Vegetation, Flora and Fauna Assessment, and Targeted Conservation Significant Flora and Fauna Survey: Flying Fish

Fortescue Metals Group Limited

science+design

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Direct all inquiries to: **Ecoscape (Australia) Pty Ltd**

9 Stirling Highway • PO Box 50 North Fremantle WA 6159

Ph: (08) 9430 8955 Fax: (08) 9430 8977

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Executive Summary

Ecoscape was commissioned by Fortescue Metals Group Limited to undertake Level 1 flora and vegetation and Level 1 fauna assessments, and targeted conservation significant flora and fauna species surveys of exploration tenements E47/1373 and M47/1404 (known as 'Flying Fish') in Fortescue's Western Hub project area, approximately 70 km west-north-west of Tom Price in the Pilbara region of Western Australia.

The assessments included background 'desktop' research and a reconnaissance (field) survey to verify the accuracy of the background research. Targeted searches for conservation significant flora and fauna species and significant ecological communities were also conducted.

The flora and vegetation desktop assessment identified:

- the study area does not fall within an Environmentally Sensitive Area
- there is one Threatened Ecological Community in the Hamersley subregion (*vulnerable 'Themeda* grasslands on cracking clays (Hamersley Station, Pilbara)', however the Department of Environment and Conservation database search identified it as occurring more than 15 km from the study area
- there are 29 Priority Ecological Communities in the Pilbara Region, with the most likely to occur in the vicinity being the *P1* 'Brockman Iron cracking clay communities of the Hamersley Range' and *P3* '*Triodia* sp. Robe River assemblages of mesas of the Robe Valley'
- there were two Threatened Flora (TF) and 51 Priority Listed Flora (PF) species identified from the Department of Environment and Conservation database search request of the Western Hub area and 15 km buffer, none of which have previously been recorded from within the study area.

The fauna desktop assessment identified:

- three Threatened and six Migratory Fauna species were identified by the *Environment Protection and Biodiversity Conservation Act* (1999) Protected Matters Search Tool as potentially occurring in the study area and 10 km buffer
- there were seven threatened and priority listed fauna species identified from the Department of Environment and Conservation (DEC) database search of the Western Hub area and 20 km buffer, none of which have previously been recorded from within the study area
- a search of the *NatureMap* database and previous fauna survey reports indicated four additional priority fauna species that may be expected to occur in the study area
- the fauna species of highest conservation significance that are likely to occur in the study area, listed under the *Environment Protection and Biodiversity Conservation Act* (1999), are *Dasyurus hallucatus* (Northern Quoll, Endangered), *Rhinonicteris aurantia* (Pilbara Leaf-nosed Bat, Vulnerable), and *Liasis olivaceus barroni* (Pilbara Olive Python, Vulnerable).

The flora and vegetation field survey was undertaken over three days (approximately 66 person hours for the combined adjacent Flying Fish and Eliwana tenements) in July 2011 and identified:

- a total of 130 dominant and characteristic vascular flora taxa within the study area from relevé sites and opportunistic observations
- no flora listed as Threatened under the Commonwealth *Environment Protection and Biodiversity Conservation Act* (1999) or gazetted under the Government of Western Australia's *Wildlife Conservation Act* (1950) were recorded from the study area, however the presence of the two most likely Threatened Flora species (*Lepidium catapycnon* and *Thryptomene wittweri*) cannot be discounted as their usual habitat was largely not accessible during the survey
- four Department of Environment and Conservation-listed Priority Flora; *Acacia bromilowiana* (P4), *Eremophila magnifica* subsp. *magnifica* (P4), *Eremophila magnifica* subsp. *velutina* (P3) and *Indigofera* sp. Bungaroo Creek (P3)
- three introduced flora species, **Bidens bipinnata* (Bipinnate Beggartick), **Cenchrus ciliaris* (Buffel Grass) and **Vachellia farnesiana* (Mimosa Bush), none of which are recognised under the *Agriculture and Related Resources Protection Act 1976* as Declared Plants
- 18 different vegetation types, none of which are considered to represent any recognised TECs or PECs
- the following vegetation types had a degree of significance, however they do not have any statutory conservation significance:
    - 'all major ephemeral water courses' have been identified as an 'Ecosystem at Risk' in Kendrick (2002). Within the study area the **EvAcTt** vegetation type can be considered analogous with this 'Ecosystem at Risk'. Due to presence of *Eucalyptus victrix* as a dominant species, **EvAcTt** is also considered to be a potential groundwater dependent ecosystem and may also be considered to have a restricted distribution due it being restricted to a landform occupying only small extents
    - the **AaEfT?e**, **ApTw**, **EgAmTw** and **ElAmTw**^{2} vegetation types are associated with hills and include hilltops and therefore may be considered analogous to the 'Hilltop floras, Hamersley Range' *vulnerable* 'Ecosystem at Risk'
- the vegetation condition was approximately evenly divided between Good and Excellent, depending of the density of weeds, impacts from grazing and effects of fire.

The fauna field survey to verify findings of the desktop assessment was undertaken from 25 July to 1 August 2011 (220 person hours including travel for the combined adjacent Flying Fish and Eliwana tenements) and identified:

- four habitat types, corresponding to creeklines/drainage lines on lower slopes and valley floors; Spinifex grassland on slopes; sheltered gorges and gullies; and exposed upper slopes, clifflines and ridges
- habitat was in good to excellent condition throughout the study area

- a total of 49 vertebrate species recorded (10 mammals, one reptile, 38 birds), of which one species is listed by the *Environment Protection and Biodiversity Conservation Act* (1999), *Merops ornatus* (Rainbow Bee-eater, Migratory); and two were Priority listed (*P4*) by Department of Environmemnt and Conservation, *Ardeotis australis* (Australian Bustard) and *Pseudomys chapmani* (Western Pebble-mound Mouse)
- a total of 15 fauna species of conservation significance are either known or considered likely to occur in the study area.

1.0 Introduction

1.1 Project Overview

Ecoscape was commissioned by Fortescue Metals Group Limited (Fortescue) to undertake a Level 1 Flora and Vegetation assessment and a Vertebrate Fauna and Fauna Habitat assessment and targeted conservation significant flora and fauna species survey of the exploration area known as 'Flying Fish'.

1.1.1 STUDY AREA LOCATION

The Flying Fish exploration area (the study area) is in the Shire of Ashburton, approximately 70 km west-north-west of Tom Price in the Pilbara region. It comprises exploration tenements E47/1373 and M47/1404, and its location is shown in **Figure 1**.

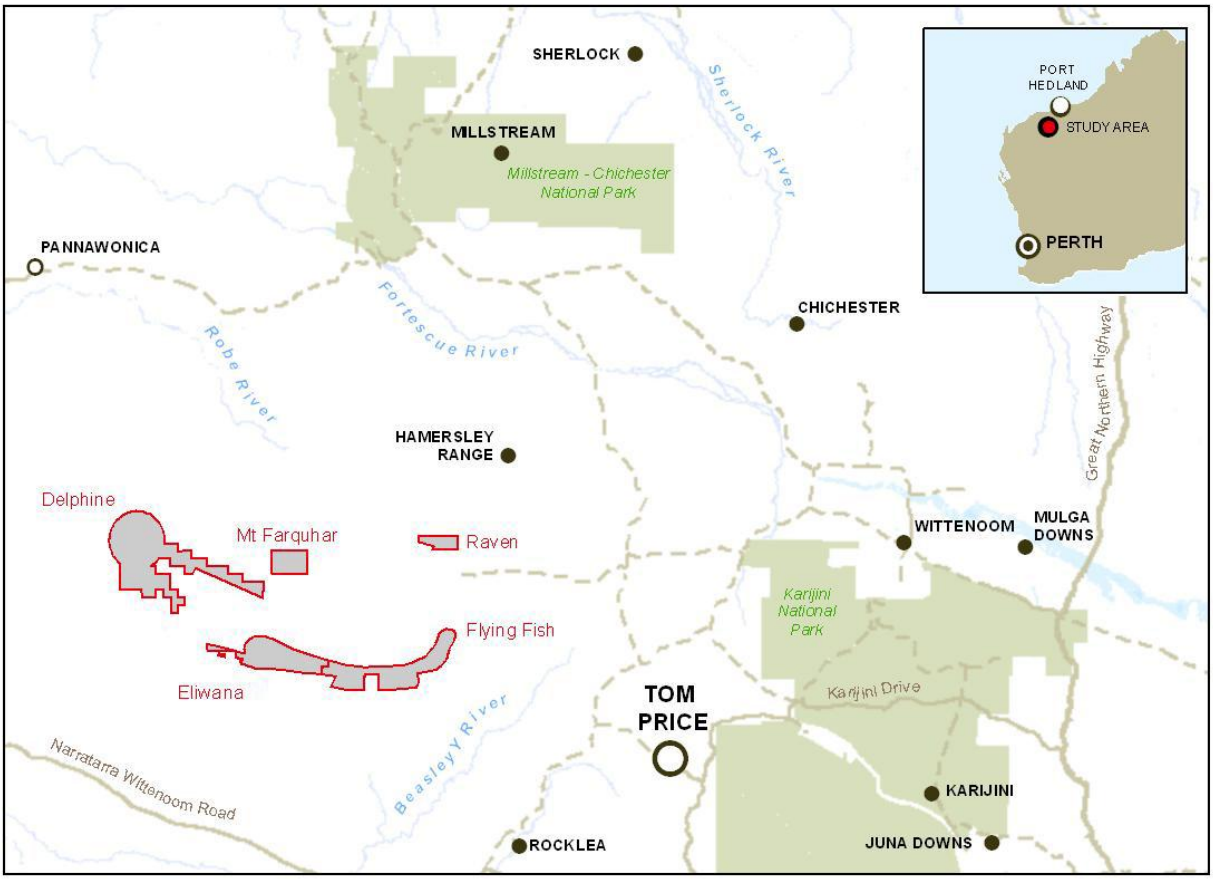

Figure 1: Study area locations

1.2 Project Objectives

The Level 1 Flora and Vegetation assessment and targeted conservation significant flora species searches were undertaken to be compliant with:

- *Guidance Statement No. 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessments in Western Australia* (EPA 2004a)
- *Terrestrial Biological Surveys as an Element of Biodiversity Protection Position Statement No.* 3 (EPA 2002).

The flora and vegetation assessment involved:

- a background research or 'desktop' study at the locality scale involving a search of all sources of literature, data and map-based information
- a reconnaissance survey to verify the accuracy of the 'desktop' study, to further delineate and characterise the flora and range of vegetation units present within the study area and to identify potential impacts. This involved a survey by qualified botanists to undertake selective, low intensity sampling of the flora and vegetation, including mapping of vegetation units and condition at an appropriate scale
- a targeted survey for conservation significant species and ecological communities.

The Level 1 Fauna assessment and targeted conservation significant fauna species searches were undertaken to be compliant with:

- EPA *Guidance Statement No.56: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004b)
- *Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA & DEC 2010)
- *Environment Protection and Biodiversity Conservation Act 1999 referral guidelines for the endangered northern quoll, Dasyurus hallucatus, EPBC Act policy statement 3.25* (DSEWPaC 2011a).

The fauna assessment involved:

- a background research or 'desktop' study at the locality scale involving a search of all sources of literature, data and map-based information
- a reconnaissance survey to verify the accuracy of the 'desktop' study, to further delineate and characterise the fauna and faunal assemblages present within the study area and to identify potential impacts. This involved a survey by qualified zoologists to undertake selective, low intensity sampling of the fauna and faunal assemblages, and to provide habitat descriptions and habitat maps of the study area
- a targeted survey for conservation significant fauna species and their habitats.

1.3 Previous Surveys

Previous surveys in the Pilbara, reviewed to reference regional flora and vegetation information, include:

- Ecoscape (2012b) *Vegetation, Flora and Fauna Assessment, and Targeted Conservation Significant Flora and Fauna Survey: Eliwana,* Unpublished report for Fortescue Metals Group Ltd
- Ecoscape (2012a) *Vegetation, Flora and Fauna Assessment, and Targeted Conservation Significant Flora and Fauna Survey: Delphine,* Unpublished report for Fortescue Metals Group Ltd
- Ecoscape (2012c) *Vegetation, Flora and Fauna Assessment, and Targeted Conservation Significant Flora and Fauna Survey: Mt Farquhar,* Unpublished report for Fortescue Metals Group Ltd
- Ecoscape (2012d) *Vegetation, Flora and Fauna Assessment, and Targeted Conservation Significant Flora and Fauna Survey: Raven,* Unpublished report for Fortescue Metals Group Ltd
- Ecoscape (2011b) *Pilbara Iron Ore Project – Blacksmith Flora and Vegetation Survey,* Unpublished report for Flinders Mines Ltd
- Ecoscape (2010a) *Level Two Flora and Vegetation Assessment, Firetail Mining Area*, Unpublished report for Fortescue Metals Group Ltd
- ENV Australia (2010) *Solomon Project: Kings Flora and Vegetation Assessment*, Unpublished report for Fortescue Metals Group Ltd
- Coffey Environments (2010b) *Flora and Vegetation Assessment, Solomon Project and Investigator*, Unpublished report for Fortescue Metals Group Ltd.
- Coffey Environments (2010c) *Flora and Vegetation Assessment, Solomon Rail Project Volume 1*, Unpublished report for Fortescue Metals Group Ltd.

Previous fauna surveys reviewed pertaining to the central and western Hamersley subregion of the Pilbara include:

- Bamford MJ (2002) *Karratha to Tom Price Highway: Karratha to Nanutarra-Munjina Road Section. Assessment of Fauna values and results of Fauna Survey May 2002*. Unpublished report commissioned by Gutteridge, Haskins and Davey Pty Ltd; Appendix D of Main Roads Western Australia (2003) Karratha – Tom Price Road, Karratha to Nanutarra-Munjina Rd Section, Consultative Environmental Review (Assessment No. 1244)
- Biota Environmental Sciences (2009) *Hope Downs IV Northern Quoll Position Paper*, Unpublished report for Rio Tinto Iron Ore on behalf of Hamersley HMS
- Coffey Environments (2008) *Level 2 Terrestrial Vertebrate Fauna Assessment for the Solomon Project*, Unpublished report for Fortescue Metals Group Ltd
- Ecologia (2010a) *Fortescue Metals Group Ltd Solomon Project: Kings Area Vertebrate Fauna Assessment*, Unpublished report for Fortescue Metals Group Ltd

- Ecoscape (2011a) *Level 1 Vertebrate Fauna Assessment – Rail Options*. Unpublished report for Flinders Mines Ltd
- Ecoscape (2011c) *Pilbara Iron Ore Project – Blacksmith Vertebrate Fauna and Short Range Endemic Survey,* Unpublished report for Flinders Mines Ltd
- Ecoscape (2010c) *Solomon Project – Rail Re-alignment Fauna Assessment*, Unpublished report for Fortescue Metals Group Ltd
- Ecoscape (2010b) *Solomon Project – Rail Camp Sites 1, 2 and 3, Fauna Assessment*, Unpublished report for Fortescue Metals Group Ltd
- Ecoscape (2010d) *Vertebrate Fauna and Fauna Habitat Assessment for the Firetail Project*, Unpublished report for Fortescue Metals Group Ltd
- Morgan D, Ebner B, and Beatty S (2009) *Fishes in groundwater dependent pools of the Fortescue and Yule Rivers; Pilbara, Western Australia*. Centre for Fish and Fisheries Research, Murdoch University
- Muir BG (ed) (1983) *A Fauna Survey of the Hamersley Range National Park, Western Australia, 1980*, National Parks Authority of Western Australia, Bulletin No 1.

2.0 Existing Environment

2.1 Physical Environment

2.1.1 CLIMATE

The Pilbara region experiences an arid climate, which is influenced by two air masses, the Indian tropical maritime air moving in from the west or north-west, and the tropical continental air from the inland. During the warmer part of the year, there is a hot low-pressure system over the region resulting in clear skies and very high temperatures from November to February with average maximum temperatures generally between 35°C and 40°C. During the winter months the average maximum temperature generally falls to between 22°C and 30°C, the range of which is generally greater in inland areas away from the moderating effects of onshore winds common in coastal areas (Australian Government 2009).

The Pilbara lies south of the area normally penetrated by the northwest monsoon in the summer months, and is only occasionally influenced by weather systems of the westerly circulation in the winter months; rainfall is therefore low and variable. The majority of rainfall occurs between December and March, as the result of moist tropical storms and cyclones originating in the north, with a pronounced dry period between August and November (Australian Government 2009).

Figure 2 outlines monthly rainfall and temperature averages for the Wittenoom Bureau of Meteorology (BoM) site, approximately 120 km to the east and derived from data collected between 1950 and 2011. Weather data for the 12 months prior to the survey, also included in **Figure 2**, is derived from Wittenoom (for rainfall) and Paraburdoo Airport (for temperature) (BoM 2012). Paraburdoo Airport is located approximately 140 km south-east of Eliwana.

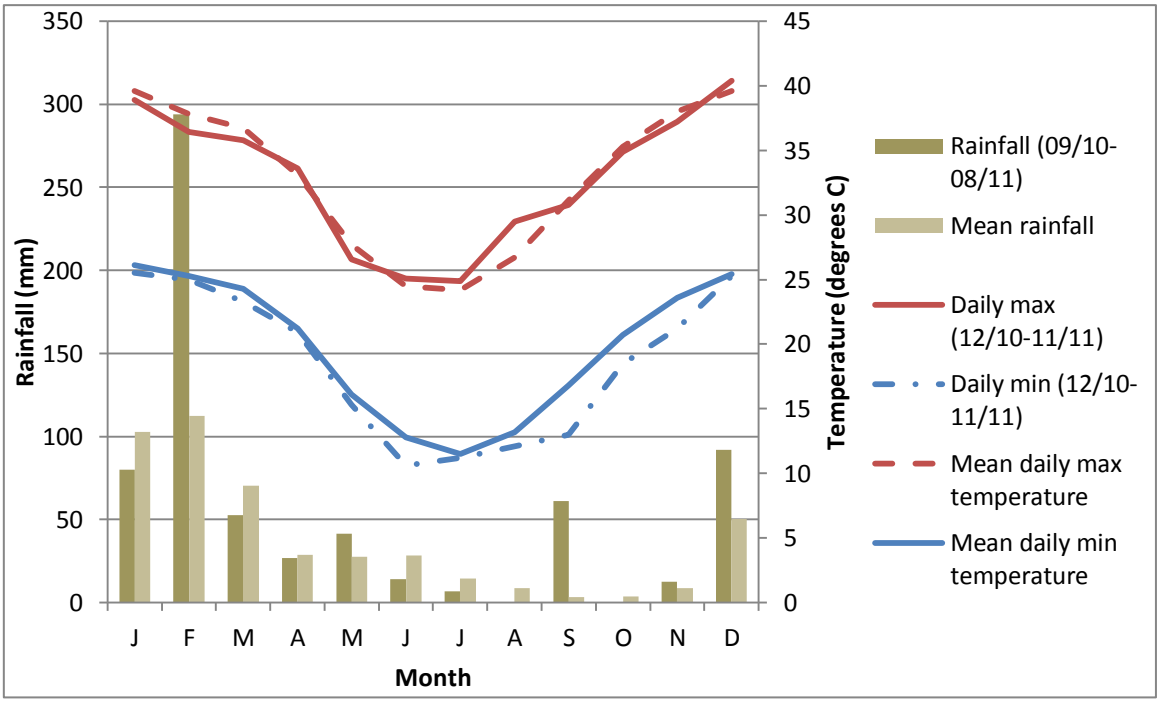

Figure 2: Monthly rainfall, and daily maxima and minima for Wittenoom BoM site (1950 – 2011) and Paraburdoo Airport (2011) (BoM 2012)

2.1.2 GEOLOGY

Table 1 displays the geological units occur in the Flying Fish study area (Seymour *et al*. 1988; Thorne *et al*. 1996). Digital data is not available for the entire area, and inclusion of these units is based on interpretation of hardcopy maps.

Table 1: Geological Units of the Flying Fish study area (Seymour *et al*. 1988; Thorne *et al*. 1996)

Unit	Description
AFj	Jeerinah Formation: pelite, metasandstone, chert, metabasaltic pillow lava and breccias, and metamorphorphosed felsic volcanic rock; intruded by numerous metadolerite sills.
Qc	Colluvium – superficial, unconsolidated sand and gravel
Czk	Calcrete – sheet carbonate, found along major drainage lines.
Ahs	Mount McRae Shale and Mount Sylvia Formation: pelite, chert, and banded iron formation
Qw	Alluvium and colluvium – red-brown sandy and clayey soil; on low slope and sheetwash areas.
PHb	Brockman Iron Formation: banded iron-formation, chert, and pelite.
PHt	Medium to coarse-grained metadolerite sills in Hamersley Group.
PHj	Weeli Wolli Formation: banded iron-formation (commonly jaspilitic), pelite, and numerous metadolerite sills.
Czr	Hematite-goethite deposits on banded iron-formation and adjacent scree deposits.
Czp	Robe Pisolite: pisolitic limonite deposits developed along river channels.
PHw	Woongarra Rhyolite: metamorphosed rhyolite, rhyodarite, rhyolitic breccias, and banded iron-formation.
Qa	Alluvium - unconsolidated silt, sand, and gravel; in drainage channels and adjacent floodplains
Czc	Colluvium - partly consolidated quartz and rock fragments in silt and sand matris; old valley-fill deposits, locally derived
AFd	Medium- to coarse-grained metadolerite sills intruded into Fortescue Group.
AHm	Marra Mamba Iron Formation: chert, banded iron-formation, and pelite.

2.1.3 LAND SYSTEMS

The Department of Agriculture, as part of the rangeland resource surveys, has comprehensively described and mapped the biophysical resources of the Pilbara region, together with an evaluation of the condition of the soils and vegetation throughout (Van Vreeswyk *et al*. 2004a). As part of this process an inventory of land types, land systems and land units with particular use capabilities, habitats or conservation values were established to assist in land use planning. According to this mapping, the following land systems (grouped according to land type on the basis of a combination of landform, soil, vegetation, and drainage characteristics) occur within the study area (**Table 2**).

Table 2: Descriptions of land types and systems occurring in the Flying Fish study area (Van Vreeswyk *et al*. 2004a)

Unit	Description
Land type 1	**Hills and ranges with spinifex grasslands**
Newman land system	Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands.
Rocklea land system	Basalt hills, plateaux, lower slopes and minor stony plains supporting hard spinifex (and occasionally soft spinifex) grasslands.
Land type 3	**Plateaux, mesas and breakaways with spinifex grasslands**
Robe land system	Low limonite mesas and buttes supporting soft spinifex (and occasionally hard spinifex) grasslands.
Land type 5	**Dissected plains with spinifex grasslands**
Platform land system	Dissected slopes and raised plains supporting hard spinifex grasslands.
Land type 8	**Stony plains with spinifex grasslands**
Boolgeeda land system	Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands and mulga shrublands.

The extent of the land systems outlined above within the Flying Fish study area is indicated in **Map 1**, and their regional extent is provided in **Table 3**.

Table 3: Extent of land systems within the Flying Fish study area and regional representation.

Land System	Extent within study area (km^2)	Proportion of study area (%)	Pilbara extent (km^2)	Pilbara extent (%)
Boolgeeda Land System	36.80	23.40%	7748.00	0.47%
Newman Land System	76.69	48.77%	14580.00	0.53%
Platform Land System	16.49	10.49%	1570.00	1.05%
Robe land System	0.95	0.61%	865.00	0.11%
Rocklea Land System	26.31	16.73%	22993.00	0.11%

2.1.4 DRAINAGE

The main drainage line of the study area is unnamed, and flows in a southwest direction, eventually joining Boolgeeda Creek. Several minor drainage lines also dissect the study area (**Map 1**).

2.2 Biological Environment

2.2.1 BIOGEOGRAPHIC REGION

The Flying Fish study area is located within the Pilbara biogeographic region as defined in the Interim Biogeographical Regionalisation for Australia (IBRA) (Commonwealth of Australia 2011). Biogeographic regions are delineated on the basis of similar climate, geology, landforms, vegetation and fauna. The Pilbara biogeographic region includes four major components; the Hamersley, Fortescue Plains, Chichester and Roebourne subregions (Thackway & Cresswell 1995). The study area is located entirely within the Hamersley subregion described in the 2002 Biodiversity Audit of Western Australia's 53 Biogeographical Subregions (McKenzie *et al.* 2003) as:

> *Mountainous area of Proterozoic sedimentary ranges and plateaux, dissected by gorges (basalt, shale and dolerite). Mulga low woodland over bunch grasses on fine textured soils in valley floors, and* Eucalyptus leucophloia *over* Triodia brizoides *on skeletal soils of the ranges. The climate is semi-desert tropical, average 300mm rainfall, usually in summer cyclonic or thunderstorm events. Winter rain is not uncommon. Drainage into either the Fortescue to the north, the Ashburton to the south, or the Robe to the west.*

2.2.2 FLORA

2.2.2.1 Conservation Significant Flora Species

Threatened Flora (TF) species are listed by the Department of Environment and Conservation (DEC), with some given additional legislative protection by being listed listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (*EPBC Act* 1999) (Commonwealth of Australia 1999).

TF species were previously known in Western Australian as Declared Rare Flora (DRF), however the definition has recently been aligned with the Commonwealth category of TF. Flora species are classified as TF or listed as Priority Flora (PF) where populations are geographically restricted or threatened by local processes. The DEC enforces regulations under Government of Western Australia's *Wildlife Conservation Act (WC Act)* (1950) to conserve TF (termed 'rare flora' in the *WC Act*) and protect significant populations. Rare flora species are gazetted under Sub-section 2 of Section 23F of the *WC Act (1950)*, thereby making it an offence to remove or damage rare flora without Ministerial approval.

Definitions of the Commonwealth (Department of Sustainability, Environment, Water, Population and Communities, DSEWPaC) categories are also provided in **Table 18** in **Appendix One**. Not all DEC-listed TF species are listed under the *EPBC Act*.

There are six categories covering TF and PF species (DEC 2011a), which are outlined in **Table 19** in **Appendix One**.

PF for Western Australia are regularly reviewed by the DEC whenever new information becomes available, with species status altered or removed from the list when data indicates that they no longer meet the requirements outlined in **Table 19**.

DEC Database Search

The DEC Threatened Flora database search (DEC reference 04-0711FL, conducted for the Western Hub Project area and 40 km buffer; 18, 548 km^2) identifies TF and PF data from validated populations of TF and some PF from the Threatened Flora Database and specimens in the Western Australian Herbarium. For the purposes of this report, combined, TF and PF species are referred to as *conservation significant flora* species, although PF species do not have legislative protection.

Fifty three conservation significant vascular flora taxa (species, subspecies and varieties) were identified from the DEC Threatened Flora database search as occurring within 40 km of the combined Western Hub and Central Pilbara (Mt Macleod West) study areas (**Table 23** in **Appendix Two**).

Two TF taxa, *Lepidium catapycnon* and *Thryptomene wittweri,* were identified from the DEC database search conducted for this survey, along with 12 P1 taxa, nine P2 taxa, 25 P3 taxa and three P4. None were identified as having previously been recorded from the Flying Fish study area.

The conservation significant flora species identified by the DEC database search request that have been recorded nearest to the Flying Fish study area are:

- *Acacia bromilowiana*; one record from approximately 8.5 km to the east
- *Dampiera anonyma*; one record from approximately 8 km to the east
- *Eremophila magnifica* subsp. *velutina*; one record from approximately 8.5 km to the east, one record from approximately 1 km to the south, and one record from approximately 13 km to the north
- *Ptilotus mollis*, one record from approximately 1 km to the north-east
- *Ptilotus subspinescens*; four records from approximately 1 km to 2.5 km to the north-east and seven records from approximately 3 km to 20 km to the south, and 11 records from approximately 1 km to 20 km to the south-east
- *Sida* sp. Barlee Range; one record from approximately 1.5 km to the south-east and six records from approximately 8.5 km to the east
- *Sida* sp. Hamersley Range (K. Newbey 10692); two records from approximately 8.5 km to the east
- *Spartothamnella puberula*; one record from approximately 12 km to the north-east.

Map 2 illustrates the locations of species closest to the study area.

The DEC Threatened Flora database search does not identify other *significant flora* species, described in *Guidance Statement No. 51* (EPA 2004a) as including keystone or relictual species, those having

anomalous features, range extremities, range extensions, population outliers, restricted subtaxa and hybrids, local endemics or poorly reserved species.

Expert taxonomic advice from the Western Australian Herbarium (WAH) was sought when collected plant specimens are suspected to meet one of these criteria.

Protected Matters Search

A review of the DSEWPaC online databases (Protected Matters Search Tool and Species Profile and Threats Database) was also conducted to identify any additional threatened flora with Commonwealth protection nearby. The results of the Protected Matters Search are reproduced in **Appendix Three**.

2.2.2.2 Introduced Species

Declared Plants are introduced species listed under the *Agriculture and Related Resources Protection Act 1976* (Government of Western Australia 1976) and require a degree of control, depending on their rating in the district they are encountered (Government of Western Australia 2009).

Plants declared as *P1* prohibit movement of plants or seeds, including prohibiting the movement of contaminated machinery and produce. *P2* Declared Plants require eradication of the infestation until no plants remain, *P3* Declared Plants require control preventing spread of seed or plant pars within and from the property, including destroying plants and preventing seed set, and *P4* Declared Plants are required to be controlled to prevent the spread of the infestation, including destroying plants and preventing seed set.

Declared Plants were recorded if observed in the study area.

Introduced species (weeds) are commonly recorded, particularly in disturbed areas including those targeted for grazing by introduced species, including cattle. Plants are regarded as introduced if they are listed as such on FloraBase (Western Australian Herbarium 2012).

Commonly occurring introduced species recorded from the Hamersley Range area include:

- Bipinnate Beggartick, **Bidens bipinnata*
- Buffel Grass, **Cenchrus ciliaris*
- Kapok Bush, **Aerva javanica*
- Mimosa Bush, **Vachellia farnesiana*
- Ruby Dock, **Acetosa vesicaria*
- Spiked Malvastrum, **Malvastrum americanum*
- Ulcardo Melon, **Cucumis melo* subsp. *agrestis*.

2.2.3 VEGETATION

2.2.3.1 Beard's Vegetation Mapping

John Beard and associates conducted a systematic survey of native vegetation during the 1970s, and described the vegetation systems in Western Australian at a scale of 1:250 000 in the south-west of Western Australia and at a scale of 1:1 000 000 in the less developed areas of the state. The vegetation survey of Western Australia maps and explanatory memoirs (1974-1981) are credited to J.S. Beard (or Beard with various co-authors).

Beard's vegetation maps attempted to depict the native vegetation as it was presumed to be at the time of settlement, and is known as the pre-European vegetation type and extent and has since been developed in digital form by Shepherd *et al.* (2002).

The vegetation associations identified from the study area are:

- 18 - Low woodland; mulga (*Acacia aneura*)
- 82 - Hummock grasslands, low tree steppe; snappy gum over *Triodia wiseana*
- 175 - Short bunch grassland - savanna/grass plain (Pilbara)
- 567 - Hummock grasslands, shrub steppe; mulga & kanji over soft spinifex & *Triodia basedowii.*

The extent of the broad vegetation associations within the study area is displayed in **Map 3**.

2.2.3.2 Threatened and Priority Ecological Communities

Threatened Ecological Communities (TECs) are categorised at both State level (DEC 2010b) and Commonwealth level (Commonwealth of Australia 1999), while Priority Ecological Communities (PECs) are classed at State level (DEC 2010c; 2011c). The status of the State and Commonwealth ratings are summarised in **Table 18** and **Table 19** in **Appendix One**.

According to the list of TECs on the DEC TEC database endorsed by the Minister for the Environment (DEC 2010b), there are two State-listed TECs within the Pilbara bioregion:

1. The *vulnerable 'Themeda* grasslands on cracking clays (Hamersley Station, Pilbara)'. This TEC is described as grassland plains dominated by the perennial *Themeda* (kangaroo grass) and many annual herbs and grasses.
2. The *endangered '*Ethel Gorge aquifer stygobiont community'.

Of these, only the *Themeda* grassland TEC is located within the Hamersley (PIL3) IBRA subregion (Kendrick 2002).

There are no Commonwealth-listed TECs within the Pilbara bioregion (DSEWPaC 2011c).

There are 29 PECs listed as occurring in the Pilbara bioregion (DEC 2011c). Whilst exact locations of these are unknown, the PECs most likely to occur in and near the study area are:

- The *P1* 'Brockman Iron cracking clay communities of the Hamersley Range'. Rare tussock grassland dominated by *Astrebla lappacea* in the Hamersley Range, on the Newman land system. Tussock grassland on cracking clays- derived in valley floors, depositional floors. This is a rare community and the landform is rare. Known from near West Angeles, Newman, Tom Price and boundary of Hamersley and Brockman Stations.
- The *P3* '*Triodia* sp. Robe River assemblages of mesas of the Robe Valley'. *Triodia* sp. Robe River (MET 12,369) is apparently geographically restricted to the extreme south western end of the Hamersley Range where it is known from an area extending from the Fortescue River south east to the Beasley River. The majority of occurrences have been recorded from the Robe River valley south to Duck Creek. These occurrences are typically restricted to mesas and cordillo landforms where the plant assemblages are dominated by or contain *Triodia* sp. Robe River. The community is a mosaic of plant assemblages and is not contained in any reserves.

Communities identified from the DEC and Protected Matters database searches were specifically targeted during the vegetation survey, according to potential areas of shared landform, geological and habitat characteristics within the study area. Any vegetation types encountered during the field surveys exhibiting floristic or structural affinities with identified TECs/PECs, based upon available descriptions, were highlighted for further analysis.

DEC Database Search

The DEC Ecological Communities database search (search reference number 04-0711EC, conducted for the Western Hub area and 15 km buffer) identified the following TEC and PEC within approximately 15km of the Western Hub study area:

- *vulnerable* TEC '*Themeda* grasslands on cracking clays (Hamersley Station, Pilbara)', although there are no known occurrences within 15 km of the Flying Fish study area
- *P3* PEC '*Triodia* sp. Robe River assemblages of mesas of the Pilbara'.

The DEC Ecological Communities database search does not identify other *significant vegetation* described in *Guidance Statement No. 51* (EPA 2004a), including scarce vegetation types, communities including unusual species or a novel combination of species, vegetation acting as a refuge or key habitat for threatened species, vegetation representative of a range of a unit, or vegetation having a restricted distribution.

Map 2 displays the locations of the TECs identified from the DEC database search.

2.2.3.3 Ecosystems at Risk

'Ecosystems at Risk' were identified by regional ecologists and others as part of the then Department of Conservation and Land Management's (CALM, now DEC) *Biodiversity Audit of Western Australia's*

53 Biogeographical Subregions in 2002 (CALM 2002). These are not provided any formal legislative protection.

'Ecosystems at Risk' identified from the Hamersley subregion (PIL3) of the Pilbara bioregion that may occur in or near the study area include:

- the *vulnerable* 'Grove/inter-grove mulga, eastern Hamersley Range' ecosystem, threatened by grazing, weeds and hydrological change
- the *vulnerable* 'Valley floor mulga' ecosystem, threatened by grazing, weeds, fire and hydrological change
- the *endangered* 'Lower-slope mulga' ecosystem, threatened by fire
- the *vulnerable* 'Hill-top floras, Hamersley Range' ecosystem, threatened by fire
- the *vulnerable* 'All major ephemeral water courses' ecosystem, threatened by grazing and weeds
- the 'Other stygofauna associated with aquifers near mining below water table' ecosystem, threatened by mine dewatering.

2.2.3.4 Groundwater Dependent Ecosystems

Groundwater dependent ecosystems (GDEs) are ecosystems that are dependent on groundwater for their survival at some stage or stages of their lifecycle, however groundwater use cannot be equated with groundwater dependence (Eamus 2009). Generally GDEs in the Pilbara are associated with drainage.

Phreatophytic species are those that have greater water use than can be provided from the surface soil profile. Phreatophytic species can be obligate phreatophytes, ie wetland species dependent on freely available water, or facultative phreatophytes, dependent on groundwater for part of their lifecycle and/or in times of drought (Maunsell Australia Pty Ltd 2006).

Several species found in riparian areas are considered to be facultative phreatophytes, including (in the Pilbara) *Eucalyptus camaldulensis* and *E. victrix*. However, there is some debate regarding groundwater dependence of *E. victrix*, with various studies considering that it is not dependent on groundwater, and is at most only weakly phreatophytic (Resource and Environmental Management Pty Ltd 2007), and tolerant of lowered groundwater tables (Batini 2008 cited in EPA & Hamersley Iron 2010; Maunsell Australia Pty Ltd 2006). Whilst it is not possible, based on current knowledge, to be certain if *Eucalyptus victrix* is dependent on groundwater or not, the precautionary principle outlined in *Position Statement No. 7 – Principles of Environmental Protection* (EPA 2004c) should be applied and this species considered to be at least partly dependent on groundwater. Therefore, for the purpose of this report, vegetation containing *E. victrix* is considered to potentially be a GDE.

Melaleuca argentea is considered by some (Astron Environmental Services 2008) to be an obligate phreatophyte (dependent on groundwater), however others (Grierson 2010) consider this species to

be dependent on surface water, rather than groundwater. As it is generally associated with wetter areas, it is reasonable to consider it to be dependent on freely available water. *Melaleuca argentea*, and other obligate phreatophytes including rushes and sedges associated with wetlands (eg *Typha domingensis* and *Cyperus vaginatus*), are vulnerable to changes in surface hydrology. They are not considered to be indicative of GDEs.

Other species associated with drainage lines (eg *Acacia citrinoviridis* and *Eucalyptus xerothermica*) are more efficient at extracting water from the soil surface profile and are not considered to be dependent on groundwater (Astron Environmental Services 2008).

2.2.3.5 Sheet Flow Dependent Communities

Mulga (*Acacia aneura* sens lat) often occurs as a grove – intergrove formation on valley floors and floodplains. Regeneration of these groves are generally considered to be dependent on sheet water flow in times of heavy rain (Muller 2005).

Mulga is the common name for *Acacia aneura*. Until recently there were 12 varieties of *Acacia aneura* in Western Australia. Following a revision of this group, a number of distinct species are now recognized. The common name 'Mulga', for the purposes of this report, includes the closely-related *Acacia aneura* var. *intermedia, A. aptaneura, A. ayersiana, A. brachystachya, A. caesaneura, A. catenulata* subsp. *catenulata, A. craspedocarpa, A. fuscaneura, A. incurvaneura, A. macraneura, A. minyura, A. pteraneura, A. ramulosa* and *A. sibirica*. Seven of these occur in the Pilbara bioregion, of which *Acacia aptaneura* is the most common and widespread. The common name, 'Mulga', is still applicable to the newly recognised species.

2.2.4 FAUNA

The conservation status of fauna species is assessed under Commonwealth and State Acts being the *EPBC Act* (1999) and the Western Australian *WC Act* (1950). The significance levels for fauna used in the *EPBC Act* (1999) are those recommended by the International Union for the Conservation of Nature and Natural Resources (IUCN) and reviewed by Mace and Stuart (1994). *EPBC Act* (1999) categories are listed in **Appendix One**.

The Western Australian *WC Act* (1950) uses a set of Schedules but also classifies species using some of the IUCN categories. DEC Schedules, which provide special protection to listed fauna under the *WC Act* (1950) and definitions are shown in **Appendix One**.

In Western Australia, the DEC has produced a supplementary list of Priority fauna, listed using priority codes, which are species that are not considered threatened under *the WC Act* (1950) but for which the DEC considers there is cause for concern. DEC Priority fauna categories definitions are shown in **Appendix One**. Priority fauna Lists have no statutory standing, but are used to assist the DEC when considering which fauna are most in need of more surveys or other investigations, in order to establish their status in the wild.

The Priority Fauna List for Western Australia is reviewed by the DEC whenever new information on relevant taxa becomes available. Taxa are removed from the list by the DEC as they cease to meet the requirements identified above. In addition to these conservation levels, species that have been introduced are indicated.

Vertebrate taxonomy in this report follows the Western Australian Museum (WAM) checklists last updated February 2012, except for birds where the classification and sequence follows Christidis and Boles (2008).

2.2.4.1 Database Search Results

EPBC Protected Matters Search Tool

Results of the Protected Matters Search Tool (**Appendix Three**) were obtained for each of the Western Hub study areas (Delphine, Mt Farquhar, Raven, and Eliwana and Flying Fish) using a buffer of 10 km around each. Three threatened fauna species were listed as potentially occurring in each of the study areas (**Table 4**, EPBC status *EN* and *VU*; PMST report M):

- *Dasyurus hallucatus* (Northern Quoll) – EN
- *Rhinonicteris aurantia* (Pilbara Leaf-nosed Bat) – VU
- *Liasis olivaceus barroni* (Pilbara Olive Python) – VU.

The PMST results also list *Migratory* and *Invasive* species. Migratory and/or invasive species identified as potentially occurring in all of the study areas include:

- *Apus pacificus* (Fork-tailed Swift) - M
- *Ardea ibis* (Cattle Egret) - M
- *Ardea modesta* (=*alba*) (Eastern Great Egret) - M
- *Charadrius veredus* (Oriental Plover) - M
- *Haliaeetus leucogaster* (White-bellied Sea-Eagle) – M and L
- *Merops ornatus* (Rainbow Bee-eater) – M.

DEC Database Search

A search of the DEC Threatened, Priority or other specially protected fauna database was conducted for an area comprising the Western Hub study areas with a buffer of 20 km. There were seven conservation significant fauna species identified as known to occur within this area (**Table 4**):

- *Ardeotis australis* (Australian Bustard) – *P4*
- *Burhinus grallarius* (Bush Stone-curlew) – *P4*
- *Macroderma gigas* (Ghost Bat) – *P4*
- *Notoscincus butleri* (Lined Soil-crevice Skink) – *P4*
- *Ramphotyphlops ganei* (Pilbara Blindsnake) – *P1*
- *Rhinonicturis aurantia* (Pilbara Leaf-nosed Bat) – *VU*
- *Sminthopsis longicaudata* (Long-tailed Dunnart) – *P4.*

NatureMap and other resources

A search of DEC's online NatureMap database identified 199 faunal taxa (**Appendix Four**) as occurring in a polygon containing all of the Western Hub study areas (fewer species, as subspecies and synonyms are often listed separately). In addition to species identified by the DEC Threatened and priority search and PMST, a number of further taxa of conservation significance were listed as known to occur in this area (**Table 4**):

- *Burhinus grallarius* (Bush Stone-curlew) – *P4*
- *Leggadina lakedownensis* (Short-tailed Mouse) – P4
- *Pseudomys chapmani* (Western Pebble-mound Mouse) – P4
- *Sminthopsis longicaudata* (Long-tailed Dunnart)– *P4.*

Kendrick (2002) provides a summary of biodiversity values for the Hamersley subregion (IBRA PIL3). **Table 4** includes species mentioned by Kendrick, regardless of Schedule and Priority status, that are recorded from the western Hamersley Range.

The remaining species listed in **Table 4** are those of conservation significance (DEC P3 or P4) that have been reported in other fauna surveys of areas in the western Hamersley Range. A more complete listing of the expected vertebrate fauna expected in the study area is given in **Table 26** (**Appendix Eight**).

Table 4: Threatened, Priority and other conservation-significant fauna search results

Family	Common Name	Species	EPBC status	WCA status	DEC status	DEC Threatened fauna database	EPBC Protected Matters report	Hamersley (Kendrick)
Terapontidae	Fortescue Grunter	*Leiopotherapon aheneus*			*P 4*			+
Dasyuridae	Northern Quoll	*Dasyurus hallucatus*	*E N*	*S 1*	*T*		L	+
	Long-tailed Dunnart	*Sminthopsis longicaudata*			*P 4*	+		+
Macropodidae	Spectacled Hare-wallaby	*Lagorchestes conspicillatus leichardti*			*P 3*			
Megadermatidae	Ghost Bat	*Macroderma gigas*			*P 4*	+		+
Hipposideridae	Pilbara Leaf-nosed Bat	*Rhinonicteris aurantia*	*V U*	*S 1*	*T*	+	L	+
Muridae	Short-tailed Mouse	*Leggadina lakedownensis*			*P 4*			
	Western Pebble-mound Mouse	*Pseudomys chapmani*			*P 4*			+
Scincidae	Soil-crevice Skink	*Notoscincus butleri*			*P 4*	+		
Typhlopidae	Blind Snake	*Ramphotyphlops ganei*			*P 1*	+		+
Pythonidae	Pilbara Olive Python	*Liasis olivaceus barroni*	*V U*	*S 1*				+
Apodidae	Fork-tailed Swift	*Apus pacificus*	*M*				M	
Ardeidae	Great Egret	*Ardea modesta* (=*alba*)	*M*				M	
	Cattle Egret	*Ardea ibis*	*M*				M	
Accipitridae	White-bellied Sea-eagle	*Haliaeetus leucogaster*	*M*				L	
Falconidae	Grey Falcon	*Falco hypoleucos*			*P 4*			
	Peregrine Falcon	*Falco peregrinus*	*M*	*S 4*				+
Otididae	Australian Bustard	*Ardeotis australis*			*P 4*	+		
Burhinidae	Bush Stone-curlew	*Burhinus grallarius*			*P 4*	+		+
Charadriidae	Oriental Plover	*Charadrius veredus*	*M*				M	
Meropidae	Rainbow Bee-eater	*Merops ornatus*	*M*				M	
Estrildidae	Star Finch (western)	*Neochmia ruficauda subclarescens*			*P 4*			

Abbreviations (EPBC status) *EN*, endangered; *VU*, vulnerable; *M*, migratory; (WC Status) *S1*, Schedule 1 'rare or likely to become extinct'; *S4*, Schedule 4 'other specially protected fauna'; (DEC status) *T*, 'rare or likely to become extinct'; *P1*, Priority 1 'Taxa with few, poorly known populations on threatened lands'; *P4*, Priority 4 'Taxa in need of monitoring'; (EPBC Protected Matters Search Tool) L, 'Species or species habitat likely to occur'; M, 'Species or species habitat may occur'; (other columns) +, listed as present.

3.0 Field Survey Methods

3.1 Flora and Vegetation

The Level 1 flora and vegetation assessment was undertaken to be compliant with Environmental Protection Authority (EPA) *Guidance Statement No. 51* (2004a) and *Position Statement No.* 3 (2002).

Level 1 surveys incorporate background research and a reconnaissance survey, and are often used to identify preliminary information that may be of assistance when preparing for a more intensive and detailed survey. A targeted conservation significant flora survey was also conducted of the study area.

The data collected during the field survey was used to:

- describe and map the broad vegetation types of the study area to indicate the distribution and relative abundance of each vegetation unit and to help define units of particular conservation value
- identify vascular flora taxa of particular conservation significance
- identify significant infestations of introduced plant species and occurrences of Declared Plants.

The vegetation was described and mapped using relevés recorded in characteristic areas of each vegetation type, as assessed in the field. The data recorded from each relevé included physical characteristics of the environment (habitat). Up to five dominant and characteristic species from each of the traditional three strata (upper, mid and ground, including cover class for each stratum), along with each species' maximum height and cover were recorded.

Targeted and opportunistic searches for conservation significant flora species, targeting Threatened Flora (TF) and Priority 1 (P1) and Priority 2 (P2) taxa, were also undertaken.

3.1.1 FIELD SURVEYS

The flora and vegetation field survey was conducted by Stephen Kern (flora collecting licence SL009477) and Richard Daniel (flora collecting licence SL009247) over three days, during July 2011. The field survey of the Flying Fish study area was conducted in conjunction with the survey of the immediately adjacent Eliwana exploration tenement. Some vegetation survy results recorded from Eliwana but applicable to both areas are presented in this report.

3.1.1.1 Vegetation Descriptions

Vegetation was described from each of the relevès using the height and estimated cover of dominant and characteristic species of each stratum, based on the National Vegetation Inventory System (NVIS; National Heritage Trust 2003) (**Table 5**), recorded at Level V. Up to three species per stratum were recorded from each stratum (upper, mid and ground) from each relevé.

The vegetation condition of the relevés were assessed using a rating scale that was based on a scale devised by Trudgen (1991), which the DEC has previously advised as the most appropriate for assessing vegetation condition in the Pilbara region (Coffey Environments 2007). This rating scale is outlined in **Table 6**. The vegetation condition of the study area was assessed by extrapolating the value recorded for each relevé and applying the condition to the vegetation type in the vicinity.

A number of vegetation type descriptions were based on relevé data collected from the immediately adjacent Eliwana study area, which was assessed concurrently with the Flying Fish area.

3.1.2 TIMING OF SURVEYS

The flora and vegetation survey of the Flying Fish study area was conducted during winter (July), when the majority of ephemeral flora species are usually flowering. Season conditions in 2011 were considered to be excellent. Rainfall in the season December 2010 – June 2011 was 607.9 mm, which is 139.9% of the December – July long-term mean of 434.5 mm (BoM 2012) (**Figure 3**).

The timing of the field survey, in July, was not optimal to identify all species, particularly some grasses. However many conservation significant shrub and herb taxa are known to flower during this period, providing negligible limitations in terms of identifying these.

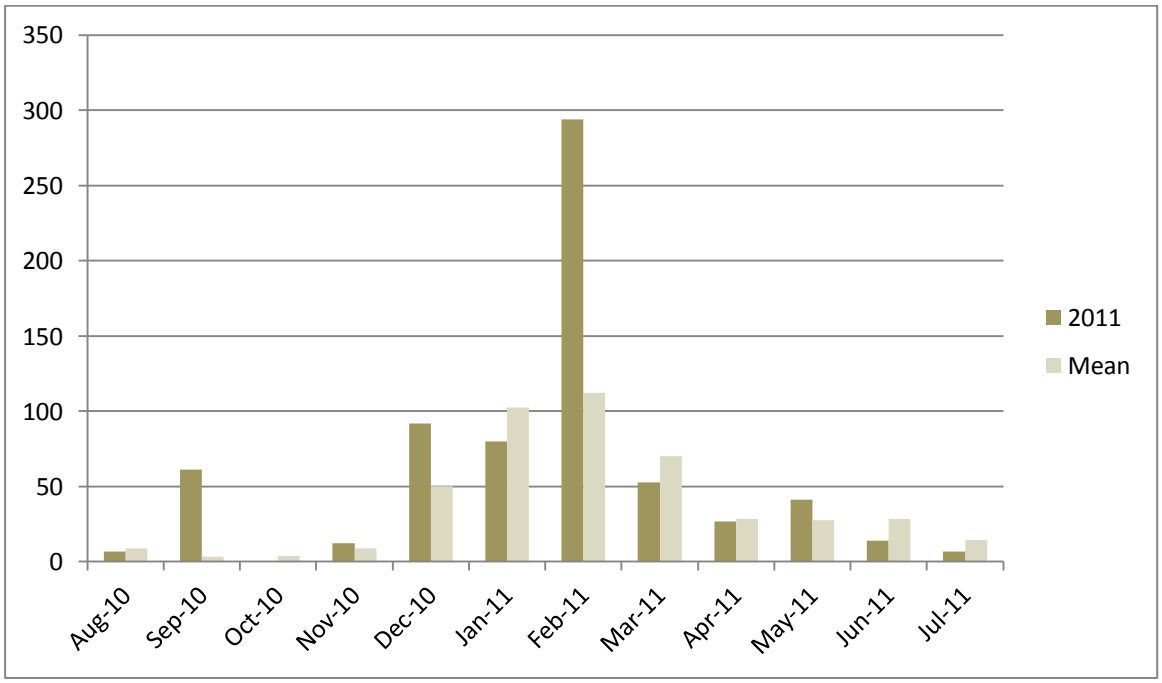

Figure 3: Monthly rainfall totals for the Wittenoom BoM site for the periods preceding the survey (August 2010 – July 2011) (BoM 2012)

Table 5: NVIS structural formation terminology (terrestrial vegetation) (National Heritage Trust 2003)

	Cover Characteristics							
	Foliage cover *	70-100	30-70	10-30	<10	» 0 (scattered)	0-5 (clumped)	unknown
	Cover code	d	c	i	r	bi	bc	unknown
Growth Form	**Height Ranges (m)**	**Structural Formation Classes**						
tree, palm	<10,10-30, >30	closed forest	open forest	woodland	open woodland	isolated trees	isolated clumps of trees	trees
tree mallee	<3, <10, 10-30	closed mallee forest	open mallee forest	mallee woodland	open mallee woodland	isolated mallee trees	isolated clumps of mallee trees	mallee trees
shrub, cycad, grass-tree, tree-fern	<1,1-2,>2	closed shrubland	shrubland	open shrubland	sparse shrubland	isolated shrubs	isolated clumps of shrubs	shrubs
mallee shrub	<3, <10, 10-30	closed mallee shrubland	mallee shrubland	open mallee shrubland	sparse mallee shrubland	isolated mallee shrubs	isolated clumps of mallee shrubs	mallee shrubs
heath shrub	<1,1-2,>2	closed heathland	heathland	open heathland	sparse heathland	isolated heath shrubs	isolated clumps of heath shrubs	heath shrubs
chenopod shrub	<1,1-2,>2	closed chenopod shrubland	chenopod shrubland	open chenopod shrubland	sparse chenopod shrubland	isolated chenopod shrubs	isolated clumps of chenopod shrubs	chenopod shrubs
samphire shrub	<0.5,>0.5	closed samphire shrubland	samphire shrubland	open samphire shrubland	sparse samphire shrubland	isolated samphire shrubs	isolated clumps of samphire shrubs	samphire shrubs
hummock grass	<2,>2	closed hummock grassland	hummock grassland	open hummock grassland	sparse hummock grassland	isolated hummock grasses	isolated clumps of hummock grasses	hummock grasses
tussock grass	<0.5,>0.5	closed tussock grassland	tussock grassland	open tussock grassland	sparse tussock grassland	isolated tussock grasses	isolated clumps of tussock grasses	tussock grasses
other grass	<0.5,>0.5	closed grassland	grassland	open grassland	sparse grassland	isolated grasses	isolated clumps of grasses	other grasses
sedge	<0.5,>0.5	closed sedgeland	sedgeland	open sedgeland	sparse sedgeland	isolated sedges	isolated clumps of sedges	sedges
rush	<0.5,>0.5	closed rushland	rushland	open rushland	sparse rushland	isolated rushes	isolated clumps of rushes	rushes
herb	<0.5,>0.5	closed herbland	herbland	open herbland	sparse herbland	isolated herbs	isolated clumps of herrbs	herbs
fern	<1,1-2,>2	closed fernland	fernland	open fernland	sparse fernland	isolated ferns	isolated clumps of ferns	ferns
bryophyte	<0.5	closed bryophyte-land	bryophyte-land	open bryophytelan d	sparse bryophytelan d	isolated bryophytes	isolated clumps of bryophytes	bryophytes
lichen	<0.5	closed lichenland	lichenland	open lichenland	sparse lichenland	isolated lichens	isolated clumps of lichens	lichens
vine	<10,10-30, >30	closed vineland	vineland	open vineland	sparse vineland	isolated vines	isolated clumps of vines	vines

Table 6: Vegetation condition rating scale (Trudgen 1991)

Condition Rating	Description
E=Excellent	Pristine or nearly so; no obvious signs of damage caused by activities of European man.
VG= Very Good	Some relatively slight signs of damage caused by 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 **Ursinia anthemoides* or **Briza* spp., or occasional vehicle tracks.
G=Good	More obvious signs of damage caused by activities of European man, including some obvious signs of 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 **Ehrharta* spp.
P=Poor	Still retains basic vegetation structure or ability to regenerate to it after very obvious activities of European man, such as grazing, partial clearing (chaining) or frequent fires. Weeds as above, probably plus some aggressive ones such as **Ehrharta* spp.
VP=Very Poor	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.
D=Degraded	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.

3.1.2.1 Relevé Data

The botanical survey involved the sampling of relevés (unmarked areas with the vegetation described as if it occurred within a 50 m x 50 m area, which is the standard quadrat size used in the Pilbara for botanical surveys), with the following parameters recorded at each relevé site:

- MGA coordinates recorded in GDA 94 datum using a hand-held Global Positioning System (GPS), to an accuracy usually within 5 m
- vegetation description based on the height and estimated cover of dominant and characteristic species and strata
- description of landform and habitat
- broad description of surface soil type and stony surface mantle
- evidence of grazing, mining exploration activities, weed invasion, frequent fires etc. Fire effects were only considered a negative impact if they were caused by repeated burning, eg for pastoral purposes.

Representative photographs of the vegetation at each site were taken using a digital camera.

Voucher specimens of dominant and characteristic taxa were only collected when the assessors could not identify the species with certainty in the field. Specimens collected were dried and treated in accordance with the requirements of the Western Australian Herbarium. These voucher specimens were identified by Ecoscape and ME Trudgen, using appropriate publications, and/or

comparison with pressed specimens housed at the Western Australian Herbarium, but have not yet been submitted to the Herbarium.

3.1.2.2 Conservation Significant Flora

No systematic grid search of the study area was undertaken for conservation significant flora species. However, targeted searches of areas identified from the DEC database search were conducted, including slopes, hilltops (where accessible), rock piles, calcrete and adjacent areas, clay pans and drainage lines were undertaken. Opportunistic searches were also conducted when moving between relevé sites.

Where possible, the space between surveyors was 20-30 m in order to widen the search area.

3.1.2.3 Introduced Flora

Opportunistic observation of significant infestations of introduced species (weeds) and presence of *Declared Plants* were recorded from the study area.

3.1.3 BOTANICAL LIMITATIONS

Table 7: Botanical limitations

Possible Limitations	Constraints (Yes/No); Significant, Moderate or Negligible	Comments
Competency/experience of the consultant botanist	No constraints	Lead survey staff have relevant recent experience surveying in the Pilbara region.
Proportion of the flora identified	No constraints	The survey was conducted as a Level 1 reconnaissance survey, with no floristic quadrats recorded. All dominant species used to identify vegetation characteristics were identified. The survey included a targeted search for conservation significant flora species. All potential TF and PF flora were identified.
Sources of information (historic/recent or new data)	Negligible	There were few sources of information relevant to the area, however the survey was a reconnaissance survey to acquire the information.
Proportion of the task achieved and further work that may need to be undertaken	Negligible	The reconnaissance survey was conducted at sufficient detail to identify major flora and vegetation attributes in preparation for a more detailed survey. Inaccessible areas would require more intensive surveys for conservation significant flora species.
Timing/weather/season/cycle	Negligible	The timing of the field survey and weather were optimal to identify plant species with above average rainfall prior to the survey, which was conducted in July 2011.
Intensity of survey	Negligible	The study area was surveyed at sufficient intensity to describe the dominant flora and vegetation types of the area in preparation for a more intensive (Level 2) survey. Accessible areas were sufficiently surveyed to identify the presence of most conservation significant flora species.
Completeness (eg was relevant area fully surveyed)	Moderate	Much of the area was not accessible by vehicle. Where possible, areas were accessed by walking however the far northern and southern extents were not recorded in as much detail due to the time required for complete access, which was not available for a reconnaissance survey. Despite this, sufficient areas were groundtruthed to enable reasonable interpretation of aerial imagery to identify major vegetation types.
Resources (eg degree of expertise available for plant identification)	No constraints	The survey did not record floristic quadrats. Dominant and characteristic species were all identified.
Remoteness and/or access problems	Moderate	The far northern and southern extents were not accessible by vehicle and were accessed by walking. A Level 2 survey would require a significant amount of walking to adequately survey the area to the degree required.
Availability of contextual (eg bioregional) information for the study area	Negligible	Little biological information is available for the study area, however this survey was conducted as a Level 1 reconnaissance survey to acquire background information.

3.2 Fauna

The fauna assessment methodology used complies with a Level 1 survey based on the EPA's *Guidance for the Assessment of Environmental Factors No 56: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western* Australia (EPA 2004b), and *Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA & DEC 2010). The targeted trapping for Northern Quoll considered the *EPBC Act 1999 Referral guidelines for the endangered Northern Quoll* (DSEWPaC 2011a)

3.2.1 FIELD SURVEY

The fauna and habitat field survey was conducted by Bruce Turner (Principal Environmental Scientist) and Michael Harris (field assistant) over eight days in July-August 2011, under DEC Regulation 17 fauna licence SF008134.

The fauna assessment comprised a reconnaissance survey of the study area combined with targeted cage trapping for Northern Quoll. The Northern Quoll methodology was endorsed by DSEWPC Officer Tim McGrath as it utilised cage trapping in conjunction with motion sensitive camera sets and intensive searching in denning habitat. The reconnaissance aspect of the survey was used to verify the applicability of background desktop studies familiarise survey personnel with the study area and provide habitat assessments and habitat maps.

Techniques used in the reconnaissance survey include:

- bird census using both visual and auditory techniques
- spotlighting significant habitat i.e. gorges, caves and creeks
- motion sensitive cameras set in likely areas of fauna activity for conservation significant fauna species
- leaf litter raking, rock pile and fallen log hand searching
- identification of scats, bones, tracks, diggings and burrows and the analysis of the contents of predator scats

These techniques are considered to be addressing the Level 1 survey guidelines, of EPA Guidance Statement No. 56, as part of a single visit reconnaissance survey as they are used to "*further delineate and characterise the fauna and faunal assemblages present in the target area*". A more detailed survey of greater intensity which includes a range of trapping methods and the development of a fauna inventory list per habitat type would be considered a Level 2 survey.

Habitat Condition Assessment

Fauna habitat was assessed according to the following conditions defined by Coffey Environments (2010a):

- *High quality fauna habitat* – These areas closely approximate the vegetation mix and quality that would have been in the area prior to any disturbance. The habitat has

connectivity with other habitats and is likely to contain the most natural vertebrate fauna assemblage.

- *Very good fauna habitat* - These areas show minimal signs of disturbance (e.g. grazing, clearing, fragmentation, weeds) and generally retain many of the characteristics of the habitat if it had not been disturbed. The habitat has connectivity with other habitats. Fauna assemblages in these areas are likely to be minimally effected by disturbance.
- *Good fauna habitat* – These areas showed signs of disturbance (e.g. grazing, clearing, fragmentation, weeds) but generally retain many of the characteristics of the habitat if it had not been disturbed. The habitat has connectivity with other habitats and fauna assemblages in these areas are likely to be affected by disturbance.
- *Disturbed fauna habitat*– These areas showed signs of significant disturbance. Many of the trees, shrubs and undergrowth are cleared. These areas may be in the early succession and regeneration stages. Areas may show signs of significant grazing, contain weeds or have been damaged by vehicle or machinery. Habitats are fragmented or have limited connectivity with other fauna habitats. Fauna assemblages in these areas are likely to differ significantly from what might be expected in the area had the disturbance not occurred.
- *Highly degraded fauna habitat* – These areas often have a significant loss of vegetation, an abundance of weeds, and a large number of vehicle tracks or are completely cleared. They exhibit limited or no fauna habitat connectivity. Faunal assemblages in these areas are likely to be significantly different to what might have been in the area pre-disturbance.

Opportunistic Observations

Opportunistic observations were made during the day whilst driving and walking the study area (**Map 7**). Searches were conducted by two personnel during the survey period. Searches were focussed on potential conservation significant fauna species habitats, including rocky gorges, hilltops and cave areas, creeklines, spoil heaps and water holes. Opportunistic searches also comprise spotlighting along roads and at water holes. Photography was used to record observations, allowing subsequent identification of animals and tracks not determinable in the field.

Bird Census

Bird censuses were undertaken each day at sunrise and sunset. Each census requires the observer to remain in one place for a duration of 20 minutes, recording the number of bird species and number of individuals of each species, in the immediate surrounding area, based on sightings and calls. Census points were undertaken in all habitat types, including Spinifex grasslands, creeklines (gorges), water holes and hilltops. Birds observed or heard, while travelling around the site or checking traps were also recorded in a species list.

Trail Cameras

Trail cameras were set up in positions chosen to maximise the likelihood of capturing fauna movement. These locations included cave entrances, creek lines and water holes. Bait was also scattered in front of cameras to increase the likelihood of attracting fauna. Cameras were set up to record still images or video, from 6pm (sunset) to 6am (sunrise) being the activity period of nocturnal species. These were operational for seven nights during the survey.

Bat Echolocation Recording

Echolcation recordings were undertaken on the adjacent Eliwana exploration tenement (Ecoscape 2012b).

Targeted Northern Quoll Trapping

Consultation prior to the survey commencing was undertaken with DSEWPC Officer Mr Tim McGrath who provided a response that the approach to be used by Ecoscape is consistent with the guidance as outlined in the draft referral guidelines for the Northern Quoll (pers comm McGrath 2011).

Cage traps were set in areas of potential critical denning and foraging Northern Quoll habitat within the study area. These locations included rocky gorges, caves, water holes and creeklines. Traps were placed in protected areas, covered with either a hessian bag or Spinifex to provide shade. Traps remained in place for three nights and were checked early each morning. Bait was replaced when required. Bait used was universal type as specified in the DSEWPC guidelines (DSEWPC 2011a). Field survey effort is indicated in **Table 8**.

Table 8: Survey effort Flying Fish

Technique	Flying Fish
Cage traps	52 nights
Trail cameras	14 nights
Bird census	2 x 20 minutes
Spotlighting	4 person hours
Hand searching	14 person hours

3.2.2 TAXONOMY AND NOMENCLATURE

Taxonomy and nomenclature for fauna species used in this report follows that of the Western Australian Museum, except for bats, which follow Armstrong and Reardon (Armstrong & Reardon 2006) and birds which follow Christidis and Boles (2008).

Table 9 lists the references used. Ecoscape has presumed that the identifications referred to in the Appendices or in reports used to provide local and regional comparative data were correct and has only corrected records where the nomenclature was obviously incorrect.

Table 9: References used for species identification

Reference	Identification
Menkhorst and Knight (2004)	Terrestrial Mammals
Churchill (2009)	Bats
WA Museum field guides: Storr *et al*. (1983; 1990; 1999; 2002) Wilson and Swan (2008)	Reptiles
Tyler and Doughty (2009)	Frogs
Simpson and Day (2004)	Birds
Triggs (1996)	Scats and tracks

3.2.1 SURVEY LIMITATIONS

Table 10: Limitations of fauna survey

Possible Limitations	Constraints (Yes/No): Significant, Moderate or Negligible	Comment
Competency/experience of the consultant conducting the survey	No Constraint	All field survey staff have relevant recent experience surveying in the Pilbara region. Senior staff have extensive experience with species identification over all fauna assemblages
Scope	Yes, Negligible	Scope as Level 1 survey, not including invertebrates or attempting to inventory all species present; access to all habitat types was unconstrained.
Proportion of fauna identified, recorded and/or collected	Yes, Negligible	No vertebrate species collected, nearly all vertebrate fauna observed identified
Proportion of the task achieved and further work that may need to be undertaken	Yes, Moderate	Reconnaissance and targeted surveys were adequate to identify and map likely habitats for conservation significant species, but not to determine their actual presence, distribution or abundance
Timing/weather/season/cycle	Yes, Negligible	Survey conducted in July-August suitable for mammals, but not most reptiles or some birds that would be more active or only present in warmer/wetter conditions
Intensity of survey (eg In retrospect was the intensity adequate?)	No Constraint	Intensity judged to be adequate for level of survey
Disturbances which affected results of the survey	Yes, Moderate	Unusually poor climatic conditions in recent years have probably reduced abundance of some species.
Sources of information	Yes, Negligible	Most relevant information sources readily available
Completeness (eg Was relevant area fully surveyed?)	Yes, Negligible	All habitats accessed
Resources (eg Degree of expertise available for identification)	No Constraint	Adequate resources available
Remoteness and/or access problems	Yes, Moderate	Study area large in proportion to time available, some areas not accessed due to time constraints
Availability of contextual (eg bioregional) information for the survey area	Yes, Negligible	Physical environmental information not limiting. Flora and vegetation context provided by concurrent survey included in this report. Previous fauna surveys conducted in the same IBRA subregion allowed species inventory to be predicted, but some relevant taxonomic revisions and survey results are not currently available

4.0 Field Survey Results

4.1 Flora

4.1.1 CONSERVATION SIGNIFICANT FLORA SPECIES

Environmental Protection and Biodiversity Conservation Act 1999

No plant taxon recorded in the study area is listed as Threatened pursuant to Schedule 1 of the *EPBC Act* (1999).

Wildlife Conservation Act 1950

No plant taxon recorded in the survey is gazetted as a TF pursuant to Subsection 2 of Section 23F of the *WC Act* (1950).

Priority Flora

The four Priority Flora taxa recorded from the study area are listed below. Their locations are included in **Table 11** and shown on **Map 5**. Threatened and Priority Flora Report Forms are included in **Appendix Six**, and a brief description of each taxa given below.

Table 11: Coordinates of Priority Flora species

Species	Cons. Code	GDA mE	GDA mN
Acacia bromilowiana Maslin	P4	505829	7508863
Eremophila magnifica subsp. *magnifica*	P4	500224	7510183
Eremophila magnifica subsp. *magnifica*	P4	512161	7509981
Eremophila magnifica subsp. *velutina*	P3	521996	7511306
Eremophila magnifica subsp. *velutina*	P3	512292	7509649
Eremophila magnifica subsp. *velutina*	P3	518148	7509003
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	P3	517745	7508421
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	P3	507461	7510421
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	P3	527480	7520277
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	P3	507448	7510184

***Acacia bromilowiana* (P4)**

Acacia bromilowiana is a tree or shrub to 12 m high (**Plate 1** and **Plate 2**). It is known only from the Pilbara bioregion from 24 herbarium records from the Hamersley Range and Balfour Downs Station. One population of over 50 individuals was recorded within the Flying Fish study area from high hillcrests on rocky skeletal soil.

Plate 1: *Acacia bromilowiana* habit

Plate 2: *Acacia bromilowiana* flowers

***Eremophila magnifica* subsp. *magnifica* (P4)**

Eremophila magnifica is a very distinctive species to 1.5 m tall with purple flowers, its leaves smell of nutmeg when crushed. *Eremophila magnifica* subsp. *magnifica* (**Plate 3** and **Plate 4**) has glabrous leaves (with ciliate leaf margins) whilst *E. magnifica* subsp. *velutina* has a velvety leaf surface. There are 17 herbarium records of *Eremophila magnifica* subsp. *magnifica* all of which come from the Hamersley Range. Within the study area, two populations of *Eremophila magnifica* subsp. *magnifica*, each of over 20 plants were recorded from rocky habitats of the **ElTw** vegetation type.

Plate 3: *Eremophila magnifica* subsp. *magnifica* flowers and foliage

Plate 4: *Eremophila magnifica* subsp. *magnifica* form

***Eremophila magnifica* subsp. *velutina* (P3)**

Eremophila magnifica is a very distinctive species to 1.5 m tall with purple flowers, its leaves smell of nutmeg when crushed. *Eremophila magnifica* subsp. *magnifica* has glabrous leaves (with ciliate leaf margins) whilst *E. magnifica* subsp. *velutina* (**Plate 5** and **Plate 6**) has a velvety leaf surface. *Eremophila magnifica* subsp. *velutina* is known from 12 herbarium records, all of which come from the Hamersley Range. Within the study area, three populations of *Eremophila magnifica* subsp. *velutina* each of approximately 10-20 individuals were recorded from rocky habitats of the **ElTw** vegetation type.

Plate 5: *Eremophila magnifica* subsp. *velutina* flowers and foliage

Plate 6: *Eremophila magnifica* subsp. *velutina* form

***Indigofera* sp. Bungaroo Creek (S. van Leeuwen 4301) (P3)**

Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301) is an upright shrub to 2.5 m tall with red flowers (**Plate 7** and **Plate 8).** It is known from drainage lines and gorges of the Hamersley Range, with eight herbarium records. Within the study area *Indigofera* sp. Bungaroo Creek (S. van Leeuwen 4301) was recorded from four populations in drainage lines, typically as a dominant species of the shrub stratum. Numbers of individuals from each population were estimated in the hundreds.

Plate 7: *Indigofera* sp. Bungaroo Creek (S. van Leeuwen 4301) form

Plate 8: *Indigofera* sp. Bungaroo Creek (S.van Leeuwen 4301) flowers and foliage

Undescribed Species

Two undescribed ('phrase name') taxa, *Gompholobium* sp. Pilbara (N.F. Norris 908) and *Sida* sp. Shovelanna Hill (S. van Leeuwen 3842), were recorded in addition to the undescribed PF listed above. Both species are widespread across the Hamersley Range and are not considered to be of conservation significance.

Species Range Extents

All of the dominant and characteristic species recorded during this assessment were within their usual extents, however *Eucalyptus socialis*, *Eremophila magnifica* subsp. *magnifica* and *E. magnifica* subsp. *velutina* are on the western edge of their usual ranges.

4.1.2 INTRODUCED FLORA

No Declared Plants were recorded from the study area.

Bidens bipinnata* (Bipinnate Beggartick), **Cenchrus ciliaris* (Buffel Grass) and **Vachellia farnesiana* (Mimosa Bush) were recorded from major drainage lines of the study area (Map 4**). Locations of all introduced flora records are shown in **Table 12**.

Table 12: Coordinates of introduced flora species

Species	GDA mE	GDA mN
**Bidens bipinnata*	528690	7520024
**Bidens bipinnata*	508006	7510096
**Bidens bipinnata*	528401	7519387
**Cenchrus ciliaris*	512410	7508734
**Cenchrus ciliaris*	514996	7509624
**Cenchrus ciliaris*	521598	7512794
**Vachellia farnesiana*	521596	7512503
**Vachellia farnesiana*	521598	7512794

4.1.3 FLORA INVENTORY

As this survey did not include recording of floristic quadrats a complete flora inventory was not recorded, and species richness cannot be assessed with confidence.

A total of 130 dominant and characteristic vascular flora taxa were recorded from relevé sites and opportunistic observations (**Appendix Seven**). Of these, two were of conservation significance (**Table 11**) and three were introduced (**Table 12**).

4.2 Vegetation

4.2.1 VEGETATION TYPES

The following 18 vegetation types were recorded and delineated from the Flying Fish study area. The extent of each of these vegetation types are shown in **Table 13**. Data for the Flying Fish relevé sites is presented in **Appendix Five**.

Table 13: Extents of each vegetation type in the study area

Code	Vegetation Type	Relevé #	Area (ha)	Percent of study area
AaEfT?e	*Acacia aptaneura* and *A. pruinocarpa* woodland over *Eremophila forrestii* subsp. *forrestii* sparse shrubland over *Triodia ?epactia* open hummock grassland	49	72.46	0.46
AbTw^{1}	*Acacia bivenosa*, *A. atkinsiana* and *A. sibirica* open shrubland over *Triodia wisean*a hummock grassland	4, 5	2140.09	13.61
AbTw^{2}	*Acacia bivenosa*, *A. pruinocarpa* and *A. marramamba* open shrubland over *Triodia wiseana* and *Eriachne mucronata* open grassland	32	256.31	1.63
AeTw^{1}	*Acacia exilis*, *A. trudgeniana* and *A. inaequilatera* open shrubland over *Triodia wiseana* open hummock grassland	10, 44*	152.94	0.973
AeTw^{2}	*Acacia exilis*, *A. pruinocarpa* and *A. marramamba*, open shrubland over *Triodia wiseana* open hummock grassland	36	68.20	0.434

Code	Vegetation Type	Relevé #	Area (ha)	Percent of study area
AxEc	*Acacia xiphophylla* and *A. sibirica* tall open shrubland over *Eremophila cuneata*, *Maireana* sp., and *Rhagodia eremaea* low sparse shrubland	20	18.18	0.12
CdAiTm	*Corymbia deserticola* subsp. *deserticola* and *Eucalyptus leucophloia* subsp. *leucophloia* open woodland over *Acacia inaequilatera*, *A. pyrifolia* var. *pyrifolia* and *A. atkinsiana* sparse shrubland over *Triodia* aff. *melvillei* and *T. wiseana* hummock grassland	6, 13, 30, 34, 40	963.02	6.12
ChAiTw	*Corymbia hamersleyana* and *E. leucophloia* subsp. *leucophloia* open woodland over *Acacia inaequilatera*, *A. bivenosa* and *Senna artemisioides* subsp. *oligophylla* sparse shrubland over *Triodia wiseana* hummock grassland with *Ptilotus auriculifolius* and *Aristida holathera* var. *holathera* sparse herbs and grasses	16,23, 25, 26 42*, 48*	2753.77	17.51
EgAaTe/ ElAaTe	Mosaic of: *Eucalyptus gamophylla* woodland over *Acacia atkinsiana*, *Senna glutinosa* subsp. *glutinosa* and *A. exilis* sparse shrubland over *Triodia epactia* hummock grassland and *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* open woodland over *Acacia atkinsiana*, *A. ancistrocarpa* and *A. bivenosa* sparse shrubland over *Triodia epactia* hummock grassland	14, 22, 29, 35, 38	2031.75	12.92
EgAmTw	*Eucalyptus gamophylla*, *E. leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* open woodland over *Acacia maitlandii*, *A. atkinsiana* and *A. monticola* open shrubland over *Triodia wiseana* hummock grassland	18, 33	227.64	1.45
ElAbTl	*Eucalyptus leucophloia* subsp. *leucophloia* open woodland over *Acacia bivenosa*, *Senna glutinosa* subsp. *glutinosa* and *S. glutinosa* subsp. *pruinosa* sparse shrubland over *Triodia longiceps* and *T. wiseana* hummock grassland	24, 39	114.79	0.73
ElAiTw	*Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* open woodland over *Acacia inaequilatera* and *A. bivenosa* (spindly variant) sparse shrubland over *Triodia wiseana* hummock grassland	47*	56.36	0.36
ElAmTw[1]	*Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* open woodland over *Acacia maitlandii*, *Senna glutinosa* subsp. *pruinosa* and *Ptilotus rotundifolius* sparse shrubland over *Triodia wiseana* hummock grassland	19	655.61	4.17

Code	Vegetation Type	Relevé #	Area (ha)	Percent of study area
ElAmTw^2	*Eucalyptus leucophloia* subsp. *leucophloia* open woodland over *Acacia maitlandii*, *A. pruinocarpa* and *Grevillea wickhamii* open shrubland over *Triodia wiseana* hummock grassland	8, 12, 17. 28, 41	5256.35	33.43
EsSaTw	*Eucalyptus socialis* subsp. *eucentrica* over *Senna artemisioides* subsp. *oligophylla*, *A. synchronicia* and *Stylobasium spathulatum* sparse shrubland over *Triodia wiseana* and *T. longiceps* open hummock grassland	15, 31	309.39	1.97
EvAcTt	*Eucalyptus victrix* and *E. xerothermica* woodland over *Acacia citrinoviridis*, *Gossypium robinsonii* and *Melaleuca glomerata* shrubland over *Themeda triandra*, *Triodia epactia* and *Enteropogon ramosus* tussock grassland/hummock grassland	1*, 27, 37	106.99	0.68
ExAaTe	*Eucalyptus xerothermica*, *Corymbia hamersleyana* and *Acacia aptaneura* woodland over *A. ancistrocarpa, Gossypium robinsonii* and *A. atkinsiana* open shrubland over *Triodia epactia*, *Themeda triandra* and *Chrysopogon fallax* hummock grassland/tussock grassland	3, 7, 11	346.50	2.20
Tw	*Triodia wiseana* hummock grassland with *Themeda* sp., *Gomphrena cunninghamii* and *Ptilotus auriculifolius* sparse tussock grasses and herbs	21	194.03	1.23
TOTAL			**15724.39**	**100.00**

*Releves recorded within the Eliwana study area

Vegetation codes are formulated using initials for dominant and characteristic species in each strata, following Fortescue's *Flora and Vegetation Guidelines* (2011) and subsequent instructions.

AaEfT?e

Vegetation type description: *Acacia aptaneura* and *A. pruinocarpa* woodland over *Eremophila forrestii* subsp. *forrestii* sparse shrubland over *Triodia ?epactia* open hummock grassland. *Melaleuca eleuterostachya*, *Lepidium platypetalum*, *Eriachne mucronata*, *Triodia longiceps* and *T. wiseana* were recorded from the scree slopes associated with the mesa.

This vegetation type occurred on a mesa plateau of the Robe land system and was assessed from a single relevé. The vegetation condition of the relevés was Excellent. **Plate 9** illustrates the **AaEfT?e** vegetation type. The dominant species of *Triodia* appeared to be *Triodia epactia* with resinous leaf sheaths and distinctive smell, but did not contain any reproductive material. *Triodia epactia* does not characteristically occur on mesa tops, and as such the identification of this species is uncertain.

Plate 9: AaEfT?e vegetation type (relevé EFF11R49)

AbTw[1]

Vegetation type description: *Acacia bivenosa*, *A. atkinsiana* and *A. sibirica* open shrubland over *Triodia wiseana* hummock grassland. Other common species included *A. aptaneura*, *A. exilis* and *A. synchronicia*.

This vegetation type occurred on valley floors of the Boolgeeda land system and was assessed from two relevés. The vegetation condition of the relevés was Very good. **Plate 10** illustrates the **AbTw[1]** vegetation type.

Plate 10: AbTw[1] vegetation type (relevé EFF11R04)

AbTw^2

Vegetation type description: *Acacia bivenosa*, *A. pruinocarpa* and *A. marramamba* open shrubland over *Triodia wiseana* and *Eriachne mucronata* open grassland. *Senna glutinosa* subsp. *glutinosa* is also characteristic of the mid stratum.

This vegetation type occurred on steep high slopes of the Newman land system and was assessed from one relevé. This vegetation type is likely to be more widespread than mapped, but is difficult to distinguish without ground truthing. The vegetation condition of the relevé was Excellent. **Plate 11** illustrates the **AbTw^2** vegetation type.

Plate 11: AbTw^2 vegetation type (relevé EFF11R32)

AeTw[1]

Vegetation type description: *Acacia exilis*, *A. trudgeniana* and *A. inaequilatera* open shrubland over *Triodia wiseana* open hummock grassland. Other common species included *Eriachne aristidea*, *E. pulchella* subsp. *dominii*, *Goodenia microptera*, *Polycarpaea holtzei* and *Schizachyrium fragile*.

This vegetation type occurred on gentle footslopes and was assessed from one relevé. The vegetation condition of the relevé was Very good. **Plate 12** illustrates the **AeTw[1]** vegetation type.

Plate 12: AeTw[1] vegetation type (relevé EFF11R10)

AeTw^2

Vegetation type description: *Acacia exilis*, *A. pruinocarpa* and *A. marramamba* open shrubland over *Triodia wiseana* open hummock grassland. Other common species included *Petalostylis labicheoides*, *A. monticola, Indigofera monophylla*, *Bulbostylis barbata* and *Eriachne pulchella* subsp. *dominii*.

This vegetation type occurred on hillcrests of the Newman land system and was assessed from one relevé. It is likely that this vegetation type is more extensive than was mapped, but is difficult to distinguish from the **ElTw** community based on interpretation of aerial imagery. The vegetation condition of the relevé was Very good. **Plate 13** illustrates the **AeTw^2** vegetation type.

Plate 13: AeTw^2 vegetation type (relevé EFF11R36)

AxEc

Vegetation type description: *Acacia xiphophylla* and *A. sibirica* tall open shrubland over *Eremophila cuneata*, *Maireana* sp. and *Rhagodia eremaea* low sparse shrubland. *A. synchronicia* is also common.

This vegetation type occurred on a small clay flat and was assessed from a single relevé. The vegetation condition of the relevé was Very good. **Plate 14** illustrates the **AxEc** vegetation type.

Plate 14: AxEc vegetation type (relevé EFF11R20)

CdAiTm

Vegetation type description: *Corymbia deserticola* subsp. *deserticola* and *Eucalyptus leucophloia* subsp. *leucophloia* open woodland over *Acacia inaequilatera*, *A. pyrifolia* var. *pyrifolia* and *A. atkinsiana* sparse shrubland over *Triodia* aff. *melvillei* and *T. wiseana* hummock grassland. Other common species included *Acacia marramamba, Amphipogon sericeus*, *Schizachyrium fragile* and *Goodenia stobbsiana*.

This vegetation type occurred on raised plains and undulating landscapes of the Platform land system and was assessed from five relevés. The vegetation condition of the relevés were recorded as Very good to Excellent. **Plate 15** illustrates the **CdAiTm** vegetation type.

Plate 15: CdAiTm vegetation type (relevé EFF11R34)

ChAiTw

Vegetation type description: *Corymbia hamersleyana* and *E. leucophloia* subsp. *leucophloia* open woodland over *Acacia inaequilatera*, *A. bivenosa* and *Senna artemisioides* subsp. *oligophylla* sparse shrubland over *Triodia wiseana* hummock grassland with *Ptilotus auriculifolius* and *Aristida holathera* var. *holathera* sparse herbs and grasses.

This vegetation type occurred on the Rocklea land system and was assessed from four relevés. The vegetation condition of the relevés were recorded as Excellent. **Plate 16** illustrates the **ChAiTw** vegetation type.

Plate 16: ChAiTw vegetation type (relevé EFF11R23)

EgAaTe/ElAaTe

Vegetation type description: **EgAaTe/ElAaTe** is a complex of vegetation types that form a mosaic across the study area, with boundaries difficult to delineate from aerial imagery. The following vegetation types were recorded within this mosaic:

- *Eucalyptus gamophylla* woodland over *Acacia atkinsiana*, *Senna glutinosa* subsp. *glutinosa* and *A. exilis* sparse shrubland over *Triodia epactia* hummock grassland
- *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* open woodland over *Acacia atkinsiana*, *A. ancistrocarpa* and *A. bivenosa* sparse shrubland over *Triodia epactia* hummock grassland.

Senna artemisioides subsp. *oligophylla* is also a characteristic species of the *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* dominated portion of the mosaic.

This vegetation complex occurred across valley floors and was assessed from five relevés. The vegetation condition of the relevés was Very good to Excellent. **Plate 17** and **Plate 18** illustrate the variety of vegetation types included in the **EgAaTe/ElAaTe** vegetation complex.

Plate 17: *Eucalyptus gamophylla* dominated EgAaTe/ElAaTe vegetation type (relevé EFF11R38)

Plate 18: *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* dominated EgAaTe/ElAaTe vegetation type (relevé EFF11R29)

EgAmTw

Vegetation type description: *Eucalyptus gamophylla*, *E. leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* open woodland over *Acacia maitlandii*, *A. atkinsiana* and *A. monticola* open shrubland over *Triodia wiseana* hummock grassland. *Senna glutinosa* subsp. *glutinosa* is also a common component of the mid stratum.

This vegetation type occurred on high hillcrests of the Newman land system and was assessed from two relevés. The vegetation condition of the relevés were recorded as Excellent. **Plate 19** illustrates the **EgAmTw** vegetation type.

Plate 19: EgAmTw vegetation type (relevé EFF11R33)

ElAbTl

Vegetation type description: *Eucalyptus leucophloia* subsp. *leucophloia* open woodland over *Acacia bivenosa*, *Senna glutinosa* subsp. *glutinosa* and *S. glutinosa* subsp. *pruinosa* sparse shrubland over *Triodia longiceps* and *T. wiseana* hummock grassland.

This vegetation type occurred on undulating lower slopes and was assessed from two relevés. The vegetation condition of the relevés were recorded as Very good to Excellent. **Plate 20** illustrates the **ElAbTl** vegetation type.

Plate 20: ElAbTl vegetation type (relevé EFF11R39)

ElAiTw

Vegetation type description: *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* open woodland over *Acacia inaequilatera* and *A. bivenosa* (spindly variant) sparse shrubland over *Triodia wiseana* hummock grassland.

This vegetation type occurred on hills of the Rocklea land system and was assessed from one relevé. The vegetation condition of the relevé was Excellent. **Plate 21** illustrates the **ElAiTw** vegetation type.

Plate 21: ElAiTw vegetation type (relevé EFF11R47)

ElAmTw[1]

Vegetation type description: *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* open woodland over *Acacia maitlandii*, *Senna glutinosa* subsp. *pruinosa* and *Ptilotus rotundifolius* sparse shrubland over *Triodia wiseana* hummock grassland. Other common species included *Senna glutinosa* subsp. *glutinosa, Bulbostylis barbata* and *Schizachyrium fragile*.

This vegetation type occurred on low hills of the Newman land system and was assessed from one relevé. The vegetation condition of the relevé was *excellent*. **Plate 20** illustrates the **ElAmTw[1]** vegetation type.

Plate 22: ElAmTw[1] vegetation type (relevé EFF11R19)

ElAmTw^2

Vegetation type description: *Eucalyptus leucophloia* subsp. *leucophloia* open woodland over *Acacia maitlandii*, *A. pruinocarpa* and *Grevillea wickhamii* subsp. *hispidula*, sparse shrubland over *Triodia wiseana* hummock grassland. Other common species included *Acacia pyrifolia* var. *pyrifolia*, *Senna glutinosa* subsp. *glutinosa, Bulbostylis barbata*, *Eriachne pulchella* subsp. *dominii*, *Fimbristylis simulans*, *Polycarpaea holtzei, Schizachyrium fragile*. The P3 listed *Eremophila magnifica* subsp. *velutina* was recorded from this vegetation type

This vegetation type occurred on the Newman land system, associated with hill slopes and crests. This vegetation type is highly variable, particularly with regards to the mid-stratum. It was assessed from five relevés. The vegetation condition of the relevés was recorded as Very good to Excellent. **Plate 23** illustrates the **ElAmTw^2** vegetation type.

Plate 23: ElAmTw^2 vegetation type (relevé EFF11R12)

EsSaTw

Vegetation type description: *Eucalyptus socialis* subsp. *eucentrica* mallee woodland over *Senna artemisioides* subsp. *oligophylla*, *Acacia synchronicia* and *Stylobasium spathulatum* sparse shrubland over *Triodia wiseana* and *T. longiceps* open hummock grassland. *Capparis umbellata* is also a characteristic species of the mid stratum.

This vegetation type occurred on rocky calcrete rises and was assessed from two relevés. The vegetation condition of the relevés were recorded as Very good to Excellent. **Plate 24** illustrates the **EsSaTw** vegetation type.

Plate 24: EsSaTw vegetation type (relevé EFF11R15)

EvAcTt

Vegetation type description: *Eucalyptus victrix* and *E. xerothermica* woodland over *Acacia citrinoviridis*, *Gossypium robinsonii* and *Melaleuca glomerata* shrubland over *Themeda triandra*, *Triodia epactia* and *Enteropogon ramosus* tussock grassland/hummock grassland. Other common species include *Acacia tumida* var. *pilbarensis*, *Cyperus vaginatus* and *Eulalia aurea.* The P3 listed taxon, *Indigofera* sp. Bungaroo Creek (S. van Leeuwen 4301) was commonly recorded in the **EvAcTt** vegetation type. The introduced species' **Cenchrus ciliaris* (Buffel Grass) and **Vachellia farnesiana* (Mimosa Bush) were recorded from this vegetation type.

This vegetation type was associated with major drainage lines. It was assessed from two relevés. The vegetation condition of the relevés was recorded as Good to Very good. **Plate 25** illustrates the **EvAcTt** vegetation type.

Plate 25: EvAcTt vegetation type (relevé EFF11R37)

ExAaTe

Vegetation type description: *Eucalyptus xerothermica*, *Corymbia hamersleyana and Acacia aptaneura* woodland over *Acacia ancistrocarpa, Gossypium robinsonii* and *A. atkinsiana* open shrubland over *Triodia epactia*, *Themeda triandra* and *Chrysopogon fallax* hummock grassland/tussock grassland. Other common species include *Acacia bivenosa*, *Eremophila longifolia* and *Eulalia aurea.*

This vegetation type was associated with minor to mid-order drainage lines and was assessed from three relevés. The vegetation condition of the relevés were Very good. **Plate 26** illustrates the **ExAaTe** vegetation type.

Plate 26: ExAaTe vegetation type (relevé EFF11R11)

Tw

Vegetation type description: *Triodia wiseana* hummock grassland with *Themeda* sp., *Gomphrena cunninghamii* and *Ptilotus auriculifolius* sparse tussock grasses and herbs. *Acacia inaequilatera* forms a scattered upper stratum in some areas.

This vegetation type occurred on the Newman land system, associated with steep rocky scree slopes. It was assessed from a single relevé. The vegetation condition of the relevé was Excellent. **Plate 27** illustrates the **Tw** vegetation type.

Plate 27: Tw vegetation type (relevé EFF11R21)

4.2.2 CONSERVATION SIGNIFICANCE OF VEGETATION TYPES

Threatened or Priority Ecological Communities

No vegetation assessed as being, or likely to be considered, as a TEC or PEC was recorded from the Flying Fish study area. Development of the study area is unlikely to impact on known TECs or PECs as none are known from within 15 km.

'Ecosystems at Risk'

'Ecosystems at Risk' do not have any statutory protection. They were identified by regional ecologists and others as part of the then Department of Conservation and Land Management's (CALM, now DEC) *Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002* (CALM 2002).

The DEC considers 'Hilltop floras, Hamersley Range' as a *vulnerable* 'Ecosystem at Risk' due to frequent fires preventing regeneration and deliberate burning (Kendrick 2002). Despite the Flying Fish study area being within the Hamersley Range, there were no large hills with significantly

different vegetation (ie the slopes and hilltops were very similar) to consider them to be 'Hilltop floras'.

'All major ephemeral water courses' is also identified as an 'Ecosystem at Risk' in Kendrick (2002). Several ephemeral water courses dissect the study area, mostly tributaries of Boolgeeda Creek. Numerous smaller drainage lines are also present across the study area. The **EvAcTt** vegetation type is associated with major ephemeral water courses, however most of the water courses within the study area have been impacted by grazing by cattle and horses, with weed invasions also commonly recorded. Changes to hydrology from future mining activities are likely to impact on watercourses in the study area.

Other nearby 'Ecosystems at Risk' listed in Kendrick (2002) include 'Valley floor Mulga', and 'Lower slopes Mulga'. Mulga (*Acacia aptaneura*) occurs within the study area, particularly within the **ExAaTe**, **AaEfT?e** and **AbTw^2** vegetation types. Mulga may be impacted directly by future mining activities (clearing) or by future changes to surface and subsurface water flow as a result of future activities in the study area, however potential impacts are as yet unknown.

Groundwater Dependent Ecosystems

Eucalyptus camaldulensis subsp. *refulgens*, that is considered to indicate a GDE, was not recorded from the study area.

The only potential GDE recorded from the study area was vegetation type **EvAcTt** that was dominated by *E. victrix*. Current evidence does not clearly indicate if *E. victrix* is dependent on groundwater (see **Section 2.2.3.4**), therefore this vegetation type is considered as only a potential GDE. Vegetation type **EvAcTt** was recorded as being in Good to Very Good condition within the study area.

Other species associated with minor drainage lines, including *Acacia* spp. (eg *A. tumida, A. citrinoviridis*), *Corymbia hamersleyana* and *Eucalyptus xerothermica* are not considered to be groundwater dependent (Astron Environmental Services 2008).

Sheet Flow Dependent Communities

Grove – intergrove Mulga (*Acacia aptaneura*) is considered to be dependent on surface water flows to regenerate. Mulga groves were not identified from the study area.

4.2.3 VEGETATION CONDITION

Relevés were recorded in areas that were typical of the targeted vegetation type. The vegetation condition (Trudgen 1991) was recorded for the relevé and extrapolated to each vegetation type.

The extents and proportion of each vegetation condition rating category is shown in **Table 14**. **Map 6** shows vegetation condition in the study area.

Table 14: Vegetation Condition (Trudgen 1991)

Condition Rating	Excellent	Very good	Good	Poor	Very poor	Degraded
Extent (ha)	8013.87	106.99	7603.53	0	0	0
Proportion (%)	50.96	0.68	48.36	0	0	0

4.3 Fauna

4.3.1 HABITAT TYPES

Four habitat types were identified and assigned codes for ease of mapping (ie EFF1 for Flying Fish habitat type 1). Each habitat type was mapped and delineated based on the following types:

- EFF1 - Creeklines/drainage lines on lower slopes and valley floors
- EFF2 - Open shrubland or open woodland over Spinifex grassland on slopes
- EFF3 - Sheltered gorges/gullies
- EFF4 - Exposed upper slopes, clifflines and ridges.

The condition of all habitats was assessed by field surveyors as excellent, with abundant fresh growth of *Triodia* spp., *Acacia* spp. and other vegetation. No surface water was recorded and all drainage appears to be ephemeral, although rockholes accessible to animals are likely to exist in some gullies (based on presence of Euros, *Macropus robustus*) as this species is known to congregate at water sources.

The habitats were mapped based on landscape position, vegetation and soil type and are shown on **Map 7**. The majority of the study area is made up of habitat types EFF2 and EFF4 which are comprised of either the Boolgeeda, Platform or Newman land systems (**Plate 29** and **Plate 31**). **Table 15** shows the amount of each habitat type within the study area and the percentage extent.

Table 15: Amount and extent of each habitat type

Habitat Type	Area (ha)	Proportion of study area (%)
EFF1 - Creeklines/drainage lines on lower slopes and valley floors	459	2.9
EFF2 - Open shrubland or open woodland over spinifex grassland on slopes	1774	11.3
EFF3 - Sheltered gorges/gullies	35	0.2
EFF4 - Exposed upper slopes, clifflines and ridges	13456	85.6
Total	**15724**	

Habitats EFF1 (**Plate 28**) and EFF3 (**Plate 30**) made up a small percentage of the study area however they provide values of shelter, water resources and foraging making these habitats important for the survival and persistence for many fauna species.

Plate 28: Habitat type EFF1

Plate 29: Habitat type EFF2

Plate 30: Habitat type EFF3

Plate 31: Habitat type EFF4

4.3.2 BIRD CENSUS

Thirty eight species of birds were identified by sight or call. The number of individuals for each species recorded ranged from one individual (recorded for nine species) to approximately 52 individuals. Eight or more individuals were recorded in the following species, which are thus regarded as common and conspicuous in the study area:

- *Lichenostomus virescens* (Singing Honeyeater, 52)
- *Melopsittacus undulatus* (Budgerigar, 34)
- *Manorina flavigula* (Yellow-throated Miner, 36)
- *Geopelia cuneata* (Diamond Dove, 33)
- *Emblema pictum* (Painted Finch, 20)
- *Artamus minor* (Little Woodswallow, 20)
- *Merops ornatus* (Rainbow Bee-eater, 18)
- *Geophaps plumifera* (Spinifex Pigeon, 16)

- *Rhipidura leucophrys* (Willy Wagtail, 16)
- *Craticus tibicen* (Australian Magpie, 13)
- *Coracina novaehollandiae* (Black-faced Cuckoo-shrike, 11)
- *Eleophus roseicapillus* (Galah, 11)
- *Pomatostomus temporalis* (Grey-crowned Babbler, 11)
- *Ocyphaps lophotes* (Crested Pigeon, 10).

Two conservation-listed species were recorded; Rainbow Bee-eater (EPBC-listed migratory species, but widespread and common; recorded in five of six census sessions) and a single Australian Bustard (DEC *P4*).

4.3.3 TRAIL CAMERAS

No identifiable fauna images were recorded.

Table 16: Camera co-ordinates in metres (GDA94 MGA zone 50).

Item	Easting	Northing
Trail Camera	512537	7509636
Trail Camera	524835	7514864

4.3.4 BAT ECHOLOCATION RECORDING

Bat echolocation recordings were undertaken in the immediately adjacent Eliwana exploration tenement. As the habitat types of the two areas are similar and the areas are contiguous, the results are applicable to both areas.

Three nights of Bat echolocation recordings were taken in Eliwana in habitat types EFF1, EFF3 and EFF4. Mr Bob Bullen from Bat Call WA identified the following species as present within the study area:

- *Taphozous georgianus* (Common Sheathtail Bat)
- *Chaerephon jobensis* (Northern Freetail Bat)
- *Mormopterus beccarii* (Beccari's Freetail Bat)
- *Nyctophilus geoffroyi* (Lesser Long-eared Bat)
- *Chalinolobus gouldii* (Gould's Wattled Bat)
- *Scotorepens greyii* (Little Broad-nosed Bat)
- *Vespadelus finlaysoni* (Finlayson's Cave Bat).

The continuous recording equipment used, supplied by Bat Call WA, is capable of recording both Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*) and Ghost Bat (*Macroderma gigas)* echolocation calls. No recordings of these two species were identified on the recordings. Locations of recording sites are included in the Eliwana report (Ecoscape 2012b).

4.3.5 TRAPPING

No captures of any species were made in 52 trap nights at Flying Fish. Traps were set for a total of 52 trap nights and baited and checked each morning within two hours of sunrise. Traps were located in both denning and foraging habitat of the Northern Quoll.

4.3.6 OPPORTUNISTIC OBSERVATIONS

Observations from Flying Fish habitats included the following:

- *Macropus robustus* (Euro)
- unidentified *Petrogale* sp. (Rock Wallaby)
- *Trichosurus vulpecula* (Brush-tailed Possum) were recorded as present based on scats (Triggs 1996)
- *Pseudomys chapmani* (Western Pebble-mound Mouse, DEC P4); three mounds observed
- *Bos taurus* (Cattle)
- *Canis lups dingo* (Dingo scat)
- *Felis catus* (feral Cat, identified from tracks).

4.3.7 SUMMARY

Using all methods, 49 vertebrate species were recorded (10 mammals, one reptile, 38 birds) and are listed in **Table 25** (**Appendix Eight**).

5.0 Discussion

5.1 Flora

5.1.1 FLORA OF CONSERVATION SIGNIFICANCE

A total of 130 vascular flora taxa were recorded within the study area from relevé sites and opportunistic observations (**Appendix Seven**). The seasonal conditions at the time of the survey were considered excellent.

Fifty three conservation significant flora taxa (TF and PF) were identified by the DEC database search of an 18, 548 km^2 area, with none identified as having previously been recorded within the study area. It is considered that the majority would have identifiable (if present) due to survey timing (coinciding with the majority of species' flowering periods) and excellent seasonal conditions. However, as a result of the broad scale nature of this survey across a large area it is not possible to rule out the possibility of additional conservation significant flora occurring within the study area. In order to maximise the chances of finding conservation significant species, known habitat, particularly of TF, P1 and P2 taxa, were targeted for intensive searches.

Two TF species listed under the Commonwealth *EPBC Act* (1999) as *vulnerable* and *WC Act* (1950), *Lepidium catapycnon* and *Thryptomene wittweri,* were identified from the DEC database search request as occurring close to the study area. Neither was located during searches of high hills that were accessible during the field assessment. Both are known to occur high in the landscape, in areas that were mostly inaccessible during the field survey. Therefore, although it is unlikely that they occur in the study area, the landform and habitat of both occur, and their occurrence cannot be discounted without intensive survey.

There were four PF (*Acacia bromilowiana*, *Eremophila magnifica* subsp. magnifica, *Eremophila magnifica* subsp. *velutina* and *Indigofera* sp. Bungaroo Creek) recorded within the study area.

Acacia bromilowiana (P4) was recorded from a single population of greater than 50 indivudulas on a high hillcrest on rocky skeletal soil. It is likely that additional populations may occur within the study area on similar landform types.

Within the study area, two populations of *Eremophila magnifica* subsp. *magnifica* (P4) totalling more than 45 individuals were recorded from rocky habitats of the **ElTw** vegetation type. It is likely that additional populations occur within the study area.

Three populations of *Eremophila magnifica* subsp. *velutina* (P3) totalling more than 30 individuals were recorded from rocky habitats of the **ElTw** vegetation type.

Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301) (P3) was recorded from four populations totaling hundreds of individuals in drainage lines, typically as a dominant species of the shrub stratum.

5.1.1.1 Conservation Significant Flora Risk Assessment

This assessment of the Flying Fish study area was a Level 1 survey according to EPA *Guidance Statement No. 51* (EPA 2004a) and *Position Statement No.* 3 (EPA 2002), and was conducted as a reconnaissance survey with targeted searches for conservation significant flora. Due to the size of the study area, restricted access to some areas due to lack of tracks, steep terrain and time constraints, and the nature of the survey (reconnaissance), it was not possible to search the entire study area for conservation significant flora.

A risk assessment, identifying the likelihood of conservation significant species occurring on the Flying Fish study area is included in **Table 27**, **Appendix Nine**. The likelihood of a species occurring in the study area is based on the following attributes, as listed on FloraBase (WAH & DEC 2011a; 2011b) and tailored to Pilbara populations and including recent information from recent nearby surveys. The attributes were:

- the broad soil type usually associated with the species
- the broad landform usually associated with the species
- the usual vegetation (characteristic species) with which the species is usually associated
- the species having previously been recorded from nearby (approximately 50 km).

The likelihood rating is assigned using the following categories:

- Does occur (ie it was recorded within the study area)
- Almost certain: it is expected to occur within the study area (but was not recorded within the study area)
- Likely: it will probably occur within the study area
- Unlikely: it could occur but is not expected
- None (Rare): none of the attributes of soil, landform and associated vegetation that are characteristic of the species occur in the study area, and it has not previously been recorded nearby. Therefore it almost certainly does not occur within the study area.

The conservation significant flora most likely to occur in the study area but not recorded during the survey are:

- *Calotis squamigera* (P1)
- *Sida* sp. Hamersley Range (K. Newbey 10692) (P1)
- *Sida* sp. Barlee Range (S van Leeuwen 1642) (P3)
- *Rhynchosia bungarensis* (P4).

It is not possible to determine the consequence of future impacts on these species as resource and infrastructure areas are unknown.

5.1.2 INTRODUCED SPECIES

Three introduced flora species, **Bidens bipinnata* (Bipinnate Beggartick), **Cenchrus ciliaris* (Buffel Grass) and **Vachellia farnesiana* (Mimosa Bush) were recorded from the study area. Infestations of these weeds were restricted to major drainage lines, and none were considered to be significant infestations.

None of these species are recognised under the *Agriculture and Related Resources Protection Act* 1976 as Declared Plants.

5.2 Vegetation

5.2.1 VEGETATION OF CONSERVATION SIGNFICANCE

Eighteen vegetation types were recorded from the Flying Fish study area, none of which are considered to represent any recognised TEC or PEC. No vegetation types have any formal conservation significance.

No sheet flow dependent Mulga communities were identified from the study area.

Several 'Ecosystems at Risk' were identified from the study area. Ecosystems at Risk' do not have any formal conservation significance.

No known Groundwater Dependent Ecosystems (GDEs) dominated by *Eucalyptus camaldulensis* subsp. *refulgens* were identified from the study area. *Eucalyptus victrix* dominated vegetation was identified from the study area, represented by vegetation type **EvAcTt**. *E. victrix* is considered to be potentially indicative of a GDE (see **Section 4.1.2.2**).

'All major ephemeral water courses' have been identified as an 'Ecosystem at Risk' in Kendrick (2002). Within the study area the **EvAcTt** vegetation type can be considered analogous with this 'Ecosystem at Risk'.

Other nearby 'Ecosystems at Risk' listed in Kendrick (2002) include 'Valley floor Mulga', and 'Lower slopes Mulga'. Mulga (*Acacia aptaneura*) occurs within the study area, particularly within the **ExAaTe**, **AaEfT?e** and **AbTw^2** vegetation types. The **ExAaTe** vegetation type contains restricted pockets of mulga dominated valley floor vegetation, whilst **AaEfT?e** occurs on a mesa of the Robe land system and **AbTw^2** occurs on mid to upper slopes. Mulga may be impacted directly by future mining activities (clearing) or by future changes to surface and subsurface water flow as a result of future activities in the study area, however potential impacts are as yet unknown.

All of the other vegetation types recorded in the study area are considered to be relatively widespread and well represented in the broader region.

5.2.2 VEGETATION CONDITION

The vegetation condition of the Flying Fish study area, assessed using the Trudgen (1991) Vegetation Condition Rating Scale, ranged from Good to Excellent depending of the density of weeds, impacts from grazing and effects of fire. **Table 14** shows the extent and proportions of each condition rating within the Flying Fish study area.

Over half (50.96%) of the study area has been assessed as being in Excellent condition, indicating the general lack of human disturbance. The area assessed as being in Excellent condition is usually associated with hills and slopes. However, almost half (48.36%) of the area has been assessed as being in Good condition, indicating the impact of grazing and weed invasion.

5.3 Fauna and Habitat

5.3.1 CONSERVATION SIGNIFICANT AND OTHER SPECIALLY PROTECTED FAUNA POTENTIALLY OCCURRING IN THE STUDY AREA

Habitat requirements, documented or potential presence at the Flying Fish study area are discussed for each listed species, including Threatened and Priority species and also one that is listed as a Key Threatening Process. Species and common names are followed by abbreviations denoting conservation status (described in **Appendix One**). Potential impacting processes include:

- mortality during clearing
- mortality during operations
- habitat loss leading to reduction in population size
- habitat loss leading to population fragmentation
- hydrological change (affecting habitat)
- habitat degradation due to weed invasion
- impact of disturbance, light and/or pollutants on habitat quality
- changes in abundance of predators and/or competitors, including introduced species
- changes in fire regime.

MAMMALS

***Dasyurus hallucatus* (Northern Quoll)**

Conservation status

EPBC Act EN, WC Act S1 (EN)

Distribution and Preferred habitat

The Northern Quoll formerly occurred across northern Australia from the Pilbara region in Western Australia to south-eastern Queensland. A 75% reduction of available habitat occurred during the 20th century, so that the species is now restricted to the Pilbara and north Kimberley in Western

Australia and a few discrete populations across the Northern Territory and eastern Queensland (Braithwaite & Griffiths 1994). Pilbara populations are considered to be already fragmented and to have been in decline since the mid-1980s, with the precise causes unknown (Threatened Species Scientific Committee 2005). Northern Quolls are most common on dissected rocky escarpments, but are also found in eucalypt forest and woodland (Oakwood 2008). Potential denning / shelter habitat (considered critical for quoll survival) includes rocky gorges, gullies and escarpments associated with *Corymbia* woodland, boulder fields, termite mounds, and small caves. Foraging or dispersal habitat is considered to include any areas of predominantly native vegetation up to 2 km from denning habitat (DSEWPC 2012).

Biota (2009) made a very useful compilation of Northern Quoll distribution records and trapping results across the Pilbara, which were mapped and related to Land Systems (Van Vreeswyk *et al.* 2004b), but their discussion does not fully account for unequal distribution of area and trapping effort. While Biota (2009; table 4.1) ranked land systems based on the raw number of Northern Quoll records (regarding those with 8 or more as containing 'core habitat'), they are ranked here (**Table 17**) based on the number of records in proportion to area.

Table 17: Ranking of Land Systems by number of Northern Quoll (NQ) records (if >3) in proportion to land area

Land Systems present in study area marked (*)

Land System	Area (ha) (Van Vreeswyk *et al*. 2004b)	NQ records (Biota 2009)	NQ records per 10,000 km2
Robe*	865	31	358
Horseflat	1,261	7	56
Wona	1,815	10	55
Calcrete	1,444	5	35
Macroy	13,095	38	29
Rocklea*	22,993	49	21
River	4,088	8	20
Capricorn	5,296	10	19
McKay	4,202	5	12
Boolgeeda*	7,748	5	6.5
Newman*	14,580	7	4.8

Ecology

Northern Quolls are nocturnal and opportunistic omnivores feeding primarily on large insects, small vertebrates and soft fruits. They are both arboreal and terrestrial and use a variety of den sites including rock crevices, tree hollows, logs, termite mounds, house roofs and goanna burrows (Oakwood 2008). Breeding tends to occur near creeklines, where individuals go to drink when water is available. Body size, home range size and survival rate vary between rocky and savannah habitats, but the ecology of Pilbara populations has not been well studied. The short generations (reproductive maturity at 11 months), large litter sizes (up to eight) and large home ranges of this species mean that population density and occupancy of habitat may fluctuate greatly between years

(Schmitt *et al.* 1989), and sites that are occupied only occasionally may still be critical for long-term survival in the region.

Likelihood of Occurrence

There are scattered records of Northern Quoll within the Hamersley subregion, including some within 30 km of the study area (Biota 2009; not all in DEC 2011b), and potential denning habitat occurs in the study area in the form of sheltered and vegetated gullies and creeklines. The northern part of the study area includes areas of Rocklea and Robe land systems (**Map 1**) that may contain preferred habitat (**Table 17**), most likely associated with breakaways (dissected escarpment). Thus, although no evidence that the species currently occurs was obtained by trapping, motion-sensitive camera or searching for scats and other signs, the area appears to contain suitable habitat and may be occupied intermittently.

Potential Impacts

If Northern Quoll does not currently occur in the study area there will be no direct impact due to mining activity. However, because populations and area of occupancy may fluctuate, impact to suitable habitat could be significant even though it is not currently occupied. This can be minimized by avoiding disturbance to gorges, wooded creeklines and breakaways.

***Sminthopsis longicaudata* (Long-tailed Dunnart)**

Conservation status

DEC P4

Distribution and Preferred habitat

This species of Dasyuridae is rare and patchily distributed in rocky areas of central Western Australia (Pilbara, Murchinson, Northeastern Goldfields, Ashburton, and Gibson Desert regions) and a few sites in central southern Northern Territory, but at times it can be locally common. It is found in rocky scree and plateau areas, generally with little vegetation or of spinifex hummock grassland, shrubs, and open woodland (Burbidge *et al.* 2008).

Ecology

This species is nocturnal, and its diet includes a variety of invertebrates. Females in captivity give birth to up to five young between the months of October and December (Pavey 2006). There appear to be no major threats to this species. In the range within central Australia this species is affected by the spread of exotic buffel grass, which increases frequency and intensity of fires, and this is also likely to be an issue in some areas in Western Australia (IUCN 2011).

Likelihood of Occurrence

While Long-tailed Dunnart not detected in this survey, it was not specifically targeted (which would require Elliott and pit traps) and can be assumed to occur; there are records of this species near the north-eastern end of Flying Fish (DEC 2011b) and suitable habitat occurs throughout the study area.

Potential Impacts

Significant changes in vegetation or increase in fire frequency are not likely to occur as a result of mining activity. If a population is present, there may be some local impact (increased mortality) during clearing and operations, but this is unlikely to be significant on a regional scale.

Lagorchestes conspicillatus leichardti (Spectacled Hare-wallaby - mainland)

Conservation status

DEC P3

Distribution and Preferred habitat

The Spectacled Hare Wallaby (Macropodidae) has declined dramatically in WA; it is now extremely rare and reduced to a few isolated populations in the Pilbara and Kimberley regions (Ingleby 1991; Wildlife Australia 1996). It occupies a wide variety of habitat types including: open forests, open woodland, tall shrublands, tussock grasslands and hummock grasslands. In the drier southern parts of its range it commonly occupies spinifex (*Triodia* or *Plectrachne* spp.) sandplains interspersed with low shrubs and a diversity of either soft grasses, sedges or herb species; it is not dependent on extensive vegetation cover or surface water (Ingleby & Westoby 1992).

Ecology

This small nocturnal macropod shelters by day under grass tussocks or shrubs, and feeds on grass, herbs, seeds, and browse (shrub foliage). Threats probably include introduced predators (foxes in southern parts of the range, and possibly cats), and impacts on food resources and habitat from the pastoral industry (particularly sheep, which are now relatively unimportant in the Pilbara) and changes in fire regimes (Ingleby 1991; Ingleby & Westoby 1992; Wildlife Australia 1996).

Likelihood of Occurrence

There is an extant population in the eastern Pilbara near Jimblebar, but the only record of this species in the central Hamersley dates from 1966 (DEC 2011b), and it is unlikely that a population still occurs in the subregion.

Potential Impacts

No impact is likely, as the species is considered to be locally extinct.

Macroderma gigas **(Ghost Bat)**

Conservation status

DEC P4

Distribution and Preferred habitat

Australia's only carnivorous bat (Megadermatidae) occurs in a wide range of humid tropical habitats (savanna woodlands, mangroves, rainforest) but also in the arid zone near rock outcrops. Its range appears to have contracted into northern Australia in relatively recent times, disappearing from Central Australia (Churchill & Helman 1990). Regional populations are centred on maternity roosts that are genetically isolated from each other, and only 10 such sites are known to exist (Worthington-Wilmer *et al.* 1994). Populations disperse in the non-breeding (dry) season (Toop 1979; 1985), but the Pilbara population is separated from other populations by extensive sandy deserts (Richards & Hand 1995).

Ecology

The Ghost Bat forages by gleaning (picking prey items from surfaces), eating large insects, frogs, lizards, small birds and mammals. Tidemann et al. (1985) reported Ghost Bats in the Northern Territory foraged, on average, 1.9km from their day roost, with a mean foraging area of 61 ha. This species detects prey using eyes and ears rather than using echolocation, and changes vantage points about every 15 minutes during foraging periods, with a mean distance of 360 m between them. It is an obligate troglodyte, and survival is critically dependent on finding natural roosts in caves, crevices, deep overhangs, and artifical roosts such as abandoned mine adits (Hall *et al*. 1997). Threats include disturbance and loss of roosting sites due to mining, tourism and internal dereliction of mines through aging of timber supports (Hall *et al*. 1997). In recent times population declines could be attributable to competition for prey with foxes, feral cats, and prey lost through habitat modification by fire and livestock (Environment Australia 1999).

Likelihood of Occurrence

This species was not detected by analysis of echolocation calls from this survey, although numerous other bats were, so it is not abundant. There are several records within 20 km to north, south and east of the Flying Fish study area (DEC 2011b), and suitable roost caves are likely to exist in the hills and escarpments. Ghost Bats are likely to be present, at least intermittently, in any part of the study area.

Potential Impacts

Some impact may occur through clearing (reduction of foraging area) and mining operations (eg roadkill, impact of artificial light).

***Rhinonicteris aurantia* (Pilbara Leaf-nosed Bat)**

Conservation status

WC Act VU

Distribution and Preferred habitat

The Pilbara Leaf-nosed Bat is an isolated population of a species (Orange Leaf-nosed Bat or Orange Horseshoe Bat) that also occurs from the Kimberley to north-west Queensland. This species has very specific requirements for roosting caves, which need to provide a stable, hot and very humid environment (Van Dyck & Strahan 2008). Pilbara populations are divided into three discrete subpopulations (eastern Pilbara mines and granite, Hamersley Range, Upper Gascoyne), separated by relatively flat areas that impede gene flow such as the Fortescue and Ashburton valley. Many records of the species in the region are of bats in flight or roadkills, so the number of distinct roosts is not known. The roosting site is often at depth, in mines, small crevices within caves (usually those ascending between sedimentary rock layer), and with associated groundwater seeps (Armstrong 2001). Simple vertical shafts are not used, and shallow caves beneath mesa bluffs are also unlikely roost sites. Suitable roosting conditions (high temperature and humidity) are likely to be more broadly available in the wet season, allowing greater dispersal at this time.

Ecology

Typically, the Pilbara Leaf-nosed Bat flies low in the open spaces in watercourses and gorges, and over *Triodia* grassland, sometimes within centimetres of the ground, but up to 2–3 m in height. It feeds on a range of insects, but mainly moths. Feeding is mainly close to roost sites, the bat returning to the roost several times during the night between feeding flights. This species is very sensitive to even slight human disturbances. If subject to continual human interference it may completely abandon a roost. It often shares roosts with the Ghost Bat, *Macroderma gigas,* Finlayson's Cave Bat, *Vespadelus finlaysoni,* Common Sheath-tailed Bat, *Taphzous georgianus*, and possibly Hill's Sheath-tailed Bat, *Taphozous hilli,* in some parts of its range. Consequently, any management strategy that benefits the Pilbara Leaf-nosed Bat is also likely to benefit these species (Armstrong 2001; Churchill *et al*. 1988; DSEWPaC 2012).

Likelihood of Occurrence

This species was not detected by analysis of echolocation calls from this survey, although numerous other bats were. There are records from the eastern and western Hamersley but few from the central section (DEC 2011b), and no indication of deep horizontal caves providing suitable roosts was observed in this survey. It is therefore unlikely that the species occurs as a resident, but it may be able to utilize rocky and woodland areas during part of the year.

Potential Impacts

Little or no impact is likely to occur to this species, probably limited to small numbers of individuals using the study area during dispersal in the wet season.

***Leggadina lakedownensis* (Northern Short-tailed Mouse, Lakeland Downs Mouse)**

Conservation status

DEC *P4*

Distribution and Preferred habitat

This native rodent (Muridae) is a nocturnal species found in areas of open tussock and hummock grassland, acacia shrubland, and savanna woodland, on alluvial clay or sandy soils. The population is rare and scattered on the mainland with large annual fluctuations that may not correlate with environmental fluctuations or seasonality (Moro & Kutt 2008).

Ecology

Females give birth to two litters annually. Litters contain up to four young and the gestation period lasts about 30 days. No major or general threats have been identified (IUCN 2011).

Likelihood of Occurrence

There are *NatureMap* (DEC 2011b) records of this species adjacent to the eastern end of the study area and others to the north and south, so it is likely to occur on the site, especially along the river valleys where clay and sandy soils with *Acacia* shrubland represent suitable habitat.

Potential Impacts

Given the patchy and fluctuating population, any impact would be very difficult to measure but some may occur due to clearing and operations. Any impact would be minor in proportion to the area affected, as suitable habitat is extensive in the region.

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

Conservation status

DEC P4

Distribution and Preferred habitat

This native rodent (Muridae) is common in many parts of the Pilbara. The species is restricted to non-coastal, central and eastern parts of the Pilbara, Western Australia, although it was formerly more widespread (IUCN 2011). Abandoned mounds found in the Gascoyne and Murchison districts indicate a recent decline in distribution, most likely due to fox and feral cat predation. The species does however appear secure in its remaining range (Start 2008). This species occurs across the central and southern Pilbara and into smaller ranges of the Little Sandy Desert. The preferred habitat is gentle slopes of rocky ranges (comprising tops as well as lower slopes of hills) sparsely vegetated by *Triodia* grasses, *Senna, Acacia* and *Ptilotus* species.

Ecology

This species lives in small family groups in burrows below mounds of pebbles. Each mouse utilises and maintains several mounds, and active mounds are identifiable by structural features and absence of vegetation, but remain recognisable for some time once abandoned (Anstee 1996). Females can produce several litters of four young annually. There appear to be no major threats to this species. The reasons for its elimination from the southern portion of its range are unclear, but may have been related to predation by feral cats and foxes. Mining may be a localized threat (Anstee *et al.* 1997), but this would not significantly affect the overall population size (IUCN 2011). Diet has not been reported, but likely to be mainly seeds, with some leaves and invertebrates.

Likelihood of Occurrence

Inactive mounds observed in the study area indicate recent presence; the species is recorded throughout the Pilbara (DEC 2011b) and is likely to be resident.

Potential Impacts

Any impacts from the proposal are unlikely to be significant for this species due to the low density of populations and extensive known distribution of habitat across the region.

BIRDS

***Apus pacificus* (Fork-tailed Swift)**

Conservation status

EPBC Act Migratory

Distribution and Preferred habitat

In Australia the Fork-tailed Swift (Apodidae) mostly occurs over dry and open inland plains, but also over a wide variety of land and marine habitats. In Western Australia, it is considered uncommon to moderately common near the north-west, west and south-east coasts, common in the Kimberley and rare or scarce elsewhere (Johnstone & Storr 1998). Some birds have been sighted in Western Australia arriving from Indonesia between October–November. Flocks have been recorded near

Broome on southward passage across the continent. In north and north-west Western Australia, most birds have departed by the end of April.

Ecology

A non-breeding visitor, this bird feeds on flying insects and is almost exclusively aerial in habits, flying from less than 1 m to at least 300 m above ground and probably much higher (Simpson & Day 2004). Fork-tailed Swifts are nomadic and typically respond to broad-scale weather pattern changes. They are attracted to thunderstorms and cyclonic disturbances where they can be seen in flocks hawking insects from the storm fronts with numbers ranging from a few individuals to flocks of up to 2,000 birds. There are no significant threats to the Fork-tailed Swift in Australia (DSEWPaC 2011b).

Likelihood of Occurrence

Fork-tailed Swifts were not observed on this survey but there are numerous records from the central Hamersley (DEC 2011b) and it would certainly occur in the study area. The species is likely to seasonally visit the area to forage.

Potential Impacts

No impact is likely to occur because of the bird's nomadic aerial habits.

***Ardea modesta* (Eastern Great Egret)**

Conservation status

EPBC Act Migratory

Distribution and Preferred habitat

Eastern Great Egrets (Ardeidae; listed by DEC as *Ardea alba modesta*) are widespread in Australia, occurring in a wide range of wetland habitats and breeding (November to April, depending on rainfall) in colonies in wooded and shrubby swamps.

Ecology

Eastern Great Egrets feed on a wide range of invertebrates and small vertebrates including birds, reptiles and small mammals. The species undertakes some regular seasonal movements, mostly to and from breeding colonies, and towards the coast in the dry season. Regional differences in reporting rates suggest that individuals migrate north to winter in tropical northern Australia, consistent with changes in the availability of suitable wetland habitat. Regular migration to locations outside of Australia is suspected but not confirmed. Threats include loss and/or degradation of foraging and especially breeding habitat through alteration of water flows, drainage and/or clearing of wetlands for development, frequent burning of wetland vegetation used as nest sites, salinisation, and invasion by exotic plants or fishes (DSEWPaC 2011b).

Likelihood of Occurrence

There are few records of Great Egret in the Hamersley IBRA subregion relative to nearby subregions (DEC 2011b); it was not recorded during this survey, and no suitable wetland habitat was present in the study area. However, it is likely to visit the study area when surface water is present after sufficient rainfall.

Potential Impacts

Impact on this species may occur through reduction of wet-season foraging area, but this is unlikely to be significant at the population level because of the large area of similar habitats available in the region.

***Ardea ibis* (Cattle Egret)**

Conservation status

EPBC Act Migratory

Distribution and Preferred habitat

The Cattle Egret (Ardeidae) is a relatively recent colonist of Australia (from 1948) from Asia, and occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands. The main areas of distribution are from Wyndham (WA) to Arnhem Land (NT), and in south-eastern Australia, but there are scattered records in other areas; it remains extremely rare in arid and semi-arid regions (DSEWPaC 2011b). It uses predominately shallow, open and fresh wetlands including poorly drained pastures and swamps with tall grass, abundant aquatic flora and emergent vegetation. It has been recorded on earthen dam walls and ploughed fields, and is commonly associated with the habitats of farm animals (particularly cattle, but also pigs, sheep, horses and deer) but avoids low grass pastures.

Ecology

The Cattle Egret feeds mostly on grasshoppers during the breeding season. It is, however, known to consume other insects including cicadas, centipedes, spiders, cattle ticks, frogs (including cane toads), lizards (particularly skinks) and small mammals (Marchant & Higgins 1990). The Cattle Egret is known to follow earth-moving machinery and has been located at rubbish tips. Breeds in colonies in wooded swamps such as mangrove forests (e.g. the lower Adelaide River, Northern Territory), Melaleuca swamps (e.g. Shortland, NSW) and the eucalypt/lignum swamps of the Murray-Darling Basin. They may breed in artificial situations or close to urban areas; generally the nesting trees are inundated except where breeding on small islands. Nests are sited usually in middle to upper branches (Marchant & Higgins 1990). No major threats, but individuals are susceptible to predation by feral Cats when roosting on the ground or in low vegetation.

Likelihood of Occurrence

In the Pilbara there are only a few records, from Fortescue Marsh, and Ophthalmia Dam near Newman (DEC 2011b), and no breeding is reported in this area. Cattle Egrets have not been recorded within 200 km of the study site and are unlikely to occur regularly. May visit the site as a vagrant after major rainfall events.

Potential Impacts

No impact is likely.

***Haliaeetus leucogaster* (White-bellied Sea-Eagle)**

Conservation status

EPBC Act M

Distribution and Preferred habitat

A large raptor (Accipitridae) distributed mainly along coastlines, offshore islands and large inland waterways, with breeding only in limited areas of its range; it also occurs around freshwater swamps, lakes, and reservoirs. It is common and widespread in much of southern Asia, but has declined in some areas including Australia.

Ecology

Feeds on a wide variety of fish, crustaceans, turtles, waterbirds, and terrestrial vertebrates including carrion. Breeding occurs in tall open forest or woodland. The main threats are loss of habitat due to land development, and the disturbance of nesting pairs by human activity (DSEWPaC 2011b).

Likelihood of Occurrence

White-bellied Sea-Eagles are recorded along the lower Fortescue River, and there are also records on Fortescue Marsh, and Ophthalmia Dam near Newman, but are not known to extend into the Hamersley Range (DEC 2011b). This species is unlikely to occur near the study site.

Potential Impacts

No impact to this species is likely.

***Falco hypoleucos* (Grey Falcon)**

Conservation status

DEC P4

Distribution and Preferred habitat

Grey Falcons are a rare, nomadic species sparsely distributed across much of arid and semi-arid Australia; sightings are very uncommon, but coastal sightings may occur in drought years. Occurs in a wide variety of arid habitats including open woodlands and open acacia shrubland, hummock and tussock grasslands, low shrublands and may also be seen around swamps and waterholes that attract prey (Ehmann & Watson 2008). Grey Falcons once occurred across much of Western Australia, with sightings as far south as York and New Norcia during colonial times. However, the current distribution is now thought to be restricted to north of 26°S (Johnstone & Storr 1998), ie the latitude of Shark Bay and the SA-NT border. The distribution of the Grey Falcon is centred on inland drainage systems. It prefers areas of timbered lowland plains, particularly *Acacia* shrublands that are crossed by tree-lined watercourses. However, it may also frequent other grassland and woodland habitats (IUCN 2011).

Ecology

Grey falcons feed on a wide variety of birds, but most often on ground-feeding parrots and pigeons, as well as some snakes, lizards, and grasshoppers. They use the nests of crows, kites or eagles, most often placed in upper branches of emergent eucalypts, often on a tree-lined watercourse, and eggs are laid between July and October (Ehmann & Watson 2008; Olsen & Olsen 1986).

Likelihood of Occurrence

The Grey Falcon was not recorded during the field survey. There are previous records in the central but not western Hamersley (DEC 2011b), but suitable foraging and nesting habitat exists at the study site (*Acacia* shrublands and tree-lined creeklines) and it may occur sporadically.

Potential Impacts

Impact is likely to be very minor due to the low density of population and ability to relocate to unaffected areas.

***Falco peregrinus* (Peregrine Falcon)**

Conservation status

WC Act (1950) *Schedule 4*

The Bonn Convention defines as Migratory, "any species or lower taxon…, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries." The EPBC Act (1999) includes as Migratory all taxa listed in Appendix II of the Bonn Convention, including "All species in the family Falconidae for which Australia is a Range State" (Department of the Environment and Heritage 2001). However, these criteria are now applied at the level of subspecies or population; the two subspecies of *F. peregrinus* that occur in Australia (out of 19 worldwide) do not regularly cross borders, and the EPBC Act is not applied to them (Debus 2009). Thus, this species is not listed on recent PMST results, although it would have been in previous years (up to about 2009).

Distribution and Preferred habitat

This species (Falconidae) is uncommon but wide-ranging throughout Australia, preferring areas with rocky ledges, cliffs, watercourses, open woodland or margins with cleared land.

Ecology

Feeds almost exclusively on birds (including pigeons, parrots and passerines) which are captured in flight, but rarely takes mammals (eg possums, rabbits) (Olsen *et al.* 2008). Ledges, cliff faces, large tree hollows and spouts, or abandoned nests of other raptors are used for nesting.

Likelihood of Occurrence

Individual Peregrine Falcons are occasionally sighted throughout the region (DEC 2011b) and would certainly use the study area at least for foraging. Abundant cliffs, large trees along watercourses that may contain hollows, or stick-nests of other raptor species (eg Australian Kestrel, Wedge-tailed Eagle) are likely to provide suitable nesting sites.

Potential Impacts

Impacts on adult individuals or foraging habitat are not likely to be significant, but destruction of tree hollows or existing nests of other birds could affect value of the habitat for breeding, especially if any are in use by this species. Impact is likely to be minor due to low density of population and ability to relocate to unaffected areas.

***Ardeotis australis* (Australian Bustard)**

Conservation status

DEC P4

Distribution and Preferred habitat

The Australian Bustard (Otididae) typically occurs in open country, preferring grasslands, low shrublands, grassy woodlands and other structurally similar but artificial habitats such as croplands

and airfields. There has been a large historical decline in abundance, particularly south of the tropics, but to a smaller extent across northern Australia where it remains moderately common (Garnett & Crowley 2000).

Ecology

Bustards (Otididae) are large, nomadic, partly nocturnal birds with an omnivorous diet comprising seeds, fruit, vegetation, invertebrates and small vertebrates. Numbers of Australian Bustard present in any particular area fluctuate with the availability of food with seasons and following irregular rainfall, and variation between regions in timing and duration of residence and breeding activity has been documented (Ziembicki & Woinarski 2012). Decline is attributed to hunting, degradation of grassland habitat by sheep and rabbits, predation by foxes and cats, and thickening of vegetation due to overgrazing or lack of fire (Garnett & Crowley 2000; Schodde & Tidemann 1986). As ground nesters, they are particularly vulnerable to fire in the nesting season, and readily desert nests in response to disturbance by humans, sheep or cattle (Garnett & Crowley 2000).

Likelihood of Occurrence

One Australian Bustard was sighted in this survey, and they are likely to occur in much of the study area, particularly in grassland habitats (including open to sparse woodland and shrubland).

Potential Impacts

Some increased mortality and reduction in foraging range can be expected as a result of mining, but impact is likely to be minor due to the nomadic habits of this bird and large contiguous areas of habitat.

Burhinus grallarius **(Bush Stone-curlew)**

Conservation status

DEC P4

Distribution and Preferred habitat

While this bird, also known as the Bush Thick-knee (Burhinidae) is found in all mainland states, it is sparsely distributed and continues to decline. Historically the species was widely distributed throughout much of Western Australia but is now considered rare, with an estimated population of 15,000 individuals (Garnett & Crowley 2000). It prefers grassy woodlands with low, sparse grassy or herb understorey.

Ecology

The species is insectivorous, preying primarily upon beetles, although they will also eat seeds and shoots, frogs, lizards and snakes (Marchant & Higgins 1993). Activity is mainly nocturnal, especially on moonlit nights (NSW National Parks and Wildlife Service 1999). Breeding takes place mainly from August to January, but at any time of year depending on local conditions. They are usually seen in pairs, but sometimes form flocks. Branches on the ground are essential for the bird's camouflage, and it is unlikely to attempt nesting without it (Department of Sustainability and Environment (Victoria) 2005). Since Bush Stone-curlews are a ground dwelling and non-migratory species they are quite susceptible to local disturbances by humans and to predation by cats and foxes (Frith 1976;

Johnstone & Storr 1998). They are most common where land disturbance is minimal and generally become rare or extinct around human settlements (Johnstone & Storr 1998).

Likelihood of Occurrence

There are records from a few kilometres to the north and south (DEC 2011b), and this species is likely to occur on the site, especially along the river valleys. However, the bird is relatively easy to detect by its loud and distinctive calls (usually at night), so the lack of closer and more recent reports suggests low abundance in the area.

Potential Impacts

Increased traffic, clearing of shrubland/woodland habitat, and mining activity along this river valley could therefore have some impact on the local population. Adult birds are able to move away from disturbances, but disruption of breeding due to disturbance of logs and branches on the ground could be the most significant impact.

***Charadrius veredus* (Oriental Plover)**

Conservation status

EPBC Act M

Distribution and Preferred habitat

The Oriental Plover (Charadriidae) breeds in Mongolia and adjacent parts of Manchuria and Siberia, and spends the non-breeding season (September to March) in northern Australia, in both coastal and inland areas. Most records are along the north-western coast, between Exmouth Gulf and Derby in Western Australia. Immediately after arriving, Oriental Plovers spend a few weeks in coastal habitats before dispersing further inland to flat, open, semi-arid or arid grasslands, particularly locations with short, sparse grass interspersed with hard, bare ground, such as claypans, dry paddocks, lawns, cattle camps, or recently burnt grasslands. Saltmarsh and mudflats are also used for feeding and roosting.

Ecology

Diet poorly known, but includes various insects. Often feeds in mixed flocks with other waterbirds, and sometimes at night. This species is not considered globally threatened (DSEWPaC 2011b).

Likelihood of Occurrence

There are very few records in the Hamersley Range (DEC 2011b), the species was not recorded in this survey, and no suitable habitat appears to exist in the study area currently. Temporarily attractive conditions would exist after grassland fires and it may occur sporadically.

Potential Impacts

Little or no impact is likely due to the low density of occurrence in the area and ability to relocate to unaffected areas.

***Charadrius veredus* (Oriental Plover)**

Conservation status

EPBC Act M

Distribution and Preferred habitat

The Oriental Plover (Charadriidae) breeds in Mongolia and adjacent parts of Manchuria and Siberia, and spends the non-breeding season (September to March) in northern Australia, in both coastal and inland areas. Most records are along the north-western coast, between Exmouth Gulf and Derby in Western Australia. Immediately after arriving, Oriental Plovers spend a few weeks in coastal habitats before dispersing further inland to flat, open, semi-arid or arid grasslands, particularly locations with short, sparse grass interspersed with hard, bare ground, such as claypans, dry paddocks, lawns, cattle camps, or recently burnt grasslands. Saltmarsh and mudflats are also used for feeding and roosting.

Ecology

Diet poorly known, but includes various insects. Often feeds in mixed flocks with other waterbirds, and sometimes at night. This species is not considered globally threatened (DSEWPaC 2011b).

Likelihood of Occurrence

There are very few records in the Hamersley Range (DEC 2011b), the species was not recorded in this survey, and no suitable habitat appears to exist in the study area currently. Temporarily attractive conditions would exist after grassland fires and it may occur sporadically.

Potential Impacts

Little or no impact is likely due to the low density of occurrence in the area and ability to relocate to unaffected areas.

***Neochmia ruficauda subclarescens* (Star Finch [western])**

Conservation status

DEC P4

This subspecies is listed as Least Concern (Garnett *et al*. 2011), but conservation categories may not provide sufficient information about actual status. The Cape York subspecies (*N. r. clarescens*) is Near Threatened, but is not listed by federal or state statutes as it has been recognized as a separate subspecies for only a few years; some Pilbara survey records are identified as that form, in error. The southern or eastern subspecies *N. r. ruficauda* is listed under the EPBC Act as EN, but Garnett *et al*. (2011) consider it Critically Endangered, possibly extinct.

Distribution and Preferred habitat

Star Finches (Estrildidae) live in reedbeds, grasslands and eucalypt woodland close to water. The western subspecies has three sub-populations: 1. Shark Bay to Pilbara, 2. Fitzroy River valley, West Kimberley, and 3. Gibb River to Gulf of Carpentaria.

Ecology

A seed-eater like most other 'finches'; reported to feed on seeds of sedges (*Cyperus* sp.) and Buffel Grass (*Cenchrus ciliaris*), but also insects during the breeding season. Birds tend to be resident in large flocks close to permanent waterways during the dry season, and disperse to breed during the wet season. The main threat is thought to be overgrazing of grasslands near water; the species may also require mosaic burning to maintain food supply.

Likelihood of Occurrence

There are scattered records of this species through the Hamersley (DEC 2011b), though it was not recorded in any of the recent survey reports consulted. It was not recorded in this survey and is unlikely to occur in the study area during the dry season due to the limited availability of surface water. Wet season surveys would be required to determine whether breeding sites occur.

Potential Impacts

Any impact is likely to be restricted to wet season breeding habitat, when the birds are dispersed from colonies and thus able to relocate to avoid disturbance, so considered minor.

REPTILES

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

Conservation status

EPBC Act VU, WC Act S1, DEC VU

Distribution and Preferred habitat

The Pilbara subspecies of the Olive Python (Pythonidae) only occurs in the ranges of the Pilbara region of Western Australia, and islands of the Dampier Archipelago. It inhabits watercourses and areas of permanent water in rocky gorges and gullies (Pearson 2003). The Pilbara subspecies was reported from nine localities when first described (Smith 1981) and listed as Threatened in WA soon afterward, but many more locality records have accumulated subsequently (Pearson 1993) and it has been considered "Not threatened, or likely to be. Shouldn't be on list, common and widespread" (Kendrick 2002). The species is considered stable and in sizable numbers at some known sites (Pearson 2003).

Ecology

This subspecies is an adept swimmer, often hunting in water, feeding on a variety of vertebrates including rock wallabies, fruit bats, ducks, and pigeons. Individuals may be sedentary (with a discrete home range associated with water) for most of the year, but can move several kilometres through rocky hills in some seasons, e.g. during June and July males may travel long distances to locate females for breeding (Pearson 2003; Wilson & Swan 2008)). Individuals spend the cooler winter months sheltering in caves and rock crevices. In the warmer months the pythons can move widely, usually in close proximity to water and rock outcrops (DEWHA 2008). In late winter or early spring males will travel large distances to find and mate with females.

They are mostly found close to permanent waterholes, not because they need to drink frequently but because their prey does. They are most often seen at night and are generally found around rocky areas, rocky outcrops and cliffs, but they also shelter in logs, flood debris, caves, tree hollows and thick vegetation. Juvenile Olive Pythons feed on small reptiles and (probably) frogs as well as small mammals, shifting to birds and medium-sized mammals (e.g. quolls, rock-wallabies) as adults, which may grow to at least 4 m.

Population size estimates are difficult due to the species cryptic nature and lack of a reliable trapping or census method (DEWHA 2008). The main threats to this subspecies come from predation from feral cats and foxes, particularly of juveniles, loss of suitable prey species (e.g. due to Fox in coastal

areas), and accidental or deliberate killing of individual snakes, especially roadkill (Pearson 2003). Cane Toads (*Chaunus marinus*), which are likely to reach parts of the Pilbara in the next decade, may also cause the death of some individual young snakes. However, the continued abundance of Olive Pythons in the Queensland Gulf Country indicates that neither direct human action (associated with the long-established mining and pastoral industries there), nor Cane Toads, constitute a major threat to survival where toads have been present for over two decades.

Likelihood of Occurrence

There are numerous NatureMap records of the Pilbara Olive Python from the Hamersley Range (DEC 2011b). No signs of this species were detected in this survey, but it is likely to be present, with individuals possibly moving seasonally between the river valley and sheltered gorges. Feeding opportunities may be limited by the lack of permanent water, but the presence of Euro, Rock Rats and other mammals indicates that resources to support Olive Pythons currently exist.

Potential Impacts

Increased traffic, clearing and excavation along the drainage lines could have some impact on local populations, which could be significant if it affects sites important for feeding and breeding.

***Notoscincus butleri* (Lined Soil-crevice Skink)**

Conservation status

DEC P4

Distribution and Preferred habitat

This species of skink was described based on a single specimen from Dampier (Storr 1979) [as distinct from Dampierland, a potential source of confusion], then reported from the Harding River dam (Lake Poongkaliyarra) (Storr *et al.* 1999), but is now also known from numerous localities in the western Hamersley ranges (NatureMap). It is associated with rocky and spinifex-dominated areas near creek and river margins (Wilson & Swan 2008).

Ecology

Small, secretive diurnal skink that basks and forages among leaf litter and close to low vegetation; egg-laying, feeds on small invertebrates (Wilson & Swan 2008).

Likelihood of Occurrence

There are records both north and south of Flying Fish (DEC 2011b) so it is likely to occur in suitable habitat along creeks and drainage lines in the study area.

Potential Impacts

Clearing, traffic, and excavation along the valley may have some impact on local populations.

***Ramphotyphlops ganei* (Pilbara Blindsnake)**

Conservation status

DEC P1

Distribution and Preferred habitat

This species of Blindsnake (Typhlopidae) occurs at widely scattered sites in the Pilbara, including the eastern and western Hamersley, Fortescue valley, and Chichester range (Aplin 1998; DEC 2011b). It

appears to be associated with moist areas such as gorges, gullies and floodplains, though there is a record from sandy soil with spinifex (WAM record cited by Ecologia 2010b).

Ecology

Like most other typhlopids it presumably feeds on eggs, larvae and pupae of ants, and individuals are likely to mostly inhabit the topsoil, termitaria and ant nests (Webb & Shine 1993). Typhlopids emerge only at night and follow chemical trails to locate food sources and mates, and are most often seen active or trapped in warm, humid conditions.

Likelihood of Occurrence

This species has not been recorded in the vicinity but may occur in the study area, especially in sheltered gullies such as those cutting through the hills and escarpment north of the river valley.

Potential Impacts

Impact on this species would be very difficult to measure but would be minimized by avoiding disturbance to such gully sites, and is likely to be minor in any case because it is broadly distributed within the Pilbara.

AMPHIBIANS

***Chaunus marinus* (Cane Toad)**

Conservation status

EPBC Act Key Threatening Process: '*The biological effects, including lethal toxic ingestion, caused by Cane Toads (Bufo marinus)'*

Distribution and Preferred habitat

Cane Toads (formerly *Bufo marinus*, Bufonidae) have not become established in the Pilbara but are present in the eastern Kimberley and their range is expected to continue expanding westwards, both on the ground (at approximately 30 km per year) and over longer distances through accidental transport (eg in or under shipping containers, or with potted plants, soil or building materials). Potential distribution has been modeled based on the requirements of adult toads, eggs and larvae with regard to water availability and temperature (Kearney *et al.* 2008); this model predicts that most of the Pilbara can be occupied, and that the Great Sandy Desert is not a barrier to expansion. There is also evidence that adaptation to local conditions has occurred at fast (measurable) rates during range expansion, so that the area of distribution projected from previous occurrences increases over time (Phillips *et al*. 2008; Urban *et al*. 2007).

Ecology

The Cane Toad is a large terrestrial anuran that preys on arthropods, molluscs and small vertebrates, and produces extremely toxic secretions from glands in the skin (also present in eggs and larvae). Native predators attempting to eat toads usually die immediately, and this has had major impacts on freshwater crocodiles, large elapid snakes, varanid lizards, and marsupial carnivores within the current area of toad distribution. Adult toads are long-lived, so populations are able to occupy areas where breeding fails in most years due to lack of surface water (DEWHA 2010).

Likelihood of Occurrence

'Toad-busting' and biological control are not considered likely to prevent continued range expansion, and the focus now is on 'protecting our most vulnerable native species on a local scale' (DSEWPaC 2011b). Thus, it must be assumed that Cane Toads will reach the Pilbara within a few decades (by range expansion along the coast) or considerably sooner (by accidental introduction) and then spread within it to all available habitat.

Potential Impacts

Establishment of Cane Toads in the Pilbara would have a severe impact on some vertebrate populations, particularly Northern Quoll. Even if toads could not normally become established if introduced to the study area (e.g. due to ephemeral waterholes, high evaporation rates, temperature extremes; Kearney *et al.* 2008), there is a risk that the presence of mine infrastructure and increased use of water on site would create more favourable conditions for their breeding and survival. The incremental risk from this project (set against risks arising from existing development and tourism) must be considered quite low, but is reducible by efforts to avoid accidental transportation of toads and prevent their access to water sources (eg Florance *et al.* 2011).

FISH

***Leiopotherapon aheneus* (Fortescue Grunter)**

Conservation status

DEC P4

Distribution and Preferred habitat

The Fortescue Grunter (Terapontidae) is endemic to the Pilbara region of Western Australia *(Allen et al.* 2002). The species has only been recorded from permanent water along the Fortescue, Robe and Ashburton drainage systems (Beesley 2006; Morgan *et al*. 2009).

Ecology

It occurs in slow to fast flowing streams and pools, and feeds on small crustaceans and juvenile fish, growing to a maximum length of 13 cm (Allen *et al.* 2002). When in suitable numbers the species displays schooling behaviour presumably as a defence mechanism (Morgan & Gill 2004).

Likelihood of Occurrence

This species is unlikely to occur within the study area at the current time. It is possible that Fortescue Grunter could move into the study area after cyclonic activity and flooding links permanent water bodies via drainage systems, but persistence would be unlikely as there are no permanent flowing watercourses.

Potential Impacts

No impact is likely.

5.3.2 EXTENT AND VULNERABILITY OF SIGNIFICANT HABITATS

Of the four habitats identified above (**Section 4.2.1**), the most restricted and potentially significant is EFF3 – sheltered gullies or gorges, which could provide habitat for Northern Quolls, Pilbara Olive Pythons and *Ramphotyphlops ganei* if they were present. The significance of this habitat on Flying Fish is reduced by the apparent absence of available water during the dry season, though there may

be small rockholes or seeps that were not detected, or humid caves within gullies that may provide habitat for bats, including Pilbara Leaf-nosed Bat and Ghost Bat. The gully or gorge habitats in the Flying Fish area are located as pockets within habitat EFF4 (exposed upper slopes and clifflines) and are likely to suffer little direct disturbance from mining activity concentrating on valley floors.

The EFF1 habitat could potentially be important for significant species. This habitat consists of creeklines and drainage lines on lower slopes and valley floors, river channels that extend between hills and adjacent areas of woodland/shrubland and tussock grassland. This is the most likely habitat for Rainbow Bee-eater, Bustard (both observed to be present), Bush Stone-curlew, and Northern Short-tailed Mouse. During the wet season this might also provide breeding habitat for Star Finch. This habitat may potentially be disturbed within the tenement as a result of mining activity, howerver the fauna species that could be affected remain widely distributed and are currently at a lower level of conservation concern.

Habitats EFF2 and EFF4 are more open areas on lower and upper slopes with hard Spinifex and scattered trees, together with exposed clifflines. The slopes provide habitat for Pebble-mound Mouse and Long-tailed Dunnart, however similar habitats are very extensive and connected throughout the region so that little impact is likely to occur.

5.3.3 FAUNA CONCLUSIONS

The three species of highest conservation significance, based on their listing in both the *WC Act* 1950 and the *EPBC Act* 1999, are:

- *Dasyurus hallucatus* (Northern Quoll) - EN
- *Rhinonicteris aurantia* (Pilbara Leaf-nosed Bat) - VU
- *Liasis olivaceus barroni* (Pilbara Olive Python) - VU.

None of these were recorded during the Level 1 survey or the targeted Northern Quoll survey undertaken in July-August 2011. There is suitable habitat present for each of these species within the study area, but Northern Quoll and Pilbara Leaf-nosed Bat can be inferred not to occur at the present time, though they may use the site in some years or seasons. Presence of Pilbara Olive Python is more likely to be undetected, and this species may be resident. Further more detailed survey would be required to confidently exclude the presence of these species in the Flying Fish study area.

Of the bird species listed under the *EPBC Act* as Migratory in **Table 4**, *Apus pacificus* (Fork-tailed Swift) and *Merops ornatus* (Rainbow Bee-eater) occur in the study area and the others are likely or possible transient visitors. None of them are likely to be significantly impacted by disturbance.

The following *WC Act* Schedule 4 and DEC Priority fauna species are known or likely to occur in the study area, but potential impact of the project is considered to be minor and local: *Macroderma gigas* (Ghost Bat, P4), *Leggadina lakedownensis* (Northern Short-tailed Mouse, P4), *Pseudomys*

chapmani (Western Pebble-mound Mouse, P4), *Falco hypoleucos* (Grey Falcon, P4), *Falco peregrinus* (Peregrine Falcon, *WC Act* S4), *Ardeotis australis* (Australian Bustard, P4), *Burhinus grallarius* (Bush Stone-curlew, P4), *Neochmia ruficauda subclarescens* (Star Finch [western], P4), *Notoscincus butleri* (Lined Soil-crevice Skink, P4), and *Ramphotyphlops ganei* (Pilbara Blindsnake, P1).

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Maps

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RED HILL CREEK
ROBE RIVER
CAVES CREEK
SERPENTINE CREEK
DUCK CREEK
PINARRA CREEK
BOOLGEEDA CREEK
Mt Brockman Rd
Duck Creek Rd

Delphine
Mt Farquhar
Raven
Eliwanna
Flying Fish

Legend

River; Creek

Roads

Sealed Roads
Unsealed Roads
Western Hub Survey Areas

DAFWA Land Systems

BGD - Boolgeeda Land System - Stony lower slopes and plains below hill systems; not degraded or eroded.
BNY - Bonney Land System - Low rounded hills and undulating stony plains supporting soft spinifex grasslands.
BRO - Brockman Land System - Alluvial plains with cracking clay soils supporting tussock grasslands.
CPN - Capricorn Land System - Rugged hills and ridges on sedimentary rocks; poorly accessible, not degraded or eroded.
DOR - Dollar Land System - Stony plains supporting acacia shrublands.
HOY - Hooley Land System - Alluvial clay plains supporting a mosaic of snakewood shrublands and tussock grasslands.
JUR - Jurrawarrina Land System - Hardpan plains and alluvial tracts supporting mulga shrublands with tussock and spinifex grasses.
KLN - Kooline Land System - Rough, red shale hills and saline drainage floors; stony short grass forb pastures in poor to good condition; moderate erosion on drainage floors.
MCK - McKay Land System - Hills, ridges, plateaux remnants and breakaways of metasedimentary and sedimentary rocks supporting hard spinifex grasslands.
NEW - Newman Land System - Rugged ironstone ridges, plateaux and mountains; hard spinifex pastures in good to excellent condition; no erosion.
PAR - Paraburdoo Land System - Stony drainage floors and gilgai plains developed from basalt; snakewood with stony chenopod pastures in poor to fair condition; moderate erosion on drainage floors.
PLA - Platform Land System - Dissected slopes and raised plains supporting hard spinifex grasslands.
PRA - Prairie Land System - Undulating stony plains and granite hills supporting acacia-eremophila-cassia shrublands and minor soft spinifex grasslands
RIV - River Land System - Flood plains and terraces flanking major rivers and creeks; little pasture degradation or erosion.
ROB - Robe Land System - Low limonite mesas and buttes supporting soft spinifex (and occasionally hard spinifex) grasslands.
ROC - Rocklea Land System - Rugged basalt hills and dissected plateaux; poorly accessible, not degraded or eroded.
TAB - Table Land System - Low calcrete plateaux, mesas and lower plains supporting mulga and cassia shrublands and minor spinifex grasslands.
WNM - Wannamunna Land System - Hardpan plains and internal drainage tracts supporting mulga shrublands and woodlands (and occasionally eucalypt woodlands)
WON - Wona Land System - Basalt upland gilgai plains supporting tussock grasslands and minor hard spinifex grasslands

GDA 1994 MGA Zone 50

Map 1

Aug 2011

Western Hub Flora and Fauna Surveys

Land Systems

prepared for FORTESCUE METALS GROUP

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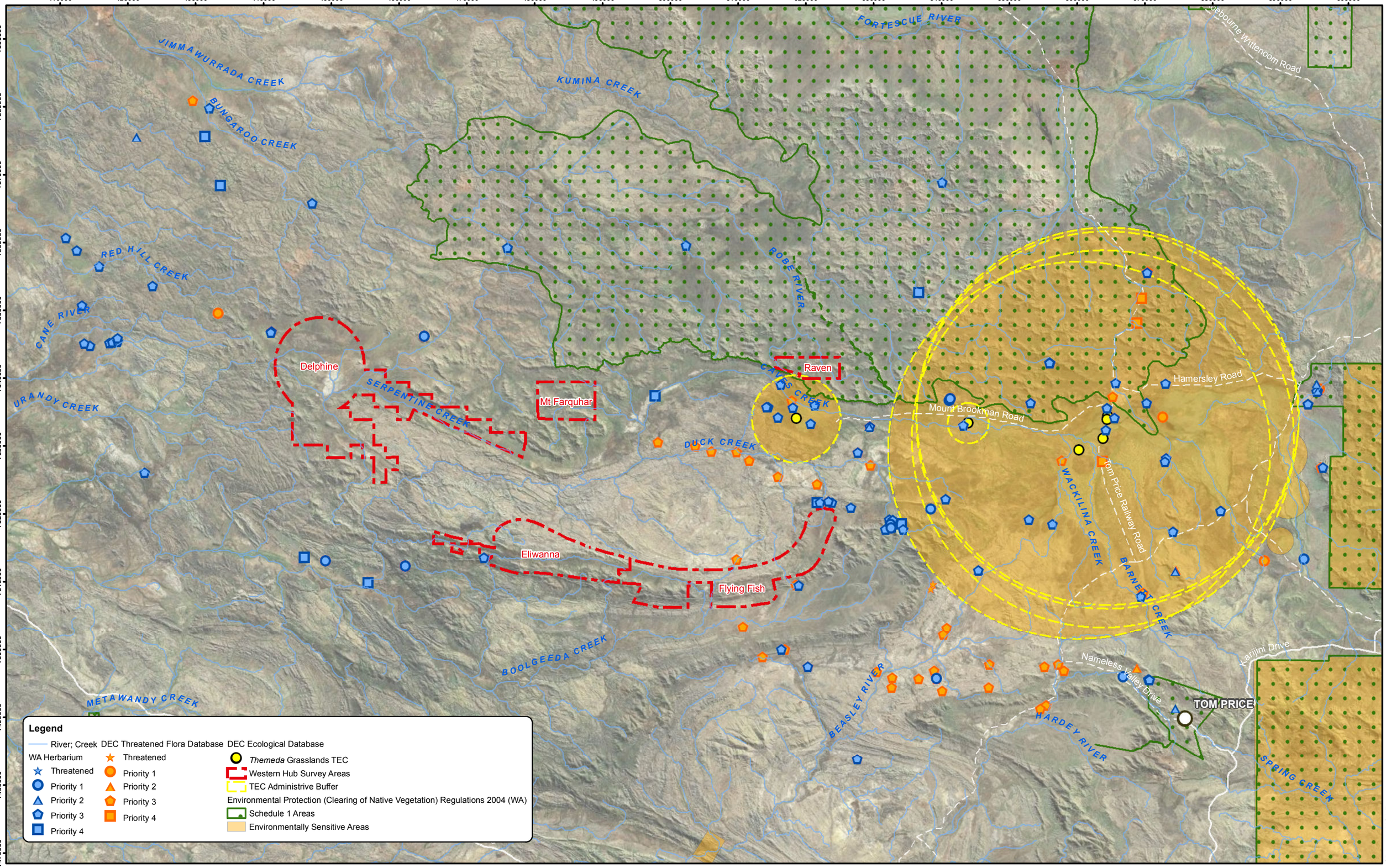
ecoscape



Legend

River; Creek

WA Herbarium
- Threatened
- Priority 1
- Priority 2
- Priority 3
- Priority 4

DEC Threatened Flora Database
- Threatened
- Priority 1
- Priority 2
- Priority 3
- Priority 4

DEC Ecological Database
- *Themeda* Grasslands TEC
- Western Hub Survey Areas
- TEC Administrive Buffer

Environmental Protection (Clearing of Native Vegetation) Regulations 2004 (WA)
- Schedule 1 Areas
- Environmentally Sensitive Areas

Map 2

Aug 2011

Western Hub Flora and Fauna Surveys

DEC Database Search Results and Environmental Protection (Clearing of Native Vegetation) Regulation Areas

prepared for FORTESCUE METALS GROUP

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RED HILL CREEK
ROBE RIVER
SERPENTINE CREEK
CAVES CREEK
DUCK CREEK
PINARRA CREEK
BOOLGEEDA CREEK
BEASLEY RIVER
Mt Brockman Rd
Duck Creek Rd

Delphine
Mt Farquhar
Raven
Eliwanna
Flying Fish

82 565 569 18 175 178 29 567 103 157 580 588 568

Legend

River; Creek

Roads

Sealed Roads
Unsealed Roads
Western Hub Survey Areas

Pre-European Vegetation (DEC 2006)

Vegetation Association

18 : Low woodland; mulga (*Acacia aneura*)
29 : Sparse low woodland; mulga, discontinuous in scattered groups
82 : Hummock grasslands, low tree steppe; snappy gum over *Triodia wiseana*
103 : Hummock grasslands, shrub steppe; snakewood over soft spinifex and *Triodia wiseana*
157 : Hummock grasslands, grass steppe; hard spinifex, *Triodia wiseana*
175 : Short bunch grassland - savanna/grass plain (Pilbara)
178 : Hummock grasslands, grass steppe; hard spinifex, *Triodia basedowii*
181 : Shrublands; mulga and snakewood scrub
565 : Hummock grasslands, low tree steppe; bloodwood over soft spinifex
567 : Hummock grasslands, shrub steppe; mulga and kanji over soft spinifex and *Triodia basedowii*
568 : Hummock grasslands, shrub steppe; mulga and snakewood over *Triodia wiseana*
569 : Hummock grasslands, low tree steppe; bloodwood over soft spinifex and *Triodia wiseana*
580 : Mosaic: Shrublands; eremophila and cassia dwarf scrub / Hummock grasslands, grass steppe; hard spinifex (*Triodia wiseana*)

GDA 1994 MGA Zone 50

Map 3

Aug 2011

Western Hub Flora and Fauna Surveys

Vegetation Associations

prepared for FORTESCUE METALS GROUP

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Project No. 2668-11

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Is
Bb
Bb
Cc
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Vf
Emv
Emv
Emm
Is
Bb
Emm
Emv
Cc
Ab
Cc
Emv
Is

BOOLGEEDA CREEK

GDA 1994 MGA Zone 50

Legend

- River; Creek
- Eliwanna Survey Areas
- Introduced Flora

Species

- Bb *Bidens bipinnata* L.
- Cc *Cenchrus ciliaris* L.
- Vf *Vachellia farnesiana* (L.) Wight and Arn.

- Conservation Significant Flora (CSF)

Species

- Ab *Acacia bromilowiana* Maslin (P4)
- Emm *Eremophila magnifica* Chinnock subsp. *magnifica* (P4)
- Emv *Eremophila magnifica* subsp. *velutina* Chinnock (P3)
- Is *Indigofera* sp. Bungaroo Creek (S. van Leeuwen 4301) (P3)

Imagery supplied by FMG

Map 4

Aug 2011

Western Hub Flora and Fauna Surveys

Conservation Siginificant and Introduced Flora

prepared for FORTESCUE METALS GROUP

0 1 2 3 4 Kilometers

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ElTw
Tw
EgAaTe/ElAaTe
EFF11R39
ElAbTl
ExAaTe
AeTw
EgAaTe/ElAaTe
ElTw
Tw
AprTw
EFF11R35
EFF11R36
AaEfT?e
EFF11R49
ChAiTw
EvAcTt
EFF11R41
EFF11R40
EFF11R38
EFF11R37
CdAiTm
CdAiTm
EFF11R34
EvAcTt
ExAaTe
EFF11R32
AbTw2
EgAaTe/ElAaTe
EFF11R33
EsSaTw
EsSaTw
ElTw
EgAmTw
Tw
Tw
EvAcTt
Tw
EgAaTe/ElAaTe
ElAmTw
ExAaTe
EvAcTt
Map 5c
Map 5a
Map 5b
Overview Map

Legend

Releves
River; Creek
Flying Fish Survey Area

Vegetation Type

AaEfT?e: *Acacia aptaneura* and *A. pruinocarpa* woodland over *Eremophila forrestii* subsp. *forrestii* sparse shrubland over *Triodia ?epactia* open hummock grassland

AbTw1: *Acacia bivenosa, Acacia atkinsiana* and *Acacia sibirica* open shrubland over *Triodia wiseana* hummock grassland

AbTw2: *Acacia bivenosa, A. pruinocarpa and A. marramamba* open shrubland over *Triodia wiseana* and *Eriachne mucronata* open grassland

AeTw: *Acacia exilis, Acacia trudgeniana* and *Acacia inaequilatera* open shrubland over *Triodia wiseana* open hummock grassland

ApTw: *Acacia exilis, A. pruinocarpa* and *A. marramamba* open shrubland over *Triodia wiseana* open hummock grassland

AxEc: *Acacia xiphophylla* and *Acacia sibirica* tall open shrubland over *Eremophila cuneata, Maireana* sp. and *Rhagodia eremaea* low sparse shrubland

CdAiTm: *Corymbia deserticola* subsp. *deserticola* and *Eucalyptus leucophloia* subsp. *leucophloia* open woodland over *Acacia inaequilatera, A. pyrifolia* var. *pyrifolia, and A. atkinsiana* sparse shrubland over *Triodia* aff. melvillei and *Triodia wiseana* hummock grassland

ChAiTw: *Corymbia hamersleyana* and *E. leucophloia* subsp. *leucophloia* open woodland over *Acacia inaequilatera*, *A. bivenosa* and *Senna artemisioides* subsp. *oligophylla* sparse shrubland over *Triodia wiseana* hummock grassland with *Ptilotus auriculifolius* and *Aristida holathera* var. *holathera* sparse herbs and grasses

EgAaTe/ElAaTe: Mosaic of: *Eucalyptus gamophylla* woodland over *Acacia atkinsiana, Senna glutinosa* subsp. *glutinosa* and *A. exilis* sparse shrubland over *Triodia epactia* hummock grassland and *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* open woodland over *Acacia atkinsiana, A. ancistrocarpa* and *A. bivenosa* sparse shrubland over *Triodia epactia* hummock grassland

EgAmTw: *Eucalyptus gamophylla, Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* open woodland over *Acacia maitlandii, A. atkinsiana* and *A. monticola* open shrubland over *Triodia wiseana* hummock grassland

ElAbTl: *Eucalyptus leucophloia* subsp. *leucophloia* open woodland over *Acacia bivenosa, Senna glutinosa* subsp. *glutinosa* and *S. glutinosa* subsp. *pruinosa* sparse shrubland over *Triodia longiceps* and *T. wiseana* hummock grassland

ElAiTw: *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* open woodland over *Acacia inaequilatera* and *Acacia bivenosa* (spindly variant) sparse shrubland over *Triodia wiseana* hummock grassland

ElAmTw: *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* open woodland over *Acacia maitlandii, Senna glutinosa* subsp. *pruinosa* and *Ptilotus rotundifolius* sparse shrubland over *Triodia wiseana* hummock grassland

ElTw: *Eucalyptus leucophloia* subsp. *leucophloia* open woodland over *Acacia maitlandii, A. pruinocarpa* and *Grevillea wickhamii* open shrubland over *Triodia wiseana* hummock grassland

EsSaTw: *Eucalyptus socialis* subsp. *eucentrica* over *Senna artemisioides* subsp. *oligophylla, A. synchronicia* and *Stylobasium sphacelatum* sparse shrubland over *Triodia wiseana* and *T. longiceps* open hummock grassland

EvAcTt: *Eucalyptus victrix* and *E. xerothermica* woodland over *Acacia citrinoviridis, Gossypium robinsonii* and *Melaleuca glomerata* shrubland over *Themeda triandra, Triodia epactia, Enteropogon ramosus* and *Cyperus vaginatus* grassland/sedgeland

ExAaTe: *Eucalyptus xerothermica, Corymbia hamersleyana* and *Acacia aptaneura* woodland over *Acacia ancistrocarpa, Gossypium robinsonii* and *A. atkinsiana* open shrubland over *Triodia epactia, Themeda triandra* and *Chrysopogon fallax* grassland

Tw: *Triodia wiseana* hummock grassland with *Themeda* sp., *Gomphrena cunninghamii* and *Ptilotus auriculifolius* sparse tussock grasses and forbs

GDA 1994 MGA Zone 50

Imagery supplied by FMG

Map 5a

Aug 2011

Western Hub Flora and Fauna Surveys

Vegetation Types

prepared for FORTESCUE METALS GROUP

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Project No. 2668-11

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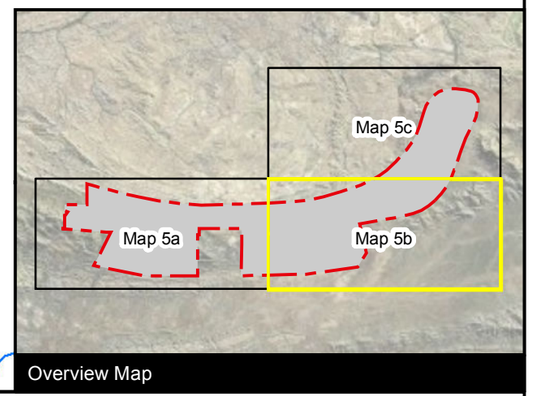
ChAiTw ExAaTe EvAcTt Tw AbTw1 ElTw EsSaTw EgAaTe/ElAaTe CdAiTm EgAmTw ElAmTw AxEc



Legend

- Releves
- River; Creek
- Flying Fish Survey Area

Vegetation Type

- AaEfT?e: *Acacia aptaneura* and *A. pruinocarpa* woodland over *Eremophila forrestii* subsp. *forrestii* sparse shrubland over *Triodia ?epactia* open hummock grassland
- AbTw1: *Acacia bivenosa, Acacia atkinsiana* and *Acacia sibirica* open shrubland over *Triodia wiseana* hummock grassland
- AbTw2: *Acacia bivenosa, A. pruinocarpa and A. marramamba* open shrubland over *Triodia wiseana* and *Eriachne mucronata* open grassland
- AeTw: *Acacia exilis, Acacia trudgeniana* and *Acacia inaequilatera* open shrubland over *Triodia wiseana* open hummock grassland
- ApTw: *Acacia exilis, A. pruinocarpa* and *A. marramamba* open shrubland over *Triodia wiseana* open hummock grassland
- AxEc: *Acacia xiphophylla* and *Acacia sibirica* tall open shrubland over *Eremophila cuneata, Maireana* sp. and *Rhagodia eremaea* low sparse shrubland
- CdAiTm: *Corymbia deserticola* subsp. *deserticola* and *Eucalyptus leucophloia* subsp. *leucophloia* open woodland over *Acacia inaequilatera, A. pyrifolia* var. *pyrifolia, and A. atkinsiana* sparse shrubland over *Triodia* aff. melvillei and *Triodia wiseana* hummock grassland
- ChAiTw: *Corymbia hamersleyana* and *E. leucophloia* subsp. *leucophloia* open woodland over *Acacia inaequilatera, A. bivenosa* and *Senna artemisioides* subsp. *oligophylla* sparse shrubland over *Triodia wiseana* hummock grassland with *Ptilotus auriculifolius* and *Aristida holathera* var. *holathera* sparse herbs and grasses
- EgAaTe/ElAaTe: Mosaic of: *Eucalyptus gamophylla* woodland over *Acacia atkinsiana, Senna glutinosa* subsp. *glutinosa* and *A. exilis* sparse shrubland over *Triodia epactia* hummock grassland and *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* open woodland over *Acacia atkinsiana, A. ancistrocarpa* and *A. bivenosa* sparse shrubland over *Triodia epactia* hummock grassland
- EgAmTw: *Eucalyptus gamophylla, Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* open woodland over *Acacia maitlandii, A. atkinsiana* and *A. monticola* open shrubland over *Triodia wiseana* hummock grassland
- ElAbTl: *Eucalyptus leucophloia* subsp. *leucophloia* open woodland over *Acacia bivenosa, Senna glutinosa* subsp. *glutinosa* and *S. glutinosa* subsp. *pruinosa* sparse shrubland over *Triodia longiceps* and *T. wiseana* hummock grassland
- ElAiTw: *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* open woodland over *Acacia inaequilatera* and *Acacia bivenosa* (spindly variant) sparse shrubland over *Triodia wiseana* hummock grassland
- ElAmTw: *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* open woodland over *Acacia maitlandii, Senna glutinosa* subsp. *pruinosa* and *Ptilotus rotundifolius* sparse shrubland over *Triodia wiseana* hummock grassland
- ElTw: *Eucalyptus leucophloia* subsp. *leucophloia* open woodland over *Acacia maitlandii, A. pruinocarpa* and *Grevillea wickhamii* open shrubland over *Triodia wiseana* hummock grassland
- EsSaTw: *Eucalyptus socialis* subsp. *eucentrica* over *Senna artemisioides* subsp. *oligophylla, A. synchronicia* and *Stylobasium sphacelatum* sparse shrubland over *Triodia wiseana* and *T. longiceps* open hummock grassland
- EvAcTt: *Eucalyptus victrix* and *E. xerothermica* woodland over *Acacia citrinoviridis, Gossypium robinsonii* and *Melaleuca glomerata* shrubland over *Themeda triandra, Triodia epactia, Enteropogon ramosus* and *Cyperus vaginatus* grassland/sedgeland
- ExAaTe: *Eucalyptus xerothermica, Corymbia hamersleyana* and *Acacia aptaneura* woodland over *Acacia ancistrocarpa, Gossypium robinsonii* and *A. atkinsiana* open shrubland over *Triodia epactia, Themeda triandra* and *Chrysopogon fallax* grassland
- Tw: *Triodia wiseana* hummock grassland with *Themeda* sp., *Gomphrena cunninghamii* and *Ptilotus auriculifolius* sparse tussock grasses and forbs

GDA 1994 MGA Zone 50

Imagery supplied by FMG

Map 5b

Aug 2011

Western Hub Flora and Fauna Surveys

Vegetation Types

prepared for FORTESCUE METALS GROUP

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Project No. 2668-11

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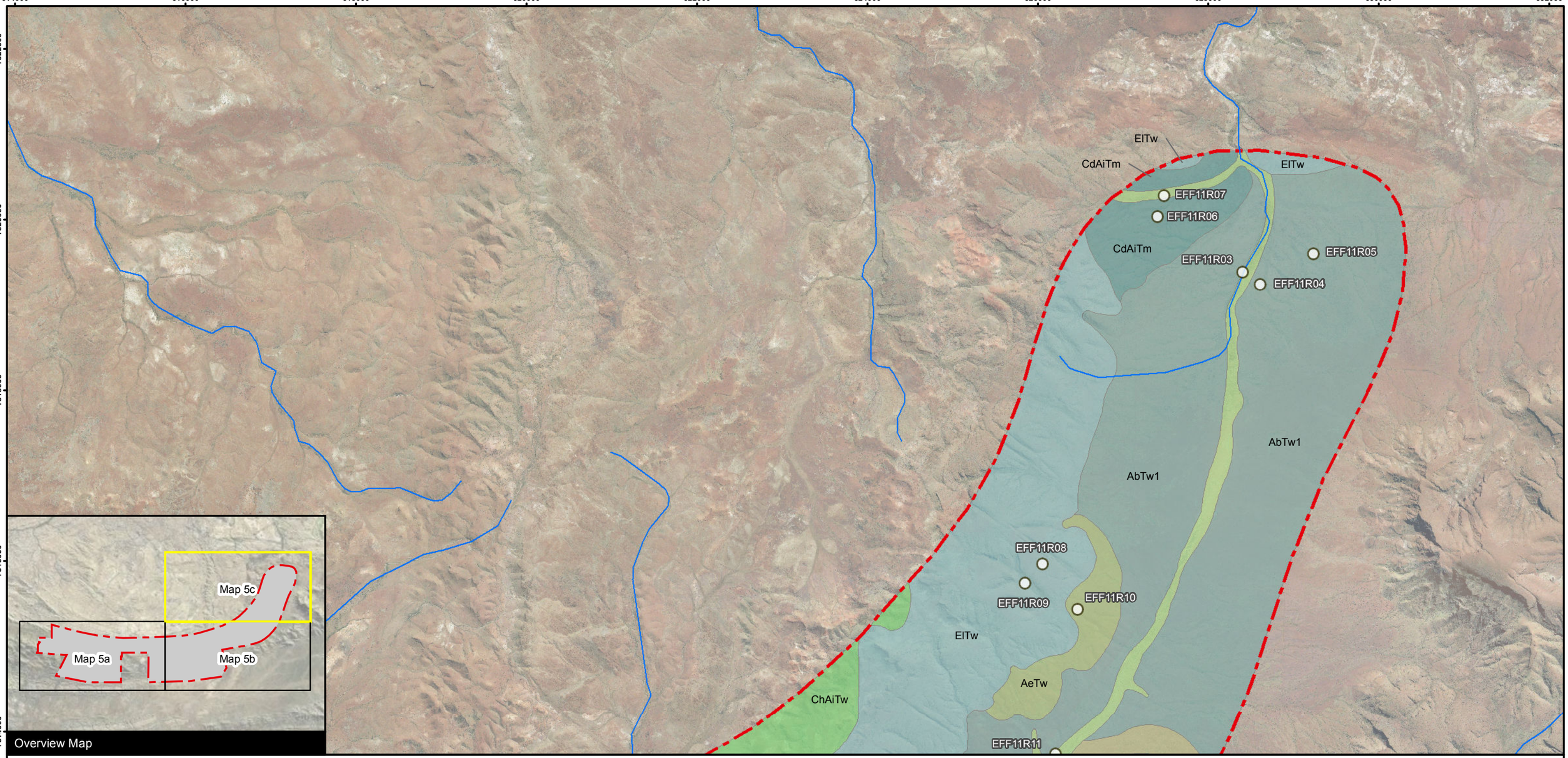


Legend

- Releves
- River; Creek
- Flying Fish Survey Area

Vegetation Type

- AaEfT?e: *Acacia aptaneura* and *A. pruinocarpa* woodland over *Eremophila forrestii* subsp. *forrestii* sparse shrubland over *Triodia ?epactia* open hummock grassland
- AbTw1: *Acacia bivenosa, Acacia atkinsiana* and *Acacia sibirica* open shrubland over *Triodia wiseana* hummock grassland
- AbTw2: *Acacia bivenosa, A. pruinocarpa and A. marramamba* open shrubland over *Triodia wiseana* and *Eriachne mucronata* open grassland
- AeTw: *Acacia exilis, Acacia trudgeniana* and *Acacia inaequilatera* open shrubland over *Triodia wiseana* open hummock grassland
- ApTw: *Acacia exilis, A. pruinocarpa* and *A. marramamba* open shrubland over *Triodia wiseana* open hummock grassland
- AxEc: *Acacia xiphophylla* and *Acacia sibirica* tall open shrubland over *Eremophila cuneata*, *Maireana* sp. and *Rhagodia eremaea* low sparse shrubland
- CdAiTm: *Corymbia deserticola* subsp. *deserticola* and *Eucalyptus leucophloia* subsp. *leucophloia* open woodland over *Acacia inaequilatera, A. pyrifolia* var. *pyrifolia, and A. atkinsiana* sparse shrubland over *Triodia* aff. melvillei and *Triodia wiseana* hummock grassland
- ChAiTw: *Corymbia hamersleyana* and *E. leucophloia* subsp. *leucophloia* open woodland over *Acacia inaequilatera, A. bivenosa* and *Senna artemisioides* subsp. *oligophylla* sparse shrubland over *Triodia wiseana* hummock grassland with *Ptilotus auriculifolius* and *Aristida holathera* var. *holathera* sparse herbs and grasses
- EgAaTe/ElAaTe: Mosaic of: *Eucalyptus gamophylla* woodland over *Acacia atkinsiana, Senna glutinosa* subsp. *glutinosa* and *A. exilis* sparse shrubland over *Triodia epactia* hummock grassland and *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* open woodland over *Acacia atkinsiana, A. ancistrocarpa* and *A. bivenosa* sparse shrubland over *Triodia epactia* hummock grassland
- EgAmTw: *Eucalyptus gamophylla, Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* open woodland over *Acacia maitlandii, A. atkinsiana* and *A. monticola* open shrubland over *Triodia wiseana* hummock grassland
- ElAbTl: *Eucalyptus leucophloia* subsp. *leucophloia* open woodland over *Acacia bivenosa, Senna glutinosa* subsp. *glutinosa* and *S. glutinosa* subsp. *pruinosa* sparse shrubland over *Triodia longiceps* and *T. wiseana* hummock grassland
- ElAiTw: *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* open woodland over *Acacia inaequilatera* and *Acacia bivenosa* (spindly variant) sparse shrubland over *Triodia wiseana* hummock grassland
- ElAmTw: *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* open woodland over *Acacia maitlandii, Senna glutinosa* subsp. *pruinosa* and *Ptilotus rotundifolius* sparse shrubland over *Triodia wiseana* hummock grassland
- ElTw: *Eucalyptus leucophloia* subsp. *leucophloia* open woodland over *Acacia maitlandii, A. pruinocarpa* and *Grevillea wickhamii* open shrubland over *Triodia wiseana* hummock grassland
- EsSaTw: *Eucalyptus socialis* subsp. *eucentrica* over *Senna artemisioides* subsp. *oligophylla, A. synchronicia* and *Stylobasium sphacelatum* sparse shrubland over *Triodia wiseana* and *T. longiceps* open hummock grassland
- EvAcTt: *Eucalyptus victrix* and *E. xerothermica* woodland over *Acacia citrinoviridis, Gossypium robinsonii* and *Melaleuca glomerata* shrubland over *Themeda triandra, Triodia epactia, Enteropogon ramosus* and *Cyperus vaginatus* grassland/sedgeland
- ExAaTe: *Eucalyptus xerothermica, Corymbia hamersleyana* and *Acacia aptaneura* woodland over *Acacia ancistrocarpa, Gossypium robinsonii* and *A. atkinsiana* open shrubland over *Triodia epactia, Themeda triandra* and *Chrysopogon fallax* grassland
- Tw: *Triodia wiseana* hummock grassland with *Themeda* sp., *Gomphrena cunninghamii* and *Ptilotus auriculifolius* sparse tussock grasses and forbs

GDA 1994 MGA Zone 50

Imagery supplied by FMG

Map 5c

Aug 2011

Western Hub Flora and Fauna Surveys

Vegetation Types

prepared for FORTESCUE METALS GROUP

0 0.5 1 1.5 2 Kilometers

1:45,000 @ A3

Project No. 2668-11

ecoscape

498000 500000 502000 504000 506000 508000 510000 512000 514000 516000 518000 520000 522000 524000 526000 528000 530000

7522000 7520000 7518000 7516000 7514000 7512000 7510000 7508000 7506000 7504000 7502000

EFF11R07
EFF11R06
EFF11R05
EFF11R03
EFF11R04
EFF11R08
EFF11R09
EFF11R10
EFF11R11
EFF11R14
EFF11R27
EFF11R26
EFF11R16
EFF11R15
EFF11R13
EFF11R25
EFF11R12
EFF11R28
EFF11R39
EFF11R49
EFF11R23
EFF11R24
EFF11R35
EFF11R36
EFF11R41
EFF11R40
EFF11R37
EFF11R38
EFF11R34
EFF11R32
EFF11R33
EFF11R29
EFF11R31
EFF11R22
EFF11R30
EFF11R17
EFF11R18
EFF11R21
EFF11R20
EFF11R19

BOOLGEEDA CREEK

Legend

River; Creek

Flying Fish Survey Area

Releves

Vegetation Condition (Trudgen (1991) Scale)

- Excellent
- Very Good
- Good
- Poor
- Very Poor
- Degraded

Mapping

Vegetation Condition (Trudgen (1991) Scale)

- Excellent
- Very Good
- Good
- Poor
- Very Poor
- Degraded

GDA 1994 MGA Zone 50

Imagery supplied by FMG

Map 6

Aug 2011

Western Hub Flora and Fauna Surveys

Vegetation Condition

prepared for FORTESCUE METALS GROUP

0 1 2 3 4 Kilometers

1:85,000 @ A3

Project No. 2668-11

ecoscape

498000 501000 504000 507000 510000 513000 516000 519000 522000 525000 528000 531000

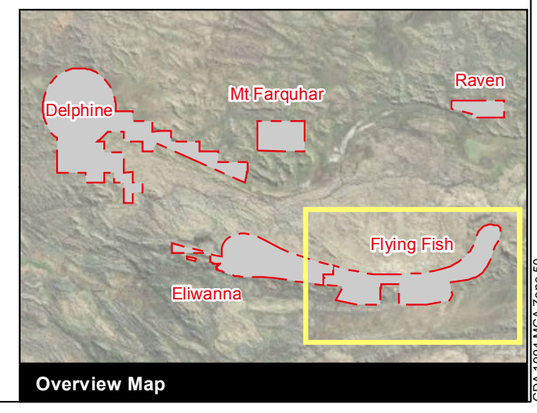
7523000 7520000 7517000 7514000 7511000 7508000 7505000 7502000

Legend

- Trail Camera Locations
- Bird Census Point
- Cage Trap Locations
- Search Tracks
- Flying Fish Survey Area
- Northern Quoll Critical Habitat

Fauna Habitat Types

- EFF1 - Creeklines/drainage lines on lower slopes and valley floors
- EFF2 - Open Shrubland or Open woodland over Spinifex grassland on slopes
- EFF3 - Sheltered gorges/gullies
- EFF4 - Exposed upper slopes, clifflines and ridges



Overview Map

GDA 1994 MGA Zone 50

Imagery supplied by FMG

Map 7

Sept 2011

Western Hub Flora and Fauna Surveys

Fauna Habitat Types, Critical Habitat and Locations of Cage Traps, Trail Cameras and Bird Census Points

prepared for Fortescue Metals Group Ltd

0 1 2 3 4 5 Km

1:94,698 @ A3

Project No. 2668-11

ecoscape

Appendix One: Definitions and Criteria

Table 18: EPBC Act categories for flora and fauna (Commonwealth of Australia 1999)

EPBC Act Category	Definition
Extinct	A native species is eligible to be included in the extinct category at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
Extinct in the wild	A native species is eligible to be included in the extinct in the wild category at a particular time if, at that time: (a) it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or (b) it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically Endangered	A native species is eligible to be included in the critically endangered category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered	A native species is eligible to be included in the endangered category at a particular time if, at that time: (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable	A native species is eligible to be included in the vulnerable category at a particular time if, at that time: (a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.
Conservation Dependent	A native species is eligible to be included in the conservation dependent category at a particular time if, at that time: (a) the species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or (b) the following subparagraphs are satisfied: (i) the species is a species of fish; (ii) the species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximised; (iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory; (iv) cessation of the plan of management would adversely affect the conservation status of the species.

Table 19: DEC conservation codes for flora and fauna (DEC 2011a)

Conservation Codes for Western Australian Flora and Fauna
T: Schedule 1 under the *Wildlife Conservation Act 1950*
• **Threatened Fauna** (Fauna that is rare or is likely to become extinct) • **Threatened Flora** (Declared Rare Flora – Extant) Taxa* that 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.
X: Schedule 2 under the *Wildlife Conservation Act 1950*
• **Presumed Extinct Fauna** • **Presumed Extinct Flora** (Declared Rare Flora – Extinct) Taxa which have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such.
1A: Schedule 3 under the *Wildlife Conservation Act 1950*
• **Birds protected under an international agreement** Birds that are subject to an agreement between governments of Australia and Japan relating to the protection of migratory birds and birds in danger of extinction.
S: Schedule 4 under the *Wildlife Conservation Act 1950*
• **Other specially protected fauna** Fauna that is in need of special protection, otherwise than for the reasons mentioned in the above schedules.
Threatened fauna and flora (Schedule 1) are further ranked by the Department according to their level of threat using IUCN Red List criteria. **CR:** Critically Endangered – considered to be facing an extremely high risk of extinction in the wild. **EN**: Endangered – considered to be facing a very high risk of extinction in the wild. **VU:** Vulnerable – considered to be facing a high risk of extinction in the wild.
Taxa that have not yet been adequately surveyed to be listed under Schedule 1 or 2 are added to the Priority Flora and Priority Fauna Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora or fauna. Taxa 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 for other than taxonomic reasons, are placed in Priority 4. These taxa require regular monitoring. Conservation Dependent species are placed in Priority 5.
1: Priority One: Poorly-known taxa
Taxa that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.
2: Priority Two: Poorly-known taxa
Taxa that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.

Conservation Codes for Western Australian Flora and Fauna
3: Priority Three: Poorly-known taxa
Taxa that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Taxa may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.
4: Priority Four: Rare, Near Threatened and other taxa in need of monitoring
(a) **Rare.** Taxa 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 taxa are usually represented on conservation lands. (b) **Near Threatened**. Taxa 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) Taxa that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
5: Priority Five: Conservation Dependent taxa
Taxa that are not threatened but are subject to a specific conservation program, the cessation of which would result in the taxa becoming threatened within five years.

Table 20: DEC definitions and criteria for TECs and PECs (DEC 2010a)

Criteria	Definition
Threatened 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);

Criteria	Definition
	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): D) The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated. E) 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. F) 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.
Priority Ecological Communities	
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 may 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

Criteria	Definition
	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. i. 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. ii. 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. iii. 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.

Table 21: *EPBC Act* categories for TECs (DSEWPaC 2011c)

EPBC Act Category	Definition
Critically Endangered (CR)	An ecological community that is facing an extremely high risk of extinction in the wild in the immediate future.
Endangered (EN)	An ecological community that is not critically endangered, and is facing a very high risk of extinction in the wild in the new future.
Vulnerable (VU)	An ecological community that is not critically endangered or endangered, and is facing a high risk of extinction in the medium-term future.

Table 22: DEC conservation codes for flora and fauna (DEC 2011a)

Conservation Codes for Western Australian Flora and Fauna
T: Schedule 1 under the *Wildlife Conservation Act 1950*
• **Threatened Fauna** (Fauna that is rare or is likely to become extinct) • **Threatened Flora** (Declared Rare Flora – Extant) Taxa* that 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.
X: Schedule 2 under the *Wildlife Conservation Act 1950*
• **Presumed Extinct Fauna** • **Presumed Extinct Flora** (Declared Rare Flora – Extinct) Taxa which have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such.
1A: Schedule 3 under the *Wildlife Conservation Act 1950*
• **Birds protected under an international agreement** Birds that are subject to an agreement between governments of Australia and Japan relating to the protection of migratory birds and birds in danger of extinction.
S: Schedule 4 under the *Wildlife Conservation Act 1950*
• **Other specially protected fauna** Fauna that is in need of special protection, otherwise than for the reasons mentioned in the above schedules.
Threatened fauna and flora (Schedule 1) are further ranked by the Department according to their level of threat using IUCN Red List criteria. **CR:** Critically Endangered – considered to be facing an extremely high risk of extinction in the wild. **EN**: Endangered – considered to be facing a very high risk of extinction in the wild. **VU:** Vulnerable – considered to be facing a high risk of extinction in the wild.
Taxa that have not yet been adequately surveyed to be listed under Schedule 1 or 2 are added to the Priority Flora and Priority Fauna Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora or fauna. Taxa 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 for other than taxonomic reasons, are placed in Priority 4. These taxa require regular monitoring. Conservation Dependent species are placed in Priority 5.
1: Priority One: Poorly-known taxa
Taxa that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.
2: Priority Two: Poorly-known taxa
Taxa that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.

Conservation Codes for Western Australian Flora and Fauna
3: Priority Three: Poorly-known taxa
Taxa that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Taxa may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.
4: Priority Four: Rare, Near Threatened and other taxa in need of monitoring
(a) **Rare.** Taxa 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 taxa are usually represented on conservation lands. (b) **Near Threatened**. Taxa 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) Taxa that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
5: Priority Five: Conservation Dependent taxa
Taxa that are not threatened but are subject to a specific conservation program, the cessation of which would result in the taxa becoming threatened within five years.

Appendix Two: DEC Database Search Results (Flora)

Table 23: DEC database search results (Flora)

Species	Habit	Flowering	Landform\Soil	Vegetation Type
		T		
Lepidium catapycnon	Open, woody perennial, herb or shrub, 0.2-0.3 m high, stems zigzag	Oct	Skeletal soils, hillsides	*Triodia wiseana* hummock grassland. With *Acacia bivenosa, A. inaequilatera, A. pruinocarpa, A. pyrifolia, Triodia* sp. Shovelanna Hill.
Thryptomene wittweri	Spreading or rounded shrub, 0.5–1.5(–2.1) m high	Apr/Jul/ Aug	Skeletal red stony soils. Breakaways, stony creek beds	
		P1		
Bothriochloa decipens var. *cloncurrensis*	-	-	-	-
Calotis squamigera	Procumbent annual, herb, to 0.21 m high	Jul	Pebbly loam	
Eragrostis sp. Mt Robinson (S.van Leeuwen 4109)	Tussock-forming perennial, grass-like or herb, to 0.3 m high	Sep	Red-brown skeletal soils, ironstone. Steep slopes, summits	
Eremophila sp. West Angelas (S. van Leeuwen 4086)	-	-	-	
Eremophila sp. Snowy Mountain (S. van. Leeuwen 3737)	-	-	-	
Eremophila spongiocarpa	Compact, succulent-leaved shrub, to 1 m high	May/Sep	Weakly saline alluvial plain on margins of marsh	
Eucalyptus lucens	Mallee, to 4.5 m high, bark smooth, white, sometimes slightly powdery; leaves glossy green		Ironstone rocky slopes and mountain tops, high in the landscape	
Genus sp. Hamersley Range hilltops (S van Leeuwen 4345)	Rounded shrub, to 0.4 m high	Oct	Skeletal, brown gritty soil over ironstone. Hill summit	Growing in VOSM of *Eucalyptus leucophloia* and *E. gamophylla* over LSB of *Senna pruinosa, Acacia bivenosa, A. maitlandii* and *A. pyrifolia* over ODSD of *A. marramamba* over MDHG of *Triodia* sp.
Sida sp. Hamersley Range (K. Newbey 10692)	-	-	-	n VOSM of *Eucalyptus gamophylla* and *E. xerothermica* with scattered emergent *E. leucophloia* over OLSB of *Acacia pyrifolia* (SVL 4375) and *Hakea lorea* over DHG of *Triodia* sp.
Tetratheca fordiana ms	Dwarf shrub, 0.3–0.4 m high	-	Shale pocket amongst ironstone	
Teucrium pilbaranum	Rounded shrub, to 0.4 m high	May/Sep	Clay. Crab hole plain in a river floodplain, margin of calcrete table	*Chrysopogon fallax* tussock grassland, Open woodland of *Eucalyptus victrix*, with a tussock grass understorey of *Eriachne benthamii*
Vittadinia sp. Coondewanna Flats (s. van Leeuwen 4684)	Tall daisy to 1 m , open canopy, in late flower and dehiscing fruit, cream/white flowers.	May/Sep	Clay loam soils	*Acacia* thicket over mixed grassland. Species dominating in area include: *Acacia aneura, Eucalyptus ?xerothermica, Themeda ?triandra*.

Species	Habit	Flowering	Landform\Soil	Vegetation Type
P2				
Adiantum capillus-veneris	Rhizomatous, perennial, herb (fern), 0.1-0.2 m high	-	Moist, sheltered sites in gorges and on cliff walls	
Cladium procerum	Densely tufted perennial, grass-like or herb (sedge), 2 m high	Nov	Perennial pools	
Eremophila forrestii subsp. Pingandy (M.E. Trudgen 2662)	Low shrub 0.5 m tall with red or pinky flowers with long exerted stamens	May-Jul	Stony soil, slopes	
Oxalis sp. Pilbara (M.E. Trudgen 12725)	Small herb to 10 cm tall. Leaves green above, purple below	-	Red-brown pebbly/rocky loam amongst boulders	
Paspalidium retiglume	Tufted annual, grass-like or herb, 0.1–0.5 m high	Apr	Clay	
Pilbara trudgenii	Gnarled, aromatic shrub, to 1 m high	Sep.	Skeletal, red stony soil over ironstone. Hill summits, steep slopes, screes, cliff faces.	
Scaevola sp. Hamersley Range basalts (S. van Leeuwen 3675)	Shrub, to 1 m high	Jul-Aug.	Skeletal, brown gritty soil over basalt. Summits of hills, steep hills	Growing in VOSM of *Eucalyptus kingsmillii* and *Eucalyptus* aff. *hamersleyana* over LSA of Acacia *hamersleyensis* over OLSD of *Ptilotus rotundifolius* over DHG of *Triodia* sp. (SVL 2476).
Spartothamnella puberula	Shrub, 0.35–1.5 m high	Sep-Nov	Rocky loam, sandy or skeletal soils, clay. Sandplains, hills	*Corymbia ferriticola* low woodland over *Petalostylis labicheoides* and *Acacia aneura* tall open shrubland over *Triodia pungens* and *T.* sp. Mt Ella hummock grassland and *Themeda triandra* open tussock grassland.
Vigna sp. central (M.E. Trudgen 1626)	50 m high x 50 m wide.	-	Sandy plain, Plain with thin sheet of sand (light orange / brown) over compacted hardpan and limestone rock, Claypan of fine cracking clays. Basalt hills in the immediate distance.	*Triodia epactia* hummock grassland over **Cenchrus ciliaris* very open tussock grassland, *Indigofera colutea / Vigna* sp Central / *Rhynchosia minima* low open shrubland. *Eucalyptus camaldulensis* and **Cenchrus ciliaris* association.
P3				
Acacia daweana	Spreading shrub, 0.3–1.5(–2) m high	Jul-Sep	Stony red loamy soils. Low rocky rises, along drainage lines	
Acacia subtiliformis	Spindly, slender, erect shrub, to 3.5 m high	Jun	On rocky calcrete plateau	
Calotis latiuscula	Erect herb, to 0.5 m high	Jun-Oct	Sand, loam. Rocky hillsides, floodplains, rocky creeks or river beds	
Dampiera anonyma ms	Multistemmed perennial, herb, to 0.5(-1) m high	Jun-Sep	Skeletal red-brown to brown gravelly soil over banded ironstone, basalt, shale and jaspilite. Hill summits, upper slopes	

Species	Habit	Flowering	Landform\Soil	Vegetation Type
Dampiera metallorum ms	Rounded, multistemmed perennial, herb, to 0.5 m high	Apr-Oct	Skeletal red-brown gravely soils over banded ironstone. Steep slopes and summits	
Eragrostis crateriformis	Annual, grass-like or herb, 0.17–0.42 m high	Jan-Jul	Clayey loam or clay. Creek banks, depressions	
Eragrostis surreyana	Tufted annual herb 5-8 (-13) cm high	May-Sep	Drainage line, red-brown clay	
Eremophila forrestii subsp. *viridis*	Much-branched shrub, ca 1 m high	Aug	Sandplain	
Eremophila magnifica subsp. *velutina*	Shrub, 0.5–1.5 m high	Aug-Sep	Skeletal soils over ironstone. Summits	
Fimbristylis sieberiana	Shortly rhizomatous, tufted perennial, grass-like or herb (sedge), 0.25–0.6 m high	May-Jun	Mud, skeletal soil pockets. Pool edges, sandstone cliffs	
Geijera salicifolia	Tree, 1.5–6 m high	Sep	Skeletal soils, stony soils. Massive rock scree, gorges	
Glycine falcata	Mat-forming perennial, herb, to 0.2 m high. Fl. blue, purple	May-Jul	Floodplains. Black clayey sand. Along drainage depressions in crabhole plains on river	
Gymnanthera cunninghamii	Erect shrub 1-2 m high	Jan-Dec	Sandy soils	
Indigofera gilesii subsp. *gilesii*	Shrub, to 1.5 m high	May/Aug	Pebbly loam amongst boulders & outcrops, hills	
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	Erect shrub to 2.3 m high, red-pink flowers	Jul-Oct	Creeks and gorges	
Iotasperma sessilifolium	Erect herb. Fl. pink.	-	Cracking clay, black loam. Edges of waterholes, plains	
Oldenlandia sp. Hamersley Station (A.A. Mitchell PRP 1479)	Spreading annual, herb, 0.05–0.1 m high	Mar.	Cracking clay, basalt. Gently undulating plain with large surface rocks, flat crabholed plain	
Olearia mucronata	Densely branched, unpleasantly aromatic shrub, 0.6–1 m high. Fl. white, yellow	Aug-Jan	Schistose hills, along drainage channels	
Phyllanthus aridus	Erect, much-branched shrub, to 0.25 m high. Fl. cream, green	May–Jun	Sandstone, gravel, red sand	
Ptilotus subspinescens	Compact shrub, to 0.8 m high. Fl. pink, bases of screes	Sep–Oct	Gentle rocky slopes, screes and the bases of screes	
Rhagodia sp. Hamersley (M. Trudgen 17794)	Erect shrub	-	Floodplain / lower slopes	
Rostellularia adscendens var.*latifolia*	Herb or shrub, 0.1–0.3 m high	Apr-May	Ironstone soils. Near creeks, rocky hills	
Sida sp. Barlee Range (S van Leeuwen 1642)	Spreading shrub, to 0.5 m high	Aug	Skeletal red soils pockets. Steep slope	
Swainsona sp. Hamersley Station (A.A. Mitchell 196)	Prostrate annual, herb, to 0.1 m high	Mat	Flat crabholed plain.	Open *Eremophila maculata* shrubland over moderately dense herbs. Tussock grassland of *Astrebla pectinata*.

Species	Habit	Flowering	Landform\Soil	Vegetation Type
Triodia sp. Mt. Ella (ME Trudgen 12739)	Perennial, grass-like or herb, 0.4 m high	-	Light orange-brown, pebbly loam. Amongst rocks & outcrops, gully slopes	
Triodia sp. Robe River (M.E. Trudgen et al. MET 12367)	Perennial hummock grass to 0.6 m high	-	Rocky hills and mesas	
P4				
Acacia bromilowiana	Tree or shrub, to 12 m high	Jul-Aug	Red skeletal stony loam, orange-brown pebbly, gravel loam, laterite, banded ironstone, basalt. Rocky hills, breakaways, scree slopes, gorges, creek beds	
Eremophila magnifica subsp. *magnifica*	Shrub, 0.5-1.5 m high	Aug-Nov	Skeletal soils over ironstone. Rocky screes	
Livistona alfredii	Tree-like monocot (palm) to 10 m high	Jun-Sep	Edges of permanent pools	
Rhynchosia bungarensis	Compact, prostrate shrub, to 0.5 m high	-	Pebbly, coarse sand, banks of flow line	

Appendix Three: EPBC Protected Matters Search Tool

Australian Government
Department of Sustainability, Environment, Water, Population and Communities

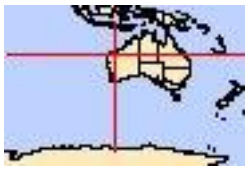
EPBC Act Protected Matters Report: Coordinates

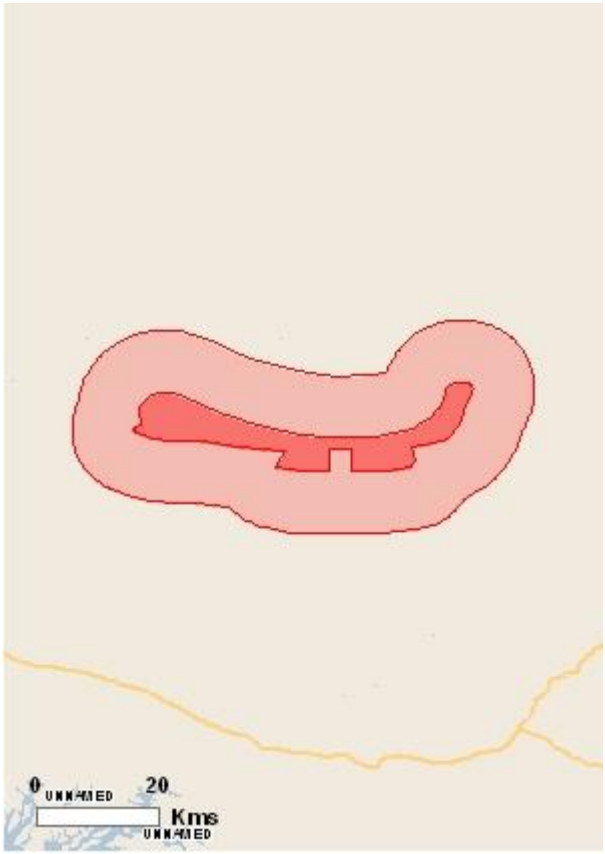
This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

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

Information about the EPBC Act including significance guidelines, forms and application process details can be found at http://www.environment.gov.au/epbc/assessmentsapprovals/index.html

Report created: 30/06/11 14:33:30





This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates
Buffer: 10.0Km

Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Significance (Ramsar Wetlands):	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Threatened Ecological Communitites:	None
Threatened Species:	4
Migratory Species:	8

Other Matters Protected by the EPBC Act

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

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

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

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

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	6
Whales and Other Cetaceans:	None

Critical Habitats:	None
Commonwealth Reserves:	None

Report Summary for Extra Information

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

Place on the RNE:	None
State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	5
Nationally Important Wetlands:	None

Details

Matters of National Environmental Significance

Threatened Species		**[Resource Information]**
Name	Status	Type of Presence
MAMMALS		
Dasyurus hallucatus		
Northern Quoll [331]	Endangered	Species or species habitat likely to occur within area
Rhinonicteris aurantia (Pilbara form)		
Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat likely to occur within area
PLANTS		
Lepidium catapycnon		
Hamersley Lepidium, Hamersley Catapycnon [9397]	Vulnerable	Species or species habitat likely to occur within area
REPTILES		
Liasis olivaceus barroni		
Olive Python (Pilbara subspecies) [66699]	Vulnerable	Species or species habitat may occur within area

Migratory Species		**[Resource Information]**
Name	Status	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat may occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Merops ornatus		

Rainbow Bee-eater [670]	Species or species habitat may occur within area
Migratory Wetlands Species	
Ardea alba	
Great Egret, White Egret [59541]	Species or species habitat may occur within area
Ardea ibis	
Cattle Egret [59542]	Species or species habitat may occur within area
Charadrius veredus	
Oriental Plover, Oriental Dotterel [882]	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species **[Resource Information]**

Name	Status	Type of Presence
Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat may occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Charadrius veredus		
Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area

Extra Information

Invasive Species **[Resource Information]**

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

Name	Status	Type of Presence
Mammals		
Felis catus		
Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Oryctolagus cuniculus		
Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Vulpes vulpes		
Red Fox, Fox [18]		Species or species habitat may occur within area
Plants		
Cenchrus ciliaris		
Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area

Prosopis spp.
Mesquite, Algaroba [68407] Species or species habitat may occur within area

Caveat

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

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

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

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

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

Only selected species covered by the following provisions of the EPBC Act have been mapped:
- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:
- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:
- non-threatened seabirds which have only been mapped for recorded breeding sites;
- seals which have only been mapped for breeding sites near the Australian continent.

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

Coordinates

-22.428789 117.29458,-22.43374 117.294131,-22.438299 117.292869,-22.444075 117.290232,-22.453276 117.285171,-22.461862 117.281508,-22.475556 117.276816,-22.481446 117.274117,-22.487028 117.270772,-22.492213 117.266817,-22.496812 117.262348,-22.500732 117.257385,-22.503852 117.251864,-22.506131 117.245772,-22.50818 117.237237,-22.513447 117.205331,-22.533764 117.210443,-22.538804 117.207092,-22.543424 117.204161,-22.548504 117.165129,-22.549806 117.116016,-22.527922 117.116808,-22.527938 117.116667,-22.516578

117.11672,-22.516578 117.084501,-22.521175 117.08453,-22.521162 117.083333,-22.55 117.083333,-22.549841 117.044652,-22.542714 117.005192,-22.51943 117.018088,-22.519274 117.014538,-22.517067 116.984551,-22.513482 116.951993,-22.506067 116.895666,-22.504434 116.877187,-22.503956 116.863312,-22.504073 116.843285,-22.503384 116.834356,-22.502158 116.827855,-22.501673 116.8258,-22.500725 116.822101,-22.499847 116.819015,-22.499122 116.816794,-22.498383 116.814816,-22.496418 116.810164,-22.495371 116.807567,-22.494738 116.805776,-22.49433 116.80437,-22.493681 116.801522,-22.493314 116.800108,-22.492964 116.799092,-22.492619 116.798365,-22.492318 116.79789,-22.491969 116.797473,-22.491585 116.797131,-22.491149 116.796855,-22.49056 116.796604,-22.490001 116.796442,-22.489037 116.796263,-22.488231 116.796195,-22.487644 116.796223,-22.487115 116.796336,-22.486649 116.796526,-22.486157 116.79682,-22.485529 116.797308,-22.485105 116.79774,-22.484736 116.79824,-22.484323 116.798968,-22.483713 116.800334,-22.483009 116.801908,-22.482508 116.802845,-22.482051 116.803545,-22.481662 116.804027,-22.481223 116.804457,-22.480732 116.804831,-22.480013 116.805257,-22.479242 116.805608,-22.478436 116.805889,-22.47761 116.806095,-22.47675 116.806223,-22.475885 116.806277,-22.474806 116.806255,-22.474015 116.806167,-22.473562 116.806052,-22.466832 116.804894,-22.460289 116.804582,-22.456121 116.80507,-22.452177 116.806289,-22.448307 116.808493,-22.444803 116.811481,-22.441717 116.815045,-22.439113 116.818991,-22.436203 116.825289,-22.434372 116.831888,-22.433512 116.838656,-22.433549 116.84552,-22.434351 116.852365,-22.436404 116.861339,-22.439312 116.869772,-22.44471 116.881855,-22.457555 116.908369,-22.463501 116.922833,-22.469814 116.941482,-22.476941 116.966367,-22.489679 117.016467,-22.494681 117.038693,-22.497415 117.054443,-22.499305 117.070347,-22.50025 117.086309,-22.500059 117.101775,-22.498772 117.137531,-22.497929 117.155625,-22.496739 117.16683,-22.494617 117.178124,-22.491034 117.191591,-22.486129 117.206522,-22.482787 117.214505,-22.479734 117.220172,-22.475836 117.225784,-22.469802 117.232719,-22.46162 117.240545,-22.45655 117.244611,-22.451102 117.247998,-22.445072 117.250455,-22.434506 117.253724,-22.430494 117.2555,-22.426827 117.257921,-22.423658 117.261012,-22.421148 117.264604,-22.419466 117.268633,-22.418676 117.273022,-22.418609 117.277645,-22.419368 117.28483,-22.420482 117.28924,-22.421404 117.291105,-22.422663 117.292604,-22.424395 117.293698,-22.426471 117.294336,-22.428789 117.29458

Acknowledgements

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

-Department of Environment, Climate Change and Water, New South Wales
-Department of Sustainability and Environment, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment and Natural Resources, South Australia
-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts
-Environmental and Resource Management, Queensland
-Department of Environment and Conservation, Western Australia
-Department of the Environment, Climate Change, Energy and Water
-Birds Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-SA Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW

-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
-State Forests of NSW
-Other groups and individuals

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

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

Department of Sustainability, Environment, Water, Population and Communities
GPO Box 787
Canberra ACT 2601 Australia
+61 2 6274 1111 ABN

Appendix Four: NatureMap Fauna Search

NatureMap Species Report

Created By bruce turner on 30/06/2011

Kingdom Animalia
Current Names Only Yes
Species Group All Animals
Method 'By Polygon'

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1.	24559	*Acanthagenys rufogularis (Spiny-cheeked Honeyeater)*			
2.	24260	*Acanthiza apicalis (Broad-tailed Thornbill (Inland Thornbill))*			
3.	24265	*Acanthiza uropygialis (Chestnut-rumped Thornbill)*			
4.	25332	*Acanthophis wellsi (Pilbara Death Adder)*			
5.	25536	*Accipiter fasciatus (Brown Goshawk)*			
6.	24283	*Accipiter fasciatus subsp. didimus*			
7.	30833	*Amphibolurus longirostris*			
8.	24539	*Amytornis striatus subsp. striatus*		P4	
9.	24540	*Amytornis striatus subsp. whitei*			
10.	25448	*Antaresia stimsoni (Stimson's Python)*			
11.	24285	*Aquila audax (Wedge-tailed Eagle)*			
12.	24341	*Ardea pacifica (White-necked Heron)*			
13.	24610	*Ardeotis australis (Australian Bustard)*		P4	
14.	25566	*Artamus cinereus (Black-faced Woodswallow)*			
15.	24352	*Artamus cinereus subsp. melanops*			
16.	24355	*Artamus minor (Little Woodswallow)*			
17.	24356	*Artamus personatus (Masked Woodswallow)*			
18.	25331	*Brachyurophis approximans*			
19.	24359	*Burhinus grallarius (Bush Stone-curlew)*		P4	
20.	25715	*Cacatua roseicapilla (Galah)*			
21.	24726	*Cacatua roseicapilla subsp. roseicapilla*			
22.	25716	*Cacatua sanguinea (Little Corella)*			
23.	24039	*Canis lupus subsp. dingo (Dingo)*	Y		
24.	25015	*Carlia munda*			
25.	24181	*Chaerephon jobensis (Northern Freetail-bat)*			
26.	24186	*Chalinolobus gouldii (Gould's Wattled Bat)*			
27.	24431	*Chrysococcyx basalis (Horsfield's Bronze Cuckoo)*			
28.	24833	*Cincloramphus cruralis (Brown Songlark)*			
29.	24834	*Cincloramphus mathewsi (Rufous Songlark)*			
30.	24395	*Climacteris melanura subsp. wellsi*			
31.	25675	*Colluricincla harmonica (Grey Shrike-thrush)*			
32.	24611	*Colluricincla harmonica subsp. brunnea*			
33.	24613	*Colluricincla harmonica subsp. rufiventris*			
34.	25568	*Coracina novaehollandiae (Black-faced Cuckoo-shrike)*			
35.	24362	*Coracina novaehollandiae subsp. novaehollandiae*			
36.	24363	*Coracina novaehollandiae subsp. subpallida*			
37.	24416	*Corvus bennetti (Little Crow)*			
38.	25593	*Corvus orru (Torresian Crow)*			
39.	24418	*Corvus orru subsp. cecilae (Western Crow)*			
40.	25701	*Coturnix ypsilophora (Brown Quail)*			
41.	24672	*Coturnix ypsilophora subsp. cervina*			
42.	24420	*Cracticus nigrogularis (Pied Butcherbird)*			
43.	25595	*Cracticus tibicen (Australian Magpie)*			
44.	24423	*Cracticus tibicen subsp. tibicen (Black-backed Magpie)*			
45.	25596	*Cracticus torquatus (Grey Butcherbird)*			
46.	30893	*Cryptoblepharus buchananii*			
47.	30892	*Cryptoblepharus ustulatus*			
48.	24865	*Ctenophorus caudicinctus subsp. caudicinctus*			
49.	24874	*Ctenophorus isolepis subsp. citrinus*			
50.	24876	*Ctenophorus isolepis subsp. isolepis*			
51.	24889	*Ctenophorus scutulatus*			
52.	25036	*Ctenotus duricola*			
53.	25041	*Ctenotus grandis subsp. grandis*			
54.	25043	*Ctenotus grandis subsp. titan*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
55.	25045	*Ctenotus helenae*			
56.	25054	*Ctenotus mimetes*			
57.	25060	*Ctenotus pantherinus subsp. acripes*			
58.	25064	*Ctenotus pantherinus subsp. ocellifer*			
59.	25070	*Ctenotus robustus*			
60.	25072	*Ctenotus rubicundus*			
61.	25071	*Ctenotus rutilans*			
62.	25073	*Ctenotus saxatilis (Rock Ctenotus)*			
63.	25074	*Ctenotus schomburgkii*			
64.	25075	*Ctenotus severus*			
65.	24435	*Cuculus pallidus (Pallid Cuckoo)*			
66.	25090	*Cyclodomorphus melanops subsp. melanops*			
67.	25375	*Cyclorana maini (Sheep Frog)*			
68.	25547	*Dacelo leachii (Blue-winged Kookaburra)*			
69.	24998	*Delma elegans*			
70.	25001	*Delma nasuta*			
71.	25002	*Delma pax*			
72.	25004	*Delma tincta*			
73.	25295	*Demansia psammophis subsp. cupreiceps*			
74.	25297	*Demansia rufescens (Rufous Whipsnake)*			
75.	25607	*Dicaeum hirundinaceum (Mistletoebird)*			
76.	24441	*Dicaeum hirundinaceum subsp. hirundinaceum*			
77.	24926	*Diplodactylus conspicillatus (Fat-tailed Gecko)*			
78.	24944	*Diplodactylus savagei*			
79.	24899	*Diporiphora valens*			
80.	25094	*Egernia formosa*			
81.	24631	*Emblema pictum (Painted Finch)*			
82.	24570	*Epthianura tricolor (Crimson Chat)*			
83.	24257	*Equus asinus (Donkey)*	Y		
84.	25109	*Eremiascincus richardsonii (Broad-banded Sand Swimmer)*			
85.	24837	*Eremiornis carteri (Spinifex-bird)*			
86.	24368	*Eurostopodus argus (Spotted Nightjar)*			
87.	25621	*Falco berigora (Brown Falcon)*			
88.	24471	*Falco berigora subsp. berigora*			
89.	25622	*Falco cenchroides (Australian Kestrel)*			
90.	24472	*Falco cenchroides subsp. cenchroides*			
91.	24474	*Falco longipennis subsp. longipennis*			
92.	24041	*Felis catus (Cat)*	Y		
93.	24956	*Gehyra pilbara*			
94.	24958	*Gehyra punctata*			
95.	24959	*Gehyra variegata*			
96.	24401	*Geopelia cuneata (Diamond Dove)*			
97.	25585	*Geopelia striata (Peaceful Dove)*			
98.	24403	*Geopelia striata subsp. placida*			
99.	24404	*Geophaps plumifera (Spinifex Pigeon)*			
100.	25530	*Gerygone fusca (Western Gerygone)*			
101.	24271	*Gerygone fusca subsp. fusca*			
102.	24443	*Grallina cyanoleuca (Magpie-lark)*			
103.	24296	*Hamirostra isura (Square-tailed Kite)*			
104.	24961	*Heteronotia binoei (Bynoe's Gecko)*			
105.	24962	*Heteronotia spelea (Desert Cave Gecko)*			
106.	24492	*Hirundo nigricans subsp. nigricans*			
107.	24572	*Lacustroica whitei (Grey Honeyeater)*			
108.	24367	*Lalage tricolor (White-winged Triller)*			
109.	24217	*Leggadina lakedownensis (Short-tailed Mouse)*		P4	
110.	25135	*Lerista flammicauda*			
111.	25155	*Lerista muelleri*			
112.	25005	*Lialis burtonis*			
113.	24575	*Lichenostomus keartlandi (Grey-headed Honeyeater)*			
114.	24578	*Lichenostomus penicillatus (White-plumed Honeyeater)*			
115.	24581	*Lichenostomus virescens (Singing Honeyeater)*			
116.	25661	*Lichmera indistincta (Brown Honeyeater)*			
117.	24582	*Lichmera indistincta subsp. indistincta*			
118.	30933	*Lucasium stenodactylum*			
119.	30934	*Lucasium wombeyi*			
120.	24180	*Macroderma gigas (Ghost Bat)*		P4	
121.	25489	*Macropus robustus*			
122.	24135	*Macropus robustus subsp. erubescens (Euro, Biggada)*			
123.	24136	*Macropus rufus (Red Kangaroo, Marlu)*			
124.	25651	*Malurus lamberti (Variegated Fairy-wren)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
125.	24544	*Malurus lamberti subsp. assimilis*			
126.	24548	*Malurus leucopterus subsp. leucopterus*		T	
127.	24583	*Manorina flavigula (Yellow-throated Miner)*			
128.	24736	*Melopsittacus undulatus (Budgerigar)*			
129.	25184	*Menetia greyii*			
130.	25187	*Menetia surda subsp. surda*			
131.	24598	*Merops ornatus (Rainbow Bee-eater)*			
132.	24302	*Mirafra javanica subsp. horsfieldii*			
133.	25193	*Morethia ruficauda subsp. exquisita*			
134.	24182	*Mormopterus beccarii (Beccari's Freetail-bat)*			
135.	24223	*Mus musculus (House Mouse)*	Y		
136.	24972	*Nephrurus wheeleri subsp. cinctus*			
137.	24095	*Ningaui timealeyi (Pilbara Ningaui)*			
138.	24819	*Ninox connivens subsp. connivens (Barking Owl)*			
139.	25196	*Notoscincus butleri*		P4	
140.	25197	*Notoscincus ornatus subsp. ornatus*			
141.	24742	*Nymphicus hollandicus (Cockatiel)*			
142.	24407	*Ocyphaps lophotes (Crested Pigeon)*			
143.	24976	*Oedura marmorata (Marbled Velvet Gecko)*			
144.	24618	*Oreoica gutturalis (Crested Bellbird)*			
145.	25680	*Pachycephala rufiventris (Rufous Whistler)*			
146.	24624	*Pachycephala rufiventris subsp. rufiventris*			
147.	24627	*Pardalotus rubricatus (Red-browed Pardalote)*			
148.	25682	*Pardalotus striatus (Striated Pardalote)*			
149.	24629	*Pardalotus striatus subsp. uropygialis*			
150.	24658	*Petroica cucullata (Hooded Robin)*			
151.	24409	*Phaps chalcoptera (Common Bronzewing)*			
152.	24101	*Planigale ingrami (Long-tailed Planigale)*			
153.	25721	*Platycercus zonarius (Australian Ringneck (Ring-necked Parrot))*			
154.	24751	*Platycercus zonarius subsp. zonarius*			
155.	24905	*Pogona minor subsp. minima (Dwarf Bearded Dragon)*		T	
156.	24907	*Pogona minor subsp. minor*			
157.	25706	*Pomatostomus temporalis (Grey-crowned Babbler)*			
158.	24684	*Pomatostomus temporalis subsp. rubeculus*			
159.	24106	*Pseudantechinus woolleyae (Woolley's Pseudantechinus)*			
160.	25261	*Pseudechis australis (Mulga Snake)*			
161.	24233	*Pseudomys chapmani (Western Pebble-mound Mouse)*		P4	
162.	24235	*Pseudomys desertor (Desert Mouse)*			
163.	24237	*Pseudomys hermannsburgensis (Sandy Inland Mouse)*			
164.	25263	*Pseudonaja modesta (Ringed Brown Snake)*			
165.	25432	*Pseudophryne douglasi (Gorge Toadlet)*			
166.	24757	*Ptilonorhynchus maculatus subsp. guttatus (Western Bowerbird)*			
167.	25009	*Pygopus nigriceps*			
168.	25277	*Ramphotyphlops grypus*			
169.	25279	*Ramphotyphlops hamatus*			
170.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
171.	24454	*Rhipidura leucophrys subsp. leucophrys*			
172.	24982	*Rhynchoedura ornata (Beaked Gecko)*			
173.	24200	*Scotorepens greyii (Little Broad-nosed Bat)*			
174.	30948	*Smicrornis brevirostris (Weebill)*			
175.	24115	*Sminthopsis longicaudata (Long-tailed Dunnart)*		P4	
176.	24116	*Sminthopsis macroura (Stripe-faced Dunnart)*			
177.	24556	*Stipiturus ruficeps subsp. ruficeps*			
178.	24927	*Strophurus elderi*			
179.	24949	*Strophurus wellingtonae*			
180.	25307	*Suta punctata (Spotted Snake)*			
181.	24207	*Tachyglossus aculeatus (Echidna)*			
182.	30870	*Taeniopygia guttata (Zebra Finch)*			
183.	30871	*Taeniopygia guttata subsp. castanotis*			
184.	24175	*Taphozous georgianus (Common Sheathtail-bat)*			
185.	24176	*Taphozous hilli (Hill's Sheathtail-bat)*			
186.	25202	*Tiliqua multifasciata (Central Blue-tongue)*			
187.	24308	*Todiramphus pyrrhopygia (Red-backed Kingfisher)*			
188.	24851	*Turnix velox (Little Button-quail)*			
189.	30814	*Tympanocryptis cephalus (Pebble Dragon)*			
190.	25445	*Uperoleia russelli (Northwest Toadlet)*			
191.	25209	*Varanus acanthurus (Spiny-tailed Monitor)*			
192.	25210	*Varanus brevicauda (Short-tailed Pygmy Monitor)*			
193.	30825	*Varanus bushi (Pilbara Mulga Monitor)*			
194.	25212	*Varanus eremius (Pygmy Desert Monitor)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
195.	25224	*Varanus pilbarensis (Pilbara Rock Monitor)*			
196.	25227	*Varanus tristis subsp. tristis (Racehorse Monitor)*			
197.	25311	*Vermicella snelli*			
198.	24205	*Vespadelus finlaysoni (Finlayson's Cave Bat)*			
199.	24248	*Zyzomys argurus (Common Rock-rat)*			

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

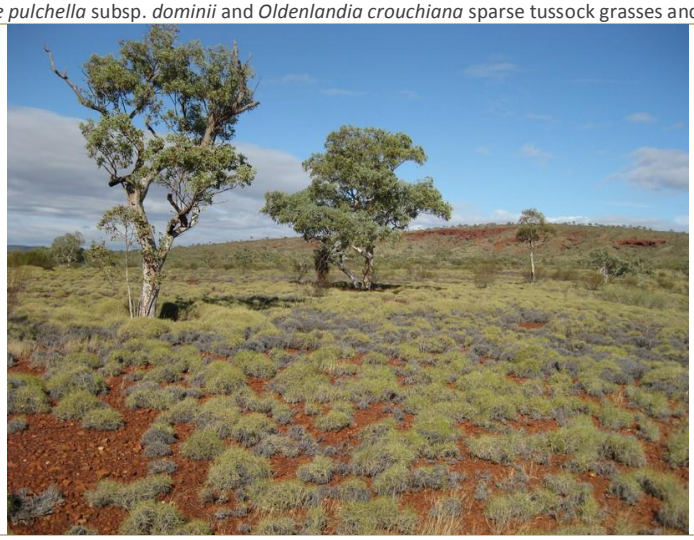
[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only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

Appendix Five: Relevé Data

Site	EFF11R03	
Described by	SK, RD	12/07/2011
MGA Zone	GDA94 50	528400 **mE** 7519386 **mN**
Landform	Open depression/ drainage line	
Soil	Red brown loam	
Rock Type	Ironstone	
Vegetation Description	*Acacia aptaneura* and *Eucalyptus xerothermica* woodland/ mallee woodland over *Triodia epactia, Eulalia aurea* and *Chrysopogon fallax* hummock grassland/tussock grassland	
Vegetation Condition	Very good	
Notes	Weeds: **Bidens* bipinnata minor infestation. *Themeda triandra* also characteristic.	
Photo		

Site	EFF11R04	
Described by	SK	12/07/2011
MGA Zone	GDA94 50	528606 **mE** 7519246 **mN**
Landform	Flat	
Soil	Red brown loam	
Rock Type	Ironstone	
Vegetation Description	*A. sibirica*, *Acacia bivenosa* and *A. synchronicia* open shrubland over *Triodia wiseana* hummock grassland	
Vegetation Condition	Very good	
Notes	*A. atkinsiana* also characteristic.	
Photo		

Site	EFF11R05	
Described by	SK, RD	12/07/2011
MGA Zone	GDA94 50	529232 **mE** 7519602 **mN**
Landform	Undulating plain	
Soil	Red brown loam	
Rock Type	Ironstone	
Vegetation Description	*Acacia aptaneura* and *Corymbia deserticola* subsp. *deserticola* open woodland over *Acacia atkinsiana, A. exilis* and *A. bivenosa* sparse shrubland over *Triodia wiseana* open hummock grassland	
Vegetation Condition	Very good	
Notes	*Eucalyptus gamophylla* in patches. *Codonocarpus cotinifolius* also characteristic.	
Photo		

Site	EFF11R06	
Described by	SK, RD	12/07/2011
MGA Zone	GDA94 50	527397 **mE** 7520033 **mN**
Landform	Raised undulating landscape	
Soil	Red brown loam	
Rock Type	Ironstone	
Vegetation Description	*Eucalyptus leucophloia* subsp. *leucophloia* open woodland over *Acacia exilis, A. atkinsiana* and *Senna glutinosa* subsp. *pruinosa* sparse shrubland over *Triodia wiseana and T.* aff. *melvillei* hummock grassland	
Vegetation Condition	Very good	
Notes	*Eriachne pulchella* subsp. *dominii* and *Oldenlandia crouchiana* sparse tussock grasses and herbs	
Photo		

Site	EFF11R07	
Described by	SK, RD	12/07/2011
MGA Zone	GDA94 50	527479 **mE** 7520277 **mN**
Landform	Minor drainage line	
Soil	Red brown loam	
Rock Type	Ironstone	
Vegetation Description	*Corymbia hamersleyana* and *Eucalyptus xerothermica* woodland over *Petalostylis labicheoides, Gossypium robinsonii* and *Acacia atkinsiana* shrubland over *Triodia epactia* hummock grassland with *Eriachne mucronata* and *Themeda triandra* open tussock grasses and *Scaevola amblyanthera* var. *centralis* sparse herbs	
Vegetation Condition	Very good	
Notes	Priority Species: *Indigofera* sp. Bungaroo Creek. *A. maitlandii* and *A. ancistrocarpa* also characteristic.	
Photo		

Site	EFF11R08	
Described by	SK, RD	12/07/2011
MGA Zone	GDA94 50	526052 **mE** 7515964 **mN**
Landform	Gentle east facing mid-slope	
Soil	Red brown loam	
Rock Type	Ironstone	
Vegetation Description	*Eucalyptus leucophloia* subsp. *leucophloia*, *Hakea chordophylla* and *Corymbia hamersleyana* open woodland over *Acacia maitlandii* and *Grevillea wickhamii* subsp. *hispidula* open shrubland over *Triodia wiseana* and *Triodia* aff. *melvillei* hummock grassland	
Vegetation Condition	Very good	
Notes	Relatively high shrub component in mid stratum *Eriachne pulchella* subsp. *dominii*, *Polycarpaea holtzei* and *Acacia spondylophylla* sparse tussock grasses, herbs and shrubs	
Photo		

Site	EFF11R09	
Described by	SK, RD	12/07/2011
MGA Zone	GDA94 50	525845 **mE** 7515734 **mN**
Landform	Gorge/gully	
Soil	Red brown loam	
Rock Type	Ironstone	
Vegetation Description	*Corymbia hamersleyana* open woodland over *Acacia pruinocarpa, A. maitlandii* and *A. pyrifolia* var. *pyrifolia* open shrubland over *Triodia epactia* and *Triodia wiseana* open hummock grassland	
Vegetation Condition	Very good	
Notes	Steep sided gully within Newman formation. Weeds: **Bidens bipinnata*. *Gossypium robinsonii* also characteristic. *Eriachne mucronata* sparse tussock grasses.	
Photo		

Site	EFF11R10	
Described by	SK, RD	12/07/2011
MGA Zone	GDA94 50	526463 **mE** 7515429 **mN**
Landform	Very gentle east facing lower slope	
Soil	Red brown loam	
Rock Type	Ironstone	
Vegetation Description	*Acacia exilis*, *A. trudgeniana* and *A. inaequilatera* open shrubland over *Triodia wiseana* hummock grassland	
Vegetation Condition	Very good	
Notes	*Eriachne pulchella* subsp. *dominii* and *Polycarpaea holtzei* sparse tussock grasses and herbs	
Photo		

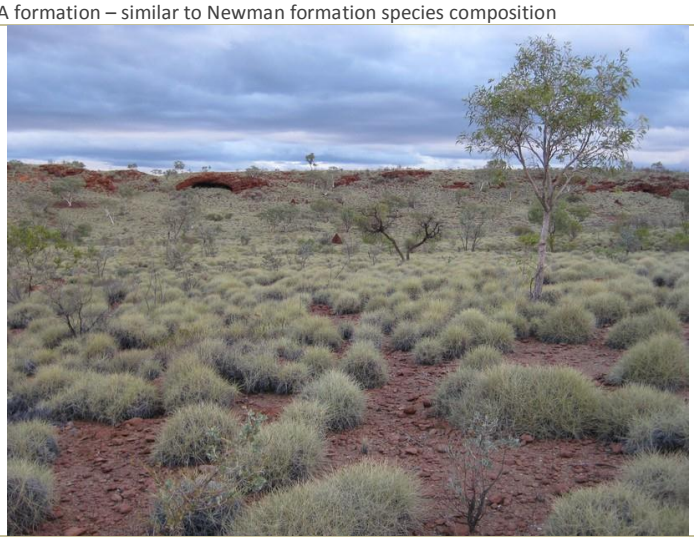
Site	EFF11R11	
Described by	SK, RD	12/07/2011
MGA Zone	GDA94 50	526203 **mE** 7513743 **mN**
Landform	Wide depression/drainage	
Soil	Red brown loam	
Rock Type	Ironstone	
Vegetation Description	*Corymbia hamersleyana* and *Eucalyptus xerothermica* open woodland over *Acacia ancistrocarpa*, *A. bivenosa* and *A. pyrifolia* var. *pyrifolia* open shrubland over *Triodia epactia, Chrysopogon fallax* and *Eulalia aurea* hummock grassland/tussock grassland	
Vegetation Condition	Very good	
Notes	Same drainage line as R03 with slightly different dominants (no mulga). *Eremophila longifolia*, *Senna artemisioides* subsp. *oligophylla, Themeda triandra* and *Aristida latifolia* also characteristic.	
Photo		

Site	EFF11R12	
Described by	SK, RD	12/07/2011
MGA Zone	GDA94 50	526127 **mE** 7511919 **mN**
Landform	Mid-slope	
Soil	Red brown loam	
Rock Type	Ironstone	
Vegetation Description	*Eucalyptus leucophloia* subsp. *leucophloia* and *Hakea chordophylla* open woodland over *Acacia pruinocarpa, Senna glutinosa* subsp. *glutinosa* and *Grevillea wickhamii* subsp. *hispidula* sparse shrubland over *Triodia wiseana* hummock grassland	
Vegetation Condition	Excellent	
Notes	Newman formation. Typical *E. leucophloia* over *T. wiseana*. *Acacia pyrifolia* var. *pyrifolia* also characteristic. *Eriachne pulchella* subsp. *dominii*, *E. aristidea, Polycarpaea holtzei, Bulbostylis barbata* tussock grasses, herbs and sedges.	
Photo		

Site	EFF11R13	
Described by	SK, RD	12/07/2011
MGA Zone	GDA94 50	526203 **mE** 7512481 **mN**
Landform	Top of hill in PLA land system	
Soil	Red brown loam	
Rock Type	Ironstone	
Vegetation Description	*Corymbia deserticola* subsp. *deserticola* open woodland over *Acacia inaequilatera, A. pruinocarpa* and *Senna glutinosa* subsp. *glutinosa* sparse shrubland over *Triodia wiseana* and *T.* aff. *melvillei* hummock grassland	
Vegetation Condition	Very good	
Notes	Very similar to EFF11R06. *Hakea chordophylla* also characteristic. *Eriachne aristidea*, *Amphipogon sericeus* and *Fimbristylis simulans* sparse tussock grasses and sedges	
Photo		

Site	EFF11R13	
Site		
Described by	SK, RD	12/07/2011
MGA Zone	GDA94 50	526198 **mE** 7513497 **mN**
Landform	Very gentle west facing flat	
Soil	Red brown loam	
Rock Type	Ironstone	
Vegetation Description	*Acacia inaequilatera*, *Senna glutinosa* subsp. *glutinos* and *Acacia exilis* sparse shrubland over *Triodia epactia* hummock grassland with *Eucalyptus gamophylla* and *Corymbia hamersleyana* isolated trees	
Vegetation Condition	Excellent	
Notes	Similar to EFF11R04, but dominated by *Triodia epactia.* *A. ancistrocarpa, Senna artemisioides* subsp. *oligophylla* and *Bonamia rosea* also characteristic.	
Photo		

Site	EFF11R15	
Described by	SK, RD	12/07/2011
MGA Zone	GDA94 50	525000 **mE** 7512548 **mN**
Landform	Low undulating rises	
Soil	Red brown loam	
Rock Type	Calcrete	
Vegetation Description	*Eucalyptus socialis* subsp. *eucentrica*, *Eucalyptus xerothermica* and *Corymbia hamersleyana* mallee woodland over *Senna artemisioides* subsp. *oligophylla*, *Acacia synchronicia* and *A. bivenosa* sparse shrubland over *Triodia wiseana* open hummock grassland	
Vegetation Condition	Very good	
Notes	Located near foothills of Newman formation.	
Photo		

Site	EFF11R16	
Described by	SK, RD	12/07/2011
MGA Zone	GDA94 50	522902 **mE** 7512690 **mN**
Landform	Undulating hills	
Soil	Red brown loam	
Rock Type	Basalt	
Vegetation Description	*Corymbia hamersleyana* and *Eucalyptus leucophloia* subsp. *leucophloia* open woodland over *Acacia inaequilatera* and *A. bivenosa* sparse shrubland over *Triodia wiseana* hummock grassland with *Acacia spondylophylla* sparse shrubs.	
Vegetation Condition	Excellent	
Notes	ROCKLEA formation – similar to Newman formation species composition	
Photo		

Site	EFF11R17	
Described by	SK, RD	13/07/2011
MGA Zone	GDA94 50	518148 **mE** 7509002 **mN**
Landform	North facing upper slope near breakaway edge	
Soil	Red brown rocky loam	
Rock Type	Ironstone	
Vegetation Description	*Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia ferriticola* open woodland over *Acacia marramamba*, *A. atkinsiana* and *Eremophila magnifica* subsp. *velutina* open shrubland over *Triodia wiseana* hummock grassland	
Vegetation Condition	Excellent	
Notes	*Eremophila magnifica* subsp. *velutina* (P3). Newman formation upper slope. Typical hill slope vegetation. *A. pruinocarpa* and *Tribulus suberosus* also characteristic. *Eriachne mucronata*, *Ptilotus fusiformis*, *Eriachne pulchella* subsp. *dominii* and *Bulbostylis barbata* sparse tussock grasses, herbs and sedges.	
Photo		

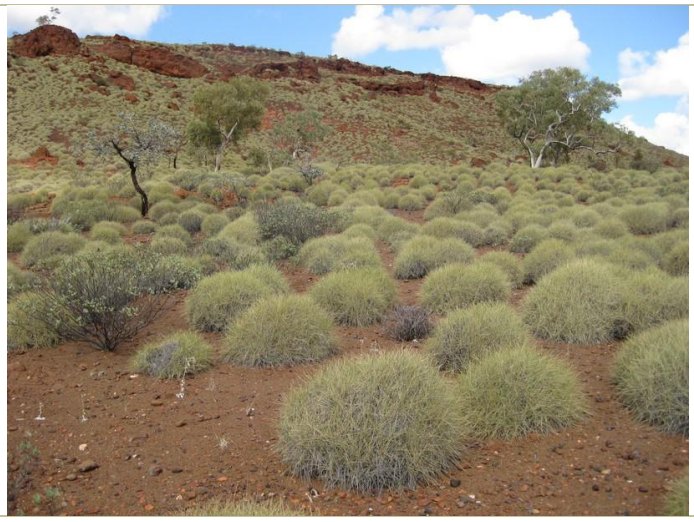
Site	EFF11R18	
Described by	SK, RD	13/07/2011
MGA Zone	GDA94 50	518247 **mE** 7508817 **mN**
Landform	Gentle north west facing hillcrest	
Soil	Red brown loam	
Rock Type	Ironstone	
Vegetation Description	*Eucalyptus gamophylla* and *Eucalyptus leucophloia* subsp. *leucophloia* open woodland over *Acacia maitlandii, A. atkinsiana* and *Hakea chordophylla* open shrubland over *Triodia wiseana* hummock grassland	
Vegetation Condition	Excellent	
Notes	*Senna glutinosa* subsp. *glutinosa* also characteristic. *Eriachne pulchella* subsp. *dominii*, *Bulbostylis barbata* and *Eriachne mucronata* sparse tussock grasses and sedges.	
Photo		

Site	EFF11R19	
Described by	SK, RD	13/07/2011
MGA Zone	GDA94 50	517801 **mE** 7507018 **mN**
Landform	Very gently sloped low undulating hill top	
Soil	Red brown loam	
Rock Type	Ironstone	
Vegetation Description	*Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* open woodland over *Acacia maitlandii*, *Senna glutinosa* subsp. *pruinosa* and *Ptilotus rotundifolius* sparse shrubland over *Triodia wiseana* hummock grassland	
Vegetation Condition	Excellent	
Notes	*Senna glutinosa* subsp. *glutinosa, Schizachyrium fragile* and *Bulbostylis barbata* common.	
Photo		

Site	EFF11R20	
Described by	SK, RD	13/07/2011
MGA Zone	GDA94 50	518006 **mE** 7507276 **mN**
Landform	Flat	
Soil	Red brown loam	
Rock Type	Ironstone	
Vegetation Description	*Acacia xiphophylla* and *Acacia sibirica* tall open shrubland over *Eremophila cuneata*, *Maireana* sp. and *Rhagodia eremaea* low sparse shrubland	
Vegetation Condition	Very good	
Notes	Occasional *Triodia epactia* hummock grasses. *A. synchronicia* also characteristic.	
Photo		

Site	EFF11R21	
Described by	SK, RD	13/07/2011
MGA Zone	GDA94 50	51856 3**mE** 7508645 **mN**
Landform	Steep north facing scree slope	
Soil	Red brown loam	
Rock Type	Ironstone	
Vegetation Description	*Triodia wiseana* hummock grassland with *Themeda* sp., *Gomphrena cunninghamii* and *Ptilotus auriculifolius* sparse tussock grasses/herbs	
Vegetation Condition	Excellent	
Notes		
Photo		

Site	EFF11R22	
Described by	SK, RD	13/07/2011
MGA Zone	GDA94 50	517943 **mE** 7509813 **mN**
Landform	Flat	
Soil	Red brown loam	
Rock Type	Ironstone	
Vegetation Description	*Eucalyptus leucophloia* subsp. *leucophloia* isolated trees over *Acacia atkinsiana*, *Senna glutinosa* subsp. *glutinosa* and *S. glutinosa* subsp. *x luerssenii* sparse shrubland over *Triodia epactia* hummock grassland	
Vegetation Condition	Excellent	
Notes	*S. artemisioides* subsp. *oligophylla* and *A. ancistrocarpa* also characteristic. *Eriachne aristidea*, *Enneapogon polyphyllus* and *Aristida holathera* var. *holathera* sparse tussock grasses.	
Photo		

Site	EFF11R23	
Described by	SK, RD	13/07/2011
MGA Zone	GDA94 50	517455 **mE** 7511112 **mN**
Landform	Rolling hills	
Soil	Red brown loam	
Rock Type	Basalt	
Vegetation Description	*Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* open woodland over *Acacia inaequilatera* sparse shrubland over *Triodia wiseana* hummock grassland with *Senna artemisioides* subsp. *oligophylla* and *Ptilotus auriculifolius* sparse shrubs and herbs	
Vegetation Condition	Very good	
Notes		
Photo		

Site	EFF11R24	
Described by	SK, RD	13/07/2011
MGA Zone	GDA94 50	517332 **mE** 7510779 **mN**
Landform	Moderately sloped lower-slope around base of breakaway	
Soil	Red brown loam	
Rock Type	Ironstone	
Vegetation Description	*Eucalyptus leucophloia* subsp. *leucophloia* open woodland over *Senna glutinosa* subsp. *pruinosa* and *Acacia bivenosa* sparse shrubland over *Triodia longiceps* and *Triodia wiseana* hummock grassland.	
Vegetation Condition	Excellent	
Notes	Small area, too small to map.	
Photo		

Site	EFF11R25	
Described by	SK, RD	13/07/2011
MGA Zone	GDA94 50	521610 **mE** 7512350 **mN**
Landform	Gentle south facing mid-slope, undulating lower rises	
Soil	Red brown loam	
Rock Type	Basalt	
Vegetation Description	*Corymbia hamersleyana* open woodland over *Acacia inaequilatera*, *A. pyrifolia* var. *pyrifolia* and *Hakea chordophylla* sparse shrubland over *Triodia wiseana* hummock grassland	
Vegetation Condition	Very good	
Notes	*Senna glutinosa* subsp. *glutinosa* and *S. artemisioides* subsp. oligophylla also characteristic.	
Photo		

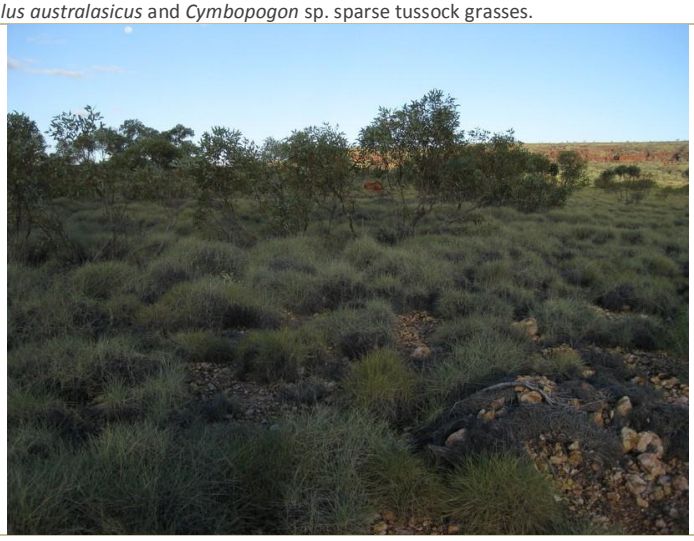
Site	EFF11R26	
Described by	SK, RD	13/07/2011
MGA Zone	GDA94 50	521420 **mE** 7512791 **mN**
Landform	Flat, rolling low rises	
Soil	Red brown loam	
Rock Type	Basalt	
Vegetation Description	*Corymbia hamersleyana* isolated trees over *Acacia inaequilatera*, *Senna glutinosa* subsp. *pruinosa* and *A. ancistrocarpa* sparse shrubland over *Triodia wiseana* open hummock grassland	
Vegetation Condition	Excellent	
Notes	*Ptilotus auriculifolius*, *Aristida contorta*, *Eriachne aristidea* and *Sporobolus australasicus* sparse herbs and tussock grasses.	
Photo		

Site	EFF11R27	
Described by	SK, RD	13/07/2011
MGA Zone	GDA94 50	521597 **mE** 7512794 **mN**
Landform	Major drainage	
Soil	Red brown loam	
Rock Type	Ironstone	
Vegetation Description	*Eucalyptus victrix* woodland over *Acacia citrinoviridis* and *Gossypium robinsonii* open shrubland over *Themeda triandra* and *Cyperus vaginatus* open grassland/ sedgeland.	
Vegetation Condition	Very good	
Notes	*Melaleuca glomerata* also characteristic.	
Photo		

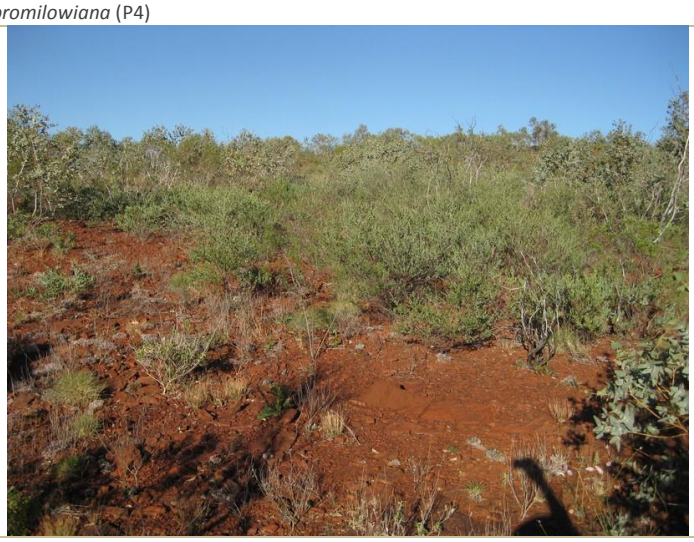
Site	EFF11R28	
Described by	SK, RD	13/07/2011
MGA Zone	GDA94 50	521911 **mE** 7511616 **mN**
Landform	Gentle south facing upper slope near crest	
Soil	Red brown loam	
Rock Type	Ironstone	
Vegetation Description	*Acacia exilis*, *A. synchronicia* and *Senna glutinosa subsp. glutinosa* open shrubland over *Triodia wiseana* hummock grassland with *Acacia spondylophylla* and *Eriachne pulchella* subsp. *dominii* sparse shrubs and tussock grasses with *Eucalyptus leucophloia* subsp. *leucophloia* isolated trees	
Vegetation Condition	Excellent	
Notes	*A. maitlandii* and *S. glutinosa* subsp. *pruinosa* also characteristic.	
Photo		

Site	EFF11R29	
Described by	SK, RD	13/07/2011
MGA Zone	GDA94 50	520663 **mE** 7510281 **mN**
Landform	Flat to slightly undulating	
Soil	Red brown loam	
Rock Type	Ironstone	
Vegetation Description	*Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* isolated trees over *Acacia ancistrocarpa*, *Senna artemisioides* subsp. *oligophylla* and *A. bivenosa* open shrubland over *Triodia epactia* hummock grassland with *Aristida contorta* and *Boerhavia coccinea* sparse tussock grasses and shrubs	
Vegetation Condition	Very good	
Notes		
Photo		

Site	EFF11R30	
Described by	SK, RD	13/07/2011
MGA Zone	GDA94 50	518118 **mE** 7509834 **mN**
Landform	Gentle north facing slope amongst undulating low hills	
Soil	Red brown loam	
Rock Type	Ironstone	
Vegetation Description	*Corymbia deserticola* subsp. *deserticola* and *Eucalyptus leucophloia* subsp. *leucophloia* open woodland over *Senna glutinosa* subsp. *glutinosa*, *Acacia inaequilatera* and *A. atkinsiana* sparse shrubland over *Triodia wiseana* open hummock grassland	
Vegetation Condition	Excellent	
Notes	*S. artemisioides* subsp. *oligophylla* and *A. marramamba* also characteristic. *Amphipogon sericeus, Goodenia stobbsiana*, *Eriachne pulchella* subsp. *dominii* and *E. aristidea* sparse tussock grasses and herbs.	
Photo		

Site	EFF11R31	
Described by	SK, RD	13/07/2011
MGA Zone	GDA94 50	514193 **mE** 7509262 **mN**
Landform	Gentle west facing undulating hill	
Soil	Red brown loam	
Rock Type	Calcrete	
Vegetation Description	*Eucalyptus socialis* subsp. *eucentrica* mallee woodland over *Capparis umbonata, Stylobasium spathulatum* and *Eremophila fraseri* subsp. *fraseri* sparse shrubland over *Triodia longiceps* and *Triodia wiseana* hummock grassland	
Vegetation Condition	Very good	
Notes	*Sporobolus australasicus* and *Cymbopogon* sp. sparse tussock grasses.	
Photo		

Site	EFF11R32	
Described by	SK, RD	14/07/2011
MGA Zone	GDA94 50	505849 **mE** 7509311 **mN**
Landform	North facing mid-slope of the largest hill in project area	
Soil	Red brown loam	
Rock Type	Ironstone	
Vegetation Description	*Acacia bivenosa*, *A. pruinocarpa* and *A. marramamba* open shrubland over *Triodia wiseana* and *Eriachne mucronata* open hummock grassland/grassland	
Vegetation Condition	Excellent	
Notes	*Senna glutinosa* subsp. *glutinosa, Corchorus crozophorifolius* and *Sida* sp. Shovelanna Hill common	
Photo		

Site	EFF11R33	
Described by	SK, RD	14/07/2011
MGA Zone	GDA94 50	505829 **mE** 7508863 **mN**
Landform	Gentle north facing crest	
Soil	Red skeletal loam	
Rock Type	Ironstone	
Vegetation Description	*Eucalyptus gamophylla* and *Corymbia hamersleyana* woodland/ mallee woodland over *Acacia monticola*, *Senna glutinosa* subsp. *glutinosa* and *A. bromilowiana* open shrubland over T*riodia wiseana* open hummock grassland	
Vegetation Condition	Very good	
Notes	*Petalostylis labicheoides*, *A. atkinsiana* also characteristic. *Ptilotus exaltatus* var. *exaltatus*, *Polycarpaea holtzei* and *Eriachne pulchella* subsp. *dominii* sparse herbs and tussock grasses. *Acacia bromilowiana* (P4)	
Photo		

Site	EFF11R34	
Described by	SK, RD	14/07/2011
MGA Zone	GDA94 50	505795 **mE** 7509682 **mN**
Landform	Undulating foothills	
Soil	Red brown loam	
Rock Type	Ironstone	
Vegetation Description	*Eucalyptus deserticola* subsp. *deserticola* and *Eucalyptus leucophloia* subsp. *leucophloia* open woodland over *Acacia pruinocarpa*, *A. marramamba* and *A. inaequilatera* sparse shrubland over *Triodia wiseana* and *T.* aff *melvillei* open hummock grassland	
Vegetation Condition	Excellent	
Notes	*A. atkinsiana* and *Senna glutinosa* subsp. *glutinosa* also characteristic. *Eriachne pulchella* subsp. *dominii*, *Goodenia stobbsiana* and *Amphipogon sericeus* sparse tussock grasses and herbs.	
Photo		

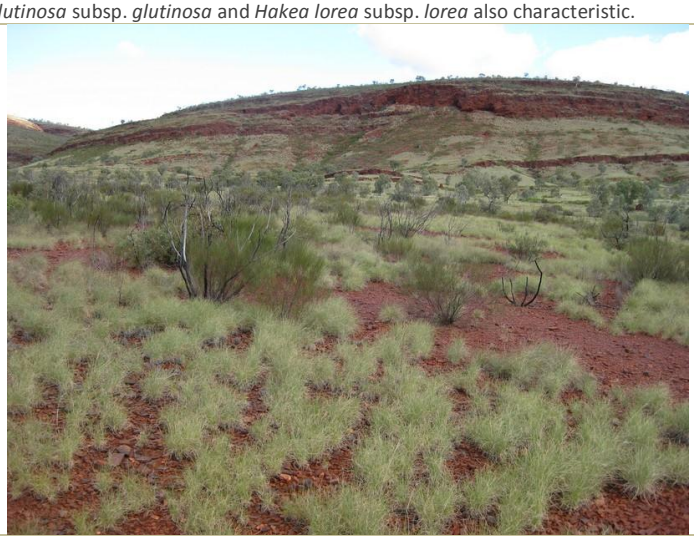
Site	EFF11R35	
Described by	SK, RD	14/07/2011
MGA Zone	GDA94 50	505507 **mE** 7510655 **mN**
Landform	Very gentle north facing lower slope (almost flat)	
Soil	Red brown loam	
Rock Type	Ironstone	
Vegetation Description	*Eucalyptus leucophloia* subsp. *leucophloia*, *Corymbia hamersleyana* and *Acacia aptaneura* open woodland over *Acacia bivenosa*, *A. kempeana* and *A. atkinsiana* sparse shrubland over *Triodia wiseana* and *Triodia epactia* hummock grassland	
Vegetation Condition	Very good	
Notes	*Senna glutinosa* subsp. *glutinosa* and *A. exilis* also characteristic. *Eriachne pulchella* subsp. *dominii*, *Paraneurachne muelleri* and *Aristida holathera* var. *holathera* sparse tussock grasses.	
Photo		

Site	EFF11R36	
Described by	SK, RD	14/7/2011
MGA Zone	GDA94 50	507597 mE 7510646 mN
Landform	Hillcrest plateau	
Soil	Red brown skeletal loam	
Rock Type	Ironstone	
Vegetation Description	*Acacia exilis*, *A. pruinocarpa* and *A. marramamba* open shrubland over *Triodia wiseana* open hummock grassland	
Vegetation Condition	Very good	
Notes	*Petalostylis labicheoides* and *A. monticola* also characteristic. *Indigofera monophylla*, *Bulbostylis barbata*, *Eriachne pulchella* subsp. *dominii* sparse shrubs/sedges/tussock grasses.	
Photo		

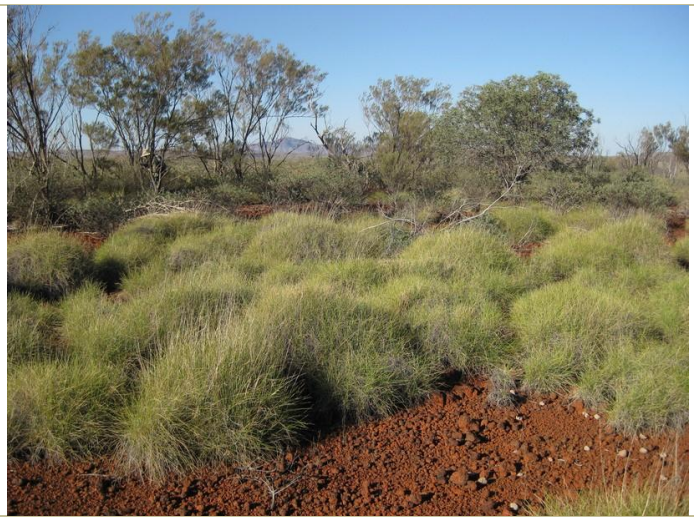
Site	EFF11R37	
Described by	SK, RD	14/7/2011
MGA Zone	GDA94 50	507448 mE 7510184 mN
Landform	Drainage line	
Soil	Red brown sandy loam	
Rock Type	Ironstone	
Vegetation Description	*Eucalyptus victrix* and *Eucalyptus xerothermica* open woodland over *Acacia citrinoviridis*, *Gossypium robinsonii* and *Acacia tumida* subsp. *pilbarensis* open shrubland over *Triodia epactia*, *Themeda triandra*, and *Enteropogon ramosus* open hummock grassland/open tussock grassland	
Vegetation Condition		
Notes	*Indigofera* sp. Bungaroo Creek (P3) present in this drainage line. *Acacia bivenosa, Stylobasium spathulatum, Eulalia aurea* and *Eriachne tenuiculmis* also characteristic.	
Photo		

Site	EFF11R38	
Described by	SK, RD	14/7/2011
MGA Zone	GDA94 50	504352 mE 7510274 mN
Landform	Valley floor flat	
Soil	Red brown loam	
Rock Type	Ironstone	
Vegetation Description	*Eucalyptus gamophylla*, *Corymbia deserticola* subsp. *deserticola* and *Eucalyptus leucophloia* subsp. *leucophloia* mallee woodland/ woodland over *Acacia atkinsiana*, *A. kempeana* and *A. monticola* sparse shrubland over *Triodia epactia* hummock grassland	
Vegetation Condition	Very good	
Notes	*Senna glutinosa* subsp. *glutinosa* and *A. tumida* subsp. *pilbarensis* also characteristic. *Eulalia aurea*, *Scaevola parvifolia* subsp. *pilbarae*, *Bonamia rosea* and *Paraneurachne muelleri* sparse tussock grasses and herbs.	
Photo		

Site	EFF11R39	
Described by	SK, RD	14/7/2011
MGA Zone	GDA94 50	503672 mE 7511817 mN
Landform	Undulating low hills, very gentle slope	
Soil	Red brown loam	
Rock Type	?Ironstone (appears to be metamorphosed)	
Vegetation Description	*Eucalyptus leucophloia* subsp. *leucophloia* open woodland over *Senna glutinosa* subsp. *glutinosa* and *Acacia bivenosa* sparse shrubland over *Triodia longiceps* and *Triodia wiseana* open hummock grassland	
Vegetation Condition	Very good	
Notes	*Cassytha capillaris*, *Paraneurachne muelleri* and *Eriachne pulchella* subsp. *dominii* sparse vines and tussock grasses.	
Photo		

Site	EFF11R40	
Described by	SK, RD	14/7/2011
MGA Zone	GDA94 50	501735 mE 7510283 mN
Landform	Undulating foothills	
Soil	Red brown rocky loam	
Rock Type	Ironstone	
Vegetation Description	*Acacia exilis*, *A. marramamba* and *A. atkinsiana* open shrubland over *Triodia* aff. *melvillei* and *T. wiseana* hummock grassland with *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia deserticola* subsp. *deserticola* isolated trees	
Vegetation Condition	Very good	
Notes	*Senna glutinosa* subsp. *glutinosa* and *Hakea lorea* subsp. *lorea* also characteristic.	
Photo		

Site	EFF11R41	
Described by	SK, RD	14/7/2011
MGA Zone	GDA94 50	500392 mE 7510283 mN
Landform	Moderate upper slope of large hill	
Soil	Red brown rocky loam	
Rock Type	Ironstone	
Vegetation Description	*Eucalyptus leucophloia* subsp. *leucophloia* open woodland over *Petalostylis labicheoides*, *Acacia orthocarpa* and *Senna glutinosa* subsp. *glutinosa* open shrubland over *Triodia wiseana* open hummock grassland	
Vegetation Condition	Very good	
Notes	*Hakea lorea* subsp. *lorea* also characteristic. *Indigofera monophylla*, *Dampiera candicans*, *Aristida holathera* var. *holathera* and *Trachymene oleracea* subsp. *oleracea* sparse shrubs, herbs and tussock grasses.	
Photo		

Site	EFF11R49	
Described by	SK, RD	17/7/2011
MGA Zone	GDA94 50	511156 mE 7511409 mN
Landform	Mesa top, flat	
Soil	Red brown skeletal loam	
Rock Type	Ironstone	
Vegetation Description	*Acacia aptaneura* and *A. pruinocarpa* woodland over *Eremophila forrestii* subsp. *forrestii* sparse shrubland over *Triodia ?epactia* open hummock grassland	
Vegetation Condition	Excellent	
Notes		
Photo		

Appendix Six: Threatened and Priority Flora Report Forms

Department of Environment and Conservation
Our environment, our future

Threatened and Priority Flora Report Form

Version 1.0 January 2010

Please complete as much of the form as possible, with emphasis on those sections bordered in black.

TAXON: Eremophila magnifica subsp. magnifica **TPFL Pop. No:** _____

OBSERVATION DATE: 14 /7/2011 **CONSERVATION STATUS:** P4 New population ☒

OBSERVER/S: S. Kern, R. Daniel **PHONE:** 94308955

ROLE: Botanists **ORGANISATION:** Ecoscape

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place):

Flying Fish project area, Approximately 60km NW of Tom Price

Reserve No: _____

DEC DISTRICT: Pilbara **LGA:** Shire of Ashburton Land manager present: ☐

DATUM: GDA94 / MGA94 ☐ AGD84 / AMG84 ☐ WGS84 ☒ Unknown ☐

COORDINATES: (If UTM coords provided, **Zone** is also required) DecDegrees ☐ DegMinSec ☐ UTMs ☒

Lat / Northing: 7510183

Long / Easting: 500224

ZONE: 50

METHOD USED: GPS ☒ Differential GPS ☐ Map ☐

No. satellites: _____ Map used: _____

Boundary polygon captured: ☐ Map scale: _____

LAND TENURE:

Nature reserve ☐	Timber reserve ☐	Private property ☐	Rail reserve ☐	Shire road reserve ☐
National park ☐	State forest ☐	Pastoral lease ☒	MRWA road reserve ☐	Other Crown reserve ☐
Conservation park ☐	Water reserve ☐	UCL ☐	SLK/Pole _____ to _____	Specify other: Exploration Lease

AREA ASSESSMENT: Edge survey ☐ Partial survey ☒ Full survey ☐ Area observed (m²): _____

EFFORT: Time spent surveying (minutes): _____ No. of minutes spent / 100 m²: _____

POP'N COUNT ACCURACY: Actual ☐ Extrapolation ☐ Estimate ☒ Count method: _____ (Refer to field manual for list)

WHAT COUNTED: Plants ☒ Clumps ☐ Clonal stems ☐

TOTAL POP'N STRUCTURE:

	Mature:	Juveniles:	Seedlings:	Totals:
Alive	20+			
Dead				

Area of pop (m²): _____

Note: Pls record count as numbers (not percentages) for database.

QUADRATS PRESENT: No. _____ Size _____ Data attached ☐ Total area of quadrats (m²): _____

Summary Quad. Totals: Alive				

REPRODUCTIVE STATE: Clonal ☐ Vegetative ☐ Flowerbud ☐ Flower ☑ Immature fruit ☐ Fruit ☐ Dehisced fruit ☐ Percentage in flower: 100 %

CONDITION OF PLANTS: Healthy ☒ Moderate ☐ Poor ☐ Senescent ☐

COMMENT: Erect shrub to 1-5m

THREATS - type, agent and supporting information: Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. **Specify agent** where relevant. Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme. Estimate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)	**Current impact (N-E)**	**Potential Impact (L-E)**	**Potential Threat Onset (S-L)**
• Clearing	N	H	M
•			
•			

Please return completed form to DEC, Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983

RECORDS: Please forward to **Administrative Officer, Flora,** Species and Communities Branch.

Record entered by: _____ **Sheet No.:** _____ **Record Entered in Database** ☐

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Threatened and Priority Flora Report Form

Version 1.0 January 2010

HABITAT INFORMATION:

LANDFORM:
Crest ☐
Hill ☐
Ridge ☐
Outcrop ☐
Slope ☑
Flat ☐
Open depression ☐
Drainage line ☐
Closed depression ☐
Wetland ☐

ROCK TYPE:
Granite ☐
Dolerite ☐
Laterite ☐
Ironstone ☑
Limestone ☐
Quartz ☐
Specify other: _____

LOOSE ROCK: (on soil surface; eg gravel, quartz fields)
0-10% ☐
10-30% ☐
30-50% ☐
50-100% ☑

SOIL TYPE:
Sand ☐
Sandy loam ☐
Loam ☑
Clay loam ☐
Light clay ☐
Peat ☐
Specify other: rocky

SOIL COLOUR:
Red ☑
Brown ☑
Yellow ☐
White ☐
Grey ☐
Black ☐
Specify other: _____

DRAINAGE:
Well drained ☑
Seasonally inundated ☐
Permanently inundated ☐
Tidal ☐

Specific **Landform** Element: _____
(Refer to field manual for additional values)

CONDITION OF SOIL: Dry ☑ Moist ☐ Waterlogged ☐ Inundated ☐

VEGETATION CLASSIFICATION*:
Eg: **1.** Banksia woodland (B. attenuata, B. ilicifolia); **2.** Open shrubland (Hibbertia sp., Acacia spp.) ; **3.** Isolated clumps of sedges (Mesomelaena tetragona)

1. _____
2. _____
3. _____
4. _____

ASSOCIATED SPECIES: _____

Other (non-dominant) spp _____

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 *Australian Soil and Land Survey Field Handbook* guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine ☐ Excellent ☑ Very good ☐ Good ☐ Degraded ☐ Completely degraded ☐

COMMENT: _____

FIRE HISTORY: **Last Fire:** Season/Month: _____ Year: _____ **Fire Intensity:** High ☐ Medium ☐ Low ☐ No signs of fire ☐

FENCING: Not required ☐ Present ☐ Replace / repair ☐ Required ☐ Length req'd: _____

ROADSIDE MARKERS: Not required ☒ Present ☐ Replace / reposition ☐ Required ☐ Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.) _____

SPECIMEN: Collectors No: EFF11-V WA Herb. ☑ Regional Herb. ☐ District Herb. ☐ Other: _____

ATTACHED: Map ☐ Mudmap ☐ Photo ☐ GIS data ☐ Field notes ☐ Other: _____

COPY SENT TO: Regional Office ☐ District Office ☐ Other:

Submitter of Record: Stephen Kern Role: Botanist Signed: Stephen Kern Date: 27/9/2011

Please return completed form to DEC, Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983

RECORDS: Please forward to **Administrative Officer, Flora,** Species and Communities Branch.

Record entered by: _____ **Sheet No.:** _____ **Record Entered in Database** ☐

Department of Environment and Conservation
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Threatened and Priority Flora Report Form

Version 1.0 January 2010

Please complete as much of the form as possible, with emphasis on those sections bordered in black.

TAXON: Indigofera sp. Bungaroo Creek **TPFL Pop. No:**

OBSERVATION DATE: 14/7/2011 **CONSERVATION STATUS:** P3 New population ☒

OBSERVER/S: S. Kern, R. Daniel **PHONE:** 94308955

ROLE: Botanists **ORGANISATION:** Ecoscape

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place):

Flying Fish project area, Approximately 60km NW of Tom Price

Reserve No:

DEC DISTRICT: Pilbara **LGA:** Shire of Ashburton Land manager present: ☐

DATUM: GDA94 / MGA94 ☐ AGD84 / AMG84 ☐ WGS84 ☒ Unknown ☐

COORDINATES: (If UTM coords provided, **Zone** is also required) DecDegrees ☐ DegMinSec ☐ UTMs ☒

Lat / Northing: 7510421

Long / Easting: 507461

ZONE: 50

METHOD USED: GPS ☒ Differential GPS ☐ Map ☐

No. satellites: _____ Map used: _____

Boundary polygon captured: ☐ Map scale: _____

LAND TENURE:

Nature reserve ☐	Timber reserve ☐	Private property ☐	Rail reserve ☐	Shire road reserve ☐
National park ☐	State forest ☐	Pastoral lease ☒	MRWA road reserve ☐	Other Crown reserve ☐
Conservation park ☐	Water reserve ☐	UCL ☐	SLK/Pole _____ to _____	Specify other: Exploration Lease

AREA ASSESSMENT: Edge survey ☐ Partial survey ☒ Full survey ☐ Area observed (m²): _____

EFFORT: Time spent surveying (minutes): _____ No. of minutes spent / 100 m²: _____

POP'N COUNT ACCURACY: Actual ☐ Extrapolation ☐ Estimate ☒ Count method: _____ (Refer to field manual for list)

WHAT COUNTED: Plants ☒ Clumps ☐ Clonal stems ☐

TOTAL POP'N STRUCTURE:

	Mature:	Juveniles:	Seedlings:	Totals:
Alive	200+			
Dead				

Area of pop (m²): _____

Note: Pls record count as numbers (not percentages) for database.

QUADRATS PRESENT: No. _____ Size _____ Data attached ☐ Total area of quadrats (m²): _____

Summary Quad. Totals: Alive				

REPRODUCTIVE STATE: Clonal ☐ Vegetative ☐ Flowerbud ☐ Flower ☑ Immature fruit ☐ Fruit ☐ Dehisced fruit ☐ Percentage in flower: 100 %

CONDITION OF PLANTS: Healthy ☒ Moderate ☐ Poor ☐ Senescent ☐

COMMENT: Erect shrub to 2m

THREATS - type, agent and supporting information: Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. **Specify agent** where relevant. Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme Estimate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)	**Current impact (N-E)**	**Potential Impact (L-E)**	**Potential Threat Onset (S-L)**
• Clearing	N	H	M
•			
•			

Please return completed form to DEC, Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983

RECORDS: Please forward to **Administrative Officer, Flora,** Species and Communities Branch.

Record entered by: _____ **Sheet No.:** _____ **Record Entered in Database** ☐

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Threatened and Priority Flora Report Form

Version 1.0 January 2010

HABITAT INFORMATION:

LANDFORM:
Crest ☐
Hill ☐
Ridge ☐
Outcrop ☐
Slope ☐
Flat ☐
Open depression ☐
Drainage line ☑
Closed depression ☐
Wetland ☐

ROCK TYPE:
Granite ☐
Dolerite ☐
Laterite ☐
Ironstone ☑
Limestone ☐
Quartz ☐
Specify other: _____

LOOSE ROCK: (on soil surface; eg gravel, quartz fields)
0-10% ☐
10-30% ☐
30-50% ☐
50-100% ☑

SOIL TYPE:
Sand ☐
Sandy loam ☑
Loam ☐
Clay loam ☐
Light clay ☐
Peat ☐
Specify other: _____

SOIL COLOUR:
Red ☑
Brown ☑
Yellow ☐
White ☐
Grey ☐
Black ☐
Specify other: _____

DRAINAGE:
Well drained ☑
Seasonally inundated ☐
Permanently inundated ☐
Tidal ☐

Specific **Landform** Element: _____
(Refer to field manual for additional values)

CONDITION OF SOIL: Dry ☑ Moist ☐ Waterlogged ☐ Inundated ☐

VEGETATION CLASSIFICATION*:
Eg: 1. Banksia woodland (B. attenuata, B. ilicifolia); 2. Open shrubland (Hibbertia sp., Acacia spp.); 3. Isolated clumps of sedges (Mesomelaena tetragona)

1. Eucalyptus victrix, E. xerothermica
2. A. citrinoviridis, Gossypium robinsonii, Acacia tumida
3. Triodia epactia, Themeda triandra
4.

ASSOCIATED SPECIES:

Other (non-dominant) spp

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 *Australian Soil and Land Survey Field Handbook* guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine ☐ Excellent ☐ Very good ☑ Good ☐ Degraded ☐ Completely degraded ☐

COMMENT:

FIRE HISTORY: **Last Fire:** Season/Month: _____ Year: _____ **Fire Intensity:** High ☐ Medium ☐ Low ☐ No signs of fire ☐

FENCING: Not required ☐ Present ☐ Replace / repair ☐ Required ☐ Length req'd: _____

ROADSIDE MARKERS: Not required ☒ Present ☐ Replace / reposition ☐ Required ☐ Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.)

SPECIMEN: Collectors No: _____ WA Herb. ☐ Regional Herb. ☐ District Herb. ☐ Other: _____

ATTACHED: Map ☐ Mudmap ☐ Photo ☐ GIS data ☐ Field notes ☐ Other: _____

COPY SENT TO: Regional Office ☐ District Office ☐ Other:

Submitter of Record: Stephen Kern Role: Botanist Signed: Stephen Kern Date: 27/9/2011

Please return completed form to DEC, Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983

RECORDS: Please forward to **Administrative Officer, Flora,** Species and Communities Branch.

Record entered by: _____ **Sheet No.:** _____ **Record Entered in Database** ☐

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Please complete as much of the form as possible, with emphasis on those sections bordered in black.

TAXON: Eremophila magnifica subsp. magnifica **TPFL Pop. No:**

OBSERVATION DATE: 17 /7/2011 **CONSERVATION STATUS:** P 4 New population ☒

OBSERVER/S: S. Kern, R. Daniel **PHONE:** 94308955

ROLE: Botanists **ORGANISATION:** Ecoscape

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place):

Flying Fish project area, Approximately 60km NW of Tom Price

Reserve No:

DEC DISTRICT: Pilbara **LGA:** Shire of Ashburton Land manager present: ☐

DATUM:
GDA94 / MGA94 ☐
AGD84 / AMG84 ☐
WGS84 ☒
Unknown ☐

COORDINATES: (If UTM coords provided, **Zone** is also required)
DecDegrees ☐ DegMinSec ☐ UTMs ☒

Lat / Northing: 7509981

Long / Easting: 512161

ZONE: 50

METHOD USED:
GPS ☒ Differential GPS ☐ Map ☐

No. satellites: _____ Map used: _____

Boundary polygon captured: ☐ Map scale: _____

LAND TENURE:

Nature reserve ☐	Timber reserve ☐	Private property ☐	Rail reserve ☐	Shire road reserve ☐
National park ☐	State forest ☐	Pastoral lease ☒	MRWA road reserve ☐	Other Crown reserve ☐
Conservation park ☐	Water reserve ☐	UCL ☐	SLK/Pole _____ to _____	Specify other: Exploration Lease

AREA ASSESSMENT: Edge survey ☐ Partial survey ☒ Full survey ☐ Area observed (m²): _____

EFFORT: Time spent surveying (minutes): _____ No. of minutes spent / 100 m²: _____

POP'N COUNT ACCURACY: Actual ☐ Extrapolation ☐ Estimate ☒ Count method: _____ (Refer to field manual for list)

WHAT COUNTED: Plants ☒ Clumps ☐ Clonal stems ☐

TOTAL POP'N STRUCTURE:	Mature:	Juveniles:	Seedlings:	Totals:
Alive	25+			
Dead				

Area of pop (m²): _____

Note: Pls record count as numbers (not percentages) for database.

QUADRATS PRESENT: No. _____ Size _____ Data attached ☐ Total area of quadrats (m²): _____

Summary Quad. Totals: Alive				

REPRODUCTIVE STATE: Clonal ☐ Vegetative ☐ Flowerbud ☐ Flower ☑

Immature fruit ☐ Fruit ☐ Dehisced fruit ☐ Percentage in flower: 100 %

CONDITION OF PLANTS: Healthy ☒ Moderate ☐ Poor ☐ Senescent ☐

COMMENT: Erect shrub to 1.5m tall

THREATS - type, agent and supporting information: Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. **Specify agent** where relevant. Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme Estimate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)	**Current impact (N-E)**	**Potential Impact (L-E)**	**Potential Threat Onset (S-L)**
• Clearing	N	H	M
•			
•			

Please return completed form to DEC, Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983

RECORDS: Please forward to **Administrative Officer, Flora,** Species and Communities Branch.

Record entered by: _____ **Sheet No.:** _____ **Record Entered in Database** ❑

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HABITAT INFORMATION:

LANDFORM:
- Crest ☐
- Hill ☐
- Ridge ☐
- Outcrop ☐
- Slope ☑
- Flat ☐
- Open depression ☐
- Drainage line ☐
- Closed depression ☐
- Wetland ☐

ROCK TYPE:
- Granite ☐
- Dolerite ☐
- Laterite ☐
- Ironstone ☑
- Limestone ☐
- Quartz ☐

Specify other: _____

LOOSE ROCK: (on soil surface; eg gravel, quartz fields)
- 0-10% ☐
- 10-30% ☐
- 30-50% ☐
- 50-100% ☑

SOIL TYPE:
- Sand ☐
- Sandy loam ☐
- Loam ☑
- Clay loam ☐
- Light clay ☐
- Peat ☐

Specify other: _____

SOIL COLOUR:
- Red ☑
- Brown ☑
- Yellow ☐
- White ☐
- Grey ☐
- Black ☐

Specify other: _____

DRAINAGE:
- Well drained ☑
- Seasonally inundated ☐
- Permanently inundated ☐
- Tidal ☐

Specific **Landform** Element: _____
(Refer to field manual for additional values)

CONDITION OF SOIL: Dry ☑ Moist ☐ Waterlogged ☐ Inundated ☐

VEGETATION CLASSIFICATION*:

Eg: **1.** Banksia woodland (B. attenuata, B. ilicifolia); **2.** Open shrubland (Hibbertia sp., Acacia spp.) ; **3.** Isolated clumps of sedges (Mesomelaena tetragona)

1. _____
2. _____
3. _____
4. _____

ASSOCIATED SPECIES: _____

Other (non-dominant) spp _____

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 *Australian Soil and Land Survey Field Handbook* guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine ☐ Excellent ☑ Very good ☐ Good ☐ Degraded ☐ Completely degraded ☐

COMMENT: _____

FIRE HISTORY: **Last Fire:** Season/Month: _____ Year: _____ **Fire Intensity:** High ☐ Medium ☐ Low ☐ No signs of fire ☐

FENCING: Not required ☐ Present ☐ Replace / repair ☐ Required ☐ Length req'd: _____

ROADSIDE MARKERS: Not required ☒ Present ☐ Replace / reposition ☐ Required ☐ Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.) _____

SPECIMEN: Collectors No: _____ WA Herb. ☐ Regional Herb. ☐ District Herb. ☐ Other: _____

ATTACHED: Map ☐ Mudmap ☐ Photo ☐ GIS data ☐ Field notes ☐ Other: _____

COPY SENT TO: Regional Office ☐ District Office ☐ Other:

Submitter of Record: Stephen Kern Role: Botanist Signed: Stephen Kern Date: 27/9/2011

Please return completed form to DEC, Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983

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Record entered by: _____ **Sheet No.:** _____ **Record Entered in Database** ☐

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Please complete as much of the form as possible, with emphasis on those sections bordered in black.

TAXON: Eremophila magnifica subsp. velutina **TPFL Pop. No:**

OBSERVATION DATE: 17 /7/2011 **CONSERVATION STATUS:** P 3 New population ☒

OBSERVER/S: S. Kern, R. Daniel **PHONE:** 94308955

ROLE: Botanists **ORGANISATION:** Ecoscape

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place):

Flying Fish project area, Approximately 60km NW of Tom Price

Reserve No:

DEC DISTRICT: Pilbara **LGA:** Shire of Ashburton Land manager present: ☐

DATUM:
GDA94 / MGA94 ☐
AGD84 / AMG84 ☐
WGS84 ☒
Unknown ☐

COORDINATES: (If UTM coords provided, **Zone** is also required)
DecDegrees ☐ DegMinSec ☐ UTMs ☒
Lat / Northing: 7509649
Long / Easting: 512292
ZONE: 50

METHOD USED:
GPS ☒ Differential GPS ☐ Map ☐
No. satellites: _____ Map used: _____
Boundary polygon captured: ☐ Map scale: _____

LAND TENURE:

Nature reserve ☐	Timber reserve ☐	Private property ☐	Rail reserve ☐	Shire road reserve ☐
National park ☐	State forest ☐	Pastoral lease ☒	MRWA road reserve ☐	Other Crown reserve ☐
Conservation park ☐	Water reserve ☐	UCL ☐	SLK/Pole _____ to _____	Specify other: Exploration Lease

AREA ASSESSMENT: Edge survey ☐ Partial survey ☒ Full survey ☐ Area observed (m²): _____

EFFORT: Time spent surveying (minutes): _____ No. of minutes spent / 100 m²: _____

POP'N COUNT ACCURACY: Actual ☐ Extrapolation ☐ Estimate ☒ Count method: _____
(Refer to field manual for list)

WHAT COUNTED: Plants ☒ Clumps ☐ Clonal stems ☐

TOTAL POP'N STRUCTURE:

	Mature:	Juveniles:	Seedlings:	Totals:
Alive	10+			
Dead				

Area of pop (m²): _____

Note: Pls record count as numbers (not percentages) for database.

QUADRATS PRESENT: No. _____ Size _____ Data attached ☐ Total area of quadrats (m²): _____

Summary Quad. Totals: Alive				

REPRODUCTIVE STATE: Clonal ☐ Vegetative ☐ Flowerbud ☐ Flower ☑
Immature fruit ☐ Fruit ☐ Dehisced fruit ☐ Percentage in flower: 100 %

CONDITION OF PLANTS: Healthy ☒ Moderate ☐ Poor ☐ Senescent ☐

COMMENT: Erect shrub to 1.5m

THREATS - type, agent and supporting information: Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. **Specify agent** where relevant. Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme Estimate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)	**Current impact (N-E)**	**Potential Impact (L-E)**	**Potential Threat Onset (S-L)**
• Clearing	N	H	M
•			
•			

Please return completed form to DEC, Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983

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Record entered by: _____ **Sheet No.:** _____ **Record Entered in Database** ☐

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HABITAT INFORMATION:

LANDFORM:
Crest ☐
Hill ☐
Ridge ☐
Outcrop ☐
Slope ☑
Flat ☐
Open depression ☐
Drainage line ☐
Closed depression ☐
Wetland ☐

ROCK TYPE:
Granite ☐
Dolerite ☐
Laterite ☐
Ironstone ☑
Limestone ☐
Quartz ☐
Specify other: _____

LOOSE ROCK: (on soil surface; eg gravel, quartz fields)
0-10% ☐
10-30% ☐
30-50% ☐
50-100% ☑

SOIL TYPE:
Sand ☐
Sandy loam ☐
Loam ☑
Clay loam ☐
Light clay ☐
Peat ☐
Specify other: rocky

SOIL COLOUR:
Red ☐
Brown ☑
Yellow ☐
White ☐
Grey ☐
Black ☐
Specify other: _____

DRAINAGE:
Well drained ☑
Seasonally inundated ☐
Permanently inundated ☐
Tidal ☐

Specific **Landform** Element: _____
(Refer to field manual for additional values)

CONDITION OF SOIL: Dry ☑ Moist ☐ Waterlogged ☐ Inundated ☐

VEGETATION CLASSIFICATION*:
1.
2.
3.
4.

Eg: **1.** Banksia woodland (B. attenuata, B. ilicifolia); **2.** Open shrubland (Hibbertia sp., Acacia spp.); **3.** Isolated clumps of sedges (Mesomelaena tetragona)

ASSOCIATED SPECIES:

Other (non-dominant) spp

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 *Australian Soil and Land Survey Field Handbook* guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine ☐ Excellent ☑ Very good ☐ Good ☐ Degraded ☐ Completely degraded ☐

COMMENT:

FIRE HISTORY: **Last Fire:** Season/Month: _____ Year: _____ **Fire Intensity:** High ☐ Medium ☐ Low ☐ No signs of fire ☐

FENCING: Not required ☐ Present ☐ Replace / repair ☐ Required ☐ Length req'd: _____

ROADSIDE MARKERS: Not required ☒ Present ☐ Replace / reposition ☐ Required ☐ Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.)

SPECIMEN: Collectors No: _____ WA Herb. ☐ Regional Herb. ☐ District Herb. ☐ Other: _____

ATTACHED: Map ☐ Mudmap ☐ Photo ☐ GIS data ☐ Field notes ☐ Other: _____

COPY SENT TO: Regional Office ☐ District Office ☐ Other:

Submitter of Record: Stephen Kern Role: Botanist Signed: Stephen Kern Date: 27/9/2011

Please return completed form to DEC, Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983

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Please complete as much of the form as possible, with emphasis on those sections bordered in black.

TAXON: Indigofera sp. Bungaroo Creek **TPFL Pop. No:**

OBSERVATION DATE: 13/7/2011 **CONSERVATION STATUS:** P3 New population ☒

OBSERVER/S: S. Kern, R. Daniel **PHONE:** 94308955

ROLE: Botanists **ORGANISATION:** Ecoscape

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place):

Flying Fish project area, Approximately 60km NW of Tom Price

Reserve No:

DEC DISTRICT: Pilbara **LGA:** Shire of Ashburton Land manager present: ☐

DATUM:
GDA94 / MGA94 ☐
AGD84 / AMG84 ☐
WGS84 ☒
Unknown ☐

COORDINATES: (If UTM coords provided, **Zone** is also required)
DecDegrees ☐ DegMinSec ☐ UTMs ☒

Lat / Northing: 7508421

Long / Easting: 517745

ZONE: 50

METHOD USED:
GPS ☒ Differential GPS ☐ Map ☐

No. satellites: _____ Map used: _____

Boundary polygon captured: ☐ Map scale: _____

LAND TENURE:

Nature reserve ☐	Timber reserve ☐	Private property ☐	Rail reserve ☐	Shire road reserve ☐
National park ☐	State forest ☐	Pastoral lease ☒	MRWA road reserve ☐	Other Crown reserve ☐
Conservation park ☐	Water reserve ☐	UCL ☐	SLK/Pole _____ to _____	Specify other: Exploration Lease

AREA ASSESSMENT: Edge survey ☐ Partial survey ☒ Full survey ☐ Area observed (m²): _____

EFFORT: Time spent surveying (minutes): _____ No. of minutes spent / 100 m²: _____

POP'N COUNT ACCURACY: Actual ☐ Extrapolation ☐ Estimate ☒ Count method: _____
(Refer to field manual for list)

WHAT COUNTED: Plants ☒ Clumps ☐ Clonal stems ☐

TOTAL POP'N STRUCTURE:	**Mature:**	**Juveniles:**	**Seedlings:**	**Totals:**
Alive	100+			
Dead				

Area of pop (m²): _____

Note: Pls record count as numbers (not percentages) for database.

QUADRATS PRESENT: No. _____ Size _____ Data attached ☐ Total area of quadrats (m²): _____

Summary Quad. Totals: Alive				

REPRODUCTIVE STATE: Clonal ☐ Vegetative ☐ Flowerbud ☐ Flower ☑
Immature fruit ☐ Fruit ☐ Dehisced fruit ☐ Percentage in flower: 100 %

CONDITION OF PLANTS: Healthy ☒ Moderate ☐ Poor ☐ Senescent ☐

COMMENT: Erect shrub to 1.5m

THREATS - type, agent and supporting information: Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. **Specify agent** where relevant. Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme Estimate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)	**Current impact (N-E)**	**Potential Impact (L-E)**	**Potential Threat Onset (S-L)**
• Clearing	N	H	M
•			
•			

Please return completed form to DEC, Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983

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HABITAT INFORMATION:

LANDFORM:
Crest ☐
Hill ☐
Ridge ☐
Outcrop ☐
Slope ☐
Flat ☐
Open depression ☐
Drainage line ☑
Closed depression ☐
Wetland ☐

ROCK TYPE:
Granite ☐
Dolerite ☐
Laterite ☐
Ironstone ☑
Limestone ☐
Quartz ☐
Specify other: _____

LOOSE ROCK: (on soil surface; eg gravel, quartz fields)
0-10% ☐
10-30% ☐
30-50% ☐
50-100% ☐

SOIL TYPE:
Sand ☐
Sandy loam ☐
Loam ☑
Clay loam ☐
Light clay ☐
Peat ☐
Specify other: _____

SOIL COLOUR:
Red ☑
Brown ☑
Yellow ☐
White ☐
Grey ☐
Black ☐
Specify other: _____

DRAINAGE:
Well drained ☑
Seasonally inundated ☐
Permanently inundated ☐
Tidal ☐

Specific **Landform** Element: _____
(Refer to field manual for additional values)

CONDITION OF SOIL: Dry ☑ Moist ☐ Waterlogged ☐ Inundated ☐

VEGETATION CLASSIFICATION*:
Eg: **1.** Banksia woodland (B. attenuata, B. ilicifolia); **2.** Open shrubland (Hibbertia sp., Acacia spp.) ; **3.** Isolated clumps of sedges (Mesomelaena tetragona)

1. _____
2. _____
3. _____
4. _____

ASSOCIATED SPECIES: _____

Other (non-dominant) spp _____

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 *Australian Soil and Land Survey Field Handbook* guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine ☐ Excellent ☑ Very good ☐ Good ☐ Degraded ☐ Completely degraded ☐

COMMENT: _____

FIRE HISTORY: **Last Fire:** Season/Month: _____ Year: _____ **Fire Intensity:** High ☐ Medium ☐ Low ☐ No signs of fire ☐

FENCING: Not required ☐ Present ☐ Replace / repair ☐ Required ☐ Length req'd: _____

ROADSIDE MARKERS: Not required ☒ Present ☐ Replace / reposition ☐ Required ☐ Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.) _____

SPECIMEN: Collectors No: _____ WA Herb. ☐ Regional Herb. ☐ District Herb. ☐ Other: _____

ATTACHED: Map ☐ Mudmap ☐ Photo ☐ GIS data ☐ Field notes ☐ Other: _____

COPY SENT TO: Regional Office ☐ District Office ☐ Other:

Submitter of Record: Stephen Kern Role: Botanist Signed: Stephen Kern Date: 27/9/2011

Please return completed form to DEC, Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983

RECORDS: Please forward to **Administrative Officer, Flora,** Species and Communities Branch.

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Please complete as much of the form as possible, with emphasis on those sections bordered in black.

TAXON: Acacia bromilowiana **TPFL Pop. No:**

OBSERVATION DATE: 14 /7/2011 **CONSERVATION STATUS:** P 4 New population ☒

OBSERVER/S: S. Kern, R. Daniel **PHONE:** 94308955

ROLE: Botanists **ORGANISATION:** Ecoscape

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place):

Flying Fish project area, Approximately 60km NW of Tom Price

Reserve No:

DEC DISTRICT: Pilbara **LGA:** Shire of Ashburton Land manager present: ☐

DATUM:
GDA94 / MGA94 ☐
AGD84 / AMG84 ☐
WGS84 ☒
Unknown ☐

COORDINATES: (If UTM coords provided, **Zone** is also required)
DecDegrees ☐ DegMinSec ☐ UTMs ☒
Lat / Northing: 7508863
Long / Easting: 505829
ZONE: 50

METHOD USED:
GPS ☒ Differential GPS ☐ Map ☐
No. satellites: _____ Map used: _____
Boundary polygon captured: ☐ Map scale: _____

LAND TENURE:

Nature reserve ☐	Timber reserve ☐	Private property ☐	Rail reserve ☐	Shire road reserve ☐
National park ☐	State forest ☐	Pastoral lease ☒	MRWA road reserve ☐	Other Crown reserve ☐
Conservation park ☐	Water reserve ☐	UCL ☐	SLK/Pole _____ to _____	Specify other: Exploration Lease

AREA ASSESSMENT: Edge survey ☐ Partial survey ☒ Full survey ☐ Area observed (m²): _____

EFFORT: Time spent surveying (minutes): _____ No. of minutes spent / 100 m²: _____

POP'N COUNT ACCURACY: Actual ☐ Extrapolation ☐ Estimate ☒ Count method: _____
(Refer to field manual for list)

WHAT COUNTED: Plants ☒ Clumps ☐ Clonal stems ☐

TOTAL POP'N STRUCTURE:

	Mature:	Juveniles:	Seedlings:	Totals:
Alive	50+			
Dead				

Area of pop (m²): _____

Note: Pls record count as numbers (not percentages) for database.

QUADRATS PRESENT: No. _____ Size _____ Data attached ☐ Total area of quadrats (m²): _____

Summary Quad. Totals: Alive				

REPRODUCTIVE STATE: Clonal ☐ Vegetative ☐ Flowerbud ☐ Flower ☐
Immature fruit ☐ Fruit ☐ Dehisced fruit ☐ Percentage in flower: _____ %

CONDITION OF PLANTS: Healthy ☒ Moderate ☐ Poor ☐ Senescent ☐

COMMENT: Rounded shrub to 1-8m

THREATS - type, agent and supporting information: Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. **Specify agent** where relevant. Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme Estimate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)	**Current impact (N-E)**	**Potential Impact (L-E)**	**Potential Threat Onset (S-L)**
• Clearing	N	H	M
•			
•			

Please return completed form to DEC, Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983

RECORDS: Please forward to **Administrative Officer, Flora,** Species and Communities Branch.

Record entered by: _____ **Sheet No.:** _____ **Record Entered in Database** ❑

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HABITAT INFORMATION:

LANDFORM:
Crest ☑
Hill ☐
Ridge ☐
Outcrop ☐
Slope ☐
Flat ☐
Open depression ☐
Drainage line ☐
Closed depression ☐
Wetland ☐

ROCK TYPE:
Granite ☐
Dolerite ☐
Laterite ☐
Ironstone ☑
Limestone ☐
Quartz ☐
Specify other: _____

LOOSE ROCK:
(on soil surface; eg gravel, quartz fields)
0-10% ☐
10-30% ☐
30-50% ☐
50-100% ☑

SOIL TYPE:
Sand ☐
Sandy loam ☐
Loam ☑
Clay loam ☐
Light clay ☐
Peat ☐
Specify other: rocky

SOIL COLOUR:
Red ☑
Brown ☑
Yellow ☐
White ☐
Grey ☐
Black ☐
Specify other: _____

DRAINAGE:
Well drained ☑
Seasonally inundated ☐
Permanently inundated ☐
Tidal ☐

Specific **Landform** Element: _____
(Refer to field manual for additional values)

CONDITION OF SOIL: Dry ☑ Moist ☐ Waterlogged ☐ Inundated ☐

VEGETATION CLASSIFICATION*:
1. _____
2. _____
3. _____
4. _____

Eg: **1.** Banksia woodland (B. attenuata, B. ilicifolia); **2.** Open shrubland (Hibbertia sp., Acacia spp.) ; **3.** Isolated clumps of sedges (Mesomelaena tetragona)

ASSOCIATED SPECIES: _____

Other (non-dominant) spp _____

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 *Australian Soil and Land Survey Field Handbook* guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine ☐ Excellent ☑ Very good ☐ Good ☐ Degraded ☐ Completely degraded ☐

COMMENT: _____

FIRE HISTORY: **Last Fire:** Season/Month: _____ Year: _____ **Fire Intensity:** High ☐ Medium ☐ Low ☐ No signs of fire ☐

FENCING: Not required ☐ Present ☐ Replace / repair ☐ Required ☐ Length req'd: _____

ROADSIDE MARKERS: Not required ☒ Present ☐ Replace / reposition ☐ Required ☐ Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.)

SPECIMEN: Collectors No: _____ WA Herb. ☐ Regional Herb. ☐ District Herb. ☐ Other: _____

ATTACHED: Map ☐ Mudmap ☐ Photo ☐ GIS data ☐ Field notes ☐ Other: _____

COPY SENT TO: Regional Office ☐ District Office ☐ Other:

Submitter of Record: Stephen Kern Role: Botanist Signed: Stephen Kern Date: 27/9/2011

Please return completed form to DEC, Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983

RECORDS: Please forward to **Administrative Officer, Flora,** Species and Communities Branch.

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Please complete as much of the form as possible, with emphasis on those sections bordered in black.

TAXON: Eremophila magnifica subsp. velutina **TPFL Pop. No:**

OBSERVATION DATE: 13/7/2011 **CONSERVATION STATUS:** P 3 New population ☒

OBSERVER/S: S. Kern, R. Daniel **PHONE:** 94308955

ROLE: Botanists **ORGANISATION:** Ecoscape

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place):

Flying Fish project area, Approximately 60km NW of Tom Price

Reserve No:

DEC DISTRICT: Pilbara **LGA:** Shire of Ashburton Land manager present: ☐

DATUM:
GDA94 / MGA94 ☐
AGD84 / AMG84 ☐
WGS84 ☒
Unknown ☐

COORDINATES: (If UTM coords provided, **Zone** is also required)
DecDegrees ☐ DegMinSec ☐ UTMs ☒
Lat / Northing: 7509003
Long / Easting: 518148
ZONE: 50

METHOD USED:
GPS ☒ Differential GPS ☐ Map ☐
No. satellites: _____ Map used: _____
Boundary polygon captured: ☐ Map scale: _____

LAND TENURE:

Nature reserve ☐	Timber reserve ☐	Private property ☐	Rail reserve ☐	Shire road reserve ☐
National park ☐	State forest ☐	Pastoral lease ☒	MRWA road reserve ☐	Other Crown reserve ☐
Conservation park ☐	Water reserve ☐	UCL ☐	SLK/Pole _____ to _____	Specify other: Exploration Lease

AREA ASSESSMENT: Edge survey ☐ Partial survey ☒ Full survey ☐ Area observed (m²): _____

EFFORT: Time spent surveying (minutes): _____ No. of minutes spent / 100 m²: _____

POP'N COUNT ACCURACY: Actual ☐ Extrapolation ☐ Estimate ☒ Count method: _____
(Refer to field manual for list)

WHAT COUNTED: Plants ☒ Clumps ☐ Clonal stems ☐

TOTAL POP'N STRUCTURE:

	Mature:	Juveniles:	Seedlings:	Totals:
Alive	10+			
Dead				

Area of pop (m²): _____

Note: Pls record count as numbers (not percentages) for database.

QUADRATS PRESENT: No. _____ Size _____ Data attached ☐ Total area of quadrats (m²): _____

Summary Quad. Totals: Alive				

REPRODUCTIVE STATE: Clonal ☐ Vegetative ☐ Flowerbud ☐ Flower ☑
Immature fruit ☐ Fruit ☐ Dehisced fruit ☐ Percentage in flower: 50 %

CONDITION OF PLANTS: Healthy ☒ Moderate ☐ Poor ☐ Senescent ☐

COMMENT: Erect shrub to 1.5m

THREATS - type, agent and supporting information: Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. **Specify agent** where relevant. Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme Estimate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)	Current impact (N-E)	Potential Impact (L-E)	Potential Threat Onset (S-L)
• Clearing	N	H	M
•			
•			

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HABITAT INFORMATION:

LANDFORM:
Crest ☐
Hill ☐
Ridge ☐
Outcrop ☐
Slope ☑
Flat ☐
Open depression ☐
Drainage line ☐
Closed depression ☐
Wetland ☐

ROCK TYPE:
Granite ☐
Dolerite ☐
Laterite ☐
Ironstone ☑
Limestone ☐
Quartz ☐
Specify other: _____

LOOSE ROCK: (on soil surface; eg gravel, quartz fields)
0-10% ☐
10-30% ☐
30-50% ☐
50-100% ☑

SOIL TYPE:
Sand ☐
Sandy loam ☐
Loam ☑
Clay loam ☐
Light clay ☐
Peat ☐
Specify other: _____

SOIL COLOUR:
Red ☑
Brown ☑
Yellow ☐
White ☐
Grey ☐
Black ☐
Specify other: _____

DRAINAGE:
Well drained ☑
Seasonally inundated ☐
Permanently inundated ☐
Tidal ☐

Specific **Landform** Element: _____
(Refer to field manual for additional values)

CONDITION OF SOIL: Dry ☑ Moist ☐ Waterlogged ☐ Inundated ☐

VEGETATION CLASSIFICATION*:
Eg: **1.** Banksia woodland (B. attenuata, B. ilicifolia); **2.** Open shrubland (Hibbertia sp., Acacia spp.) ; **3.** Isolated clumps of sedges (Mesomelaena tetragona)

1. _____
2. _____
3. _____
4. _____

ASSOCIATED SPECIES: _____

Other (non-dominant) spp _____

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 *Australian Soil and Land Survey Field Handbook* guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine ☐ Excellent ☑ Very good ☐ Good ☐ Degraded ☐ Completely degraded ☐

COMMENT: _____

FIRE HISTORY: **Last Fire:** Season/Month: _____ Year: _____ **Fire Intensity:** High ☐ Medium ☐ Low ☐ No signs of fire ☐

FENCING: Not required ☐ Present ☐ Replace / repair ☐ Required ☐ Length req'd: _____

ROADSIDE MARKERS: Not required ☒ Present ☐ Replace / reposition ☐ Required ☐ Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.) _____

SPECIMEN: Collectors No: _____ WA Herb. ☐ Regional Herb. ☐ District Herb. ☐ Other: _____

ATTACHED: Map ☐ Mudmap ☐ Photo ☐ GIS data ☐ Field notes ☐ Other: _____

COPY SENT TO: Regional Office ☐ District Office ☐ Other:

Submitter of Record: Stephen Kern Role: Botanist Signed: Stephen Kern Date: 27/9/2011

Please return completed form to DEC, Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983

RECORDS: Please forward to **Administrative Officer, Flora,** Species and Communities Branch.

Record entered by: _____ **Sheet No.:** _____ **Record Entered in Database** ❑

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Please complete as much of the form as possible, with emphasis on those sections bordered in black.

TAXON: Eremophila magnifica subsp. velutina **TPFL Pop. No:** _____

OBSERVATION DATE: 13 /7/2011 **CONSERVATION STATUS:** P 3 New population ☒

OBSERVER/S: S. Kern, R. Daniel **PHONE:** 94308955

ROLE: Botanists **ORGANISATION:** Ecoscape

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place):

Flying Fish project area, Approximately 60km NW of Tom Price

Reserve No: _____

DEC DISTRICT: Pilbara **LGA:** Shire of Ashburton Land manager present: ☐

DATUM:
GDA94 / MGA94 ☐
AGD84 / AMG84 ☐
WGS84 ☒
Unknown ☐

COORDINATES: (If UTM coords provided, **Zone** is also required)
DecDegrees ☐ DegMinSec ☐ UTMs ☒
Lat / Northing: 7511306
Long / Easting: 521996
ZONE: 50

METHOD USED:
GPS ☒ Differential GPS ☐ Map ☐
No. satellites: _____ Map used: _____
Boundary polygon captured: ☐ Map scale: _____

LAND TENURE:

Nature reserve ☐	Timber reserve ☐	Private property ☐	Rail reserve ☐	Shire road reserve ☐
National park ☐	State forest ☐	Pastoral lease ☒	MRWA road reserve ☐	Other Crown reserve ☐
Conservation park ☐	Water reserve ☐	UCL ☐	SLK/Pole _____ to _____	Specify other: Exploration Lease

AREA ASSESSMENT: Edge survey ☐ Partial survey ☒ Full survey ☐ Area observed (m²): _____

EFFORT: Time spent surveying (minutes): _____ No. of minutes spent / 100 m²: _____

POP'N COUNT ACCURACY: Actual ☐ Extrapolation ☐ Estimate ☒ Count method: _____
(Refer to field manual for list)

WHAT COUNTED: Plants ☒ Clumps ☐ Clonal stems ☐

TOTAL POP'N STRUCTURE:

	Mature:	Juveniles:	Seedlings:	Totals:
Alive	104			
Dead				

Area of pop (m²): _____

Note: Pls record count as numbers (not percentages) for database.

QUADRATS PRESENT: No. _____ Size _____ Data attached ☐ Total area of quadrats (m²): _____

Summary Quad. Totals: Alive				

REPRODUCTIVE STATE: Clonal ☐ Vegetative ☐ Flowerbud ☐ Flower ☒
Immature fruit ☐ Fruit ☐ Dehisced fruit ☐ Percentage in flower: 50 %

CONDITION OF PLANTS: Healthy ☒ Moderate ☐ Poor ☐ Senescent ☐

COMMENT: Erect shrub to 1.5m

THREATS - type, agent and supporting information: Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. **Specify agent** where relevant. Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme Estimate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)	**Current impact (N-E)**	**Potential Impact (L-E)**	**Potential Threat Onset (S-L)**
• Clearing	N	H	M
•			
•			

Please return completed form to DEC, Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983

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HABITAT INFORMATION:

LANDFORM:
Crest ☐ Hill ☐ Ridge ☐ Outcrop ☐ Slope ☑ Flat ☐ Open depression ☐ Drainage line ☐ Closed depression ☐ Wetland ☐

ROCK TYPE:
Granite ☐ Dolerite ☐ Laterite ☐ Ironstone ☑ Limestone ☐ Quartz ☐
Specify other: _____

LOOSE ROCK: (on soil surface; eg gravel, quartz fields)
0-10% ☐ 10-30% ☐ 30-50% ☐ 50-100% ☑

SOIL TYPE:
Sand ☐ Sandy loam ☐ Loam ☑ Clay loam ☐ Light clay ☐ Peat ☐
Specify other: _____

SOIL COLOUR:
Red ☑ Brown ☑ Yellow ☐ White ☐ Grey ☐ Black ☐
Specify other: _____

DRAINAGE:
Well drained ☑ Seasonally inundated ☐ Permanently inundated ☐ Tidal ☐

Specific **Landform** Element: _____
(Refer to field manual for additional values)

CONDITION OF SOIL: Dry ☑ Moist ☐ Waterlogged ☐ Inundated ☐

VEGETATION CLASSIFICATION*:
Eg: **1.** Banksia woodland (B. attenuata, B. ilicifolia); **2.** Open shrubland (Hibbertia sp., Acacia spp.) ; **3.** Isolated clumps of sedges (Mesomelaena tetragona)

1. _____
2. _____
3. _____
4. _____

ASSOCIATED SPECIES: _____

Other (non-dominant) spp _____

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 *Australian Soil and Land Survey Field Handbook* guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine ☐ Excellent ☑ Very good ☐ Good ☐ Degraded ☐ Completely degraded ☐

COMMENT: _____

FIRE HISTORY: **Last Fire:** Season/Month: _____ Year: _____ **Fire Intensity:** High ☐ Medium ☐ Low ☐ No signs of fire ☐

FENCING: Not required ☐ Present ☐ Replace / repair ☐ Required ☐ Length req'd: _____

ROADSIDE MARKERS: Not required ☒ Present ☐ Replace / reposition ☐ Required ☐ Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.)

SPECIMEN: Collectors No: EFF-11-08 WA Herb. ☑ Regional Herb. ☐ District Herb. ☐ Other: _____

ATTACHED: Map ☐ Mudmap ☐ Photo ☐ GIS data ☐ Field notes ☐ Other: _____

COPY SENT TO: Regional Office ☐ District Office ☐ Other:

Submitter of Record: Stephen Kern Role: Botanist Signed: Stephen Kern Date: 27/9/2011

Please return completed form to DEC, Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983

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Please complete as much of the form as possible, with emphasis on those sections bordered in black.

TAXON: Indigofera sp. Bungaroo Creek **TPFL Pop. No:**

OBSERVATION DATE: 12/7/2011 **CONSERVATION STATUS:** P3 New population ☒

OBSERVER/S: S. Kern, R. Daniel **PHONE:** 94308955

ROLE: Botanists **ORGANISATION:** Ecoscape

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place):

Flying Fish project area, Approximately 60km NW of Tom Price

Reserve No:

DEC DISTRICT: Pilbara **LGA:** Shire of Ashburton Land manager present: ☐

DATUM: GDA94 / MGA94 ☐ AGD84 / AMG84 ☐ WGS84 ☒ Unknown ☐

COORDINATES: (If UTM coords provided, **Zone** is also required) DecDegrees ☐ DegMinSec ☐ UTMs ☒

Lat / Northing: 7520277

Long / Easting: 527480

ZONE: 50

METHOD USED: GPS ☒ Differential GPS ☐ Map ☐

No. satellites: _____ Map used: _____

Boundary polygon captured: ☐ Map scale: _____

LAND TENURE:

Nature reserve ☐ Timber reserve ☐ Private property ☐ Rail reserve ☐ Shire road reserve ☐

National park ☐ State forest ☐ Pastoral lease ☒ MRWA road reserve ☐ Other Crown reserve ☐

Conservation park ☐ Water reserve ☐ UCL ☐ SLK/Pole _____ to _____ Specify other: Exploration Lease

AREA ASSESSMENT: Edge survey ☐ Partial survey ☒ Full survey ☐ Area observed (m²): _____

EFFORT: Time spent surveying (minutes): _____ No. of minutes spent / 100 m²: _____

POP'N COUNT ACCURACY: Actual ☐ Extrapolation ☐ Estimate ☒ Count method: _____ (Refer to field manual for list)

WHAT COUNTED: Plants ☒ Clumps ☐ Clonal stems ☐

TOTAL POP'N STRUCTURE:	**Mature:**	**Juveniles:**	**Seedlings:**	**Totals:**
Alive	100+			
Dead				

Area of pop (m²): _____

Note: Pls record count as numbers (not percentages) for database.

QUADRATS PRESENT: No. _____ Size _____ Data attached ☐ Total area of quadrats (m²): _____

Summary Quad. Totals: Alive				

REPRODUCTIVE STATE: Clonal ☐ Vegetative ☐ Flowerbud ☐ Flower ☐

Immature fruit ☐ Fruit ☐ Dehisced fruit ☐ Percentage in flower: _____ %

CONDITION OF PLANTS: Healthy ☒ Moderate ☐ Poor ☐ Senescent ☐

COMMENT: Erect shrub to 1·8m

THREATS - type, agent and supporting information: Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. **Specify agent** where relevant. Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme Estimate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)	**Current impact (N-E)**	**Potential Impact (L-E)**	**Potential Threat Onset (S-L)**
• Clearing	N	H	M
•			
•			

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RECORDS: Please forward to **Administrative Officer, Flora,** Species and Communities Branch.

Record entered by: _____ **Sheet No.:** _____ **Record Entered in Database** ❑

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HABITAT INFORMATION:

LANDFORM:
Crest ☐
Hill ☐
Ridge ☐
Outcrop ☐
Slope ☐
Flat ☐
Open depression ☐
Drainage line ☑
Closed depression ☐
Wetland ☐

ROCK TYPE:
Granite ☐
Dolerite ☐
Laterite ☐
Ironstone ☑
Limestone ☐
Quartz ☐
Specify other: _____

LOOSE ROCK: (on soil surface; eg gravel, quartz fields)
0-10% ☐
10-30% ☐
30-50% ☑
50-100% ☐

SOIL TYPE:
Sand ☐
Sandy loam ☑
Loam ☐
Clay loam ☐
Light clay ☐
Peat ☐
Specify other: _____

SOIL COLOUR:
Red ☑
Brown ☑
Yellow ☐
White ☐
Grey ☐
Black ☐
Specify other: _____

DRAINAGE:
Well drained ☑
Seasonally inundated ☐
Permanently inundated ☐
Tidal ☐

Specific **Landform** Element: _____
(Refer to field manual for additional values)

CONDITION OF SOIL: Dry ☑ Moist ☐ Waterlogged ☐ Inundated ☐

VEGETATION CLASSIFICATION*:
Eg: 1. Banksia woodland (B. attenuata, B. ilicifolia); 2. Open shrubland (Hibbertia sp., Acacia spp.); 3. Isolated clumps of sedges (Mesomelaena tetragona)

1. Corymbia hamersleyana, Eucalyptus xerothermica
2. Petalostylis labicheoides, Acacia atkinsiana, Gunnypsum robinsonii
3. Triodia epactia
4.

ASSOCIATED SPECIES:

Other (non-dominant) spp

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 *Australian Soil and Land Survey Field Handbook* guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine ☐ Excellent ☐ Very good ☑ Good ☐ Degraded ☐ Completely degraded ☐

COMMENT:

FIRE HISTORY: **Last Fire:** Season/Month: _____ Year: _____ **Fire Intensity:** High ☐ Medium ☐ Low ☐ No signs of fire ☐

FENCING: Not required ☐ Present ☐ Replace / repair ☐ Required ☐ Length req'd: _____

ROADSIDE MARKERS: Not required ☒ Present ☐ Replace / reposition ☐ Required ☐ Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.)

SPECIMEN: Collectors No: EFF11-09 WA Herb. ☑ Regional Herb. ☐ District Herb. ☐ Other: _____

ATTACHED: Map ☐ Mudmap ☐ Photo ☐ GIS data ☐ Field notes ☐ Other: _____

COPY SENT TO: Regional Office ☐ District Office ☐ Other:

Submitter of Record: Stephen Kern Role: Botanist Signed: Stephen Kern Date: 27/9/2011

Please return completed form to DEC, Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983

RECORDS: Please forward to **Administrative Officer, Flora,** Species and Communities Branch.

Record entered by: _____ **Sheet No.:** _____ **Record Entered in Database** ☐

Appendix Seven: Flora Species List

Table 24: Flora species list

Family	Species	Introduced	Cons. Code
Amaranthaceae	*Alternanthera nana*		
	Gomphrena cunninghamii		
	Ptilotus astrolasius		
	Ptilotus auriculifolius		
	Ptilotus calostachyus		
	Ptilotus clementii		
	Ptilotus exaltatus var. *exaltatus*		
	Ptilotus fusiformis		
	Ptilotus obovatus		
	Ptilotus rotundifolius		
Araliaceae	*Astrotricha hamptonii*		
	Trachymene oleracea subsp. *oleracea*		
Asteraceae	**Bidens bipinnata*	X	
	Pterocaulon sphacelatum		
Boraginaceae	*Trichodesma zeylanicum* var. *zeylanicum*		
Brassicaceae	*Lepidium platypetalum*		
Capparaceae	*Capparis umbellata*		
Caryophyllaceae	*Polycarpaea holtzei*		
	Polycarpaea longiflora		
Chenopodiaceae	*Dysphania rhadinostachya* subsp. *rhadinostachya*		
	Rhagodia eremaea		
Cleomaceae	*Cleome viscosa*		
Convolvulaceae	*Bonamia rosea*		
Cyperaceae	*Bulbostylis barbata*		
	Cyperus vaginatus		
	Fimbristylis simulans		
Fabaceae	*Acacia ancistrocarpa*		
	Acacia aptaneura		
	Acacia atkinsiana		
	Acacia bivenosa		
	Acacia bromilowiana		
	Acacia citrinoviridis		
	Acacia exilis		
	Acacia hamersleyensis		
	Acacia inaequilatera		
	Acacia kempeana		
	Acacia maitlandii		
	Acacia marramamba		
	Acacia monticola		
	Acacia orthocarpa		
	Acacia pruinocarpa		

Family	Species	Introduced	Cons. Code
Fabaceae	*Acacia pyrifolia* var. *pyrifolia*		
	Acacia sibirica		
	Acacia spondylophylla		
	Acacia synchronicia		
	Acacia trudgeniana		
	Acacia tumida var. *pilbarensis*		
	Acacia xiphophylla		
	Gompholobium sp. Pilbara (N.F. Norris 908)		
	Indigofera monophylla		
	Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)		P3
	Petalostylis labicheoides		
	Rhynchosia minima		
	Senna artemisioides subsp. *helmsii*		
	Senna artemisioides subsp. *oligophylla*		
	Senna glutinosa subsp. *glutinosa*		
	Senna glutinosa subsp. *pruinosa*		
	Senna glutinosa subsp. x *luerssenii*		
	Senna venusta		
	**Vachellia farnesiana*	X	
Goodeniaceae	*Dampiera candicans*		
	Goodenia microptera		
	Goodenia stobbsiana		
	Scaevola amblyanthera var. *centralis*		
	Scaevola parvifolia subsp. *pilbarae*		
Gyrostemonaceae	*Codonocarpus cotinifolius*		
Haloragaceae	*Haloragis gossei var. gossei*		
Lamiaceae	*Clerodendrum floribundum* var. *angustifolium*		
Lauraceae	*Cassytha capillaris*		
Malvaceae	*Abutilon dioicum*		
	Corchorus crozophorifolius		
	Gossypium australe (Whim Creek form)		
	Gossypium robinsonii		
	Keraudrenia nephrosperma		
	Melhania oblongifolia		
	Sida sp. Shovelanna Hill (S. van Leeuwen 3842)		
Myrtaceae	*Corymbia deserticola* subsp. *deserticola*		
	Corymbia ferriticola		
	Corymbia hamersleyana		
	Eucalyptus gamophylla		
	Eucalyptus leucophloia subsp. *leucophloia*		
	Eucalyptus socialis subsp. *eucentrica*		
	Eucalyptus victrix		
	Eucalyptus xerothermica		
	Melaleuca eleuterostachya		
	Melaleuca glomerata		

Family	Species	Introduced	Cons. Code
Nyctaginaceae	*Boerhavia coccinea*		
Oleaceae	*Jasminum didymum* subsp. *lineare*		
Poaceae	*Amphipogon sericeus*		
	Aristida contorta		
	Aristida holathera var. *holathera*		
	Aristida latifolia		
	**Cenchrus ciliaris*	X	
	Chrysopogon fallax		
	Cymbopogon procerus		
	Enneapogon polyphyllus		
	Enteropogon ramosus		
	Eriachne aristidea		
	Eriachne mucronata		
	Eriachne pulchella subsp. *dominii*		
	Eriachne tenuiculmis		
	Eulalia aurea		
	Paraneurachne muelleri		
	Schizachyrium fragile		
	Sporobolus australasicus		
	Themeda triandra		
	Triodia aff. *melvillei*		
	Triodia epactia		
	Triodia longiceps		
	Triodia wiseana		
Polygalaceae	*Polygala* aff. *isingii*		
Proteaceae	*Grevillea wickhamii* subsp. *hispidula*		
	Hakea chordophylla		
	Hakea lorea subsp. lorea		
Rubiaceae	*Oldenlandia crouchiana*		
	Psydrax latifolia		
Santalaceae	*Santalum lanceolatum*		
Sapindaceae	*Dodonaea coriacea*		
Scrophulariaceae	*Eremophila cuneata*		
	Eremophila forrestii subsp. *forrestii*		
	Eremophila fraseri subsp. *fraseri*		
	Eremophila latrobei subsp. *glabra*		
	Eremophila longifolia		
	Eremophila magnifica subsp. *magnifica*		P4
	Eremophila magnifica subsp. *velutina*		P3
Solanaceae	*Solanum diversiflorum*		
	Solanum sturtianum		
Stylidiaceae	*Stylidium spathulatum*		
Zygophyllaceae	*Tribulus macrocarpus*		
	Tribulus suberosus		

'*' = introduced species

Appendix Eight: Fauna species lists

Table 25: List of Fauna species recorded at Eliwana/Flying Fish by this survey

Family	Species	Common Name	Cons. status
Mammals			
Dasyuridae	*Pseudantechinus woolleyae*	Woolley's Pseudantechinus	
Macropodidae	*Macropus robustus*	Euro, Biggada	
	Petrogale sp.	Rock-wallaby	
Phalangeridae	*Trichosurus vulpecula*	Brush-tailed Possum	
Muridae	*Pseudomys chapmani*	Western Pebble-mound Mouse	P 4
	Zyzomys argurus	Common Rock-rat	
Bovidae	*Bos taurus*	Cow	
Equidae	*Equus caballus*	Horse	
Canidae	*Canis lupus dingo*	Dingo	
Felidae	*Felis catus*	Cat	
Reptiles			
Agamidae	*Ctenophorus caudicinctus*	Ringtailed Dragon	
Birds			
Columbidae	*Phaps chalcoptera*	Common Bronzewing	
	Ocyphaps lophotes	Crested Pigeon	
	Geophaps plumifera	Spinifex Pigeon	
	Geopelia cuneata	Diamond Dove	
Eurostopodidae	*Eurostopodus argus*	Spotted Nightjar	
Aegothelidae	*Aegotheles cristatus*	Owlet Nightjar	
Accipitridae	*Aquila audax*	Wedge-tailed Eagle	
Falconidae	*Falco cenchroides*	Australian Kestrel	
Otididae	*Ardeotis australis*	Australian Bustard	P 4
Turnicidae	*Turnix velox*	Little Button-quail	
Cacatuidae	*Eolophus roseicapillus*	Galah	
Psittacidae	*Barnardius zonarius*	Australian Ringneck	
	Melopsittacus undulatus	Budgerigar	
Cuculidae	*Chalcites osculans*	Black-eared Cuckoo	
Meropidae	*Merops ornatus*	Rainbow Bee-eater	M
Maluridae	*Malurus leucopterus*	White-winged Fairy-wren	
Acanthizidae	*Smicrornis brevirostris*	Weebill	
	Acanthiza chrysorrhoa	Yellow-rumped Thornbill	
Pardalotidae	*Pardalotus striatus*	Striated Pardalote	
Meliphagidae	*Certhionyx variegates*	Pied Honeyeater	
	Lichenostomus virescens	Singing Honeyeater	
	Lichenostomus keartlandi	Grey-headed Honeyeater	
	Lichenostomus penicillatus	White-plumed Honeyeater	
	Manorina flavigula	Yellow-throated Miner	
Pomatostomidae	*Pomatostomus temporalis*	Grey-crowned Babbler	
Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike	
Pachycephalidae	*Pachycephala rufiventris*	Rufous Whistler	
	Colluricincla harmonica	Grey Shrike-thrush	
	Oreoica gutturalis	Crested Bellbird	
Artamidae	*Artamus minor*	Little Woodswallow	
	Cracticus nigrogularis	Pied Butcherbird	
	Cracticus tibicen	Australian Magpie	
Rhipiduridae	*Rhipidura leucophrys*	Willie Wagtail	
Corvidae	*Corvus orru*	Torresian Crow	
Monarchidae	*Grallina cyanoleuca*	Magpie-lark	
Petroicidae	*Melanodryas cucullata*	Hooded Robin	
Megaluridae	*Eremiornis carteri*	Spinifexbird	
Estrildidae	*Emblema pictum*	Painted Finch	

Table 26: Vertebrate taxa known or potentially present in the Western Hub study areas.

Family	Species	Common Name	EPBC status	WCA status	DEC status	DEC Threatened fauna database	EPBC Protected Matters report	Hamersley PIL3		Raven	Mt Farquhar	Eliwana/FF	Delphine	Mt McLeod	Mt McL N-Map	Mesa A and G	Mesa J	WPIOP	Blacksmith	Karijini NP	Solomon	Solomon Rail	V. Kings	Firetail South	Firetail North	West Turner	Brockman Sync 4	Fortescue River
FISH																												
Anguillidae	*Anguilla bicolor*	Indian Short-finned Eel																										+
Clupeidae	*Nematalosa erebi*	Bony Bream															+											+
Gobiidae	*Glossogobius giurus*	Flathead Goby																										+
Melanotaeniidae	*Melanotaenia australis*	Western Rainbowfish											+				+				+		+					+
Plotosidae	*Neosilurus hyrtli*	Hyrtl's Tandan											+				+				+		+					
	Neosilurus sp.(**1**)	(Eel-tailed Catfish, Tandan)																										+
	Neoarius graeffei	Lesser Salmon Catfish																										+
Terapontidae	*Amniataba percoides*	Barred Grunter															+						+					+
	Leiopotherapon unicolor	Spangled Perch															+				+		+					+
	Leiopotherapon aheneus	Fortescue Grunter			*P 4*			+									+											+
	Unnamed sp.																											+
AMPHIBIANS																												
Hylidae	*Cyclorana maini*	Sheep Frog													+			5		79	13		+			1	14	
	Cyclorana platycephala	Water-holding Frog																		5								
	Litoria rubella	Little Red Tree Frog											+	1				84	2	c	1		+	2			1	
Myobatrachidae	*Pseudophryne douglasi*	Gorge Toadlet																+		4								
	Uperoleia glandulosa	Glandular Toadlet																	2				+	3				
	Uperoleia russelli	Northwest Toadlet													+			6			62		+				(+)	
	Uperoleia sp. (one of preceding)																			16								
Limnodynastidae	*Limnodynastes spenceri*	Desert Burrowing Frog																		1								
MAMMALS																												
Tachyglossidae	*Tachyglossus aculeatus*	Echidna													+	5				+			+	1				
Dasyuridae	*Dasykaluta rosamondae*	Kaluta													+		+	10	2	20	14		+	1		17	3	
	Dasyurus hallucatus	Northern Quoll	*E N*	*S 1*	*EN*	+	L	+								1	+	4	1		1		+	2	3		(+)	
	Ningaui timealeyi	Pilbara Ningaui													+	10		47	2	156	7		+		4	33	27	
	Planigale ingrami	Long-tailed Planigale													+			13		1	112				8	3		
	Planigale maculata	Common Planigale																		3	3				1			
	Planigale sp. (**2**)																	+	4					20			(+)	
	Pseudantechinus macdonnellensis	Fat-tailed Pseudantechinus																		1								
	Pseudantechinus roryi	Rory's Pseudantechinus																										
	Pseudantechinus woolleyae	Woolley's Pseudantechinus										1			+				1				+			2	(+)	
	Sminthopsis macroura	Stripe-faced Dunnart													+			6		25	101		+		5	7	(+)	
	Sminthopsis longicaudata	Long-tailed Dunnart			*P 4*	+		+							+			1									(+)	

Family	Species	Common Name	EPBC status	WCA status	DEC status	DEC Threatened fauna database	EPBC Protected Matters report	Hamersley PIL3		Raven	Mt Farquhar	Eliwana/FF	Delphine	Mt McLeod	Mt McL N-Map	Mesa A and G	Mesa J	WPIOP	Blacksmith	Karijini NP	Solomon	Solomon Rail	V. Kings	Firetail South	Firetail North	West Turner	Brockman Sync 4	Fortescue River
	Sminthopsis ooldea	Ooldea Dunnart																		5								
Macropodidae	*Macropus robustus*	Euro, Biggada								+	+	1	3	+	+	13		46	1	+	+	+	+	14	10	27	5	
	Macropus rufus	Red Kangaroo, Marlu													+			5		+			+			3	n	
	Petrogale "penicillata"	Brush-tailed Rock-wallaby																		+								
	Petrogale rothschildi	Rothschild's Rock-wallaby																									(+)	
	Petrogale sp.	Rock-wallaby										4	2						1					1				
	Lagorchestes conspicillatus leichardti	Spectacled Hare-wallaby			*P 3*										+													
Phalangeridae	*Trichosurus vulpecula*	Brush-tailed Possum									1	1	1					+	1					2				
Megadermatidae	*Macroderma gigas*	Ghost Bat			*P 4*	+		+							+	+		2	+	+			+				(+)	
Hipposideridae	*Rhinonicteris aurantia*	Pilbara Leaf-nosed Bat	*V U*	*S 1*	*VU*	+	L	+										7										
Emballonuridae	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail-bat																1		6	24		+	+	+	2		
	Taphozous georgianus	Common Sheathtail-bat								20					+		+	83		18	25		+	+	+	14	+	
	Taphozous hilli	Hill's Sheathtail-bat													+					46			+				(+)	
Molossidae	*Chaerephon jobensis*	Northern Freetail-bat														+		+		17	7		+					
	Mormopterus beccarii	Beccari's Freetail-bat													+					58	7		+	+	+			
	Mormopterus loriae cobourgiana	Western Little Freetail-bat																		+							+	
	Mormopterus sp.	South-western Freetail-bat																	+									
	Tadarida australis	White-striped Freetail-bat																3		1							+	
Vespertilionidae	*Nyctophilus bifax*	Northwestern Long-eared Bat																		1								
	Nyctophilus geoffroii	Lesser Long-eared Bat																		1								
	Nyctophilus gouldii	Gould's Long-eared Bat																		+								
	Nyctophilus arnhemensis	Arnhem Land Long-eared Bat																									?	
	Nyctophilus sp. indet.																				+		+					
	Chalinolobus gouldii	Gould's Wattled Bat													+	+		7	1	75	27		+	+	+	6	+	
	Chalinolobus morio	Chocolate Wattled Bat																								6		
	Scotorepens greyii	Little Broad-nosed Bat													+	+		5	1	34	25		+	+	+	2	+	
	Scotorepens balstoni	Inland Broad-nosed Bat																1										
	Vespadelus finlaysoni (**3**)	Finlayson's Cave Bat													+	+	+	70	1	39	27		+	+	+	50	+	
Muridae	*Leggadina lakedownensis*	Short-tailed Mouse			*P 4*	+									+												(+)	
	Mus musculus	House Mouse			*Y*										+			+		127	13		+			2	1	
	Notomys alexis	Spinifex Hopping-mouse									1			2						1								
	Pseudomys chapmani	Western Pebble-mound Mouse			*P 4*			+		2			2	2	+		(+)	9	+	15			+			12	1	
	Pseudomys delicatulus	Delicate Mouse														2		1										
	Pseudomys desertor	Desert Mouse													+			7	1		146		+	10	1	6	3	
	Pseudomys hermannsburgensis	Sandy Inland Mouse													+			49		62	156		+		3	23	2	
	Zyzomys argurus	Common Rock-rat										1			+	1		49	1	16			+	8	4	161	13	

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Leporidae	*Oryctolagus cuniculus*	Rabbit			*Y*		L																					
Bovidae	*Bos taurus*	Cow									+	22	26	+				5		+	+		+					
Equidae	*Equus asinus*	Donkey			*Y*										+			1		+							n	
	Equus caballus	Horse										3	3														6	
Canidae	*Canis lupus dingo*	Dingo			*Y*						+	1		3	+	11		11	3	+	9	+	+	3	1	8	1	
	Canis lupus familiaris	Dog											4															
	Vulpes vulpes	Fox			*Y*		M													+								
Felidae	*Felis catus*	Cat			*Y*		L					1	1	1				1	1	+	2	+	+	2	1	1	2	
REPTILES																												
Cheluidae	*Chelodina steindachneri*	Flat-shelled Turtle															+			2								
Agamidae	*Amphibolurus gilberti*	Gilbert's Dragon																		+								
	Amphibolurus longirostris	Long-nosed Dragon													+	1		11	3	vc	81		+	1		16	4	
	Caimanops amphiboluroides	Mulga Dragon																1		(2)		+						
	Ctenophorus caudicinctus	Ringtailed Dragon								1	2	2	+	10	+	17		48	6	vc	111		+	4	12	41	47	
	Ctenophorus isolepis	Military Dragon													+	8		45	2	7	64		+			8	31	
	Ctenophorus nuchalis	Central Netted Dragon														5		8										
	Ctenophorus reticulatus	Western Netted Dragon													+			+		3								
	Ctenophorus scutulatus	Lozenge-marked Dragon																+										
	Diporiphora valens	Pilbara Two-lined Dragon													+					6						4	5	
	Diporiphora winneckei	Blue-lined Dragon																		+							(?)	
	Pogona minor (**4**)	Western Bearded Dragon													+			2		mc			+			3	2	
	Pogona minor mitchelli	Northwest Bearded Dragon								1			+	5					3		41			1	3			
	Tympanocryptis cephalus	Pebble Dragon													+			+									(+)	
Gekkonidae	*Gehyra pilbara*	Pilbara Dtella													+				1	6	2		+				(+)	
	Gehyra punctata	Spotted Dtella													+			25	38	mc	1		+	2	2	1	4	
	Gehyra purpurascens	Purple Dtella																16					+					
	Gehyra variegata	Common Dtella											+		+			+		c	17		+	3	4	24	6	
	Heteronotia binoei	Bynoe's Prickly Gecko								1	1				+	9		44	9	mc	98		+	3	13	14	40	
	Heteronotia planiceps	North-west Prickly Gecko						+																				
	Heteronotia spelea	Desert Cave Gecko													+			2	2	2			+				(+)	
Carphodactylidae	*Underwoodisaurus seorsus* (**3**)	Pilbara Barking Gecko																	2				+	1	1			
	Nephrurus laevis pilbarensis	Pilbara Smooth Knobtail Gecko														2												
	Nephrurus wheeleri cinctus	Banded Knob-tailed gecko													+			1	2	mc	13		+	1			1	
Diplodactylidae	*Crenadactylus ocellatus*	Clawless gecko													+			2	1				+					
	Diplodactylus conspicillatus	Fat-tailed gecko													+	6		29	1	+	234		+			7	50	
	Diplodactylus mitchelli	Pilbara Stone Gecko																+										
	Diplodactylus savagei	Yellow-spotted Pilbara Gecko													+			14	1		2		+		1	2	5	

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	Lucasium squarrosum (3)	Spotted Ground Gecko																		+								
	Lucasium stenodactylum	Sand-plain Gecko													+	6		7		4			+				140	
	Lucasium wombeyi	Pilbara Ground Gecko													+			2		(3)	49		+		5		21	
	Oedura marmorata	Marbled Velvet Gecko								2	2				+			5	17	3			+	1	1		(+)	
	Rhynchoedura ornata	Beaked Gecko													+	2		1		(2)						2	88	
	Strophurus elderi	Jewelled Gecko													+			6		1	4		+			3	8	
	Strophurus jeanae	Southern Phasmid Gecko																		(2)	26		+					
	Strophurus strophurus	Western Spiny-tail gecko																					+					
	Strophurus wellingtonae	Western Shield Spiny-tail Gecko									1				+				2	2	17		+	2	1	5	4	
Pygopodidae	*Delma butleri*																		1					1				
	Delma elegans														+			2	1	(2)	2		+	1			(+)	
	Delma haroldi														+													
	Delma nasuta														+	3		6	1	7	6		+	3	2	6	16	
	Delma pax														+			6	1		14		+	8	2	1	6	
	Delma tincta														+			+		2			+			3	2	
	Lialis burtonis	Burton's Legless lizard												1	+	2		3	1	mc	10		+	1	2	4	10	
	Pygopus nigriceps	Hooded Scaly-foot													+	1		2		mc	12		+		3		2	
Scincidae	*Carlia munda*	Shaded-litter Rainbow Skink									3			1	+	5		8	7	11	268		+	5	16	7	14	
	Carlia triacantha	Rainbow Skink													+					1	80		+		2			
	Cryptoblepharus buchananii														+													
	Cryptoblepharus carnabyi (3)															4				6							3	
	Cryptoblepharus plagiocephalus (3)																			9						3	1	
	Cryptoblepharus ustulatus	Russet Snake-eyed Skink													+			1	1				+	2				
	Ctenotus duricola	Pilbara Ctenotus								1					+	4		16	1	c	111		+		14	3	19	
	Ctenotus grandis	Grand Ctenotus									1				+	2		24	23		234		+	12		1	22	
	Ctenotus hanloni	Nimble Ctenotus														10		8								4		
	Ctenotus helenae	Clay-soil Ctenotus													+	2		6		13	467		+	1	13	1		
	Ctenotus "aff. *helenae*"																	8									37	
	Ctenotus leonhardii	Leonhard's Ctenotus																			5		+					
	Ctenotus mimetes	Checker-sided Ctenotus																+										
	Ctenotus pantherinus	Leopard Ctenotus									1				+	8		36	4	15	330		+	2	16	27	40	
	Ctenotus piankai	Coarse Sands Ctenotus																		+							(?)	
	Ctenotus quattuordecimlineatus	Fourteen-lined Ctenotus						+																				
	Ctenotus aff. *robustus*														+			+									(+)	
	Ctenotus rubicundus	Ruddy Ctenotus												1	+			2		2				1		2	(+)	
	Ctenotus rutilans	Rusty-shouldered Ctenotus													+			+		uc	4		+				4	
	Ctenotus saxatilis	Rock Ctenotus											+	1	+	14		96	13	26	326		+	36	61	3	6	

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	Ctenotus schomburgkii	Barred Wedge-snout Ctenotus													+			+		7						4	8	
	Ctenotus serventyi	Sandy-loam Ctenotus																+										
	Ctenotus severus	Stern Ctenotus																+										
	Ctenotus uber uber	Spotted Ctenotus																+										
	Cyclodomorphus melanops	Spinifex Slender Bluetongue													+			1	1	c	36		+	1	1	1	12	
	Egernia cygnitos (**3**)	West Pilbara Spiny-tail Skink																+										
	Egernia formosa	Goldfields Crevice-skink													+			+		2	1		+				3	
	Eremiascincus fasciolatus	Narrow-banded Sandswimmer													+				1		1		+					
	Eremiascincus isolepis	Northern Bar-lipped Skink																+										
	Eremiascincus richardsonii	Broad-banded Sandswimmer													+	1				uc							(+)	
	Eremiascincus sp. (=*musivus*?)																	+								1		
	Lerista bipes	Northwestern Sandslider														47		+										
	Lerista clara																	2										
	Lerista sp.															4												
	Lerista flammicauda (incl. "*frosti*")	Pilbara Flame-tailed Slider													+			4	3	6						2		
	Lerista jacksoni	Jackson's Lerista																+							1		2		
	Lerista muelleri (3)	Wood-mulch Slider													+			6	5	1			+				5	
	Lerista rolfei	Rolfe's Slider																+										
	Lerista verhmens	Powerful Lerista													+			+			36		+					
	Lerista zietzi	Blue-tailed Skink						+										1			4		+	2	4			
	Menetia greyii	Common Dwarf Skink											+		+	4		5	3		42		+	8	4	2	11	
	Menetia surda	Western Dwarf Skink													+			+		uc						1	18	
	Morethia ruficauda exquisita	Fire-tailed Skink								1	4			1	+	1		10	5	mc	3		+		3	4	2	
	Notoscincus butleri	Lined Soil-crevice Skink			*P4*	+									+		+	+			1		+			1	2	
	Notoscincus ornatus	Ornate Soil-crevice Skink													+			4										
	Proablepharus reginae	Western Soil-crevice Skink													+					1	1		+					
	Tiliqua multifasciata	Central Blue-tongue								1					+			2	5	c	42		+	1		2	2	
Varanidae	*Varanus acanthurus*	Ridge-tailed Monitor													+			9	8	mc	102		+	2	13	4	7	
	Varanus brevicauda	Short-tailed Pygmy Monitor													+			9	3	mc	248		+			1	7	
	Varanus bushi	Pilbara Mulga Monitor													+			+			18	+	+	2		1		
	Varanus caudolineatus	Stripe-tailed Monitor													+					c								
	Varanus eremius	Pygmy Desert Monitor													+	2		6	4		91		+		1		8	
	Varanus giganteus	Perentie												1				3	1	(2)			+	1			1	
	Varanus gilleni	Pigmy Mulga Monitor																3									(+)	
	Varanus gouldii	Sand Monitor																		(1)								
	Varanus panoptes	Yellow-spotted Monitor																+	2	1+	21		+	1			2	
	Varanus pilbarensis	Pilbara Rock Monitor													+			+		3			+				1	

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	Varanus tristis	Black-tailed Monitor													+			+	1	1	2		+	1	1	1	2	
	Varanus sp. (unidentified juv.)																				7							
Typhlopidae	*Ramphotyphlops ammodytes*														+			9		(1)	2		+			3		
	Ramphotyphlops "australis"																			+								
	Ramphotyphlops "bituberculatus"																			+								
	Ramphotyphlops ganei				P1	+		+							+			+	1				+					
	Ramphotyphlops grypus														+			10	5	mc	25		+	1	4	6	6	
	Ramphotyphlops hamatus														+			+		5								
	Ramphotyphlops pilbarensis							+							+			1			6		+		2		4	
	Ramphotyphlops waitii																			4								
Pythonidae	*Antaresia perthensis*	Pigmy Python													+			+		2			+	1			(+)	
	Antaresia stimsoni	Stimson's Python												1	+			+	4	(1)	64		+	1			(+)	
	Aspidites melanocephalus	Black-headed Python																	1	(1)	2		+	1				
	Liasis olivaceus barroni	Pilbara Olive Python	V U	S1	VU			+						(1)				3	1	2			+			1		
Elapidae	*Acanthophis wellsi*	Pilbara Death Adder													+	2		3		(1)			+	1		1	(+)	
	Brachyurophis approximans	Pilbara Shovel-nosed Snake													+			2	1	5	34		+	1	5	1	4	
	Demansia psammophis	Yellow-faced Whipsnake													+	1		2		uc	5		+				2	
	Demansia rufescens	Rufous Whipsnake													+			+		c	20		+	3	1	2		
	Furina ornata	Moon Snake													+	1		5	1	3	12		+	1		1	2	
	Parasuta monachus	Monk Snake																2		mc	5		+			6	4	
	Pseudechis australis	Mulga Snake									+			1	+			1	1	c	45		+	1			1	
	Pseudonaja modesta	Ringed Brown Snake													+			1		2	7		+			1		
	Pseudonaja mengdeni (3)	Gwardar																		3	6		+		3	1	1	
	Suta fasciata	Desert Banded Snake																		mc	4		+			2	(+)	
	Suta punctata	Spotted Snake													+	1		+		(1)								
	Vermicella snelli	Pilbara Bandy Bandy																	1	(1)			+			1		
BIRDS																												
Casuariidae	*Dromaius novaehollandiae*	Emu								1					+	3		24	2	uc	1	+	+				2	
Phasianidae	*Coturnix pectoralis*	Stubble Quail																+			2				2			
	Coturnix ypsiliophora	Brown Quail													+			2			2		+	4				
Anatidae	*Cygnus atratus*	Black Swan																		s								
	Chenonetta jubata	Australian Wood Duck													+					s								
	Malacorhynchus membranaceus	Pink-eared Duck													+					s								
	Anas gracilis	Grey Teal													+					uc							5	
	Anas superciliosus	Pacific Black Duck													+			+		uc	2						3	
	Aythya australis	Hardhead													+					s								
Podicipedidae	*Tachybaptus novaehollandiae*	Australasian Grebe													+			+		uc								

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	Poliocephalus poliocephalus	Hoary-headed Grebe													+					uc								
Columbidae	*Phaps chalcoptera*	Common Bronzewing									1	1	1	1	+	1		11	2	mc	3		1	1	1	18	12	
	Phaps elegans	Brush Bronzewing														3												
	Phaps histrionica	Flock Bronzewing																		(+)								
	Ocyphaps lophotes	Crested Pigeon								1	1	10	+	55	+			223	1	mc	16	+	7	2		83	91	
	Geophaps plumifera	Spinifex Pigeon								2	4	16	5		+			320	1	mc	51		13	18	22	170	72	
	Geopelia cuneata	Diamond Dove								9	21	33	12	5	+	5		69	1	c	35		12		11	65	304	
	Geopelia striata	Peaceful Dove													+	1		15		uc	40	+	1	15	33	6		
Podargidae	*Podargus strigoides*	Tawny Frogmouth													+					s			+	1			1	
Eurostopodidae	*Eurostopodus argus*	Spotted Nightjar										1		1	+			12		c	45		+	1			8	
Aegothelidae	*Aegotheles cristatus*	Owlet Nightjar										4	1		+			1		s			+	2				
Apodidae	*Apus pacificus*	Fork-tailed Swift	*M*				M								+			+		mc			+					
Anhingidae	*Anhinga melanogaster*	Australasian Darter																		uc								
Phalacrocoracidae	*Microcarbo melanoleucos*	Little Pied Cormorant																		s	2				2			
	Phalacrocorax carbo	Great Cormorant																		s								
Pelecanidae	*Pelecanus conspicillatus*	Australian Pelican													+					(2)								
Ardeidae	*Ardea pacifica*	White-necked Heron												3	+			2		uc			+				2	
	Ardea modesta (=*alba*)	Great Egret	*M*				M								+					s								
	Ardea ibis	Cattle Egret	*M*				M																					
	Egretta novaehollandiae	White-faced Heron											1		+	1		+	1	uc							6	
	Nycticorax caledonicus	Nankeen Night-heron																		uc								
Threskiornithidae	*Threskiornis spinicollis*	Straw-necked Ibis													+			4		uc								
Accipitridae	*Elanus axillaris*	Black-shouldered Kite													+					uc	4		1			2		
	Lophoictinia isura	Square-tailed Kite													+					+			+					
	Hamirostra melanosternon	Black-breasted Buzzard																+		s								
	Haliaeetus leucogaster	White-bellied Sea-eagle	*M*				L																					
	Haliastur sphenurus	Whistling Kite								1				3	+			1		mc	1		+			2	2	
	Milvus migrans	Black Kite													+					mc								
	Accipiter fasciatus	Brown Goshawk													+	2		3	1	uc	2		+	2			1	
	Accipiter cirrocephalus	Collared Sparrowhawk													+			+		mc	1		+		1			
	Circus assimilis	Spotted Harrier												1	+			7		c						1	3	
	Aquila audax	Wedge-tailed Eagle										1	+	1	+			18	1	mc			+			4	3	
	Hieraeetus morphnoides	Little Eagle													+	2		+		uc						2	2	
	Pandion cristatus	Eastern Osprey																		(1)								
Falconidae	*Falco cenchroides*	Australian Kestrel								1		2	4		+	1		10	1	c	1		+	1		3	6	
	Falco berigora	Brown Falcon								3	1		6		+	1		21	1	c	5	+	3	2		17	9	
	Falco longipennis	Australian Hobby													+			1		uc		+	+			1	1	

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	Falco hypoleucos	Grey Falcon			*P4*													1		+								
	Falco peregrinus	Peregrine Falcon	*M*	*S4*	*S*			+					1					+		uc								
Rallidae	*Gallirallus philippensis*	Buff-banded Rail																		(1)								
	Porzana tabuensis	Spotless Crake																		mc								
	Porzana fluminea	Spotted Crake																		(+)								
	Tribonyx ventralis	Black-tailed Native-hen																		s								
	Fulica atra	Eurasian Coot													+					s								
Otididae	*Ardeotis australis*	Australian Bustard			*P4*	+						1	10	2	+			23		mc		+	+			1	17	
Burhinidae	*Burhinus grallarius*	Bush Stone-curlew			*P4*			+			1				+					s				1			1	
Recurvirostridae	*Himantopus himantopus*	Black-winged Stilt													+					(3)								
Charadriidae	*Charadrius veredus*	Oriental Plover	*M*				M																					
	Elseyornis melanops	Black-fronted Dotterel											2		+	1				mc							3	
	Erythrogonys cinctus	Red-kneed Dotterel																		(+)								
Turnicidae	*Turnix velox*	Little Button-quail								1		2	+		+			6	1	mc	4		1	2			3	
Scolopacidae	*Gallinago megala*	Swinhoe's Snipe	*M*												+													
	Numenius minutus	Little Curlew																1										
	Tringa glareola	Wood Sandpiper																		(2)								
	Actitis hypoleucos	Common Sandpiper													+					(1)								
	Calidris ferruginea	Curlew Sandpiper																		+								
Glareolidae	*Glareola maldivarum*	Oriental Pratincole	*M*				(M)																					
Laridae	*Chlidonias hybrida*	Whiskered Tern																		(3)								
Cacatuidae	*Eolophus roseicapillus*	Galah									2	11	7	31	+	2		274	7	uc		+	+	4		39	42	
	Cacatua sanguinea	Little Corella								1	4		4	82	+	1		34		mc	5		+	12	5	35	63	
	Nymphicus hollandicus	Cockatiel												71	+	3		45		mc	10		+	12	10	2	79	
	Calyptorhynchus banksii	Red-tailed Black Cockatoo																		(+)								
Psittacidae	*Barnardius zonarius*	Australian Ringneck									3	7	3	7	+	1		26	6	c	52	+	7	15	19	64	58	
	Psephotus varius	Mulga Parrot																		(1)								
	Melopsittacus undulatus	Budgerigar								30	70	34	28	15	+	8		275		mc	104		46	20		6	266	
	Neopsephotus bourkii	Bourke's Parrot													+					uc								
Cuculidae	*Centropus phasianinus*	Pheasant Coucal													+			+			2		+		2			
	Chalcites osculans	Black-eared Cuckoo										1								(1)						1		
	Chalcites basalis	Horsfield's Bronze-Cuckoo													+	2		11		mc	30		4		6	8	3	
	Cacomantis pallidus	Pallid Cuckoo									1			1	+	2		10		mc	7		+		1	23	15	
Strigidae	*Ninox connivens*	Barking Owl																		1?								
	Ninox novaeseelandiae	Boobook Owl													+					uc	1		+	1				
Tytonidae	*Tyto javanica*	Eastern Barn Owl																		(2)							1	
Halcyonidae	*Dacelo leachii*	Blue-winged Kookaburra								1					+	1		5		mc	29		5	2	22		4	

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	Todiramphus sanctus	Sacred Kingfisher											1		+	1		+	1	mc	73		+	2	72			
	Todiramphus pyrrhopygia	Red-backed Kingfisher												1	+			8		mc			+	1		4	15	
Meropidae	*Merops ornatus*	Rainbow Bee-eater	*M*				M			2	4	18	7	2	+	5		109	10	c	53	+	7	26	12	30	32	
Climacteridae	*Climacteris melanura*	Black-tailed Treecreeper								2	2			1	+					mc	2						1	
Ptilonorhynchidae	*Ptilonorhynchus guttatus*	Western Bowerbird								2	12				+			2	2	uc	21		2	2	1	1	16	
Maluridae	*Malurus leucopterus* (**4**)	White-winged Fairy-wren										4	+		+			13	1	uc	17		15			24	36	
	Malurus lamberti	Variegated Fairy-wren								8	21				+	4		96	3	c	136	+	46	21	31	236	147	
	Stipiturus ruficeps	Rufous-crowned Emu-wren													+	2		2		uc						25	21	
	Amytornis striatus (**4**)	Striated Grasswren													+	2		4			12		5		6	17	6	
	Amytornis striatus whitei	Striated Grasswren													+			+		r								
Acanthizidae	*Sericornis magnirostris*	Large-billed Scrubwren																		+								
	Calamanthus campestris	Rufous Fieldwren													+													
	Pyrrholaemus brunneus	Redthroat													+					s								
	Smicrornis brevirostris	Weebill									5	1	+	1	+	1		78	8	mc	261		69	11	37	370	431	
	Gerygone fusca fusca	Western Gerygone													+	4		5		c	2		+	2		15	3	
	Acanthiza robustirostris	Slaty-backed Thornbill													+					s								
	Acanthiza uropygialis	Chestnut-rumped Thornbill													+					c						31	18	
	Acanthiza apicalis	Broad-tailed (Inland) Thornbill													+				+	mc						34	3	
	Acanthiza chrysorrhoa	Yellow-rumped Thornbill										4	3		+				1	s		+		4				
Pardalotidae	*Pardalotus rubricatus*	Red-browed Pardalote													+	2		5	2	mc	30		4		7	4	21	
	Pardalotus striatus	Striated Pardalote								9	1	2	+	27	+	1		3	1	c	12		1		2	10	21	
Meliphagidae	*Certhionyx variegates*	Pied Honeyeater										6	+		+					s			+			1		
	Lichenostomus virescens	Singing Honeyeater								6	4	52	13	4	+			259	3	mc	107	+	20	5	1	98	277	
	Lichenostomus keartlandi	Grey-headed Honeyeater								3	33	5	2		+	3		148	3	mc	90		5	26	22	41	26	
	Lichenostomus plumulus	Grey-fronted Honeyeater													+			2		+								
	Lichenostomus penicillatus	White-plumed Honeyeater								4		6	8		+	1		96	1	c	97	+	1	9	85	20	3	
	Purnella albifrons	White-fronted Honeyeater																5		uc							3	
	Manorina flavigula	Yellow-throated Miner								8	3	26	11	10	+			139	15	mc	73		9	26	12	36	188	
	Acanthagenys rufogularis	Spiny-cheeked Honeyeater													+			40	1	c	6		+	9	1	46	133	
	Conopophila whitei	Grey Honeyeater													+			2		uc						1		
	Sugomel niger	Black Honeyeater													+	6		12		mc			+					
	Ephthianura tricolor	Crimson Chat													+			11		mc							16	
	Ephthianura aurifrons	Orange Chat																		(+)								
	Lichmera indistincta	Brown Honeyeater									5				+	4		131	1	mc	10		2	2		46	27	
	Melithreptus gularis	Black-chinned Honeyeater								2					+			3		mc	3		+	2			1	
Pomatostomidae	*Pomatostomus temporalis*	Grey-crowned Babbler										11	8		+	1		14	1	uc	30		5	3	23	145	23	
	Pomatostomus superciliosus	White-browed Babbler													+												5	

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Eupetidae	*Cinclosoma castaneothorax*	Chestnut-breasted Quail-thrush													+			1								3	
	Psophodes occidentalis	Chiming Wedgebill								2	1				+												
Neosittidae	*Daphoenositta chruysoptera*	Varied Sittella													+					mc	7						
Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike								4	11	11	27	10	+	3		23		c	44	+	9	4	10	25	55	
	Coracina maxima	Ground Cuckoo-shrike													+					s			+			2	8	
	Lalage tricolor [sueurii]	White-winged Triller								1	3		5	1	+	1		4		c	21		1		4	1	43	
Pachycephalidae	*Pachycephala rufiventris*	Rufous Whistler								11	9	3	7	11	+	2		20	2	c	119	+	13	4	65	56	76	
	Colluricincla harmonica	Grey Shrike-thrush									8	1	4	1	+			14	5	mc	126		30	12	63	47	37	
	Oreoica gutturalis	Crested Bellbird										4	+		+	2		91	3	mc	71		21	6	16	58	36	
Artamidae	*Artamus personatus*	Masked Woodswallow													+			1118	1	uc			+			3		
	Artamus cinereus	Black-faced Woodswallow								2	5			9	+	1		51	4	mc	36		4	8		95	88	
	Artamus minor	Little Woodswallow								4	5	19	4		+	2		10		mc	10		2	23	4	12	24	
	Cracticus torquatus	Grey Butcherbird												1	+			1	1	mc	7		+	4	4	6	21	
	Cracticus nigrogularis	Pied Butcherbird								6	1	1	+	2	+	2		27	3	mc	35		2	12	8	36	43	
	Cracticus tibicen	Australian Magpie								3		13	9	1	+			17	3	mc	7	+	2			9	11	
Rhipiduridae	*Rhipidura fuliginosa*	Grey Fantail													+	1				s						7	
	Rhipidura leucophrys	Willie Wagtail								3	11	16	7	4	+	5		108	4	mc	37		3	10	15	89	97	
Corvidae	*Corvus bennetti*	Little Crow													+			4		(+)		+	+	2		2		
	Corvus orru	Torresian Crow								6	3	6	6	6	+	2		59	3	mc	12	+	1	6	1	75	36	
Monarchidae	*Grallina cyanoleuca*	Magpie-Lark									1	2	6	4	+	1		22	2	mc	9	+	+	8	6	24	23	
Petroicidae	*Petroica goodenovii*	Red-capped Robin								2					+			+		mc						3	4	
	Melanodryas cucullata	Hooded Robin									1	6	2		+			16	2	mc	8		2	1		16	10	
	Poecilodryas superciliosa	White-browed Robin																		+								
Alaudidae	*Mirafra javanica horsfieldii*	Horsfield's (Singing) Bushlark								1	1				+			+		s								
Acrocephalidae	*Acrocephalus australis*	Australian Reed-warbler																		s								
Megaluridae	*Cincloramphus mathewsi*	Rufous Songlark													+	1		2		mc	8		+				16	
	Cincloramphus cruralis	Brown Songlark													+			3		uc			+			3	2	
	Eremiornis carteri	Spinifexbird								2		5	2		+	3		14	3	mc	71		8	8	2	13	19	
Hirundinidae	*Hirundo neoxena*	Welcome Swallow																+										
	Petrochelidon ariel	Fairy Martin													+	2				(+)			+				1	
	Petrochelidon nigricans	Tree Martin													+			1		c	9		+				2	
Nectariniidae	*Dicaeum hirundinaceum*	Mistletoebird													+	1		1		mc	30		+		21	6	8	
Estrildidae	*Taeniopygia guttata*	Zebra Finch								33	15		4	235	+	6		309	20+	v c	67	+	7	32	6	817	2051	
	Neochmia ruficauda subclarescens	Star Finch (western)			P4										+					c								
	Emblema pictum	Painted Finch								12	4	20	+		+	10		35		c	88		12	6	2	139	282	
Motacillidae	*Anthus novaeseelandiae*	Australasian Pipit													+			1		s							7	

Notes to Table:

EPBC Act status **EN** Endangered, **VU** Vulnerable, **M** Migratory

WC Act status **S1** Schedule 1 (Rare or likely to become extinct), **S4** (Specially protected)

DEC status **P1-P5** Priority code, others as above

EPBC protected matters report **M** species or habitat may occur, **L** species or habitat likely to occur

+ recorded in area; numbers refer to specimens trapped, sightings, traces (depending on species and survey); codes **vc** very common, **c** common, **mc** moderately common, **uc** uncommon, **s** scarce

(**1**) Morgan *et al.* (2009) consider *Neosilurus* sp. in Fortescue River as distinct from *N. hyrtlii* (type locality Fitzroy River, Qld)

(**2**) *Planigale* is represented by two undescribed species in the Pilbara, which have often been conflated with *P. ingrami* and *P. maculata* (Blacket *et al*. 2000; Gibson & McKenzie 2009).

(**3**) Some extralimital species records have been deleted (e.g. *Litoria spenceri*) or assigned to the similar (or similarly-named) species likely to be intended, if it is unique (e.g. Yellow-throated Honeyeater [Tasmanian endemic] => Yellow-throated Miner; *Vespadelus pumilus* [Eastern Forest Bat] scored as *V. finlaysoni*). In some cases this is not possible, e.g. former *Cryptoblepharus plagiocephalus* includes *C. ustulatus* and *C. buchanani* (Horner 2007); former *Lerista muelleri* includes *L. clara* and *L. verhmens* as well as *L. muelleri* sensu strict (Smith & Adams 2007). Pilbara specimens previously identified as *Underwoodisaurus milii* (or *Nephrurus milii*) are now recognised as *Underwoodisaurus seorsus*, which 'may be of conservation concern' (Doughty & Oliver 2011); *Egernia cygnitos* is the western Pilbara species formerly included in *E. depressa* (Doughty *et al.* 2011). *Lucasium squarrosum* record retained, but likely to represent *L. wombeyi*.

(**4**) Mainland WA records of *Malurus leucopterus* are mostly identified as *M. leucopterus leuconotus* (blue with white wings), but the few records from the western Hamersley range on NatureMap (DEC 2011b) are identified as *M. leucopterus leucopterus*, the black-plumaged subspecies of Dirk Hartog Island. The Hamersley records come from fauna survey returns and the identifications are listed as 'certain'. A similar situation applies to two other conservation-listed subspecies. Peter Mawson (DEC; email 26 Aug 2011) states: "*Amytornis striatus striatus* – is restricted to the DEC Midwest and Goldfields regions. Any records from the Pilbara are most likely *Amytornis striatus whitei* (not threatened or Priority listed). *Malurus leucopterus leucopterus* – is restricted to Dirk Hartog Island, and so any Pilbara records should be *M. l. leuconotus*. *Pogona minor minima* – is restricted to the Abrolhos Islands and any records in the Pilbara are most likely *Pogona minor minor*."

Appendix Nine: Conservation Significant Flora Risk Assessment

Table 27: Conservation Significant Flora Risk Assessment

Species	Cons Code	Soil	Landform	Vegetation	Soil Type Present	Landform Present	Associated Vegetation Present	Known from Nearby	Likelihood of Occurring in Flying Fish
Lepidium catapycnon	T	Skeletal soils	Hillsides	*Eucalyptus leucophloia*, *Triodia* spp.	Y	Y	Y	N	Possible
Thryptomene wittweri	T	Skeletal red stony soils	Breakaways, stony creek beds	*Eucalyptus kingsmillii*	Y	N	N	N	None (Rare)
Bothriochloa decipiens var. *cloncurrensis*	P1	Clay, loam	Damp depression; clay plain	Mulga, *Eucalyptus camaldulensis*	N	N	N	N	None (Rare)
Calotis squamigera	P1	Pebbly loam	Plain	Mulga, *Acacia xiphophylla*	Y	y	y	N	Possible
Eragrostis sp. Mt Robinson (S.van Leeuwen 4109)	P1	Red-brown skeletal soils, ironstone	Steep slopes, summits	*Eucalyptus kingsmillii*	Y	N	N	N	None (Rare)
Eremophila sp. West Angelas (S. van Leeuwen 4086)	P1	Banded ironstone	High hills, summits	*Eucalyptus kingsmillii*, Mulga	Y	N	N	N	None (Rare)
Eremophila sp. Snowy Mountain (S. van. Leeuwen 3737)	P1	Ironstone	High hills, summits	*Eucalyptus leucophloia*	Y	Y	Y	N	Unlikely
Eremophila spongiocarpa	P1	Weakly saline alluvium	Alluvial plain on margins of marsh	Samphire	N	N	N	N	None (Rare)
Eucalyptus lucens	P1	Ironstone rocks	Rocky slopes and mountain tops, high in the landscape	*Eucalyptus kingsmillii*	Y	N	N	N	None (Rare)
Genus sp. Hamersley Range hilltops (S van Leeuwen 4345)	P1	Skeletal, brown gritty soil over ironstone	Hill summit	*Eucalyptus leucophloia, Triodia* spp.	Y	N	Y	Y	Possible
Sida sp. Hamersley Range (K. Newbey 10692)	P1	Skeletal soil; ironstone	Hilltops, cliffs, scree	*Eucalyptus leucophloia*, *Eucalyptus gamophylla*	Y	Y	Y	Y	Likely
Tetratheca fordiana ms	P1	Shale pocket amongst ironstone	Midslope	*Eucalyptus kingsmillii*	Y	N	N	N	None (Rare)
Teucrium pilbaranum	P1	Clay	Crab hole plain in a river floodplain, margin of calcrete table	*Eucalyptus camaldulensis, Eucalyptus victrix, Chrysopogon fallax*	N	N	N	N	None (Rare)
Vittadinia sp. Coondewanna Flats (S. van Leeuwen 4684)	P1	Clay loam soils	Plain	Mulga	N	N	N	N	None (Rare)
Adiantum capillus-veneris	P2	Rocky	Moist, sheltered sites in gorges and on cliff walls	Unknown	Y	N	N	N	None (Rare)

Species	Cons Code	Soil	Landform	Vegetation	Soil Type Present	Landform Present	Associated Vegetation Present	Known from Nearby	Likelihood of Occurring in Flying Fish
Cladium procerum	P2	Loam, gravel	Perennial pools	Unknown	Y	Y	Y	N	Possible
Eremophila forrestii subsp. Pingandy (M.E. Trudgen 2662)	P2	Stony soil	Slopes, low in landscape	Mulga	Y	Y	y	N	Possible
Oxalis sp. Pilbara (M.E. Trudgen 12725)	P2	Red-brown pebbly/rocky loam amongst boulders	Gullies	*Acacia* spp, *Eucalyptus leucophloia*	Y	Y	Y	N	Possible
Paspalidium retiglume	P2	Clay; cracking	Plain	Grassland/herbland	N	N	N	N	None (Rare)
Pilbara trudgenii	P2	Skeletal, red stony soil over ironstone	Hill summits, steep slopes, screes, cliff faces	*Eucalyptus kingsmillii*	Y	N	N	N	None (Rare)
Scaevola sp. Hamersley Range basalts (S. van Leeuwen 3675)	P2	Skeletal, brown gritty soil over basalt	Summits of hills, steep hills	*Eucalyptus kingsmillii*	Y	N	N	N	None (Rare)
Spartothamnella puberula	P2	Rocky loam, sandy or skeletal soils, clay	Gorge, gully	*Acacia* spp.	Y	N	N	Y	None (Rare)
Vigna sp. central (M.E. Trudgen 1626)	P2	Sandy plain; sand over compacted hardpan and limestone rock; claypan of fine cracking clays	Plain, claypan (valleys in CPP)	*Triodia epactia*, Mulga, *Eucalyptus camaldulensis*	Y	Y	Y	N	Possible
Acacia daweana	P3	Stony red loamy soils	Low rocky rises, along drainage lines	*Acacia* spp, *Eucalyptus* spp.	Y	Y	Y	N	Possible
Acacia subtiliformis	P3	Rocky calcrete plateau	Plateau	*Triodia* spp.	Y	Y	Y	N	Unlikely
Calotis latiuscula	P3	Sand, loam	Plain	Mulga	N	N	N	Y	None (Rare)
Dampiera anonyma ms	P3	Skeletal red-brown to brown gravelly soil over banded ironstone, basalt, shale and jaspilite	Hill summits, upper slopes	*Eucalyptus kingsmillii, Acacia hamersleyana*	Y	N	N	Y	None (Rare)
Dampiera metallorum ms	P3	Skeletal red-brown gravely soils over banded ironstone	Steep slopes and summits	*Eucalyptus kingsmillii*	Y	N	N	N	None (Rare)
Eragrostis crateriformis	P3	Clayey loam or clay	Creek banks, depressions	*Triodia epactia, Eucalyptus victrix*	Y	Y	Y	N	Possible
Eragrostis surreyana	P3	Red-brown clay	Drainage line	*Eucalyptus victrix, Eucalyptus camaldulensis, Cyperus vaginatus*	N	N	N	N	None (Rare)

Species	Cons Code	Soil	Landform	Vegetation	Soil Type Present	Landform Present	Associated Vegetation Present	Known from Nearby	Likelihood of Occurring in Flying Fish
Eremophila forrestii subsp. *viridis*	P3	Unknown	Sandplain	Unknown	N	N	N	N	None (Rare)
Eremophila magnifica subsp. *velutina*	P3	Skeletal soils over ironstone	Summits	*Eucalyptus kingsmillii*	Y	N	N	N	Does occur
Fimbristylis sieberiana	P3	Mud, skeletal soil pockets	Pool edges, sandstone cliffs	*Cyperus vaginatus*	Y	Y	Y	N	Possible
Geijera salicifolia	P3	Skeletal soils, stony soils	Massive rock scree, gorges	Mulga	N	N	N	N	None (Rare)
Glycine falcata	P3	Black clayey sand	Floodplains; depressions in crabhole plains on river	Grassland; *Eriachne* spp.	N	N	N	Y	None (Rare)
Gymnanthera cunninghamii	P3	Sand, calcrete, clay loam	Drainage line	*Eucalyptus camaldulensis, Eucalyptus victrix, Acacia citrinoviridis*	Y	N	N	Y	Unlikely
Indigofera gilesii subsp. *gilesii*	P3	Pebbly loam amongst boulders & outcrops	Hills	*Eucalyptus leucophloia, Corymbia hamersleyana, Corymbia ferriticola*	Y	Y	Y	N	Unlikely
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	P3	Alluvium, skeletal ironstone	Creeks and gorges	Not given	Y	Y	Y	N	Does occur
Iotasperma sessilifolium	P3	Cracking clay, black loam	Edges of waterholes, plains	Grassland, *Eriachne* spp., *Astrebla* spp., *Eucalyptus victrix*	N	N	N	N	None (Rare)
Oldenlandia sp. Hamersley Station (A.A. Mitchell PRP 1479)	P3	Cracking clay, basalt	Gently undulating plain with large surface rocks, flat crabholed plain	*Astrebla* grassland; Mulga	N	N	N	N	None (Rare)
Olearia mucronata	P3	Schist	Schistose hills, along drainage channels	Mulga; grassland	N	N	N	N	None (Rare)
Phyllanthus aridus	P3	Sandstone, gravel, red sand	Sandplain, hills'	Coastal	N	N	N	N	None (Rare)
Ptilotus subspinescens	P3	Rocky	Gentle rocky slopes, screes and the bases of screes	Unknown	Y	Y	Unknown	Y	Unlikely
Rhagodia sp. Hamersley (M. Trudgen 17794)	P3	Clay loam, sand loam, colluvium	Floodplain / lower slopes	Mulga; *Triodia* grassland	N	N	N	N	Unlikely
Rostellularia adscendens var. *latifolia*	P3	Ironstone soils	Near creeks, rocky hills	Mulga; *Eucalyptus kingsmillii*	Y	Y	N	N	Unlikely
Sida sp. Barlee Range (S van Leeuwen 1642)	P3	Skeletal red soils pockets	Steep slope	*Ficus brachypoda, Corymbia ferriticola, Eucalyptus victrix, Eucalyptus kingsmillii*	Y	Y	Y	Y	Likely
Swainsona sp. Hamersley Station (A.A. Mitchell 196)	P3	Clay loam (cracking)	Flat crabholed plain	*Astrebla* grassland; Mulga	N	N	N	Y	None (Rare)

Species	Cons Code	Soil	Landform	Vegetation	Soil Type Present	Landform Present	Associated Vegetation Present	Known from Nearby	Likelihood of Occurring in Flying Fish
Triodia sp. Mt. Ella (ME Trudgen 12739)	P3	Light orange-brown, pebbly loam. Amongst rocks & outcrops, gully slopes	Hilltops, gorges, gullies	*Eucalyptus leucophloia, Corymbia ferriticola*, Mulga	Y	Y	N	N	Unlikely
Triodia sp. Robe River (M.E. Trudgen et al. MET 12367)	P3	Banded ironstone, Robe pisolite	Rocky hills and mesas	*Eucalyptus leucophloia, Acacia pruinocarpa, Acacia bivenosa, Acacia inaequilatera*	N	Y	Y	Y	None (Rare)
Acacia bromilowiana	P4	Red skeletal stony loam, orange-brown pebbly, gravel loam, laterite, banded ironstone, basalt	Rocky hills, breakaways, scree slopes, gorges, creek beds	*Eucalyptus leucophloia, Eucalyptus kingsmillii, Corymbia ferriticola, Acacia hamersleyensis*	Y	Y	Y	Y	Does occur
Eremophila magnifica subsp. *magnifica*	P4	Skeletal soils over ironstone	Rocky screes	*Corymbia hamersleyana, Eucalyptus leucophloia, Eucalyptus kingsmillii*	Y	Y	Y	Y	Does occur
Livistona alfredii	P4	Stony loam, limestone	Edges of permanent pools	*Eucalyptus camaldulensis , Eucalyptus victrix, Corymbia opaca*	Y	Y	Y	Y	Unlikely
Ptilotus mollis	P4	Rocky	Stony hills and screes	*Eucalyptus leucophloia*, Mulga, *Triodia* spp.	Y	N	Y	Y	Possible
Rhynchosia bungarensis	P4	Pebbly, coarse sand	Banks of flow line	Various	Y	Y	Y	Y	Almost certain