

## Level 1 Vegetation, Flora and Fauna Assessment, and Targeted Conservation Significant Flora and Fauna Survey: Delphine

Fortescue Metals Group Limited



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Level 1 Vegetation, Flora and Fauna Assessment, and Targeted Conservation *Significant Flora and Fauna Survey:*

*Delphine*

**Our Reference:**

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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 survey of exploration tenements E47/1832 and E47/1988 (known as 'Delphine'), approximately 135 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, vegetation and fauna desktop assessment of the biological environment identified:

- there were two Threatened Flora and 51 Priority Listed Flora species identified from the Western Australian Department of Environment and Conservation database search request of the Western Hub area and 15 km buffer; none of which have been previously recorded from within the study area
- one Threatened Ecological Community occurs in the Hamersley subregion ('*Themeda* grasslands on cracking clays (Hamersley Station, Pilbara)'), however, the Department of Environment and Conservation database search did not identify it as occurring within 15 km of the study area
- there are 29 Priority Ecological Communities known from the Pilbara Region, with the most likely to occur in the vicinity being the 'Brockman Iron cracking clay communities of the Hamersley Range' and '*Triodia* sp. Robe River assemblages of mesas of the Robe Valley'
- there were seven Threatened and Priority listed Fauna species identified from the Department of Environment and Conservation database search of the Western Hub area and 20 km buffer, none of which have been recorded from within the Delphine study area in previous surveys.
- three Threatened and six Migratory Fauna species were identified by the Environment Protection and Biodiversity Conservation (EPBC) Protected Matters Search Tool as potentially occurring in the study area and 10 km buffer
- 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 are Northern Quoll (*Dasyurus hallucatus*, Endangered), Pilbara Leaf-nosed Bat (*Rhinoicteris aurantia*, Vulnerable), and Pilbara Olive Python (*Liasis olivaceus barroni*, Vulnerable).

The flora and vegetation field survey was undertaken in July 2011 by four assessors over five days (110 person hours, including travel) and identified:

- up to 40% of the area was not accessible due to lack of tracks and steep slopes, particularly the western portion of the study area



- 43% of the study area had been recently burnt; in these areas most of the vegetation could not be mapped to vegetation type with confidence due to the lack of vegetation and unreliability if interpreted from aerial imagery
- a total of 87 vascular flora taxa were recorded within the study area from relevé sites and opportunistic observations
- no Threatened Flora gazetted under the Government of Western Australia's *Wildlife Conservation Act 1950* or listed as Threatened pursuant to Schedule 1 of the *Environment Protection and Biodiversity Conservation Act 1999* were recorded from the study area
- three Department of Environment and Conservation listed Priority Flora were recorded from the study area: *Indigofera* sp. Bungaroo Creek (P3), *Rhynchosia bungarensis* (P3) and *Triodia* sp. Robe River (P3). *Indigofera* sp. Bungaroo Creek and *Triodia* sp. Robe River were dominant and characteristic species of one vegetation type (EIBTw and EIAcTR respectively).
- one species, *Gompholobium oreophilum*, is an approximate 80 km westerly extension of its known range. Three species recorded are at the edge of their usual extents including *Acacia pachyacra* (western edge), *Eremophila forrestii* subsp. *hastieana* (northern edge) and *Triodia* sp. Robe River (eastern edge)
- four introduced flora species (weeds) were identified from the study area: \**Argemone ochroleuca* (Mexican poppy), \**Cenchrus ciliaris* (Buffel Grass) \**Malvastrum americanum* (Spiked Malvastrum) and \**Vachellia farnesiana* (Mimosa Bush). None of these are recognised under the *Agriculture and Related Resources Protection Act 1976* as Declared Plants in the Pilbara.
- nineteen different vegetation types, including a valley floor mosaic, none of which are considered to represent a TEC
- vegetation with similarities to the description of the 'Triodia sp. Robe River assemblages of mesas of the Pilbara' Priority Ecological Community was identified, however it did not occur on the definitive landform (mesas) and is unlikely to be included in the Priority Ecological Community. Additional data will be required in order for an accurate determination to be made by the Department of Environment and Conservation
- vegetation considered to represent a Groundwater Dependent Ecosystem (GDE) was recorded; **EcMbCv** (*Eucalyptus camaldulensis* subsp. *refulgens*, *E. victrix* and *Melaleuca argentea* woodland) occupying 235.4 ha, and potential GDEs **EvTr** (*Eucalyptus victrix* open woodland) and **ExAcCc** (*Eucalyptus xerothematica* and *E. victrix* open forest) occupying 83.9 ha of the unburnt extent
- vegetation condition ranged from poor to excellent depending on impacts from grazing, introduced species and fire. Feral horse (brumby) grazing was observed to have had significant impact in some areas.

The fauna field survey to verify findings of the desktop assessment and target conservation-significant species was undertaken from 25 July to 4 August 2011 and consisted of a total of 220 person hours. The survey identified:

- four habitat types, corresponding to: spinifex (*Triodia* spp.) grassland on valley floors; open shrubland/open woodland over spinifex grassland on slopes; creeklines/drainage lines on lower slopes and valley floor; and sheltered gorges/gullies
- habitat was assessed to be in *very good* to *high quality* condition throughout the study area (by criteria of Coffey Environments 2010a)
- a total of 60 vertebrate species recorded (two fish, one amphibian, eight mammals, five reptiles, 44 birds), of which:
  - o two were Priority listed by the Department of Environment and Conservation: *Pseudomys chapmani* (Western Pebble-mound Mouse; record based on active mounds) and *Ardeotis australis* (Australian Bustard), both P4
  - o one Migratory listed under the *Environment Protection and Biodiversity Conservation Act* (1999): *Merops ornatus* (Rainbow Bee-eater)
  - o one Specially Protected under Schedule 4 of the *Wildlife Conservation Act* (1950): *Falco peregrinus* (Peregrine Falcon)
- a total of 20 Fauna species of conservation significance are either known or considered potentially to occur in the study area;
  - o eleven of these species would be likely to suffer negligible or no impact from proposed mining activity for various reasons outlined in **Section 5**
  - o nine of these species would be likely to suffer minor or moderate impact depending on the location of the disturbance, including the Australian Bustard that was confirmed to occur in the study area.

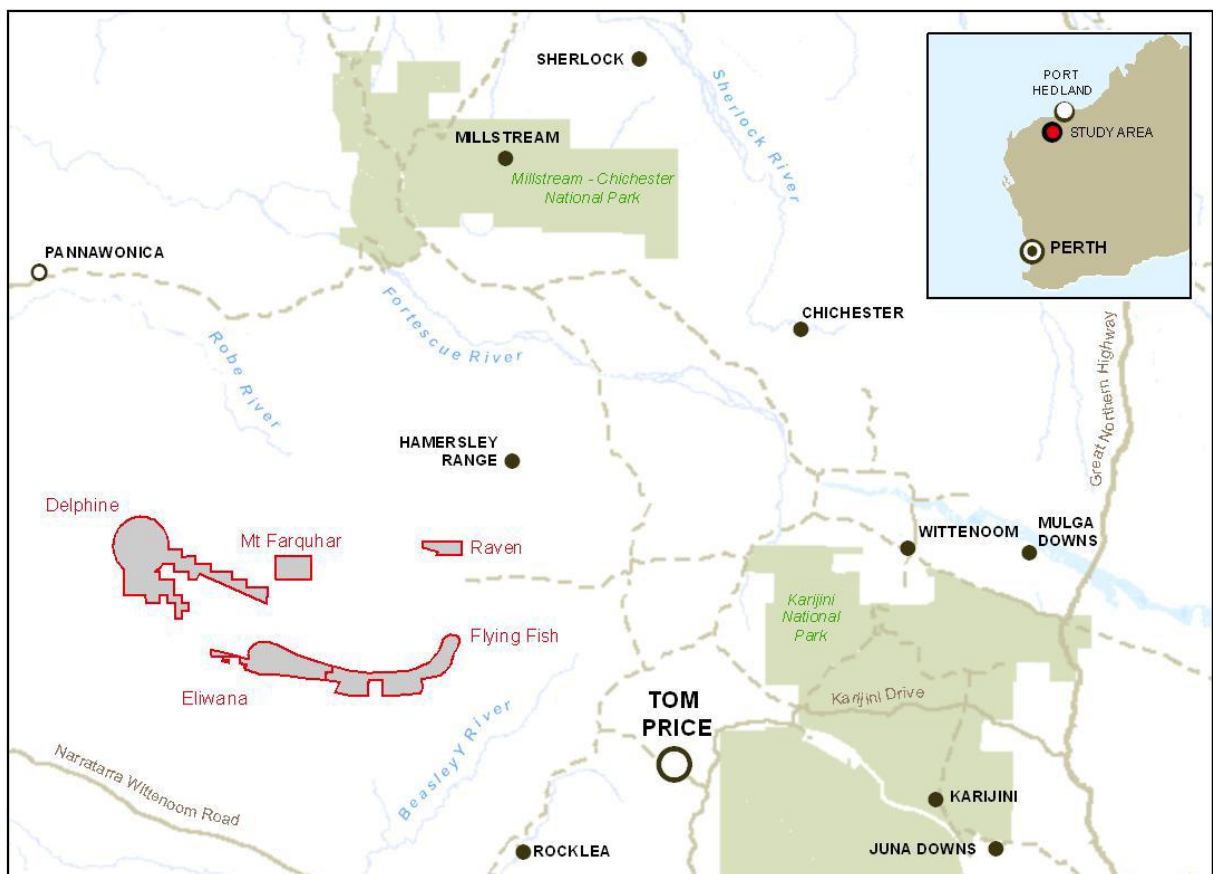
# 1.0 Introduction

## 1.1 Project Overview

Ecoscape was commissioned by Fortescue Metals Group Limited (Fortescue) to undertake Level 1 Flora and Vegetation and Level 1 Fauna assessments, and targeted conservation significant flora and fauna species survey of exploration tenements E47/1832 and E47/1988 (known as ‘Delphine’), approximately 135 km west-north-west of Tom Price in the Pilbara region of Western Australia.

### 1.1.1 STUDY AREA LOCATION

The Delphine exploration tenements (E47/1832 and E47/1988) are 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 Environmental Protection Authority (EPA):

- *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 background study (desktop assessment), 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 background study (desktop assessment), 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 flora and vegetation information, include:

- Ecoscape (2012a) *Central Pilbara Project Level 2 Flora and Vegetation Assessment*, Unpublished report for Fortescue Metals Group Ltd
- Ecoscape (2012b) *Level 1 Vegetation, Flora and Fauna Assessment, and Target Conservation Significant Flora and Fauna Survey: Eliwana*, Unpublished report for Fortescue Metals Group Ltd
- Ecoscape (2012c) *Level 1 Vegetation, Flora and Fauna Assessment, and Target Conservation Significant Flora and Fauna Survey: Flying Fish*, Unpublished report for Fortescue Metals Group Ltd
- Ecoscape (2012d) *Level 1 Vegetation, Flora and Fauna Assessment, and Target Conservation Significant Flora and Fauna Survey: Mt Farquhar*, Unpublished report for Fortescue Metals Group Ltd
- Ecoscape (2012e) *Level 1 Vegetation, Flora and Fauna Assessment, and Target 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.

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

- Bamford (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 *et al.* (2009) *Fishes in groundwater dependent pools of the Fortescue and Yule Rivers; Pilbara, Western Australia*. Centre for Fish and Fisheries Research, Murdoch University
- Muir (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 north-west 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 170 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 160 km south-east of Delphine.

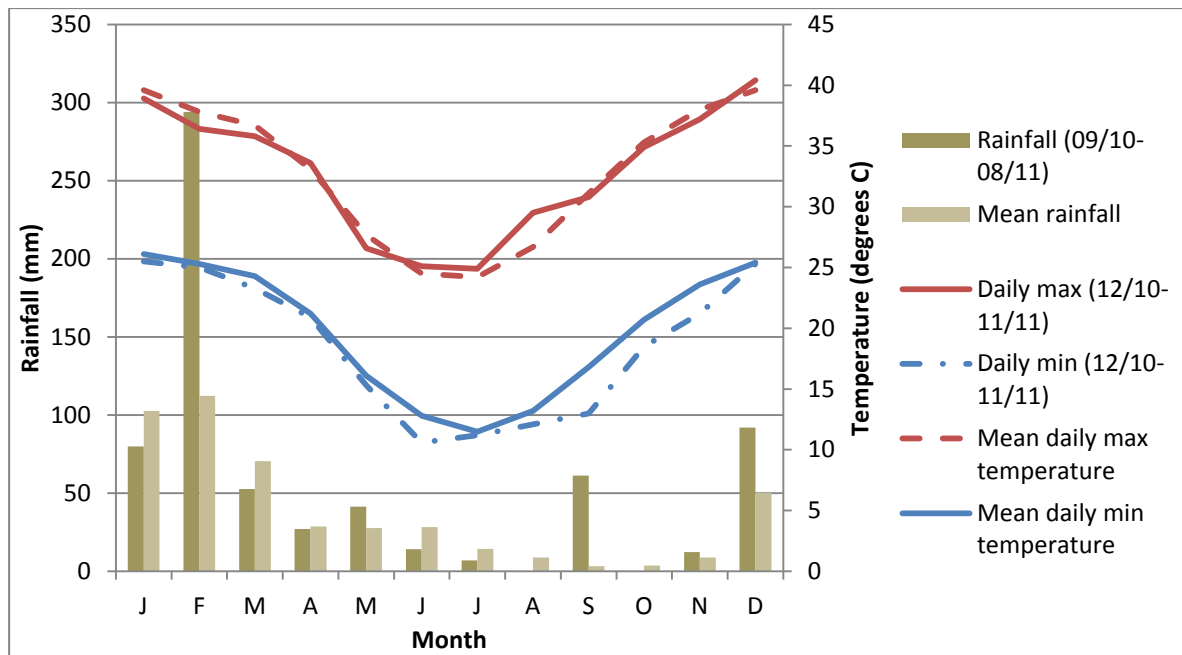


Figure 2: Monthly rainfall, and daily maxima and minima for Wittenoom BoM site (1950 – 2011) and Paraburdoo Airport (2011) (BoM 2012)

### 2.1.2 GEOLOGY

The following geological units occur in the Delphine study area (Seymour et al. 1988). Digital mapping is not available to display the data, and inclusion of these units is based on interpretation of hardcopy maps.

Table 1: Geological Units of the Delphine study area (Seymour et al. 1988)

Unit	Description
Fj	Jeerinah Formation: mudstone, shale, chert, banded iron-formation and basalt. Intruded by abundant dolerite sills.
Hm	Marra Mamba Iron Formation: chert and banded iron-formation with some shale. Contains crocidolite and hematite.
Tc	Colluvium – partly consolidated valley fill deposits
Qa	Alluvium - unconsolidated silt, sand, and gravel; in drainage channels and adjacent floodplains
Tp	Robe Pisolite: pisolitic limonite deposits with fossil wood fragments. Occurs along old river channels. Contains iron ore.
Hb	Brockman Iron Formation: banded iron-formation, chert and shale. Contains hematite
Hs	Mount McCrae Shale: shale, siltstone, dolomitic mudstone with banded iron formation and chert Mount Sylvia Formation: three thin banded iron-formation units and dolomitic mudstone.
To	Calcrete – limestone and calcareous gravels with opaline silica
Hd	Wittenoom Dolomite: grey, thin-bedded dolomite with some shale, chert and iron-formation.
Qc	Colluvium – superficial, unconsolidated sand and gravel



### 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.* 2004). 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 Delphine study area (Van Vreeswyk *et al.* 2004)**

Unit	Description
<b>Land type 1</b>	<b>Hills and ranges with spinifex grasslands</b>
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.
<b>Land type 4</b>	<b>Plateaux, mesas and breakaways with acacia shrublands</b>
Table land system	Low calcrete plateaux, mesas and lower plains supporting mulga and cassia shrublands and minor spinifex grasslands.
<b>Land type 5</b>	<b>Dissected plains with spinifex grasslands</b>
Platform land system	Dissected slopes and raised plains supporting hard spinifex grasslands.
<b>Land type 8</b>	<b>Stony plains with spinifex grasslands</b>
Boolgeeda land system	Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands and mulga shrublands.
<b>Land type 12</b>	<b>Wash plains on hardpan with groved mulga shrublands (sometimes with spinifex understorey)</b>
Wannamunna land system	Hardpan plains and internal drainage tracts supporting mulga shrublands and woodlands (and occasionally eucalypt woodlands).

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

**Table 3: Extent of land systems within the Delphine study area and regional representation.**

Land System	Extent within study area (km <sup>2</sup> )	Proportion of study area (%)	Pilbara extent (km <sup>2</sup> )	Pilbara extent (%)
Newman Land System	118.04	38.88%	14580	0.81%
Rocklea Land system	18.88	6.22%	22993	0.08%
Table Land system	13.11	4.3178%	77	17.03%
Platform Land system	2.32	0.76%	1570	0.15%
Boolgeeda Land System	149.50	49.24%	7748	1.93%
Wannamunna Land system	1.77	0.58%	577	0.31%

#### **2.1.4 DRAINAGE**

The most significant drainage line of the study area is known as Serpentine Creek, occurs near the southern edge of the eastern portion of the Delphine study area; in this portion of the study area the creek is a minor to mid-order drainage channel flowing in a north-westerly direction. Near the centre of the study area, where the eastern 'arm' joins with the western portion of the study area, Serpentine Creek joins with other tributaries from the north to become a major drainage line, with the flow continuing southwards through the study area. Serpentine Creek is a tributary of Duck Creek, which in turn is a tributary of the Ashburton River (**Map 1**).

## **2.2 Biological Environment**

#### **2.2.1 BIOGEOGRAPHIC REGION**

The Delphine study area is located within the Pilbara biogeographic region as defined in the Interim Biogeographical Regionalisation for Australia (IBRA) (Commonwealth of Australia 2011a). 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**

For the purposes of this report, conservation significant flora species are those that are listed as Threatened Flora (TF) and Priority Flora (PF).

TF species are listed by the DEC, with some given additional legislative protection by being listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)* (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. 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*, 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 21** in **Appendix One**. Not all DEC-listed TF species are listed under the *EPBC Act*.

Flora species may also be listed by the DEC as PF where populations are geographically restricted or threatened by local processes.

There are six DEC categories covering TF and PF species (DEC 2011a), which are outlined in **Table 22** in **Appendix One**.

### 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<sup>2</sup>) identifies TF and PF data from validated populations of TF and some PF from the Threatened Flora Database (DEFL), specimens in the Western Australian Herbarium (WAH) and the DEC TF (DRF) and PF Database (Access database).

Fifty four 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 Western Hub study areas (**Table 25, Appendix Two**). **Map 2** illustrates the locations of species closest to the study area.

Two TF taxa, *Lepidium catapycnon* and *Thryptomene wittweri*, were identified by the DEC database search, along with 52 PF taxa as occurring within the database search area (**Table 4**). None were identified as having previously been recorded from the Delphine study area.

**Table 4: Summary of conservation significant flora identified by the DEC database search**

Conservation Status	Number of Taxa
Threatened Flora	2
Priority One	12
Priority Two	9
Priority Three	26
Priority Four	5

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

- *Calotis latiuscula*, one record from less than 1 km to the north-west
- *Indigofera* sp. Bungaroo Creek (S. van Leeuwen 4301), one record from approximately 16 km to the south

- *Sida* sp. Hamersley Range (K. Newbey 10692), one record from approximately 16 km to the south and one recorded approximately 10 km to the east
- *Genus* sp. Hamersley Range hilltops (S. van Leeuwen 4345), one record from approximately 10 km to the north-west.

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.

### 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 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 parts 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.

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 (WAH 1998-).

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

- Bipinnate Beggarticks, *\*Bidens bipinnata*
- Buffel Grass, *\*Cenchrus ciliaris*
- Kapok Bush, *\*Aerva javanica*
- Mimosa Bush, *\*Vachellia farnesiana*
- Ruby Dock, *\*Acetosa vesicaria*
- Spiked Malvastrum, *\*Malvastrum americanum*

## 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 Australia 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. This mapping has since been re-defined in some areas and developed in digital form by Shepherd *et al.* (2002).

The broad vegetation associations based on Shepherd *et al.* (2002) occurring in the study area are:

- 82 - Hummock grasslands, low tree steppe; snappy gum over *Triodia wiseana*
- 567 - Hummock grasslands, shrub steppe; mulga and kanji over soft spinifex & *Triodia basedowii*
- 569 - Hummock grasslands, low tree steppe; bloodwood over soft spinifex and *Triodia wiseana*.

The extent of the broad vegetation associations in the study area are 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 23** and **Table 24, Appendix One**.

According to the list of TECs on the Department of Environment and Conservation 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 2011e).

There are 29 PECs listed as occurring in the Pilbara bioregion (DEC 2011c). Many PECs are either not mapped in the Pilbara bioregion or their locations not available to the public; therefore exact locations are often 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'. This community is typically restricted to mesas and cordillo landforms where the plant assemblages are dominated by or contain *Triodia* sp. Robe River and are indicative of inverted landscapes; that is, where *Triodia* sp. Robe River occurs in combination with species that are considered 'out-of-context' from their normal habitat. The community is a combination of *Triodia* sp. Robe River with *Acacia pruinocarpa*, *A. citrinoviridis* on slopes or peaks of mesas. These two *Acacias* are generally found associated with Pilbara creeklines, and their occurrence is probably indicative of the genesis of the mesa surfaces in wetlands, then erosion of the landscape and 'inversion of the landscape' such that the mesa slopes and peaks that were previously low in the landscape become high points.

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) identified the following TEC and PEC within approximately 15 km 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 Delphine 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* (EPA2004a), 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 (eg 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 (eg Resource and Environmental Management Pty Ltd 2007). 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.

For the purposes of this report, the presence of any facultative phreatophyte (in the Delphine area; *E. camaldulensis* subsp. *refulgens* and *E. victrix*) is considered to indicate a potential GDE.

*Melaleuca argentea* is considered by some (eg Astron Environmental Services 2008) to be an obligate phreatophyte (dependent on groundwater), however others (eg 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 of sheet flow in times of heavy rain (eg Muller 2005).

Mulga was previously considered 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 new taxa have been identified. The common name ‘Mulga’, for the purposes of this report, includes the closely-related *Acacia aptaneura*, *A. pteraneura*, *A. macranura*, *A. fuscaneura*, *A. caesaneura*, *A. ayersiana*, *A. incurvaneura*, *A. brachystachya*, *A. catenulata* subsp. *catenulata*, *A. craspedocarpa*, *A. minyura*, *A. ramulosa*, *A. sibirica* and *A. aneura* var. *intermedia*. 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* and the Western Australian *WC Act*. The significance levels for fauna used in the *EPBC Act* are those recommended by the International Union for the Conservation of Nature and Natural Resources (IUCN) and reviewed by Mace & Stuart (1994). *EPBC Act* categories are listed in **Appendix One**.

The Western Australian *WC Act* 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* 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* but for which the DEC considers there is cause for concern. Some Priority species, however, are also assigned to the IUCN Conservation Dependent category (P5). DEC Priority categories definitions are shown in **Table 22, Appendix One**. It is important to recognise that such Priority 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 includes taxa organised by priority codes that either:

- have recently been removed from the schedule of threatened fauna,
- have a restricted range, are uncommon or are declining in range and/or abundance, but which do not meet the criteria for inclusion on the schedule of threatened fauna,
- have been nominated for consideration for the schedule of threatened fauna and for which there is insufficient information for the advisory committee to make an assessment of their status; and
- are worthy of inclusion on such a list, as determined by the DEC.

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.

#### **EPBC Protected Matters Search Tool**

Results of the *Protected Matters Search Tool* (PMST; DSEWPac 2011b) were obtained for the Delphine study area using a buffer of 10 km. Three *Threatened Species* of fauna were listed as potentially occurring (**Table 5**, EPBC status EN and VU; PMST report L):

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

The PMST results also list *Migratory* and *Invasive* species. Migratory species identified as potentially occurring in all of the study areas include (**Table 5**):

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

### DEC Database Search

A search of the DEC Threatened, Priority or other specially protected fauna database was conducted for an area comprising the Delphine study area with a buffer of 50 km. There were six conservation significant fauna species identified through DEC database searches as known to occur within this area (**Table 5**):

- *Dasyurus hallucatus* (Northern Quoll) EN
- *Rhinonicteris aurantia* (Pilbara Leaf-nosed Bat) VU
- *Macroderma gigas* (Ghost Bat) P4
- *Ardeotis australis* (Australian Bustard) P4
- *Notoscincus butleri* (Soil-crevice Skink) P4
- *Ramphotyphlops ganei* (Blindsnake) P1.

### NatureMap and other resources

A search of DEC's online *NatureMap* (2011b) 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, two further taxa of conservation significance were listed as known to occur in this area (**Table 5**):

- *Leggadina lakedownensis* (Short-tailed Mouse) P4
- *Pseudomys chapmani* (Western Pebble-mound Mouse) P4.

Kendrick (2002) provides a summary of biodiversity values for the Hamersley subregion (IBRA PIL3). **Table 5** 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 5** 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 28 (Appendix Eight)**.

**Table 5: Threatened, Priority and other conservation significant fauna search results**

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

Abbreviations (EPBC status) EN, endangered; VU, vulnerable; M, migratory; (WC Act 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 report) L, 'Species or species habitat likely to occur'; M, 'Species or species habitat may occur'; (other columns) +, listed as present.

## 3.0 Methods

### 3.1 Flora and Vegetation

The Level 1 flora and vegetation assessment was undertaken to be compliant with 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.

In addition to the Level 1 survey, targeted searches for conservation significant flora species were also conducted.

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. Expert taxonomic advice from the Western Australian Herbarium (WAH) was sought when collected plant specimens are suspected to be of conservation significance.

#### 3.1.1 FIELD SURVEYS

The flora and vegetation field survey was conducted by Lyn Atkins (flora collecting licence SL009324), Stephen Kern (flora collecting licence SL009477), Hayley Hughes (flora collecting licence SL009379) and Richard Daniel (flora collecting licence SL009247) over five days (110 person hours, including travel), during July 2011.

### 3.1.1.1 Vegetation Descriptions

Vegetation was described from each of the relevés 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 20**), recorded at Level V.

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 recorded for each relevé and extrapolated to each vegetation type.

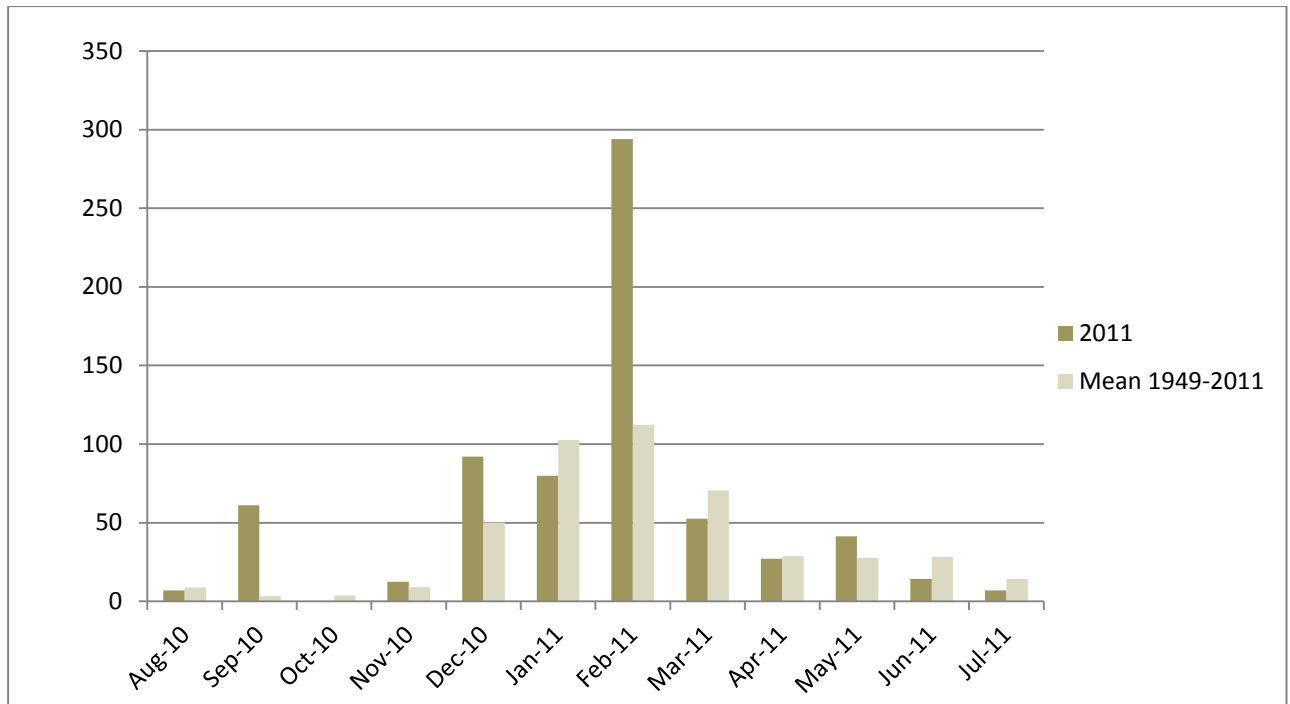
**Table 6: Vegetation condition rating scale (Trudgen 1991)**

Condition Rating	Description
<b>E=Excellent</b>	Pristine or nearly so; no obvious signs of damage caused by activities of European man.
<b>VG= Very Good</b>	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 <i>*Ursinia anthemoides</i> or <i>*Briza</i> spp., or occasional vehicle tracks.
<b>G=Good</b>	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 <i>*Ehrharta</i> spp.
<b>P=Poor</b>	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 <i>*Ehrharta</i> spp.
<b>VP=Very Poor</b>	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.
<b>D=Degraded</b>	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 TIMING OF SURVEYS

The flora and vegetation survey of the Delphine study area was conducted during winter (July), when a significant proportion of ephemeral species are flowering. Seasonal conditions in 2011 were considered to be excellent as 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 grasses as many flower during February to April. 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)**

### 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 and frequent fires (fire effects were only considered a negative impact if they were caused by repeated burning).

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

Voucher specimens of dominant and characteristic taxa were 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 WAH. These voucher specimens were identified by Ecoscape and ME Trudgen, using appropriate publications, and/or comparison with pressed specimens housed at the WAH.

### **3.1.2.2 Conservation Significant Flora**

Targeted searches of areas identified as potentially supporting conservation significant flora identified from the DEC database search were conducted. These typically include slopes, hilltops, rock piles, calcrete areas and adjacent, clay pans and drainage lines. 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**

Significant infestations of introduced species (weeds) and the presence of Declared Plants were recorded from the study area during the field survey.

### 3.1.3 BOTANICAL LIMITATIONS

Any limitations identified from the Delphine survey are summarised in **Table 7**.

**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. There were no specimens collected in the field resembling TF or PF that could not identified to species level.
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.
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. Accessible areas were sufficiently surveyed to identify the presence of most conservation significant flora species. The Hamersley Range (north-eastern edge of the study area) was not accessible due to steep slopes. Burnt areas in the far west were not assessed as vegetation had not recovered sufficiently to enable identification of vegetation types or to enable targeted searches for conservation significant flora.
Completeness (eg was relevant area fully surveyed)	Moderate	Much of the area was not accessible by vehicle or had been recently burnt. Where possible, areas were accessed by walking however the Hamersley Range section of the study area was largely inaccessible due to steep slopes and the western portion had been recently burnt. 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.
Availability of contextual (eg bioregional) information for the study area	Negligible	Little biological information is available for the Delphine study area. Available literature and data from nearby areas of the Hamersley Range have been reviewed.



## 3.2 Fauna

The fauna assessment methodology used was developed to comply with Ecoscape's interpretation of the requirements of a Level 1 survey based upon 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 3 days in early August 2011, under DEC Regulation 17 fauna licence SF008134.

The fauna assessment comprised a reconnaissance survey of the study area combined with targeted trapping for Northern Quoll. 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. Timing of the targeted survey is consistent with DSEWPaC survey guidelines for Northern Quoll (May-August inclusive, primarily to avoid disturbance during the reproductive period).

Techniques used in the reconnaissance survey include:

- bird census using both visual and auditory techniques
- spotlighting significant habitat i.e. gorges, caves and creeks
- trail 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 predator scats.

#### 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 are 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 waterholes. 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, 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**

Two trail cameras were set up in positions chosen to maximise the likelihood of capturing fauna movement, adjacent to a creek. 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 6 pm (sunset) to 6 am (sunrise). These were operational for two nights during the survey. **Table 8** lists the coordinates for the locations of each camera.

**Table 8: Camera coordinates in metres (GDA94 MGA zone 50).**

Item	Easting	Northing
Trail Camera	460700	7529107
Trail Camera	555057	7536746

### **Reconnaissance Northern Quoll Assessment**

Consultation prior to the survey commencing was undertaken with DSEWPaC 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).

Trapping was conducted as one method to obtain confirmation of presence, but was not sufficient in extent and duration to infer absence from negative results. Cage traps were set in an area of potential Northern Quoll habitat within the study area, close to a creekline with waterhole adjacent to low cliffs containing crevices. Twenty cage traps were placed in protected sites, covered with either a hessian bag or Spinifex to provide shade. Traps remained in place overnight and were checked and removed in the morning. Bait used was universal type as specified in the DSEWPaC guidelines.

Field survey effort for Delphine is indicated in **Table 9**.

**Table 9: Survey effort, Delphine**

Technique	Survey Effort
Cage traps	20 nights
Trail cameras	4 nights (48 hours)
Bird census	2 x 20 minutes
Spotlighting	4 person hours
Hand searching	20 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 (2006) and birds which follow Christidis & Boles (2008).

**Table 10** lists the references used in identification. 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 10: References used for species identification.**

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

### 3.2.3 FAUNA SURVEY LIMITATIONS

**Table 11: 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	No Constraint	Scope as Level 1 survey, not including invertebrates or attempting to inventory all species present; access to all habitat types and potential Northern Quoll habitat was unconstrained.
Proportion of fauna identified, recorded and/or collected	No Constraint	No vertebrate species collected, all vertebrate fauna observed identified
Proportion of the task achieved and further work that may need to be undertaken	No Constraint	Reconnaissance and targeted surveys were adequate to identify and map likely habitats for conservation significant species in the study area.
Timing/weather/season/cycle	No Constraint	Survey conducted in July-August was ideal for mammals, particularly the Northern Quoll.
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	Exploration activity (clearing tracks) has caused localised habitat degradation but probably not further altered the fauna assemblage to a significant extent, and also improved access
Sources of information	No Constraint	Most relevant information sources readily available
Completeness (eg Was relevant area fully surveyed?)	Yes, Negligible	All significant habitats accessed. However, some potentially important locations were not accessed (>2 km off tracks).
Resources (eg Degree of expertise available for identification)	No Constraint	Adequate resources available
Remoteness and/or access problems	Yes, Negligible	Some areas unable to be accessed due to distance from tracks and difficult landscape.
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 Results

### 4.1 Flora and Vegetation

#### 4.1.1 FLORA

##### 4.1.1.1 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 three species of Priority Flora recorded from the study area are listed below. Their locations are included in **Table 12** and shown on **Map 4**. Threatened and Priority Flora Report Forms are included in **Appendix Five**, and a brief description of each taxa given below.

**Table 12: Coordinates of Priority Flora species**

Species	Cons. Code	GDA mE	GDA mN
<i>Indigofera</i> sp. Bungaroo Creek (S. van Leeuwen 4301)	P3	460817	7528573
<i>Indigofera</i> sp. Bungaroo Creek (S. van Leeuwen 4301)	P3	461600	7541087
<i>Indigofera</i> sp. Bungaroo Creek (S. van Leeuwen 4301)	P3	455320	7540374
<i>Indigofera</i> sp. Bungaroo Creek (S. van Leeuwen 4301)	P3	455060	7536802
<i>Indigofera</i> sp. Bungaroo Creek (S. van Leeuwen 4301)	P3	453544	7540228
<i>Indigofera</i> sp. Bungaroo Creek (S. van Leeuwen 4301)	P3	453829	7540121
<i>Indigofera</i> sp. Bungaroo Creek (S. van Leeuwen 4301)	P3	457913	7532442
<i>Indigofera</i> sp. Bungaroo Creek (S. van Leeuwen 4301)	P3	474861	7532941
<i>Indigofera</i> sp. Bungaroo Creek (S. van Leeuwen 4301)	P3	475844	7532813
<i>Indigofera</i> sp. Bungaroo Creek (S. van Leeuwen 4301)	P3	475882	7532855
<i>Indigofera</i> sp. Bungaroo Creek (S. van Leeuwen 4301)	P3	475859	7532764
<i>Indigofera</i> sp. Bungaroo Creek (S. van Leeuwen 4301)	P3	475559	7532524
<i>Indigofera</i> sp. Bungaroo Creek (S. van Leeuwen 4301)	P3	482218	7529633
<i>Rhynchosia bungarensis</i> Maesen	P4	482219	7529512
<i>Triodia</i> sp. Robe River (M.E. Trudgen et al. MET 12367)	P3	458083	7528384
<i>Triodia</i> sp. Robe River (M.E. Trudgen et al. MET 12367)	P3	458323	7528834
<i>Triodia</i> sp. Robe River (M.E. Trudgen et al. MET 12367)	P3	454598	7530693
<i>Triodia</i> sp. Robe River (M.E. Trudgen et al. MET 12367)	P3	454988	7545024
<i>Triodia</i> sp. Robe River (M.E. Trudgen et al. MET 12367)	P3	456489	7531282
<i>Triodia</i> sp. Robe River (M.E. Trudgen et al. MET 12367)	P3	455452	7535833

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

*Indigofera* sp. Bungaroo Creek (S. van Leeuwen 4301) is an upright shrub to 2.5 m tall with red flowers (**Plate 1**, **Plate 2**). 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 commonly recorded from major and mid-order drainage lines (**EcMbCv** and **AtTt** vegetation units), frequently with populations of hundreds of plants, and on steep rocky slopes of the Hamersley Range (**EIBTw** vegetation unit), also at times with populations of hundreds. The habitat of this species in Delphine is consistent with the usual habitats listed on FloraBase (WAH 1998-).



Plate 1: *Indigofera* sp. Bungaroo Creek (S. van Leeuwen 4301) form



Plate 2: *Indigofera* sp. Bungaroo Creek (S. van Leeuwen 4301) flowers and foliage

### ***Rhynchosia bungarensis***

*Rhynchosia bungarensis* is a compact or prostrate shrub to 0.5 m high with yellow flowers (**Plate 3**, **Plate 4**). It is known from 55 herbarium records, most of which come from the Pilbara Bioregion. A single group of approximately three plants was recorded in the Delphine study area, on clay soil adjacent to a large clay pan in vegetation type **AcTe**.



Plate 3: *Rhynchosia bungarensis* flowers



Plate 4: *Rhynchosia bungarensis* form

### ***Triodia* sp. Robe River (M.E. Trudgen et al MET 12367)**

*Triodia* sp. Robe River (M.E. Trudgen et al MET 12367) is a hummock grass with soft leaves (**Plate 5**). It is known from 24 herbarium records, predominantly from the regions around Mt Stuart Station and Red Hill Station. Populations recorded within the Delphine study area are on the approximate eastern edge of the species known extent. *Triodia* sp. Robe River was a dominant and characteristic species of vegetation type **EIAcTR** and characteristic species of vegetation type **EIAmTw**.



Plate 5: *Triodia* sp. Robe River (M.E. Trudgen et al MET12367)



## Species Range Extension

Based on NatureMap records (DEC 2011b), the following species are on the edge of their usual extents or are range extensions:

- *Acacia pachyacra*, on the western edge of its usual population or an outlier
- *Eremophila forrestii* subsp. *hastieana*, on the northern edge of its usual extent
- *Gompholobium oreophilum*, an approximately 80 km western range extension
- *Triodia* sp. Robe River, on the eastern edge of its usual extent.

All other dominant and characteristic species recorded during this assessment were within their usual extents.

### 4.1.1.2 Introduced Flora

No Declared Plants were recorded during the survey. However, Mexican Poppy (*\*Argemone ochroleuca*) was identified during the survey from three locations indicated on **Map 4** associated with clay soils on river banks and clay pans (**Plate 6** and **Plate 7**). Mexican Poppy is not listed as a Declared Plant in the Pilbara, however, in most other parts of Western Australia Mexican Poppy is a Declared Plant, requiring control or prohibiting the movement of plants or seeds, including contaminated machinery and produce.

No significant infestations of introduced species were recorded during the survey, however three additional introduced species were recorded from the study area. *\*Cenchrus ciliaris* (Buffel Grass), *\*Malvastrum americanum* (Spiked Malvastrum) and *\*Vachellia farnesiana* (Mimosa Bush) were recorded from mid-order drainage lines of the study area and in the vicinity of cattle yards near the centre of the study area (**Map 4**). Locations of all introduced flora records are shown in **Table 13**.

**Table 13: Coordinates of introduced flora species**

Species	GDA mE	GDA mN
<i>*Argemone ochroleuca</i>	457995	7532538
<i>*Argemone ochroleuca</i>	482226	7529562
<i>*Argemone ochroleuca</i>	482210	7529488
<i>*Argemone ochroleuca</i>	460817	7528573
<i>*Cenchrus ciliaris</i>	456327	7539160
<i>*Cenchrus ciliaris</i>	457394	7539500
<i>*Malvastrum americanum</i>	457394	7539500
<i>*Vachellia farnesiana</i>	457394	7539500



Plate 6. Mexican poppy flower



Plate 7. Mexican poppy form

#### 4.1.2 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 87 dominant and characteristic vascular flora taxa were recorded from relevé sites and opportunistic observations in the survey (**Appendix Six**). Of these, three were of conservation significance (**Table 12**) and four were introduced (**Table 13**).

#### 4.1.3 VEGETATION

##### 4.1.3.1 Vegetation Types

Twenty vegetation types, including two mosaic units, were recorded from the Delphine study area. The unburnt extents of each of these vegetation types are shown in **Table 14**. Data for the Delphine relevé sites is presented in **Appendix Seven**.

Approximately 13, 077 ha of Delphine had been recently burnt. It was not possible to accurately map vegetation types in many of the recently burnt areas; any mapping of these areas is based on interpretation of aerial imagery and assessor’s local knowledge. In some cases there was sufficient remaining vegetation to enable interpretation of the vegetation type. **Table 15** shows estimated extents of each vegetation type in the burnt area.

**Table 14: Extents of each vegetation type in the study area**

Code	Vegetation Type	Condition	Relevé	Unburnt Area (ha)	Unburnt Proportion
AaCf	<i>Acacia aptaneura</i> open woodland over <i>Chrysopogon fallax</i> and <i>Eulalia aurea</i> open tussock grassland with <i>Eremophila longifolia</i> scattered shrubs	Excellent	D12	(125.1 – all burnt)	(0.4%)

Code	Vegetation Type	Condition	Relevé	Unburnt Area (ha)	Unburnt Proportion
AaTw/ AaTe/ AiTw <sup>1</sup>	<b>Mosaic of:</b> 1. <i>Acacia ancistrocarpa</i> , <i>A. atkinsiana</i> and <i>A. tenuissima</i> open shrubland over <i>Triodia wiseana</i> and <i>T. epactia</i> open hummock grassland with <i>Eucalyptus</i> spp. and <i>Corymbia</i> spp. scattered trees/mallees	Good-Excellent	D01, D04, D24, D29	7020.3	23.1%
	2. <i>Acacia aptaneura</i> , <i>A. atkinsiana</i> and <i>A. ancistrocarpa</i> open shrubland over <i>Triodia epactia</i> , <i>Eremophila forrestii</i> subsp. <i>hastieana</i> and <i>Triodia wiseana</i> open hummock grassland/sparse shrubland, with occasional <i>Eucalyptus xerothermica</i> , <i>E. gamophylla</i> and <i>Corymbia hamersleyana</i> scattered trees	Very good-Excellent	D03, D10, D13, D22		
	3. <i>Acacia inaequilatera</i> sparse shrubland over <i>Triodia wiseana</i> open hummock grassland with <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> , <i>Corymbia hamersleyana</i> and <i>Hakea lorea</i> subsp. <i>lorea</i> scattered trees/tall shrubs	Very good-Excellent	D09, D5a		
AbTw	<i>Acacia bivenosa</i> , <i>Petalostylis labicheoides</i> and <i>A. inaequilatera</i> sparse shrubland over <i>Triodia wiseana</i> open hummock grassland with <i>Eucalyptus xerothermica</i> and <i>Corymbia hamersleyana</i> scattered trees (or mallees)	Very good - Excellent	D15, D2a	584.9	1.9%
AcTe	<i>Acacia citrinoviridis</i> , <i>A. pruinocarpa</i> and <i>A. aptaneura</i> shrubland over <i>Triodia epactia</i> , <i>Paraneurachne muelleri</i> and <i>Ipomoea muelleri</i> sparse hummock grassland/sparse tussock grassland/sparse vineland	Good	D30	13.5	0.04%
AiTw <sup>2</sup>	<i>Acacia inaequilatera</i> , <i>A. bivenosa</i> and <i>A. ancistrocarpa</i> open shrubland over <i>Triodia wiseana</i> and <i>Indigofera monophylla</i> open hummock grassland/sparse shrubland	Very good	D21, D3a	1562.3	5.21
AtTt	<i>Acacia tumida</i> var. <i>pilbarensis</i> , <i>Grevillea wickhamii</i> subsp. <i>hispidula</i> and <i>Indigofera</i> sp. Bungaroo Creek shrubland over <i>Themeda triandra</i> , <i>Eriachne tenuiculmis</i> and <i>Triodia wiseana</i> tussock grassland/sparse hummock grassland	Very good	D27	73.1	0.2%

Code	Vegetation Type	Condition	Relevé	Unburnt Area (ha)	Unburnt Proportion
EcMbCv	<i>Eucalyptus camaldulensis</i> subsp. <i>refulgens</i> , <i>E. victrix</i> and <i>Melaleuca argentea</i> woodland over <i>M. bracteata</i> , <i>Acacia citrinoviridis</i> and <i>A. colei</i> var. <i>colei</i> open shrubland over <i>Cyperus vaginatus</i> , <i>Stemodia viscosa</i> , and <i>S. grossa</i> sparse sedgeland/sparse herbland	Very good	D18, D4a	235.4	0.8%
EIAcTR	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and <i>Corymbia hamersleyana</i> open woodland over <i>Acacia citrinoviridis</i> and <i>A. pyrifolia</i> var. <i>pyrifolia</i> sparse shrubland over <i>Triodia</i> sp. Robe River and <i>T. wiseana</i> hummock grassland	Excellent	D19	95.2	0.3%
EIAmTw	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and <i>Corymbia hamersleyana</i> open woodland over <i>Acacia maitlandii</i> and <i>Dodonaea lanceolata</i> subsp. <i>lanceolata</i> sparse shrubland over <i>Triodia wiseana</i> , <i>Triodia</i> sp. Robe River and <i>Acacia hilliana</i> hummock grassland/sparse shrubland	Very good-Excellent	D02, D05, D7a	4647.8	15.3%
EIApTw	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> open woodland over <i>Acacia pachyacra</i> , <i>A. trudgeniana</i> and <i>A. bivenosa</i> open shrubland over <i>Triodia wiseana</i> open hummock grassland	Very good-Excellent	D07, D23, D25, D26	1030.2	3.4%
EIApTw/ AtTt	<b>Mosaic of:</b> 1. <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> open woodland over <i>Acacia pachyacra</i> , <i>A. trudgeniana</i> and <i>A. bivenosa</i> open shrubland over <i>Triodia wiseana</i> open hummock grassland 2. <i>Acacia tumida</i> var. <i>pilbarensis</i> , <i>Grevillea wickhamii</i> subsp. <i>hispidula</i> and <i>Indigofera</i> sp. Bungaroo Creek shrubland over <i>Themeda triandra</i> , <i>Eriachne tenuiculmis</i> and <i>Triodia wiseana</i> tussock grassland/sparse hummock grassland	Very good-Excellent	(see individual vegetation types)	57.8	0.2%
EIIBTw	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> open woodland over <i>Indigofera</i> sp. Bungaroo Creek (S. van Leeuwen 4301), <i>Stylobasium spathulatum</i> and <i>Eremophila latrobei</i> subsp. <i>glabra</i> open shrubland over <i>Triodia wiseana</i> , <i>Cymbopogon ambiguus</i> and <i>Eriachne mucronata</i> open hummock grassland/sparse tussock grassland	Excellent	D28	313.2	1.0%

Code	Vegetation Type	Condition	Relevé	Unburnt Area (ha)	Unburnt Proportion
EvTr	<i>Eucalyptus victrix</i> open woodland over <i>Tephrosia rosea</i> var. <i>glabrior</i> , <i>Stemodia viscosa</i> and <i>Euphorbia australis</i> sparse shrubland/scattered herbs.	Excellent	D08	45.4	0.2%
ExAbTe	<i>Eucalyptus xerothermica</i> open woodland over <i>Acacia bivenosa</i> and <i>Senna</i> spp. open shrubland over <i>Triodia epactia</i> , <i>Triodia wiseana</i> and <i>Eulalia aurea</i> hummock grassland/sparse tussock grasses	Very good-Excellent	D06, D1a	554.9	1.8%
ExAbTw	<i>Eucalyptus xerothermica</i> and <i>Corymbia hamersleyana</i> open woodland over <i>Acacia bivenosa</i> , <i>A. ancistrocarpa</i> and <i>Stylobasium spathulatum</i> shrubland over <i>Triodia wiseana</i> , <i>Triodia epactia</i> and <i>Senna artemisioides</i> subsp. <i>oligophylla</i> open hummock grassland/sparse shrubland	Very good	D16	187.5	0.6%
ExAcCc	<i>Eucalyptus xerothermica</i> and <i>E. victrix</i> open forest over <i>Acacia colei</i> var. <i>colei</i> , <i>Melaleuca bracteata</i> and <i>Gossypium robinsonii</i> open shrubland with <i>*Cenchrus ciliaris</i> and <i>Cyperus vaginatus</i> scattered tussock grass/scattered sedges	Good	D17	38.5	0.1%
ExApTe	<i>Eucalyptus xerothermica</i> and <i>Corymbia hamersleyana</i> open woodland over <i>Acacia pyrifolia</i> var. <i>pyrifolia</i> , <i>Gossypium robinsonii</i> and <i>Petalostylis labicheoides</i> open shrubland over <i>Triodia epactia</i> , <i>Paraneurachne muelleri</i> and <i>Eriachne tenuiculmis</i> open hummock grassland/sparse tussock grassland	Very good	D11, D6a	527.8	1.7%
Te	<i>Triodia epactia</i> , <i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i> and <i>Sporobolus australasicus</i> scattered hummock grass/scattered herbs/scattered grass	Poor	D31	16.3	0.1%
Tw <sup>1</sup>	<i>Triodia wiseana</i> and <i>Acacia hilliana</i> open hummock grassland/sparse shrubland with <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> , <i>Corymbia deserticola</i> subsp. <i>deserticola</i> and <i>C. hamersleyana</i> scattered trees	Excellent	D14	18.0	0.1%
Tw <sup>2</sup>	<i>Triodia wiseana</i> sparse hummock grassland with <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> scattered trees and <i>Acacia bivenosa</i> and <i>A. victoriae</i> scattered shrubs	Very good	D20	263.0	0.9%
Burnt	Recently burnt area			13076.8	43.1%
<b>TOTAL</b>				<b>30361.8</b>	<b>100.0</b>

**Table 15: Estimated vegetation type extents in burnt area**

Interpreted Vegetation Type	Area (ha)	Proportion
Burnt (uninterpretable)	8861.07	29.18%
Burnt - <b>AbTw</b>	458.38	1.51%
Burnt - <b>AaCf</b>	125.13	0.41%
Burnt - <b>AnTw/AaTe/AiTw<sup>1</sup></b>	1867.28	6.15%
Burnt - <b>ElAmTw</b>	644.05	2.12%
Burnt - <b>ElApTw</b>	308.42	1.02%
Burnt - <b>Tw<sup>1</sup></b>	14.64	0.05%
Burnt - <b>ExAbTe</b>	619.56	2.04%
Burnt - <b>ExAbTw</b>	29.54	0.10%
Burnt - <b>ExAcCc</b>	18.11	0.06%
Burnt - <b>ExApTe</b>	130.63	0.43%
<b>TOTAL</b>	<b>13076.80</b>	<b>43.07%</b>

## AaCf

**Vegetation type description:** *Acacia aptaneura* open woodland over *Chrysopogon fallax* and *Eulalia aurea* open tussock grassland with *Eremophila longifolia* scattered shrubs. The area where this vegetation type occurred had largely been recently burnt however vegetation type extent mapping was possible as the soil colour and texture was noticeably different (both on-ground and using aerial imagery), and there was sufficient regenerated vegetation to confirm vegetation changes.

This vegetation type occurred on clay valley floors of the Wannamunna land system and was assessed from one relevé. The vegetation condition of the relevé was Excellent. **Plate 8** illustrates the **AaCf** vegetation type.



**Plate 8: AaCf vegetation type (relevé D12)**

### Valley Floor Mosaic: AaTw/AaTe/AiTw1

The valley floors of the Delphine study area consist of a mosaic of vegetation types, often at fine scale (eg foreground and background vegetation of **Plate 9**) and grading between the characteristic types, and was not mappable at the scale of a Level 1 survey. A Level 2 survey is more likely to differentiate between the main vegetation types below, and identify additional vegetation types differentiated by the dominance of the understory *Triodia* spp., dominance of different suites of *Acacia* spp. (eg *A. ancistrocarpa*/*A. atkinsiana*/*A. tenuissima* or *A. inaequilatera*), and the presence of different overstorey species including *Eucalyptus gamophylla* and *Acacia aptaneura*.

The main vegetation types within this mosaic are:

#### 1). AaTw (valley floor shrublands dominated by *Acacia* spp.)

**Vegetation type description:** *Acacia ancistrocarpa*, *A. atkinsiana* and *A. tenuissima* open shrubland over *Triodia wiseana* and *T. epactia* open hummock grassland with *Eucalyptus* spp. and *Corymbia* spp. scattered trees/mallees. The upper stratum, where present, consisted of scattered (ie <2% canopy cover) *Eucalyptus gamophylla*, *Corymbia hamersleyana*, *C. deserticola* subsp. *deserticola* and *E. leucophloia* subsp. *leucophloia*. The middle stratum also included *Acacia bivenosa*, *A. citrinoviridis*, *A. inaequilatera*, *A. maitlandii*, *A. monticola*, *A. pyrifolia* subsp. *pyrifolia*, *A. tenuissima*, *Gossypium australe* and *Senna* spp. including *S. glutinosa* subsp. *glutinosa*. The ground stratum was mostly dominated by *Triodia wiseana*, however *T. epactia* was dominant in some places. Other ground stratum species included *Bonamia rosea*, *Ipomoea muelleri*, *Keraudrenia* sp. and *Paraneurachne muelleri*.

This vegetation type occurred on valley floors of the Boolgeeda land system and was assessed from four relevés (D01, D04, D24, D28), one of which (D28) was considered to be a transition between this vegetation type and **AcTe**. The vegetation condition of the relevés ranged from Good to Excellent. **Plate 9** and **Plate 10** illustrate the **AaTw** vegetation type.





Plate 9: AaTw vegetation type (relevé D24)



Plate 10: AaTw vegetation type (relevé D04)

## 2). AaTe (valley floor shrublands and woodlands including *Acacia aptaneura*)

**Vegetation type description:** *Acacia aptaneura*, *A. atkinsiana* and *A. ancistrocarpa* open shrubland over *Triodia epactia*, *Eremophila forrestii* subsp. *hastieana* and *Triodia wiseana* open hummock grassland/sparse shrubland, with occasional *Eucalyptus xerothermica*, *E. gamophylla* and *Corymbia hamersleyana* scattered trees. Other common species include *A. inaequilatera*, *A. bivenosa*, *A. maitlandii*, *A. tenuissima*, *Bonamia rosea* and *Senna artemisioides* subsp. *oligophylla* x *helmsii*.

*Acacia aptaneura* occurred in clumps with other *Acacia* spp., or dispersed. It was not the distinctive grove-intergrove (sheet flow Mulga) formation, where groves of Mulga (*Acacia aptaneura*) occur usually in a linear arrangement with a tussock grass and herbaceous understorey (with some smaller shrubs and often with *A. pruinocarpa* in the overstorey), with spaces between the groves (intergrove) usually dominated by tussock grasses.

This vegetation type occurred on valley floors of the Boolgeeda land system and was assessed from four relevés (D03, D10, D13, D22). The vegetation condition of the relevés were Very good to Excellent. **Plate 11** and **Plate 12** illustrate the **AaTe** vegetation type.



Plate 11: AaTe vegetation type (relevé D13)



Plate 12: AaTe vegetation type (relevé D22)

### 3). AiTw<sup>1</sup> (valley floor and lower slopes shrubland)

**Vegetation type description:** *Acacia inaequilatera* sparse shrubland over *Triodia wiseana* open hummock grassland with *Eucalyptus leucophloia* subsp. *leucophloia*, *Corymbia hamersleyana* and *Hakea lorea* subsp. *lorea* scattered trees/tall shrubs. Other common species include *A. tenuissima*, *A. ancistrocarpa*, *A. atkinsiana*, *Eriachne pulchella* subsp. *dominii*, *Indigofera monophylla*, *Petalostylis labicheoides*, *Ptilotus astrolasius*, *Senna glutinosa* subsp. *pruinosa* and *S. glutinosa* subsp. *glutinosa*. Some of the shrub species, particularly *Petalostylis labicheoides*, were often confined to minor depressions/flow lines (eg **Plate 14**).

This vegetation type occurred on valley floors of the Boolgeeda land system and was assessed from two relevés. The vegetation condition of the relevés were Very Good to Excellent. **Plate 13** and **Plate 14** illustrate the AiTw<sup>1</sup> vegetation type.



Plate 13: AiTw<sup>1</sup> vegetation type (relevé D09)



Plate 14: AiTw<sup>1</sup> vegetation type (relevé D5a)

## AbTw

**Vegetation type description:** *Acacia bivenosa*, *Petalostylis labicheoides* and *A. inaequilatera* sparse shrubland over *Triodia wiseana* open hummock grassland with *Eucalyptus xerothermica* and *Corymbia hamersleyana* scattered trees (or mallees). Other common species included *Senna glutinosa* subsp. *pruinosa*, *Phyllanthus* sp. and *Sporobolus australasicus*.

This vegetation type occurred on raised calcrete platforms of the Table land system and was assessed from two relevés. The vegetation condition of the relevés were Very Good to Excellent. **Plate 15** illustrates the **AbTw** vegetation type.



**Plate 15: AbTw vegetation type (relevé D15)**

## AcTe

**Vegetation type description:** *Acacia citrinoviridis*, *A. pruinocarpa* and *A. aptaneura* shrubland over *Triodia epactia*, *Paraneurachne muelleri* and *Ipomoea muelleri* sparse hummock grassland/sparse tussock grassland/sparse vineland. Other common species include *Cymbopogon ambiguus* and *Eremophila longifolia* and *Gossypium australe*.

This vegetation type occurred on valley floors in areas included in the Boolgeeda land system, however the clay soil is not typical for this land system and is more similar to that found in the Brockman land system (nearby). The **AcTe** vegetation type was assessed from one relevé where the vegetation condition was Good. The area of this vegetation type was observed to have been heavily impacted by horses, and perhaps cattle, with vegetation extensively grazed and trampled. **Plate 16** illustrates the **AcTe** vegetation type.

It is possible that small area of similar vegetation may occur on alluvial fans at the foot of the Hamersley Range, however these were not assessed separately.



**Plate 16: AcTe vegetation type (relevé D30)**

## AiT<sup>w</sup><sup>2</sup>

**Vegetation type description:** *Acacia inaequilatera*, *A. bivenosa* and *A. ancistrocarpa* open shrubland over *Triodia wiseana* and *Indigofera monophylla* open hummock grassland/sparse shrubland. Other common species included *A. synchronicia*, *Aristida contorta*, *Euphorbia australis*, *Hakea lorea* subsp. *lorea*, *Oldenlandia crouchiana*, *Senna notabilis* and \**Vachellia farnesiana*.

This vegetation type occurred on valley floors of the Rocklea land system and was assessed from two relevés. The vegetation condition of the relevés were Very good. **Plate 17** illustrates the **AiT<sup>w</sup><sup>2</sup>** vegetation type.



**Plate 17: AiTw<sup>2</sup> vegetation type (relevé D3a)**

## AtTt

**Vegetation type description:** *Acacia tumida* var. *pilbarensis*, *Grevillea wickhamii* subsp. *hispidula* and *Indigofera* sp. Bungaroo Creek shrubland over *Themeda triandra*, *Eriachne tenuiculmis* and *Triodia wiseana* tussock grassland/sparse hummock grassland. Other common species include *Tephrosia rosea* var. *glabrior* and *Corymbia hamersleyana*.

This vegetation type was associated with very minor drainage line on lower slopes and through valleys floors, largely in the Boolgeeda land system, and was assessed from one relevé. The vegetation condition of the relevé was Very Good. **Plate 18** illustrates the **AtTt** vegetation type.

Approximately 58 ha of vegetation on an alluvial fan in the eastern portion of the study area consisted of a fine-scale mosaic of this vegetation type with vegetation type **ElApTw**.



**Plate 18: AtTt vegetation type (relevé D27)**

## EcMbCv

**Vegetation type description:** *Eucalyptus camaldulensis* subsp. *refulgens*, *E. victrix* and *Melaleuca argentea* woodland over *M. bracteata*, *Acacia citrinoviridis* and *A. colei* var. *colei* A open shrubland over *Cyperus vaginatus*, *Stemodia viscosa*, and *S. grossa* sparse sedgeland/sparse herbland. Other common species include *A. pyriformis* var. *pyriformis*, *Gossypium robinsonii*, *Sporobolus australasicus* and *Typha domingensis*.

This vegetation type occurred in major drainage lines and was assessed from two relevés. The vegetation condition of the relevés were Very Good. **Plate 19** illustrates the **EcMbCv** vegetation type. Permanent pools were found in various locations along the major drainage line (Serpentine Creek) that included this vegetation type (**Plate 20**); fish were sighted swimming in some of these.



**Plate 19:** EcMbCv vegetation type (relevé D18)



**Plate 20:** Permanent pool in EcMbCv (near relevé D18)

## EIAcTR

**Vegetation type description:** *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* open woodland over *Acacia citrinoviridis* and *A. pyrifolia* var. *pyrifolia* sparse shrubland over *Triodia* sp. Robe River (M.E. Trudgen et al MET 12367) and *T. wiseana* hummock grassland. Other common species include *Acacia pruinocarpa*. *Triodia* sp. Robe River (M.E. Trudgen et al MET 12367) is listed as a Priority 3 species by the DEC.

This vegetation is similar to the 'Triodia sp. Robe River assemblages of mesas of the Robe Valley' PEC, however discussions with the DEC Species and Communities Branch<sup>1</sup> have not clarified if it is included in the PEC, although it is considered unlikely. This vegetation type was not located on mesas, however it is uncertain if the geology is pisolitic or the landform regarded as 'cordillo', both of which also qualify as the PEC. Additional surveys, including full floristic quadrat recordings, and a more comprehensive geological description will be required before the DEC can make a determination if this vegetation type meets the description of the PEC.

This vegetation type occurred on upper slopes and hilltops of low rolling hills of the Newman land system and was assessed from one relevé. The vegetation condition of the relevé was Excellent. **Plate 21** illustrates the EIAcTR vegetation type.



**Plate 21: EIAcTR vegetation type (relevé D19)**

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<sup>1</sup> Emails of September 15 and 16, Val English and Jill Pryde, **Appendix Nine**.



## ElAmTw

**Vegetation type description:** *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* open woodland over *Acacia maitlandii* and *Dodonaea lanceolata* subsp. *lanceolata* sparse shrubland over *Triodia wiseana*, *Triodia* sp. Robe River and *Acacia hilliana* hummock grassland/sparse shrubland. *Triodia* sp. Robe River is listed as a Priority 3 species. Other common species included *Acacia adoxa* var. *adoxo*, *A. arida*, *Goodenia stobbsiana*, *Hibiscus sturtii* var. *campylochlamys*, *Jasminum didymum* subsp. *lineare*, *Oldenlandia crouchiana*, *Ptilotus fusiformis*, *Senna notabilis*, *S. venusta* and *Trichodesma zeylanicum* var. *zeylanicum*.

This vegetation type occurred on low hills and lower slopes of the Newman land system and edges of the Boolgeeda land system, and was assessed from three relevés. The vegetation condition of the relevés were Very good to Excellent. **Plate 22** illustrates the **ElAmTw** vegetation type.



**Plate 22: ElAmTw vegetation type (relevé D05)**

## ElApTw

**Vegetation type description:** *Eucalyptus leucophloia* subsp. *leucophloia* open woodland over *Acacia pachyacra*, *A. trudgeniana* and *A. bivenosa* open shrubland over *Triodia wiseana* open hummock grassland. Other common species include *Senna glutinosa* subsp. *pruinosa*, *A. atkinsiana*, *A. ancistrocarpa*, *Ptilotus* spp., including *P. helipteroides*, *Senna glutinosa* subsp. *glutinosa* and *Triodia epactia*.

This vegetation type occurred on lower slopes (upper valley slopes) below the southern escarpment of the Hamersley Range and isolated hills (**Plate 23**, Mt Delphine), on the border of the Newman and Boolgeeda land systems. It was assessed from four relevés, where the vegetation condition was Very Good to Excellent. **Plate 23** and **Plate 24** illustrate the **ElApTw** vegetation type.

Approximately 58 ha of vegetation on an alluvial fan in the eastern portion of the study area consisted of a fine-scale mosaic of this vegetation type with vegetation type **AtTt**.



**Plate 23:** ElApTw vegetation type (relevé D07)



**Plate 24:** ElApTw vegetation type (relevé D23)

## EIBTw

**Vegetation type description:** *Eucalyptus leucophloia* subsp. *leucophloia* open woodland over *Indigofera* sp. Bungaroo Creek (S. van Leeuwen 4301), *Stylobasium spathulatum* and *Eremophila latrobei* subsp. *glabra* open shrubland over *Triodia wiseana*, *Cymbopogon ambiguus* and *Eriachne mucronata* open hummock grassland/sparse tussock grassland. Other common species included *Acacia pruinocarpa*, *Dodonaea coriacea*, *Hakea chordophylla*, *Schizachyrium fragile* and *Eriachne* spp.

The dominant species of the middle stratum (*Indigofera* sp. Bungaroo Creek) is listed as P3. It is more frequently found along drainage lines, however its type specimen (S. van Leeuwen 4301) was collected from a steep rocky slope on the Hamersley Range (WAH 1998-).

This vegetation type occurred on steep rocky slopes of the southern escarpment of the Hamersley Range, on the Newman land system, and was assessed from one relevé. The vegetation condition of the relevé was Excellent. **Plate 25** illustrates the **EIBTw** vegetation type.



**Plate 25: EIBTw vegetation type (relevé D28)**

## EvTr

**Vegetation type description:** *Eucalyptus victrix* open woodland over *Tephrosia rosea* var. *glabrior*, *Stemodia viscosa* and *Euphorbia australis* sparse shrubland/scattered herbs. Other common species include *Eriachne tenuiculmis*, *Stemodia grossa* and *Cymbopogon* sp.

This vegetation type occurred in mid-order drainage lines with stony alluvial soil, largely on the Boolgeeda land system and was assessed from one relevé. The vegetation condition of the relevé was Excellent. **Plate 26** illustrates the **EvTr** vegetation type.



**Plate 26: EvTr vegetation type (relevé D8)**

## ExAbTe

**Vegetation type description:** *Eucalyptus xerothermica* open woodland over *Acacia bivenosa* and *Senna* spp. open shrubland over *Triodia epactia*, *Triodia wiseana* and *Eulalia aurea* hummock grassland/sparse tussock grasses. The upper stratum included *Corymbia hamersleyana* and *Eucalyptus leucophloia* subsp. *leucophloia*; dominance varied between the three eucalypts, with this stratum often being sparse. Other common species include *Acacia ancistrocarpa*, *Acacia inaequilatera*, *Dysphania rhadinostachya*, *Eriachne pulchella* subsp. *dominii* and *Hakea lorea* subsp. *lorea*. The *Senna* spp. included *S. artemisioides* subsp. *oligophylla*, *S. glutinosa* subsp. *glutinosa* and *S. notabilis*, with dominance varying between these.

This vegetation type occurred on valley floors of the Boolgeeda land system and was assessed from two relevés. The vegetation condition of the relevés were Very Good to Excellent. **Plate 27** illustrates the **ExAbTe** vegetation type.

A Level 2 flora and vegetation survey is likely to divide this vegetation type into additional types, based largely on the differences between the ground stratum dominance of *Triodia* spp.



**Plate 27: ExAbTe vegetation type (relevé D06)**

## ExAbTw

**Vegetation type description:** *Eucalyptus xerothermica* and *Corymbia hamersleyana* open woodland over *Acacia bivenosa*, *A. ancistrocarpa* and *Stylobasium spathulatum* shrubland over *Triodia wiseana*, *Triodia epactia* and *Senna artemisioides* subsp. *oligophylla* open hummock grassland/sparse shrubland. Other common species include *Chrysopogon fallax*.

This vegetation type occurred on clay soil between raised calcrete platforms of the Table land system and was assessed from one relevé. The vegetation condition of the relevé was Very Good. **Plate 28** illustrates the **ExAbTw** vegetation type.



**Plate 28: ExAbTw vegetation type (relevé D16)**

## ExAcCc

**Vegetation type description:** *Eucalyptus xerothermica* and *E. victrix* open forest over *Acacia colei* var. *colei*, *Melaleuca bracteata* and *Gossypium robinsonii* open shrubland with \**Cenchrus ciliaris* and *Cyperus vaginatus* scattered tussock grass/scattered sedges. Other common species include *Acacia pyrifolia* subsp. *pyrifolia*.

This vegetation type occurred in mid-order drainage lines on clay soil, on the boundary between the Table and Boolgeeda land systems, and was assessed from one relevé. The vegetation condition of the relevé was Good, with evidence of cattle grazing (weeds and trampling), and recent flooding.

**Plate 29** illustrates the **ExAcCc** vegetation type.



**Plate 29: ExAcCc vegetation type (relevé D17)**

## ExApTe

**Vegetation type description:** *Eucalyptus xerothermica* and *Corymbia hamersleyana* open woodland over *Acacia pyrifolia* subsp. *pyrifolia*, *Gossypium robinsonii* and *Petalostylis labicheoides* open shrubland over *Triodia epactia*, *Paraneurachne muelleri* and *Eriachne tenuiculmis* open hummock grassland/sparse tussock grassland. Other common species included *Tephrosia rosea* var. *glabrior*, *A. monticola*, *A. colei* var. *colei*, *Polymeria ambigua*, *Senna notabilis*, *Stylobasium spathulatum* and *Themeda triandra*; *Eucalyptus victrix* occurred very sparsely along the drainage lines.

This vegetation type occurred on minor drainage lines, outwash areas and floodplains, generally on the Boolgeeda land system and was assessed from two relevés. The vegetation condition of the relevés were Very Good. **Plate 30** illustrates the **ExApTe** vegetation type.



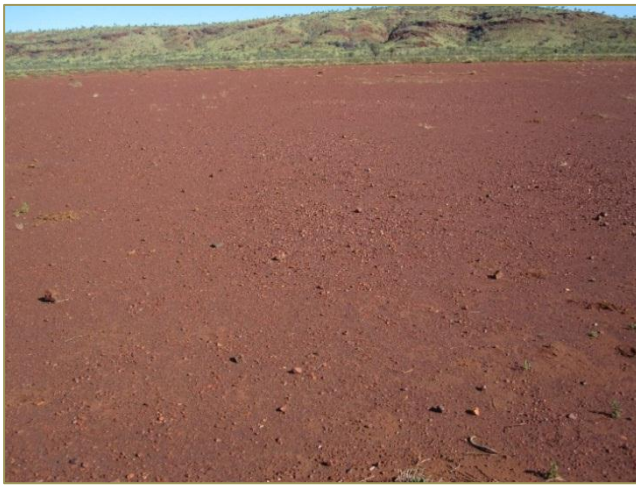
**Plate 30: ExApTe vegetation type (relevé D11)**



## Te

**Vegetation type description:** *Triodia epactia*, *Dysphania rhadinostachya* subsp. *rhadinostachya* and *Sporobolus australasicus* scattered hummock grass/scattered herbs/scattered grass. There were few plants over most of the area included as this vegetation type (**Plate 31**), with the ecotone between this vegetation type (**Plate 32**) and the adjacent **AcTe** vegetation type having the understorey species of this vegetation type but not the overstorey (larger shrub) species.

This vegetation type occurred on red clay soil included in the Boolgeeda land system, however the soil was more similar to that found in the nearby Brockman land system. This vegetation type was assessed from one relevé where the vegetation condition was Poor due to cattle and horse grazing.



**Plate 31: Te vegetation type (relevé D31)**



**Plate 32: Te vegetation type (near relevé D31)**

## **Tw<sup>1</sup>**

**Vegetation type description:** *Triodia wiseana* and *Acacia hilliana* open hummock grassland/sparse shrubland with *Eucalyptus leucophloia* subsp. *leucophloia*, *Corymbia deserticola* subsp. *deserticola* and *C. hamersleyana* scattered trees. *Gompholobium oreophilum* was also frequently observed in this vegetation type, however there was virtually no middle stratum.

This vegetation type occurred lower slopes and undulating valleys of the Boolgeeda land system and was assessed from one relevé. The vegetation condition of the relevé was Excellent. **Plate 33** illustrates the Tw<sup>1</sup> vegetation type.



**Plate 33: Tw<sup>1</sup> vegetation type (relevé D14)**

## **Tw<sup>2</sup>**

**Vegetation type description:** *Triodia wiseana* sparse hummock grassland with *Eucalyptus leucophloia* subsp. *leucophloia* scattered trees and *Acacia bivenosa* and *A. victoriae* scattered shrubs. Other common species include various *Senna* spp. and *Ptilotus* spp. Similar vegetation on the Rocklea land system further east is dominated by *Triodia brizoides*, however this species' known distribution is east of the Delphine area.

This vegetation type occurred amongst quartz and basalt boulder piles within the Rocklea land system and was assessed from one relevé. The vegetation condition of the relevé was Very Good.

**Plate 34** illustrates the Tw<sup>2</sup> vegetation type.



**Plate 34: Tw<sup>2</sup> vegetation type (relevé D20)**

#### 4.1.3.2 Conservation Significance of Vegetation Types

##### Threatened or Priority Ecological Communities

No vegetation assessed as being, or likely to be considered, as a TEC was recorded from within the Delphine study area or adjacent.

Vegetation that may represent the PEC '*Triodia* sp. Robe River assemblages of mesas of the Robe Valley', was recorded from the Delphine study area. The DEC Species and Communities Branch, in discussions via email (included in **Appendix Nine**), were unable to make a determination if the area mapped as vegetation type **EIAcTR** is included in the PEC. However, it is considered unlikely as the area was not on a mesa; it was on a low rolling hill, similar to those shown in the background of **Plate 21**, which shows the vegetation type. Detailed floristic studies, conducted in an appropriate season, and geological studies to determine if the rock type is pisolitic (although it is not mapped as such) will be required before the DEC can make a determination.

##### '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). The study area is located, at least in part, in the Hamersley Range and contains areas of hills and ridges. As the summits of the hills and ridges were not accessible during the field survey due to steep terrain and time constraints, it is unknown if the hilltops have flora that is different to the slopes, and therefore likely to be included as 'Hilltop flora'. However, it is considered unlikely as the hills were not particularly high and did not appear to have different vegetation, when viewed from a distance and assessed using aerial imagery. **Plate 23** (Mt Delphine; background) and **Plate 24** (background) illustrate the Hamersley Range in the study area.

'All major ephemeral water courses' is also identified as an 'Ecosystem at Risk' in Kendrick (2002). Serpentine Creek is likely to be considered to be a 'major ephemeral water course' due to its having apparently permanent or semi-permanent pools. It flows southwards through part of the Delphine study area. The riparian area considered to be a 'major' watercourse is mapped as vegetation type **EcMbCv**. There was evidence of trampling by livestock and Brumbies, however significant damage was not observed and most livestock and cattle were observed in more open areas along smaller watercourses.

Other nearby 'Ecosystems at Risk' listed in Kendrick (2002) include 'Valley floor Mulga', and 'Lower slopes Mulga'. Mulga (*Acacia aneura* sens lat) occurs in the study area, both as valley floor Mulga

(within the valley floor mosaic **AnTw/AaTe/AiTw**<sup>1</sup> and **AcTe** vegetation types) and in a grove – intergrove formation in vegetation type **AaCf**. No ‘Lower slope Mulga’ was observed in the area.

### Groundwater Dependent Ecosystems

*Eucalyptus camaldulensis* is considered to be facultative phreatophytic, so can access groundwater, and is considered to be at least partly groundwater dependent (Dresel *et al.* 2010; Eamus *et al.* 2006). *E. camaldulensis* was recorded in the **EcMbCv** vegetation type in major drainage lines. This vegetation type can be considered to be a groundwater dependant ecosystem (GDE).

The **EvTr** and **ExAcCc** vegetation types contain *Eucalyptus victrix* as a dominant species. Current evidence does not clearly indicate if *Eucalyptus victrix* is dependent on groundwater (see **Section 2.2.3.4**), therefore these vegetation types are considered only as potential GDEs. The **EvTr** vegetation type was assessed as being in Excellent condition, whilst **ExAcCc** was assessed as being in Good condition.

*Melaleuca argentea* was also recorded in **EcMbCv**. There is some conjecture if this species is considered to be groundwater dependent (eg Astron Environmental Services 2008; Maunsell Australia Pty Ltd 2006) or dependent on surface water availability (eg Grierson 2010), however it is undisputed that it is dependent on having access to significant quantities of water for its survival. Any changes to hydrology are likely to have a significant impact on this species.

Other species associated with the minor drainage lines, including *Acacia* spp. (eg *A. tumida*) and *Corymbia hamersleyana*, are not considered to be groundwater dependent (eg Astron Environmental Services 2008). There has been little research on *Melaleuca* spp. (other than *Melaleuca argentea*), and their water requirements are unknown. However, these species (including *M. bracteata*) are associated with species that indicate the presence of a GDE, and therefore their water use requirements are of only secondary significance.

### Sheet Flow Dependent Communities

Sheet flow dependent (grove – intergrove) Mulga, is considered to be dependent on surface water flows to regenerate (eg Muller 2005). Mulga groves were identified from the study area and mapped as vegetation type **AaCf**. They were located on the north-western portion of the study area, on the Wannamunna land system.

### Other Measures of Vegetation Type Significance

Section 6.1 of EPA *Guidance Statement No. 51* (EPA 2004a) lists several criteria why vegetation may be considered to be significant in addition to its listing as a TEC or PEC or because the extent is below a minimum threshold. These reasons, which may apply at a number of scales but are not defined in detail, include:

- scarcity

- unusual species
- novel combinations of species
- role as a refuge
- role as a key habitat for threatened species or large populations representing a significant proportion of the local to regional total population of a species
- being representative of the range of a unit (particularly a good local and/or regional example of a unit in 'prime' habitat, at the extremes of range, recently discovered range extension or isolated outliers of the main range)
- restricted distribution.

None of the listed criteria of vegetation significance were identified from the study area.

#### 4.1.3.3 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 16**.

**Table 16: Vegetation Condition (Trudgen 1991)**

Condition Rating	Excellent	Very good	Good	Poor	Very poor	Degraded	Burnt
<b>Extent (ha)</b>	3600.82	12764.17	903.76	16.30	0	0	13076.80
<b>Proportion (%)</b>	11.68	42.04	2.98	0.05	0	0	43.07

## 4.2 Fauna

### 4.2.1 HABITAT TYPES

Four main habitat types were identified and mapped based on landscape position, vegetation and soil type, and are shown on **Map 7**. They were described as:

- DEL1 Spinifex grasslands on valley floors (**Plate 35**), corresponding mainly to Boolgeeda Land System (**Table 2**) and vegetation types **AaTw/AaTe/AiTw1** (**Section 4.1.3.1**)
- DEL2 Open Shrubland or Open Woodland over Spinifex (*Triodia* spp.) grassland on slopes (**Plate 36**), corresponding mainly to Newman Land System and vegetation type **EIAmTw**
- DEL3 Creeklines/drainage lines (**Plate 37**), mainly cutting through DEL1, with woodland vegetation types including **ExApTe, ExAcCc, EcMbCv**
- DEL4 Sheltered gorges / gullies (**Plate 38**), mainly cutting through DEL2, predominantly with vegetation type **ExApTe**.

The condition of all habitats was determined to be *very good* to *high quality* (Coffey 2010a), with only minor disturbance, no evidence of recent fire, and abundant fresh growth of *Triodia* spp. and *Acacia* spp. Surface water in the form of large pools was recorded in Serpentine Creek and gorges in the southern portion of the study area.

**Table 17** shows the amount of each habitat type within the study area and the percentage extent. The majority of the study area is made up of habitat types DEL1 and DEL2. Habitat Type DEL3 and DEL4 correspond to topographic and hydrological features within the two widespread habitat types, and 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 including (if present) Northern Quoll and Pilbara Olive Python (**Section 5.3**).

**Table 17: Amount and area extent of each habitat type**

Habitat Type	Area (ha)	Proportion of study area (%)
DEL1 – spinifex grassland on valley floors	17533	57.8
DEL2 – open shrubland/open woodland over spinifex on slopes	11822	38.9
DEL3 – creeklines/drainage lines	852	2.8
DEL4 – sheltered gorges/gullies	153	0.5
Total	30360	



**Plate 35: Habitat Type DEL1**



**Plate 36: Habitat Type DEL2**





**Plate 37: Habitat Type DEL3**



**Plate 38: Habitat Type DEL4**

#### **4.2.2 BIRD CENSUS**

Two sessions of bird census took place on two successive days at waterholes on Serpentine Creek (**Map 7**), during which 37 species of birds were identified by sight, the number of individuals ranging from one (nine species) to approximately 20. Eight or more individuals were recorded in the following species, which are thus regarded as common and conspicuous at the site:

- *Melopsittacus undulates*, Budgerigar (28)
- *Coracina novaehollandiae*, Black-faced Cuckoo-shrike (27)
- *Lichenostomus virescens*, Singing Honeyeater (13)
- *Geopelia cuneata*, Diamond Dove (12)

- *Manorina flavigula*, Yellow-throated Miner (11)
- *Cracticus tibicen*, Australian Magpie (9)
- *Lichenostomus penicillatus*, White-plumed Honeyeater (8) and
- *Pomatostomus temporalis*, Grey-crowned Babbler (8).

The abundance and composition of the bird fauna was influenced by the presence of waterholes of considerable size (uncommon in the region at this season), although the only species really dependent on water were *Euseyornis melanops* (Black-fronted Dotterel, 2) and *Egretta novaehollandiae* (White-faced Heron, 1). The presence of *Aquila audax* (Wedge-tailed Eagle) and three *Falco* species (*F. cenchroides* Australian Kestrel, *F. berigora* Brown Falcon, and *F. peregrinus* Peregrine Falcon) reflects the concentration of birds and other prey in these conditions.

#### 4.2.3 TRAIL CAMERAS

Two trail cameras were set for two nights on waterholes near cliffs along Serpentine Creek, targeting Pilbara Olive Python. No identifiable images of fauna were obtained.

#### 4.2.4 TRAPPING

No captures of any species were made in 10 trap nights at Delphine.

#### 4.2.5 OPPORTUNISTIC OBSERVATIONS

Seven bird species (in addition to those recorded in the census) were identified by calls alone, or opportunistically at other times and locations in the Delphine study area, bringing the total to 44. Small groups of *Ardeotis australis* (Australian Bustards, DEC P4) were sighted on two occasions.

*Macropus robustus* (Euro, three individuals sighted), *Petrogale* sp. (Rock Wallaby, presumably *P. rothschildi*), and *Trichosurus vulpecula* (Brush-tailed Possum) were recorded as present based on scats. Two active mounds of *Pseudomys chapmani* (Western Pebble-mound Mouse, DEC P4) were observed. Also present were *Bos taurus* (Cattle), *Equus caballus* (Horses), *Canis lupus dingo* (Dingo, from sightings and other signs) and *Felis catus* (feral Cat, identified from tracks). No evidence of *Dasyurus hallucatus* (Northern Quoll) presence was recorded either by either motion-sensitive camera, cave searching, tracks or hand searching.

#### 4.2.6 SUMMARY

Using all methods, 60 vertebrate species were recorded during the survey (two fish, one frog, eight mammals, five reptiles, 44 birds) and are listed in **Table 27 (Appendix Eight)**. Conservation listed species recorded were *Falco peregrinus* (Peregrine Falcon, WCA Schedule 4), *Ardeotis australis* (Australian Bustard, DEC P4), *Merops ornatus* (Rainbow Bee-eater, EPBC-listed migratory species, but widespread and common; recorded in both census sessions) and *Pseudomys chapmani* (Western Pebble-mound Mouse, DEC P4, identified by presence of active mounds).

## 5.0 Discussion

### 5.1 Flora and Vegetation

#### 5.1.1 FLORA OF CONSERVATION SIGNIFICANCE

A total of 87 vascular flora taxa were recorded within the study area from relevé sites and opportunistic observations (**Appendix Six**). This does not represent a full flora inventory. The seasonal conditions were considered ideal, and despite the lack of intensive floristic sampling a high number of annual flora species were observed during this survey.

Fifty-four conservation significant flora taxa (TF and PF) were identified by the DEC database search of an 18, 548 km<sup>2</sup> area, with none identified as having previously been recorded within the study area. Ecological data for these species are included in **Table 25, Appendix Two**. It is considered that the majority would have identifiable (if present) due to survey timing (coinciding with the majority of species' flowering periods) and ideal seasonal conditions.

The DEC database search includes two TF species listed under the *EPBC Act* as *vulnerable* and *WC Act*, *Lepidium catapycnon* and *Thryptomene wittweri*. Neither was recorded from the survey area. In the Pilbara, both are known to occur high in the landscape on cliffs, in crevices and high scree slopes, usually with a southerly aspect. These areas were largely inaccessible during the field survey, however accessible areas were targeted for survey and neither species were located.

Three PF species (*Indigofera* sp. Bungaroo Creek, *Rhynchosia bungarensis* and *Triodia* sp. Robe River) were recorded from the study area.

*Indigofera* sp. Bungaroo Creek (P3) was a dominant and characteristic species of steep rocky slopes of the Hamersley range (vegetation type **EIIBTw**), a characteristic species of minor drainage lines (vegetation type **AtTt**) and frequently observed along major drainage lines (in vegetation type **EcMbCv**).

*Rhynchosia bungarensis* (P3) was observed on clay valley floors in vegetation type **AcTe**.

*Triodia* sp. Robe River (P3) was a dominant and characteristic species of vegetation type **EIAcTR** and characteristic species of vegetation type **EIAmTw**.

As a result of the significant proportion of recently burnt vegetation, it is not possible to rule out the possibility of additional conservation significant flora occurring within the study area. A conservation significant flora risk assessment was conducted to identify species that are likely to occur in the study area that were not recorded during this survey.

### 5.1.1.1 Conservation Significant Flora Risk Assessment

This assessment of the Delphine 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 Delphine study area is included in **Table 29, Appendix Ten**. The likelihood of a species occurring in the study area is based on the following attributes, as listed on FloraBase (WAH 1998-) and tailored to Pilbara populations and including 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 (note: although not accessible during this survey, there is no aerial imagery colouration that indicates the presence of *Eucalyptus kingsmillii* subsp. *kingsmillii* on high hilltops in the Delphine study area)
- the species having previously been recorded from nearby (approximately 50 km; including the current WH surveys).

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)
- 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); soil type, landform and associated vegetation present
- *Sida* sp. Hamersley Range (K. Newbey 10692) (P1); soil type, landform and associated vegetation present. Known from nearby
- *Teucrium pilbaranum* (P1); soil type, landform and associated vegetation present
- *Spartothamnella puberula* (P2); soil type, landform and associated vegetation present. Known from nearby
- *Acacia subtiliformis* (P3); soil type, landform and associated vegetation present

- *Calotis latiuscula* (P3); soil type, landform and associated vegetation present. Known from nearby
- *Eremophila magnifica* subsp. *velutina* (P3); although the landform and associated vegetation as listed on FloraBase are not present, Ecoscape has recorded this taxon from landforms and vegetation types similar to those found within this study area
- *Ptilotus subspinescens* (P3); soil type and landform present. Known from nearby
- *Rhagodia* sp. Hamersley (M. Trudgen 17794) (P3); soil type, landform and associated vegetation present
- *Sida* sp. Barlee Range (S van Leeuwen 1642) (P3); soil type, landform and associated vegetation present. Known from nearby
- *Acacia bromilowiana* (P4); soil type, landform and associated vegetation present. Known from nearby
- *Eremophila magnifica* subsp. *magnifica* (P4); soil type, landform and associated vegetation present. Known from nearby
- *Goodenia nuda* (P4); soil type, landform and associated vegetation present. Known from nearby
- *Ptilotus mollis* (P4); soil type, landform and associated vegetation present. Known from nearby.

### 5.1.2 INTRODUCED SPECIES

No species recognised under the *Agriculture and Related Resources Protection Act 1976* as Declared Plants in the Pilbara were recorded in the survey.

Four introduced flora species, *\*Argemone ochroleuca* (Mexican poppy), *\*Cenchrus ciliaris* (Buffel Grass) *\*Malvastrum americanum* (Spiked Malvastrum) and *\*Vachellia farnesiana* (Mimosa Bush) were recorded from the study area. Infestations of these weeds were restricted to drainage lines and the vicinity of cattle yards near the centre of the study area.

## 5.2 Vegetation

### 5.2.1 VEGETATION CONSERVATION SIGNIFICANCE

Twenty vegetation types were recorded from the Delphine study area, including one mosaic on valley floors that could not be mapped at the scale of a Level 1 survey. None of these match the descriptions of any recognised TECs.

The **EIAcTR** vegetation type is similar to the 'Triodia sp. Robe River assemblages of mesas of the Robe Valley' Priority 3 PEC. Until recently, any vegetation communities containing *Triodia* sp. Robe River (M.E. Trudgen *et al.* MET12367), irrespective of density or landform, were under a broad concept of this PEC. However, the definition has been refined to include only vegetation communities with dominant *Acacia citrinoviridis* and *A. pruinocarpa*, and occurring on mesas and pisoltic geology. Whilst the dominant plant species are those listed, the required landform and likely the geology are

different. It is unlikely that this vegetation type is analogous with the PEC, however full floristic data and more detailed geology and soil descriptions are required before the DEC can make a final determination. Approximately 1075 ha (including 257 ha of burnt area interpreted to be this vegetation type) of **EIAcTR** was mapped across the study area.

Vegetation considered to indicate a GDE or potential GDE was recorded along much of the main drainage line (Serpentine Creek) flowing through Delphine. One vegetation type that included phreatophytic species and considered to indicate a GDE was recorded from the study area: **EcMbCv** (*Eucalyptus camaldulensis* subsp. *refulgens*, *E. victrix* and *Melaleuca argentea* woodland). Two other vegetation types that may indicate a potential GDE were also recorded: **EvTr** (*Eucalyptus victrix* open woodland) and **ExAcCc** (*Eucalyptus xerothematica* and *E. victrix* open forest).

Vegetation displaying the spatial patterning associated with sheet flow dependent Mulga was recorded from the north-western portion of the study area. Vegetation type **AaCf** (*Acacia aptaneura* open woodland) occupied 125.1 ha of the Delphine study area; all of this area had been recently burnt.

‘Ecosystems at Risk’ listed in Kendrick (2002) include ‘Valley floor Mulga’ (considered to include ‘sheetflow dependent communities’ of grove – intergrove Mulga). Several valley floor vegetation types include Mulga (*Acacia aptaneura*) as a dominant and characteristic species. These include **AaCf** described above, and **AcTe** (*Acacia citrinoviridis*, *A. pruinocarpa* and *A. aptaneura* shrubland) and the valley floor mosaic vegetation type **AnTw/AaTe/AiT<sup>1</sup>** that include Mulga as characteristic and often dominant species (in the **AaTe** (*Acacia aptaneura*, *A. atkinsiana* and *A. ancistrocarpa* open shrubland) component), but do not appear to be sheet flow dependent.

Other ‘Ecosystems at Risk’ listed in Kendrick (2002) include ‘All major ephemeral water courses’. Within the study area the **EcMbCv** vegetation type can be considered analogous with this ‘Ecosystem at Risk’, and is also considered to be a GDE.

It is unlikely that the ‘Ecosystem at Risk’ ‘Hilltop floras, Hamersley Range’ occurs in the Delphine study area as there are no high hilltops likely to support vegetation that is different to that of the hillslopes. Additionally, only the northern part of the Delphine study area is in the Hamersley Range; the southern part is considered to be in the Lawloit Range.

‘Ecosystems at Risk’ do not have any formal conservation significance.

Two vegetation types may be considered to be locally significant as the dominant and characteristic species from one stratum are listed as PF; **EIAcTR** (where ‘TR’ is *Triodia* sp. Robe River, P3) and **EIBTw** (where ‘IB’ is *Indigofera* sp. Bungaroo Creek, P3). Vegetation type **EIAmTw** also includes *Triodia* sp. Robe River and **AtTt** contains *Indigofera* sp. Bungaroo Creek as a characteristic but not

dominant species. However, these vegetation types are unlikely to have conservation significance beyond significance of the constituent flora.

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 Delphine study area, assessed using the Trudgen (1991) Vegetation Condition Scale, ranged from Poor to Excellent depending of the density of introduced species, impacts from grazing and effects of fire.

Almost half (43.07%) of the Delphine study area had been recently burnt. Whilst it was not possible to determine vegetation condition in this area, there is no reason to consider that it would have been in significantly different condition to the unburnt section, which was largely in Very Good (42.04%) or Excellent (11.86%) condition.

Impacts of grazing by feral horses (Brumbies) was observed to be significant along the clay soils of the valley of the western portion of Delphine. No other areas of the Delphine study area were assessed as being in Poor condition (0.05%).

## **5.3 Fauna and Habitat**

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

Habitat requirements and documented or potential presence at the Delphine study area are discussed for each listed species. Species and common names are followed by abbreviations denoting conservation status (described in **Appendix One**). Potential impacting processes (not all relevant in any particular case) 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.* 2004), 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 18**) based on the number of records in proportion to area.

**Table 18: 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 <i>et al.</i> 2004)	NQ records (Biota 2009)	NQ records per 10,000 km <sup>2</sup>
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

The study area lies within the modeled distribution of Northern Quoll (PMST, **Appendix Three**); there are scattered records of the species within the Hamersley subregion, including one approximately 30 km west of the study area (DEC Threatened and Priority Fauna search; Biota 2009; not all in DEC 2011b), which is probably within dispersal distance for individual Northern Quolls. Potential denning and high-quality foraging habitat also occurs in the study area in the form of sheltered and vegetated gullies, breakaways and major drainage lines with *Eucalyptus* and *Corymbia* woodland (critical habitat, DSEWPaC 2011c). The trapping conducted as part of this survey was not sufficient in duration, intensity or area of coverage, to demonstrate absence. 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 at least intermittently.

### Potential Impacts

If Northern Quoll does not currently occur in the study area there will be no immediate impact due to mining activity. However, because populations and area of occupancy may fluctuate, it is possible that the species may occur at other times. Drilling and future mining is likely to be restricted to valley floors, and impacts on suitable habitat (wooded creeklines, habitat type DEL3) could be significant even if this habitat is not currently occupied. Disturbance to suitable habitat (gorges, major drainage lines and breakaways; habitat types DEL3 and DEL4) should be minimized.

## ***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. 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 was not detected in this survey, there are records of this species within 30 km to the east of the study area (DEC 2011b) and suitable habitat occurs throughout Delphine, so it may occur.

#### 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.

### ***Rhinonictis 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) 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, 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, *Taphozous 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; Churchill 1991; DSEWPaC 2012).

#### Likelihood of Occurrence

There are records from the eastern and western Hamersley but none 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 for foraging 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.

### ***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 (Worthington-Wilmer *et al.* 1999), and only 10 such sites are known to exist in the Pilbara (Armstrong & Anstee 2000). 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). The Pilbara population is thought to comprise approximately 600 individuals (IUCN 2011).

#### 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. Survival is critically dependent on finding natural roosts in caves, crevices, deep overhangs, and artificial 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

No maternity roost for this species is known to be present closer than Karijini National Park (Armstrong & Anstee 2000). However, there are several records within 50 km of Delphine (DEC 2011b), and caves suitable as day roosts are likely to occur in gorges, clifflines and breakaways in parts of the study area, so Ghost Bats are likely to be present at least intermittently.

### Potential Impacts

Very minor impact may occur through clearing (reduction of foraging area) and mining operations (eg roadkill, impact of artificial light). Day roost caves may occur in clifflines (within habitat types DEL3 and DEL4).

## ***Leggadina lakedownensis* (Short-tailed 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 in the vicinity of the study area, so it may occur along the drainage lines where clay and sandy soils with *Acacia* shrubland represent suitable habitat.

### Potential Impacts

Some impact may occur to individuals and habitat during clearing and operations. The extent of impact would be very difficult to measure due to the the patchy and fluctuating population of the species, but 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, but the species appears to be 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 may utilise and maintain several mounds, and active mounds are identifiable by structural features and absence of vegetation, but remain recognisable for some time once abandoned (Anstee 1996; Anstee *et al.* 1997). Females can produce several litters of four young annually. There appear to be no major threats to this species, but dits elimination from the southern portion of its range may be related to predation by feral cats and foxes (Start 2008). Mining may be a localized threat (Anstee *et al.* 1997), but is unlikely to significantly affect the overall population size (IUCN 2011). This species' diet has not been detailed but species it is likely to be omnivorous like other *Pseudomys* species, including seeds, other plant parts, and invertebrates (Murray *et al.* 1999).

#### Likelihood of Occurrence

Active mounds were recorded in the study area, indicating current presence. Suitable habitat for this species is extremely abundant and practically continuous (comprising tops as well as lower slopes of hills) and the species is recorded throughout the Pilbara (DEC 2011b).

#### 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, WC Act S3**

#### 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 2011d).

### 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, WC Act S3**

### 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 2011d).

### 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, but is likely to utilise river valleys and waterholes along Serpentine Creek.

### Potential Impacts

Some impact to 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, WC Act S3**

### 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 2011d). 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, and also consumes 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, but 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 Migratory, WC Act S3**

#### 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 2011d).

#### 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). Pools along the Duck Creek – Serpentine Creek system may provide suitable foraging habitat, but 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. Impact can be minimised by avoiding clearing of trees along creeklines, where nests may occur.

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

#### Conservation status

**WC Act S4**

#### 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 one was observed within the Delphine study area during the survey. 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). Nesting occurs typically at the boundary between grassland and shrubland or woodland areas.

### 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 2007). 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

Australian Bustards remain fairly common throughout the region (DEC 2011b), suitable foraging and breeding habitat occurs over most of the Delphine study area, and 10 individuals were sighted during the field survey.

### Potential Impacts

Some increased mortality and reduction in foraging range may be likely as a result of disturbances in the study area, but individuals are able to move away from disturbance, and any impact on the overall population is likely to be minor. Timing of clearing activity relative to nesting may affect impact, but this is difficult to anticipate because breeding cycles and locations may depend on irregular rainfall events (Ziembicki & Woinarski 2007).

### ***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

The Bush Stone-curlew was not observed during the field survey of Delphine, and the nearest records are approximately 60 km east and west. However, suitable habitat for this species occurs along the river valleys and it may be expected to occur.

### Potential Impacts

If a population is present, some impact may occur through increased traffic, clearing of shrubland/woodland habitat, and other disturbance.

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

#### Conservation status

**EPBC Act Migratory, WC Act S3**

### 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 2012).

### Likelihood of Occurrence

There are few inland records of this species in the Pilbara, the nearest being approximately 75 km north-east in the Fortescue Valley, and it was not recorded during the survey. Grassland habitats in the study area may be utilised occasionally when grass is short, eg after fire.

### Potential Impacts

Any impact to this species is likely to be very minor due to its mobility and the large area of similar but sparsely utilised habitats in the region.

## ***Merops ornatus* (Rainbow Bee-eater)**

### Conservation status

**EPBC Act Migratory, WC Act S3**

### Distribution and Preferred habitat

The Rainbow Bee-eater is widespread throughout most of Australia, and does not depend on any particular habitat or vegetation type for feeding or breeding. They are scarce to common throughout much of Western Australia except for the arid interior, preferring lightly wooded, sandy country near water (DSEWPaC 2012).

### Ecology

Bee-eaters feed mainly on insects taken in flight (hawking), but also take prey from the ground and foliage (gleaning). Populations in southern Australia are migratory, wintering in Indonesia and New Guinea, moving south over summer and breeding in Australia, but the species is resident and present year-round in parts of northern Australia including the Pilbara (DSEWPaC 2012). Nesting occurs in burrows dug in flat or slightly sloping ground, sandy banks or cuttings, and often at the margins of roads or tracks; breeding is often colonial and cooperative (Boland 2004).

### Likelihood of Occurrence

Rainbow Bee-eaters are common throughout the region (DEC 2011b) and were seen along river channels throughout the study area, and suitable conditions for breeding may exist along banks of dry drainage lines.

### Potential Impacts

Disturbance to areas utilised by the Rainbow Bee-eater, such as sand banks of creeks and drainage lines used to burrow to create nesting chambers between September and February, may have some impact on the breeding success of this species. However, historical disturbance does not represent a major issue to this species and it is common in cleared and semi-cleared habitats (DSEWPaC 2012). No significant impact is likely.

## 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 (Department of Environment Water Heritage and the Arts 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.

#### Likelihood of Occurrence

There are numerous NatureMap records of the Pilbara Olive Python from the Hamersley Range; few of them are in the western part of the range, which is partly attributable to less intense survey

activity (DEC 2011b). No signs of this species were detected in this survey, but it is likely to be a resident due to the large number of permanent waterholes observed in the study area.

#### Potential Impacts

The main threats to this subspecies come from predation by 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 by people (Pearson 2003). Clearing and mining activity along drainage lines and around waterholes would have some impact by direct mortality or disruption of prey activity.

### ***Ramphotyphlops ganei* (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 (Greer 1997;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 may occur in the study area, especially along the drainage lines and in sheltered gullies throughout the study area.

#### Potential Impacts

Some impact to this species may occur by loss of habitat through clearing; impact would be very difficult to quantify because of the low detectability of the species, but it is likely to be minor because it is broadly distributed within the Pilbara.

### ***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 approximately 30 km north-west of the Delphine study area, and also further east along the valley of Duck Creek (DEC 2011b). This species was not recorded in the survey but may occur, as suitable habitat appears to be present along the drainage lines.

#### Potential Impacts

Clearing, traffic, and other disturbance close to creeks and drainage lines may have some impact on local populations.

## **AMPHIBIANS**

No conservation significant native amphibian species were expected to occur in the study area based on the desktop assessment, and none were recorded during the field survey.

### ***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/Rhinella marina*, 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) and predicts that most of the Pilbara can be occupied. 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' (DEC 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. Dispersal from coastal areas is likely to occur via the Ashburton River and annually flowing tributaries, and the presence of permanent waterholes in the study area makes it likely that toads would become established if introduced to the area in its natural state (cf Kearney *et al.* 2008).

### Potential Impacts

Establishment of Cane Toads in the Pilbara would have a severe impact on some vertebrate populations, particularly Northern Quoll. While they are likely to reach and establish in the study area within decades without further intervention, the impact may be modified in timing or severity by actions in the study area. 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

The Delphine study area contains Serpentine Creek and other major drainage lines which are connected, through Duck Creek, to the Ashburton River. The drainage lines within the study area contain permanent flowing water, providing suitable habitat in which the Fortescue Grunter may be likely to occur.

### Potential Impacts

Some impact is possible if there is disturbance of flow or sediments in creeks where this fish may occur.

## **5.3.2 EXTENT AND VULNERABILITY OF SIGNIFICANT HABITATS**

Of the four main habitat types identified (**Section 4.2.1**), the two most restricted are potentially significant for several conservation significant fauna species. Either or both DEL3 (creeklines/drainage lines) and DEL4 (sheltered gullies or gorges) could provide foraging and breeding habitat for Northern Quolls, Pilbara Olive Pythons, Grey and Peregrine Falcons, migratory waterbirds, and other Priority vertebrates (skink, blindsnake and fish), and non-breeding roosts or foraging habitat for Pilbara Leaf-nosed Bats and Ghost Bats. Major drainage lines and waterholes are present and indicate high-quality (critical) habitat for Northern Quolls and Pilbara Olive Pythons in their vicinity (**Map 7**). Gully or gorge habitats located within habitat DEL2 (Spinifex on slopes) are likely to suffer little direct disturbance from mining activity concentrating on valley floors, but those within or adjacent to DEL1 may be disturbed or destroyed.

Habitat DEL1 (Spinifex grasslands on valley floors) is also potentially important for some significant species. This is the most likely habitat, including potential breeding habitat, for Rainbow Bee-eater, Australian Bustard (both observed to be present), and Short-tailed Mouse. This habitat is likely to be largely disturbed within the tenement as a result of mining activity; however, similar habitat is abundant throughout the Pilbara, and the fauna species that could be affected remain widely distributed and are currently at a lower level of conservation concern.

Habitat DEL2 corresponds to more open areas on upper slopes with hard Spinifex and open to scattered shrubs and trees, together with exposed cliffines (**Map 7**). The slopes are likely to provide habitat for Bush Stone-curlew (not recorded), Western Pebble-mound Mouse and Long-tailed Dunnart (not recorded), and cliffines are potential nesting areas for Peregrine Falcon; 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 that may occur in the Delphine study area, based on their listing in both the *WC Act* and *EPBC Act*, are as follows:

- Northern Quoll (*Dasyurus hallucatus*) - EN
- Pilbara Leaf-nosed Bat (*Rhinoicteris aurantia*) - VU



- Pilbara Olive Python (*Liasis olivaceus barroni*) - VU.

None of these were recorded through the Level 1 survey or the Northern Quoll reconnaissance undertaken in July-August 2011. There is habitat present for each of these species within the study area, as defined by the Northern Quoll referral guidelines and SPRAT sheet information from the DSEWPaC web pages (DSEWPaC 2011c;2011d). If present, the Pilbara Leaf-nosed Bat is least likely to be impacted because its utilisation of the study area is likely to be limited to foraging and wet season dispersal, while the other two species, if present, would be more dependent on local resources.

Rainbow Bee-eater (*Merops ornatus*) is present and probably resident rather than migratory in this region, but any impact on this species is likely to be local and temporary. The other bird species listed under the EPBC Act as Migratory are all possible transient visitors to the study area and are not likely to be significantly impacted by disturbance.

Australian Bustard (*Ardeotis australis*) and Peregrine Falcon (*Falco peregrinus*) are present and could be impacted to some extent depending on the location and timing of disturbance relative to breeding activity, but adults are able to move away from disturbance. Western Pebble-mound Mouse (*Pseudomys chapmani*) is less mobile but impact would be low because of the large and continuous extent of suitable (but sparsely occupied) habitat in the region. Presence of the other DEC Priority listed species is possible but not confirmed by the survey, and there could be minor to moderate impact on some species if present. Detailed survey using a range of trapping and survey techniques would be required to determine the presence of these species within the study area.

In **Table 19**, possible impacts are summarised in relation to habitat types on the assumption that all species occur in the study area where suitable habitat is present. Localised impact is regarded as '**negligible**' if no population decline would result; '**minor**', short-term population decline for duration of disturbance, no change in viability or conservation status; '**moderate**', permanent population decline without change in viability or conservation status.

**Table 19: Possible impacts to conservation significant fauna in the study area (species known to occur in bold)**

Scientific Name	Common Name	Predicted Impact
<b>THREATENED AND PRIORITY SPECIES</b>		
<b>Mammals</b>		
<i>Dasyurus hallucatus</i>	Northern Quoll	Minor to moderate impact possible in habitat types DEL3 and DEL 4
<i>Sminthopsis longicaudata</i>	Long-tailed Dunnart	Negligible to minor local impact, any habitat type
<i>Macroderma gigas</i>	Ghost Bat	Negligible impact (including possible minor roost caves in habitat types DEL3 and DEL4)
<i>Rhinonicteris aurantia</i>	Pilbara Leaf-nosed Bat	Negligible impact (roost caves unlikely, wet season dispersal roosts may occur in habitat types DEL3 and DEL4)
<i>Leggadina lakedownensis</i>	Short-tailed Mouse	Negligible impact, in habitat types DEL1 and DEL2
<b><i>Pseudomys chapmani</i></b>	<b>Western Pebble-mound Mouse</b>	Negligible impact, in habitat types DEL1 and DEL2
<b>Birds</b>		
<i>Falco hypoleucos</i>	Grey Falcon	Negligible impact, minor if nesting occurs (DEL3)
<b><i>Falco peregrinus</i></b>	<b>Peregrine Falcon</b>	Negligible impact in all habitats, only if nesting occurs (no impact on cliff sites likely)
<b><i>Ardeotis australis</i></b>	<b>Australian Bustard</b>	Negligible to minor impact in all habitat types
<i>Burhinus grallarius</i>	Bush Stone-curlew	Negligible to minor impact, mainly restricted to habitat type DEL2
<b>Reptiles</b>		
<i>Liasis olivaceus barroni</i>	Pilbara Olive Python	Minor to moderate impact possible, habitat type DEL3 and DEL4
<i>Notoscincus butleri</i>	Lined Soil-crevice Skink	Negligible to minor impact, habitat type DEL3
<i>Ramphotyphlops ganei</i>	Blindsnake	Negligible to minor impact, habitat types DEL1, DEL 3, DEL4
<b>Fish</b>		
<i>Leiopotherapon aheneus</i>	Fortescue Grunter	Possible minor to moderate impact (if present) in habitat type DEL3
<b>MIGRATORY SPECIES</b>		
<i>Apus pacificus</i>	Fork-tailed Swift	Negligible or no impact in all habitat types
<i>Ardea modesta</i>	Eastern Great Egret	Negligible or minor impact (habitat type DEL3)
<i>Ardea ibis</i>	Cattle Egret	Negligible or no impact (habitat type DEL3)
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	Negligible or no impact (habitat type DEL3)
<i>Charadrius veredus</i>	Oriental Plover	Negligible or no impact on vagrants (habitat types DEL1, DEL3)
<b><i>Merops ornatus</i></b>	<b>Rainbow Bee-eater</b>	Negligible impact in all habitat types

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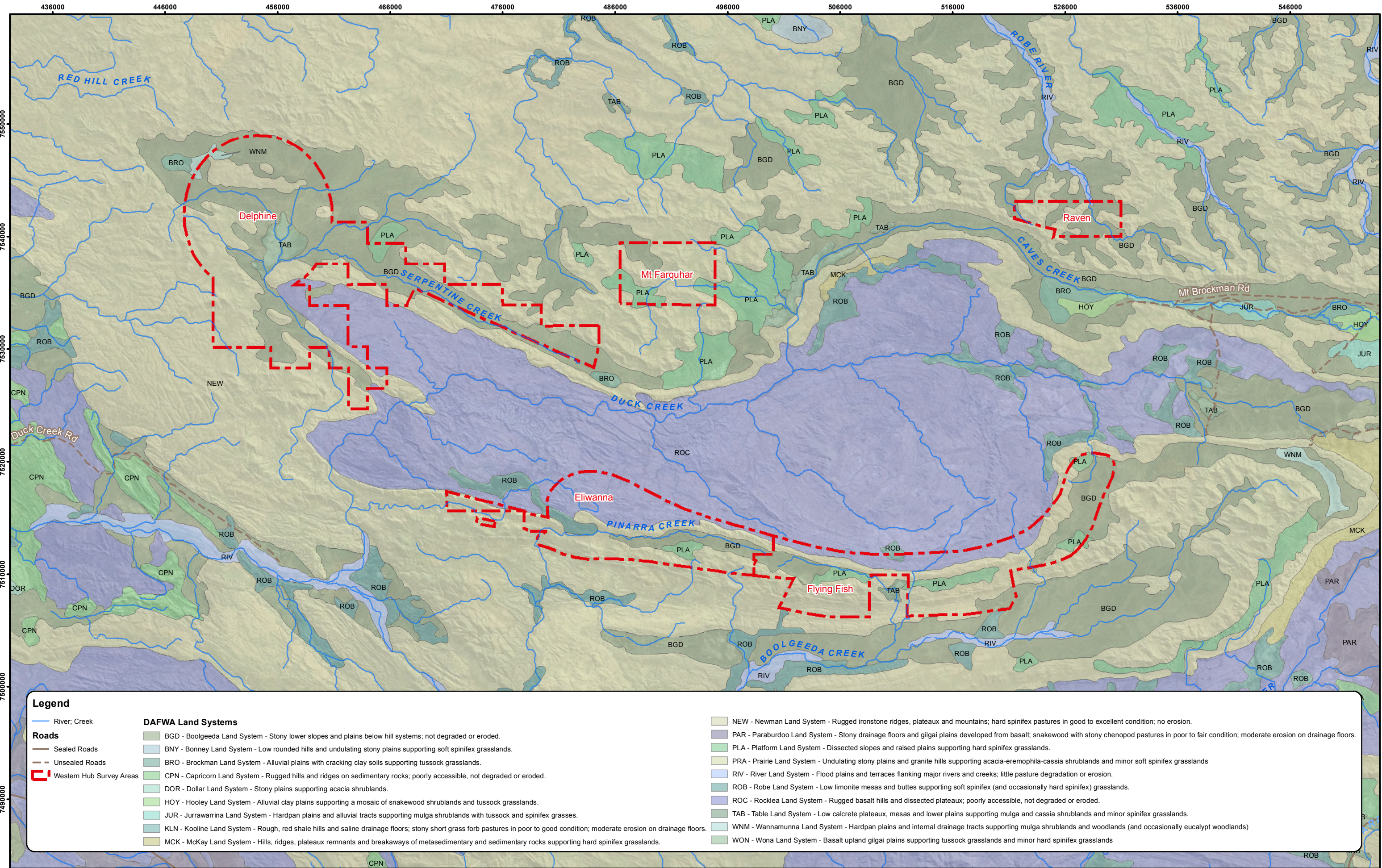
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## Maps



**Legend**

**River; Creek**  
 River; Creek

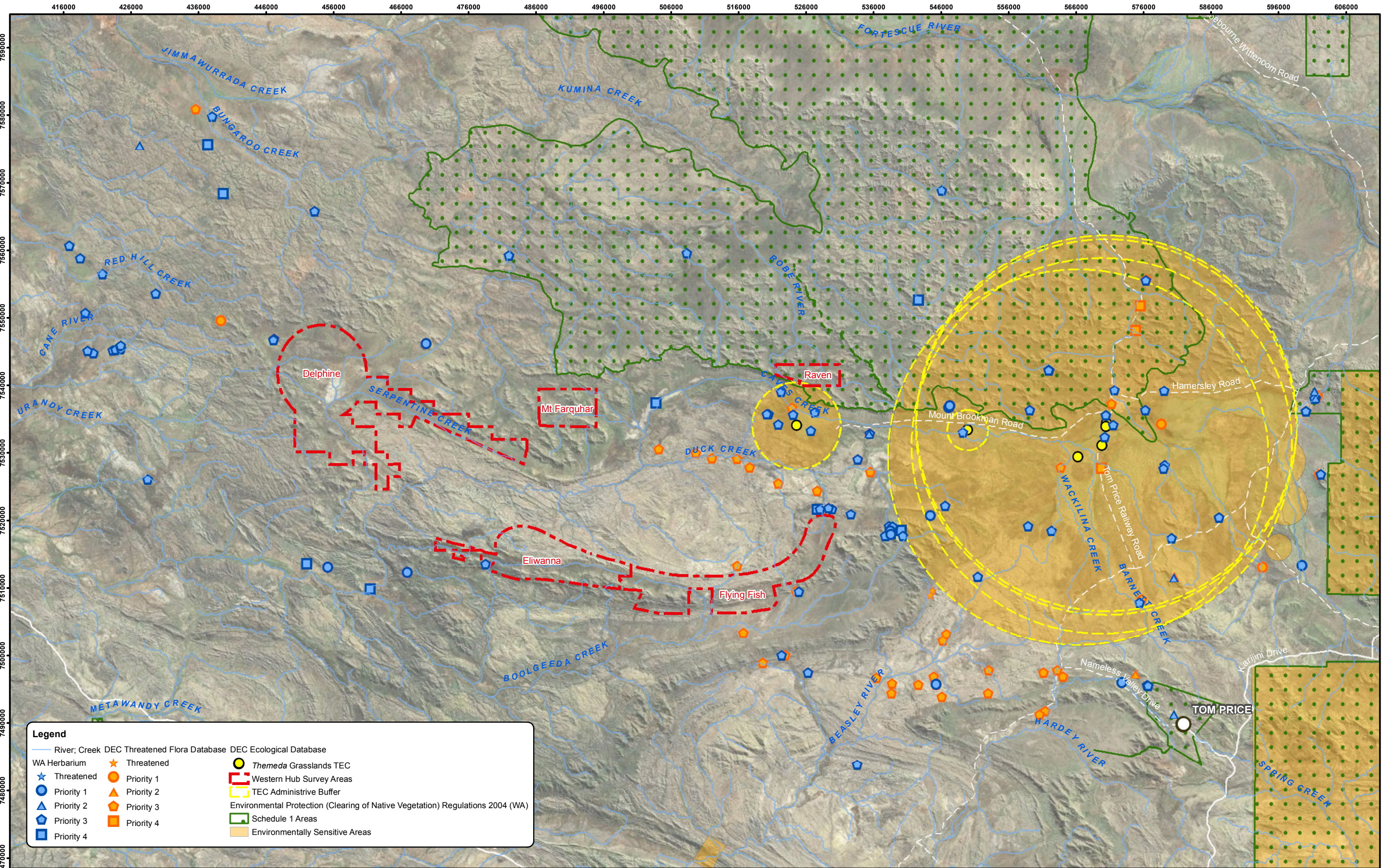
**Roads**  
 Sealed Roads  
 Unsealed Roads  
 Western Hub Survey Areas

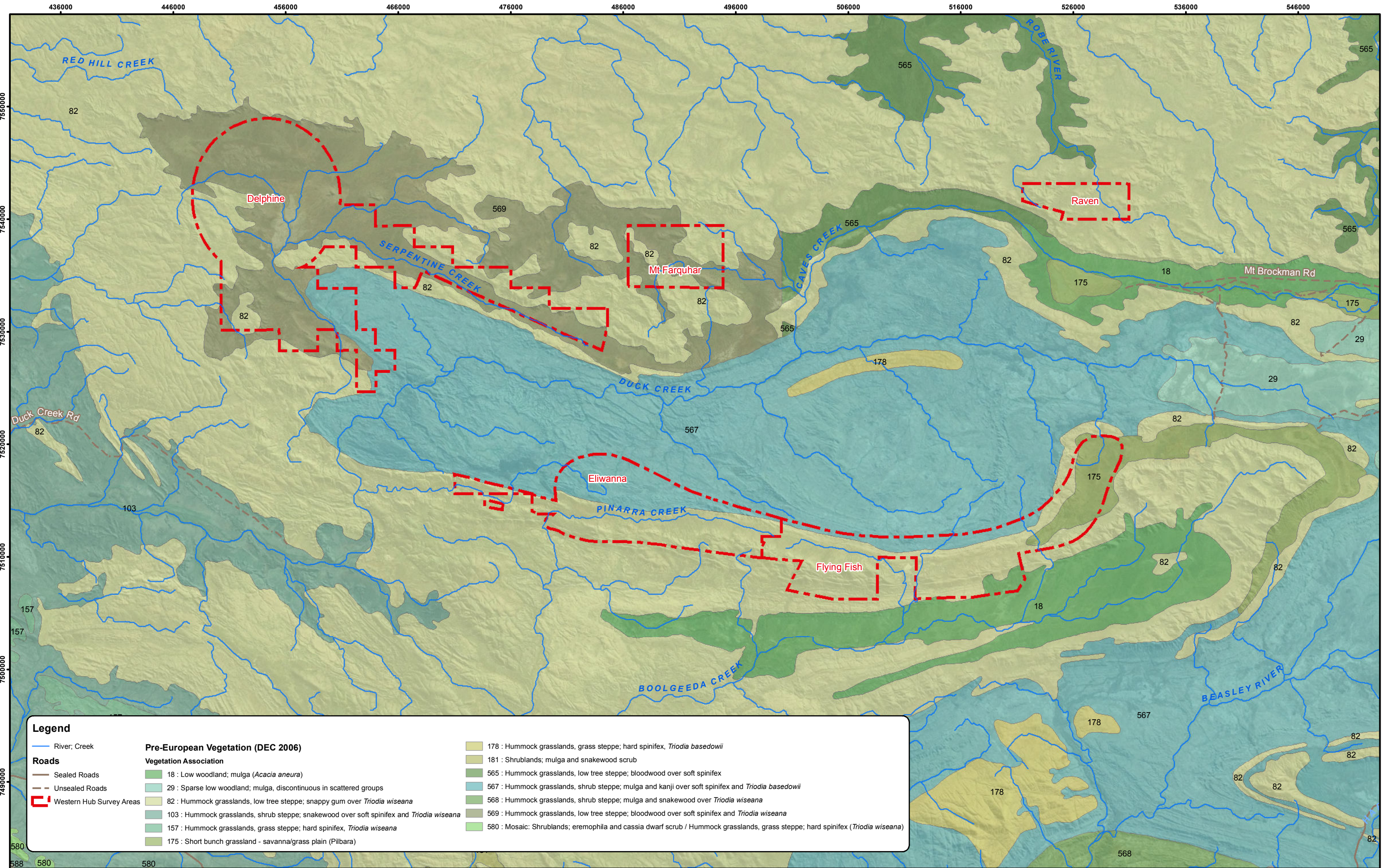
**DAFWA Land Systems**

- 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



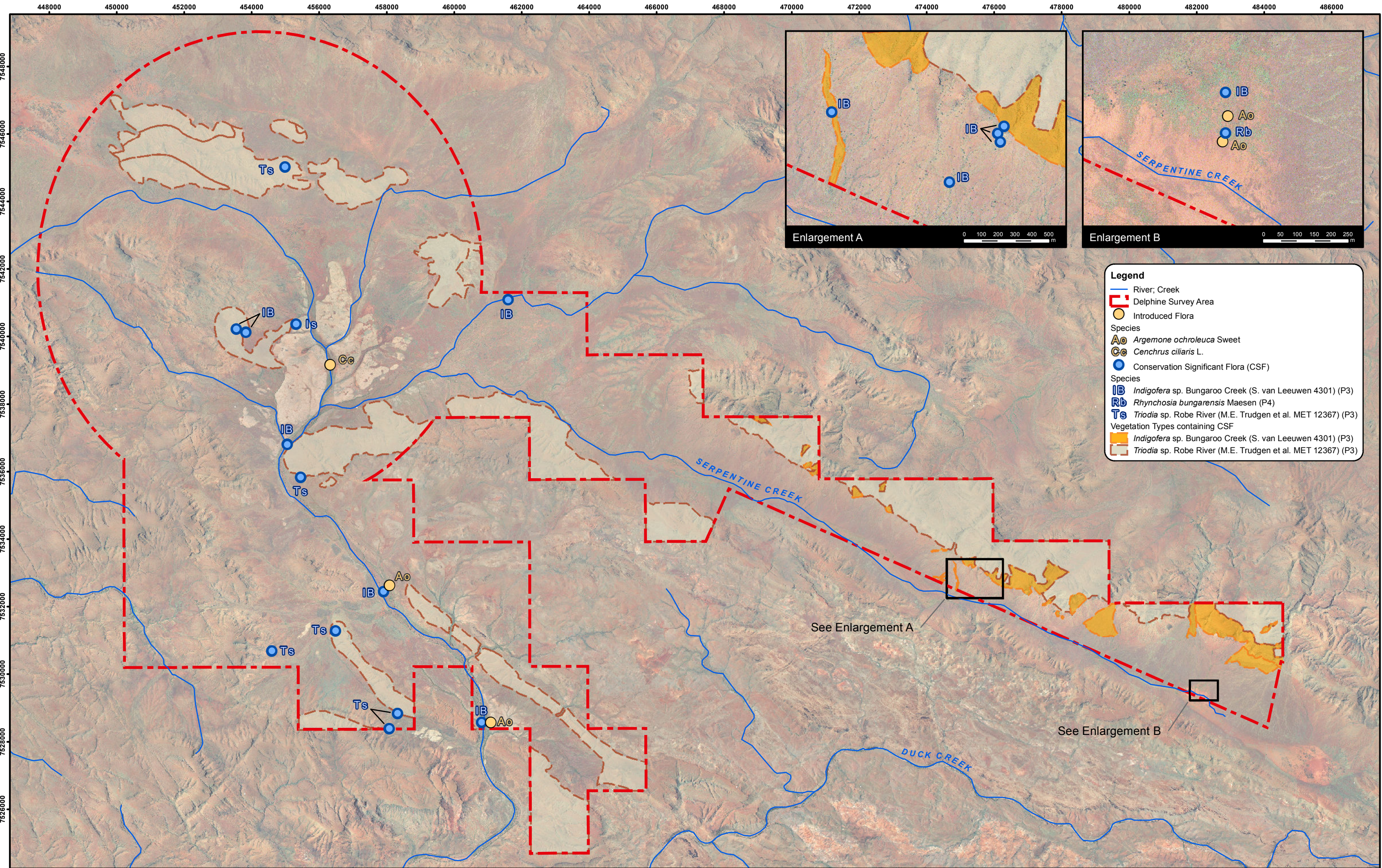
GDA 1994 MGA Zone 50





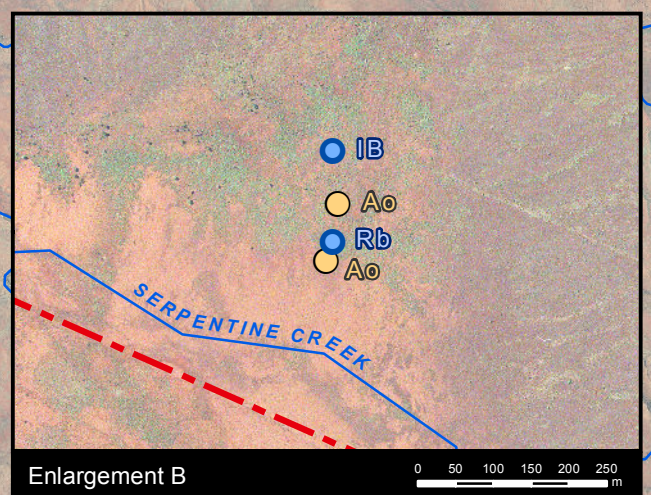
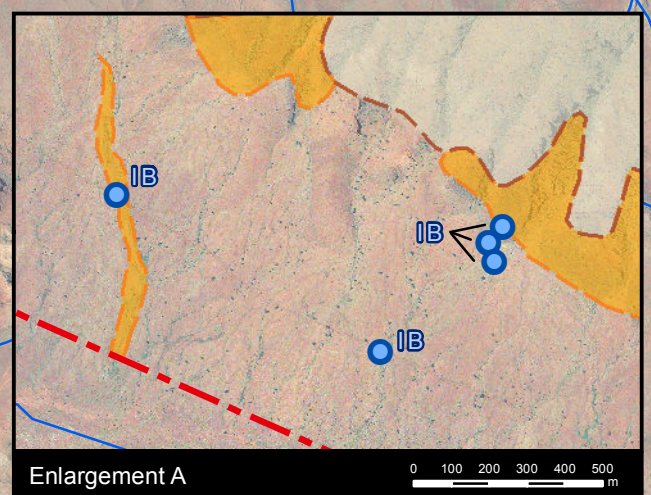
GDA 1994 MGA Zone 50





**Legend**

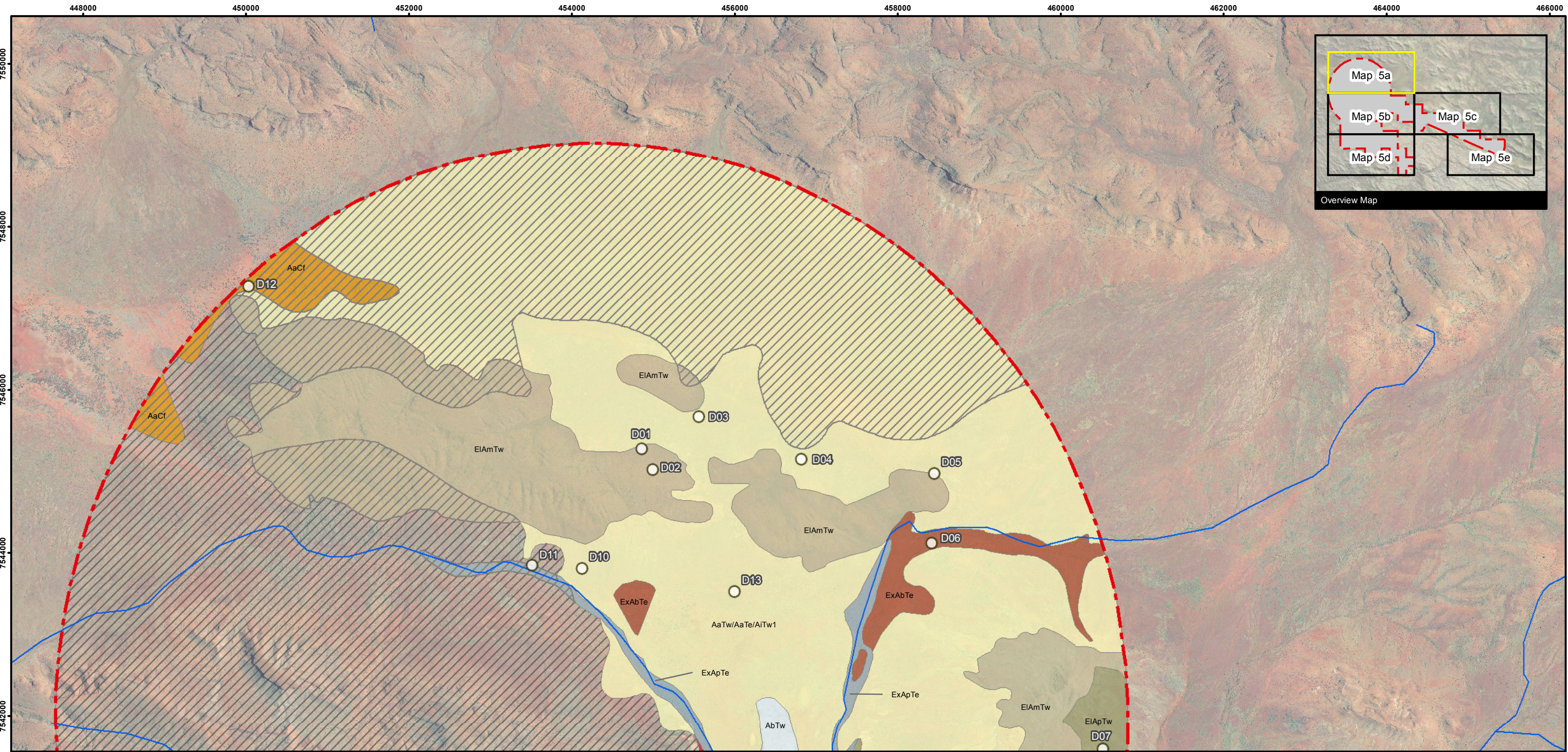
- River; Creek
- Delphine Survey Area
- Introduced Flora
- Species**
- Argemone ochroleuca* Sweet
- Cenchrus ciliaris* L.
- Conservation Significant Flora (CSF)
- Species**
- Indigofera* sp. Bungaroo Creek (S. van Leeuwen 4301) (P3)
- Rhynchosia bungarensis* Maesen (P4)
- Triodia* sp. Robe River (M.E. Trudgen et al. MET 12367) (P3)
- Vegetation Types containing CSF**
- Indigofera* sp. Bungaroo Creek (S. van Leeuwen 4301) (P3)
- Triodia* sp. Robe River (M.E. Trudgen et al. MET 12367) (P3)



GDA 1994 MGA Zone 50

Imagery supplied by FMG



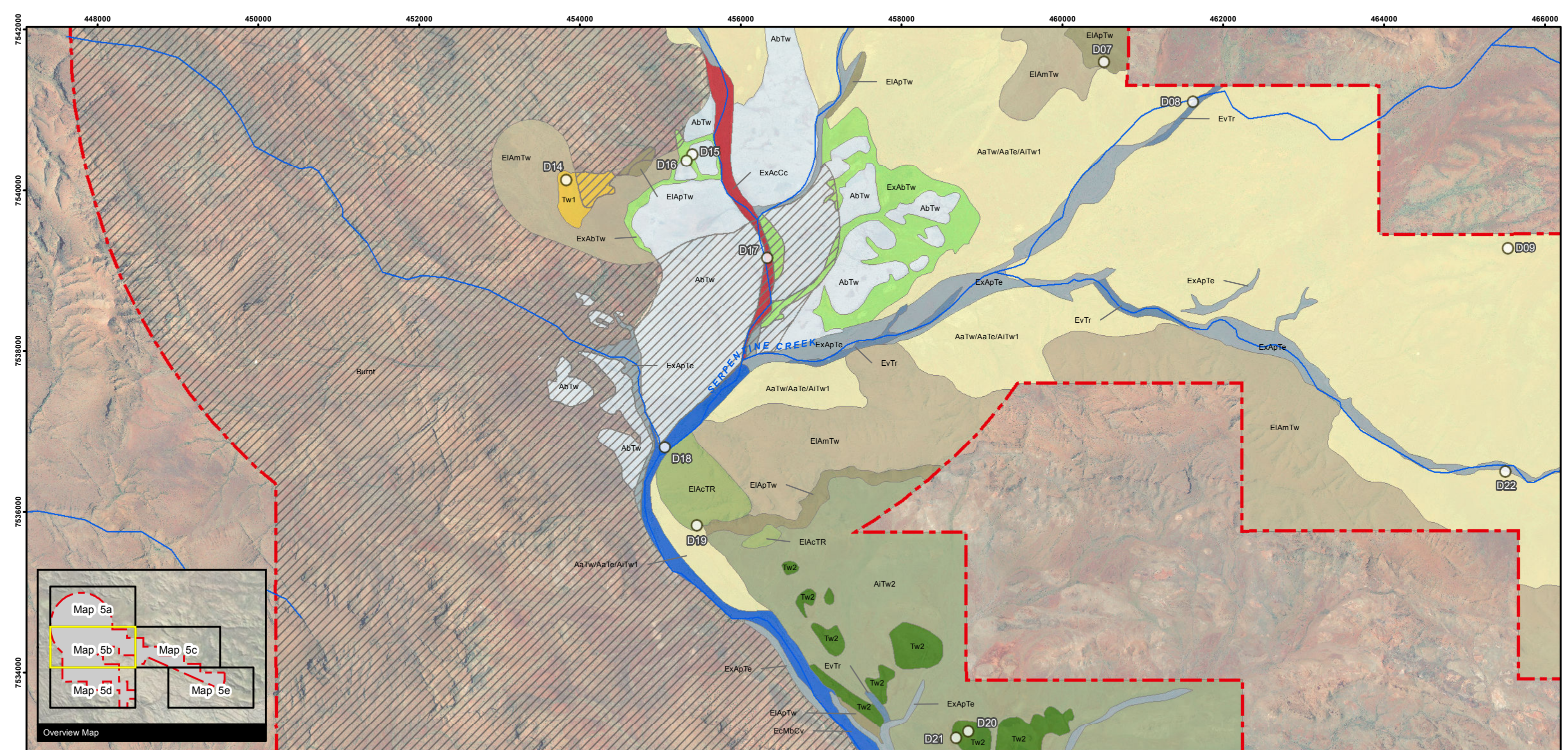


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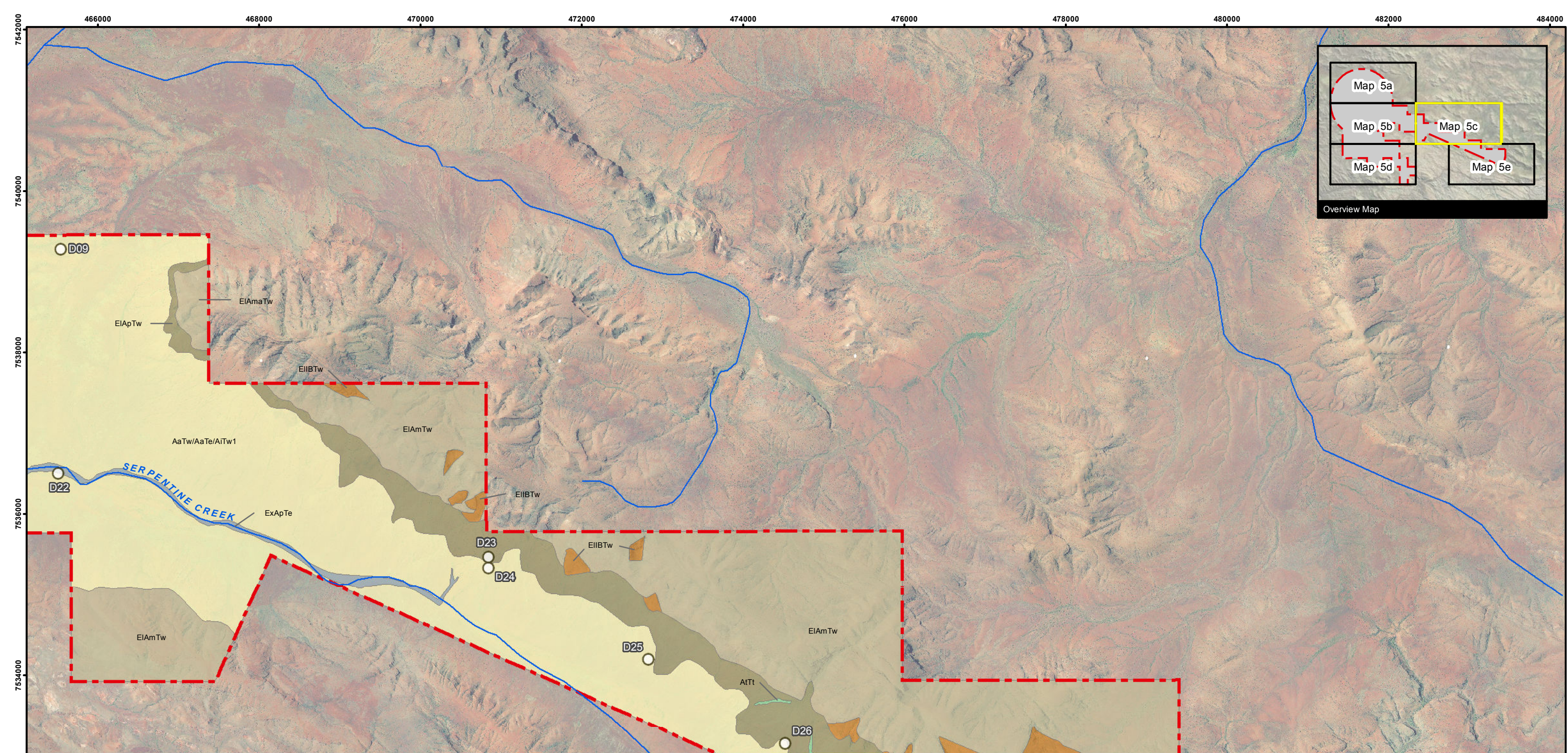
- Relevés
- River, Creek
- Delphine Survey Area

Vegetation Description	Code	Vegetation Description	Code
Mosaic of: 1. <i>Acacia ancistrocarpa</i> , <i>A. atkinsiana</i> and <i>A. tenuissima</i> open shrubland over <i>Triodia wiseana</i> and <i>T. epactia</i> open hummock grassland; 2. <i>Acacia aptaneura</i> , <i>A. atkinsiana</i> and <i>A. ancistrocarpa</i> open shrubland over <i>Triodia epactia</i> , <i>Eremophila forrestii</i> subsp. <i>hastiana</i> and <i>Triodia wiseana</i> open hummock grassland/sparse shrubland; 3. <i>Acacia inaequilatera</i> sparse shrubland over <i>Triodia wiseana</i> open hummock grassland	AaTw/AaTe/AiTw1	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> open woodland over <i>Indigofera</i> sp. Bungaroo Creek (S. van Leeuwen 4301), <i>Stylobasium spathulatum</i> and <i>Eremophila latrobei</i> subsp. <i>glabra</i> open shrubland over <i>Triodia wiseana</i> , <i>Cymbopogon ambiguus</i> and <i>Eriachne mucronata</i> open hummock grassland/sparse tussock grassland	EIIBTw
<i>Acacia aptaneura</i> open woodland over <i>Chrysopogon fallax</i> and <i>Eulalia aurea</i> open tussock grassland with <i>Eremophila longifolia</i> scattered shrubs	AaCf	<i>Eucalyptus victrix</i> open woodland over <i>Tephrosia rosea</i> var. <i>glabrior</i> , <i>Stemodia viscosa</i> and <i>Euphorbia australis</i> sparse shrubland/scattered herbs. Other common species <i>Stemodia grossa</i> and <i>Cymbopogon</i> sp.	EvTr
<i>Acacia bivenosa</i> , <i>Petalostylis labicheoides</i> and <i>A. inaequilatera</i> sparse shrubland over <i>Triodia wiseana</i> open hummock grassland with <i>Eucalyptus xerothermica</i> and <i>Corymbia hamersleyana</i> scattered trees (or mallees)	AbTw	<i>Eucalyptus xerothermica</i> open woodland over <i>Acacia bivenosa</i> and <i>Senna</i> spp. open shrubland over <i>Triodia epactia</i> , <i>Triodia wiseana</i> and <i>Eulalia aurea</i> hummock grassland/sparse tussock grasses	ExAbTe
<i>Acacia citrinoviridis</i> , <i>A. pruinocarpa</i> and <i>A. aptaneura</i> shrubland over <i>Triodia epactia</i> , <i>Paraneurachne muelleri</i> and <i>Ipomoea muelleri</i> sparse hummock grassland/sparse tussock grassland/sparse vineland	AcTe	<i>Eucalyptus xerothermica</i> and <i>Corymbia hamersleyana</i> open woodland over <i>Acacia bivenosa</i> , <i>A. ancistrocarpa</i> and <i>Stylobasium spathulatum</i> shrubland over <i>Triodia wiseana</i> , <i>Triodia epactia</i> and <i>Senna artemisioides</i> subsp. <i>oligophylla</i> open hummock grassland/sparse shrubland	ExAbTw
<i>Acacia inaequilatera</i> , <i>A. bivenosa</i> and <i>A. ancistrocarpa</i> open shrubland over <i>Triodia wiseana</i> and <i>Indigofera monophylla</i> open hummock grassland/sparse shrubland	AiTw2	<i>Eucalyptus xerothermica</i> and <i>E. victrix</i> open forest over <i>Acacia coleii</i> var. <i>coleii</i> , <i>Melaleuca bracteata</i> and <i>Gossypium robinsonii</i> open shrubland with * <i>Cenchrus ciliaris</i> and <i>Cyperus vaginatus</i> scattered tussock grass/scattered sedges	ExAcCc
<i>Acacia tumida</i> var. <i>pilbarensis</i> , <i>Grevillea wickhamii</i> subsp. <i>hispidula</i> and <i>Indigofera</i> sp. Bungaroo Creek shrubland over <i>Themeda triandra</i> , <i>Eriachne tenuiculmis</i> and <i>Triodia wiseana</i> tussock grassland/sparse hummock grassland	AiTt	<i>Eucalyptus xerothermica</i> and <i>Corymbia hamersleyana</i> open woodland over <i>Acacia pyrifolia</i> var. <i>pyrifolia</i> , <i>Gossypium robinsonii</i> and <i>Petalostylis labicheoides</i> open shrubland over <i>Triodia epactia</i> , <i>Paraneurachne muelleri</i> and <i>Eriachne tenuiculmis</i> open hummock grassland/sparse tussock grassland	ExApTe
<i>Eucalyptus camaldulensis</i> subsp. <i>refulgens</i> , <i>E. victrix</i> and <i>Melaleuca argentea</i> woodland over <i>M. bracteata</i> , <i>Acacia citrinoviridis</i> and <i>A. coleii</i> var. <i>coleii</i> open shrubland over <i>Cyperus vaginatus</i> , <i>Stemodia viscosa</i> and <i>S. grossa</i> sparse sedgeland/sparse herbland	EcMbCv	<i>Triodia epactia</i> , <i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i> and <i>Sporobolus australasicus</i> scattered hummock grass/scattered forbs/scattered grass	Te
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and <i>Corymbia hamersleyana</i> open woodland over <i>Acacia citrinoviridis</i> and <i>A. pyrifolia</i> var. <i>pyrifolia</i> sparse shrubland over <i>Triodia</i> sp. Robe River and <i>T. wiseana</i> hummock grassland	EIAcTR	<i>Triodia wiseana</i> and <i>Acacia hilliiana</i> open hummock grassland/sparse shrubland with <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> , <i>Corymbia deserticola</i> subsp. <i>deserticola</i> and <i>C. hamersleyana</i> scattered trees	Tw1
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and <i>Corymbia hamersleyana</i> open woodland over <i>Acacia maitlandii</i> and <i>Dodonaea lanceolata</i> subsp. <i>lanceolata</i> sparse shrubland over <i>Triodia wiseana</i> , <i>Triodia</i> sp. Robe River and <i>Acacia hilliiana</i> hummock grassland/sparse shrubland	EIAMTw	<i>Triodia wiseana</i> sparse hummock grassland with <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> scattered trees and <i>Acacia bivenosa</i> and <i>A. victoriae</i> scattered shrubs	Tw2
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> open woodland over <i>Acacia pachyacra</i> , <i>A. trudgeniana</i> and <i>A. bivenosa</i> open shrubland over <i>Triodia wiseana</i> open hummock grassland	EIApTw	Recently burnt	Burnt

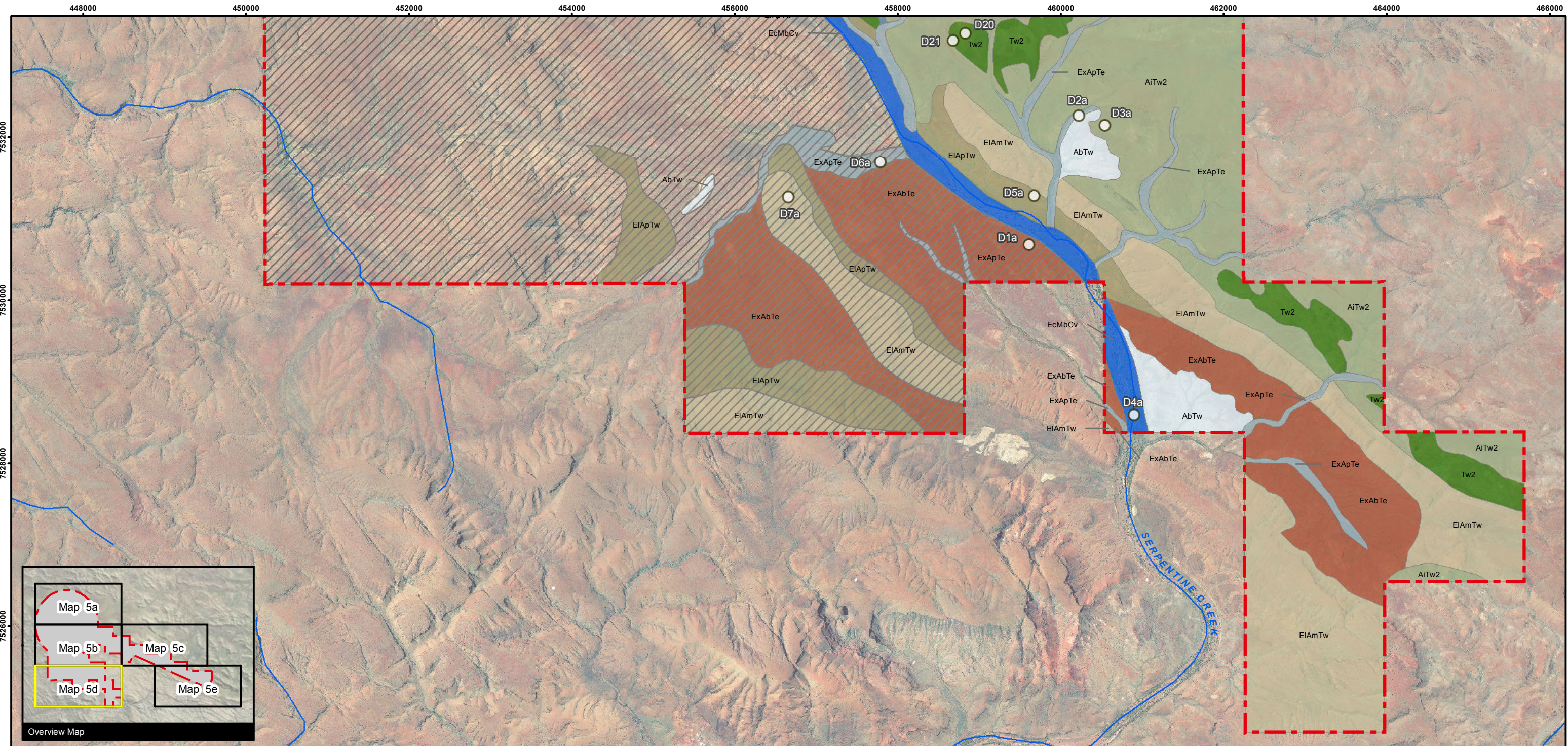
GDA 1994 MGA Zone 50



Legend	
	Releves
	River, Creek
	Delphine Survey Area
Vegetation Description	
	AaTw/AaTe/AiTw1
	AaCf
	AbTw
	AcTe
	AiTw2
	AiTt
	EcMbCv
	EiAcTR
	EiAmTw
	EiApTw
	EiIBTw
	EvTr
	ExAbTe
	ExAbTw
	ExAcCc
	ExApTe
	Te
	Tw1
	Tw2
	Burnt
<p>Mosaic of: 1. <i>Acacia ancistrocarpa</i>, <i>A. atkinsiana</i> and <i>A. tenuissima</i> open shrubland over <i>Triodia wiseana</i> and <i>T. epactia</i> open hummock grassland; 2. <i>Acacia aptaneura</i>, <i>A. atkinsiana</i> and <i>A. ancistrocarpa</i> open shrubland over <i>Triodia epactia</i>, <i>Eremophila forrestii</i> subsp. <i>hastiana</i> and <i>Triodia wiseana</i> open hummock grassland/sparse shrubland; 3. <i>Acacia inaequilatera</i> sparse shrubland over <i>Triodia wiseana</i> open hummock grassland</p> <p><i>Acacia aptaneura</i> open woodland over <i>Chrysopogon fallax</i> and <i>Eulalia aurea</i> open tussock grassland with <i>Eremophila longifolia</i> scattered shrubs</p> <p><i>Acacia bivenosa</i>, <i>Petalostylis labicheoides</i> and <i>A. inaequilatera</i> sparse shrubland over <i>Triodia wiseana</i> open hummock grassland with <i>Eucalyptus xerothermica</i> and <i>Corymbia hamersleyana</i> scattered trees (or mallees)</p> <p><i>Acacia citrinoviridis</i>, <i>A. pruinocarpa</i> and <i>A. aptaneura</i> shrubland over <i>Triodia epactia</i>, <i>Paraneurachne muelleri</i> and <i>Ipomoea muelleri</i> sparse hummock grassland/sparse tussock grassland/sparse vineland</p> <p><i>Acacia inaequilatera</i>, <i>A. bivenosa</i> and <i>A. ancistrocarpa</i> open shrubland over <i>Triodia wiseana</i> and <i>Indigofera monophylla</i> open hummock grassland/sparse shrubland</p> <p><i>Acacia tumida</i> var. <i>pilbarensis</i>, <i>Grevillea wickhamii</i> subsp. <i>hispidula</i> and <i>Indigofera</i> sp. Bungaroo Creek shrubland over <i>Themeda triandra</i>, <i>Eriachne tenuiculmis</i> and <i>Triodia wiseana</i> tussock grassland/sparse hummock grassland</p> <p><i>Eucalyptus camaldulensis</i> subsp. <i>refulgens</i>, <i>E. victrix</i> and <i>Melaleuca argentea</i> woodland over <i>M. bracteata</i>, <i>Acacia citrinoviridis</i> and <i>A. coleii</i> var. <i>coleii</i> open shrubland over <i>Cyperus vaginatus</i>, <i>Stemodia viscosa</i> and <i>S. grossa</i> sparse sedgeland/sparse herbland</p> <p><i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and <i>Corymbia hamersleyana</i> open woodland over <i>Acacia citrinoviridis</i> and <i>A. pyriformis</i> var. <i>pyriformis</i> sparse shrubland over <i>Triodia</i> sp. Robe River and <i>T. wiseana</i> hummock grassland</p> <p><i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and <i>Corymbia hamersleyana</i> open woodland over <i>Acacia maitlandii</i> and <i>Dodonaea lanceolata</i> subsp. <i>lanceolata</i> sparse shrubland over <i>Triodia wiseana</i>, <i>Triodia</i> sp. Robe River and <i>Acacia hilliiana</i> hummock grassland/sparse shrubland</p> <p><i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> open woodland over <i>Acacia pachyacra</i>, <i>A. trudgeniana</i> and <i>A. bivenosa</i> open shrubland over <i>Triodia wiseana</i> open hummock grassland</p> <p><i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> open woodland over <i>Indigofera</i> sp. Bungaroo Creek (S. van Leeuwen 4301), <i>Stylobasium spathulatum</i> and <i>Eremophila latrobei</i> subsp. <i>glabra</i> open shrubland over <i>Triodia wiseana</i>, <i>Cymbopogon ambiguus</i> and <i>Eriachne mucronata</i> open hummock grassland/sparse tussock grassland</p> <p><i>Eucalyptus victrix</i> open woodland over <i>Tephrosia rosea</i> var. <i>glabrior</i>, <i>Stemodia viscosa</i> and <i>Euphorbia australis</i> sparse shrubland/scattered herbs. Other common species <i>Stemodia grossa</i> and <i>Cymbopogon</i> sp.</p> <p><i>Eucalyptus xerothermica</i> open woodland over <i>Acacia bivenosa</i> and <i>Senna</i> spp. open shrubland over <i>Triodia epactia</i>, <i>Triodia wiseana</i> and <i>Eulalia aurea</i> hummock grassland/sparse tussock grasses</p> <p><i>Eucalyptus xerothermica</i> and <i>Corymbia hamersleyana</i> open woodland over <i>Acacia bivenosa</i>, <i>A. ancistrocarpa</i> and <i>Stylobasium spathulatum</i> shrubland over <i>Triodia wiseana</i>, <i>Triodia epactia</i> and <i>Senna artemisioides</i> subsp. <i>oligophylla</i> open hummock grassland/sparse shrubland</p> <p><i>Eucalyptus xerothermica</i> and <i>E. victrix</i> open forest over <i>Acacia coleii</i> var. <i>coleii</i>, <i>Melaleuca bracteata</i> and <i>Gossypium robinsonii</i> open shrubland with <i>Cenchrus ciliaris</i> and <i>Cyperus vaginatus</i> scattered tussock grass/scattered sedges</p> <p><i>Eucalyptus xerothermica</i> and <i>Corymbia hamersleyana</i> open woodland over <i>Acacia pyriformis</i> var. <i>pyriformis</i>, <i>Gossypium robinsonii</i> and <i>Petalostylis labicheoides</i> open shrubland over <i>Triodia epactia</i>, <i>Paraneurachne muelleri</i> and <i>Eriachne tenuiculmis</i> open hummock grassland/sparse tussock grassland</p> <p><i>Triodia epactia</i>, <i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i> and <i>Sporobolus australasicus</i> scattered hummock grass/scattered forbs/scattered grass</p> <p><i>Triodia wiseana</i> and <i>Acacia hilliiana</i> open hummock grassland/sparse shrubland with <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>, <i>Corymbia deserticola</i> subsp. <i>deserticola</i> and <i>C. hamersleyana</i> scattered trees</p> <p><i>Triodia wiseana</i> sparse hummock grassland with <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> scattered trees and <i>Acacia bivenosa</i> and <i>A. victoriae</i> scattered shrubs</p> <p>Recently burnt</p>	



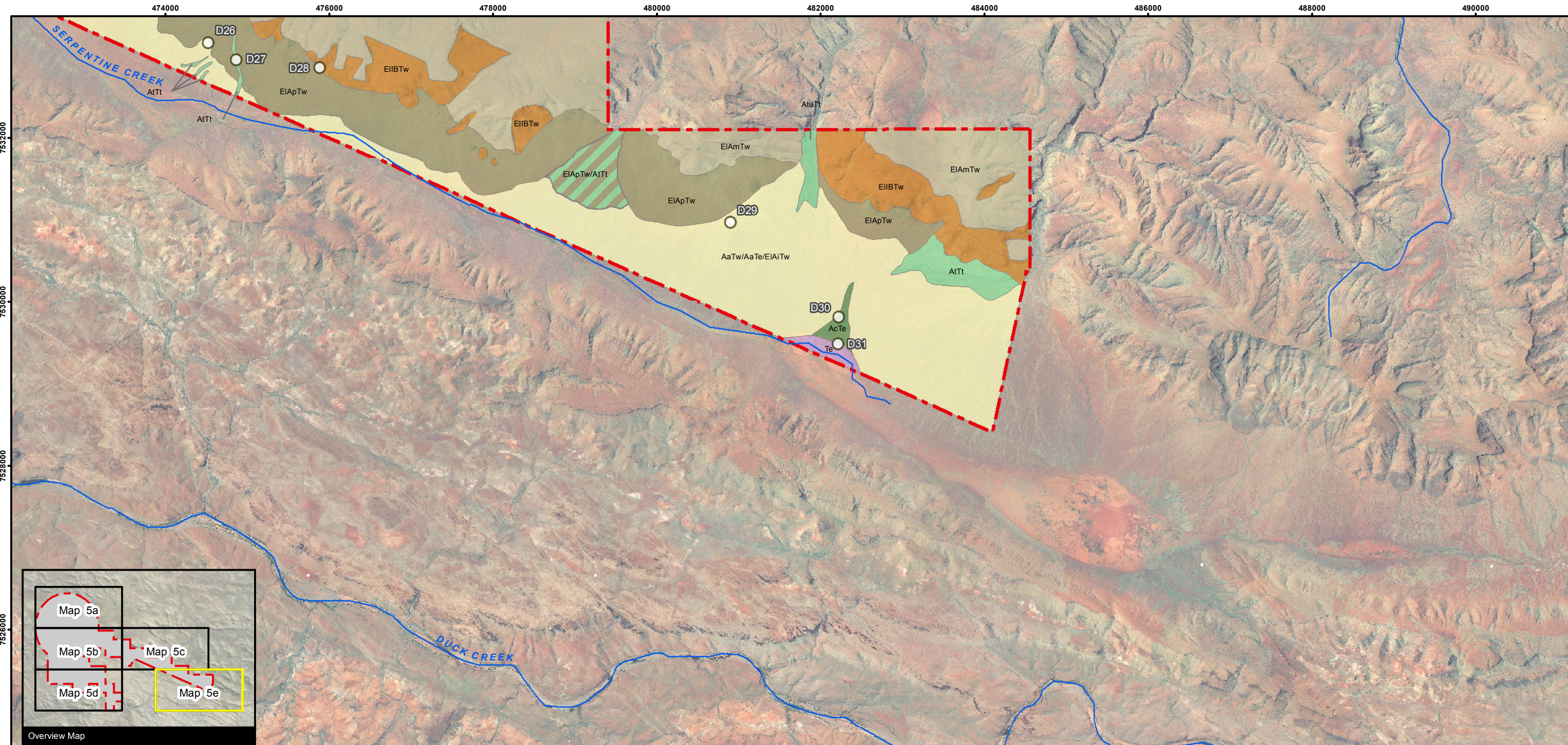
Legend	
	Relevés
	River, Creek
	Delphine Survey Area
Vegetation Description	
	AaTw/AaTe/AiTw1
	AaCf
	AbTw
	AcTe
	AiTw2
	AiTt
	EcMbCv
	EIAcTR
	EIAmTw
	EIApTw
	EIIBTw
	EvTr
	ExAbTe
	ExAbTw
	ExAcCc
	ExApTe
	Te
	Tw1
	Tw2
	Burnt
<p>Mosaic of: 1. <i>Acacia ancistrocarpa</i>, <i>A. atkinsiana</i> and <i>A. tenuissima</i> open shrubland over <i>Triodia wiseana</i> and <i>T. epactia</i> open hummock grassland; 2. <i>Acacia aptaneura</i>, <i>A. atkinsiana</i> and <i>A. ancistrocarpa</i> open shrubland over <i>Triodia epactia</i>, <i>Eremophila forrestii</i> subsp. <i>hastiana</i> and <i>Triodia wiseana</i> open hummock grassland/sparse shrubland; 3. <i>Acacia inaequilatera</i> sparse shrubland over <i>Triodia wiseana</i> open hummock grassland</p> <p><i>Acacia aptaneura</i> open woodland over <i>Chrysopogon fallax</i> and <i>Eulalia aurea</i> open tussock grassland with <i>Eremophila longifolia</i> scattered shrubs</p> <p><i>Acacia bivenosa</i>, <i>Petalostyllis labicheoides</i> and <i>A. inaequilatera</i> sparse shrubland over <i>Triodia wiseana</i> open hummock grassland with <i>Eucalyptus xerothermica</i> and <i>Corymbia hamersleyana</i> scattered trees (or mallees)</p> <p><i>Acacia citrinoviridis</i>, <i>A. pruinocarpa</i> and <i>A. aptaneura</i> shrubland over <i>Triodia epactia</i>, <i>Paraneurachne muelleri</i> and <i>Ipomoea muelleri</i> sparse hummock grassland/sparse tussock grassland/sparse vineland</p> <p><i>Acacia inaequilatera</i>, <i>A. bivenosa</i> and <i>A. ancistrocarpa</i> open shrubland over <i>Triodia wiseana</i> and <i>Indigofera monophylla</i> open hummock grassland/sparse shrubland</p> <p><i>Acacia tumida</i> var. <i>pilbarensis</i>, <i>Grevillea wickhamii</i> subsp. <i>hispidula</i> and <i>Indigofera</i> sp. Bungaroo Creek shrubland over <i>Themeda triandra</i>, <i>Eriachne tenuiculmis</i> and <i>Triodia wiseana</i> tussock grassland/sparse hummock grassland</p> <p><i>Eucalyptus camaldulensis</i> subsp. <i>refulgens</i>, <i>E. victrix</i> and <i>Melaleuca argentea</i> woodland over <i>M. bracteata</i>, <i>Acacia citrinoviridis</i> and <i>A. colei</i> var. <i>colei</i> open shrubland over <i>Cyperus vaginatus</i>, <i>Stemodia viscosa</i> and <i>S. grossa</i> sparse sedgeland/sparse herbland</p> <p><i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and <i>Corymbia hamersleyana</i> open woodland over <i>Acacia citrinoviridis</i> and <i>A. pyriformis</i> var. <i>pyriformis</i> sparse shrubland over <i>Triodia</i> sp. Robe River and <i>T. wiseana</i> hummock grassland</p> <p><i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and <i>Corymbia hamersleyana</i> open woodland over <i>Acacia maitlandii</i> and <i>Dodonaea lanceolata</i> subsp. <i>lanceolata</i> sparse shrubland over <i>Triodia wiseana</i>, <i>Triodia</i> sp. Robe River and <i>Acacia hilliiana</i> hummock grassland/sparse shrubland</p> <p><i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> open woodland over <i>Acacia pachyacra</i>, <i>A. trudgeniana</i> and <i>A. bivenosa</i> open shrubland over <i>Triodia wiseana</i> open hummock grassland</p> <p><i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> open woodland over <i>Indigofera</i> sp. Bungaroo Creek (S. van Leeuwen 4301), <i>Stylobasium spathulatum</i> and <i>Eremophila latrobei</i> subsp. <i>glabra</i> open shrubland over <i>Triodia wiseana</i>, <i>Cymbopogon ambiguus</i> and <i>Eriachne mucronata</i> open hummock grassland/sparse tussock grassland</p> <p><i>Eucalyptus victrix</i> open woodland over <i>Tephrosia rosea</i> var. <i>glabrior</i>, <i>Stemodia viscosa</i> and <i>Euphorbia australis</i> sparse shrubland/scattered herbs. Other common species <i>Stemodia grossa</i> and <i>Cymbopogon</i> sp.</p> <p><i>Eucalyptus xerothermica</i> open woodland over <i>Acacia bivenosa</i> and <i>Senna</i> spp. open shrubland over <i>Triodia epactia</i>, <i>Triodia wiseana</i> and <i>Eulalia aurea</i> hummock grassland/sparse tussock grasses</p> <p><i>Eucalyptus xerothermica</i> and <i>Corymbia hamersleyana</i> open woodland over <i>Acacia bivenosa</i>, <i>A. ancistrocarpa</i> and <i>Stylobasium spathulatum</i> shrubland over <i>Triodia wiseana</i>, <i>Triodia epactia</i> and <i>Senna artemisioides</i> subsp. <i>oligophylla</i> open hummock grassland/sparse shrubland</p> <p><i>Eucalyptus xerothermica</i> and <i>E. victrix</i> open forest over <i>Acacia colei</i> var. <i>colei</i>, <i>Melaleuca bracteata</i> and <i>Gossypium robinsonii</i> open shrubland with <i>Cenchrus ciliaris</i> and <i>Cyperus vaginatus</i> scattered tussock grass/scattered sedges</p> <p><i>Eucalyptus xerothermica</i> and <i>Corymbia hamersleyana</i> open woodland over <i>Acacia pyriformis</i> var. <i>pyriformis</i>, <i>Gossypium robinsonii</i> and <i>Petalostyllis labicheoides</i> open shrubland over <i>Triodia epactia</i>, <i>Paraneurachne muelleri</i> and <i>Eriachne tenuiculmis</i> open hummock grassland/sparse tussock grassland</p> <p><i>Triodia epactia</i>, <i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i> and <i>Sporobolus australasicus</i> scattered hummock grass/scattered forbs/scattered grass</p> <p><i>Triodia wiseana</i> and <i>Acacia hilliiana</i> open hummock grassland/sparse shrubland with <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>, <i>Corymbia deserticola</i> subsp. <i>deserticola</i> and <i>C. hamersleyana</i> scattered trees</p> <p><i>Triodia wiseana</i> sparse hummock grassland with <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> scattered trees and <i>Acacia bivenosa</i> and <i>A. victoriae</i> scattered shrubs</p> <p>Recently burnt</p>	



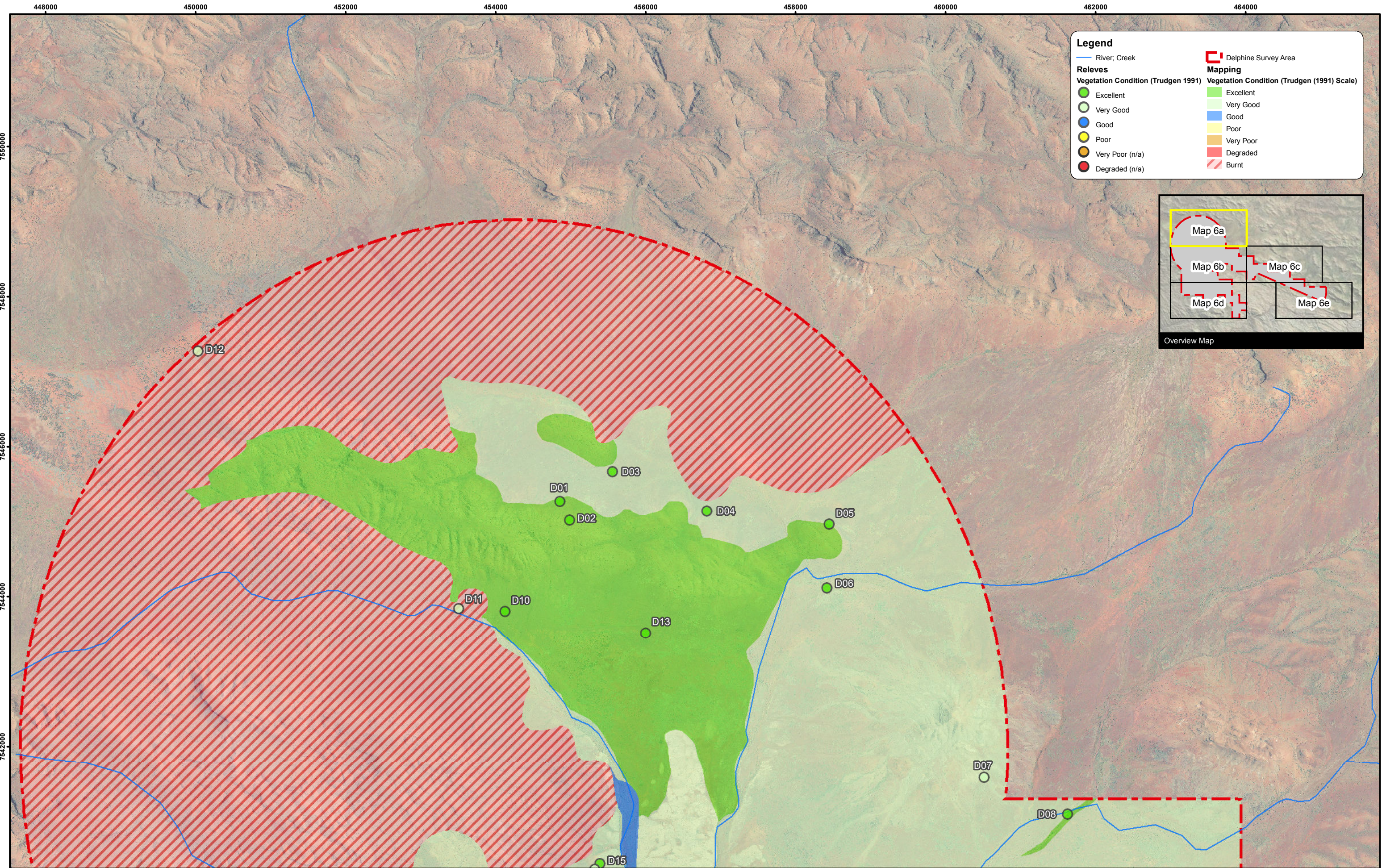
**Legend**

○ Releves  
 — River, Creek  
 □ Delphine Survey Area

Vegetation Description	Code	Description
Mosaic of: 1. <i>Acacia ancistrocarpa</i> , <i>A. atkinsiana</i> and <i>A. tenuissima</i> open shrubland over <i>Triodia wiseana</i> and <i>T. epactia</i> open hummock grassland; 2. <i>Acacia aptaneura</i> , <i>A. atkinsiana</i> and <i>A. ancistrocarpa</i> open shrubland over <i>Triodia epactia</i> , <i>Eremophila forrestii</i> subsp. <i>hastiana</i> and <i>Triodia wiseana</i> open hummock grassland/sparse shrubland; 3. <i>Acacia inaequilatera</i> sparse shrubland over <i>Triodia wiseana</i> open hummock grassland	AaTw/AaTe/AiTw1	
<i>Acacia aptaneura</i> open woodland over <i>Chrysopogon fallax</i> and <i>Eulalia aurea</i> open tussock grassland with <i>Eremophila longifolia</i> scattered shrubs	AaCf	
<i>Acacia bivenosa</i> , <i>Petalostylis labicheoides</i> and <i>A. inaequilatera</i> sparse shrubland over <i>Triodia wiseana</i> open hummock grassland with <i>Eucalyptus xerothermica</i> and <i>Corymbia hamersleyana</i> scattered trees (or mallees)	AbTw	
<i>Acacia citrinoviridis</i> , <i>A. pruinocarpa</i> and <i>A. aptaneura</i> shrubland over <i>Triodia epactia</i> , <i>Paraneurachne muelleri</i> and <i>Ipomoea muelleri</i> sparse hummock grassland/sparse tussock grassland/sparse vineland	AcTe	
<i>Acacia inaequilatera</i> , <i>A. bivenosa</i> and <i>A. ancistrocarpa</i> open shrubland over <i>Triodia wiseana</i> and <i>Indigofera monophylla</i> open hummock grassland/sparse shrubland	AiTw2	
<i>Acacia tumida</i> var. <i>pilbarensis</i> , <i>Grevillea wickhamii</i> subsp. <i>hispidula</i> and <i>Indigofera</i> sp. Bungaroo Creek shrubland over <i>Themeda triandra</i> , <i>Eriachne tenuiculmis</i> and <i>Triodia wiseana</i> tussock grassland/sparse hummock grassland	AITt	
<i>Eucalyptus camaldulensis</i> subsp. <i>refulgens</i> , <i>E. victrix</i> and <i>Melaleuca argentea</i> woodland over <i>M. bracteata</i> , <i>Acacia citrinoviridis</i> and <i>A. colei</i> var. <i>colei</i> open shrubland over <i>Cyperus vaginatus</i> , <i>Stemodia viscosa</i> and <i>S. grossa</i> sparse sedgeland/sparse herbland	EcMbCv	
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and <i>Corymbia hamersleyana</i> open woodland over <i>Acacia citrinoviridis</i> and <i>A. pyrifolia</i> var. <i>pyrifolia</i> sparse shrubland over <i>Triodia</i> sp. Robe River and <i>T. wiseana</i> hummock grassland	EIAcTR	
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and <i>Corymbia hamersleyana</i> open woodland over <i>Acacia maitlandii</i> and <i>Dodonaea lanceolata</i> subsp. <i>lanceolata</i> sparse shrubland over <i>Triodia wiseana</i> , <i>Triodia</i> sp. Robe River and <i>Acacia hilliiana</i> hummock grassland/sparse shrubland	EIAmTw	
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> open woodland over <i>Acacia pachyacra</i> , <i>A. trudgeniana</i> and <i>A. bivenosa</i> open shrubland over <i>Triodia wiseana</i> open hummock grassland	EIApTw	
	EIIBTW	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> open woodland over <i>Indigofera</i> sp. Bungaroo Creek (S. van Leeuwen 4301), <i>Stylobasium spathulatum</i> and <i>Eremophila latrobei</i> subsp. <i>glabra</i> open shrubland over <i>Triodia wiseana</i> , <i>Cymbopogon ambiguus</i> and <i>Eriachne mucronata</i> open hummock grassland/sparse tussock grassland
	EVTr	<i>Eucalyptus victrix</i> open woodland over <i>Tephrosia rosea</i> var. <i>glabrior</i> , <i>Stemodia viscosa</i> and <i>Euphorbia australis</i> sparse shrubland/scattered herbs. Other common species <i>Stemodia grossa</i> and <i>Cymbopogon</i> sp.
	ExAbTe	<i>Eucalyptus xerothermica</i> open woodland over <i>Acacia bivenosa</i> and <i>Senna</i> spp. open shrubland over <i>Triodia epactia</i> , <i>Triodia wiseana</i> and <i>Eulalia aurea</i> hummock grassland/sparse tussock grasses
	ExAbTw	<i>Eucalyptus xerothermica</i> and <i>Corymbia hamersleyana</i> open woodland over <i>Acacia bivenosa</i> , <i>A. ancistrocarpa</i> and <i>Stylobasium spathulatum</i> shrubland over <i>Triodia wiseana</i> , <i>Triodia epactia</i> and <i>Senna artemisioides</i> subsp. <i>oligophylla</i> open hummock grassland/sparse shrubland
	ExAcCc	<i>Eucalyptus xerothermica</i> and <i>E. victrix</i> open forest over <i>Acacia colei</i> var. <i>colei</i> , <i>Melaleuca bracteata</i> and <i>Gossypium robinsonii</i> open shrubland with <i>Cenchrus ciliaris</i> and <i>Cyperus vaginatus</i> scattered tussock grass/scattered sedges
	ExApTe	<i>Eucalyptus xerothermica</i> and <i>Corymbia hamersleyana</i> open woodland over <i>Acacia pyrifolia</i> var. <i>pyrifolia</i> , <i>Gossypium robinsonii</i> and <i>Petalostylis labicheoides</i> open shrubland over <i>Triodia epactia</i> , <i>Paraneurachne muelleri</i> and <i>Eriachne tenuiculmis</i> open hummock grassland/sparse tussock grassland
	Te	<i>Triodia epactia</i> , <i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i> and <i>Sporobolus australasicus</i> scattered hummock grass/scattered forbs/scattered grass
	Tw1	<i>Triodia wiseana</i> and <i>Acacia hilliiana</i> open hummock grassland/sparse shrubland with <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> , <i>Corymbia deserticola</i> subsp. <i>deserticola</i> and <i>C. hamersleyana</i> scattered trees
	Tw2	<i>Triodia wiseana</i> sparse hummock grassland with <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> scattered trees and <i>Acacia bivenosa</i> and <i>A. victoriae</i> scattered shrubs
	Burnt	Recently burnt



Legend		
	Relevés	
	River, Creek	
	Delphine Survey Area	
Vegetation Description		
	AaTw/AaTe/AITw1	Mosaic of: 1. <i>Acacia ancistrocarpa</i> , <i>A. atkinsiana</i> and <i>A. tenuissima</i> open shrubland over <i>Triodia wiseana</i> and <i>T. epactia</i> open hummock grassland; 2. <i>Acacia aptaneura</i> , <i>A. atkinsiana</i> and <i>A. ancistrocarpa</i> open shrubland over <i>Triodia epactia</i> , <i>Eremophila forrestii</i> subsp. <i>hastiana</i> and <i>Triodia wiseana</i> open hummock grassland/sparse shrubland; 3. <i>Acacia inaequilatera</i> sparse shrubland over <i>Triodia wiseana</i> open hummock grassland
	AaCf	<i>Acacia aptaneura</i> open woodland over <i>Chrysopogon fallax</i> and <i>Eulalia aurea</i> open tussock grassland with <i>Eremophila longifolia</i> scattered shrubs
	AbTw	<i>Acacia bivenosa</i> , <i>Petalostylis labicheoides</i> and <i>A. inaequilatera</i> sparse shrubland over <i>Triodia wiseana</i> open hummock grassland with <i>Eucalyptus xerothermica</i> and <i>Corymbia hamersleyana</i> scattered trees (or mallees)
	AcTe	<i>Acacia citrinoviridis</i> , <i>A. pruinocarpa</i> and <i>A. aptaneura</i> shrubland over <i>Triodia epactia</i> , <i>Paraneurachne muelleri</i> and <i>Ipomoea muelleri</i> sparse hummock grassland/sparse tussock grassland/sparse vineland
	AITw2	<i>Acacia inaequilatera</i> , <i>A. bivenosa</i> and <i>A. ancistrocarpa</i> open shrubland over <i>Triodia wiseana</i> and <i>Indigofera monophylla</i> open hummock grassland/sparse shrubland
	AITt	<i>Acacia tumida</i> var. <i>pilbarensis</i> , <i>Grevillea wickhamii</i> subsp. <i>hispidula</i> and <i>Indigofera</i> sp. Bungaroo Creek shrubland over <i>Themeda triandra</i> , <i>Eriachne tenuiculmis</i> and <i>Triodia wiseana</i> tussock grassland/sparse hummock grassland
	EcMbCv	<i>Eucalyptus camaldulensis</i> subsp. <i>refulgens</i> , <i>E. victrix</i> and <i>Melaleuca argentea</i> woodland over <i>M. bracteata</i> , <i>Acacia citrinoviridis</i> and <i>A. coleii</i> var. <i>coleii</i> open shrubland over <i>Cyperus vaginatus</i> , <i>Stemodia viscosa</i> and <i>S. grossa</i> sparse sedgeland/sparse herbland
	EIAcTR	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and <i>Corymbia hamersleyana</i> open woodland over <i>Acacia citrinoviridis</i> and <i>A. pyriformis</i> var. <i>pyriformis</i> sparse shrubland over <i>Triodia</i> sp. Robe River and <i>T. wiseana</i> hummock grassland
	EIAmTw	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and <i>Corymbia hamersleyana</i> open woodland over <i>Acacia maitlandii</i> and <i>Dodonaea lanceolata</i> subsp. <i>lanceolata</i> sparse shrubland over <i>Triodia wiseana</i> , <i>Triodia</i> sp. Robe River and <i>Acacia hilliana</i> hummock grassland/sparse shrubland
	EIApTw	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> open woodland over <i>Acacia pachyacra</i> , <i>A. trudgeniana</i> and <i>A. bivenosa</i> open shrubland over <i>Triodia wiseana</i> open hummock grassland
	EIIBTw	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> open woodland over <i>Indigofera</i> sp. Bungaroo Creek (S. van Leeuwen 4301), <i>Stylobasium spathulatum</i> and <i>Eremophila latrobei</i> subsp. <i>glabra</i> open shrubland over <i>Triodia wiseana</i> , <i>Cymbopogon ambiguus</i> and <i>Eriachne mucronata</i> open hummock grassland/sparse tussock grassland
	EvTr	<i>Eucalyptus victrix</i> open woodland over <i>Tephrosia rosea</i> var. <i>glabrior</i> , <i>Stemodia viscosa</i> and <i>Euphorbia australis</i> sparse shrubland/scattered herbs. Other common species <i>Stemodia grossa</i> and <i>Cymbopogon</i> sp.
	ExAbTe	<i>Eucalyptus xerothermica</i> open woodland over <i>Acacia bivenosa</i> and <i>Senna</i> spp. open shrubland over <i>Triodia epactia</i> , <i>Triodia wiseana</i> and <i>Eulalia aurea</i> hummock grassland/sparse tussock grasses
	ExAbTw	<i>Eucalyptus xerothermica</i> and <i>Corymbia hamersleyana</i> open woodland over <i>Acacia bivenosa</i> , <i>A. ancistrocarpa</i> and <i>Stylobasium spathulatum</i> shrubland over <i>Triodia wiseana</i> , <i>Triodia epactia</i> and <i>Senna artemisioides</i> subsp. <i>oligophylla</i> open hummock grassland/sparse shrubland
	ExAcCc	<i>Eucalyptus xerothermica</i> and <i>E. victrix</i> open forest over <i>Acacia coleii</i> var. <i>coleii</i> , <i>Melaleuca bracteata</i> and <i>Gossypium robinsonii</i> open shrubland with <i>Cenchrus ciliaris</i> and <i>Cyperus vaginatus</i> scattered tussock grass/scattered sedges
	ExApTe	<i>Eucalyptus xerothermica</i> and <i>Corymbia hamersleyana</i> open woodland over <i>Acacia pyriformis</i> var. <i>pyriformis</i> , <i>Gossypium robinsonii</i> and <i>Petalostylis labicheoides</i> open shrubland over <i>Triodia epactia</i> , <i>Paraneurachne muelleri</i> and <i>Eriachne tenuiculmis</i> open hummock grassland/sparse tussock grassland
	Te	<i>Triodia epactia</i> , <i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i> and <i>Sporobolus australasicus</i> scattered hummock grass/scattered forbs/scattered grass
	Tw1	<i>Triodia wiseana</i> and <i>Acacia hilliana</i> open hummock grassland/sparse shrubland with <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> , <i>Corymbia deserticola</i> subsp. <i>deserticola</i> and <i>C. hamersleyana</i> scattered trees
	Tw2	<i>Triodia wiseana</i> sparse hummock grassland with <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> scattered trees and <i>Acacia bivenosa</i> and <i>A. victoriae</i> scattered shrubs
	Burnt	Recently burnt



**Legend**

— River, Creek

**Releves**

● Excellent  
○ Very Good  
● Good  
● Poor  
● Very Poor (n/a)  
● Degraded (n/a)

**Mapping**

■ Delphine Survey Area

**Vegetation Condition (Trudgen 1991)**

■ Excellent  
■ Very Good  
■ Good  
■ Poor  
■ Very Poor  
■ Degraded  
■ Burnt

**Overview Map**

Map 6a  
Map 6b  
Map 6c  
Map 6d  
Map 6e

**Map 6a**

Western Hub Flora and Fauna Surveys  
**Vegetation Condition**

Aug 2011

prepared for FORTESCUE METALS GROUP

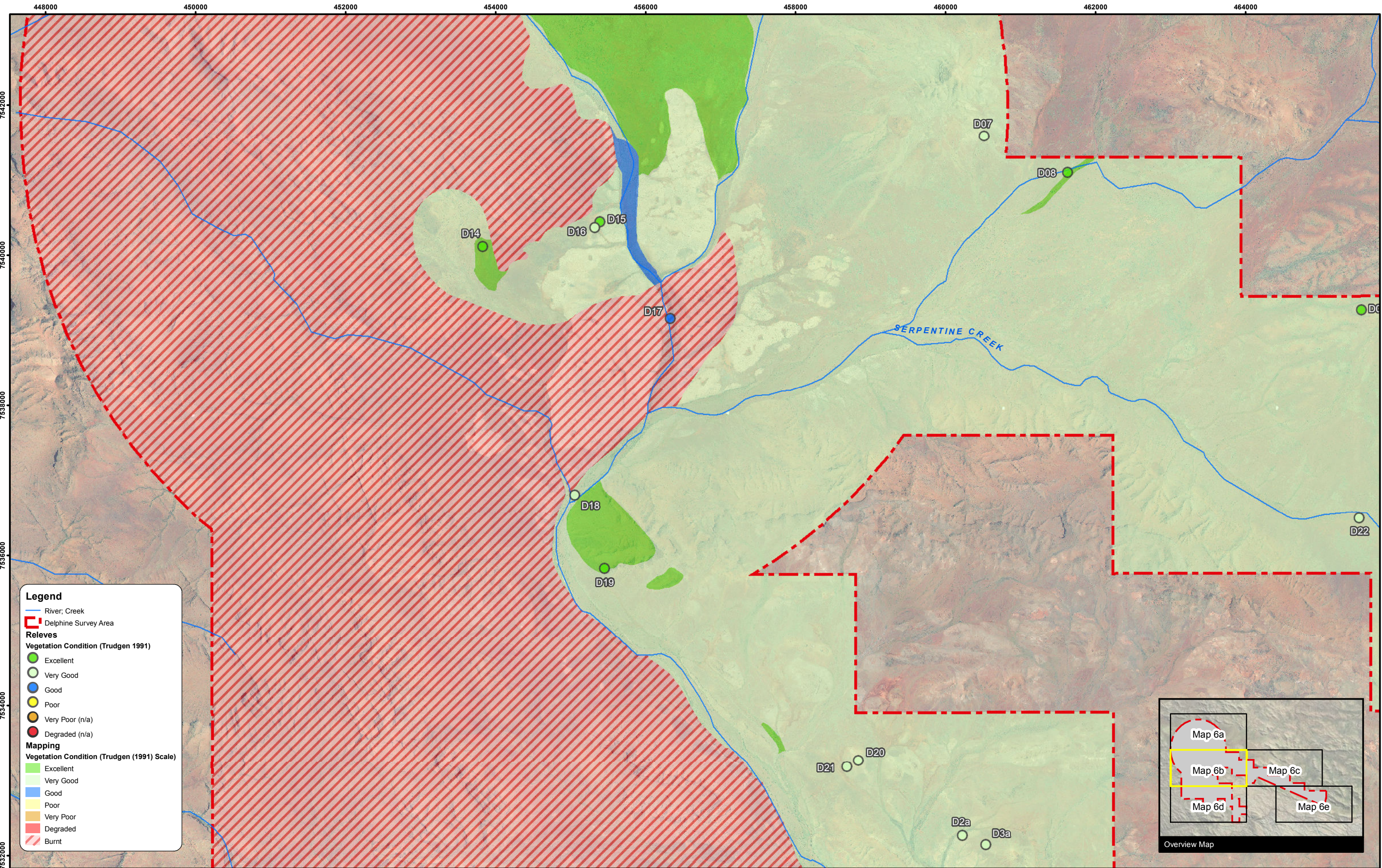
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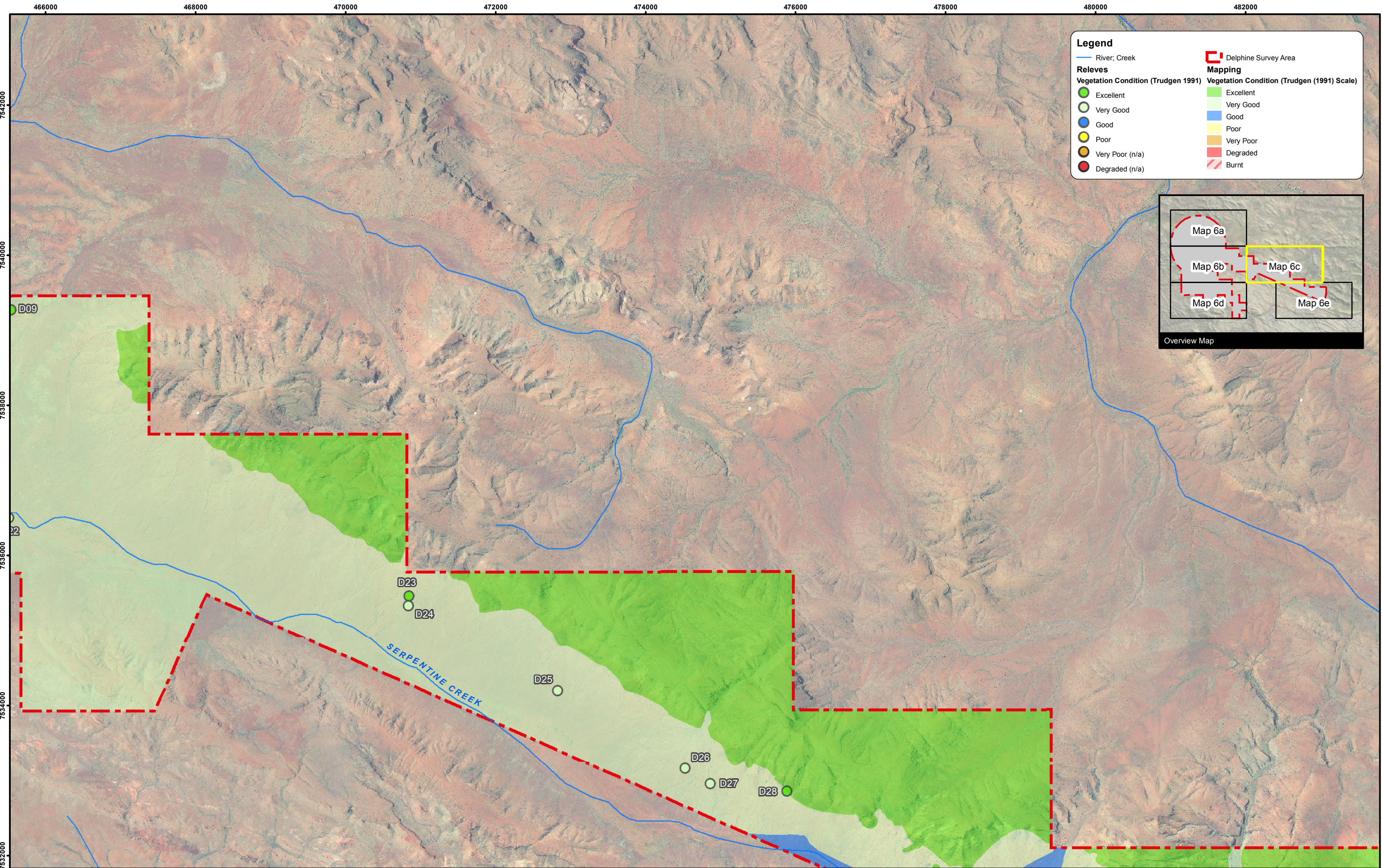
Imagery supplied by FMG



GDA 1994 MGA Zone 50







**Legend**

— River, Creek

**Releves**

- Excellent
- Very Good
- Good
- Poor
- Very Poor (n/a)
- Degraded (n/a)

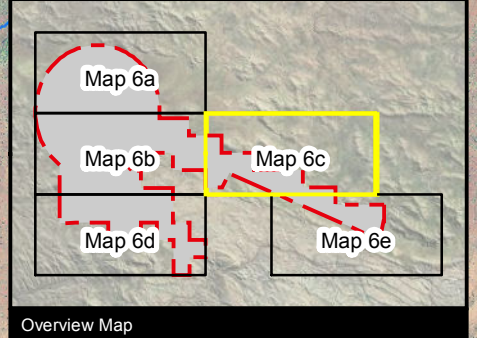
**Mapping**

**Vegetation Condition (Trudgen 1991)**

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

**Vegetation Condition (Trudgen (1991) Scale)**

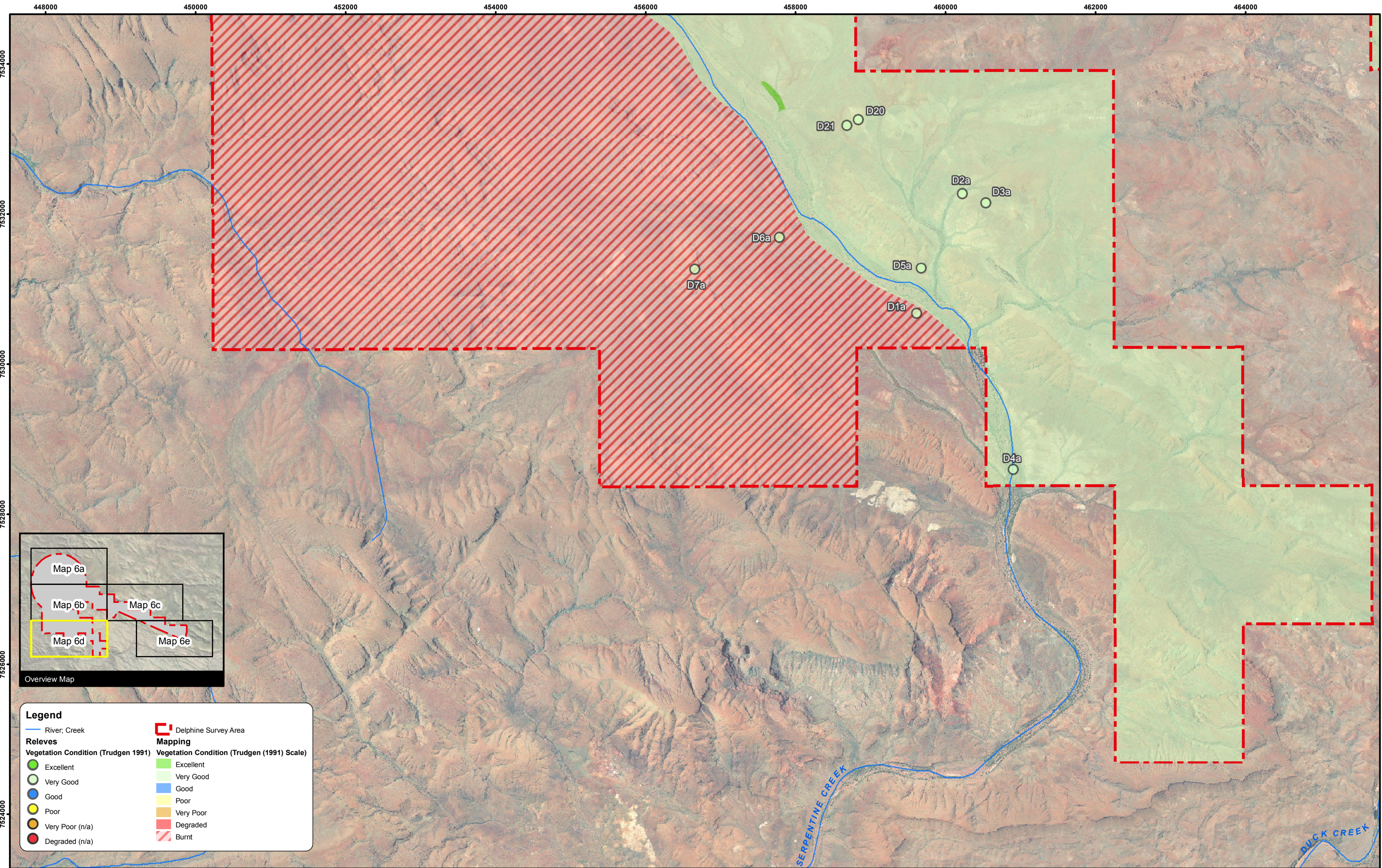
- Excellent
- Very Good
- Good
- Poor
- Very Poor
- Degraded
- Burnt



Imagery supplied by FMG



GDA 1994 MGA Zone 50



**Legend**

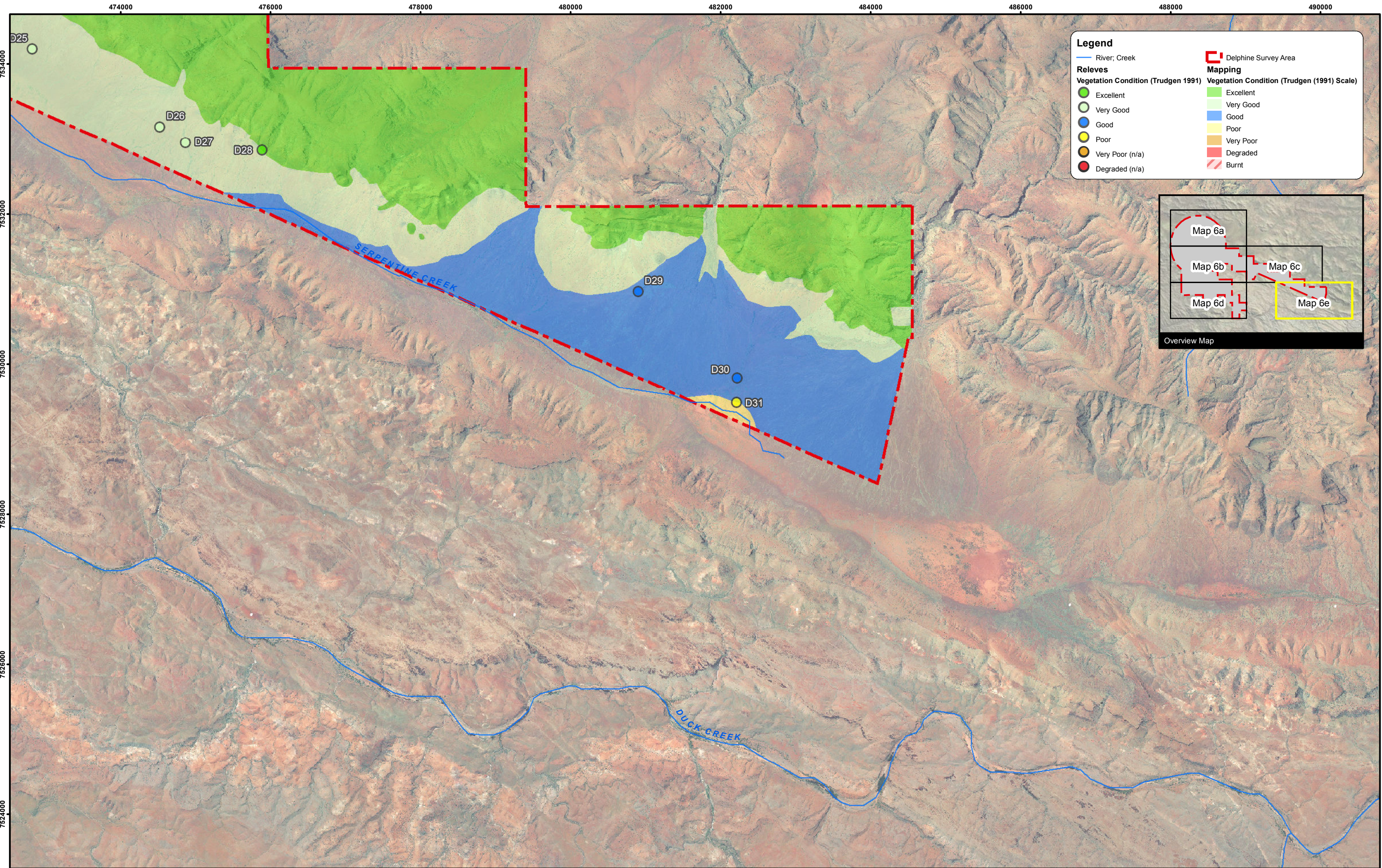
— River, Creek

**Releves**

Vegetation Condition (Trudgen 1991)	Vegetation Condition (Trudgen (1991) Scale)
● Excellent	● Excellent
○ Very Good	○ Very Good
○ Good	○ Good
○ Poor	○ Very Poor
○ Very Poor (n/a)	○ Degraded
○ Degraded (n/a)	○ Burnt

■ Delphine Survey Area

GDA 1994 MGA Zone 50



**Legend**

— River, Creek

**Releves**

- Excellent
- Very Good
- Good
- Poor
- Very Poor (n/a)
- Degraded (n/a)

**Mapping**

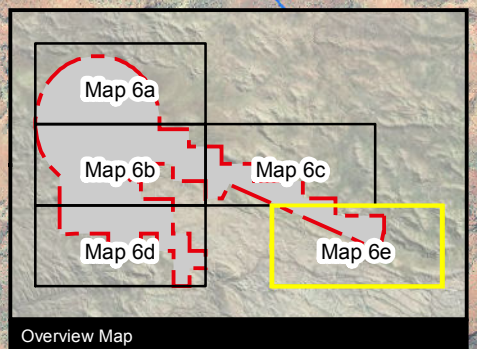
■ Delphine Survey Area

**Vegetation Condition (Trudgen 1991)**

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

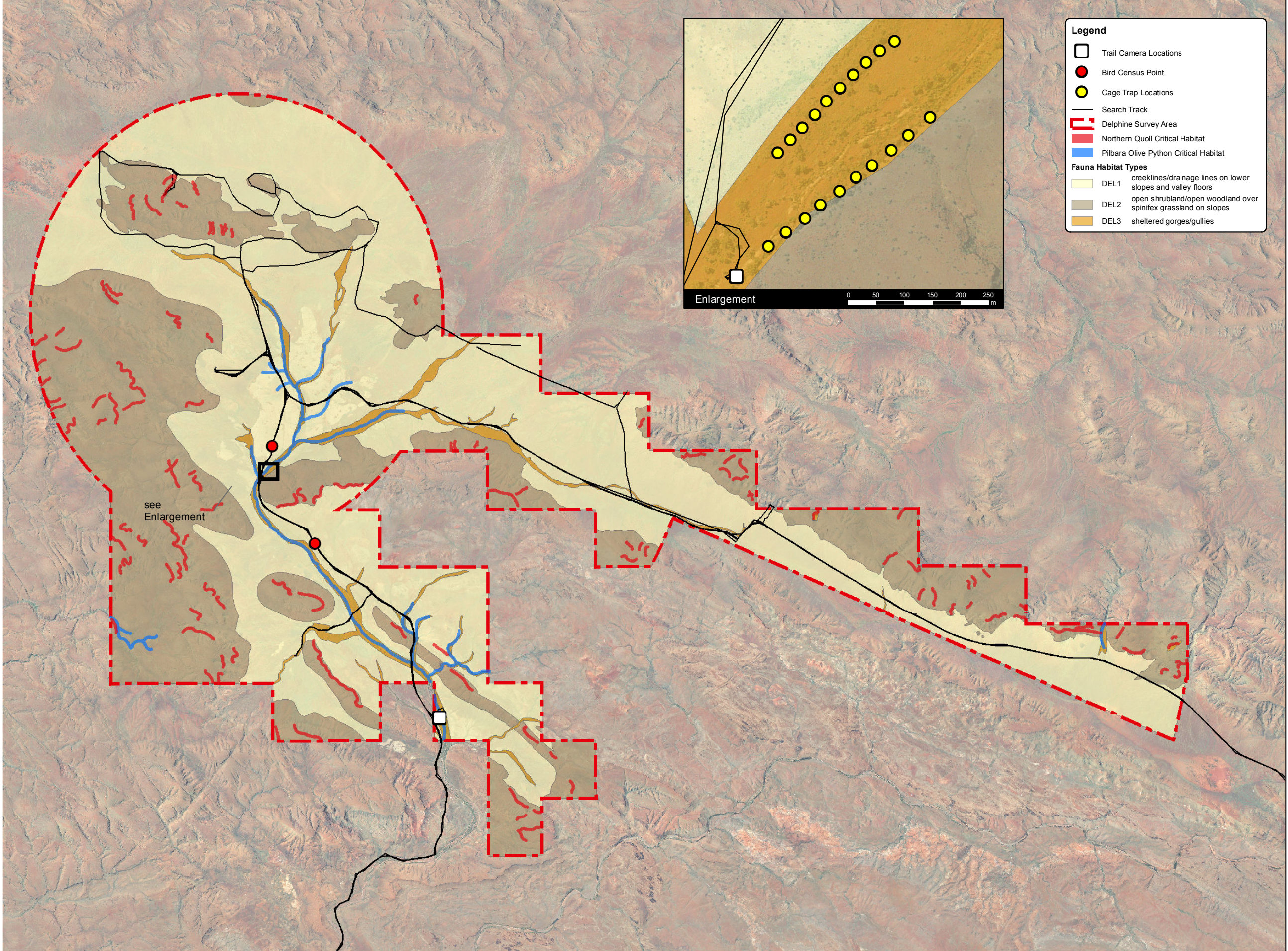
**Vegetation Condition (Trudgen (1991) Scale)**

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



441000 446000 451000 456000 461000 466000 471000 476000 481000 486000

7550000  
7545000  
7540000  
7535000  
7530000  
7525000



**Legend**

- Trail Camera Locations
- Bird Census Point
- Cage Trap Locations
- Search Track
- Delphine Survey Area
- Northern Quoll Critical Habitat
- Pilbara Olive Python Critical Habitat

**Fauna Habitat Types**

- DEL1 creeklines/drainage lines on lower slopes and valley floors
- DEL2 open shrubland/open woodland over spinifex grassland on slopes
- DEL3 sheltered gorges/gullies

see Enlargement

Enlargement  
0 50 100 150 200 250 m

GDA 1994 MGA Zone 50

Imagery supplied by FMG

**Map 7**

**Western Hub Flora and Fauna Surveys  
Fauna Habitat Types, Critical Habitats and Locations of Cage Traps, Trail Cameras and Bird Census Points**

Oct 2011

prepared for Fortescue Metals Group Ltd



1:119,978 @ A3  
Project No. 2620-11



## Appendix One: Definitions and Criteria

**Table 20: NVIS structural formation terminology (terrestrial vegetation) (National Heritage Trust 2003)**

Growth Form	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
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 herbs	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 bryophyteland	sparse bryophyteland	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,	closed	vineland	open	sparse	isolated vines	isolated	vines

Cover Characteristics							
>30	vineland		vineland	vineland		clumps of vines	

NVIS uses the term 'forbs' (non-grassy herbs). The use of 'herb' instead of 'forb' is at Fortescue's request.

**Table 21: 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: <ul style="list-style-type: none"> <li>(a) it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or</li> <li>(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.</li> </ul>
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: <ul style="list-style-type: none"> <li>(a) it is not critically endangered; and</li> <li>(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.</li> </ul>
Vulnerable	A native species is eligible to be included in the vulnerable category at a particular time if, at that time: <ul style="list-style-type: none"> <li>(a) it is not critically endangered or endangered; and</li> <li>(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.</li> </ul>
Conservation Dependent	A native species is eligible to be included in the conservation dependent category at a particular time if, at that time: <ul style="list-style-type: none"> <li>(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</li> <li>(b) the following subparagraphs are satisfied: <ul style="list-style-type: none"> <li>(i) the species is a species of fish;</li> <li>(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;</li> <li>(iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory;</li> <li>(iv) cessation of the plan of management would adversely affect the conservation status of the species.</li> </ul> </li> </ul>

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

Conservation Codes for Western Australian Flora and Fauna
<b>T:</b> Schedule 1 under the <i>Wildlife Conservation Act 1950</i>
<ul style="list-style-type: none"> <li>• <b>Threatened Fauna</b> (Fauna that is rare or is likely to become extinct)</li> <li>• <b>Threatened Flora</b> (Declared Rare Flora – Extant)</li> </ul> <p>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.</p>
<b>X:</b> Schedule 2 under the <i>Wildlife Conservation Act 1950</i>
<ul style="list-style-type: none"> <li>• <b>Presumed Extinct Fauna</b></li> <li>• <b>Presumed Extinct Flora</b> (Declared Rare Flora – Extinct)</li> </ul> <p>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.</p>
<b>1A:</b> Schedule 3 under the <i>Wildlife Conservation Act 1950</i>
<ul style="list-style-type: none"> <li>• <b>Birds protected under an international agreement</b></li> </ul> <p>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.</p>
<b>S:</b> Schedule 4 under the <i>Wildlife Conservation Act 1950</i>
<ul style="list-style-type: none"> <li>• <b>Other specially protected fauna</b></li> </ul> <p>Fauna that is in need of special protection, otherwise than for the reasons mentioned in the above schedules.</p>
<p>Threatened fauna and flora (Schedule 1) are further ranked by the Department according to their level of threat using IUCN Red List criteria.</p> <p><b>CR:</b> Critically Endangered – considered to be facing an extremely high risk of extinction in the wild.</p> <p><b>EN:</b> Endangered – considered to be facing a very high risk of extinction in the wild.</p> <p><b>VU:</b> Vulnerable – considered to be facing a high risk of extinction in the wild.</p>
<p>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.</p>
<b>1: Priority One: Poorly-known taxa</b>
<p>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.</p>
<b>2: Priority Two: Poorly-known taxa</b>
<p>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.</p>

**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 23: DEC definitions and criteria for TECs and PECs (DEC 2010a)**

Criteria		Definition
<b>Threatened Ecological Communities</b>		
Presumed Destroyed (PD)	Totally	<p>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.</p> <p>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):                      Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats or                      All occurrences recorded within the last 50 years have since been destroyed</p>
Critically (CR)	Endangered	<p>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.</p> <p>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):</p> <p>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):                      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);                      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.</p> <p>Current distribution is limited, and one or more of the following apply (i, ii or iii):                      geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening</p>



Criteria	Definition
	<p>processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years);</p> <p>there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes;</p> <p>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.</p> <p>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).</p>
Endangered (EN)	<p>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.</p> <p>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):</p> <p>D) 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):</p> <ul style="list-style-type: none"> <li>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);</li> <li>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.</li> </ul> <p>Current distribution is limited, and one or more of the following apply (i, ii or iii):</p> <ul style="list-style-type: none"> <li>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);</li> <li>there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes;</li> <li>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.</li> </ul> <p>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).</p>
Vulnerable (VU)	<p>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.</p> <p>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):</p> <p>G) The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated.</p> <p>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.</p> <p>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.</p>

Criteria	Definition
<b>Priority Ecological Communities</b>	
Priority One	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	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	<p>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;</p> <p>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;</p> <p>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 feral stock, and inappropriate fire regimes.</p> <p>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.</p>
Priority Four	<p>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.</p> <p>J) 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.</p> <p>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.</p> <p>Ecological communities that have been removed from the list of threatened communities during the past five years.</p>
Priority Five	<p><i>Conservation Dependent Ecological Communities</i></p> <p>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.</p>

**Table 24: EPBC Act categories for TECs (Commonwealth of Australia 2011b)**

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.

## Appendix Two: DEC Database Search Results (Flora)

**Table 25: DEC database search results (Flora)**

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

Species	Habit	Flowering	Landform\Soil	Vegetation Type
<b>P2</b>				
<i>Adiantum capillus-veneris</i>	Rhizomatous, perennial, herb (fern), 0.1-0.2 m high	-	Moist, sheltered sites in gorges and on cliff walls	
<i>Cladium procerum</i>	Densely tufted perennial, grass-like or herb (sedge), 2 m high	Nov	Perennial pools	
<i>Eremophila forrestii</i> 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	
<i>Oxalis</i> sp. Pilbara (M.E. Trudgen 12725)	Small herb to 10 cm tall. Leaves green above, purple below	-	Red-brown pebbly/rocky loam amongst boulders	
<i>Paspalidium retiglume</i>	Tufted annual, grass-like or herb, 0.1–0.5 m high	Apr	Clay	
<i>Pilbara trudgenii</i>	Gnarled, aromatic shrub, to 1 m high	Sep.	Skeletal, red stony soil over ironstone. Hill summits, steep slopes, screes, cliff faces.	
<i>Scaevola</i> 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 <i>Eucalyptus kingsmillii</i> and <i>Eucalyptus</i> aff. <i>hamersleyana</i> over LSA of <i>Acacia hamersleyensis</i> over OLSD of <i>Ptilotus rotundifolius</i> over DHG of <i>Triodia</i> sp. (SVL 2476).
<i>Spartothamnella puberula</i>	Shrub, 0.35–1.5 m high	Sep-Nov	Rocky loam, sandy or skeletal soils, clay. Sandplains, hills	<i>Corymbia ferritcola</i> low woodland over <i>Petalostylis labicheoides</i> and <i>Acacia aneura</i> tall open shrubland over <i>Triodia pungens</i> and <i>T. sp.</i> Mt Ella hummock grassland and <i>Themeda triandra</i> open tussock grassland.
<i>Vigna</i> 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.	<i>Triodia epactia</i> hummock grassland over <i>Cenchrus ciliaris</i> very open tussock grassland, <i>Indigofera colutea</i> / <i>Vigna</i> sp Central / <i>Rhynchosia minima</i> low open shrubland. <i>Eucalyptus camaldulensis</i> and <i>Cenchrus ciliaris</i> association.
<b>P3</b>				
<i>Acacia daweana</i>	Spreading shrub, 0.3–1.5(–2) m high	Jul-Sep	Stony red loamy soils. Low rocky rises, along drainage lines	
<i>Acacia subtiliformis</i>	Spindly, slender, erect shrub, to 3.5 m high	Jun	On rocky calcrete plateau	
<i>Calotis latiuscula</i>	Erect herb, to 0.5 m high	Jun-Oct	Sand, loam. Rocky hillsides, floodplains, rocky creeks or river beds	
<i>Dampiera anonyma</i> 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	
<i>Dampiera metallorum</i> ms	Rounded, multistemmed perennial, herb, to 0.5 m high	Apr-Oct	Skeletal red-brown gravelly soils over banded ironstone. Steep slopes and summits	

Species	Habit	Flowering	Landform\Soil	Vegetation Type
<i>Eragrostis crateriformis</i>	Annual, grass-like or herb, 0.17–0.42 m high	Jan-Jul	Clayey loam or clay. Creek banks, depressions	
<i>Eragrostis surreyana</i>	Tufted annual herb 5-8 (-13) cm high	May-Sep	Drainage line, red-brown clay	
<i>Eremophila forrestii</i> subsp. <i>viridis</i>	Much-branched shrub, ca 1 m high	Aug	Sandplain	
<i>Eremophila magnifica</i> subsp. <i>velutina</i>	Shrub, 0.5–1.5 m high	Aug-Sep	Skeletal soils over ironstone. Summits	
<i>Fimbristylis sieberiana</i>	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	
<i>Geijera salicifolia</i>	Tree, 1.5–6 m high	Sep	Skeletal soils, stony soils. Massive rock scree, gorges	
<i>Glycine falcata</i>	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	
<i>Gymnanthera cunninghamii</i>	Erect shrub 1-2 m high	Jan-Dec	Sandy soils	
<i>Indigofera gilesii</i> subsp. <i>gilesii</i>	Shrub, to 1.5 m high	May/Aug	Pebbly loam amongst boulders & outcrops, hills	
<i>Indigofera</i> sp. Bungaroo Creek (S. van Leeuwen 4301)	Erect shrub to 2.3 m high, red-pink flowers	Jul-Oct	Creeks and gorges	
<i>Iotasperma sessilifolium</i>	Erect herb. Fl. pink.	-	Cracking clay, black loam. Edges of waterholes, plains	
<i>Oldenlandia</i> 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	
<i>Olearia mucronata</i>	Densely branched, unpleasantly aromatic shrub, 0.6–1 m high. Fl. white, yellow	Aug-Jan	Schistose hills, along drainage channels	
<i>Phyllanthus aridus</i>	Erect, much-branched shrub, to 0.25 m high. Fl. cream, green	May-Jun	Sandstone, gravel, red sand	
<i>Ptilotus subspinescens</i>	Compact shrub, to 0.8 m high. Fl. pink, bases of screes	Sep-Oct	Gentle rocky slopes, screes and the bases of screes	
<i>Rhagodia</i> sp. Hamersley (M. Trudgen 17794)	Erect shrub	-	Floodplain / lower slopes	
<i>Rostellularia adscendens</i> var. <i>latifolia</i>	Herb or shrub, 0.1–0.3 m high	Apr-May	Ironstone soils. Near creeks, rocky hills	
<i>Scaevola</i> 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 <i>Eucalyptus kingsmillii</i> and <i>Eucalyptus</i> aff. <i>hamersleyana</i> over LSA of <i>Acacia hamersleyensis</i> over OLSD of <i>Ptilotus rotundifolius</i> over DHG of <i>Triodia</i> sp. (SVL 2476).
<i>Sida</i> sp. Barlee Range (S van Leeuwen 1642)	Spreading shrub, to 0.5 m high	Aug	Skeletal red soils pockets. Steep slope	
<i>Swainsona</i> sp. Hamersley Station (A.A. Mitchell 196)	Prostrate annual, herb, to 0.1 m high	Mat	Flat crabholed plain.	Open <i>Eremophila maculata</i> shrubland over moderately dense herbs. Tussock grassland of <i>Astrebla pectinata</i> .

<i>Species</i>	<i>Habit</i>	<i>Flowering</i>	<i>Landform\Soil</i>	<i>Vegetation Type</i>
<i>Triodia</i> 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	
<i>Triodia</i> sp. Robe River (M.E. Trudgen et al. MET 12367)	Perennial hummock grass to 0.6 m high	-	Rocky hills and mesas	
<b>P4</b>				
<i>Acacia bromilowiana</i>	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	
<i>Eremophila magnifica</i> subsp. <i>magnifica</i>	Shrub, 0.5-1.5 m high	Aug-Nov	Skeletal soils over ironstone. Rocky screes	
<i>Livistona alfredii</i>	Tree-like monocot (palm) to 10 m high	Jun-Sep	Edges of permanent pools	
<i>Rhynchosia bungarensis</i>	Compact, prostrate shrub, to 0.5 m high	-	Pebbly, coarse sand, banks of flow line	

## Appendix Three: EPBC Protected Matters Search Results





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 14:24:46**

## [Summary](#)

## [Details](#)

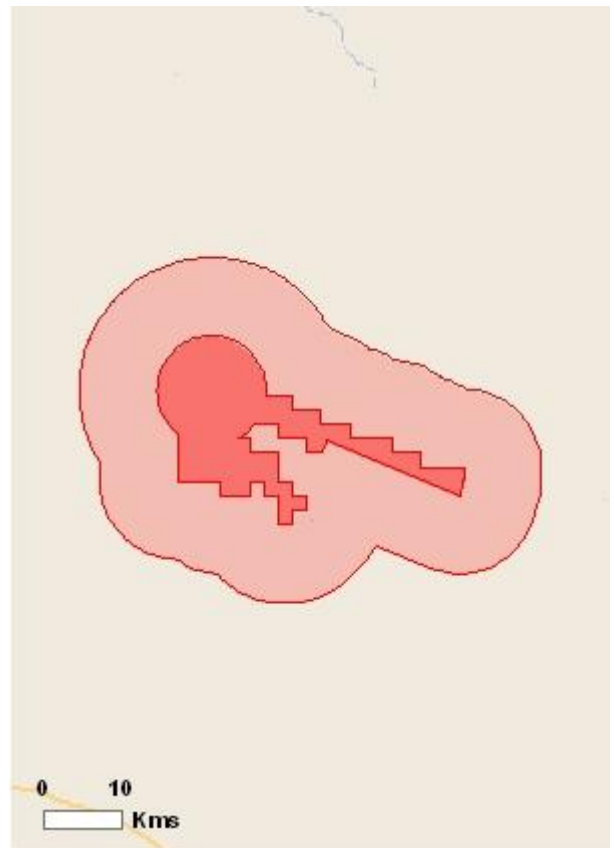
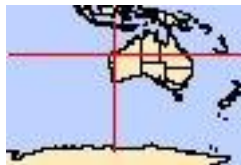
[Matters of NES](#)

[Other matters protected by  
the EPBC Act](#)

[Extra Information](#)

## [Caveat](#)

## [Acknowledgements](#)



This map may contain data which are  
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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>.

<a href="#">World Heritage Properties:</a>	None
<a href="#">National Heritage Places:</a>	None
<a href="#">Wetlands of International Significance (Ramsar Wetlands):</a>	None
<a href="#">Great Barrier Reef Marine Park:</a>	None
<a href="#">Commonwealth Marine Areas:</a>	None
<a href="#">Threatened Ecological Communities:</a>	None
<a href="#">Threatened Species:</a>	4
<a href="#">Migratory Species:</a>	9

## 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>.

<a href="#">Commonwealth Lands:</a>	None
<a href="#">Commonwealth Heritage Places:</a>	None
<a href="#">Listed Marine Species:</a>	7
<a href="#">Whales and Other Cetaceans:</a>	None

<a href="#">Critical Habitats:</a>	None
<a href="#">Commonwealth Reserves:</a>	None

## Report Summary for Extra Information

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

<a href="#">Place on the RNE:</a>	None
<a href="#">State and Territory Reserves:</a>	None
<a href="#">Regional Forest Agreements:</a>	None
<a href="#">Invasive Species:</a>	5
<a href="#">Nationally Important Wetlands:</a>	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
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##### [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
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#### REPTILES

##### [Liasis olivaceus barroni](#)

Olive Python (Pilbara subspecies) [66699]	Vulnerable	Species or species habitat may occur within area
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#### 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
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##### [Ardea alba](#)

Great Egret, White Egret [59541]		Species or species habitat may occur within area
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##### [Ardea ibis](#)

Cattle Egret [59542]		Species or species habitat may occur within area
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#### Migratory Terrestrial Species

##### [Haliaeetus leucogaster](#)

White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
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##### [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

[Glareola maldivarum](#)

Oriental Pratincole [840] 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

[Glareola maldivarum](#)

Oriental Pratincole [840] 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 Resources 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

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## 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](#)
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- [-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.

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[Department of Sustainability, Environment, Water, Population and Communities](#)

GPO Box 787

Canberra ACT 2601 Australia

+61 2 6274 1111 [ABN](#)

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

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

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

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
195.	25224 <i>Varanus pilbarensis</i> (Pilbara Rock Monitor)			
196.	25227 <i>Varanus tristis subsp. tristis</i> (Racehorse Monitor)			
197.	25311 <i>Vermicella snelli</i>			
198.	24205 <i>Vespadelus finlaysoni</i> (Finlayson's Cave Bat)			
199.	24248 <i>Zyzomys argurus</i> (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

<sup>1</sup> For NatureMap's purposes, species flagged as endemic are those whose records are wholly 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: Threatened Flora Report Forms

Insert forms – amend page numbers as appropriate

## Appendix Six: Flora Species Lists

**Table 26: Flora species list**


Family	Species	Introduced	Cons. Code
Amaranthaceae	<i>Ptilotus astrolasius</i>		
	<i>Ptilotus fusiformis</i>		
	<i>Ptilotus helipteroides</i>		
	<i>Ptilotus</i> sp.		
Boraginaceae	<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>		
Chenopodiaceae	<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>		
Convolvulaceae	<i>Bonamia rosea</i>		
	<i>Ipomoea muelleri</i>		
	<i>Polymeria ambigua</i>		
Cyperaceae	<i>Cyperus vaginatus</i>		
Euphorbiaceae	<i>Adriana tomentosa</i>		
	<i>Euphorbia australis</i>		
Fabaceae	<i>Acacia adoxa</i> var. <i>adoxo</i>		
	<i>Acacia ancistrocarpa</i>		
	<i>Acacia aptaneura</i>		
	<i>Acacia arida</i>		
	<i>Acacia atkinsiana</i>		
	<i>Acacia bivenosa</i>		
	<i>Acacia citrinoviridis</i>		
	<i>Acacia colei</i> var. <i>colei</i>		
	<i>Acacia hilliana</i>		
	<i>Acacia inaequilatera</i>		
	<i>Acacia maitlandii</i>		
	<i>Acacia monticola</i>		
	<i>Acacia pachyacra</i>		
	<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>		
	<i>Acacia synchronicia</i>		
	<i>Acacia tenuissima</i>		
	<i>Acacia trudgeniana</i>		
	<i>Acacia victoriae</i>		
	<i>Gompholobium oreophilum</i>		
	<i>Indigofera monophylla</i>		
	<i>Indigofera</i> sp. Bungaroo Creek		P3
	<i>Petalostylis labicheoides</i>		
	<i>Rhynchosia bungarensis</i>		P3
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>			
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>			
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>			
<i>Senna glutinosa</i> subsp. <i>pruinosa</i>			


Family	Species	Introduced	Cons. Code
Fabaceae	<i>Senna notabilis</i>		
	<i>Senna venusta</i>		
	<i>Tephrosia rosea</i> var. <i>glabrior</i>		
	* <i>Vachellia farnesiana</i>	X	
Goodeniaceae	<i>Goodenia stobbsiana</i>		
Malvaceae	<i>Gossypium australe</i>		
	<i>Gossypium robinsonii</i>		
	<i>Hibiscus sturtii</i> var. <i>campylochlamys</i>		
	<i>Keraudrenia</i> sp.		
Myrtaceae	<i>Corymbia deserticola</i> subsp. <i>deserticola</i>		
	<i>Corymbia hamersleyana</i>		
	<i>Eucalyptus camaldulensis</i> subsp. <i>refulgens</i>		
	<i>Eucalyptus gamophylla</i>		
	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>		
	<i>Eucalyptus victrix</i>		
	<i>Eucalyptus xerothermica</i>		
	<i>Melaleuca argentea</i>		
	<i>Melaleuca bracteata</i>		
Oleaceae	<i>Jasminum didymum</i> subsp. <i>lineare</i>		
Papaveraceae	* <i>Argemone ochroleuca</i>	X	
Phyllanthaceae	<i>Phyllanthus</i> sp.		
Plantaginaceae	<i>Stemodia grossa</i>		
	<i>Stemodia viscosa</i>		
Poaceae	<i>Aristida contorta</i>		
	* <i>Cenchrus ciliaris</i>	X	
	<i>Chrysopogon fallax</i>		
	<i>Cymbopogon ambiguus</i>		
	<i>Eriachne mucronata</i>		
	<i>Eriachne pulchella</i> subsp. <i>dominii</i>		
	<i>Eriachne tenuiculmis</i>		
	<i>Eulalia aurea</i>		
	<i>Paraneurachne muelleri</i>		
	<i>Sporobolus australasicus</i>		
	<i>Sporobolus</i> sp.		
	<i>Themeda triandra</i>		
	<i>Triodia epactia</i>		
	<i>Triodia</i> sp. Robe River		P3
<i>Triodia wiseana</i>			
Proteaceae	<i>Grevillea wickhamii</i> subsp. <i>hispidula</i>		
	<i>Hakea lorea</i> subsp. <i>lorea</i>		
Rubiaceae	<i>Oldenlandia crouchiana</i>		
Sapindaceae	<i>Dodonaea coriacea</i>		
	<i>Dodonaea lanceolata</i>		





Family	Species	Introduced	Cons. Code
	<i>Eremophila forrestii</i> subsp. <i>hastieana</i>		
Scrophulariaceae	<i>Eremophila latrobei</i> subsp. <i>glabra</i>		
	<i>Eremophila longifolia</i>		
Surianaceae	<i>Stylobasium spathulatum</i>		
Typhaceae	<i>Typha domingensis</i>		


## Appendix Seven: Relevé Data


Site	D01		
Described by	LA, HH	15/7/2011	
MGA Zone	GDA94 50	454850mE	7545271mN
Landform	Very gentle north facing lower slope		
Soil	Red brown clay loam		
Rock Type	Ironstone		
Vegetation Description	<i>Acacia ancistrocarpa</i> , <i>A. maitlandii</i> , <i>A. monticola</i> open shrubland over <i>Triodia wiseana</i> , <i>Keraudrenia</i> sp., <i>Bonamia rosea</i> open hummock grassland/ sparse shrubland with <i>Eucalyptus gamophylla</i> and <i>Corymbia deserticola</i> subsp. <i>deserticola</i> isolated trees/mallees		
Vegetation Condition	Excellent		
Notes	Lower slope/ valley floor.		
Photo			


Site		D02	
Described by	LA, HH	15/7/2011	
	MGA Zone	GDA94 50	454988mE 7545024mN
Landform	Gentle north facing lower slope		
Soil	Red brown clay loam		
Rock Type	Ironstone and chert; 2-10% outcropping		
Vegetation Description	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and <i>Corymbia hamersleyana</i> open woodland over <i>Triodia wiseana</i> , <i>Acacia hilliana</i> , <i>Triodia</i> sp. Robe River, <i>A. adoxa</i> var. <i>adoxo</i> hummock grassland/ sparse shrubland with <i>Dodonaea lanceolata</i> subsp. <i>lanceolata</i> and <i>A. maitlandii</i> isolated shrubs		
Vegetation Condition	Excellent		
Notes			
Photo			


Site		D03	
Described by	LA, HH	15/7/2011	
	MGA Zone	GDA94 50	455553mE 7545671mN
Landform	Valley floor		
Soil	Red brown clay		
Rock Type	Ironstone		
Vegetation Description	<i>Acacia atkinsiana</i> , <i>A. ancistrocarpa</i> and <i>A. maitlandii</i> sparse shrubland over <i>Triodia wiseana</i> , <i>Eremophila forrestii</i> subsp. <i>hastieana</i> , <i>Triodia epactia</i> hummock grassland/isolated low shrubs with <i>A. aptaneura</i> and <i>A. inaequilatera</i> tall sparse shrubs		
Vegetation Condition	Excellent		
Notes			
Photo			


Site		D04	
Described by	LA, HH	15/7/2011	
	MGA Zone	GDA94 50	456811mE 7545145mN
Landform	Valley floor		
Soil	Red brown clay loam		
Rock Type	Ironstone		
Vegetation Description	<i>Acacia ancistrocarpa</i> , <i>A. maitlandii</i> and <i>A. tenuissima</i> open shrubland over <i>Triodia wiseana</i> , <i>Bonamia rosea</i> and <i>Keraudrenia</i> sp. open hummock grassland/ sparse shrubs with <i>Eucalyptus gamophylla</i> , <i>Corymbia hamersleyana</i> and <i>Corymbia deserticola</i> subsp. <i>deserticola</i> isolated trees/ mallees		
Vegetation Condition	Excellent		
Notes			
Photo			


Site		D05	
Described by	LA, HH	15/7/2011	
	MGA Zone	GDA94 50	458445mE 7544970mN
Landform	Gentle north facing mid slope of low rise		
Soil	Red brown clay loam		
Rock Type	Ironstone		
Vegetation Description	<i>Acacia maitlandii</i> sparse shrubland over <i>Triodia wiseana</i> hummock grassland with <i>Corymbia hamersleyana</i> and <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> isolated trees.		
Vegetation Condition	Excellent		
Notes			
Photo			


Site		D06	
Described by	LA, HH	15/7/2011	
	MGA Zone	GDA94 50	458412mE 7544119mN
Landform	Valley floor		
Soil	Red brown clay loam		
Rock Type	Ironstone		
Vegetation Description	<i>Acacia ancistrocarpa</i> , <i>Senna artemisioides</i> subsp. <i>oligophylla</i> and <i>Acacia bivenosa</i> open shrubland over <i>Triodia epactia</i> and <i>Eulalia aurea</i> hummock grassland/ sparse tussock grasses with <i>Eucalyptus xerothermica</i> and <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> isolated trees.		
Vegetation Condition	Excellent		
Notes			
Photo			


Site		D07	
Described by	LA, HH	15/7/2011	
	MGA Zone	GDA94 50	460512mE 7541594mN
Landform	Very gentle south facing lower slope		
Soil	Red brown clay loam		
Rock Type	Ironstone		
Vegetation Description	<i>Triodia wiseana</i> , <i>Ptilotus</i> sp. hummock grassland/ sparse herbs with <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and <i>Corymbia hamersleyana</i> isolated trees with <i>Acacia bivenosa</i> and <i>Senna glutinosa</i> subsp. <i>pruinosa</i> sparse shrubs		
Vegetation Condition	Very good		
Notes			
Photo			


Site		D08	
Described by	LA, HH	15/7/2011	
	MGA Zone	GDA94 50	461624mE 7541104mN
Landform	Drainage line		
Soil	Red brown sand		
Rock Type	Mixed (alluvial)		
Vegetation Description	<i>Eucalyptus victrix</i> open woodland over <i>Tephrosia rosea</i> var. <i>glabrior</i> , <i>Stemodia viscosa</i> , <i>Euphorbia australis</i> and <i>Eriachne tenuiculmis</i> sparse shrubland/scattered herbs/scattered tussock grasses		
Vegetation Condition	Excellent		
Notes			
Photo			

Site		D09	
Described by	LA, HH	15/7/2011	
	MGA Zone	GDA94 50	465537mE 7539278mN
Landform	Valley floor/rise		
Soil	Red brown clay loam		
Rock Type	Ironstone		
Vegetation Description	<i>Acacia inaequilatera</i> , <i>A. tenuissima</i> , <i>A. ancistrocarpa</i> and <i>A. atkinsiana</i> sparse shrubland over <i>Triodia wiseana</i> open hummock grassland with <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> , <i>Corymbia hamersleyana</i> and <i>Hakea lorea</i> subsp. <i>lorea</i> scattered trees/tall shrubs		
Vegetation Condition	Excellent		
Notes			
Photo			


Site		D10	
Described by	LA, HH	15/7/2011	
MGA Zone	GDA94 50	454122mE	7543807mN
Landform	Valley/lower slope		
Soil	Red brown clay loam		
Rock Type	Ironstone		
Vegetation Description	<i>Acacia atkinsiana</i> , <i>A. inaequilatera</i> , <i>A. bivenosa</i> and <i>A. aptaneura</i> sparse shrubland over <i>Triodia wiseana</i> and <i>Bonamia rosea</i> open hummock grassland/sparse shrubs with <i>Eucalyptus gamophylla</i> , <i>E. xerothermica</i> and <i>Corymbia hamersleyana</i> sparse trees		
Vegetation Condition	Excellent		
Notes			
Photo			


Site		D11	
Described by	LA,HH	17/7/2011	
MGA Zone	GDA94 50	453508 mE	7543849 mN
Landform	Outwash/floodplain		
Soil	Red brown sand		
-	Ironstone		
Vegetation Description	<i>Eucalyptus xerothermica</i> and <i>Corymbia hamersleyana</i> open woodland over <i>Gossypium robinsonii</i> , <i>Acacia monticola</i> and <i>A. pyrifolia</i> subsp. <i>pyrifolia</i> open shrubland over <i>Triodia epactia</i> , <i>Senna notabilis</i> , <i>Paraneurachne muelleri</i> , <i>Themeda triandra</i> and <i>Eriachne tenuiculmis</i> open hummock grassland/sparse shrubland/sparse tussock grassland		
Vegetation Condition	Very good		
Notes	Very sparse <i>Eucalyptus victrix</i> in vegetation type. Some buffel grass		
Photo			


Site		D12	
Described by	LA,HH	17/7/2011	
MGA Zone	GDA94 50	450028 mE	7547274 mN
Landform	Valley flat		
Soil	Red brown clay loam		
Rock Type	-		
Vegetation Description	<i>Acacia aptaneura</i> open woodland over <i>Chrysopogon fallax</i> and <i>Eulalia aurea</i> open tussock grassland with <i>Eremophila longifolia</i> scattered shrubs		
Vegetation Condition	Very good		
Notes	Recently burnt (<1 year) in most places. Mulga ( <i>Acacia aptaneura</i> ) not burnt in some areas.		
Photo			


Site		D13	
Described by	LA,HH	17/7/2011	
MGA Zone	GDA94 50	455996 mE	7543520 mN
Landform			
Soil	Red brown clay loam		
Rock Type	Ironstone		
Vegetation Description	<i>Acacia bivenosa</i> , <i>A. aptaneura</i> , <i>A. tenuissima</i> and <i>A. atkinsiana</i> open shrubland over <i>Triodia epactia</i> , <i>Eulalia aurea</i> and <i>Themeda triandra</i> open hummock grassland/sparse tussock grassland with <i>Eucalyptus xerothermica</i> scattered trees		
Vegetation Condition	Excellent		
Notes			
Photo			





Site		D14	
Described by	LA,HH	17/7/2011	
	MGA Zone	GDA94 50	453829 mE 7540121 mN
Landform	Lower slope		
Soil	Red brown clay loam		
Rock Type	Ironstone		
Vegetation Description	<i>Triodia wiseana</i> and <i>Acacia hilliana</i> open hummock grassland/sparse shrubland with <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> , <i>Corymbia deserticola</i> subsp. <i>deserticola</i> and <i>C. hamersleyana</i> scattered trees		
Vegetation Condition	Excellent		
Notes	Near Delphine camp		
Photo			


Site		D15	
Described by	LA,HH	17/7/2011	
	MGA Zone	GDA94 50	455391 mE 7540448 mN
Landform	Rise in valley floor		
Soil	Brown silty clay		
Rock Type	Calcrete; 10-20% outcropping		
Vegetation Description	<i>Acacia bivenosa</i> and <i>Petalostylis labicheoides</i> sparse shrubland over <i>Triodia wiseana</i> and <i>Phyllanthus</i> sp. open hummock grassland/scattered herbs with <i>Eucalyptus xerothermica</i> scattered trees		
Vegetation Condition	Excellent		
Notes	Calcrete rise.		
Photo			


Site		D16	
Described by	LA,HH	17/7/2011	
	MGA Zone	GDA94 50	455321 mE 7540373 mN
Landform	Valley floor		
Soil	Red brown clay loam		
Rock Type	Ironstone		
Vegetation Description	<i>Eucalyptus xerothermica</i> and <i>Corymbia hamersleyana</i> open woodland over <i>Acacia bivenosa</i> , <i>A. ancistrocarpa</i> and <i>Stylobasium spathulatum</i> shrubland over <i>Triodia wiseana</i> , <i>Triodia epactia</i> , <i>Senna artemisioides</i> subsp. <i>oligophylla</i> and <i>Chrysopogon fallax</i> open hummock grassland/sparse shrubland/sparse tussock grassland		
Vegetation Condition	Very good		
Notes	Clay between calcrete rises. Disturbed by fire and grazing; occasional <i>Vachellia farnesiana</i>		
Photo			


Site		D17	
Described by	LA,HH	17/7/2011	
	MGA Zone	GDA94 50	456320 mE 7539160 mN
Landform	Drainage line		
Soil	Red brown clay		
Rock Type	Ironstone		
Vegetation Description	<i>Eucalyptus xerothermica</i> and <i>E. victrix</i> open forest over <i>Acacia coleii</i> var. <i>coleii</i> , <i>Melaleuca bracteata</i> , <i>Gossypium robinsonii</i> and <i>Acacia pyrifolia</i> var. <i>pyrifolia</i> open shrubland with <i>Cenchrus ciliaris</i> and <i>Cyperus vaginatus</i> scattered tussock grass/scattered sedge		
Vegetation Condition	Good		
Notes	Drainage line near calcrete		
Photo			


Site		D18	
Described by	LA,HH	18/7/2011	
	MGA Zone	GDA94 50	455054 mE 7536805 mN
Landform	Riparian (major drainage)		
Soil	Red brown stony silt		
Rock Type	Mixed		
Vegetation Description	<i>Eucalyptus camaldulensis</i> subsp. <i>refulgens</i> woodland over <i>Melaleuca bracteata</i> , <i>Acacia citrinoviridis</i> , <i>A. colei</i> var. <i>colei</i> and <i>A. pyrifolia</i> var. <i>pyrifolia</i> open shrubland over <i>Stemodia viscosa</i> , <i>Cyperus vaginatus</i> and <i>Sporobolus</i> sp. sparse herbland/sparse sedgeland/sparse grassland		
Vegetation Condition	Very good		
Notes	Permanent pools nearby		
Photo			


Site		D19	
Described by	LA,HH	18/7/2011	
	MGA Zone	GDA94 50	455452 mE 7535833 mN
Landform	Mid-slope of rocky hill		
Soil	Red brown sandy loam		
Rock Type	Ironstone; 10-20% outcropping		
Vegetation Description	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and <i>Corymbia hamersleyana</i> open woodland over <i>Acacia citrinoviridis</i> and <i>A. pyrifolia</i> var. <i>pyrifolia</i> sparse shrubland over <i>Triodia</i> sp. Robe River and <i>T. wiseana</i> hummock grassland		
Vegetation Condition	Excellent		
Notes	Vegetation similar to PEC ' <i>Triodia</i> sp. Robe River assemblages of mesas in the Pilbara' except for the characteristic landform (on rolling hills; not mesas)		
Photo			


Site		D20	
Described by	LA,HH	18/7/2011	
MGA Zone	GDA94 50	455452 mE	7535833 mN
Landform	Plateau		
Soil	Brown clay loam		
Rock Type	Quartz, basalt; 2-10% outcropping		
Vegetation Description	<i>Triodia wiseana</i> sparse hummock grassland with <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> scattered trees and <i>Acacia bivenosa</i> and <i>A. victoriae</i> scattered shrubs		
Vegetation Condition	Very good		
Notes	Rocklea Land system Grazed, burnt May include <i>Triodia brizoides</i>		
Photo			


Site		D21	
Described by	LA,HH	18/7/2011	
MGA Zone	GDA94 50	458679 mE	7533187 mN
Landform	Valley/plateau		
Soil	Red brown clay with gilgai		
Rock Type	Ironstone/quartz/basalt		
Vegetation Description	<i>Triodia wiseana</i> and <i>Senna notabilis</i> open hummock grassland/sparse shrubland with <i>Acacia inaequilatera</i> , <i>A. bivenosa</i> , <i>A. ancistrocarpa</i> and <i>A. victoriae</i> scattered shrubs		
Vegetation Condition	Very good		
Notes	Grazed, burnt. Occasional <i>Vachellia farnesiana</i> .		
Photo			


Site	D22	
Described by	LA,HH	18/7/2011
MGA Zone	GDA94 50	465508 mE 7536501 mN
Landform	Valley floor	
Soil	Red brown clay loam	
Rock Type	Ironstone	
Vegetation Description	<i>Acacia ancistrocarpa</i> , <i>A. bivenosa</i> and <i>A. aptaneura</i> open shrubland over <i>Triodia epactia</i> , <i>Eremophila forrestii</i> subsp. <i>hastieana</i> and <i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i> open hummock grassland/sparse shrubland	
Vegetation Condition	Very good	
Notes	Grazed	
Photo		


Site	D23	
Described by	LA,HH	19/7/2011
MGA Zone	GDA94 50	470841 mE 7535466 mN
Landform		
Soil	Red brown clay loam	
Rock Type	Ironstone	
Vegetation Description	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> open woodland over <i>Triodia wiseana</i> hummock grassland with <i>Acacia bivenosa</i> and <i>Senna glutinosa</i> subsp. <i>pruinosa</i> scattered shrubs	
Vegetation Condition	Excellent	
Notes		
Photo		


Site		D24	
Described by	LA,HH	19/7/2011	
	MGA Zone	GDA94 50	476838 mE 7535333 mN
Landform	Lower slope		
Soil	Red brown clay loam		
Rock Type	Ironstone		
Vegetation Description	<i>Acacia atkinsiana</i> , <i>A. ancistrocarpa</i> and <i>Senna glutinosa</i> subsp. <i>glutinosa</i> open shrubland over <i>Triodia wiseana</i> and <i>T. epactia</i> open hummock grassland with <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> scattered trees		
Vegetation Condition	Very good		
Notes	Grazed		
Photo			

Site		D25	
Described by	LA,HH	19/7/2011	
	MGA Zone	GDA94 50	472822 mE 7534200 mN
Landform	Lower slope		
Soil	Red brown clay loam		
Rock Type	Ironstone		
Vegetation Description	<i>Acacia pachyacra</i> sparse shrubland over <i>Triodia wiseana</i> and <i>Ptilotus helipteroides</i> open hummock grassland/sparse shrubland with <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> scattered trees		
Vegetation Condition	Very good		
Notes	Grazed		
Photo			


Site	D26		
Described by	LA,HH	19/7/2011	
MGA Zone	GDA94 50	474522 mE	7533163 mN
Landform	Lower slope		
Soil	Red brown clay loam		
Rock Type	Ironstone		
Vegetation Description	<i>Acacia pachyacra</i> and <i>A. trudgeniana</i> sparse shrubland over <i>Triodia wiseana</i> hummock grassland		
Vegetation Condition	Very good		
Notes	Grazed		
Photo			

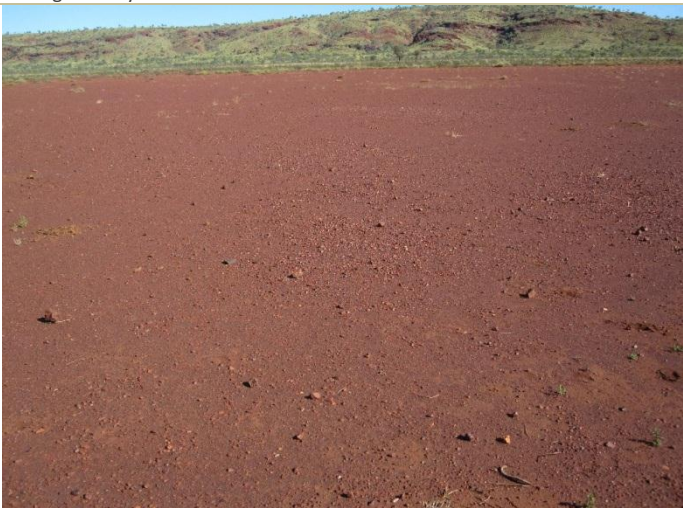
Site	D27		
Described by	LA,HH	19/7/2011	
MGA Zone	GDA94 50	474860 mE	7532955 mN
Landform	Minor drainage/footslope		
Soil	Red brown clay loam		
Rock Type	Ironstone		
Vegetation Description	<i>Acacia tumida</i> var. <i>pilbarensis</i> , <i>Grevillea wickhamii</i> subsp. <i>hispidula</i> and <i>Indigofera</i> sp. Bungaroo Creek shrubland over <i>Themeda triandra</i> , <i>Eriachne tenuiculmis</i> , <i>Triodia wiseana</i> and <i>Tephrosia rosea</i> var. <i>glabrior</i> tussock grassland/sparse hummock grassland/sparse shrubland		
Vegetation Condition	Very good		
Notes	Grazed		
Photo			


Site		D28	
Described by	LA,HH	19/7/2011	
	MGA Zone	GDA94 50	475881 mE 7532856 mN
Landform	Mid-lower slope		
Soil	Red brown clay loam		
Rock Type	Ironstone conglomerate		
Vegetation Description	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> open woodland over <i>Indigofera</i> sp. Bungaroo Creek, <i>Stylobasium spathulatum</i> , <i>Eremophila latrobei</i> subsp. <i>glabra</i> , <i>Acacia pruinocarpa</i> and <i>Dodonaea coriacea</i> open shrubland over <i>Triodia wiseana</i> , <i>Cymbopogon ambiguus</i> and <i>Eriachne mucronata</i> open hummock grassland/sparse tussock grassland		
Vegetation Condition	Excellent		
Notes	Steep slope; southern face of Hamersley Range. No disturbance noted.		
Photo			


Site		D29	
Described by	LA,HH	19/7/2011	
	MGA Zone	GDA94 50	480897 mE 7530971 mN
Landform	Valley floor		
Soil	Red brown clay loam		
Rock Type	Ironstone		
Vegetation Description	<i>Acacia inaequilatera</i> , <i>A. pyrifolia</i> var. <i>pyrifolia</i> , <i>A. citrinoviridis</i> , <i>A. bivenosa</i> and <i>Gossypium australe</i> open shrubland over <i>Triodia epactia</i> , <i>Paraneurachne muelleri</i> and <i>Ipomoea muelleri</i> open hummock grassland/sparse tussock grassland/sparse vineland		
Vegetation Condition	Good		
Notes	Heavily grazed by horses and cattle		
Photo			





Site		D30	
Described by	LA,HH	19/7/2011	
	MGA Zone	GDA94 50	482220 mE 7529816 mN
Landform	Valley floor		
Soil	Red brown clay loam		
Rock Type	Ironstone pebbles (sparse)		
Vegetation Description	<i>Acacia citrinoviridis</i> , <i>A. pruinocarpa</i> , <i>A. aptaneura</i> , <i>Eremophila longifolia</i> and <i>Gossypium australe</i> shrubland over <i>Triodia epactia</i> , <i>Paraneurachne muelleri</i> , <i>Ipomoea muelleri</i> and <i>Cymbopogon ambiguus</i> sparse hummock grassland/sparse tussock grassland/sparse vineland		
Vegetation Condition	Good		
Notes	Grazed by cattle and horses		
Photo			

Site		D31	
Described by	LA,HH	19/7/2011	
	MGA Zone	GDA94 50	482211 mE 7529487 mN
Landform	Valley floor		
Soil	Red clay		
Rock Type	Mixed		
Vegetation Description	<i>Triodia epactia</i> , <i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i> and <i>Sporobolus australasicus</i> scattered hummock grass/scattered herbs/scattered grass		
Vegetation Condition	Poor		
Notes	Trampled and grazed by cattle and horses		
Photo			

Site		D1a	
Described by	SK, RD	18/7/2011	
	MGA Zone	GDA94 50	459607 mE 7530681 mN
Landform	Valley floor/flat		
Soil	Red brown loam		
Rock Type	Ironstone		
Vegetation Description	<i>Corymbia hamersleyana</i> and <i>Eucalyptus xerothermica</i> open woodland over <i>Acacia inaequilatera</i> , <i>A. bivenosa</i> , <i>Hakea lorea</i> subsp. <i>lorea</i> and <i>Senna glutinosa</i> subsp. <i>glutinosa</i> sparse shrubland over <i>Triodia wiseana</i> , <i>Senna notabilis</i> , <i>Dysphania rhadinostachya</i> , <i>Eriachne pulchella</i> subsp. <i>dominii</i> open hummock grassland/ sparse herbs and grasses.		
Vegetation Condition	Very good		
Notes	Mostly burnt within last 2 years		
Photo			


Site		D2a	
Described by	SK, RD	18/7/2011	
	MGA Zone	GDA94 50	460221m E 7532271 mN
Landform	Low rise; slightly undulating		
Soil	Brown clay loam		
Rock Type	Calcrete		
Vegetation Description	<i>Eucalyptus xerothermica</i> and <i>Corymbia hamersleyana</i> open woodland over <i>Acacia inaequilatera</i> , <i>A. bivenosa</i> and <i>Senna glutinosa</i> subsp. <i>pruinosa</i> sparse shrubland over <i>Triodia wiseana</i> and <i>Sporobolus australasicus</i> open hummock grassland/sparse grassland		
Vegetation Condition	Very good		
Notes	Grazed		
Photo			

Site		D3a	
Described by	SK, RD	18/7/2011	
	MGA Zone	GDA94 50	460534 mE 7532149 mN
Landform	Valley		
Soil	Red brown loam		
Rock Type	Ironstone/quartz		
Vegetation Description	<i>Acacia inaequilatera</i> , <i>A. bivenosa</i> , <i>A. synchronicia</i> , <i>Hakea lorea</i> subsp. <i>lorea</i> and <i>A. ancistrocarpa</i> open shrubland over <i>Triodia wiseana</i> , <i>Indigofera monophylla</i> , <i>Oldenlandia crouchiana</i> , <i>Euphorbia australis</i> and <i>Aristida contorta</i> open hummock grassland/sparse shrubland/sparse herbs/sparse tussock grasses		
Vegetation Condition	Very good		
Notes	Grazed		
Photo			

Site		D4a	
Described by	SK, RD	19/7/2011	
	MGA Zone	GDA94 50	460900 mE 7528600 mN
Landform	Major drainage line		
Soil	Clay loam		
Rock Type	Ironstone gravel		
Vegetation Description	<i>Eucalyptus camaldulensis</i> subsp. <i>refulgens</i> , <i>E. victrix</i> and <i>Melaleuca argentea</i> open forest over <i>Acacia pyrifolia</i> var. <i>pyrifolia</i> and <i>Gossypium robinsonii</i> sparse shrubland over <i>Cyperus vaginatus</i> and <i>Stemodia grossa</i> sparse sedgeland/sparse herbland		
Vegetation Condition	Very good		
Notes	Grazed		
Photo			

Site	D5a	
Described by	SK, RD	18/7/2011
MGA Zone	GDA94 50	459672 mE 7531283 mN
Landform	Lower slope	
Soil	Red brown loam	
Rock Type	Ironstone	
Vegetation Description	<i>Corymbia hamersleyana</i> and <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> open woodland over <i>Acacia inaequilatera</i> , <i>Petalostylis labicheoides</i> , <i>Senna glutinosa</i> subsp. <i>pruinosa</i> and <i>Senna glutinosa</i> subsp. <i>glutinosa</i> sparse shrubland over <i>Triodia wiseana</i> , <i>Indigofera monophylla</i> , <i>Eriachne pulchella</i> subsp. <i>dominii</i> and <i>Ptilotus astrolasius</i> open hummock grassland/sparse shrubland/sparse tussock grassland	
Vegetation Condition	Very good	
Notes	Grazed	
Photo		

Site	D6a	
Described by	SK, RD	18/7/2011
MGA Zone	GDA94 50	457781 mE 7531697 mN
Landform	Drainage (wide)	
Soil	Red brown clay loam	
Rock Type	-	
Vegetation Description	<i>Eucalyptus xerothermica</i> and <i>Corymbia hamersleyana</i> mallee woodland/open woodland over <i>Petalostylis labicheoides</i> , <i>Acacia pyrifolia</i> var. <i>pyrifolia</i> , <i>A. colei</i> var. <i>colei</i> , <i>Gossypium robinsonii</i> and <i>Stylobasium spathulatum</i> open shrubland over <i>Triodia epactia</i> , <i>Tephrosia rosea</i> var. <i>glabrior</i> , <i>Paraneurachne muelleri</i> , <i>Eriachne tenuiculmis</i> and <i>Polymeria ambigua</i> sparse hummock grassland/sparse shrubland/sparse herbland	
Vegetation Condition	Very good	
Notes	Grazed, possibly weedy	
Photo		

Site	D7a	
Described by	SK, RD	18/7/2011
MGA Zone	GDA94 50	456656 mE 7531264 mN
Landform	Upper slope	
Soil	Rocky red brown loam, 2-10% outcropping	
Rock Type	Ironstone	
Vegetation Description	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> open woodland over <i>Triodia</i> sp. Robe River, <i>T. epactia</i> , <i>Acacia maitlandii</i> , <i>Goodenia stobbsiana</i> and <i>Hibiscus sturtii</i> var. <i>campylochlamys</i> open tussock grassland/sparse shrubland/sparse herbland	
Vegetation Condition	Very good	
Notes	Recently burnt Other common species include <i>Ptilotus fusiformis</i> , <i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i> , <i>Senna notabilis</i> , <i>Jasminum didymum</i> subsp. <i>lineare</i> , <i>Acacia arida</i> , <i>Oldenlandia crouchiana</i> and <i>Senna venusta</i>	
Photo		

## Appendix Eight: Fauna Species Lists

**Table 27: List of Fauna species recorded at Delphine by this survey**

Family	Species	Common Name	Cons. status	Pres/no.
<b>Fish</b>				
Melanotaeniidae	<i>Melanotaenia australis</i>	Western Rainbowfish		+
Plotosidae	<i>Neosilurus aff. hyrtli</i>	Tandan (Eel-tailed Catfish)		+
<b>Amphibians</b>				
Hylidae	<i>Litoria rubella</i>	Little Red Tree Frog		+
<b>Mammals</b>				
Macropodidae	<i>Macropus robustus</i>	Euro, Biggada		3
	<i>Petrogale sp.</i>	Rock-wallaby		2
Phalangeridae	<i>Trichosurus vulpecula</i>	Brush-tailed Possum		1
Muridae	<i>Pseudomys chapmani</i>	Western Pebble-mound Mouse	P 4	2
Bovidae	<i>Bos taurus</i>	Cow		2 6
Equidae	<i>Equus caballus</i>	Horse		3
Canidae	<i>Canis lupus familiaris</i>	Dog		4
Felidae	<i>Felis catus</i>	Cat		1
<b>Reptiles</b>				
Agamidae	<i>Ctenophorus caudicinctus</i>	Ringtailed Dragon		+
	<i>Pogona minor mitchelli</i>	Northwest Bearded Dragon		+
Gekkonidae	<i>Gehyra variegata</i>	Common Dtella		+
Scincidae	<i>Ctenotus saxatilis</i>	Rock Ctenotus		+
	<i>Menetia greyii</i>	Common Dwarf Skink		+
<b>Birds</b>				
Columbidae	<i>Phaps chalcoptera</i>	Common Bronzewing		1
	<i>Ocyphaps lophotes</i>	Crested Pigeon		+
	<i>Geophaps plumifera</i>	Spinifex Pigeon		5
	<i>Geopelia cuneata</i>	Diamond Dove		1 2
Aegothelidae	<i>Aegotheles cristatus</i>	Owlet Nightjar		1
Ardeidae	<i>Egretta novaehollandiae</i>	White-faced Heron		1
Accipitridae	<i>Aquila audax</i>	Wedge-tailed Eagle		+
Falconidae	<i>Falco cenchroides</i>	Australian Kestrel		4
	<i>Falco berigora</i>	Brown Falcon		6
	<i>Falco peregrinus</i>	Peregrine Falcon	M, S4	1
Otididae	<i>Ardeotis australis</i>	Australian Bustard	P 4	1 0
Charadriidae	<i>Elseornis melanops</i>	Black-fronted Dotterel		2
Turnicidae	<i>Turnix velox</i>	Little Button-quail		+
Cacatuidae	<i>Eolophus roseicapillus</i>	Galah		7
	<i>Cacatua sanguinea</i>	Little Corella		4
Psittacidae	<i>Barnardius zonarius</i>	Australian Ringneck		3
	<i>Melopsittacus undulatus</i>	Budgerigar		2 8
Halcyonidae	<i>Todiramphus sanctus</i>	Sacred Kingfisher		1
Meropidae	<i>Merops ornatus</i>	Rainbow Bee-eater	M	7
Maluridae	<i>Malurus leucopterus</i>	White-winged Fairy-wren		+

Family	Species	Common Name	Cons. status	Pres/no.
Acanthizidae	<i>Smicrornis brevirostris</i>	Weebill		+
	<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill		3
Pardalotidae	<i>Pardalotus striatus</i>	Striated Pardalote		+
Meliphagidae	<i>Certhionyx variegates</i>	Pied Honeyeater		+
	<i>Lichenostomus virescens</i>	Singing Honeyeater		13
	<i>Lichenostomus keartlandi</i>	Grey-headed Honeyeater		2
	<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater		8
	<i>Manorina flavigula</i>	Yellow-throated Miner		11
Pomatostomidae	<i>Pomatostomus temporalis</i>	Grey-crowned Babbler		8
Campephagidae	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike		27
	<i>Lalage tricolor [sueurii]</i>	White-winged Triller		5
Pachycephalidae	<i>Pachycephala rufiventris</i>	Rufous Whistler		7
	<i>Colluricincla harmonica</i>	Grey Shrike-thrush		4
	<i>Oreoica gutturalis</i>	Crested Bellbird		+
Artamidae	<i>Artamus minor</i>	Little Woodswallow		4
	<i>Cracticus nigrogularis</i>	Pied Butcherbird		+
	<i>Cracticus tibicen</i>	Australian Magpie		9
Rhipiduridae	<i>Rhipidura leucophrys</i>	Willie Wagtail		7
Corvidae	<i>Corvus orru</i>	Torresian Crow		6
Monarchidae	<i>Grallina cyanoleuca</i>	Magpie-Lark		6
Petroicidae	<i>Melanodryas cucullata</i>	Hooded Robin		2
Megaluridae	<i>Eremiornis carteri</i>	Spinifexbird		2
Estrildidae	<i>Taeniopygia guttata</i>	Zebra Finch		4
	<i>Emblema pictum</i>	Painted Finch		+

Table 28: Regional vertebrate fauna of the western Hamersley Range

See notes to table for symbol codes

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	Karjini NP	Solomon	Solomon Rail	V. Kings	Firetail South	Firetail North	West Turner	Brockman Sync 4	Fortescue River	
<b>FISH</b>																												
Anguillidae	<i>Anguilla bicolor</i>	Indian Short-finned Eel																										+
Clupeidae	<i>Nematalosa erebi</i>	Bony Bream														+												+
Gobiidae	<i>Glossogobius giurus</i>	Flathead Goby																										+
Melanotaeniidae	<i>Melanotaenia australis</i>	Western Rainbowfish										+				+				+		+						+
Plotosidae	<i>Neosilurus hyrtli</i>	Hyrtl's Tandan										+				+				+		+						
	<i>Neosilurus</i> sp.(1)	(Eel-tailed Catfish, Tandan)																										+
	<i>Neoarius graeffei</i>	Lesser Salmon Catfish																										+
Terapontidae	<i>Amniataba percoides</i>	Barred Grunter														+						+						+
	<i>Leiopotherapon unicolor</i>	Spangled Perch														+				+		+						+
	<i>Leiopotherapon aheneus</i>	Fortescue Grunter				P 4										+												+
	Unnamed sp.																											+
<b>AMPHIBIANS</b>																												
Hylidae	<i>Cyclorana maini</i>	Sheep Frog												+			5		79	13		+			1	14		
	<i>Cyclorana platycephala</i>	Water-holding Frog																	5									
	<i>Litoria rubella</i>	Little Red Tree Frog										+	1				84	2	c	1		+	2			1		
Myobatrachidae	<i>Pseudophryne douglasi</i>	Gorge Toadlet															+		4									
	<i>Uperoleia glandulosa</i>	Glandular Toadlet																2				+	3					
	<i>Uperoleia russelli</i>	Northwest Toadlet												+			6			62		+					(+)	
	<i>Uperoleia</i> sp. (one of preceding)																		16									
Limnodynastidae	<i>Limnodynastes spenceri</i>	Desert Burrowing Frog																	1									
<b>MAMMALS</b>																												
Tachyglossidae	<i>Tachyglossus aculeatus</i>	Echidna												+	5				+			+	1					
Dasyuridae	<i>Dasykaluta rosamondae</i>	Kaluta												+		+	10	2	20	14		+	1		17	3		
	<i>Dasyurus hallucatus</i>	Northern Quoll	E N	S1	EN	+	L	+							1	+	4	1		1		+	2	3		(+)		
	<i>Ningaiu timealeyi</i>	Pilbara Ningai												+	10		47	2	156	7		+		4	33	27		
	<i>Planigale ingrami</i>	Long-tailed Planigale												+			13		1	112				8	3			
	<i>Planigale maculata</i>	Common Planigale																	3	3				1				
	<i>Planigale</i> sp. (2)																+	4						20		(+)		
	<i>Pseudantechinus macdonnellensis</i>	Fat-tailed Pseudantechinus																		1								
	<i>Pseudantechinus roryi</i>	Rory's Pseudantechinus																										
	<i>Pseudantechinus woolleyae</i>	Woolley's Pseudantechinus																	1				+			2	(+)	
<i>Sminthopsis macroura</i>	Stripe-faced Dunnart													+			6		25	101		+		5	7	(+)		



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	Karjini NP	Solomon	Solomon Rail	V. Kings	Firetail South	Firetail North	West Turner	Brockman Sync 4	Fortescue River	
	<i>Sminthopsis longicaudata</i>	Long-tailed Dunnart			P 4	+		+						+			1									(+)		
	<i>Sminthopsis ooldea</i>	Ooldea Dunnart																	5									
Macropodidae	<i>Macropus robustus</i>	Euro, Biggada							+	+	1	3	+	+	13		46	1	+	+	+	+	14	10	27	5		
	<i>Macropus rufus</i>	Red Kangaroo, Marlu												+			5		+		+				3	n		
	<i>Petrogale "penicillata"</i>	Brush-tailed Rock-wallaby																	+									
	<i>Petrogale rothschildi</i>	Rothschild's Rock-wallaby																									(+)	
	<i>Petrogale sp.</i>	Rock-wallaby										4	2						1					1				
	<i>Lagorchestes conspicillatus leichardti</i>	Spectacled Hare-wallaby				P 3																						
Phalangeridae	<i>Trichosurus vulpecula</i>	Brush-tailed Possum								1	1	1					+	1						2				
Megadermatidae	<i>Macroderma gigas</i>	Ghost Bat			P 4	+		+									2	+	+							(+)		
Hipposideridae	<i>Rhinonicteris aurantia</i>	Pilbara Leaf-nosed Bat	V U	S1	VU	+	L	+									7											
Emballonuridae	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat															1		6	24		+	+	+	2			
	<i>Taphozous georgianus</i>	Common Sheath-tail-bat							20					+		+	83		18	25		+	+	+	14	+		
	<i>Taphozous hilli</i>	Hill's Sheath-tail-bat												+					46			+				(+)		
Molossidae	<i>Chaerephon jobensis</i>	Northern Freetail-bat															+		17	7		+						
	<i>Mormopterus beccarii</i>	Beccari's Freetail-bat												+					58	7		+	+	+				
	<i>Mormopterus loriae cobourgiana</i>	Western Little Freetail-bat																	+							+		
	<i>Mormopterus sp.</i>	South-western Freetail-bat																	+									
	<i>Tadarida australis</i>	White-striped Freetail-bat															3		1							+		
Vespertilionidae	<i>Nyctophilus bifax</i>	Northwestern Long-eared Bat																	1									
	<i>Nyctophilus geoffroii</i>	Lesser Long-eared Bat																	1									
	<i>Nyctophilus gouldii</i>	Gould's Long-eared Bat																	+									
	<i>Nyctophilus arnhemensis</i>	Arnhem Land Long-eared Bat																									?	
	<i>Nyctophilus sp. indet.</i>																			+		+						
	<i>Chalinolobus gouldii</i>	Gould's Wattled Bat												+	+		7	1	75	27		+	+	+	6	+		
	<i>Chalinolobus morio</i>	Chocolate Wattled Bat																							6			
	<i>Scotorepens greyii</i>	Little Broad-nosed Bat												+	+		5	1	34	25		+	+	+	2	+		
	<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat																1										
<i>Vespadelus finlaysoni (3)</i>	Finlayson's Cave Bat												+	+	+	70	1	39	27		+	+	+	50	+			
Muridae	<i>Leggadina lakedownensis</i>	Short-tailed Mouse			P 4	+								+												(+)		
	<i>Mus musculus</i>	House Mouse			Y									+			+		127	13		+			2	1		
	<i>Notomys alexis</i>	Spinifex Hopping-mouse								1			2						1									
	<i>Pseudomys chapmani</i>	Western Pebble-mound Mouse			P 4			+	2			2	2	+		(+)	9	+	15			+			12	1		
	<i>Pseudomys delicatulus</i>	Delicate Mouse															1											
	<i>Pseudomys desertor</i>	Desert Mouse												+			7	1		146		+	10	1	6	3		
<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse												+			49		62	156		+		3	23	2			

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	<i>Zyomys argurus</i>	Common Rock-rat									1			+	1		49	1	16			+	8	4	161	13			
Leporidae	<i>Oryctolagus cuniculus</i>	Rabbit			Y		L																						
Bovidae	<i>Bos taurus</i>	Cow								+	22	26	+				5		+	+		+							
Equidae	<i>Equus asinus</i>	Donkey			Y									+			1		+							n			
	<i>Equus caballus</i>	Horse									3	3														6			
Canidae	<i>Canis lupus dingo</i>	Dingo			Y					+	1		3	+	11		11	3	+	9	+	+	3	1	8	1			
	<i>Canis lupus familiaris</i>	Dog										4																	
	<i>Vulpes vulpes</i>	Fox			Y		M												+										
Felidae	<i>Felis catus</i>	Cat			Y		L				1	1	1				1	1	+	2	+	+	2	1	1	2			
<b>REPTILES</b>																													
Cheluidae	<i>Chelodina steindachneri</i>	Flat-shelled Turtle														+													
Agamidae	<i>Amphibolurus gilberti</i>	Gilbert's Dragon																	+										
	<i>Amphibolurus longirostris</i>	Long-nosed Dragon												+	1		11	3	vc	81		+	1		16	4			
	<i>Caimanops amphiboluroides</i>	Mulga Dragon															1		(2)		+								
	<i>Ctenophorus caudicinctus</i>	Ringtailed Dragon							1	2	2	+	10	+	17		48	6	vc	111		+	4	12	41	47			
	<i>Ctenophorus isolepis</i>	Military Dragon												+	8		45	2	7	64		+			8	31			
	<i>Ctenophorus nuchalis</i>	Central Netted Dragon																		5									
	<i>Ctenophorus reticulatus</i>	Western Netted Dragon													+					+									
	<i>Ctenophorus scutulatus</i>	Lozenge-marked Dragon																		+									
	<i>Diporiphora valens</i>	Pilbara Two-lined Dragon													+											4	5		
	<i>Diporiphora winneckei</i>	Blue-lined Dragon																										(?)	
	<i>Pogona minor (4)</i>	Western Bearded Dragon													+			2		mc		+			3	2			
	<i>Pogona minor mitchelli</i>	Northwest Bearded Dragon								1			+	5							3			1	3				
<i>Tympanocryptis cephalus</i>	Pebble Dragon													+					+								(+)		
Gekkonidae	<i>Gehyra pilbara</i>	Pilbara Dtella												+				1	6	2		+					(+)		
	<i>Gehyra punctata</i>	Spotted Dtella												+			25	38	mc	1		+	2	2	1	4			
	<i>Gehyra purpurascens</i>	Purple Dtella															16				+								
	<i>Gehyra variegata</i>	Common Dtella										+		+			+		c	17		+	3	4	24	6			
	<i>Heteronotia binoei</i>	Bynoe's Prickly Gecko							1	1				+	9		44	9	mc	98		+	3	13	14	40			
	<i>Heteronotia planiceps</i>	North-west Prickly Gecko																											
	<i>Heteronotia spelea</i>	Desert Cave Gecko													+			2	2	2		+					(+)		
Carphodactylidae	<i>Underwoodisaurus seorsus (3)</i>	Pilbara Barking Gecko																			+	1	1						
	<i>Nephrurus laevis pilbarensis</i>	Pilbara Smooth Knobtail Gecko																											
	<i>Nephrurus wheeleri cinctus</i>	Banded Knob-tailed gecko												+			1	2	mc	13		+	1			1			
Diplodactylidae	<i>Crenadactylus ocellatus</i>	Clawless gecko												+			2	1			+								
	<i>Diplodactylus conspicillatus</i>	Fat-tailed gecko												+	6		29	1	+	234		+			7	50			
	<i>Diplodactylus mitchelli</i>	Pilbara Stone Gecko															+												

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	<i>Diplodactylus savagei</i>	Yellow-spotted Pilbara Gecko												+			14	1		2		+		1	2	5		
	<i>Lucasium squarrosus</i> (3)	Spotted Ground Gecko																	+									
	<i>Lucasium stenodactylum</i>	Sand-plain Gecko												+	6		7		4			+				140		
	<i>Lucasium wombeyi</i>	Pilbara Ground Gecko												+			2		(3)	49		+		5		21		
	<i>Oedura marmorata</i>	Marbled Velvet Gecko							2	2				+			5	17	3			+	1	1		(+)		
	<i>Rhynchoedura ornata</i>	Beaked Gecko												+	2		1		(2)						2	88		
	<i>Strophurus elderi</i>	Jewelled Gecko												+			6		1	4		+			3	8		
	<i>Strophurus jeanae</i>	Southern Phasmid Gecko																	(2)	26		+						
	<i>Strophurus strophurus</i>	Western Spiny-tail gecko																				+						
	<i>Strophurus wellingtonae</i>	Western Shield Spiny-tail Gecko								1					+				2	2	17	+	2	1	5	4		
Pygopodidae	<i>Delma butleri</i>																	1					1					
	<i>Delma elegans</i>													+			2	1	(2)	2		+	1			(+)		
	<i>Delma haroldi</i>													+														
	<i>Delma nasuta</i>													+	3		6	1	7	6		+	3	2	6	16		
	<i>Delma pax</i>													+			6	1		14		+	8	2	1	6		
	<i>Delma tincta</i>													+			+		2			+			3	2		
	<i>Lialis burtonis</i>	Burton's Legless lizard											1	+	2		3	1	mc	10		+	1	2	4	10		
	<i>Pygopus nigriceps</i>	Hooded Scaly-foot												+	1		2		mc	12		+		3		2		
Scincidae	<i>Carlia munda</i>	Shaded-litter Rainbow Skink								3			1	+	5		8	7	11	268		+	5	16	7	14		
	<i>Carlia triacantha</i>	Rainbow Skink												+					1	80		+		2				
	<i>Cryptoblepharus buchananii</i>													+														
	<i>Cryptoblepharus carnabyi</i> (3)														4				6							3		
	<i>Cryptoblepharus plagiocephalus</i> (3)																		9						3	1		
	<i>Cryptoblepharus ustulatus</i>	Russet Snake-eyed Skink												+			1	1				+	2					
	<i>Ctenotus duricola</i>	Pilbara Ctenotus							1					+	4		16	1	c	111		+		14	3	19		
	<i>Ctenotus grandis</i>	Grand Ctenotus								1				+	2		24	23		234		+	12		1	22		
	<i>Ctenotus hanloni</i>	Nimble Ctenotus													10											4		
	<i>Ctenotus helenae</i>	Clay-soil Ctenotus												+	2		6		13	467		+	1	13	1			
	<i>Ctenotus "aff. helenae"</i>																8										37	
	<i>Ctenotus leonhardii</i>	Leonhard's Ctenotus																		5		+						
	<i>Ctenotus mimetes</i>	Checker-sided Ctenotus																+										
	<i>Ctenotus pantherinus</i>	Leopard Ctenotus								1				+	8		36	4	15	330		+	2	16	27	40		
	<i>Ctenotus piankai</i>	Coarse Sands Ctenotus																		+							(?)	
	<i>Ctenotus quattuordecimlineatus</i>	Fourteen-lined Ctenotus																										
	<i>Ctenotus aff. robustus</i>													+				+									(+)	
<i>Ctenotus rubicundus</i>	Ruddy Ctenotus												1	+			2		2				1		2	(+)		
<i>Ctenotus rutilans</i>	Rusty-shouldered Ctenotus													+			+		uc	4		+				4		

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	<i>Ctenotus saxatilis</i>	Rock Ctenotus										+	1	+	14		96	13	26	326		+	36	61	3	6	
	<i>Ctenotus schomburgkii</i>	Barred Wedge-snout Ctenotus												+			+		7					4	8		
	<i>Ctenotus serventyi</i>	Sandy-loam Ctenotus															+										
	<i>Ctenotus severus</i>	Stern Ctenotus															+										
	<i>Ctenotus uber uber</i>	Spotted Ctenotus															+										
	<i>Cyclodomorphus melanops</i>	Spinifex Slender Bluetongue												+			1	1	c	36		+	1	1	1	12	
	<i>Egernia cygnitis</i> (3)	West Pilbara Spiny-tail Skink															+										
	<i>Egernia formosa</i>	Goldfields Crevice-skink												+			+		2	1		+				3	
	<i>Eremiascincus fasciolatus</i>	Narrow-banded Sandswimmer												+				1		1		+					
	<i>Eremiascincus isolepis</i>	Northern Bar-lipped Skink															+										
	<i>Eremiascincus richardsonii</i>	Broad-banded Sandswimmer												+	1											(+)	
	<i>Eremiascincus</i> sp. (=musivus?)																+							1			
	<i>Lerista bipes</i>	Northwestern Sandslider															+										
	<i>Lerista clara</i>																2										
	<i>Lerista</i> sp.																4										
	<i>Lerista flammicauda</i> (incl. "frost")	Pilbara Flame-tailed Slider												+			4	3	6						2		
	<i>Lerista jacksoni</i>	Jackson's Lerista															+						1		2		
	<i>Lerista muelleri</i> (3)	Wood-mulch Slider												+			6	5	1			+				5	
	<i>Lerista rolfei</i>	Rolfe's Slider															+										
	<i>Lerista verhmens</i>	Powerful Lerista												+			+			36		+					
	<i>Lerista zietzi</i>	Blue-tailed Skink						+									1			4		+	2	4			
	<i>Menetia greyii</i>	Common Dwarf Skink										+	+	4			5	3		42		+	8	4	2	11	
	<i>Menetia surda</i>	Western Dwarf Skink											+				+		uc					1	18		
	<i>Morethia ruficauda exquisita</i>	Fire-tailed Skink							1	4			1	+	1		10	5	mc	3		+		3	4	2	
	<i>Notoscincus butleri</i>	Lined Soil-crevice Skink			P4	+							+		+	+	+			1		+		1	2		
	<i>Notoscincus ornatus</i>	Ornate Soil-crevice Skink											+				4										
	<i>Proablepharus reginae</i>	Western Soil-crevice Skink											+						1	1		+					
	<i>Tiliqua multifasciata</i>	Central Blue-tongue							1				+				2	5	c	42		+	1		2	2	
Varanidae	<i>Varanus acanthurus</i>	Ridge-tailed Monitor											+				9	8	mc	102		+	2	13	4	7	
	<i>Varanus brevicauda</i>	Short-tailed Pygmy Monitor											+				9	3	mc	248		+			1	7	
	<i>Varanus bushi</i>	Pilbara Mulga Monitor											+				+			18	+	+	2		1		
	<i>Varanus caudolineatus</i>	Stripe-tailed Monitor											+						c								
	<i>Varanus eremius</i>	Pygmy Desert Monitor											+	2			6	4		91		+		1		8	
	<i>Varanus giganteus</i>	Perentie											1				3	1	(2)			+	1			1	
	<i>Varanus gilleni</i>	Pigmy Mulga Monitor															3									(+)	
	<i>Varanus gouldii</i>	Sand Monitor																		(1)							
	<i>Varanus panoptes</i>	Yellow-spotted Monitor																+	2	1+	21		+	1			2

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	<i>Varanus pilbarensis</i>	Pilbara Rock Monitor												+			+		3			+				1	
	<i>Varanus tristis</i>	Black-tailed Monitor												+			+	1	1	2		+	1	1	1	2	
	<i>Varanus</i> sp. (unidentified juv.)																			7							
Typhlopidae	<i>Ramphotyphlops ammodytes</i>													+			9		(1)	2		+			3		
	<i>Ramphotyphlops "australis"</i>																										
	<i>Ramphotyphlops "bituberculatus"</i>																										
	<i>Ramphotyphlops ganei</i>				P1	+		+						+			+	1				+					
	<i>Ramphotyphlops grypus</i>													+			10	5	mc	25		+	1	4	6	6	
	<i>Ramphotyphlops hamatus</i>													+			+		5								
	<i>Ramphotyphlops pilbarensis</i>								+					+			1			6		+		2		4	
	<i>Ramphotyphlops waitii</i>																			4							
Pythonidae	<i>Antaresia perthensis</i>	Pigmy Python												+			+		2			+	1			(+)	
	<i>Antaresia stimsoni</i>	Stimson's Python											1	+			+	4	(1)	64		+	1			(+)	
	<i>Aspidites melanocephalus</i>	Black-headed Python																1	(1)	2		+	1				
	<i>Liasis olivaceus barroni</i>	Pilbara Olive Python	V U	S1	VU			+					(1)				3	1	2			+			1		
Elapidae	<i>Acanthophis wellsi</i>	Pilbara Death Adder												+	2		3		(1)		+	1		1	(+)		
	<i>Brachyurophis approximans</i>	Pilbara Shovel-nosed Snake												+			2	1	5	34		+	1	5	1	4	
	<i>Demansia psammophis</i>	Yellow-faced Whipsnake												+	1		2		uc	5		+				2	
	<i>Demansia rufescens</i>	Rufous Whipsnake												+			+		c	20		+	3	1	2		
	<i>Furina ornata</i>	Moon Snake												+	1		5	1	3	12		+	1		1	2	
	<i>Parasuta monachus</i>	Monk Snake															2		mc	5		+			6	4	
	<i>Pseudechis australis</i>	Mulga Snake								+			1	+			1	1	c	45		+	1			1	
	<i>Pseudonaja modesta</i>	Ringed Brown Snake												+			1		2	7		+			1		
	<i>Pseudonaja mengdeni (3)</i>	Gwardar																	3	6		+		3	1	1	
	<i>Suta fasciata</i>	Desert Banded Snake																	mc	4		+			2	(+)	
	<i>Suta punctata</i>	Spotted Snake												+	1		+		(1)								
<i>Vermicella snelli</i>	Pilbara Bandy Bandy																	1	(1)		+			1			
<b>BIRDS</b>																											
Casuariidae	<i>Dromaius novaehollandiae</i>	Emu							1					+	3		24	2	uc	1	+	+				2	
Phasianidae	<i>Coturnix pectoralis</i>	Stubble Quail															+			2				2			
	<i>Coturnix ypsilophora</i>	Brown Quail												+			2			2		+	4				
Anatidae	<i>Cygnus atratus</i>	Black Swan																	s								
	<i>Chenonetta jubata</i>	Australian Wood Duck												+					s								
	<i>Malacorhynchus membranaceus</i>	Pink-eared Duck												+					s								
	<i>Anas gracilis</i>	Grey Teal												+					uc							5	
	<i>Anas superciliosus</i>	Pacific Black Duck												+			+		uc	2						3	
<i>Aythya australis</i>	Hardhead												+					s									

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Podicipedidae	<i>Tachybaptus novaehollandiae</i>	Australasian Grebe												+			+		uc								
	<i>Poliiocephalus poliocephalus</i>	Hoary-headed Grebe												+					uc								
Columbidae	<i>Phaps chalcoptera</i>	Common Bronzewing								1	1	1	1	+	1		11	2	mc	3		1	1	1	18	12	
	<i>Phaps elegans</i>	Brush Bronzewing													3												
	<i>Phaps histrionica</i>	Flock Bronzewing																	(+)								
	<i>Ocyphaps lophotes</i>	Crested Pigeon							1	1	10	+	55	+			223	1	mc	16	+	7	2		83	91	
	<i>Geophaps plumifera</i>	Spinifex Pigeon							2	4	16	5		+			320	1	mc	51		13	18	22	170	72	
	<i>Geopelia cuneata</i>	Diamond Dove							9	21	33	12	5	+	5		69	1	c	35		12		11	65	304	
	<i>Geopelia striata</i>	Peaceful Dove												+	1		15		uc	40	+	1	15	33	6		
Podargidae	<i>Podargus strigoides</i>	Tawny Frogmouth												+					s			+	1			1	
Eurostopodidae	<i>Eurostopodus argus</i>	Spotted Nightjar															12		c	45		+	1			8	
Aegothelidae	<i>Aegotheles cristatus</i>	Owlet Nightjar															1		s			+	2				
Apodidae	<i>Apus pacificus</i>	Fork-tailed Swift	M				M							+					mc			+					
Anhingidae	<i>Anhinga melanogaster</i>	Australasian Darter																	uc								
Phalacrocoracidae	<i>Microcarbo melanoleucos</i>	Little Pied Cormorant																	s	2				2			
	<i>Phalacrocorax carbo</i>	Great Cormorant																	s								
Pelecanidae	<i>Pelecanus conspicillatus</i>	Australian Pelican												+					(2)								
Ardeidae	<i>Ardea pacifica</i>	White-necked Heron											3	+			2		uc			+				2	
	<i>Ardea modesta (=alba)</i>	Great Egret	M				M							+					s								
	<i>Ardea ibis</i>	Cattle Egret	M				M																				
	<i>Egretta novaehollandiae</i>	White-faced Heron											1	+	1		+	1	uc							6	
	<i>Nycticorax caledonicus</i>	Nankeen Night-heron																		uc							
Threskiornithidae	<i>Threskiornis spinicollis</i>	Straw-necked Ibis												+			4		uc								
Accipitridae	<i>Elanus axillaris</i>	Black-shouldered Kite												+					uc	4		1			2		
	<i>Lophoictinia isura</i>	Square-tailed Kite												+					+								
	<i>Hamirostra melanosternon</i>	Black-breasted Buzzard															+		s								
	<i>Haliaeetus leucogaster</i>	White-bellied Sea-eagle	M				L																				
	<i>Haliastur sphenurus</i>	Whistling Kite							1				3	+			1		mc	1		+			2	2	
	<i>Milvus migrans</i>	Black Kite												+					mc								
	<i>Accipiter fasciatus</i>	Brown Goshawk												+	2		3	1	uc	2		+	2			1	
	<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk												+			+		mc	1		+		1			
	<i>Circus assimilis</i>	Spotted Harrier											1	+			7		c						1	3	
	<i>Aquila audax</i>	Wedge-tailed Eagle									1	+	1	+			18	1	mc			+			4	3	
	<i>Hieraeetus morphnoides</i>	Little Eagle												+	2		+		uc						2	2	
<i>Pandion cristatus</i>	Eastern Osprey																	(1)									
Falconidae	<i>Falco cenchroides</i>	Australian Kestrel							1		2	4		+	1		10	1	c	1		+	1		3	6	
	<i>Falco berigora</i>	Brown Falcon							3	1		6		+	1		21	1	c	5	+	3	2		17	9	

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	<i>Falco longipennis</i>	Australian Hobby												+			1		uc		+	+			1	1	
	<i>Falco hypoleucos</i>	Grey Falcon			P4												1		+								
	<i>Falco peregrinus</i>	Peregrine Falcon	M	S4	S			+				1					+		uc								
Rallidae	<i>Gallirallus philippensis</i>	Buff-banded Rail																	(1)								
	<i>Porzana tabuensis</i>	Spotless Crane																	mc								
	<i>Porzana fluminea</i>	Spotted Crane																	(+)								
	<i>Tribonyx ventralis</i>	Black-tailed Native-hen																	s								
	<i>Fulica atra</i>	Eurasian Coot												+					s								
Otididae	<i>Ardeotis australis</i>	Australian Bustard			P4	+				1	10	2	+				23		mc		+	+			1	17	
Burhinidae	<i>Burhinus grallarius</i>	Bush Stone-curlew			P4			+		1				+					s				1		1		
Recurvirostridae	<i>Himantopus himantopus</i>	Black-winged Stilt												+					(3)								
Charadriidae	<i>Charadrius veredus</i>	Oriental Plover	M				M																				
	<i>Euseyonis melanops</i>	Black-fronted Dotterel										2		+	1				mc							3	
	<i>Erythronyx cinctus</i>	Red-kneed Dotterel																	(+)								
Turnicidae	<i>Turnix velox</i>	Little Button-quail							1	2	+			+			6	1	mc	4		1	2			3	
Scolopacidae	<i>Gallinago megala</i>	Swinhoe's Snipe	M											+													
	<i>Numenius minutus</i>	Little Curlew															1										
	<i>Tringa glareola</i>	Wood Sandpiper																	(2)								
	<i>Actitis hypoleucos</i>	Common Sandpiper												+					(1)								
	<i>Calidris ferruginea</i>	Curlew Sandpiper																	+								
Glareolidae	<i>Glareola maldivarum</i>	Oriental Pratincole	M				(M)																				
Laridae	<i>Chlidonias hybrida</i>	Whiskered Tern																	(3)								
Cacatuidae	<i>Eolophus roseicapillus</i>	Galah								2	11	7	31	+	2		274	7	uc		+	+	4		39	42	
	<i>Cacatua sanguinea</i>	Little Corella							1	4		4	82	+	1		34		mc	5		+	12	5	35	63	
	<i>Nymphicus hollandicus</i>	Cockatiel											71	+	3		45		mc	10		+	12	10	2	79	
	<i>Calyptrorhynchus banksii</i>	Red-tailed Black Cockatoo																	(+)								
Psittacidae	<i>Barnardius zonarius</i>	Australian Ringneck								3	7	3	7	+	1		26	6	c	52	+	7	15	19	64	58	
	<i>Psephotus varius</i>	Mulga Parrot																	(1)								
	<i>Melopsittacus undulatus</i>	Budgerigar							30	70	34	28	15	+	8		275		mc	104		46	20	6	266		
	<i>Neopsephotus bourkii</i>	Bourke's Parrot												+					uc								
Cuculidae	<i>Centropus phasianinus</i>	Pheasant Coucal												+			+			2		+		2			
	<i>Chalcites osculans</i>	Black-eared Cuckoo											1						(1)						1		
	<i>Chalcites basalis</i>	Horsfield's Bronze-Cuckoo												+	2		11		mc	30		4		6	8	3	
	<i>Cacomantis pallidus</i>	Pallid Cuckoo								1			1	+	2		10		mc	7		+		1	23	15	
Strigidae	<i>Ninox connivens</i>	Barking Owl																	1?								
	<i>Ninox novaeseelandiae</i>	Boobook Owl												+					uc	1		+	1				
Tytonidae	<i>Tyto javanica</i>	Eastern Barn Owl																	(2)							1	

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Halcyonidae	<i>Dacelo leachii</i>	Blue-winged Kookaburra							1					+	1		5		mc	29		5	2	22		4		
	<i>Todiramphus sanctus</i>	Sacred Kingfisher										1		+	1		+	1	mc	73		+	2	72				
	<i>Todiramphus pyrrhopygia</i>	Red-backed Kingfisher											1	+			8		mc			+	1		4	15		
Meropidae	<i>Merops ornatus</i>	Rainbow Bee-eater	M				M		2	4	18	7	2	+	5		109	10	c	53	+	7	26	12	30	32		
Climacteridae	<i>Climacteris melanura</i>	Black-tailed Treecreeper							2	2			1	+					mc	2						1		
Ptilonorhynchidae	<i>Ptilonorhynchus guttatus</i>	Western Bowerbird							2	12				+			2	2	uc	21		2	2	1	1	16		
Maluridae	<i>Malurus leucopterus</i> (4)	White-winged Fairy-wren									4	+		+			13	1	uc	17		15			24	36		
	<i>Malurus lamberti</i>	Variogated Fairy-wren							8	21				+	4		96	3	c	136	+	46	21	31	236	147		
	<i>Stipiturus ruficeps</i>	Rufous-crowned Emu-wren												+	2		2		uc						25	21		
	<i>Amytornis striatus</i> (4)	Striated Grasswren												+	2		4			12		5		6	17	6		
	<i>Amytornis striatus whitei</i>	Striated Grasswren												+			+		r									
Acanthizidae	<i>Sericornis magnirostris</i>	Large-billed Scrubwren																	+									
	<i>Calamanthus campestris</i>	Rufous Fieldwren												+														
	<i>Pyrrholaemus brunneus</i>	Redthroat												+					s									
	<i>Smicronis brevirostris</i>	Weebill								5	1	+	1	+	1		78	8	mc	261		69	11	37	370	431		
	<i>Gerygone fusca fusca</i>	Western Gerygone												+	4		5		c	2		+	2		15	3		
	<i>Acanthiza robustirostris</i>	Slaty-backed Thornbill												+					s									
	<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill												+					c						31	18		
	<i>Acanthiza apicalis</i>	Broad-tailed (Inland) Thornbill												+				+	mc						34	3		
Pardalotidae	<i>Pardalotus rubricatus</i>	Red-browed Pardalote												+	2		5	2	mc	30		4		7	4	21		
	<i>Pardalotus striatus</i>	Striated Pardalote							9	1	2	+	27	+	1		3	1	c	12		1		2	10	21		
Meliphagidae	<i>Certhionyx variegates</i>	Pied Honeyeater									6	+	+						s			+			1			
	<i>Lichenostomus virescens</i>	Singing Honeyeater							6	4	52	13	4	+			259	3	mc	107	+	20	5	1	98	277		
	<i>Lichenostomus keartlandi</i>	Grey-headed Honeyeater							3	33	5	2		+	3		148	3	mc	90		5	26	22	41	26		
	<i>Lichenostomus plumulus</i>	Grey-fronted Honeyeater												+			2		+									
	<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater							4		6	8		+	1		96	1	c	97	+	1	9	85	20	3		
	<i>Purnella albifrons</i>	White-fronted Honeyeater															5		uc							3		
	<i>Manorina flavigula</i>	Yellow-throated Miner							8	3	26	11	10	+			139	15	mc	73		9	26	12	36	188		
	<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater												+			40	1	c	6		+	9	1	46	133		
	<i>Conopophila whitei</i>	Grey Honeyeater												+			2		uc						1			
	<i>Sugomel niger</i>	Black Honeyeater												+	6		12		mc			+						
	<i>Ephthianura tricolor</i>	Crimson Chat												+			11		mc								16	
	<i>Ephthianura aurifrons</i>	Orange Chat																	(+)									
	<i>Lichmera indistincta</i>	Brown Honeyeater									5			+	4		131	1	mc	10		2	2		46	27		
<i>Melithreptus gularis</i>	Black-chinned Honeyeater								2				+			3		mc	3		+	2				1		
Pomatostomidae	<i>Pomatostomus temporalis</i>	Grey-crowned Babbler									11	8		+	1		14	1	uc	30		5	3	23	145	23		





Notes to Table:

(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* (Gibson & McKenzie 2009). [Unpublished names have been used in some Ecoscape reports in error]

(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 stricto (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 squarrosus* 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; pers comm 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: Correspondence

## Lyn Atkins

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**From:** Pryde, Jill <Jill.Pryde@dec.wa.gov.au>  
**Sent:** Friday, 16 September 2011 12:45 PM  
**To:** Lyn Atkins  
**Cc:** English, Val  
**Subject:** FW: Triodia Sp Robe R PEC

Lyn – see response in red below. Jill

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**From:** Lyn Atkins [mailto:LynA@ecoscape.com.au]  
**Sent:** Thursday, 15 September 2011 4:54 PM  
**To:** English, Val  
**Subject:** RE: Triodia Sp Robe R PEC

Hi Val,

Thanks for following up on this.

Just need to confirm:

1. Themeda grassland TEC is only grassland, not with overstorey. Please confirm that the photo below does not qualify as the TEC. And yes, we know the TEC is being mapped for DEC but we were still told to go ahead and do it...**NO NOT IT**



2. *Astrebla* grassland, which is in the Duck Creek area south of the Hamersley Range (photo immediately below, border of Hamersley and Brockman Station), not Fortescue or Chichesters (although second photo below may be in South Fortescue catchment, but still south of Hamersley Range on Hamersley Station) on cracking clays on the Brockman land system (and Steve is correct, land system mapping does not pick up veg types at the detail to be equivalent). Pretty sure we have the PEC but would like confirmation. **Yes this is the Brockman PEC at Nammuldi. Has been extensively mapped by RTIO as part of the Nammuldi Silvergrass project.**



3. Your/Steve's advice is that *Triodia* sp. Robe River PEC is confined to mesas with *Acacia citrinoviridis* and *A. pruinocarpa*. Please confirm if low hills with this combination are/not PEC. See photo. No can do, cant' identify the shrubs in this pic and not clear if it is a Mesa or just rolling hills. Also is the geology Robe Pisolite?



Thanks,

Lyn

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**From:** English, Val [<mailto:Val.English@dec.wa.gov.au>]  
**Sent:** Thursday, 15 September 2011 2:33 PM  
**To:** Lyn Atkins  
**Cc:** Pryde, Jill  
**Subject:** FW: Triodia Sp Robe R PEC

Hi Lyn

A few responses from Stephen van Leeuwen below

Cheers  
Val

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**From:** Lyn Atkins [<mailto:LynA@ecoscape.com.au>]  
**Sent:** Tuesday, 13 September 2011 2:57 PM  
**To:** English, Val  
**Subject:** Pilbara TEC and PEC information

Hi Val,

I'm wondering if you can assist, or pass me onto someone who can, with clarifying some TEC and PECs in the central/western Hamersley Ranges.

Basically, we've done a bit of vegetation survey work for Fortescue Metals Group in the Hamersley Station/UCL/Mt Stuart Station area, and encountered three potential TEC/PECs.

Do you have any information available to help define:

1. TEC '*Themeda* grasslands on cracking clays (Hamersley Station, Pilbara)': we have found it to exist, by our definition, as grasslands dominated (when ungrazed) or at least characterised (when grazed) by *Themeda* sp.

Hamersley Station (usually, but apparently it is a bit of a phenotypic muddle). However we have also found it to occur as an unmappable mosaic with *Acacia* shrublands, or with an open overstorey of (most commonly) *Eucalyptus victrix*, *Hakea lorea*, *Vachellia farnesiana* or *Acacia victoria/synchronica*, or co-dominant with *Astrebla* spp.

Are all of these considered to be the TEC? All are on the Brockman land system. **No, only grassland dominated by the Themeda is the TEC. And RTIO are currently mapping that for DEC as part of Marandoo Offset.**

2. P1 PEC 'Brockman Iron cracking clay communities of the Hamersley Range', dominated by *Astrebla lappacea*.

We have found many *Astrebla* grasslands, generally dominated by *A. pectinata*, but also with *A. lappacea* and *A. elymoides*. However, none were on the Newman land system, which is how the PEC is described – but as the Newman land system is hilly (by definition 'rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands'), it is also not where grasslands (other than *Triodia*) generally occur (**but they do**), nor where cracking clays occur. **But it does!** Therefore the description strikes us as anomalous.

Is there more info available to help us define the PEC? We have always found it on cracking clays on the Brockman land system (and occasionally as a bit of a mosaic on the Hooley land system) – and this does fit the description. **This PEC only occurs in the Hamersleys, not in the Fortescue valley or in the Chichesters. Yes it always occurs as a cracking clay unit down on the valley floor. Occurs on valley floors with Brockman iron detrital. Landsystem mapping not at a sufficient resolution to delimit to pick up extent of this PEC**

3. P3 PEC '*Triodia* sp. Robe River assemblages of mesas of the Robe Valley'. We've also found vegetation that fits this description. As far as we have been able to define (including by asking Malcolm Trudgen), any area dominated by *Triodia* sp. Robe River qualifies as this PEC. (I'm not a big fan of *Triodia*, but this species is actually attractive! Our nicknames are 'rockstar *Triodia*' or 'cousin It *Triodia*'.)

Is there any more info available on this PEC? **Yes all occurrences of *Triodia* sp Robe River were originally PEC but now refined to just the occurrences where it is on Mesa landforms with *Acacia citrinoviridis* and *A pruinocarpa* as the dominant overstorey. In future, other community types with *Triodia* Robe River may again be listed as PEC as DEC get more information and our knowledge grows.**

Thanks,

Lyn

**Lyn Atkins**

Associate Environmental Scientist  
Ecologist/Botanist

**ecoscape**

PO Box 50 / 9 Stirling Highway, North Fremantle WA 6159  
Ph: (08) 9430 8955 | Mob: 0438 040 962 | Fax: (08) 9430 8977  
www.ecoscape.com.au

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## Appendix Ten: Conservation Significant Flora Risk Assessment

**Table 29: Conservation Significant Flora Risk Matrix**

Species	Cons Code	Soil	Landform	Vegetation	Soil Type Present	Landform Present	Associated Vegetation Present	Known from Nearby	Likelihood of Occurring in Delphine
<i>Lepidium catapycnon</i>	T	Skeletal soils	Hillsides	<i>Eucalyptus leucophloia</i> , <i>Triodia</i> spp.	Y	Y	Y	N	Unlikely
<i>Thryptomene wittweri</i>	T	Skeletal red stony soils	Breakaways, stony creek beds	<i>Eucalyptus kingsmillii</i>	Y	Y	Y	N	Unlikely
<i>Bothriochloa decipiens</i> var. <i>cloncurrensis</i>	P1	Clay, loam	Damp depression; clay plain	Mulga, <i>Eucalyptus camaldulensis</i>	Y	U	Y	N	Unlikely
<i>Calotis squamigera</i>	P1	Pebbly loam	Plain	Mulga, <i>Acacia xiphophylla</i>	Y	Y	Y	N	Likely
<i>Eragrostis</i> sp. Mt Robinson (S. van Leeuwen 4109)	P1	Red-brown skeletal soils, ironstone	Steep slopes, summits	<i>Eucalyptus kingsmillii</i>	Y	Y	N	N	Unlikely
<i>Eremophila</i> sp. West Angelas (S. van Leeuwen 4086)	P1	Banded ironstone	High hills; summits	<i>Eucalyptus kingsmillii</i> , Mulga	N	N	N	N	None (rare)
<i>Eremophila</i> sp. Snowy Mountain (S. van. Leeuwen 3737)	P1	Ironstone	High hills; summits	<i>Eucalyptus leucophloia</i>	Y	N	Y	N	Unlikely
<i>Eremophila spongiocarpa</i>	P1	Weakly saline alluvium	Alluvial plain on margins of marsh	Samphire	N	N	N	N	None (rare)
<i>Eucalyptus lucens</i>	P1	Ironstone rocks	Rocky slopes and mountain tops, high in the landscape	<i>Eucalyptus kingsmillii</i>	Y	N	N	N	None (rare)
<i>Genus</i> sp. Hamersley Range hilltops (S van Leeuwen 4345)	P1	Skeletal, brown gritty soil over ironstone	Hill summit	<i>Eucalyptus leucophloia</i> , <i>Triodia</i> spp.	Y	N	Y	Y	Unlikely
<i>Sida</i> sp. Hamersley Range (K. Newbey 10692)	P1	Skeletal soil; ironstone	Hilltops, cliffs, scree	<i>Eucalyptus leucophloia</i> , <i>Eucalyptus gamophylla</i>	Y	Y	Y	Y	Likely
<i>Tetradlea fordiana</i> ms	P1	Shale pocket amongst ironstone	Midslope	<i>Eucalyptus kingsmillii</i>	Y	Y	N	N	Unlikely
<i>Teucrium pilbaranum</i>	P1	Clay	Crab hole plain in a river floodplain, margin of calcrete table	<i>Eucalyptus camaldulensis</i> , <i>Eucalyptus victrix</i> , <i>Chrysopogon fallax</i>	Y	Y	Y	N	Likely
<i>Vittadinia</i> sp. Coondewanna Flats (s. van Leeuwen 4684)	P1	Clay loam soils	Plain	Mulga	Y	Y	Y	N	Unlikely
<i>Adiantum capillus-veneris</i>	P2	Rocky	Moist, sheltered sites in gorges and on cliff walls	Unknown	Y	Y	Y	N	Unlikely

Species	Cons Code	Soil	Landform	Vegetation	Soil Type Present	Landform Present	Associated Vegetation Present	Known from Nearby	Likelihood of Occurring in Delphine
<i>Cladium procerum</i>	P2	Loam, gravel	Perennial pools	Unknown	Y	Y	U	N	Unlikely
<i>Eremophila forrestii</i> subsp. Pingandy (M.E. Trudgen 2662)	P2	Stony soil	Slopes, low in landscape	Mulga	Y	Y	Y	N	Unlikely
<i>Oxalis</i> sp. Pilbara (M.E. Trudgen 12725)	P2	Red-brown pebbly/rocky loam amongst boulders	Gullies	<i>Acacia</i> spp, <i>Eucalyptus leucophloia</i>	Y	Y	Y	N	Unlikely
<i>Paspalidium retiglume</i>	P2	Clay; cracking	Plain	Grassland/herbland	N	Y	Y	N	Unlikely
<i>Pilbara trudgenii</i>	P2	Skeletal, red stony soil over ironstone	Hill summits, steep slopes, screes, cliff faces	<i>Eucalyptus kingsmillii</i>	Y	Y	N	N	Unlikely
<i>Scaevola</i> sp. Hamersley Range basalts (S. van Leeuwen 3675)	P2	Skeletal, brown gritty soil over basalt	Summits of hills, steep hills	<i>Eucalyptus kingsmillii</i>	Y	Y	N	N	Unlikely
<i>Spartothamnella puberula</i>	P2	Rocky loam, sandy or skeletal soils, clay	Gorge, gully	<i>Acacia</i> spp.	Y	Y	Y	Y	Likely
<i>Vigna</i> 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)	<i>Triodia epactia</i> , Mulga, <i>Eucalyptus camaldulensis</i>	N	Y	Y	N	Unlikely
<i>Acacia daweana</i>	P3	Stony red loamy soils	Low rocky rises, along drainage lines	<i>Acacia</i> spp, <i>Eucalyptus</i> spp.	Y	Y	Y	N	Unlikely
<i>Acacia subtiliformis</i>	P3	Rocky calcrete plateau	Plateau	<i>Triodia</i> spp.	Y	Y	Y	N	Likely
<i>Calotis latiuscula</i>	P3	Sand, loam	Plain	Mulga	Y	Y	Y	Y	Almost certain
<i>Dampiera anonyma</i> ms	P3	Skeletal red-brown to brown gravelly soil over banded ironstone, basalt, shale and jaspilite	Hill summits, upper slopes	<i>Eucalyptus kingsmillii</i> , <i>Acacia hamersleyana</i>	Y	N	N	Y	Unlikely
<i>Dampiera metallorum</i> ms	P3	Skeletal red-brown gravelly soils over banded ironstone	Steep slopes and summits	<i>Eucalyptus kingsmillii</i>	Y	Y	N	N	Unlikely
<i>Eragrostis crateriformis</i>	P3	Clayey loam or clay	Creek banks, depressions	<i>Triodia epactia</i> , <i>Eucalyptus victrix</i>	Y	Y	Y	N	Unlikely
<i>Eragrostis surreyana</i>	P3	Red-brown clay	Drainage line	<i>Eucalyptus victrix</i> , <i>Eucalyptus camaldulensis</i> , <i>Cyperus vaginatus</i>	Y	Y	Y	N	Unlikely

Species	Cons Code	Soil	Landform	Vegetation	Soil Type Present	Landform Present	Associated Vegetation Present	Known from Nearby	Likelihood of Occurring in Delphine
<i>Eremophila forrestii</i> subsp. <i>viridis</i>	P3	Unknown	Sandplain	Unknown	U	N	U	N	Unlikely
<i>Eremophila magnifica</i> subsp. <i>velutina</i>	P3	Skeletal soils over ironstone	Summits	<i>Eucalyptus kingsmillii</i>	Y	N	N	Y	Likely
<i>Fimbristylis sieberiana</i>	P3	Mud, skeletal soil pockets	Pool edges, sandstone cliffs	<i>Cyperus vaginatus</i>	Y	Y	Y	N	Unlikely
<i>Geijera salicifolia</i>	P3	Skeletal soils, stony soils	Massive rock scree, gorges	Mulga	Y	Y	Y	N	Unlikely
<i>Glycine falcata</i>	P3	Black clayey sand	Floodplains; depressions in crabhole plains on river	Grassland; <i>Eriachne</i> spp.	N	N	Y	Y	Unlikely
<i>Gymnanthera cunninghamii</i>	P3	Sand, calcrete, clay loam	Drainage line	<i>Eucalyptus camaldulensis</i> , <i>Eucalyptus victrix</i> , <i>Acacia citrinoviridis</i>	Y	N	N	Y	Unlikely
<i>Indigofera gilesii</i> subsp. <i>gilesii</i>	P3	Pebbly loam amongst boulders & outcrops	Hills	<i>Eucalyptus leucophloia</i> , <i>Corymbia hamersleyana</i> , <i>Corymbia ferriticola</i>	Y	Y	Y	N	Unlikely
<i>Indigofera</i> sp. Bungaroo Creek (S. van Leeuwen 4301)	P3	Alluvium, skeletal ironstone	Creeks and gorges	Not given	Y	Y	Y	Y	Does occur
<i>Iotasperma sessilifolium</i>	P3	Cracking clay, black loam	Edges of waterholes, plains	Grassland, <i>Eriachne</i> spp., <i>Astrebla</i> spp., <i>Eucalyptus victrix</i>	N	N	N	Y	Unlikely
<i>Oldenlandia</i> sp. Hamersley Station (A.A. Mitchell PRP 1479)	P3	Cracking clay, basalt	Gently undulating plain with large surface rocks, flat crabholed plain	<i>Astrebla</i> grassland; Mulga	Y	Y	N	N	Unlikely
<i>Olearia mucronata</i>	P3	Schist	Schistose hills, along drainage channels	Mulga; grassland	N	Y	Y	N	Unlikely
<i>Phyllanthus aridus</i>	P3	Sandstone, gravel, red sand	Sandplain, hills	Coastal	N	N	N	N	None (rare)
<i>Ptilotus subspinescens</i>	P3	Rocky	Gentle rocky slopes, screes and the bases of screes	Unknown	Y	Y	U	Y	Likely
<i>Rhagodia</i> sp. Hamersley (M. Trudgen 17794)	P3	Clay loam, sand loam, colluvium	Floodplain / lower slopes	Mulga; <i>Triodia</i> grassland	Y	Y	Y	N	Likely
<i>Rostellularia adscendens</i> var. <i>latifolia</i>	P3	Ironstone soils	Near creeks, rocky hills	Mulga; <i>Eucalyptus kingsmillii</i>	Y	Y	Y	N	Unlikely
<i>Sida</i> sp. Barlee Range (S van Leeuwen 1642)	P3	Skeletal red soils pockets	Steep slope	<i>Ficus brachypoda</i> , <i>Corymbia ferriticola</i> , <i>Eucalyptus victrix</i> , <i>Eucalyptus kingsmillii</i>	Y	Y	Y	Y	Likely
<i>Swainsona</i> sp. Hamersley Station (A.A. Mitchell 196)	P3	Clay loam (cracking)	Flat crabholed plain	<i>Astrebla</i> grassland; Mulga	N	N	Y	Y	Unlikely

Species	Cons Code	Soil	Landform	Vegetation	Soil Type Present	Landform Present	Associated Vegetation Present	Known from Nearby	Likelihood of Occurring in Delphine
<i>Triodia</i> sp. Mt. Ella (ME Trudgen 12739)	P3	Light orange-brown, pebbly loam. Amongst rocks & outcrops, gully slopes	Hilltops, gorges, gullies	<i>Eucalyptus leucophloia</i> , <i>Corymbia ferriticola</i> , Mulga	Y	Y	Y	N	Unlikely
<i>Triodia</i> sp. Robe River (M.E. Trudgen et al. MET 12367)	P3	Banded ironstone, Robe pisolite	Rocky hills and mesas	<i>Eucalyptus leucophloia</i> , <i>Acacia pruinocarpa</i> , <i>Acacia bivenosa</i> , <i>Acacia inaequilatera</i>	Y	Y	Y	Y	Does occur
<i>Acacia bromilowiana</i>	P4	Red skeletal stony loam, orange-brown pebbly, gravel loam, laterite, banded ironstone, basalt	Rocky hills, breakaways, scree slopes, gorges, creek beds	<i>Eucalyptus leucophloia</i> , <i>Eucalyptus kingsmillii</i> , <i>Corymbia ferriticola</i> , <i>Acacia hamersleyensis</i>	Y	Y	Y	Y	Likely
<i>Eremophila magnifica</i> subsp. <i>magnifica</i>	P4	Skeletal soils over ironstone	Rocky screes	<i>Corymbia hamersleyana</i> , <i>Eucalyptus leucophloia</i> , <i>Eucalyptus kingsmillii</i>	Y	Y	Y	Y	Likely
<i>Goodenia nuda</i>	P4	Alluvium, loam, clay (various)	Adjacent to drainage, floodplain, hills	Various	Y	Y	Y	Y	Likely
<i>Livistona alfredi</i>	P4	Stony loam, limestone	Edges of permanent pools	<i>Eucalyptus camaldulensis</i> , <i>Eucalyptus victrix</i> , <i>Corymbia opaca</i>	Y	Y	Y	Y	Unlikely
<i>Ptilotus mollis</i>	P4	Rocky	Stony hills and screes	<i>Eucalyptus leucophloia</i> , Mulga, <i>Triodia</i> spp.	Y	Y	Y	Y	Likely
<i>Rhynchosia bungarensis</i>	P4	Pebbly, coarse sand	Banks of flow line	Various	Y	Y	Y	Y	Does occur