



# Wildflower Rail Construction Camp: Native Vegetation Clearing Permit Report







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# 1.0 Summary

## 1.1 Background to the Project

As part of Rio Tinto Iron Ore's proposal to expand its iron ore operations in the Pilbara from the current capacity of 220 million tonnes per annum (Mtpa) to 320 Mtpa, a significant increase in construction camp capacity is required.

Vegetation clearing is required for placement of buildings and infrastructure for the proposed Wildflower construction camp and village. Clearing will be kept to a minimum and managed to minimise environmental impact.

## 1.2 Scope and Purpose of this Report

This report is intended as a supporting document to Robe River Mining Company's application for a NVCP for the construction of the proposed Wildflower rail construction camp. It has been prepared on the basis of a review of existing information for the project area, combined with a site visit by three botanists (Michi Maier, Paul Hoffman and Julia Mattner of Biota) and a zoologist (Roy Teale of Biota) on the 21<sup>st</sup> of March 2008.

## 1.3 Vegetation

Five intact vegetation types were recorded from the Wildflower Camp study area:

- *Eucalyptus gamophylla* low open mallee woodland over *Acacia dictyophleba*, *A. steedmanii* subsp. *borealis*, *A. bivenosa* tall open shrubland over *Triodia* sp. Shovelanna Hill hummock grassland occurring generally over the low stony plains of the Boolgeeda Land System in the northern half of the study area (15.33 ha);
- *Acacia dictyophleba* (*A. steedmanii* subsp. *borealis*) tall open shrubland over *Triodia pungens* hummock grassland in lower-lying sections of the same low stony plains (49.34 ha); and
- three Mulga vegetation types on the clayey plains of the Wannamunna Land System in the southern half of the study area, comprising *Acacia aneura* tall open shrubland to low open forest over a variable understorey dominated by either a mixed open tussock grassland or an open hummock grassland of *Triodia melvillei* or *T. pungens* (total of 65.84 ha).

These vegetation types are typical of such habitats in the locality, and do not comprise Threatened Ecological Communities or Priority Ecological Communities.

## 1.4 Flora

A total of 138 species of native flora, from 79 genera belonging to 30 families, was recorded from the Wildflower Camp area. The dominant plant groups and the broad suite of species recorded were typical for stony and clayey plains habitats located in this section of the Hamersley subregion.

### 1.4.1 Flora of Conservation Significance

No Declared Rare Flora were recorded from the Wildflower Camp study area, and none would be expected to occur. No Priority flora were recorded from the study area. Most of the Priority species recorded previously in the locality would not be expected to occur due to an absence of suitable habitat, however there is a possibility that the Priority 1 *Goodenia lyrata* may occur on the clayey plains in the southern section of the study area. If there is to be any clearing of

this habitat beyond the existing disturbance areas, then further targeted searches for this species should be undertaken in the immediate development areas.

### 1.4.2 Introduced Flora

Five weed species were recorded from the Wildflower Camp study area. While none of these are Declared Plants for the Pilbara, Natal Redtop (*\*Melinis repens*) and Buffel Grass (*\*Cenchrus ciliaris*) are considered to be serious environmental weeds. It is recommended that control spraying be undertaken immediately to eradicate the infestation of *\*Melinis repens*, which at present is largely restricted to a section of the rehabilitation area which is the site of the old Wildflower Camp. This area should be quarantined until the weed has been confirmed as eradicated.

## 1.5 Fauna Habitats

The fauna habitat classification was developed on the basis of the dominant landforms and vegetation types. The classification does not cover all habitats available to the entire assemblage of invertebrate and vertebrate fauna, as this would be difficult to resolve and logistically impracticable to sample. Rather, the classifications provide a convenient framework within which to summarise species occurrence.

While five vegetation types have been described for the Wildflower Camp area, these constitute two broad terrestrial fauna habitat types:

- Mixed *Acacia* tall open shrubland over *Triodia* hummock grassland on stony plains with a loamy substrate; and
- Mulga (*Acacia aneura*) low open woodland over *Triodia* hummock grassland and mixed tussock grassland on plains with a clay to clay-loam substrate.

The broad fauna habitats found within the Wildflower Camp are widespread in the Pilbara bioregion, and as such would not be considered under threat by the proposed works.

## 1.6 Fauna of Conservation Significance Potentially Occurring in the Area

The following threatened fauna species potentially occur in the Wildflower Camp study area: Night Parrot (*Pezoporus occidentalis*), Northern Quoll (*Dasyurus hallucatus*), Pilbara Orange Leafnosed-Bat (*Rhynonictis aurantius*), Pilbara Olive Python (*Liasis olivaceus barroni*), Bilby (*Macrotis lagotis*) and Western Pebble-mound Mouse (*Pseudomys chapmani*). The first four species are listed Federally under the EPBC Act 1999 as well as being State-listed.

The proposed clearing for the Wildflower Camp is considered unlikely to have a significant impact on these fauna of conservation significance given that there is no core habitat for any of the taxa within the study area (ie. no roosting caves, etc).

## 1.7 Assessment Against the Ten Clearing Principles

On the basis of the above information, it is considered that the proposed clearing for the Wildflower Rail Construction Camp is not at variance with the Ten Clearing Principles listed under Schedule 5 of the *Environmental Protection Act 1986*.

The following management strategies are recommended:

- Control spraying should be conducted immediately for the infestation of *\*Melinis repens* on the site of the old Wildflower Camp. The area should be quarantined until this infestation has



been confirmed to be eradicated. Strict weed hygiene measures must be subsequently implemented to ensure that no additional weeds are introduced to the study area or the vicinity.

- Clearing of the Mulga vegetation on the clayey plains of the southern section of the study area should be minimised wherever possible, as these habitats are more susceptible to erosion than the stony plains of the northern section.
- If there is to be any clearing of the clayey plains habitat beyond the existing disturbance areas, then further targeted searches for the Priority 1 *Goodenia lyrata* should be undertaken in the immediate development areas.
- The proposed location of the Wildflower Camp should be discussed with the Department of Environment and Conservation, given that this area will fall within the boundaries of the Karijini National Park following the enacting of the State pastoral exclusion process in 2015.

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## 2.0 Introduction

### 2.1 Project Background

Rio Tinto Iron Ore (RTIO) is seeking approvals to expand its iron ore operations in the Pilbara from the current capacity of 220 million tonnes per annum (Mtpa) to 320 Mtpa. This will involve establishment of new and expansion of existing mines, expansion of an existing port facility at Cape Lambert, and expansion of the existing rail network to accommodate the additional 100 Mtpa. A significant increase in construction camp capacity is required to deliver the 320 Mtpa project.

As part of this expansion, temporary camp facilities at the Wildflower site are proposed to accommodate on-ground construction personnel for the duration of the project.

### 2.2 Description of the Proposed Clearing

A Native Vegetation Clearing Permit (NVCP) is required for the Wildflower site to facilitate the construction of a camp. Clearing within the NVCP boundaries is required in specific areas preparatory to the placement of buildings and infrastructure for the proposed construction camp and village.

Clearing shall be carried out using the following plant & equipment:

- Bulldozer for large areas;
- Grader for large areas;
- Front end loader and Bobcat for smaller areas; and
- Articulated Dump Truck for the relocation of overburden.

Prior to the commencement of clearing activities a RTIO vegetation clearing approval will be required in accordance with RTIO-HSE-0043075 Clearing Procedure. Management strategies will include but not be limited to the following:

- No clearing or works will be undertaken outside the approval boundaries.
- The area to be cleared will be kept to a minimum and clearly demarcated using bunting and appropriate signage.
- Topsoil will be stockpiled for rehabilitation purposes.
- Stockpiles will be clearly signposted, and kept to a maximum 2.0m height to minimise erosion.
- Dust suppression will be carried out on stockpiles using potable water only.

### 2.3 Scope and Limitations of this Study

#### 2.3.1 Scope and Purpose of this Report

This report is intended as a supporting document to Robe River Mining Company's application for a NVCP for the Wildflower rail construction camp, as indicated in Figure 2.1. It has been prepared on the basis of a review of existing information for the project area, combined with a site visit by three botanists (Michi Maier, Paul Hoffman and Julia Mattner of Biota) and a zoologist (Roy Teale of Biota) on the 21<sup>st</sup> of March 2008.

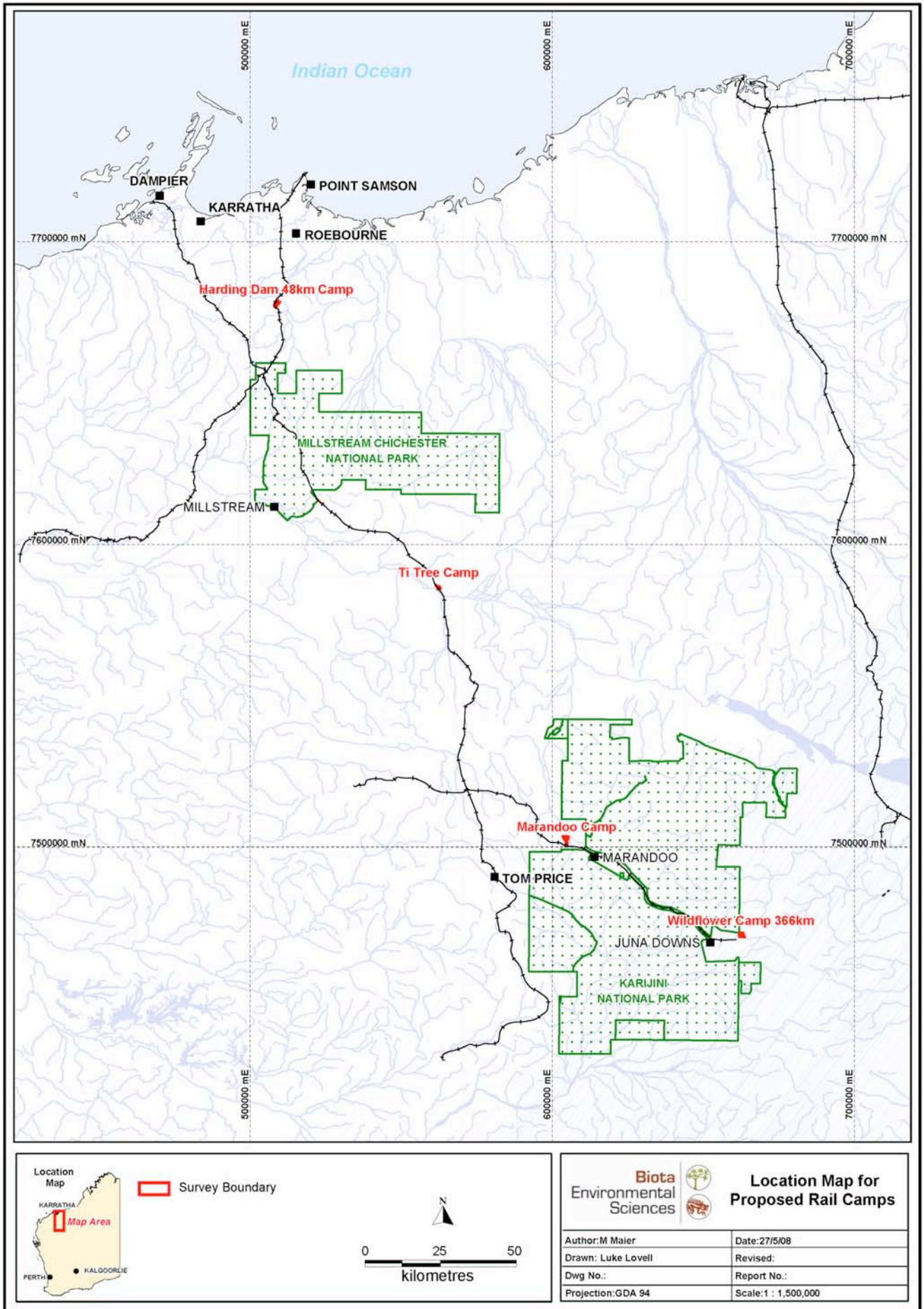


Figure 2.1: Locality map for the Wildflower Rail Construction Camp.

## 2.3.2 Methodology of this Study

### 2.3.2.1 Flora and Vegetation

The review of existing information comprised:

- a search for “protected matters” relevant to the rail camp under the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999*, conducted online in May 2008;
- a search of the Department of Environment and Conservation (DEC) and WA Herbarium databases in May 2008 for Declared Rare Flora (DRF) and Priority Flora recorded within approximately 30 km of the study area; and
- review of published and unpublished reports of relevance to the area (these comprised mostly regional scale reports such as the Department of Agriculture Land Systems mapping (van Vreeswyk et al. 2004; see Section 2.4.3) and the summary of bioregional data (Section 2.4.2)).

During the site visit, the following data was recorded:

- One standard 50m by 50m (or equivalent area) floristic survey quadrat was established in a major vegetation unit in the study area, and one relevé (unbounded floristic survey sites) was also recorded. Various physical parameters were recorded at each of these sites, along with a list of all species present and their estimated percent foliar cover.
- All of the major habitats were traversed on foot, and a list of all species present was recorded to supplement the list of flora obtained from the floristic survey sites. Flora of potential management concern (ie. species of conservation significance and weeds) were specifically targeted as part of this work, and locations were recorded using a hand-held Global Positioning System (GPS).

### 2.3.2.2 Fauna

Fauna species potentially occurring in the area were identified through the compilation of an expected species inventory on the basis of known species distributions and habitat availability, with particular emphasis on fauna of elevated conservation significance and Short Range Endemics (SREs).

Searches of the DEC Threatened Fauna Database, Western Australian Museum (WAM) FaunaBase, the *EPBC Act 1999* Protected Matters Database and the DEC Pilbara Biological Survey Database were conducted within a 25 km buffer of the Wildflower Camp (Appendix 5). The search coordinates used for the Wildflower Camp were:

- 22°51'39.6"S and 118°35'13.2"E.

During the site visit, the following data was recorded:

- Fauna habitats were described on the basis of landform, substrate and associated vegetation.
- Targeted searches were undertaken for fauna of potential conservation significance (eg. camaenid land snails and mygalomorph spiders, which may include potential SRE species).

## 2.3.3 Limitations of this Study

### 2.3.3.1 Flora and Vegetation

While the species list recorded by the study provides a good indication of the floristic composition of the area, this should be taken as indicative rather than exhaustive given the following:

- The site assessment comprised a single day visit by three botanists to the area.
- Some sections of the northern study area had been burnt 1-2 years ago.

- While the field survey followed considerable rainfall and was optimal for observation of many annual species, many species were present as only small seedlings and some taxa (such as Spring-flowering Asteraceae) would not have been present at the time of survey.
- While foot traverses were walked through all the major habitats in the study area, the entire area was not systematically searched.

### 2.3.3.2 Fauna

Given the primarily desktop nature of this report regarding vertebrate fauna, the principal limitation of this study relates to the absence of a Level Two fauna survey. Although a reconnaissance site visit and targeted SRE search was carried out, no systematic sampling of vertebrate fauna was performed and this report should not be treated as an exhaustive or conclusive account of fauna in the study area.

While foot traverses through the main habitats of the study area were conducted during the site reconnaissance and SRE survey, not all sections of the study area were ground-truthed or searched for fauna.

## 2.4 Regional Context of the Study Area

### 2.4.1 Geology

Large scale (1:500,000) and widespread geological mapping of the Pilbara was conducted by Thorne and Trendall (2001). According to this, the Wildflower Camp study area comprises two geology types:

- the northern half of the study area is located over Colluvium; partly consolidated quartz and rock fragments in silt and sand matrix; old valley fill deposits, locally derived; and
- the southern half of the study area comprises Alluvium and Colluvium, described as red-brown sandy and clayey soil on low slope and sheetwash areas.

### 2.4.2 IBRA Bioregion and Subregion

The Interim Biogeographic Regionalisation for Australia (IBRA) recognises 85 bioregions (Environment Australia 2000). The Wildflower Camp study area lies within the Pilbara bioregion. With increasing survey work, it is becoming apparent that the Pilbara is a major centre of biodiversity in Western Australia. This appears to be related to the region's diversity of geological, altitudinal and climatic elements, as well as its location. The Pilbara is a transitional zone between the floras of the Eyrean (central desert) and southern Torresian (tropical) bioclimatic regions, and contains elements of both floras (see for example van Leeuwen and Bromilow (2002) for a detailed discussion of the significance of the Hamersley Range). Similarly, the Pilbara is also a transitional zone for fauna. In 2003 in recognition of the high species diversity and high levels of endemism in the region, the Pilbara was nominated as one of 15 national biodiversity "hotspots" by the Minister for the Environment and Heritage (go to <http://www.environment.gov.au/minister/env/2003/mr03oct03.html>).

The Pilbara bioregion is divided into four subregions<sup>1</sup>, described by Environment Australia (2000) as the four major components of the Pilbara Craton:

- Hamersley (PIL1): mountainous area of Proterozoic ranges and plateaux with low Mulga woodland over bunch grasses on fine textured soils, and Snappy Gum over *Triodia brizoides* on the skeletal sandy soils of the ranges;

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<sup>1</sup> These subregions are largely equivalent to the physiographic regions of Beard (1975), although the coastal portion of Beard's Abydos Plain unit comprises the Roebourne Plains subregion, while the inland portion is included within the Chichester subregion.

- Fortescue Plains (PIL2): alluvial plains and river frontages with salt marsh, Mulga-bunch grass and short grass communities on alluvial plains and River Gum woodlands fringing drainage lines;
- Chichester (PIL3): Archaean granite and basalt plains supporting shrub steppes of *Acacia pyrifolia* over *Triodia pungens* hummock grasses, with Snappy Gum steppes occurring on the ranges; and
- Roebourne Plains (PIL4): quaternary alluvial plains with a grass savanna and shrub steppe of *Acacia translucens* over *Triodia pungens* and marine alluvial flats with samphire, *Sporobolus* and Mangal.

The Wildflower Camp is located in the Hamersley subregion (see Kendrick 2001).

### 2.4.3 Land Systems

Land Systems (Rangelands) mapping covering the study area has been prepared by the Western Australian Department of Agriculture (van Vreeswyk et al 2004). Land Systems are comprised of repeating patterns of topography, soils, and vegetation (Christian and Stewart 1953) (ie. a series of "land units" that occur on characteristic physiographic types within the Land System).

A total of 107 Land Systems occur in the Pilbara bioregion. [This information was obtained by combining the Land System mapping for the Pilbara (van Vreeswyk et al. 2004) and Ashburton (Payne et al. 1988), and intersecting this with the Pilbara bioregion (Environment Australia 2000) in ArcView 3.2.]

Land Systems mapped by the Department of Agriculture (van Vreeswyk et al. 2004) for the region including the study area are shown in Figure 2.2.

Two Land Systems occur within the Wildflower Camp area, descriptions of which are provided in Table 2.1. The Boolgeeda Land System dominates the stony plains in the northern half of the study area, while the clayey plains in the southern half of the area comprise the Wannamunna Land System.

**Table 2.1: Descriptions of Land Systems occurring within the Wildflower Camp study area** (descriptions from van Vreeswyk et al. 2004).

Land System	Code	Description
Boolgeeda	RGEBGD	Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands and mulga shrublands
Wannamunna	RGEWNM	Hardpan plains and internal drainage tracts supporting mulga shrublands and woodlands (and occasionally eucalypt woodlands).

The total areas for each Land System both within the study area and within a 12.5 km buffer for regional context are provided in Table 2.2, along with the percentage of each Land System mapped for the Pilbara. While the Boolgeeda Land System is widespread and abundant through the Pilbara bioregion, the Wannamunna Land System is less common and concentrated in the eastern half of the Hamersley subregion.

**Table 2.2: Extent of Land Systems occurring within the Wildflower Camp study area and within 12.5 km of the study area.**

Land System	Total Area in the 'Pilbara' Bioregion (Ranking*)	Area within the Wildflower Camp study area		Area within a 12.5 km buffer around the Wildflower Camp study area	
		Ha	% of total	Ha	% of total
Boolgeeda	961,634 (103 <sup>rd</sup> )	79.6	0.0083	25057	2.6
Wannamunna	63,013 (60 <sup>th</sup> )	65.1	0.10	3393	5.4

\*Ranking of Land System in terms of area out of the 107 Land Systems in the Pilbara bioregion; ranked from least abundant in terms of area (1<sup>st</sup>) to most abundant (107<sup>th</sup>).

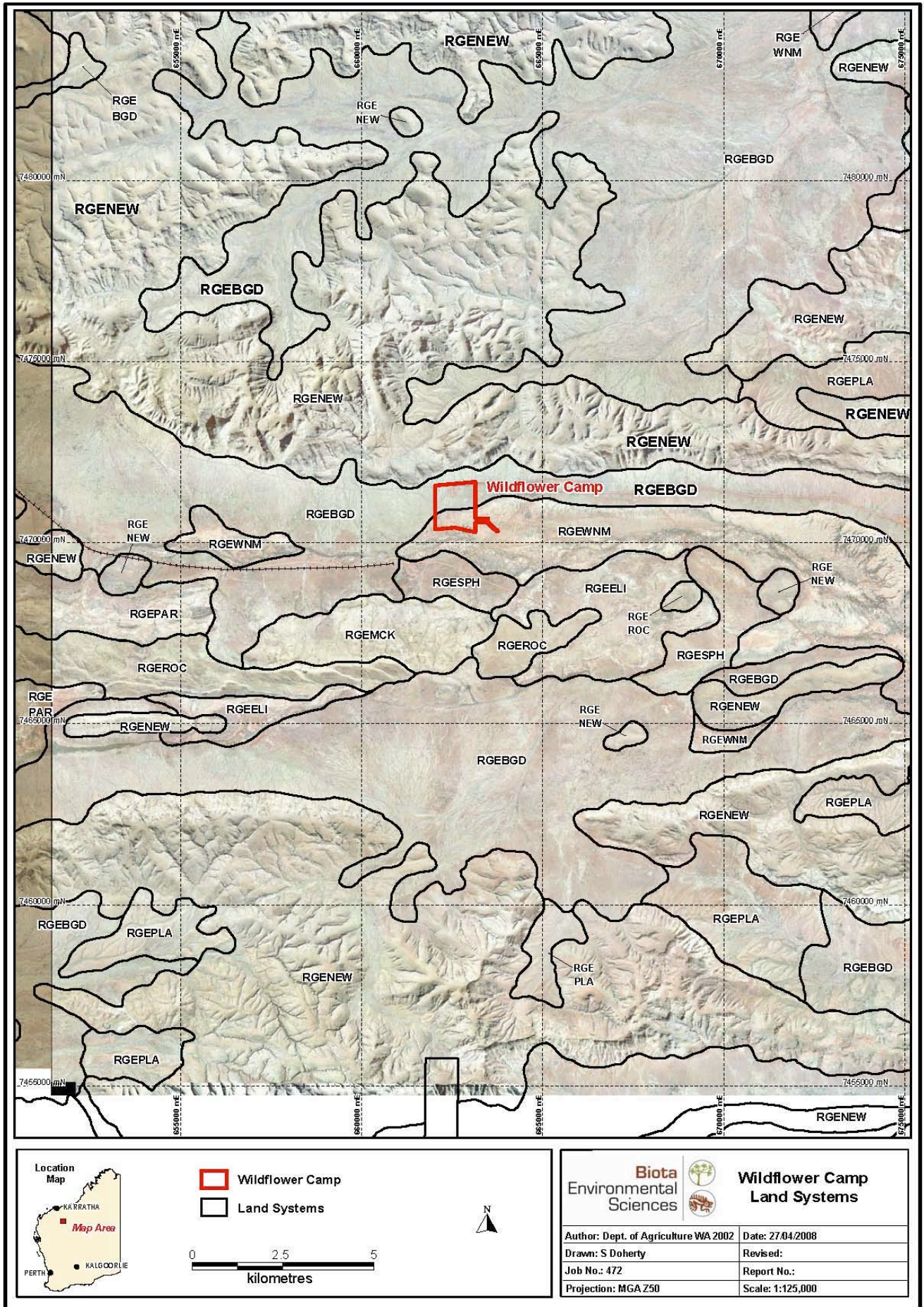


Figure 2.2: Land Systems in the locality including the Wildflower Camp.



A description of the land units occurring in each Land System is provided below.

#### **2.4.3.1 Boolgeeda Land System**

The Boolgeeda Land System is characterised by stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands and mulga shrublands. Component landform units comprise:

- Low hills and rises;
- Stony slopes and upper plains;
- Stony lower plains;
- Mulga groves; and
- Narrow drainage floors and channels (van Vreeswyk et al. 2004).

The northern half of the Wildflower Camp study area comprised the stony lower plains landform unit, which is described as typically supporting hummock grasslands of Hard Spinifex (*Triodia wiseana* or *T. lanigera*) or Soft Spinifex (*Triodia pungens*), often with moderately close tall shrublands of *Acacia aneura* and other acacias (van Vreeswyk et al. 2004).

#### **2.4.3.2 Wannamunna Land System**

The Wannamunna Land System is characterised by hardpan plains and internal drainage tracts supporting mulga shrublands and woodlands (and occasionally eucalypt woodlands). Component landform units comprise:

- Stony plains;
- Hardpan plains;
- Calcrete platforms;
- Groves; and
- Internal drainage plains (van Vreeswyk et al. 2004).

The area mapped as Wannamunna Land System in the southern half of the Wildflower Camp study area comprised hardpan plains with scattered groves. Hardpan plains are described as supporting very scattered tall or low shrublands of Mulga (*Acacia aneura*), *Eremophila* species, Cotton Bush (*Ptilotus obovatus*) and *Maireana villosa*. Groves are described as moderately close to closed woodlands of *Acacia aneura* with numerous undershrubs and tussock grasses such as Ribbon Grass (*Chrysopogon fallax*) and Kangaroo Grass (*Themeda triandra*) (van Vreeswyk et al. 2004).

#### **2.4.4 Beard's Vegetation Mapping**

Beard (1975) mapped the vegetation of the Pilbara at a scale of 1:1,000,000. The study area lies entirely within the Fortescue Botanical District of the Eremaean Botanical Province as defined by Beard. The vegetation of this province is typically open, and frequently dominated by spinifex, wattles and occasional Eucalypts.

The Wildflower Camp study area is encompassed by one of Beard's mapping units:

- the "Hamersley 18" unit comprises Mulga (*Acacia aneura*) continuous low woodland.

Given the broad nature of Beard's mapping, this unit is only broadly applicable to the vegetation occurring on site (see Section 3.1).

## 2.4.5 Conservation Reserves in the Locality

There is a single conservation reserve in the region including the Wildflower Camp: the eastern boundary of the A-class Karijini National Park is less than 200 m north-west of the north-western corner of the study area (Figure 2.1).

The Pilbara bioregion is listed as a medium priority for funding for land purchase under the National Reserves System Co-operative Program due to the limited representation of the area in conservation reserves. Portions of various pastoral leases in the region have been nominated for exclusion for public purposes in 2015, when the leases come up for renewal. Many of the submissions are from the Department of Environment and Conservation, with the intention of adding these areas to the existing conservation estate in order to provide a comprehensive, adequate and representative reserve system. One of these exclusions comprises an 82,636 ha area of Juna Downs Station west of the Great Northern Highway, which is proposed to be added to the Karijini National Park. Although the exclusion encompasses the proposed Wildflower Camp site, the camp will be decommissioned and rehabilitated by the time this process is enacted.

## 2.4.6 Significant Vegetation Communities Known from the Locality

The framework under which significant communities are classified is provided in Appendix 1.

### 2.4.6.1 Threatened Ecological Communities under the EPBC Act 1999

No Threatened Ecological Communities (TECs) listed under the EPBC Act 1999 have been recorded from the Wildflower locality or from the broader Hamersley subregion.

### 2.4.6.2 Threatened and Priority Ecological Communities listed by DEC

The TEC which comprises "*Themeda* grasslands of the Pilbara region" is restricted to areas of heavy clays, and occurs from north-west of Tom Price to the vicinity of Newman. The nearest known occurrence is some 80 km to the north-west of Wildflower Camp. This TEC is considered to be at risk from grazing and trampling by stock, weed invasion, changed fire regimes and alteration of hydrology.

There are a number of Priority Ecological Communities (PECs) listed for the Pilbara bioregion, however none of these are associated with habitats in the Wildflower Camp study area.

### 2.4.6.3 Other Ecosystems Considered to be At Risk by DEC

A number of ecosystems in each WA IBRA bioregion are listed as "ecosystems at risk" from various threatening processes, including grazing, increased fire frequency and weed invasion (see May and McKenzie 2003).

Several ecosystems at risk have been identified for the Hamersley subregion, including:

- "Lower-slope mulga", which we understand to refer to areas of Mulga (*Acacia aneura*) over spinifex hummock grasslands, is listed as being under threat from frequent fires preventing regeneration of the *Acacia* overstorey (see Kendrick 2001).
- "All major ephemeral water courses" of the Hamersley subregion are considered to be threatened by grazing and trampling by stock, large fires and weed invasion, particularly from Buffel Grass (*\*Cenchrus ciliaris*) and Ruby Dock (*\*Acetosa vesicaria*); Kendrick (2001).

While the stony plains in the northern half of the Wildflower Camp study area would not constitute lower slope habitat *per se*, there is a narrow band of Mulga over spinifex in the interzone between this habitat and the clayey plains in the south (see Section 3.1).

### 2.4.6.4 Refugia

Gorges of the Hamersley Range are listed in Kendrick (2001) as being of significance as refugia, since they provide refuge sites for species requiring high humidity and those that are intolerant

of fire (eg. White Cypress Pine, *Callitris columellaris*). Such areas frequently support species restricted to rocky and/or humid habitats, including Priority flora such as *Sida* sp. Barlee Range (S. van Leeuwen 1642) and *Triumfetta leptacantha*. The Wildflower Camp study area encompasses only stony and clayey plains; no gorges are present.

#### 2.4.7 Significant Flora Species Known from the Locality

The framework under which significant species are classified is provided in Appendix 1.

The search of the DEC and WA Herbarium databases for rare flora collected previously within a 30 km buffer of the Wildflower Camp study area yielded numerous records of 15 species:

- There were a number of records of the DRF *Thryptomene wittweri* from 13 and 14 km south of the study area. In the Pilbara, this species is restricted to high-altitude (>1000 m) mountain tops. There are scattered records from the southern central Pilbara, and the western Gascoyne and Little Sandy Desert bioregions.
- There were two records of the Priority 1 species, *Goodenia lyrata*, from 15 km east-south-east and 22 km south-east of the study area. This species is recorded infrequently from claypans, and has a broad distribution from the central southern Pilbara to the Murchison and Gibson Desert.
- There was one record of the Priority 1 species, *Goodenia* sp. East Pilbara (A.A. Mitchell PRP 727), from 15 km east-south-east of the study area. As the informal phrase-name suggests, the current distribution of this species is in the eastern Pilbara, where it typically occurs on calcareous substrates.
- There was one record of the Priority 1 species, *Lobelia heterophylla* subsp. Pilbara (R. Meissner & Y. Caruso 1), from 16 km north-north-west of the study area. This herb has a distribution extending from the southern Pilbara to the northern Murchison bioregion.
- There were three records of the Priority 2 species, *Acacia daweana*, from between 19 and 22 km north-west of the study area. This spreading shrub has a small distribution in the central Hamersley Ranges, occurring on low rocky rises and along drainage lines.
- There were three records of the Priority 2 species, *Acacia effusa*, from 11 km west-south-west, 19 km north-west and 22 km north-west of the study area. This moderate-height shrub has minniritchi bark, and is typically recorded on stony plains and scree slopes. This species has a relatively narrow distribution through the eastern Hamersley Ranges.
- There was one record of the Priority 2 species, *Olearia fluvialis*, from 19 km south-east of the study area. This species has been recorded from the western to the central Pilbara, and typically occurs in the cobbly beds of moderate-sized creeklines, particularly those supporting Coolibahs (*Eucalyptus victrix*).
- There was one record of the Priority 3 species, *Acacia bromilowiana*, from 16 km east of the study area. This species occurs mainly in the eastern Hamersley subregion, on rocky hills, breakaways and scree slopes.
- There was one record of the Priority 3 species, *Bulbine pendula*, from 5 km west-north-west of the study area. This species is restricted to heavy cracking clays, but has a broad distribution from the southern Pilbara as far as the Carnarvon, Murchison and Little Sandy Desert bioregions.
- There were records of the Priority 3 species, *Dampiera metallorum*, from between 5 and 14 km north-west, 16 km north-north-west and 14 km south of the study area. This low shrub species is restricted to the upper slopes and summits of tall hills in the eastern Hamersley Ranges.
- There was one record of the Priority 3 species, *Indigofera gilesii* subsp. *gilesii*, from 10 km south-east of the study area. This species has a narrow distribution through the southern central Pilbara and typically occurs on stony hills, particularly in rocky minor flowlines on these.

- There were three records of the Priority 3 perennial grass, *Ischaemum albovillosum*, from locations 1 km north, 6 km east and 3 km south-east of the study area. This grass occurs through the central Pilbara and is restricted to areas of heavy clay, particularly on basalts.
- There was one record of the Priority 3 species, *Plantago* sp. Hamersley (M.E. Trudgen 11207), from 6 km east-south-east of the study area. This annual herb is restricted to heavy crabhole clay plains of the central southern Pilbara.
- There were two records of the Priority 3 species, *Rostellularia adscendens* var. *latifolia*, from 15 km south-west and 23 km west-south-west of the study area. This species has a disjunct distribution, with population centres in the Hamersley subregion and the far eastern Chichester subregion. It has been recorded from near creeklines and on rocky hills.
- There were two records of the Priority 4 species, *Eremophila magnifica* subsp. *magnifica*, from 6 and 14 km north-west of the study area. This perennial shrub species occurs in a band through the central Pilbara, and is typically found on the slopes and crests of steep rocky hills.

## 3.0 Vegetation and Flora of the Proposed Clearing Area

### 3.1 Vegetation of the Proposed Clearing Area

The vegetation types recorded from the Wildflower Camp study area are shown in Figure 3.1 and described further in the following sections. Vegetation structure was described and condition (health) was ranked according to the classifications in Appendix 2 (equivalent condition rankings used in BushForever are also presented therein).

#### 3.1.1 Vegetation Types

##### Disturbed areas

Approximately 10% of the study area comprised areas that had been cleared for a previous accommodation village and associated infrastructure, including access tracks and roads. The village and infrastructure areas have been ripped and support mixed open shrublands dominated by *Petalostylis labicheoides* over scattered grasses. Scattered planted River Gums (*Eucalyptus camaldulensis*) were also present (Plate 3.1).

Five main vegetation types were identified within the remainder of the Wildflower Camp study area, three of which have been mapped together as they occur as a mosaic of small stands and are difficult to differentiate using aerial photography.

##### **EgAdAsbAbTps      *Eucalyptus gamophylla* low open mallee woodland over *Acacia dictyophleba*, *A. steedmanii* subsp. *borealis*, *A. bivenosa* tall open shrubland over *Triodia* sp. Shovelanna Hill hummock grassland**

The broad stony plains in the northern half of the study area supported scattered shrubs to tall open shrublands dominated by *Acacia dictyophleba*, *A. steedmanii* subsp. *borealis* and *A. bivenosa* over hummock grasslands of the undescribed species *Triodia* sp. Shovelanna Hill (S. van Leeuwen 3835). An open cover of the low mallee *Eucalyptus gamophylla* was also typically present. Other associated species included *Acacia ancistrocarpa*, *Aristida holathera* var. *holathera*, *Gompholobium karjini*, *Hakea lorea* subsp. *lorea* and *Keraudrenia nephrosperma*. Much of this area had been burnt in the last few years (Plate 3.2), hence no quadrats or relevés were located in this vegetation type. Despite some areas being burnt, the vegetation was in Excellent condition (see Appendix 2).

##### **AdAsbTp      *Acacia dictyophleba* (*A. steedmanii* subsp. *borealis*) tall open shrubland over *Triodia pungens* hummock grassland**

Lower-lying areas and poorly-defined flow areas through the stony plains supported similar vegetation but with *Triodia pungens* dominating the hummock grassland. While still classed as a tall open shrubland, the cover of shrubs was typically greater than in the previous vegetation type. Scattered *Corymbia deserticola* subsp. *deserticola* trees and *Eucalyptus gamophylla* mallees were also typically present. Other associated species included *Acacia bivenosa*, *A. pachyacra*, *Cassia oligophylla* and *Halgania gustafsenii*. This vegetation was in Excellent condition. Relevé WFC-MA, Plate 3.3.

##### **AanTm / AanTp / Aan/G      *Acacia aneura* tall open shrubland to low open forest over *Triodia melvillei* / *T. pungens* open hummock grassland or mixed open tussock grassland**

These three vegetation types were mapped as a mosaic, as they occur in small intermingled patches which are difficult to discriminate using aerial photography. The clayey plains in the southern half of the study area supported tall open shrublands to low open forests of Mulga (*Acacia aneura*) over a patchy understorey dominated by variable amounts of either the hummock grasses *Triodia melvillei* or *T. pungens*, or the tussock grasses *Chrysopogon fallax*,

*Digitaria brownii* and/or *Themeda triandra*. Areas bare of perennial ground cover would probably support numerous annual herbs and grasses in good seasons, including species such as *Aristida contorta*, *Enneapogon polyphyllus* and *Sclerolaena cornishiana*. Other associated species recorded from this vegetation included *Acacia pruinocarpa*, *Alternanthera nana*, *Cassia helmsii*, *Cheilanthes sieberi* subsp. *sieberi*, *Enchylaena tomentosa* var. *tomentosa*, *Eremophila lanceolata*, *Goodenia prostrata*, *Rhagodia eremaea* and *Sida platycalyx*. This vegetation was considered to be in only Good condition, with scattered weeds present and extensive grazing and trampling by cattle. Site WFC01; Plate 3.4 to Plate 3.7; interzone Plate 3.8.



**Plate 3.1:** Regenerating vegetation on the site of the old Wildflower Camp.



**Plate 3.2:** Recently burnt area of vegetation unit EgAdAsbAbTsp.



**Plate 3.3:** Vegetation unit AdAsbTp (relevé WFC-MA).



**Plate 3.4:** Vegetation unit AanTm.



**Plate 3.5:** Vegetation unit AanTp.



**Plate 3.6:** Vegetation unit Aan/G (site WFC01).



**Plate 3.7: Vegetation unit Aan/G.**



**Plate 3.8: Interzone between vegetation unit AdAsbTp and AanTp on stony plain: Mulga tall open shrubland over *Triodia pungens* hummock grassland.**

### 3.1.2 Vegetation of Conservation Significance

No TECs or PECs occur within the Wildflower Camp study area. While some vegetation types of conservation significance (for example, the *Themeda* grasslands TEC) are present in the broader locality, these occur on habitats that are not present within the study area (see Section 2.4.6). The five intact vegetation types identified within the study area are typical of such habitats (stony and clayey plains) in the locality. Despite some areas being recently burnt, the vegetation of the stony plains in the northern half of the study area was in Excellent condition. The vegetation of the southern clayey plains was considered to be in Good condition, supporting scattered weeds and showing signs of grazing and trampling by stock. If grazing pressure was reduced, the condition would be expected to improve to Very Good (see Appendix 2). All of the vegetation types have inherent conservation value as relatively intact native vegetation.

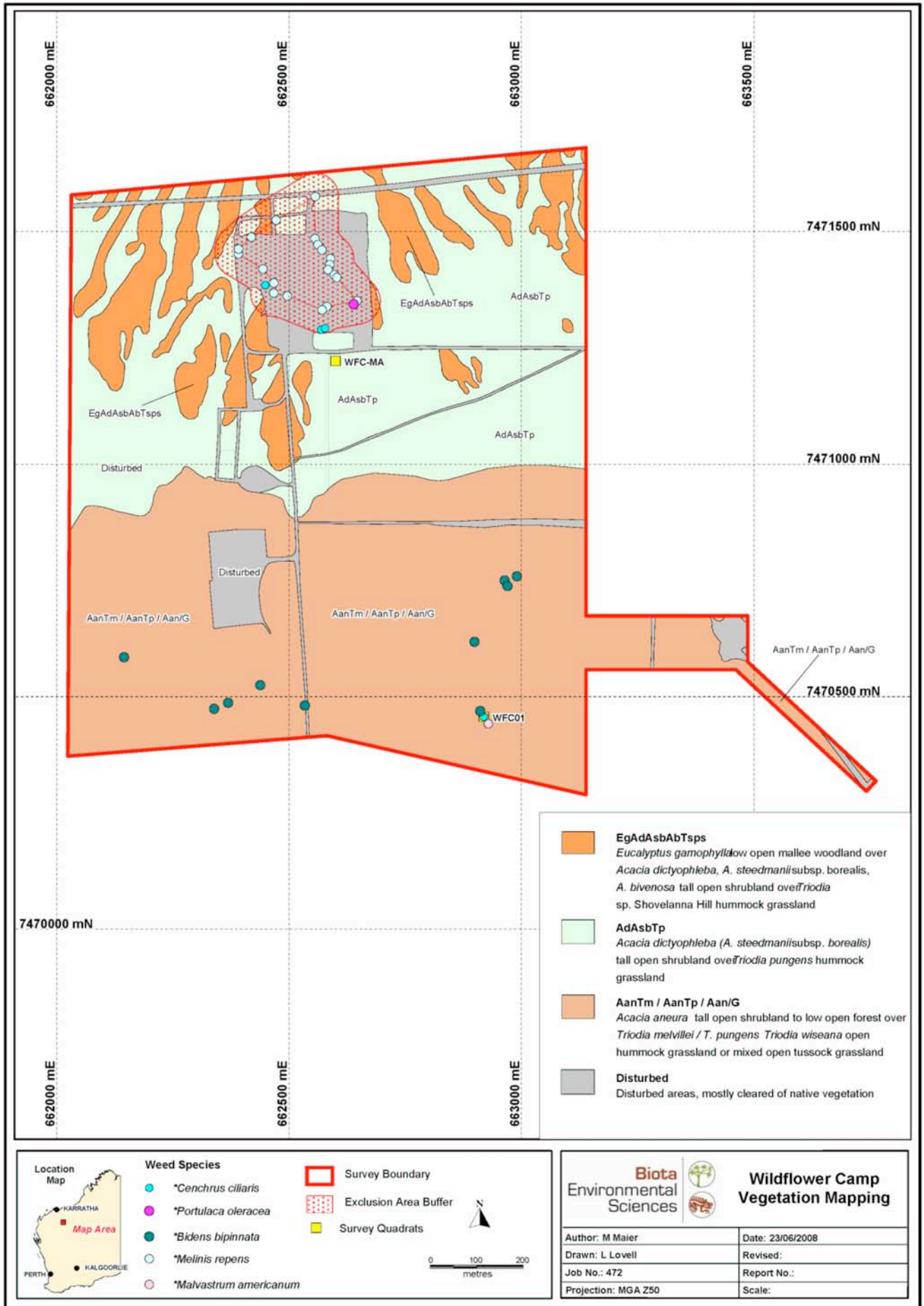


Figure 3.1: Vegetation of the Wildflower Camp study area. NB. \**Melinis* data and exclusion area buffer supplied by Rio Tinto.



## 3.2 Flora of the Proposed Clearing Area

### 3.2.1 Overview of the Flora

A total of 138 species of native flora, from 79 genera belonging to 30 families, was recorded from the Wildflower Camp area during the current study (see Appendix 3). One additional local native species (*Eucalyptus camaldulensis* var. *obtusa*) had been planted within the historic camp area, but would not naturally occur in the habitats of the study area.

A breakdown of the number of native taxa in the dominant plant families and genera is provided in Table 3.1. The dominant plant groups and the suite of species recorded were typical for stony and clayey plains habitats located in this section of the Hamersley subregion.

**Table 3.1: Numbers of native species in the dominant plant families and genera within the Wildflower Camp study area.**

Family	Number of Native Species
Poaceae (grass family)	33
Mimosaceae (wattle family)	15
Malvaceae (hibiscus family)	13
Chenopodiaceae (saltbush, bluebush family)	9
Amaranthaceae (mulla-mulla family)	7
Asteraceae (daisy family)	6
Caesalpinaceae (senna family)	5
Goodeniaceae (fan-flower family)	5
Myoporaceae (emu-flower, poverty bush family)	5
Genus	Number of Native Species
<i>Acacia</i> (wattles)	15
<i>Sida</i> (sidas)	6
<i>Eremophila</i> (emu-flowers, poverty bushes)	5
<i>Ptilotus</i> (mulla-mullas)	5
<i>Senna</i> (sennas / cassias)	4
<i>Triodia</i> (spinifex)	4

### 3.2.2 Flora of Conservation Significance

No Declared Rare Flora<sup>2</sup> (DRF) species were recorded from the Wildflower Camp study area (see Appendix 3), and none would be expected to occur.

Only two DRF are currently listed for the Pilbara, and neither would be expected to occur on the basis of their known distributions and habitat preferences:

- While there are known populations of *Thryptomene wittweri* as close as 13 km to the Wildflower Camp study area, there is no suitable habitat for this species (mountain crests of >1000 m elevation) either within or adjacent to the study area.
- While suitable habitat for *Lepidium catapycnon* (stony plains) occurs in the northern section of the Wildflower Camp area, the nearest known populations are some 80 km away. No individuals were observed within the hummock grasslands of the northern half of the study area during the current survey.

<sup>2</sup> See Appendix 1 for the conservation significance ranking framework for DRF and Priority species.

No Priority flora were recorded from the study area during the current survey work. Of the numerous Priority species recorded from the vicinity of the Wildflower Camp study area (see Section 2.4.7), most are restricted to habitats that are absent from the study area:

- *Bulbine pendula*, *Ischaemum albovillosum* and *Plantago* sp. Hamersley (M.E. Trudgen 11207) are restricted to heavier (typically cracking) clay substrates than those of the hardpan clayey plains present in the southern section of the Wildflower Camp study area.
- *Goodenia* sp. East Pilbara (A.A. Mitchell PRP 727) is most typically recorded on calcareous stony plains;
- *Acacia bromilowiana*, *Eremophila magnifica* subsp. *magnifica*, *Indigofera gilesii* subsp. *gilesii* and *Lobelia heterophylla* subsp. Pilbara (R. Meissner & Y. Caruso 1) are restricted to rocky habitats;
- *Dampiera metallorum* is restricted to high altitude hill crests and slopes; and
- *Olearia fluvialis* is typically recorded in the cobbly beds of moderate-sized creeklines supporting Coolibahs (*Eucalyptus victrix*).

This leaves four species:

- *Acacia dawsoniana* and *A. effusa* have both been recorded from stony plains habitats like those in the northern half of the Wildflower Camp study area. While it is noted that the entire area was not systematically searched for rare flora, representative traverses were walked through this habitat, during which these robust shrub species were not observed.
- *Rostellularia adscendens* var. *latifolia* has been recorded from various habitats in the Pilbara but is infrequently recorded. The populations known from the vicinity of the Wildflower Camp area have all been located on rocky hills, however a location near Marandoo is on a clayey plain. It is possible but unlikely that this species occurs in the Wildflower Camp study area.
- The population of the Priority 1 *Goodenia lyrata* which is located 15 km east-south-east of the Wildflower Camp is located in the same broad physiographic unit containing the clayey plains of the southern study area. It is possible that this species occurs in the Mulga vegetation of the southern study area. If there is to be any substantial clearing within this area, then systematic searches of the immediate development area should be conducted.

### 3.2.3 Introduced Flora

The stony habitats of the northern section of the Wildflower Camp study area are not conducive to weed invasion, however the clayey plains supporting Mulga vegetation in the southern section are more susceptible.

Five weed species were recorded from the study area (see Figure 3.1, Appendix 4). While none of these species are Declared Plants for the Pilbara under the *Agriculture and Related Resources Protection Act 1976*, *\*Melinis* and *\*Cenchrus* species are considered to be serious environmental weeds. Each weed species is discussed in more detail below.

- ***\*Melinis repens* (Natal Redtop)**

Natal Redtop is tufted perennial grass from South Africa that occurs mainly on roadsides from the South-west to the Kimberley. In the Pilbara this highly invasive species has been recorded from the vicinity of Tom Price and from the Great Northern Highway, north of Newman. Natal Redtop was known to occur at the Wildflower Camp prior to the March 2008 field survey. During this survey, the boundaries of this population were more accurately delineated by systematically walking at 50 m intervals through the area and recording representative coordinates at regular intervals, with the aim of identifying the margins of the stand (Appendix 4). Additional traverses were walked more generally through the study area, but these were more widely spaced. Further searches subsequently conducted in the area by Emil Thoma of Pilbara Iron and contractor weed sprayers have identified considerably larger numbers of plants than were recorded in March 2008 (Emil Thoma, Pilbara Iron, pers. comm. 2008).

At present, Natal Redtop appears confined to an area of some 260 m<sup>2</sup> of previously disturbed ground. Virtually all records are from the site of the old Wildflower Camp, with a single record from the eastern side of the junction of the access track with the main gravel road (Figure 3.1). The population size is estimated at ~2000-3000 individuals (Emil Thoma, Pilbara Iron, pers. comm. 2008). There is currently no sign of this weed having spread into the adjacent intact vegetation.

It is recommended that this area is immediately quarantined and control spraying is undertaken to eradicate this infestation. Follow-up spraying will be necessary to deal with recruitment from the soil seed bank, as the species was already in flower at the time of survey.

- **\**Cenchrus ciliaris* (Buffel Grass)**

Buffel Grass is a tufted perennial grass species, which was introduced to the Pilbara as a fodder species along with the less common Birdwood Grass (\**C. setiger*). Both are highly invasive species and can cause severe degradation of native vegetation along creeklines, in loamy coastal habitats and on rockpiles, particularly where there has been previous physical disturbance of the soil profile and/or heavy grazing. There were four records of scattered individuals of Buffel Grass from the Wildflower Camp study area; three from the rehabilitation area comprising the site of the old camp, and one from Mulga vegetation in the southern section of the study area (Figure 3.1 and Appendix 4).

- **\**Malvastrum americanum* (Spiked Malvastrum)**

Spiked Malvastrum is a low shrub from tropical America, which is widespread through the Pilbara along creeklines, on floodplains and in Mulga vegetation, particularly in areas frequented by cattle. There were two records of Spiked Malvastrum from the southern section of the Wildflower Camp study area, and it is probable that this species occurs more widely through the Mulga vegetation in this area (Figure 3.1 and Appendix 4).

- **\**Bidens bipinnata* (Bipinnate Beggartick)**

Bipinnate Beggartick is an erect annual herb with distinct narrow black seeds featuring barbed awns. This species occurs from north of Geraldton to the Kimberley. It is common on clay soils, and in the Pilbara typically occurs in creeklines and in Mulga vegetation, particularly in areas frequented by cattle. There were numerous records of Bipinnate Beggartick from the Wildflower Camp study area, all from Mulga vegetation on clayey plains, and it is probable that this species occurs more widely through the southern section of this area (Figure 3.1 and Appendix 4).

- **\**Portulaca oleracea* (Purslane)**

Purslane is a small succulent herb that was previously considered native to most of Western Australia, but has recently been designated as an introduced species for the State. There was a single record of Purslane from the rehabilitation area which is the site of the old Wildflower Camp, however it is probable that this species is more widespread through the area (Figure 3.1 and Appendix 4).

## 3.3 Summary of Species of Management Concern

### 3.3.1 Threatened Flora Species

No DRF were recorded from the Wildflower Camp study area, and none would be expected to occur (Section 3.2.2).

No Priority flora were recorded from the Wildflower Camp (Section 3.2.2). Of the species which have been previously collected in the locality, most are restricted to habitats which are not present in the study area. However, it is possible that the Priority 1 *Goodenia lyrata* may occur in Mulga vegetation on the clayey plains of the southern half of the study area. If any additional clearing is to take place in this habitat beyond the existing disturbance areas, then further systematic searches of the immediate development area should be conducted.

### **3.3.2 Introduced Species**

The stony habitats of the northern section of the Wildflower Camp study area are not overly conducive to weed invasion, however the clayey plains supporting Mulga vegetation in the southern section are more susceptible. Five weed species were recorded, of which Natal Redtop (*\*Melinis repens*) and Buffel Grass (*\*Cenchrus ciliaris*) are considered to be serious environmental weeds (Section 3.2.3). It is recommended that control spraying be undertaken immediately to eradicate the infestation of *\*Melinis repens*, which at present is largely restricted to the rehabilitation area which is the site of the old Wildflower Camp. The area should be quarantined until such time as the weed has been eradicated.

## 4.0 Assessment of Fauna and Fauna Habitats

### 4.1 Background

Assessments of the significance of fauna and their habitats are typically based upon their distribution and abundance across the bioregion within which a study area is located. Where large-scale development proposals are involved, fauna inventories are compiled and compared to known inventories from the bioregion to establish their value. Where only small areas are to be disturbed however, only those elements considered to be of greatest significance are typically assessed.

Four elements, which are outlined in further detail below, are usually assessed on this basis:

- the fauna habitats available within the proposed development area;
- an inventory of terrestrial fauna likely to occur in the study area on the basis of species distributions and available habitats;
- fauna of elevated conservation significance (ie. Threatened fauna); and
- Short-range Endemic (SRE) fauna.

It should be noted that few if any terrestrial vertebrate fauna species in the Pilbara are known to be restricted to areas the size of the current study area.

### 4.2 Fauna Habitats

The fauna habitat classification was developed on the basis of the dominant landforms and vegetation types. The classification does not cover all habitats available to the entire assemblage of invertebrate and vertebrate fauna, as this would be difficult to resolve and logistically impracticable to sample. Rather, the classifications provide a convenient framework within which to summarise species occurrence.

The faunal assemblage within these "habitats" will depend to some extent on the Land System in which they occur, and can differ for each Land System (as expressed in the vegetation classification). On this basis, it is the vegetation unit that best approximates a broad habitat classification.

While five vegetation types have been described for the Wildflower Camp area (see Section 3.1.1), these constitute two broad terrestrial fauna habitat types:

- Mixed *Acacia* tall open shrubland over *Triodia* hummock grassland on stony plains with a loamy substrate; and
- Mulga (*Acacia aneura*) low open woodland over *Triodia* hummock grassland and mixed tussock grassland on plains with a clay to clay-loam substrate.

The broad fauna habitats found within Wildflower Camp are widespread in the Pilbara bioregion, and as such would not be considered under threat by the proposed works.

### 4.3 Fauna Taxa Potentially Occurring in the Area

#### 4.3.1 Overall Fauna

A terrestrial vertebrate species list for the Wildflower Camp area was generated from database searches and literature reviews (Appendix 5 and Appendix 6; see Section 2.3.2.2). This list is summarised in Table 4.1.

**Table 4.1: Number of terrestrial fauna species potentially occurring within the Wildflower Camp area.**

Fauna Group	Number of Species
Avifauna	8
Mammals	5
Amphibians	0
Reptiles	13
<b>Total</b>	<b>26</b>

This vertebrate fauna species list is not an exhaustive inventory for the Hamersley subregion or for the Wildflower Camp study area, but rather a reflection of the information available for this study.

### 4.3.2 Threatened Fauna

The following threatened fauna species potentially occur in the Wildflower Camp study area: Night Parrot (*Pezoporus occidentalis*), Northern Quoll (*Dasyurus hallucatus*), Pilbara Orange Leafnosed-Bat (*Rhinonictis aurantius*), Pilbara Olive Python (*Liasis olivaceus barroni*), Bilby (*Macrotis lagotis*) and Western Pebble-mound Mouse (*Pseudomys chapmani*) (Table 4.2). Four of these species are listed Federally under the EPBC Act 1999 as well as being State-listed. The Threatened Fauna Statutory Framework can be found in Appendix 1.

**Table 4.2: Conservation significant terrestrial vertebrate fauna potentially occurring within the Wildflower Camp area.**

Species	Status	
	State	Federal
<i>Pezoporus occidentalis</i> (Night Parrot)	Schedule 1	Endangered
<i>Dasyurus hallucatus</i> (Northern Quoll)	Schedule 1	Endangered
<i>Rhinonictis aurantius</i> (Pilbara Orange Leafnosed-Bat)	Schedule 1	Vulnerable
<i>Liasis olivaceus barroni</i> (Pilbara Olive Python)	Schedule 1	Vulnerable
<i>Macrotis lagotis</i> (Bilby)	Schedule 1	
<i>Pseudomys chapmani</i> (Western Pebble-mound Mouse)	Priority 4	

These threatened fauna species are discussed below.

#### 4.3.2.1 *Pezoporus occidentalis* (Night Parrot)

**State: Schedule 1 'Critically Endangered' Federal: Endangered**

Night Parrots have been reported from every state on the Australia mainland. Suitable habitat occurs, or has occurred, across most of the inland, covering at least half of the continent. Records are sparsely distributed through this area, however there do appear to be concentrations of records in western Queensland and the eastern Pilbara (Higgins 1999). There is a confirmed record from Minga Well north of the Fortescue Marsh (approx. 100 km north of Newman, and 250 km east of Brockman) and an unconfirmed sighting from near Yandicoogina on the edge of the Marshes (Mr Roy Teale, Biota, pers. obs.).

Night Parrots inhabit areas where there is dense, low vegetation, which provides them shelter during the day. Most records come from hummock grasslands with spinifex (porcupine grass, *Triodia*), from areas dominated by samphire or, particularly, where these two habitats are juxtaposed. It has been suggested that birds move into the grasslands when *Triodia* is seeding. They have also been reported in low chenopod shrublands with saltbush and bluebush, and from areas of Mitchell grass (*Astrebla*) with scattered chenopods.

It is unlikely that this species would occur within the Wildflower Camp study area due to a lack of suitable habitat.

#### 4.3.2.2 *Dasyurus hallucatus* (Northern Quoll)

**State: Schedule 1, 'Endangered'; Federal: Endangered**

The Northern Quoll was originally recorded across Northern Australia from the Northwest Cape, Western Australia to south-east Queensland but has declined in recent years. Its distribution is now restricted to six main areas: the north and western top end of the Northern Territory, north of Cape York, the Atherton-Cairns area, the Carnarvon Range-Bowen area of Queensland (Menkhorst and Knight 2001), and the northwest Kimberley and Pilbara regions of Western Australia (Braithwaite and Griffiths 1994). It also occurs on numerous islands off the Australian coast (Abbott and Burbidge 1995, Burbidge and McKenzie 1978).

In the Pilbara, the Northern Quoll is most abundant in open, rocky habitat and is also commonly found in gorges and near creek lines, where breeding is successful (Strahan 2004). There are no gorges, rocky hills, rockpiles or rocky creeklines within the Wildflower Camp study area or in the vicinity. While it is possible that the Northern Quoll may forage through the habitats encompassed by the study area, these do not represent core habitat.

Under the *EPBC Act 1999*, an action requires referral to the Federal Environment Minister if it is deemed likely to have a significant impact on a matter of national environmental significance (eg. a listed threatened species such as the Northern Quoll *Dasyurus hallucatus*). Given the apparently broad distribution of the Northern Quoll in the Pilbara bioregion, the small scale of clearing required for the current proposal, and the lack of core habitat for this species in the project disturbance area, it is considered that the action will not result in a significant impact to the Northern Quoll.

#### 4.3.2.3 *Liasis olivaceus barroni* (Pilbara Olive Python)

**State: Schedule 1 'Vulnerable'; Federal: Vulnerable**

Regarded as a Pilbara endemic, this subspecies has a known distribution that coincides roughly with the Pilbara bioregion (Environment Australia 2000). This python occurs in rocky areas within the Pilbara, showing a preference for habitats near water, particularly rock pools. There are no gorges, escarpments, rockpiles or permanent water pools within either the Wildflower Camp study area or in the locality. While it is possible that the Olive Python may move through the area at times, the study area does not comprise core habitat. Given the small scale of clearing for the camp development, the conservation status of this species is unlikely to be altered by the current proposal. Normal management practice is to remove any individuals out of harm's way if encountered.

#### 4.3.2.4 *Macrotis lagotis* (Bilby)

The former range of the Bilby included most of the semi-arid areas of mainland Australia, however, it is now confined to *Triodia* hummock grassland and *Acacia* scrub across parts of northern Australia. Similar to the Mulgara, the species has been documented as holding temporary home ranges and showing relatively rapid changes in distribution in response to variation in habitat resources (Johnson 1995).

While it is possible that the Bilby occurs in the Wildflower Camp study area as suitable habitat is available, given the small scale of clearing for the camp development, the conservation status of this species would not be altered by the current proposal.

#### 4.3.2.5 *Pseudomys chapmani* (Western Pebble-mound Mouse)

**State: Priority 4**

The Western Pebble-mound Mouse is common to very common in suitable habitat within the Hamersley and Chichester subregions of the Pilbara bioregion, and is well known for its behaviour of constructing extensive mounds of small stones, typically on scree slopes and stony plains with hummock grasslands.

Given the small scale of clearing for the camp development, the conservation status of this species would not be altered by the current proposal.

### 4.3.3 Short Range Endemic (SRE) Taxa

Taxonomic groups of invertebrates with naturally small distributions are described as Short Range Endemics and are in part characterised by poor dispersal capabilities, confinement to disjunct habitats and low fecundity (Harvey 2002, Ponder and Colgan 2002). Given the importance of short-range endemism to the conservation of biodiversity, the assessment of such invertebrate taxa is a potentially important component of impact assessment. Due to this potentially high level of importance, targeted microhabitat searches are undertaken during fauna surveys. Examples of taxonomic groups that show high levels of short-range endemism in this respect include mygalomorph spiders, millipedes, pseudoscorpions and freshwater and terrestrial molluscs.

#### Mygalomorph Spiders

Whilst this group is regularly collected in the Pilbara bioregion, much of the taxonomy remains unresolved. This group is known to support a number of taxa with very limited distributions, and several species are included under Schedule 1 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2008* (although none of these species occur in the Pilbara bioregion). Biota is currently cooperating with the WA Museum and DEC to establish a reference collection for all Pilbara mygalomorphs, so as to provide contextual information for use in determining conservation significance for this group.

Four mygalomorph spiders were dug up from burrows and collected from the Wildflower Camp study area during the site visit. These were all from the family Nemesiidae and believed to be from the genus *Aname*, however further identifications will be determined in consultation with staff from the Western Australian Museum.

#### Terrestrial Molluscs (Pulmonata)

In his review of the conservation status of Australia's non-marine molluscs, Ponder (1997) identifies over 900 described terrestrial land snails from 23 families, with the most speciose families being the Camaenidae (408 taxa), Helicarionidae (60 taxa), Pupillidae (41 taxa), Bulimulidae (31 taxa), Punctidae (23 taxa) and Pupinidae (19 taxa). There are 230 described taxa in Western Australia, with 201 of these restricted to this State (Ponder 1997). Within the Pilbara bioregion, the most conspicuous elements of this fauna are the *Rhagada* and *Quistrachia* species (Camaenidae), though several *Bothriembryon* species (Bulimulidae) are known.

No land snails were collected from the Wildflower camp study area.



## 5.0 Assessment Against the Ten Clearing Principles

### 5.1 Overview

Robe River Mining Company proposes to construct an accommodation village at Wildflower Camp to support rail construction personnel associated with the duplication of rail between Cape Lambert and Juna Downs (see Section 2.1). It is anticipated that the total area required to be cleared for the camp will be only a subsection of the study area surveyed. It is considered that this proposed clearing is not at variance with the Ten Clearing Principles under Schedule 5 of the *Environmental Protection Act 1986*, each of which is addressed below.

### 5.2 Clearing Principles

#### 5.2.1 Potential Impact on a High Level of Biological Diversity

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

Five intact vegetation types were recorded from the Wildflower Camp study area (Section 3.1.1), all of which are typical of such habitats in the locality. The total number of native species recorded from the study area is within the expected range for an area of this size in this locality, and is not considered to represent a high species richness. The proposed clearing will therefore not impact any features of high diversity.

#### 5.2.2 Potential Impact to any Significant Habitat for Indigenous Fauna

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

We are interpreting the intent of this principle to be:

- does the vegetation represent an unusual habitat for the locality?; and/or
- does the vegetation represent a core or primary habitat for fauna species of conservation significance?

The primary habitats present within the Wildflower Camp study area (*Acacia* shrublands over spinifex on stony plains, and Mulga woodlands over spinifex or tussock grasses on clayey plains; Section 4.2) are widespread and abundant in the locality. While some Scheduled or Priority fauna species may utilise these habitats (see Section 4.3), neither the landforms nor vegetation types represent core habitat for any of these species of conservation significance.

#### 5.2.3 Potential Impact to any Rare Flora

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

No Declared Rare Flora were recorded from the Wildflower Camp study area, and none would be expected to occur (Section 3.2.2). No Priority flora were recorded from the study area. There is a possibility that the Priority 1 species *Goodenia lyrata* may occur in on the clayey plains in the southern section of the study area. If there is to be any clearing of this habitat beyond the existing disturbance areas, then further targeted searches for this species should be undertaken in the immediate development areas.

#### **5.2.4 Potential Impact on any Threatened Ecological Communities**

*Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a threatened ecological community.*

No Threatened Ecological Communities or Priority Ecological Communities occur within the Wildflower Camp study area (Section 3.1.2). The Mulga over spinifex vegetation occurring at the interzone between the stony and clayey plains may be considered to be an ecosystem at risk (Section 2.4.6.3), however the proposed clearing of this vegetation is minimal, even at a local scale.

#### **5.2.5 Potential Impact on any Native Vegetation Remnant in an Area that has been Extensively Cleared**

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

Most of the Pilbara bioregion has never been cleared, however a combination of weed invasions, hot frequent bushfires, feral predators and grazing by exotic herbivores is causing a loss of soil fertility and vegetation cover through some pastoral areas. Erosion from increased runoff velocities is also occluding drainage lines in places (McKenzie et al. 2002). While historic clearing has taken place for the previous accommodation village in the Wildflower Camp study area, this is negligible in comparison to the Pilbara-wide representation of Beard's broad vegetation units mapped for the study area (see Section 2.4.4). The vegetation types identified within the project area thus do not represent remnant stands of extensively cleared vegetation units.

#### **5.2.6 Potential Impact on any Watercourse and/or Wetland**

*Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.*

There are no permanent watercourses or wetlands within the Wildflower Camp study area.

#### **5.2.7 Potential to Cause Appreciable Land Degradation**

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

Apart from the areas cleared for the historic accommodation village and associated infrastructure (access tracks, etc), the habitats and vegetation types of the Wildflower Camp study area are in relatively good condition. The soils of the northern half of the study area comprise stony loams which are not overly conducive to erosion or weed invasion following disturbance. The clayey loams of the southern half of the study area would be more susceptible to both erosion and weed invasion, and further development in this area should be avoided.

Control spraying should be conducted immediately for the infestation of *Melinis repens* on the site of the old Wildflower Camp, and this area should be quarantined until this aggressive weed is eradicated. Strict weed hygiene measures must be implemented to ensure that no additional weeds are introduced to the study area or the vicinity (particularly given the proximity of the Karijini National Park). Provided these measures are undertaken, it is considered that the proposed clearing will not increase land degradation in the project area.

## 5.2.8 Potential Impact on Adjacent or Nearby Conservation Areas

*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.*

Currently the boundary of the A-class Karijini National Park is less than 200 m north-west of the north-western corner of the Wildflower Camp study area (Section 2.4.5). Provided that the population of *Melinis repens* is eradicated, and effective weed management strategies are subsequently implemented, it is considered that the proposed clearing will have no impact on this conservation reserve.

It is noted that once the WA pastoral exclusion process is enacted in 2015, the addition of a section of Juna Downs Station to the Karijini National Park will mean that the location of the Wildflower Camp will effectively be within the reserve itself (Section 2.4.5). Although the camp will have been decommissioned and the site rehabilitated by the time this extension of the Park occurs, it is recommended that the proponent discusses the proposed location of this camp with the Department of Environment and Conservation in light of this.

## 5.2.9 Potential Deterioration in Water Quality

*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.*

There are no significant surface drainage systems in the Wildflower Camp study area. Given the small scale of clearing required for the proposed project, there is no reason to expect that surface or groundwater quality in the area would be affected.

## 5.2.10 Potential to Cause or Exacerbate Flooding

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

The stony plains of the northern section of the Wildflower Camp study area would shed water during heavy rain events to the more low-lying clayey plains in the southern section. There may be some ponding of water on these clayey plains after substantial rain, however given the small amount of vegetation clearing proposed for the study area, this would not be expected to exacerbate either the frequency or the intensity of flooding through these areas.

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# Appendix 1

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## Framework for Conservation Significance Ranking of Communities and Species







## A. Definitions, Categories and Criteria for Threatened and Priority Ecological Communities

### 1. General Definitions

#### Ecological Community

A naturally occurring biological assemblage that occurs in a particular type of habitat.

Note: The scale at which ecological communities are defined will often depend on the level of detail in the information source, therefore no particular scale is specified.

A **threatened ecological community** (TEC) is one which is found to fit into one of the following categories; "presumed totally destroyed", "critically endangered", "endangered" or "vulnerable".

Possible threatened ecological communities that do not meet survey criteria are added to DEC's Priority Ecological Community Lists under Priorities 1, 2 and 3. Ecological Communities that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

An **assemblage** is a defined group of biological entities.

**Habitat** is defined as the areas in which an organism and/or assemblage of organisms lives. It includes the abiotic factors (eg. substrate and topography), and the biotic factors.

**Occurrence:** a discrete example of an ecological community, separated from other examples of the same community by more than 20 metres of a different ecological community, an artificial surface or a totally destroyed community.

By ensuring that every discrete occurrence is recognised and recorded future changes in status can be readily monitored.

**Adequately Surveyed** is defined as follows:

"An ecological community that has been searched for thoroughly in most likely habitats, by relevant experts."

**Community structure** is defined as follows:

"The spatial organisation, construction and arrangement of the biological elements comprising a biological assemblage" (eg. Eucalyptus salmonophloia woodland over scattered small shrubs over dense herbs; structure in a faunal assemblage could refer to trophic structure, eg. dominance by feeders on detritus as distinct from feeders on live plants).

Definitions of **Modification** and **Destruction** of an ecological community:

**Modification:** "changes to some or all of ecological processes (including abiotic processes such as hydrology), species composition and community structure as a direct or indirect result of human activities. The level of damage involved could be ameliorated naturally or by human intervention."

**Destruction:** "modification such that reestablishment of ecological processes, species composition and community structure within the range of variability exhibited by the original community is unlikely within the foreseeable future even with positive human intervention."

**Note:** Modification and destruction are difficult concepts to quantify, and their application will be determined by scientific judgement. Examples of modification and total destruction are cited below:

Modification of ecological processes: The hydrology of Toolibin Lake has been altered by clearing of the catchment such that death of some of the original flora has occurred due to dependence on fresh water. The system may be bought back to a semblance of the original state by redirecting saline runoff and pumping waters of the rising underground watertable away to restore the hydrological balance. Total destruction of downstream lakes has occurred due to hydrology being altered to the point that few of the original flora or fauna species are able to tolerate the level of salinity and/or water logging.

Modification of structure: The understorey of a plant community may be altered by weed invasion due to nutrient enrichment by addition of fertiliser. Should the additional nutrients be removed from the system the balance may be restored, and the original plant species better able to compete. Total destruction may occur if additional nutrients continue to be added to the system causing the understorey to be completely replaced by weed species, and death of overstorey species due to inability to tolerate high nutrient levels.

Modification of species composition: Pollution may cause alteration of the invertebrate species present in a freshwater lake. Removal of pollutants may allow the return of the original inhabitant species. Addition of residual highly toxic substances may cause permanent changes to water quality, and total destruction of the community.

**Threatening processes** are defined as follows:

"Any process or activity that threatens to destroy or significantly modify the ecological community and/or affect the continuing evolutionary processes within any ecological community."

Examples of some of the continuing threatening processes in Western Australia include: general pollution; competition, predation and change induced in ecological communities as a result of introduced animals; competition and displacement of native plants by introduced species; hydrological changes; inappropriate fire regimes; diseases resulting from introduced micro-organisms; direct human exploitation and disturbance of ecological communities.

**Restoration** is defined as returning an ecological community to its pre-disturbance or natural state in terms of abiotic conditions, community structure and species composition.

**Rehabilitation** is defined as the re-establishment of ecological attributes in a damaged ecological community although the community will remain modified.

## **2. Definitions and Criteria for Presumed Totally Destroyed, Critically Endangered, Endangered and Vulnerable Ecological Communities**

### **ECOLOGICAL COMMUNITIES**

#### **Presumed Totally Destroyed (PD)**

An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future.

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 ( A or B):

- A) Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats or
- B) All occurrences recorded within the last 50 years have since been destroyed

#### **Critically Endangered (CR)**

An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated.

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. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C):

- A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply (i or ii):
  - i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years);
  - ii) modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated.
- B) Current distribution is limited, and one or more of the following apply (i, ii or iii):
  - i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years);

- ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes;
  - iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes.
- C) The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).

**Endangered (EN)**

An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.

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. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B, or C):

- A) The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement and either or both of the following apply (i or ii):
  - i) the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years);
  - ii) modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated.
- B) Current distribution is limited, and one or more of the following apply (i, ii or iii):
  - i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years);
  - ii) there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes;
  - iii) there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes.
- C) The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).

**Vulnerable (VU)**

An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.

An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B or C):

- A) The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated.
- B) The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations.
- C) The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.

### 3. Definitions and Criteria for Priority Ecological Communities

#### **PRIORITY ECOLOGICAL COMMUNITY LIST**

Possible threatened ecological communities that do not meet survey criteria or that are not adequately defined are added to the Priority Ecological Community Lists under Priorities 1, 2 and 3. These three categories are ranked in order of priority for survey and/or definition of the community, and evaluation of conservation status, so that consideration can be given to their declaration as threatened ecological communities. Ecological Communities that are adequately known, and are rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

#### **Priority One:** Poorly-known ecological communities

Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.

#### **Priority Two:** 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, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.

#### **Priority Three:** Poorly known ecological communities

- (i) 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;
- (ii) 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;
- (iii) 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 by domestic and/or feral stock, and inappropriate fire regimes.

Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.

**Priority Four:** 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.

- (a) Rare. Ecological communities known from few occurrences 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 communities are usually represented on conservation lands.
- (b) Near Threatened. Ecological communities 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) Ecological communities that have been removed from the list of threatened communities during the past five years.

#### **Priority Five:** 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.

**Reference:** Department of Environment and Conservation 2007.

## B. Threatened Flora Statutory Framework

In Western Australia, all native flora species are protected under the *Wildlife Conservation Act 1950-1979*, making it an offence to remove or harm native flora species without approval. In addition to this basic level of statutory protection, a number of plant species are assigned an additional level of conservation significance based on the fact that there are a limited number of known populations, some of which may be under threat.

Species of the highest conservation significance are designated Declared Rare Flora (DRF), either extant or presumed extinct:

- **X: Declared Rare Flora - Presumed Extinct:** taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently, and have been gazetted as such, following approval by the Minister for the Environment, after recommendation by the State's Endangered Flora Consultative Committee;
- **R: Declared Rare Flora - Extant:** 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, following approval by the Minister for the Environment, after recommendation by the State's Endangered Flora Consultative Committee (Atkins 2008). (= *Threatened Flora* = *Endangered* + *Vulnerable*)

Species that appear to be rare or threatened, but for which there is insufficient information to properly evaluate their conservation significance, are assigned to one of four Priority flora categories:

- **P1: Priority One - Poorly Known:** 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., or the plants are under threat, e.g. from disease, grazing by feral animals, 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 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 which are known from several 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 need of further survey.
- **P4: Priority Four - Rare:** 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.

Note that of the above classifications, only 'Declared Rare Flora' has statutory standing. The Priority Flora classifications are employed by the Department of Environment and Conservation to manage and classify their database of species considered potentially rare or at risk, but these categories have no legislative status. Note also that proposals that appear likely to affect DRF require formal written approval from the Minister for the Environment under Section 23(f) of the *Wildlife Conservation Act 1950-1979* in addition to the requirements of the *Environmental Protection (Native Vegetation Clearing) Regulations 2004*.

### References:

Atkins, K.J. (2008). Declared Rare and Priority Flora List for Western Australia. Prepared by the Department of Environment and Conservation, 26 February 2008.

### C. Threatened Fauna Statutory Framework

Native fauna species that are rare, threatened with extinction, or have high conservation value are specially protected by law under the *Western Australian Wildlife Conservation Act 1950-1979*. In addition, many of these species are listed under the *Federal Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act 1999)*.

#### C1. Wildlife Conservation Act 1950-1979

Classification of rare and endangered fauna under the *Wildlife Conservation (Specially Protected Fauna) Notice 2006* recognises four distinct schedules of taxa:

1. Schedule 1 taxa are fauna which are rare or likely to become extinct and are declared to be fauna in need of special protection;
2. Schedule 2 taxa are fauna which are presumed to be extinct and are declared to be fauna in need of special protection;
3. Schedule 3 taxa are birds which are subject to an agreement between the governments of Australia and Japan relating to the protection of migratory birds and birds in danger of extinction, which are declared to be fauna in need of special protection; and
4. Schedule 4 taxa are fauna that are in need of special protection, otherwise than for the reasons mentioned in paragraphs (1), (2) and (3).

In addition to the above, fauna are also classified under five different Priority codes:

- **Priority One:** Taxa with few, poorly known populations on threatened lands. Taxa which are known from a few specimens or sight records from one or a few localities on lands not managed for conservation. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.
- **Priority Two:** Taxa with few, poorly known populations on conservation lands, or taxa with several, poorly known populations not on conservation lands. Taxa which are known from few specimens or sight records from one or a few localities on lands not under immediate threat of habitat destruction or degradation. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.
- **Priority Three:** Taxa with several, poorly known populations, some on conservation lands. Taxa which are known from few specimens or sight records from several localities, some of which are on lands not under immediate threat of habitat destruction or degradation. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.
- **Priority Four:** Taxa in need of monitoring. Taxa which are considered to have been adequately surveyed or for which sufficient knowledge is available and which are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands. Taxa which are declining significantly but are not yet threatened.
- **Priority Five:** Taxa in need of monitoring. Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

#### C2. EPBC Act 1999

Fauna species of national conservation significance are listed under the *EPBC Act 1999*, and may be classified as 'critically endangered', 'endangered', 'vulnerable' or 'conservation dependent' (consistent with IUCN categories: <http://www.iucn.org/themes/ssc/redlist2006/categories.htm>).

Migratory wader species are also protected under the *EPBC Act 1999*. The national List of Migratory Species consists of those species listed under the following International Conventions:

- Japan-Australia Migratory Bird Agreement (JAMBA);
- China-Australia Migratory Bird Agreement (CAMBA); and
- Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention).

## Appendix 2

# Vegetation Structural Classification and Condition Ranking Scale







**Vegetation Structural Classes\***

Stratum	Canopy Cover (%)				
	70-100%	30-70%	10-30%	2-10%	<2%
Trees over 30 m	Tall closed forest	Tall open forest	Tall woodland	Tall open woodland	Scattered tall trees
Trees 10-30 m	Closed forest	Open forest	Woodland	Open woodland	Scattered trees
Trees under 10 m	Low closed forest	Low open forest	Low woodland	Low open woodland	Scattered low trees
Shrubs over 2 m	Tall closed scrub	Tall open scrub	Tall shrubland	Tall open shrubland	Scattered tall shrubs
Shrubs 1-2 m	Closed heath	Open heath	Shrubland	Open shrubland	Scattered shrubs
Shrubs under 1 m	Low closed heath	Low open heath	Low shrubland	Low open shrubland	Scattered low shrubs
Hummock grasses	Closed hummock grassland	Hummock grassland	Open hummock grassland	Very open hummock grassland	Scattered hummock grasses
Grasses, Sedges, Herbs	Closed tussock grassland / bunch grassland / sedgeland / herbland	Tussock grassland / bunch grassland / sedgeland / herbland	Open tussock grassland / bunch grassland / sedgeland / herbland	Very open tussock grassland / bunch grassland / sedgeland / herbland	Scattered tussock grasses / bunch grasses / sedges / herbs

\* Based on Muir (1977), and Aplin's (1979) modification of the vegetation classification system of Specht (1970):  
 Aplin T.E.H. (1979). The Flora. Chapter 3 In O'Brien, B.J. (ed.) (1979). *Environment and Science*. University of Western Australia Press; Muir B.G. (1977). Biological Survey of the Western Australian Wheatbelt. Part II: Vegetation and habitat of Bendering Reserve. *Records of the Western Australian Museum, Suppl. No. 3*; Specht R.L. (1970). Vegetation. In *The Australian Environment*. 4th edn (Ed. G.W. Leeper). Melbourne.

**Vegetation Condition Scale\***

<p><b>E = Excellent</b> (=Pristine of BushForever)            Pristine or nearly so; no obvious signs of damage caused by the activities of European man.</p>
<p><b>VG = Very Good</b> (= Excellent of BushForever)            Some relatively slight signs of damage caused by the activities of European man. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds such as <i>*Ursinia anthemoides</i> or <i>*Briza</i> spp., or occasional vehicle tracks.</p>
<p><b>G = Good</b> (= Very Good of BushForever)            More obvious signs of damage caused by the activities of European man, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or by selective logging. Weeds as above, possibly plus some more aggressive ones such as <i>*Ehrharta</i> spp.</p>
<p><b>P = Poor</b> (= Good of BushForever)            Still retains basic vegetation structure or ability to regenerate to it after very obvious impacts of activities of European man, such as grazing, partial clearing (chaining) or frequent fires. Weeds as above, probably plus some more aggressive ones such as <i>*Ehrharta</i> spp.</p>
<p><b>VP = Very Poor</b> (= Degraded of BushForever)            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 including very aggressive species.</p>
<p><b>D = Completely Degraded</b> (= Completely Degraded of BushForever)            Areas that are completely or almost completely without native species in the structure of their vegetation; ie. areas that are cleared or 'parkland cleared' with their flora comprising weed or crop species with isolated native trees or shrubs.</p>

\* Based on Trudgen M.E. (1988). A Report on the Flora and Vegetation of the Port Kennedy Area. Unpublished report prepared for Bowman Bishaw and Associates, West Perth.



## Appendix 3

### List of Flora Species Recorded from the Wildflower Camp Study Area





**NB.** –OPP denotes opportunistic collections

\* denotes introduced species (weeds)

Numbers indicate estimated percent foliar cover; + indicates <1%.

<b>FAMILY / Species</b>	<b>WFC01</b>	<b>WFC-MA</b>	<b>WFC-OPP</b>
<b>ADIANTACEAE (007)</b>			
<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>	+		√
<b>AMARANTHACEAE (106)</b>			
<i>Alternanthera nana</i>			√
<i>Gomphrena cunninghamii</i>			√
<i>Ptilotus astrolasius</i> var. <i>astrolasius</i>			√
<i>Ptilotus calostachyus</i> var. <i>calostachyus</i>			√
<i>Ptilotus exaltatus</i> var. <i>exaltatus</i>			√
<i>Ptilotus roei</i>	+		√
<i>Ptilotus rotundifolius</i>		+	√
<b>ASCLEPIADACEAE (305)</b>			
<i>Cynanchum floribundum</i>			√
<i>Rhyncharhena linearis</i>			√
<b>ASTERACEAE (345)</b>			
* <i>Bidens bipinnata</i>	1		√
<i>Centipeda thespidioides</i>	+		
<i>Pterocaulon sphacelatum</i>		+	√
<i>Pterocaulon sphaeranthoides</i>	+		
<i>Streptoglossa decurrens</i>			√
<i>Vittadinia dissecta</i> var. <i>hirta</i>			√
<i>Vittadinia obovata</i>			√
<b>BORAGINACEAE (310)</b>			
<i>Halgania cyanea</i>			√
<i>Halgania gustafsenii</i> var. <i>compactus</i>		1	
<b>CAESALPINIACEAE (164)</b>			
<i>Petalostylis labicheoides</i>			√
<i>Senna artemisioides</i> subsp. <i>helmsii</i>			√
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>		+	√
<i>Senna notabilis</i>			√
<i>Senna pleurocarpa</i> var. <i>angustifolia</i>			√
<b>CAPPARACEAE (137A)</b>			
<i>Capparis lasiantha</i>		+	
<i>Cleome viscosa</i>			√
<b>CHENOPODIACEAE (105)</b>			
<i>Dysphania glomulifera</i> subsp. <i>eremaea</i>			√
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>			√
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>			√
<i>Maireana villosa</i>			√
<i>Maireana villosa</i> x <i>planifolia</i> ?	+		
<i>Rhagodia eremaea</i>			√
<i>Rhagodia</i> sp. Hamersley (M. Trudgen 17794)	+		√
<i>Salsola tragus</i>			√
<i>Sclerolaena cornishiana</i>	+		√
<b>CONVOLVULACEAE (307)</b>			
<i>Bonamia rosea</i>			√
<i>Duperreya commixta</i>			√
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	+		√
<i>Ipomoea muelleri</i>			√
<b>EUPHORBIACEAE (185)</b>			
<i>Euphorbia australis</i>			√
<i>Euphorbia australis</i> (mid-green form)			√

<b>FAMILY / Species</b>	<b>WFC01</b>	<b>WFC-MA</b>	<b>WFC-OPP</b>
<b>GOODENIACEAE (341)</b>			
<i>Dampiera candidans</i>			√
<i>Goodenia microptera</i>			√
<i>Goodenia prostrata</i>			√
<i>Goodenia stobbsiana</i>			√
<i>Scaevola parvifolia</i> subsp. <i>pilbarae</i>			√
<b>GYROSTEMONACEAE (108)</b>			
<i>Codonocarpus cotinifolius</i>			√
<b>LAMIACEAE (313)</b>			
<i>Spartothamnella teucriflora</i>			√
<b>LAURACEAE (131)</b>			
<i>Cassytha capillaris</i>			√
<b>LORANTHACEAE (097)</b>			
<i>Amyema fitzgeraldii</i>			√
<b>MALVACEAE (221)</b>			
<i>Abutilon cunninghamii</i>			√
<i>Abutilon otocarpum</i> (acute leaf form)			√
<i>Abutilon trudgenii</i>			√
<i>Gossypium robinsonii</i>			√
<i>Hibiscus brachychlaenus</i>			√
<i>Hibiscus</i> aff. <i>coatesii</i>			√
<i>Hibiscus platyklamys</i>			√
* <i>Malvastrum americanum</i>	1		
<i>Sida arenicola</i>			√
<i>Sida cardiophylla</i>			√
<i>Sida echinocarpa</i>			√
<i>Sida</i> aff. <i>fibulifera</i> (MET Site 1308)			√
<i>Sida platycalyx</i>	1		√
<i>Sida spinosa</i>			√
<b>MIMOSACEAE (163)</b>			
<i>Acacia adsurgens</i>			√
<i>Acacia ancistrocarpa</i>			√
<i>Acacia aneura</i> var. <i>intermedia</i>	10		
<i>Acacia aneura</i> var. <i>pilbarana</i>	40		
<i>Acacia bivenosa</i>		+	√
<i>Acacia coriacea</i> subsp. <i>pendens</i>			√
<i>Acacia dictyophleba</i>		10	√
<i>Acacia elachantha</i>		+	√
<i>Acacia maitlandii</i>			√
<i>Acacia pachyacra</i>		+	√
<i>Acacia pruinocarpa</i>		+	√
<i>Acacia steedmanii</i> subsp. <i>borealis</i>		+	√
<i>Acacia tetragonophylla</i>			√
<i>Acacia trachycarpa</i>			√
<i>Acacia trudgeniana</i>			√
<b>MYOPORACEAE (326)</b>			
<i>Eremophila forrestii</i> subsp. <i>forrestii</i>			√
<i>Eremophila lanceolata</i>	+		√
<i>Eremophila latrobei</i> subsp. <i>glabra</i>			√
<i>Eremophila latrobei</i> x <i>forrestii</i>	+		
<i>Eremophila longifolia</i>			√
<b>MYRTACEAE (273)</b>			
<i>Corymbia deserticola</i> subsp. <i>deserticola</i>		<1	√
<i>Corymbia hamersleyana</i>		+	√
<i>Eucalyptus camaldulensis</i> var. <i>obtusa</i> (planted in rehab area)			√
<i>Eucalyptus gamophylla</i>		+	√

<b>FAMILY / Species</b>	<b>WFC01</b>	<b>WFC-MA</b>	<b>WFC-OPP</b>
<b>NYCTAGINACEAE (107)</b>			
<i>Boerhavia coccinea</i>			√
<i>Boerhavia repleta</i>			√
<b>OLEACEAE (301)</b>			
<i>Jasminum didymum</i> subsp. <i>lineare</i>		+	√
<b>PAPILIONACEAE (165)</b>			
<i>Glycine canescens</i>			√
<i>Gompholobium karrjini</i>			√
<i>Indigofera monophylla</i> (brown calyx form)			√
<i>Rhynchosia minima</i>			√
<b>POACEAE (031)</b>			
<i>Amphipogon sericeus</i>			√
<i>Aristida contorta</i>	+		√
<i>Aristida holathera</i> var. <i>holathera</i>			√
<i>Aristida inaequiglumis</i>			√
<i>Bothriochloa ewartiana</i>			√
* <i>Cenchrus ciliaris</i>	2		√
<i>Chloris pectinata</i>			√
<i>Chrysopogon fallax</i>	5		√
<i>Cymbopogon ambiguus</i>		+	√
<i>Cymbopogon oblectus</i>			√
<i>Dactyloctenium radulans</i>			√
<i>Dichanthium sericeum</i> subsp. <i>humilius</i>			√
<i>Digitaria ammophila</i>			√
<i>Digitaria brownii</i>			√
<i>Enneapogon polyphyllus</i>			√
<i>Enneapogon robustissimus</i>			√
<i>Eragrostis cumingii</i>			√
<i>Eragrostis setifolia</i>			√
<i>Eragrostis tenellula</i>			√
<i>Eriachne aristidea</i>			√
<i>Eriachne helmsii</i>			√
<i>Eriachne pulchella</i> subsp. <i>dominii</i>			√
<i>Eulalia aurea</i>			√
<i>Iseilema membranaceum</i>			√
* <i>Melinis repens</i>			√
<i>Panicum effusum</i> var. <i>effusum</i>			√
<i>Paraneurachne muelleri</i>			√
<i>Paspalidium rarum</i>			√
<i>Perotis rara</i>			√
<i>Themeda triandra</i>			√
<i>Triodia longiceps</i>	1		√
<i>Triodia melvillei</i>	1		√
<i>Triodia pungens</i>		45	√
<i>Triodia</i> sp. Shovelanna Hill (S. van Leeuwen 3835)			√
<i>Urochloa occidentalis</i> subsp. <i>occidentalis</i>			√
<b>PORTULACACEAE (111)</b>			
* <i>Portulaca oleracea</i>	+		√
<i>Portulaca pilosa</i>	+		
<b>PROTEACEAE (090)</b>			
<i>Grevillea berryana</i>	+		
<i>Hakea chordophylla</i>			√
<i>Hakea lorea</i> subsp. <i>lorea</i>			√
<b>RUBIACEAE (331)</b>			
<i>Psydrax latifolia</i>			√
<i>Spermacoce brachystema</i>			√

<b>FAMILY / Species</b>	<b>WFC01</b>	<b>WFC-MA</b>	<b>WFC-OPP</b>
<b>SOLANACEAE (315)</b>			
<i>Solanum horridum</i>			√
<i>Solanum lasiophyllum</i>			√
<b>STERCULIACEAE (223)</b>			
<i>Keraudrenia nephrosperma</i>			√
<i>Melhania oblongifolia</i>			√
<i>Waltheria indica</i>			√
<b>TILIACEAE (220)</b>			
<i>Corchorus lasiocarpus</i> subsp. <i>lasiocarpus</i>			√
<b>VIOLACEAE (243)</b>			
<i>Hybanthus aurantiacus</i>			√



## Appendix 4

### Locations of Weeds Recorded from the Wildflower Camp Study Area





**Representative locations of \*Melinis repens in the Wildflower Camp study area.**

**NB.** These records are superseded by estimates of 2000-3000 individuals within the camp site obtained in May 2008 by Emil Thoma (Pilbara Iron).

<b>Easting (WGS84, Zone 50)</b>	<b>Northing (WGS84, Zone 50)</b>	<b>Density</b>	<b>Location</b>
662555	7471570	x1	E corner of access track and road
662539	7471494	scattered	Historic camp rehabilitation area
662536	7471449	x 15	Historic camp rehabilitation area
662531	7471425	scattered	Historic camp rehabilitation area
662519	7471395	scattered	Historic camp rehabilitation area
662512	7471434	scattered	Historic camp rehabilitation area
662511	7471374	scattered	Historic camp rehabilitation area
662508	7471472	scattered	Historic camp rehabilitation area
662505	7471390	scattered	Historic camp rehabilitation area
662499	7471423	scattered	Historic camp rehabilitation area
662495	7471382	scattered	Historic camp rehabilitation area
662472	7471344	scattered	Historic camp rehabilitation area
662462	7471454	scattered	Historic camp rehabilitation area
662454	7471446	x1	Historic camp rehabilitation area

**Locations of \*Cenchrus ciliaris recorded in the Wildflower Camp study area.**

<b>Location</b>	<b>Easting (mE; WGS84, Zone 50)</b>	<b>Northing (mN; WGS84, Zone 50)</b>	<b>Density</b>
WFC01	663919	7470457	scattered (2%)
WFC-opp	662449	7471385	scattered; hardly any in this rehabilitation area
WFC-opp	662569	7471289	scattered
WFC-opp	662578	7471292	scattered

**Locations of \*Malvastrum americanum recorded in the Wildflower Camp study area.**

<b>Location</b>	<b>Easting (mE; WGS84, Zone 50)</b>	<b>Northing (mN; WGS84, Zone 50)</b>	<b>Density</b>
WFC01	663919	7470457	scattered (1%)
WFC-opp	569662	7538910	x1

**Locations of \*Bidens bipinnata recorded in the Wildflower Camp study area.**

<b>Location</b>	<b>Easting (mE; WGS84, Zone 50)</b>	<b>Northing (mN; WGS84, Zone 50)</b>	<b>Density</b>
WFC01	663919	7470457	scattered (1%)
WFC-opp	662145	7470585	scattered
WFC-opp	662339	7470474	scattered
WFC-opp	662369	7470487	scattered
WFC-opp	662438	7470525	scattered
WFC-opp	662534	7470481	scattered
WFC-opp	662899	7470618	scattered
WFC-opp	662964	7470750	scattered
WFC-opp	662970	7470738	scattered
WFC-opp	662990	7470759	dense

**Locations of \*Portulaca oleracea recorded in the Wildflower Camp study area.**

<b>Location</b>	<b>Easting (mE; WGS84, Zone 50)</b>	<b>Northing (mN; WGS84, Zone 50)</b>	<b>Density</b>
WFC-OPP	662639	7471344	scattered



## Appendix 5

### Results of Fauna Database Searches for the Locality including the Wildflower Camp Study Area

- DEC Threatened Fauna Database
  - WA Museum FaunaBase
- EPBC Act 1999 Protected Matters Database
  - DEC Pilbara Biological Survey Database





**DEC Threatened Fauna Database****Threatened and Priority Fauna Database**

Page 1 of 1

22.626°S 118.34°E / 23.114°S 118.829°E Pilbara Iron Rail Duplication rail camp - Site 8

<i>Date</i>	<i>Certainty</i>	<i>Seen</i>	<i>Location Name</i>	<i>Method</i>
<b>Priority Four: Taxa in need of monitoring</b>				
<i>Pseudomys chapmani</i>			<b>Western Pebble-mound Mouse, Ngadji</b>	<i>3 records</i>
This species is well-known for the characteristic pebble-mounds which it constructs over underground burrow systems. These mounds are most common on spurs and lower slopes of rocky hills.				
1992	1		Packsaddle Hill	Caught or trapped
1994	1		Karijini NP	
1996	1		Boundary Ridge	Caught or trapped

\* Information relating to any records provided for listed species:-

Date: date of recorded observation

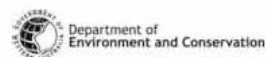
Certainty (of correct species identification): 1=Very certain; 2=Moderately certain; and 3=Not sure.

Seen: Number of individuals observed.

Location Name: Name of reserve or nearest locality where observation was made

Method: Method or type of observation

Monday, 7 April 2008



**WA Museum FaunaBase****Amphibians**

No records found

**-22.755, 118.709 and -22.980, 118.468****Birds collected between****-22.755, 118.709 and -22.980, 118.468**

Acanthizidae

*Pyrrholaemus brunneus*

Psittacidae

*Cacatua roseicapilla assimilis*

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**Mammals collected between****-22.755, 118.709 and -22.980, 118.468**

Dasyuridae

*Ningau timealeyi*

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Agamidae

*Ctenophorus caudicinctus caudicinctus**Diporiphora valens*

Gekkonidae

*Diplodactylus pulcher**Gehyra variegata**Heteronotia binoei**Strophurus wellingtonae*

Pygopodidae

*Delma haroldi*

Scincidae

*Carlia munda**Ctenotus duricola**Ctenotus helenae**Ctenotus pantherinus ocellifer**Cyclodomorphus melanops melanops*

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**Reptiles collected between****EPBC Act 1999 Protected Matters Database**

<b>Matters of National Environmental Significance</b>		
<b>Threatened Species</b>	<b>Status</b>	<b>Type of Presence</b>
<b>Birds</b>		
<i>Pezoporus occidentalis</i> Night Parrot	Endangered	Species or species habitat likely to occur within area
<b>Mammals</b>		
<i>Dasyurus hallucatus</i> Northern Quoll	Endangered	Species or species habitat may occur within area
<i>Macrotis lagotis</i> Greater Bilby	Vulnerable	Species or species habitat may occur within area
<i>Rhinioncteris aurantius</i> (Pilbara form) Pilbara Leaf-nosed Bat	Vulnerable	Community likely to occur within area
<b>Reptiles</b>		
<i>Liasis olivaceus barroni</i> Olive Python (Pilbara subspecies)	Vulnerable	Species or species habitat may occur within area
<b>Plants</b>		
<i>Lepidium catapycnon</i> Hamersley Lepidium, Hamersley Catapycnon	Vulnerable	Species or species habitat likely to occur within area
<i>Thryptomene wittweri</i> Mountain Thryptomene	Vulnerable	Species or species habitat likely to occur within area

<b>Migratory Species</b>	<b>Status</b>	<b>Type of Presence</b>
<b>Migratory Terrestrial Species</b>		
<b>Birds</b>		
<i>Merops ornatus</i> Rainbow Bee-eater	Migratory	Species or species habitat may occur within area
<i>Pezoporus occidentalis</i> Night Parrot	Migratory	Species or species habitat likely to occur within area



<b>Migratory Wetland Species</b>		
<b>Birds</b>		
<i>Ardea alba</i> Great Egret, White Egret	Migratory	Species or species habitat may occur within area
<i>Ardea ibis</i> Cattle Egret	Migratory	Species or species habitat may occur within area
<i>Charadrius veredus</i> Oriental Plover, Oriental Dotterel	Migratory	Species or species habitat may occur within area
<b>Migratory Marine Birds</b>		
<i>Apus pacificus</i> Fork-tailed Swift	Migratory	Species or species habitat may occur within area
<i>Ardea alba</i> Great Egret, White Egret	Migratory	Species or species habitat may occur within area
<i>Ardea ibis</i> Cattle Egret	Migratory	Species or species habitat may occur within area

<b>Other Matters Protected by the EPBC Act</b>		
<b>Listed Marine Species</b>	<b>Status</b>	<b>Type of Presence</b>
<b>Birds</b>		
<i>Apus pacificus</i> Fork-tailed Swift	Listed – overfly marine area	Species or species habitat may occur within area
<i>Ardea alba</i> Great Egret, White Egret	Listed – overfly marine area	Species or species habitat may occur within area
<i>Ardea ibis</i> Cattle Egret	Listed – overfly marine area	Species or species habitat may occur within area
<i>Charadrius veredus</i> Oriental Plover, Oriental Dotterel	Listed – overfly marine area	Species or species habitat may occur within area
<i>Merops ornatus</i> Rainbow Bee-eater	Listed – overfly marine area	Species or species habitat may occur within area

### **DEC Pilbara Biological Survey Database**

No Pilbara Biological Survey sites were located within the 25 km buffer around Wildflower Camp.



## Appendix 6

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# Summary of Terrestrial Fauna Species for Wildflower Camp and Surrounds Based on Database Searches and Literature Review





**Avifauna**

Common Name	Species Name
Great Egret	<i>Ardea alba</i>
Cattle Egret	<i>Ardea ibis</i>
Oriental Plover	<i>Charadrius veredus</i>
Galah	<i>Cacatua roseicapilla</i>
Night Parrot	<i>Pezoporus occidentalis</i>
Fork-tailed Swift	<i>Apus pacificus</i>
Rainbow Bee-eater	<i>Merops ornatus</i>
Redthroat	<i>Pyrrholaemus brunneus</i>

**Mammals**

Common Name	Species Name
Northern Quoll	<i>Dasyurus hallucatus</i>
Pilbara Ningau	<i>Ningau timealeyi</i>
Bilby	<i>Macrotis lagotis</i>
Pilbara Orange Leafnosed-bat	<i>Rhinonictis aurantius</i>
Western Pebble-mound Mouse	<i>Pseudomys chapmani</i>

**Amphibians**

No individuals have been recorded within the 25 km buffer area around Wildflower Camp.

**Reptiles**

Species Name
<i>Ctenophorus caudicinctus caudicinctus</i>
<i>Diporiphora valens</i>
<i>Diplodactylus pulcher</i>
<i>Strophurus wellingtonae</i>
<i>Gehyra variegata</i>
<i>Heteronotia binoei</i>
<i>Delma haroldi</i>
<i>Carlia munda</i>
<i>Ctenotus duricola</i>
<i>Ctenotus helenae</i>
<i>Ctenotus pantherinus ocellifer</i>
<i>Cyclodomorphus melanops</i>
<i>Liasis olivaceus barroni</i>