Wingellina Nickel Project

Terrestrial Flora, Vegetation and Fauna Desktop Review and Preliminary Findings from Selected Survey Data - 497500mE, 7118000mN; and 498100mE, 7117900mN

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EXECUTIVE SUMMARY

Outback Ecology was commissioned by Metals X Limited to conduct a terrestrial flora and vegetation assessment and terrestrial fauna assessment of the Wingellina Nickel Project, within exploration tenement E69/535 in Western Australia. The flora, vegetation and fauna surveys were components of a broader study undertaken concurrently by Outback Ecology, including assessment of subterranean fauna, soils and waste materials within the project area. The field surveys were conducted throughout April and early May 2008.

This report provides a summary of the findings of the flora and vegetation desktop review; and a brief summary of flora, vegetation and fauna data collected from a targeted area within the Wingellina project area which is bounded by 497500mE, 7118000mN and 498100mE, 7117900mN, located within E69/535

The Wingellina project area is approximately 8 km south-west of Surveyor Generals Corner, within the Wingellina Hills, which lie to the north of the Musgrave Ranges in the Ngaanyatjarra Lands Indigenous Protected Area. The project area lies within the Mann-Musgrave subregion of the Central Ranges bioregion.

The flora, vegetation and fauna surveys were planned and implemented as far as practicable in accordance with the Environmental Protection Authority (EPA) Position Statement No 3 “Terrestrial Biological Surveys as an Element of Biodiversity Protection” (EPA, 2002); Guidance Statement No 51 “Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA, 2004); and Guidance Statement No 56 “Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia” (EPA, 2004).

The objectives of the flora and vegetation survey were to:

- Conduct a desktop review of ecological data relevant to the survey area; and
- Undertake a site visit to:
    - Complete a census and develop an inventory of flora, including Declared Rare or Priority flora, located within the project area ;
    - Conduct a quadrat-based survey across the survey area to define, describe, delineate and map vegetation associations across the survey area; and
    - Provide an initial assessment of the regional and local conservation significance of the flora and vegetation.

The objectives of the terrestrial fauna assessment of the Wingellina project were to:

- Develop an inventory of terrestrial vertebrate fauna species, and selected invertebrate fauna considered as potential short-range endemics, identified from the project area, or likely to be

present within the project area. This incorporated a desktop review of available information and background information to delineate habitat variables;

- Assess site information in the regional context by comparisons with available data from other localities within the bioregion, and to provide an assessment of current and potential impacts on significant fauna populations and habitats;
- Provide quantitative data that can provide a baseline against which future impacts and rehabilitation can be assessed, and the basis of a monitoring program.

Flora, vegetation and ecological communities

No Threatened Ecological Communities (TECs) or 'at risk' communities as defined by the Department of Environment and Water Resources (Federal) or the Department of Environment and Conservation (DEC) (State) were identified as occurring with the survey area.

A total of 15 plant taxa were recorded from within the area to which this report relates. No flora of conservation significance was recorded from this area. No alien taxa were recorded from this area.

The vegetation within this area was described as *Eucalyptus socialis* subsp *socialis* Open Shrub Mallee over mixed species Dwarf Scrub C over *Triodia helmsii* Dense Hummock Grass. The vegetation was assessed as being degraded, according to the scale of Keighery (1994). Main causes of disturbance were repeated fires and grazing by camels. The vegetation was not considered to have significant conservation value.

The area to which this report relates was identified during a survey conducted by Halpern Glick Maunsell Pty Ltd.(2002) as containing vegetation that may be of potential conservation significance. The assessment by Halpern Glick Maunsell Pty Ltd (2002) was based on interpretation of aerial photography and is not consistent with the data collected during the survey conducted by Outback Ecology in April 2008.

Fauna

The targeted area for which this report has been prepared, was not included in a systematic trapping regime or physically ground-truthed by fauna survey personnel during the April 2008 fauna survey. However, on examination of aerial and site photographs, databases and available literature, and the habitat description of the area, it is unlikely that any fauna species of conservation significance would be found over the targeted area. The targeted area is heavily degraded from disturbance by frequent fires and grazing by camels. These disturbances would preclude any species of conservation significance occurring over the area

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1.0 INTRODUCTION

1.1 Project Background

Outback Ecology was commissioned by Metals X Limited to conduct a terrestrial flora and vegetation assessment and terrestrial fauna assessment of the Wingellina Nickel Project, within exploration tenement E69/535 in Western Australia (**Figure 1**). The flora, vegetation and fauna assessments were components of a broader study undertaken concurrently by Outback Ecology, including assessment of subterranean fauna, soils and waste materials within the project area. The field surveys were conducted throughout April and early May 2008.

The Wingellina project area is approximately 8 km south-west of Surveyor Generals Corner, within the Wingellina Hills, which lie to the north of the Musgrave Ranges in the Ngaanyatjarra Lands Indigenous Protected Area. The project area lies within the Mann-Musgrave subregion of the Central Ranges bioregion

This report provides a summary of the findings of the flora and vegetation desktop review; and a brief summary of flora, vegetation and terrestrial fauna data collected from a targeted area within the Wingellina project area which is bounded by 497500mE, 7118000mN and 498100mE, 7117900mN, located within E69/535 (Figure 2)

The surveys were planned and implemented as far as practicable in accordance with the Environmental Protection Authority (EPA) Position Statement No 3 “Terrestrial Biological Surveys as an Element of Biodiversity Protection” (EPA, 2002); Guidance Statement No 51 “Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA, 2004); and Guidance Statement No 56 “Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia” (EPA, 2004).

1.2 Scope and Objectives of the Study

The objectives of the flora and vegetation survey were to:

- Conduct a desktop review of ecological data relevant to the survey area; and
- Undertake a site visit to:
    - Complete a census and develop an inventory of flora, including Declared Rare or Priority, flora located within the project area ;
    - Conduct a quadrat-based survey across the survey area to define, describe, delineate and map vegetation associations across the survey area; and
    - Provide an initial assessment of the regional and local conservation significance of the flora and vegetation.

The objectives of the terrestrial fauna assessment of the Wingellina project were to:

- Develop an inventory of terrestrial vertebrate fauna species, and selected invertebrate fauna considered as potential short-range endemics, identified from the project area, or likely to be present within the project area. This incorporated a desktop review of available information and background information to delineate habitat variables;
- Assess site information in the regional context by comparisons with available data from other localities within the bioregion, and to provide an assessment of current and potential impacts on significant fauna populations and habitats;
- Provide quantitative data that can provide a baseline against which future impacts and rehabilitation can be assessed, and the basis of a monitoring program.

Outback Ecology conducted a flora and fauna surveys over the Wingellina project area during April 2008. This report provides a summary of the findings of the desktop review and a brief summary of data collected from an area bounded by 497500mE, 7118000mN and 498100mE, 7117900mN, located within E69/535 (**Figure 2**)

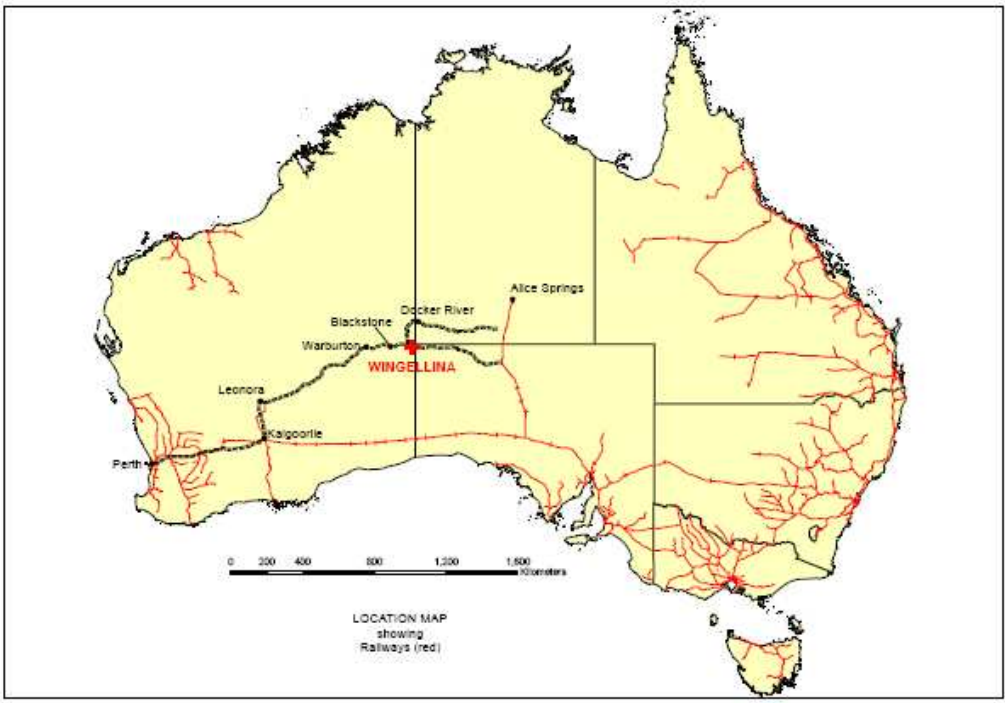

Figure 1 Locality map of Wingellina project area.

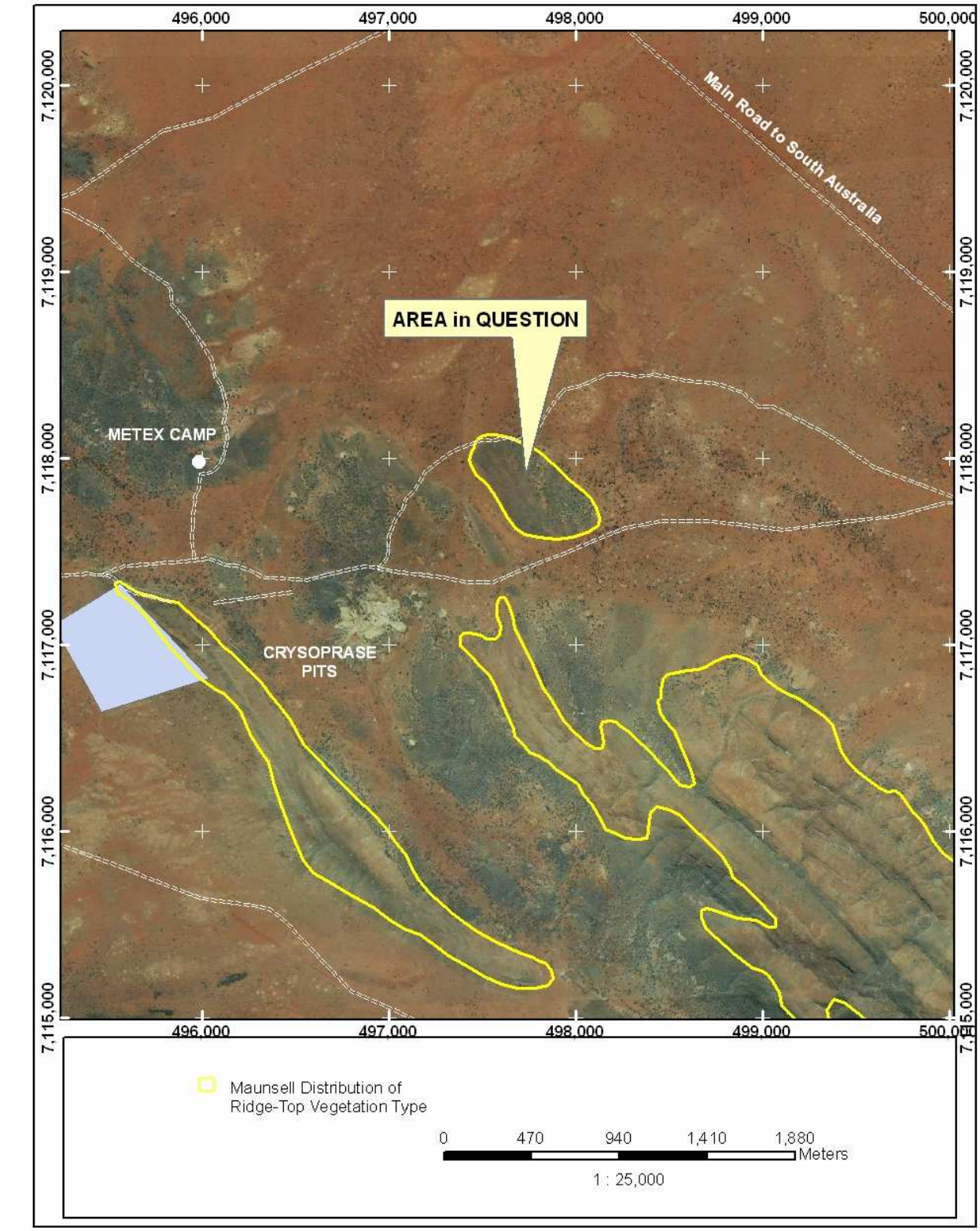

Figure 2 Aerial photograph showing area to which this summary report relates

2.0 EXISTING ENVIRONMENT

2.1 Climate

The climate of the Central Ranges is characterised as a true arid desert, with hot summers and mild winters (BOM, 2008). The region is influenced by a northern tropical/summer climatic pattern. Rainfall is variable, however the majority is received during summer, largely due to the movement of low pressure troughs and tropical lows associated with monsoon troughs moving south in the region. Winters are mild and associated with a high pressure subtropical ridge (BOM, 2008).

The Giles weather station is the nearest registered meteorological station, located approximately130km to the north west of the project area. The weather station was established in 1956 by the Australian Weapons Research Establishment (Defense, Science and Technology Organisation) (BOM, 2008). Mean annual rainfall recorded at Giles is 284mm, with the majority received between November and March (**Figure 3**). Mean maximum daily temperature of 37.2 ℃ is recorded during January, with the minimum mean temperature of 6.8 ℃ recorded during July. (BOM, 2008)

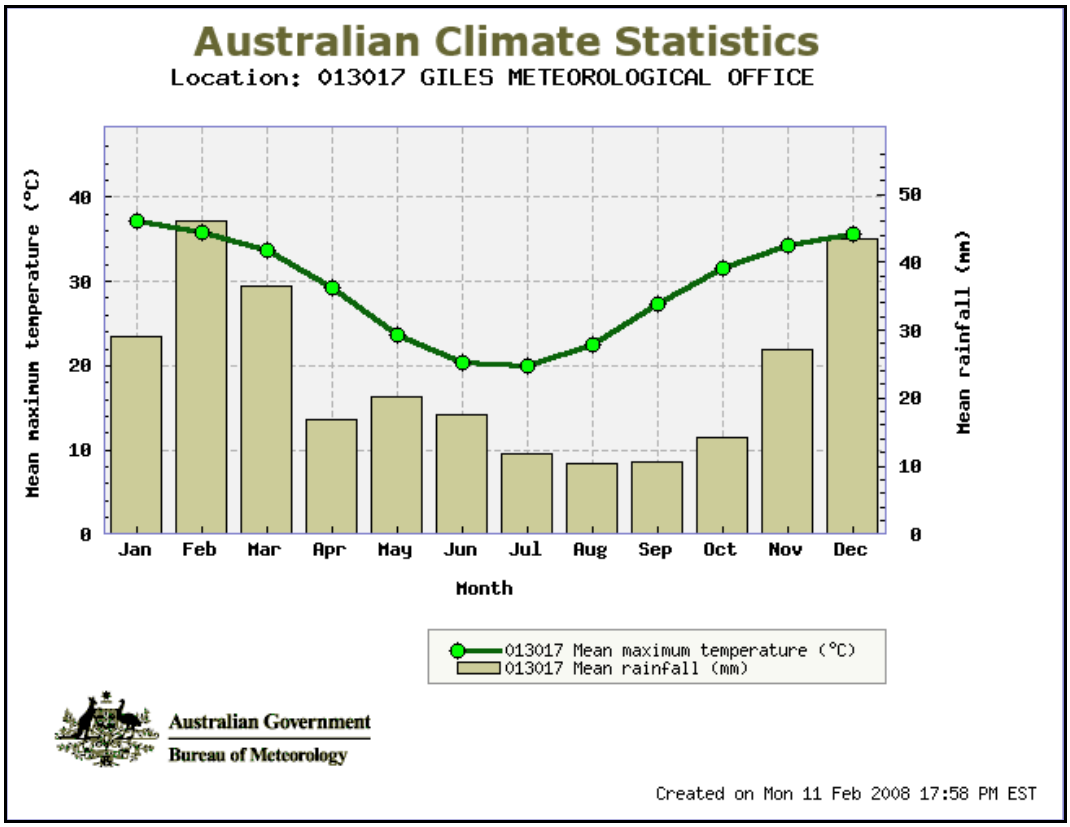

Figure 3 Climate data for Giles Meteorological Office (BOM, 2008).

2.2 IBRA Region – Central Ranges Biogeographic Region

The Wingellina Nickel Project is located within the Mann-Musgrave block of the Central Ranges bioregion. The Mann-Musgrave subregion is located in Western Australia and the south-west corner of the Northern Territory (Graham and Cowan, 2001). This subregion is characterised by a high

proportion of Proterozoic ranges (both volcanic and quartzites) and derived soil plains, interspersed with red Quaternary sandplains with some Permian exposure (Graham and Cowan, 2001).

The sandplains support low open woodlands of either Desert Oak or Mulga over *Triodia basedowii* hummock grasslands, while low open woodlands of Ironwood and Corkwoods over tussock or hummock grasses often fringe the ranges (Graham and Cowan, 2001). The ranges support mixed wattle scrub or C*allitris glaucophylla* woodlands over hummock and tussock grasslands.

3.0 METHODS

3.1 Flora Desktop Review

A review of databases and publicly available information was conducted prior to the field surveys. The desktop review consisted of the following:

- A search of the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* Protected Matters database for flora of conservation significance and Threatened Ecological Communities (TEC) known, or likely, to occur within the survey areas;
- A search of the Department of Environment and Conservation (DEC) *Threatened (Declared Rare) Flora* database, the *Western Australian Herbarium (WAHERB)* database and the *Declared Rare and Priority Flora List* for Rare and Priority flora collected from the survey area and surrounds;
- A search of the DEC Threatened Ecological Communities (TEC) database for listings of communities recorded within the survey area and surrounds;
- A search of the South Australian herbarium databases for information regarding flora of conservation significance collected from the area within South Australia adjacent to the project area;
- A search of the Northern Territory Department of Natural Resources, Environment and the Arts (NRETA) for flora of conservation significance collected from the area within the Northern Territory adjacent to the project area; and
- A limited review of publicly available ecological information pertaining to the survey areas and surrounds.

3.1.1 Environment Protection and Biodiversity Conservation (EPBC) Act 1999 Protected Matters Database Search

The *EPBC Act* is a federal government act that was enacted to protect the environment, with a focus on matters of National Environmental Significance (DEWHA, 2008). The act serves to provide a means to manage threats to the natural environment by:

- providing for the protection of biodiversity conservation through the identification of threatening processes, protecting critical habitat, preparation of management plans and issuing conservation orders;

- providing for compliance and enforcement through a range of actions including court injunctions and environmental auditing; and
- providing for an additional level of approval for activities likely to impact on aspects of the natural environment protected under the Act.

A database has been established to manage listings under the Act; the Protected Matters database. A search of the Commonwealth *EPBC Protected Matters* database was undertaken for an area within a radius of 100km around a centre of 26° 4' 4.94", 128° 57' 54.59" to determine whether there were any listings under the Act for the project area. In particular, the search was employed to determine whether there were any TEC or protected flora known or likely to occur within the project areas. Threatened Ecological Communities classified as threatened are protected by Schedule 2 of the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999.* Approval from the Minister for the Environment and Heritage must be sought to undertake any action that is likely to have a significant impact on a listed TEC. There are three categories of TECs under the *EPBC Act 1999* – 'Critically Endangered', 'Endangered' and 'Vulnerable'.

3.1.2 Declared Rare and Priority Flora – DEC Database Search

Declared Rare Flora (DRF) are gazetted under subsection 2 of section 23F of the Western Australian *Wildlife Conservation Act 1950* and as such it is an offence to damage such flora. The Priority Flora list does not have the same legal status as the DRF Schedule, however Priority Flora are considered under the *Environmental Protection Act 1986* as enforced by the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*, when determining biodiversity value of an area (DoIR, 2006). Definitions of Declared Rare and Priority Flora species are provided in **Appendix A**.

Prior to the field survey, a search was conducted of the Department of Environment and Conservation's *Threatened (Declared Rare) Flora* database and the *Western Australian Herbarium Specimen* database for rare and priority species opportunistically collected within a radius of approximately 50km surrounding the central point **26º03'16"S, 128º56'53"E** of the WIngellina survey area. Due to the paucity of flora records from the Wingellina area and the proximity of the South Australian and Northern Territory state borders, a search of both these Government *Threatened (Declared Rare) Flora* databases was made for the same area. In addition, the South Australian Herbarium made available a species list from a survey of the Wingellina made by the South Australian Herbarium in 2006. Species lists provided by South Australian DEH and Herbarium were checked against FloraBase (Western Australian Herbarium online database) to determine Priority Status in Western Australia

3.1.3 Threatened Ecological Communities – DEC Database Search

In Western Australia, the Department of Environment and Conservation (DEC) recognizes four categories of Threatened Ecological Communities (TECs) within WA, as developed by English and Blyth (1997). These include – 'Presumed Totally Destroyed', 'Critically Endangered', 'Endangered' and 'Vulnerable' (**Appendix A**). Other ecological communities that are considered to possibly be

under threat but do not meet the survey criteria associated with TECs, are listed under the Department's Priority Ecological Community List under Priorities1, 2 and 3. Those ecological communities which are considered to be adequately known and are rare but not threatened, or which have been recently removed from the threatened list, are classified as Priority 4 and require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5 (Naturebase, 2006).

In addition to TECs, ecosystems are also described as being 'at risk'. The status of 'at risk' is recognised by the DEC and the Department of Environment, Water, Heritage and Art. Whilst not conferring any form of legislative protection, the application of the 'at risk' status is a useful tool that highlights ecosystems that may be subject to threatening processes and as such, could potentially become a Threatened Ecological Community in the future.

A search of the DEC TEC database was undertaken for an area of an approximately radius of 50km surrounding the central point **26º03'16"S, 128º56'53"E** of the Wingellina survey area. In addition, the potential presence of 'at risk' ecosystems within the survey areas was determined by reviewing listings in the DEC biodiversity audit report for the Central Ranges 1 Bioregion (Graham and Cowan, 2001).

3.1.4 Review of Existing Reports

The following report was reviewed:

- Halpern Glick Maunsell Pty Ltd (2002) *Acclaim Exploration NL Wingellina Baseline Biological Survey*.

3.2 Vegetation Field Survey

3.2.1 Timing of Surveys

The survey was undertaken between April 13th – 22nd, 2008. Rainfall in the three months immediately preceding the survey was below average; however, rainfall received during December was significantly above the long term average (**Figure 4**).

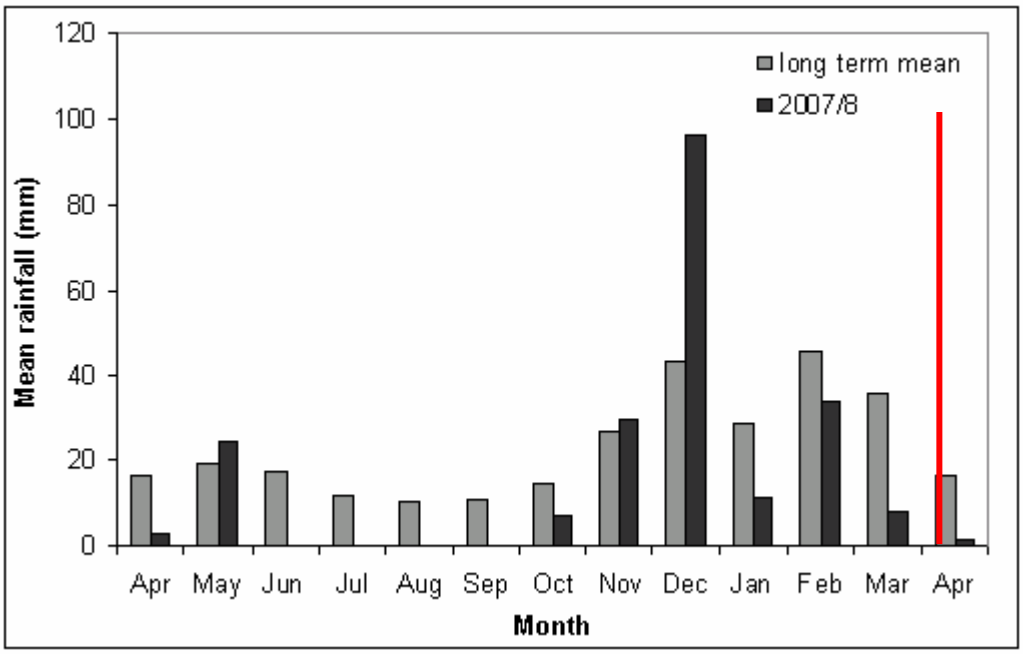

Figure 4 Monthly rainfall received at Giles weather station from April 2007 – April 2008 in comparison to the long-term mean monthly rainfall. The red line indicates the timing of survey.

3.2.2 Survey personnel

Personnel involved in the flora and vegetation survey of the Wingellina Nickel Project were:

Mr Brett Neasham	BSc. (Biol) Hons (Env. Man)	Botanist/Environmental Scientist
Ms Belinda Newman	BSc. Env Biol	Botanist/Environmental Scientist

Specimen identifications:

Mr Brett Neasham	Bsc. (Biol) Hons (Env Man)	Botanist/Environmental Scientist
Ms Belinda Newman	BSc. Env Biol	Botanist/Environmental Scientist
Dr Aleida Williams	PhD (Plant Science)	Botanist/Environmental Scientist
Mr David Leach	BSc. (Hons)	Botanist/Environmental Scientist

3.2.3 Survey Methods

One 30m x 30m quadrat was located within the area to which this report relates. Within this quadrat, the following was recorded:

- Location (recorded in WGS84 UTM)
- Estimated height and percentage foliar cover of all flora species. Topographic position.
- Slope.
- Soil type and exposed rock or surface rocks.
- Type of litter and percent cover.
- Assessment of the condition of vegetation, based on the scale of Keighery (1994) (**Appendix B**).
- A photograph of the vegetation

All plant specimens collected were assigned a sample number in the field, with a sample collected for identification and a sample placed in a field herbarium. Fruit was collected where possible to further aid identification. Specimens collected were identified by reference to taxonomic guides and Western Australian Herbarium samples. A complete list of species identified during the survey is presented in **Appendix D**. Nomenclature follows Paczkowska and Chapman (2000) except for name changes, which were sourced from the Western Australian Herbarium (2008).

3.3 Limitations of Flora Survey

The EPA (2004) lists a number of possible limitations and constraints that may impinge on the adequacy of flora and vegetation surveys. This report is a summary document providing information on a specific location within an area subject to a detailed survey. A summary of the limitations of the survey are provided in the report documenting the findings of the survey.

3.4 Fauna Sources of Information

3.4.1 Vertebrates

Database searches were made prior to the field survey. Database search areas were defined by polygons that were centred on the Project area and covered at least 250km by 250km (the 'search area') or a point search with a 50km buffer. Database searches of these areas were made using the following databases and internet tools:

- The Western Australian Museum (WAM) FaunaBase database to identify potential vertebrate fauna within the study area. The bounding coordinates used were:
    - 24.56°S, 125.65°E; and
    - 27.007°S, 128.97°E.
- Threatened and Priority Fauna Database held by the Department of Environment and Conservation (DEC) to facilitate the identification of species of conservation significance within the study area. The bounding coordinates used were:
    - 25.6022°S, 128.427°E; and
    - 26.514°S, 129. 421°E, with a 50km buffer.
- Biological Database held by the Department of Natural Resources, Environment and the Arts (NRETA), Northern Territory. The bounding coordinates used were:
    - 24.66°S, 129.25°E; and
    - 26.20°S, 131.42°E.
- Biological Database of South Australia (BDBSA), Department of Environment and Heritage (DEH). The bounding coordinates used were:
    - 26.12°S, 129.25°E; and

- 27.29°S, 130.55°E.

- The Protected Matters and Environmental Reporting Tools of the Australian Government Department of Environment and Water Resources to identify fauna species of national environmental significance that are protected under the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* potentially occurring within the area. The bounding coordinates used were:
  - 24.937°S, 127.230°E; and
  - 27.192°S, 127.230°E.
- The Environmental Reporting tool of the Australian Government Department of Environment and Water Resources to identify fauna species of national environmental significance. The bounding coordinates used were:
  - 24.258°S, 127.010°E; and
  - 27.375°S, 130.530°E.
- The Birds Australia database to identify avifauna potentially occurring over the study area.
- The Australian Natural Resources Atlas of the National Land and Water Resources Audit to gain information on significant fauna and fauna habitats within the Central Ranges bioregion.
- The Australian Wetlands Database of the Australian Government Department of Environment and Water Resources to ascertain regionally significant wetland habitats occurring over the study area.

A review of literature was also undertaken to provide a list of mammals, reptiles, amphibians and birds that have the potential to occur over the study area. The vertebrate fauna of the region has been the subject of very few studies, predominantly as part of other mining Projects in the region including: HGM (2002), Wingellina Baseline Biological Survey. The Department for Environment and Heritage (DEH) has undertaken intensive surveys over the Central Ranges in South Australia, in the vicinity of the Anangu Pitjantjatjara lands from 1991 to 2001 (Robinson *et* al, 2003). In 2006, a joint study of the Central Ranges took place with the Western Australia Museum, South Australia Museum, Department of Environment and Conservation (WA), Department of Environment and Heritage (SA) and the Ngaanyatjarra people (Pearson *et al* 2006). Communications were undertaken with appropriate WAM staff to determine which vertebrate species may be required for collection and lodging with WAM.

Information from the sources outlined above was augmented with additional information relating to species' likelihood of occurrence based upon personal experience and general patterns of distribution and known habitat preferences. Many of the species present on regional lists have specific habitat requirements that may be present in the general area, but not in the specific habitats of the Project area. Some species, therefore, will be included in lists but are unlikely to be present in the actual study area. Relevant texts from which information on general patterns of distribution was obtained included:

- Mammals: Churchill (1998); Menkhorst and Knight (2001); Strahan (2002).
- Birds: The Handbook of Australian, New Zealand and Antarctic Birds (Birds Australia, various editors and dates); Barrett *et al*. 2003; Blakers *et al*. (1984); Johnstone and Storr (1998 and 2004);
- Amphibians: Tyler *et al.* (2000).
- Reptiles: Storr *et al*. (1983, 1990, 1999 and 2002); Wilson and Swan (2003).

3.4.2 Potential Short-range Endemic Invertebrates

The EPA (2004) acknowledges that short-range endemism is a characteristic that should be considered in impact assessments. Short-range endemism refers to taxa with naturally-restricted distributional ranges, usually less than 10,000km^2. These taxa are also characterised by poor dispersal, reliance on discontinuous habitats, low growth rates, often seasonally-active in cooler, wetter months and often exhibit low fecundity. Consultation with appropriate experts from the Western Australian Museum has determined the following groups of invertebrate species should be targeted within the study area:

- Terrestrial molluscs (land snails);
- Scorpions;
- Pseudoscorpions;
- Mygalomorph spiders; and
- Myriopods (millipedes, centipedes).

While species habitat preference varies, there are several common habitat factors favoured by the targeted groups. Primarily, more mesic areas are preferred as they offer protection from heat, desiccation and predators, and provide a source of moisture. Examples of such habitats at a broad scale include gorges, rocky ranges and ridges (particularly those that face south or southeast and/or near water supplies), and rivers and creeklines. Such areas are more likely to provide the habitat attributes required for these species. Gorges, rocky ranges and ridges were trapped over the Project area.

3.5 Fauna Field Survey

3.5.1 Survey Timing

A systematic fauna survey was conducted between the 8th April and 17th April, 2008. Maximum temperatures during the fauna survey ranged between 27.2ºC and 34.7ºC with minima between 11.1ºC and 26.3ºC. Very little rainfall occurred prior to the fauna survey with the highest of 96.4mm recorded for the previous December (BOM, 2008).

3.5.2 Fauna Survey Personnel

The April 2008 fauna survey of the Wingellina project area was conducted by:

Dr Bill Low	PhD. Zoology	Senior Consultant (Low Ecological Services)
Mr David Steane	B.Sc. (Hons)	Zoologist (Outback Ecology Services)
Mr Paul Bolton	B. Sc (Hons)	Biologist (Short-range Endemic invertebrates) (Outback Ecology Services)

3.5.3 Survey Site Selection

A desktop review of habitats present at the site was conducted prior to the April 2008 fauna survey. Aerial photography, contour mapping, land systems mapping, and Beard (1974) mapping were used to determine preliminary site selection, which was based upon the dominant landform and vegetation type. Sampling sites were chosen as being:

1. Representative of the major fauna habitats present
2. Representative of areas of environmental impact potentially arising from the proposal
3. Areas of ecological sensitivity or discrete habitats that may support short-range endemic invertebrates

A major influence over site selection was the number and frequency of broadscale wildfires over the Project area. Examination of Landgate Satellite Remote Sensing Services Fire Scar Mapping (Landgate, 2008) (accurate to 1km) indicated that fires had burnt extensive areas particularly during 1997, 1998 and 2000, affecting Mulga woodlands.

The targeted area for the purpose of this report, bounded by 497500mE, 7118000mN and 498100mE, 7117900mN, was not included in a systematic trapping regime or physically ground truthed during the terrestrial fauna survey of the Wingellina project area in April 2008. However examination of aerial imagery (**Figure 2**) and site photographs (**Appendix D**), databases and past available literature, and the habitat description of the area, the occurrence of conservation significant fauna could be determined.

4.0 RESULTS

4.1 Flora Desktop Review

4.1.1 Environment Protection and Biodiversity Conservation (EPBC) Act 1999 Protected Matters Database Search

There are no Threatened Ecological Communities or Threatened Flora, as defined under the *EPBC Act 1999,* within 100km of the Wingellina Nickel Project

4.1.2 Declared Rare and Priority Flora

A total of 64 taxa ascribed a conservation code have been previously collected in the search area in Western Australia, South Australia and the Northern Territory (**Table 1**). None of these taxa are considered Declared Rare Flora, as defined under the Western Australian *Wildlife Conservation Act 1950*. Nine Priority taxa have been lodged from within the area defined in the database search, of which two taxa were Priority 1, one Priority 2, five Priority 3, and one Priority 4. Only four of the nine species have been collected in Western Australia according to the WA Herbarium priority database.

Conservation codes given to some species differed between WA, SA and NT databases. Four species, *Calotis latiuscula (P3), Acacia calciola (P4), Eucalyptus sparsa (P3), and Stackhousia clementii (P1)* have not been give conservation codes by SA and NT. Two species, *Dampiera roycei* and *Ophioglossum polyphyllum,* are considered rare by SA but are not assigned conservation codes in either WA or NT. A number of species that have been listed as occurring within the 50 km search area are unknown in the Western Australian Flora

4.1.3 Threatened Ecological Communities

No Declared TECs were identified as potentially occurring within the Wingellina search area by the DEC database search. No ecosystems at risk have been identified in the Western Australian part of the CR1 bioregion (Graham and Cowan, 2001)

Table 1 Summary of database results for flora of conservation significance collected in the region within which the Wingellina project is located.

The table summarises the results of DEC, SA herbarium (South Australia) and NRETA (Northern Territory) database searches based on a centre of 26º03'16"S, 128º56'53"E and a radius of 50 km. Definitions of conservation codes for each state/territory are given in Appendix 1; nt= near threatened, V=vulnerable, R=rare, P=priority, LC= least concern, No code=nor conservation code assigned. No record= species not listed in database search results, Unknown=unknown in the WA flora.

		Western Australia		South Australia		Northern Territory	
Family	Species	Conservation code	Number of records	Conservation code	Number of records	Conservation code	Number of records
APIACEAE	*Trachymene bialata*					nt	4
ASTERACEAE	*Calotis latiuscula*	P3	3	No code	4	LC	
ASTERACEAE	*Chthonocephalus pseudevax*					nt	3
ASTERACEAE	*Minuria multiseta*					nt	1
ASTERACEAE	*Rhodanthe laevis*					nt	1
BRASSICACEAE	*Arabidella nasturtium*					nt	1
BRASSICACEAE	*Cuphonotus andraeanus*					nt	1
BRASSICACEAE	*Menkea lutea*	P1	1	R	5	Not found	
BRASSICACEAE	*Menkea sphaerocarpa*					nt	1
CAESALPINIACEAE	*Senna artemisioides* subsp. *glaucifolia*					nt	1
CAMPANULACEAE	*Lobelia gibbosa* var. *gibbosa*					nt	2
CHENOPODIACEAE	*Dysphania sphaerosperma*					nt	1
CHENOPODIACEAE	*Einadia nutans* subsp. *nutans*					nt	3
CHENOPODIACEAE	*Maireana lanosa*					nt	1
CHENOPODIACEAE	*Maireana pentatropis*					nt	1
CHENOPODIACEAE	*Tecticornia (Halosarcia) pruinosa*					nt	2
EPACRIDACEAE	*Leucopogon sonderensis*	Unknown				nt	3
EUPHORBIACEAE	*Monotaxis luteiflora*					nt	2
EUPHORBIACEAE	*Poranthera leiosperma*					nt	2
		Western Australia		South Australia		Northern Territory	

Family	Speices	Cons. code	No. records	Cons. code	No. records	Cons. code	No. records
FRANKENIACEAE	*Frankenia punctata*					nt	2
GOODENIACEAE	*Dampiera dentata*					nt	5
GOODENIACEAE	*Dampiera roycei*			R	1	LC	
GOODENIACEAE	*Goodenia brunnea*	Unknown		R	1	nt	1
GOODENIACEAE	*Goodenia glandulosa*					nt	1
GOODENIACEAE	*Goodenia occidentalis*					nt	2
GOODENIACEAE	*Goodenia rupestris*	Unknown				nt	1
HALORAGACEAE	*Glischrocaryon aureum* var. *angustifolium*					nt	2
JUNCACEAE	*Juncus continuus*	Unknown				nt	4
LAMIACEAE	*Microcorys macredieana*	P3	No record	No record	No record	nt	1
LAMIACEAE	*Prostanthera wilkieana*					nt	2
LAMIACEAE	*Teucrium grandiusculum* subsp. *grandiusculum*	P2	1	v	4	nt	1
LILIACEAE	*Arthropodium strictum*	Unknown				nt	2
LILIACEAE	*Caesia chlorantha*					nt	1
LILIACEAE	*Tricoryne elatior*					nt	3
LILIACEAE	*(Wurmbea centralis* subsp. *Centralis)*					nt	11
LILIACEAE	*Wurmbea deserticola*					nt	1
LYTHRACEAE	*Lythrum paradoxum*	P3	1	No record		Not record	
MALVACEAE	*Hibiscus brachychlaenus*					nt	1
MALVACEAE	*Sida calyxhymenia*					nt	5
MIMOSACEAE	*Acacia abbreviata*	Unknown				nt	1
MIMOSACEAE	*Acacia ammobia*	Unknown				nt	21
MIMOSACEAE	*Acacia auricoma*	P3	No record	No record	No record	nt	18
MIMOSACEAE	*Acacia calciola*	P4	No record	No code	1	No record	No record
MYOPORACEAE	*Eremophila alternifolia*					nt	9
MYOPORACEAE	*Eremophila clarkei*					nt	4

Family	Speices	Western Australia		South Australia		Northern Territory	
		Cons. code	No. records	Cons. code	No. records	Cons. code	No. records
MYOPORACEAE	*Eremophila maculata* subsp*. brevifolia*					nt	1
MYRTACEAE	*Eucalyptus sparsa*	P3	No record	No code	5	dd	13
MYRTACEAE	*Melaleuca faucicola*	Unknown				nt	4
MYRTACEAE	*Melaleuca fulgens* subsp. *corrugata*					nt	2
OPHIOGLOSSACEAE	*Ophioglossum lusitanicum*					nt	2
OPHIOGLOSSACEAE	*Ophioglossum polyphyllum*			R	1		
POACEAE	*Enneapogon caerulescens*					nt	3
POACEAE	*Eragrostis sterilis*	unknown				nt	5
POACEAE	*(Eriachne scleranthoides)*					nt	7
PRIMULACEAE	*Samolus eremaeus*	No code		R	2		
PROTEACEAE	*Grevillea pterosperma*					nt	2
PROTEACEAE	*Hakea standleyensis*	unknown				nt	1
RHAMNACEAE	*Stenanthemum petraeum*					nt	11
SANTALACEAE	*Santalum acuminatum*					v	5
STACKHOUSIACEAE	*Stackhousia clementii*	P1	No record	No code	1	LC	3
STERCULIACEAE	*Rulingia luteiflora*					nt	3
VERBENEACEAE	*Pityrodia loxocarpa*					nt	1
XANTHORRHOEACEAE	*Xanthorrhoea thorntonii*					nt	4
ZYGOPHYLLACEAE	*Zygophyllum ovatum*					nt	1

4.1.4 Review of Existing Reports

The area to which this report relates was surveyed by Halpern Glick Maunsell Pty Ltd in 2002. The key findings from that survey are:

- A total of 188 taxa from 87 genera and 37 families.
- No flora of conservation significance.
- Six weed taxa were recorded during the survey; *Acetosa vesicaria; Cenchrus ciliaris; Chloris virgata; Eragrostis tenuifolia; Malvastrum americanum;* and *Solanum histrix*.
- Vegetation divisions were based on geomorphology, with three groupings; plains; mid slopes and small hills; and hills, ridges and breakaways.
- Seven vegetation units were described and delineated:
    - **A**: Plains vegetation
        - **A1**: Open Shrubland of *Hakea lorea* and *Senna artemisioides* subsp. x *artemisioides* over mixed grasses and herbs in clay on low plains.
        - **A2**: Grassland of Poaceae spp. with occasional *Senna glutinosa* subsp. *glutinosa* and *Sida fibulifera* in patches of cracking clay.
        - **A3**: Dense Low Woodland of *Eucalyptus mannensis* subsp. *mannensis* over *Acacia pachyacra, A. prainii* and *Dodonaea viscosa* subsp. *angustissima* over *Triodia rigidissima* and *Triodia ?helmsii* in sand over clay on low plains.
    - **B**: Mid slopes and small hills
        - **B1**: Dense Low Woodland of *Eucalyptus socialis* subsp. *eucentrica* and *Acacia aneura* var *major* over mixed shrubs over *Triodia scariosa* in clay on low ferricrete ridges.
        - **B2**: Very Open Shrubland of *Acacia pruinocarpa* and *A. aneura* var *major* over *Senna pleurocarpa* var. *pleurocarpa* over *Triodia scariosa* in clay on midslopes or low rocky hills.
        - **B3**: Low Scrub over *Triodia* spp. in sand on sand dune.
    - **C**: Hills, ridges and breakaways
        - **C1**: Low Open Woodland of *Eucalyptus gamophylla* and *Eucalyptus socialis* subsp. *eucentrica* over *Acacia validinervia* over mixed shrubs over *Triodia scariosa* in clay loam on upper slopes of mafic ridges.

Vegetation type C1 was considered by Halpern *et al.* (2000) to be located over the area to which this report relates.

4.2 Flora Field Survey

4.2.1 Vegetation Types – Descriptions

One vegetation unit was described within the area surveyed. This unit was restricted to the area of low gabbro outcropping to which this report relates. The vegetation unit was:

Eucalyptus socialis subsp *socialis* Open Shrub Mallee over mixed species Dwarf Scrub C over *Triodia helmsii* Dense Hummock Grass

4.2.2 Vegetation Condition Assessment

Vegetation within the survey area was assessed as being in Degraded condition according to the scale of Keighery (1994) (**Appendix B**). The main causes of degradation were fire and grazing by camels. The area surveyed was covered by *Triodia helmsii*, which were considered to be in good condition, but the structure and condition of middle and upper strata was clearly affected by fires and grazing. The remains of a number of burnt trees and shrubs were noted within the area. In addition to this, there was clear evidence of stripping of vegetation on shrubs. Continued grazing or frequent fires will potentially destroy what remains of the middle and upper strata in this area.

4.2.3 Conservation Significance of Vegetation Types

The vegetation surveyed during this survey was not considered to be of conservation significance. This vegetation unit and variations of it are considered to be locally common, do not host flora of conservation significance and are not considered to be in condition consistent with warranting protection.

4.3 Summary of Flora

A total of 15 species (including subspecies and variants) was recorded in the survey area. A full list of the flora recorded is located in **Appendix D.** No Declared Rare or Priority Flora were recorded in the area. No alien taxa were recorded from within the survey area.

4.4 Fauna species of Conservation Significance

The only fauna species of conservation significance found over the whole of the Wingellina project area during the survey was the Australian Bustard (*Ardeotis australis*). This is listed as a Priority 4 species in accordance with the DEC Priority Fauna list. This species is not restricted to the above mentioned target area. It is unlikely that any fauna species of conservation significance would be found over the area as the habitat is heavily degraded from disturbance by frequent fires and grazing by camels. These disturbances would tend to preclude any species of conservation significance occurring over the area

Based on a review of site images and aerial imagery it is considered unlikely that the targeted area contains suitable habitat for invertebrate SRE fauna.

5.0 DISCUSSION

5.1 Flora and Vegetation

Halpern Glick Maunsell Pty Ltd. (2002) described the vegetation over the survey area as being of potential conservation significance and warranting further surveys to better quantify local distribution. Based on data collected during the survey conducted by Outback Ecology in April 2008, this view is not supported. Halpern *et al.* (2000) had described the vegetation within the survey areas as being the same as the vegetation on hills, ridge tops and breakaways within the Wingellina Nickel Project. Whilst host geology is similar with both vegetation units hosted on gabbro, there are distinct differences in topography and slope. This difference in topography has resulted in differences in species present. Therefore, it is argued that the vegetation recorded in the area to which this report relates is not the same as the hills and ridges vegetation of Halpern *et al.* (2000) and is not considered to have conservation value.

5.2 Fauna species of Conservation Significance

An examination of aerial (**Figure 2**) and site photographs (**Appendix D**), and the habitat description of the area bounded by 497500mE, 7118000mN and 498100mE, 7117900mN, located within E69/535, was made to determine the likely occurrence of fauna species of conservation significance. It is unlikely that any fauna species of conservation significance would be found over the area as the habitat is degraded from disturbance by frequent fires and grazing by camels. These disturbances would tend to preclude any species of conservation significance occurring over the area

6.0 REFERENCES

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Appendix A
Definitions of Declared Rare and Priority Flora and Threatened Ecological Community Classifications

Definition of Declared Rare and Priority Flora Species (CALM, 2005)

Conservation Code	Category Description
R	*Declared Rare Flora – Extant Taxa* "Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such."
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, e.g. road verges, urban areas, farmland, active mineral leases, etc. May include taxa with threatened populations on protected lands. 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 are in urgent need of 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 are in need of further survey."
P4	*Priority Four – Poorly Known 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."

Definition of Threatened Ecological Community classifications (English, 2003)

TEC Classification	Description
Presumed Totally Destroyed	Community is unlikely to be able to be rehabilitated.
Critically Endangered	There are immediate threats throughout its range.
Endangered	Threatened throughout most of its range in near future.
Vulnerable	Vulnerable to threatening processes/may move into higher threat category.

Appendix B
Vegetation Condition Scale

Vegetation Condition Scale (Keighery, 1994).

Code	Description
Pristine	Pristine or nearly so. No obvious signs of disturbance.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good	Vegetation structure altered, obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
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 or shrubs.

Appendix C

Classification of Vegetation Structural Formation and Height Classes

LIFE FORM/HEIGHT CLASS	CANOPY COVER			
	DENSE **70% - 100%**	**MID DENSE** **30% - 70%**	**SPARSE** **10% - 30%**	**VERY SPARSE** **2% - 10%**
Trees > 30m	Dense Tall Forest	Tall Forest	Tall Woodland	Open Tall Woodland
Trees 15 – 30m	Dense Forest	Forest	Woodland	Open Woodland
Trees 5 – 15m	Dense Low Forest A	Low Forest A	Low woodland A	Open Low Woodland A
Trees < 5m	Dense Low Forest B	Low Forest B	Low Woodland B	Open Low Woodland B
Mallee Tree Form	Dense Tree Mallee	Tree Mallee	Open Tree Mallee	Very Open Tree Mallee
Mallee Shrub Form	Dense Shrub Mallee	Shrub Mallee	Open Shrub Mallee	Very Open Shrub Mallee
Shrubs > 2m	Dense Thicket	Thicket	Scrub	Open Scrub
Shrubs 1.5 – 2m	Dense Heath A	Heath A	Low Scrub A	Open Low Scrub A
Shrubs 1 – 1.5m	Dense Heath B	Heath B	Low Scrub B	Open Low Scrub B
Shrubs 0.5 – 1m	Dense Low Heath C	Low Heath C	Dwarf Scrub C	Open Dwarf Scrub C
Shrubs 0 – 0.5m	Dense Low Heath D	Low Heath D	Dwarf Scrub D	Open Dwarf Scrub D
Mat Plants	Dense Mat Plants	Mat Plants	Open Mat Plants	Very Open Mat Plants
Hummock Grass	Dense Hummock Grass	Mid-dense Hummock Grass	Hummock Grass	Open Hummock Grass
Bunch grass >0.5m	Dense Tall Grass	Tall Grass	Open Tall Grass	Very Open Tall Grass
Bunch grass < 0.5m	Dense Low Grass	Low Gras	Open Low Grass	Very Open Low Grass
Herbaceous spp.	Dense Herbs	Herbs	Open Herbs	Very Open Herbs
Sedges > 0.5m	Dense Tall Sedges	Tall Sedges	Open Tall Sedges	Very Open Tall Sedges
Sedges < 0.5m	Dense Low Sedges	Low Sedges	Open Low Sedges	Very Open Low Sedges
Ferns	Dense ferns	Ferns	Open Ferns	Very Open Ferns
Mosses, liverworts	Dense Mosses	Mosses	Open Mosses	Very Open Mosses

Appendix D
Quadrat Data

Site	WIN28
Coordinates	52J 497954mE 7117597mN
Description	*Eucalyptus socialis* subsp *socialis* Open Shrub Mallee over mixed species Dwarf Scrub C over *Triodia helmsii* Dense Hummock Grass
Plot size	30m * 30m
Topography	undulating valley floor
Soil	red clay
Exposed rock type	gabbro rock
Litter cover (%)	2%
Bare ground (%)	30%
Condition	degraded
Disturbance details	fire, grazing by camels
Fire history	frequent
Trees	*Eucalyptus socialis* subsp *eucentrica*
Shrubs >2m	
Shrubs 1-2m	*Senna artemisioides* subsp *petiolaris*
Shrubs <1m	*Halgania cyanea, Acacia pruinocarpa, Sida calyxhymenia* *Salsola tragus, Ptilotus obovatus* var *obovatus, Acacia kempeana* unid BGN080, *Sida* sp aff *ammophila*
Hummock grasses	*Triodia helmsii,*
Grasses	*Themeda* sp BGN0190, *Cymbopogon obtectus, Aristida contorta* *Eragrostis* sp

Appendix E

Environment Protection and Biodiversity Conservation (EPBC) Act Protected Matters Database Search

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

You may wish to print this report for reference before moving to other pages or websites.

The Australian Natural Resources Atlas at http://www.environment.gov.au/atlas may provide further environmental information relevant to your selected area. Information about the EPBC Act including significance guidelines, forms and application process details can be found at http://www.environment.gov.au/epbc/assessmentsapprovals/index.html

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Search Type: Point

Buffer: 100 km

Coordinates: -26.06803,128.9651

Report Contents:

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance - see http://www.environment.gov.au/epbc/assessmentsapprovals/guidelines/index.html.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Significance: (Ramsar Sites)	None
Commonwealth Marine Areas:	None
Threatened Ecological Communities:	None
Threatened Species:	5
Migratory Species:	5

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

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

Please note that the current dataset on Commonwealth land is not complete. Further information on Commonwealth land would need to be obtained from relevant sources including Commonwealth agencies, local agencies, and land tenure maps.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species. Information on EPBC Act permit requirements and application forms can be found at http://www.environment.gov.au/epbc/permits/index.html.

Commonwealth Lands:	1
Commonwealth Heritage Places:	None
Places on the RNE:	1
Listed Marine Species:	4
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves:	None

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

State and Territory Reserves:	2
Other Commonwealth Reserves:	None
Regional Forest Agreements:	None

Details
Matters of National Environmental Significance

Threatened Species [Dataset Information]	Status	Type of Presence
Birds		
Leipoa ocellata Malleefowl	Vulnerable	Species or species habitat likely to occur within area
Mammals		
Dasycercus cristicauda Mulgara	Vulnerable	Species or species habitat likely to occur within area
Notoryctes typhlops	Endangered	Species or species habitat likely to

Yitjarritjarri, Southern Marsupial Mole		occur within area
Petrogale lateralis MacDonnell Ranges race Warru, Black-footed Rock-wallaby (MacDonnell Ranges race)	Vulnerable	Species or species habitat may occur within area
Reptiles		
Egernia kintorei Great Desert Skink, Tjakura, Warrarna, Mulyamiji	Vulnerable	Species or species habitat may occur within area

Migratory Species [Dataset Information]	Status	Type of Presence
Migratory Terrestrial Species		
Birds		
Leipoa ocellata Malleefowl	Migratory	Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater	Migratory	Species or species habitat may occur within area
Migratory Wetland Species		
Birds		
Charadrius veredus Oriental Plover, Oriental Dotterel	Migratory	Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole	Migratory	Species or species habitat may occur within area
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift	Migratory	Species or species habitat may occur within area
Other Matters Protected by the EPBC Act		

Listed Marine Species [Dataset Information]	Status	Type of Presence
Birds		
Apus pacificus Fork-tailed Swift	Listed - overfly marine area	Species or species habitat may occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel	Listed - overfly marine area	Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole	Listed - overfly marine area	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater	Listed - overfly marine area	Species or species habitat may occur within area

Commonwealth Lands [Dataset Information]
Defence

Places on the RNE [Dataset Information] Note that not all Indigenous sites may be listed.

Natural

Ranges of the Western Desert WA

Extra Information

State and Territory Reserves [Dataset Information]

Ngaanyatjarra Lands Indigenous Protected Area, WA

Watarru Indigenous Protected Area, SA

Caveat

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

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

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

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

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under "type of presence". For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the migratory and marine provisions of the Act have been mapped.

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

threatened species listed as extinct or considered as vagrants

some species and ecological communities that have only recently been listed

some terrestrial species that overfly the Commonwealth marine area

migratory species that are very widespread, vagrant, or only occur in small numbers.

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

non-threatened seabirds which have only been mapped for recorded breeding sites;

seals which have only been mapped for breeding sites near the Australian continent.

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

Acknowledgments

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

New South Wales National Parks and Wildlife Service

Department of Sustainability and Environment, Victoria

Department of Primary Industries, Water and Environment, Tasmania

Department of Environment and Heritage, South Australia Planning SA

Parks and Wildlife Commission of the Northern Territory

Environmental Protection Agency, Queensland

Birds Australia

Australian Bird and Bat Banding Scheme

Australian National Wildlife Collection
Natural history museums of Australia
Queensland Herbarium
National Herbarium of NSW
Royal Botanic Gardens and National Herbarium of Victoria
Tasmanian Herbarium
State Herbarium of South Australia
Northern Territory Herbarium
Western Australian Herbarium
Australian National Herbarium, Atherton and Canberra
University of New England
Other groups and individuals