Level 1 Flora & Fauna Survey of the

Julius Project

Proposed Haul Road

(L53/206)

Prepared for

Echo Resources Limited

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Version 1

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Glossary

Acronym	Description
BA	Birdlife Australia (Formerly RAOU, Birds Australia).
BAM Act	Biosecurity and Agriculture Management Act 2007, WA Government.
BC	Botanica Consulting.
BC Act	*Biodiversity Conservation Act* (2016). WA Government.
BOM	Bureau of Meteorology.
CALM	Department of Conservation and Land Management (now DPaW), WA Government.
CAMBA	China Australia Migratory Bird Agreement 1998.
DAFWA	Department of Agriculture and Food, WA Government.
DEC	Department of Environment and Conservation (now DPaW), WA Government.
DEP	Department of Environment Protection (now DER), WA Government.
DEWHA	Department of the Environment, Water, Heritage and the Arts (now DotE), Australian Government
DER	Department of Environment Regulation (formerly DEC, DoE), WA Government.
DMP	Department of Mines and Petroleum (formerly DoIR), WA Government.
DoE	Department of Environment (now DER/DPaW), WA Government.
DoIR	Department of Industry and Resources (now DMP), WA Government.
DotEE	Department of the Environment and Energy (formerly DSEWPaC, DEWHA, DEH and DotE), Australian Government.
DPaW	Department of Parks and Wildlife (formerly DEC, CALM, DoE), WA Government.
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities (now DotEE, formerly DEH, DEWHA), Australian Government.
Echo	Echo Resources Limited
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 metres).
IBRA	Interim Biogeographic Regionalisation 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	Kilometre (1,000 metres).
MVG	Major Vegetation Groups.
NVIS	National Vegetation Information System.
OEPA	Office of the Environmental Protection Authority, WA Government.
PEC	Priority Ecological Community.
RAOU	Royal Australia Ornithologist Union.
ROKAMBA	Republic of Korea-Australia Migratory Bird Agreement 2007.
SRE	Short Range Endemic.
SSC	Species Survival Commission, International.
TEC	Threatened Ecological Community.
WA	Western Australia.

Acronym	Description
WAHERB	Western Australian Herbarium.
WAM	Western Australian Museum, WA Government.
WC Act	Wildlife Conservation Act 1950, WA Government.

Executive Summary

Botanica Consulting was commissioned by Echo Resources Limited to undertake a Level 1 flora and fauna survey of the Julius Project haul road (referred to as the 'survey area'), located approximately 76km south-east of Wiluna, Western Australia. The survey was conducted on the 18th of February 2017 covering an area of approximately 109 ha. The survey area encompasses the entire boundary of L53/206, which is 28 km in length by 40 metres width.

Eight broad vegetation communities were identified within the survey area. These communities were identified within five landform types and comprised of one major vegetation group according to the National Vegetation Information System, Major Vegetation Group definition. These communities were represented by a total of 17 Families, 29 Genera and 65 Taxa. The broad scale terrestrial fauna habitats within the survey area have been identified as comprising a mosaic of clay-loam plains, drainage depressions, quartz-rocky plains, rocky hillslopes and sand-loam plains. With respect to native vertebrate fauna, 24 mammal (including eight bat species), 100 bird, 85 reptile and eight frog species have previously been recorded in the general area, some of which have the potential to occur in or utilise the survey area at times.

No Threatened Flora taxa, pursuant to subsection (2) of section 23F of the State *Wildlife Conservation (WC)* Act 1950[1], the Commonwealth *Environment Protection and Biodiversity Conservation* (EPBC Act) 1999 and as listed by the Department of Parks and Wildlife (DPaW) were identified within the survey area. No Priority Flora taxa, as listed by the DPaW, were identified within the survey area. No threatened, migratory or priority fauna taxa were positively identified as being present during the field survey however the literature review identified 11 species as having been previously recorded or as being potentially present in the general vicinity of the survey area. The current status on site and/or in the general area of some species is difficult to determine, however, based on the habitats present and, in some cases, recent nearby records, two species of conservation significance (peregrine falcon and rainbow bee-eater) can be regarded as possibly utilising the survey area for some purpose at times.

Impacts on these species and fauna in general (including invertebrates) that may occur as a consequence of development at the site is considered unlikely to be significant. Populations of all species can be expected to persist in these areas with no change in any one species conservation status being significantly affected. This conclusion is primarily based on the relatively small size of the impact footprint and the extensive habitat connectivity with adjoining areas. Impacts on fauna and fauna habitat are therefore anticipated to be localised, small/negligible and as a consequence manageable.

None of the vegetation communities/ habitats within the survey area were found to have National Environmental Significance as defined by the Commonwealth EPBC Act 1999. No Threatened Ecological Communities (TEC) pursuant to Commonwealth or State legislation were recorded within the survey area. No Priority Ecological Communities (PEC) were recorded within the survey area. The survey area is not located within an Environmentally Sensitive Area (ESA) as listed under the *Environmental Protection* (EP Act) 1986 or Schedule 1 Area as described in Regulation 6 and Schedule 1, clause 4 of the *Environmental Protection (Clearing of Native Vegetation) Regulations* (EP Regulations) 2004. The survey area is not located within a listed or proposed conservation area managed by DPaW. The nearest DPaW managed land is the Wanjarri Nature Reserve, which is listed as a "Class A" Nature Reserve, located approximately 26km south-west of the survey area.

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[1] *Biodiversity Conservation Act 2016* received assent on 21 September 2016 with Parts of the Act coming into effect on 3 December 2016. Once fully enacted with enabling subsidiary regulations, it will replace the *Wildlife Conservation Act 1950*.

Based on the vegetation condition rating scale adapted from Keighery, 1994 and Trudgen, 1988 (ranging from ‘pristine’ to ‘completely degraded’) three vegetation communities were rated as ‘good’ and the remaining five vegetation communities were rated as ‘very good’. No introduced taxa were identified within the survey area.

1 Introduction

1.1 Project Description

Botanica Consulting (BC) was commissioned by Echo Resources Limited (Echo) to undertake a Level 1 flora and fauna survey of the Julius Project proposed haul road (referred to as the 'survey area'), located approximately 76km south-east of Wiluna, Western Australia, Western Australia (Figure 1). The survey area encompasses the entire boundary of L53/206, which is 28 km in length by 40 metres width. The survey was conducted on the 18th February 2017 covering an area of approximately 109 ha.

1.2 Survey Objectives

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

- Gather background information on flora and vegetation in the target area (literature review, database and map-based searches);
- Compile broad scale vegetation community flora maps and species list of the survey area;
- Document and map locations of any Threatened or Priority listed flora species located;
- Assess the regional and local conservation status of plant species and ecological communities within the survey area; and
- Identify and map occurrences of any "Declared and Environmental" weeds within the survey area.

The fauna assessment was conducted in accordance with the requirements of a Level 1 terrestrial fauna survey as defined in EPA Guidance Statement 56 (EPA 2004). 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;
- Document and map locations of any Threatened or Priority listed fauna species located; and
- Assess the regional and local conservation status of fauna species and fauna habitats within the survey area.

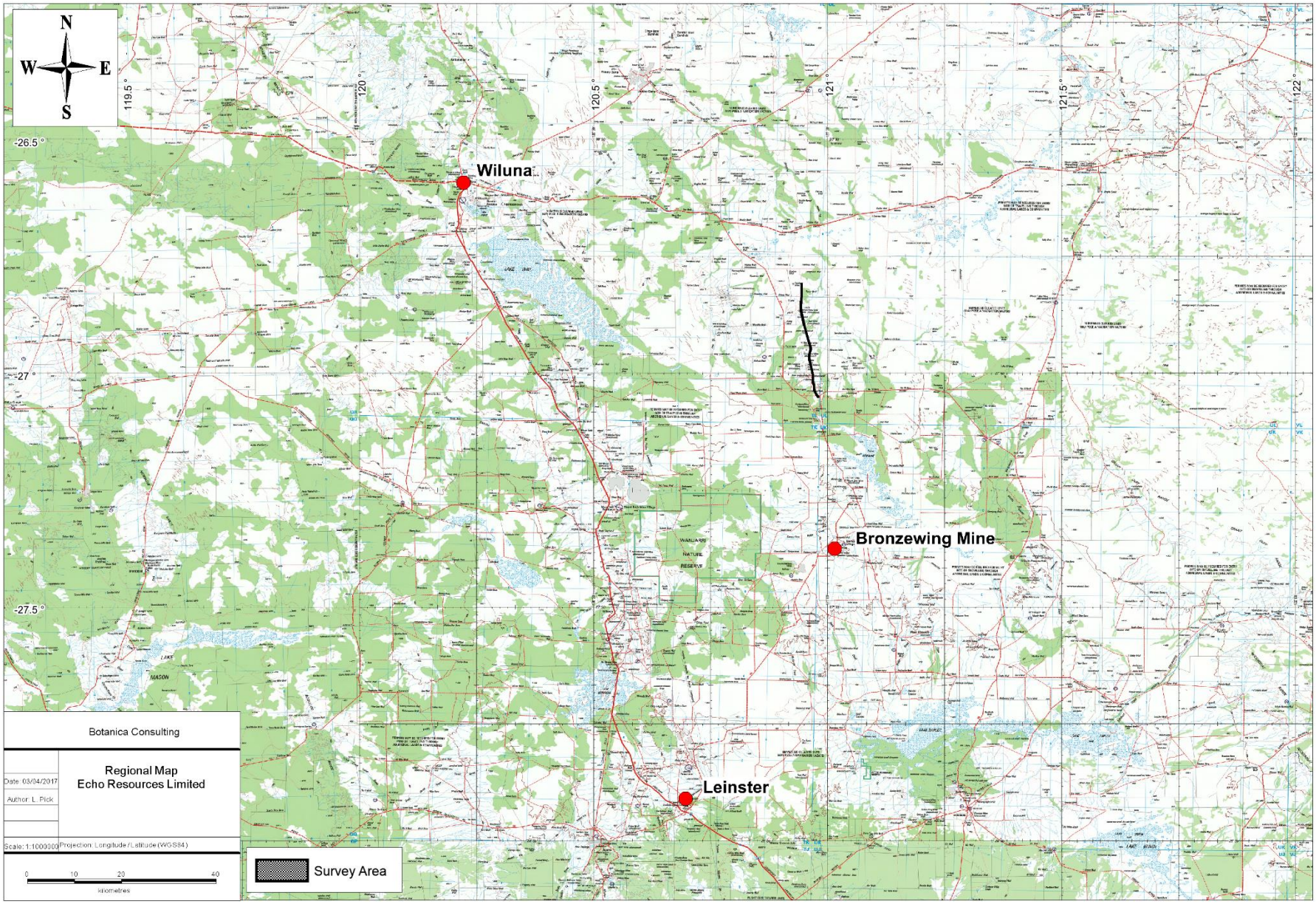

Figure 1: Regional map of the survey area

2 Regional Biophysical Environment

2.1 Regional Environment

The survey area lies within the Austin Botanical District of the Eremaean Province of WA. The Austin Botanical District consists of predominantly of Mulga low woodland on plains and reduces to scrub on hills (Beard, 1990).

Based on the Interim Biogeographic Regionalisation of Australia (IBRA) the Eremaean Province is divided into IBRA regions with the survey area located within the Murchison Bioregion of Western Australia. The Murchison Bioregion is further divided into two subregions, Eastern Murchison (MUR1) and Western Murchison (MUR2) with the survey area located within the Eastern Murchison subregion (Figure 2).

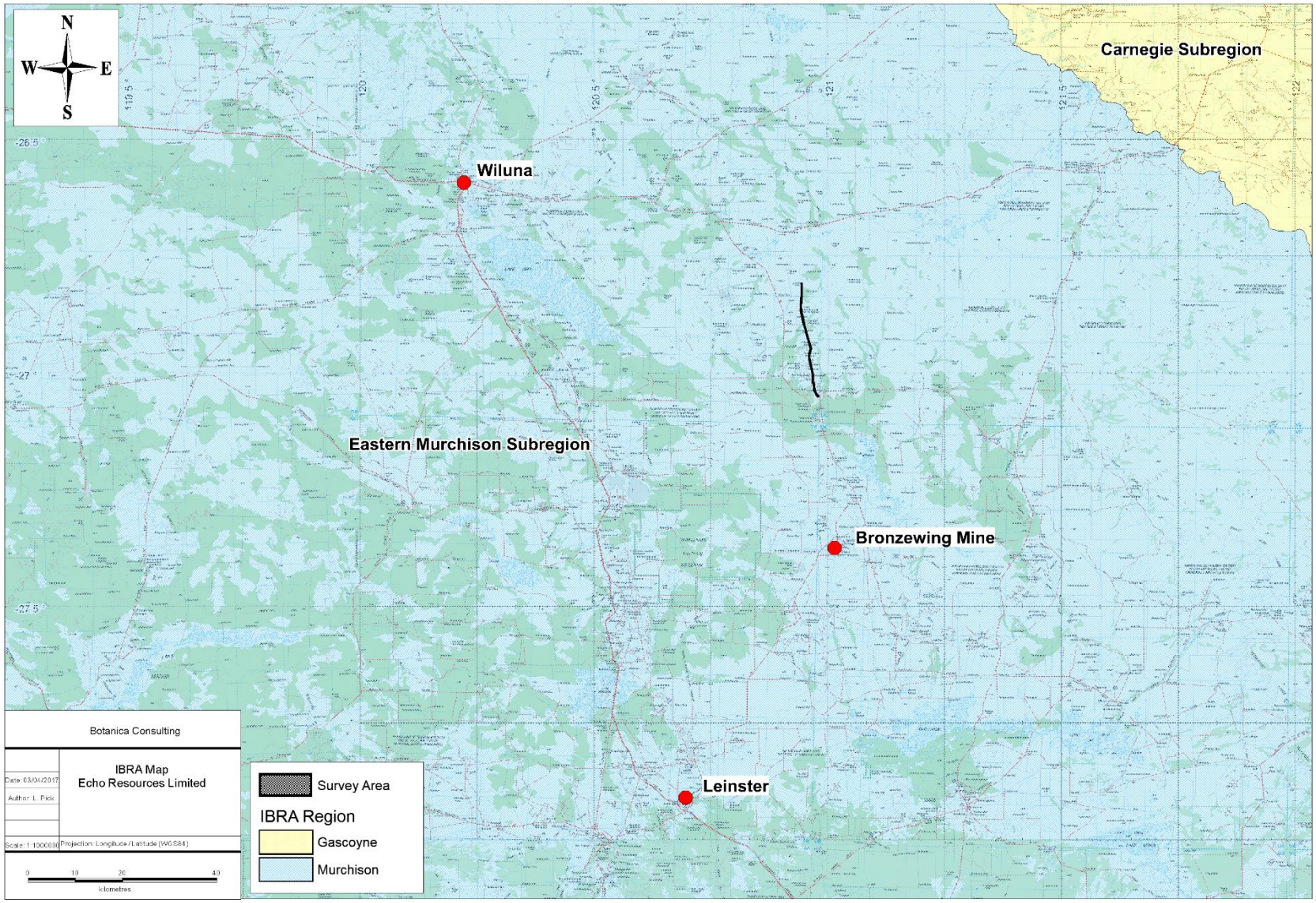

Figure 2: Map of IBRA Regions in relation to the survey area

2.2 Vegetation

Vegetation of the Eastern Murchison subregion in the Austin Botanical District is predominantly Mulga low woodlands on plains, often rich in ephemerals, which reduce to scrub on hills. It is also characterised by hummock grasslands, Saltbush shrublands and Samphire shrublands (Beard, 1990; Cowan, 2001).

The DAFWA GIS file (2011) indicates that the survey area is located within Pre-European Beard vegetation associations Wiluna 18, 29 and 39 (Figure 3). The extent of these associations as described by the DAFWA is shown in Table 1.

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). Development within the survey area will not significantly reduce the extent of these vegetation associations.

Table 1: Remaining Beard Vegetation Associations within the survey area

Vegetation Association	Pre-European Extent (ha)	Current Extent (ha)	Pre-European extent remaining (%)	% of Current extent within DPaW managed lands	Vegetation Description (Beard, 1990)
Wiluna 18	4273509.96	4256038.43	99.59	9.59	Low woodland; mulga (*Acacia aneura*)
Wiluna 29	772,807.52	772,613.53	99.97	10.87	Sparse low woodland; mulga, discontinuous in scattered groups
Wiluna 39	411,278.07	406,212.45	98.77	6.47	Shrublands; mulga scrub

Figure 3: Map of Pre-European Vegetation Associations in the vicinity of the survey area

2.3 Topography & Soils

The Eastern Murchison subregion lies on the northern parts of the 'Southern Cross' and 'Eastern Goldfields' Terrains of the Yilgarn Craton. This subregion is characterised by its internal drainage and extensive area of elevated red desert sandplains (Cowan, 2001). Another important feature of the system is the Salt Lake systems associated with the occluded Paleo within drainage system. Beard (1990) describes the topography of the region as undulating with occasional ranges of low hills and extensive sandplains located in the East. The dominant soil type is a shallow earthy loam, overlying red-brown hardpan. Red earthy sands can be found on the sandplains.

The survey area lies within the Murchison Province, which consists of Hardpan wash plains and sandplains (with some stony plains, hills, mesas and salt lakes) on the granitic rocks and greenstone of the Yilgarn Craton. The Murchison Province is located in the inland Mid-west and northern Goldfields between three Springs, the Gascoyne River, Wiluna, Cosmo Newberry and Menzies Soil types are dominated by red loamy earths, red sandy earths, red shallow loams, red deep sands and red-brown hardpan shallow loams with some red shallow sands and red shallow sandy duplexes present. Vegetation communities are dominated by Mulga shrublands with spinifex grasslands and some bowgada shrublands, Eucalypt woodlands and halophytic shrublands (DAFWA, 2014).

The Murchison province is further divided into seven soil-landscape zones, with the survey area located within the Salinaland Plains Zone (279). The Salinaland Plains Zone is characterised by sandplains (with hardpan wash plains and some mesas, stony plains and salt lakes) on granitic rocks (and some greenstone) of the Yilgarn Craton. Soils are characterised by red sandy earths, red deep sands, red shallow loams and red loamy earths with some red-brown hardpan shallow loams, Salt Lake soils and red shallow sandy duplexes. Vegetation consists of Mulga shrublands with spinifex grasslands (and some halophytic shrublands and Eucalypt woodlands). This zone is located in the northern Goldfields extending from Lakes Barlee and Lake Ballard to Wiluna and Laverton (Tille, 2016). The Salinaland Plains Zone is further divided into soil landscape systems with the survey area located within five soil landscape systems as shown in Table 2 and Figure 4 (DAFWA, 2014).

Table 2: Soil Landscape Systems within the survey area

Soil Landscape System	Mapping Unit Code	Description
Ararak System	279Ar	Broad plains with mantles of ironstone gravel supporting mulga shrublands with wanderrie grasses.
Tiger System	279Tg	Gravelly hardpan plains and sandy banks with mulga shrublands and wanderrie grasses.
Trennaman System	279Tn	Sandy hardpan plains and broad drainage zones supporting groved mulga shrublands and wanderrie grasses.
Violet System	279Vi	Gently undulating gravelly plains on greenstone, laterite and hardpan, with low stony rises and minor saline plains; supporting groved mulga and bowgada shrublands and occasionally chenopod shrublands.
Wiluna System	279Wi	Low greenstone hills with occasional lateritic breakaways and broad stony slopes, lower saline stony plains and broad drainage tracts; supporting sparse mulga and other acacia shrublands with patches of halophytic shrubs.

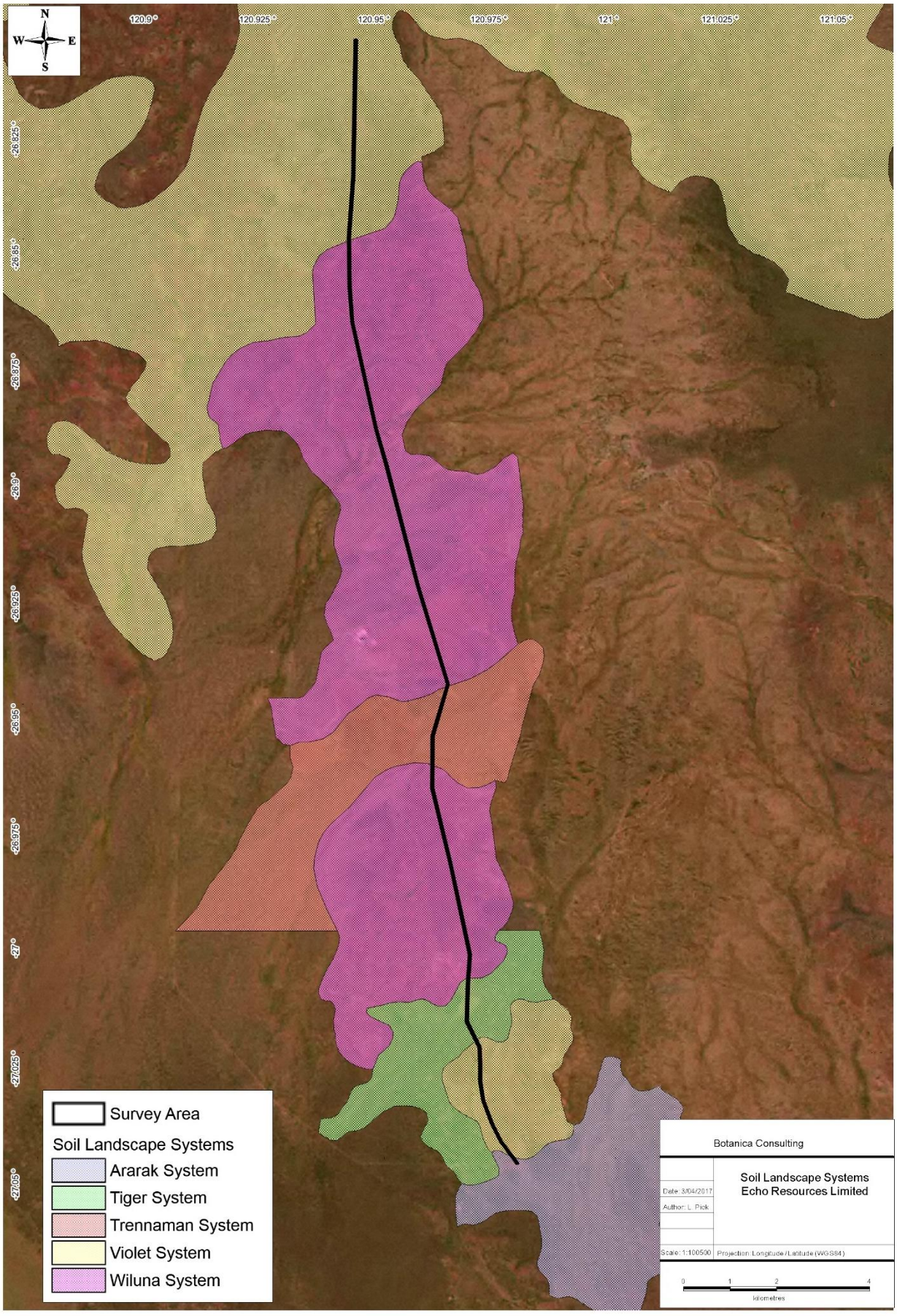

Figure 4: Map of Soil Landscape Systems within the survey area

2.4 Hydrology

According to the Geoscience Australia (2001) drainage/ inland water GIS database, there are no defined drainage lines or inland water sources (lakes/ playas) within the survey area (Figure 5). 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. According to the BOM *Atlas of Groundwater Dependent Ecosystems* (BOM, 2017a) there are no GDE's within the survey area.

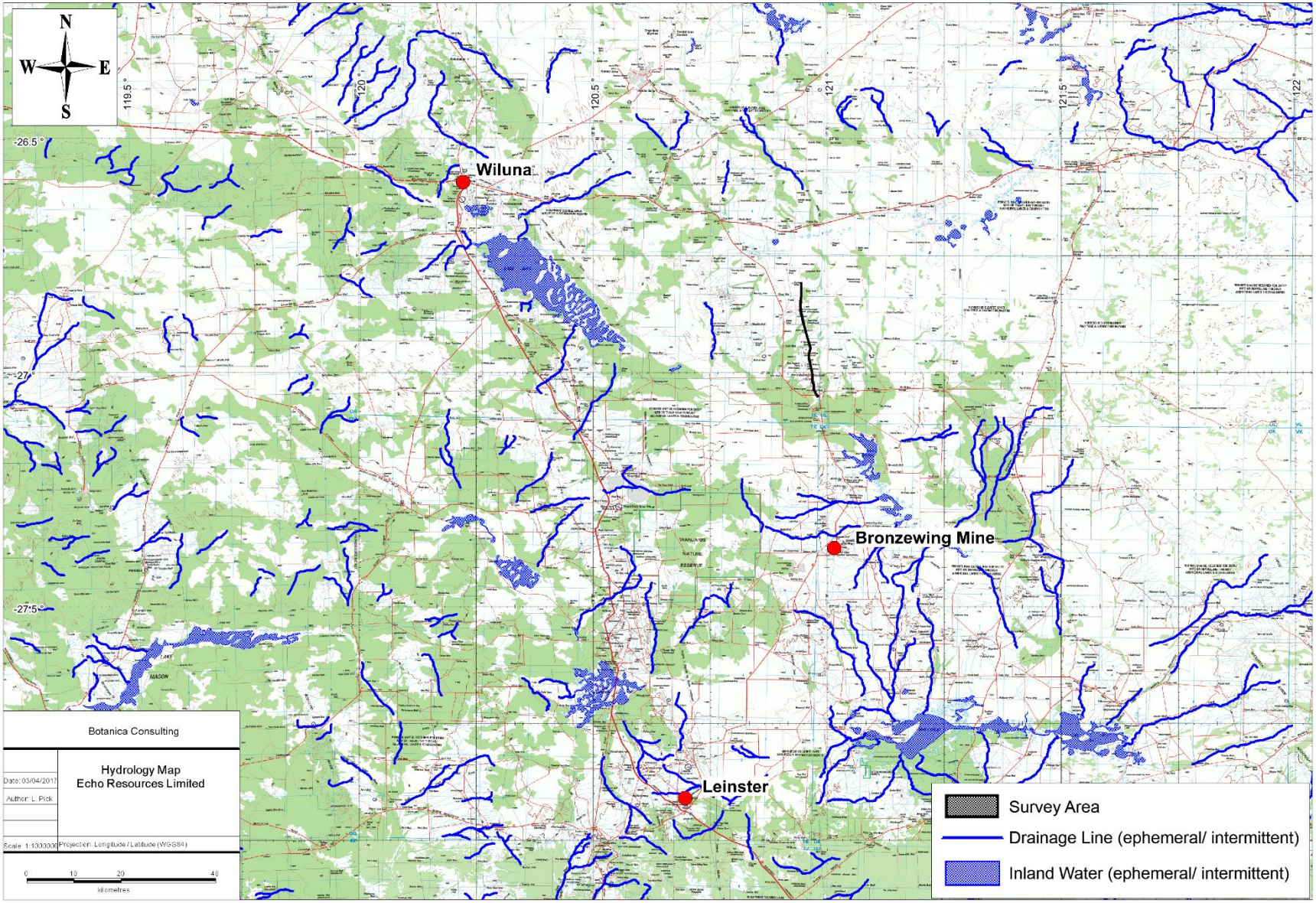

Figure 5: Surface hydrology within the survey area

2.5 Climate

The climate of the Eastern Murchison Subregion is characterised as arid with mainly winter rain averaging approximately 200mm per annum (Cowan, 2001). Monthly rainfall for the nearest active BoM weather station (Millrose Station) located approximately 44km north of the survey area is shown in Figure 6. Rainfall received at Millrose in January 2017, preceding the survey area was above average. Average weather conditions obtained from the Wiluna weather station, located approximately 76km north-west of the survey area is shown in Figure 7 (BOM, 2017b).

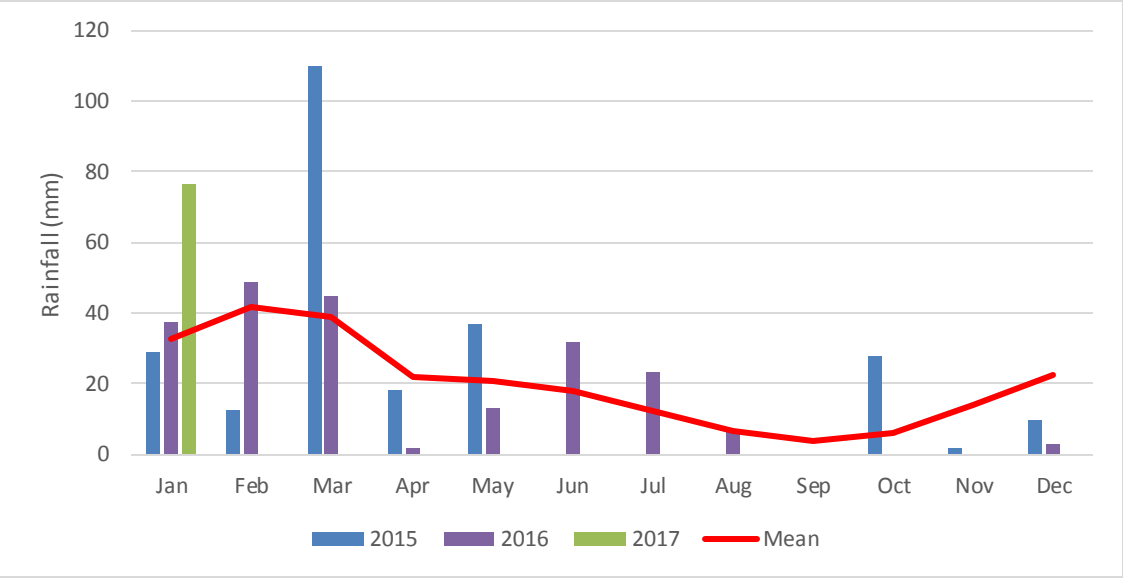

Figure 6: Monthly rainfall from January 2015 to January 2017[2] and mean monthly rainfall (March 1929 to January 2017) for the Millrose weather station #13006 (BOM, 2017b).

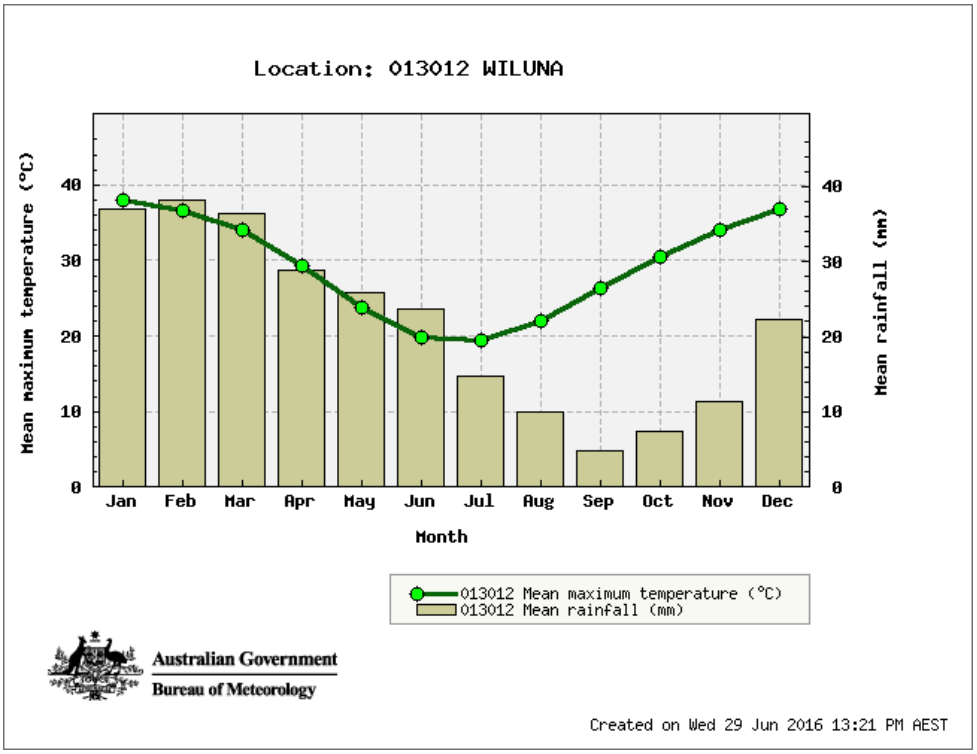

Figure 7: Mean monthly rainfall and maximum temperature for the Wiluna weather station #13012 (BOM, 2017c).

[2] No rainfall data recorded since Jan 2017

2.6 Land Use

The dominant land uses for the Eastern Murchison Subregion include Grazing – native pastures, UCL and Crown Reserves, Mining and Conservation (Cowan, 2001). The survey area is located on the boundary of the Barwidgee Pastoral Lease.

3 Survey Methodology

3.1 Desktop Assessment

Searches of the following databases were undertaken to aid in the compilation of a list of flora taxon within the survey area:

- DPaW's NatureMap Database (DPaW, 2016a); and
- DotEE Protected matters search tool (DotEE, 2016a).

The searches were conducted for an area encompassing a 40 km radius of the centre coordinates – -26.76417 S, 120.94639 E. It should be noted that these lists are based on observations from a broader area than the survey area (40km radius) and therefore may include taxon not present. The databases also often included 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.

Prior to the field survey, a combined search of the DPaW's Flora of Conservation Significance databases (DPaW, 2016b) was undertaken within a 40km radius of the survey area. These significant flora species were examined on the Western Australian Herbarium's (WAHERB) web page prior to the survey, to familiarise staff with their appearance. Locations of Threatened Flora and Priority Flora were overlaid on aerial photography of the area. Vegetation descriptions and available images of the Priority Flora were also obtained from Florabase.

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

- EPBC Act. Administered by the Australian Government (DotEE);
- WC Act. Administered by the WA Government (DPaW);
- 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
- DPaW Priority Flora/ Fauna list. A non-legislative list maintained by DPaW for management purposes.

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

- Japan Australia Migratory Bird Agreement 1981 (JAMBA)[3];
- China Australia Migratory Bird Agreement 1998 (CAMBA);
- Republic of Korea-Australia Migratory Bird Agreement 2007 (ROKAMBA); and

[3] Species listed under JAMBA are also specially protected under Schedule 5 of the WC Act.

- Bonn Convention 1979 (The Convention on the Conservation of Migratory Species of Wild Animals).

All migratory bird species listed in the annexes to these bilateral agreements are protected in Australia as matters of national environmental significance (NES) under the EPBC Act.

Table 3 and Table 4 below provide the definitions of conservation significant flora and fauna.

Table 3: Definitions of Conservation Significant Flora

Code	Category
State categories of threatened and priority species	
T	***Threatened flora*** is flora that has been declared to be 'likely to become extinct or is rare, or otherwise in need of special protection', pursuant to section 23F (2) of the Wildlife Conservation Act.
P1	Priority One – Poorly Known Taxa "Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey."
P2	Priority Two – Poorly Known Taxa "Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but urgently need further survey."
P3	Priority Three – Poorly Known Taxa "Taxa which are known from several populations and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but needs further survey."
P4	Priority Four – Rare Taxa "Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5 – 10 years."
P5	Priority Five-Conservation Dependent Taxa Taxa that are not threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.
Commonwealth categories of threatened species	
Extinct	Taxa where there is no reasonable doubt that the last member of the species has died.
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.
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.
Endangered	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.
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.

Code	Category
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.

Table 4: Definitions of Conservation Significant Fauna

Code	Category
State categories of threatened and priority species	
Schedule 1	Critically Endangered – Threatened species considered to be facing an extremely high risk of extinction in the wild.
Schedule 2	Endangered – Threatened species considered to be facing a very high risk of extinction in the wild.
Schedule 3	Vulnerable – Threatened species considered to be facing a high risk of extinction in the wild.
Schedule 4	Species which have been adequately searched for and there is no reasonable doubt that the last individual has died.
Schedule 5	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 the Bonn Convention, relating to the protection of migratory birds.
Schedule 6	Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened.
Schedule 7	Fauna otherwise in need of special protection to ensure their conservation.
P1	Priority One – Poorly Known Taxa 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 Two – Poorly Known Taxa 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 Three – Poorly Known Taxa 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 Four – Rare, Near Threatened and other species in need of monitoring

Code	Category
	(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 do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. (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	
Extinct	Taxa where there is no reasonable doubt that the last member of the species has died.
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.
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.
Endangered	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.
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.
Near Threatened	Taxa which has been evaluated but does not qualify for CR, EN or VU now but is close to qualifying or likely to qualify in the near future.
Least Concern	Taxa which has been evaluated but does not qualify for CR, EN, VU, or NT but is likely to qualify for NT in the near future.
Data Deficient	Taxa for which there is inadequate information to make a direct or indirect assessment of its risk of extinction based on its distribution and/or population status.

A search of the DPaW PEC and TEC database was also conducted within a 40km radius of the survey area (DPaW, 2016c). Table 5 provides definitions for conservation significant communities.

Table 5: Definitions of Conservation Significant Communities

Category Code	Category
State categories of Threatened Ecological Communities (TEC)	
PTD	**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.
CE	**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:

Category Code	Category
	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.
E	**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.
V	**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; 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).
E	**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).
V	**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**

Category Code	Category
	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.

3.1.1 Invertebrate Fauna of Conservation Significance

It can be difficult to identify what may be conservation significant invertebrate species (e.g. Short Range Endemics - SREs) as there are uncertainties in determining the range-restrictions of many species due to lack of surveys, lack of taxonomic resolutions within target taxa and problems in identifying certain life stages. Where invertebrates are collected during surveys, a high percentage are likely to be unknown, or for known species there can be limited knowledge or information on their distribution (Harvey 2002).

For this report, the review of potential terrestrial invertebrate species of conservation significance has included a search of the DPaW NatureMap database (DPaW 2016) and the DotE protected matters database (DotE 2016). Invertebrate surveys, assessments and reviews have been undertaken in nearby areas in the past, though most are not publically available or very difficult to source and therefore could not be referenced. Some of those available have been used to gauge the likely presence/absence of significant invertebrate assemblages in the wider area, though as with the databases searches some reports refer to species that would not occur in the survey area due to a lack of suitable habitat.

3.2 Field Assessment

BC conducted a Level 1 flora and fauna survey, covering an area of approximately 109 ha. The survey area encompasses the entire boundary of L53/206, which is 28 km in length by 40 metres width. The survey was completed on the 18th February 2017 with the area traversed on foot and 4WD by two staff members.

3.2.1 Flora Assessment

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 species;
- Landform classification;
- Health Rating;
- Fauna habitat;
- Collection and documentation of unknown plant specimens; and
- GPS location, photograph and collection of flora of fauna of conservation significance if encountered.

Unknown specimens collected during the survey were identified with the aid of samples housed at the BC Herbarium and Western Australian Herbarium (WAHERB). Structural vegetation classification based on National Vegetation Information System (NVIS) Growth Form/ Height Classifications (provided in Appendix 1) was used to determine different vegetation communities based on the vegetation structure and dominant species. Similar vegetation communities were recognised visually in the field. Vegetation communities were classified in accordance with the NVIS to a minimum Level 5 classification which includes recording Dominant growth form, height, cover and species for the three traditional strata (i.e. Upper, Middle and Ground).

3.2.2 Fauna Assessment

Vegetation and landform units identified during the flora and vegetation survey 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 if it was likely that any species of conservation significance would be utilising the areas that maybe impacted on as a consequence of development at the site. The habitat information obtained was also used to aid in finalising 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 survey area were assessed and specific elements identified, if present, to determine the likelihood of listed threatened species utilising the area and its significance to them.

Opportunistic observations of fauna species were made during all field survey work which involved a series of close spaced transects across the site during the day while searching microhabitats such as logs, rocks, leaf litter and 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.

3.2.3 Personnel involved

Jim Williams - Environmental Consultant/Botanist (Diploma of Horticulture)
Lauren Pick - Senior Environmental Consultant (Bachelor of Science)
Greg Harewood - Zoologist (Bachelor of Science)

3.2.4 Scientific licences

Table 6: Scientific Licences of Botanica Staff coordinating the survey

Licensed staff	Permit Number	Valid Until
Jim Williams	SL011451	21-05-2017
Lauren Pick	SL011450	21-05-2017

3.3 Survey limitations and constraints

It is important to note that flora and fauna surveys will entail limitations notwithstanding careful planning and design. Potential limitations are listed in Table 7.

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 flora 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 flora 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 7: Limitations and constraints associated with the survey.

Variable	Potential Impact on Survey	Details
Competency/ Experience	Not a constraint	The BC personnel that conducted the survey were regarded as suitably qualified and experienced. **Coordinating Botanist/Zoologist:** Jim Williams & Greg Harewood **Field Staff:** Jim Williams, Lauren Pick & Greg Harewood **Data Interpretation:** Jim Williams, Lauren Pick & Greg Harewood
Timing of survey, weather & season	Minor constraint	Fieldwork was conducted in February prior to the recommended DPaW/ EPA guidelines primary survey period (March-June, 6-8 weeks post wet season). However, the survey was conducted following high rainfall in January (post wet-season).
Area disturbance	Not a constraint	Area has been disturbed by existing pastoral and mining activities. However, vegetation was mostly intact.
Survey Effort/ Extent	Not a constraint	Survey intensity was appropriate for the size/significance of the area with a Level 1 survey completed to identify vegetation communities, fauna habitat and any Flora/Fauna of Conservation Significance.
Availability of contextual information at a regional and local scale	Not a constraint	Threatened flora database search provided by the DPaW was used to identify any potential locations of Threatened/Priority Flora species. DAFWA, DPaW and DotEE databases were reviewed to obtain appropriate regional desktop information on the biophysical environment of the local region. Results of previous flora/ fauna assessments within the local area were also reviewed to provide context on the local environment.
Completeness	Not a constraint	In the opinion of BC, the survey area was covered sufficiently in order to identify vegetation assemblages. Due to the extensive experience and familiarity of the BC staff with flora within the region, it is estimated that approximately 90% of the flora within the survey area was able to be fully identified. The vegetation communities for this study were based on visual descriptions of locations in the field. The distribution of these vegetation communities outside the survey area is not known, however vegetation communities identified were categorised via comparison to vegetation distributions throughout WA specified in the NVIS obtained from the Australian Government (DotEE, 2016b).

4 Results

4.1 Desktop Assessment

4.1.1 Previous Surveys

Flora and fauna surveys, assessments and reviews have been undertaken in nearby areas in the past, though not all are publically available and could not be referenced. The most significant of those available have been used as the primary reference material for the flora and fauna as listed below.

- Animal Plant Mineral (2015), Vegetation Clearing Permit Application, Matilda Gold Project, Support Information for Matilda Mine Site Native Vegetation Clearing (Purpose) Permit Application, October 2015.

- ATA Environmental (2007), Golden West Resources Wiluna Project - Short Range Endemic (SRE) Invertebrate Survey. Unpublished letter report for Keith Lindbeck and Associates on behalf of Golden West Resources Ltd.

- BC (2015a), Level 2 Flora and Vegetation Survey of the North Laverton Gold Project. Prepared for Bullseye Mining Ltd.

- BC (2015b), Level 1 Flora & Vegetation Survey: Proposed Haul Roads for the North Laverton Gold Project. Prepared for Bullseye Mining Ltd.

- BC (2016), Level 1 Flora & Fauna Survey, Julius Project. Prepared for Echo Resources Limited.

- Blackwell, M. J. and Trudgen, M. E. (1980). Report on the Flora and Vegetation of the Lake Way Joint Venture Uranium Project Area: together with an assessment of the impact of this project upon the landscape, flora and vegetation of this area and its regeneration potential.

- Ecologia (1993), Bronzewing Gold Project. Notice of Intent. Botanical Assessment Survey. Report prepared for Great Central Mine.

- Hall, N.J., Newbey, K.R., McKenzie, N.L., Keighery, G.J., Rolfe, J.K & Youngson, W. K., (1993), The Biological survey of the Eastern Goldfields of Western Australia Part 7: Sandstone-Sir Samuel. Laverton-Leonora study area, West. Aust. Mus. Suppl. **47.**

- Halpern Glick Maunsell, (1997). Barwidgee Pastoral Lease *Mulgara Dasycercus cristicauda* Survey. Unpublished report prepared for Great Central Mines, November 1997.

- Harewood, G. (2015), Fauna Assessment, Laverton Gold Project. Unpublished report for Bullseye Mining Limited.

- Ninox Wildlife Consulting (1989), Vertebrate Fauna Assessment of the Proposed Mt McClure Gold Project. Unpublished report.

- Ninox Wildlife Consulting (1993), Vertebrate Fauna Assessment of the Proposed Bronzewing Gold Project. Unpublished report prepared for Signet Engineering Pty. Ltd. (February 1993).

- Ninox Wildlife Consulting (2007), A Vertebrate Fauna Survey of the Wiluna West Project Area Western Australia # 3. Unpublished report for Keith Lindbeck and Associates on behalf of Golden West Resources Ltd.

- Outback Ecology Services (OES) (2006), Report on the distribution of *Eremophila pungens* (P4) within the Bronzewing – Mt McClure Gold Project. Unpublished report prepared for View Resources Ltd (September 2006).

- Outback Ecology Services (OES) (2009), Lake Maitland Baseline Terrestrial Fauna Survey. Unpublished report for Mega Uranium Pty Ltd.

- Outback Ecology Services (OES) (2010), Application for a Purpose Permit to Clear Native Vegetation at the Bronzewing– Mt McClure Project: – Corboys Prospect M 53/15. Prepared for Navigator Resources Limited.

- Pringle, H. J. R, Van Vreeswyk, A. M. E. and Gilligan, S. A. (1994), An inventory and condition survey of the north-eastern Goldfields, Western Australia. Technical Bulletin No. 87. Department of Agriculture, Western Australia.

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

- Trudgen, M. (1989). A Flora and Vegetation Survey of Part of the Cyprus Gold Mount McClure Gold Mining Leases. Report prepared for Cyprus Gold for inclusion in the Mt McClure Project Feasibility Study, Volume 2 Environmental Study.

Some of the abovementioned reports refer to flora and fauna surveys carried a considerable distance from the survey area being assessed and therefore, as with the databases searches, some refer to species that would not occur in the survey area due it being out of their normal range or due to a lack of suitable habitat (extent and/or quality) and this fact was taken into consideration when compiling the potential flora and fauna species list for the survey area.

4.1.2 Flora of Conservation Significance

The results of the combined search of the DPaW's Flora of Conservation Significance databases, NatureMap Database and Protected Matters search tool, recorded no Threatened Flora and no Priority Flora taxon within the survey area. One Threatened Flora taxon and 28 Priority Flora taxa were listed within a 40km radius of the survey area. These taxa were assessed and ranked for their likelihood of occurrence within the survey area (Table 8). The rankings and criteria used were:

- Unlikely: Area is outside of the currently documented distribution for the species/no suitable habitat (type, quality and extent) was identified as being present during the field/desktop assessment.

- Possible: Area is within the known distribution of the species in question and habitat of at least marginal quality was identified as being present during the field/desktop assessment, supported in some cases by recent records being documented from within or near the area.

- Known to Occur: The species in question was positively identified as being present during the field survey.

Table 8: Likelihood of Occurrence – Flora Species of Conservation Significance

Taxon	Conservation Code	Description	Likelihood of Occurrence
Atriplex yeelirrie	T	Subdioecious plant distinguished by its dome shaped habit and divaricate woody branches. Female plants have distinctive fan-like fruits (with or without appendages). Highly restricted distribution limited to two populations on Yeelirrie Station.	Unlikely
Austroparmelina macrospora	P3	No description available	Possible
Baeckea sp. Sandstone (C.A. Gardner s.n. 26 Oct. 1963)	P3	Upright shrub, ca 1 m high. Fl. white, Oct. Orange sand. Flats.	Unlikely
Beyeria lapidicola	P1	No description available	Possible

Taxon	Conservation Code	Description	Likelihood of Occurrence
Calytrix praecipua	P3	Shrub, 0.3-0.7 m high. Fl. pink-white, Jun to Jul or Sep to Nov. Skeletal sandy soils over granite or laterite. Breakaways, outcrops.	Unlikely
Calytrix verruculosa	P3	Shrub, 0.4-0.75 m high. Fl. pink/white, Aug or Oct. Sandy clay.	Possible
Cratystylis centralis	P3	Much-branched, brittle, greyish shrub, to 1 m high. Red sandy loam with ironstone gravel. Flat plains, breakaway country.	Unlikely
Eremophila arguta	P1	Shrub.	Possible
Eremophila campanulata	P3	Low shrub, ca 0.3 m high, 0.4 m wide. Fl. purple-red, Sep. Stony red/brown clay.	Possible
Eremophila congesta	P1	Upright shrub, to 1.2 m high. Fl. purple-blue, Aug to Sep. Lateritic outcrops in greenstone hills, stony quartzite slopes.	Unlikely
Eremophila flaccida subsp. *attenuata*	P3	Erect, compact shrub, ca 0.5 m high. Fl. pink & blue, May. Stony clay over quartzite. Hillslopes, ridges.	Possible
Eremophila gracillima	P3	Low flat shrub, ca 0.3 m high, 1.2 m wide. Fl. blue, Sep. Stony flats.	Possible
Eremophila pungens	P4	Erect, viscid shrub, 0.5-1.5 m high. Fl. purple-violet, Jun to Aug. Sandy loam, clayey sand over laterite. Plains, ridges, breakaways.	Unlikely
Euryomyrtus inflata	P3	Shrub, 0.3-0.7 m high, leaves dull green, fruits erect. Fl. white-pink, Jun to Jul. Deep red sand. Flat plain.	Possible
Gunniopsis propinqua	P3	Prostrate annual or perennial, herb, 0.03-0.1 m high. Fl. white/pink, Aug to Sep. Stony sandy loam. Lateritic outcrops, winter-wet sites.	Unlikely
Hemigenia exilis	P4	Erect, multi-stemmed shrub, 0.5-2 m high. Fl. blue-purple/white, Apr or Sep to Nov. Laterite. Breakaways, slopes.	Unlikely
Hibiscus sp. Wonganoo Station (K. Boladeras 125)	P1	No description available	Possible
Homalocalyx echinulatus	P3	Shrub, 0.45-1 m high. Fl. pink, Jun to Sep. Laterite. Breakaways, sandstone hills.	Unlikely
Maireana prosthecochaeta	P3	Open, densely-leaved shrub, 0.3-0.6 m high. Laterite. Hills, salty places.	Unlikely
Neurachne lanigera	P1	Tufted perennial, grass-like or herb, 0.15-0.3 m high. Fl. other, Jul to Aug or Oct. Red sand, laterite. Rocky outcrops, plains.	Possible
Olearia mucronata	P3	Densely branched, unpleasantly aromatic shrub, 0.6-1 m high. Fl. white & yellow, Aug to Dec or Jan. Schistose hills, along drainage channels.	Unlikely
Prostanthera ferricola	P3	Erect, openly-branched shrub, 0.3-1 m high. Shallow red-brown skeletal sandy loam on banded ironstone, laterite, basalt or quartz. Gently inclined mid to	Unlikely

Taxon	Conservation Code	Description	Likelihood of Occurrence
		upper slopes of hills, rocky crests, outcrops.	
Ptilotus luteolus	P3	No description available	Possible
Sauropus sp. Woolgorong (M. Officer s.n. 10/8/94)	P3	Shrub, 0.3-1 m high. Fl. yellow, Jun. Red sand. Plains.	Possible
Sida picklesiana	P3	No description available	Possible
Stackhousia clementii	P3	Dense broom-like perennial, herb, to 0.45 m high. Fl. green/yellow/brown. Skeletal soils. Sandstone hills.	Unlikely
Tecticornia sp. Lake Way (P. Armstrong 05/961)	P1	No description available	Possible
Tribulus adelacanthus	P3	Prostrate herb, plants villous; leaflet pairs 3-6; fruits 5-winged, lacking spines, 10-14 mm high.	Possible
Xanthoparmelia nashii	P3	No description available	Possible

4.1.3 Vertebrate Fauna of Conservation Significance

The vertebrate fauna of conservation significance identified during the literature review as previously being recorded in the general area have been assessed and ranked for their likelihood of occurrence within the survey area itself (Table 9). The rankings and criteria used were:

- 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 much of the Eastern Murchison Bioregion. Populations do however persist outside of this area.
- Unlikely: The survey area is outside of the current/main 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 survey area itself would not support a population or part population of the species
- Possibly occurs: The 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. 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. 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.

Table 9: Likelihood of Occurrence – Vertebrate Fauna Species of Conservation Significance

Species	Conservation Status (see Table 4 for codes)			Potential Habitats Within Survey Area			Likelihood of Occurrence
	EPBC Act	WC Act	DPAW Priority	Foraging Habitat	Breeding Habitat	Total Extent (ha)	
Malleefowl *Leipoa ocellata*	VU	S3	-	Clay /Loam plains & Sand/Loam plains.	None	28 ha (26% of total area).	Unlikely. Habitat very marginal in quality. North eastern limit of main documented range. Few nearby records.
Great Egret *Ardea alba*	Mig	S5	-	None		None	Would not occur. Outside current documented range. Preferred habitat absent. No previous records.
Peregrine Falcon *Falco peregrinus*	-	S7	-	Air space above all habitats.	None	109 ha (100% of total area).	Possible but probably only rarely.
Oriental Plover *Charadis veredus*	Mig	S5	-	None		0 ha	Would not occur. Preferred habitat absent. No previous records.
Grey Wagtail *Motacilla cinerea*	Mig	S5	-	None		0 ha	Would not occur. Preferred habitat absent. No previous records.
Yellow Wagtail *Motacilla flava*	Mig	S5	-	None		0 ha	Would not occur. Preferred habitat absent. No previous records.
Princess Parrot *Polytelis alexandrae*	VU	-	P4	None		0 ha	Unlikely. Outside normal range. Habitat appears unsuitable. No recent records in general area.
Night Parrot *Pezoporus occidentalis*	EN	S1	-	None		0 ha	Unlikely Preferred habitat absent. No previous records in close proximity.
Fork-tailed Swift *Apus pacificus*	Mig	S5	-	Air space above all habitats.	None	109 ha (100% of total area).	Unlikely - flyover only on very rare occasions. No previous records nearby.
Rainbow Bee-eater *Merops ornatus*	Mig	S3	-	Sand/Loam plains & Clay/Loam plains.	Sand/Loam Plains	109 ha (100% of total area).	Possible
Brush-tailed Mulgara *Dasycercus blythi*	-	-	P4	None		0 ha	Unlikely – Habitat appears unsuitable or marginal at best.

4.1.1 Invertebrate Fauna of Conservation Significance

The NatureMap database search returned twenty-one invertebrate species records (DPaW 2017). None of these records are flagged as being "endemic to the query area" which indicates they have all been recorded outside of the 40km radius applied to the search. This supports a tentative conclusion none are likely to be SRE species and none have a distribution confined to the survey area alone.

A search of the federal EPBC Act database using the Protected Matters Search Tool (DotE 2016b) returned no reference to invertebrates.

There appears to be very few available terrestrial invertebrate fauna survey reports for the general area and only two were sourced (ATA 2007, Outback 2009).

ATA's survey was carried out within Golden West Resources Wiluna Iron Ore Project area, which is located about 100km west of the Julius Project area. ATA conducted hand foraging for mygalomorph spiders, pseudo-scorpions and scorpions within Banded Ironstone Formation ranges, mulga woodlands and hummock grasslands. Ten spiders, but no pseudo-scorpions or scorpions were collected. Only one spider specimen was subsequently identified as being a mygalomorph spider and therefore of potential interest with respect to short rang endemism. However, the specimen was a juvenile and could not be identified to species level and therefore is actual/possible SRE status was not determined.

ATA did however conclude that because the specimen was collected in a habitat unit that was widespread in the area the species in question was likely to have a wide distribution and its status was therefore unlikely to change as a consequence of mining, given the relatively small impact area (ATA 2007).

Outback carried out a fauna survey in 2008/2009 at the Lake Maitland Uranium Project area, which is located about 50 km south of the Julius Project area. The SRE component of this survey focused on invertebrate taxa that have characteristics which make them prone to short range endemism. The targeted taxa in the surveys were mygalomorph spiders, Myriopods (millipedes, centipedes), scorpions, pseudoscorpions and terrestrial snails.

The collected specimens were identified by taxonomic experts at the Western Australian Museum and the University of Western Australia. A number of mygalomorph taxa were collected in the Lake Maitland Project area that may have restricted ranges, however, Outback reported that it was difficult to make conclusive comments without a review of the genera and the further collection of representative male specimens from within and outside the Project area.

None of the species of pseudoscorpions, centipedes or terrestrial snails that were collected during the Lake Maitland Project area survey were considered to exhibit short range endemism, with most being widely distributed within the semi-arid zone of Western Australia. Some uncertainty relating to the status of two scorpion type species collected, "maitland1" and "maitland2" from the genus *Urodacus* was however reported. At the time of the survey the genus was under review and the taxonomy and possible SRE status of these specimens was therefore uncertain (Outback 2009). It is unclear if this uncertainly was ever resolved.

In conclusion Outback stated that if large areas, known to be inhabited by possible short range endemic taxa (specifically mygalomorph spiders), are to be impacted by the development, it would

be useful to establish whether populations of the species present also exist outside the areas of impact (Outback 2009).

With respect to the Julius Project haul road area the conclusions drawn during the course of these previous invertebrate studies in nearby areas can be applied in this instance. The vegetation and habitat assessment detailed in other sections of this report suggests that most areas represent common widespread vegetation/habitat units with no obvious boundaries or subdivisions present that would represent species isolators which would restrict certain invertebrate species to the survey area alone. Given the small area of impact of the proposed haul road and the lack of areas of high potential as suitable SRE habitat it is considered very unlikely that any one invertebrate species would be restricted to the survey area. It can therefore be expected that even the most restricted invertebrate species (if in fact present) will persist in adjoining areas despite the localised loss of some habitat within the survey area itself.

4.2 Field Assessment

4.2.1 Flora of Conservation Significance

Flora of conservation significance identified in the desktop assessment as potentially occurring within the survey area were targeted during the field assessment. No Threatened Flora taxa pursuant to subsection (2) of section 23F of the WC Act and the EPBC Act were identified within the survey area. No Priority Flora taxa were identified within the survey area.

4.2.1 Vertebrate Fauna of Conservation Significance

Fauna of conservation significance identified in the desktop assessment as potentially occurring within the survey area were targeted during the field assessment. No evidence of any threatened, migratory or priority fauna species utilising the survey area was observed.

4.2.2 Opportunistic Fauna Observations

Opportunistic fauna observations are listed in Appendix 6. A total of 16 native fauna species were observed (or positively identified from foraging evidence, scats, tracks, skeletons or calls) within or near the survey area over the survey period. Evidence of one introduced species (camel) using the survey area was also gathered. With the exception of the red kangaroo all observations of native fauna were of common, widespread bird species.

4.3 Vegetation Communities

Eight broad vegetation communities were identified within the survey area. These communities were identified within five landform types and comprised of one major vegetation group according to the NVIS, Major Vegetation Group (MVG) definition (Table 10). A map showing the vegetation communities present in the survey area is provided in Appendix 3. These communities were represented by a total 22 Families, 36 Genera and 74 Taxa, as listed in Appendix 4.

Table 10: Summary of vegetation communities and area within the survey area

Landform	NVIS Major Vegetation Group	Vegetation Community	Vegetation Code	Area (Ha)	Area (%)
Clay-Loam Plain	Acacia Forests and Woodlands (MVG6)	Low woodland of *Acacia incurvaneura* over mid open shrubland of *Eremophila linearis/ Senna* sp. Meekatharra (E. Bailey 1-26) and low chenopod shrubland of *Maireana triptera* on clay-loam plain	CLP-AFW1	10	9.17
		Open low woodland of *Acacia pruniocarpa* over mid sparse shrubland of *Eremophila fraseri/ Eremophila paisleyi* and low open tussock grassland of *Eragrostis eriopoda* on clay-loam plain	CLP-AFW2	12	11.01

Landform	NVIS Major Vegetation Group	Vegetation Community	Vegetation Code	Area (Ha)	Area (%)
Drainage Depression	Acacia Forests and Woodlands (MVG6)	Open forest of *Acacia incurvaneura* over tall open shrubland of *Acacia ramulosa* var. *ramulosa* and low tussock grassland of *Eragrostis kennedyae* in drainage depression	DD-AFW1	13	11.93
Quartz-Rocky Plain	Acacia Forests and Woodlands (MVG6)	Low woodland of *Acacia incurvaneura* over mid open shrubland of *Senna* sp. Meekatharra (E. Bailey 1-26) and low open tussock grassland of *Eragrostis eriopoda* on quartz-rocky plain	QRP-AFW1	33	30.28
		Low woodland of *Acacia incurvaneura* over mid open shrubland of *Senna* sp. Meekatharra (E. Bailey 1-26) and low open shrubland of *Ptilotus obovatus* on quartz-rocky plain	QRP-AFW2	12	11.01
Rocky Hillslope	Acacia Forests and Woodlands (MVG6)	Low woodland of *Acacia incurvaneura/A. pruniocarpa* over mid open shrubland of *Scaevola spinescens* and low open tussock grassland of *Eriachne mucronata/ Eragrostis eriopoda* on rocky hillslope	RH-AFW1	7	6.42
		Low woodland of *Acacia balsamea* over mid open shrubland of Senna sp. Meekatharra (E. Bailey 1-26) and low open shrubland of *Ptilotus obovatus/ Solanum lasiophyllum* on rocky hillslope	RH-AFW2	16	14.68
Sand-Loam Plain	Acacia Forests and Woodlands (MVG6)	Low woodland of *Acacia caesaneura/A. incurvaneura* over low open shrubland of *Eremophila forrestii* and low open tussock grassland of *Eragrostis eriopoda* on sand-loam plain	SLP-AFW1	6	5.50
TOTAL				**109**	**100**

Clay-Loam Plain: Acacia Forests and Woodlands

4.3.1 Low woodland of *Acacia incurvaneura* over mid open shrubland of *Eremophila linearis/ Senna* sp. Meekatharra (E. Bailey 1-26) and low chenopod shrubland of *Maireana triptera* on clay-loam plain (CLP-AFW1)

The total flora recorded within this vegetation community was represented by a total of 8 Families, 12 Genera and 19 Taxa (Plate 1). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 11. According to the NVIS, this vegetation community is best represented by the MVG 6- Acacia Forests and Woodlands (DotEE, 2017).

Table 11: Vegetation assemblage for Low woodland of *Acacia incurvaneura* over low scrub of *Eremophila linearis/ Senna* sp. Meekatharra (E. Bailey 1-26) and dwarf scrub of *Maireana triptera* on clay-loam plain

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree <10m	10-30%	*Acacia incurvaneura*
Shrub 1-2m	10-30%	*Eremophila linearis* *Senna* sp. Meekatharra (E. Bailey 1-26)
Chenopod Shrub <1m	30-70%	*Maireana georgei*

Plate 1: Low woodland of *Acacia incurvaneura* over low scrub of *Eremophila linearis/ Senna* sp. Meekatharra (E. Bailey 1-26) and dwarf scrub of *Maireana triptera* on clay-loam plain

4.3.2 Open low woodland of *Acacia pruniocarpa* over mid sparse shrubland of *Eremophila fraseri/ Eremophila paisleyi* and low open tussock grassland of *Eragrostis eriopoda* on clay-loam plain (CLP-AFW2)

The total flora recorded within this vegetation community was represented by a total of 10 Families, 13 Genera and 22 Taxa (Plate 3). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 13. According to the NVIS, this vegetation community is best represented by the MVG 6- Acacia Forests and Woodlands (DotEE, 2017).

Table 12: Vegetation assemblage for Open low woodland of *Acacia pruniocarpa* over mid sparse shrubland of *Eremophila fraseri/ Eremophila paisleyi* and low open tussock grassland of *Eragrostis eriopoda* on clay-loam plain

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree <10m	2-10%	*Acacia pruniocarpa*
Shrub 1-2m	2-10%	*Eremophila fraseri* *Eremophila paisleyi*
Tussock Grass <0.5m	10-30%	*Eragrostis eriopoda*

Plate 2: Open low woodland of *Acacia pruniocarpa* over mid sparse shrubland of *Eremophila fraseri/ Eremophila paisleyi* and low open tussock grassland of *Eragrostis eriopoda* on clay-loam plain

Drainage Depression: Acacia Forests and Woodlands

4.3.3 Open forest of *Acacia incurvaneura* over tall open shrubland of *Acacia ramulosa* var. *ramulosa* and low tussock grassland of *Eragrostis kennedyae* in drainage depression (DD-AFW1)

The total flora recorded within this vegetation community was represented by a total of 8 Families, 11 Genera and 19 Taxa (Plate 3). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 13. According to the NVIS, this vegetation community is best represented by the MVG 6- Acacia Forests and Woodlands (DotEE, 2017).

Table 13: Vegetation assemblage for Open forest of *Acacia incurvaneura* over tall open shrubland of *Acacia ramulosa* var. *ramulosa* and low tussock grassland of *Eragrostis kennedyae* in drainage depression

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree <10m	30-70%	*Acacia incurvaneura*
Shrub 1-2m	10-30%	*Acacia ramulosa* var. *ramulosa*
Tussock Grass <0.5m	10-30%	*Eragrostis kennedyae*

Plate 3: Open forest of *Acacia incurvaneura* over tall open shrubland of *Acacia ramulosa* var. *ramulosa* and low tussock grassland of *Eragrostis kennedyae* in drainage depression

Quartz-Rocky Plain: Acacia Forests and Woodlands

4.3.4 Low woodland of *Acacia incurvaneura* over mid open shrubland of *Senna* sp. Meekatharra (E. Bailey 1-26) and low open tussock grassland of *Eragrostis eriopoda* on quartz-rocky plain (QRP-AFW1)

The total flora recorded within this vegetation community was represented by a total of 11 Families, 13 Genera and 20 Taxa (Plate 4). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 14. According to the NVIS, this vegetation community is best represented by the MVG 6- Acacia Forests and Woodlands (DotEE, 2017).

Table 14: Vegetation assemblage for Low woodland of *Acacia incurvaneura* over mid open shrubland of *Senna* sp. Meekatharra (E. Bailey 1-26) and low open tussock grassland of *Eragrostis eriopoda* on quartz-rocky plain

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree <10m	10-30%	*Acacia incurvaneura*
Shrub 1-2m	10-30%	*Senna* sp. Meekatharra (E. Bailey 1-26)
Tussock Grass <0.5m	10-30%	*Eragrostis eriopoda*

Plate 4: Low woodland of *Acacia incurvaneura* over mid open shrubland of *Senna* sp. Meekatharra (E. Bailey 1-26) and low open tussock grassland of *Eragrostis eriopoda* on quartz-rocky plain

4.3.5 Low woodland of *Acacia incurvaneura* over mid open shrubland of *Senna* sp. Meekatharra (E. Bailey 1-26) and low open shrubland of *Ptilotus obovatus* on quartz-rocky plain (QRP-AFW2)

The total flora recorded within this vegetation community was represented by a total of 7 Families, 10 Genera and 16 Taxa (Plate 5). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 15. According to the NVIS, this vegetation community is best represented by the MVG 6- Acacia Forests and Woodlands (DotEE, 2017).

Table 15: Vegetation assemblage for Low woodland of *Acacia incurvaneura* over mid open shrubland of *Senna* sp. Meekatharra (E. Bailey 1-26) and low open shrubland of *Ptilotus obovatus* on quartz-rocky plain

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree <10m	10-30%	*Acacia incurvaneura*
Shrub 1-2m	10-30%	*Senna* sp. Meekatharra (E. Bailey 1-26)
Shrub <1m	10-30%	*Ptilotus obovatus*

Plate 5: Low woodland of *Acacia incurvaneura* over mid open shrubland of *Senna* sp. Meekatharra (E. Bailey 1-26) and low open shrubland of *Ptilotus obovatus* on quartz-rocky plain

Rocky Hillslope: Acacia Forests and Woodlands

4.3.6 Low woodland of *Acacia incurvaneura/ A. pruniocarpa* over mid open shrubland of *Scaevola spinescens* and low open tussock grassland of *Eriachne mucronata/ Eragrostis eriopoda* on rocky hillslope (RH-AFW1)

The total flora recorded within this vegetation community was represented by a total of 11 Families, 13 Genera and 20 Taxa (Plate 6). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 16. According to the NVIS, this vegetation community is best represented by the MVG 6- Acacia Forests and Woodlands (DotEE, 2017).

Table 16: Vegetation assemblage for Low woodland of *Acacia incurvaneura/ A. pruniocarpa* over mid open shrubland of *Scaevola spinescens* and low open tussock grassland of *Eriachne mucronata/ Eragrostis eriopoda* on rocky hillslope

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree <10m	10-30%	*Acacia incurvaneura* *Acacia pruniocarpa*
Shrub <1m	10-30%	*Scaevola spinescens*
Tussock Grass <0.5m	10-30%	*Eragrostis eriopoda* *Eriachne mucronata*

Plate 6: Low woodland of *Acacia incurvaneura/ A. pruniocarpa* over mid open shrubland of *Scaevola spinescens* and low open tussock grassland of *Eriachne mucronata/ Eragrostis eriopoda* on rocky hillslope

4.3.7 Low woodland of *Acacia balsamea* over mid open shrubland of *Senna* sp. Meekatharra (E. Bailey 1-26) and low open shrubland of *Ptilotus obovatus/ Solanum lasiophyllum* on rocky hillslope (RH-AFW2)

The total flora recorded within this vegetation community was represented by a total of 9 Families, 12 Genera and 17 Taxa (Plate 7). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 17. According to the NVIS, this vegetation community is best represented by the MVG 6- Acacia Forests and Woodlands (DotEE, 2017).

Table 17: Vegetation assemblage for Low woodland of *Acacia balsamea* over mid open shrubland of *Senna* sp. Meekatharra (E. Bailey 1-26) and low open shrubland of *Ptilotus obovatus/ Solanum lasiophyllum* on rocky hillslope

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree <10m	10-30%	*Acacia balsamea*
Shrub 1-2m	10-30%	*Senna* sp. Meekatharra (E. Bailey 1-26)
Shrub <0.5m	10-30%	*Ptilotus obovatus* *Solanum lasiophyllum*

Plate 7: Low woodland of *Acacia balsamea* over mid open shrubland of *Senna* sp. Meekatharra (E. Bailey 1-26) and low open shrubland of *Ptilotus obovatus/ Solanum lasiophyllum* on rocky hillslope

Sand-Loam Plain: Acacia Forests and Woodlands

4.3.8 Low woodland of *Acacia caesaneura/ A. incurvaneura* over low open shrubland of *Eremophila forrestii* and low open tussock grassland of *Eragrostis eriopoda* on sand-loam plain (SLP-AFW1)

The total flora recorded within this vegetation community was represented by a total of 8 Families, 13 Genera and 27 Taxa (Plate 8). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 18. According to the NVIS, this vegetation community is best represented by the MVG 6- Acacia Forests and Woodlands (DotE, 2016b).

Table 18: Vegetation assemblage for Low woodland of *Acacia caesaneura/ A. incurvaneura* over low open shrubland of *Eremophila forrestii* and low open tussock grassland of *Eragrostis eriopoda* on sand-loam plain

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree <10m	10-30%	*Acacia caesaneura* *Acacia incurvaneura*
Shrub 1-2m	10-30%	*Eremophila forrestii*
Tussock Grass <0.5m	10-30%	*Eragrostis eriopoda*

Plate 8: Low woodland of *Acacia caesaneura/ A. incurvaneura* over low open shrubland of *Eremophila forrestii* and low open tussock grassland of *Eragrostis eriopoda* on sand-loam plain

4.4 Vegetation of Conservation Significance

No Threatened Flora, pursuant to subsection (2) of section 23F of the WC Act and the EPBC Act were identified within the survey area. No Priority taxa as listed by the DPaW were identified within the survey area. There were no TEC as listed under Commonwealth and State Legislation or PEC as listed by DPaW located within the survey area.

The survey area is not located within an ESA or Schedule 1 Area as listed under the EP Act or EP Regulations. The survey area is not located within a listed or proposed conservation area managed by DPaW. The nearest DPaW managed land is the Wanjarri Nature Reserve, which is listed as a "Class A" Nature Reserve, located approximately 26km south-west of the survey area. A map showing the survey area in relation to areas of conservation significance is provided in Appendix 2.

4.5 Vegetation Condition

Based on the vegetation condition rating scale adapted from Keighery, 1994 and Trudgen, 1988 (Appendix 5), three vegetation communities were rated as 'good' which depicts that vegetation structure has been impacted by 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. The remaining five vegetation communities were rated as 'very good' (Table 19) which depicts that vegetation has been subject to 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. A map showing the vegetation condition within the survey area is provided in Figure 8.

Table 19: Vegetation condition within the survey area

Landform	NVIS Major Vegetation Group	Vegetation Community	Vegetation Code	Condition Rating
Clay-Loam Plain	Acacia Forests and Woodlands (MVG6)	Low woodland of *Acacia incurvaneura* over mid open shrubland of *Eremophila linearis/ Senna* sp. Meekatharra (E. Bailey 1-26) and low chenopod shrubland of *Maireana triptera* on clay-loam plain	CLP-AFW1	Good
		Open low woodland of *Acacia pruniocarpa* over mid sparse shrubland of *Eremophila fraseri/ Eremophila paisleyi* and low open tussock grassland of *Eragrostis eriopoda* on clay-loam plain	CLP-AFW2	Very Good
Drainage Depression	Acacia Forests and Woodlands (MVG6)	Open forest of *Acacia incurvaneura* over tall open shrubland of *Acacia ramulosa* var. *ramulosa* and low tussock grassland of *Eragrostis kennedyae* in drainage depression	DD-AFW1	Very Good
Quartz-Rocky Plain	Acacia Forests and Woodlands (MVG6)	Low woodland of *Acacia incurvaneura* over mid open shrubland of *Senna* sp. Meekatharra (E. Bailey 1-26) and low open tussock grassland of *Eragrostis eriopoda* on quartz-rocky plain	QRP-AFW1	Very Good
		Low woodland of *Acacia incurvaneura* over mid open shrubland of *Senna* sp. Meekatharra (E. Bailey 1-26) and low open shrubland of *Ptilotus obovatus* on quartz-rocky plain	QRP-AFW2	Good
Rocky Hillslope	Acacia Forests and Woodlands (MVG6)	Low woodland of *Acacia incurvaneura/ A. pruniocarpa* over mid open shrubland of *Scaevola spinescens* and low open tussock grassland of *Eriachne mucronata/ Eragrostis eriopoda* on rocky hillslope	RH-AFW1	Very Good

Landform	NVIS Major Vegetation Group	Vegetation Community	Vegetation Code	Condition Rating
		Low woodland of *Acacia balsamea* over mid open shrubland of Senna sp. Meekatharra (E. Bailey 1-26) and low open shrubland of *Ptilotus obovatus/ Solanum lasiophyllum* on rocky hillslope	RH-AFW2	Very Good
Sand-Loam Plain	Acacia Forests and Woodlands (MVG6)	Low woodland of *Acacia caesaneura/ A. incurvaneura* over low open shrubland of *Eremophila forrestii* and low open tussock grassland of *Eragrostis eriopoda* on sand-loam plain	SLP-AFW1	Good

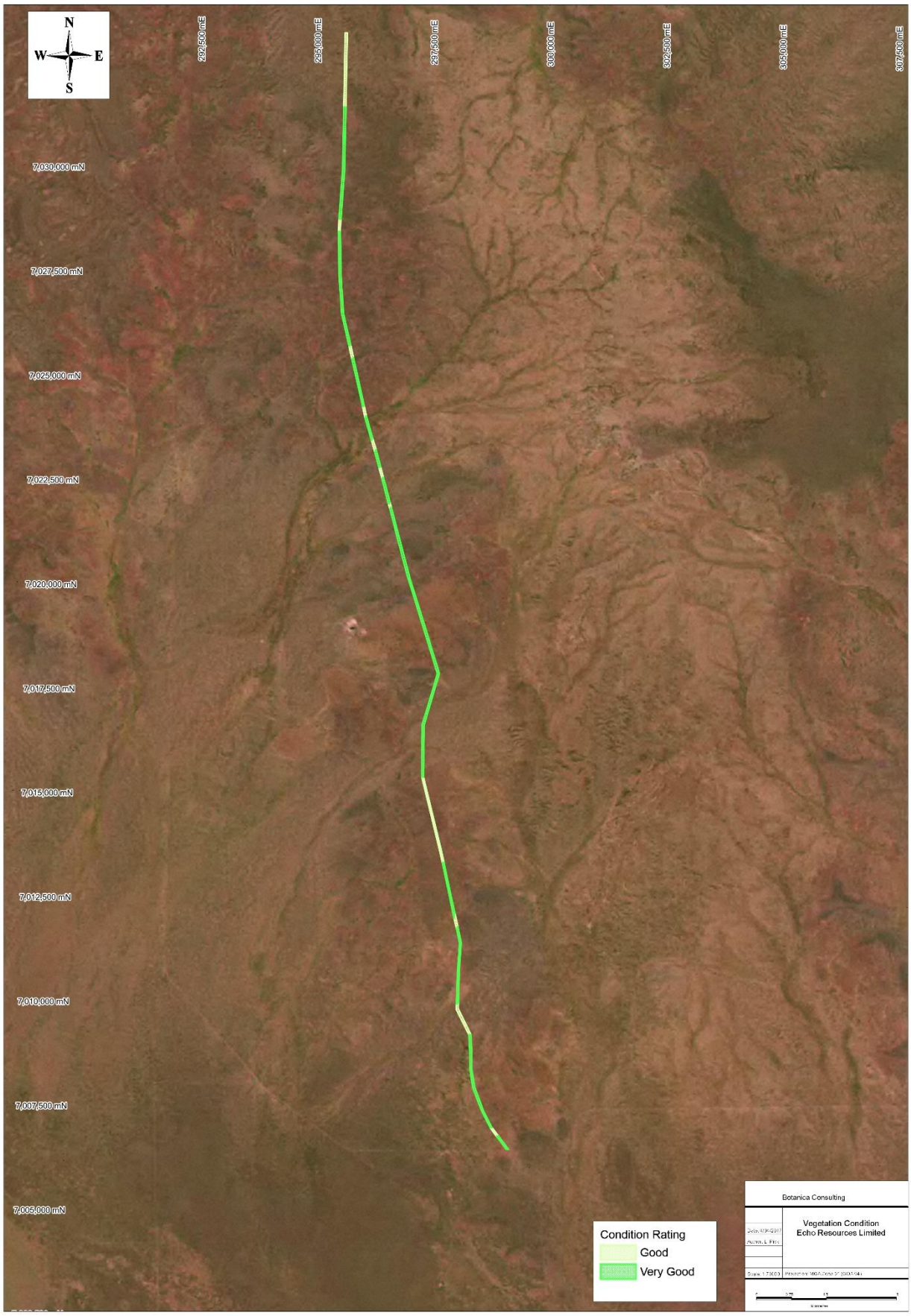

Figure 8: Vegetation condition within the survey area

4.6 Introduced Plants

No introduced taxa were recorded within the survey area; however, the survey took place after heavy rains and there were many small germinants and some of which may have been introduced.

4.7 Fauna Habitat

The broad scale terrestrial fauna habitats within the survey area presented below are based on vegetation and associated landforms identified during the flora and vegetation assessment. The extent of the identified fauna habitats and a summary description of each are provided in Table 20 below.

All of the broad scale fauna habitats identified appear to be widespread and well represented in areas surrounding the Julius Project haul road survey area.

Table 20: Main Terrestrial Fauna Habitats within the Proposed Haul Road Project survey area

Fauna Habitat Description	Example Image
Clay Loam Plains *Acacia* Forests and Woodlands Total Area = 22 ha (~20%)	
Drainage Depressions *Acacia* Forests and Woodlands Total Area = 13 ha (~12%)	

Fauna Habitat Description	Example Image
Quartz-Rocky Plains *Acacia* Forests and Woodlands Total Area = 45 ha (~41%)	
Rocky Hillslope *Acacia* Forests and Woodlands Total Area = 23 ha (~21%)	
Sand-Loam Plain *Acacia* Forests and Woodlands Total Area = 6 ha (~6%)	

4.7.1 Fauna Inventory – Vertebrate Fauna

A list of expected vertebrate fauna species likely to occur in the survey area was compiled from information obtained during the literature review and is presented in Appendix 6. The results of some previous fauna surveys carried out in the general area are also summarised in this species listing as are the DPaW NatureMap database search results.

Table 21 summarises the numbers of potential species based on vertebrate class considered likely to be present in the general vicinity of the survey area based on the complete list held Appendix 6.

Not all species listed in existing databases and publications as potentially occurring within the region (i.e. *EPBC Act* Threatened Fauna and Migratory species lists, DPAW NatureMap Fauna Database and various publications) are considered likely to be present within the survey area. The list of potential fauna takes into consideration that firstly the species in question is not known to be locally/regionally extinct and secondly that suitable habitat for each species, as identified during the habitat assessment, is present within the survey area, though compiling an accurate list has limitations (see **Section 3.3 Survey limitations and constraints**).

Table 21: Summary of Potential Vertebrate Fauna Species

Group	Total number of potential species	Potential number of specially protected species	Potential number of migratory species	Potential number of priority species	Number of species observed Level 1 Survey
Amphibians	8	0	0	0	0
Reptiles	85	0	0	0	0
Birds	100	1	1	0	15
Non-Volant Mammals	25[9]	0	0	0	21
Volant Mammals (Bats)	8	0	0	0	0
Total	**226[9]**	**1**	**1**	**0**	17[1]

Superscript = number of introduced species included in the total. Note: Where a species state and federal conservation status is different, the highest category is used.

Despite the omission of some species it should be noted that the list provided is still very likely an over estimation of the fauna species utilising the survey area (either on a regular or infrequent basis) as a result of the precautionary approach adopted for the assessment. At any one time only a subset of the listed potential species is likely to be present within the bounds of the survey area.

The literature review identified 11 threatened/specially protected, migratory or priority vertebrate fauna species as having been previously recorded or as being potentially present in the general vicinity of the survey area (see Table 21).

The current status on site and/or in the general area of some species is difficult to determine, however, based on the habitats present and, in some cases, recent nearby records, two species of conservation significance can be regarded as possibly utilising the survey area for some purpose at times, these being:

- *Falco peregrinus* Peregrine Falcon – S7 (*WC Act*)
  The species potentially utilises some sections of the survey area as part of a much larger home range, though records in this area are rare and while listed as a potential species, it can be expected to occur only very occasionally. Unlikely to breed within the survey area

- *Merops ornatus* Rainbow Bee-eater – S5 (*WC Act*), Migratory (*EPBC Act*)
  Common seasonal visitor to southern half of WA. Likely to use the survey area on occasions though it would not be specifically attracted to the site. Some potential for the species to breed in some sections of the survey area where ground conditions are suitable. Population levels would however not be significant as it usually breeds in pairs and rarely in small colonies (Johnstone and Storr 1998).

Habitat onsite for those species listed above, while considered possibly suitable, may be marginal in extent/quality and therefore the animals in question may only visit the area for short periods or as rare/uncommon vagrants.

A number of other species of conservation significance, while possibly present in the general area and/or the East Murchison region are not listed as potential species due to the survey area being outside of their currently recognised range, a lack of suitable habitat or known/very likely local or regional extinction (and no subsequent recruitment from adjoining areas).

Given the fauna habitats present within survey area appear to be widespread and well represented in areas surrounding the Julius Project haul road area it is considered unlikely that any significant impact on the status of any fauna species utilising the site will occur. While there will be some localised loss of habitat, fauna populations can be expected to persist despite development within the survey area proceeding.

5 Relevant Legislation and Compliance with Recognised Standards

5.1 Commonwealth Legislation

Commonwealth *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*

The aim of this Act is to protect matters of national environmental significance, and is used by the Commonwealth DotEE 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. There are nine matters of national environmental significance protected under this act including:

- 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 species and ecological communities
- migratory species
- Commonwealth marine areas
- the Great Barrier Reef Marine Park
- nuclear actions (including uranium mining)
- a water resource, in relation to coal seam gas development and large coal mining development.

The survey area does not have national environmental significance under the EPBC Act. There were no world/ national heritage places, wetlands of international importance, threatened flora species or communities, as listed under the *EPBC Act*, identified within the survey area.

The state and federally listed migratory bird, the rainbow bee-eater may occur with the survey area at times. This species is common in the southern part of the state during its spring/summer migration period. It is not a threatened species and is therefore not of specific concern. It's local and regional scale conservation status will not be impacted on by the proposal proceeding.

5.2 State Legislation

5.2.1 Clearing of Native Vegetation

Under Section 51C of the EP Act and the EP Regulations any clearing of native vegetation in Western Australia that is not eligible for exemption under Schedule 6 of the EP Act or under the EP Regulations requires a clearing permit from the DER or DMP. Under Section 51A of the EP Act 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 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 for clearing an area exceeding 10ha per tenement, clearing in ESA's as declared under Section 51B of the EP Act or within Schedule 1 Areas as described in Regulation 6 and Schedule 1, clause 4 of the EP Regulations.

The survey area is not located within an ESA or Schedule 1 Area; however, a clearing permit is required as clearing will exceed 10ha.

5.2.2 Environmental Protection Act WA 1986

This Act pertains to the assessment of applications for clearing permits and aims to protect Threatened Flora/ Fauna and Threatened Ecological Communities from clearing. Threatened Ecological Communities are protected even where exemptions for a clearing permit may apply. The Act enforces both financial and/or imprisonment penalties on those who unlawfully damage a TEC.

The survey area does not contain any TEC or Threatened Flora. While some listed threatened/specially protected fauna species may occur in the area at times the proposed development is considered highly unlikely to significantly impact on any species given the large expanses of similar habitat in adjoining areas.

5.2.3 Wildlife Conservation Act WA 1950

This Act is used by the Western Australian DPaW to list flora/fauna taxa as being protected and the level of protection needed. Taxa are classified as 'Threatened" when their populations are geographically restricted or are threatened by local processes. Under this Act all native flora and fauna are protected throughout the State. Financial penalties are enforced under this Act if threatened taxa are collected without an appropriate licence.

The survey area does not contain any Threatened Flora listed under the WC Act 1950. The peregrine falcon (listed as fauna in need of special protection) potentially utilises some sections of the survey area as part of a much larger home range, though records in this area of its range are very uncommon. It would not breed in the survey area and probably only occurs rarely. No significant impact on this species or its preferred habitat is anticipated.

5.2.4 DPaW Priority lists

The DPaW lists 'Priority' flora and fauna taxa which are under consideration for declaration as Rare Flora or Fauna. Taxa classed as Priority 1-3 are in urgent need of further survey, whereas Priority 4 taxa are considered to have been adequately surveyed but may become vulnerable or rare in future years. Priority 4 taxa are also taxa that have been removed from the threatened taxa list in the past 5 years. Priority 5 taxa are those taxa which are not currently threatened but are subject to a specific conservation program, the cessation of which would result in the taxon likely to become threatened within 5 years The DPaW also lists PECs, which identifies those communities that may need monitoring before possible nomination for TEC status. These priority taxa and communities have no formal legal protection until they are endorsed by the Minister as being Threatened.

Results of the database searches revealed 28 Priority Flora within a 40km radius of the survey area, of which 14 had the potential to occur within the survey area. No Priority Flora were identified within the survey area. A small number of priority fauna species have previously been recorded in the general area however none are considered likely to utilise the survey area primarily due to a total absence of suitable habitat.

5.1 Native Vegetation Clearing Principles

Based on the outcomes from the survey undertaken, as presented in this report, BC provides the following comments regarding the native vegetation clearing principles, listed under Schedule 5 of the EP Act (Table 22).

Table 22: Assessment of development within the survey area 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 in the local 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 habitat identified within the survey area. Fauna habitats are well represented outside of the survey area.	Clearing is unlikely to be at variance to this principle
(c)	includes, or is necessary for the continued existence of rare flora.	No Threatened Flora taxa, pursuant to subsection (2) of section 23F of the WC Act 1950 and the EPBC Act 1999 were identified within the survey area.	Clearing is unlikely to be 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 State and Commonwealth legislation occur within the survey area.	Clearing is unlikely to be at variance to this principle
(e)	is significant as a remnant of native vegetation in an area that has been extensively cleared	The survey area occurs within the pre-European Beard vegetation associations Wiluna 18, 29 and 39 which retain >98% of the 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	According to the Geoscience Australia database (2001), there are no defined drainage lines or inland waters (lakes/ playas) within the survey area. One drainage depression (ephemeral floodplain) was	Clearing is unlikely to be at variance to this principle

Letter	Principle	Assessment	Outcome
Native vegetation should not be cleared if it:			
	with a watercourse or wetland	identified within the survey area. This drainage depression is only active after heavy or prolonged rainfall. Vegetation of this drainage depression comprised of Open forest of *Acacia incurvaneura* over tall open shrubland of *Acacia ramulosa* var. *ramulosa* and low tussock grassland of *Eragrostis kennedyae*. This vegetation is not considered riparian vegetation and is found in the surrounding areas.	
(g)	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	The survey area occurs within the pre-European Beard vegetation associations Wiluna 18, 29 and 39 which retain >98% of the original pre-European vegetation extent. Clearing within these vegetation associations is not 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 any current or proposed Conservation Reserves managed by DPaW and listed by the EPA.	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.	According to the Geoscience Australia database (2001), there are no defined drainage lines or inland waters (lakes/ playas) within the survey area. One drainage depression (ephemeral floodplain) was identified within the survey area. This drainage depression is only active after heavy or prolonged rainfall. Vegetation of this drainage depression comprised of Open forest of *Acacia incurvaneura* over tall open shrubland of *Acacia ramulosa* var. *ramulosa* and low tussock grassland of *Eragrostis kennedyae*. This vegetation is not considered riparian vegetation and is found in the surrounding areas. Most rainfall is lost by evaporation or surface runoff. Only a small portion infiltrates the soil and recharges the groundwater.	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 is unreliable and highly variable with an average rainfall of 200mm and an evaporation rate of 2461mm. The region is not prone to flooding and does not contain riparian vegetation.	Clearing is unlikely to be at variance to this principle

6 Conclusions and Recommendations

6.1 Conclusions

Eight broad vegetation communities were identified within the survey area. These communities were identified within five landform types and comprised of one major vegetation group. These communities were represented by a total of 17 Families, 29 Genera and 65 Taxa. The broad scale terrestrial fauna habitats within the survey area have been identified as comprising a mosaic of clay-loam plains, drainage depressions, quartz-rocky plains, rocky hillslopes and sand-loam plains. With respect to native vertebrate fauna, 24 mammals (including eight bat species), 100 bird, 85 reptile and eight frog species have previously been recorded in the general area, some of which have the potential to occur in or utilise the survey area at times.

No Threatened Flora taxa or Priority Flora taxa were identified within the survey area. No threatened, migratory or priority fauna taxa were positively identified as being present during the field survey however the literature review identified 11 species as having been previously recorded or as being potentially present in the general vicinity of the survey area. The current status on site and/or in the general area of some species is difficult to determine, however, based on the habitats present and, in some cases, recent nearby records, two species of conservation significance (peregrine falcon and rainbow bee-eater) can be regarded as possibly utilising the survey area for some purpose at times.

Impacts on these species and fauna in general (including invertebrates) that may occur as a consequence of development at the site is considered unlikely to be significant. Populations of all species can be expected to persist in these areas with no change in any one species conservation status being significantly affected. This conclusion is primarily based on the relatively small size of the impact footprint and the extensive habitat connectivity with adjoining areas. Impacts on fauna and fauna habitat are therefore anticipated to be localised, small/negligible and as a consequence manageable.

None of the vegetation communities within the survey area were found to have National Environmental Significance as defined by the Commonwealth EPBC Act. No TEC or PEC were identified within the survey area. The survey area is not located within an ESA, Schedule 1 Area or a Conservation Reserve/ DPaW managed land. Vegetation condition ranged from 'good' to 'very good'. No introduced taxa were identified within the survey area; however, the area comprised of several germinants some of which are potentially introduced species.

6.2 Recommendations

- Minimise disturbance to vegetation associated with the drainage depression
- Implement weed management/ vehicle hygiene procedures during clearing/ site access to prevent spread of introduced species.

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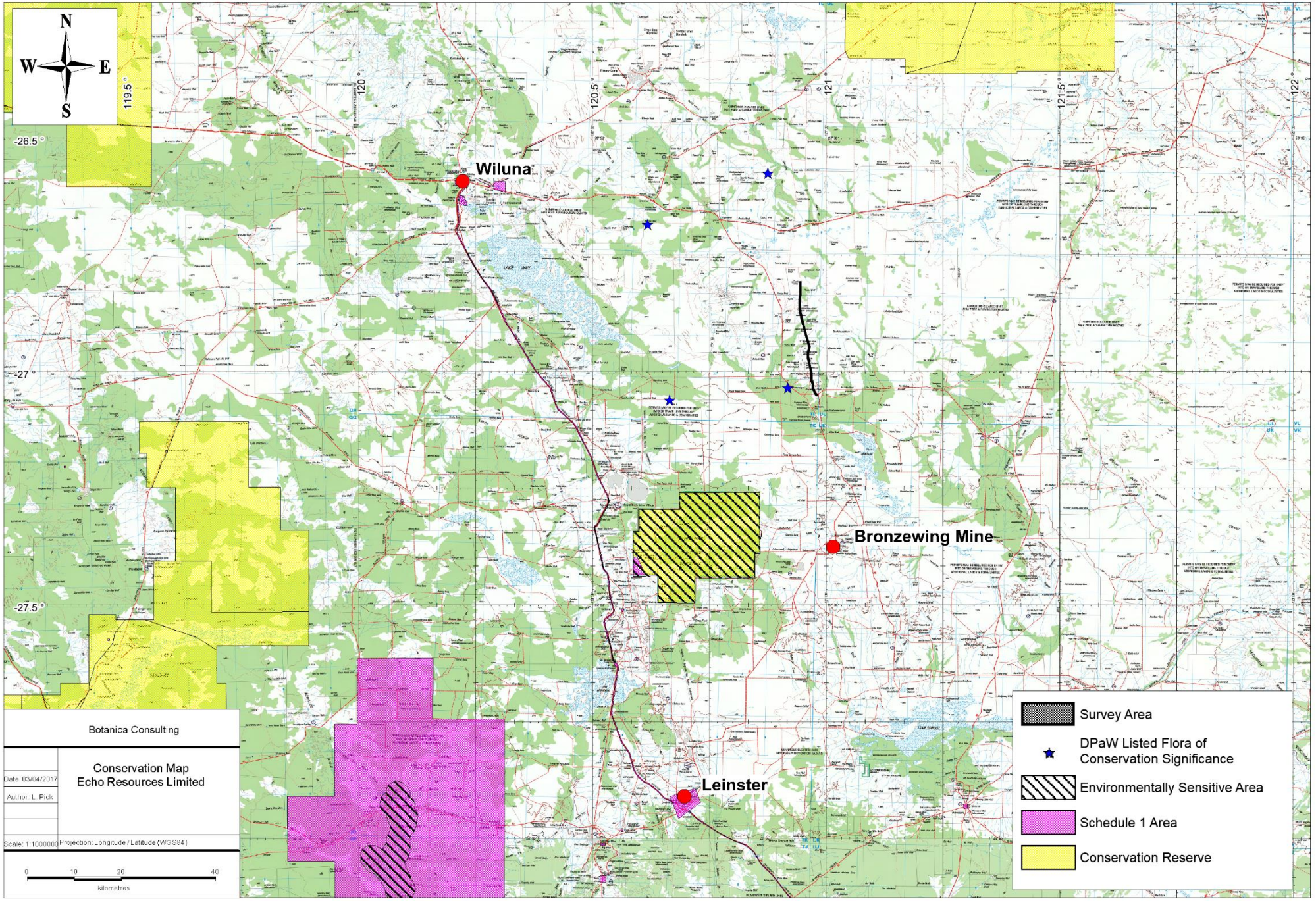
Appendix 1: Growth Form/ Height Classification

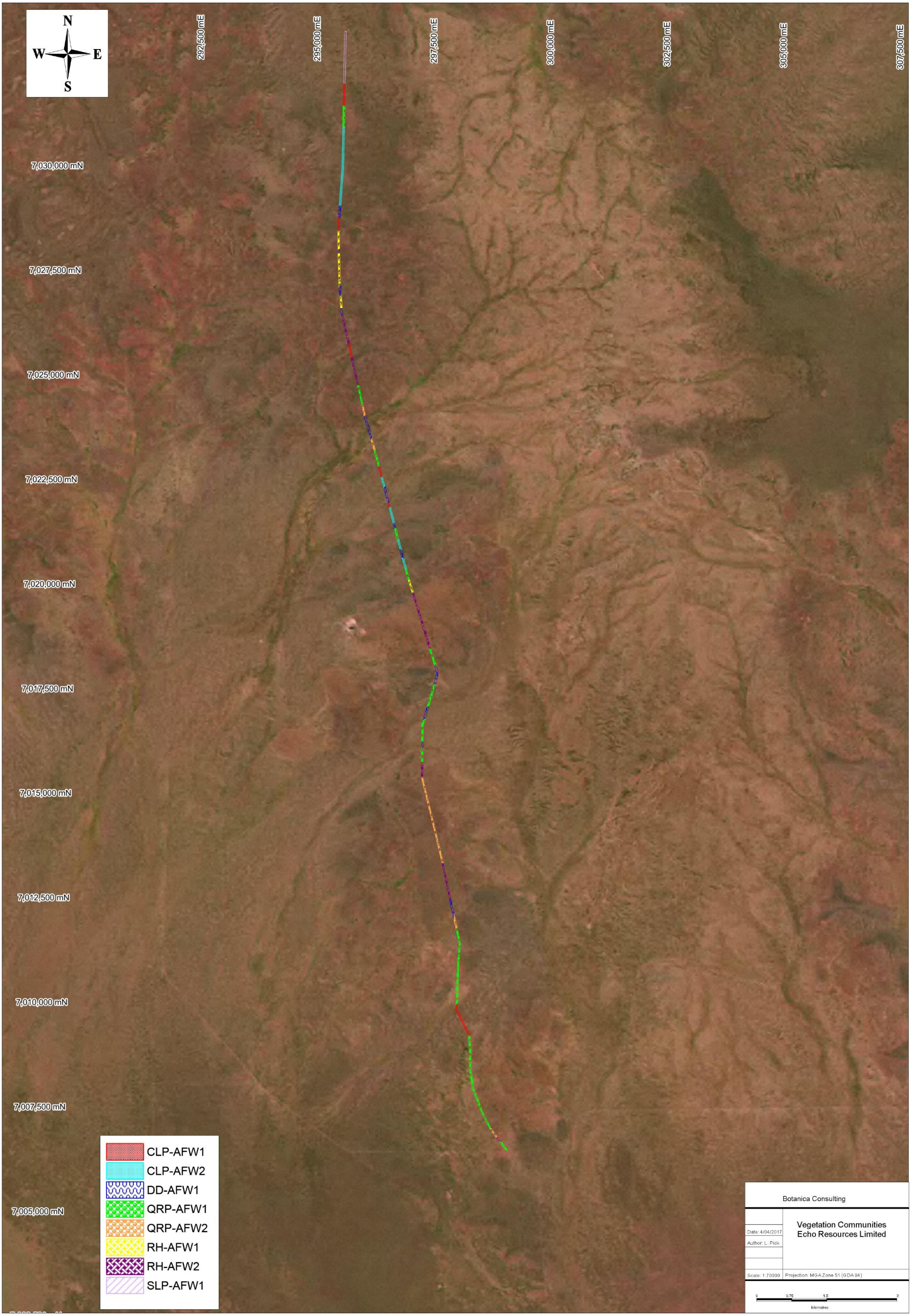
Growth Form	Height Ranges (m)	Height Class	Foliage Cover						
			70-100%	30-70%	10-30%	5-10%	0-5%	0-1%	unknown
tree, palm	>30	tall	closed forest	open forest	woodland	open woodland	isolated clumps of trees	isolated trees	trees
	10-30	mid							
	<10	low							
tree mallee	10-30	tall	closed mallee forest	open mallee forest	mallee woodland	open mallee woodland	isolated clumps of mallee trees	isolated mallee trees	mallee trees
	3-10	mid							
	<3	low							
mallee shrub	10-30	tall	closed mallee shrubland	mallee shrubland	open mallee shrubland	sparse mallee shrubland	isolated clumps of mallee shrubs	isolated mallee shrubs	mallee shrubs
	3-10	mid							
	<3	low							
shrub, cycad, grass-tree, tree-fern	>2	tall	closed shrubland	shrubland	open shrubland	sparse shrubland	isolated clumps of shrubs	isolated shrubs	shrubs
	1-2	mid							
	<1	low							
heath shrub	>2	tall	closed heathland	heathland	open heathland	sparse heathland	isolated clumps of heath shrubs	isolated heath shrubs	heath shrubs
	1-2	mid							
	<1	low							
chenopod shrub	>2	tall	closed chenopod shrubland	chenopod shrubland	open chenopod shrubland	sparse chenopod shrubland	isolated clumps of chenopod shrubs	isolated chenopod shrubs	chenopod shrubs
	1-2	mid							
	<1	low							
samphire shrub	>0.5	mid	closed samphire shrubland	samphire shrubland	open samphire shrubland	sparse samphire shrubland	isolated clumps of samphire shrubs	isolated samphire shrubs	samphire shrubs
	<0.5	low							
hummock grass	>2	tall	closed hummock grassland	hummock grassland	open hummock grassland	sparse hummock grassland	isolated clumps of hummock grasses	isolated hummock grasses	hummock grasses
	1-2	mid							
	<0.5	low							
tussock grass	>2	tall	closed tussock grassland	tussock grassland	open tussock grassland	sparse tussock grassland	isolated clumps of tussock grasses	isolated tussock grasses	tussock grasses
	1-2	mid							
	<1	low							
other grass	1-2	tall	closed grassland	grassland	open grassland	sparse grassland	isolated clumps of grasses	isolated grasses	other grasses
	0.5-1	mid							
	<0.5	low							

Growth Form	Height Ranges (m)	Height Class	Foliage Cover						
			70-100%	30-70%	10-30%	5-10%	0-5%	0-1%	unknown
sedge	1-2	tall	closed sedgeland	sedgeland	open sedgeland	sparse sedgeland	isolated clumps of sedges	isolated sedges	sedges
	0.5-1	mid							
	<0.5	low							
rush	1-2	tall	closed rushland	rushland	open rushland	sparse rushland	isolated clumps of rushes	isolated rushes	rushes
	0.5-1	mid							
	<0.5	low							
forb	1-2	tall	closed forbland	forbland	open forbland	sparse forbland	isolated clumps of forbs	isolated forbs	forbs
	0.5-1	mid							
	<0.5	low							
fern	>2	tall	closed fernland	fernland	open fernland	sparse fernland	isolated clumps of ferns	isolated ferns	ferns
	1-2	mid							
	0-1	low							
bryophyte	0.5-1	tall	closed bryophyteland	bryophyteland	open bryophyteland	sparse bryophyteland	isolated clumps of bryophytes	isolated bryophytes	bryophytes
	0-0.5	low							
lichen	0.5-1	tall	closed lichenland	lichenland	open lichenland	sparse lichenland	isolated clumps of lichens	isolated lichens	lichens
	0-0.5	low							
vine	>30	tall	closed vineland	vineland	open vineland	sparse vineland	isolated clumps of vines	isolated vines	vines
	10-30	mid							
	5-10	low							
aquatic	0.5-1	tall	closed aquatic bed	aquatic bed	open aquatic bed	sparse aquatics	isolated clumps of aquatics	isolated aquatics	aquatics
	0-0.5	low							
seagrass	0.5-1	tall	closed seagrass bed	seagrass bed	open seagrass bed	sparse seagrass bed	isolated clumps of seagrasses	isolated seagrasses	seagrasses
	0-0.5	low							

Appendix 2: Regional map of the survey area including areas of conservation significance



Appendix 3: Vegetation Communities Maps



N
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293,000 mE
294,000 mE
295,000 mE
296,000 mE
297,000 mE
298,000 mE
299,000 mE
300,000 mE
301,000 mE

7,033,000 mN
7,032,000 mN
7,031,000 mN
7,030,000 mN
7,029,000 mN
7,028,000 mN
7,027,000 mN
7,026,000 mN
7,025,000 mN
7,024,000 mN
7,023,000 mN
7,022,000 mN
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7,020,000 mN

- CLP-AFW1
- CLP-AFW2
- DD-AFW1
- QRP-AFW1
- QRP-AFW2
- RH-AFW1
- RH-AFW2
- SLP-AFW1

Botanica Consulting

Vegetation Communities
North Map 1
Echo Resources Limited

Date: 4/04/2017	
Author: L. Pick	
Office:	
Drawing:	
Scale: 1:35000	Projection: MGA Zone 51 (GDA 94)

0 250 500 1,000
metres

N
W
E
S

296,000 mE
297,000 mE
298,000 mE
299,000 mE
300,000 mE
301,000 mE
302,000 mE
303,000 mE
304,000 mE

7,018,000 mN
7,017,000 mN
7,016,000 mN
7,015,000 mN
7,014,000 mN
7,013,000 mN
7,012,000 mN
7,011,000 mN
7,010,000 mN
7,009,000 mN
7,008,000 mN
7,007,000 mN
7,006,000 mN

CLP-AFW1
CLP-AFW2
DD-AFW1
QRP-AFW1
QRP-AFW2
RH-AFW1
RH-AFW2
SLP-AFW1

Botanica Consulting

Vegetation Communities
South Map 2
Echo Resources Limited

Date: 4/04/2017
Author: L. Pick
Office:
Drawing:
Scale: 1:35000
Projection: MGA Zone 51 (GDA 94)

0 250 500 1,000
metres

Appendix 4: List of species identified within each vegetation community

(A) Denotes Annual species (WAHERB, 2017)

Family	Genus	Taxon	CLP-AFW1	CLP-AFW2	DD-AFW1	QRP-AFW1	QRP-AFW2	RH-AFW1	RH-AFW2	SLP-AFW1
Amaranthaceae	*Ptilotus*	*aervoides (A)*				*			*	
Amaranthaceae	*Ptilotus*	*obovatus*					*		*	*
Amaranthaceae	*Ptilotus*	*schwartzii*		*		*		*		*
Chenopodiaceae	*Maireana*	*georgei*					*			*
Chenopodiaceae	*Maireana*	*platycarpa*								*
Chenopodiaceae	*Maireana*	*triptera*					*			*
Chenopodiaceae	*Sclerolaena*	*cuneata*				*	*	*		*
Chenopodiaceae	*Sclerolaena*	*densiflora*				*	*	*		
Chenopodiaceae	*Sclerolaena*	*diacantha*				*	*	*		
Chenopodiaceae	*Sclerolaena*	*obliquicuspis*				*	*	*		
Chenopodiaceae	*Tecticornia*	*disarticulata*					*			
Fabaceae	*Acacia*	*ayersiana*		*						*
Fabaceae	*Acacia*	*balsamea*							*	
Fabaceae	*Acacia*	*caesaneura*		*						*
Fabaceae	*Acacia*	*craspedocarpa*	*				*		*	
Fabaceae	*Acacia*	*incurvaneura*	*	*	*	*	*	*	*	*
Fabaceae	*Acacia*	*pruniocarpa*		*		*		*	*	*
Fabaceae	*Acacia*	*pteraneura*			*					
Fabaceae	*Acacia*	*quadrimarginea*						*		
Fabaceae	*Acacia*	*ramulosa* var. *ramulosa*	*		*					
Fabaceae	*Acacia*	*tetragonophylla*			*	*	*	*		*
Fabaceae	*Senna*	*artemisioides* subsp. *artemisioides*			*					
Fabaceae	*Senna*	sp. Meekatharra (E. Bailey 1-26)	*		*	*	*	*	*	*
Goodeniaceae	*Scaevola*	*spinescens*				*		*		
Loranthaceae	*Amyema*	*preissii*	*	*						
Malvaceae	*Hibiscus*	*burtonii*							*	
Malvaceae	*Sida*	*calyxhymenia*				*				
Malvaceae	*Sida*	*ectogama*	*	*				*	*	
Myrtaceae	*Thryptomene*	*decussata*						*		
Myrtaceae	*Eucalyptus*	*lucasii*		*						*
Pittosporaceae	*Pittosporum*	*angustifolium*			*					

Family	Genus	Taxon	CLP-AFW1	CLP-AFW2	DD-AFW1	QRP-AFW1	QRP-AFW2	RH-AFW1	RH-AFW2	SLP-AFW1
Poaceae	*Aristida*	*contorta (A)*					*		*	*
Poaceae	*Enneapogon*	*caerulescens*			*					
Poaceae	*Eragrostis*	*dielsii (A)*			*					
Poaceae	*Eragrostis*	*eriopoda*	*	*		*		*		*
Poaceae	*Eragrostis*	*kennedyae*			*					
Poaceae	*Eragrostis*	*pergracilis (A)*							*	
Poaceae	*Eriachne*	*mucronata*	*	*		*		*		*
Poaceae	*Monachather*	*paradoxus*	*	*						
Poaceae	*Paspalidium*	*clementii*			*					
Poaceae	*Triodia*	*irritans*	*	*						*
Proteaceae	*Grevillea*	*berryana*	*	*		*		*		
Proteaceae	*Hakea*	*kippistiana*					*			
Proteaceae	*Hakea*	*lorea*							*	
Pteridaceae	*Cheilanthes*	*sieberi*			*				*	
Rubiaceae	*Psydrax*	*latifolia*	*	*	*	*				*
Rubiaceae	*Psydrax*	*suaveolens*	*	*	*					*
Santalaceae	*Exocarpos*	*aphyllus*					*			
Santalaceae	*Santalum*	*lanceolatum*			*			*	*	
Santalaceae	*Santalum*	*spicatum*						*	*	
Sapindaceae	*Dodonaea*	*viscosa* subsp. *mucronata*				*		*		
Scrophulariaceae	*Eremophila*	*paisleyi*		*		*				
Scrophulariaceae	*Eremophila*	*forrestii* subsp. *forrestii*	*			*				*
Scrophulariaceae	*Eremophila*	*fraseri*		*						*
Scrophulariaceae	*Eremophila*	*galeata*		*			*		*	
Scrophulariaceae	*Eremophila*	*gilesii* subsp. *variabilis*	*							*
Scrophulariaceae	*Eremophila*	*jucunda*		*	*					*
Scrophulariaceae	*Eremophila*	*latrobei* subsp. *glabra*								*
Scrophulariaceae	*Eremophila*	*latrobei* subsp. *latrobei*	*	*	*					
Scrophulariaceae	*Eremophila*	*linearis*	*							
Scrophulariaceae	*Eremophila*	*margarethae*	*	*						*
Scrophulariaceae	*Eremophila*	*conglomerata*						*		
Scrophulariaceae	*Eremophila*	*serrulata*			*					
Scrophulariaceae	*Eremophila*	*spectabilis* subsp. *brevis*								*
Solanaceae	*Solanum*	*lasiophyllum*	*	*	*	*			*	*

Appendix 5: Vegetation Health Condition Scale adapted from Keighery 1994 and Trudgen 1988 (DPaW & EPA, 2016)

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

Fauna Recorded or Potentially in Region of Survey Are

Julius Project - Echo Resources Limited

Approximate centroid 26.76417°S and 121.94639°E

Compiled by Greg Harewood - July 2016

Recorded (Sighted/Heard/Signs) = X

Botanica (2016). Level 1 Flora and Fauna Survey Julius Project. Unpublished report for Echo Resources Limited.

Harewood, G. (2015). Fauna Assessment (L1) - Laverton Gold Project. Unpublished report for Bullseye Mining Limited.

Outback Ecology Services (2009). Lake Maitland Baseline Terrestrial Fauna Survey. Unpublished report for Mega Uranium Pty Ltd.

Nonix (2007). A Vertebrate Fauna Survey of the Wiluna West Project Area Western Australia # 3. Unpublished report for Golden West Resources Ltd.

Terrestrial Ecosystems (2011). Level 2 Fauna Risk Assessment for the Granny Deeps Project Area. Unpublished report. February 2011.

Hall, N.J., McKenzie, N.L. and Keighery, G.J. (eds) (1994). The Biological Survey of the Eastern Goldfields of WA - Pt 10: Sandstone-Sir Samuel and Laverton-Leonora Study Areas. Records of the WAM, Supplement 47: 1 – 166

DPaW (2016). NatureMap Database Search – "By Circle" Centre 120° 56' 47" E, 26° 45' 51" S (plus 40km buffer). Accessed 21 May 2016.

Class **Family** *Species*	Common Name	Conservation Status	BC 2016	Harewood 2015	Outback 2009	Ninox 2007	TE 2011	Hall et al. 1994	DPaW 2016
Amphibia									
Myobatrachidae Ground or Burrowing Frogs									
Neobatrachus kunapalari	Kunapalari Frog	LC					X	X	
Neobatrachus sutor	Shoemaker Frog	LC					X		
Neobatrachus wilsmorei	Plonking Frog	LC							
Opisthodon spenceri	Centralian Burrowing Frog								
Pseudophryne occidentalis	Western Toadlet	LC							

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Class **Family** *Species*	Common Name	Conservation Status	BC 2016	Harewood 2015	Outback 2009	Ninox 2007	TE 2011	Hall et al. 1994	DPaW 2016
Hylidae Tree or Water-Holding Frogs									
Cyclorana maini	Sheep Frog	LC					X	X	
Cyclorana platycephala	Water-holding Frog	LC					X	X	
Litoria rubella	Little Red Tree Frog	LC				X			X
Reptilia									
Carphodactylidae Knob-tailed Geckos									
Nephrurus laevissimus	Pale Knob-tail Gecko								X
Nephrurus levis	Smooth Knob-tail Gecko								
Nephrurus vertebralis	Midline Knob-tailed Gecko				X	X			
Nephrurus wheeleri	Banded Knob-tailed Gecko				X	X			

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Class **Family** *Species*	Common Name	Conservation Status	BC 2016	Harewood 2015	Outback 2009	Ninox 2007	TE 2011	Hall et al. 1994	DPaW 2016
Diplodactylidae Geckoes									
Diplodactylus conspicillatus	Fat-tailed Gecko				X			X	
Diplodactylus granariensis	Western Stone Gecko					X	X		
Diplodactylus pulcher	Western Saddled Ground Gecko				X	X	X		
Lucasium squarrosus	Mottled Ground Gecko					X		X	
Lucasium stenodactylus	Sand-plain Gecko	LC			X	X			
Rhynchoedura ornata	Beaked Gecko				X	X	X	X	
Strophurus assimilis	Goldfields Spiny-tailed Gecko								
Strophurus elderi	Jewelled Gecko				X			X	
Strophurus strophurus	Ring-tailed Gecko							X	
Strophurus wellingtonae	Western-shield Spiny-tailed Gecko	LC				X	X	X	X

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Class **Family** *Species*	Common Name	Conservation Status	BC 2016	Harewood 2015	Outback 2009	Ninox 2007	TE 2011	Hall et al. 1994	DPaW 2016
Gekkonidae Geckoes									
Gehyra purpurascens	Purple Arid Dtella				X			X	
Gehyra variegata	Variegated Dtella			X	X	X	X	X	X
Heteronotia binoei	Bynoe's Gecko				X	X	X	X	X
Underwoodisaurus milii	Barking Gecko							X	
Pygopodidae Legless Lizards									
Delma butleri	Unbanded Delma							X	
Delma nasuta	Long-nosed Delma				X			X	
Lialis burtonis	Burton's Legless Lizard				X			X	
Pygopus nigriceps	Hooded Scaly Foot								X

Class **Family** *Species*	Common Name	Conservation Status	BC 2016	Harewood 2015	Outback 2009	Ninox 2007	TE 2011	Hall et al. 1994	DPaW 2016
Agamidae Dragon Lizards									
Caimanops amphiboluroides	Mulga Dragon					X	X		
Ctenophorus caudicinctus	Ring-tailed Dragon					X			X
Ctenophorus cristatus	Bicycle Dragon			X					
Ctenophorus fordi	Mallee Sand Dragon							X	
Ctenophorus isolepis	Military Dragon			X	X	X		X	X
Ctenophorus nuchalis	Central Netted Dragon			X	X			X	
Ctenophorus reticulatus	Western Netted Dragon							X	X
Ctenophorus salinarum	Salt Pan Dragon			X	X			X	
Ctenophorus scutulatus	Lozenge-marked Bicycle Dragon			X	X	X		X	X
Moloch horridus	Thorny Devil				X			X	X
Pogona minor	Western Bearded Dragon				X			X	
Tympanocryptis cephala	Pebble Dragon						X		

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Class **Family** *Species*	Common Name	Conservation Status	BC 2016	Harewood 2015	Outback 2009	Ninox 2007	TE 2011	Hall et al. 1994	DPaW 2016
Varanidae Monitor's or Goanna's									
Varanus brevicauda	Short-tailed Pygmy Monitor							X	
Varanus caudolineatus	Stripe-tailed Pygmy Monitor					X	X	X	X
Varanus eremius	Pygmy Desert Monitor				X	X			
Varanus gouldii	Sand Monitor			X	X			X	
Varanus panoptes	Yellow-spotted Monitor			X	X	X	X		
Varanus tristis	Racehorse Monitor								X

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Class **Family** *Species*	Common Name	Conservation Status	BC 2016	Harewood 2015	Outback 2009	Ninox 2007	TE 2011	Hall et al. 1994	DPaW 2016
Scincidae Skinks									
Cryptoblepharus buchananii	Buchanan's Snake-eyed Skink				X	X		X	
Ctenotus ariadnae	Ariadna's Ctenotus								
Ctenotus atlas	Southern Mallee Ctenotus				X				
Ctenotus brooksi	Central Wedge-snout Ctenotus								
Ctenotus calurus	Blue-tailed Skink								X
Ctenotus dux	Narrow-lined Skink								
Ctenotus grandis	Giant Desert Ctenotus				X				
Ctenotus greeri	Greer's Ctenotus							X	
Ctenotus hanloni	Nimble Ctenotus								
Ctenotus helenae	Dusky Ctenotus				X			X	
Ctenotus leonhardii	Leonhardi's Skink			X	X		X		X
Ctenotus pantherinus	Leopard Ctenotus				X			X	X

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Class **Family** *Species*	Common Name	Conservation Status	BC 2016	Harewood 2015	Outback 2009	Ninox 2007	TE 2011	Hall et al. 1994	DPaW 2016
Ctenotus piankai	Pianka's Ctenotus								
Ctenotus schomburgkii	Barred Wedge-snout Ctenotus			X	X	X		X	
Ctenotus severus	Stern Rock Ctenotus				X				
Ctenotus uber	Spotted Ctenotus			X					
Cyclodomorphus melanops	Eastern Slender Blue-tongue								
Egernia depressa	Pygmy Spiny-tailed Skink				X		X		X
Egernia formosa	Goldfields Crevise Skink								
Egernia inornata	Desert Skink								
Egernia striata	Night Skink								
Eremiascincus richardsonii	Broad-banded Sand Swimmer				X		X		X
Lerista bipes	Western Two-toed Slider				X				
Lerista desertorum	Giant Desert Slider				X	X	X	X	X

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Class **Family** *Species*	Common Name	Conservation Status	BC 2016	Harewood 2015	Outback 2009	Ninox 2007	TE 2011	Hall et al. 1994	DPaW 2016
Lerista kingi	Common Mulch Skink							X	
Lerista muelleri	Common Mulch Skink				X	X			
Lerista timida	Dwarf Three-toed Slider					X			X
Menetia greyii	Dwarf Skink				X	X	X	X	X
Morethia butleri	Woodland Dark-flecked Morethia						X	X	X
Tiliqua multifasciata	Central Blue-tongue				X		X	X	
Tiliqua occipitalis	Western Bluetongue							X	
Typhlopidae Blind Snakes									
Anilios bicolor	Dark-spined Blind Snake						X		
Anilios hamatus	Northern Hook-snouted Blind Snake					X		X	
Anilios waitii	Common Beaked Blind Snake								
Boidae Pythons, Boas									
Antaresia stimsoni	Stimson's Python								

Class **Family** *Species*	Common Name	Conservation Status	BC 2016	Harewood 2015	Outback 2009	Ninox 2007	TE 2011	Hall et al. 1994	DPaW 2016
Elapidae Elapid Snakes									
Brachyurophis fasciolata	Narrow-banded Shovel-nosed Snake								
Demansia psammophis	Yellow-faced Whipsnake								
Furina ornata	Moon Snake							X	
Parasuta monachus	Monk Snake				X	X	X		
Pseudechis australis	Mulga Snake							X	
Pseudechis butleri	Spotted Mulga Snake								
Pseudonaja modesta	Ringed Brown Snake					X			X
Pseudonaja nuchalis	Gwardar								
Simoselaps bertholdi	Jan's Banded Snake					X		X	
Suta fasciata	Rosen's Snake						X		
Aves									
Casuariidae Emus, Cassowarries									
Dromaius novaehollandiae	Emu	LC		X	X	X	X	X	X

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Class **Family** *Species*	Common Name	Conservation Status	BC 2016	Harewood 2015	Outback 2009	Ninox 2007	TE 2011	Hall et al. 1994	DPaW 2016
Megapodiidae Moundbuilders									
Leipoa ocellata	Malleefowl	S3 VU VU A2bce+3ce				X			
Anatidae Geese, Swans, Ducks									
Anas gracilis	Grey Teal	LC					X	X	X
Anas rhynchotis	Australasian Shoveler	LC							X
Anas superciliosa	Pacific Black Duck	LC					X	X	X
Chenonetta jubata	Australian Wood Duck	LC					X	X	X
Tadorna tadornoides	Australian Shelduck	LC						X	X
Ardeidae Herons, Egrets, Bitterns									
Ardea novaehollandiae	White-faced Heron	LC		X			X	X	
Threskiornithidae Ibises, Spoonbills									
Threskiornis molucca	Australian White Ibis	LC							

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Class **Family** *Species*	Common Name	Conservation Status	BC 2016	Harewood 2015	Outback 2009	Ninox 2007	TE 2011	Hall et al. 1994	DPaW 2016
Accipitridae Kites, Goshawks, Eagles, Harriers									
Accipiter cirrocephalus	Collared Sparrowhawk	LC			X	X			
Accipiter fasciatus	Brown Goshawk	LC							
Aquila audax	Wedge-tailed Eagle	LC		X	X	X	X	X	X
Aquila morphnoides	Little Eagle	LC		X	X			X	
Circus assimilis	Spotted Harrier	LC						X	X
Elanus caeruleus	Black-shouldered Kite	LC		X	X				
Haliastur indus	Brahminy Kite	LC							
Haliastur sphenurus	Whistling Kite	LC							X
Hamirostra melanosternon	Black-breasted Buzzard	LC				X			X
Milvus migrans	Black Kite	LC			X				

Class **Family** *Species*	Common Name	Conservation Status	BC 2016	Harewood 2015	Outback 2009	Ninox 2007	TE 2011	Hall et al. 1994	DPaW 2016
Falconidae Falcons									
Falco berigora	Brown Falcon	LC		X	X	X	X	X	X
Falco cenchroides	Australian Kestrel	LC	X	X	X	X	X	X	X
Falco longipennis	Australian Hobby	LC			X			X	X
Falco peregrinus	Peregrine Falcon	S7 LC				X			
Rallidae Rails, Crakes, Swamphens, Coots									
Fulica atra	Eurasian Coot	LC					X	X	X
Otididae Bustards									
Ardeotis australis	Australian Bustard	LC				X		X	X
Turnicidae Button-quails									
Turnix velox	Little Button-quail	LC				X			
Burhinidae Stone Curlews									
Burhinus grallarius	Bush Stone-curlew	LC			X				

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Class **Family** *Species*	Common Name	Conservation Status	BC 2016	Harewood 2015	Outback 2009	Ninox 2007	TE 2011	Hall et al. 1994	DPaW 2016
Charadriidae Lapwings, Plovers, Dotterels									
Charadrius melanops	Black-fronted Dotterel	LC			X		X	X	
Vanellus tricolor	Banded Lapwing	LC						X	X
Columbidae Pigeons, Doves									
Geopelia cuneata	Diamond Dove	LC		X	X	X		X	X
Ocyphaps lophotes	Crested Pigeon	LC	X	X	X	X	X	X	X
Phaps chalcoptera	Common Bronzewing	LC	X	X	X	X	X	X	X

Class **Family** *Species*	Common Name	Conservation Status	BC 2016	Harewood 2015	Outback 2009	Ninox 2007	TE 2011	Hall et al. 1994	DPaW 2016
Psittacidae Parrots									
Cacatua roseicapilla	Galah	LC		X	X	X		X	
Cacatua sanguinea	Little Corella	LC			X				
Melopsittacus undulatus	Budgerigar	LC		X	X	X		X	X
Neophema bourkii	Bourke's Parrot			X		X		X	
Nymphicus hollandicus	Cockatiel	LC		X	X			X	X
Platycercus varius	Mulga Parrot	LC		X	X	X	X	X	
Platycercus zonarius	Australian Ringneck	LC		X	X	X	X	X	
Cuculidae Parasitic Cuckoos									
Chrysococcyx basalis	Horsfield's Bronze Cuckoo	LC		X				X	
Chrysococcyx osculans	Black-eared Cuckoo	LC		X		X			
Cuculus pallidus	Pallid Cuckoo	LC		X			X	X	

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Class **Family** *Species*	Common Name	Conservation Status	BC 2016	Harewood 2015	Outback 2009	Ninox 2007	TE 2011	Hall et al. 1994	DPaW 2016
Strigidae Hawk Owls									
Ninox novaeseelandiae	Boobook Owl	LC							
Podargidae Frogmouths									
Podargus strigoides	Tawny Frogmouth	LC		X	X			X	
Caprimulgidae Nightjars									
Eurostopodus argus	Spotted Nightjar	LC		X	X				
Aegothelidae Owlet-nightjars									
Aegotheles cristatus	Australian Owlet-nightjar	LC			X	X		X	
Halcyonidae Tree Kingfishers									
Todiramphus pyrrhopygia	Red-backed Kingfisher	LC		X		X	X	X	
Meropidae Bee-eaters									
Merops ornatus	Rainbow Bee-eater	S5 Mig JA LC							

Class **Family** *Species*	Common Name	Conservation Status	BC 2016	Harewood 2015	Outback 2009	Ninox 2007	TE 2011	Hall et al. 1994	DPaW 2016
Climacteridae Treecreepers									
Climacteris affinis	White-browed Treecreeper	LC		X				X	
Maluridae Fairy Wrens, GrassWrens									
Malurus lamberti	Variegated Fairy-wren	LC	X	X	X			X	X
Malurus leucopterus	White-winged Fairy-wren	LC		X	X		X	X	X
Malurus splendens	Splendid Fairy-wren	LC		X	X	X	X		X

Class **Family** *Species*	Common Name	Conservation Status	BC 2016	Harewood 2015	Outback 2009	Ninox 2007	TE 2011	Hall et al. 1994	DPaW 2016
Acanthizidae Thornbills, Gerygones, Fieldwrens & Whitefaces									
Acanthiza apicalis	Broad-tailed Thornbill	LC		X		X	X	X	X
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	LC		X		X	X	X	X
Acanthiza iredalei	Slender-billed Thornbill	LC							
Acanthiza robustirostris	Slaty-backed Thornbill	LC		X	X	X	X		X
Acanthiza uropygialis	Chestnut-rumped Thornbill	LC		X	X	X		X	X
Aphelocephala leucopsis	Southern Whiteface	LC		X		X	X	X	X
Gerygone fusca	Western Gerygone	LC							X
Pyrrholaemus brunneus	Redthroat	LC		X	X	X			
Smicrornis brevirostris	Weebill	LC			X	X		X	X
Pardalotidae Pardalotes									
Pardalotus striatus	Striated Pardalote	LC					X	X	X

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Class **Family** *Species*	Common Name	Conservation Status	BC 2016	Harewood 2015	Outback 2009	Ninox 2007	TE 2011	Hall et al. 1994	DPaW 2016
Meliphagidae Honeyeaters, Chats									
Acanthagenys rufogularis	Spiny-cheeked Honeyeater	LC		X	X	X	X	X	X
Certhionyx niger	Black Honeyeater	LC						X	
Certhionyx variegatus	Pied Honeyeater	LC		X			X	X	
Epthianura tricolor	Crimson Chat	LC		X	X	X	X	X	
Lichenostomus keartlandi	Grey-headed Honeyeater	LC			X				
Lichenostomus ornatus	Yellow-plumed Honeyeater	LC			X				
Lichenostomus penicillatus	White-plumed Honeyeater	LC			X				
Lichenostomus plumulus	Grey-fronted Honeyeater	LC		X	X			X	
Lichenostomus virescens	Singing Honeyeater	LC		X	X	X	X	X	
Lichmera indistincta	Brown Honeyeater	LC			X			X	X
Manorina flavigula	Yellow-throated Miner	LC	X	X	X	X	X	X	X
Phylidonyris albifrons	White-fronted Honeyeater	LC		X				X	

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Petroicidae Australian Robins									
Microeca fascinans	Jacky Winter	LC						X	X
Petroica cucullata	Hooded Robin	LC		X		X	X	X	
Petroica goodenovii	Red-capped Robin	LC		X	X	X	X	X	X
Pomatostomidae Babblers									
Pomatostomus superciliosus	White-browed Babbler	LC	X	X	X	X	X	X	
Pomatostomus temporalis	Grey-crowned Babbler	LC		X		X			X
Cinclosomatidae Whipbirds, Wedgebills, Quail Thrushes									
Cinclosoma castaneothorax	Chestnut-breasted Quail-thrush	LC	X	X		X			
Cinclosoma castanotus	Chestnut Quail-thrush	LC			X				
Psophodes occidentalis	Chiming Wedgebill	LC			X				
Neosittidae Sitellas									
Daphoenositta chrysoptera	Varied Sittella	LC		X		X			

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Class **Family** *Species*	Common Name	Conservation Status	BC 2016	Harewood 2015	Outback 2009	Ninox 2007	TE 2011	Hall et al. 1994	DPaW 2016
Pachycephalidae Crested Shrike-tit, Crested Bellbird, Shrike Thrushes, Whistlers									
Colluricincla harmonica	Grey Shrike-thrush	LC		X	X	X	X	X	X
Oreoica gutturalis	Crested Bellbird	LC	X	X	X	X	X	X	X
Pachycephala rufiventris	Rufous Whistler	LC		X	X	X	X	X	X
Dicruridae Monarchs, Magpie Lark, Flycatchers, Fantails, Drongo									
Grallina cyanoleuca	Magpie-lark	LC		X	X	X	X	X	X
Rhipidura fuliginosa	Grey Fantail	LC							
Rhipidura leucophrys	Willie Wagtail	LC	X	X	X	X	X	X	X
Campephagidae Cuckoo-shrikes, Trillers									
Coracina maxima	Ground Cuckoo-shrike	LC				X	X	X	
Coracina novaehollandiae	Black-faced Cuckoo-shrike	LC	X	X	X	X	X	X	X
Lalage tricolor	White-winged Triller	LC		X	X	X	X	X	

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Artamidae Woodswallows, Butcherbirds, Currawongs									
Artamus cinereus	Black-faced Woodswallow	LC	X	X	X	X	X	X	X
Artamus minor	Little Woodswallow	LC				X	X		
Artamus personatus	Masked Woodswallow	LC		X		X	X	X	X
Cracticidae Currawongs, Magpies & Butcherbirds									
Cracticus nigrogularis	Pied Butcherbird	LC		X	X	X	X	X	X
Cracticus tibicen	Australian Magpie	LC	X	X	X	X	X	X	X
Cracticus torquatus	Grey Butcherbird	LC		X	X	X	X	X	X
Strepera versicolor	Grey Currawong	LC				X		X	
Corvidae Ravens, Crows									
Corvus bennetti	Little Crow	LC			X	X	X	X	X
Corvus orru	Torresian Crow	LC	X	X		X	X		X

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Ptilonorhynchidae Bowerbirds									
Ptilonorhynchus maculatus	Western Bowerbird			X	X	X	X		
Motacillidae Old World Pipits, Wagtails									
Anthus australis	Australian Pipit	LC	X	X	X	X	X	X	
Estrildidae Grass Finches & Mannikins									
Taeniopygia guttata	Zebra Finch	LC	X	X	X	X	X	X	X
Dicaeidae Flowerpeckers									
Dicaeum hirundinaceum	Mistletoebird	LC				X	X	X	X
Hirundinidae Swallows, Martins									
Cheramoeca leucosternus	White-backed Swallow	LC			X	X	X	X	
Hirundo ariel	Fairy Martin	LC							
Hirundo neoxena	Welcome Swallow	LC		X	X	X	X		
Hirundo nigricans	Tree Martin	LC					X	X	

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Sylviidae Old World Warblers									
Cincloramphus cruralis	Brown Songlark	LC						X	X
Cincloramphus mathewsi	Rufous Songlark	LC						X	
Mammalia									
Tachyglossidae Echidnas									
Tachyglossus aculeatus	Echidna	LC		X	X	X		X	

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Dasyuridae Carnivorous Marsupials									
Antechinomys laniger	Kultarr	LC				X	X		
Dasycercus blythi	Brush-tailed Mulgara	P4 LC				X			X
Ningaui ridei	Wongai Ningaui	LC			X	X		X	
Pseudantechinus woolleyae	Woolley's Pseudantechinus	LC				X			
Sminthopsis crassicaudata	Fat-tailed Dunnart	LC						X	
Sminthopsis dolichura	Little long-tailed Dunnart	LC				X	X		
Sminthopsis hirtipes	Hairy-footed Dunnart	LC					X	X	
Sminthopsis macroura	Stripe-faced Dunnart	LC			X	X	X	X	X
Sminthopsis ooldea	Ooldea Dunnart	LC			X			X	
Macropodidae Kangaroos, Wallabies									
Macropus robustus	Euro	LC		X	X	X	X	X	
Macropus rufus	Red Kangaroo	LC	X	X	X	X		X	

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Emballonuridae Sheath-tailed Bats									
Taphozous hilli	Hill's Sheathtail-bat	LC		X	X	X			
Molossidae Freetail Bats									
Austronomus australis	White-striped Freetail-bat	LC			X			X	
Mormopterus beccarii	Beccari's Freetail-bat	LC				X			
Ozimops petersi	Inland Freetail-bat	LC		X	X	X	X	X	
Vespertilionidae Ordinary Bats									
Chalinolobus gouldii	Gould's Wattled Bat	LC		X	X	X	X	X	
Nyctophilus geoffroyi	Lesser Long-eared Bat	LC			X	X		X	X
Scotorepens balstoni	Inland Broad-nosed Bat	LC			X	X	X	X	X
Vespadelus baverstocki	Inland Forest Bat	LC							
Vespadelus finlaysoni	Finlayson's Cave Bat	LC		X	X	X	X		

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Muridae Rats, Mice									
Mus musculus	House Mouse	Introduced			X	X	X	X	
Notomys alexis	Spinifex Hopping-mouse	LC			X	X	X	X	X
Pseudomys bolami	Bolam's Mouse	LC							
Pseudomys desertor	Desert Mouse	LC			X				X
Pseudomys hermannsburgensis	Sandy Inland Mouse	LC			X	X	X	X	X
Canidae Dogs, Foxes									
Canis lupus	Dog/Dingo	Introduced		X	X	X			
Vulpes vulpes	Red Fox	Introduced			X			X	
Felidae Cats									
Felis catus	Cat	Introduced		X	X	X	X	X	

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Bovidae Horned Ruminants									
Bos taurus	European Cattle	Introduced		X	X	X			
Capra hircus	Goat	Introduced		X					
Ovis aries	Sheep	Introduced			X				
Camelidae Camels									
Camelus dromedarius	Camel	Introduced	X	X		X		X	
Leporidae Rabbits, Hares									
Oryctolagus cuniculus	Rabbit	Introduced		X	X	X	X	X	

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