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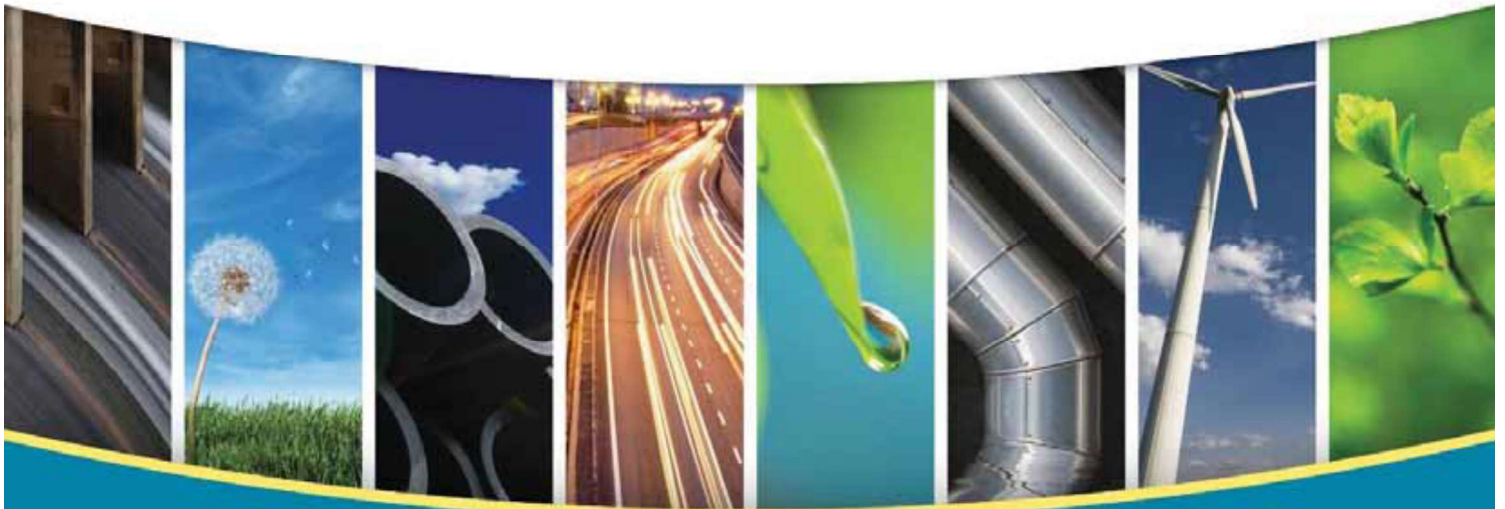
REPORT

CORUNNA DOWNS PROJECT PUBLIC ROAD UPGRADE:

LEVEL 1 FAUNA ASSESSMENT

Prepared for Atlas Iron Limited

December 2016



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Executive Summary

Atlas Iron Limited (Atlas) commissioned MWH, to conduct a Level 1 fauna assessment (this Assessment) of the Corunna Downs Public Road Upgrade (the Project), located between Marble Bar and the Corunna Downs project, located approximately 33 km south (by road) of Marble Bar in the Pilbara region of Western Australia. The Project refers to the Marble Bar-Woodstock Road, which will be upgraded for a distance of approximately 33 km from the Corunna Downs mine to Halse Road near Marble Bar (**Figure 1-2**). Provision has been included along the length of the Public Road Upgrade for borrow pits and groundwater abstraction. Two areas were given consideration in compiling this assessment (**Figure 1-2**):

- the **Application Area**, which encompasses 655 ha of land surveyed for this assessment and comprises 74.24 ha of Existing Cleared Areas; and
- The indicative **Project Footprint**, which occurs entirely within the Application Area and encompasses 150 ha of land.

The overarching objective for this Assessment was to assess potential impacts of the Project to native fauna occurring, and with the potential to occur, within the Application Area via way of a Level 1 fauna Survey. The Survey was conducted over two days, on the 2nd and 5th of October 2016. The Survey composed sampling at 15 sites, where one person hour was spent looking for fauna, and habitat assessments that were conducted at sites within each habitat type.

The desktop study identified a total of 325 species of vertebrate fauna, which have previously been recorded and/or have the potential to occur within the Application Area. This comprises 38 native mammals, nine non-native mammals, 164 birds, 104 reptiles and ten amphibians. Of the 325 species of vertebrate fauna identified as being previously recorded and/or having the potential to occur, 32 are considered to be of conservation significance, comprising nine mammals, 19 birds and four reptiles.

Six broad fauna habitat types were identified and mapped over the Application Area. This is in addition to area mapped as Existing Cleared Areas, which comprised the existing Marble Bar-Woodstock Road, existing borrow pits, and historical clearing for excavations and historical mines such as the Comet Gold Mine. The Existing Cleared Areas within the Application Area comprised 74.24 ha (11%). The habitat types were, in order of extent, Spinifex Stony Plain, Calcrete, Stony Rises, Drainage Line, Riverine and Rocky Foothills. Vegetation condition ranged from Excellent to Good. Fire, infestation of weeds (particularly Buffel Grass) and feral grazing were the most commonly recorded disturbance factors. Two habitats, Drainage Line and Riverine, were considered to have a limited extent within the Application Area and considered to be of significance for their ability to support species of conservation significance.

A total of 28 vertebrate fauna species were recorded during the field survey, comprising four mammals (two native), 16 birds and eight reptile species. This list includes two introduced vertebrate fauna species, the European Cattle (*Bos taurus*) and Horse (*Equus caballus*). No fauna were recorded during the Survey

that had not been identified during the desktop study. The two species of conservation significance Confirmed in the Application Area were the Western Pebble-mound Mouse (*Pseudomys chapmani*; Priority 4 listed by the Department of Parks and Wildlife) and the Rainbow bee-eater (*Merops ornatus*; Schedule 5 under the *Wildlife Conservation Act 1950*). Of these species, two were Confirmed as occurring within the Application Area, two were assessed as Very Likely, three as Likely, 12 as Possible, and 13 as Unlikely, to occur. Those considered Very Likely or Likely were:

- Ghost Bat (*Macroderma gigas*) – listed as Vulnerable (*Environment Protection and Biodiversity Conservation Act 1999*) and Schedule 3 (WC Act);
- Pilbara Leaf-nosed Bat (*Rhinonictis aurantia*) – listed as Vulnerable (EPBC Act) and Schedule 3 (WC Act);
- Spectacled Hare-wallaby (*Lagorchestes conspicillatus leichardti*) – listed as Priority 3 by DPaW;
- Long-tailed Dunnart (*Sminthopsis longicaudata*) – listed as Priority 4 by DPaW; and
- Eastern Great Egret (*Ardea modesta*) – listed as Schedule 5 (Migratory; WC Act).

Database searches and a literature review yielded a total of 46 terrestrial short-range endemic invertebrate species from target groups that have been collected within a 100 km radius of the Application Area. Of these species, the millipede *Antichiropus* 'DIP034' the snail *Rhagada* 'cf. *richardsonii*' and the slater *Buddelundia* '86' have a high potential to occur within the Application Area as they have been collected in close proximity to the Project in the same habitats that occur in the Application Area. Ten additional SRE species have a medium potential to occur in the Application Area on the basis of proximity and known habitat associations. Habitats with potential to support short-range endemic species, Drainage Line and Riverine habitat have limited distribution in the Application Area and are well represented outside the Application Area.

Nine threatening processes were identified as having the potential to threaten fauna within or surrounding the Application Area, these were: clearing, vehicle collision, noise and vibration, dust emissions, artificial lighting, altered hydrology, altered fire regimes, introduced flora and introduced fauna. Of the broad fauna habitats that have potential to be adversely affected, two are considered to be of significance to fauna assemblages, fauna of conservation significance and/or short-range endemic invertebrates; Drainage Line and Riverine. Approximately 6.2 ha (16.5%) and 2.8 ha (17.5%) of the Drainage Line and Riverine habitat occurs within the indicative Project Footprint, respectively.

Pre-determined categories were used to rank the expected local impacts of the Project on fauna of conservation significance. These impacts were considered within a broader, regional context. Impacts were assessed based on the assumption that no management actions or mitigation strategies would be implemented. Of the 19 species assessed, two were assessed as having a Moderate level of impact (the Pilbara Leaf-nosed Bat and Ghost Bat), four were assessed as having a Low level of impact, five were assessed as having a Minimal level of impact, and eight were assessed as having Negligible impact. No species of national environmental significance (listed under the EPBC) were deemed likely to suffer a 'significant' impact and a referral under the Commonwealth's EPBC Act is not required.

Atlas Iron Limited

Corunna Downs Project Public Road Upgrade: Level 1 Fauna Assessment

CONTENTS

Executive Summary	i
1 Introduction	1
1.1 Project Background and Location	1
1.2 Scope and Objectives	1
1.3 Background to Protection of Fauna	2
2 Existing Environment	5
2.1 Biogeographic Region	5
2.2 Climate	7
2.3 Land Systems	8
2.4 Pre-European Vegetation	10
2.5 Land Use	12
3 Desktop Study	14
3.1 Database Searches	14
3.2 Literature Review	14
3.3 Desktop Study Results: Vertebrate Fauna	23
3.4 Desktop Study Results: SRE Invertebrate Fauna	25
4 Field Survey Methodology	29
4.1 Survey Timing and Weather	29
4.2 Survey Team and Licensing	29
4.3 Terrestrial Fauna Assessment	29
4.3.1 Habitat Mapping and Assessment	29
4.3.2 Targeted Search Methods	32
4.4 Taxonomy and Nomenclature	32
4.5 Likelihood of Occurrence	33
5 Results and Discussion	34
5.1 Fauna Habitats	34
5.2 Vertebrate Fauna Assemblages	39
5.3 Conservation Significant Fauna Species	40
5.4 Short-range Endemic Invertebrate Fauna	48
5.5 Limitations and Constraints	48

6	Potential Impacts.....	50
6.1	Threatening Processes.....	50
6.1.1	Clearing	50
6.1.2	Vehicle Collision	53
6.1.3	Noise and Vibration.....	53
6.1.4	Dust Emissions	54
6.1.5	Artificial Lighting.....	54
6.1.6	Altered Hydrology	54
6.1.7	Altered Fire Regimes	55
6.1.8	Introduced Flora.....	55
6.1.9	Introduced Fauna	56
6.2	Impacts on Broad Fauna Habitats	56
6.2.1	Drainage Line.....	57
6.2.2	Riverine.....	57
6.3	Impacts on Vertebrate Fauna Assemblages	58
6.4	Impacts on SRE Invertebrate Fauna	58
6.5	Impacts on Vertebrate Fauna of Conservation Significance	58
6.6	Impacts on Matters of National Significance	69
6.6.1	What is an important population of a species?	69
6.6.2	What is habitat critical to the survival of a species?	70
6.7	General Management Recommendations	75
6.8	Project Design	75
6.9	Habitat Removal and Modification	75
6.10	Project Operations	76
6.11	Rehabilitation and Closure.....	76
7	Conclusions.....	77
8	References.....	79

LIST OF TABLES

Table 2-1: Land systems occurring within the Application Area	8
Table 2-2: Pre-European Vegetation Association Systems within the Application Area	10
Table 3-1: Databases searched	14
Table 3-2: Key findings of vertebrate fauna literature sources	15
Table 3-3: Key findings of SRE invertebrate fauna literature sources	19
Table 3-4: Summary of vertebrate fauna recorded by the desktop study	23
Table 3-5: Conservation listed fauna identified by the desktop study	24
Table 3-6: Records of SRE invertebrates returned by the database searches and literature review	26
Table 4-1: Daily weather observations at Marble Bar (station 004106) for the Survey period.....	29
Table 5-1: Attributes of broad fauna habitat types within the Application Area	35

Table 5-2: Vertebrate fauna species recorded during the survey	39
Table 5-3: Likelihood of conservation listed vertebrate fauna species occurring over the Application Area 41	
Table 5-4: Potential limitations and constraints of the field survey	48
Table 6-1: Habitat extents in the Application Area and Project Footprint	51
Table 6-2: Ranking criteria for Project local impacts on fauna of conservation significance	59
Table 6-3: Project impacts on fauna of conservation significance and suggested management actions ..	60
Table 6-4: Significance of Project to fauna of national environmental significance	71

LIST OF FIGURES

Figure 1-1: Regional location of the Application Area	3
Figure 1-2: The Application Area and indicative Project Footprint	4
Figure 2-1: Location of the Application Area with respect to IBRA bioregions and subregions	6
Figure 2-2: Climate data recorded at Marble Bar (BoM station 004020 and 004106).....	7
Figure 2-3: Land systems occurring across the Application Area	9
Figure 2-4: Pre-European vegetation associations occurring across the Application Area.....	11
Figure 2-5: Land use in the Application Area and surrounds	13
Figure 3-1: Location of vertebrate fauna surveys conducted within the vicinity of the Application Area ..	18
Figure 3-2: Location of SRE invertebrate fauna surveys conducted within the vicinity of the Application Area .. 22	
Figure 3-3: SRE invertebrates identified from the desktop study as having a high potential to occur in the Application Area	28
Figure 4-1: Location of Survey sites	31
Figure 5-1: Fauna habitats within the Application Area	38
Figure 6-1: Application Area and Project Footprint with respect to fauna habitats	52

APPENDICES

Appendix A	Definition of Codes and Terms Used to Describe Conservation Significance
Appendix B	Vertebrate Fauna Previously Recorded Within the Vicinity of the Application Area
Appendix C	Potential Terrestrial SRE Invertebrate Species Identified in the Desktop Study
Appendix D	Fauna Habitat Assessments
Appendix E	Locations of Fauna of Conservation Significance Recorded within the Application Area

1 Introduction

1.1 Project Background and Location

Atlas Iron Limited (Atlas) commissioned MWH Australia Pty Ltd (MWH), to conduct a Level 1 fauna assessment (this Assessment) of the Corunna Downs Public Road Upgrade (the Project), located between Marble Bar and the Corunna Downs project, in the Pilbara region of Western Australia (**Figure 1-1**).

The Public Road Upgrade (PRU) refers to the Marble Bar-Woodstock Road, which will be upgraded for a distance of approximately 33 kilometres (km) from the Corunna Downs mine in the south of the Project to Halse Road near Marble Bar in the north of the Project (**Figure 1-2**). Provision has been included along the length of the PRU for borrow pits and groundwater abstraction. Two areas were given consideration in compiling this assessment (**Figure 1-2**):

- the **Application Area**, which encompasses 655 hectares (ha) of land surveyed for this assessment and comprises 74.24 ha of existing cleared areas; and
- The indicative **Project Footprint**, which occurs entirely within the Application Area and encompasses 150 ha of land.

The indicative Project Footprint occurs entirely within the Application Area, however the exact alignment of the Project Footprint is yet to be confirmed. Regardless of the final layout of the Project Footprint, Atlas have committed to locating the Project within the Application Area and having a total Project Footprint of no more than 150 ha in total.

1.2 Scope and Objectives

This Assessment is based on the findings of a desktop study, including database searches and a comprehensive literature review, and a Level 1 terrestrial fauna survey conducted within the Application Area on the 2nd and 5th of October 2016 (the Survey). The overarching objective for this Assessment was to assess potential impacts of the Project to native vertebrate fauna and short-range endemic (SRE) invertebrate fauna occurring, and with the potential to occur, within the Application Area. The specific objectives of this Assessment were to:

- Complete a desktop review of relevant literature and databases for the Application Area;
- Describe fauna habitats and their condition by means of a field survey;
- Delineate and map fauna habitats and their condition, in the Application Area; and
- Assess potential impacts of the Project on fauna assemblages and their habitats.

The survey methodology adopted for the Survey was aligned with the relevant sections of the following guidelines:

- EPA (2002), *Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection*;
- EPA (2004), *Guidance Statement No. 56: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia*;
- EPA and DEC (2010), *Technical Guide: Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment*;
- EPA (2009) Guidance No. 20, *Sampling of Short-range Endemic Invertebrate Fauna for Environmental Impact Assessment in Western Australia*;

1.3 Background to Protection of Fauna

Fauna of conservation significance within this report are defined as species listed as Threatened under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), and the *Wildlife Conservation Act 1950* (WC Act). The term also extends to those species listed as Priority fauna on the Western Australian Department of Parks and Wildlife's (DPaW) Priority Species List which lists fauna which have not been assigned statutory protection, but are considered to be of conservation significance as they are near threatened, or threatened but data deficient, generally rare but not threatened, require monitoring, or have been recently removed from a threatened category. For further information on conservation rankings under the EPBC Act, WC Act, and the DPaW Priority Species List, see **Appendix A**.

A key objective of this Survey was to identify and assess the potential impacts of the Project to such species. This is an essential step in ensuring that any future Environmental Impact Assessment for the Project is adequately informed, due to the legislative protection afforded to these species. As such, discussion of fauna of conservation significance comprises a large portion of this report.

In addition to vertebrate fauna, there exist invertebrate fauna that have restricted distributions, referred to as Short-range Endemic (SRE) invertebrates, which require consideration. Some better known SRE species have been listed under State or Commonwealth legislation. However, the majority of SRE species have not been listed under legislation, often due to lack of taxonomic knowledge (EPA 2009). SRE invertebrates in general are considered relevant to environmental impact assessment as habitat loss and degradation can decrease their prospects for persistence (EPA 2009).

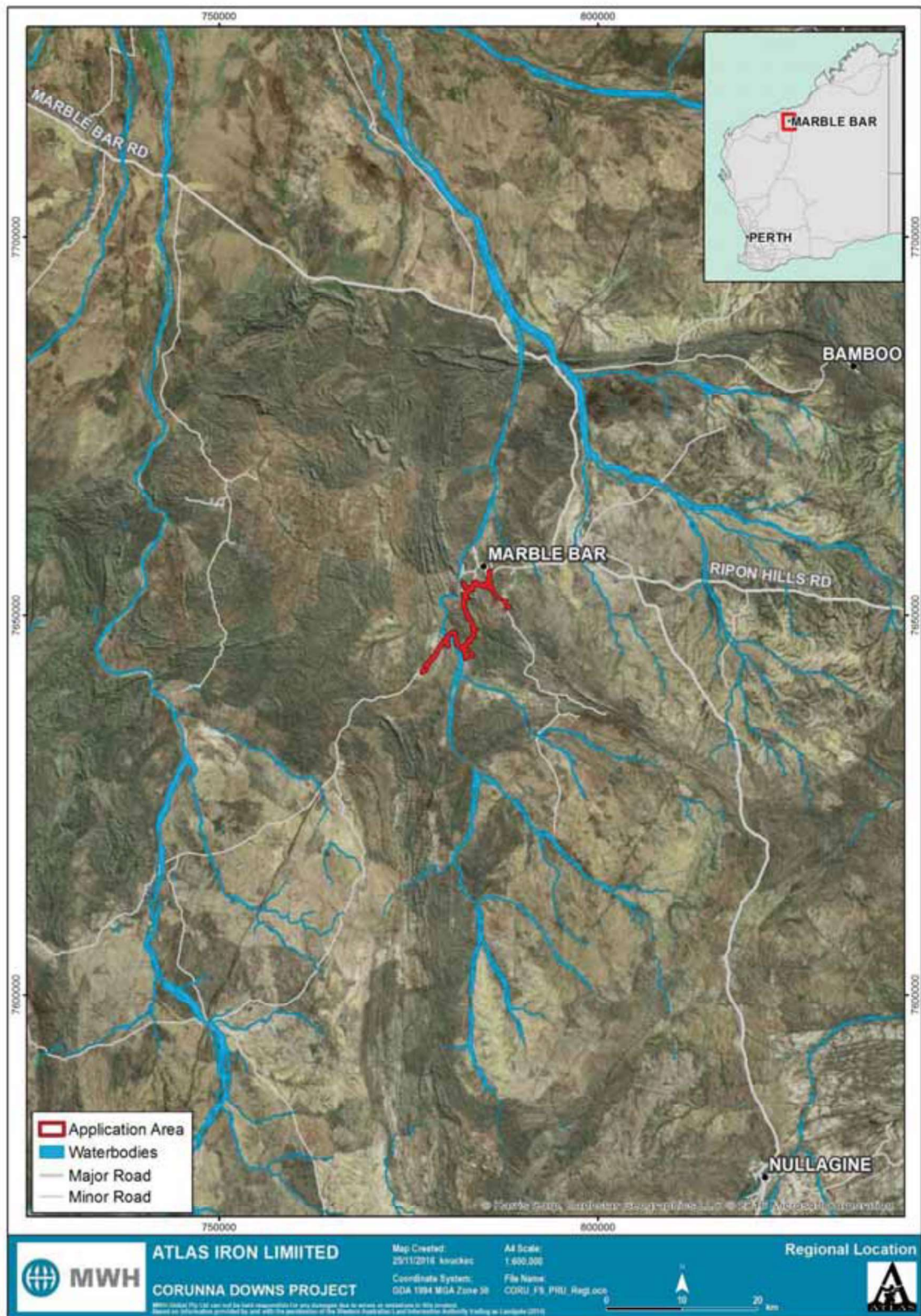


Figure 1-1: Regional location of the Application Area

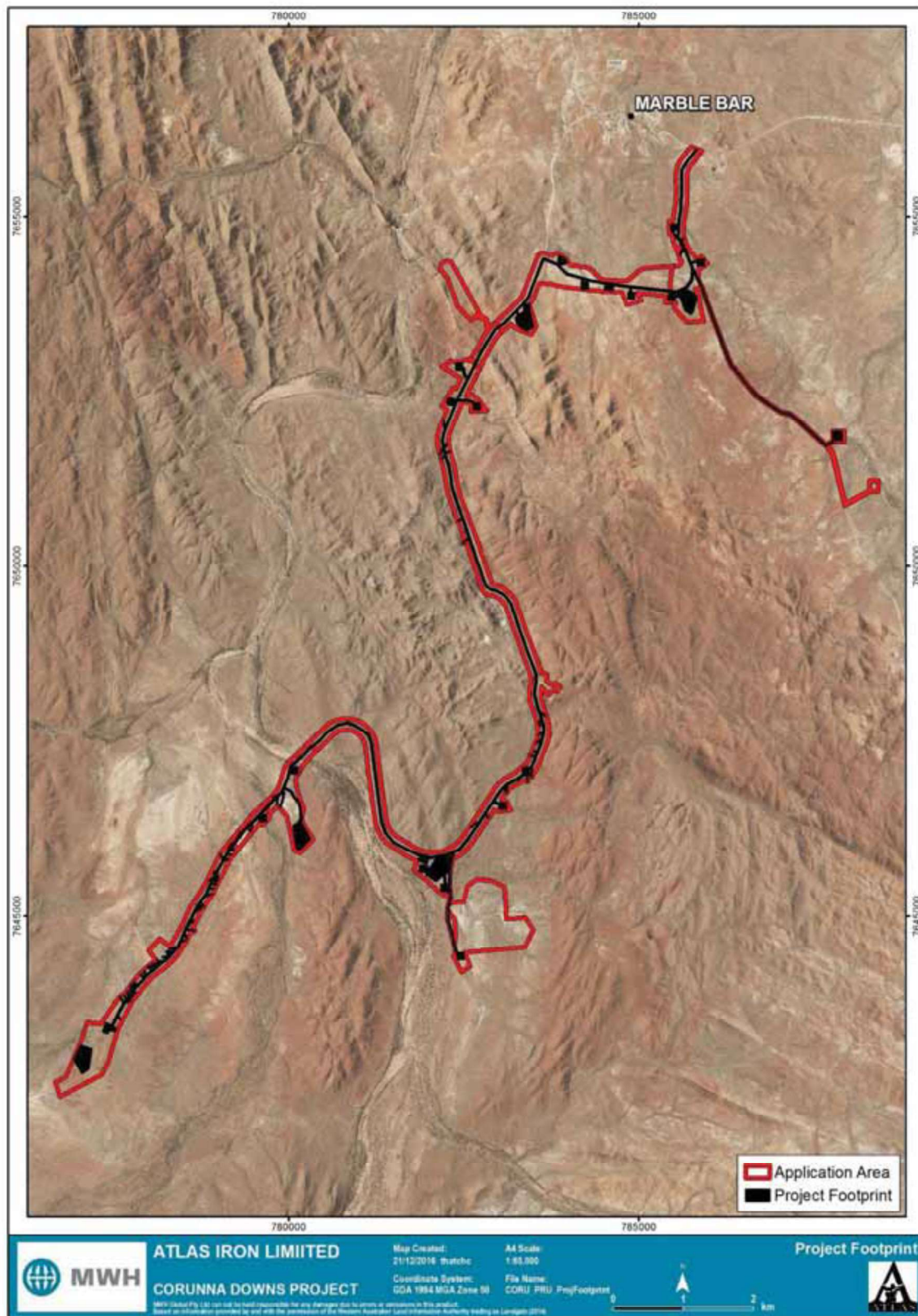


Figure 1-2: The Application Area and indicative Project Footprint

2 Existing Environment

2.1 Biogeographic Region

The Interim Biogeographic Regionalisation for Australia (IBRA) is a bioregional framework that divides Australia into 89 bioregions and 419 subregions on the basis of climate, geology, landforms, vegetation and fauna (Thackway and Cresswell 1995).

The Application Area is located within the Pilbara bioregion (**Figure 2-1**), which encompasses approximately 178,500 km² of land in northern Western Australia (McKenzie *et al.* 2009). The Pilbara bioregion has a semi-desert tropical climate, with active drainage in the Fortescue, De Grey and Ashburton river systems (McKenzie *et al.* 2003). A combination of invasive weeds, altered fire regimes, feral predators and grazing by introduced herbivores has resulted in ecosystem degradation, and consequently a loss of vegetation and native species.

The Pilbara bioregion is further classified into four sub-regions – Chichester, Roebourne, Fortescue Plains, and Hamersley (McKenzie *et al.* 2003). The Application Area is located within the Chichester subregion (**Figure 2-1**). The Chichester subregion is the largest of the four, encompassing 47% (83,700 km²) of the Pilbara bioregion (McKenzie *et al.* 2009). The Chichester subregion is characterised by undulating Archaean granite and basalt plains with substantial areas of basalt ranges (Kendrick and McKenzie 2001). The basalt plains host a shrub steppe of *Acacia inaequilatera* over *Triodia* spp. hummock grasslands, while tree steppes of *Eucalyptus leucophloia* occur on the ranges (Kendrick and McKenzie 2001). The northern part of the Chichester subregion is relatively flat and undulating, dominated by large alluvial floodplains associated with the De Grey River system and its tributaries (McKenzie *et al.* 2003).

The Application Area contains landscape and habitat features typical of the Chichester subregion. The local area is broadly comprised of low rolling hills and extensive undulating stony plains dominated by *Triodia* spp. hummock grasslands and intersected by drainage systems. Broadly speaking, the Application Area is influenced by those same ecological and landscape processes that characterise the Chichester subregion. That is, the flora and fauna are typically semi-arid inhabiting, adapted to alternating wet and dry seasonal patterns of rainfall (Leighton 2004), with fire being one of the principal determinants of habitat and vegetation structure. The Application Area is subject to those same threatening processes found throughout the subregion, in particular being grazing by introduced herbivores (Kendrick and McKenzie 2001).

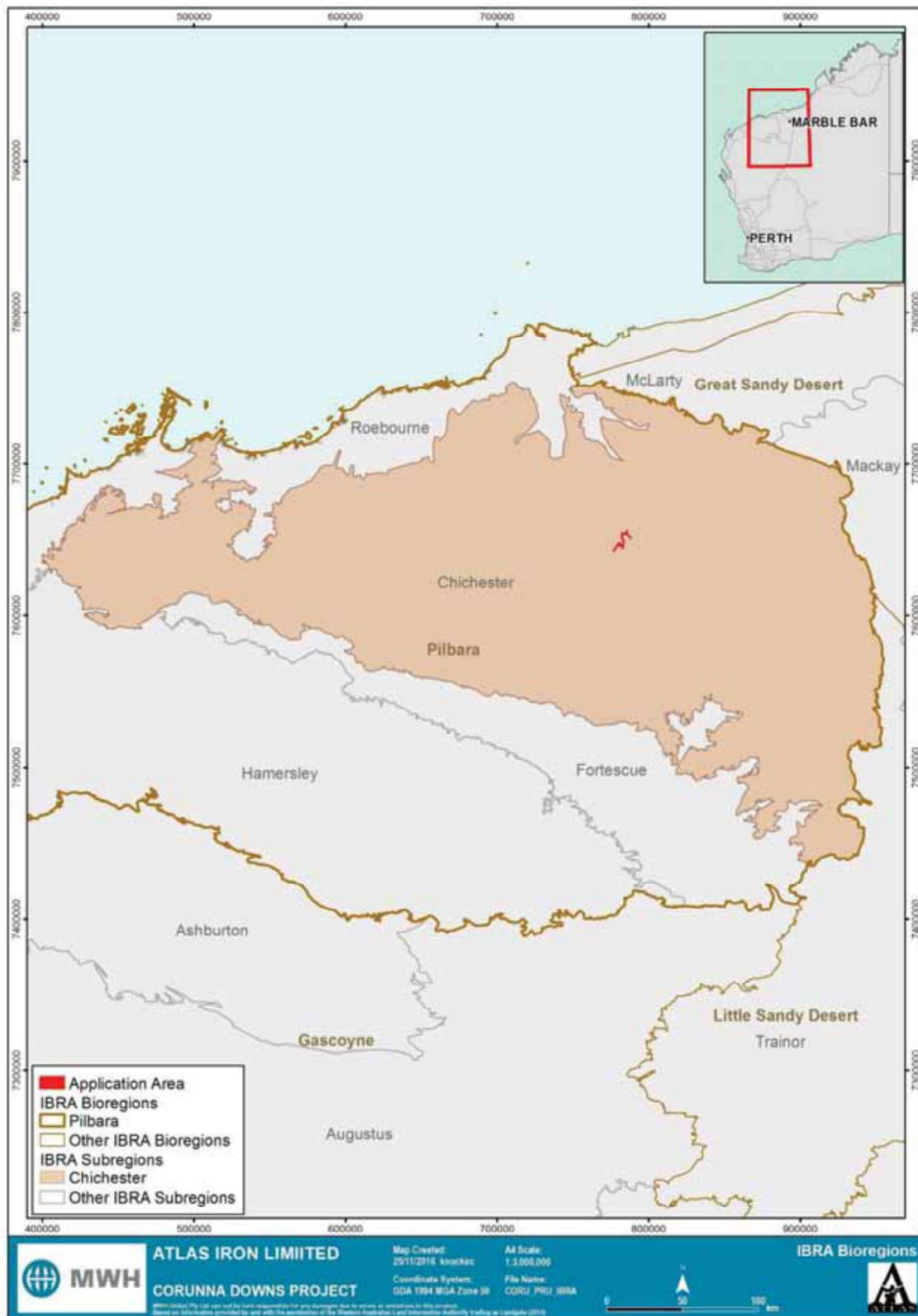


Figure 2-1: Location of the Application Area with respect to IBRA bioregions and subregions

2.2 Climate

The Application Area is located in the northern section of the Pilbara bioregion, which experiences a semi-arid climate characterised by hot summers and relatively warm, dry winters (Leighton 2004). Tropical cyclones can occur between January and April, bringing sporadic, drenching rainfall events (Leighton 2004). The closest Bureau of Meteorology (BoM) weather station to the Application Area is located at Marble Bar (station 004106; previously station 004020), the terminal point for the Application Area (BoM 2016).

Summer in the Pilbara occurs from November to February when the mean maximum temperature for Marble Bar is 41.5°C and the mean minimum temperature is 25.5°C (**Figure 2-2**). Marble Bar averages 98 days above 40°C per year (Leighton 2004). Winter occurs from June to August when the mean maximum temperature for Marble Bar is 29.6°C and the mean minimum temperature is 11.7°C (**Figure 2-2**).

Rainfall at Marble Bar occurs mainly in the first half of the year, with a mean average annual rainfall of 357 mm (BoM 2016). Rainfall within the region can be highly localised and unpredictable (Leighton 2004), with substantial fluctuations occurring from year to year (BoM 2016).

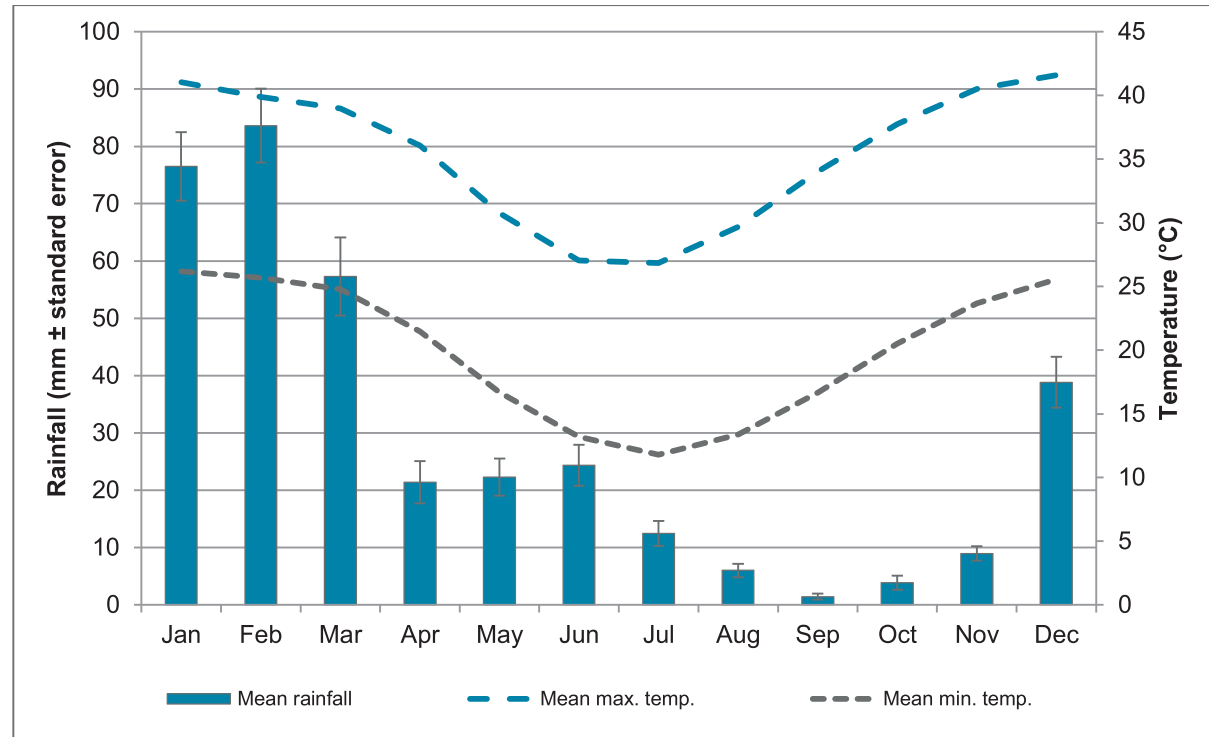


Figure 2-2: Climate data recorded at Marble Bar (BoM station 004020 and 004106)

Source: (BoM 2016), data collected between 1895-2014 for rainfall, and 1901-2016 for temperature

2.3 Land Systems

A regional land survey was undertaken in the Pilbara region between 1995 and 1999, by the, then, Department of Agriculture (now the Department of Agriculture and Food) and the then Department of Land Administration (now Landgate). The objective of the survey was to develop a comprehensive description of biophysical resources and assess the vegetation composition and soil condition within the region. This information was used by van Vreeswyk *et al.* (2004) to classify and map the land systems of the Pilbara region according to landform, soil, vegetation, geology and geomorphology.

Five land systems occur within the Application Area (**Table 2-1; Figure 2-3**). The Rocklea and Satirist land systems occupy most (88%) of the Application Area, defined broadly by low rolling hills and stony plain supporting hard spinifex (**Table 2-1; Figure 2-3**).

Table 2-1: Land systems occurring within the Application Area

Land system	Brief Description	Extent in Application Area	
		Ha	%
Rocklea	Basalt hills, plateaux, lower slopes and minor stony plains supporting hard (and occasionally soft spinifex) grasslands	452	69
Satirist	Stony plains and low rises supporting hard spinifex grasslands, and gilgai plains supporting tussock grasslands	103	16
Macroy	Sandy/Stony plains and occasional tor fields based on granite supporting hard and soft spinifex shrubby grasslands	51	8
River	Narrow, seasonally active flood plains and major river channels supporting moderately close, tall shrublands or woodlands of acacias and fringing communities of eucalypts sometimes with tussock grasses or spinifex	28	4
Capricorn	Hills and ridges of sandstone and dolomite supporting low shrublands or shrubby spinifex grasslands	21	3
Total		655	100

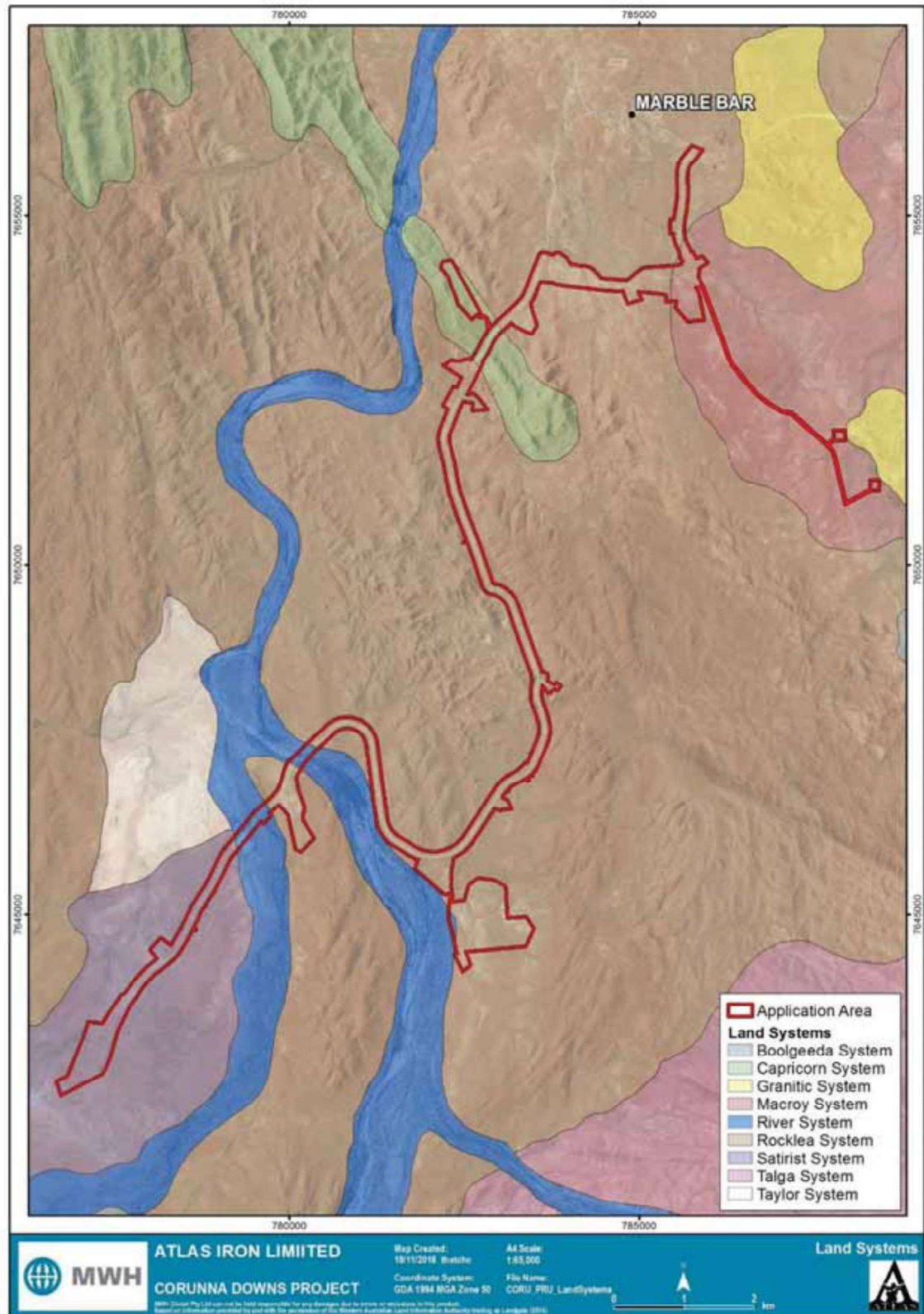


Figure 2-3: Land systems occurring across the Application Area

2.4 Pre-European Vegetation

Vegetation types reflect changes in geology, landform, soil type and hydrology, all of which are likely factors governing the distribution of vertebrate fauna taxa. The Application Area is located within the Fortescue botanical district of the Eremaean botanical province (Beard 1990). The Fortescue botanical district is characterised by tree (*Eucalyptus* and *Corymbia* spp.) and shrub (*Acacia* spp., *Hakea* spp., *Grevillea* spp. and *Senna* spp.) steppe communities and *Triodia* spp. hummock grasslands (Beard 1990).

The Pilbara region was mapped by Beard (1975) at a scale of 1:1,000,000. These vegetation systems have since been updated by Shepherd *et al.* (2002) to conform to National Vegetation Information System (NVIS) standards (ESCAVI 2003). The Application Area is located within the Abydos Plain and George Ranges vegetation association systems (Table 2-2; Figure 2-4).

Table 2-2: Pre-European Vegetation Association Systems within the Application Area

System	System code	Description	Extent in Application Area	
			Ha	%
George Ranges	102	Hummock grasslands, low tree steppe; snappy gum over <i>Triodia wiseana</i>	340	52
	43	Mosaic: Hummock grasslands, open low tree-steppe; snappy gum over <i>Triodia wiseana</i> / Hummock grasslands, shrub-steppe; kanji over <i>Triodia pungens</i>	179	27
	5	Medium woodland; river gum (<i>Eucalyptus camaldulensis</i>)	8	1
Abydos Plain	43	Hummock grasslands, shrub steppe; kanji over soft spinifex	3	1
Total			655	100

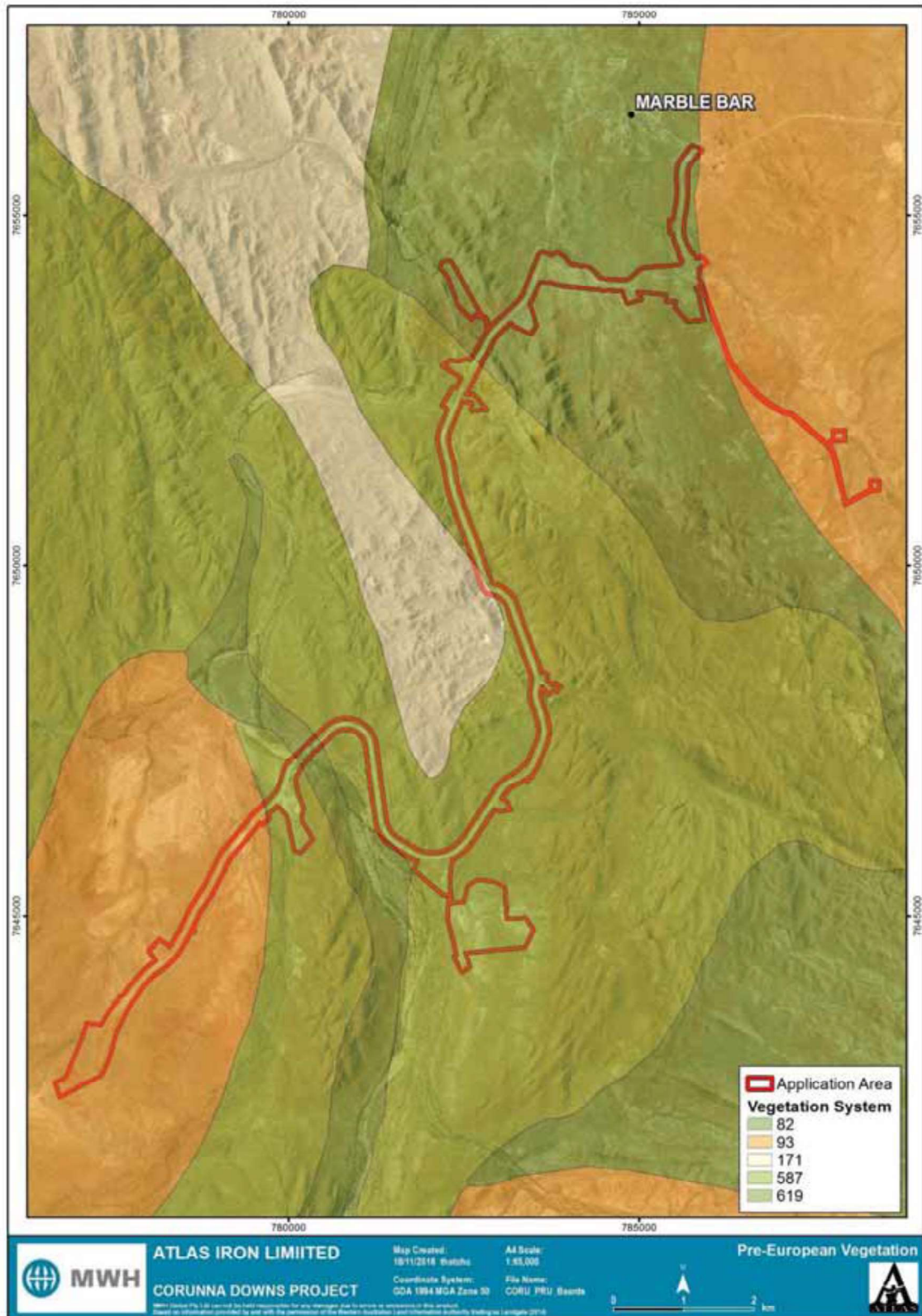


Figure 2-4: Pre-European vegetation associations occurring across the Application Area

2.5 Land Use

Land tenure in the Pilbara consists primarily of pastoral leases, with other crown reserves, such as Aboriginal reserves, and leasehold reserves (McKenzie *et al.* 2003). National parks and reserves, and unallocated crown land are the other major land use categories present in the region (McKenzie *et al.* 2003). In the Chichester subregion, the dominant land uses are pastoralism (i.e. grazing of native pasture by cattle), Aboriginal lands and reserves, vacant crown land and crown reserves, conservation, and mining (Kendrick and McKenzie 2001). The Chichester subregion has 6.6% of its land surface reserved under some form of conservation tenure, including the Abydos-Woodstock reserve (60 km west of the Application Area), Millstream-Chichester National Park (190 km west), Mungaroona Range Nature Reserve (116 km south-west) and Meentheena ex-pastoral lease (54 km east) (Kendrick and McKenzie 2001).

In the Chichester subregion, the dominant land uses are pastoralism (i.e. grazing of native pasture by cattle), Aboriginal lands and reserves, vacant crown land and crown reserves, conservation, and mining (Kendrick and McKenzie 2001). The Chichester subregion has 6.6% of its land surface reserved under some form of conservation tenure, including the Abydos-Woodstock reserve (60 km west of the Application Area), Millstream-Chichester National Park (190 km west), Mungaroona Range Nature Reserve (116 km south-west) and Meentheena ex-pastoral lease (54 km east) (Kendrick and McKenzie 2001).

Approximately 50% of the Application Area lies within the Eginbah Pastoral Station and the remaining 50% comprises Unallocated Crown Land (**Figure 2-5**). The Eginbah Pastoral Station is currently active and is managed in conjunction with the Hillside Pastoral Station (RDA 2013). Evidence of pastoral activity is widespread in the Application Area, with cattle frequently observed, land degradation around water holes and drainage lines apparent and introduced pasture grasses such as Buffel Grass (**Cenchrus ciliaris*) being present in a number of habitat types.

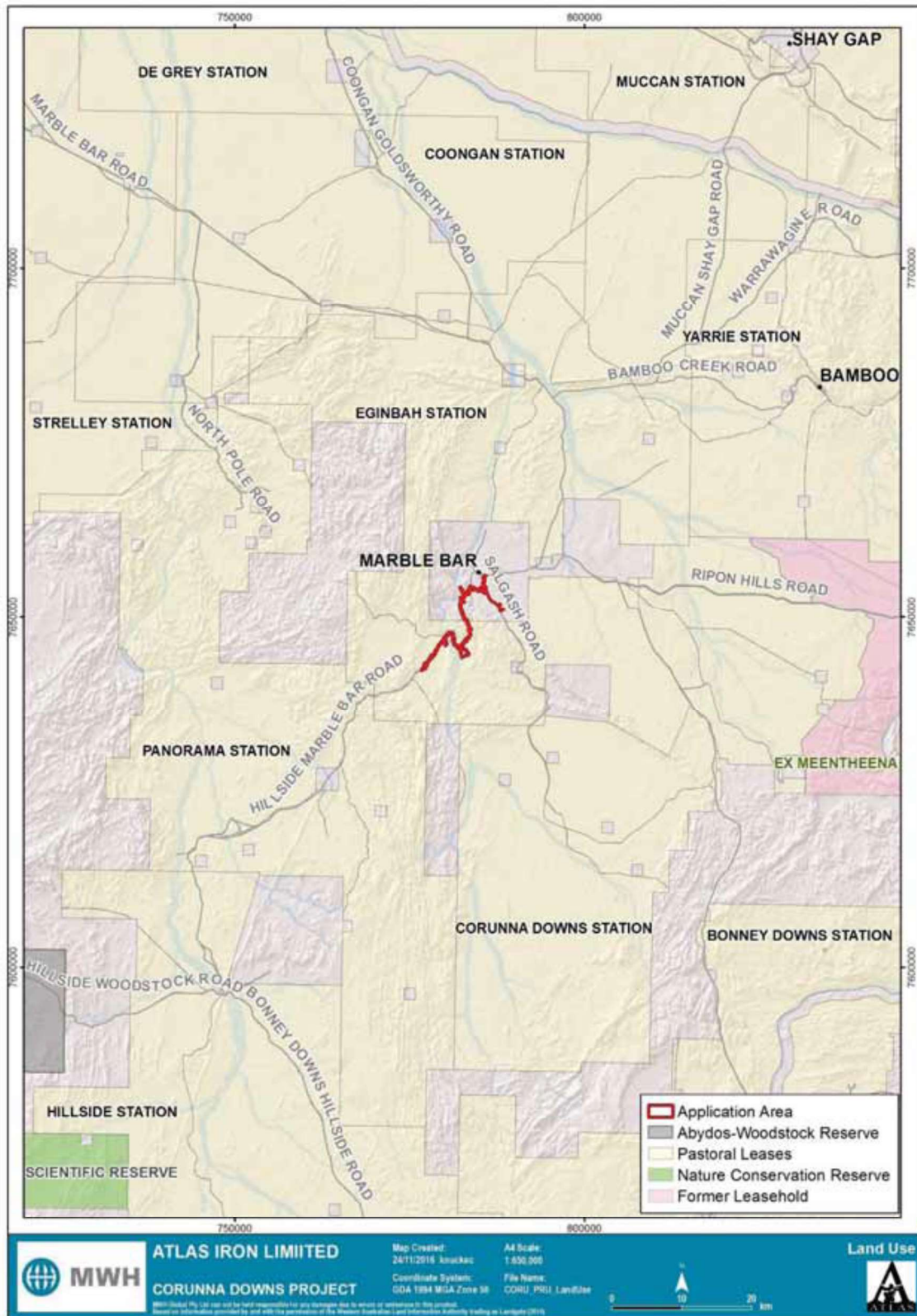


Figure 2-5: Land use in the Application Area and surrounds

3 Desktop Study

A desktop study, comprising database searches and literature reviews, was conducted prior to the field survey. The objective of the desktop study was to gather background information on the local region, to provide an indication of which fauna species and habitats were likely to be present, and to provide a regional context to inform the analysis of field survey findings. Key results of the database searches and literature review are presented in **Section 3.1**.

3.1 Database Searches

For the purpose of database searching, the Application Area was defined as a central point with coordinates 772687 mE and 7627386 mN (GDA94, UTM 50K; **Table 3-1**). Search buffers differed due to the technical capabilities of individual databases, as well as features surrounding the Application Area relevant to different species groups.

Table 3-1: Databases searched

Reference	Custodian	Database	Date obtained	Search area buffer (km)
DPaW (2016b)	Department of Parks and Wildlife (DPaW)	Threatened and Priority Fauna Database	21/10/2016	50
Birdlife Australia (2014)	Birdlife Australia	Birdlife Atlas Database	4/02/2014	75
DPaW (2016a)	Department of Parks and Wildlife (DPaW)	NatureMap	11/10/2016	40
DoEE (2016a)	Department of the Environment and Energy (DoEE)	Protected Matters Search Tool	11/10/2016	40
Western Australian Museum (2014a)	Western Australian Museum (WAM)	Arachnid and Diplopod Database	8/04/2014	square 300 x 300 km
Western Australian Museum (2014b)	Western Australian Museum	Terrestrial Mollusc Database	20/01/2014	square 300 x 300 km

3.2 Literature Review

The literature review considered 12 vertebrate fauna studies (**Table 3-2; Figure 3-1**) and ten SRE invertebrate fauna studies (**Table 3-3, Figure 3-2**) conducted within 100 km of the Application Area. Each of these studies involved detailed fauna field surveys including trapping programs. The results of each survey were collated to generate an inventory of the vertebrate fauna (**Appendix B**) and potential SRE species (**Appendix C**) known to occur in the locality of the Application Area and the surrounding region.

Table 3-2: Key findings of vertebrate fauna literature sources

Reference	Survey details	Proximity to Application Area	Methods	Habitats defined or noted	Vertebrate fauna assemblage found	Fauna of conservation significance	Notes
1 Outback Ecology (2014b)	Project: McPhee Creek Haul Road Client: Atlas Iron Limited Survey type: Two-phase, Level 2 survey Survey date: June/July 2013 and March 2014	20 km south	- Pitfall trapping - Elliott trapping - Funnel trapping - Cage trapping - Active searching - Avifauna census - Systematic searching - Targeted searching - Spotlighting - Bat echolocation recording - Opportunistic observations	- Spinifex Sandplain - Granitic Uplands - Rocky Foothills - Acacia, Spinifex on Sandplain - Spinifex Stony Plain - Stony Rise - Drainage Line - Hard Spinifex on Calcrete - Riverine - Granite Outcrop - Dolerite Ridge - Rocky Ridge and Gorge - Disturbance - Riverine Shrubland - Sandstone Ridge Top	216 vertebrate species: 33 native mammal 6 introduced mammal 96 bird 73 reptile 8 amphibian	Threatened: - Northern Quoll - Greater Bilby - Ghost Bat - Pilbara Leaf-nosed Bat - Pilbara Olive Python Priority: <i>Arillos ganei</i> <i>Ctenodactylus uber johnstonei</i> - Spectacled Hare-wallaby - Brush-tailed Mulgara - Western Pebble-mound Mouse Migratory: - Rainbow Bee-eater	Systematic sampling covered a relatively small portion of the Study Area due to access constraints. Riverine, Drainage Line and Granite Outcrop habitats were considered the most important habitat types as they are relatively uncommon in the surrounding landscape. Northern Quolls were recorded in small portion of Rocky Ridge and Gorge Habitat in the eastern portion of the survey area, while the Greater Bilby was recorded in Spinifex Sandplain habitat also in the east.
2 Outback Ecology (2012c)	Project: McPhee Creek DSO Project Client: Atlas Iron Limited Survey type: Two-phase, Level 2 Survey date: September 2011 and March 2012	55 km south-east	- Pitfall trapping - Elliott trapping - Funnel trapping - Cage trapping - Active searching - Avifauna census - Systematic searching - Targeted searching - Spotlighting - Bat echolocation recording - Opportunistic observations	- Spinifex Stony Plain - Rocky Ridge and Gorge - Ironstone Ridge Top - Drainage Line - Calcrete - Channel Iron Deposit - Rocky Foothills - Sandstone Ridge Top	164 vertebrate species: 24 native mammal 5 introduced mammal 72 bird 60 reptile 3 amphibian	Threatened: - Northern Quoll - Ghost Bat - Pilbara Leaf-nosed Bat - Pilbara Olive Python Priority: - Long-tailed Dunnart - Western Pebble-mound Mouse Migratory: - Rainbow Bee-eater	Northern Quolls and Pilbara Leaf-nosed Bats were largely confined to Rocky Ridge and Gorge Habitat. The Greater Bilby was recorded within the Spinifex Stony Plain habitat type, within a small occurrence of Spinifex grassland with Acacia shrubs.
3 Outback Ecology (2013b)	Project: Mt Webber DSO Project Client: Atlas Iron Limited Survey type: Two-phase, Level 2 survey Survey date: March/April 2010 and September/October 2010	37 km west	- Pitfall trapping - Elliott trapping - Funnel trapping - Cage trapping - Active searching - Avifauna census - Systematic searching - Targeted searching - Spotlighting - Bat echolocation recording - Opportunistic observations	- Rocky Foothills - Rocky Ridges and Gorges - Stony Rise - Granitic Uplands - Spinifex Stony Plain - Acacia, Spinifex on Sandplain - Spinifex Sandplain - Riverine - Drainage Line - Upland Drainage Line - Hard Spinifex on Calcrete - Granite outcrop - Disturbance (i.e. cleared land) - Riverine Shrubland	155 vertebrate species: 20 native mammal 2 introduced mammal 68 bird 59 reptile 6 amphibian	Threatened: - Northern Quoll - Ghost Bat - Pilbara Leaf-nosed Bat - Pilbara Olive Python Priority: <i>Arillos ganei</i> - Western Pebble-mound Mouse Migratory: - Rainbow Bee-eater	Habitats identified within the survey area were consistent with habitat types known to occur in the vicinity and wider region. Within the survey area, the Rocky Ridges and Gorges habitat type was identified as the most important for supporting species of conservation significance. Seventeen caves were considered regionally significant because of their high quality and their scarcity in the surrounding region.
4 Outback Ecology (2012a)	Project: Hercules DSO Project Client: Atlas Iron Limited Survey type: Single-phase, Level 2 survey Survey date: March 2011	100 km north-west	- Pitfall trapping - Elliott trapping - Funnel trapping - Cage trapping - Active searching - Avifauna census - Systematic searching - Targeted searching - Spotlighting - Bat echolocation recording - Opportunistic observations	- Rocky Foothills - Rocky Ridge - Spinifex Stony Plain - Scree Slope - Drainage Line	85 vertebrate species: 11 native mammal 1 introduced mammal 39 bird 31 reptile 3 amphibian	Threatened: - Northern Quoll - Ghost Bat - Pilbara Leaf-nosed Bat Priority: - Western Pebble-mound Mouse Migratory: - Rainbow Bee-eater	Habitats identified within the survey area were consistent with habitat types known to occur in the vicinity and wider region. Within the survey area, the Rocky Ridge habitat type was identified as the most important for supporting species of conservation significance, as it contained an abundance of outcroppings, caves, crevices and gorges. Drainage Line habitat was also noted as important due to the fauna assemblages recorded therein and its relative paucity in the survey area.
5 Outback Ecology (2011a)	Project: Atydos DSO Project Client: Atlas Iron Limited Survey type: Two-phase, Level 2 survey Survey date: April-May and September 2010	65 km north-west	- Pitfall trapping - Funnel trapping - Funnel trapping - Cage trapping - Active searching - Avifauna census - Systematic searching - Targeted searching - Spotlighting - Bat echolocation recording - Opportunistic observations	- Stony Rises - Drainage Line - Rocky Foothills - Rocky Ridges and Gorges	99 vertebrate species: 15 native mammal 1 introduced mammal 39 bird 41 reptile 3 amphibian	Threatened: - Northern Quoll - Ghost Bat - Pilbara Leaf-nosed Bat - Pilbara Olive Python Migratory: - Rainbow Bee-eater	Habitats identified within the survey area were consistent with habitat types known to occur in the vicinity and wider region. Within the survey area, the Rocky Ridges and Gorges and Drainage Line habitat types were identified as the most important for supporting species of conservation significance as they possess microhabitats that are not typically found in the similar habitat in the surrounding region (e.g. semi-permanent water pools and water seeps, large deep caves and crevices).

Reference	Survey details	Proximity to Application Area	Methods	Habitats defined or noted	Vertebrate fauna assemblage found	Fauna of conservation significance	Notes
6 Outback Ecology Ecologists (2010a)	<u>Project:</u> Turner River Hub Project <u>Client:</u> Atlas Iron Limited <u>Survey type:</u> Two-phase, Level 2 <u>Survey date:</u> April-May and September-October 2010	37 km west	- Pitfall trapping - Elliott trapping - Funnel trapping - Cage trapping - Active searching - Avifauna census - Systematic searching - Targeted searching - Spotlighting - Bat echolocation recording - Opportunistic observations	- Acacia, Spinifex on Sandplain - Drainage Line - Riverine - Rocky Foothills - Spinifex Sandplain - Spinifex Stony plain - Stony Rise - Channel Iron Deposit - Granite Outcrop - Granitic Uplands - Riverine Shrubland - Rocky Ridges and Gorges - Stony Rise	<u>180 vertebrate species:</u> 24 native mammal 5 introduced mammal 75 bird 70 reptile 6 amphibian	<u>Threatened:</u> - Northern Quoll - Ghost Bat - Pilbara Leaf-nosed Bat - Pilbara Olive Python <u>Priority:</u> - Anillos ganei - Spectacled Here-wallaby - Brush-tailed Mulgara - Western Pebble-mound Mouse <u>Migratory:</u> - Eastern Great Egret - Rainbow Bee-eater	This Assessment considered data only from the Turner River Hub, Southern Haul Road and Mt Webber components of this field survey. The field survey sampled areas further toward the north, i.e. toward Port Hedland, but these data were excluded as they were derived from habitat types unlikely to occur within the Study Area, e.g. Mangroves.
7 ecologia Environment (2010b)	<u>Project:</u> Mt Webber DSO Project <u>Client:</u> Gralia Resources NL <u>Survey type:</u> Single-phase, Level 2 <u>Survey date:</u> April 2010	37 km west	- Pitfall trapping - Funnel trapping - Cage trapping - Active searching - Avifauna census - Systematic searching - Targeted searching - Spotlighting - Bat echolocation recording - Opportunistic observations	- Rivers and Creeklines - Rock Breakaways - Rock Gullies - Spinifex-covered Low Hills - Plains and Slopes	<u>88 vertebrate species:</u> 15 native mammal 1 introduced mammal 34 bird 34 reptile 4 amphibian	<u>Threatened:</u> - Northern Quoll - Pilbara Leaf-nosed Bat <u>Priority:</u> - Western Pebble-mound Mouse <u>Migratory:</u> - Rainbow Bee-eater	This single-phase survey was performed following an unusually dry 'wet season', although the species assemblage recorded was considered representative Habitats identified within the survey area were consistent with habitat types known to occur in the vicinity and wider region.
8 Outback Ecology Ecologists (2009)	<u>Project:</u> Wodgina DSO Project <u>Client:</u> Atlas Iron Limited <u>Survey type:</u> Single-phase, Level 2 and targeted fauna assessment <u>Survey date:</u> April/May and July/August 2009	100 km north-west	- Pitfall trapping - Elliott trapping - Funnel trapping - Cage trapping - Active searching - Avifauna census - Systematic searching - Targeted searching - Spotlighting - Bat echolocation recording - Opportunistic observations	- Ridge - Hill Crest - Scree Slope - Minor Drainage Line - Gully - Shrubland on Flat Elevated Ridge Top - Low Stony Rise/Hills - Minor Gorge	<u>90 vertebrate species:</u> 16 native mammal 2 introduced mammal 46 bird 24 reptile 2 amphibian	<u>Threatened:</u> - Northern Quoll - Ghost Bat - Pilbara Leaf-nosed Bat <u>Priority:</u> - Western Pebble-mound Mouse <u>Migratory:</u> - Rainbow Bee-eater	Habitats identified within the survey area were consistent with habitat types known to occur in the vicinity and wider region. Outcropping ironstone ridges, minor gorges and drainage lines were considered the most significant habitat for fauna of conservation significance. Fourteen Ghost Bat roost locations were recorded, including four considered to be particularly significant due to high numbers of bats observed.
9 Bamford Consulting Ecologists (2009b)	<u>Project:</u> Nullagine Iron Ore Project <u>Client:</u> BC Iron <u>Survey type:</u> Two-phase, Level 2 <u>Survey date:</u> June/July and October 2008	75 km south-east	- Pitfall trapping - Elliott trapping - Funnel trapping - Cage trapping - Active searching - Avifauna census - Targeted searching - Spotlighting - Bat echolocation recording - Opportunistic observations	- Spinifex and Grassland Plains - Rocky Hills - Gorges and Gullies - Ephemeral Drainage Lines - Major Watercourses	<u>114 vertebrate species:</u> 12 native mammal 2 introduced mammal 62 bird 35 reptile 3 amphibian	<u>Threatened:</u> - Northern Quoll - Pilbara Olive Python <u>Priority:</u> - Western Pebble-mound Mouse <u>Migratory:</u> - Rainbow Bee-eater	A total of 72 mounds of the Western Pebble-mound Mouse were recorded within spinifex and grassland plains, a high proportion (71%) of which were active. The area surveyed has a long history of pastoralism and was considered to have a moderate degree of habitat alteration from grazing; however, gorge and gully habitat, identified as important for the Northern Quoll, was still in good condition.
10 Bamford Consulting Ecologists (2009a)	<u>Project:</u> Abydos DSO Project <u>Client:</u> Atlas Iron Limited <u>Survey type:</u> Two-phase, Level 2 survey <u>Survey date:</u> October 2008 and April 2009	65 km north-west	- Pitfall trapping - Elliott trapping - Funnel trapping - Cage trapping - Active searching - Avifauna census - Targeted searching - Spotlighting - Bat echolocation recording - Opportunistic observations	- Ironstone Ridges - Sandstone Ridges - Major Gorges - Minor Shallow Gorges - Cliff faces - Drainage Line - Waterholes and Springs - Caves - Undulating Stony Plains - Minor Cracking Clays	<u>123 vertebrate species:</u> 13 native mammal 4 introduced mammal 72 bird 30 reptile 4 amphibian	<u>Threatened:</u> - Northern Quoll - Ghost Bat - Pilbara Leaf-nosed Bat - Pilbara Olive Python <u>Priority:</u> - Western Pebble-mound Mouse <u>Migratory:</u> - Rainbow Bee-eater	A highly significant natural maternity roost of the Ghost Bat was recorded along with six additional roost sites with regionally significant numbers of resident bats. Significant habitat features recorded included gorges, cliffs, caves, drainage lines, waterholes and mature stands of Spinifex.

Reference	Survey details	Proximity to Application Area	Methods	Habitats defined or noted	Vertebrate fauna assemblage found	Fauna of conservation significance	Notes
11 How <i>et al.</i> (1991)	Project: Abydos-Woodstock Reserve Client: Western Australian Museum Survey type: Major biodiversity survey Survey date: Nine sessions from 1988 - 1990	65 km west-south-west	- Pitfall trapping - Elliott trapping - Mist nets for bats - Targeted searching - Avifauna census - Systematic searching - Opportunistic recording	- Rocky Slope - Ridge - Plateau - Rock-piles - Thickets - Woodlands - Scrublands/Shrublands - Herbaceous Formations and Communities	190 vertebrate species: 21 native mammal 5 introduced mammal 92 bird 87 reptile 5 amphibian	Threatened: - Northern Quoll - Ghost Bat - Peregrine Falcon - Pilbara Olive Python Priority: <i>Ctenotus uber johnstonei</i> - Spectacled Hare-wallaby - Brush-tailed Mulgara - Western Pebble-mound Mouse Migratory: - Common Greenshank - Fork-tailed Swift - Rainbow Bee-eater	The Abydos-Woodstock Reserve was found to be depauperate in avifauna, due largely to the lack of free-standing water and mulga plains, which are known to support a greater diversity of birds in the southern Pilbara. Rocky Slope, Ridge, Plateau and Rock-pile habitats were deemed particularly important to mammal and reptile assemblages. Fauna abundance remained reasonably consistent across different habitats and seasons, although species composition varied significantly. Species richness decreased substantially after fire, particularly for mammals.
12 MWH (2016d)	Project: Corumba Downs Project Client: Atlas Iron Limited Survey type: Two-phase, Level 2 survey Survey date: Feb/Mar 2014 and Sept/Oct 2016	Adjacent to Application Area	- Pitfall trapping - Elliott trapping - Funnel trapping - Cage trapping - Active searching - Avifauna census - Systematic searching - Targeted searching - Spotlighting - Bat echolocation recording - Opportunistic observations	- Drainage Line - Riverine - Rocky Foothills - Spinifex Sandplain - Spinifex Stony plain - Stony Rise - Ironstone Ridgeline - Granitic Uplands - Riverine - Rocky Ridges and Gorges - Calcrete - Granite Outcrop	172 vertebrate species: 26 native mammal 5 introduced mammal 71 bird 66 reptile 4 amphibian	Threatened: - Northern Quoll - Pilbara Leaf-nosed Bat - Ghost Bat - Pilbara Olive Python - Peregrine Falcon Priority: - Western Pebble-mound Mouse - Spectacled Hare-wallaby Migratory: - Rainbow Bee-eater	Within the survey area, the Rocky Ridge and Gorge habitat type was identified as locally significant for supporting species of conservation significance, as it contained an abundance of outcroppings, caves, crevices and gorges. Additional locally significant habitats included Drainage Line, Riverine and Granite Outcrop. Several significant microhabitat features were recorded including two regionally important roosting sites for the Pilbara Leaf-nosed Bat, seven nocturnal refuges for the Ghost Bat and/or Pilbara Leaf-nosed Bat, and eleven permanent/semi-permanent water sources, which provide potential habitat for the Northern Quoll, Pilbara Leaf-nosed Bat and Pilbara Olive Python.

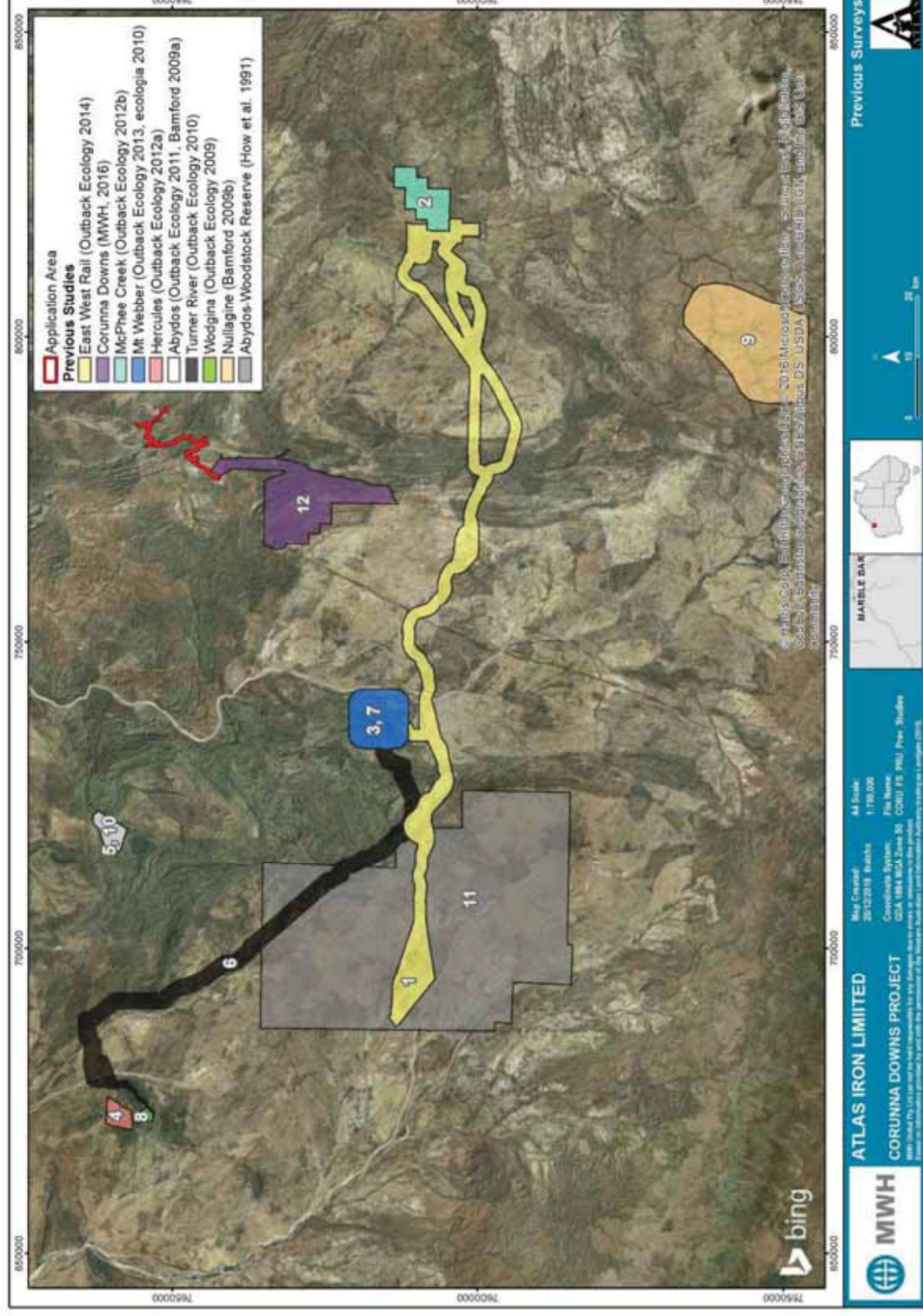


Figure 3-1: Location of vertebrate fauna surveys conducted within the vicinity of the Application Area

Table 3-3: Key findings of SRE invertebrate fauna literature sources

Reference	Survey Details	Proximity to Survey Area*	Methods	Habitats	Number of invertebrates recorded	Number of SRE invertebrates recorded*	Comments
A Outback Ecology (2014a)	<u>Project:</u> McPhee Creek Haul Road Project: SRE Invertebrate Fauna Survey <u>Client:</u> Atlas Iron Limited <u>Survey type:</u> Level 1 Targeted SRE Survey <u>Survey date:</u> February 2014	35 km south	- Targeted searching - Leaf litter collection - Soil sieving	- Spinifex sandplain - Granite uplands - Rocky foothills - Acacia, spinifex on sandplain - Spinifex stony plain - Stony rise - Drainage line - Hard spinifex on calcrete - Riverine - Granite outcrop - Dolerite ridge - Rocky ridge and gorge - Disturbance - Riverine shrubland - Sandstone ridge top.	117 invertebrate specimens from 20 identifiable species.	Five potential SRE species: - Buddelundia '11' - Karaops 'sp. indet' - Synsphyronus '7/5 short' - Buddelundia '86'	Species recorded at the East-west Transport Corridor have potential to occur in the Application Area because many of the habitats that have a high potential to support SRE taxa are well connected between the Application Areas.
B Outback Ecology (2013a)	<u>Project:</u> Abydos Iron Ore Project <u>Client:</u> Atlas Iron Limited <u>Survey type:</u> Level 2 Survey and EIA <u>Survey date:</u> March – July 2010	60 km north-west	- Wet pitfall trapping - Targeted searching - Leaf litter collection - Soil sieving	- Rocky ridge and gorge - Riverine - Drainage depression - Ridge top - Drainage line - Spinifex sand plain - Spinifex stony plain	1,453 invertebrate specimens from 43 identifiable species	Six potential SRE species: - Aops 'pilbara 2' - Tyrannochthonius 'near andrus' - Buddelundia 'sp. 11' - Buddelundia 'sp. 18' 'Gen. nov.' 'sp. Nov.' (snail) - Antichthopus 'DIP005'	Habitat is typical of the Pilbara region and represents that found within the Application Area. However, species recorded at the Abydos Project are unlikely to occur in the Application Area due to the distance between the projects and a lack of connectivity between habitats likely to support SRE taxa.
C Outback Ecology (2012d)	<u>Project:</u> Mt Webber Iron Ore Project <u>Client:</u> Atlas Iron Limited <u>Survey type:</u> Level 2 Survey and EIA <u>Survey date:</u> March 2010 – March 2012	45 km south-west	- Wet pitfall trapping - Targeted searching - Leaf litter collection - Soil sieving	- Rocky foothills - Rocky ridge and gorge - Stony rise - Granite uplands - Spinifex stony plain - Acacia, spinifex sandplain - Spinifex sandplain - Riverine - Drainage line - Uplands drainage - Hard spinifex on calcrete - Granite outcrop - Riverine shrubland	1,189 invertebrate specimens from 25 identifiable species.	Eight potential SRE species: - Kworkan 'MYG200'; - Karaops 'Mt Webber' - Karaops 'SEL001' - Karaops 'SEL002' - Buddelundia 'sp. nov. 11' - Buddelundia 'sp. nov. 18' 'Gen. nov.' 'Sp. nov. B' (slater) - Quistrachia turneri	Habitat is typical of the Pilbara region and represents that found within the Application Area. However, species recorded at the Mt Webber Project are unlikely to occur in the Application Area due to the distance between the projects and a lack of connectivity between habitats likely to support SRE taxa.
D Outback Ecology (2011b)	<u>Project:</u> Turner River Hub Project: Southern Haul Road <u>Client:</u> Atlas Iron Limited <u>Survey type:</u> Level 2 Survey <u>Survey date:</u> March – May 2010	50 km West	- Wet pitfall trapping - Targeted searching - Leaf litter collection - Soil sieving	A number of habitats were identified in the Project due to the extensive survey area. Of these six were of significance to SRE invertebrate fauna: - Granite outcrop - Rocky ridge and gorge - Riverine - Drainage depression - Drainage lines - Calcrete breakaway	4,863 invertebrate specimens from 62 identifiable species.	Eight potential SRE species: - Aname 'MYG208' - Aname 'MYG209' - Karaops 'sp. 'Wodgina' - Karaops 'sp. Mt Webber' - Urodacus 'pilbara 13' - Barrowdillo 'sp. Nov. 2' - Buddelundia 'sp. 11' - Laevophiloscia sp.	Habitat is typical of the Pilbara region and represents that found within the Application Area. However, species recorded at the Turner River Project are unlikely to occur in the Application Area due to the distance between the projects and a lack of connectivity between habitats likely to support SRE taxa.

Reference	Survey Details	Proximity to Survey Area*	Methods	Habitats	Number of invertebrates recorded	Number of SRE invertebrates recorded*	Comments
E	<u>Project:</u> Mt Webber Iron Ore Project <u>Client:</u> Giralda Resources <u>Survey type:</u> Level 2 Survey <u>Survey date:</u> March 2010	50 km west	- Wet pitfall trapping - Targeted searching - Leaf litter collection - Soil sieving	Habitat was not assessed in this report.	371 invertebrate specimens from 19 identifiable species	Four potential SRE species: <i>Anane MYG001</i> <i>Kwonkan MYG002</i> <i>Synothela</i> sp. <i>Buddelundia</i> 'sp. 11'	Habitat is typical of the Pilbara region and represents that found within the Application Area. However, species recorded at the Mt Webber Project are unlikely to occur in the Application Area due to the distance between the projects and a lack of connectivity between habitats likely to support SRE taxa.
F	<u>Project:</u> Turner River Hub Project Southern Haul Road Realignment <u>Client:</u> Atlas Iron Limited <u>Survey type:</u> Level 2 Survey <u>Survey date:</u> March – May 2011	70 km West	- Wet pitfall trapping - Targeted searching - Leaf litter collection - Soil sieving	- Rocky foothills - Rocky ridge - Stony rise - Granite outcrop - Spinifex stony plain - Spinifex sandplain - Riverine - Drainage line - Drainage depression - Clay depression	281 invertebrate specimens from 31 identifiable species	Five potential SRE species: <i>Karaos</i> sp. <i>Feaella</i> 'PSE017' <i>Buddelundia</i> sp. 'nov. 11' <i>Buddelundia</i> sp. 'nov. 20' - Gen. nov. 'Sp. nov. B' (slater)	Habitat is typical of the Pilbara region and represents that found within the Application Area. However, species recorded at the Southern Haul Deviation Project are unlikely to occur in the Application Area due to the distance between the projects and a lack of connectivity between habitats likely to support SRE taxa.
G	<u>Project:</u> McPhee Creek Iron Ore Project <u>Client:</u> Atlas Iron Limited <u>Survey type:</u> Level 2 Survey <u>Survey date:</u> February – March 2012	55 km Southeast	- Wet pitfall trapping - Targeted searching - Leaf litter collection - Soil sieving	- Rocky foothills - Spinifex stony plain - Rocky ridge and gorge - Sandstone ridge - Ironstone ridge - Drainage line - Calcrete plain - Channel iron deposit	380 invertebrate specimens from 21 identifiable species.	Six potential SRE species: <i>Beierobium</i> 'sp. 8/4 lge' - Genus '7/4 sp. nov.' <i>Xenobium</i> 'PSE063' <i>Antichropus</i> 'DIP026' <i>Buddelundia</i> 'sp. 11' <i>Buddelundia</i> 'sp. 18'	Habitat is typical of the Pilbara region and represents that found within the Application Area. However, species recorded at the McPhee Creek Project are unlikely to occur in the Application Area due to the distance between the projects and a lack of connectivity between habitats likely to support SRE taxa.
H	<u>Project:</u> Sulphur Springs Copper - Zinc Project <u>Client:</u> Venturex Resources Limited <u>Survey type:</u> Targeted survey and EIA <u>Survey date:</u> January 2010	55 km Northwest	- Targeted searching - Leaf litter collection - Soil sieving	Only drainage features were assessed. Five drainage features were identified: - Gorge - Creek Line - Riverine - Drainage Line - Floodplain	153 invertebrate specimens from 13 identifiable species	Four potential SRE species: <i>Antichropus</i> 'DIP005' <i>Antichropus</i> 'DIP034' <i>Buddelundia</i> 'sp. 11' <i>Feaella</i> 'PSE007'	Habitat is typical of the Pilbara region and represents that found within the Application Area. However, species recorded at Spinifex Ridge Project are unlikely to occur in the Application Area due to the distance between the projects and a lack of connectivity between habitats likely to support SRE taxa.
I	<u>Project:</u> North Star Project <u>Client:</u> Fortescue Metals Group <u>Survey type:</u> Level 2 Survey and EIA <u>Survey date:</u> February/March 2011	75 km Northwest	- Wet pitfall trapping - Targeted searching - Leaf litter collection	Habitats were not assessed in this report.	450 invertebrate specimens from 31 identifiable species	Four potential SRE species: <i>Buddelundia</i> 'sp. 11' <i>Buddelundia</i> 'sp. 18' <i>Succinea</i> sp. <i>Antichropus</i> sp.	Habitat is typical of the Pilbara region and represents that found within the Application Area. However, species recorded at the North Star Project are unlikely to occur in the Application Area due to the distance between the projects and a lack of connectivity between habitats likely to support SRE taxa.

Reference	Survey Details	Proximity to Survey Area*	Methods	Habitats	Number of invertebrates recorded	Number of SRE invertebrates recorded*	Comments
J MWH (2016c)	<u>Project:</u> Corunna Downs Project <u>Client:</u> Atlas Iron Limited <u>Survey type:</u> Level 2 Survey and EIA <u>Survey date:</u> February 2014 & October 2016	Adjacent to Application Area	- Wet pitfall trapping - Targeted searching - Leaf litter collection - Soil sieving	- Drainage Line - Riverine - Rocky Foothills - Spinifex Sandplain - Stony Rise - Ironstone Ridgtop - Granitic Uplands - Riverine - Rocky Ridges and Gorges - Calcrete - Granite Outcrop	761 invertebrate specimens from 31 identifiable species	Two Confirmed SRE species; <i>Feaella</i> sp. nov. <i>Paradoxosomatidae</i> sp. indet. Three Likely SRE species; <i>Acanthodillo</i> sp. indet. <i>Buddelundinae</i> 'mw' <i>Philosciidae</i> 'Corunna' Thirteen Potential SRE species; <i>Karaops</i> sp. indet. <i>Karaops</i> sp. indet.2. <i>Aureocrypta</i> sp. indet <i>Aneme</i> sp. indet <i>Lychas</i> 'gracilimanus complex' <i>Lychas</i> 'bituberculatus complex' <i>Urodacus</i> 'hairy tail complex' <i>Urodacus</i> 'bilbara 16' <i>Urodacus</i> sp. indet. <i>Buddelundia</i> '11' <i>Buddelundia</i> '88' <i>Rhagada</i> 'convicta complex' <i>Rhagada</i> sp. 'nov.'	Two habitats, Rocky Ridge and Gorge and Granite Outcrops, were considered to have a high potential to support SRE species. Additionally, one habitat, Drainage Lines, has a medium potential to support SRE species. Other habitats in the Application Area were widespread and well-connected in the landscape.

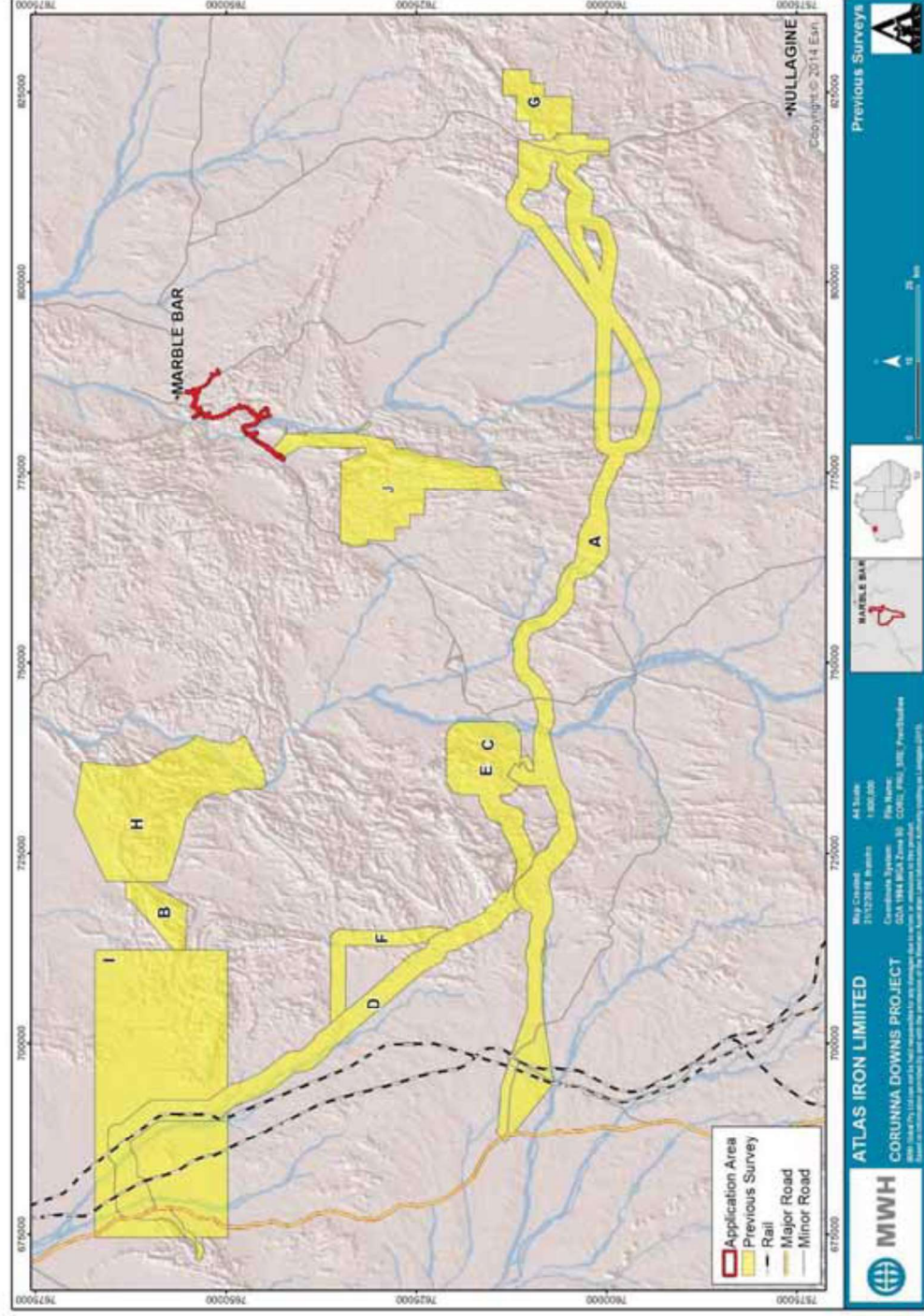


Figure 3-2: Location of SRE invertebrate fauna surveys conducted within the vicinity of the Application Area

3.3 Desktop Study Results: Vertebrate Fauna

The desktop study identified a total of 325 species of vertebrate fauna, which have previously been recorded and/or have the potential to occur within the Application Area (**Table 3-4; Appendix B**). This comprises 38 native mammals, nine non-native mammals, 164 birds, 104 reptiles and ten amphibians. Many of these species are unlikely to occur in the Application Area because these records are from a large area encompassing a wide range of habitats, many of which do not occur within the Application Area. Furthermore, small, common, ground-dwelling reptile and mammal species tend to be patchily distributed even where appropriate habitats are present, and many species of bird can occur as regular migrants, occasional visitors or vagrants. Of the 325 species of vertebrate fauna identified as being previously recorded and/or having the potential to occur, 32 are considered to be of conservation significance, comprising nine mammals, 19 birds and four reptiles (**Table 3-5**).

Table 3-4: Summary of vertebrate fauna recorded by the desktop study

Faunal Group	Literature sources												Database searches			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mammals	33	24	20	11	15	24	15	16	16	13	21	26	9	-	27	4
Mammals (non-native)	6	5	2	1	1	5	1	2	2	4	5	5	-	-	5	9
Birds	95	72	68	39	39	75	34	46	46	72	92	71	14	141	106	13
Reptiles	69	59	58	31	41	68	32	24	24	30	65	66	3	-	67	1
Amphibians	7	3	6	3	3	6	4	2	2	4	5	4	-	-	5	-
Totals	210	163	154	85	99	178	86	90	90	123	188	172	26	141	210	27

KEY

Literature Review

- 1: Outback Ecology (2014b) McPhee Creek Haul Road Project: Terrestrial Vertebrate Fauna Survey (phases 1 and 2)
- 2: Outback Ecology (2012c) McPhee Creek Project: Terrestrial Vertebrate Fauna Baseline Survey
- 3: Outback Ecology (2013b) Mt Webber DSO Project: Terrestrial Vertebrate Fauna Impact Assessment
- 4: Outback Ecology (2012a) Hercules Project: Terrestrial Vertebrate Fauna Baseline Survey
- 5: Outback Ecology (2011a) Abydos DSO Project: Terrestrial Vertebrate Fauna Baseline Survey
- 6: Outback Ecology (2010a) Turner River Hub: Terrestrial Vertebrate Fauna Baseline Survey
- 7: ecologia Environment (2010b) Mount Webber Iron Ore Project: Vertebrate Fauna Assessment
- 8: Outback Ecology (2009) Wodgina DSO Project: Terrestrial Vertebrate Fauna Assessment
- 9: Bamford Consulting Ecologists (2009b) Fauna Assessment of the BC Iron Nullagine Iron Ore Project
- 10: Bamford Consulting Ecologists (2009a) Vertebrate Fauna Assessment of the Abydos DSO Project
- 11: How *et al.* (1991) Ecological Survey of the Abydos-Woodstock Reserve, Western Australia
- 12: (MWH 2016d) Corunna Downs Project: Terrestrial Vertebrate Fauna Assessment

Database Searches

- 13: DPaW (2016b) Threatened and Priority Fauna Database
- 14: Birdlife Australia (2014) Birddata Custom Atlas Bird List
- 15: DPaW (2016a) NatureMap Database
- 16: DoEE (2016a) Protected Matters Search Tool

Table 3-5: Conservation listed fauna identified by the desktop study

Species		Conservation Status	
		EPBC Act	WC Act
Curlew Sandpiper	<i>Calidris ferruginea</i>	Cr, Mi	S3, S5
Northern Quoll	<i>Dasyurus hallucatus</i>	En	S2
Night Parrot	<i>Pezoporus occidentalis</i>	En	S1
Australian Painted Snipe	<i>Rostratula australis</i>	En	S2
Greater Bilby	<i>Macrotis lagotis</i>	Vu	S3
Ghost Bat	<i>Macroderma gigas</i>	Vu	S3
Pilbara Leaf-nosed Bat	<i>Rhinonicteris aurantius</i>	Vu	S3
Pilbara Olive Python	<i>Liasis olivaceus barroni</i>	Vu	S3
Grey Falcon	<i>Falco hypoleucos</i>	-	S3
Peregrine Falcon	<i>Falco peregrinus</i>	-	S7
-	<i>Anilius ganei</i>	-	P1
-	<i>Ctenotus nigrilineatus</i>	-	P1
-	<i>Ctenotus uber johnstonei</i>	-	P2
Spectacled Hare-wallaby	<i>Lagorchestes conspicillatus leichardti</i>	-	P3
Brush-tailed Mulgara	<i>Dasycercus blythi</i>	-	P4
Long-tailed Dunnart	<i>Sminthopsis longicaudata</i>	-	P4
Lakeland Downs Mouse	<i>Leggadina lakedownensis</i>	-	P4
Western Pebble-mound Mouse	<i>Pseudomys chapmani</i>	-	P4
Fork-tailed Swift	<i>Apus pacificus</i>	Mi	S5
Oriental Plover	<i>Charadrius veredus</i>	Mi	S5
Oriental Pratincole	<i>Glareola maldivarum</i>	Mi	S5
Sharp-tailed Sandpiper	<i>Calidris acuminata</i>	Mi	S5
Wood Sandpiper	<i>Tringa glareola</i>	Mi	S5
Common Sandpiper	<i>Actitis hypoleucos</i>	Mi	S5
Common Greenshank	<i>Tringa nebularia</i>	Mi	S5
Glossy Ibis	<i>Plegadis falcinellus</i>	Mi	S5
Barn Swallow	<i>Hirundo rustica</i>	Mi	S5
Grey Wagtail	<i>Motacilla cinerea</i>	Mi	S5
Yellow Wagtail	<i>Motacilla flava</i>	Mi	S5
Cattle Egret	<i>Ardea ibis</i>		S5
Eastern Great Egret	<i>Ardea modesta</i>		S5
Rainbow Bee-eater	<i>Merops ornatus</i>		S5

3.4 Desktop Study Results: SRE Invertebrate Fauna

Endemism refers to the restriction of a species to a particular area, at a continental, national or local scale (Allen *et al.* 2002). Harvey (2002) defines a restricted range as a species with a maximum range of 10,000 km². Comprehensive systematic reviews of different faunal groups often reveal the presence of SRE invertebrate species (Harvey 2002). Some better known SRE species have been listed under State or Commonwealth legislation. However, the majority of SRE species have not been listed under legislation, often due to lack of taxonomic knowledge (EPA 2009). SRE invertebrates in general are considered relevant to environmental impact assessment as habitat loss and degradation can decrease their prospects for persistence (EPA 2009).

Database searches and a literature review yielded a total of 46 terrestrial SRE invertebrate species from target groups that have been collected within a 100 km radius of the Application Area. Only specimens identified to species or morphospecies are presented in this section, as it is not possible to determine species distribution based on genus only.

These species were ranked as having a high, medium or low potential to occur in the Application Area depending on the availability of habitat and the proximity of the collection record in relation to the Application Area. Of the 46 species identified in the desktop study, three species, the millipede *Antichiropus* 'DIP034', the snail *Rhagada* 'cf. richardsonii' and the slater *Buddelundia* '86', were considered to have a high potential of occurring in the Application Area as they have been collected within 10 km of the Application Area and from similar habitat as what occurs in the Application Area (**Table 3-6; Figure 3-3**). Ten additional species were considered to have a medium potential of occurring in the Application Area as it has previously been recorded within 10 km and 30 km from the Application Area and within similar habitats as what occurs in the Application Area (**Table 3-6**). The remaining 33 species had low potential to occur in the Application Area and are listed in **Appendix C**. No existing specimens have previously been collected from within the Application Area.

Table 3-6: Records of SRE invertebrates returned by the database searches and literature review

Species Name	Taxa	Source	Reference	Habitat(s)	Likelihood of occurrence in the Application Area	Reason for Likelihood	
						Similar habitat present in Application Area?	Closest record to Application Area
<i>Rhagada richardsonii</i>	Snail	WA Museum	(Western Australian Museum 2014b)	Rocky ridge and gorge/Riverine	High	Yes	0.75 km
<i>Antichiropus</i> 'DIP034'	Millipede	WA Museum	(Western Australian Museum 2014a)	Urban (natural habitat unknown)	High	Possible	0.75 km
<i>Buddelundia</i> '86'	Slater	McPhee Creek Haul Road Project: East-west Transport Corridor	(Outback Ecology 2014a)	Rocky foothills, Stony Rise, Ironstone Ridgeline, Calcrete	High	Yes	9 km
		Corunna Downs Project	(MWH 2016b)				
<i>Lychas</i> 'hairy tail complex'	Scorpion	Corunna Downs Project	(MWH 2016b)	Stony Rise, Rocky Ridge and Gorge	Medium	Yes	12 km
<i>Rhagada</i> 'convicta complex'	Snail	Corunna Downs Project	(MWH 2016b)	Drainage Line	Medium	Yes	13 km
<i>Faealia</i> sp. nov.	Pseudoscorpion	Corunna Downs Project	(MWH 2016b)	Drainage Line	Medium	Yes	13 km
<i>Buddelundia</i> sp. 11	Slater	McPhee Creek Mine and Rail Project: East-west Transport Corridor	(Outback Ecology 2014a)	Rocky Ridge and Gorge, Granite Outcrop, Rocky Foothills, Drainage Line, Channel Iron Deposit, Stony Rise, Spinifex Stony Plain, Calcrete	Medium	Yes	13 km
		McPhee Creek Iron Ore Project	(Outback Ecology 2012b)				
		Mt Webber DSO Project	(Outback Ecology 2012d)				
		Abydos DSO Project	(Outback Ecology 2013a)				

Species Name	Taxa	Source	Reference	Habitat(s)	Likelihood of occurrence in the Application Area	Reason for Likelihood	
						Similar habitat present in Application Area?	Closest record to Application Area
		Corunna Downs Project	(MWH 2016b)				
Buddelundiinae 'mw'	Slater	Mt Webber DSO Project	(Outback Ecology 2012d)	Rocky Ridge and Gorge, Granite Outcrop, Rocky Foothills,	Medium	Yes	15 km
		Corunna Downs Project	(MWH 2016b)				
<i>Lychas</i> 'bituberculatus complex'	Scorpion	Corunna Downs Project	(MWH 2016b)	Rocky Foothills, Rocky Ridge and Gorge, Calcrete	Medium	Yes	16 km
<i>Antichiropus</i> 'DIP038'	Millipede	WA Museum	(Western Australian Museum 2014a)	Drainage line	Medium	Yes	21 km
<i>Karaops</i> 'sp indet.1'	Selenopid spider	Corunna Downs Project	(MWH 2016b)	Calcrete	Medium	Yes	21 km
<i>Lychas</i> 'gracilimanus complex'	Scorpion	Corunna Downs Project	(MWH 2016b)	Calcrete	Medium	Yes	21 km
<i>Urodacus</i> 'pilbara 16'	Scorpion	Corunna Downs Project	(MWH 2016b)	Drainage Line	Medium	Yes	21 km

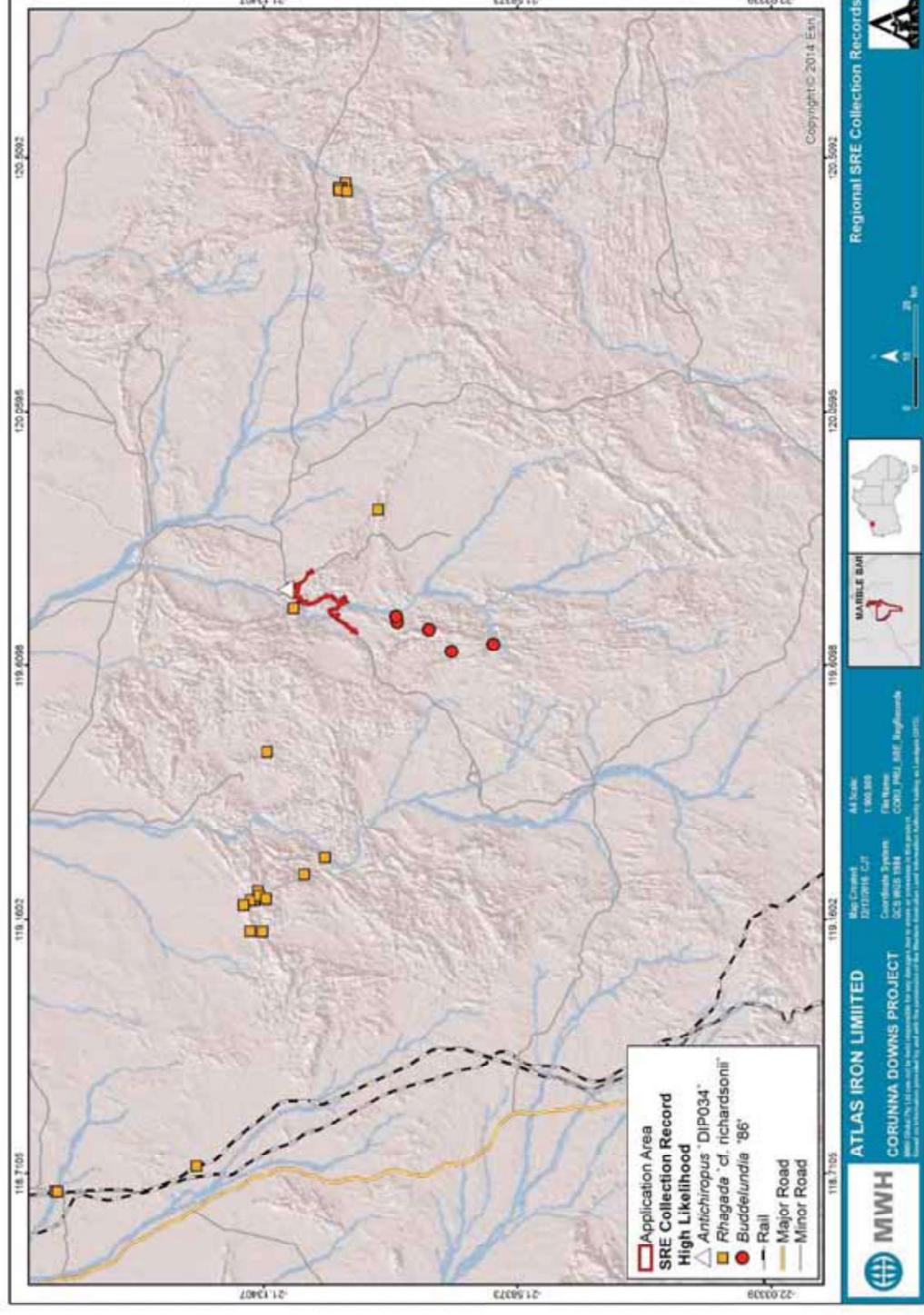


Figure 3-3: SRE invertebrates identified from the desktop study as having a high potential to occur in the Application Area

4 Field Survey Methodology

4.1 Survey Timing and Weather

The Survey was conducted over two days, on the 2nd and 5th of October 2016. The maximum and minimum temperatures were 38.4°C and 15.6°C, respectively (**Table 4-1**). Rain was recorded during the early hours of the 2nd of October. Weather experienced during the Survey was considered appropriate for sampling fauna and did not hamper the ability to meet this component of the scope. Regardless, the main focus of the Survey was to identify habitats and assess their likelihood to support fauna of conservation significance, rather than to record fauna species themselves.

Table 4-1: Daily weather observations at Marble Bar (station 004106) for the Survey period

Date	Temperature (°C)		Rainfall (mm)	Relative humidity (%)	
	Min	Max		0900	1500
2/10/2016	15.7	32.7	2.6	34	6
5/10/2016	15.6	38.4	0.0	7	7

4.2 Survey Team and Licensing

The field Survey was conducted by experienced zoologists from MWH. The Survey was undertaken by Principal Zoologist Andre Schmitz and Senior Zoologist Paul Bolton. The survey was conducted under DPaW Regulation 17 licence 01-000059-1, issued on the 22nd of September 2016.

4.3 Terrestrial Fauna Assessment

4.3.1 Habitat Mapping and Assessment

Prior to any field work, broad habitat types within the Application Area were identified from inspection of aerial photography, satellite imagery and topographical maps. During the Survey, habitat types were ground-truthed and mapped at a broad scale using an iterative approach that combined rapid on-ground assessment points in the field, satellite imagery, aerial photography and digital elevation models.

Fauna habitat assessments were undertaken at various sites along the Application Area (**Figure 4-1**). The purpose of the habitat assessments were to characterise the quality and complexity of habitat provided for fauna, with a focus on species of conservation significance. At each location, the following key habitat parameters were recorded:

- landscape and soil features;
- vegetation cover, condition and dominant species composition;
- the presence or absence of logs or other habitat structures;

-
- estimate of leaf litter cover percentage and type;
 - the presence or absence of water; and
 - types of disturbance and levels of disturbance.

Habitat condition assessments were also performed. Each of the representative areas was given a rating of Excellent, Very Good, Good, Degraded or Completely Degraded based on Keighery (1994) and the overall condition of the habitat relevant to fauna.

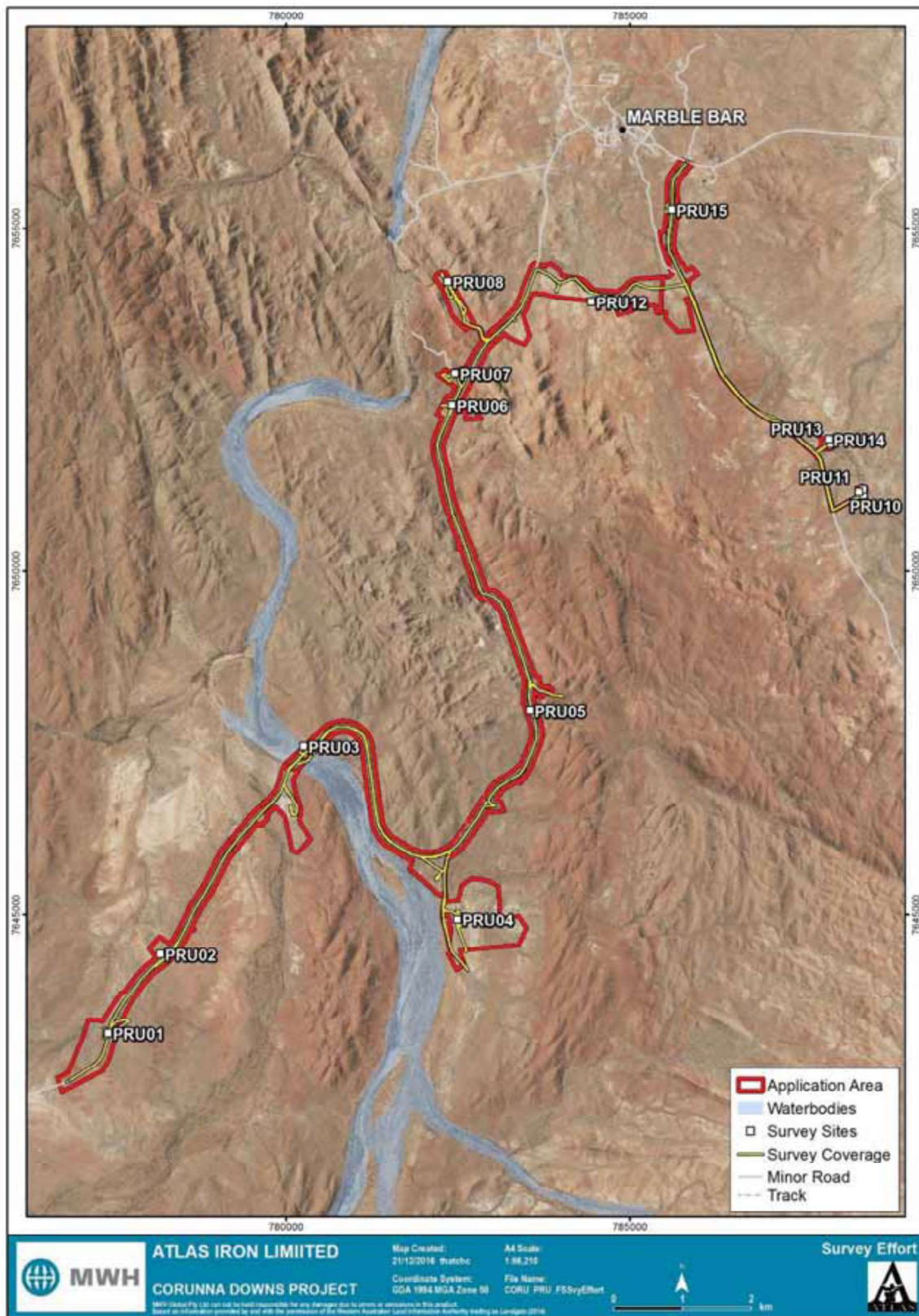


Figure 4-1: Location of Survey sites

4.3.2 Targeted Search Methods

Searches were conducted for one person hour at 15 sites to search for fauna of conservation significance and to develop a species list. Survey effort focused on habitat likely to support fauna of conservation significance (**Table 3-5**), specifically:

- Drainage Line and Riverine habitat: Targeted searches of water pools, riparian vegetation, rocky habitat and crevices for evidence of the Northern Quoll (*Dasyurus hallucatus*) and Pilbara Olive Python (*Liasis olivaceus barroni*), including tracks, scats and sloughs; and for migratory bird species that may utilise water sources within these habitats.
- Spinifex stony plain and stony rise habitat: Searches were made for the characteristic mounds of the Western Pebble-mound Mouse (*Pseudomys chapmani*).

Searching methods included hand-searching for cryptic species, for example by overturning logs and stones, searching beneath the bark of dead trees, investigating crevices and searching for burrows, tracks, diggings, scats, and other signs of fauna. Aural surveys for avifauna were also carried out. All vertebrate fauna seen or heard, or whose presence was inferred from secondary evidence (i.e. scats and tracks) was documented. Additionally, any fauna observed opportunistically while traversing the Application Area were documented.

4.4 Taxonomy and Nomenclature

Wildlife taxonomy is a dynamic field due to the ongoing description of new species and increased understanding of the relationships of taxa through genetic and morphological studies. The nomenclature and taxonomy of all mammals, reptiles and amphibians in this report follow the Checklist of the Vertebrates of Western Australia (WAM 2016), and that of birds follows the Birdlife Australia Working List of Australian Birds (Birdlife Australia 2016) based on Christidis and Boles (2008).

Vertebrate fauna species were identified in the field, where needed, using standard field guides or scientific publications for:

- mammals (Churchill 2008, Menkhorst and Knight 2014, Morton 1990, van Dyck and Strahan 2008);
- birds (Johnstone and Storr 1998, 2004, Morcombe 2004, Pizzey and Knight 2012, Simpson and Day 2010);
- reptiles (Cogger 2014, Storr *et al.* 1983, 1990, 1999, 2002, Wilson and Swan 2014); and
- amphibians (Cogger 2014, Tyler and Doughty 2009).

4.5 Likelihood of Occurrence

The likelihood of occurrence of each species of conservation significance identified from the desktop study was assessed and ranked using the following definitions:

- **Confirmed** – the presence of the species in the Application Area has been recorded unambiguously during the last ten years (i.e. during recent surveys of the Application Area or from recent records obtained via database searches);
- **Very Likely** – the Application Area lies within the known distribution of the species and contains suitable habitat(s), plus the species generally occurs in suitable habitat and has been recorded nearby within the last 20 years;
- **Likely** – the Application Area lies within the known distribution of the species and the species has been recorded nearby within the last 20 years; however, either:
 - a. the Application Area contains only a small area of suitable habitat, or habitat that is only marginally suitable; or
 - b. the species is generally rare and patchily distributed in suitable habitat;
- **Possible** – there is an outside chance of occurrence, because:
 - a. the Application Area is just outside the known distribution of the species, but it does contain suitable and sufficient habitat (the species may be common, rare, or patchily distributed); or
 - b. the Application Area lies within the known distribution of the species, but the species is very rare and/or patchily distributed; or
 - c. the Application Area lies on the edge of, or within, the known distribution and has suitable habitat, but the species has not been recorded in the area for over 20 years; or
- **Unlikely** – the Application Area lies outside the known distribution of the species, the Application Area does not contain suitable habitat, and the species has not been recorded in the area for over 20 years.

5 Results and Discussion

5.1 Fauna Habitats

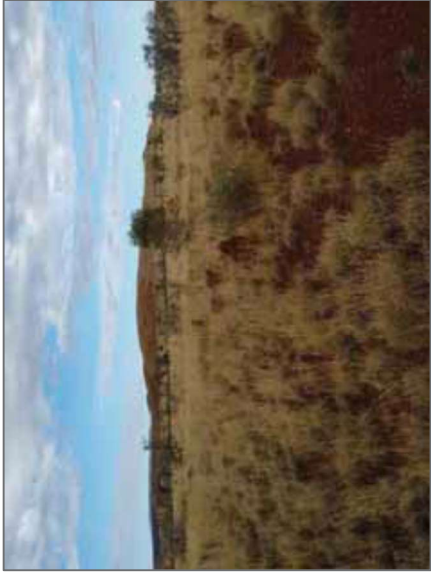
Six broad fauna habitat types were identified and mapped over the Application Area (**Table 5-1**; **Figure 5-1**). This is in addition to area mapped as 'Existing Cleared Areas', which comprised the existing Marble Bar-Woodstock Road, existing borrow pits, historical clearing, excavations and historical mines such as the Comet Gold Mine. The Existing Cleared Areas comprises 74.2 ha (11%) within the Application Area. The habitat types were, in order of extent, Spinifex Stony Plain, Calcrete, Stony Rises, Drainage Line, Riverine and Rocky Foothills. Vegetation condition ranged from Excellent to Good. Fire, infestation of weeds (particularly Buffel Grass) and feral grazing were the most commonly recorded disturbance factors (**Table 5-1**).

Each of the habitat types identified have been defined in terms of distribution and significance according to the following criteria:

- Distribution: those habitats widespread and common within the Application Area (>5%) were categorised as Widespread; otherwise habitats were categorised as being of Limited Extent. Four of the six habitats within the Application Area were considered Widespread (**Table 5-1**). The remaining two were considered to have a Limited Extent within the Application Area, although this does not necessarily reflect the extent of the habitat in the wider region.
- Significance: those habitats considered capable of supporting species of conservation significance or distinct fauna assemblages were categorised as Significant; otherwise they were categorised as being of Limited Significance. Two of the six habitats, were considered Significant based on an ability to support species of conservation significance or distinct assemblages (**Table 5-1**).

Table 5-1: Attributes of broad fauna habitat types within the Application Area

Habitat type	Extent (ha)	Vegetation and substrate description	Value to terrestrial fauna	Habitat condition	Disturbance types	Representative photograph
Spinifex Stony Plain • Widespread • Limited Significance	282 ha (43%)	Sparse woodland of <i>Corymbia hamersleyana</i> over mixed open shrubland dominated by <i>Acacia pyrifolia</i> , <i>Acacia inaequilatera</i> , <i>Senna spp.</i> , and <i>Grevillia wickhamii</i> over dense hummock grassland of <i>Triodia</i> spp. and herbs on reddish brown sandy loam	This habitat type was characterised by extensive spinifex cover over a stony substrate with occasional patches of interspersed sandier substrate. It contained very little woody debris and leaf litter, and poor burrowing suitability	Excellent - Good	Recent fire, historical mining, tracks	
Calcrete • Widespread • Limited Significance	153 ha (23%)	Scattered <i>Corymbia hamersleyana</i> over scattered <i>Acacia inaequilatera</i> shrubland over low hard hummock grassland of <i>Triodia</i> spp. on clay-loam with calcrete	The Calcrete habitat was characterised by extensive hard-spinifex hummock grassland over a stony, calcareous substrate. This habitat contained very little woody debris, leaf litter and low burrowing suitability.	Very Good	Recent fire and cattle adjacent	

Habitat type	Extent (ha)	Vegetation and substrate description	Value to terrestrial fauna	Habitat condition	Disturbance types	Representative photograph
Stony Rises - Widespread - Limited Significance	84 ha (13%)	Scattered <i>Corymbia hamersleyana</i> trees over scattered toopen shrubland dominated by <i>Grevillea wickhamii</i> , <i>Acacia inaequilatera</i> and/or <i>Hakea lorea</i> ; over open to dense hummock grassland of <i>Triodia</i> spp. on skeletal soils of brown clay-loam	The Stony Rises habitat was characterised by rolling hills supporting <i>Triodia</i> hummock grasslands and small rocky outcrops. It contained very little woody debris and leaf litter, and poor burrowing suitability.	Excellent - Very Good	Recent fire, cattle grazing and trampling	
Drainage Line - Widespread - Significant	38 ha (6%)	Open woodland dominated by <i>Eucalyptus victrix</i> and/or <i>E. camaldulensis</i> , over open-dense shrubland of <i>Acacia tumida</i> and/or <i>Melaleuca glomerata</i> with scattered/clumps of tussock grasses dominated * <i>Cenchrus ciliaris</i> , <i>Eriachne</i> spp. and <i>Triodia</i> spp. hummock grasses on river sand and alluvial loam	The Drainage Line habitat was recorded throughout the Application Area and supported a thin band of eucalypts as well as a dense shrubland of <i>Acacia</i> species (e.g. <i>Acacia tumida</i>), often over soft spinifex and Buffel Grass, and usually on sandy or loamy alluvial soils. It provides moderate amounts of woody debris, leaf litter and tree hollows, and is prone to pooling water.	Good	Cattle, weeds, recent fire	

Habitat type	Extent (ha)	Vegetation and substrate description	Value to terrestrial fauna	Habitat condition	Disturbance types	Representative photograph
Riverine - Limited Extent - Significant	16 ha (2%)	Woodland of <i>Eucalyptus victrix</i> , <i>E. camaldulensis</i> and/or <i>Melaleuca argentea</i> over shrubland of <i>Hakea Lorea</i> , <i>Melaleuca glomerata</i> and/or <i>Grevillea pyramidalis</i> with pockets of <i>Tridodia</i> hummock grassland and * <i>Cenchrus ciliaris</i> tussock grassland on brown sandy river sands and brown sandy loam.	The Riverine habitat differed from Drainage Line habitat by the presence of large open sandy channels which were often fringed by large eucalypts with tree hollows. The Riverine habitat holds a stable source of food and water and high amount of woody debris and leaf litter	Very Good - Good	Cattle and camel grazing, weeds	
Rocky Foothills - Limited Extent - Limited Significance	9 ha (1%)	Scattered <i>Corymbia hamersleyana</i> trees over scattered to open shrubland dominated by <i>Grevillea wickhamii</i> and/or <i>Acacia inaequilatera</i> over hard spinifex on stony red clay loam	Rocky Foothills were characterised by low hills with <i>Tridodia</i> hummock grasslands and small rocky outcrops containing cracks, crevices and loose rocks for saxicolous fauna. It contained very little woody debris and leaf litter, and poor burrowing suitability.	Excellent - Good	Recent fire, tracks	

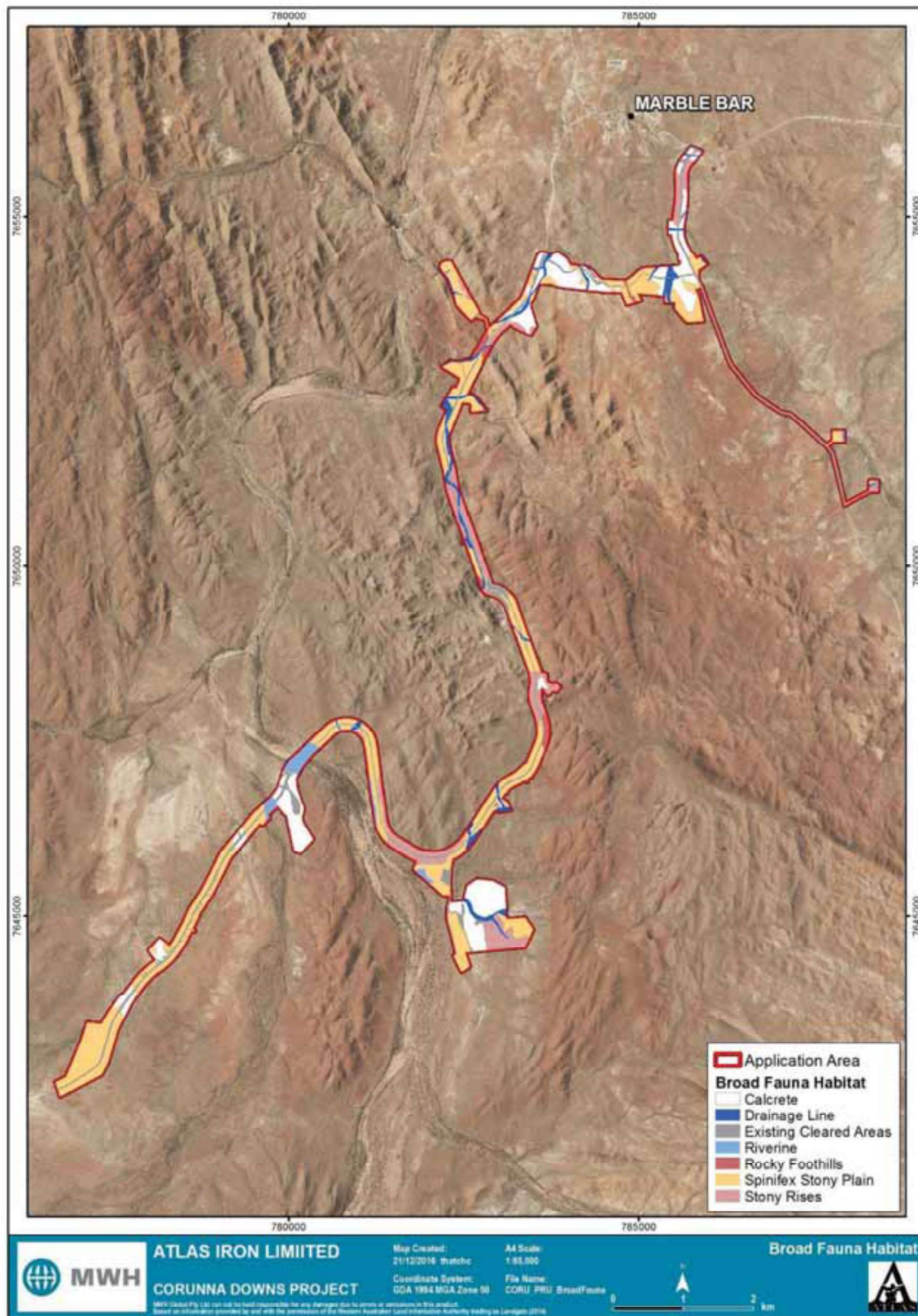


Figure 5-1: Fauna habitats within the Application Area

5.2 Vertebrate Fauna Assemblages

A total of 28 vertebrate fauna species were recorded during the field survey (**Table 5-2**), comprising four mammals (two native), 16 birds and eight reptile species. This list includes two introduced vertebrate fauna species, the European Cattle (*Bos taurus*) and Horse (*Equus caballus*). No fauna were recorded during the Survey that had not been identified during the desktop study (**Appendix B**).

Table 5-2: Vertebrate fauna species recorded during the survey

Family and Species name	Common name	Conservation status	
		EPBC Act	In WA
Mammals			
Bovidae			
* <i>Bos taurus</i>	European Cattle		
Equidae			
* <i>Equus caballus</i>	Horse		
Macropodidae			
<i>Osphranter robustus</i>	Euro		
Muridae			
<i>Pseudomys chapmani</i>	Western Pebble-mound Mouse		P4
Birds			
Acanthizidae			
<i>Smicrornis brevirostris</i>	Weebill		
Cacatuidae			
<i>Cacatua roseicapillus</i>	Galah		
Campephagidae			
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike		
Columbidae			
<i>Geopelia cuneata</i>	Diamond Dove		
<i>Geophaps plumifera</i>	Spinifex Pigeon		
<i>Ocyphaps lophotes</i>	Crested Pigeon		
Dicruridae			
<i>Grallina cyanoleuca</i>	Magpie-lark		
<i>Rhipidura leucophrys</i>	Willie Wagtail		
Estrildidae			
<i>Emblema pictum</i>	Painted Finch		
<i>Taeniopygia guttata</i>	Zebra Finch		
Halcyonidae			
<i>Dacelo leachii</i>	Blue-winged Kookaburra		
Meliphagidae			
<i>Conopophila whitei</i>	Grey Honeyeater		
<i>Ptilotula keartlandi</i>	Grey-headed Honeyeater		
<i>Manorina flavigula</i>	Yellow-throated Miner		
<i>Ptilotula penicillatus</i>	White-plumed Honeyeater		
Meropidae			
<i>Merops ornatus</i>	Rainbow Bee-eater		S5
Reptiles			
Agamidae			
<i>Amphibolurus longirostris</i>	Long-nosed Dragon		
<i>Ctenophorus caudicinctus</i>	Ring-tailed Dragon		
<i>Ctenophorus isolepis</i>	Central Military Dragon		
Elapidae			
<i>Acanthophis wellsi</i>	Pilbara Death Adder		

Family and Species name	Common name	Conservation status	
		EPBC Act	In WA
Gekkonidae			
Heteronotia binoei	Bynoe's Gecko		
Scincidae			
Ctenotus duricola			
Lerista bipes	North-western Sandslider		
Morethia ruficauda	Lined Firetail Skink		

5.3 Conservation Significant Fauna Species

The desktop study identified 32 species of conservation significance that potentially occur in the Application Area (see **Section 3.3**), comprising nine mammals, 19 birds and four reptiles (**Table 3-5**). The likelihood of each of these species was assessed and ranked (**Table 5-3**), based on criteria described in **Section 4.5**. Of the 32 species recorded from the desktop study:

- Nine species are listed as Threatened under the EPBC Act and/or WC Act (**Table 5-3**). Legislation has been developed at national (EPBC Act) and state (WC Act) levels to protect species of fauna that have been formally recognised as rare, threatened with extinction or having high conservation value (**Appendix A**);
- Eight are recognised by DPaW as Priority fauna (**Table 5-3**). DPaW recognises several species that are not listed under the WC Act or the EPBC Act but for which there is some conservation concern, and has produced a supplementary list of Priority fauna (**Appendix A**);
- One species is listed as recognised by state (WC Act) to be in need of special protection (**Table 5-3**); and
- Fifteen species are listed as Migratory under the EPBC Act and/or Schedule 5 under the WC Act (**Table 5-3**). Most of these species are protected under international agreements (**Appendix A**).

Note that some of the species referred to above, listed as Threatened, Migratory and/or Priority fauna, may be included in multiple groups. Of these species listed, two were Confirmed as occurring within the Application Area, two were assessed as Very Likely, three as Likely, 12 as Possible, and 13 as Unlikely, to occur (**Table 5-3**).

The two species of conservation significance Confirmed in the Application Area were the Western Pebble-mound Mouse (P4) and the Rainbow Bee-eater (S5) (**Appendix E**). The two species Very Likely to occur in the Application Area are the Ghost Bat and Pilbara Leaf-nosed Bat. The closest known Ghost Bat and Pilbara Leaf-nosed Bat diurnal roost is located at the dis-used Comet mine. The Comet Mine is located approximately 80 m from the Application Area boundary and approximately 150 m from the existing Marble Bar-Woodstock Road. There have not been any recent surveys of the Comet Gold Mine DoE (2016a), however earlier surveys recorded Ghost Bats at the dis-used mine at varying numbers, 35 in 1981 to 100+ in 1996.

Table 5-3: Likelihood of conservation listed vertebrate fauna species occurring over the Application Area

Common name (Scientific name)	Conservation status		Broad habitat type	Likelihood of occurrence
	EPBC Act	In WA		
Curlw Sandpiper <i>Calidris ferruginea</i>	Cr, Mi	S3, S5	The Curlw Sandpiper occurs in intertidal mudflats of estuaries, lagoons, mangroves, as well as beaches, rocky shores and around lakes, dams and floodwaters (Geering <i>et al.</i> 2007).	Unlikely Nearest DPaW (2016a) record located ~250 km south of the Application Area, at Ophthalmia Dam and very few inland records of the species. Species only recorded from DoEE Protected Matters database, which is based on estimated species distribution, rather than actual field records.
Northern Quoll <i>Dasyurus hallucatus</i>	En	S2	In the Pilbara, ironstone ridges, scree slopes of sandstone or ironstone and granite boulders and outcrops (Cramer <i>et al.</i> 2016b, Molloy <i>et al.</i> 2016).	Possible Species recorded extensively throughout the Corunna Downs Project Area which is adjacent to the Application Area for this Project. Most records of the species are from within Rocky Ridge and Gorge habitat although there have been some records from with Drainage Line and Riverine habitats. Both Riverine and Drainage Line habitats intersect the Application Area. The Drainage Line and Riverine habitats provide potential foraging and dispersal corridors for the species.
Night Parrot <i>Pezoporus occidentalis</i>	En	S1	Known to inhabit treeless or sparsely wooded long unburnt spinifex hummock plains often interspersed with chenopods (Davis and Metcalf 2008, Pyke and Ehrlich 2014).	Unlikely Nearest DPaW (2016a) record located ~135 km south-west from near the Fortescue Marsh (Davis and Metcalf 2008). Species only recorded from DoEE Protected Matters database, which is based on estimated species distribution, rather than actual field records.
Australian Painted Snipe <i>Rostratula australis</i>	En	S2	Shallow, well-vegetated temporary or infrequently filled inland wetlands (Garnett <i>et al.</i> 2011, Knuckey <i>et al.</i> 2013).	Unlikely Nearest DPaW (2016a) record located ~170 km south of the Application Area, near Fortescue Marsh, but otherwise very few records within the Pilbara region (Knuckey <i>et al.</i> 2013). Species only recorded from DoEE Protected Matters database, which is based on estimated species distribution, rather than actual field records.

Common name (<i>Scientific name</i>)	Conservation status		Broad habitat type	Likelihood of occurrence
	EPBC Act	In WA		
Greater Bilby <i>Macrotis lagotis</i>	Vu	S3	Variety of habitats including spinifex hummock grassland and <i>Acacia</i> shrubland, on soft soils (Burrows et al. 2012). In the Pilbara often associated with major drainage line sandy terraces (How et al. 1991).	Unlikely Populations of the species are scattered and rare within its distribution (van Dyck and Strahan 2008). Nearest DPaW (2016b) records located ~30 km south-west of the Application Area and ~45 km south-east at McPhee Creek (Outback Ecology 2014b). Expanses of suitable habitat for burrowing not present in Application Area.
Ghost Bat <i>Macroderma gigas</i>	Vu	S3	The species roosts within deep humid caves, rock crevice and abandoned mines (Armstrong and Anstee 2000). The species will forage in most habitat types and will travel 2 km from a roost to hunt (Churchill 2008).	Very Likely A regionally important diurnal roost located adjacent to the Application Area at the dis-used Comet Mine (DoE 2016a). This roost is thought to represent a maternity roost for the species (Armstrong and Anstee 2000). Additionally, the Alexander mine (approximately 1.1 km south of Comet Mine) is a known roost for the species and is located approximately 190m from the Application Area (Armstrong and Anstee 2000). The species will forage over all habitats within the Application Area.
Pilbara Leaf-nosed Bat <i>Rhinonicteris aurantia</i>	Vu	S3	Species roosts within caves and abandoned mines with high humidity (95%) and temperature (32 °C). Species forages in caves and along waterbodies with fringing vegetation (Armstrong 2001, DoE 2016b).	Very Likely A roosting colony has previously been recorded at the disused Comet mine (Hall et al. 1997). However the occurrence of the species at this mine has been sporadic and therefore is likely to represent a transitory diurnal roost or nocturnal refuge (Armstrong 2001). Species is likely to forage and drink from temporary/seasonal pools within the Drainage Line and Riverine habitats of the Application Area.
Pilbara Olive Python <i>Liasis olivaceus barroni</i>	Vu	S3	Species commonly recorded along watercourses and areas of permanent water, particularly in rocky gorges, escarpments and gullies (Pearson 1993).	Possible The species was recorded from four records within the Corunna Downs Project Area which is adjacent to the Application Area for this Project. It is likely that the species will utilise Drainage Line and Riverine habitats for foraging and dispersal.

Common name (Scientific name)	Conservation status		Broad habitat type	Likelihood of occurrence
	EPBC Act	In WA		
Grey Falcon <i>Falco hypoleucos</i>	-	S3	Timbered lowlands, particularly Acacia shrubland and along inland drainage systems. Also frequent spinifex and tussock grassland (Burbidge et al. 2010, Olsen and Olsen 1986).	Possible Nearest DPaW (2016b) records located ~45 km east from 1994, ~45 km north from 2005 and ~60 km north-east from 1999. Species is generally scarce within region. If present, the species is likely to forage and nest within the Drainage Line and Riverine habitats of the Application Area.
Peregrine Falcon <i>Falco peregrinus</i>	-	S7	The species occurs along coastal cliffs, rivers and ranges as well as wooded watercourses and lakes, nesting on cliffs, granite outcrops and quarries (Johnstone and Storr 1998).	Possible One individual was observed at Corunna Downs (MWH 2016d) and at Abydos-Woodstock Reserve by How et al. (1991). The species may utilise the Drainage Line and Riverine habitats for foraging only, if at all present.
A species of blind snake <i>Anilius ganei</i>	-	P1	This species is endemic to the Pilbara and known from a relatively small number of specimens. Records are sparse and widespread, but it is thought to be linked to moist gorge and gully habitats (Doughty et al. 2011, Wilson and Swan 2014).	Unlikely Nearest DPaW (2016a) records located ~200 km south of the Application Area within the Hamersley Ranges, however the species has also been recorded in close proximity to the Application Area in Rocky Ridge and Gorge habitat (Outback Ecology 2010a, 2013b, 2014b). However, the species is unlikely to occur in the Application Area due to a lack of suitable habitat.
A species of skink <i>Ctenotus nigrilineatus</i>	-	P1	Little is known about the habitat preferences of the species. Previous records have however been collected from spinifex plains at the base of granite outcrops (How et al. 1991).	Possible Nearest DPaW (2016a) record located ~65 km west of the Application Area, from Abydos-Woodstock Reserve in 1990 (How et al. 1991), and ~85 km south near Nullagine. Specific habitat requirements of the species are not confirmed but the species may occur within the Spinifex Stony Plains of the Application Area.
A species of skink <i>Ctenotus uber johnstonei</i>	-	P2	The habitat requirements of the species are largely unknown although it is believed the species is associated compacted clayey soil with sparse plant cover (Wilson and Swan 2014).	Possible Nearest DPaW (2016a) record located ~20 km south of the Application Area. The species was also recorded at Mt Webber Outback Ecology (2014b). Its habitat preferences are poorly understood, and in the absence of additional information it is considered possible to occur in the Application Area.

Common name (Scientific name)	Conservation status		Broad habitat type	Likelihood of occurrence
	EPBC Act	In WA		
Spectacled Hare-wallaby <i>Lagorchestes conspicillatus leichardti</i>	-	P3	The Spectacled Hare-wallaby occurs in tussock and hummock grasslands and <i>Acacia</i> shrublands (Ingleby and Westoby 1992).	Likely Species recorded during four previous surveys in the vicinity of the Application Area (How <i>et al.</i> 1991, MWH 2016d, Outback Ecology 2010a, 2014b). The species is likely to utilise long unburned patches of Triodia in the Spinifex Stony Plain habitat within the Application Area.
Brush-tailed Mulgara <i>Dasyercus blythi</i>	-	P4	Sand plains and gibber plains with moderately dense spinifex with 'runways' between clumps (van Dyck and Strahan 2008).	Unlikely Nearest DPaW (2016a) record located ~15 km east of the Application Area from 1959. Signs of this species (i.e. diggings/burrows) were recorded in three previous surveys (How <i>et al.</i> 1991, Outback Ecology 2010a, 2014b) in the vicinity of the Application Area however the lack of spinifex sandplain habitat means that the species is unlikely to occur within the Application Area.
Long-tailed Dunnart <i>Sminthopsis longicaudata</i>	-	P4	Typically occurs on plateaus near breakaways and scree slopes, and on rugged boulder-strewn scree slopes (Gibson and McKenzie 2009). Once considered rare but now shown to be relatively common and widespread in rocky habitats (van Dyck and Strahan 2008).	Likely Nearest DPaW (2016b) records located ~35 km east of the Application Area. The species was recently recorded at McPhee Creek (Outback Ecology 2012c), located 45 km from the Application Area. The Rocky Foothills habitat provides suitable habitat for the species.
Lakeland Downs Mouse <i>Leggadina lakedownensis</i>	-	P4	Tussock and hummock grassland, <i>Acacia</i> shrubland, and savannah woodland, on cracking clays and alluvial clays (Kutt and Kemp 2005, Moro and Morris 2000).	Unlikely Nearest DPaW (2016b) record, a WAM specimen, located ~20 km west of the Application Area. However suitable habitat for the species does not occur within the Application Area.
Western Pebble-mound Mouse <i>Pseudomys chapmani</i>	-	P4	Spurs and rocky hills with many small pebbles vegetated by spinifex islands (Anstee 1996, Anstee and Armstrong 2001, Anstee <i>et al.</i> 1997).	Confirmed The species was recorded on 11 occasions during the Survey from nine old and two recently active mounds. Ten of the records were recorded within Spinifex Stony Plain habitat and the remaining one was recorded within the Stony Rises habitat. The species was recorded in eleven of the 12 surveys conducted within the region and from two database searches. The species is likely to be widespread through the Stony Rises, Spinifex Stony Plains and Rocky Foothill habitats

Common name (<i>Scientific name</i>)	Conservation status		Broad habitat type	Likelihood of occurrence
	EPBC Act	In WA		
Fork-tailed Swift <i>Apus pacificus</i>	Mi	S5	The Fork-tailed Swift is an aerial specialist that overflies numerous habitats (Pizzey and Knight 2012).	Possible Nearest DPaW (2016a) record located ~75 km north-west of the Application Area from 2011. The species was also recorded by How <i>et al.</i> (1991). The species may flyover the Application Area on an irregular basis, but is not dependent on habitats within the Application Area.
Oriental Plover <i>Charadrius veredus</i>	Mi	S5	Species occurs as a non-breeding summer migrant which occurs throughout the region. Species predominantly occurs within near-coastal samphire and grass flats, also beaches, tidal creeks, saltwork ponds and sewage ponds (Johnstone <i>et al.</i> 2013).	Unlikely Nearest DPaW (2016a) record located ~25 km north-east of the Application Area. Preferred habitat for the species does not occur within the Application Area and the species is generally uncommon in region
Oriental Pratincole <i>Glareola maldivarum</i>	Mi	S5	Species occurs as a non-breeding summer migrant which occurs throughout the region. Species favours open grassy plains (including airfields and sports ovals), samphire and open mudflats and beaches (Johnstone <i>et al.</i> 2013).	Unlikely Nearest DPaW (2016a) record located ~150 km north-west of the Application Area, from Port Hedland and no inland records of the species. Species only recorded from DoEE Protected Matters database, which is based on estimated species distribution, rather than actual field records.
Sharp-tailed Sandpiper <i>Calidris acuminata</i>	Mi	S5	Species occurs as a non-breeding summer migrant which occurs throughout the region. Species favours flooded samphire flats and grasslands, mangrove creeks, mudflats, beaches, river pools, saltwork ponds (where commonly located on hypersaline ponds) sewage ponds, and freshwater soaks (Johnstone <i>et al.</i> 2013).	Possible Nearest DPaW (2016a) record located ~25 km north-east of the Application Area, from freshwater pools east of Marble Bar. The species may occur as an irregular visitor to pools within the Riverine and Drainage Line habitats of the Application Area, but is not dependent on habitats within the Application Area.
Wood Sandpiper <i>Tringa glareola</i>	Mi	S5	Species occurs as a non-breeding summer migrant which occurs throughout the region. Occurs mainly in river pools, sewage ponds, flooded claypans, freshwater lagoons and bore overflows (Johnstone <i>et al.</i> 2013).	Possible Nearest DPaW (2016a) record located ~25 km north-east of the Application Area, from freshwater pools east of Marble Bar. The species may occur as an irregular visitor to pools within the Riverine and Drainage Line habitats of the Application Area, but is not dependent on habitats within the Application Area.

Common name (<i>Scientific name</i>)	Conservation status		Broad habitat type	Likelihood of occurrence
	EPBC Act	In WA		
Common Sandpiper <i>Actitis hypoleucos</i>	Mi	S5	Species occurs as a non-breeding summer migrant which occurs throughout the region. Species favours tidal and reef flats, beaches, saltwork ponds, river pools, flooded claypans, freshwater soaks and ephemeral waters (Johnstone et al. 2013).	Possible Nearest DPaW (2016a) records located ~25 km north-east of the Application Area at Marble Bar from 2005. The species may occur as an irregular visitor to pools within the Riverine and Drainage Line habitats of the Application Area, but is not dependent on habitats within the Application Area.
Common Greenshank <i>Tringa nebularia</i>	Mi	S5	Species occurs as a non-breeding summer migrant which occurs throughout the region. Occurs mainly in Tidal mudflats, mangrove creeks, flooded samphire flats, beaches, river pools, and saltwork and sewage ponds (Johnstone et al. 2013).	Possible Nearest DPaW (2016a) record located ~25 km north-east of the Application Area, from freshwater pools east of Marble Bar. The species may occur as an irregular visitor to pools within the Riverine and Drainage Line habitats of the Application Area, but is not dependent on habitats within the Application Area.
Glossy Ibis <i>Plegadis falcinellus</i>	Mi	S5	Freshwater wetlands, irrigated areas, margins of dams, floodplains, brackish and saline wetlands, tidal mudflats, pastures, lawns and public gardens (Johnstone et al. 2013).	Possible Nearest DPaW (2016a) record located ~50 km north of the Application Area, from the Coongan Riverine system. The species may occur as an irregular visitor to pools within the Riverine and Drainage Line habitats of the Application Area, but is not dependent on habitats within the Application Area.
Barn Swallow <i>Hirundo rustica</i>	Mi	S5	Open country in coastal lowlands, often near water, towns and cities. Also over freshwater wetlands, paperbark woodland, mesophyll shrub thickets and grasslands (Pizzey and Knight 2012).	Unlikely Nearest DPaW (2016a) record located ~150 km north-west of the Application Area, from Port Hedland and no inland records of the species. Species only recorded from DoEE Protected Matters database, which is based on estimated species distribution, rather than actual field records.
Grey Wagtail <i>Motacilla cinerea</i>	Mi	S5	Little is known about the biology of the Grey Wagtail. This species occurs near fast-flowing water (Pizzey and Knight 2012).	Unlikely Nearest DPaW (2016a) record located ~550 km north-west of the Application Area, from Broome. Species only recorded from DoEE Protected Matters database, which is based on estimated species distribution, rather than actual field records.

Common name (<i>Scientific name</i>)	Conservation status		Broad habitat type	Likelihood of occurrence
	EPBC Act	In WA		
Yellow Wagtail <i>Motacilla flava</i>	Mi	S5	Little is known about the biology of the Yellow Wagtail. This species occurs near salt works, paddocks and marshes (Pizzey and Knight 2012).	Unlikely No previous surveys in the vicinity of the Application Area have recorded the species and it was reported only by the DoEE Protected Matters database, which is based on estimated species distributions rather than actual field records.
Cattle Egret <i>Ardea ibis</i>		S5	Occurs in a wide range of habitats including, marshes, reservoirs, lakes, swamps, and riverside woodlands and often forage in fields with grazing livestock (Pizzey and Knight 2012).	Unlikely Nearest DPaW (2016a) record located ~160 km south of the Application Area, from the Fortescue Marsh and generally very few inland records of the species. Species only recorded from DoEE Protected Matters database, which is based on estimated species distribution, rather than actual field records.
Eastern Great Egret <i>Ardea modesta</i>		S5	Forages in a wide range of wetland habitats including, flooded claypans, flooded samphire (inundated by rain or high tides), river pools, sewage ponds, mangrove creeks and saltwork ponds (Johnstone et al. 2013). Breeding recorded in treed drainages lines and inland islands (Johnstone et al. 2013).	Likely Nearest DPaW (2016b) records located ~8 km east of the Application Area within Emu Creek, the same Riverine system that runs adjacent to the Application Area. Species also recorded by Outback Ecology (2010a). Species is likely to forage and potentially nest within the Riverine and Drainage Line habitats occurring within the Application Area.
Rainbow Bee-eater <i>Merops ornatus</i>		S5	Lightly wooded, often sandy country, preferring areas near water (Johnstone et al. 2013).	Confirmed The species was recorded on two occasions within the Application Area from the Riverine habitat and the Spinifex Stony Plain habitat. Species likely to forage and breed within the Drainage Line and Riverine habitats of the Application Area, although is not dependent on these habitats within the Application Area. Previously recorded from all surveys conducted within the vicinity of the Application Area.

5.4 Short-range Endemic Invertebrate Fauna

Database searches and a literature review yielded a total of 46 terrestrial SRE invertebrate species from target groups that have been collected within a 100 km radius of the Application Area (**Section 3.4**). No collection records were identified from within the Study Area. Based on the proximity of previous records and availability of habitat, three species, the millipede *Antichiropus* 'DIP034', the snail *Rhagada* 'cf. *richardsonii*' and the slater *Buddelundia* '86' were considered to have a high potential of occurring in the Application Area. Ten additional SRE species have a medium potential to occur in the Application Area on the basis of proximity and known habitat associations. Habitats with potential to support short-range endemic species, Drainage Line and Riverine habitat have limited distribution in the Application Area, but are well represented outside the Application Area.

5.5 Limitations and Constraints

There are a number of possible limitations and constraints that can impinge on the adequacy of fauna surveys (EPA 2004). These are discussed below (**Table 5-4**), with respect to the Survey of the Application Area. In summary, no limitations compromised the Survey.

Table 5-4: Potential limitations and constraints of the field survey

Factor	Constraint	Comments
Competency and experience of consultants	No	The field personal have appropriate qualifications and several years' experience undertaking fauna surveys of this nature within this region.
Scope	No	The scope was well defined. Fauna and their habitats were surveyed using standardised and well-established techniques. Relevant databases and previous studies surrounding the Application Area were reviewed.
Proportion of species identified	No	All vertebrate fauna encountered were identified. Although a comprehensive fauna inventory is not a vital component for this level of survey (Level 1). No invertebrate specimens were collected for identification.
Information sources (e.g. historic or recent)	No	The Application Area is located in a relatively well-surveyed region in which MWH has substantial experience. Several previous studies in close proximity to the Application Area were available for review during the assessment.
Proportion of task achieved, and further work which might be needed	No	Planned survey works were conducted and completed according to scope.
Timing / weather / season / cycle	No	Weather experienced during the Survey was considered adequate for sampling fauna. Days were relatively warm, increasing the activity of ground dwelling reptiles. Identifying species was however not the focus of this assessment, which was to identify fauna habitats and habitats suitable for fauna of conservation significance. Mapping and interpretation of suitable fauna habitat was not hampered by the weather experienced during the survey.

Factor	Constraint	Comments
Disturbances	No	The majority of the habitat within the Application Area was considered to be 'Very Good', with disturbance due to grazing by introduced fauna and historic mining activity.
Intensity	No	Fifteen sites were sampled for presence of fauna and had habitat assessments conducted. This level of on-ground survey effort is appropriate for a Level 1 terrestrial fauna assessment.
Completeness	No	The survey was conducted at 15 sites chosen to ensure adequate representative coverage of the Application Area. Representative habitats within the Application Area were sampled on foot and the entirety of the Application Area was traversed by vehicle.
Resources	No	Resources were adequate to carry out the survey and the survey participants were competent in identification of species present.
Remoteness / access problems	No	All survey sites were easily accessible by vehicle and on foot.
Availability of contextual information	No	The data available for the Chichester subregion was adequate for the level of survey work undertaken during this assessment.

6 Potential Impacts

6.1 Threatening Processes

Threatening processes relevant to the Pilbara bioregion have been identified by Regional Development Australia (RDA) *Pilbara: State of the Environment Report* (2013), and include land clearing, fragmentation, altered fire regimes and introduced flora and fauna. Threatening processes specifically associated with the Project are discussed in **Section 6.1.1** to **Section 6.1.9**, and are based on the Project Footprint. The impact of clearing and vehicle collision will be wholly contained within the Application Area, however other threatening processes, noise and vibration, dust emissions, artificial lighting, altered hydrology, altered fire regimes, introduced flora and fauna, are not restricted, and will potentially impact species and individuals occurring within and outside the Application Area. The degree to which this occurs varies accordingly to each threatening process and each species.

6.1.1 Clearing

Clearing of vegetation is a necessary part of the Project, and represents the most direct impact to fauna and fauna habitats. Development of the Project will result in a maximum loss of 150 ha (Project Footprint), and this may occur anywhere within the Application Area according to Project requirements. However, it should be noted that 74.2 ha within the Application Area comprises Existing Cleared Areas and therefore only 75.8 ha will actually be cleared.

Clearing is believed to be the largest and most widespread threat to Australian biodiversity, and is regarded as the most dominant threat to biodiversity within the eastern Pilbara region (Evans *et al.* 2011). Although 99.58% of the Pilbara remains uncleared (Government of Western Australia 2015), the key habitats required for endemic and threatened species of the region are often the most threatened due to the focus of mining activities (e.g. Cramer *et al.* 2016a, Cramer *et al.* 2016b). Clearing would reduce the size and quality of habitats, through edge effects and habitat fragmentation, and is likely to heighten the effects of other threatening processes such as introduced flora (Keighery 2010), introduced fauna (Doherty *et al.* 2015) and altered fire regimes (Knorr *et al.* 2014). A total of six habitat types occur within the Application Area, all of which are of limited significance to terrestrial fauna, with the exception of the Drainage Line and Riverine habitats (**Table 6-1**; **Figure 6-1**). Additionally, all habitats are well connected with the surrounding landscape and none are confined to the Application Area.

In addition to habitat loss, land clearance is likely to result in the direct loss of individual animals. Species at greatest risk are those that reside in habitats that are more limited in their extent or species that are sedentary in nature and will be unable to move during clearing activities. This is particularly the case for SRE species, which by definition, have poor dispersal capabilities (Harvey 2002) and are therefore unable to emigrate from land as it is being cleared. However, even mobile fauna, which may be able to avoid direct mortality, may face subsequent impacts depending on the availability of suitable habitat elsewhere and the ability to disperse there. While fauna may be able to escape direct mortality by dispersing into

nearby habitats the overall carrying capacity of the Application Area will be reduced, and required niches may already be filled (Parker *et al.* 2015). Individuals may either fail to establish due to competition and thus not survive long term, or displace their competitors and they, in turn, will not survive long term (Parker *et al.* 2015).

Table 6-1: Habitat extents in the Application Area and Project Footprint

Fauna habitat	Category [#]	Extent within* (ha)	
		Application Area	Project Footprint
Spinifex Stony Plain	- Widespread - Limited significance	282.2	51.6 (18.3%)
Calcrete	- Widespread - Limited significance	153.0	31.1 (20.3%)
Stony Rises	- Widespread - Limited significance	83.6	8.1 (9.7%)
Drainage Line	- Widespread - Significant	37.6	6.2 (16.5%)
Riverine	- Limited extent - Significant	15.9	2.8 (17.5%)
Rocky Foothills	- Limited extent - Limited significance	8.8	1.0 (11.5%)
Existing Cleared Areas	- Limited extent - Limited significance	74.2	48.9 (65.9%)
Totals		655	150

[#]see Section 5.1 for definitions.

*percentages denote the Project Footprint extent of each habitat type within the Application Area

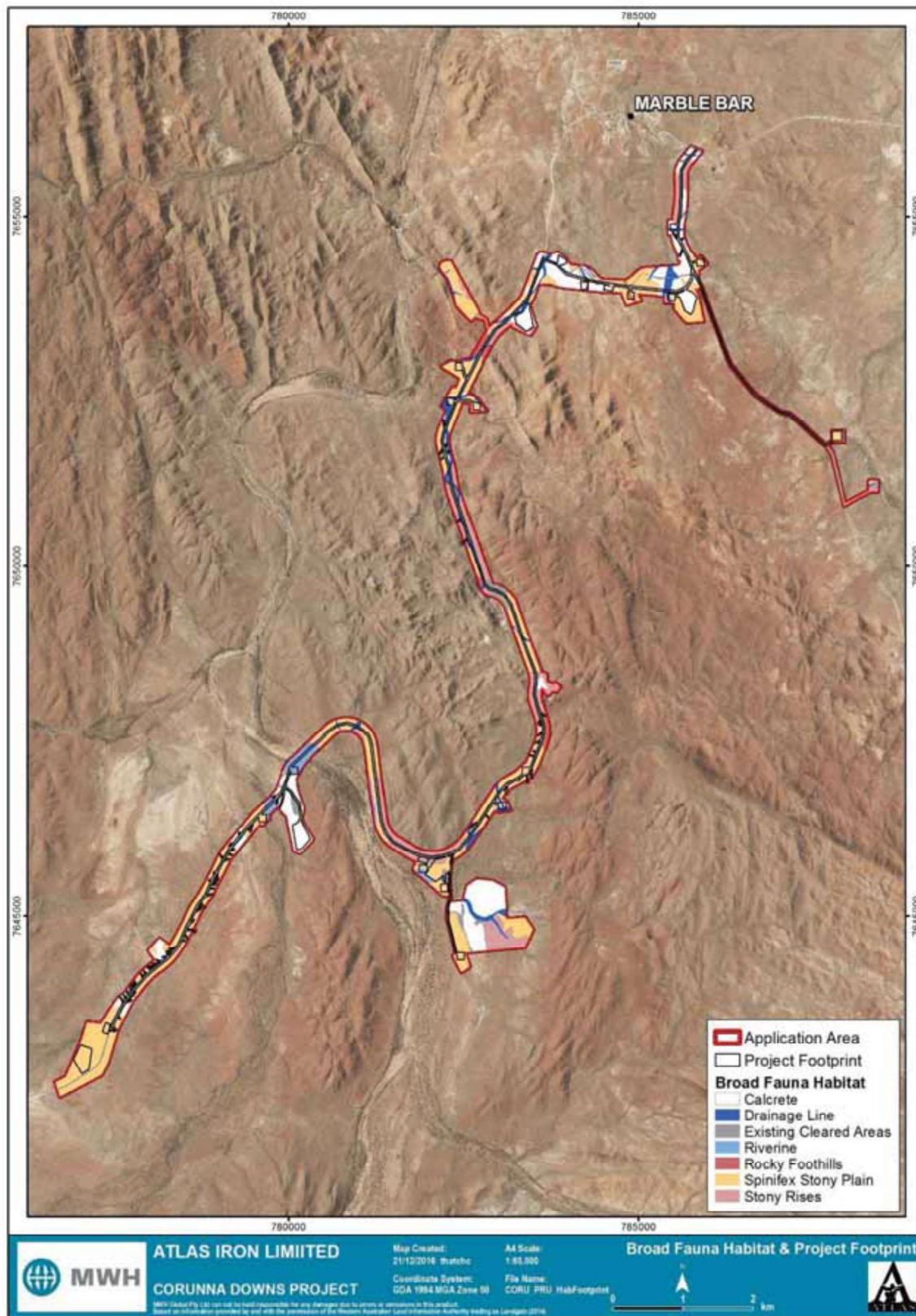


Figure 6-1: Application Area and Project Footprint with respect to fauna habitats

6.1.2 Vehicle Collision

The construction of roads, extends well beyond the impacts caused by habitat loss, including reducing habitat quality, altering animal behaviour, promoting activity of predatory (often introduced) fauna, and the most significant, direct mortality through vehicle collision (Polak *et al.* 2014). Once constructed, the Project would involve comparatively high vehicle movements on a continuous basis (24 hours per day, seven days per week) based on haulage of 6 MTPa. Consequently, fauna mortality through vehicle collisions are likely to increase. Incidents typically only involve individuals; however, the cumulative effect can be considerable (Gleeson and Gleeson 2012). Collisions with animals are more likely to occur at night (Rowden *et al.* 2008). Additionally, increases in vehicle collision is likely to promote species which feed on road-kill carrion, potentially driving other species away from the area and altering the local species assemblage (Dickman 1996).

The Project Footprint consists mainly of a road that will bisect each habitat type found in the Application Area (**Figure 6-1**). Ground-dwelling species that forage within intersecting habitat are most likely to be at risk, this includes species of conservation significance such as the Northern Quoll (Cramer *et al.* 2016b), Pilbara Olive Python (Burbidge 2004, Pearson 2003), Macropods such as the Spectacled Hare-wallaby (Rowden *et al.* 2008) and larger reptiles. Aerial species, such as the Pilbara Leaf-nosed Bat and the Ghost Bat, may also be at risk when foraging at low altitudes, particularly given the proximity of a nearby diurnal roost of (potentially) both species. The Pilbara Leaf-nosed Bats, in particular, has a curiosity for light sources which has resulted in an extensive number of vehicle collisions (Cramer *et al.* 2016a, van Dyck and Strahan 2008).

6.1.3 Noise and Vibration

The development and ongoing operation of the Project is likely to generate noise and vibration due to the general operation of heavy machinery and vehicles, diesel generators and the presence of personnel. The effects of noise on wildlife have been well studied, although responses vary depending on age and sex (for a comprehensive summary see Newport *et al.* 2014). Impacts caused by noise range from interruptions in feeding and resting behaviour, to complete abandonment of an area (Newport *et al.* 2014). Noise may lead to abandonment of roost sites for bats (K. Armstrong *pers. comm.* in Woinarski *et al.* 2014), and reduced hunting efficiency in bats due to disturbance of their echolocation system (Siemers and Schaun 2010). Species that may be especially at risk of disturbed communication are those that use calls to communicate or navigate. Raven (2008), suggests that vibrations created by heavy earthmoving equipment may actually attract spiders and other arachnids, which subsequently places these individuals at risk of direct contact with mining activities. There may also be a significant impact of vibration from heavy vehicles on scorpions as they use vibration for prey detection, navigation and courting (Volschenk 2011).

Ghost Bats are easily disturbed when roosting; young may be dislodged by adults in rapid take-offs and individuals may not return to roost sites after being disturbed (K. Armstrong *pers. comm.* in Woinarski *et*

al. 2014). The Pilbara Leaf-nosed Bat is also susceptible to mining activity when in close proximity to roosting sites (Biota 2013). The noise and vibration disturbance caused by vehicles has not been specifically studied for either species, however ongoing monitoring at the Lalla Rookh Ghost Bat and Pilbara Leaf-nosed Bat maternity has shown no decline since a haulage route was created <250 m from the entrance of the mine in 2013 (MWH 2016a). Additionally, given that a road is already located in the Project Footprint it is unlikely that noise and vibration poses a serious threat to the persistence of either species.

6.1.4 Dust Emissions

Dust emissions will be created as part of construction, haulage and general traffic activities, the impacts of which will not be confined to the Application Area. Dust emissions have the potential to affect surrounding vegetation and water sources which fauna rely on, as well as impacting individuals directly. High levels of dust have been associated with a reduction in plant growth and productivity and, alteration of soil chemistry leading to changes in vegetation community structure (Farmer 1993). Such effects are likely to impact on faunal assemblages via a reduction in food resource availability and shelter. Studies in semi-arid regions of Western Australia have however failed to prove negative effects of dust on arid-zone flora, suggesting that the impact of dust emissions within such ecosystems is not as prominent as witnessed in other systems (Matsuki *et al.* 2016). Significant reductions in Ghost Bat and Pilbara Leaf-nosed Bat activity has however been witnessed at mine sites within the region, believed to be due to heavy airborne dust clouds (R. Bullen *pers. comm.*).

6.1.5 Artificial Lighting

Exposure of fauna to artificial light may interfere with biological and behavioral activities that are governed by the length of day (photoperiod), including reproduction, dormancy, foraging and migration (Bradshaw and Holzapfel 2007, Le Corre *et al.* 2002, Stone *et al.* 2015). Some examples include reduced foraging activity in nocturnal mice (Bird *et al.* 2004) and suspension of normal feeding and reproductive behaviour in nocturnal frogs (Bird *et al.* 2004, Harder 2002). This artificial lighting may affect resident mammal, bird, reptile, amphibian and invertebrate assemblages within the vicinity of light sources, both within and outside the Application Area. Excessive light is likely to have an effect on the natural foraging behaviour of bats, in particular the Pilbara Leaf-nosed Bat, which is thought to be attracted to light sources (Cramer *et al.* 2016a). Long-term studies at Mt Dove, has however shown that Pilbara Leaf-nosed Bat activity is not impacted by artificial illumination, and perhaps increases species activity, presumably due to increased foraging resources (C. Knuckey and R. Bullen *unpub. data.*).

6.1.6 Altered Hydrology

Availability of water and nutrients is the primary limiting factor in arid and semi-arid environments (James *et al.* 1995). Water dependent ecosystems in the Application Area include temporary waterholes

associated with the Drainage Line and Riverine habitats. Removal of water from these habitat types, or a change in the timing, quantity, quality or distribution of water available to them (see Kingsford et al. 2004), may have negative impacts on the fauna assemblages within. In the Application Area and its broader surrounds, water sources in the Drainage Line and Riverine habitats may experience reduced hydrological input due to alteration of natural flows as part of construction of roads. Additionally, dewatering (such as for dust suppression) and local reductions in groundwater recharge, may impact upon groundwater dependent ecosystems within the area, including outside the Application Area (Nevill et al. 2010). As a consequence, vegetation reliant on available groundwater, such as riparian *Melaleuca* spp. or *Eucalyptus* spp. may be negatively affected. While species of fauna inhabiting these areas may be adapted to surviving without the direct consumption of water, the removal of these riparian habitats will have effects on vegetation and resources within these microhabitats that they depend on for foraging and sheltering.

6.1.7 Altered Fire Regimes

The development and ongoing operation of the Project may alter the fire regime of the Application Area through the introduction of unplanned fire caused by vehicle movements. Fire may impact fauna via direct contact, or indirectly by long-term habitat modification brought about by inappropriate fire frequency and intensity (Woinarski *et al.* 2014). Inappropriate fire regimes, such as large, hot fires late in the dry season, are likely to have adverse effects on fauna habitat and could alter fauna assemblages present in the Application Area. For example, fire is known to be of fundamental importance to habitat suitability for the Spectacled Hare-wallaby (van Dyck and Strahan 2008). Species most at risk of direct impact include small, sedentary species which occur in homogenous, fire-prone habitats, such as the Western Pebble-mound Mouse, *Ctenotus nigrilineatus*, and species which occur primarily in fire refuge habitats, such as the Drainage Line and Riverine habitats, like the Northern Quoll (Woinarski *et al.* 2001), Pilbara Olive Python (Pearson 2003) and SRE invertebrate fauna (EPA 2009). Additionally, some species, due to their life histories are susceptible to fire, such as the Ghost Bat (Bullen and McKenzie 2011) and Spectacled Hare-wallaby (Ingleby and Westoby 1992).

6.1.8 Introduced Flora

Environmental weeds already present in the Application Area may be spread due to increased vehicle usage and new weed species may be brought into the Application Area by mobile equipment during construction and operation of the Project. Weed invasion is widely recognised as having a negative impact on fauna species, as it can fundamentally alter the composition and structure of native vegetation communities (Cowie and Werner 1993, Gordon 1998). In the extreme, entire ecosystems can be modified directly (Sodhi and Ehrlich 2010), and indirectly through increase fuel loads which in-turn alter the local fire regime (Miller *et al.* 2010).

Invasion by non-native species typically results in declines in native plant species richness, but the response of fauna may be more complicated, with individual invasions potentially resulting in increase, decrease or no-change scenarios for different assemblages (Grice 2006). For example, even at low densities, Buffel Grass (*Cenchrus ciliaris*) can affect the composition of ground vegetation and birds (Smyth *et al.* 2009, Young and Schlesinger 2015). The habitats within the Application Area are largely weed free (MWH 2016d), and there is potential for substantial change to occur to vegetation communities should invasive flora be introduced and become established. The Drainage and Riverine habitats are at greatest risk of floristic and structural change resulting from an increase in introduced flora.

6.1.9 Introduced Fauna

Introduced fauna, both herbivorous and predatory, can cause fundamental changes to ecosystems and are thought to have contributed to the decline and extinction of many species in Australia (Abbott 2002, Burbidge and McKenzie 1989, Ford *et al.* 2001, Short and Smith 1994, Woinarski *et al.* 2014, 2015). Of the 20 key threatening processes listed under the EPBC Act, 12 are concerned with introduced flora and fauna, including predation by the Red Fox (*Vulpes vulpes*) and the feral Cat (*Felis catus*) which are known to have major negative impacts on small and medium-sized native vertebrates in Australia (Dickman 1996).

Of the nine species with the potential to occur in the Application Area, all but three, the feral Cat, House Mouse and Domestic Cattle – are listed as ‘Declared Pests’ under the *Biosecurity and Agriculture Management Act 2007* (WA), which calls for reduction of their numbers when they are running wild or feral. The Project may provide additional resources or habitat which may attract and support a greater abundance of feral animals in the area. Introduced predators may also be attracted into the Application Area as a result of the scavenging opportunities generated by the presence of road kill along roads (Dickman 1996), which may in turn adversely affect populations of native fauna. Of particular concern would be an increase in the size or density of the local population of feral Cats, which are not only a direct predator of the Northern Quoll, Pilbara Olive Python and other ground-dwelling fauna, but also compete for food resources and habitat requirements with these and others.

6.2 Impacts on Broad Fauna Habitats

Fauna habitat loss as a direct result of land clearing and excavation is considered to be a primary impact of the Project on terrestrial fauna. Land clearance is listed as a Key Threatening Process under the EPBC Act, although it is also recognised as a necessary component of developing a resources project in an undeveloped area.

A maximum of 150 ha, inclusive of 74.2 ha of Existing Cleared Areas, will be required for the development of the Project within the Application Area, potentially affecting instances of six broad fauna habitats (**Table**

6-1; Figure 6-1). Of the broad fauna habitats that have potential to be adversely affected, two are considered to be of significance to fauna assemblages, fauna of conservation significance and/or SRE invertebrates; Drainage Line and Riverine. The other broad fauna habitat types to be affected by the Project, Spinifex Stony Plain, Calcrete, Stony Rises and Rocky Foothills, are considered to be of limited significance for conservation significant vertebrate fauna and have a low potential to support SRE, and are therefore excluded from further discussion.

6.2.1 Drainage Line

Drainage Line habitat consists of minor watercourses, creeks and channels that support *Eucalyptus*, *Corymbia* and *Melaleuca* woodlands subject to regular flooding and seasonal ponding. This is a significant habitat type for fauna as it provides a range of microhabitats, such as seasonal water pools, moist depressions, sedges and rushes on alluvial soil (How *et al.* 1991). The Drainage Line habitat type is scattered throughout the Application Area (**Figure 5-1**), and its linear arrangement provides linkages between other sources of food and water (How *et al.* 1991). Drainage Line habitat was identified as having a medium potential to support SRE species.

A total of 6.2 ha of the Application Area comprises Drainage Line habitat. This habitat type is widespread in the broader landscape, and the affected areas are contiguous with surrounding occurrences of Drainage Line habitat. Fauna occurring within this habitat type are therefore unlikely to be substantially impacted by the Project, from a regional perspective. Nonetheless, where Drainage Line habitat is cleared, steps should be taken to minimise local hydrological impacts so as to retain ecological function both within the Application Area and downstream.

6.2.2 Riverine

The Riverine habitat contains very similar microhabitats to that of the Drainage Line and as such contains a very similar ecological role. The Riverine habitat type is located in the south-west margins of the Application Area (**Figure 5-1**), and its linear arrangement provides linkages between other sources of food and water (How *et al.* 1991). Riverine habitat was identified as having a medium potential to support SRE species.

A total of 2.8 ha of the Application Area comprises Riverine habitat and a substantial amount is known to occur outside the Application Area to the east (in association with the Emu Creek system). This habitat type is widespread in the broader landscape, and the affected areas are contiguous with surrounding occurrences of Riverine habitat. Fauna occurring within this habitat type are therefore unlikely to be substantially impacted by the Project, from a regional perspective. Nonetheless, where Riverine habitat is cleared, steps should be taken to minimise local hydrological impacts so as to retain ecological function in water pools and moist depressions, both within the Application Area and downstream.

6.3 Impacts on Vertebrate Fauna Assemblages

A total of 325 vertebrate fauna species, comprising 38 native mammals, nine non-native mammals, 164 birds, 104 reptiles and ten amphibians, were identified as potentially occurring in the Application Area during the desktop study component of the Survey (**Section 3.3**). The majority of these species form assemblages that occur across a variety of habitats present within and surrounding the Application Area.

In terms of vertebrate fauna assemblages, the Application Area was not determined to be an area of exceptionally high biodiversity from a regional point of view. Clearing of vegetation and vehicle collisions are likely to result in the direct loss of individuals during initial clearing activities; however, those assemblages occurring across a range of habitats or those occurring in widespread habitats are unlikely to be significantly impacted by the Project. From a regional perspective, the impacts of the Project on fauna assemblages are unlikely to be significant.

6.4 Impacts on SRE Invertebrate Fauna

The desktop study identified three SRE species, the millipede *Antichiropus* 'DIP034', the snail *Rhagada* 'cf. *richardsonii*' and the *Buddelundia* '86' as having a high potential of occurring within the Application Area. Ten additional SRE species have a medium potential to occur in the Application Area on the basis of proximity and known habitat associations. Although these species have potential to occur in the Application Area, the presence of regional records suggests that the Project is unlikely to affect the long term survival of the species. Habitats with potential to support SRE species, the Drainage Line and Riverine habitats, have limited distribution in the Application Area but are well represented outside the Application Area. Consequently, impacts to SRE species and habitats are considered to be minimal.

6.5 Impacts on Vertebrate Fauna of Conservation Significance

The desktop study of the Survey identified 32 species of conservation significance that potentially occur in the Application Area; 13 of these were considered Unlikely to occur and are not discussed further in this Assessment. Of the remaining 19 species, two species were Confirmed within the Application Area, two as Very Likely, three as Likely, 12 as Possible, to occur (**Table 5-3**). For definitions regarding the likelihood of occurrence for species of conservation significance, refer to **Section 4.5**.

Pre-determined categories were used to rank the expected local impacts of the Project on fauna of conservation significance (**Table 6-2**; **Table 6-3**). These impacts were considered within a broader, regional context (**Table 6-3**). Impacts were assessed based on the assumption that no management actions or mitigation strategies would be implemented. Of the 19 species assessed, two were assessed as having a Moderate level of impact (the Pilbara Leaf-nosed Bat and Ghost Bat), five were assessed as

having a Low level of impact, eight were assessed as having a Minimal level of impact, and seven were assessed as having Negligible impact (**Table 6-3**).

Species specific management actions and strategies to manage the impacts of the Project on fauna of conservation significance were also developed (**Table 6-3**). The level of impact of the Project on these species is likely to be reduced should the recommended actions and strategies be implemented. More general management recommendations are provided in **Section 6.7**.

Table 6-2: Ranking criteria for Project local impacts on fauna of conservation significance

Impact	Description [#]
Negligible	No perceived effect on population
Minimal	No population decline expected
Low	Short-term population decline expected within Application Area (recovery expected after life of the Project)
Moderate	Permanent population decline expected – no perceived threat to population persistence
High	Permanent population decline expected – persistence of local population threatened
Extreme	Local population extinction likely

[#]these impacts can be expected within the Application Area and surrounding 10 km

Table 6-3: Project impacts on fauna of conservation significance and suggested management actions

Species	Localised impacts	Regional context	Species specific management actions
Threats and reasoning for listing Northern Quoll (<i>Dasyurus hallucatus</i>) Endangered – EPBC Act Schedule 2 – WC Act The species is threatened by several, interacting factors. The largest, Cane Toads (<i>Bufo marinus</i>), currently threatens outside of the Pilbara although this is likely to become an issue in the coming decades (Tingley <i>et al.</i> 2013). Within the Pilbara the current largest threats to the species are: inappropriate fire regimes; predation by feral Cats, wild dogs and foxes; habitat loss and fragmentation (mostly associated with mining ventures); and habitat degradation due to invasive pasture grasses (Woinarski <i>et al.</i> 2014).	Low - The species was not recorded within the Application Area but was assessed as Possible to occur, based on habitat preferences and previous records. - Foraging and dispersal habitat connecting populations important for the long-term survival of the species is considered habitat critical to the species. It is likely the Drainage Line and Riverine habitats represent suitable foraging and dispersal habitat for the species and connect adjoining populations. - Approximately 37.6 ha and 6.2 ha of Drainage Line habitat, is located within the Application Area and Project Footprint, respectively. Approximately 15.9 ha and 2.8 ha of Riverine habitat, is located within the Application Area and Project Footprint, respectively. - Vehicle collisions with the species is likely to increase, particularly during night-time hours and where infrastructure intersects habitat critical to the species. - Altered hydrological regimes within the Application Area may impact the quality and availability of water within Drainage Line and Riverine habitat both within and downstream of the Application Area. - Frequent fire in habitat critical to the species is a significant threat to the species (Woinarski <i>et al.</i> 2014). An increase in fire frequency, directly through hauling activity or indirectly through increasing fuel loads via introduced flora species, is likely to have short term impacts on the species. - The species is preyed upon by both Dog/Dingo and feral Cats (Woinarski <i>et al.</i> 2014, 2015). The increase in either population is likely to impact the species within and surrounding the Application Area.	- The species has been recorded in most surveys conducted within the vicinity of the Application Area (Appendix B). - Habitats within the Application Area, are connected to similar habitat outside the Application Area, as well as similar habitat outside the Application Area. - The Application Area provides supporting habitat only (foraging and dispersal) and suitable denning habitat (rocky ridges and gorges) is not located in the Application Area. - In the Pilbara, the species occurs in fragmented populations, however the genetic connectivity, and therefore dispersal capabilities, of the species is thought to be high (Spencer <i>et al.</i> 2013). Therefore development of the Project is unlikely to significantly impact dispersal capabilities and genetic connectivity of surrounding populations.	During the design and planning phase of the Project, consider aligning infrastructure footprints to avoid habitats that are known to, or have been identified as supporting habitat (e.g. Drainage Line, Riverine) wherever possible.

Species	Threats and reasoning for listing	Localised impacts	Regional context	Species specific management actions
Ghost Bat (<i>Macroderma gigas</i>) Vulnerable – EPBC Act Schedule 3 – WC Act	Five moderate-severe threats have been identified for the species (Woinarski <i>et al.</i> 2014). The most severe being (human) disturbance to maternity roost sites, followed by habitat loss caused by mining, collision with fences, contamination of roost sites within old mines and collapse of roost sites within old mines (Woinarski <i>et al.</i> 2014).	Moderate	- Within the Pilbara region the species has a very widespread but patchy distribution (Armstrong and Anstee 2000). - One regionally important maternity roosts is located within the vicinity of the Application Area (80 m) – Comet Mine. Headcounts of the species from here range from 35-100 (DoE 2016a). - The Alexander mine (approximately 1.1 km south of Comet Mine) is a known roost for the species and is located approximately 190m from the Application Area (Armstrong and Anstee 2000). - Klondyke Queen Mine (another regionally important diurnal roost) is located ~17 km south-east of the Application Area. It is likely that individuals from these two roosts frequent the Application Area on a nightly basis. - Habitats within the Application Area, are connected to similar habitat outside the Application Area. - The extent of the regional population is more likely to be limited by the extent and condition of diurnal roost sites as oppose to the extent of foraging habitat. No significant diurnal roosts will be removed as part of the Project.	- Include monitoring of the Comet Mine as part of the Corunna Downs Project monitoring program to assess the impact of the Project on the Ghost Bat population. - During the design and planning phase of the Project, consider aligning infrastructure footprints to avoid habitats that are known to, or have been identified as, likely to support the species, specifically the Comet Mine where the species has been recorded. - To reduce the impact of artificial light on this species during the night, use light shielding and position lights to illuminate areas such as pathways and roads, rather than the habitat and night sky, and avoid inadvertent illumination of important habitat features, such as caves and overhangs. - Ensure suitable dust control for the Project, particularly on haul roads and within borrow pits near Comet Mine. - Avoid the use of single-line wire fencing, particularly barbed wire.
		- The species was not recorded within the Application Area but was assessed as Highly Likely to occur, based on a known diurnal roost occurring 80 m west of the Application Area (150m from the existing Marble Bar - Woodstock Road), and one (Klondyke Queen) located 17 km south-east of the Application Area. - Habitats within the Application Area do not represent particularly important foraging or roosting habitat for the species, although all habitats may be utilised by the species for foraging. - Noise and vibration impacts associated with vehicle movements are unlikely pose a serious threat based on monitoring at Lalla Rookh (MWH 2016a). - Vehicle collisions with the species are likely to increase, particularly during night-time hours and particularly in proximity to the Comet Mine. - Fire is known to cause local abandonment of diurnal roosts by the species (Armstrong and Anstee 2000). An increase in fire frequency, either directly through haulage activity or indirectly through increasing fuel loads via introduced flora species, is likely to have short term impacts on the species - particularly in proximity to the Comet Mine. - Vegetation simplification, through introduced flora, or altered hydrological regimes may impact on foraging strategies at productive riparian sites. - The impact of dust emissions on the species is not proven but is likely to be a factor influencing nightly foraging behaviour of the species and has caused decline at other mines within the region (DoE 2016a). - The impacts of artificial lighting on the species is unknown, however based on the impacts to other (often large) microbats (Stone <i>et al.</i> 2015), artificial lighting created during construction may potentially altering foraging behaviour of the species – particularly when in proximity to the Comet Mine. - Collisions with fences is known to be a significant threatening process for the species, particularly barbed wire and single-line wire fencing (Armstrong and Anstee 2000).		

Species	Localised impacts	Regional context	Species specific management actions
Threats and reasoning for listing Pilbara Leaf-nosed Bat (<i>Rhinonicteris aurantius</i>) Vulnerable – EPBC Act Schedule 3 – WC Act Three major threats identified for the species, the most severe being the potential loss of roosting habitat due to mining (Woinarski <i>et al.</i> 2014); followed by collapse of roost sites within old mines (Hall <i>et al.</i> 1997) and human disturbance causing roost abandonment (Armstrong 2001).	Moderate - The species was not recorded within the Application Area but was assessed as Highly Likely to occur, based on a known diurnal roost occurring 80 m west of the Application Area (150m from the existing Marble Bar - Woodstock Road), and two located 15 km south-west at Corunna Downs (MWH 2016d). - The Drainage Line and Riverine habitat are likely to provide foraging and dispersal habitat for the species and connect adjoining populations. - Vehicle collisions with the species are likely to increase, particularly during night-time hours and where lighting infrastructure is located within proximity to the Comet Mine. - Artificial lighting appears to be of little impact to the species, and it appears the species is attracted to such areas for foraging (C. Knuckey and R. Bullen <i>unpub. data.</i>). - Noise and vibration impacts associated with vehicle movements are unlikely pose a serious threat based on monitoring at Lalla Rookh (MWH 2016a). - The impact of dust emissions on the species is unknown but is likely to be a factor influencing nightly foraging behaviour or the species (Section 6.1.4).	- Six Permanent Diurnal Roosts are known to occur within 60 km of Marble Bar, suggesting a high regional population of the species. Additionally a number of Non-permanent Breeding Roosts and Transitory Diurnal Roosts are known to occur (MWH 2016d). - The distribution of the species is limited by the scarcity of caves that possess the required microclimates for roosting (Armstrong 2001, Churchill 1991). No significant diurnal roosts will be removed as part of the Project. - If foraging habitat is removed, it is possible that it will cause a small decline in the population as a consequence of disruption to an established foraging pattern however this is not expected to be substantial as all habitats within the Application Area are extensive outside the Application Area.	- Include monitoring of the Comet Mine as part of the Corunna Downs Project monitoring program to assess the impact of the Project on the Pilbara Leaf-nosed Bat population. - During the design and planning phase of the Project, consider aligning infrastructure footprints to avoid habitats that are known to, or have been identified as, likely to support the species. Specifically the Comet Gold Mine. - To reduce the impact of artificial light on this species during the night, use light shielding and position lights to illuminate areas such as pathways and roads, rather than the habitat and night sky and avoid inadvertent illumination of important habitat features, such as caves, overhangs and water sources. - Ensure suitable dust control for the Project, particularly on haul roads and within pits near diurnal roosting sites.

Species	Threats and reasoning for listing	Localised impacts	Regional context	Species specific management actions
Pilbara Olive Python (<i>Liasis olivaceus barroni</i>) Vulnerable – EPBC Act Schedule 3 – WC Act The main threats identified to the species are predation of juvenile and prey items (such as the Northern Quoll and Rock-wallabies) by the feral Cat and Red Fox, and destruction of habitat from resources development (Pearson 2003). Also major fire events are likely to impact the species (Pearson 2003).	Low - The species was not recorded within the Application Area but was assessed as Possible to occur, based on habitat preferences and previous records. - It is likely the Drainage Line and Riverine habitats represent suitable foraging and dispersal habitat of the species, although such habitat are unlikely to represent habitat critical to the long term survival of the species. - Within Drainage Line and Riverine habitats, individuals crossing the road are likely to be subjected to an increase risk of road strike. - Approximately 37.6 ha and 6.2 ha of Drainage Line habitat, is located within the Application Area and Project Footprint, respectively. Approximately 15.9 ha and 2.8 ha of Riverine habitat, is located within the Application Area and Project Footprint, respectively. - Juveniles of the species is preyed upon by the Red Fox and by feral Cats (Pearson 2003). An increase in either population is likely to impact the species within and surrounding the Project. - Additional water bodies such as Turkeys Nests and sewage ponds, associated with mining or development, appear to benefit the species (Pearson 2003).	Negligible - The species was not recorded within the Application Area but was assessed as Possible to occur, based on habitat preferences and previous records. - Rocky Ridge and Gorge, Drainage Line and Riverine habitat may contain suitable nest sites, such as cliff lines and trees in elevated locations (Garrett <i>et al.</i> 2011). - Approximately 37.6 ha and 6.2 ha of Drainage Line habitat, is located within the Application Area and Project Footprint, respectively. Approximately 15.9 ha and 2.8 ha of Riverine habitat, is located within the Application Area and Project Footprint, respectively. - The species is highly mobile and adults, during the non-breeding season, would be expected to disperse ahead of clearing.	- Although the species is patchily distributed, the Pilbara Olive Python is widespread across the Pilbara (DPaW 2016b). - The species was recorded during eight of the eleven surveys conducted within the vicinity of the Application Area (MWH 2016d). - Habitats within the Application Area, are connected to similar habitat outside the Application Area (particularly to the north; Figure 6-1).	- During the design and planning phase of the Project, consider aligning infrastructure footprints to avoid habitats that are known to, or have been identified as, likely to support the species (e.g. Drainage Line and Riverine habitats). Specifically water sources and where development will disrupt hydrology surrounding water sources. - If the species is encountered in areas close to infrastructure, authorised snake handlers should relocate individuals to undisturbed areas of suitable habitat.
				- The Grey Falcon is widespread across much of Australia with scattered records through the Pilbara region (Barrett <i>et al.</i> 2003, Garnett and Crowley 2000). - The species was not recorded from any Survey conducted within the vicinity of the Application Area (MWH 2016d). - Suitable foraging and nesting habitat for the Grey Falcon is widespread across the Pilbara Region.
Grey Falcon (<i>Falco hypoleucos</i>) Schedule 3 – WC Act Largest threat to species is associated with clearing for agriculture, which has reduced habitat in semi-arid zones (Garnett <i>et al.</i> 2011). Also grazing by exotic herbivores is likely to have reduced regeneration of trees in the arid zone, therefore reducing nesting habitat availability (Garnett <i>et al.</i> 2011).				Not applicable

Species	Threats and reasoning for listing	Localised impacts	Regional context	Species specific management actions
Peregrine Falcon <i>(Falco peregrinus)</i> Schedule 7 – WC Act	Habitat loss appears to be a major threat, particularly in woodland areas where the species nests in areas with cliffs. Other threats include accidental poisoning from dog baits and historically agricultural chemicals DDT and Dieldrin which cause a decrease in eggshell thickness (DoE 2016d).	Minimal - The species was not recorded within the Application Area but was assessed as Possible to occur, based on habitat preferences and previous records. - Suitable foraging and dispersal habitat for the species, although such habitat is unlikely to represent habitat critical to the long term survival of the species. - Approximately 37.6 ha and 6.2 ha of Drainage Line habitat, is located within the Application Area and Project Footprint, respectively. Approximately 15.9 ha and 2.8 ha of Riverine habitat, is located within the Application Area and Project Footprint, respectively. - Suitable habitat is located outside the Application Area and within the surrounding region. The species is unlikely to be reliant on habitats within the Application Area. - The species is highly mobile and adults, during the non-breeding season, would be expected to disperse ahead of clearing.	- The Peregrine Falcon is widespread across much of Australia with scattered records through the Pilbara region (Barrett <i>et al.</i> 2003, Garnett and Crowley 2000). - The species was recorded from two Survey’s conducted within the vicinity of the Application Area, at Corunna Down directly south of the Application Area (MWH 2016d), and Abydos-Woodstock Reserve, located ~65 km south-west of the Application Area (How <i>et al.</i> 1991). - Suitable foraging and nesting habitat for the Peregrine Falcon is widespread across the Pilbara Region.	During the design and planning phase of the Project, consider aligning infrastructure footprints to avoid habitats that are known to, or have been identified as, likely to support the species (e.g. Drainage Line and Riverine habitats). Specifically mature trees lining Drainage Line and Riverine habitats.
	Ctenotus nigrilineatus Priority 1 – DPaw Priority List	Specific threats to the species are unknown. The species is listed because it is only known from a single location near Woodstock (How <i>et al.</i> 1991) and little is known about its biology or habitat preferences.	Minimal - The species was not recorded within the Application Area but was assessed as Possible to occur, based on habitat preferences and previous records. - The habitat requirements of the species are largely unknown although it is believed the species is associated with spinifex at the base of granite outcrops (How and Dell 2004, Storr <i>et al.</i> 1999). - Approximately 282.2 ha of the Spinifex Stony Plain habitat is located in the Application Area, including 51.6 ha in the Project Footprint. - An increase in the feral Cat population is likely to impact the species within and surrounding the Project. - As the species has a preference for spinifex habitats, it’s possible that any local population (if present) could be impacted in the short-term by alteration of the local fire regime.	- Clearing of the Spinifex Stony Plain habitat in the Application Area will reduce the amount of habitat available for this species however only a small portion of such habitat is located within the Application Area compared to that located in the wider region (Figure 6-1). - The species was only recorded from one survey conducted within the vicinity of the Application Area (How and Dell 2004, How <i>et al.</i> 1991). - Little is known of the regional distribution of this species; however, it is unlikely that any local impacts would manifest at a regional scale.

Species	Localised impacts	Regional context	Species specific management actions
Threats and reasoning for listing <i>Ctenopus uber johnstonei</i> Priority 2 – DPaW Priority List Specific threats to species unknown. The species is listed because its distribution is poorly known, with some occurrences on lands managed for conservation and/or the species appears to be under immediate threat from known threatening processes.	Minimal - The species was not recorded within the Application Area but was assessed as Possible to occur, based on habitat preferences and previous records. - The habitat requirements of the species are largely unknown although it is believed the species is associated with compacted clayey soil with sparse plant cover, represented by sections of the Spinifex Stony Plain habitat of the Application Area. Approximately 282.2 ha of the Spinifex Stony Plain habitat is located in the Application Area, including 51.6 ha in the Project Footprint. - An increase in the feral Cat population is likely to impact the species within and surrounding the Project.	- Clearing of the Spinifex Stony Plain habitat in the Application Area will reduce the amount of high quality habitat available for this species within the region. - Little is known of the regional distribution of this species; however, it is unlikely that any local impacts would manifest at a regional scale.	Not applicable
Spectacled Hare-wallaby (<i>Lagorchestes conspicillatus leichardti</i>) Priority 3 – DPaW Priority List Most severe threats identified as predation by the Red Fox, habitat loss and fragmentation (Woinarski <i>et al.</i> 2014). Moderate threats comprise predation by feral Cats and inappropriate fire regimes (Woinarski and Fisher 1995).	Low - The species was not recorded within the Application Area but was assessed as Likely to occur, based on habitat preferences and previous records. - The habitat requirements of the species are largely unknown although it is believed the species is associated with spinifex plains (Ingleby 1991, Ingleby and Westoby 1992), represented by the Spinifex Stony Plain habitat of the Application Area. Approximately 282.2 ha of the Spinifex Stony Plain habitat is located in the Application Area, including 51.6 ha in the Project Footprint. - An increase in the feral Cat and/or Red Fox population is likely to impact the species within, and surrounding, the Project. - As the species has a preference for spinifex habitats where large mature hummocks may provide refuge habitat from predators, it's likely that the local population will be impacted by alteration of the local fire regime.	- Within the Pilbara the species is considered relatively rare (Woinarski <i>et al.</i> 2014), with very few recent records of the species (DPaW 2016b). It is believed that without suitable management the species could be functionally lost from the region within the next 20 years (Canwardine <i>et al.</i> 2014). - The species was recorded in three of the 11 surveys conducted within the vicinity of the Application Area (MWH 2016d). The lack of recent records of the species in the region suggests that local area could be of importance to the species.	During the design and planning phase of the Project, consider aligning infrastructure footprints to avoid habitats that are known to, or have been identified as, likely to support the species (e.g. Spinifex Stony Plain habitat). Specifically old growth Spinifex habitats.

Species	Threats and reasoning for listing	Localised impacts	Regional context	Species specific management actions
Long-tailed Dunnart <i>(Sminthopsis longicaudata)</i> Priority 4 – DPaw Priority List No major threats identified to species, and protected on the basis of being (a) rare and not considered threatened although could be if circumstances change; or (b) is not conservation dependent but is close to quantifying for Vulnerable.		Negligible - The species was not recorded within the Application Area but was assessed as Likely to occur, based on habitat preferences and previous records. - The species is often associated with rugged rocky areas (Gibson and McKenzie 2009, van Dyck and Strahan 2008), represented by Rocky Foothills habitat of the Application Area. Approximately 8.8 ha of the Rocky Foothills habitat is located in the Application Area, including 1.0 ha in the Project Footprint. - An increase in the feral Cat population is likely to impact the species within and surrounding the Project.	- The species was recorded from one survey conducted within the vicinity of the Application Area (Outback Ecology 2012c), however the species has a widely scattered distribution through Western Australia and the Pilbara (Gibson and McKenzie 2009). - Little is known of the regional distribution of this species; however, it is unlikely that any local impacts would manifest at a regional scale.	Not applicable
	Western Pebble-mound Mouse <i>(Pseudomys chapmani)</i> Priority 4 – DPaw Priority List Habitat loss and fragmentation (due to mining) is regarded as most severe threat to the species, specifically iron-ore mining which destroys mounds and habitat (Woinarski et al. 2014); predation by cats is unknown but may be significant (Woinarski et al. 2014).	Low - The species was recorded on 11 occasions during the Survey from nine old and two recently active mounds. Ten of the records were recorded within Spinifex Stony Plain habitat and the remaining one was recorded within the Stony Rise habitat. - The species is associated with stony plains represented by sections of the Spinifex Stony Plain habitat of the Application Area. Approximately 282.2 ha of the Spinifex Stony Plain habitat is located in the Application Area, including 51.6 ha in the Project Footprint. - Due to the limited mobility of the species, individuals will not be able to relocate in advance of progressive clearing. - An increase in the feral Cat population is likely to impact the species within and surrounding the Project.	- Habitat within the Application Area is small relative to available habitat in the wider Application Area and within the wider Pilbara region (van Vreeswyk et al. 2004). - The species was recorded in ten of the 11 surveys conducted within the region and from two database searches (MWH 2016d). - The species is widely distributed in the region, it is unlikely that any local impacts would manifest at a regional scale.	- Avoid clearing of pebble-mounds wherever possible. This includes inactive mounds, which may be re-used by subsequent generations (Anstee 1996, Anstee and Armstrong 2001) - Record location and status (i.e. active or inactive) of mounds if encountered and demarcate appropriately.

Species	Localised impacts	Regional context	Species specific management actions
Threats and reasoning for listing Fork-tailed Swift <i>(Apus pacificus)</i> Migratory – EPBC Act Schedule 5 – WC Act Species migratory between Australia and much of Asia. Therefore protected under international agreements CAMBA, JAMBA and ROKAMBA. There are no significant threats to the Fork-tailed Swift in Australia. Potential threats include habitat destruction and predation by feral animals (DoEE 2016b).	Negligible - The species was not recorded within the Application Area but was assessed as Possible to occur, based on habitat preferences and previous records. - Within Australia the species is almost entirely an aerial species, and therefore has the possibility to fly-over any of the habitats present within the Application Area. Although is unlikely to be dependent on any habitat in particular.	- Potential habitat is widespread and common through region (Johnstone <i>et al.</i> 2013). - It is unlikely that the species will be adversely impacted by development of the Project	Not Applicable
Migratory Shorebirds (various): Sharp-tailed Sandpiper (<i>Calidris acuminata</i>) Wood Sandpiper (<i>Tringa glareola</i>) Common Sandpiper (<i>Actitis hypoleucos</i>) Common Greenshank (<i>Tringa nebularia</i>) Glossy Ibis (<i>Plegadis falcinellus</i>) Migratory – EPBC Act Schedule 5 – WC Act Species migratory between Australia and Siberia, and through much of Asia. Therefore protected under international agreements CAMBA, JAMBA and ROKAMBA. Habitat loss and degradation are the largest threats to the species, particularly the availability of foraging and roosting sites required for successful migration and breeding (DoEE 2016b).	Negligible - None of these species were recorded within the Application Area, and all were assessed as Possible to occur, based on habitat preferences and previous records. - Each of these species occurs within Australia on a seasonal basis only (Johnstone <i>et al.</i> 2013). - Each of the species has a possibility of occurring within the Drainage Line and Riverine habitat types for foraging only although neither species is reliant on these habitats within the Application Area	- The potential habitat within the Application Area is small relative to available habitat in the wider region (Johnstone <i>et al.</i> 2013). - It is unlikely that any of these species will be adversely impacted by development of the Project	Not Applicable

Species	Threats and reasoning for listing	Localised impacts	Regional context	Species specific management actions
Eastern Great Egret <i>(Ardea modesta)</i> Schedule 5 – WC Act Species migratory between Australia and much of Asia. Habitat loss and/or degradation of foraging and especially breeding habitat is the largest threat to the species (DoEE 2016b).	Minimal - The species was not recorded within the Application Area but was assessed as Likely to occur, based on habitat preferences and previous records. - The species is associated with Drainage Line and Riverine habitats within the Application Area which it utilises for nesting and foraging. Approximately 37.6 ha and 6.2 ha of Drainage Line habitat, is located within the Application Area and Project Footprint, respectively. Approximately 15.9 ha and 2.8 ha of Riverine habitat, is located within the Application Area and Project Footprint, respectively. - Altered hydrological regimes within the Application Area may impact the quality and availability of water within adjacent Drainage Line and Riverine habitat (including outside the Application Area) that this species utilises.	Minimal - The species was recorded on two occasion within the Application Area from the Riverine habitat and the Spinifex Stony Plain habitat. - The species is most commonly recorded in Drainage Line and Riverine type habitats which it uses for foraging and breeding. Approximately 37.6 ha and 6.2 ha of Drainage Line habitat, is located within the Application Area and Project Footprint, respectively. Approximately 15.9 ha and 2.8 ha of Riverine habitat, is located within the Application Area and Project Footprint, respectively.	- Potential habitat is widespread and common throughout region (Johnstone <i>et al.</i> 2013), and potential habitat within the Application Area is small relative to available habitat in the wider region. - It is unlikely that the species will be adversely impacted by the development of the Project	Not Applicable
Rainbow Bee-eater <i>(Merops ornatus)</i> Schedule 5 – WC Act Species migratory between Australia and eastern Indonesia. The Cane Toad is perceived as being the only major threat to the species as it has been documented feeding on eggs and especially nestlings (Garnett <i>et al.</i> 2011).	Minimal - The species was recorded on two occasions within the Application Area from the Riverine habitat and the Spinifex Stony Plain habitat. - The species is most commonly recorded in Drainage Line and Riverine type habitats which it uses for foraging and breeding. Approximately 37.6 ha and 6.2 ha of Drainage Line habitat, is located within the Application Area and Project Footprint, respectively. Approximately 15.9 ha and 2.8 ha of Riverine habitat, is located within the Application Area and Project Footprint, respectively.	- Potential habitat is widespread and common through region (Johnstone <i>et al.</i> 2013), and potential habitat within the Application Area is small relative to available habitat in the wider region. - It is unlikely that the species will be adversely impacted by development of the Project.	During the design and planning phase of the Project, consider aligning infrastructure footprints to avoid habitats that are known to, or have been identified as, likely to support the species (e.g. Drainage Line and Riverine habitats).	

6.6 Impacts on Matters of National Significance

For the purposes of this Assessment, matters of national environmental significance are defined as fauna that are listed under the EPBC Act and that have been Confirmed to occur within the Application Area or are considered Likely or Very Likely to occur. Fauna that are listed under the EPBC Act but are considered Unlikely or Possible to occur in the Application Area are not considered.

The terminology, rationale and criteria used to determine whether an impact is 'significant' is consistent with the Commonwealth's *Matters of National Environmental Significance: Significant impact guidelines 1.1* (DoE 2013). Additionally, criteria to determine the significance of impact to the Northern Quoll was sought from the *EPBC Act referral guideline for the endangered northern quoll* *Dasyurus hallucatus* (DoE 2016c), and for the Pilbara Leaf-nosed Bat from the *Conservation listing advice for* *Rhinonicteris aurantia* (*Pilbara form*) *Pilbara leaf-nosed Bat* (DoE 2016b). The following key definitions are directly relevant to the information presented below. Impacts were assessed based on the assumption that no management actions or mitigation strategies would be implemented.

6.6.1 What is an important population of a species?

An 'important population' for the Ghost Bat and Pilbara Olive Python, is defined by DoE (2013) as a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- key source populations either for breeding or dispersal;
- populations that are necessary for maintaining genetic diversity; and/or
- populations that are near the limit of the species range.

For the Northern Quoll, a population important for the long-term survival of the species is defined by DoE (2016c) as a population which is:

- high density Northern Quoll populations, which occur in refuge-rich habitat critical to the survival of the species, including where cane toads are present;
- occurring in habitat that is free of cane toads and unlikely to support cane toads upon arrival i.e. granite habitats in WA, populations surrounded by desert and without permanent water;
- subject to ongoing conservation or research actions i.e. populations being monitored by government agencies or universities or subject to reintroductions or translocations.

For the Pilbara Leaf-nosed Bat, individuals existing within the Pilbara and upper Gascoyne represent an important population, comprising multiple colonies (DoE 2016b).

6.6.2 What is habitat critical to the survival of a species?

For the Ghost Bat and Pilbara Olive Python, 'habitat critical to the survival of a species or ecological community' is defined by DoE (2013) as areas that are necessary:

- for activities such as foraging, breeding, roosting, or dispersal;
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators);
- to maintain genetic diversity and long term evolutionary development; and/or
- for the reintroduction of populations or recovery of the species or ecological community.

For the Northern Quoll, habitat critical to the survival of the species is defined DoE (2016c) as: Habitat within the modelled distribution of the Northern Quoll (see DoE 2016c), which provides shelter for breeding, refuge from fire or predation and potential poisoning from Cane Toads. Habitat critical to the survival usually occurs in the form of:

- offshore islands where the Northern Quoll is known to exist
- Rocky habitats such as ranges, escarpments, mesas, gorges, breakaways, boulder fields, major drainage lines or treed creek lines;
- Structurally diverse woodland or forest areas containing large diameter trees, termite mounds or hollow logs.

Dispersal and foraging habitat associated with or connecting populations important for the long-term survival of the Northern Quoll are also considered habitat critical to the survival of the Northern Quoll.

For the Pilbara Leaf-nosed Bat, habitat critical to the survival of the species is defined by DoE (2016b) as:

- underground diurnal roosts, either as (listed in order of importance):
 - Permanent Diurnal Roosts;
 - Non-permanent Diurnal Roosts; or
 - Transitory Diurnal Roosts.
- Suitable foraging habitat (listed below in order of importance) located within vicinity of a diurnal roost:
 - gorges with pools;
 - gullies
 - rocky outcrops
 - major watercourses
 - open grasslands and woodlands

Table 6-4: Significance of Project to fauna of national environmental significance

Species	Listing status	Likelihood of occurrence	Nature of impact	Rationale for nature of impact
Northern Quoll	Endangered	Confirmed	Not Significant	There are five criteria used to assess whether a proposed action will have a significant impact on the Northern Quoll (DoE 2016c), each is addressed below: • “result in the loss of habitat critical to the survival of the Northern Quoll” – Dispersal and foraging habitat associated with or connecting populations important for the long-term survival of the species is considered habitat critical to the survival of the Northern Quoll (DoE 2016c). Such habitat exists in the Application Area in the form of Drainage Line and Riverine habitat. However infrastructure within these habitats already present in the Application Area and minimal additional clearing of these habitat is required. Additionally, clearing is unlikely to impact upon the functionality of these habitats to the species. The Project is unlikely to cause significant impact to the species based on this criteria. • “decrease the size of a population important for the long-term survival of the northern quoll and therefore interfere with the recovery of the species” – It is unlikely that the Application Area will support a ‘population important for the long-term survival’ of the species, given that only dispersal and foraging habitat is present. The Project is unlikely to cause significant impact to the species based on this criteria. • “introduce inappropriate fire regimes or grazing activities that substantially degrade habitat critical to the survival of the Northern Quoll or decrease the size of a population important for the long term survival of the species” – The proposed Project is unlikely to increase impact caused by grazing in the area, nor is it likely to significantly change the fire regimes. The Project is unlikely to cause significant impact to the species based on this criteria. • “fragment a population important for the long term survival into two or more populations” - It is unlikely that the Application Area will support a ‘population important for the long-term survival’ of the species, given that only dispersal and foraging habitat is present. The Project is unlikely to cause significant impact to the species based on this criteria. • “result in invasive species or increase of them... becoming established in [Northern Quoll] habitat, namely cane toads, feral cats, red foxes or exotic grasses” – It is unlikely that the development of the Project will exacerbate the threat caused by introduced species already existing within the Application Area, or result in the establishment of a new introduced species in the Application Area. The Project is unlikely to cause significant impact to the species based on this criteria

Species	Listing status	Likelihood of occurrence	Nature of impact	Rationale for nature of impact
Ghost Bat	Vulnerable	Confirmed	Not Significant	There are nine criteria used to assess whether a proposed action will have a significant impact on 'Vulnerable' listed species, each is addressed below: • “lead to a long-term decrease in the size of an important population of a species” – The population of Ghost Bats inhabiting Comet Mine (adjacent to the Application Area) represents an 'important population'. However, development of the Project is unlikely to affect the roost site. The Project is unlikely to cause significant impact to the species based on this criteria. • “reduce the area of occupancy of an important population” – Development of the Project will not affect the Comet Mine roost site directly, and therefore will not reduce the area of occupancy of the species. The Project is unlikely to cause significant impact to the species based on this criteria. • “fragment an existing important population into two or more populations” – Development of the Project will not fragment the population occurring over the Application Area. The Project is unlikely to cause significant impact to the species based on this criteria. • “adversely affect habitat critical to the survival of the species” – Development of the Project will not affect the Comet Mine roost site directly, and therefore will not adversely affect habitat critical to the survival of the species. The Project is unlikely to cause significant impact to the species based on this criteria. • “disrupt the breeding cycle of an important population” – Development of the Project will not affect the Comet Mine roost site directly. Impacts such as vehicle collision, noise and dust are the largest threats posed by the Project and already impact the roost due to presence of an existing road. Such threats are unlikely to exacerbate to the point that the breeding cycle will be interrupted. The Project is unlikely to cause significant impact to the species based on this criteria. • “modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline” – Development of the Project will not affect the Comet Mine roost site directly. Impacts such as vehicle collision, noise and dust are the largest threats posed by the Project and already impact the roost due to presence of an existing road. Such threats are unlikely to exacerbate to the point that the species is likely to decline. The Project is unlikely to cause significant impact to the species based on this criteria. • “result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat” – The proposed Project is unlikely to cause the introduction of a species harmful to the Ghost Bat. The Project is unlikely to cause significant impact to the species based on this criteria. • “introduce disease that may cause the species to decline” – The proposed Project is unlikely to introduce disease into the area. The Project is unlikely to significant impact the species based on this criteria. • “interfere substantially with the recovery of the species” – Despite presence of the species, the Application Area does not provide habitat critical to the survival of the species and is therefore unlikely to interfere with the species recovery. The Project is unlikely to significant impact the species based on this criteria.

Species	Listing status	Likelihood of occurrence	Nature of impact	Rationale for nature of impact
Pilbara Leaf-nosed Bat	Vulnerable	Confirmed	Not Significant	There are five criteria used to assess whether a proposed action will have a significant impact on the Pilbara Leaf-nosed Bat, each is addressed below: • “lead to a long-term decrease in the size of the Pilbara Leaf-nosed Bat population” – It is possible that the population of Pilbara Leaf-nosed Bats inhabiting Comet Mine (adjacent to the Application Area) represents an ‘important population’. However, development of the Project will not affect the roost site and, therefore the long-term survival of the species. The Project is unlikely to cause significant impact to the species based on this criteria. • “reduce the area of occupancy of the Pilbara Leaf-nosed Bat” – Development of the Project will not affect the Comet Mine roost site directly, and therefore will not reduce the area of occupancy of the species. The Project is unlikely to cause significant impact to the species based on this criteria. • “adversely affect habitat critical to the Pilbara Leaf-nosed Bat” – Development of the Project will not affect the Comet Mine roost site directly, and therefore will not adversely affect habitat critical to the survival of the species. The Project is unlikely to cause significant impact to the species based on this criteria. • “disrupt the breeding cycle of an important colony” – Development of the Project will not affect the Comet Mine roost site (which is not confirmed or proven not to be a breeding roost) directly. Impacts such as vehicle collision, noise and dust are the largest threats posed by the Project and already impact the roost due to presence of an existing road. Such threats are unlikely to exacerbate to the point that the breeding cycle will be interrupted. The Project is unlikely to cause significant impact to the species based on this criteria. • “modify, destroy, remove or isolate or decrease the availability or quality of Pilbara Leaf-nosed Bat habitat to the extent that the species is likely to decline” – Development of the Project will not affect the Comet Mine roost site directly. Impacts such as vehicle collision, noise and dust are the largest threats posed by the Project and already impact the roost due to presence of an existing road. Such threats are unlikely to exacerbate to the point that the species is likely to decline. The Project is unlikely to cause significant impact to the species based on this criteria.

Species	Listing status	Likelihood of occurrence	Nature of impact	Rationale for nature of impact
Pilbara Olive Python	Vulnerable	Confirmed	Not Significant	There are nine criteria used to assess whether a proposed action will have a significant impact on 'Vulnerable' listed species, each is addressed below: • “lead to a long-term decrease in the size of an important population of a species” – The Application Area is unlikely to support an 'important population'. The Project is unlikely to cause significant impact to the species based on this criteria. • “reduce the area of occupancy of an important population” – The Application Area is unlikely to support an 'important population'. The Project is unlikely to cause significant impact to the species based on this criteria. • “fragment an existing important population into two or more populations” – The Application Area is unlikely to support an 'important population'. The Project is unlikely to cause significant impact to the species based on this criteria. • “adversely affect habitat critical to the survival of the species” – The Application Area does not contain 'habitat critical to the survival of the species', but rather foraging and dispersal habitat, only. The Project is unlikely to cause significant impact to the species based on this criteria. • “disrupt the breeding cycle of an important population” – The Application Area is unlikely to support an 'important population'. The Project is unlikely to cause significant impact to the species based on this criteria. • “modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline” – The Application Area does not contain 'habitat critical to the survival of the species', but rather foraging and dispersal habitat, only. The Project involves minimal clearing of such habitats and will not impact the functionality of these habitats. The Project is unlikely to cause significant impact to the species based on this criteria. • “result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat” – The Red Fox represents the largest invasive species threat to the species. The Project is unlikely to cause introduction of the Red Fox, or significantly exacerbate the threat posed by already present invasive species. The Project is unlikely to cause significant impact to the species based on this criteria. • “introduce disease that may cause the species to decline” – The proposed Project is unlikely to introduce disease into the area. The Project is unlikely to significantly impact the species based on this criteria. • “interfere substantially with the recovery of the species” – The Project is located on active pastoral lease. Development of the proposed Project is unlikely to interfere substantially with any conservation recovery initiative for the species. The Project is unlikely to significantly impact the species based on this criteria.

6.7 General Management Recommendations

The following broad management recommendations have been developed as a guide for mitigating the potential impacts of the Project to fauna habitat and native fauna assemblages in general. Management recommendations specific to fauna of conservation significance are listed in **Table 6-3**. Additional management suggestions to mitigate the impacts of development of the Northern Quoll are detailed by (DoE 2016c).

6.8 Project Design

- During Project design, consider options for aligning infrastructure footprints to avoid or minimise clearing of habitats that are known to or have been identified as likely to support species of conservation significance, such as Drainage Line and Riverine habitats;
- Where roads crossover Drainage Line and Riverine habitats, consider the use of culverts to minimise the impacts of altered hydrology.

6.9 Habitat Removal and Modification

- Where practicable, minimise land disturbance and clearing activities in habitat known to or likely to support species of conservation significance, such as Drainage Line, Riverine and Spinifex Stony Plain habitats;
- Demarcate clearing boundaries in the field using Atlas environmental personnel or appropriate representatives;
- Stockpile cleared vegetation, topsoil and oversize waste overburden separately to ensure maximum reuse of these resources in subsequent rehabilitation;
- Minimise and manage impacts to natural surface hydrology to ensure the Drainage Line and Riverine habitats is maintained.
- Minimise potential for waterbirds to be attracted to artificial water sources;
- Wherever possible, undertake clearing progressively over time to allow fauna to disperse to other suitable habitats within the surrounds;
- Prepare and implement a weed management strategy to prevent the spread of existing weed species and the establishment of new weeds. The weed management strategy should ensure that any machinery (particularly for earthworks) entering the Project should be subject to quarantine/hygiene measures that ensure that no contaminated soils or weed seeds enter the area.
- Retain corridors or linkages, for example culverts underneath roads in key habitat areas, so that individuals can move between remaining habitat patches; and
- Consider timing of clearing activities to reduce the impact on nesting birds and breeding season of the Northern Quoll (May to November; Oakwood 2000).

6.10 Project Operations

- Design artificial lighting to illuminate designated operations areas and limit illumination of the surrounding landscape. Specifically, ensure that operational areas and transport routes are designed to avoid inadvertent illumination of significant microhabitat features such as caves, water sources and substantial rocky outcrops;
- Implement dust suppression measures to reduce the effects of dust on vegetation and natural water bodies, and hence on fauna habitats and assemblages – dust suppression measures should include management of vehicle speed and water-suppression on unsealed roads
- Manage fuel loads of weeds to reduce risk of high fire intensity
- Conduct monitoring and control of feral animals and implement management measures to prevent the increase of feral species numbers and control the attraction of any new feral species to the Project, including proper hygiene practices and appropriate disposal of waste;
- Implement measures to minimise road kill, especially for nocturnal species or those prone to vehicle collisions – such measures could include changing the speed and times at which vehicles travel, signage, erecting barriers, and providing alternative routes for fauna in strategic areas where fauna are known to cross major transport routes;
- Investigate strategies to reduce impacts of high frequency traffic on fauna and barriers to fauna dispersal created by the haul road corridors;
- Modify existing habitat to make it less suitable for feral Cats e.g. reduce fragmentation by rehabilitating tracks and clearings and making it more structurally complex with shelter and escape sites;
- Educate mine site personnel and contractors with respect to fauna of conservation significance;
- Any incident that results in the injury or death of fauna, particularly fauna species of conservation significance should be reported to DPaW and specimens should be retained (i.e. stored in a freezer) for further examination by DPaW or the Western Australian Museum (WAM).

6.11 Rehabilitation and Closure

- Implement a progressive rehabilitation and closure plan to ensure disturbed areas are rehabilitated as soon as practicable.

7 Conclusions

Six broad fauna habitat types were identified and mapped over the Application Area. This is in addition to areas mapped as Existing Cleared Areas, which comprised the existing Marble Bar-Woodstock Road, existing borrow pits, historical clearing, excavations and historical mines such as the Comet Mine. The Existing Cleared Areas within the Application Area comprised 74.2 ha (11%). The habitat types were, in order of extent, Spinifex Stony Plain, Calcrete, Stony Rises, Drainage Line, Riverine and Rocky Foothills. Vegetation condition ranged from Excellent to Good condition.

The inventory of fauna developed from desktop study and the Survey suggests that vertebrate fauna assemblages and habitats in the Application Area are representative of those in equivalent parts of the Pilbara bioregion, and that the Application Area does not represent an area of particularly high biodiversity from a regional perspective. The Survey did confirm the presence of two species of fauna of conservation significance within the Application Area, Western Pebble-mound Mouse and Rainbow Bee-eater. Of the broad fauna habitats that have potential to be adversely affected, two are considered to be of significance to fauna assemblages, fauna of conservation significance and/or SRE invertebrates; Drainage Line and Riverine. The Drainage Line and Riverine habitats, which occupy 37.6 ha and 15.9 ha of the Application Area, respectively, are also considered significant habitats for their capacity to provide foraging and dispersal habitats for the Northern Quoll, Pilbara Leaf-nosed Bat and Pilbara Olive Python.

Impacts of the Project on fauna of conservation significance, at the local scale, are expected to be greatest for the Ghost Bat and Pilbara Leaf-nosed Bat. The localised impact on each of these species is expected to be moderate. This is due namely to the proximity of the Application Area to a known roost of the Ghost Bat and (likely) Pilbara Leaf-nosed Bat, the disused Comet Gold Mine. The roost site is located approximately 80 m from the Application Area and approximately 150m from the existing Marble Bar-Woodstock road. Counts of Ghost Bats at the mine have been recorded from 35 in 1981 to 100+ in 1996, although recent data is unavailable.

The Northern Quoll, Pilbara Olive Python, Spectacled Hare-wallaby and Western Pebble-mound Mouse are expected to experience low localised impact, as they are not dependent from habitats within the Application Area, they each have a high ability to disperse through the landscape and/or their expected low density through the Application Area. The remaining species of conservation significance are expected to have a Minimal or Negligible impact from the Project, or are Unlikely to be present within the Application Area. No species protected under the EPBC Act are likely to suffer a 'significant impact' based on the Commonwealth's *Matters of National Environmental Significance: Significant impact guidelines 1.1*. Various management measures have been recommended to reduce impacts of the overall Project and for each species.

Three SRE invertebrate fauna species, the millipede *Antichiropus* 'DIP034', the snail *Rhagada* 'cf *richardsonii*' and the slater *Buddelundia* '86', have a high potential to occur within the Application area as

they have been collected in close proximity to the Project in the same habitats that occur in the Application Area. Although these species have potential to occur in the Application Area, the presence of regional records suggests that the Project is unlikely to affect the long term survival of the species. Habitats with potential to support short-range endemic species, Drainage Line and Riverine habitat have limited distribution in the Application Area and are well represented outside the Application Area.

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Appendices

Appendix A Definition of Codes and Terms Used to Describe Conservation Significance

Fauna may be accorded legislative protection by being listed under the *Environment Protection and Biodiversity Conservation Act 1999* and/or the *Wildlife Conservation Act*, or by being listed on the Western Australian Department of Parks and Wildlife's Priority Species List. This Appendix presents a summary of the different rankings and listings used to describe conservation status. Some categories, such as 'extinct', 'extinct in the wild' and 'conservation dependent' (EPBC Act) are not presented here, as the table includes only the information needed to understand the codes presented in the preceding report. Refer to the relevant legislation for full descriptions of all codes in use, as well as their associated criteria.

Status	Code	Description
Categories used under the EPBC Act		
Critically Endangered	Cr	Fauna that is considered to be facing an extremely high risk of extinction in the wild in the immediate future
Endangered	En	Fauna that is considered to be facing a very high risk of extinction in the wild in the near future
Vulnerable	Vu	Fauna that is considered to be facing a high risk of extinction in the wild in the medium-term future
Migratory	Mi	Species that migrate to, over and within Australia and its external territories
Schedules used under the WC Act		
Schedule 1	S1	Fauna that is rare or likely to become extinct
Schedule 2	S2	Fauna that is presumed to be extinct
Schedule 3	S3	Birds that are subject to an agreement between the governments of Australia and Japan relating to the protection of migratory birds
Schedule 4	S4	Fauna that is in need of special protection, other than for reasons mentioned above
Priorities assigned under the DPaW Priority Fauna List		
Priority 1	P1	Taxa with few, poorly known populations on threatened lands. These are known from few specimens or sight records from one or a few localities on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, active mineral leases. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna
Priority 2	P2	Taxa with few, poorly known populations on conservation lands. These are known from few specimens or sight records from one or a few localities on lands not under immediate threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna
Priority 3	P3	Taxa with several, poorly known populations, some on conservation lands. These are known from few specimens or sight records from several localities, some of which are on lands not under immediate threat of habitat destruction or degradation. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna
Priority 4	P4	Taxa in need of monitoring. These are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands
Priority 5	P5	Taxa in need of monitoring. These are not considered threatened but are subject to a specific conservation programme, the cessation of which would result in the species becoming threatened within five years

Appendix B Vertebrate Fauna Previously Recorded Within the Vicinity of the Application Area

KEY

Literature Review

- 1: Outback Ecology (2014b) McPhee Creek Haul Road Project: Terrestrial Vertebrate Fauna Survey (phases 1 and 2)
- 2: Outback Ecology (2012c) McPhee Creek Project: Terrestrial Vertebrate Fauna Baseline Survey
- 3: Outback Ecology (2013b) Mt Webber DSO Project: Terrestrial Vertebrate Fauna Impact Assessment
- 4: Outback Ecology (2012a) Hercules Project: Terrestrial Vertebrate Fauna Baseline Survey
- 5: Outback Ecology (2011a) Abydos DSO Project: Terrestrial Vertebrate Fauna Baseline Survey
- 6: Outback Ecology (2010a) Turner River Hub: Terrestrial Vertebrate Fauna Baseline Survey
- 7: ecologia Environment (2010b) Mount Webber Iron Ore Project: Vertebrate Fauna Assessment
- 8: Outback Ecology (2009) Wodgina DSO Project: Terrestrial Vertebrate Fauna Assessment
- 9: Bamford Consulting Ecologists (2009b) Fauna Assessment of the BC Iron Nullagine Iron Ore Project
- 10: Bamford Consulting Ecologists (2009a) Vertebrate Fauna Assessment of the Abydos DSO Project
- 11: How *et al.* (1991) Ecological Survey of the Abydos-Woodstock Reserve, Western Australia
- 12: (MWH 2016d) Corunna Downs Project: Terrestrial Vertebrate Fauna Assessment

Database Searches

- 13: DPaW (2016b) Threatened and Priority Fauna Database
- 14: Birdlife Australia (2014) Birddata Custom Atlas Bird List
- 15: DPaW (2016a) NatureMap Database
- 16: DoEE (2016a) Protected Matters Search Tool

Species name	Common name	Conservation status		This survey	Literature review										Database searches					
		EPBC Act	WA Status		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mammals																				
Bovidae																				
<i>Bos taurus</i>	*European Cattle			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Camelidae																				
<i>Camelus dromedarius</i>	*Dromedary			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Canidae																				
<i>Canis dingo</i>	Dingo			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Vulpes vulpes</i>	*Fox																		*	
Dasyuridae																				
<i>Dasypercus blythi</i>	Brush-tailed Mulgara	-	P4	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Dasykaluta rosamondae</i>	Kaluta			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Dasyurus hallucatus</i>	Northern Quoll	En	S2	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Ningauia timealeyi</i>	Pilbara Ningau			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Planigale ingrami</i>	Long-tailed Planigale			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Pseudantechinus royi</i>	Tan False Antechinus										*	*	*	*	*	*	*	*	*	*
<i>Pseudantechinus woolleyae</i>	Woolley's Pseudantechinus			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Sminthopsis longicaudata</i>	Long-tailed Dunnart	-	P4	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Sminthopsis macroura</i>	Stripe-faced Dunnart				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Sminthopsis youngsoni</i>	Lesser Hairy-footed Dunnart			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Emballonuridae																				
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Taphozous georgianus</i>	Common Sheath-tail-bat			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Taphozous hilli</i>	Hill's Sheath-tail-bat			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Equidae																				
<i>Equus asinus</i>	*Donkey							*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Equus caballus</i>	*Horse			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Felidae																				
<i>Felis catus</i>	*Cat			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Hipposideridae																				
<i>Rhinonictis aurantius</i> (Pilbara form)	Pilbara Leaf-nosed Bat	Vu	S3	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Leporidae																				
<i>Oryctolagus cuniculus</i>	*Rabbit																		*	*
Macropodidae																				
<i>Lagorchestes conspicillatus leichardti</i>	Spectacled Hare-wallaby (mainland)	-	P3	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

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<i>Macropus robustus</i>	Euro			*	*	*	*	*	*	*	*	*	*	*	*	*			*	
<i>Macropus rufus</i>	Red Kangaroo				*	*	*	*	*	*	*	*	*	*	*	*			*	
<i>Petrogale rothschildi</i>	Rothschild's Rock-wallaby				*	*	*	*	*	*	*	*	*	*	*	*			*	
Megadermatidae																				
<i>Macroderma gigas</i>	Ghost Bat	Vu	S3		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Molossidae																				
<i>Austronomus australis</i>	White-striped Freetail-bat				*							*		*						
<i>Cheirophon jobensis</i>	Northern Freetail-bat				*	*	*			*	*	*	*			*				
<i>Mormopterus beccarii</i>	Beccan's Freetail-bat				*	*	*				*					*				
Muridae																				
<i>Leggadina lekedownensis</i>	Lakeland Downs Mouse	-	P4														*		*	
<i>Mus musculus</i>	*House Mouse				*	*							*		*	*			*	*
<i>Notomys alexis</i>	Spinifex Hopping-mouse				*				*											
<i>Pseudomys chapmani</i>	Western Pebble-mound Mouse	-	P4	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Pseudomys delicatulus</i>	Delicate Mouse			*	*					*				*	*	*			*	*
<i>Pseudomys desertor</i>	Desert Mouse				*	*				*	*	*	*	*	*	*			*	*
<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse				*	*			*	*					*	*			*	*
<i>Pseudomys nanus</i>	Western Chestnut Mouse				*															
<i>Zyzomys argurus</i>	Common Rock-rat				*	*	*	*	*	*	*	*	*	*	*	*			*	*
Phalangeridae																				
<i>Trichosurus vulpecula</i>	Common Brush-tail Possum			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Sulidae																				
<i>Sus scrofa</i>	*Pig				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Tachyglossidae																				
<i>Tachyglossus aculeatus</i>	Short-beaked Echidna			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Thylacomyidae																				
<i>Macrotis lagotis</i>	Greater Bilby	Vu	S3	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Vespertilionidae																				
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Scotorepens greyii</i>	Little Broad-nosed Bat			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Vespadelus finlaysoni</i>	Inland Cave Bat			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Birds																				
Acanthizidae																				
<i>Acanthiza apicalis</i>	Inland Thornbill			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Acanthiza robustirostris</i>	Slaty-backed Thornbill																*	*	*	*
<i>Gerygone fusca</i>	Western Gerygone			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

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<i>Smicromis brevirostris</i>	Weebill			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Accipitridae																			
<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk												*	*	*	*	*	*	*
<i>Accipiter fasciatus</i>	Brown Goshawk			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Aquila audax</i>	Wedge-tailed Eagle			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Circus approximans</i>	Swamp Harrier			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Circus assimilis</i>	Spotted Harrier			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Elanus axillaris</i>	Black-shouldered Kite			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle													*	*	*	*	*	
<i>Haliaeetus spheurnus</i>	Whistling Kite			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Hamirostra melanosternon</i>	Black-breasted Buzzard									*	*	*	*	*	*	*	*	*	*
<i>Hieraaetus morphnoides</i>	Little Eagle									*	*	*	*	*	*	*	*	*	*
<i>Milvus migrans</i>	Black Kite			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Pandion cristatus</i>	Eastern Osprey															*	*	*	*
Acrocephalidae																			
<i>Acrocephalus australis</i>	Australian Reed-Warbler					*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Aegothelus cristatus</i>	Australian Owllet-nightjar			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Alaudidae																			
<i>Miralra javanica</i>	Horsfield's Bushlark			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Anatidae																			
<i>Anas gracilis</i>	Grey Teal			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Anas superciliosa</i>	Pacific Black Duck			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Aythya australis</i>	Hardhead																*	*	*
<i>Chenonetta jubata</i>	Australian Wood Duck																*	*	*
<i>Cygnus atratus</i>	Black Swan								*	*	*	*	*	*	*	*	*	*	*
<i>Dendrocygna eytoni</i>	Plumed Whistling-Duck									*	*	*	*	*	*	*	*	*	*
<i>Melacorhynchus membranaceus</i>	Pink-eared Duck															*	*	*	*
Anhingidae																			
<i>Anhinga novaehollandiae</i>	Australasian Darter			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Apodidae																			
<i>Apus pacificus</i>	Fork-tailed Swift										*	*	*	*	*	*	*	*	*
Ardeidae																			
<i>Ardea ibis</i>	Cattle Egret																	*	*
<i>Ardea intermedia</i>	Intermediate Egret															*	*	*	*
<i>Ardea modesta</i>	Eastern Great Egret								*	*	*	*	*	*	*	*	*	*	*
<i>Ardea pacifica</i>	White-necked Heron			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Egretta garzetta</i>	Little Egret																*	*	*

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<i>Egretta novaehollandiae</i>	White-faced Heron				*					*			*	*			*	*	*
<i>Nycticorax caledonicus</i>	Nankeen Night Heron				*														
Artamidae																			
<i>Artamus chinensis</i>	Black-faced Woodswallow			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Artamus leucorhynchus</i>	White-breasted Woodswallow																*		
<i>Artamus minor</i>	Little Woodswallow			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Artamus personatus</i>	Masked Woodswallow			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Cracticus nigrogularis</i>	Pied Butcherbird			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Cracticus tibicen</i>	Australian Magpie			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Cracticus torquatus</i>	Grey Butcherbird																*		
Burhinidae																			
<i>Burhinus grallarius</i>	Bush Stone-curlew			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Cacatuidae																			
<i>Cacatua roseicapillus</i>	Galah			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Cacatua sanguinea</i>	Little Corella			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Nymphicus hollandicus</i>	Cockatiel			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Campephagidae																			
<i>Coracina maxima</i>	Ground Cuckoo-shrike									*									
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Lalage suevii</i>	White-winged Triller			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Casuaridae																			
<i>Dromaius novaehollandiae</i>	Emu									*	*	*	*	*	*	*	*	*	*
Charadriidae																			
<i>Charadrius ruficapillus</i>	Red-capped Plover																*		
<i>Charadrius veredus</i>	Oriental Plover		Mi													*	*	*	*
<i>Eisayornis melanops</i>	Black-fronted Dotterel			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Erythronyx cinclus</i>	Red-kneed Dotterel																*	*	*
<i>Vanellus miles</i>	Masked Lapwing																*	*	*
<i>Vanellus tricolor</i>	Banded Lapwing								*										
Ciconiidae																			
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Climacteridae																			
<i>Climacteris melanura</i>	Black-tailed Treecreeper			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Columbidae																			
<i>Geopelia cuneata</i>	Diamond Dove			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Geopelia striata</i>	Peaceful Dove			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Geophaps plumifera</i>	Spinifex Pigeon			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

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<i>Ocyphaps lophotes</i>	Crested Pigeon			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
<i>Phaps chalcoptera</i>	Common Bronzewing				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Corvidae																				
<i>Corvus bennetti</i>	Little Crow			*				*	*	*	*	*	*	*	*	*	*	*	*	
<i>Corvus orru</i>	Torresian Crow			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Cuculidae																				
<i>Cacomantis pallidus</i>	Pallid Cuckoo			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
<i>Centropus phasianinus</i>	Pheasant Coucal			*	*	*				*	*	*	*	*	*	*	*	*	*	
<i>Chalcites basalis</i>	Horsfield's Bronze-Cuckoo			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
<i>Chalcites osculans</i>	Black-eared Cuckoo			*						*	*	*	*	*	*	*	*	*	*	
Estrildidae																				
<i>Emblema pictum</i>	Painted Finch			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
<i>Neochmia ruficauda</i>	Star Finch									*	*	*	*	*	*	*	*	*	*	
<i>Taeniopygia guttata</i>	Zebra Finch			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Eurostopodidae																				
<i>Eurostopodus argus</i>	Spotted Nightjar			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Falconidae																				
<i>Falco berigora</i>	Brown Falcon			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
<i>Falco cenchroides</i>	Australian Kestrel			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
<i>Falco hypoleucos</i>	Grey Falcon	-	S3					*	*	*	*	*	*	*	*	*	*	*	*	
<i>Falco longipennis</i>	Australian Hobby			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
<i>Falco peregrinus</i>	Peregrine Falcon	-	S7										*	*	*	*	*	*	*	
<i>Falco subniger</i>	Black Falcon			*					*	*	*	*	*	*	*	*	*	*	*	
Glareolidae																				
<i>Glareola maldivarum</i>	Oriental Pratincole	Mi	S5									*	*	*	*	*	*	*	*	
<i>Sillita isabellae</i>	Australian Pratincole											*	*	*	*	*	*	*	*	
Halcyonidae																				
<i>Dacelo leachii</i>	Blue-winged Kookaburra			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
<i>Todiramphus pyrrhopygius</i>	Red-backed Kingfisher			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
<i>Todiramphus sanctus</i>	Sacred Kingfisher			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Hirundinidae																				
<i>Hirundo neoxena</i>	Welcome Swallow			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
<i>Hirundo rustica</i>	Barn Swallow	Mi	S5									*	*	*	*	*	*	*	*	
<i>Petrochelidon ariel</i>	Fairy Martin			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
<i>Petrochelidon nigricans</i>	Tree Martin			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Laridae																				
<i>Chlidonias hybrida</i>	Whiskered Tern																*	*	*	

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Maluridae																					
Amytornis striatus	Striated Grasswren				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Malurus lamberti	Variegated Fairy-wren				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Malurus leucopterus	White-winged Fairy-wren				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Stipiturus ruficeps	Rufous-crowned Emu-wren				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Megaluridae																					
Eremiornis carteri	Spiniflexbird				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Megalurus cruralis	Brown Songlark				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Megalurus gramineus	Little Grassbird																*	*	*		
Megalurus mathewsi	Rufous Songlark				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Meliphagidae																					
Acanthagenys rufogularis	Spiny-cheeked Honeyeater					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Certhionyx variegatus	Pied Honeyeater				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Conopophila whitei	Grey Honeyeater			*				*													
Epthianura tricolor	Crimson Chat				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Gavicalis virescens	Singing Honeyeater				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Lichmera indistincta	Brown Honeyeater				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Manorina flavigula	Yellow-throated Miner				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Melithreptus gularis	Black-chinned Honeyeater				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Ptilotula keartlandi	Grey-headed Honeyeater			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Ptilotula ornatus	Yellow-plumed Honeyeater				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Ptilotula penicillatus	White-plumed Honeyeater			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Ptilotula plumulus	Grey-fronted Honeyeater			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Purnella albigrons	White-fronted Honeyeater				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Sugomel niger	Black Honeyeater				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Meropidae																					
Merops ornatus	Rainbow Bee-eater	Mi	S5	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Monarchidae																					
Grallina cyanoleuca	Magpie-lark			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Motacillidae																					
Anthus novaeseelandiae	Australian Pipit			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Motacilla cinerea	Grey Wagtail	Mi	S5																*	*	
Motacilla flava	Yellow Wagtail	Mi	S5																*	*	
Nectarinidae																					
Dicaeum hirundinaceum	Mistletoebird			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Otididae																					
Ardeotis australis	Australian Bustard			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	

Species name	Common name	Conservation status		This survey	Literature review										Database searches					
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Pachycephalidae																				
Colluricincla harmonica	Grey Shrike-thrush				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Oreoca gutturalis	Crested Bellbird				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Pachycephala rufiventris	Rufous Whistler				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Pardalotidae																				
Pardalotus rubricatus	Red-browed Pardalote				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Pardalotus striatus	Striated Pardalote				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Pelecanidae																				
Pelecanus conspicillatus	Australian Pelican												*	*	*	*	*	*	*	*
Petroicidae																				
Melanodryas cucullata	Hooded Robin				*										*		*	*	*	*
Petroica goodenovii	Red-capped Robin												*	*	*	*	*	*	*	*
Phalacrocoracidae																				
Microcarbo melanoleucos	Little Pied Cormorant				*				*								*	*	*	*
Phalacrocorax sulcirostris	Little Black Cormorant											*					*	*	*	*
Phalacrocorax varius	Pied Cormorant								*											
Phasianidae																				
Coturnix pectoralis	Stubble Quail				*									*						
Coturnix ypsilophora	Brown Quail				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Podargidae																				
Podargus strigoides	Tawny Frogmouth				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Poliocephalus poliocephalus	Hoary-headed Grebe																*	*	*	*
Tachybaptus novaehollandiae	Australasian Grebe				*				*					*			*	*	*	*
Pomatostomidae																				
Pomatostomus superciliosus	White-browed Babbler				*				*					*			*	*	*	*
Pomatostomus temporalis	Grey-crowned Babbler				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Psittacidae																				
Barnardius zonarius	Australian Ringneck				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Melopsittacus undulatus	Budgerigar				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Neopsopholus bourkii	Bourke's Parrot								*				*				*	*	*	*
Pezoporus occidentalis	Night Parrot	En	S1																	*
Ptilonorhynchidae																				
Ptilonorhynchus maculatus guttatus	Western Bowerbird				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Rallidae																				
Fulica atra	Eurasian Coot																*	*	*	*
Gallinallus philippensis	Buff-banded Rail																*	*	*	*
Porphyrio porphyrio	Purple Swamphen																*	*	*	*

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<i>Porzana tabuensis</i>	Spottless Crake																	*	*		
<i>Tribonyx ventralis</i>	Black-tailed Native-hen																	*	*		
Recurvirostridae																					
<i>Himantopus himantopus</i>	Black-winged Stilt																*	*	*		
Rhipiduridae																					
<i>Rhipidura albiscapa</i>	Grey Fantail										*						*				
<i>Rhipidura leucophrys</i>	Willie Wagtail		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Rostratulidae																					
<i>Rostratula australis</i>	Australian Painted Snipe	En	S2																*		
Scolopacidae																					
<i>Actitis hypoleucos</i>	Common Sandpiper	Mi	S5														*	*	*		
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	Mi	S5														*	*			
<i>Calidris ferruginea</i>	Curlfew Sandpiper	Cr, Mi	S3, S5																	*	
<i>Tringa glareola</i>	Wood Sandpiper	Mi	S5														*	*	*		
<i>Tringa nebularia</i>	Common Greenshank	Mi	S5								*	*	*	*	*	*	*	*	*		
Strigidae																					
<i>Ninox boobook</i>	Boobook Owl			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
<i>Ninox connivens</i>	Barking Owl										*	*	*	*	*	*	*	*	*		
Threskiornithidae																					
<i>Platalea regia</i>	Royal Spoonbill																	*	*		
<i>Plegadis falcinellus</i>	Glossy Ibis	Mi	S5														*	*	*		
<i>Threskornis molucca</i>	Australian White Ibis																*	*	*		
<i>Threskornis spinicollis</i>	Straw-necked Ibis										*	*	*	*	*	*	*	*	*		
Timaliidae																					
<i>Zosterops lateralis</i>	Silvereye			*																	
Turnicidae																					
<i>Turnix velox</i>	Little Button-quail			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Tytonidae																					
<i>Tyto javanica</i>	Eastern Barn Owl										*	*	*	*	*	*	*	*	*		
Reptiles																					
Agamidae																					
<i>Amphibolurus longirostris</i>	Long-nosed Dragon		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
<i>Ctenophorus caudicinctus</i>	Ring-tailed Dragon		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
<i>Ctenophorus cristatus</i>	Crested Dragon																		*		
<i>Ctenophorus isolepis</i>	Central Military Dragon		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
<i>Ctenophorus nuchalis</i>	Central Nettle Dragon		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
<i>Ctenophorus reticulatus</i>	Western Nettle Dragon						*	*	*	*	*	*	*	*	*	*	*	*	*	*	

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<i>Ctenophorus scutellatus</i>	Lozenge-marked Dragon									*									*	
<i>Diporiphora valens</i>	Pilbara Two-line Dragon				*															
<i>Diporiphora winneckiei</i>	Canegrass Dragon							*							*					
<i>Pogona minor</i>	Dwarf Bearded Dragon				*	*	*					*			*				*	
Chelidae																				
<i>Chelodina steindachneri</i>	Flat-shelled Turtle				*									*	*			*		
Elapidae																				
<i>Acanthophis pyrrhus</i>	Desert Death Adder														*	*				
<i>Acanthophis wellsii</i>	Pilbara Death Adder		*					*					*						*	
<i>Brachyurophis approximans</i>	North-western Shovel-nosed Snake		*	*	*		*	*						*	*					
<i>Demansia psammophis</i>	Yellow-faced Whip Snake		*	*	*			*						*	*			*		
<i>Demansia rufescens</i>	Rufous Whipsnake		*	*	*		*	*		*			*	*	*			*	*	
<i>Furina ornata</i>	Orange-naped Snake		*	*	*			*		*				*	*			*	*	
<i>Parasuta monachus</i>	Monk Snake															*				
<i>Pseudechis australis</i>	King Brown Snake		*	*			*	*					*	*	*				*	
<i>Pseudonaja mengdeni</i>	Western Brown Snake		*	*	*		*	*		*			*	*	*			*	*	
<i>Pseudonaja modesta</i>	Ringed Brown Snake			*				*		*			*	*	*				*	
<i>Suta fasciata</i>	Rosen's Snake		*		*		*					*							*	
<i>Suta punctata</i>	Little Spotted Snake												*	*	*				*	
<i>Vermicella snelli</i>			*					*	*										*	
Gekkonidae																				
<i>Crenadactylus ocellatus</i>	Clawless Gecko				*															
<i>Diplodactylus conspicillatus</i>	Fat-tailed Diplodactylus		*	*	*	*	*	*	*	*				*	*			*	*	
<i>Diplodactylus savagei</i>	Yellow-spotted Pilbara Gecko		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
<i>Gehyra pilbara</i>	Pilbara Diella		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
<i>Gehyra punctata</i>	Spotted Diella		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
<i>Gehyra purpurascens</i>	Purplish Diella		*				*	*	*	*	*	*	*	*	*	*	*	*	*	
<i>Gehyra variegata</i>	Tree Diella		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
<i>Heteronotia binoei</i>	Bynoe's Gecko		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
<i>Heteronotia spelea</i>	Desert Cave Gecko		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
<i>Lucasium stenodactylum</i>	Crowned Gecko		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
<i>Lucasium wombeyi</i>	Pilbara Ground Gecko		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
<i>Nephurus levis</i>	Three-lined Knob-tail					*	*	*	*	*	*	*	*	*	*	*	*	*	*	
<i>Oedura marmorata</i>	Marbled Velvet Gecko		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
<i>Rhynchoedura ornata</i>	Beaked Gecko		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
<i>Strophurus elderi</i>	Jewelled Gecko		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
<i>Strophurus jeanae</i>	Southern Phasmid Gecko													*	*	*	*	*	*	

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<i>Strophurus wellingtonae</i>	Western Shield Spiny-tailed Gecko												*							
Pygopodidae																				
<i>Delma butleri</i>	Unbanded Delma				*				*	*			*	*			*		*	
<i>Delma elegans</i>	Pilbara Delma				*			*										*		
<i>Delma haroldi</i>	Neck-barred Delma			*																
<i>Delma nasuta</i>	Sharp-snouted Delma			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Delma pax</i>	Peace Delma			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Delma tincta</i>	Excitable Delma			*				*								*	*	*	*	*
<i>Lialis burtonis</i>	Burton's Snake-lizard			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Pygopus nigriceps</i>	Hooded Scaly-foot							*	*							*	*			
Pythonidae																				
<i>Antaresia perthensis</i>	Pygmy Python				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Antaresia simsoni</i>	Stimson's Python			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Aspidites melanocephalus</i>	Black-headed Python							*				*	*	*	*	*	*	*	*	*
<i>Liasis olivaceus barroni</i>	Olive Python (Pilbara)	Vu	S3	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Scincidae																				
<i>Carilia munda</i>	Shaded-litter Rainbow-skink			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Carilia triacantha</i>	Desert Rainbow-skink			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Cryptoblepharus buchananii</i>	Callose-palmed Shinning-skink											*	*	*	*	*	*	*	*	*
<i>Cryptoblepharus ustulatus</i>				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Ctenotus duricola</i>			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Ctenotus grandis</i>	Grand Ctenotus			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Ctenotus inornatus</i>	Stony-soil Ctenotus			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Ctenotus leonhardii</i>	Leonhardi's Ctenotus			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Ctenotus nigrilineatus</i>	Pin-striped Finesnout Ctenotus	-	P1									*	*	*	*	*	*	*	*	*
<i>Ctenotus pantherinus</i>	Leopard Ctenotus			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Ctenotus plankai</i>	Coarse Sands Ctenotus			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Ctenotus robustus</i>	Robust Ctenotus																			
<i>Ctenotus rubicundus</i>	Ruddy Ctenotus			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Ctenotus rullians</i>	Rusty-shouldered Ctenotus			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Ctenotus schomburgkii</i>	Barred Wedgesnout Ctenotus			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Ctenotus severnyi</i>	North-western Sandy-loam Ctenotus											*	*	*	*	*	*	*	*	*
<i>Ctenotus uber</i>				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Ctenotus uber johnstonei</i>		-	P2	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Cyclodomorphus melanops</i>	Spinifex Slender Blue-tongue				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Egernia epsipolus</i>	Pygmy Spiny-tailed Skink							*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Egernia formosa</i>	Goldfields Crevice-skink			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

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<i>Egernia pilbarensis</i>	Pilbara Crevice-skink						*													
<i>Eremiascincus fasciolatus</i>	Narrow-banded Sand-swimmer								*											
<i>Eremiascincus richardsonii</i>	Broad-banded Sand-swimmer				*								*							
<i>Lerista bipes</i>	North-western Sandslider			*	*		*		*		*				*	*			*	
<i>Lerista clara</i>					*		*		*		*								*	
<i>Lerista flammicauda</i>	Pilbara Flame-tailed Slider					*			*											
<i>Lerista jacksoni</i>					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Lerista muelleri</i>	Wood Mulch-slider				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Lerista verreauxi</i>					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Lopholis striata</i>	Nocturnal Desert-skink			*	*				*						*					
<i>Menetia greyii</i>	Common Dwarf Skink			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Menetia surda</i>	Western Dwarf Skink																		*	
<i>Morethia ruficauda</i>	Lined Firetail Skink			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Notoscincus ornatus</i>	Ornate Soil-crevice Skink			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Proablepharus reginae</i>	Western Soil-crevice Skink			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Tiliqua multifasciata</i>	Centralian Blue-tongue			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Typhlopidae																				
<i>Anilius ammodontes</i>					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Anilius ganei</i>		-	P1		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Anilius gypsus</i>	Long-beaked Blind Snake			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Anilius hamatus</i>	Pale-headed Blind Snake			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Anilius pilbarensis</i>					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Varanidae																				
<i>Varanus acanthurus</i>	Ridge-tailed Monitor			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Varanus brevicauda</i>	Short-tailed Pygmy Monitor			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Varanus caudolineatus</i>	Stripe-tailed Monitor			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Varanus eremius</i>	Pygmy Desert Monitor			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Varanus giganteus</i>	Perentie			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Varanus gouldii</i>	Gould's Goanna			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Varanus panoptes</i>	Yellow-spotted Monitor			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Varanus pilbarensis</i>	Pilbara Rock Monitor			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Varanus tristis</i>	Black-headed Monitor			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Amphibians																				
Hylidae																				
<i>Cyclorana australis</i>	Giant Frog				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Cyclorana mainii</i>	Main's Frog			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Litoria rubella</i>	Desert Tree Frog			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

Species name	Common name	Conservation status		This survey	Literature review										Database searches				
		EPBC Act	WA Status		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Limnodynastidae																			
<i>Neobatrachus aquilonius</i>	Northern Burrowing Frog												*						
<i>Neobatrachus sutor</i>	Shoemaker Frog				*				*										*
<i>Noladen nicholisi</i>	Desert Spadefoot Toad					*													*
<i>Platyplectrum spenceri</i>	Spencer's Burrowing Frog				*	*			*	*		*	*	*	*				
Myobatrachidae																			
<i>Pseudophryne douglasi</i>	Douglas's Toadlet				*														
<i>Uperoleia glandulosa</i>	Glandular Toadlet				*					*	*	*	*	*	*				
<i>Uperoleia saxatilis</i>	Pilbara Toadlet				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

Appendix C Potential Terrestrial SRE Invertebrate Species Identified in the Desktop Study

Species Name	Taxa	Source	Reference	Habitat(s)	Likelihood of occurrence in the Application Area	Reason for Likelihood	
						Similar habitat present in Application Area?	Closest record to Application Area
<i>Rhagada richardsonii</i>	Snail	WA Museum	(Western Australian Museum 2014b)	Rocky ridge and gorge/Riverine	High	Yes	0.75 km
<i>Antichiropus</i> 'DIP034'	Millipede	WA Museum	(Western Australian Museum 2014a)	Urban (natural habitat unknown)	High	Possible	0.75 km
<i>Buddelundia</i> '86'	Slater	McPhee Creek Haul Road Project: East-west Transport Corridor	(Outback Ecology 2014a)	Rocky foothills, Stony Rise, Ironstone Ridggetop, Calcrete	High	Yes	9 km
		Corunna Downs Project	(MWH 2016b)				
<i>Lychas</i> 'hairy tail complex'	Scorpion	Corunna Downs Project	(MWH 2016b)	Stony Rise, Rocky Ridge and Gorge	Medium	Yes	12 km
<i>Rhagada</i> 'convicta complex'	Snail	Corunna Downs Project	(MWH 2016b)	Drainage Line	Medium	Yes	13 km
<i>Feaella</i> sp. nov.	Pseudoscorpion	Corunna Downs Project	(MWH 2016b)	Drainage Line	Medium	Yes	13 km
<i>Buddelundia</i> sp. 11	Slater	McPhee Creek Mine and Rail Project: East-west Transport Corridor	(Outback Ecology 2014a)	Rocky Ridge and Gorge, Granite Outcrop, Rocky Foothills, Drainage Line, Channel Iron Deposit, Stony Rise, Spinifex Stony Plain, Calcrete	Medium	Yes	13 km
		McPhee Creek Iron Ore Project	(Outback Ecology 2012b)				
		Mt Webber DSO Project	(Outback Ecology 2012d)				
		Abydos DSO Project	(Outback Ecology 2013a)				
		Corunna Downs Project	(MWH 2016b)				

Species Name	Taxa	Source	Reference	Habitat(s)	Likelihood of occurrence in the Application Area	Reason for Likelihood	
						Similar habitat present in Application Area?	Closest record to Application Area
<i>Karaops</i> 'sp. indet. 2'	Selenopid spider	Corunna Downs Project	(MWH 2016b)	Rocky Ridge and Gorge	Low	No	14 km
<i>Buddelundiinae</i> 'mw'	Slater	Mt Webber DSO Project	(Outback Ecology 2012d)	Rocky Ridge and Gorge, Granite Outcrop, Rocky Foothills,	Medium	Yes	15 km
		Corunna Downs Project	(MWH 2016b)				
<i>Lychas</i> 'bituberculatus complex'	Scorpion	Corunna Downs Project	(MWH 2016b)	Rocky Foothills, Rocky Ridge and Gorge, Calcrete	Medium	Yes	16 km
<i>Antichiropus</i> 'DIP038'	Millipede	WA Museum	(Western Australian Museum 2014a)	Drainage line	Medium	Yes	21 km
<i>Karaops</i> 'sp indet.1'	Selenopid spider	Corunna Downs Project	(MWH 2016b)	Calcrete	Medium	Yes	21 km
<i>Lychas</i> 'gracilimanus complex'	Scorpion	Corunna Downs Project	(MWH 2016b)	Calcrete	Medium	Yes	21 km
<i>Urodacus</i> 'pilbara 16'	Scorpion	Corunna Downs Project	(MWH 2016b)	Drainage Line	Medium	Yes	21 km
<i>Philosciidae</i> 'corunna'	Slater	Corunna Downs Project	(MWH 2016b)	Rock Ridge and Gorge	Low	No	24 km
<i>Leichhardtia sisurnius</i>	Snail	WA Museum	(Western Australian Museum 2014b)	Rocky ridge and gorge	Low	No	30 km
<i>Rhagada radleyi</i>	Snail	WA Museum	(Western Australian Museum 2014b)	Spinifex sand plain	Low	No	35 km
<i>Antichiropus</i> 'DIP011 ?'	Millipede	WA Museum	(Western Australian Museum 2014a)	Drainage line	Low	Yes	35 km
<i>Antichiropus</i> 'DIP026'	Millipede	WA Museum	(Western Australian Museum 2014a)	Rocky ridge and gorge, drainage line	Low	Yes	37 km

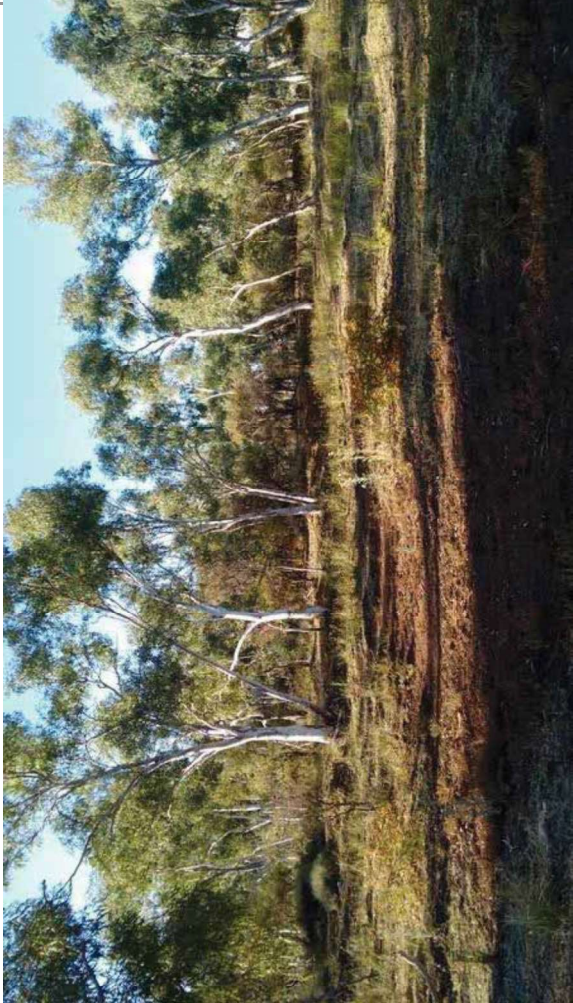
Species Name	Taxa	Source	Reference	Habitat(s)	Likelihood of occurrence in the Application Area	Reason for Likelihood	
						Similar habitat present in Application Area?	Closest record to Application Area
<i>Missulena</i> 'MYG110'	Mygalomorph spider	WA Museum	(Western Australian Museum 2014a)	Spinifex sand plain	Low	No	40 km
<i>Antichiropus</i> 'DIP005'	Millipede	WA Museum	(Western Australian Museum 2014a)	Drainage line, rocky ridge and gorge	Low	Yes	45 km
<i>Karaops nyamal</i>	Araneomorph spider	WA Museum	(Western Australian Museum 2014a)	Rocky ridge and gorge	Low	No	47 km
		Mt Webber DSO Project	(Outback Ecology 2012d)				
Buddelundia sp. nov. 18	Slater	McPhee Creek Iron Ore Project	(Outback Ecology 2012b)	Spinifex Stony Plain, Rocky Ridge and Gorge, Channel Iron Deposit	Low	Yes	50 km
		Mt Webber DSO Project	(Outback Ecology 2012d)				
		Abydos DSO Project	(Outback Ecology 2013a)				
<i>Quistrachia turneri</i>	Snail	WA Museum	(Western Australian Museum 2014b)	Rocky ridge and gorge	Low	No	50 km
		Mt Webber DSO Project	(Outback Ecology 2012d)				
<i>Kwonkan</i> 'MYG200'	Mygalomorph spider	WA Museum	(Western Australian Museum 2014a)	Rocky foothills	Low	Yes	50 km
		Mt Webber DSO Project	(Outback Ecology 2012d)				
<i>Xenopium</i> 'PSE063'	Pseudoscorpion	WA Museum	(Western Australian Museum 2014a)	Rocky ridge and gorge	Low	No	50 km
<i>Feaella</i> 'PSE007'	Pseudoscorpion	WA Museum	(Western Australian Museum 2014a)	Gully	Low	No	55 km

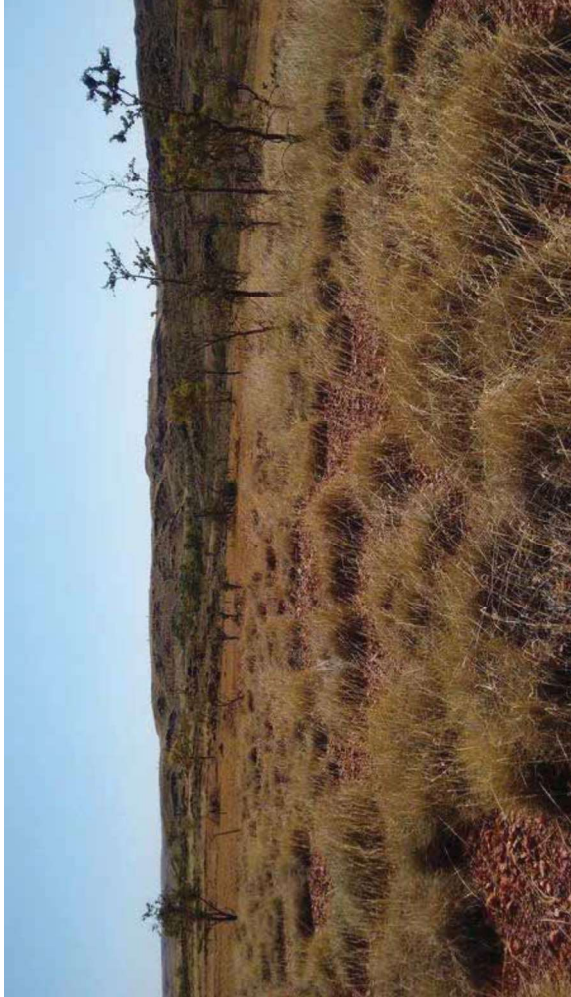
Species Name	Taxa	Source	Reference	Habitat(s)	Likelihood of occurrence in the Application Area	Reason for Likelihood	
						Similar habitat present in Application Area?	Closest record to Application Area
Aname 'MYG371-DNA'	Mygalomorph spider	WA Museum	(Western Australian Museum 2014a)	Drainage line	Low	Yes	55 km
Synothele 'MYG334'	Mygalomorph spider	WA Museum	(Western Australian Museum 2014a)	Rocky foothills	Low	Yes	57 km
Synothele 'MYG114'	Mygalomorph spider	WA Museum	(Western Australian Museum 2014a)	Spinifex sand plain	Low	No	60 km
Aureocrypta 'MYG318-DNA'	Mygalomorph spider	WA Museum	(Western Australian Museum 2014a)	Rocky ridge and gorge	Low	No	62 km
Oratemnus 'PSE018'	Pseudoscorpion	WA Museum	(Western Australian Museum 2014a)	Drainage line	Low	Yes	65 km
Spinasteron woodstock	Araneomorph spider	WA Museum	(Western Australian Museum 2014a)	Granite outcrop	Low	No	75 km
Aname 'armigera group?'	Mygalomorph spider	WA Museum	(Western Australian Museum 2014a)	Spinifex sand plain	Low	No	80 km
Urodacus 'nullagine dark'	Scorpion	WA Museum	(Western Australian Museum 2014a)	Spinifex sand plain	Low	No	85 km
Synothele 'MYG193'	Mygalomorph spider	WA Museum	(Western Australian Museum 2014a)	Spinifex sand plain	Low	No	85 km
Karaops kariyarra	Araneomorph spider	WA Museum	(Western Australian Museum 2014a)	Rocky ridge and gorge	Low	No	85 km
Synsphyronus 'PSE008'	Pseudoscorpion	WA Museum	(Western Australian Museum 2014a)	Granite outcrop	Low	No	90 km
Wesmaldra 'learmonth?'	Araneomorph spider	WA Museum	(Western Australian Museum 2014a)	Spinifex sand plain	Low	No	90 km
Aname 'MYG368-DNA'	Mygalomorph spider	WA Museum	(Western Australian Museum 2014a)	Acacia woodland	Low	No	90 km

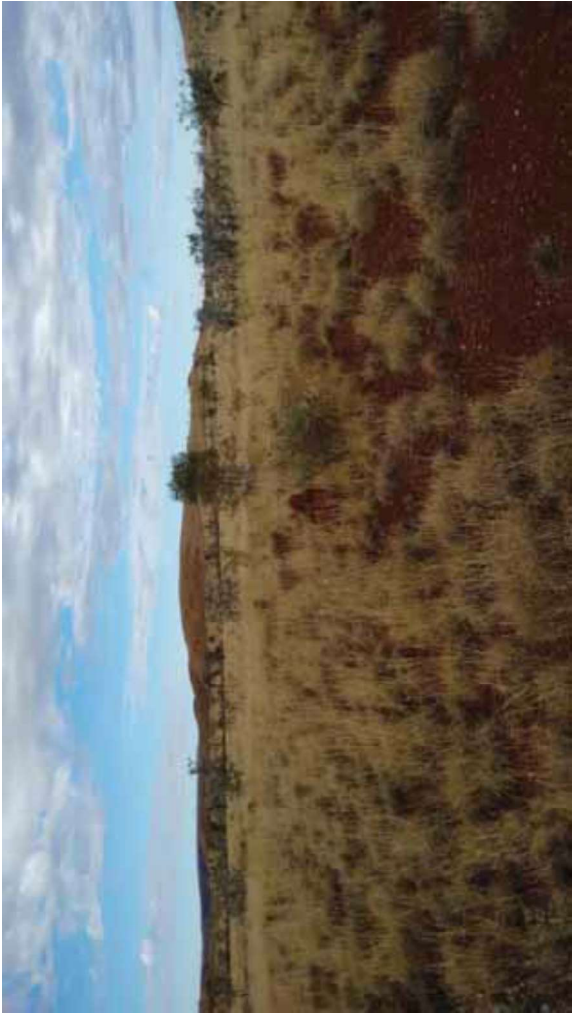
Species Name	Taxa	Source	Reference	Habitat(s)	Likelihood of occurrence in the Application Area	Reason for Likelihood	
						Similar habitat present in Application Area?	Closest record to Application Area
<i>Opopaea durranti</i>	Araneomorph spider	WA Museum	(Western Australian Museum 2014a)	Stony plain	Low	Yes	92 km
<i>Dampetrus`aurizon`</i>	Harvestman	WA Museum	(Western Australian Museum 2014a)	Rocky foothills	Low	No	95 km
<i>Aname`MYG372-DNA`</i>	Mygalomorph spider	WA Museum	(Western Australian Museum 2014a)	Drainage line	Low	Yes	95 km
<i>Karaops`aurizon`</i>	Araneomorph spider	WA Museum	(Western Australian Museum 2014a)	Rocky foothills, Granite outcrop	Low	No	96 km
<i>Karaops`BD1 (juvenile)`</i>	Araneomorph spider	WA Museum	(Western Australian Museum 2014a)	Rocky ridge and gorge	Low	No	100 km
<i>Karaops feedtime</i>	Araneomorph spider	WA Museum	(Western Australian Museum 2014a)	Stony plain	Low	Yes	100 km

Appendix D Fauna Habitat Assessments

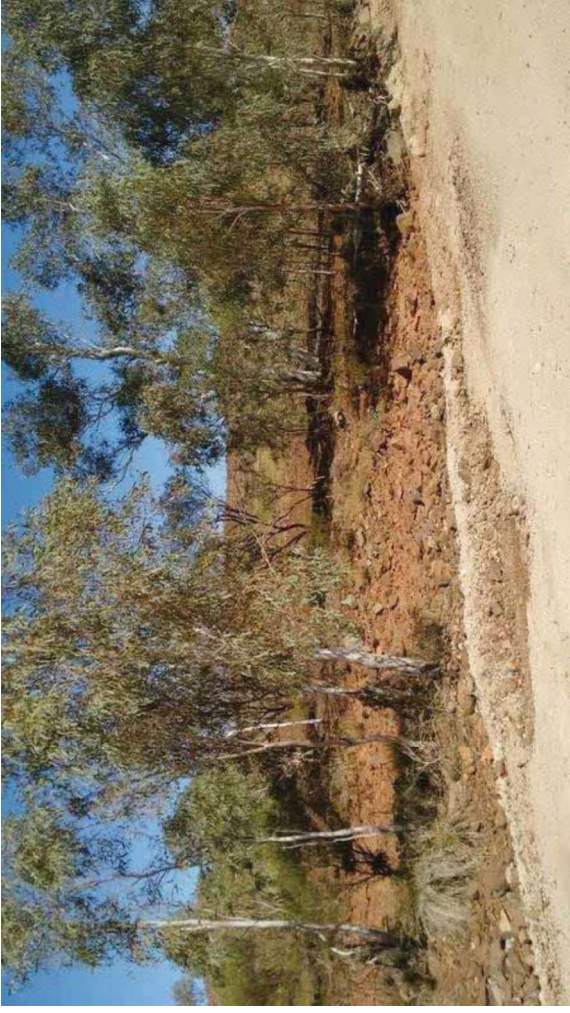
Habitat Type	Survey Sites	Landform	Aspect	Slope (degrees)			
Calcrete	PRU02, PRU04, PRU12	Plain	North	1-3			
Condition	Condition	Good					
	Disturbance Type	Clearing, Tracks					
% Ground Cover	Fire Age	5-15					
	Rock	50					
	Soil	00					
	Leaf Litter	30					
	Vegetation	20					
Rocks	Type	Calcrete					
	Size (mm)	6-20, 20-60					
	Abundance (%)	50-90					
	Exposed Bedrock (%)	2-10					
Soil	Type	Sandy loam					
	Colour	Grey					
Habitat Features	Water	No - Never	Vegetation				
	Termite Presence	None					
	Woody Debris	Rare	Stratum	Form/s	Height (m)	Cover (%)	Species
	Peeling Bark	Rare					
	Rock Crevices	None	Upper	Tree	4	< 1	Conymbia hamersleyana
	Burrowing Suitability	Low					
	Tree Hollows (<10 cm)	Rare	Lower	Hummock grass	0.5	30-70	Triodia spp.
	Tree Hollows (>10 cm)	None					

Habitat Type	Survey Site	Landform	Aspect	Slope (degrees)	
Riverine	PRU03, PRU10, PRU13	Drainage Line	North	Flat	
Condition	Condition	Very Good			
	Disturbance Type	Feral grazing, Weeds			
	Fire Age	Unknown			
	Rock	10			
% Ground Cover	Soil	03			
	Leaf Litter	02			
	Vegetation	85			
Rocks	Type	Basalt			
	Size (mm)	2–6,6–20			
	Abundance	10–20			
	Exposed Bedrock	<2			
Soil	Type	Sand			
	Colour	Grey			
Habitat Features	Water	No - Prone to Flooding	Vegetation		
	Termite Presence	None	Stratum	Form/s	Height (m)
	Woody Debris	Moderate	Upper	Tree	15
	Peeling Bark	Moderate			< 10
	Rock Crevices	None	Middle	Shrub	10–30
	Burrowing Suitability	Moderate			
	Tree Hollows (<10 cm)	Common	Lower	Tussock grass, Sedge	0.4
	Tree Hollows (>10 cm)	Common			< 1
					*Cenchrus ciliaris

Habitat Type	Survey Site	Landform	Aspect	Slope (degrees)						
Stony Rise	PRU09, PRU14, PRU15	Hill	N/A	Slight						
Condition	Condition	Very Good								
	Disturbance Type	Fire								
	Fire Age	3-5								
% Ground Cover	Rock	30								
	Soil	00								
	Leaf Litter	65								
Rocks	Vegetation	05								
	Type	Ironstone								
	Size (mm)	2–6,6–20,20–60								
	Abundance	50–90								
	Exposed Bedrock	2–10								
Soil	Type	Sandy loam								
	Colour	Brown								
Habitat Features	Water	No - Never				Vegetation				
	Termite Presence	Rare				Stratum	Form/s	Height (m)	Cover (%)	Species
	Woody Debris	Rare				Upper	Tree	3	< 1	Acacia inaequilatera, Eucalyptus hamersleyana
	Peeling Bark	Rare				Middle	Shrub	2	< 1	Acacia inaequilatera
	Rock Crevices	Rare								
	Burrowing Suitability	Low				Lower	Hummock grass	0.4	30–70	Triodia spp.
	Tree Hollows (<10 cm)	Rare								
	Tree Hollows (>10 cm)	None								

Habitat Type	Survey Site	Landform	Aspect	Slope (degrees)	
Spinifex Stony Plain	PRU01, PRU07, PRU08	Plain	South	Flat	
Condition	Condition	Very Good			
	Disturbance Type	Clearing, Feral grazing, Fire, Tracks			
	Fire Age	5-15			
	Rock	60			
	Soil	00			
% Ground Cover	Leaf Litter	35			
	Vegetation	05			
	Type	Ironstone			
Rocks	Size (mm)	6-20			
	Abundance	50-90			
	Exposed Bedrock	0			
Soil	Type	Sandy loam			
	Colour	Brown			
Habitat Features	Water	No - Never	Vegetation		
	Termite Presence	Rare	Stratum	Form/s	Height (m)
	Woody Debris	Rare	Upper	Tree	0
	Peeling Bark	Rare			< 1
	Rock Crevices	None	Middle	Shrub	2
	Burrowing Suitability	Low			< 10
	Tree Hollows (<10 cm)	None	Lower	Hummock grass	0.4
	Tree Hollows (>10 cm)	None			30-70
					Triodia spp.

Habitat Type	Survey Site	Landform	Aspect	Slope (degrees)	
Rocky Foothills	PRU05	Hill	East	Steep	
Condition	Condition	Very Good			
	Disturbance Type	Fire			
	Fire Age	<1s			
% Ground Cover	Rock	40			
	Soil	00			
	Leaf Litter	60			
	Vegetation	00			
Rocks	Type	Greenstone			
	Size (mm)	6–20,20–60,60–200			
	Abundance	>90			
	Exposed Bedrock	20–50			
Soil	Type	Sandy loam			
	Colour	Brown			
Habitat Features	Water	No - Never	Vegetation		
	Termite Presence	Rare	Stratum	Form/s	Height (m)
	Woody Debris	Rare	Upper	Tree	3
	Peeling Bark	Rare	Middle	Shrub	1.5
	Rock Crevices	Moderate			
	Burrowing Suitability	Low	Lower	Hummock grass	0.3
	Tree Hollows (<10 cm)	None			
	Tree Hollows (>10 cm)	None			
					10–30
					Triodia spp.

Habitat Type	Survey Site	Landform	Aspect	Slope (degrees)	
Drainage Line	PRU06, PRU11	Drainage Line	North	Flat	
Condition	Condition	Good			
	Disturbance Type	Feral grazing, Weeds			
	Fire Age	Unknown			
	Rock	15			
% Ground Cover	Soil	05			
	Leaf Litter	55			
	Vegetation	25			
Rocks	Type	Basalt, Ironstone			
	Size (mm)	6-20,20-60,60-200,200-600			
	Abundance	50-90			
	Exposed Bedrock	2-10			
Soil	Type	Sand			
	Colour	Brown			
Habitat Features	Water	No - Prone to Flooding	Vegetation		
	Termite Presence	None	Stratum	Form/s	Height (m)
	Woody Debris	Moderate	Upper	Tree	8
	Peeling Bark	Moderate			< 10
	Rock Crevices	Rare	Middle	Shrub	3
	Burrowing Suitability	Moderate			< 10
	Tree Hollows (<10 cm)	Rare			
	Tree Hollows (>10 cm)	None	Lower	Hummock grass	0.2
					< 10
					Triodia spp., *Cenchrus ciliaris



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