima*	*	*	
	Triodia scariosa	*		*

Family	Species	CLP-EW1	CLP-EW2	HS-EW1
Proteaceae	*Grevillea acuaria*	*		
	Grevillea huegelii	*		
	Hakea kippistiana	*		
Rhamnaceae	*Trymalium myrtillus* subsp. *myrtillus*			*
Santalaceae	*Exocarpos aphyllus*	*	*	*
	Santalum acuminatum	*		
	Santalum spicatum	*		
Sapindaceae	*Dodonaea lobulata*	*		
Scrophulariaceae	*Eremophila caperata*	*		
	Eremophila dempsteri	*		
	Eremophila glabra	*	*	*
	Eremophila interstans subsp. *interstans*	*	*	*
	Eremophila ionantha	*		
	Eremophila latrobei		*	
	Eremophila oldfieldii subsp. *angustifolia*			*
	Eremophila parvifolia subsp. *auricampa*	*		
	Eremophila scoparia			*
Solanaceae	*Lycium australe*		*	
	Solanum nummularium	*	*	

Appendix 6: Vegetation Condition Rating

Vegetation Condition Rating	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.	N/A
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	N/A	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 7: NatureMap Species List (40km buffer)

NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Guest user on 13/01/2021

Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 121° 11' 17" E,30° 46' 45" S
Buffer 40km
Group By Family

Family	Species	Records
Acanthizidae	9	470
Acarosporaceae	3	13
Accipitridae	8	43
Actinopodidae	1	4
Aegothelidae	1	2
Agamidae	12	138
Aizoaceae	6	15
Amaranthaceae	16	95
Anacardiaceae	1	4
Anatidae	11	244
Anhingidae	1	2
Apiaceae	1	9
Apocynaceae	6	53
Araliaceae	1	4
Araneidae	8	24
Arcyriaceae	1	2
Ardeidae	3	25
Artamidae	3	29
Asparagaceae	6	20
Asphodelaceae	1	4
Asteraceae	105	436
Barychelidae	1	1
Boidae	1	2
Boraginaceae	9	53
Bothriuridae	1	1
Bovidae	3	5
Branchipodidae	1	11
Brassicaceae	17	70
Bryaceae	3	3
Burramyidae	1	50
Buthidae	1	1
Cacatuidae	1	24
Cactaceae	6	8
Campanulaceae	2	8
Campephagidae	3	85
Caprimulgidae	1	2
Carphodactylidae	1	1
Caryophyllaceae	2	3
Casuariidae	1	41
Casuarinaceae	8	30
Celastraceae	2	3
Charadriidae	5	20
Cheluidae	1	1
Chenopodiaceae	73	414
Cladoniaceae	3	4
Climacteridae	1	1
Colchicaceae	1	1
Collemataceae	1	1
Columbidae	4	201
Convolvulaceae	3	7
Corvidae	3	269
Cracticidae	4	409
Crassulaceae	3	10
Cuculidae	3	16
Cupressaceae	2	16
Cyperaceae	9	11
Cyprinidae	1	1
Cyzicidae	1	1
Daphniidae	1	6
Dasyuridae	7	65
Desidae	2	2
Dicaeidae	1	18
Dicruridae	3	263
Didiereaceae	1	1
Diplodactylidae	8	134
Droseraceae	1	1
Dytiscidae	1	1
Echinosteliaceae	1	3
Elaeocarpaceae	1	2
Elapidae	16	98
Emballonuridae	1	2
Ericaceae	4	5
Estrildidae	1	12
Euphorbiaceae	9	15
Fabaceae	105	516
Falconidae	4	48
Felidae	1	17

NatureMap is a collaborative project of the Department of Biodiversity, Conservation and Attractions and the Western Australian Museum.

Fissidentaceae	2	2
Frankeniaceae	9	21
Geastraceae	1	1
Gekkonidae	5	138
Geraniaceae	5	20
Gnaphosidae	1	1
Goodeniaceae	28	131
Graphidaceae	5	11
Grimmiaceae	1	2
Gyrostemonaceae	2	3
Haemodoraceae	1	1
Halcyonidae	2	4
Haloragaceae	6	21
Hersiliidae	1	1
Hirundinidae	4	94
Hydnaceae	1	1
Hydrophilidae	2	2
Hylidae	1	1
Icmadophilaceae	1	1
Idiopidae	1	2
Juncaceae	1	1
Lamiaceae	21	129
Lamponidae	2	7
Laridae	1	2
Lecideaceae	1	2
Leporidae	1	61
Liceaceae	1	3
Limnodynastidae	4	66
Loganiaceae	3	3
Loranthaceae	6	12
Lycaenidae	3	23
Lycosidae	5	10
Lythraceae	1	1
Macropodidae	3	28
Maluridae	3	101
Malvaceae	20	82
Megalosporaceae	2	8
Megapodiidae	1	37
Meliaceae	1	1
Meliphagidae	10	970
Meropidae	1	37
Montiaceae	4	16
Motacillidae	2	3
Muridae	5	111
Myobatrachidae	1	29
Myrmecobiidae	1	1
Myrtaceae	105	601
Nemesiidae	2	4
Neosittidae	2	6
Nicodamidae	1	6
Nitrariaceae	1	2
Nyctaginaceae	1	1
Ophioglossaceae	1	1
Orchidaceae	11	14
Ostracoda	1	1
Otididae	1	3
Oxalidaceae	3	4
Oxyopidae	3	12
Pachycephalidae	5	232
Papaveraceae	1	1
Pardalotidae	3	188
Parmeliaceae	31	68
Peltulaceae	1	1
Petroicidae	5	68
Phalacrocoracidae	2	11
Phasianidae	1	1
Pholcidae	1	1
Physaraceae	1	1
Physciaceae	3	5
Pileolariaceae	1	2
Pittosporaceae	3	10
Plantaginaceae	3	11
Plumbaginaceae	1	1
Poaceae	55	168
Podargidae	1	4
Podicipedidae	2	52
Polygalaceae	2	3
Polygonaceae	3	4
Pomatostomidae	2	57
Portulacaceae	1	1
Pottiaceae	6	8
Primulaceae	1	1
Proteaceae	27	83
Psittacidae	10	100
Psoraceae	3	20
Pteridaceae	2	4
Pygopodidae	4	15
Rallidae	3	27
Ranunculaceae	1	1
Recurvirostridae	4	17
Restionaceae	2	2
Rhamnaceae	5	38
Rhizocarpaceae	1	1
Ricciaceae	1	1
Ruppiaceae	1	2
Rutaceae	12	40
Salticidae	4	15
Santalaceae	3	63
Sapindaceae	8	113
Scincidae	25	212
Scolopacidae	8	15
Scolopendridae	3	6
Scrophulariaceae	40	455
Solanaceae	17	76
Sparassidae	2	14

Stemonitidaceae	2	3
Sternophoridae	1	1
Stylidiaceae	3	7
Tachyglossidae	1	8
Teloschistaceae	5	8
Thamnocephalidae	1	1
Theraphosidae	1	3
Theridiidae	1	11
Threskiornithidae	2	10
Thylacomyidae	1	2
Thymelaeaceae	4	12
Trichiaceae	1	1
Triopsidae	1	4
Trochanteriidae	2	4
Turnicidae	1	1
Tytonidae	1	2
Urodacidae	3	3
Urticaceae	1	1
Varanidae	3	25
Verbenaceae	2	2
Verrucariaceae	4	8
Vespertilionidae	7	131
Violaceae	1	6
Zodariidae	1	1
Zosteropidae	1	25
Zygophyllaceae	8	15
TOTAL	**1250**	**10001**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Acanthizidae					
1.	24260	*Acanthiza apicalis (Broad-tailed Thornbill, Inland Thornbill)*			
2.	24261	*Acanthiza chrysorrhoa (Yellow-rumped Thornbill)*			
3.	24265	*Acanthiza uropygialis (Chestnut-rumped Thornbill)*			
4.	25528	*Aphelocephala leucopsis (Southern Whiteface)*			
5.	24266	*Aphelocephala leucopsis subsp. castaneiventris (Southern Whiteface)*			
6.	25530	*Gerygone fusca (Western Gerygone)*			
7.	34001	*Hylacola cauta subsp. whitlocki (Shy Groundwren)*			
8.	24278	*Pyrrholaemus brunneus (Redthroat)*			
9.	30948	*Smicrornis brevirostris (Weebill)*			
Acarosporaceae					
10.	27574	*Acarospora citrina*			
11.	27576	*Acarospora nodulosa*			
12.	28195	*Acarospora nodulosa var. reagens*			
Accipitridae					
13.	25535	*Accipiter cirrocephalus (Collared Sparrowhawk)*			
14.	25536	*Accipiter fasciatus (Brown Goshawk)*			
15.	24285	*Aquila audax (Wedge-tailed Eagle)*			
16.		*Elanus axillaris*			
17.	25540	*Elanus caeruleus (Black-shouldered Kite)*			
18.	24290	*Elanus caeruleus subsp. axillaris (Australian Black-shouldered Kite)*			
19.	24295	*Haliastur sphenurus (Whistling Kite)*			
20.	47965	*Hieraaetus morphnoides (Little Eagle)*			
Actinopodidae					
21.		*Missulena occatoria*			
Aegothelidae					
22.	25544	*Aegotheles cristatus (Australian Owlet-nightjar)*			
Agamidae					
23.	25458	*Ctenophorus caudicinctus (Ring-tailed Dragon)*			
24.	24871	*Ctenophorus cristatus (Bicycle Dragon)*			
25.	24873	*Ctenophorus fordi (Mallee Sand Dragon)*			
26.	24874	*Ctenophorus isolepis subsp. citrinus (Yellowy Military Dragon)*			
27.	24882	*Ctenophorus nuchalis (Central Netted Dragon)*			
28.	24886	*Ctenophorus reticulatus (Western Netted Dragon)*			
29.	24888	*Ctenophorus salinarum (Salt Pan Dragon)*			
30.	24889	*Ctenophorus scutulatus (Lozenge-marked Dragon)*			
31.	24904	*Moloch horridus (Thorny Devil)*			
32.	24907	*Pogona minor subsp. minor (Dwarf Bearded Dragon)*			
33.	30814	*Tympanocryptis cephalus (Pebble Dragon)*			
34.	39408	*Tympanocryptis lineata (Lined Earless Dragon)*			
Aizoaceae					
35.	48513	*Aizoon pubescens*	Y		
36.	11681	*Disphyma crassifolium subsp. clavellatum*			
37.	2807	*Gunniopsis quadrifida (Sturts Pigface)*			
38.	2813	*Mesembryanthemum crystallinum (Iceplant)*	Y		
39.	2814	*Mesembryanthemum nodiflorum (Slender Iceplant)*	Y		
40.	2822	*Tetragonia eremaea*			
Amaranthaceae					
41.	2648	*Alternanthera denticulata (Lesser Joyweed)*			
42.	2652	*Alternanthera nodiflora (Common Joyweed)*			
43.	2671	*Amaranthus viridis (Green Amaranth)*	Y		
44.	2690	*Ptilotus aervoides*			
45.	2707	*Ptilotus carlsonii*			
46.	38463	*Ptilotus chortophytus*		P1	
47.	48602	*Ptilotus eremita*			
48.	2721	*Ptilotus exaltatus (Tall Mulla Mulla)*			
49.	2727	*Ptilotus gaudichaudii*			
50.	2729	*Ptilotus grandiflorus*			
51.	2730	*Ptilotus helichrysoides*			
52.	2732	*Ptilotus holosericeus*			
53.	2747	*Ptilotus obovatus (Cotton Bush)*			
54.	2751	*Ptilotus polystachyus (Prince of Wales Feather)*			
55.	2752	*Ptilotus procumbens*		P1	
56.	43203	*Surreya diandra*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Anacardiaceae					
57.	17056	*Schinus molle var. areira*	Y		
Anatidae					
58.	24312	*Anas gracilis (Grey Teal)*			
59.	24313	*Anas platyrhynchos (Mallard)*			
60.	24315	*Anas rhynchotis (Australasian Shoveler)*			
61.	24316	*Anas superciliosa (Pacific Black Duck)*			
62.	24318	*Aythya australis (Hardhead)*			
63.	24319	*Biziura lobata (Musk Duck)*			
64.	24321	*Chenonetta jubata (Australian Wood Duck, Wood Duck)*			
65.	24322	*Cygnus atratus (Black Swan)*			
66.	24326	*Malacorhynchus membranaceus (Pink-eared Duck)*			
67.	24329	*Stictonetta naevosa (Freckled Duck)*			
68.	24331	*Tadorna tadornoides (Australian Shelduck, Mountain Duck)*			
Anhingidae					
69.	47414	*Anhinga novaehollandiae (Australasian Darter)*			
Apiaceae					
70.	6218	*Daucus glochidiatus (Australian Carrot)*			
Apocynaceae					
71.	6565	*Alyxia buxifolia (Dysentery Bush)*			
72.	14636	*Alyxia tetanifolia*		P3	
73.	6580	*Asclepias curassavica (Redhead Cottonbush)*	Y		
74.	12949	*Marsdenia australis*			
75.	20233	*Orbea variegata*	Y		Y
76.	48986	*Vincetoxicum lineare*			
Araliaceae					
77.	6279	*Trachymene ornata (Spongefruit)*			
Araneidae					
78.		*Argiope protensa*			
79.		*Argiope trifasciata*			
80.		*Austracantha minax*			
81.		*Backobourkia heroine*			
82.		*Celaenia excavata*			
83.		*Cyrtophora parnasia*			
84.		*Eriophora biapicata*			
85.		*Nephila edulis*			
Arcyriaceae					
86.	38964	*Arcyria cinerea*			
Ardeidae					
87.	41324	*Ardea modesta (great egret, white egret)*			
88.	24341	*Ardea pacifica (White-necked Heron)*			
89.		*Egretta novaehollandiae*			
Artamidae					
90.	25566	*Artamus cinereus (Black-faced Woodswallow)*			
91.	24353	*Artamus cyanopterus (Dusky Woodswallow)*			
92.	24356	*Artamus personatus (Masked Woodswallow)*			
Asparagaceae					
93.	1505	*Agave americana (Century Plant)*	Y		
94.	1215	*Chamaexeros fimbriata*			
95.	1216	*Chamaexeros macranthera*			
96.	1338	*Thysanotus manglesianus (Fringed Lily)*			
97.	1343	*Thysanotus patersonii*			
98.		*Thysanotus sp.*			
Asphodelaceae					
99.	1366	*Bulbine semibarbata (Leek Lily)*			
Asteraceae					
100.	7817	*Actinobole uliginosum (Flannel Cudweed)*			
101.	7834	*Angianthus prostratus*		P3	
102.	7836	*Angianthus tomentosus (Camel-grass)*			
103.	7838	*Arctotheca calendula (Cape Weed, African Marigold)*	Y		
104.	7846	*Asteridea athrixioides*			
105.	7847	*Asteridea chaetopoda*			
106.	7871	*Brachyscome ciliaris*			
107.	7878	*Brachyscome iberidifolia*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
108.	7880	*Brachyscome lineariloba*			
109.	7882	*Brachyscome perpusilla*			
110.	7903	*Calotis hispidula (Bindy Eye)*			
111.	7905	*Calotis multicaulis (Many-stemmed Burr-daisy)*			
112.	7911	*Carthamus lanatus (Saffron Thistle)*	Y		
113.	7916	*Centaurea melitensis (Maltese Cockspur, Malta Thistle)*	Y		
114.	7922	*Cephalipterum drummondii (Pompom Head)*			
115.	7924	*Ceratogyne obionoides (Wingwort)*			
116.	47074	*Chrysocephalum apiculatum subsp. norsemanense*		P3	
117.	13138	*Chrysocephalum puteale*			
118.	7935	*Cichorium intybus (Chicory)*	Y		
119.	7939	*Conyza bonariensis (Flaxleaf Fleabane)*	Y		
120.	20074	*Conyza sumatrensis*	Y		
121.	7943	*Cotula australis (Common Cotula)*			
122.	13353	*Craspedia haplorrhiza*			Y
123.	7949	*Cratystylis conocephala (Greybush)*			
124.	7950	*Cratystylis microphylla (Small-leaved Grey Bush)*			
125.	7951	*Cratystylis subspinescens (Australian Sage, Spiny Grey Bush)*			
126.	7964	*Elachanthus pusillus (Elacanth)*		P2	
127.	12739	*Erymophyllum ramosum*			
128.	14377	*Erymophyllum ramosum subsp. ramosum*			
129.	16311	*Gazania linearis*	Y		
130.	12780	*Gilberta tenuifolia*			
131.	7989	*Gnephosis brevifolia (Short-leaved Gnephosis)*			
132.	7998	*Gnephosis macrocephala*			
133.	8002	*Gnephosis tenuissima*			
134.	8008	*Helianthus annuus (Sunflower, Common Sunflower)*	Y		
135.	8045	*Helipterum craspedioides (Yellow Billy Buttons)*			
136.	12743	*Hyalosperma glutinosum*			
137.	15447	*Hyalosperma glutinosum subsp. glutinosum*			
138.	12756	*Hyalosperma zacchaeus*			
139.	8087	*Isoetopsis graminifolia (Cushion Grass)*			
140.	8094	*Kippistia suaedifolia*			
141.	29046	*Lactuca serriola forma serriola*	Y		
142.	13284	*Lawrencella rosea*			
143.	19237	*Leiocarpa websteri*			
144.	12628	*Lemooria burkittii*			
145.	8105	*Millotia myosotidifolia*			
146.	12631	*Millotia perpusilla*			
147.	8107	*Minuria cunninghamii (Bush Minuria)*			
148.	8108	*Minuria gardneri*			
149.	8110	*Minuria leptophylla (Minnie Daisy)*			
150.	29418	*Monoculus monstrosus*	Y		
151.	14186	*Myriocephalus pygmaeus*			
152.	48227	*Notisia intonsa*		P3	
153.	8134	*Olearia exiguifolia (Small-leaved Daisy Bush)*			
154.	8136	*Olearia homolepis*			
155.	19023	*Olearia incana*			
156.	8140	*Olearia muelleri (Goldfields Daisy)*			
157.	8145	*Olearia pimeleoides (Pimelea Daisybush, Burrobunga)*			
158.	8149	*Olearia rudis (Rough Daisybush)*			
159.		*Olearia sp.*			
160.	44401	*Olearia sp. Eremicola (Diels & Pritzel s.n. PERTH 00449628)*			
161.	8152	*Olearia subspicata (Spiked Daisy Bush)*			
162.	19828	*Oligocarpus calendulaceus*	Y		
163.	20661	*Oncosiphon suffruticosum (Calomba Daisy)*	Y		
164.	12642	*Ozothamnus cassiope*			
165.	45238	*Podolepis aristata subsp. affinis*			
166.	8173	*Podolepis capillaris (Wiry Podolepis)*			
167.	8177	*Podolepis lessonii*			
168.	8180	*Podolepis rugata (Pleated Podolepis)*			
169.	12731	*Podotheca wilsonii*			
170.	8187	*Pogonolepis muelleriana*			
171.	8188	*Pogonolepis stricta*			
172.	13306	*Rhodanthe battii*			
173.	13308	*Rhodanthe charsleyae*			
174.	13241	*Rhodanthe chlorocephala subsp. rosea*			
175.	13242	*Rhodanthe chlorocephala subsp. splendida*			
176.	13301	*Rhodanthe floribunda*			
177.	13293	*Rhodanthe haigii*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
178.	13294	*Rhodanthe laevis*			
179.	13234	*Rhodanthe manglesii*			
180.	13249	*Rhodanthe oppositifolia subsp. oppositifolia*			
181.	13252	*Rhodanthe pygmaea*			
182.	13253	*Rhodanthe rubella*			
183.	13254	*Rhodanthe stricta*			
184.	13237	*Rhodanthe uniflora*		P1	
185.	8200	*Schoenia cassiniana (Schoenia)*			
186.	13287	*Schoenia filifolia subsp. filifolia*			
187.	20722	*Senecio dolichocephalus*			
188.	8207	*Senecio glossanthus (Slender Groundsel)*			
189.	25881	*Senecio lacustrinus*			
190.	8213	*Senecio magnificus (Showy Groundsel)*			
191.	20161	*Senecio pinnatifolius*			
192.	8231	*Sonchus oleraceus (Common Sowthistle)*	Y		
193.	8238	*Streptoglossa liatroides*			
194.	25902	*Symphyotrichum squamatum (Bushy Starwort)*	Y		
195.	12652	*Trichanthodium skirrophorum*			
196.	8253	*Triptilodiscus pygmaeus*			
197.	11387	*Vittadinia cervicularis var. cervicularis*			
198.	11788	*Vittadinia dissecta var. hirta*			
199.	8268	*Vittadinia humerata*			
200.	8273	*Vittadinia sulcata*			
201.	13331	*Waitzia acuminata var. acuminata*			
202.	46093	*Waitzia fitzgibbonii*			
203.	13328	*Waitzia nitida*			
204.	8287	*Xanthium spinosum (Bathurst Burr, Common Cockleburr, Spiny Cockleburr, Spiny Clotburr)*	Y		
Barychelidae					
205.		*Idiommata blackwalli*			
Boidae					
206.	25240	*Morelia spilota subsp. imbricata (Carpet Python)*			
Boraginaceae					
207.	6675	*Buglossoides arvensis (Corn Gromwell)*	Y		
208.	6681	*Echium plantagineum (Paterson's Curse)*	Y		
209.	6684	*Halgania andromedifolia*			
210.	29840	*Halgania cyanea var. Allambi Stn (B.W. Strong 676)*			
211.	31117	*Halgania cyanea var. Charleville (R.W. Purdie +111)*			
212.	6691	*Halgania integerrima*			
213.	6710	*Heliotropium europaeum (Common Heliotrope)*	Y		
214.	6723	*Omphalolappula concava (Burr Stickseed)*			
215.	6727	*Trichodesma zeylanicum (Camel Bush, Kumbalin)*			
Bothriuridae					
216.		*Cercophonius michaelseni*			
Bovidae					
217.	24251	*Bos taurus (European Cattle)*	Y		
218.	24253	*Capra hircus (Goat)*	Y		
219.	34016	*Ovis aries (Sheep)*			
Branchipodidae					
220.		*Parartemia sp.*			
Brassicaceae					
221.	2990	*Alyssum linifolium (Flax-leaf Alyssum)*	Y		
222.	31876	*Arabidella chrysodema*			
223.	2992	*Arabidella trisecta*			
224.	3000	*Brassica tournefortii (Mediterranean Turnip)*	Y		
225.	3004	*Capsella bursa-pastoris (Shepherd's Purse)*	Y		
226.	3008	*Carrichtera annua (Ward's Weed)*	Y		
227.	3026	*Lepidium fasciculatum (Bundled Peppercress)*		P3	
228.	3031	*Lepidium merrallii*		P2	
229.	3033	*Lepidium oxytrichum*			
230.	3034	*Lepidium papillosum (Warty Peppercress)*			Y
231.	3059	*Phlegmatospermum eremaeum*		P3	
232.	3070	*Sisymbrium irio (London Rocket)*	Y		
233.	3072	*Sisymbrium orientale (Indian Hedge Mustard)*	Y		
234.	3076	*Stenopetalum filifolium*			
235.	3077	*Stenopetalum lineare (Narrow Thread Petal)*			
236.	30212	*Stenopetalum lineare var. lineare*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
237.	3079	*Stenopetalum pedicellare*			
Bryaceae					
238.	32331	*Bryum lanatum*			
239.	44608	*Rosulabryum billarderii*			
240.	32427	*Rosulabryum capillare*			
Burramyidae					
241.	24086	*Cercartetus concinnus (Western Pygmy-possum, Mundarda)*			
Buthidae					
242.		*Isometroides vescus*			
Cacatuidae					
243.		*Eolophus roseicapillus*			
Cactaceae					
244.	20759	*Cylindropuntia fulgida var. mamillata*	Y		
245.	33077	*Cylindropuntia imbricata*	Y		
246.	45513	*Cylindropuntia kleiniae*	Y		Y
247.	20281	*Cylindropuntia tunicata*	Y		Y
248.	31799	*Opuntia elata*	Y		
249.	44779	*Opuntia ficus-indica*	Y		
Campanulaceae					
250.	7397	*Isotoma petraea (Rock Isotome, Tundiwari)*			
251.	7386	*Wahlenbergia gracilenta (Annual Bluebell)*			
Campephagidae					
252.	24361	*Coracina maxima (Ground Cuckoo-shrike)*			
253.	25568	*Coracina novaehollandiae (Black-faced Cuckoo-shrike)*			
254.	24367	*Lalage tricolor (White-winged Triller)*			
Caprimulgidae					
255.	24368	*Eurostopodus argus (Spotted Nightjar)*			
Carphodactylidae					
256.	24971	*Nephrurus vertebralis*			
Caryophyllaceae					
257.	2914	*Spergularia diandra (Lesser Sand Spurry)*	Y		
258.	8900	*Spergularia marina*			
Casuariidae					
259.	24470	*Dromaius novaehollandiae (Emu)*			
Casuarinaceae					
260.	13904	*Allocasuarina acutivalvis subsp. acutivalvis*			
261.	1721	*Allocasuarina campestris*			
262.	1722	*Allocasuarina corniculata*			
263.	13906	*Allocasuarina eriochlamys subsp. eriochlamys*			
264.	13897	*Allocasuarina eriochlamys subsp. grossa*		P3	
265.	1730	*Allocasuarina helmsii*			
266.	1742	*Casuarina obesa (Swamp Sheoak, Kuli)*			
267.	12658	*Casuarina pauper (Black Oak)*			
Celastraceae					
268.	4734	*Stackhousia muricata*			
269.	4737	*Tripterococcus brunonis (Winged Stackhousia)*			
Charadriidae					
270.	24377	*Charadrius ruficapillus (Red-capped Plover)*			
271.	47937	*Elseyornis melanops (Black-fronted Dotterel)*			
272.	24379	*Erythrogonys cinctus (Red-kneed Dotterel)*			
273.	48135	*Thinornis rubricollis (Hooded Plover, Hooded Dotterel)*		P4	
274.	24386	*Vanellus tricolor (Banded Lapwing)*			
Cheluidae					
275.	43380	*Chelodina colliei (South-western Snake-necked Turtle)*			
Chenopodiaceae					
276.	11435	*Atriplex acutibractea subsp. acutibractea*			
277.	11489	*Atriplex acutibractea subsp. karoniensis*			
278.	2450	*Atriplex amnicola (Swamp Saltbush)*			
279.	2453	*Atriplex codonocarpa (Flat-topped Saltbush)*			
280.	2455	*Atriplex eardleyae*			
281.	2459	*Atriplex holocarpa (Pop Saltbush)*			
282.	12042	*Atriplex lindleyi subsp. inflata*			

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283.	2469	*Atriplex nummularia (Old Man Saltbush)*			
284.	11516	*Atriplex nummularia subsp. spathulata (Old Man Saltbush)*			
285.	2472	*Atriplex pumilio*			
286.	11791	*Atriplex quadrivalvata var. quadrivalvata*			
287.	2475	*Atriplex semibaccata (Berry Saltbush)*			
288.	2478	*Atriplex spongiosa (Pop Saltbush)*			
289.	2479	*Atriplex stipitata (Mallee Saltbush)*			
290.	2480	*Atriplex suberecta*			
291.	2481	*Atriplex vesicaria (Bladder Saltbush)*			
292.	2483	*Chenopodium album (Fat Hen)*	Y		
293.	2487	*Chenopodium curvispicatum*			
294.	2494	*Chenopodium murale (Nettle-leaf Goosefoot)*	Y		
295.	2498	*Didymanthus roei*			
296.	2499	*Dissocarpus paradoxus (Curious Saltbush)*			
297.	33501	*Dysphania cristata (Crested Goosefoot)*			
298.	2502	*Dysphania kalpari (Rat's Tail, Kalpari)*			
299.	33480	*Dysphania pumilio (Clammy Goosefoot)*			
300.	11704	*Einadia nutans subsp. eremaea (Climbing Saltbush)*			
301.	2510	*Enchylaena lanata*			
302.	2511	*Enchylaena tomentosa (Barrier Saltbush)*			
303.	12064	*Enchylaena tomentosa var. tomentosa (Barrier Saltbush)*			
304.	2514	*Eriochiton sclerolaenoides (Woolly Bindii)*			
305.	2533	*Maireana amoena*			
306.	2535	*Maireana appressa*			
307.	2536	*Maireana atkinsiana (Bronze Bluebush)*			
308.	2537	*Maireana brevifolia (Small Leaf Bluebush)*			
309.	2538	*Maireana carnosa (Cottony Bluebush)*			
310.	2542	*Maireana erioclada*			
311.	2543	*Maireana eriosphaera*			
312.	2544	*Maireana georgei (Satiny Bluebush)*			
313.	2545	*Maireana glomerifolia (Ball Leaf Bluebush)*			
314.	2554	*Maireana pentagona (Hairy Bluebush)*			
315.	2555	*Maireana pentatropis*			
316.	2560	*Maireana pyramidata (Sago Bush)*			
317.	2561	*Maireana radiata*			
318.	2563	*Maireana sedifolia (Pearl Bluebush, Myall)*			
319.	2565	*Maireana suaedifolia*			
320.	2567	*Maireana tomentosa (Felty Bluebush)*			
321.	11662	*Maireana tomentosa subsp. tomentosa*			
322.	2568	*Maireana trichoptera (Downy Bluebush)*			
323.	2569	*Maireana triptera (Threewinged Bluebush)*			
324.	2570	*Maireana turbinata*			
325.	2581	*Rhagodia drummondii*			
326.	2582	*Rhagodia eremaea (Thorny Saltbush)*			
327.	2587	*Roycea divaricata*			
328.	30434	*Salsola australis*			
329.	2606	*Sclerolaena cuneata (Yellow Bindii)*			
330.	2609	*Sclerolaena diacantha (Grey Copperburr)*			
331.	2610	*Sclerolaena drummondii*			
332.	2612	*Sclerolaena eurotioides (Fluffy Bindii)*			
333.	2615	*Sclerolaena fusiformis*			
334.	8877	*Sclerolaena gardneri*			
335.	2625	*Sclerolaena obliquicuspis (Limestone Bindii)*			
336.	2626	*Sclerolaena parviflora (Small-flower Saltbush)*			
337.	31719	*Tecticornia chartacea*			
338.	31492	*Tecticornia disarticulata*			
339.	46513	*Tecticornia doliiformis*			
340.	33319	*Tecticornia indica subsp. bidens*			
341.	33299	*Tecticornia pergranulata subsp. elongata*			
342.	33297	*Tecticornia pergranulata subsp. pergranulata (Blackseed Samphire)*			
343.	31618	*Tecticornia pruinosa*			
344.	33218	*Tecticornia pterygosperma subsp. pterygosperma*			
345.	31853	*Tecticornia sp. Burnerbinmah (D. Edinger et al. 101)*			
346.	33216	*Tecticornia sp. Dennys Crossing (K.A. Shepherd & J. English KS 552)*			
347.	31494	*Tecticornia triandra (Desert Glasswort)*			
348.	31717	*Tecticornia undulata*			

Cladoniaceae

349.	48176	*Cladia beaugleholei*			
350.	48177	*Cladia muelleri*			
351.	28208	*Cladonia cervicornis subsp. verticillata*			

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Climacteridae					
352.	25581	*Climacteris affinis (White-browed Treecreeper)*			
Colchicaceae					
353.	1403	*Wurmbea tenella (Eight Nancy)*			
Collemataceae					
354.	27703	*Collema coccophorum*			
Columbidae					
355.	24399	*Columba livia (Domestic Pigeon)*	Y		
356.	24407	*Ocyphaps lophotes (Crested Pigeon)*			
357.	24409	*Phaps chalcoptera (Common Bronzewing)*			
358.	25590	*Streptopelia senegalensis (Laughing Turtle-Dove)*	Y		
Convolvulaceae					
359.	6612	*Convolvulus clementii*			
360.	6614	*Convolvulus remotus*			
361.	6621	*Ipomoea calobra (Weir Vine)*			
Corvidae					
362.	24416	*Corvus bennetti (Little Crow)*			
363.	25592	*Corvus coronoides (Australian Raven)*			
364.	25593	*Corvus orru (Torresian Crow)*			
Cracticidae					
365.	24420	*Cracticus nigrogularis (Pied Butcherbird)*			
366.	25595	*Cracticus tibicen (Australian Magpie)*			
367.	25596	*Cracticus torquatus (Grey Butcherbird)*			
368.	25597	*Strepera versicolor (Grey Currawong)*			
Crassulaceae					
369.	11709	*Crassula colorata var. acuminata*			
370.	11563	*Crassula colorata var. colorata*			
371.	20268	*Crassula tetramera*			
Cuculidae					
372.	42307	*Cacomantis pallidus (Pallid Cuckoo)*			
373.	24431	*Chrysococcyx basalis (Horsfield's Bronze Cuckoo)*			
374.	24434	*Chrysococcyx osculans (Black-eared Cuckoo)*			
Cupressaceae					
375.	8466	*Callitris columellaris (White Cypress Pine)*			
376.	96	*Callitris preissii (Rottnest Island Pine, Maro)*			
Cyperaceae					
377.	765	*Chrysitrix distigmatosa*			
378.	903	*Gahnia deusta*			
379.	14539	*Isolepis australiensis*		P3	
380.	911	*Isolepis congrua*			
381.	31760	*Lepidosperma diurnum*			
382.		*Lepidosperma sp.*			
383.	30438	*Lepidosperma sp. Parker Range (N. Gibson & M. Lyons 2094)*		P1	
384.	954	*Mesomelaena preissii*			
385.	1015	*Schoenus subaphyllus*			
Cyprinidae					
386.		*Carassius auratus*			
Cyzicidae					
387.		*Ozestheria packardi*			
Daphniidae					
388.		*Daphnia carinata*			
Dasyuridae					
389.	24087	*Antechinomys laniger (Kultarr)*			
390.	24094	*Ningaui ridei (Wongai Ningaui)*			
391.	24096	*Ningaui yvonneae (Southern Ningaui)*			
392.	24108	*Sminthopsis crassicaudata (Fat-tailed Dunnart)*			
393.	24109	*Sminthopsis dolichura (Little long-tailed Dunnart)*			
394.	24111	*Sminthopsis gilberti (Gilbert's Dunnart)*			
395.	24117	*Sminthopsis ooldea (Ooldea Dunnart)*			
Desidae					
396.		*Baiami tegenarioides*			
397.		*Corasoides australis*			

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Dicaeidae					
398.	25607	*Dicaeum hirundinaceum (Mistletoebird)*			
Dicruridae					
399.	24443	*Grallina cyanoleuca (Magpie-lark)*			
400.	48096	*Rhipidura albiscapa (Grey Fantail)*			
401.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
Didiereaceae					
402.	20374	*Portulacaria afra*	Y		
Diplodactylidae					
403.	25469	*Diplodactylus granariensis*			
404.	24929	*Diplodactylus granariensis subsp. granariensis*			
405.	24940	*Diplodactylus pulcher*			
406.	42408	*Hesperoedura reticulata*			
407.	30935	*Lucasium maini*			
408.	24982	*Rhynchoedura ornata (Western Beaked Gecko)*			
409.	24923	*Strophurus assimilis (Goldfields Spiny-tailed Gecko)*			
410.	24927	*Strophurus elderi*			
Droseraceae					
411.	49090	*Drosera sp. Branched styles (S.C. Coffey 193)*			
Dytiscidae					
412.		*Allodessus bistrigatus*			
Echinosteliaceae					
413.	39027	*Echinostelium apitectum*			
Elaeocarpaceae					
414.	4530	*Tetratheca efoliata*			
Elapidae					
415.	25243	*Acanthophis pyrrhus (Desert Death Adder)*			
416.	42380	*Brachyurophis fasciolatus subsp. fasciolatus (Narrow-banded Shovel-nosed Snake)*			
417.	42381	*Brachyurophis semifasciatus (Southern Shovel-nosed Snake)*			
418.	25468	*Demansia psammophis (Yellow-faced Whipsnake)*			
419.	25247	*Demansia psammophis subsp. psammophis (Yellow-faced Whipsnake)*			
420.	25301	*Furina ornata (Moon Snake)*			
421.	25248	*Neelaps bimaculatus (Black-naped Snake)*			
422.	25253	*Parasuta gouldii*			
423.	25254	*Parasuta monachus*			
424.	25261	*Pseudechis australis (Mulga Snake)*			
425.	42416	*Pseudonaja mengdeni (Western Brown Snake)*			
426.	25263	*Pseudonaja modesta (Ringed Brown Snake)*			
427.	25264	*Pseudonaja nuchalis (Gwardar, Northern Brown Snake)*			
428.	25266	*Simoselaps bertholdi (Jan's Banded Snake)*			
429.		*Simoselaps semifasciata*			Y
430.	25269	*Suta fasciata (Rosen's Snake)*			
Emballonuridae					
431.	24176	*Taphozous hilli (Hill's Sheathtail-bat)*			
Ericaceae					
432.	6336	*Astroloma serratifolium (Kondrung)*			
433.	6401	*Leucopogon hamulosus*			
434.	16049	*Leucopogon sp. Clyde Hill (M.A. Burgman 1207)*			
435.	33018	*Styphelia sp. Bullfinch (M. Hislop 3574)*		P3	
Estrilidae					
436.	30870	*Taeniopygia guttata (Zebra Finch)*			
Euphorbiaceae					
437.	4598	*Beyeria lechenaultii (Pale Turpentine Bush)*			
438.	34276	*Beyeria sulcata var. brevipes*			
439.	34257	*Beyeria sulcata var. sulcata*			
440.	42868	*Euphorbia philochalix*			
441.	42869	*Euphorbia porcata*			
442.	19587	*Monotaxis grandiflora var. obtusifolia*			
443.	4664	*Monotaxis luteiflora*			
444.	4701	*Ricinocarpos stylosus*			
445.	4704	*Ricinocarpos velutinus*			
Fabaceae					
446.	3200	*Acacia acuminata (Jam, Mangard)*			

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447.	14584	*Acacia ancistrophylla var. ancistrophylla*			
448.	3216	*Acacia andrewsii*			
449.	3236	*Acacia beauverdiana (Pukkati)*			
450.	3248	*Acacia burkittii (Sandhill Wattle)*			
451.	3249	*Acacia calcarata*			
452.	3251	*Acacia camptoclada*			
453.	3256	*Acacia chrysella*			
454.	44469	*Acacia coatesii*		P1	Y
455.	44514	*Acacia collegialis*			
456.	3264	*Acacia colletioides (Wait-a-while)*			
457.	3269	*Acacia coolgardiensis (Spinifex Wattle)*			
458.	14623	*Acacia crenulata*		P3	
459.	16169	*Acacia deficiens*			
460.	15281	*Acacia desertorum var. desertorum*			
461.	3315	*Acacia duriuscula*			
462.	32118	*Acacia effusifolia*			
463.	3318	*Acacia enervia*			
464.	12257	*Acacia enervia subsp. explicata*			
465.	16020	*Acacia eremophila var. eremophila*			
466.	3324	*Acacia erinacea*			
467.	15282	*Acacia gibbosa*			
468.	3366	*Acacia hemiteles*			
469.	3378	*Acacia inaequiloba*			
470.	16164	*Acacia inceana subsp. inceana*			
471.	3393	*Acacia jennerae*			
472.	3394	*Acacia jensenii*			
473.	3395	*Acacia jibberdingensis*			
474.	14610	*Acacia kalgoorliensis*			
475.	3408	*Acacia lasiocalyx (Silver Wattle, Wilyurwur)*			
476.	3416	*Acacia leptopetala*			
477.	3419	*Acacia ligulata (Umbrella Bush, Watarka)*			
478.	3426	*Acacia longispinea*			
479.	13503	*Acacia masliniana*			
480.	3440	*Acacia merrallii*			
481.	3451	*Acacia multispicata*			
482.	3452	*Acacia murrayana (Sandplain Wattle)*			
483.	3463	*Acacia nyssophylla*			
484.	3478	*Acacia pachypoda*			
485.	3495	*Acacia prainii (Prain's Wattle)*			
486.	3504	*Acacia pycnantha (Golden Wattle)*	Y		
487.	3512	*Acacia rendlei*			
488.	3513	*Acacia resinimarginea*			
489.	3514	*Acacia resinistipulea*			
490.	11765	*Acacia sclerophylla var. teretiuscula*		P1	
491.	13078	*Acacia sclerosperma subsp. sclerosperma*			
492.	3539	*Acacia sericocarpa*			
493.		*Acacia sp.*			
494.	13070	*Acacia synchronicia*			
495.	3577	*Acacia tetragonophylla (Kurara, Wakalpuka)*			
496.	3600	*Acacia websteri*		P1	
497.	16157	*Acacia xerophila var. brevior*			
498.	15292	*Acacia yorkrakinensis subsp. acrita*			
499.	3682	*Alhagi maurorum*	Y		Y
500.	18427	*Bossiaea cucullata*			
501.	17417	*Cullen discolor*			
502.	17118	*Cullen leucanthum*			
503.	8977	*Daviesia aphylla*			
504.	3813	*Daviesia grahamii*			
505.	3823	*Daviesia nematophylla*			
506.	3829	*Daviesia pachyloma*			
507.	19854	*Dillwynia sp. Coolgardie (V.E. Sands 637.3.1)*			
508.	48860	*Erythrostemon gilliesii*	Y		
509.	11034	*Gastrolobium graniticum*		T	
510.	3943	*Glycyrrhiza acanthocarpa (Native Liquorice)*			
511.	29285	*Gompholobium cinereum*		P3	
512.	10777	*Gompholobium gompholobioides*			
513.	3963	*Hovea acanthoclada (Thorny Hovea)*			
514.	14779	*Jacksonia arida*			
515.	4043	*Kennedia prorepens*			
516.	4056	*Leptosema daviesioides*			

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517.	4061	*Lotus cruentus (Redflower Lotus)*			
518.	4074	*Medicago laciniata (Cutleaf Medic)*	Y		
519.	4077	*Medicago minima (Small Burr Medic)*	Y		
520.	4079	*Medicago polymorpha (Burr Medic)*	Y		
521.	4089	*Mirbelia depressa*			
522.	4094	*Mirbelia microphylla*			
523.	4097	*Mirbelia ramulosa*			
524.	4099	*Mirbelia seorsifolia*			
525.	3674	*Petalostylis cassioides*			
526.	17645	*Senna artemisioides*			
527.	12276	*Senna artemisioides subsp. filifolia*			
528.	17558	*Senna artemisioides subsp. x artemisioides*			
529.	18430	*Senna cardiosperma*			
530.	16378	*Senna pleurocarpa*			
531.	12315	*Senna pleurocarpa var. angustifolia*			
532.	12314	*Senna pleurocarpa var. pleurocarpa*			
533.	14579	*Senna sp. Austin (A. Strid 20210)*			
534.	18446	*Senna stowardii*			
535.	12355	*Swainsona affinis*			
536.	4217	*Swainsona beasleyana*			
537.	4220	*Swainsona canescens (Grey Swainsona)*			
538.	4221	*Swainsona colutoides (Bladder Vetch)*			
539.	4229	*Swainsona gracilis*			
540.	13590	*Swainsona halophila*			
541.	4230	*Swainsona incei*			
542.	4231	*Swainsona kingii*			
543.	4233	*Swainsona leeana*			
544.	4237	*Swainsona oliveri*			
545.	4238	*Swainsona oroboides (Variable Swainsona)*			
546.	13581	*Swainsona paradoxa*			
547.	12357	*Swainsona purpurea*			
548.	4243	*Swainsona rostellata*			
549.	35841	*Templetonia incrassata*			
550.	17261	*Vicia monantha subsp. triflora*	Y		
Falconidae					
551.	25621	*Falco berigora (Brown Falcon)*			
552.	24471	*Falco berigora subsp. berigora (Brown Falcon)*			
553.	25622	*Falco cenchroides (Australian Kestrel, Nankeen Kestrel)*			
554.	25623	*Falco longipennis (Australian Hobby)*			
Felidae					
555.	24041	*Felis catus (Cat)*	Y		
Fissidentaceae					
556.	32367	*Fissidens megalotis*			
557.		*Fissidens oblongifolius*			
Frankeniaceae					
558.	5191	*Frankenia cinerea*			
559.	5197	*Frankenia desertorum*			
560.	5202	*Frankenia glomerata (Cluster Head Frankenia)*		P4	
561.	5204	*Frankenia interioris*			
562.	11592	*Frankenia interioris var. interioris*			
563.	5209	*Frankenia pauciflora (Seaheath)*			
564.	14297	*Frankenia pauciflora var. pauciflora*			
565.	5212	*Frankenia setosa (Bristly Frankenia)*			
566.	5213	*Frankenia tetrapetala (Four Petaled Frankenia)*			
Geastraceae					
567.		*Geastrum sp.*			
Gekkonidae					
568.	24957	*Gehyra purpurascens*			
569.	24959	*Gehyra variegata*			
570.	25232	*Hemidactylus frenatus (Asian House Gecko)*	Y		
571.	24961	*Heteronotia binoei (Bynoe's Gecko)*			
572.	24983	*Underwoodisaurus milii (Barking Gecko)*			
Geraniaceae					
573.	4331	*Erodium aureum*	Y		
574.	4332	*Erodium botrys (Long Storksbill)*	Y		
575.	4333	*Erodium cicutarium (Common Storksbill)*	Y		
576.	4334	*Erodium crinitum (Corkscrew)*			

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577.	4335	*Erodium cygnorum (Blue Heronsbill)*			
Gnaphosidae					
578.		*Hemicloea sublimbata*			
Goodeniaceae					
579.	7413	*Brunonia australis (Native Cornflower)*			
580.	19069	*Brunonia sp. Goldfields (K.R. Newbey 6044)*			
581.	7419	*Coopernookia strophiolata*			
582.	7438	*Dampiera eriocephala (Woolly-headed Dampiera)*			
583.	13155	*Dampiera latealata*			
584.	7451	*Dampiera lavandulacea*			
585.	7456	*Dampiera luteiflora (Yellow Dampiera)*			
586.	7463	*Dampiera plumosa*		P1	
587.	7477	*Dampiera stenostachya (Narrow-spiked Dampiera)*			
588.	7480	*Dampiera tenuicaulis (Slender-stemmed Dampiera)*			
589.	13158	*Dampiera tenuicaulis var. curvula*			
590.	13159	*Dampiera tenuicaulis var. tenuicaulis*			
591.	7499	*Goodenia concinna (Elegant Goodenia)*			
592.	7504	*Goodenia dyeri*			
593.	7506	*Goodenia elderi*			
594.	7514	*Goodenia havilandii*			
595.	12523	*Goodenia helmsii*			
596.	7527	*Goodenia mimuloides*			
597.	7531	*Goodenia occidentalis*			
598.	7541	*Goodenia pusilliflora (Smallflower Goodenia)*			
599.	31837	*Goodenia salina*		P2	
600.	7565	*Goodenia xanthosperma (Yellow-seeded Goodenia)*			
601.	7569	*Lechenaultia brevifolia*			
602.	7644	*Scaevola spinescens (Currant Bush, Maroon)*			
603.	7656	*Velleia cycnopotamica*			
604.	7658	*Velleia discophora (Cabbage Poison)*			
605.	7664	*Velleia rosea (Pink Velleia)*			
606.	38061	*Verreauxia dyeri (Hairy Verreauxia)*			
Graphidaceae					
607.	32976	*Diploschistes elixii*			
608.	27720	*Diploschistes henssenіae*			
609.	27723	*Diploschistes scruposus*			
610.	27725	*Diploschistes thunbergianus*			
611.	44221	*Xalocoa ocellata*			
Grimmiaceae					
612.	32386	*Grimmia laevigata*			
Gyrostemonaceae					
613.	2778	*Codonocarpus cotinifolius (Native Poplar, Kundurangu)*			
614.	2783	*Gyrostemon racemiger*			
Haemodoraceae					
615.	1439	*Conostylis lepidospermoides (Sedge Conostylis)*		T	
Halcyonidae					
616.	42351	*Todiramphus pyrrhopygius (Red-backed Kingfisher)*			
617.	25549	*Todiramphus sanctus (Sacred Kingfisher)*			
Haloragaceae					
618.	33620	*Glischrocaryon angustifolium*			
619.	6143	*Glischrocaryon aureum (Common Popflower)*			
620.	6144	*Glischrocaryon flavescens*			
621.	11801	*Gonocarpus confertifolius var. helmsii*			
622.	20669	*Haloragis maierae*			
623.	6180	*Haloragis trigonocarpa*			
Hersiliidae					
624.		*Tamopsis circumvidens*			
Hirundinidae					
625.	47909	*Cheramoeca leucosterna (White-backed Swallow)*			
626.	24491	*Hirundo neoxena (Welcome Swallow)*			
627.	48060	*Petrochelidon ariel (Fairy Martin)*			
628.	48061	*Petrochelidon nigricans (Tree Martin)*			
Hydnaceae					
629.	38794	*Hydnum repandum*			

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Hydrophilidae					
630.		*Berosus nutans*			
631.		*Enochrus elongatulus*			
Hylidae					
632.	25388	*Litoria moorei (Motorbike Frog)*			
Icmadophilaceae					
633.	28060	*Siphula coriacea*			
Idiopidae					
634.		*Anidiops villosus*			
Juncaceae					
635.	1195	*Juncus subsecundus (Finger Rush)*			
Lamiaceae					
636.	19437	*Brachysola coerulea*			
637.	6747	*Cyanostegia angustifolia (Tinsel-flower)*			
638.	6751	*Cyanostegia microphylla (Tinsel Flower)*			
639.	41025	*Dasymalla terminalis (Native Foxglove)*			
640.	6753	*Dicrastylis brunnea*			
641.	6771	*Dicrastylis parvifolia*			
642.	6776	*Hemiphora elderi (Red Velvet)*			
643.	6779	*Lachnostachys coolgardiensis*			
644.	6881	*Marrubium vulgare (Horehound)*	Y		
645.	17206	*Physopsis viscida*			
646.	6812	*Pityrodia lepidota*			
647.	15822	*Prostanthera althoferi subsp. althoferi*			
648.	6912	*Prostanthera campbellii*			
649.	6916	*Prostanthera grylloana*			
650.	6917	*Prostanthera incurvata*			
651.	6928	*Salvia reflexa (Mintweed)*	Y		
652.	6929	*Salvia verbenaca (Wild Sage)*	Y		
653.	6937	*Teucrium sessiliflorum (Camel Bush)*			
654.	6938	*Westringia cephalantha*			
655.	34603	*Westringia cephalantha var. caterva*			
656.	9247	*Westringia rigida (Stiff Westringia)*			
Lamponidae					
657.		*Lampona cylindrata*			
658.		*Lamponina scutata*			
Laridae					
659.		*Chroicocephalus novaehollandiae*			
Lecideaceae					
660.	27825	*Lecidea ochroleuca*			
Leporidae					
661.	24085	*Oryctolagus cuniculus (Rabbit)*	Y		
Liceaceae					
662.	39041	*Licea kleistobolus*			
Limnodynastidae					
663.	25425	*Neobatrachus kunapalari (Kunapalari Frog)*			
664.	25426	*Neobatrachus pelobatoides (Humming Frog)*			
665.	25427	*Neobatrachus sutor (Shoemaker Frog)*			
666.	25428	*Neobatrachus wilsmorei (Plonking Frog)*			
Loganiaceae					
667.	46313	*Orianthera flaviflora*			
668.	46253	*Orianthera tortuosa*			
669.	16824	*Phyllangium sulcatum*			
Loranthaceae					
670.	2369	*Amyema benthamii*			
671.	11614	*Amyema gibberula var. gibberula*			
672.	13267	*Amyema linophylla subsp. linophylla*			
673.	2380	*Amyema miquelii (Stalked Mistletoe)*			
674.	2383	*Amyema preissii (Wireleaf Mistletoe)*			
675.	2396	*Lysiana casuarinae*			
Lycaenidae					
676.	33979	*Jalmenus aridus (inland hairstreak, desert blue butterfly)*		P1	Y
677.		*Jalmenus icilius*			Y

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678.	33987	*Ogyris subterrestris subsp. petrina (Arid Bronze Azure Butterfly)*		T	
Lycosidae					
679.		*Hoggicosa castanea*			
680.		*Hoggicosa forresti*			
681.		*Hoggicosa storri*			
682.		*Lycosa ariadnae*			
683.		*Tasmanicosa leuckartii*			
Lythraceae					
684.	5281	*Lythrum hyssopifolia (Lesser Loosestrife)*	Y		
Macropodidae					
685.	24132	*Macropus fuliginosus (Western Grey Kangaroo)*			
686.	24135	*Macropus robustus subsp. erubescens (Euro, Biggada)*			
687.	24136	*Macropus rufus (Red Kangaroo, Marlu)*			
Maluridae					
688.	25652	*Malurus leucopterus (White-winged Fairy-wren)*			
689.	24551	*Malurus pulcherrimus (Blue-breasted Fairy-wren)*			
690.	25654	*Malurus splendens (Splendid Fairy-wren)*			
Malvaceae					
691.	4889	*Abutilon cryptopetalum*			
692.	40903	*Androcalva aphrix*			
693.	40910	*Androcalva luteiflora (Yellow-flowered Rulingia)*			
694.	4999	*Brachychiton gregorii (Desert Kurrajong, Ngalta)*			
695.	40923	*Commersonia craurophylla (Brittle Leaved Rulingia)*			
696.	40927	*Commersonia magniflora subsp. oblongifolia*			
697.	17725	*Hannafordia bissillii subsp. latifolia*			
698.	4941	*Hibiscus solanifolius*			
699.	4955	*Lawrencia glomerata*			
700.	4956	*Lawrencia helmsii (Dunna Dunna)*			
701.	4957	*Lawrencia repens*			
702.	4959	*Lawrencia squamata*			
703.	4961	*Malva parviflora (Marshmallow)*	Y		
704.	41544	*Malva weinmanniana*			
705.	4964	*Radyera farragei (Knobby Hibiscus)*			
706.	46824	*Seringia velutina (Velvet firebush)*			
707.	4970	*Sida calyxhymenia (Tall Sida)*			
708.	4977	*Sida fibulifera (Silver Sida)*			
709.	4981	*Sida intricata (Tangled Sida)*			
710.	16924	*Sida spodochroma*			
Megalosporaceae					
711.	27587	*Aspicilia calcarea*			
712.	48911	*Aspicilia contorta*			
Megapodiidae					
713.	24557	*Leipoa ocellata (Malleefowl)*		T	
Meliaceae					
714.	4516	*Melia azedarach (White Cedar)*			
Meliphagidae					
715.	24559	*Acanthagenys rufogularis (Spiny-cheeked Honeyeater)*			
716.	24561	*Anthochaera carunculata (Red Wattlebird)*			
717.	24567	*Epthianura albifrons (White-fronted Chat)*			
718.	24570	*Epthianura tricolor (Crimson Chat)*			
719.	25659	*Lichenostomus leucotis (White-eared Honeyeater)*			
720.	24576	*Lichenostomus leucotis subsp. novaenorciae (White-eared Honeyeater)*			
721.	25661	*Lichmera indistincta (Brown Honeyeater)*			
722.	24583	*Manorina flavigula (Yellow-throated Miner)*			
723.	25663	*Melithreptus brevirostris (Brown-headed Honeyeater)*			
724.	42344	*Purnella albifrons (White-fronted Honeyeater)*			
Meropidae					
725.	24598	*Merops ornatus (Rainbow Bee-eater)*			
Montiaceae					
726.	2846	*Calandrinia calyptrata (Pink Purslane)*			
727.	2853	*Calandrinia eremaea (Twining Purslane)*			
728.	2860	*Calandrinia polyandra (Parakeelya)*			
729.	40824	*Calandrinia sculpta*			
Motacillidae					

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730.	25670	*Anthus australis (Australian Pipit)*			
731.	24599	*Anthus australis subsp. australis (Australian Pipit)*			
Muridae					
732.	24223	*Mus musculus (House Mouse)*	Y		
733.	24229	*Notomys mitchellii (Mitchell's Hopping-mouse)*			
734.	24230	*Pseudomys albocinereus (Ash-grey Mouse)*			
735.	24232	*Pseudomys bolami (Bolam's Mouse)*			
736.	24237	*Pseudomys hermannsburgensis (Sandy Inland Mouse)*			
Myobatrachidae					
737.	25434	*Pseudophryne occidentalis (Western Toadlet)*			
Myrmecobiidae					
738.	24146	*Myrmecobius fasciatus (Numbat, Walpurti)*		T	
Myrtaceae					
739.	19467	*Aluta appressa*			
740.	19466	*Aluta aspera subsp. aspera*			
741.	20726	*Astus subroseus*			
742.	5344	*Baeckea elderiana*			
743.	36038	*Baeckea sp. Koonadgin (B.L. Rye & M.E. Trudgen BLR 241137)*			
744.	5408	*Calothamnus gilesii*			
745.	5438	*Calytrix amethystina*			
746.	5442	*Calytrix birdii*			
747.	13654	*Calytrix breviseta subsp. stipulosa*			
748.	44081	*Cyathostemon verrucosus*		P3	
749.	19846	*Enekbatus eremaeus*			
750.	45244	*Ericomyrtus serpyllifolia*			
751.	19508	*Eucalyptus calycogona subsp. calycogona*			
752.	5581	*Eucalyptus campaspe (Silver Gimlet)*			
753.	12904	*Eucalyptus capillosa*			
754.	5584	*Eucalyptus celastroides (Mirret, Mired)*			
755.	14300	*Eucalyptus celastroides subsp. celastroides (Mirret)*			
756.	48436	*Eucalyptus clelandiorum*			
757.	5595	*Eucalyptus comitae-vallis (Comet Vale Mallee)*			
758.	5596	*Eucalyptus concinna (Victoria Desert Mallee)*			
759.	5607	*Eucalyptus corrugata (Rough-fruited Mallee)*			
760.	5612	*Eucalyptus cylindrocarpa (Woodline Mallee)*			
761.	34811	*Eucalyptus distuberosa subsp. distuberosa*			
762.	13549	*Eucalyptus ebbanoensis subsp. ebbanoensis*			
763.	13097	*Eucalyptus educta*		P2	
764.	5636	*Eucalyptus eremicola*			
765.	5637	*Eucalyptus eremophila (Tall Sand Mallee)*			
766.	15667	*Eucalyptus eremophila subsp. eremophila (Sand Mallee)*			
767.	5641	*Eucalyptus ewartiana (Ewart's Mallee)*			
768.	12886	*Eucalyptus flavida (Yellow-flowered Mallee)*			
769.	5648	*Eucalyptus flocktoniae (Merrit, Merid)*			
770.	18521	*Eucalyptus flocktoniae subsp. flocktoniae*			
771.	14277	*Eucalyptus fraseri subsp. fraseri*			
772.	5665	*Eucalyptus griffithsii (Griffith's Grey Gum)*			
773.	5673	*Eucalyptus horistes*			
774.	5675	*Eucalyptus incrassata (Lerp Mallee)*			
775.	31815	*Eucalyptus jutsonii subsp. jutsonii*		P4	
776.	15682	*Eucalyptus leptophylla (Narrow-leaved Red Mallee)*			
777.	13056	*Eucalyptus leptopoda subsp. subluta*			
778.	5697	*Eucalyptus lesouefii (Goldfields Blackbutt)*			
779.	12901	*Eucalyptus livida (Mallee Wandoo)*			
780.	5701	*Eucalyptus longicornis (Red Morrel, Moril)*			
781.	20802	*Eucalyptus longissima*			
782.	13037	*Eucalyptus loxophleba subsp. lissophloia*			
783.	19323	*Eucalyptus moderata*			
784.	5726	*Eucalyptus oleosa (Giant Mallee)*			
785.	20091	*Eucalyptus oleosa subsp. oleosa*			
786.	5745	*Eucalyptus pileata (Capped Mallee)*			
787.	18580	*Eucalyptus planipes*			
788.	5747	*Eucalyptus platycorys (Boorabbin Mallee)*			
789.	19064	*Eucalyptus prolixa*			
790.	12380	*Eucalyptus ravida (Silver-topped Gimlet)*			
791.	5761	*Eucalyptus rigidula (Stiff-leaved Mallee)*			
792.	12693	*Eucalyptus salicola (Salt Gum)*			
793.	5766	*Eucalyptus salmonophloia (Salmon Gum, Wurak)*			

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794.	5767	*Eucalyptus salubris (Gimlet)*			
795.	29701	*Eucalyptus sp. Mulga Rock (K.D. Hill & L.A.S. Johnson KH 2668)*			
796.	46828	*Eucalyptus sp. Southern smooth-bark (D. Nicolle & M. French DN 6916)*			
797.	13027	*Eucalyptus tenera*			
798.	5792	*Eucalyptus torquata (Coral Gum)*			
799.	5793	*Eucalyptus transcontinentalis (Redwood, Pungul)*			
800.	18293	*Eucalyptus urna*			
801.	34775	*Eucalyptus vittata*			
802.	5798	*Eucalyptus websteriana (Webster's Mallee)*			
803.	13053	*Eucalyptus websteriana subsp. norsemanica*		P1	
804.	13054	*Eucalyptus websteriana subsp. websteriana*			
805.	18269	*Eucalyptus x brachyphylla*		P4	
806.	5802	*Eucalyptus yilgarnensis (Yorrell)*			
807.	16722	*Euryomyrtus maidenii*			
808.	5815	*Homalocalyx thryptomenoides*			
809.	48651	*Hysterobaeckea ochropetala subsp. reliqua*			
810.	5840	*Kunzea pulchella (Granite Kunzea, Silky Kunzea)*			
811.	5848	*Leptospermum fastigiatum*			
812.	12692	*Leptospermum subtenue*			
813.	5864	*Malleostemon peltiger*			
814.	5865	*Malleostemon roseus*			
815.	5866	*Malleostemon tuberculatus*			
816.	15063	*Melaleuca acuminata subsp. acuminata*			
817.	19380	*Melaleuca calyptroides*			
818.	5891	*Melaleuca coccinea (Goldfields Bottlebrush)*		P3	
819.	5896	*Melaleuca cordata*			
820.	5909	*Melaleuca elliptica (Granite Bottlebrush, Ngow)*			
821.	15603	*Melaleuca fulgens subsp. fulgens*			
822.	5916	*Melaleuca halmaturorum*			
823.	19486	*Melaleuca hamata*			
824.	5922	*Melaleuca lanceolata (Rottnest Teatree, Moonah)*			
825.	5925	*Melaleuca lateriflora (Gorada)*			
826.	5929	*Melaleuca leiocarpa*			
827.	14700	*Melaleuca macronychia subsp. macronychia*			
828.	15663	*Melaleuca pauperiflora subsp. fastigiata*			
829.	5966	*Melaleuca sheathiana (Boree, Buri)*			
830.	20287	*Melaleuca zeteticorum*			
831.	9187	*Micromyrtus erichsenii*			
832.	19787	*Micromyrtus monotaxis*			
833.	5999	*Micromyrtus obovata*			
834.	6002	*Micromyrtus stenocalyx*			
835.	6018	*Rinzia carnosa (Fleshy-leaved Rinzia)*			
836.	19699	*Thryptomene australis subsp. brachyandra*			
837.	6058	*Thryptomene kochii*			
838.	20680	*Thryptomene sp. Coolgardie (E. Kelso s.n. 1902)*		P1	Y
839.	36017	*Thryptomene sp. Londonderry (R.H. Kuchel 1763)*		P1	
840.	6068	*Thryptomene urceolaris*			
841.	6073	*Verticordia chrysantha*			
842.	6109	*Verticordia picta (Painted Featherflower)*			
843.	6113	*Verticordia pritzelii (Pritzel's Featherflower)*			
Nemesiidae					
844.		*Aname armigera*			
845.		*Aname mainae*			
Neosittidae					
846.	25673	*Daphoenositta chrysoptera (Varied Sittella)*			
847.	24606	*Daphoenositta chrysoptera subsp. pileata (Varied Sittella, Black-capped Sitella)*			
Nicodamidae					
848.		*Nicodamus mainae*			
Nitrariaceae					
849.	4366	*Nitraria billardierei (Nitre Bush)*			
Nyctaginaceae					
850.	2770	*Boerhavia coccinea (Tar Vine, Wituka)*			
Ophioglossaceae					
851.	18	*Ophioglossum polyphyllum*			
Orchidaceae					
852.	15502	*Caladenia footeana*			
853.	17760	*Caladenia nobilis*			

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854.	1614	*Caladenia roei (Ant Orchid)*			
855.	30797	*Caladenia saxicola*			
856.	15400	*Cyanicula amplexans*			
857.	44161	*Diuris hazeliae*			
858.	12216	*Pterostylis roensis*			
859.	18657	*Pterostylis sp. inland (A.C. Beauglehole 11880)*			
860.	48481	*Pterostylis tryphera*			
861.	1701	*Thelymitra antennifera (Vanilla Orchid)*			
862.	20732	*Thelymitra petrophila*			
Ostracoda					
863.		*Ostracoda (unident.)*			
Otididae					
864.	24610	*Ardeotis australis (Australian Bustard)*			
Oxalidaceae					
865.	33256	*Oxalis bowiei (Bowie Wood Sorrel)*	Y		
866.	4355	*Oxalis perennans*			
867.	4356	*Oxalis pes-caprae (Soursob)*	Y		
Oxyopidae					
868.		*Oxyopes amoenus*			
869.		*Oxyopes dingo*			
870.		*Oxyopes variabilis*			
Pachycephalidae					
871.	25675	*Colluricincla harmonica (Grey Shrike-thrush)*			
872.	24618	*Oreoica gutturalis (Crested Bellbird)*			
873.	34011	*Oreoica gutturalis subsp. gutturalis (Crested Bellbird (southern))*			
874.	24619	*Pachycephala inornata (Gilbert's Whistler)*			
875.	25680	*Pachycephala rufiventris (Rufous Whistler)*			
Papaveraceae					
876.	2964	*Papaver hybridum (Rough Poppy)*	Y		
Pardalotidae					
877.	25681	*Pardalotus punctatus (Spotted Pardalote)*			
878.	25682	*Pardalotus striatus (Striated Pardalote)*			
879.	24630	*Pardalotus striatus subsp. westraliensis (Striated Pardalote)*			
Parmeliaceae					
880.	27743	*Flavoparmelia diffractaica*			
881.	27748	*Flavoparmelia rutidota*			
882.	28102	*Xanthoparmelia alternata*			
883.	28103	*Xanthoparmelia amphixantha*			
884.	28104	*Xanthoparmelia amplexula*			
885.	30660	*Xanthoparmelia auricampa*			Y
886.	32980	*Xanthoparmelia bullabullensis*			Y
887.	18001	*Xanthoparmelia dayiana*		P3	
888.	28132	*Xanthoparmelia filarszkyana*			
889.	28137	*Xanthoparmelia glareosa*			
890.	28326	*Xanthoparmelia incantata*			
891.	28142	*Xanthoparmelia incerta*			
892.	28144	*Xanthoparmelia isidiigera*			
893.	28331	*Xanthoparmelia luteonotata*			
894.	28150	*Xanthoparmelia metaclystoides*			
895.	28158	*Xanthoparmelia neorimalis*			
896.	28162	*Xanthoparmelia notata*			
897.	29984	*Xanthoparmelia paratasmanica*			Y
898.	28166	*Xanthoparmelia pertinax*			
899.	28167	*Xanthoparmelia praegnans*			
900.	29036	*Xanthoparmelia pulla*			
901.	28172	*Xanthoparmelia reptans*			
902.	44326	*Xanthoparmelia rimalis*			
903.	28327	*Xanthoparmelia semiviridis*			
904.	28180	*Xanthoparmelia succedans*			
905.	28181	*Xanthoparmelia taractica*			
906.	28182	*Xanthoparmelia tasmanica*			
907.	28184	*Xanthoparmelia terrestris*			
908.	28356	*Xanthoparmelia verrucella*			
909.	28186	*Xanthoparmelia versicolor*			
910.	28189	*Xanthoparmelia willisii*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Peltulaceae					
911.	27940	*Peltula patellata*			
Petroicidae					
912.	24650	*Drymodes brunneopygia (Southern Scrub-robin)*			
913.	24651	*Eopsaltria australis subsp. griseogularis (Western Yellow Robin)*			
914.	25693	*Microeca fascinans (Jacky Winter)*			
915.	24654	*Microeca fascinans subsp. assimilis (Jacky Winter)*			
916.	24659	*Petroica goodenovii (Red-capped Robin)*			
Phalacrocoracidae					
917.		*Microcarbo melanoleucos*			
918.	24667	*Phalacrocorax sulcirostris (Little Black Cormorant)*			
Phasianidae					
919.	24671	*Coturnix pectoralis (Stubble Quail)*			
Pholcidae					
920.		*Trichocyclus balladong*			
Physaraceae					
921.	39068	*Physarum decipiens*			
Physciaceae					
922.	41284	*Hyperphyscia syncolla*			
923.	27968	*Physcia albicans*			
924.		*Physcia sp.*			
Pileolariaceae					
925.		*Uromycladium tepperianum*			
Pittosporaceae					
926.	25798	*Billardiera fusiformis (Australian Bluebell)*			
927.	19421	*Marianthus bicolor (Painted Marianthus)*			
928.	19744	*Pittosporum angustifolium*			
Plantaginaceae					
929.	7299	*Plantago debilis*			
930.	7300	*Plantago drummondii (Sago Weed)*			
931.	14198	*Plantago sp. Mt Magnet (A.S. George 6793)*			
Plumbaginaceae					
932.	6489	*Limonium sinuatum (Perennial Sea Lavender)*	Y		
Poaceae					
933.	12025	*Amphipogon caricinus var. caricinus*			
934.	207	*Aristida contorta (Bunched Kerosene Grass)*			
935.	12063	*Aristida holathera var. holathera*			
936.	17232	*Austrostipa blackii*		P3	
937.	17236	*Austrostipa drummondii*			
938.	17237	*Austrostipa elegantissima*			
939.	17238	*Austrostipa eremophila*			
940.	17241	*Austrostipa hemipogon*			
941.	17246	*Austrostipa nitida*			
942.	17247	*Austrostipa platychaeta*			
943.	17251	*Austrostipa scabra*			
944.	36283	*Austrostipa sp. Carlingup Road (S. Kern & R. Jasper LCH 18459)*		P1	
945.	34556	*Austrostipa sp. Dowerin (G. Wiehl F 8004)*		P2	
946.	44509	*Austrostipa sp. Mt Burgess (A.A. Mitchell & P.J. Waddell 10499)*			Y
947.	17255	*Austrostipa trichophylla*			
948.	247	*Bromus arenarius (Sand Brome)*			
949.	248	*Bromus catharticus (Prairie Grass)*	Y		
950.	249	*Bromus diandrus (Great Brome)*	Y		
951.	258	*Cenchrus ciliaris (Buffel Grass)*	Y		
952.	271	*Chloris truncata (Windmill Grass)*			
953.	290	*Dactyloctenium radulans (Button Grass)*			
954.	11964	*Dichanthium sericeum subsp. sericeum*			
955.	308	*Digitaria ammophila (Silky Umbrella Grass)*			
956.	310	*Digitaria brownii (Cotton Panic Grass)*			
957.	351	*Ehrharta villosa (Pyp Grass)*	Y		
958.	356	*Enneapogon avenaceus (Bottle Washers)*			
959.	357	*Enneapogon caerulescens (Limestone Grass)*			
960.	358	*Enneapogon cylindricus (Jointed Nineawn)*			
961.	368	*Enteropogon ramosus (Windmill Grass, Curly Windmill Grass)*			
962.	376	*Eragrostis curvula (African Lovegrass)*	Y		
963.	378	*Eragrostis dielsii (Mallee Lovegrass)*			

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964.	381	*Eragrostis falcata (Sickle Lovegrass)*			
965.	393	*Eragrostis setifolia (Neverfail Grass)*			
966.	399	*Eragrostis xerophila (Knotty-butt Neverfail)*			
967.	417	*Eriachne pulchella (Pretty Wanderrie)*			
968.	448	*Hordeum glaucum (Northern Barley Grass)*	Y		
969.	449	*Hordeum leporinum (Barley Grass)*	Y		
970.	471	*Leptochloa digitata (Whorled Cane Grass)*			
971.	490	*Monachather paradoxus*			
972.	503	*Panicum decompositum (Native Millet, Kaltu-kaltu)*			
973.	519	*Paspalidium constrictum (Knottybutt Grass)*			
974.	524	*Paspalidium reflexum*			
975.	40424	*Pentameris airoides subsp. airoides*	Y		
976.	552	*Phalaris paradoxa (Paradoxa Grass)*	Y		
977.	11151	*Rostraria pumila*	Y		
978.	40425	*Rytidosperma caespitosum*			
979.	40427	*Rytidosperma setaceum*			
980.	596	*Schismus arabicus (Araby Grass)*	Y		
981.	597	*Schismus barbatus (Kelch Grass)*	Y		
982.	606	*Setaria dielsii (Diels' Pigeon Grass)*			
983.	617	*Sorghum halepense (Johnson Grass)*	Y		
984.	688	*Triodia irritans (Porcupine Grass)*			
985.	699	*Triodia scariosa*			
986.	13041	*Triodia tomentosa*			
987.	18326	*Urochloa panicoides*	Y		
Podargidae					
988.	25703	*Podargus strigoides (Tawny Frogmouth)*			
Podicipedidae					
989.	24681	*Poliocephalus poliocephalus (Hoary-headed Grebe)*			
990.	25705	*Tachybaptus novaehollandiae (Australasian Grebe, Black-throated Grebe)*			
Polygalaceae					
991.	4553	*Comesperma drummondii (Drummond's Milkwort)*			
992.	4561	*Comesperma scoparium (Broom Milkwort)*			
Polygonaceae					
993.	11052	*Persicaria prostrata*			
994.	2419	*Polygonum aviculare (Wireweed)*	Y		
995.	2443	*Rumex vesicarius (Ruby Dock)*	Y		
Pomatostomidae					
996.	24683	*Pomatostomus superciliosus (White-browed Babbler)*			
997.	34013	*Pomatostomus superciliosus subsp. ashbyi (White-browed Babbler (western wheatbelt))*			
Portulacaceae					
998.	2884	*Portulaca oleracea (Purslane, Wakati)*			
Pottiaceae					
999.	36436	*Aloina bifrons*			Y
1000.	32319	*Barbula luteola*			
1001.	32341	*Crossidium davidai*			
1002.	32346	*Didymodon torquatus*			
1003.	32438	*Syntrichia pagorum*			
1004.	32445	*Tortula muralis*			
Primulaceae					
1005.	36375	*Lysimachia arvensis (Pimpernel)*	Y		
Proteaceae					
1006.	1815	*Banksia elderiana (Swordfish Banksia)*			
1007.	15611	*Conospermum stoechadis subsp. stoechadis (Common Smokebush)*			
1008.	1946	*Grevillea acacioides*			
1009.	1949	*Grevillea acuaria*			
1010.	1962	*Grevillea beardiana (Red Combs)*			
1011.	1971	*Grevillea cagiana (Red Toothbrushes)*			
1012.	13453	*Grevillea didymobotrya subsp. didymobotrya*			
1013.	8832	*Grevillea excelsior (Flame Grevillea)*			
1014.	2009	*Grevillea georgeana*		P3	
1015.	14413	*Grevillea haplantha subsp. haplantha*			
1016.	19314	*Grevillea hookeriana subsp. apiciloba*			
1017.	2018	*Grevillea huegelii*			
1018.	19541	*Grevillea nematophylla subsp. nematophylla*			
1019.	15981	*Grevillea obliquistigma subsp. obliquistigma*			

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1020.	15978	*Grevillea oligomera*			
1021.	2056	*Grevillea paniculata*			
1022.	2077	*Grevillea pterosperma*			
1023.	12822	*Grevillea sarissa subsp. bicolor*			
1024.	13458	*Grevillea sarissa subsp. sarissa*			
1025.	2104	*Grevillea teretifolia (Round Leaf Grevillea)*			
1026.	2116	*Grevillea uncinulata (Hook-leaf Grevillea)*			
1027.	2163	*Hakea francisiana (Emu Tree)*			
1028.	2182	*Hakea minyma*			
1029.	2184	*Hakea multilineata (Grass Leaf Hakea)*			
1030.	16047	*Hakea rigida*		P2	
1031.	2274	*Persoonia saundersiana*			
1032.	2308	*Petrophile seminuda*			
Psittacidae					
1033.		*Barnardius zonarius*			
1034.	25715	*Cacatua roseicapilla (Galah)*			
1035.	25716	*Cacatua sanguinea (Little Corella)*			
1036.	24734	*Calyptorhynchus latirostris (Carnaby's Cockatoo, White-tailed Short-billed Black Cockatoo)*		T	
1037.	24736	*Melopsittacus undulatus (Budgerigar)*			
1038.	24742	*Nymphicus hollandicus (Cockatiel)*			
1039.	24748	*Platycercus varius (Mulga Parrot)*			
1040.	25721	*Platycercus zonarius (Australian Ringneck, Ring-necked Parrot)*			
1041.	24751	*Platycercus zonarius subsp. zonarius (Port Lincoln Parrot)*			
1042.	30854	*Polytelis anthopeplus subsp. westralis (Regent Parrot)*			
Psoraceae					
1043.	27998	*Psora crenata*			
1044.	27999	*Psora crystallifera*			
1045.	28000	*Psora decipiens*			
Pteridaceae					
1046.	12796	*Cheilanthes adiantoides*			
1047.	12818	*Cheilanthes sieberi subsp. sieberi*			
Pygopodidae					
1048.	24995	*Delma australis*			
1049.	25005	*Lialis burtonis*			
1050.	25008	*Pygopus lepidopodus (Common Scaly Foot)*			
1051.	25009	*Pygopus nigriceps*			
Rallidae					
1052.	25727	*Fulica atra (Eurasian Coot)*			
1053.	24769	*Porzana fluminea (Australian Spotted Crake)*			
1054.	48141	*Tribonyx ventralis (Black-tailed Native-hen)*			
Ranunculaceae					
1055.	11080	*Myosurus australis*			
Recurvirostridae					
1056.	24774	*Cladorhynchus leucocephalus (Banded Stilt)*			
1057.	25734	*Himantopus himantopus (Black-winged Stilt)*			
1058.	24775	*Himantopus himantopus subsp. leucocephalus (Black-winged Stilt)*			
1059.	24776	*Recurvirostra novaehollandiae (Red-necked Avocet)*			
Restionaceae					
1060.	1073	*Lepidobolus chaetocephalus (Bristle-headed Chaff Rush)*			
1061.	1074	*Lepidobolus deserti*			
Rhamnaceae					
1062.	16183	*Cryptandra aridicola*			
1063.	4809	*Cryptandra pungens*			
1064.	4815	*Pomaderris forrestiana*			
1065.	16200	*Stenanthemum stipulosum*			
1066.	16986	*Trymalium myrtillus subsp. myrtillus*			
Rhizocarpaceae					
1067.	28042	*Rhizocarpon tinei*			
Ricciaceae					
1068.		*Riccia limbata*			
Ruppiaceae					
1069.	116	*Ruppia polycarpa*			

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Rutaceae					
1070.	4409	*Boronia coerulescens*			
1071.	11274	*Boronia coerulescens subsp. spinescens*			
1072.	4445	*Boronia ternata*			
1073.	16621	*Phebalium appressum*		P1	
1074.	4497	*Phebalium canaliculatum*			
1075.	4498	*Phebalium clavatum*		P2	
1076.	4500	*Phebalium filifolium (Slender Phebalium)*			
1077.	14883	*Phebalium laevigatum*			
1078.	4501	*Phebalium lepidotum*			
1079.	4504	*Phebalium tuberculosum*			
1080.	18537	*Philotheca brucei subsp. brucei*			
1081.	18506	*Philotheca tomentella*			
Salticidae					
1082.		*Afraflacilla stridulator*			
1083.		*Holoplatys kalgoorlie*			Y
1084.		*Holoplatys planissima*			
1085.		*Sandalodes scopifer*			
Santalaceae					
1086.	10977	*Exocarpos aphyllus (Leafless Ballart)*			
1087.	2356	*Santalum acuminatum (Quandong, Warnga)*			
1088.	2359	*Santalum spicatum (Sandalwood, Wilarak)*			
Sapindaceae					
1089.	11730	*Alectryon oleifolius subsp. canescens*			
1090.	4752	*Dodonaea adenophora*			
1091.	4753	*Dodonaea amblyophylla*			
1092.	4769	*Dodonaea lobulata (Bead Hopbush)*			
1093.	4770	*Dodonaea microzyga*			
1094.	12034	*Dodonaea microzyga var. acrolobata*			
1095.	4780	*Dodonaea stenozyga*			
1096.	11247	*Dodonaea viscosa subsp. angustissima*			
Scincidae					
1097.	30893	*Cryptoblepharus buchananii*			
1098.	25020	*Cryptoblepharus plagiocephalus*			
1099.	25026	*Ctenotus atlas*			
1100.	25052	*Ctenotus leonhardii*			
1101.	25074	*Ctenotus schomburgkii*			
1102.	25465	*Ctenotus uber (Spotted Ctenotus)*			
1103.	25080	*Ctenotus uber subsp. uber (Spotted Ctenotus)*			
1104.	25089	*Cyclodomorphus melanops subsp. elongatus (Slender Blue-tongue)*			
1105.	25092	*Egernia depressa (Southern Pygmy Spiny-tailed Skink)*			
1106.	25094	*Egernia formosa*			
1107.	25104	*Egernia richardi*			
1108.	25109	*Eremiascincus richardsonii (Broad-banded Sand Swimmer)*			
1109.	25115	*Hemiergis initialis subsp. initialis*			
1110.		*Lerista kingi*			
1111.	25155	*Lerista muelleri*			
1112.	25162	*Lerista picturata*			
1113.	25172	*Lerista stictopleura*			
1114.	42411	*Lerista timida*			
1115.	41411	*Liopholis inornata (Desert Skink)*			
1116.	25184	*Menetia greyii*			
1117.	25188	*Morethia adelaidensis*			
1118.	25190	*Morethia butleri*			
1119.	25203	*Tiliqua occipitalis (Western Bluetongue)*			
1120.	25519	*Tiliqua rugosa*			
1121.	25207	*Tiliqua rugosa subsp. rugosa*			
Scolopacidae					
1122.	41323	*Actitis hypoleucos (Common Sandpiper)*		IA	
1123.	24779	*Calidris acuminata (Sharp-tailed Sandpiper)*		IA	
1124.	24780	*Calidris alba (Sanderling)*		IA	
1125.	24784	*Calidris ferruginea (Curlew Sandpiper)*		T	
1126.	24788	*Calidris ruficollis (Red-necked Stint)*		IA	
1127.	24803	*Tringa brevipes (Grey-tailed Tattler)*		P4	
1128.	24806	*Tringa glareola (Wood Sandpiper)*		IA	
1129.	24808	*Tringa nebularia (Common Greenshank, greenshank)*		IA	
Scolopendridae					

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1130.		*Cormocephalus bungalbinensis*			
1131.		*Scolopendra laeta*			
1132.		*Scolopendra morsitans*			
Scrophulariaceae					
1133.	14888	*Diocirea microphylla*		P3	
1134.	7180	*Eremophila alternifolia (Poverty Bush)*			
1135.	16377	*Eremophila caerulea subsp. caerulea*			
1136.	13641	*Eremophila caerulea subsp. merrallii*		P4	
1137.	13807	*Eremophila caperata*			
1138.	7189	*Eremophila clarkei (Turpentine Bush)*			
1139.	17156	*Eremophila clavata*			
1140.	7193	*Eremophila decipiens (Slender Fuchsia)*			
1141.	14895	*Eremophila decipiens subsp. decipiens*			
1142.	7195	*Eremophila dempsteri*			
1143.	7198	*Eremophila deserti*			
1144.	7200	*Eremophila drummondii*			
1145.	7212	*Eremophila gibbosa*			
1146.	14340	*Eremophila glabra subsp. glabra*			
1147.	7219	*Eremophila granitica (Thin-leaved Poverty Bush)*			
1148.	15112	*Eremophila interstans subsp. interstans*			
1149.	15111	*Eremophila interstans subsp. virgata*			
1150.	7226	*Eremophila ionantha (Violet-flowered Eremophila)*			
1151.	7234	*Eremophila longifolia (Berrigan, Tulypurpa)*			
1152.	16363	*Eremophila maculata subsp. brevifolia (Native Fuchsia)*			
1153.	7242	*Eremophila miniata (Kopi Poverty Bush)*			
1154.	14632	*Eremophila oblonga*			
1155.	15003	*Eremophila oldfieldii subsp. angustifolia*			
1156.	17168	*Eremophila oldfieldii subsp. oldfieldii*			
1157.	18570	*Eremophila oppositifolia subsp. angustifolia*			
1158.	7250	*Eremophila pantonii*			
1159.	14594	*Eremophila parvifolia subsp. auricampa*			
1160.	14516	*Eremophila praecox*		P1	
1161.	10780	*Eremophila psilocalyx*			
1162.	7259	*Eremophila pustulata (Warted Eremophila)*			
1163.	15172	*Eremophila rugosa*			
1164.	7264	*Eremophila saligna (Willowy Eremophila)*			
1165.	7267	*Eremophila scoparia (Broom Bush ()*			
1166.	7269	*Eremophila serrulata (Serrate-leaved Eremophila)*			
1167.		*Eremophila sp.*			
1168.	19528	*Eremophila sp. Mt Jackson (G.J. Keighery 4372)*			
1169.	17162	*Eremophila subfloccosa subsp. lanata*			
1170.	7278	*Eremophila veronica*		P3	
1171.	7283	*Eremophila weldii*			
1172.	17158	*Myoporum montanum (Native Myrtle)*			
Solanaceae					
1173.	6952	*Anthotroche pannosa (Felted Anthotroche)*			
1174.	6955	*Crenidium spinescens*			
1175.	10823	*Datura inoxia*	Y		
1176.	6966	*Duboisia hopwoodii (Pituri, Kundugu)*			
1177.	6967	*Lycium australe (Australian Boxthorn)*			
1178.	6968	*Lycium ferocissimum (African Boxthorn)*	Y		
1179.	6974	*Nicotiana glauca (Tree Tobacco)*	Y		
1180.	6978	*Nicotiana rotundifolia (Round-leaved Tobacco)*			
1181.	6998	*Solanum cleistogamum*			
1182.	7007	*Solanum esuriale (Quena)*			
1183.	7013	*Solanum hoplopetalum (Thorny Solanum)*			
1184.	7018	*Solanum lasiophyllum (Flannel Bush, Mindjulu)*			
1185.	7022	*Solanum nigrum (Black Berry Nightshade)*	Y		
1186.	7023	*Solanum nummularium (Money-leaved Solanum)*			
1187.	7028	*Solanum petrophilum (Rock Nightshade)*			
1188.	7030	*Solanum plicatile*			
1189.	7034	*Solanum simile (Oondoroo)*			
Sparassidae					
1190.		*Isopeda magna*			
1191.		*Isopedella saundersi*			
Stemonitidaceae					
1192.	38987	*Comatricha ellae*			
1193.	39030	*Enerthenema papillatum*			

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Sternophoridae					
1194.		*Afrosternophorus hirsti*			Y
Stylidiaceae					
1195.	7685	*Stylidium arenicola*			
1196.	7714	*Stylidium dielsianum (Tangle Triggerplant)*			
1197.	7751	*Stylidium limbatum (Fringed-leaved Triggerplant)*			
Tachyglossidae					
1198.	24207	*Tachyglossus aculeatus (Short-beaked Echidna)*			
Teloschistaceae					
1199.	48195	*Caloplaca scarlatina*			
1200.		*Caloplaca sp.*			
1201.	44983	*Fulgensia cranfieldii*			
1202.	27754	*Fulgensia subbracteata*			
1203.	45299	*Jackelixia elixii*			
Thamnocephalidae					
1204.	33934	*Branchinella denticulata (fairy shrimp (Carnarvon to Kalgoorlie))*		P3	
Theraphosidae					
1205.		*Selenotholus foelschei*			
Theridiidae					
1206.		*Latrodectus hasseltii*			
Threskiornithidae					
1207.	24841	*Platalea flavipes (Yellow-billed Spoonbill)*			
1208.	24845	*Threskiornis spinicollis (Straw-necked Ibis)*			
Thylacomyidae					
1209.	24168	*Macrotis lagotis (Bilby, Dalgyte, Ninu)*		T	
Thymelaeaceae					
1210.	5231	*Pimelea angustifolia (Narrow-leaved Pimelea)*			
1211.	11185	*Pimelea microcephala subsp. microcephala*			
1212.	12104	*Pimelea spiculigera var. thesioides*			
1213.	11910	*Pimelea suaveolens subsp. flava*			
Trichiaceae					
1214.	39059	*Perichaena vermicularis*			
Triopsidae					
1215.	39407	*Triops australiensis (Shield Shrimp)*			
Trochanteriidae					
1216.		*Corimaethes campestrus*			
1217.		*Fissarena castanea*			
Turnicidae					
1218.	24851	*Turnix velox (Little Button-quail)*			
Tytonidae					
1219.	24852	*Tyto alba subsp. delicatula (Barn Owl)*			
Urodacidae					
1220.		*Urodacus armatus*			
1221.		*Urodacus hoplurus*			
1222.		*Urodacus yaschenkoi*			
Urticaceae					
1223.	1767	*Urtica urens (Small Nettle)*	Y		
Varanidae					
1224.	25211	*Varanus caudolineatus*			
1225.	25218	*Varanus gouldii (Bungarra or Sand Monitor)*			
1226.	25526	*Varanus tristis (Racehorse Monitor)*			
Verbenaceae					
1227.	29836	*Glandularia aristigera*	Y		
1228.	13557	*Phyla canescens*	Y		
Verrucariaceae					
1229.	27739	*Endocarpon pusillum*			
1230.	27741	*Endocarpon simplicatum*			
1231.		*Placidium lacinulatum*			
1232.	27984	*Placidium squamulosum*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Vespertilionidae					
1233.	24186	*Chalinolobus gouldii (Gould's Wattled Bat)*			
1234.	24187	*Chalinolobus morio (Chocolate Wattled Bat)*			
1235.	24194	*Nyctophilus geoffroyi (Lesser Long-eared Bat)*			
1236.	24199	*Scotorepens balstoni (Inland Broad-nosed Bat)*			
1237.	24202	*Vespadelus baverstocki (Inland Forest Bat)*			
1238.	24205	*Vespadelus finlaysoni (Finlayson's Cave Bat)*			
1239.	24206	*Vespadelus regulus (Southern Forest Bat)*			
Violaceae					
1240.	11973	*Hybanthus floribundus subsp. curvifolius*			
Zodariidae					
1241.		*Storena sinuosa*			
Zosteropidae					
1242.	25765	*Zosterops lateralis (Grey-breasted White-eye, Silvereye)*			
Zygophyllaceae					
1243.	48882	*Roepera apiculata*			
1244.	48885	*Roepera aurantiaca subsp. aurantiaca*			
1245.	48890	*Roepera eremaea*			
1246.	48892	*Roepera glauca (Pale Twinleaf, Pale Twin-leaf)*			
1247.	48898	*Roepera ovata*			
1248.	48899	*Roepera reticulata*			
1249.	48903	*Roepera tetraptera*			
1250.	4383	*Tribulus terrestris (Caltrop)*	Y		

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

Appendix 8: EPBC Protected Matters Search (40km buffer)

Australian Government

Department of Agriculture, Water and the Environment

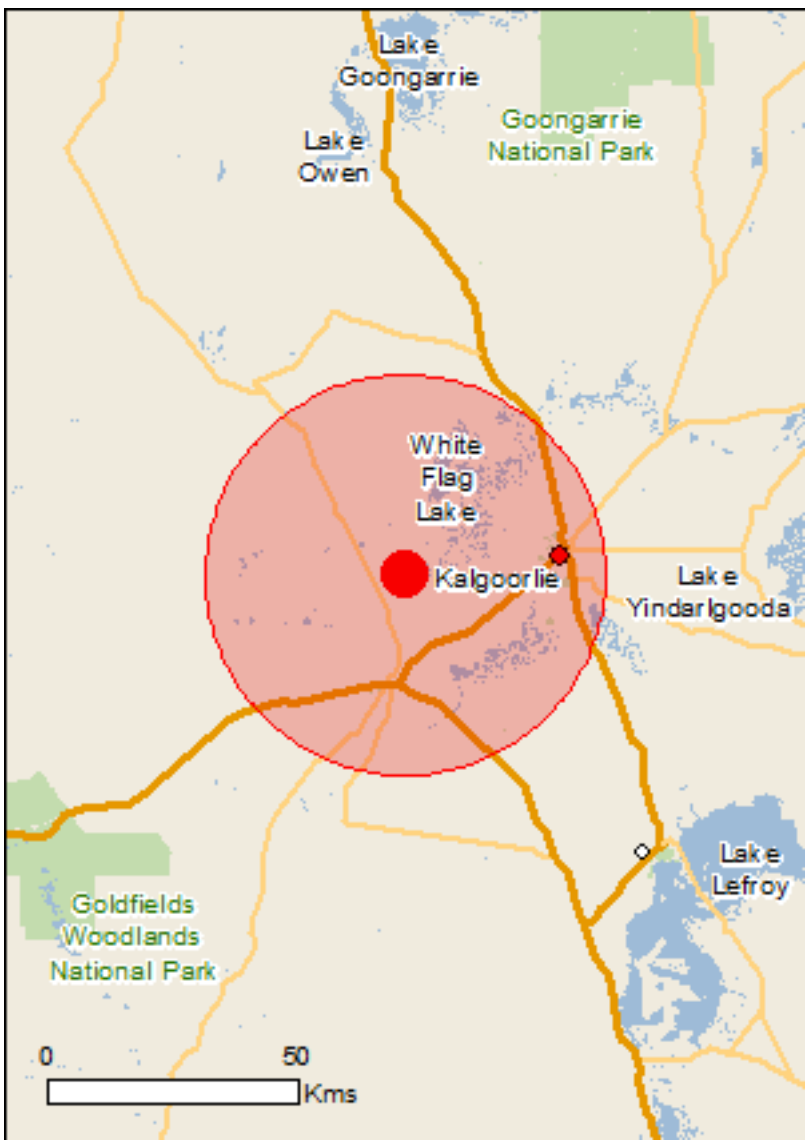
EPBC Act Protected Matters Report

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

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

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

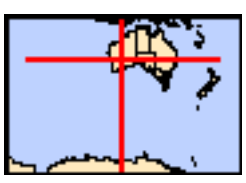
Report created: 14/01/21 00:46:31



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

Coordinates

Buffer: 40.0Km



Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	1
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	8
Listed Migratory Species:	7

Other Matters Protected by the EPBC Act

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

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	4
Commonwealth Heritage Places:	None
Listed Marine Species:	12
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	5
Regional Forest Agreements:	None
Invasive Species:	16
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

National Heritage Properties		[Resource Information]
Name	State	Status
Historic		
Goldfields Water Supply Scheme, Western Australia	WA	Listed place

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat known to occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Insects		
Ogyris subterrestris petrina Arid Bronze Azure [77743]	Critically Endangered	Species or species habitat may occur within area
Mammals		
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat may occur within area
Plants		
Gastrolobium graniticum Granite Poison [14872]	Endangered	Species or species habitat likely to occur within area
Thelymitra stellata Star Sun-orchid [7060]	Endangered	Species or species habitat may occur within area

Listed Migratory Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		

Name	Threatened	Type of Presence
Motacilla cinerea		
Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -
Defence - AIRTC KALGOORLIE
Defence - KALGOORLIE RIFLE RANGE
Defence - KALGOORLIE TRAINING DEPOT

Listed Marine Species [Resource Information]

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

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Kalgoorlie Arboretum	WA
Kangaroo Hills Timber Reserve	WA
Kurrawang	WA
Scahill Timber Reserve	WA
Yallari Timber Reserve	WA

Invasive Species	[Resource Information]

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

Name	Status	Type of Presence
Birds		
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Mammals		
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur

Name	Status	Type of Presence within area
Equus asinus Donkey, Ass [4]		Species or species habitat likely to occur within area
Equus caballus Horse [5]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Carrichtera annua Ward's Weed [9511]		Species or species habitat likely to occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Cylindropuntia spp. Prickly Pears [85131]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

Caveat

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

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

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

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

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

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

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

- migratory and
- marine

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

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

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

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

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

Coordinates

-30.78337 121.19084

Acknowledgements

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

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

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

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

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Appendix 9: GPS coordinates of Quadrat locations (GDA94, Zone 51)

Quadrat	Easting	Northing
Q1	321509	6595669
Q2	319423	6596012
Q3	319547	6595758
Q4	319651	6595624
Q5	319892	6595160
Q6	320320	6594970
Q7	321726	6595669
Q8	321486	6595035
Q9	320929	6594305
Q10	320121	6594235
Q11	320502	6593829

Appendix 10: Quadrat Datasheets and Photos

Project: Rayjax	Date: 29/10/2020	Botanists: JJ
Quadrat: 1	WP: 185-188	Photo: 59-61
Size: 20 x 20	Litter: 35%	Bare: 35%
Condition: Good	Fire: >20 years	Drainage: Low
Landform: Flat	Location: Upper	Type: Plain
Soil: Brown clay loam	Outcrops: 0	Corse Fragments: <2%, 2-6mm

Floristic Group: Sparse woodland of *Eucalyptus griffithsii* and *E. transcontinentalis* over *Acacia hemiteles* shrubland over low mixed shrubland on clay-loam plain.

Upper			**Mid**			**Lower**		
Form	**Height**	**Cover %**	**Form**	**Height**	**Cover %**	**Form**	**Height**	**Cover %**
T	5-12 m	<10	S	1-3 m	10-30	S	<0.5 m	<10
Dominant Taxa								
Eucalyptus griffithsii			*Eremophila scoparia*			*Maireana triptera*		
Other Taxa								
			Acacia hemiteles			*Olearia muelleri*		
			Acacia tetragonophylla			*Olearia pimeleoides*		
			Atriplex bunburyana			*Ptilotus obovatus.* var *obovatus*		
			Atriplex nummularia					
			Eremophila glabra					
			Exocarpos aphyllus					
			Scaevola spinescens					
			Senna artemisioides subsp. *filifolia*					

Project: Rayjax	Date: 29/10/2020	Botanists: JJ
Quadrat: 2	WP: 189	Photo: 62-64
Size: 20 x 20	Litter: 80%	Bare: 10%
Condition: Good	Fire: >20 years	Drainage: Low
Landform: Flat	Location: Upper	Type: Plain
Soil: Brown clay loam	Outcrops: 0	Corse Fragments: <2%, 2-6mm

Floristic Group: Sparse woodland of *Eucalyptus griffithsii* and *E. transcontinentalis* over *Acacia hemiteles* shrubland over low mixed shrubland on clay-loam plain.

Upper			**Mid**			**Lower**		
Form	**Height**	**Cover %**	**Form**	**Height**	**Cover %**	**Form**	**Height**	**Cover %**
T	5-12 m	30-70	S	1-3 m	10-30	S	<0.5 m	<10
Dominant Taxa								
Eucalyptus transcontinentalis			*Acacia tetragonophylla*			*Olearia muelleri*		
Other Taxa								
Eucalyptus salubris			*Acacia hemiteles*					
Eucalyptus yilgarnensis			*Eremophila caperata*					
			Eremophila glabra					
			Eremophila interstans subsp. *interstans*					
			Eremophila ionantha					
			Eremophila scoparia					
			Exocarpos aphyllus					
			Santalum acuminatum					
			Scaevola spinescens					
			Senna artemisioides subsp. *filifolia*					
			Senna cardiosperma					

Project: Rayjax	Date: 29/10/2020	Botanists: JJ
Quadrat: 3	WP: 190	Photo: 73-75
Size: 20 x 20	Litter: 35%	Bare: 35%
Condition: Good	Fire: >20 years	Drainage: Average
Landform: Midslope	Location: Upper	Type: Hillslope
Soil: Brown clay loam	Outcrops: 0	Coarse Fragments: 20-50%, 20-50mm

Floristic Group: Low woodland of *E. torquata/ E. clelandiorum* over mixed *Acacia/ Eremophila/Allocasuarina* tall shrubland over hummock grassland/mixed low shrubland on hillslope.

Upper			Mid			Lower		
Form	**Height**	**Cover %**	**Form**	**Height**	**Cover %**	**Form**	**Height**	**Cover %**
T	5-12 m	30-70	S	1-3 m	30-70	HG	<1m	<1
Dominant Taxa								
Eucalyptus torquata			*Allocasuarina campestris*			*Triodia scariosa*		
Dominant Taxa								
			Acacia colletioides			*Olearia muelleri*		
			Acacia tetragonophylla					
			Eremophila decipiens					
			Eremophila interstans subsp. *interstans*					
			Exocarpos aphyllus					
			Ptilotus obovatus. var *obovatus*					
			Scaevola spinescens					
			Senna pleurocarpa var. *angustifolia*					
			Trymalium myrtillus subsp. *myrtillus*					
			Westringia rigida					

Project: Rayjax	Date: 29/10/2020	Botanists: JJ
Quadrat: 4	WP: 195	Photo: 86-88
Size: 20 x 20	Litter: 30%	Bare: 40%
Condition: Good	Fire: >20 years	Drainage: Average
Landform: Midslope	Location: Mid	Type: Hillslope
Soil: Brown clay loam	Outcrops: 0	Coarse Fragments: 50-90%, 20-50mm, ironstone

Floristic Group: Low woodland of *E. torquata/ E. clelandiorum* over mixed *Acacia/ Eremophila/Allocasuarina* tall shrubland over hummock grassland/mixed low shrubland on hillslope.

Upper			Mid			Lower		
Form	**Height**	**Cover %**	**Form**	**Height**	**Cover %**	**Form**	**Height**	**Cover %**
T	5-12 m	10-30	S	1-3 m	10-30	S	<0.5 m	<10
Dominant Taxa								
Eucalyptus torquata			*Eremophila oldfieldii* subsp. *angustifolia*			*Triodia scariosa*		
Other Taxa								
			Acacia burkittii			*Olearia muelleri*		
			Allocasuarina campestris			*Westringia rigida*		
			Eremophila glabra					
			Eremophila interstans subsp. *interstans*					
			Exocarpos aphyllus					
			Senna artemisioides subsp. *filifolia*					
			Trymalium myrtillus subsp. *myrtillus*					

Project: Rayjax	Date: 29/10/2020	Botanists: JJ
Quadrat: 5	WP: 196	Photo: 89-91
Size: 20 x 20	Litter: 50%	Bare: 25%
Condition: Good	Fire: >20 years	Drainage: Average
Landform: Midslope	Location: Mid	Type: Hillslope
Soil: Brown clay loam	Outcrops: 0	Coarse Fragments: 50-90%, 20-50mm, ironstone

Floristic Group: Low woodland of *E. torquata/ E. clelandiorum* over mixed *Acacia/ Eremophila/Allocasuarina* tall shrubland over hummock grassland/mixed low shrubland on hillslope.

Upper			**Mid**			**Lower**		
Form	**Height**	**Cover %**	**Form**	**Height**	**Cover %**	**Form**	**Height**	**Cover %**
T	5-12 m	30-70	S	1-3 m	10-30	S	<0.5 m	<10

Dominant Taxa		
Eucalyptus torquata	*Eremophila oldfieldii* subsp. *angustifolia*	*Olearia muelleri*
Other Taxa		
Eremophila interstans subsp. *interstans*	*Acacia colletioides*	*Maireana georgei*
Santalum spicatum	*Acacia erinacea*	*Maireana tomentosa*
	Eremophila glabra	*Maireana triptera*
	Exocarpos aphyllus	
	Grevillea acuaria	
	Ptilotus obovatus. var *obovatus*	
	Senna artemisioides subsp. *filifolia*	
	Trymalium myrtillus subsp. *myrtillus*	
	Westringia rigida	

Project: Rayjax	Date: 29/10/2020	Botanists: JJ
Quadrat: 6	WP: 197	Photo: 92-94
Size: 20 x 20	Litter: 50%	Bare: 35%
Condition: Good	Fire: >20 years	Drainage:
Landform: Flat	Location: Upper	Type: Plain
Soil: Brown clay loam	Outcrops: 0	Coarse Fragments: 20-50%, 6-20mm, laterite/calcrete

Floristic Group: Low woodland of *E. torquata/ E. clelandiorum* over mixed *Acacia/ Eremophila/Allocasuarina* tall shrubland over hummock grassland/mixed low shrubland on hillslope.

Upper			Mid			Lower		
Form	**Height**	**Cover %**	**Form**	**Height**	**Cover %**	**Form**	**Height**	**Cover %**
T	5-12 m	10-30	S	1-3 m	30-70	HG	<1m	<1

Dominant Taxa		
Eucalyptus clelandiorum	*Eremophila dempsteri*	*Triodia scariosa*
Other Taxa		
	Acacia erinacea	
	Acacia hemiteles	
	Eremophila glabra	
	Grevillea acuaria	
	Olearia muelleri	
	Ptilotus obovatus. var *obovatus*	
	Scaevola spinescens	
	Trymalium myrtillus subsp. *myrtillus*	
	Westringia rigida	

Project: Rayjax	Date: 29/10/2020	Botanists: JJ
Quadrat: 7	WP: 199	Photo: 95-97
Size: 20 x 20	Litter: 25%	Bare: 50%
Condition: Good	Fire: >20 years	Drainage: Low
Landform: Flat	Location: Lower	Type: Plain
Soil: Brown clay loam	Outcrops: 0	Coarse Fragments: No coarse fragments

Floristic Group: Woodland of *E. salmonophloia* over mixed *Acacia*/*Eremophila* shrubland over low mixed chenopod shrubland on clay-loam plain

Upper			Mid			Lower		
Form	**Height**	**Cover %**	**Form**	**Height**	**Cover %**	**Form**	**Height**	**Cover %**
T	5-12 m	<10	S	1-3 m	10-30	C	.25-.5 m	<10
Dominant Taxa								
Eucalyptus salmonophloia			*Eremophila scoparia*			*Maireana erioclada*		
Other Taxa								
			Acacia hemiteles			*Frankenia setosa*		
			Atriplex nummularia			*Maireana georgei*		
			Atriplex vesicaria			*Maireana pyramidata*		
			Eremophila ionantha			*Maireana radiata*		
			Eremophila latrobei					
			Exocarpos aphyllus					
			Hakea kippistiana					
			Ptilotus obovatus. var *obovatus*					
			Solanum nummularium					

Project: Rayjax	Date: 29/10/2020	Botanists: JJ
Quadrat: 8	WP: 200	Photo: 98-100
Size: 20 x 20	Litter: 70%	Bare: 20%
Condition: Good	Fire: >20 years	Drainage:
Landform: Flat	Location: Lower	Type: Plain
Soil: Brown clay loam	Outcrops: 0	Coarse Fragments: <2%, 2-20mm, ironstone/calcrete

Floristic Group: Sparse woodland of *Eucalyptus griffithsii* and *E. transcontinentalis* over *Acacia hemiteles* shrubland over low mixed shrubland on clay-loam plain.

Upper			**Mid**			**Lower**		
Form	**Height**	**Cover %**	**Form**	**Height**	**Cover %**	**Form**	**Height**	**Cover %**
T	5-12 m	10-30	S	1-3 m	10-30	S	<0.5 m	<10

Dominant Taxa		
Eucalyptus griffithsii	*Acacia hemiteles*	*Olearia muelleri*
Other Taxa		
Eremophila interstans subsp. *interstans*	*Acacia colletioides*	*Maireana erioclada*
	Acacia erinacea	
	Atriplex nummularia	
	Dodonaea lobulata	
	Exocarpos aphyllus	
	Ptilotus obovatus. var *obovatus*	
	Scaevola spinescens	
	Senna artemisioides subsp. *filifolia*	

Project: Rayjax	Date: 29/10/2020	Botanists: JJ
Quadrat: 9	WP: 201	Photo: 101-103
Size: 20 x 20	Litter:	Bare:
Condition: Good	Fire: >20 years	Drainage: Low
Landform: Midslope	Location: Mid	Type: Hillslope
Soil: Brown clay loam	Outcrops: 0	Coarse Fragments: 2-10%, 6-20mm

Floristic Group: Sparse woodland of *Eucalyptus griffithsii* and *E. transcontinentalis* over *Acacia hemiteles* shrubland over low mixed shrubland on clay-loam plain.

Upper			**Mid**			**Lower**		
Form	**Height**	**Cover %**	**Form**	**Height**	**Cover %**	**Form**	**Height**	**Cover %**
T	5-12 m	10-30	S	1-3 m	30-70	S	.25-.5 m	<10

Dominant Taxa		
Eucalyptus transcontinentalis	*Acacia hemiteles*	*Olearia muelleri*
Other Taxa		
Eremophila interstans subsp. interstans	*Acacia erinacea*	*Maireana pentatropis*
Eucalyptus griffithsii	*Atriplex nummularia*	
	Dodonaea lobulata	
	Exocarpos aphyllus	
	Ptilotus obovatus. var *obovatus*	
	Scaevola spinescens	
	Senna artemisioides subsp. *filifolia*	
	Senna cardiosperma	
	Solanum nummularium	

Project: Rayjax	Date: 29/10/2020	Botanists: JJ
Quadrat: 10	WP: 202	Photo: 111-113
Size: 20 x 20	Litter: 15%	Bare: 80%
Condition: Good	Fire: >20 years	Drainage: Low
Landform: Flat	Location: Lower	Type: Plain
Soil: Brown clay loam	Outcrops: 0	Coarse Fragments: 2-10%, 6-20mm

Floristic Group: Woodland of *E. salmonophloia* over mixed *Acacia*/*Eremophila* shrubland over low mixed chenopod shrubland on clay-loam plain

Upper			**Mid**			**Lower**		
Form	**Height**	**Cover %**	**Form**	**Height**	**Cover %**	**Form**	**Height**	**Cover %**
T	5-12 m	<10	S	1-3 m	10-30	S	<0.5 m	<10

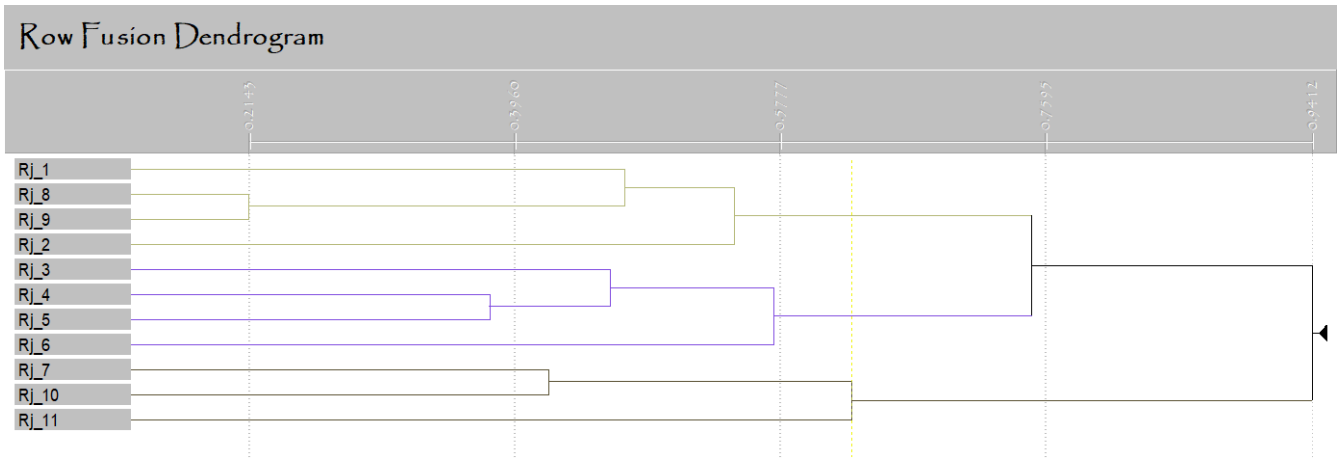
Dominant Taxa		
Eucalyptus salmonophloia	*Exocarpos aphyllus*	*Maireana erioclada*
Other Taxa		
	Acacia hemiteles	*Frankenia setosa*
	Atriplex nummularia	*Olearia muelleri*
	Atriplex vesicaria	
	Cratystylis microphylla	
	Eremophila scoparia	
	Grevillea acuaria	
	Lycium australe	
	Pittosporum angustifolium	
	Ptilotus obovatus. var *obovatus*	
	Senna artemisioides subsp. *filifolia*	

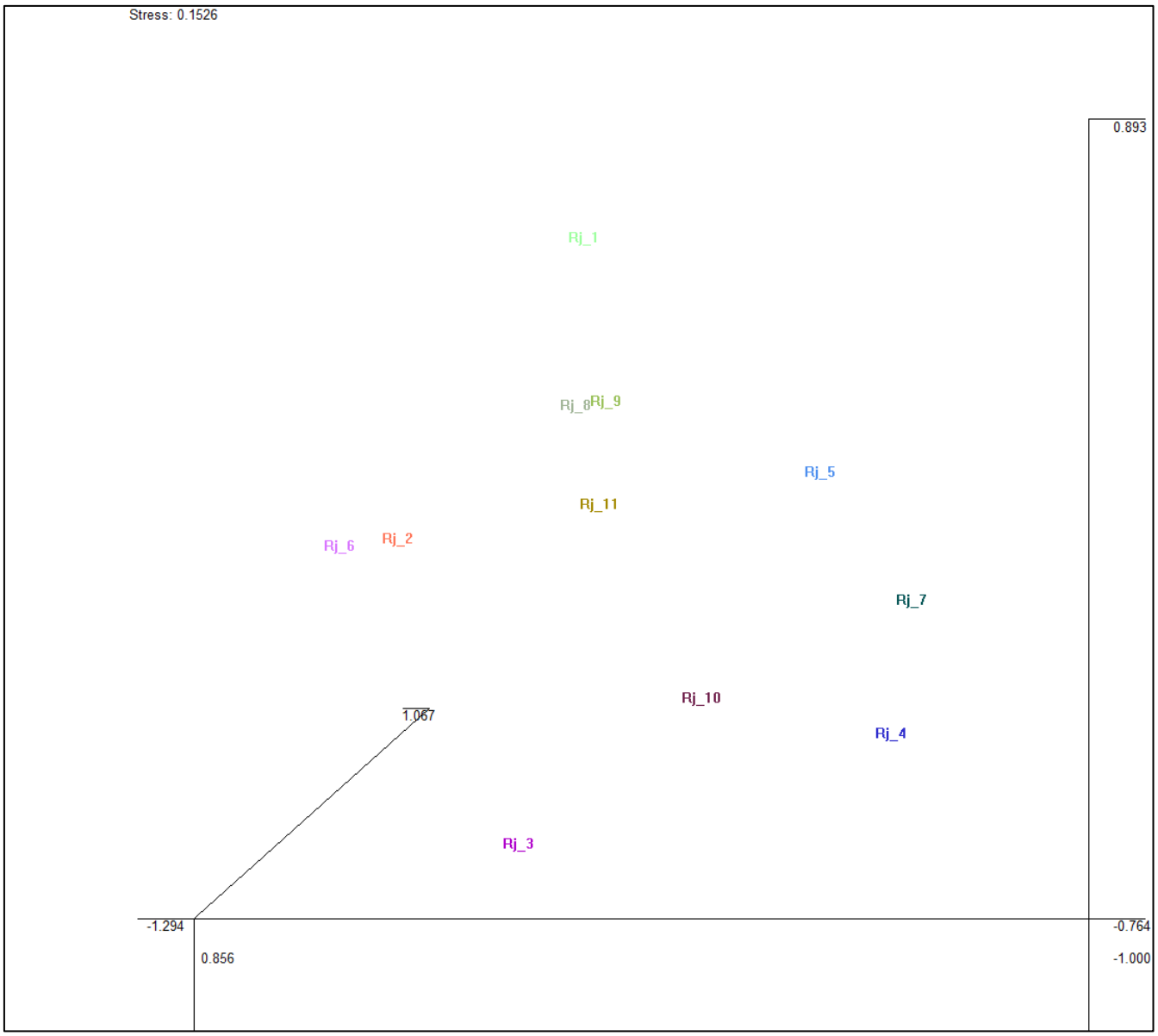
Project: Rayjax	Date: 29/10/2020	Botanists: JJ
Quadrat: 11	WP: 203	Photo: 114-116
Size: 20 x 20	Litter: 50%	Bare: 30%
Condition: Good	Fire: >20 years	Drainage: Low
Landform: Flat	Location: Lower	Type: Plain
Soil: Brown clay loam	Outcrops: 0	Coarse Fragments: 2-10%, 2-6mm

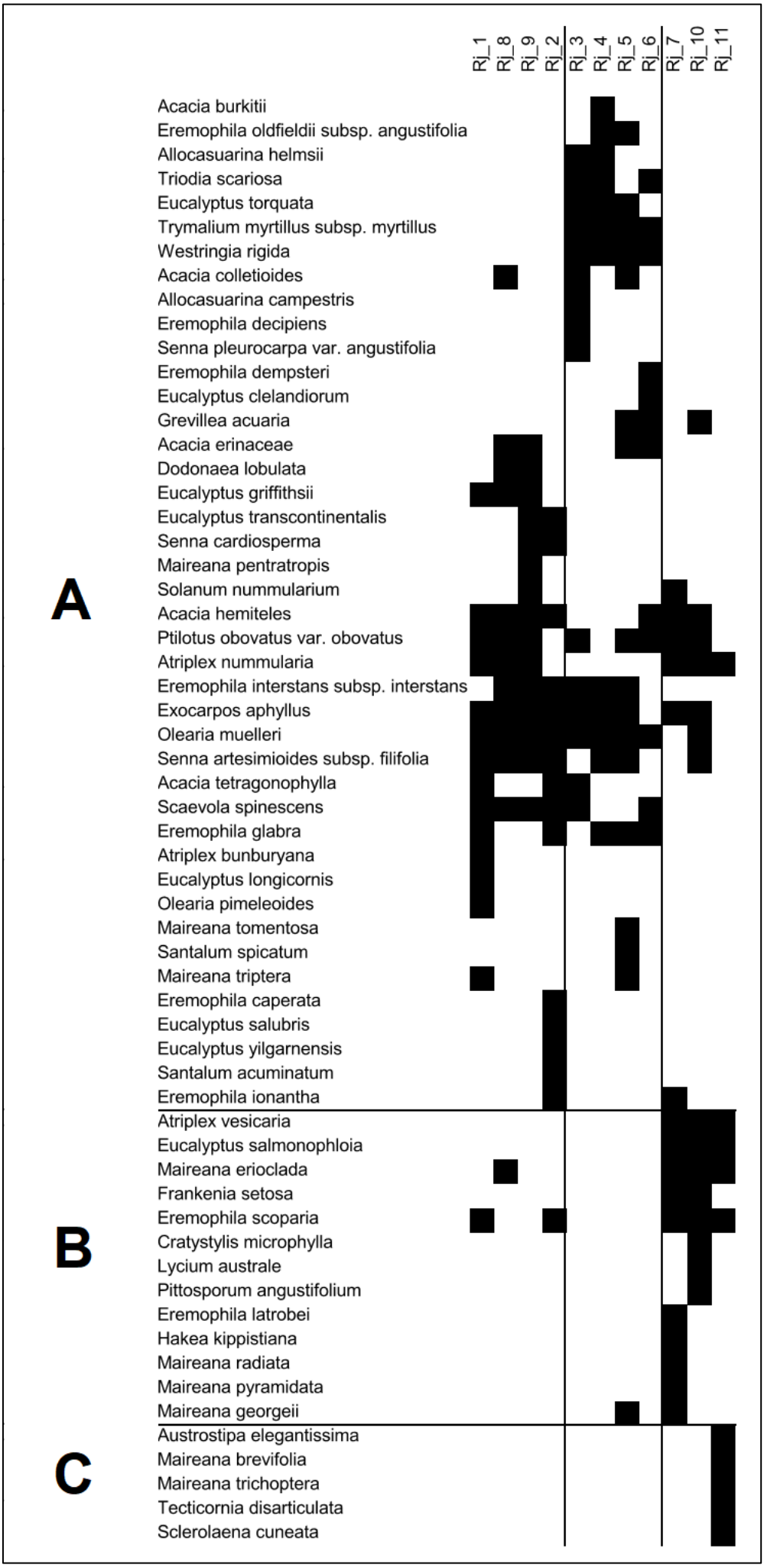
Floristic Group: Woodland of *E. salmonophloia* over mixed *Acacia*/*Eremophila* shrubland over low mixed chenopod shrubland on clay-loam plain

Upper			**Mid**			**Lower**		
Form	**Height**	**Cover %**	**Form**	**Height**	**Cover %**	**Form**	**Height**	**Cover %**
T	12-20 m	10-30	S	1-3 m	10-30	C	.25-.5 m	<1
Dominant Taxa								
Eucalyptus salmonophloia			*Eremophila scoparia*			*Maireana trichoptera*		
Other Taxa								
			Atriplex nummularia			*Austrostipa elegantissima*		
			Atriplex vesicaria			*Maireana brevifolia*		
			Tecticornia disarticulata			*Maireana erioclada*		
						Sclerolaena cuneata		

Appendix 11: PATN Analysis






Rj_1
Rj_8
Rj_9
Rj_2
Rj_3
Rj_4
Rj_5
Rj_6
Rj_7
Rj_10
Rj_11
Acacia burkitii
Eremophila oldfieldii subsp. angustifolia
Allocasuarina helmsii
Triodia scariosa
Eucalyptus torquata
Trymalium myrtillus subsp. myrtillus
Westringia rigida
Acacia colletioides
Allocasuarina campestris
Eremophila decipiens
Senna pleurocarpa var. angustifolia
Eremophila dempsteri
Eucalyptus clelandiorum
Grevillea acuaria
Acacia erinaceae
Dodonaea lobulata
Eucalyptus griffithsii
Eucalyptus transcontinentalis
Senna cardiosperma
Maireana pentratropis
Solanum nummularium
Acacia hemiteles
Ptilotus obovatus var. obovatus
Atriplex nummularia
Eremophila interstans subsp. interstans
Exocarpos aphyllus
Olearia muelleri
Senna artesimioides subsp. filifolia
Acacia tetragonophylla
Scaevola spinescens
Eremophila glabra
Atriplex bunburyana
Eucalyptus longicornis
Olearia pimeleoides
Maireana tomentosa
Santalum spicatum
Maireana triptera
Eremophila caperata
Eucalyptus salubris
Eucalyptus yilgarnensis
Santalum acuminatum
Eremophila ionantha
Atriplex vesicaria
Eucalyptus salmonophloia
Maireana erioclada
Frankenia setosa
Eremophila scoparia
Cratystylis microphylla
Lycium australe
Pittosporum angustifolium
Eremophila latrobei
Hakea kippistiana
Maireana radiata
Maireana pyramidata
Maireana georgeii
Austrostipa elegantissima
Maireana brevifolia
Maireana trichoptera
Tecticornia disarticulata
Sclerolaena cuneata
A
B
C

Appendix N: Supporting Biodiversity Survey (Arid Bronze Azure Butterfly and the Inland Hairstreak Survey)

Survey for the Arid Bronze Azure Butterfly and the Inland Hairstreak

Rayjax Project

Prepared for Evolution Mining Group

June 2021

Version 1

Prepared by:
Botanica Consulting Pty Ltd
PO Box 2027
Boulder WA 6432

Disclaimer

Quality Assurance

An internal quality review process has been implemented to each project task undertaken by BC. Each document and its contents are carefully reviewed by core members of the Consultancy team and signed off at Director Level prior to issue to the client. Draft documents are submitted to the client for comment and acceptance prior to final production.

Job number: 2021/50

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1 INTRODUCTION

Botanica Consulting Pty Ltd (Botanica) was commissioned by Evolution Mining Ltd. (Evolution) to undertake a survey for the Arid Bronze Azure Butterfly (*Ogyris subterrestris petrina*) and the Inland Hairstreak (*Jalmenus aridus*) within the Rayjax Project area and proposed haul road (referred to as the 'survey area') (Figure 1). The survey area is 385 ha in extent and is located approximately 30 km west of Kalgoorlie-Boulder, Western Australia. The survey was conducted in response to a request from the Department of Mines, Industry Regulation and Safety (DMIRS) in relation to Native Vegetation Clearing Permit 9242/1 (NVCP) for the clearing of 200 ha at the Rayjax Project. DMIRS had determined that there was the potential for both the Arid Bronze Azure Butterfly (ABAB) and the Inland Hairstreak to be present in the survey area based on the presence of suitable habitat in the application area (smooth bark Eucalyptus such as *Eucalyptus salmonophloia* and *Eucalyptus salubris* for ABAB and *Acacia tetragonophylla* for the Inland Hairstreak) and their potential distribution (both species have been historically recorded from Lake Douglas). Lake Douglas is approximately 24 km southeast of the Rayjax Project area.

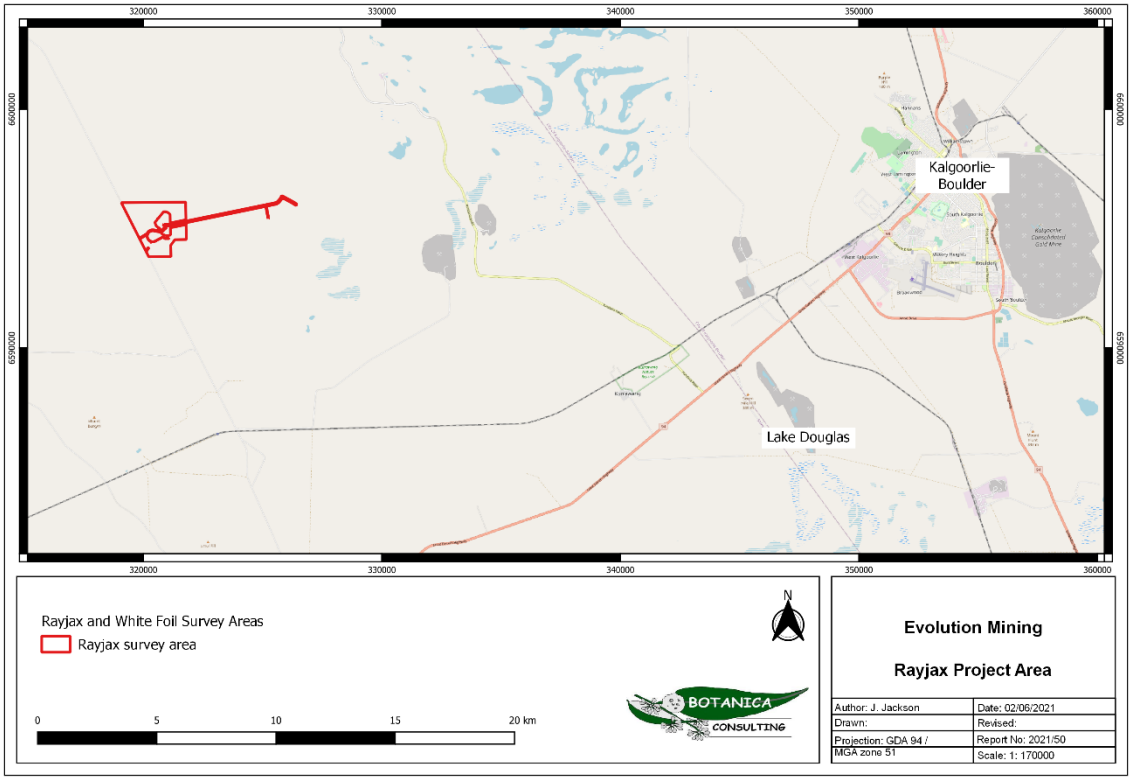

Figure 1: Regional map of the Rayjax Project Area in relation to Kalgoorlie-Boulder and Lake Douglas

1.1 Arid Bronze Azure Butterfly

The arid bronze azure butterfly is a threatened species that is listed as critically endangered under the national *Environment Protection and Biodiversity Protection Act 1999* and the state *Biodiversity Conservation Act 2016*. The ABAB is listed due to its severely fragmented distribution with only two extant subpopulations being recorded in Western Australia. These subpopulations are at Barbalin Nature Reserve west of Mukinbudin in the Western Australian wheatbelt, and at a second site ~100 km from Barbalin. A third subpopulation (the first discovered, in the 1980s) occurred near Lake Douglas, 12 km southwest of Kalgoorlie but is now locally extinct and no ABAB have been recorded there since 1993 (DBCA, 2021a).

The ABAB has an obligate association with a sugar ant *Camponotus* sp. nr. *terebrans*. The ABAB's larvae live entirely within the ant's nest during their development. The ants protect the larvae from predators and are thought to be rewarded with secretions produced by the larvae. The most critical factor for habitat occupancy by the butterfly is the presence of large colonies of the host ant; only large colonies can support the ABAB because, being a parasitic species, it requires large numbers of hosts.

1.2 Inland Hairstreak

The Inland Hairstreak is endemic to Western Australia and is listed as Priority 1 fauna under the state *Biodiversity Conservation Act 2016*. Only 16 collections are known, 15 of these are from near Kalgoorlie, one is from the Gibson desert (ALA, 2020). It was last sighted in Western Australia at Karamindie, which is about 28 km south of Kalgoorlie (DBCA, 2021a). Little is known about its biology or ecology. Based on the historical records, the larva of this species is thought to feed on leaves and flowers of young shrubs of *Senna nemophila* (recent taxonomic revisions classify as *Senna artemisioides* subsp. × *coriacea*) and mature trees of *Acacia tetragonophylla*, which grow in shallow gullies with gentle slopes (Braby, 2016). The larvae of the butterfly are attended by the Froglet ant *Froggatella kirbii*. The adults are likely to stay close to the breeding habitats. There are likely two generations per year, although adults are absent in some years (Braby, 2016).

2 METHODS

2.1 Desktop review

Prior to the field assessment a review was undertaken of literature related to the Project area, the ABAB and the Inland Hairstreak. Documents reviewed included:

- Braby, M. (2016) *The Complete Field Guide to Butterflies of Australia*. 2nd Edition. Clayton South VIC: CSIRO Publishing.
- Botanica Consulting. (2020). Rayjax Project, detailed flora/ vegetation survey and basic fauna survey. Prepared for Evolution Mining Ltd.
- Department of Biodiversity, Conservation and Attractions. (2020a). *Guideline for the survey of arid bronze azure butterfly (ABAB) in Western Australia*. Perth, WA.
- Department of Biodiversity, Conservation and Attractions. (2020b). *Arid bronze azure butterfly (ABAB) survey in Western Australia: additional information*. Perth, WA.
- Gamblin, T., Williams, M. R., Williams, A. A. E., and Richardson, J. (2009). *The ant, the butterfly and the bulldozer.* Department of Environment and Conservation, Kensington, WA.
- McArthur, A. J., Adams, M., and Shattuck, S. O. (1997). A Morphological and Molecular Review of *Camponotus terebrans* (Lowne) (Hymenoptera :Formicidae). Australian Journal of Zoology. 45 (579-598).
- Spectrum Ecology. (2020). *Binduli north expansion project: desktop report review.* Prepared for Talis, Norton Gold Fields.

These documents included survey guidelines for the ABAB prepared by the Department of Biodiversity, Conservation and Attractions (DBCA) and previous surveys for the ABAB. These assisted in designing a survey methodology for field assessment.

The survey protocol recommended by DBCA for the ABAB has two components:

i) A survey to detect if the host ant is present in large numbers, and
ii) If the ant is present, then a survey should be conducted to determine if the ABAB is present.

To survey for the host ant, sampling of smooth barked Eucalypts by disturbing the soil at the base of trees to a depth of approximately 10 cm will determine if a colony is present. Nocturnal surveys are recommended; however ants should be clearly apparent in nests when disturbed at the base of trees during the day.

The number of trees to be sampled and the approximate spacing between trees can be determined from Table 1 in the *Arid bronze azure butterfly (ABAB) survey in Western Australia:*

additional information document. For a 200 ha area to be surveyed, a minimum of 140 trees is recommended with a spacing of ~120m, for a 500 ha area to be surveyed, a minimum of 225 trees is recommended with a spacing of ~150m. Assuming that the availability of smooth barked mature Eucalypts is not a limiting factor. For this survey, a 150 m tree spacing was determined to be adequate. The plan was to traverse lines north to south through the survey area, stopping every 150 m and sampling the nearest mature smooth barked Eucalypt (e.g. *Eucalyptus salmonophloia* and *Eucalyptus salubris).*

A plan for surveying for the ABAB was not developed as this would only be done if the host ants were present, and the DBCA survey guidelines recommend these surveys are conducted in weather where the forecast maximum is ≥23ºC.

For the Inland Hairstreak, there are no published survey guidelines however, this species also has an association with an ant species; *Froggattella kirbii* which can also be searched for near known habitat trees for the species (*Acacia tetragonophylla* and *Senna artemisioides* subsp. x *coriacea*).

2.2 Field assessment

Botanica conducted a targeted survey for the ABAB and the Inland Hairstreak from the 26th to 27th May 2021, with the area traversed on foot and ATV by two Botanica staff members; Jennifer Jackson (Senior Environmental Consultant, BSc (Honours, Environmental Management) and Matthew Newlands (Environmental Technician).

2.3 Tree sampling

Lines were traversed north to south through the survey area, stopping approximately every 150 m and sampling the nearest mature smooth barked Eucalypt (e.g. *Eucalyptus salmonophloia* and *Eucalyptus salubris).* A handheld GPS unit was used to record the tracks traversed and the 150m spacing was determined from these handheld GPS units.

At each point, a smooth barked Eucalypt was located, and a hand trowel was used to disturb the leaf litter and soil to a depth of ~ 10 cm, and the following information was recorded:

- GPS location with a waypoint number,
- Photograph of the base of the tree,
- Tree species,
- The approximate diameter of the tree at a height of 1.5 m,
- If ants were present (Y/N), and
- If leafhoppers were present (Y/N).

Due to there being two people conducting the survey, at many points two trees were sampled.

3 RESULTS

3.1 Arid Bronze Azure Butterfly

A total of 112 trees were searched for the host ant *Camponotus* sp. nr. *terebrans.* The area covered and locations of trees sampled is shown in Figure 2.

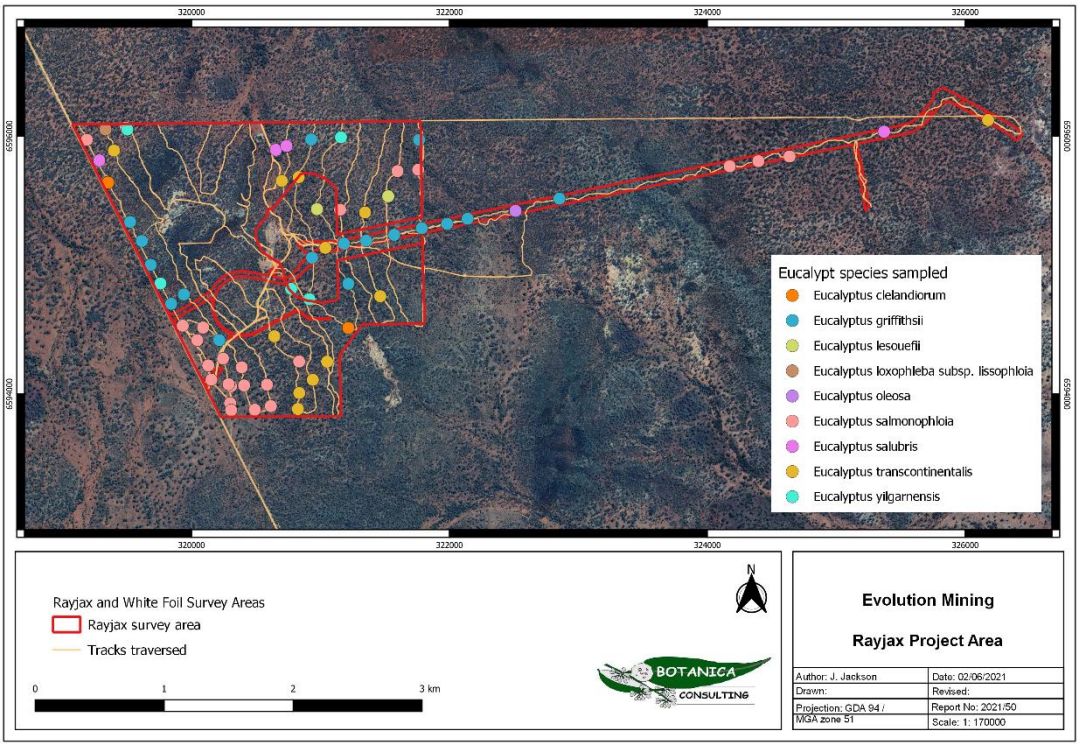

Figure 2. Map showing the tracks traversed and trees sampled within the Rayjax survey area.

Nine species of Eucalypt trees were sampled, with the numbers of each species sampled presented in Table 1. 47 *Eucalyptus salmonophloia* were sampled, and these were most abundant in the southwest and northeast corners of the survey area, consistent with the vegetation mapping done by Botanica in October 2020. Only seven *Eucalyptus salubris* trees were sampled, reflecting the scarcity of that species in the survey area. *Eucalyptus transcontinentalis* and *E. griffithsii* were common throughout the area and this is reflected in the number of these trees sampled, yet no ants were found at the base of these trees. In many areas no trees were sampled, and this was due to there not being any smooth barked Eucalypts being present in those general areas.

Table 1. Eucalypt species sampled and the number of each sampled in the Rayjax survey area.

Eucalypt species	# of each sampled
Eucalyptus clelandiorum	3
Eucalyptus griffithsii	23
Eucalyptus lesouefii	2
Eucalyptus loxophleba subsp. *lissophloia*	2
Eucalyptus oleosa	1
Eucalyptus salmonophloia	47
Eucalyptus salubris	7
Eucalyptus transcontinentalis	20
Eucalyptus yilgarnensis	7
Total	112

A colony of *Camponotus* sp. nr. *terebrans* was found in the northwest corner of the survey area (51J 319501mE 6596050mN). Less than 10 ants were seen at this location, suggesting it was a small colony. These ants were collected and verified by Greg Harewood, Zoologist who has conducted several ant and ABAB butterfly surveys in the Goldfields in recent years. The ants were identified using a reference collection of specimens obtained from a known colony at Marvel Loch.

This small colony was found at the base of a *Eucalyptus yilgarnensis*. This Eucalypt is typically a mallee that grows to about 6 m high. The bark is usually rough, fibrous, or flaky at the base of the trunk, this is known as a 'stocking', and the rest of the trunk is smooth above (DBCA, 2021b). In this case, this *E. yilgarnensis* was mostly smooth barked and did not have a stocking (Figure 3). Four other *E. yilgarnensis* were surveyed and no other *Camponotus* sp. nr. *terebrans* were found (Figure 4).

Figure 3. Photo showing two *Eucalyptus yilgarnensis* trees. The tree on the left is typical of the species, having a 'stocking'. The tree on the right has no stocking, and this was where the *Camponotus* sp. nr. *terebrans* ants were found.

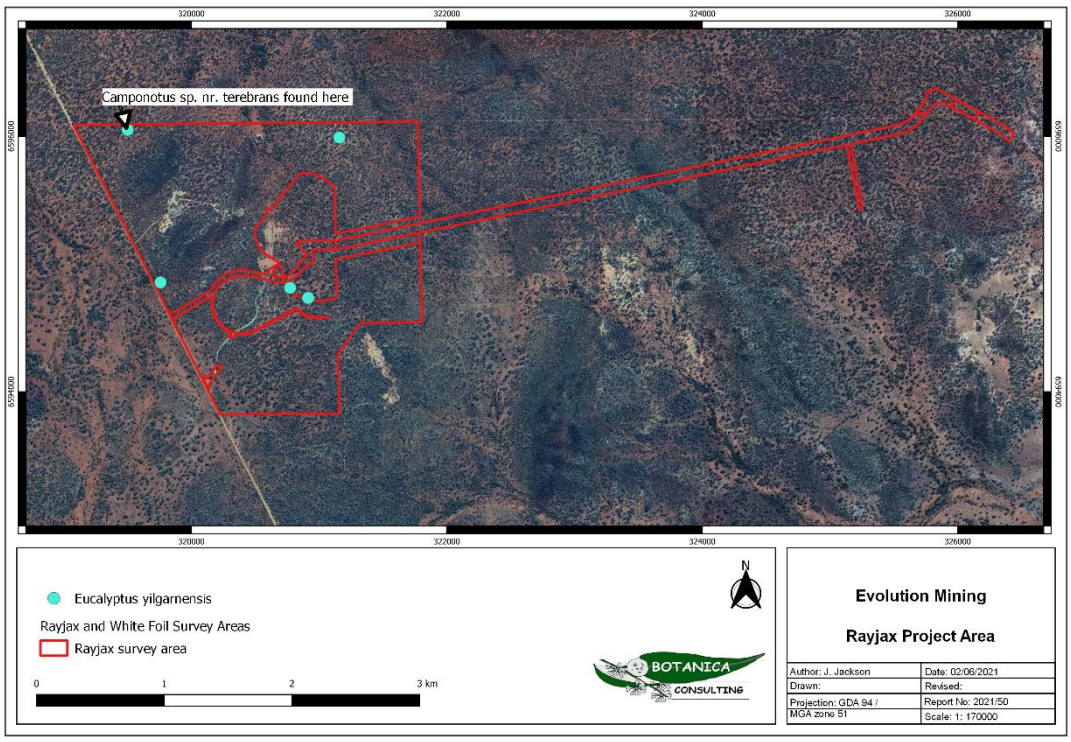

Figure 4. Map showing where a small colony of *Camponotus* sp. nr. *terebrans* was found.

3.2 Inland Hairstreak

A total of 15 *Acacia tetragonophylla* were searched for the presence of larvae of the inland hairstreak and the ground surrounding these plants was dug up to search for any Froglet ants. No *Senna artemisioides* subsp. × *coriacea* were seen in the survey area.

Nothing that appeared to be larvae or Froglet ants were seen on any of the *Acacia tetragonophylla.*

4 CONCLUSIONS AND RECOMMENDATIONS

A small colony of *Camponotus* sp. nr. *terebrans* was found in the northwestern corner of the Rayjax survey area. According to the DBCA survey guidelines for the ABAB, a survey should now be conducted for the presence of the ABAB. However these guidelines suggest the survey for the ABAB should be done in fine weather with a forecast maximum temperature ≥23ºC.

If Evolution are to go ahead with the Rayjax project, it is recommended that:

- A buffer of at least 50 m be put in place around the known colony of *Camponotus* sp. nr. *terebrans* ants.
- Survey the area in Spring for the presence of the ABAB.

For future surveys, it is recommended that *Eucalyptus yilgarnensis* trees are sampled in addition to *E. salmonophloia* and *E. salubris*.

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Spectrum Ecology. (2020). *Binduli north expansion project: desktop report review.* Prepared for Talis, Norton Gold Fields

Appendix 1. Raw data

Waypoint	Date	to Zone	Easting	Northing	Tree species	DBH (m)	Ants present Y/N	Photo #
527	26/05/2021 1:19	51J	320299	6593929	*Eucalyptus salmonophloia*	1	N	162
527	26/05/2021 1:19	51J	320299	6593929	*Eucalyptus salmonophloia*	0.7	N	
528	26/05/2021 1:22	51J	320306	6593875	*Eucalyptus salmonophloia*	0.9	N	163
528	26/05/2021 1:22	51J	320306	6593875	*Eucalyptus salmonophloia*	0.8	N	
529	26/05/2021 1:27	51J	320306	6594060	*Eucalyptus salmonophloia*	0.8	N	164
529	26/05/2021 1:27	51J	320306	6594060	*Eucalyptus salmonophloia*	0.6	N	
530	26/05/2021 1:29	51J	320287	6594075	*Eucalyptus salmonophloia*	0.65	N	165
530	26/05/2021 1:29	51J	320287	6594075	*Eucalyptus salmonophloia*	0.5	N	
531	26/05/2021 1:32	51J	320244	6594274	*Eucalyptus salmonophloia*	0.55	N	166
531	26/05/2021 1:32	51J	320244	6594274	*Eucalyptus salmonophloia*	0.5	N	
532	26/05/2021 1:39	51J	320214	6594418	*Eucalyptus griffithsii*	0.35	N	167
532	26/05/2021 1:39	51J	320214	6594418	*Eucalyptus griffithsii*	0.2	N	
533	26/05/2021 1:45	51J	320089	6594515	*Eucalyptus salmonophloia*	1	N	168
533	26/05/2021 1:45	51J	320089	6594515	*Eucalyptus salmonophloia*	0.7	N	
534	26/05/2021 1:49	51J	319931	6594529	*Eucalyptus salmonophloia*	.7, .35	N	169
534	26/05/2021 1:49	51J	319931	6594529	*Eucalyptus salmonophloia*	0.65	N	
535	26/05/2021 1:55	51J	320044	6594417	*Eucalyptus salmonophloia*	.4 x 3	N	170
535	26/05/2021 1:55	51J	320044	6594417	*Eucalyptus salmonophloia*	0.5	N	
536	26/05/2021 2:01	51J	320129	6594221	*Eucalyptus salmonophloia*	.9, .25	N	171
536	26/05/2021 2:01	51J	320129	6594221	*Eucalyptus salmonophloia*	.4, .3	N	
537	26/05/2021 2:08	51J	320153	6594110	*Eucalyptus salmonophloia*	1.2	N	172
537	26/05/2021 2:08	51J	320153	6594110	*Eucalyptus salmonophloia*	0.7	N	
538	26/05/2021 2:17	51J	319841	6594699	*Eucalyptus griffithsii*	.35, .2, .2	N	173
538	26/05/2021 2:17	51J	319841	6594699	*Eucalyptus griffithsii*	.3, .2	N	
539	26/05/2021 2:21	51J	319758	6594856	*Eucalyptus yilgarnensis*	0.15	N	174
539	26/05/2021 2:21	51J	319758	6594856	*Eucalyptus yilgarnensis*	0.2	N	
540	26/05/2021 2:30	51J	319682	6595001	*Eucalyptus griffithsii*	0.3	N	179
540	26/05/2021 2:30	51J	319682	6595001	*Eucalyptus griffithsii*	0.25	N	
541	26/05/2021 2:34	51J	319614	6595185	*Eucalyptus griffithsii*	.1, .1	N	180
541	26/05/2021 2:34	51J	319614	6595185	*Eucalyptus griffithsii*	.15, .2	N	
542	26/05/2021 2:38	51J	319523	6595333	*Eucalyptus griffithsii*	.15, .1	N	182, 181
542	26/05/2021 2:38	51J	319523	6595333	*Eucalyptus griffithsii*	.1, x3	N	
543	26/05/2021 2:43	51J	319451	6595474	*No trees to sample*			-
544	26/05/2021 2:45	51J	319353	6595638	*Eucalyptus clelandiorum*	0.25	N	183
544	26/05/2021 2:45	51J	319353	6595638	*Eucalyptus clelandiorum*	0.3	N	
545	26/05/2021 2:49	51J	319284	6595810	*Eucalyptus salubris*	.35, .3	N	184
545	26/05/2021 2:49	51J	319284	6595810	*Eucalyptus salubris*	0.3	N	
546	26/05/2021 2:54	51J	319187	6595970	*Eucalyptus salmonophloia*	.25, .2	N	185
546	26/05/2021 2:54	51J	319187	6595970	*Eucalyptus salmonophloia*	0.4	N	
547	26/05/2021 3:01	51J	319332	6596050	*Eucalyptus loxophleba* subsp. *lissophloia*	.35, .25	N	186
547	26/05/2021 3:01	51J	319332	6596050	*Eucalyptus loxophleba* subsp. *lissophloia*	.2, .2, .15	N	
548	26/05/2021 3:07	51J	319398	6595886	*Eucalyptus transcontinentalis*	0.3	N	187

Waypoint	Date	to Zone	Easting	Northing	Tree species	DBH (m)	Ants present Y/N	Photo #
548	26/05/2021 3:07	51J	319398	6595886	*Eucalyptus transcontinentalis*	0.25	N	
549	26/05/2021 3:12	51J	319460	6595743	No trees to sample			188
550	26/05/2021 3:16	51J	319673	6595448	No trees to sample			189
551	26/05/2021 3:19	51J	319787	6595191	No trees to sample			190
552	26/05/2021 3:23	51J	319940	6594771	*Eucalyptus griffithsii*	.15 x3	N	191
552	26/05/2021 3:23	51J	319940	6594771	*Eucalyptus griffithsii*	.15 x3	N	
553	26/05/2021 3:33	51J	320389	6594207	*Eucalyptus salmonophloia*	0.7	N	192
553	26/05/2021 3:33	51J	320389	6594207	*Eucalyptus salmonophloia*	0.45	N	
554	26/05/2021 3:38	51J	320407	6594066	*Eucalyptus salmonophloia*	0.8	N	193
554	26/05/2021 3:38	51J	320407	6594066	*Eucalyptus salmonophloia*	0.6	N	
555	26/05/2021 3:44	51J	320490	6593878	*Eucalyptus salmonophloia*	0.5	N	194
555	26/05/2021 3:44	51J	320490	6593878	*Eucalyptus salmonophloia*	.4, .2	N	
556	26/05/2021 3:49	51J	320614	6593906	*Eucalyptus salmonophloia*	5 trunks	N	195
556	26/05/2021 3:49	51J	320614	6593906	*Eucalyptus salmonophloia*	0.5	N	
557	26/05/2021 3:52	51J	320584	6594072	*Eucalyptus salmonophloia*	.3 x2	N	196
557	26/05/2021 3:52	51J	320584	6594072	*Eucalyptus salmonophloia*	0.4	N	
558	26/05/2021 3:56	51J	320527	6594260	*No trees to sample*			197
559	26/05/2021 4:22	51J	319490	6596064	*Eucalyptus salmonophloia*	0.5	N	198
560	26/05/2021 4:26	51J	319501	6596050	*Eucalyptus yilgarnensis*	0.3	Possible, 3 ants collected	199-202
561	26/05/2021 5:20	51J	320641	6594447	*Eucalyptus transcontinentalis*	0.25	N	203
561	26/05/2021 5:20	51J	320641	6594447	*Eucalyptus transcontinentalis*	0.2	N	
562	26/05/2021 5:27	51J	320834	6594252	*Eucalyptus salmonophloia*	7 trunks	N	204
562	26/05/2021 5:27	51J	320834	6594252	*Eucalyptus salmonophloia*	0.6	N	
563	26/05/2021 5:32	51J	320835	6594007	*Eucalyptus transcontinentalis*	0.25	N	205
563	26/05/2021 5:32	51J	320835	6594007	*Eucalyptus transcontinentalis*	0.3	N	
564	26/05/2021 5:38	51J	320824	6593884	*Eucalyptus transcontinentalis*	0.25	N	209
564	26/05/2021 5:38	51J	320824	6593884	*Eucalyptus transcontinentalis*	0.3	N	
565	26/05/2021 5:44	51J	320940	6594110	*Eucalyptus transcontinentalis*	0.55	N	210
565	26/05/2021 5:44	51J	320940	6594110	*Eucalyptus transcontinentalis*	0.3	N	
566	26/05/2021 5:56	51J	320772	6594814	*Eucalyptus yilgarnensis*	0.2	N	211
566	26/05/2021 5:56	51J	320772	6594814	*Eucalyptus yilgarnensis*	.2, .15	N	
567	26/05/2021 6:04	51J	321051	6594250	*Eucalyptus transcontinentalis*	.35, .2	N	212
567	26/05/2021 6:04	51J	321051	6594250	*Eucalyptus transcontinentalis*	0.3	N	
568	26/05/2021 6:40	51J	320654	6595892	*Eucalyptus salubris*	.35, x7	N	213, 214
568	26/05/2021 6:40	51J	320654	6595892	*Eucalyptus salubris*	0.6	N	
569	27/05/2021 0:48	51J	321037	6595133	*Eucalyptus transcontinentalis*	0.4	N	
570	27/05/2021 0:53	51J	321182	6595165	*Eucalyptus griffithsii*	0.45	N	
571	27/05/2021 0:58	51J	321354	6595188	*Eucalyptus griffithsii*	.35, .2	N	
572	27/05/2021 1:02	51J	321571	6595233	*Eucalyptus griffithsii*	.4 x3	N	
573	27/05/2021 1:06	51J	321785	6595285	*Eucalyptus griffithsii*	.25, .2	N	
574	27/05/2021 1:10	51J	321981	6595319	*Eucalyptus griffithsii*	.1 x3	N	
575	27/05/2021 1:14	51J	322140	6595358	*Eucalyptus griffithsii*	0.25	N	
576	27/05/2021 1:18	51J	322332	6595392	*Acacia tetragonophylla*		N	

Waypoint	Date	to Zone	Easting	Northing	*Tree species*	DBH (m)	Ants present Y/N	Photo #
577	27/05/2021 1:22	51J	322512	6595419	*Eucalyptus oleosa*		N	
578	27/05/2021 1:25	51J	322494	6595402	*Acacia tetragonophylla*		N	Phone
579	27/05/2021 1:26	51J	322479	6595389	*Acacia tetragonophylla*		N	
580	27/05/2021 1:38	51J	321721	6595248	*Acacia tetragonophylla*		N	
581	27/05/2021 2:30	51J	322852	6595514	*Eucalyptus griffithsii*	0.3	N	
582	27/05/2021 2:37	51J	323695	6595659	*Acacia tetragonophylla x 4*		N	
583	27/05/2021 2:42	51J	324173	6595764	*Eucalyptus salmonophloia*	0.4	N	226
583	27/05/2021 2:42	51J	324173	6595764	*Eucalyptus salmonophloia*	0.6	N	
584	27/05/2021 2:47	51J	324395	6595804	*Eucalyptus salmonophloia*	0.6	N	227
584	27/05/2021 2:47	51J	324395	6595804	*Eucalyptus salmonophloia*	.6, .4	N	
585	27/05/2021 2:53	51J	324636	6595841	*Eucalyptus salmonophloia*	0.9	N	228
585	27/05/2021 2:53	51J	324636	6595841	*Eucalyptus salmonophloia*	0.7	N	
586	27/05/2021 3:03	51J	325268	6595458	*Eucalyptus longicornis, not sampled*		N	
587	27/05/2021 3:10	51J	325370	6596033	*Eucalyptus salubris*	0.65	N	231
587	27/05/2021 3:10	51J	325370	6596033	*Eucalyptus salubris*	0.6	N	
588	27/05/2021 3:15	51J	325682	6596150	*Track*		N	
589	27/05/2021 3:19	51J	326177	6596123	*Eucalyptus transcontinentalis*	0.3	N	232
589	27/05/2021 3:19	51J	326177	6596123	*Eucalyptus transcontinentalis*	0.3	N	
590	27/05/2021 3:33	51J	321244	6596113	*Acacia tetragonophylla*		N	
591	27/05/2021 3:38	51J	321151	6595427	*Eucalyptus salmonophloia*	0.7	N	233
592	27/05/2021 4:06	51J	321203	6595121	*Acacia tetragonophylla x2*		N	
593	27/05/2021 4:10	51J	321382	6594715	*Acacia tetragonophylla*		N	
594	27/05/2021 4:14	51J	321463	6594758	*Eucalyptus transcontinentalis*	0.5	N	234
595	27/05/2021 4:21	51J	321345	6595406	*Eucalyptus transcontinentalis*	0.65	N	235
595	27/05/2021 4:21	51J	321345	6595406	*Eucalyptus transcontinentalis*	0.5	N	
596	27/05/2021 4:32	51J	321597	6595727	*Eucalyptus salmonophloia*	1	N	236
596	27/05/2021 4:32	51J	321597	6595727	*Eucalyptus salmonophloia*	0.6	N	
597	27/05/2021 4:37	51J	321524	6595532	*Eucalyptus lesouefii*	0.65	N	237
598	27/05/2021 4:51	51J	321770	6595562	*Acacia tetragonophylla x3*		N	
599	27/05/2021 4:53	51J	321757	6595738	*Eucalyptus salmonophloia*	1	N	238
599	27/05/2021 4:53	51J	321757	6595738	*Eucalyptus salmonophloia*	0.7	N	
600	27/05/2021 4:58	51J	321763	6595969	*Eucalyptus salmonophloia*	0.6	N	239
600	27/05/2021 4:58	51J	321763	6595969	*Eucalyptus griffithsii*	0.25	N	
1132	27/05/2021 0:49	51J	320699	6595651	*Eucalyptus transcontinentalis*	0.3	N	215
1133	27/05/2021 0:55	51J	320736	6595922	*Eucalyptus salubris*	0.5	N	216
1134	27/05/2021 1:01	51J	320927	6595972	*Eucalyptus griffithsii*	0.2	N	217
1135	27/05/2021 1:07	51J	320830	6595681	*Eucalyptus transcontinentalis*	0.4	N	
1136	27/05/2021 1:14	51J	320934	6595056	*Eucalyptus griffithsii*	0.5	N	218
1137	27/05/2021 1:20	51J	320913	6594734	*Eucalyptus yilgarnensis*	0.3	N	219
1138	27/05/2021 1:25	51J	321216	6594512	*Eucalyptus clelandiorum*	0.4	N	220
1139	27/05/2021 1:33	51J	321216	6594854	*Eucalyptus griffithsii*	0.3	N	221
1140	27/05/2021 1:40	51J	320972	6595432	*Eucalyptus lesouefii*	0.9	N	222
1141	27/05/2021 1:55	51J	321158	6595989	*Eucalyptus yilgarnensis*	0.2	N	223