

Atlas Iron Limited

Abydos East Link Road

Terrestrial Fauna Impact Assessment

September 2012



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Terrestrial Fauna Impact Assessment

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Executive Summary

Atlas Iron Limited (Atlas) is currently evaluating the potential of developing the Abydos East Link Road (the Project) as part of proposed mining operations for the Abydos Direct Shipping Ore project. The Project is located approximately 80 km south-east of Port Hedland in Western Australia, and the proposed road has a length of approximately 59 km.

Atlas commissioned Outback Ecology to undertake a terrestrial fauna impact assessment of the Project (This Study). The area assessed (the Study Area) was defined as an area of approximately 9,544 ha containing an Application Area of approximately 914 ha. At the time of preparing this report, the exact alignment of the haul road was still being finalised. Atlas have committed to locating the Project within the 914 ha Application Area, and clearing no more than 361 ha within the Application Area. The 361 ha area to be cleared is referred to as the Indicative Project Footprint.

This Study involved a desktop study comprising database searches, a literature review and an impact assessment. This Study did not involve a field reconnaissance survey or any other ground-truthing component. Due to extensive previous survey work, field work as not required. As such, general conclusions were drawn as to the likelihood of particular species of conservation significance occurring within the Study Area, given the habitat types likely to occur, and specific habitat features occurring therein.

The specific objectives of This Study were to:

- develop an inventory of terrestrial vertebrate fauna species and terrestrial short-range endemic (SRE) invertebrate fauna species that have been recorded or are likely to occur within the Study Area;
- provide a description of vertebrate fauna habitat, sensitive habitat and terrestrial SRE invertebrate fauna habitat expected to occur within the Study Area;
- assess desktop findings in a regional context by comparing results with available data from other relevant localities within the bioregion; and
- assess the potential impacts of the Project on terrestrial fauna and fauna habitat, particularly for species of conservation significance.

A total of five broad fauna habitats was identified within the Study Area, comprising:

- Spinifex Stony Plain (approximately 45.9% of the Study Area);
- Spinifex Sandplain (approximately 37.9% of the Study Area);
- Stony Rise (approximately 8.4% of the Study Area);
- Major Drainage Line (approximately 7.3% of the Study Area); and
- Ironstone Ridge (approximately 0.3% of the Study Area).

A total of 388 species of vertebrate fauna was identified by the desktop study as potentially occurring within the Study Area. This total comprises 39 species native mammal, 8 species of introduced mammal, 216 species of bird, 110 species of reptile, 10 species of amphibian and five species of fish.

Previous field survey work performed within or near to the Study Area has confirmed the presence of at least 188 of these species. This total comprises 25 species of native mammal, five species of introduced mammal, 93 species of bird, 55 species of reptile, five species of amphibian and five species of fish.

The literature review and database searches identified 64 species of vertebrate fauna of conservation significance that potentially occur in the Study Area. Of these, 43 species are considered unlikely to occur in the Study Area. The other 21 species, which possibly occur or are likely, very likely or known to occur within the Study Area are:

- the Northern Quoll (*Dasyurus hallucatus*), which is listed as Endangered (EPBC Act) and Schedule 1 (WC Act);
- the Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*), Pilbara Olive Python (*Liasis olivaceus barroni*) and Greater Bilby (*Macrotis lagotis*), which are listed as Vulnerable (EPBC Act) and Schedule 1 (WC Act);
- the Brush-tailed Mulgara (*Dasycercus blythi*), which is listed as Vulnerable (EPBC Act) and Priority 4 (DEC Priority Fauna list);
- the Peregrine Falcon (*Falco peregrinus*) and Woma (*Aspidites ramsayi*), which are listed as Schedule 4 (WC Act);
- a species of blind snake (*Ramphotyphlops ganei*), which is listed as Priority 1 (DEC Priority Fauna list);
- the Spectacled Hare-wallaby (*Lagorchestes conspicillatus leichardti*), which is listed as Priority 3 (DEC Priority Fauna list);
- the Ghost Bat (*Macroderma gigas*), Long-tailed Dunnart (*Sminthopsis longicaudata*), Short-tailed Mouse (*Leggadina lakedownensis*), Western Pebble-mound Mouse (*Pseudomys chapmani*), Australian Bustard (*Ardeotis australis*), Grey Falcon (*Falco hypoleucos*), Flock Bronzewing (*Phaps histrionica*) and Bush Stone-curlew (*Burhinus grallarius*), which are listed as Priority 4 (DEC Priority Fauna list); and
- the Fork-tailed Swift (*Apus pacificus*), Oriental Plover (*Charadrius veredus*), Rainbow Beeeater (*Merops ornatus*) and White-bellied Sea-eagle (*Haliaeetus leucogaster*), which are listed as Migratory (EPBC Act) and Schedule 3 (WC Act).

The desktop study identified 30 SRE invertebrate species known to occur within the broader region of the Study Area. Of these, four species have been collected in close proximity to the Study Area comprising the millipedes *Antichiropus* DIP005' and *Antichiropus* DIP034', the slater *Buddelundia* sp 11 and the pseudoscorpion *Feaella* sp. 'PSE007'. Although these species have been collected in close proximity to the Study Area they are unlikely to occur within the Study Area due to a lack of suitable habitat. The other species identified during the desktop search were unlikely to occur due to a lack of suitable habitat or a lack of connecting habitat.

Habitat clearing represents the greatest potential direct impact of the Project on fauna and fauna habitats. Of the five broad fauna habitats, three were identified as significant within the Application

Area. Spinifex Sandplain, Major Drainage Line and, to a lesser extent, Spinifex Stony Plain are habitat types of particular value to vertebrate and invertebrate fauna within the Study Area, and vegetation clearing and disturbance within these habitat types should be minimised where possible.

Previous surveys in the area provide recent, confirmed records of fauna of conservation significance occurring within the Application Area, including (but not limited to) burrows of the Mulgara and sightings of the Spectacled Hare-wallaby (Biota 2007). In addition, the abandoned mine workings of Lalla Rookh, widely recognised as a highly important roost location for the Pilbara Leaf-nosed Bat and the Ghost Bat, are on the boundary of the Study Area (approximately 519 m from the Application Area and 544 m from the Indicative Project Footprint; Bamford Consulting Ecologists 2001, DSEWPaC 2012b, MOLHAR Pty Ltd 2007). These (and other) vertebrate fauna of conservation significance should be carefully considered when planning and operating the Project.

Local and regional impacts of the project to EPBC-listed Threatened fauna are considered to be low for the Pilbara Leaf-nosed Bat and Brush-tailed Mulgara, minimal for the Northern Quoll, and negligible for the Greater Bilby and Pilbara Olive Python. Local and regional impacts of the project to EPBC-listed Migratory fauna are considered to be negligible, in each instance, for the Fork-tailed Swift, Oriental Plover, Rainbow Bee-eater and White-bellied Sea Eagle.

Within the Application Area, the Major Drainage Line habitat type is considered to have a medium potential to support SRE species. As noted before with respect to vertebrate fauna, disturbance within this habitat type should be minimised wherever possible. Outside of the Application Area, but within the Study Area, the Ironstone Ridge habitat type also has a medium potential to support SRE invertebrates when compared to habitat types in the Study Area. The majority of the Study Area, however, consists of habitats with a low potential to support SRE species – namely the Spinifex Stony Plain and the Spinifex Sandplain habitat types.

Overall, previous survey effort has adequately documented the faunal assemblages likely to be present within the Study Area. These data, combined with existing information in the literature and from fauna databases, provide a sound baseline for terrestrial vertebrate fauna and Short-range Endemic invertebrate fauna in the Study Area.

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APPENDIX A Vertebrate Species Recorded in the Study Area and Surrounds

APPENDIX B Definitions of Codes and Terms used to Describe Conservation Significance

1. INTRODUCTION

1.1. Project Location and Description

Atlas Iron Limited (Atlas) has recently entered into a service agreement with Venturex Resources Limited (Venturex) to complete the construction of a transport corridor (the Project) that will connect the Abydos DSO Project to the Marble Bar Road along tenements currently held by Venturex (L45/287, L45/189, L45/170) and Atlas (M45/1179, L45/284, L45/285). The Project area is situated approximately 80 km south-east of Port Hedland (**Figure 1**, **Figure 2**), and the proposed transport corridor has a length of approximately 59 km (**Figure 2**).

In order to submit an application for a Native Vegetation Clearing Permit and Mining Proposal to the Western Australian Department of Mines and Petroleum, Atlas is required to evaluate the biological values of the areas proposed for disturbance. With reference to Guidance 56 (EPA 2004), and given the scale and nature of impact of the proposed Project, the sensitivity of the receiving environment, and the substantial amount of previous biological work that has been conducted in the Study Area and surrounds, it was considered that a terrestrial fauna desktop study (This Study) would provide adequate background information to support a mining proposal and a Native Vegetation Clearing Permit application.

The area assessed (the Study Area) was defined as an area of approximately 9,544 ha containing an Application Area of approximately 914 ha. At the time of preparing this report, the exact alignment of the haul road was still being finalized. Atlas have committed to locating the Project within the 914 ha Application Area, and clearing no more than 361 ha within the Application Area. The 361 ha area to be cleared is referred to as the Indicative Project Footprint (**Figure 2**).

1.2. Assessment Scope and Objectives

The overall objective of This Study was to gather background biological information on the terrestrial fauna, fauna assemblages and fauna habitat within the Study Area.

The specific objectives of This Study were to:

- develop an inventory of terrestrial vertebrate fauna species and terrestrial short-range endemic (SRE) invertebrate fauna species that have been recorded or are likely to occur within the Study Area;
- provide a description of vertebrate fauna habitat, sensitive habitat and terrestrial SRE invertebrate fauna habitat expected to occur within the Study Area;
- assess desktop findings in a regional context by comparing results with available data from other relevant localities within the bioregion; and
- assess the potential impacts of the Project on terrestrial fauna and fauna habitat, particularly for species of conservation significance.

This Study was designed and conducted in accordance with:

- Environmental Protection Authority (EPA) and Department of Environment and Conservation (DEC) guidelines and position statements for conducting vertebrate fauna surveys (EPA and DEC 2010, EPA 2003, EPA 2004); and
- the EPA guideline for the sampling of terrestrial SRE invertebrate fauna for environmental impact assessment in Western Australia (EPA 2009).



Figure 1: Regional location of the Study Area



Figure 2: Study Area and proposed Indicative Project Footprint and Application Area

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 sub-bioregions on the basis of climate, geology, landforms, vegetation and fauna (McKenzie *et al.* 2003). The Study Area occurs within the Pilbara bioregion (**Figure 3**). The Pilbara bioregion encompasses approximately 178,500 km² and has a semi-arid to arid tropical climate, with active drainage in the Fortescue, De Grey and Ashburton river systems (McKenzie *et al.* 2003, McKenzie *et al.* 2009). The Pilbara has a high level of fauna biodiversity and species endemism. However, a combination of invasive weeds, altered fire regimes, feral predators and grazing by introduced herbivores is causing ecosystem degradation and consequently a loss of vegetation and of native species, in particular mammals within the critical weight range of 35 – 5,500 gram (g) body mass (McKenzie *et al.* 2003).

The Pilbara bioregion is further classified into the Chichester, Roebourne, Fortescue Plains, and Hamersley sub-bioregions (McKenzie *et al.* 2003). The majority (94.5%) of the Study Area falls within the Chichester sub-bioregion, although a small portion at its northern-most end (5.5%) falls within the Roebourne sub-bioregion (**Figure 3**).

The Chichester sub-bioregion is the largest sub-bioregion, encompassing over 47% (83,700 km²) of the Pilbara bioregion (McKenzie *et al.* 2009). It is characterised by undulating Archaean granite and basalt plains with significant 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 sub-bioregion is relatively flat and undulating, being dominated by large alluvial floodplains associated with the De Grey River system and its tributaries (McKenzie *et al.* 2009). The Chichester sub-bioregion lies predominantly inland from the coast (**Figure 3**).

The Roebourne sub-bioregion lies in between the Chichester sub-bioregion and the coast, and comprises the majority of the coastal portion of the Pilbara bioregion (**Figure 3**). In contrast to the Chichester sub-bioregion, the Roebourne sub-bioregion comprises a relatively small portion, approx 10% (18,910 km²), of the Pilbara bioregion (McKenzie *et al.* 2009). The Roebourne sub-bioregion is characterised by quaternary alluvial and older colluvial coastal and sub-coastal plains, with a grass savannah of mixed bunch and hummock grasses and a dwarf shrub steppe of *Acacia stellaticeps* or *A. pyrifolia* and *A. inaequilatera*. The uplands of the Roebourne sub-bioregion are dominated by *Triodia* hummock grasslands. Ephemeral drainage lines support *Eucalyptus victrix* or *Corymbia hamersleyana* woodlands, and *Samphire* scrublands, *Sporobolus* grasslands and low mangrove forests occur on marine alluvial flats and river deltas. Resistant linear ranges of basalts occur across the coastal plains, with minor exposures of granite (Kendrick and Stanley 2001).



Figure 3: Location of Study Area with respect to IBRA Pilbara bioregion and sub-bioregions

2.2. Climate

The Study Area is located within the northern section of the Pilbara bioregion, which experiences a semi-arid to arid-tropical climate characterised by hot summers and relatively warm, dry winters. Tropical cyclones can occur between January and April, bringing sporadic drenching rainfall events (Leighton 2004, McKenzie *et al.* 2003, McKenzie *et al.* 2009). For a detailed account of climate in the Pilbara, see Leighton (2004).

Bureau of Meteorology (BOM) weather stations 004106 and 004020 are located at Marble Bar, approximately 60 km east of the Study Area (**Figure 4**). This is the closest locality with comprehensive climate data available, and data from Marble Bar may be used as a proxy for describing climatic conditions relevant to the Study Area itself.

Summer in the Pilbara occurs from November to February (**Figure 4**), when the mean maximum monthly temperature for Marble Bar ranges from 44.6°C to 45.9°C and the minimum ranges from 18.6°C to 21.6°C (BOM 2012). Over the whole year, Marble Bar averages 98 days above 40°C (Leighton 2004). Winter occurs from June to August (**Figure 4**), when the mean maximum monthly temperature for Marble Bar ranges from 31.2°C to 34.3°C and the minimum ranges from 6.4°C to 7.8°C (BOM 2012).



Figure 4: Climate data for Marble Bar weather stations 004020 and 004106

Source: BOM (2012). Rainfall data are from station 004020 for 1895 to 2000 and station 004106 for 2001 to 2012; temperature data are from station 004020 for 1901 to 2000 and station 004106 for 2001 to 2012

2.3. Land Systems in the Study Area

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

An assessment of these land systems provides an indication of the occurrence and distribution of fauna habitats within and surrounding the Study Area. The Study Area contains eight land systems (**Table 1**). Of these, the Uaroo and Rocklea land systems occupy the majority of the Study Area (30.5% and 19.1% of the land area respectively; **Table 1**, **Figure 5**). Based on landform characteristics (**Table 1**), four of the land systems found within the Study Area are likely to be of particular significance to fauna of conservation significance:

- Boolgeeda stony slopes may support the Western Pebble-mound Mouse (*Pseudomys chapmani*);
- Macroy sandy areas within the granitic plains may support the Western Pebble-mound Mouse, Brush-tailed Mulgara (*Dasycercus blythi*), Spectacled Hare-wallaby (*Lagorchestes conspicillatus leichardti*), Australian Bustard (*Ardeotis australis*) and Bush Stone-curlew (*Burhinus grallarius*);
- River –major sandy drainage lines are likely to act as a conduit for movement and provide a stable source of resources for Northern Quolls (*Dasyurus hallucatus*), Australian Bustards (*Ardeotis australis*), Bush Stone-curlews (*Burhinus grallarius*) and fauna assemblages in general; and
- Rocklea conspicuous ridges may contain caves, gorges and overhangs that are capable of supporting Northern Quolls, Ghost Bats (*Macroderma gigas*), Pilbara Leaf-nosed Bats and Pilbara Olive Pythons (*Liasis olivaceus barroni*).

Land System	Brief description	Extent					
Llaroo	Broad sandy plains supporting shrubby hard and soft Spinifex	2,906 ha					
Caroo	grasslands	(30.5%)					
Rocklea	Basalt hills, plateaux, lower slopes and minor stony plains	1,821 ha					
NUCKIEd	supporting hard spinifex (and occasionally soft spinifex) grasslands	(19.1%)					
Boolgoodo	Stony lower slopes and plains below hill systems supporting hard	1,425 ha					
Doolgeeua	and soft spinifex grasslands or mulga shrublands						
Sotiriot	Stony plains with aninifax grasslands	975 ha					
Saunsi	Storty plains with spinnex grassiands	(10.2%)					
Conrigorn	Hills and ridges of sandstone and dolomite supporting low	834 ha					
Capilcom	shrublands or shrubby spinifex grasslands	(8.7%)					
Macrov	Stony plains and occasional tor fields based on granite supporting	782 ha					
Macroy	hard and soft spinifex grasslands	(8.2%)					
	Active floodplains, major rivers and banks supporting grassy	507 ba					
River*	eucalypt woodlands, tussock grasslands and soft Spinifex	(5 3%)					
	grasslands	(3.378)					
Platform	Dissected slopes and raised plains supporting shrubby hard	293 ha					
FIGUUIII	spinifex grasslands	(3.1%)					
	Total [†]	9,543 ha					
	Total	(100.0%)					

Table 1: Land Systems and their occurrence within the Study area

Source: Van Vreeswyk *et al.* (2004); *area measurements for this land system include bare river channels, which are not land systems in their own right but are considered units within the River land system, [†]due to rounding errors this amount is slightly lower than the 9,544 ha total size of the Study Area



Figure 5: Land systems within the Study Area

2.4. Land Uses in the Study Area

Land tenure in the Pilbara consists primarily of pastoral leases, but Aboriginal reserves and leasehold reserves also occupy a large portion of the total land area. National parks and reserves, unallocated crown land (UCL) and mining are the other major land tenure categories present. The first mining exploration in the Pilbara region commenced in the early 1800s; currently, the region provides the great majority of Western Australia's petroleum, gas and iron ore exports, and gold mining is also an important industry (Australian Natural Resources Atlas 2007).

In the Chichester sub-bioregion land tenure is dominated by pastoral leases (ie for grazing of native pasture by cattle), Aboriginal lands and reserves, UCL and crown reserves, conservation, and mining (Kendrick and McKenzie 2001). The Chichester sub-bioregion has 6.5% of its land surface reserved under some form of conservation, and includes a small portion of Western Australia's second-largest conservation area, Karijini National Park, which is located approximately 250 km south-west of the Study Area. Karijini National Park covers approximately 620,000 ha and incorporates a large section of the Hamersley Plateau. Other areas of conservation estate within the Chichester sub-bioregion include the Mungaroona Range Nature Reserve, Millstream-Chichester National Park and Meentheena ex-pastoral lease. All of these areas lie within 150 km of the Study Area (**Figure 6**).

The Study Area traverses the Panorama pastoral lease and Warrarn Native Title Claim areas (**Figure 6**), and land use within the Study Area includes mining and exploration activities and cattle grazing. Some portions of UCL also exist within the Study Area.

The Study Area is to the east of both the Fortescue Metals Group and BHP Billiton Iron Ore railway corridors (**Figure 6**). Mining and exploration tenements exist over much of the Study Area. Along its length, the Study area traverses leases held by a range of stakeholders, comprising Venturex (L45/287, L45/189 and L45/170), Atlas (L45/284, L45/285 and M45/1179), Main Roads WA (Highway 138 road reserve) and the Department of Planning (timber reserves R13619 and R13618).



Figure 6: Land uses in the vicinity of the Study Area

3. DESKTOP STUDY METHODOLOGY

3.1. Database Searches

For the purpose of database searching, the Study Area was defined as a central point with coordinates 738757 mE 7679767 mN (WGS 1984, UTM 50K). The databases and search areas used were:

- the WA DEC's Threatened and Priority Fauna Database (DEC 2012), which also incorporated a search for information on general fauna assemblages equivalent to a NatureMap search, with a search area consisting of the Study Area surrounded by a buffer zone of 75 km;
- the Birds Australia New Atlas 1998 to 2011 database (BirdLife Australia 2012), with a search area consisting of the Study Area surrounded by a buffer zone of 75 km;
- the Protected Matters Search Tool (DSEWPaC 2012a), with a search area consisting of a square box of side length 130 km – the box surrounded the central point and was delineated by the coordinates (clockwise, from the north-west corner) 673757 mE 7744767 mN, 803757 mE 7744767 mN, 803757 mE 7614767 mN and 673757 mE 7614767 mN; and;
- the Western Australian Museum (WAM) Arachnid and Millipede Database (WAM 2012; note that this database does not contain records for snails or slaters), with a search area consisting of the Study Area surrounded by a buffer zone of 100 km.

3.2. Literature Review

The literature review identified 12 previous studies of relevance (**Table 2**, **Figure 7**). For those studies of vertebrate fauna for which species lists were available (four studies), the results were collated to generate an inventory of the vertebrate fauna known to occur in the locality of the Study Area and within the surrounding wider region (**Table 2**, **Appendix A**). The Study Area has been extensively surveyed, with only a 10 km portion of the Application Area remaining unsurveyed.

					summary of previous fauna surveys				
Figure 7 Label	Reference	Survey Details	Proximity to Study Area*	Methods	Habitats	Fauna recorded	Fauna of Conservation Significance	Comment	
1. VERTE	BRATE FAUNA								
Fauna sur	veys: Abydos Project /	Area							
A	Outback Ecology (2012b)	1. Project: Abydos DSO Project Impact Assessment 2. Client: Atlas Iron Limited 3. Survey type: Desktop survey 4. Survey date: N/A		 No field component 	 Minor Shallow Gorges and Gullies Major Drainage Lines Major Ironstone Gorge Major Sandstone Gorge Cliff Faces 	No field component	<u>Threatened:</u> Northern Quoll Pilbara Leaf-nosed Bat Pilbara Olive Python <u>Priority</u> Ghost Bat	Two fauna were cons quality and surroundir	
В	Outback Ecology (2011b)	1. Project: Abydos DSO Project 2. Client: Atlas Iron Limited 3. Survey type: Two-phase, Level 2 survey 4. Survey date: April/May and September 2010		 Pitfall trapping Elliott trapping Funnel trapping Cage trapping Avifauna census Systematic searching Targeted searching Spotlighting AnaBat Opportunistic recording 	 Rocky Ridges and Gorges Rocky Foothills Drainage Lines Stony Rises 	104 vertebrate taxa:18 mammal39 bird41 reptile3 amphibians3 fish	<u>Threatened:</u> Northern Quoll Pilbara Leaf-nosed Bat Pilbara Olive Python <u>Priority:</u> Ghost Bat <u>Migratory:</u> Rainbow Bee-eater	Two signif Rocky Ric considere habitats th region (e.g deep cave fauna resi	
с	Outback Ecology (2011a)	1. Project: Abydos DSO Project: Northern Quoll 2. Client: Atlas Iron Limited 3. Survey type: Conservation significant species search 4. Survey date: August 2011	30 km south-west	 Elliot trapping Cage trapping 	 Major Sandstone Gorge Major Ironstone Gorge Ironstone Ridge Major Drainage Line Low Rounded Hills 	 17 Northern Quolls: 9 females (4 adults, 5 sub-adults) 8 males (all adults) 	<u>Threatened:</u> • Northern Quoll	Majority o gorge to tl pools, bou walls.	
D	Bamford (2009)	1. Project: Abydos DSO Project 2. Client: Atlas Iron Limited 3. Survey type: Two-phase, Level 2 survey 4. Survey date: October 2008 and April 2009	2	 Pitfall trapping Elliott trapping Funnel trapping Cage trapping Avifauna census Systematic searching Targeted searching Spotlighting AnaBat Opportunistic recording 	 Ironstone Ridges Sandstone Ridges Major Gorges Cliff Faces Major Drainage Lines Minor Drainage Lines Permanent Water Holes and Springs Caves Stony Lower Slopes and Undulatir Stony Plains Spinifex Plains on Sand/loam Soil Low Rounded Hills Minor Gorges and Gullies Cracking Clay Drainage 	125 vertebrate taxa:17 mammal72 bird30 reptile4 amphibians2 fish	Threatened:Northern QuollPilbara Leaf-nosed BatPilbara Olive PythonPriority:Ghost BatWestern Pebble-moundMouseAustralian BustardBush Stone-curlewMigratory:Rainbow Bee-eater	A highly si during the regionally	

Table 2: Summary of previous fauna surveys within the surrounding region

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na habitats (Water Dependent Ecosystems and Cliff Faces) insidered to be of regional significance as they were of high ind occurred in greater abundance than typically occurs in the ling region.

ificant fauna habitats were identified within the Study area, idges and Gorges, and Drainage Lines. These habitats are ed less common within the landscape; possess microthat are not typically found in similar habitat in the wider e.g. semi-permanent water pools and water seeps, large /es and crevices); and a range of conservation significant side within them.

of Northern Quolls were trapped within a large sandstone the south of the Abydos DSO Project area featuring water ulders, relatively thick riparian vegetation and high sheer

significant maternity roost of Ghost Bats was recorded ese surveys as well as six additional roosts, two containing y high number of bats.

Figure 7 Label	Reference	Survey Details	Proximity to Study Area*	Methods	Habitats	Fauna recorded	Fauna of Conservation Significance	Commen
Fauna sur	veys: Sulphur Springs Pr	oject Area			1			
E	Outback Ecology (2011c)	1. Project: Sulphur Springs Copper-Zinc Project 2. Client: Venturex Resources Limited 3. Survey Type: Terrestrial Fauna Desktop Survey and Reconnaissance Survey 4. Survey Date: June 2011	coincident with Study Area	Desktop survey	 Spinifex Stony Plains Rocky Foothills Scree Slop Spinifex Sandplains Drainage Line Rocky Ridges and Gorges Rubble Piles Ficus Groves 	Database search findings 392 vertebrate taxa: 53 mammal 211 bird 116 reptile 5 fish 7 amphibian More specific review findings 151 vertebrate taxa: 27 mammal 83 bird 34 reptile 5 fish 2 amphibian	Threatened Northern Quoll Mulgara Grater Bilby Pilbara Leaf-nosed bat Night Parrot Pilbara Olive Python Peregrine Falcon Woma Priority Ghost bat Spectacled Hare-wallaby Western Pebble-mound mouse Long-tailed Dunnart Lakeland Downs Mouse Australian Bustard Bush Stone-curlew Grey Falcon Star Finch Blind snake Migratory Fork-tailed Swift Cattle Egret Oriental Plover Rainbow Bee-eater Night Parrot	Rocky Rid nosed and these spe habitat tyj lacks cav denning h compone
F	Biota (2007)	1. Project: Panorama Project 2. Client: CBH Sulphur Springs Pty Ltd 3. Survey type: One-phase, Level 2 survey 4. Survey Date: August - September 2006		 Pitfall trapping Harp trapping Funnel trapping Avifauna census Systematic searching Targeted searching Opportunistic recording 	 Sandy plains Sandy/loamy plains Narrowly incised valley Ridges, hills and upper slopes Stony plains 	 73 vertebrate taxa 12 mammals 41 birds 18 reptiles 2 amphibians 	ThreatenedNorthern QuollCrest-tailed Mulgara (burrows only)Pilbara Leaf-nosed BatSpectacled Hare-wallaby PriorityPriorityWestern Pebble-mound MouseGhost BatAustralian BustardBush Stone-curlew	Survey cc for the Su invertebra
G	MOLHAR (2007)	1. Project: Sulphur Springs Copper-Zinc Project 2. Client: CBH Sulphur Springs Pty Ltd 3. Survey type: Conservation significant species search 4. Survey date: June 2007		 Anabat Opportunistic recording 	• Gorge • Gully	2 Vertebrate taxa	<u>Threatened</u> • Pilbara Leaf-nosed Bat <u>Priority</u> • Ghost Bat	The speci

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idge and Gorge habitat is most likely to support Pilbara Leafnd Ghost Bats, however deep, substantial caves required by ecies for breeding appear to be largely absent within this ype. Northern Quolls would prefer a similar habitat but again yes, crevices and outcropping required by this species as habitat. Both vertebrate fauna and SRE invertebrate ents were included in the report.

onsisted of a Level 1 for the haul road corridor and a Level 2 ulphur Springs mine area. Both vertebrate fauna and SRE ate components were included in the report.

cies forage in all 5 deep gullies examined in the area.

Figure 7 Label	Reference	Survey Details	Proximity to Study Area*	Methods	Habitats	Fauna recorded	Fauna of Conservation Significance	Commen
Н	Bamford (2001)	1. Project: Panorama Project 2. Client: CBH Sulphur Springs Pty Ltd 3. Survey type: Two-phase, Level 2 survey 4. Survey date: June and September 2001	coincident with southern portion of Study Area	 Pitfall trapping Elliott trapping Cage trapping Avifauna census Systematic searching Targeted searching Spotlighting AnaBat Harp trapping Mist netting Opportunistic recording 	 Rocky Hills Gorges Cliff Lines Undulating Plains 	 137 vertebrate taxa: 22 mammal 80 bird 29 reptile 2 amphibians 4 fish 	Threatened:Northern QuollPilbara Leaf-nosed Bat Priority:Spectacled Hare-wallabyGhost BatWestern Pebble-mound MouseAustralian BustardBush Stone-curlew	Rocky Hil habitat fo (<i>Macrode</i> Although also cons
2. SRE IN	/ERTEBRATES				-			• •
1	Outback Ecology (2012a)	1. Project: Abydos DSO Project 2. Client: Atlas Iron Limited 3. Survey Type: Two-phase, Level 2 survey 4. Survey Date: March – July 2010	30 km south-west	 Pitfall trapping Targeted searching Leaf litter & Soil Collection 	 Gorge Ridge Gully Riverine 	<u>1,453 Invertebrate</u> <u>specimens</u> from 43 species	 SRE: 6 species Scorpion Aops 'pilbara' Pseudoscorpion Tyrannocthonius 'near aridus' Slaters Buddelundia sp. 11 and Buddelundia sp. 18 Camaenid snail gen nov. sp nov. Antichiropus 'abydos' 	Within the high pote and riverin supporting significan
J	Outback Ecology (in prep.)	1. Project: Sulphur Springs Copper-Zinc Project 2. Client: Venturex Resources 3. Survey Type: Targeted Terrestrial SRE Invertebrate Fauna Assessment 4. Survey Date: January 2012	a coincident with Study Area	• Targeted searching	 Gorge Creek Line Riverine Drainage Line Floodplain 	 Terrestrial snails (64 individuals from 5 identifiable species) Aquatic snails (38 specimens from 2 species) Millipedes (29 specimens from 1 identifiable species) Slaters (20 specimens from 3 identifiable species) Pseudoscorpians (1 specimen) Mygalomorph spiders (1 specimen) 	 SRE: Millipede Antichiropus 'abydos' Slater Buddelundia sp. 11 Pseudoscorpian Feaella 'PSE007' (unable to be recollected) 	Of the hal high pote considere were cons
ĸ	Outback Ecology (2011c)	1. Project: Sulphur Springs Copper-Zinc Project 2. Client: Venturex Resources Limited 3. Survey Type: Terrestrial Fauna Desktop Survey and Reconnaissance Survey 4. Survey Date: June 2011	y	Desktop survey	 Rocky Ridges & Gorges Drainage Lines Rubble Piles Fiscus Groves 	Potentially 3 invertebrate taxa	 SRE: Millipede Antichiropus 'abydos' Mygalomorph spider <i>Kwonkan</i> 'MYG200' Pseudoscorpian <i>Feaella</i> sp 'PSE007' 	Recomme Feaella s the specie Feaella s

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ills, Gorges and Cliff-lines were identified as important or mammals, reptiles and birds, including Ghost Bats *erma gigas*) and Peregrine Falcons (*Falco peregrinus*). I limited in extent, watercourses and riparian vegetation were sidered highly significant fauna habitats.

e Study area, the Gorge habitat was considered to have a ential of supporting SRE species, where as the ridge, gully ine habitats were considered to have a medium potential of ng SRE species. The large gorge is possibly the most nt area of SRE habitat present in the study area.

abitats, the Gorge and Creek lines were considered to have ential for supporting SRE species and Riverine habitat was ed to have medium potential; all other drainage habitats insidered to have a low potential to support SRE species.

nended a targeted terrestrial invertebrate SRE survey for sp. 'PSE007' be conducted to gain a better understanding of ies distribution and identify other potential habitats for sp. 'PSE007' outside of the proposed impact area.

Figure 7 Label	Reference	Survey Details	Proximity to Study Area*	Methods	Habitats	Fauna recorded	Fauna of Conservation Significance	Commen
L	Biota (2007)	1. Project: Panorama Project 2. Client: CBH Sulphur Springs Pty Ltd 3. Survey type: One-phase, Level 2 survey 4. Survey Date: August - September 2006	coincident with Study Area	 Pitfall trapping Systematic searching Targeted searching 	 Narrowly incised valley Ridges, hills and upper slopes Stony plains 	<u>3 invertebrate taxa</u>	 SRE: Terrestrial snails (<i>Rhagada</i> sp. 'Sulphur Springs') Mygalomorph spiders (6 species) Pseudoscorpians (<i>Feaella</i> sp. 'Sulphur Springs') 	Survey ta Sulphur S invertebra

*distances measured from a single point within the Study Area: 738757 mE 7679767 mN (WGS 1984, UTM 50K), as introduced in Section 3.1.

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argeted possible short-range endemic fauna within the Springs mine site study area. Both vertebrate fauna and SRE ate components were included in the report.



Figure 7: Locations of previous studies in the vicinity of the Study Area

(see Table 2 for key to literature review study areas)

3.3. Broad Fauna Habitats

Broad fauna habitats and significant fauna habitats within the Study Area were identified by a desktop assessment, made possible due to existing habitat mapping generated for much of the Study Area during previous surveys (**Section 3.2**). Definitions of fauna habitat used in This Study are consistent with classifications used in other biodiversity assessments. Fauna habitats were mapped at a broad scale; therefore, microhabitats are not likely to be evenly distributed within them and habitat boundaries are likely to be accurate only to within 100 m.

3.4. Short Range Endemism

Endemism refers to the restriction of a species to a particular area at a continental, national or local scale (Allen *et al.* 2002). Short-range endemic (SRE) species have naturally restricted ranges of less than approximately 10,000 km² (Harvey 2002). A combination of intrinsic and extrinsic factors, such as dispersal capabilities or opportunities, habitat preferences, life history attributes, physiological attributes, biotic and abiotic interactions, habitat availability and historical factors determine not only the geographic distribution of a taxon but also its propensity for population differentiation and speciation (Ponder and Colgan 2002).

In Western Australia, many terrestrial SRE invertebrate species have Gondwanan origins and are relics of previously widespread species common to the continents of the southern hemisphere during the mesic climates of the Miocene. The subsequent aridification of Australia during the Miocene through to Pleistocene resulted in the fragmentation and contraction of once common mesic habitats. Consequently, populations dependent on these mesic habitats were also fragmented, resulting in the evolution of SRE invertebrate fauna.

Taxa prone to short range endemism tend to share several ecological and life-history characteristics, such as poor powers of dispersal, confinement to discontinuous habitats, highly seasonal activity patterns and low fecundity (Harvey 2002). The main invertebrate groups with these traits in the Pilbara region of WA include:

- mygalomorph spiders;
- scorpions;
- pseudoscorpions;
- millipedes;
- slaters; and
- snails.

3.5. Taxonomy and Nomenclature

The nomenclature and taxonomy of all mammals, reptiles and amphibians in this report follow the *Checklist of the Vertebrates of Western Australia* (WAM 2009), and those of all birds follow the *Birds Australia Checklist of Australian Birds* (in turn based on Christidis and Boles 2008). Relevant texts,

from which information on more recent taxonomic updates and general patterns of distribution are available, were also considered for:

- non-volant mammals (Menkhorst and Knight 2004, Van Dyck and Strahan 2008);
- bats (Churchill 2008);
- birds (Johnstone and Storr 1998, 2004, Morcombe 2003, Pizzey and Knight 2007);
- reptiles (Cogger 2000, Storr *et al.* 1999, 2002, Wilson and Swan 2008, Wilson and Swan 2010); and
- amphibians (Cogger 2000, Tyler and Doughty 2009).
- 3.6. Limitations and Constraints

Given the extensive survey work already completed, no specific site inspection for fauna was undertaken. A general assessment was made as to the likelihood of particular species of conservation significance occurring, given the broad habitat types likely to occur over the Study Area. Assessments of potential impacts to fauna assemblages, fauna habitats, SRE invertebrates and vertebrate fauna of conservation significance should be interpreted with this in mind.

4. RESULTS AND DISCUSSION

4.1. Fauna Habitats

This Study identified five broad habitat types within the Study Area (**Table 3**, **Figure 8**, **Figure 9**). These habitats were categorised according to existing habitat descriptions for the Abydos DSO Project (Bamford Consulting Ecologists 2009, Outback Ecology 2011a, b), and are considered widespread and typical of the Chichester bioregion. The Ironstone Ridge habitat type is represented by only a small area within the Study Area itself (**Table 3**), but is represented more widely in the immediate vicinity (eg see Bamford Consulting Ecologists 2009).

Habitat type	Description *	Land systems intersected	Extent in Study Area
Ironstone Ridge	Ridge systems incised with deep ironstone gorges, also containing minor drainage lines, gullies and rocky outcrops. Ridges support <i>Triodia</i> hummock grasslands, <i>Acacia</i> and <i>Senna</i> shrublands and scattered <i>Eucalyptus</i> spp. Small valleys support dense shrublands and gorges support riparian woodlands.	Capricorn	33 ha (0.3%)
Major Drainage Line	Support areas of <i>Eucalyptus</i> and <i>Melaleuca</i> woodlands, and permanent and seasonal waterholes. Important drainages include Six Mile Creek, Turner River and Chinnamon Creek.	Boolgeeda Capricorn Macroy River Rocklea Satirist Uaroo	700 ha (7.3%)
Spinifex Stony Plain	Stony plains support extensive <i>Triodia</i> hummock grasslands with scattered shrubs. Plains may be flat to slightly undulating.	Boolgeeda Capricorn Macroy Platform Rocklea Satirist	4,384 ha (45.9%)
Stony Rise	Stony lower slopes of ridge and gorge systems. Slopes can have minor areas of outcropping. Vegetation is predominantly <i>Triodia</i> hummock grasslands, with scattered <i>A. inaequilatera</i> and <i>G. wickhamii</i> .	Boolgeeda Capricorn Rocklea Macroy	805 ha (8.4%)
Spinifex Sandplain	Plains consisting of extensive <i>Triodia</i> hummock grasslands over flat to slightly undulating sandy and loamy soils. Scattered <i>Acacia</i> and other spp shrubs occur and are concentrated along minor drainage lines.	Macroy River Satirist Uaroo	3,622 ha (37.9%)
		Total [†]	9,544 ha (99.8%)

Table 3: Broad fauna habitats within the Study Area

*Source: Bamford Consulting Ecologists (2009), Outback Ecology (2011a, b); [†]due to rounding errors this amount is slightly lower than the 100% total for habitat proportions within the Study Area



Figure 8: Fauna habitats in the Study Area - north section



Figure 9: Fauna habitats in the Study Area - south section

4.2. Vertebrate Fauna

Potentially, up to 388 species of vertebrate fauna occur in the Study area (**Table 4**, **Appendix A**). Of these, 188 were recorded within the Study Area during previous field surveys (**Table 4**).

Found		Previous studies				Database searches				Total
raulia	Α	В	С	D	Total	Е	F	G	Total	Total
Native mammals	15	13	11	21	25	38	5	0	38	39
Introduced mammals	1	4	1	3	5	7	0	0	8	8
Birds	39	72	41	82	93	212	9	200	216	216
Reptiles	41	30	18	28	55	108	2	0	109	110
Amphibians	3	4	2	2	5	9	0	0	9	10
Fish	3	2	0	5	5	0	0	0	0	5
Total native fauna	101	121	72	138	183	367	16	200	372	381
Total fauna	102	125	73	141	188	374	16	200	380	388

 Table 4: Vertebrate species richness from database searches and previous studies

For key to literature review study codes, see **Table 2**. For database searches, codes indicate: E, DEC (2012); F, DSEWPaC (2012a); G, BirdLife Australia (2012). Species counts are combined over all survey methods.

4.3. Vertebrate Fauna of Conservation Significance

The literature review and database searches identified 64 species of conservation significance which potentially occur in the Study Area (**Appendix A**). Of these:

- ten species are listed as Threatened under the EPBC Act and/or the WC Act (Section 4.3.1);
- 15 species, including one species also listed as Threatened under the EPBC Act, are recognised by DEC as Priority Fauna (Section 4.3.2); and
- 41 species, including one species also recognised as Priority Fauna by the DEC, are birds listed as Migratory under the EPBC Act and Schedule 3 under the WC Act, due to their being subject to international agreements such as the Japan-Australia Migratory Bird Agreement, the China-Australia Migratory Bird Agreement, the Bonn Convention (The Convention on the Conservation of Migratory Species of Wild Animals) and the Republic of Korea Australia Migratory Bird Agreement (Section 4.3.3).

In **Section 4.3.1** to **Section 4.3.3**, the likelihood of each of these species of conservation significance occurring in the Study Area has been assessed and ranked. The rankings were assigned using the following definitions:

Confirmed – the presence of the species in the Study Area has been recorded unambiguously during the last ten years (ie during recent surveys of the Study Area or from recent records obtained via database searches);

- **Very likely** the Study 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 Study 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 Study 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 Study 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 Study Area lies within the known distribution of the species, but the species is very rare and/or patchily distributed; or
- c. the Study 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 Study Area lies outside the known distribution of the species, the Study Area does not contain suitable habitat, and the species has not been recorded in the area for over 20 years.

4.3.1. Threatened Fauna

Legislation has been developed at a Commonwealth (EPBC Act) and State (WC Act) level to protect fauna species that have been formally recognised as rare, threatened with extinction or having high conservation value. For the full definitions of conservation significance under these Acts, see **Appendix B**. The database and literature searches identified ten Threatened species that could potentially occur within the Study Area (**Table 5**). Of the ten species, those that could possibly occur or are likely, very likely or confirmed as occurring within the Study Area are discussed briefly below. Those considered unlikely to occur are excluded from further discussion (see **Table 5** for justification of their likelihood of occurrence within the Study Area).

Common name (Species name)Conservation statusReported by SurveysLikelihoodMarmalsFPBC1In WA2SurveysDatabasesMorthern Marsupial Mole (Notoryctes caurinus)ENS101UnlikelyComments on likelihood: The Study Area lies to the west of the known distribution of the species (Van Dyck and Strahan 2008), and does not contain suitable habitat (sandy desert with extensive dune systems). The species is rarely seen and was reported as potentially occurring in the Study Area by only one database search (DSEWPaC 2012a).1/02/1Unlikely / Very likelyCrest-tailed / Brush-tailed Mulgara (Daycercus cristicauda / blythi)EN / VUS1 / P41/02/1Unlikely / Very likelyComments on likelihood: Due to taxonomic uncertainty it is difficult to know which species is actually being referred to when the Mulgara is reported by database and literature searches; thus, the two species are treated together here. However, it is important to note that both species are considered differently under the EPBC Act, the WC Act and by the DEC under their list of PriorityFauna (see below). The Crest-tailed Mulgara is considered unlikely to occur within the Study Area, as the Study Area lies outside its known distribution (Van Dyck and Strahan 2008) and does not contain suitable habitat (sand dune ridges). The sole record of <i>D. cristicauda</i> from previous surveys in this area (Appendix A) cannot be attributed definitively to this species (as opposed to <i>D. blythi</i>), as it was derived from observation of burrows alone (Biota 2007). Furthermore, it has been claimed that the vast majority of Mulgara specimers identified in WA are of <i>D. blythi</i> , and not <i>D. cristicauda</i> (R. How, WA Museum, pers co		-	-		-			
(Species name)EPBC1In WA2SurveysDatabasesLikelihoodMammalsNorthern Marsupial Mole (Notoryctes caurinus)ENS101UnlikelyComments on likelihood: The Study Area lies to the west of the known distribution of the species (Van Dyck and Strahan 2008), and does not contain suitable habitat (sandy desert with extensive dune systems). The species is rarely seen and was reported as potentially occurring in the Study Area by only one database search (DSEWPaC 2012a).1/02/1Unlikely / Very likelyComments on likelihood: Dasycercus cristicauda / blythi)EN / VUS1 / P41/02/1Unlikely / Very likelyComments on likelihood: Due to taxonomic uncertainty it is difficult to know which species is actually being referred to when the Mulgara is reported by database and literature searches; thus, the two species are treated together here. However, it is important to note that both species are considered differently under the EPBC Act, the WC Act and by the DEC under their list of Priority Fauna (see below). The Crest-tailed Mulgara is considered unlikely to occur within the Study Area, as the Study Area lies outside its known distribution (Van Dyck and Strahan 2008) and does not contain suitable habitat (sand dune ridges). The sole record of <i>D. cristicauda</i> from previous surveys in this area (Appendix A) cannot be attributed definitively to this species (as opposed to <i>D. blythi</i>), as it was derived from observation of burrows alone (Biota 2007). Furthermore, it has been claimed that the vast majority of Mulgara specimens identified in WA are of <i>D. blythi</i> , and not <i>D. cristicauda</i> (Row WA Museum, pers comm.). Given this, and the aforementioned presence of Mulgara occurs in the Study Area. The Study	Common name	Conservation status		Reported by		Likelihood		
MammalsNorthern Marsupial Mole (Notoryctes caurinus)ENS101UnlikelyComments on likelihood: The Study Area lies to the west of the known distribution of the species (Van Dyck and Strahan 2008), and does not contain suitable habitat (sandy desert with extensive dune systems). The species is rarely seen and was reported as potentially occurring in the Study Area by only one database search (DSEWPaC 2012a).1/02/1Unlikely / Very likelyCrest-tailed / Brush-tailed Mulgara (Dasycercus cristicauda / blythi)EN / VUS1 / P41 / 02 / 1Unlikely / Very likelyComments on likelihood: Due to taxonomic uncertainty it is difficult to know which species is actually being referred to when the Mulgara is reported by database and literature searches; thus, the two species are treated together here. However, it is important to note that both species are considered differently under the EPBC Act, the WC Act and by the DEC under their list of Priority Fauna (see below). The Crest-tailed Mulgara is considered unlikely to occur within the Study Area, as the Study Area lies outside its known distribution (Van Dyck and Strahan 2008) and does not contain suitable habitat (sand dune ridges). The sole record of <i>D. cristicauda</i> from previous surveys in this area (Appendix A) cannot be attributed definitively to this species (as opposed to <i>D. blythi</i>), as it was derived from observation of burrows alone (Biota 2007). Furthermore, it has been claimed that the vast majority of Mulgara specimens identified in WA are of <i>D. blythi</i> , and the Study Area, it is considered very likely that the Brush-tailed Mulgara occurs in the Study Area. The Study Area lies within the known distribution of this species (Van Dyck and Strahan 2008), Mulgara burrows, scats and diggings have been	(Species name)	EPBC ¹	In WA ²	Surveys	Databases	LIKEIII1000		
Northern Marsupial Mole (Notoryctes caurinus)ENS101UnlikelyComments on likelihood: The Study Area lies to the west of the known distribution of the species (Van Dyck and Strahan 2008), and does not contain suitable habitat (sandy desert with extensive dune systems). The species is rarely seen and was reported as potentially occurring in the Study Area by only one database search (DSEWPaC 2012a).1/02/1Unlikely / Very likelyCrest-tailed / Brush-tailed Mulgara (Dasycercus cristicauda / blythi)EN / VUS1 / P41 / 02 / 1Unlikely / Very likelyComments on likelihood: actually being referred to when the Mulgara is reported by database and literature searchers; thus, the two species are treated together here. However, it is important to note that both species are considered differently under the EPBC Act, the WC Act and by the DEC under their list of Priority Fauna (see below). The Crest-tailed Mulgara is considered unlikely to occur within the Study Area, as the Study Area lies outside its known distribution (Van Dyck and Strahan 2008) and does not contain suitable habitat (sand dune ridges). The sole record of <i>D. cristicauda</i> from previous surveys in this area (Appendix A) cannot be attributed definitively to this species (sa opposed to <i>D. blythi</i>), as it was derived from observation of burrows alone (Biota 2007). Furthermore, it has been claimed that the vast majority of Mulgara specimens identified in WA are of <i>D. blythi</i> , and not <i>D. cristicauda</i> (R. How, WA Museum, pers comm.). Given this, and the aforementioned presence of Mulgara occurs in the Study Area. The Study Area, it is considered very likely that the Brush-tailed Mulgara occurs in the Study Area. The Study Area lies within the known distribution of this species (Van Dyck and Strahan 2008	Mammals							
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Table 5:	Threatened	fauna	potentially	occurring	in the	e Study	Area
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Background information

intersects the Study Area.

Taxonomy: Until recently the Brush-tailed Mulgara (*Dasycercus blythi*) was considered the same species as the Crest-tailed Mulgara (*Dasycercus cristicauda*); see Van Dyck and Strahan (2008). The Crest-tailed Mulgara is currently listed under the EPBC Act as Endangered using a now defunct taxonomic pseudonym *Dasycercus hillieri*, and as Schedule 1 under the WC Act using the current name *Dasycercus cristicauda*. The Brush-tailed Mulgara is currently listed under the EPBC Act as Vulnerable using the old name for this species *Dasycercus cristicauda*, and as Priority 4 by the DEC using the current name *Dasycercus blythi*.

Distribution/habitat: The current distribution of both species of Mulgara is uncertain and can only be confirmed following the correct identification and analysis of museum specimens (Pavey *et al.* 2012). Current knowledge suggests that the vast majority of Mulgara captured in Western Australia are the Brush-tailed Mulgara, *Dasycercus blythi*, and not the Crest-tailed Mulgara (Ric How, WA Museum, pers comm), though it is possible that Crest-tailed Mulgara still occur in WA (Pavey *et al.* 2012).

Threats: Introduced grazers, namely cattle and rabbits, altered fire regimes and predation by cats and foxes have contributed to the population declines of both species of Mulgara (Maxwell *et al.* 1996, Van Dyck and Strahan 2008).

Common name	Conservation status		Repor	Likelihood	
(Species name)	EPBC ¹	In WA ²	Surveys	Databases	LIKEIII1000
Northern Quoll (<i>Dasyurus hallucatus</i>)	EN	S1	4	2	Likely

Comments on likelihood: The Study Area lies within the known distribution of the Northern Quoll, and the species was recorded during each of the four nearby surveys considered during the literature review (**Appendix A**); however, the Study Area contains only a very small area of suitable habitat with potential to contain sites for denning (Ironstone Ridge; 0.3% of the Study Area). If this species occurs within the Study Area, is most likely that the Northern Quoll uses areas in the southern portion of the Study Area adjacent to rocky habitat for foraging, but it is unlikely that the Northern Quoll dens within the Study Area.

Background information

Distribution/habitat: The Northern Quoll is a medium-sized (300 g to 1 kg) carnivorous marsupial, once widely distributed across northern Australia (Menkhorst and Knight 2004). The species has experienced a precipitous decline in much of its former range in northern Queensland and the Northern Territory (Fitzsimons *et al.* 2010) in direct association with the spread of the Cane Toad (*Bufo marinus*). In Western Australia the species is mainly restricted to the Hamersley Ranges and the northern Kimberley (Menkhorst and Knight 2004), and the Pilbara region is considered to be its last 'stronghold'. The Northern Quoll is an opportunistic omnivore and is both arboreal and terrestrial, inhabiting ironstone ridges, scree slopes of sandstone or ironstone and granite boulders and outcrops. It also inhabits drainage lines and riverine habitats where it utilises tree hollows as den sites (Van Dyck and Strahan 2008). Rocky habitats with rock crevices and caves support higher densities of Northern Quolls than habitats such as *Eucalyptus* woodlands and human settlements (Van Dyck and Strahan 2008).

Biology/ecology: Little is known of the Northern Quoll's biology and ecology in the Pilbara. Knowledge gaps include home range, reproductive cycle, population ecology, diet, critical habitat requirements and the response of populations to fire. The Northern Quoll is the largest mammal species in the world known to undergo male die-off after mating (Van Dyck and Strahan 2008). As a result of this facultative die-off, the abundance of the species is cyclical and its annual reproduction is highly synchronised. The abundance of Northern Quolls in the Pilbara is lowest after the mating season, which occurs in the winter months, because a significant proportion of adult males has died off but young have not yet begun to forage independently (Oakwood 2000). Conversely, the population density is thought to be highest in the summer months, prior to the mating season and when juveniles have begun foraging independently. The majority of home range data for the Northern Quoll has been acquired from studies in the Kimberley and Northern Territory (Oakwood 2002). Schmitt *et al.* (1989) reported relatively small home ranges in rugged habitat in the Kimberley, *ie* 2.3 ha for females and 1.8 ha for males, whereas in the western Pilbara, King (1989) found a minimum activity area of 75 to 443 ha for females and 5 to 1,109 ha for males. King (1989) also found Northern Quolls moved up to 3.5 km over seven days, in an area of mainly ironstone hills sparsely covered with spinifex (*Triodia* spp) and scattered trees (*Eucalyptus* and *Acacia* spp).

Common name	Conservation status		Repor	Likolibood	
(Species name)	EPBC ¹	In WA ²	Surveys	Databases	LIKEIII1000
Pilbara Leaf-nosed Bat (Rhinonicteris aurantia)	VU	S1	4	2	Very likely

Comments on likelihood: The Study Area lies within the known distribution of the Pilbara Leafnosed Bat, the species was recorded during each of the four nearby surveys considered during the literature review (**Appendix A**) and the abandoned Lalla Rookh mine, a known roost site for the species (DSEWPaC 2012a), is on the boundary of the Study Area. The Study Area itself, however, contains only a very small area of habitat with potential to contain caves for roosting, (Ironstone Ridge; 0.3% of the Study Area). If this species occurs within the Study Area, it is most likely to be for foraging only and not for roosting.

Background information

Distribution/habitat: The Pilbara Leaf-nosed Bat is the isolated, Pilbara form of the Orange Leaf-nosed Bat (*Rhinonicteris aurantius*). The Pilbara Leaf-nosed Bat requires warm, very humid roost sites in caves and mines, as these enable the species to persist in arid climates by limiting its water loss and energy expenditure (Van Dyck and Strahan 2008). Due to its reliance on humid, moist environments for survival, it is the scarcity of caves that possess the required microclimate of 28 to 32°C temperature and 85 to 100% humidity that is thought to limit its distribution (Armstrong 2001, Churchill 1991). In the Pilbara, this species has been observed foraging in numerous habitats including *Triodia* hummock grasslands (Armstrong 2001, Churchill 1994), small watercourses near granite koppies and around pools in riverine or gorge habitats (Armstrong 2001). Observations of high activity in caves, crevices and gullies, watercourses and around pools in the Pilbara are common (Armstrong 2001). These locations are typically associated with foraging activity.

Biology/ecology: The diet of the Pilbara Leaf-nosed Bat has not been studied in any detail, however, it is assumed to be similar to that of the Orange Leaf-nosed Bat, which shows a pattern of selective foraging for moths (Lepidoptera) and beetles (Coleoptera) depending on their seasonal abundance (Churchill 1994). The home range of the Pilbara Leaf-nosed Bat has not been studied; however, it is unlikely to travel long distances from its roost sites to forage in the dry season (Armstrong 2001). Environmental conditions are more favourable in the wet season, as the weather is more humid and fluctuates less. Further, there is an increased abundance of prey and water sources (Churchill 1991). For Orange Leaf-nosed Bat populations in the Kimberley, mating has been documented as occurring in July, followed by a prolonged gestation of approximately 150 days with females giving birth in December (Churchill 2008). Young were observed to be weaned and independent by late February (Churchill 2008). The reproductive biology of the Pilbara Leaf-nosed Bat is assumed to be similar.

Threats: The Pilbara Leaf-nosed Bat is subject to several threatening processes, including flooding and human impacts such as mining (DSEWPaC 2012a).

Greater Bilby (<i>Macrotis lagotis</i>)	VU	S1	0	2	Possible
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Comments on likelihood: The Study Area lies just to the west of the known distribution of the Greater Bilby (Van Dyck and Strahan 2008), but the Study Area does contain a large amount of a habitat type consistent with that used by this species (Spinifex Sandplain; 37.9% of the Study Area).

Background information

Distribution/habitat: The Greater Bilby was formerly associated with a variety of inland habitats, including desert sandplains, dune fields with hummock grasslands, and massive red earths and *Acacia* shrublands (Maxwell *et al.* 1996), but populations underwent a sudden and widespread collapse in the early 1900s (Van Dyck and Strahan 2008). The species is now restricted to approximately 20% of its former range, with wild populations restricted predominantly to the Tanami Desert in the Northern Territory, the Great Sandy and Gibson Deserts in Western Australia, and an outlying population in south-west Queensland (DSEWPaC 2012a).

Biology/ecology: Bilbies are not reliant on surface water and receive most of their water requirements from food sources. Their diet consists of insects, larvae, seeds, bulbs, fruit and fungi (Van Dyck and Strahan 2008). Bilbies dig large burrows in sandy substrates, which can reach up to 3 m long and 1.8 m deep (Van Dyck and Strahan 2008).

Threats: The species has undergone a widespread population decline, as a result of altered fire regimes, grazing pressure from introduced herbivores and livestock, and predation by the European Red Fox (*Vulpes vulpes*) and the Cat (*Felis catus*).

Common name	Conservat	ion status	Repor	ted by			
(Species name)	EPBC ¹	In WA ²	Surveys	Databases	Likelihood		
Birds	2.20		Carroyo	Dutabacco			
Peregrine Falcon		S4	0	2	Likely		
(Falco peregrinus)		04	Ŭ	2	Likely		
Comments on likelihood: The Stur	l dy Area lies y	within the kr	own distributi	on of the Pere	arino Ealcon		
(Parrett at al. 2002) and the appaired	boo boon ro		rby on at loop				
(Barlett <i>et al.</i> 2003) and the species			iby on at leas				
(BirdLife Australia 2012); however, t	the Study A	rea contains	s only a very	small area of	naditat with		
potential to contain sites for nesting (Ironstone RI	age; 0.3% o	of the Study Ar	ea). If this sp	ecies occurs		
within the Study Area it is most likely	to be for hur	iting only, ai	nd not for nest	ing.			
Background Information	rino Eoloone o	ro charcoly di	stributed and cla	colv accordated y	with waterboles		
range and gorge environments, although the	ev do range wi	delv over river	ine and Acacia	woodland habitat	s when hunting		
(Aumann 2001, Garnett and Crowley 2000).	, at lange in				e men namnig		
Biology/ecology: The Peregrine Falcon is an	n aerial carnivor	e, which in the	e Australian arid z	one nests on inla	ind cliffs, in tree		
hollows and in steep-sided rocky outcrops	near water (P	izzey and Kn	ight 2007). The	species has a	home range of		
approximately 20 to 30 km ² .							
Reptiles							
Woma							
(Aspidites ramsayi)		54	0	1	Possible		
Comments on likelihood: The Stud	ay Area lies	on the edge	e of the known	n distribution d	of the woma		
(Wilson and Swan 2010) and does c	ontain a larg	je amount o	f habitat types	s consistent w	ith that used		
by this species (Spinifex Sandplain	and Spinifex	Stony Plair	n; 37.9% and	45.9% of the	Study Area,		
respectively), but the Woma was no	ot reported of	luring previo	ous surveys ii	n the vicinity	of the Study		
Area (Appendix A).							
Background information	(the data second const				
Laxonomy: Although the species itself is of appears to be threatened as opposed to the	t conservation	significance, it	IS the south-we	st (Wheatbelt) p	opulation which		
make this distinction.	norment popul		<i>ai.</i> 2002). The l				
Distribution/habitat: The Woma occurs in an	rid zones of We	estern Australia	a. The Woma oc	curs in woodland	, heathland and		
shrubland habitats often containing spinifex,	and shelters m	ainly in aband	oned burrows an	d soil cracks (W	ilson and Swan		
2010).	1		1		1		
Pilbara Olive Python			-	_			
(Liasis olivaceus barroni)	VU	S1	2	2	Likely		
Comments on likelihood: The Study Area lies within the known distribution of the Pilbara Olive							
Python (Wilson and Swan 2010) and the species was recorded during two of the four nearby surveys							
considered during the literature review (Appendix A); however, the Study Area contains only a very							
small area of habitat with potential to contain water pools and rocky crevices necessary to support							
residents of this species (Ironstone Ridge; 0.3% of the Study Area). The Major Drainage Line habitat							
type (7.3% of the Study Area) may also support individuals of this species, but due to its relatively							
open nature and the lack of gorges and crevices this is considered marginal habitat.							
Background information							
Distribution/habitat: The Pilbara Olive Pytho	n inhabits rocky	escarpments,	deep gullies and	l gorges within the	e Pilbara region		
and is often recorded near water holes and rive Biology/acology: The Pilbara Olive Python in	erine habitats (\ s Western Aust	Vilson and Swa	an 2008). species of spake	and can consum	ne mammale as		
large as rock wallables (Wilson and Swan 2	2008). Tracking	of individual	s using radiotele	metry has found	that individuals		
occupy distinct home ranges; however, male	s can travel lo	ng distances d	uring their breed	ing season from	June to July to		
locate females (DSEWPaC 2012a).				2			
Common name	Conservation status		Repor	Likelihood			
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(Species name)	EPBC ¹	In WA ²	Surveys	Databases	LIKEIII1000		
Great Desert Skink (<i>Liopholis kintorei</i>)	VU		0	1	Unlikely		

Comments on likelihood: The Study Area lies well to the west of the known distribution of the Great Desert Skink (DSEWPaC 2012, Wilson and Swan 2010). The closest known population of this species is in the Rudall River National Park (DSEWPaC 2012), almost 400 km south-east of the Study Area. Although the Spinifex Sandplain habitat type (37.9% of the Study Area) is consistent with that used by this species, the species is associated with habitats further inland in the central deserts. The Great Desert Skink was not reported during any of the four previous studies in the vicinity of the Study Area (**Appendix A**).

Background information

Distribution/habitat: The current distribution of the Great Desert Skink is thought to consist of seven isolated populations in Australia (DSEWPaC 2012). Three of these populations occur in the eastern interior of Western Australia in the Gibson and Great Sandy Desert at Patjarr, Lake Mackay and Rudall River National Park. In the Northern Territory, populations persist in the Tanami Desert, Uluru-Kata Tjuta National Park and the Yulara lease lands, while in South Australia one population is known to exist at Watarru on the Anangu Pitjantjatjara Lands. This species is known to occur amongst Spinifex hummocks over arid red sand flats or loamy clay soils (Wilson and Swan 2010).

Biology/ecology: The Great Desert Skink is a large, smooth bodied lizard that measures, on average, 200 mm long and up to 350 g in body mass (Pavey 2006). The species lives communally in warren systems with multiple entrances, dug amongst spinifex grasslands in sandy soils (Moseby *et al.* 2009). The Great Desert Skink is thought to forage nocturnally (Wilson and Swan 2010), consuming a wide variety of invertebrates and small vertebrates, as well as the leaves, flowers and fruits of plants (Pavey 2006).

¹ Status under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 – EN, Endangered, VU,

Vulnerable; ² Status under the Western Australian Wildlife Conservation Act 1950 – S1, Schedule 1, S4, Schedule 4, or the DEC Priority Fauna List – P4, Priority 4 Fauna; see Appendix B for full definitions of conservation status

4.3.2. Priority Fauna

The WA DEC 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. For the full definitions of Priority Fauna rankings, see **Appendix B**. The database and literature searches identified 15 species of Priority Fauna that potentially occur within the Study Area (**Table 6**), including one species, the Brush-tailed Mulgara, that is also listed as Threatened under the EPBC Act and is therefore discussed in **Section 4.3.1**. Of the remaining 14 species, those that could possibly occur or are likely, very likely or confirmed as occurring within the Study Area are discussed briefly below. Those considered unlikely to occur are excluded from further discussion (but see **Table 6** for justification of their likelihood of occurrence within the Study Area).

Table 6: Priority fauna potentially occurring in the Study area

Common name	Conservat	ion status	IS Reported by						
(Species name)	EPBC ¹	In WA ²	Surveys	Databases	Likeimood				
Mammals									
Brush-tailed Mulgara (<i>Dasycercus blythi</i>)	VU	P4	0	1	Very likely				
Comments on likelihood: See Section 4.3.1 for comments and background information.									
Ghost Bat (<i>Macroderma gigas</i>)		P4	3	1	Very likely				
Comments on Intermoda: The Study Area lies within the known distribution of the Ghost Bat, the species was recorded during three of the four nearby surveys considered during the literature review (Appendix A) and the abandoned Lalla Rookh mine, a known maternity roost site for the species (DSEWPaC 2012a), is on the boundary of the Study Area. The Study Area itself, however, contains only a very small area of habitat with potential to contain caves for roosting (Ironstone Ridge; 0.3% of the Study Area). If this species occurs within the Study Area, is most likely to be for hunting only and not for roosting.									
Distribution/habitat: Ghost bats occupy a va (Van Dyck and Strahan 2008), and roost in ur mine shafts (Menkhorst and Knight 2004). intermittently as short-term transient roosts and formations are used by maternity colonies (Arr indicative of its use. The transient day roosts microclimates similar to ambient conditions, (Armstrong and Anstee 2000). Domed ceiling exclusive to, maternity caves. Deep, humid dome ceilings are associated with permanent (Biology/ecology: The Ghost Bat is Australia large insects, frogs, lizards, small mammals a forming nursery colonies and each bearing a s is distributed around regional maternity sites, o Ghost Bats have large and well developed eye 2008). Unlike other microbats, Ghost Bats do echolocation recording may not always detect to distinguish from other ultrasonic signals, inc (<i>Taphozous georgianus</i>) in the confines of a ca	riety of habitats adisturbed cave In the Pilbara d for feeding ac nstrong and An s or feeding site whereas roost s, which assist and complex n Ghost Bat occup 's only carnivor and other. Gho ingle pup arour of which approxi- es and ears and o not use an ec their presence cluding some hi- ave.	a, from the arid s, usually with , a number of tivity by an indi- stee 2000). The s of Ghost Ba s for breeding in creating hun- nine shafts and bancy and mater ous bat and is bost Bats mate and September. mately ten are d scan an area holocation call . Further, the of igher harmonic	Pilbara to the rai several entrance: i natural formatic vidual or small nu- e structure and m ts are often shall activity have a nid microclimates d deep, humid ca ernity roosts (Hall known to feed of between July and Genetic testing h known to exist (V before swooping continuously duri echolocation calls components from	nforests of Northes, in deep fissure ons are used by imbers of individu- nicroclimate of a row overhangs an relative humidity, are often preser- aves with several <i>et al.</i> 1997). On a variety of sp d August, with bro- has shown that th an Dyck and Stra- on prey (Van Dy- ing flight. Conse- s of the Ghost Ba- n the Common S	ern Queensland s or abandoned the Ghost Bat als, whilst other oost site can be d crevices, with of above 80% it in, but are not chambers and ecies, including reeding females e entire species han 2008). rck and Strahan quently, AnaBat t can be difficult heath-tailed Bat				

Common name	Conservat	ion status	Repor	ted by					
(Species name)	EPBC ¹	In WA ²	Surveys	Databases	Likelihood				
Western Pebble-mound Mouse (<i>Pseudomys chapmani</i>)		P4	3	1	Confirmed				
Comments on likelihood: The pre	sence of the	e Western F	ebble-mound	Mouse in the	Study Area				
has been recorded unambiguously;	in 2001, ac	tive mound	s of the spec	ies were seer	n at multiple				
locations during a fauna survey of a	proposed ha	aul road cori	ridor for the Pa	anorama Proje	ect (Bamford				
Consulting Ecologists 2001). All records were obtained in the Spinifex Stony Plain habitat type									
(45.9% of the Study Area). The spe	cies was als	so reported	in two of the	other four nea	arby surveys				
considered during the literature review	w (Appendix	(A).							
Background information		,-							
Distribution/habitat: Populations are widespr	ead throughout	the ranges of	the Pilbara (Anste	e 1996). Suitabl	e habitat for the				
Western Pebble-mound Mouse is patchily dis	tributed, but it i	s known to ha	ve a preference f	or hilly, rocky lar	dscapes with a				
eucalvpt overstorev and grassy understorev a	re preferred (Fo	ord and Johnso	n 2007). It should	d be noted that th	e prevalence of				
mounds is not necessarily a reliable indicate	or of abundance	e or even pres	sence, as mound	s are often used	by successive				
generations (Anstee 1996, Ford and Johnson	2007) and ma	y persist in the	e landscape for m	any years. A hig	gh proportion of				
inactive mounds recorded may be indicative of	a population th	at has declined	d substantially ove	er the previous de	cade(s).				
9.0 m ² (Van Dyck and Strahan 2008) Breed	ding for this so	ecies can occu	ir throughout the	vear and female	s may produce				
several litters per year of up to four young each	h (Van Dyck and	d Strahan 2008	3).	jour, and remain					
Long toiled Dupport									
(Sminthonoia longiagudata)		P4	0	1	Possible				
(Sminthopsis longicaudata)									
Comments on likelihood: The St	udy Area lie	es within th	e known distr	ibution of the	Long-tailed				
Dunnart, but the species is rare and	usually sca	ttered (Van	Dyck and Str	ahan 2008).	The species				
was not found during any of the four	nearby surve	eys conside	red during the	literature revi	ew, and only				
a small part of the Study Area cont	ains habitat	types that of	could be cons	idered suitabl	e (Ironstone				
Ridge; 0.3% of the Study Area) or ma	arginal (Stong	y Rise; 8.4%	6 of the Study	Area).					
Background information									
Distribution/habitat: The Long-tailed Dunna	rt is a rock-dwe	elling specialist	(Freeland et al.	1988). It typically	occurs in arid,				
Records come from widely scattered location	t-topped nills, p s in the Austral	ian arid zone	including the Gib	s (van Dyck and son Desert Murc	Stranan 2008).				
Carnarvon Basin and Pilbara region (Van Dyc	k and Strahan 2	008).							
Biology/ecology: The long, mobile tail of the	Long-tailed Dur	nnart is though	t to aid its agility a	and movement ar	nongst rocks by				
providing greater balance (Menkhorst and Kr	night 2010). Th	ne Long-tailed	Dunnart feeds or	invertebrates ar	id may become				
torpid over the colder months (Van Dyck and S	Strahan 2008).								
Short-tailed Mouse		D4	0	1	Dogoible				
(Leggadina lakedownesis)		Г4	0	I	FUSSIBle				
Comments on likelihood: The St	l judy Area lie	l s within the	e known distr	ibution of the	Short-tailed				
Mouse and many of the babitat type	s in the Stu	dv Area ma	v he canable	of supporting	the species				
(which is found in a diverse range of	of habitat typ	es: see Va	n Dvck and S	trahan 2008)	The Short-				
tailed Mouse was not reported during	a any of the	four nearby		idered during	the literature				
tailed wouse was not reported during any of the four hearby surveys considered during the literature									
Background information	carcines yield				, 2012).				
Distribution/habitat: The Short-tailed Mouse	utilises a varie	ty of different h	nabitats including	spinifex and tuss	ock grasslands,				
samphire and sedgelands, Acacia shrublands	, tropical Euca	<i>lyptu</i> s woodlan	ds and stony ran	ges. Most of the	ese habitats are				
seasonally inundated on red or white sandy-cla	ay soils (Van Dy	ck and Straha	n 2008).	devide of the t	and a share to the				
Biology/ecology: Short-tailed Mice are nocturnal, largely solitary and individuals spend the day in simple, single-chambered									

Common name	Conservat	ion status	Repor	ted by	I livelike e el				
(Species name)	EPBC ¹	In WA ²	Surveys	Databases	Likelinood				
Spectacled Hare-wallaby									
(Lagorchestes conspicillatus		P3	1	1	Confirmed				
leichardti)									
Comments on likelihood: The pre-	esence of th	ne Spectacle	ed Hare-walla	by in the Stu	dy Area has				
recently been recorded unambiguous	sly; in 2006,	one individu	ual was seen	during a fauna	a survey of a				
proposed haul road corridor for the F	Panorama Pi	roject (Biota	2007). The l	nabitat type at	the location				
of the record is Spinifex Sandplain (3	7.9% of the	Study Area)	, adjacent to S	Spinifex Stony	Plain habitat				
(45.9% of the Study Area). During	(45.9% of the Study Area). During the same survey, tracks of the Spectacled Hare-wallaby were								
seen at the location of the individua	I sighted, a	s well as in	three other i	nstances with	in the Study				
Area. Of these, one instance was lo	ocated in Sp	inifex Sand	plain, and the	other two we	re located in				
Spinifex Stony Plain.									
Background information	iodia hummock	aracelande tue	seock grasslands	and Acacia shruh	lande				
Threats: The abundance of the Mainland S	Spectacled Har	e-wallaby has	declined drama	tically within the	Pilbara region,				
possibly due to fox predation and inappropria	ate fire regime	s, which have	prevented the de	evelopment of th	e large, mature				
grasslands it requires for shelter (Van Dyck an	d Strahan 2008	5).							
Birds									
Bush Stone-curlew		D4	2	2	Confirmed				
(Burhinus grallarius)		F4	2	2	Commed				
Comments on likelihood: The pre	esence of th	e Rush Sto	ne-curlew in	the Study Are	a has heen				
recorded unambiguously: in 2006 in	dividuals we	ere heard di	iring a fauna :	survey of a pr	oposed haul				
road corridor for the Panorama Proje	ct (Biota 20	07) They w	vere also repo	orted in 2001	during fauna				
surveys of the same area (Bamford	Consulting	Ecologists	2001) One	record (Biota	a 2007) was				
associated with the Major Drainage	Line habita	at type (7.3	% of the Stu	dv Area), wh	ile the other				
records (Bamford Consulting Ecologi	sts 2001) w	ere associat	ted with the S	pinifex Stony	Plain habitat				
type (45.9% of the Study Area).									
Background information									
Distribution/habitat: The Bush Stone-curlew	is found in a ra	inge of habitats	s including open v	woodland, dry wa	ter courses with				
fallen branches, leaf litter and sparse grass (Pi	zzey and Knigh	it 2007). a slight depres	sion on the grour	d or at the foot of	shrubs or trees				
(Johnstone and Storr 1998).	is consisting of	a silgin depies	sion on the grou		sinubs of trees				
Threats: In areas where foxes occur the speci	es has suffered	substantial de	clines, due to pre	dation of its eggs	(Johnstone and				
Storr 1998).									
Australian Bustard		D 4	0	0	O a set firme a st				
(Ardeotis australis)		P4	2	2	Confirmed				
Comments on likelihood: The pre	sence of th	ο Australiar	Bustard in t	the Study Are	a has heen				
recorded unambiguously: in 2006 inc	dividuals we	e Australiai re seen on t	hree occasion	ne Sludy Ale					
a proposed haul road corridor for the	e Panorama	Project (Bi	ota 2007) O	ne sighting w	as within the				
Major Drainage Line habitat type (7.3	3% of the S	tudv Area).	and the other	two sightings	were within				
the Spinifex Sandplain habitat type (3	87.9% of the	Study Area). There are a	also more rece	nt confirmed				
sightings of the Australian Bustard v	vithin the St	udv Area. a	, long access t	racks in the v	ricinity of the				
abandoned Lalla Rookh mine (M Young, pers obs).									
Background information	0,1	/							
Distribution/habitat: The Australian Bustard occurs over much of Western Australia, with the exception of the more heavily									
wooded southern portions of the state (Johnstone and Storr 1998). Its wider distribution includes eastern Australia and New Guinea. The Australian Bustard inhabits open dry woodlands of Mulda, arid shrublands and tussock grasslands supporting.									
spinifex species (Johnstone and Storr 1998, I	Morcombe 200	3) along with o	grasslands and d	rainage areas pa	rticularly after a				
series of years of above average rainfall (John	stone and Storr	⁻ 1998).		- '	-				
Biology/ecology: Generally, this species is	considered sca	arce to commo	on depending on	season and hat	bitat. It has an				
(Marchant and Higgins 1993).									

Common name	Conservat								
(Species name)	EPBC ¹	In WA ²	Surveys	Databases	Likelinood				
Grey Falcon (<i>Falco hypoleucos</i>)		P4	0	1	Possible				
Comments on likelihood: The Study Area lies within the known distribution of the Grey Falcon									
(Morcombe 2003), but the species is patchily distributed and sightings are rare (Barrett <i>et al.</i> 2003). If the species occurs within the Study Area, it is likely to be only on an intermittent basis due to its nomadic nature									
Background information Distribution/habitat: The Grey Falcon main annual rainfall is less than 500 mm (Garnett stony plains and <i>Acacia</i> scrublands (Morcomb Biology/ecology: This species can be rare, re	Background information Distribution/habitat: The Grey Falcon mainly occurs around inland ephemeral and permanent drainage systems where annual rainfall is less than 500 mm (Garnett <i>et al.</i> 2011). The Grey Falcon inhabits lightly wooded countryside, especially stony plains and <i>Acacia</i> scrublands (Morcombe 2003). Biology/ecology: This species can be rare, resident or nomadic to most of the semi-arid interior of Western Australia								
Pictorella Mannikin (<i>Heteromunia pectoralis</i>)		P4	0	2	Unlikely				
Comments on likelihood: The Study Area lies outside of the known distribution of the Pictorella Mannikin (Barrett <i>et al.</i> 2003, Morcombe 2003). The sole record of this species in the vicinity of the Study Area, identified by two database searches (Appendix A), is from Pardoo Creek (BirdLife Australia 2012). This location is almost 100 km from the Study Area and the individual observed was most likely a vagrant from further north, where the species is usually found.									
Eastern Curlew (<i>Numenius madagascariensis</i>)		P4	0	2	Unlikely				
Comments on likelihood: The Stu Curlew, which is coastal areas aro suitable habitat for this species, and are associated with coastal locations	idy Area lies und Australi all records i (BirdLife Aus	s outside of a (Morcom dentified by stralia 2012)	the known obe 2003), the the database	distribution of Study Area searches for	the Eastern contains no this species				
Flock Bronzewing (<i>Phaps histrionica</i>)		P4	0	1	Possible				
Comments on likelihood: The Study Area lies within the known distribution of the Flock Bronzewing (Morcombe 2003) and much of the Study Area contains habitat suitable for this species (Spinifex Sandplain and Spinifex Stony Plain; 37.9% and 45.9% of the Study Area, respectively). The Flock Bronzewing is rarely sighted and patchily distributed (Barrett <i>et al.</i> 2003), however, and the only record from the vicinity of the Study Area (Appendix A) is over 50 years old (1957; DEC 2012). Background information									
NSW and Queensland across to the north-we include treeless grassy plains, saltbush, spinife	estern coast of ex and mulga (N	Western Austra Iorcombe 2003	alia (Pizzey and I 3).	Knight 2007). Pr	eferred habitats				
Pin-striped Finesnout Ctenotus (Ctenotus nigrilineatus)		P1	0	1	Unlikely				
Comments on likelihood: The Study Area lies just outside of the known distribution of the Pin- striped Finesnout <i>Ctenotus</i> , which is known only from Woodstock in the wider region of the Study Area (Wilson and Swan 2010). The species is known from spinifex grasslands at the base of granite outcrops; in the absence of any further information on the habitat preferences of this species, it is									

Common name	Conservat	ion status	Repor	ted by	Likalihaad		
(Species name)	EPBC ¹	In WA ²	Surveys	Databases	Likeimood		
A species of blind snake (<i>Ramphotyphlops ganei</i>)		P1	0	1	Possible		
Comments on likelihood: The Study Area is within the distribution of <i>R. ganei</i> , and the species has been reported nearby on three occasions since 2005 (DEC 2012); however, the Study Area contains							
only a very small portion of habitat the and the species is apparently rare and	hat may be d patchily dis	suitable (Irc stributed (W	ilson and Swa	; 0.3% of the n 2010).	Study Area)		
Background information Distribution/habitat: This species of blind sr number of recorded specimens. Although rec with moist gorge and gully habitats (Wilson and	Background information Distribution/habitat: This species of blind snake is endemic to the Pilbara region and is known from only a relatively small number of recorded specimens. Although records for this species are sparse and widespread, it is thought to be associated with moist gorge and gully habitats (Wilson and Swan 2010).						
Dampierland Plain Slider (<i>Lerista separanda</i>)		P2	0	1	Unlikely		
Comments on likelihood: Although there is a single record of the Dampierland Plain Slider from east of Goldsworthy, approximately 150 km north-east of the Study Area (DEC 2012), the Study Area lies well to the south-west of the generally accepted distribution of this species (the Kimberley coast; Wilson and Swan 2010). Given the species is more associated with sandy coastal areas, it is not likely that the habitats within the Study Area are suitable for the Dampierland Plain Slider							

¹ Status under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* –VU, Vulnerable; ² Status under the DEC Priority Fauna List – P1, Priority 1 Fauna, P2, Priority 2 Fauna, P3, Priority 3 Fauna, P4, Priority 4 Fauna; see **Appendix B** for full definitions of conservation status

4.3.3. Migratory Birds

Many species of migratory bird are listed under the EPBC Act, the WC Act and international agreements including the Japan-Australia Migratory Bird Agreement, the China-Australia Migratory Bird Agreement, Republic of Korea Australia Migratory Bird Agreement and the Bonn Convention (The Convention on the Conservation of Migratory Species of Wild Animals).

The database searches and literature review identified 41 listed Migratory bird species that have the potential to occur in the Study Area and its surrounds (**Table 7**), including one species, the Eastern Curlew, that is also listed as Priority fauna and is therefore discussed in **Section 4.3.2**. Of the 40 other species, those that possibly occur are discussed briefly below (at the top of **Table 7**). Those considered unlikely to occur within the Study Area are excluded from further discussion (but see the remainder of **Table 7** for justification of their likelihood of occurrence within the Study Area).

Broadly speaking, the occurrence of migratory waterbirds in arid Australia is highly sporadic and many species are only likely to be present in favourable seasons when water is plentiful (Halse *et al.* 1998, Kingsford and Norman 2002, Kingsford *et al.* 2010). As no major wetlands or substantial, natural water bodies occur within the Study Area, the occurrence of most migratory waterbirds would be occasional only, and these are unlikely to be dependent on the habitats present.

Table 7:	Migratory	/ birds	potentially	/ occurring	within	the Study	area
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Common name	Conservat	tion status	Repor	ted by				
(Species name)	EPBC ¹	In WA ²	Surveys	Databases	Likelihood			
Fork-tailed Swift (<i>Apus pacificus</i>)	М	S3	0	3	Likely			
Comments on likelihood: The Stu	ldy Area is v	within the kr	nown distributi	on of the Forl	k-tailed Swift			
(Morcombe 2003), and the species has been recorded from locations around the Study Area on seven occasions since 1998 (BirdLife Australia 2012). The nature of the behaviour of this species means that it may only fly over the Study Area, however, without specifically using the habitats within.								
Background information Distribution/habitat: The species is found in a wide range of habitats from rainforests to semi desert environments often seen at very high air space or scooping water on the wing from small lakes and pools (Pizzey and Knight 2007). Biology/ecology: The Fork-tailed Swift is a nomadic species that may be seen before and after storm fronts or tropical cyclonic events, that are associated with an increase in insect activity on which the species feeds. (Johnstone and Storr 2004).								
Oriental Plover (<i>Charadrius veredus</i>)	М	S3	0	3	Likely			
Comments on likelihood: Grassland wader; the Study Area is within the distribution of the Oriental Plover, much of the Study Area contains suitable habitat (Spinifex Sandplain and Spinifex Stony Plain; 37.9% and 45.9% of the Study Area, respectively), and the species has been recorded from locations around the Study Area on six occasions since 1998 (BirdLife Australia 2012). The Oriental Plover is patchily distributed (Barrett <i>et al.</i> 2003), however, and if it does occur in the Study Area it is likely to be only intermittently when conditions are forwardable.								
Background information Distribution/habitat: The Oriental Plover bree non-breeding period in northern Australia (Ban Australia (Bamford <i>et al.</i> 2008). This specie areas, rarely feeding in wet habitats but may of 2007).	eds in northern mford <i>et al.</i> 200 s favours dry g ccupy mudflats	China and Mo 8). All importa rasslands, par or beaches to	ongolia and the b int sites in the no ticularly shorter g roost when warm	ulk of the popula n-breeding period rassland areas o conditions preva	tion spends the are in northern r recently burnt il (Geering <i>et al.</i>			
Rainbow Bee-eater (<i>Merops ornatus</i>)	М	S3	4	3	Confirmed			
Comments on likelihood: The presence of the Rainbow Bee-eater in the Study Area has been recorded unambiguously (M Young, pers obs 2012 – numerous individuals seen at 722129 7664231, WGS84 50K). There have been numerous recent reports from the surrounding area (Appendix A), and most of the habitat types within the Study area are suitable for this species.								
Background information Distribution/habitat: The Rainbow Bee-eater occupies numerous habitats including open woodlands, sandpits, riverbanks, road cuttings, beaches, cliffs, mangroves and rain forests (Pizzey and Knight 2007). The Rainbow Bee-eater can occur as a resident, breeding visitor, passage migrant or winter visitor (Pizzey and Knight 2007). Biology/ecology: This species is insectivorous, with bees and flies representing the bulk of its diet. The Rainbow Bee-eater nests in burrows dug at a slight angle in flat ground and sandy banks (Johnstone and Storr 1998). It is also known to nest in sandy embankments and cuttings and often perches on man-made structures such as power lines and fences (Johnstone and								

sandy embankments and cuttings and often perches on man-made structures such as power lines and fences (Johnstone a Storr 1998). As a consequence, it is commonly seen in areas occupied by humans such as urban areas and mining camps.

Common name	Conservat	ion status	Repor	ted by					
(Species name)	EPBC ¹	In WA ²	Surveys	Databases	Likelihood				
White-bellied Sea-eagle (<i>Haliaeetus leucogaster</i>)	М	S3	0	3	Likely				
Comments on likelihood: The Study Area lies within the known distribution of the White-bellied Sea-eagle (Morcombe 2003), a coastal raptor, and there are multiple records for the species in the vicinity of the Study Area (some as far inland as Marble Bar; BirdLife Australia 2012). The Study Area contains only a small amount of habitat capable of supporting this species (Major Drainage Line; 7.3% of the Study Area), however, and if the species were to occur in the Study Area it would only be on an intermittent basis while sufficiently large pools of water persist following the wet season. Background information Distribution/habitat: The White-bellied Sea-eagle usually occupies coastal habitats, over reefs, islands, beaches, estuaries, etc. but also has been expected from coastanally flooded inland augment flooded inland augment is has been expected from the species of the species and logoes it has been expected from the species in the species and logoes it has been expected from the species in the species and logoes it has been expected from the species in the species and logoes it has been expected from the species in the species and logoes it has been expected from the species in the species and logoes it has been expected from the species in the species and logoes it has been expected from the species in the species and logoes it has been expected from the species of the species and logoes it has been expected from the species and logoes it has been expected from the species and logoes it has been expected from the species and logoes it has been expected from the species and logoes it has been expected from the species and logoes it has been expected from the species and logoes it has been expected from the species and logoes it has been expected from the species and logoes it has been expected from the species and logoes it has been expected from the species and logoes it has been expecies and logoes it has bee									
on the large pools of major rivers (Barrett <i>et al</i> Threats: The main threats to the White-bellier of nesting pairs by human activity. Other pote and the deterioration of inland water resources	2003, Morcom d Sea-eagle are ential threats in (DSEWPaC 20	be 2003). the loss of hal clude poisoning 012b).	bitat due to land c g, shooting, comp	levelopment, and betition with Wedg	the disturbance ge-tailed Eagles				
Eastern Curlew (<i>Numenius madagascariensis</i>)	М	P4 / S3	0	2	Unlikely				
Comments on likelihood: See Section 4.3.1 for comments and background information.									
Asian Dowitcher (<i>Limnodromus semipalmatus</i>)	М	S3	0	2	Unlikely				
Comments on likelihood: Wading there is no suitable habitat within the	bird; the S Study Area.	tudy Area is	s outside of it	s normal dist	ribution, and				
Barn Swallow (<i>Hirundo rustica</i>)	М	S3	0	3	Unlikely				
Comments on likelihood: Coasta there is no suitable habitat within the	bird; the S Study Area	tudy Area is (cliffs, towns	s outside of it , often near w	s normal dist ater; Morcom	ribution, and be 2003).				
Bar-tailed Godwit (<i>Limosa lapponica</i>)	М	S3	0	2	Unlikely				
Comments on likelihood: Wading there is no suitable habitat within the	bird; the S Study Area.	tudy Area is	s outside of it	s normal dist	ribution, and				
Black-tailed Godwit (<i>Limosa limosa</i>)	М	S3	0	2	Unlikely				
Comments on likelihood: Wading bird; the Study Area is outside of its normal distribution, and there is no suitable habitat within the Study Area.									
Broad-billed Sandpiper (<i>Limicola falcinellus</i>)	М	S3	0	2	Unlikely				
Comments on likelihood: Wading bird; the Study Area is outside of its normal distribution, and there is no suitable habitat within the Study Area.									

Common name	Conservat	tion status	Renor	ted by					
(Species name)	EPBC ¹	In WA ²	Surveys	Databases	Likelihood				
Caspian Tern (<i>Hydroprogne caspia</i>)	M	S3	0	2	Unlikely				
Comments on likelihood: Seabird; the Study Area is outside of its normal distribution, and there is no suitable habitat within the Study Area.									
Cattle Egret (<i>Ardea ibis</i>)	М	S3	0	1	Unlikely				
Comments on likelihood: Wetland bird; the Study Area is just outside of its normal distribution, and there is no suitable habitat within the Study Area.									
Common Greenshank (<i>Tringa nebularia</i>)	М	S3	0	2	Unlikely				
Comments on likelihood: Wading bird; the Study Area is just outside of its normal distribution, and there is no suitable habitat within the Study Area.									
Common Sandpiper (<i>Actitis hypoleucos</i>)	М	S3	0	2	Unlikely				
Comments on likelihood: Wading bird; the Study Area is just outside of its normal distribution, and there is no suitable habitat within the Study Area.									
Common Tern (<i>Sterna hirundo</i>)	М	S3	0	2	Unlikely				
Comments on likelihood: Seabird; no suitable habitat within the Study A	the Study A rea.	rea is outsi	de of its norm	al distribution,	and there is				
Curlew Sandpiper (<i>Calidris ferruginea</i>)	М	S3	0	2	Unlikely				
Comments on likelihood: Wading there is no suitable habitat within the	bird; the S Study Area.	tudy Area i	s outside of it	ts normal dist	ribution, and				
Eastern Reef Egret (<i>Egretta sacra</i>)	М	S3	0	2	Unlikely				
Comments on likelihood: Wading there is no suitable habitat within the	bird; the Stu Study Area.	dy Area is ji	ust outside of	its normal dist	ribution, and				
Glossy Ibis (<i>Plegadis falcinellus</i>)	М	S3	0	2	Unlikely				
Comments on likelihood: Wetland bird; the Study Area is within its distribution, but there is no suitable habitat within the Study Area (well-vegetated wetlands, flooded pastures; Morcombe 2003).									

Common name	Conservat	tion status	Repor	ted by	Likelihood			
Great Knot (Calidris tenuirostris)	M	S3	0	2	Unlikely			
Comments on likelihood: Wading bird; the Study Area is outside of its normal distribution, and there is no suitable habitat within the Study Area.								
Greater Sand Plover (Charadrius leschenaultii)	М	S3	0	2	Unlikely			
Comments on likelihood: Wading there is no suitable habitat within the	bird; the S Study Area.	tudy Area is	s outside of it	s normal dist	ribution, and			
Grey Plover (<i>Pluvialis squatarola</i>)	М	S3	0	2	Unlikely			
Comments on likelihood: Wading bird; the Study Area is outside of its normal distribution, and there is no suitable habitat within the Study Area.								
Grey-tailed Tattler (<i>Tringa brevipes</i>)	М	S3	0	2	Unlikely			
Comments on likelihood: Wading bird; the Study Area is outside of its normal distribution, and there is no suitable habitat within the Study Area.								
Lesser Crested Tern (<i>Thalasseus bengalensis</i>)	М	S3	0	2	Unlikely			
Comments on likelihood: Seabird; no suitable habitat within the Study A	the Study A rea.	rea is outsio	de of its norm	al distribution,	and there is			
Lesser Frigatebird (<i>Fregata ariel</i>)	М	S3	0	2	Unlikely			
Comments on likelihood: Pelagic there is no suitable habitat within the	seabird; the Study Area.	Study Area	is outside of	its normal dist	ribution, and			
Lesser Sand Plover (Charadrius mongolus)	М	S3	0	2	Unlikely			
Comments on likelihood: Wading there is no suitable habitat within the	bird; the S Study Area.	tudy Area is	s outside of it	s normal dist	ribution, and			
Little Tern (<i>Sternula albifrons</i>)	М	S3	0	2	Unlikely			
Comments on likelihood: Seabird; the Study Area is outside of its normal distribution, and there is no suitable habitat within the Study Area.								

Common name	Conservat	ion status	Repor	ted by					
(Species name)	EPBC ¹	In WA ²	Surveys	Databases	Likelihood				
Long-toed Stint (<i>Calidris subminuta</i>)	М	S3	0	1	Unlikely				
Comments on likelihood: Wetland bird; the Study Area is within its distribution, but there is no suitable habitat within the Study Area (swamps and lakes with muddy edges; Morcombe 2003).									
Marsh Sandpiper (<i>Tringa stagnatilis</i>)	М	S3	0	2	Unlikely				
Comments on likelihood: Wetland bird; the Study Area is within its distribution, but there is no suitable habitat within the Study Area (coastal and inland wetlands; Morcombe 2003).									
Oriental Pratincole (<i>Glareola maldivarum</i>)	М	S3	0	3	Unlikely				
Comments on likelihood: Wetland bird; the Study Area is within its distribution, but there is no suitable habitat within the Study Area (coastal and inland wetlands; Morcombe 2003).									
Pacific Golden Plover (<i>Pluvialis fulva</i>)	М	S3	0	1	Unlikely				
Comments on likelihood: Wading there is no suitable habitat within the	bird; the S Study Area.	tudy Area is	s outside of it	s normal dist	ribution, and				
Pectoral Sandpiper (Calidris melanotos)	М	S3	0	2	Unlikely				
Comments on likelihood: Wetland suitable habitat within the Study Area	d bird; the S (coastal and	Study Area d inland wet	is within its d lands; Morcon	istribution, but hbe 2003).	t there is no				
Red Knot (<i>Calidris canutus</i>)	М	S3	0	2	Unlikely				
Comments on likelihood: Wading there is no suitable habitat within the	bird; the S Study Area.	tudy Area is	s outside of it	s normal dist	ribution, and				
Red-necked Phalarope (<i>Phalaropus lobatus</i>)	М	S3	0	2	Unlikely				
Comments on likelihood: Seabird; no suitable habitat within the Study A	the Study A rea.	rea is outsi	de of its norm	al distribution,	and there is				
Red-necked Stint (<i>Calidris ruficollis</i>)	М	S3	0	2	Unlikely				
Comments on likelihood: Wading suitable habitat within the Study Area	Comments on likelihood: Wading bird; the Study Area is within its distribution, but there is no suitable habitat within the Study Area (mudflats, marshes, beaches, floodwaters; Morcombe 2003).								

Common name	non name Conservation status Reported b				Likeliheed			
(Species name)	EPBC ¹	In WA ²	Surveys	Databases	Likelihood			
Ruddy Turnstone (<i>Arenaria interpres</i>)	М	S3	0	2	Unlikely			
Comments on likelihood: Wading bird; the Study Area is outside of its normal distribution, and there is no suitable habitat within the Study Area.								
Sanderling (<i>Calidris alba</i>)	М	S3	0	2	Unlikely			
Comments on likelihood: Wading there is no suitable habitat within the	bird; the S Study Area.	tudy Area is	s outside of it	s normal distr	ribution, and			
Sharp-tailed Sandpiper (<i>Calidris acuminata</i>)	М	S3	0	2	Unlikely			
Comments on likelihood: Wetland suitable habitat within the Study Area	d bird; the S (coastal and	Study Area i d inland wet	is within its d ands; Morcon	istribution, but 1be 2003).	there is no			
Terek Sandpiper (<i>Xenus cinereus</i>)	М	S3	0	2	Unlikely			
Comments on likelihood: Wading there is no suitable habitat within the	bird; the S Study Area.	tudy Area is	s outside of it	s normal dist	ribution, and			
Whimbrel (<i>Numenius phaeopus</i>)	М	S3	0	2	Unlikely			
Comments on likelihood: Wading there is no suitable habitat within the	bird; the S Study Area.	tudy Area is	s outside of it	s normal distr	ribution, and			
White-winged Black Tern (<i>Chlidonias leucopterus</i>)	М	S3	0	2	Unlikely			
Comments on likelihood: Wetland bird; the Study Area is within its distribution, but there is no suitable habitat within the Study Area (coastal and inland wetlands; Morcombe 2003).								
Wood Sandpiper (<i>Tringa glareola</i>)	М	S3	0	2	Unlikely			
Comments on likelihood: Wetland suitable habitat within the Study Area	d bird; the S (freshwater	Study Area swamps, la	is within its di kes, flooded p	istribution, but asture; Morco	there is no mbe 2003).			

¹ Status under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* – M, Migratory; ² Status under the Western Australian Wildlife Conservation Act 1950 – S3, Migratory, or the DEC Priority Fauna List – P4, Priority 4 Fauna; see **Appendix B** for full definitions of conservation status

4.4. Short Range Endemic Invertebrate Fauna Habitat

Five broad fauna habitats were identified in the Study Area (**Table 3**, **Figure 8**, **Figure 9**). These habitats were broadly categorised as having a high, medium or low potential to support SRE species based on the occurrence of sheltered microhabitats within the habitat or the isolated nature of the habitat within the surrounding landscape (**Table 8**). It should be noted that fauna habitats were mapped at a broad scale; therefore, microhabitats are not likely to be evenly distributed within them and habitat boundaries are likely to be accurate only to within 50 to 100 m. It was not feasible to map the wide range of specialised microhabitats that may be present in the Study Area; however, assessment based upon broad fauna habitats, or those of particular relevance to conservation significant fauna, provides a useful framework within which to discuss SRE species occurrence.

No habitats within the Study Area were considered to have high potential to support SRE species; however, the Major Drainage Line and Ironstone Ridge habitat types were considered to have medium potential to support SRE species. The Major Drainage Lines tend to occur in bands across the Study Area along its length, whereas the Ironstone Ridge habitat type occurs on the southern margin of the Study area (**Figure 8**, **Figure 9**). Both of these habitats have been previously recorded in close proximity in the surrounding area (Outback Ecology 2012a, in prep.). Although both of these habitats do occur in the Study Area, the majority of the Study Area is comprised of habitats with low potential to support SRE species, namely the Spinifex Stony Plain and the Spinifex Sandplain.

Habitat type	Potential to support SRE taxa	Rationale for classification	Extent in Study Area
Spinifex Stony Plain	Low	Spinifex Stony Plains are largely exposed and form an extensive and continuous habitat with only minor changes in vegetation.	4,384 ha (45.9%)
Spinifex Sandplain	Low	Spinifex Sand Plains form a habitat that is both extensive and well connected throughout the Study area and surrounding landscape	3,622 ha (37.9%)
Stony Rise	Low	Stony Rise habitat was exposed, extensive and well connected throughout the Study area and surrounding landscape	805 ha (8.4%)
Major Drainage Line	Medium	Drainage Lines retain moisture and tend to support a greater density of vegetation compared to the surrounding landscape.	700 ha (7.3%)
Ironstone Ridge	Medium	Ironstone Ridges tend to form sheltered habitat isolates that are protected from fire and are uncommon in the wider landscape.	33 ha (0.3%)
		Total [†]	9,544 ha (99.8%)

Table 8: Potential of habitats within the Study Area to support SRE invertebrate taxa

[†]due to rounding errors percentages sum to slightly less than 100%

4.5. Short Range Endemic Invertebrate Fauna Species

Database searches and a literature review yielded a total of 30 SRE invertebrate species that have been collected within a 100 km radius of the Study Area. No collection records were identified from within the Study Area. Four of these species were collected in close proximity to the Study Area during the Abydos and Sulphur Springs Terrestrial SRE invertebrate fauna surveys (Outback Ecology 2012a, in prep.). These species comprised the millipedes *Antichiropus* 'DIP005' and *Antichiropus* 'DIP034', the slater *Buddelundia* sp 11 and the pseudoscorpion *Feaella* 'PSE007'. For each of these species, suitable habitat (i.e. habitats where each of these species have been previously collected) does not occur or are of limited extent in the Study Area. It is therefore considered unlikely that these species occur within the Study Area.

Antichiropus 'DIP005'

The millipede *Antichiropus* 'DIP005' is a SRE species that was collected during both the Abydos and Sulphur Springs Terrestrial Short-range Endemic Fauna Assessments (Outback Ecology 2012a, in prep.). Since this species has been collected from a limited range in the Abydos and Sulphur Springs area (**Figure 10**), it is considered a SRE species. During these surveys, this species was collected from Ridge (southerly or easterly aspect), Gorge, Creekline, Riverine and Gully habitats. These habitats are all sheltered habitats in the landscape. Although *Antichiropus* 'DIP005' has been collected in close proximity to the Study Area, this species is unlikely to occur within the Study Area as there is a lack of suitable habitat.

Antichiropus 'DIP034'

The millipede *Antichiropus* 'DIP034' is a SRE species that was collected during both the Sulphur Springs Terrestrial Short-range Endemic Fauna Assessments (Outback Ecology 2012a, in prep.). Since this species has been collected from a limited range from the Sulphur Springs and Marble Bar area (**Figure 10**), it is considered a SRE species. During these surveys, this species was collected from Gully habitats. This habitat generally provides more shelter than other habitats in the surrounding landscape. Although *Antichiropus* 'DIP034' has been collected in close proximity to the Study area, this species is unlikely to occur within the Study area as there is a lack of suitable habitat.

• Buddelundia sp 11

The slater *Buddelundia* sp. 11 is a SRE species that has been collected from both the Abydos and Sulphur Springs Terrestrial Short-range Endemic Fauna Assessments (Outback Ecology 2012a, in prep.), as well as three other regional surveys (**Table 9**, **Figure 10**). Although this species has been collected at a number of sites in the area, its range is still limited to within 10,000 km² and therefore it is still considered an SRE species. During these surveys, this species was collected from Drainage Line, Gorge, Gully and Ridge habitats. Although *Buddelundia* sp. 11 has been collected in close proximity to the Study Area, this species is unlikely to occur within the Study area as there is limited suitable habitat.

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• Feaella 'PSE007'

The pseudoscorpion *Feaella* PSE007 is known from a single specimen collected from within Creekline habitat near Sulphur Springs by Biota (2007). The collection of a single specimen, despite repeated surveys, suggests that the species is very cryptic and may only be active during certain climatic conditions. Given the cryptic nature of the species and the record from a single location, this species has a low potential to occur in the Study area.

SRE species	Group	Source	Habitat(s)	Potential for occurrence in the Study area	Reason for potential occurrence
Antichiropus `DIP005`	Millipede	Abydos DSO Project (Outback Ecology 2012a)	Ridge (southerly or easterly aspect) Gorge Gully	Low	Habitat is limited in the Study area. Closest collection record is approximately 3 km SW of the Study area
Antichiropus `DIP034`	Millipede	Sulphur Springs Project (Outback Ecology in prep.)	Gully	Low	Habitat is limited in the Study area. Closest collection record is approximately 3 km SW of the Study area
<i>Feaella</i> `PSE007`	Pseudoscorpion	Sulphur Springs Project (Biota 2007)	South facing cliff close to drainage line	Low	Habitat is limited in the Study area. Closest collection record 4 km S of the Study area by Biota in 2007.
<i>Buddelundia</i> sp. 11	Slater	Turner River Hub Project (Outback Ecology 2010b) Abydos DSO Project (Outback Ecology 2012a)	Gorge Ridge (southerly or easterly aspect) Gully Ridge (northerly or westerly aspect)	Low	Habitat is limited in the Study area. Closest collection record approximately 3.5 km S of the Study area.
<i>Buddelundia</i> sp. 18	Slater	Abydos DSO Project (Outback Ecology 2012a)	Gorge Ridge (southerly or easterly aspect) Gully Ridge (northerly or westerly aspect)	Low	Species has been collected from a number of locations across Pilbara. Closest records are from Abydos (199 specimens) approximately 1.5 km SW of the Study area. Similar habitat occurs in the Study area.
<i>Aop</i> s 'pilbara 2'	Scorpion	Abydos DSO Project (Outback Ecology 2012a)	Ridge (southerly or easterly aspect)	Low	Species has been collected at Abydos (4 specimens) located approximately 2km S of the Study area. Habitat occurs within the Study area.
<i>Tyrannocthonius</i> 'nr aridus'	Pseudoscorpion	Abydos DSO Project (Outback Ecology 2012a) Mt Dove DSO Project (Phase 1) (Outback Ecology 2010a)	Ridge (southerly or easterly aspect) Gully Ridge (northerly or westerly aspect)	Low	Habitats are limited in the Study area. Closest collection record 2 km S (33 specimens) and 90 91 km E (2 specimens) of the Study area respectively.

Table 9: SRE invertebrate collection records yielded by database searches and literature review

SRE species	Group	Source	Habitat(s)	Potential for occurrence in the Study area	Reason for potential occurrence
<i>Barrowdillo</i> sp. nov. 2	Slater	Turner River Hub Project (Outback Ecology 2010b)	Ridge (northerly or westerly aspect)	Low	Habitat is limited in the Study Area. Closest record is 55 km S of the Study area.
Kwonkan `MYG200`	Mygalomorph Spider	Giralia Mt Webber (ecologia 2011)	South facing slope	Low	Habitat is limited in the Study Area. Closest record is 55 km S of the Study Area.
<i>Karaops</i> sp. `Mt Webber`	Selenopid Spider	Turner River Hub Project (Outback Ecology 2010b)	Ridge (southerly or easterly aspect)	Low	Habitat is limited in the Study Area. Closest record is 55 km S of the Study Area.
<i>Karaop</i> s sp. 'Wodgina'	Selenopid Spider	Turner River Hub Project (Outback Ecology 2010b)	Calcrete Breakaway Ridge (southerly or easterly aspect) Gully	Low	Habitat is limited in the Study Area Closest record is located 64 km SW of the Study Area.
Gen. nov. sp. nov	Snail	Abydos DSO Project (Outback Ecology 2012a)	Gorge Ridge (southerly or easterly aspect)	Low	Habitat is limited in the Study Area. Closest record 2.5 km SW of the Study Area.
<i>Karaops</i> sp. 'Mt Dove`	Selenopid Spider	Mt Dove DSO Project (Phase 1) (Outback Ecology 2010a)	Ridge (southerly or easterly aspect)	Low	Species represented by a single record from a habitat isolate 70 km NW from the Study Area.
Troglochernes 'sp. nov. 001'	Pseudoscorpion	Mt Dove DSO Project (Phase 1) (Outback Ecology 2010a)	Ridge (southerly or easterly aspect)	Low	Species represented by five records from a habitat isolate from 70 km NW of Study Area
<i>Antichiropus</i> `Chichester`	Millipede	WAM Database (WAM 2012)	South facing Gully Floor Creek line	Low	Species is likely to have a very restricted distribution. Closest record 104km S of the Study Area.
Aname 'MYG100'	Spider	WAM Database (WAM 2012)	Spinifex plain	Low	Habitat does occur in the Study Area, however closest record is 60 km NW
Aname 'MYG103'	Spider	WAM Database (WAM 2012)	Spinifex plain	Low	Habitat does occur in the Study Area, however closest record is 60 km NW of Study Area
Synothele 'MYG115'	Spider	WAM Database (WAM 2012)	Spinifex plain	Low	Habitat does occur in the Study Area, however closest record is 60 km N of Study Area
Synothele 'MYG114'	Spider	WAM Database (WAM 2012)	Spinifex plain	Low	Habitat does occur in the Study Area, however closest record is 100 km SE of Study Area
Kwonkan `MYG091`	Mygalomorph Spider	WAM Database (WAM 2012)	Acacia, Spinifex sand plain	Low	Habitat does not occur in the Study Area
Aname 'MYG208'	Mygalomorph Spider	Turner River Hub Project (Outback Ecology 2010b)	Acacia, Spinifex sand plain	Low	Habitat does not occur in the Study Area

SRE species	Group	Source	Habitat(s)	Potential for occurrence in the Study area	Reason for potential occurrence
Aname 'MYG209'	Mygalomorph Spider	Turner River Hub Project (Outback Ecology 2010b)	Acacia, Spinifex sand plain	Low	Habitat does not occur in the Study Area
Synsphyronus 'PSE008'	Pseudoscorpion	WAM Database (WAM 2012)	Granite Outcrop	Low	Habitat does not occur in the Study Area
Sundochernes 'PSE021'	Pseudoscorpion	WAM Database (WAM 2012)	Granite Outcrop	Low	Habitat does not occur in the Study Area
Feaella 'PSE017'	Pseudoscorpion	Turner River Hub Project (Outback Ecology 2010b)	Riverine	Low	Habitat does not occur in the Study Area
Oratemnus 'PSE018'	Pseudoscorpion	WAM Database (WAM 2012)	Granite Outcrop	Low	Habitat does not occur in the Study Area
			Granite Outcrop		
Quistrachia turneri	Slater	Turner River Hub Project (Outback Ecology 2010b)	Ridge (southerly or easterly aspect	Low	Habitats are limited in the Study area. Closest collection record 50 km S of the Study Area.
			Calcrete Breakaway		
Spherillo? sp.	Slater	Turner River Hub Project (Outback Ecology 2010b)	Granite Outcrop	Low	Habitat does not occur in the Study Area
<i>Buddelundia</i> sp. 21	Slater	Mt Dove DSO Project (Phase 1) (Outback Ecology 2010a)	Ridge (southerly or easterly aspect)	Low	Habitat is limited in the Study Area. Closest collection record approximately 70 km W of the Study area.
Urodacus 'pilbara 13'	Scorpion	Turner River Hub Project (Outback Ecology 2010b)	Maritime grassland Low Acacia heath with Spinifex	Low	Habitat does not occur in the Study Area.



Figure 10: SRE Collection records yielded by database searches and literature review

5. POTENTIAL IMPACTS

5.1. Threatening Processes

Threatening processes relevant to the Pilbara bioregion have been identified by the Australian Natural Resources Audit (Australian Natural Resources Atlas 2009) and include feral predators, inappropriate fire regimes, grazing by introduced herbivores, and invasive weeds.

Threatening processes specifically associated with the Project are categorised as either direct or indirect impacts.

Direct impacts of the Project include:

- habitat removal and modification; and
- collision with vehicles.

Indirect impacts of the Project include:

- altered hydrology;
- noise and vibration;
- artificial light exposure;
- dust emissions;
- introduced flora; and
- introduced fauna.

5.1.1. Habitat Removal and Modification

The development of the Project will result in the loss of a maximum of 361 ha of habitat via land clearance within the 914 ha Application Area. It should be noted that the Indicative Project Footprint may not be representative of the final Project footprint and that clearing (up to the maximum of 361 ha) may occur anywhere within the Application Area according to Project requirements. The habitats present within the Study Area are well represented within the surrounding region and so a reduction in size of habitats is not considered a significant consequence; rather, the fragmentation of these habitats represents the primary consequence of habitat removal.

Four of the five broad fauna habitats identified within the Study Area have the potential to be impacted by land clearance and the construction of the haul road other associated infrastructure, as they fall within the Application Area (**Table 10**). Of these four habitats, Spinifex Sandplain and Spinifex Stony Plain will be subject to the greatest direct impact from clearance activities (**Table 10**). Most of the broad fauna habitats defined in this assessment are widely represented throughout the Pilbara bioregion (Australian Natural Resources Atlas 2007) and are relatively well connected across the landscape.

Land clearing is a necessary part of the Project, and represents the most direct impact on habitats and fauna assemblages present within the Study Area. Although mobile fauna may be able to avoid direct impact from operations, the degree of subsequent impact is dependent on the availability of suitable habitat elsewhere in the vicinity and the ability of species to disperse to these habitats. Nesting birds and their young may also be directly impacted, although, this potential impact can be reduced by considering the timing of clearance activities.

Land clearance is likely to result in the direct loss of individuals. Species at greatest risk are those that reside in habitats that are limited in their extent, such as Ironstone Ridge and Major Drainage Line; however, these habitat types within the Study Area are connected to occurrences of the same habitat types immediately adjacent to the Study Area. It is therefore expected that fauna impacted by the Project in these habitat types would have the capability to disperse outside of the Study Area readily.

Land clearing will directly remove potential SRE invertebrate fauna habitat resulting in habitat contraction and potentially habitat fragmentation. Short-range endemic invertebrate fauna species typically have poor powers of dispersal and are therefore unable to emigrate from land as it is being cleared. Should SRE species be present in disturbance areas, land clearing will result in the loss of these populations. The majority of habitat in the Study Area has a low potential to support SRE species, however there are areas of Major Drainage Line habitat, which has a medium potential to support SRE species and clearing of this habitat should be limited where practicable.

Broad fauna habitat type	Regional context	Extent in Study Area	Extent in Application Area	Extent in Project Footprint
Ironstone Ridge	Limited extent; significant	33 ha (0.3%)	0 ha (0.0%)	0 ha (0.0%)
Major Drainage Line	Widespread; significant	700 ha (7.3%)	66 ha (7.2)	12 ha (3.3%)
Spinifex Sandplain	Widespread; significant	3,622 ha (37.9%)	361 ha (39.5%)	172 ha (47.5%)
Spinifex Stony Plain	Widespread; significant	4,384 ha (45.9%)	463 ha (50.7%)	165 ha (45.8%)
Stony Rise	Widespread; limited significance	805 ha (8.4%)	24 ha (2.7%)	12 ha (3.3%)
	Totals⁺	9,544 ha (99.8%)	914 ha (100.1%)	361 ha (99.9%)

Table 10: Extent of fauna habitats within the Study Area and the application area

[†]due to rounding percentages do not sum to 100%

5.1.2. Collision with vehicles

Transport of ore along the proposed haul road would occur on a continuous basis (24 hours per day and seven days per week) at road speeds of up to 100 km/h. This equates to 56 truck movements per day for a mine life of five to six years. Consequently, vehicle collisions may have an impact on some fauna assemblages. Incidents typically only involve individuals; however, the cumulative effect they may have on small or isolated populations can be considerable. The proposed haul road corridor bisects the Stony Rise, Major Drainage Line, Spinifex Sandplain and Spinifex Stony Plain habitat types (**Figure 8**, **Figure 9**). Species that typically forage at night within these habitats (eg Northern Quoll, Pilbara Leaf-nosed Bat, Ghost Bat, Spectacled Hare-wallaby, Brush-tailed Mulgara, Bush Stone-curlew, Australian Bustard) may be at risk when traversing the haul road.

5.1.3. Altered Hydrology

Availability of water and nutrients is the primary limiting factor in arid and semi-arid environments (James *et al.* 1995). The degree to which ecosystems depend on groundwater (Hatton and Evans 1998) and retention of water after substantial rainfall varies with the particular structure and function of that ecosystem, which in turn are likely to vary over time. For example, floodplains, floodouts and riparian fringes are the most productive habitats in the landscape because soils are fertile and water supply is relatively continuous as a result of reliable run-on and accessible ground water.

The vast majority of ecosystems in the Pilbara region do not feature accessible water for any length of time and numerous species are associated with these relatively infertile parts of the landscape. However, small occurrences of productive, water dependent ecosystems are distributed within the region and these provide critical refuge and habitat for organisms in times of drought (James *et al.* 1995). These ecosystems are typically limited in their extent but they represent a key resource to a diversity of fauna (Murray *et al.* 2003), including vertebrate fauna.

Within the Study Area, the Major Drainage Line habitat type is a water dependent ecosystem (**Figure 8**, **Figure 9**). Localised interruption of hydrological flows where the haul road corridor bisects Major Drainage Line habitat may result in changes in water recharge and retention (Nevill *et al.* 2010). Removal of water from this habitat type, or a change in the timing, quantity, quality or distribution of water may impact negatively upon the Major Drainage Line ecosystem, thereby affecting the fauna assemblages that are dependent upon this habitat type.

5.1.4. Noise and Vibration

The construction of the haul road is likely to generate short-term noise and vibration due to general operation of heavy machinery and vehicles. However, the use of the haul road by road trains travelling at up to 100 km/hr is anticipated to generate noise and vibration 24 hours per day for a period of five to six years. The effects of noise on wildlife have been well studied, although responses vary depending on the species and on the age and sex of the individual animal (for comprehensive summaries see Larkin *et al.* 1996, Radle 2007).

General responses to noise, across a wide variety of animal species, range from interruptions in feeding and resting behaviour to complete abandonment of a habitat area. Noise may lead to reduced population densities in small mammals, nest failure and decreased population densities in birds (Slabbekoorn and Ripmeester 2008), and abandoning of roost sites and a reduced hunting

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efficiency in bats due to disturbance of their echolocation system. Constant levels of noise also interfere with species communication, via acoustic interference (Parris and Schneider 2009). Species that may be especially at risk of disturbed communication are those that use calls to communicate over larger distances, such as the conservation significant Bush Stone-curlew (*Burhinus grallarius*) which is known to occur in the Study area.

5.1.5. Artificial Light Exposure

The Project is likely to result in an increase in exposure of fauna to artificial light. Artificial light from construction and 24 hour per day haulage activities may have detrimental effects on resident bird, mammal and reptile species. It may interfere with biological and behavioural activities that are governed by the length of day or photoperiod, including reproduction, dormancy, foraging and migration (Bradshaw and Holzapfel 2007, Le Corre *et al.* 2002). Bird *et al.* (2004) found that nocturnal mice exposed to artificial light exploited fewer food patches compared to mice exposed to areas of less light, while nocturnal frogs exposed to artificial light have been known to suspend normal feeding and reproductive behaviour (Harder 2002).

Light pollution has also been shown to interfere with timing of songbird choruses, potentially leading to reduction in breeding success or survival (Miller 2006). Excessive light is likely to have an adverse effect on the natural foraging behaviour of bats, in particular the Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*), which is attracted to artificial light sources (DSEWPaC 2012b).

5.1.6. Dust Emissions

The development and operation of the Project will create dust emissions due to construction, haulage and general traffic activities. Dust emissions may affect surrounding vegetation. High levels of dust have been associated with a reduction in plant growth and productivity, resulting in degradation of the overall ecosystem and an increased risk of disease in plants (Farmer 1993). Dust has also been linked to changes in soil chemistry and the structure of vegetation communities (Farmer 1993). This reduces the quality of fauna habitats and is likely to impact on faunal assemblages within the area, due to a reduction in food resource availability and shelter.

Dust may directly pollute water bodies, such as waterholes found within Major Drainage Line habitat, by increasing turbidity or potentially altering water chemistry. This would affect fauna and flora dependent on these water sources.

5.1.7. Introduced Flora

Environmental weeds may be brought in by mobile equipment during construction and operation of the haul road. 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). 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, both Smyth *et al.* (2009) and Binks *et al.* (2005) found that even at low densities, Buffel Grass (*Cenchrus ciliaris*) affected the composition of ground vegetation, birds and ant fauna, leading to declines in some species.

5.1.8. Introduced Fauna

Introduced fauna (both herbivorous and predatory) cause fundamental changes to ecosystems, and have lead to the decline and extinction of many species in Australia (Abbott 2002, Burbidge and McKenzie 1989, Ford *et al.* 2001, Short and Smith 1994). Of the 19 Key Threatening Processes to native ecosystems and species listed under the EPBC Act, 11 are concerned with introduced flora and fauna.

The Project area may provide additional resources or habitat (eg via mobile camps during construction) that may attract and support a greater abundance of feral animals in the area, which in turn may adversely impact on populations of native fauna. Of concern would be an increase in the size of the local population of feral Cats (*Felis catus*), which are not only a predator of the Northern Quoll (*Dasyurus hallucatus*) but also directly compete for food resources and habitat requirements with this and other species. Introduced predators may also be attracted into the Project area as a result of the scavenging opportunities generated by the presence of road kill along the haul road.

5.2. Impacts On Fauna Habitats

Fauna habitat loss as a direct result of land clearing for the Project is considered one of the primary impacts on terrestrial fauna (both vertebrate and SRE invertebrate). Land clearance is a key threatening process, although it is recognised as a necessary component of developing a resources Project in an undeveloped/greenfield area. It is likely that sedentary fauna currently residing within areas to be cleared would be lost and more mobile fauna would be displaced.

A maximum of 361 ha of fauna habitat within the Application Area will be removed for the Project, spanning four different broad fauna habitats (**Table 10**, **Figure 8**, **Figure 9**). Of the broad fauna habitats occurring within the Study Area that have potential to be impacted, three are considered to be of significance to fauna assemblages and conservation significant fauna (ie Major Drainage Line, Spinifex Sandplain, Spinifex Stony Plain; **Table 10**). These habitats are discussed individually below in terms of the degree, nature and implication of impacts on them. The fourth broad fauna habitat type to be impacted by the Project, Stony Rise, is considered to be of limited significance; it is therefore excluded from further discussion.

5.2.1. Spinifex Sandplain

The ability of Spinifex Sandplain habitat to support fauna assemblages is dependent on fire regime, which comprises fire frequency, extent, intensity and timing. Areas of Spinifex Sandplain that remain long unburnt contain large, mature hummocks of spinifex (*Triodia* spp), which are considered an

important habitat element for fauna assemblages and in particular, fauna of conservation significance such as the Mulgara and Spectacled Hare-wallaby (Menkhorst and Knight 2010, Pizzey and Knight 2007). Both of these species have been recorded in the Study Area in this habitat type during previous surveys, as has the Australian Bustard (**Section 4.3**).

Spinifex Sandplain habitat is widespread within the Study Area (37.9% of the Study Area) and in the broader landscape. This habitat type is well connected in the broader landscape, and progressive clearing of vegetation is likely to allow fauna occurring within the proposed Application Area to disperse to adjacent areas of equivalent habitat. Furthermore, the broad nature of these habitats suggests that they are unlikely to be significantly impacted by the proposed Project.

5.2.2. Major Drainage Line

Major Drainage Line habitat consists of major rivers and drainage line habitat that support grassy Eucalypt and *Melaleuca* woodlands that are subject to regular flooding (eg the Strelley River and its tributaries). This is a significant habitat for fauna as it provides a range of microhabitats, such as permanent and seasonal water pools, moist depressions, sedges and rushes on alluvial soil, as well as a stable source of resources within vast areas of relatively resource-poor spinifex plains (How *et al.* 1991). The Rainbow Bee-eater, Australian Bustard and Bush Stone-curlew have been recorded in the Study Area in this habitat type during previous surveys (**Section 4.3**). Other fauna of conservation significance, such as the Northern Quoll, are also likely to utilise this habitat type (**Section 3.2**).

The Project area bisects Major Drainage Line habitat in several places (**Figure 8**, **Figure 9**). This habitat type is widespread in the broader landscape, only a relatively small area of this habitat type is likely to be impacted and these instances are contiguous with surrounding occurrences of this habitat. Fauna occurring within this habitat type are therefore unlikely to be impacted by the Project, from a regional perspective. Nonetheless, where Major Drainage Line habitat is traversed, steps should be taken to minimise hydrological impacts.

5.2.3. Spinifex Stony Plain

As for Spinifex Sandplain, the ability of Spinifex Stony Plain habitat to support fauna assemblages is linked to fire regime and the presence of large, mature hummocks of spinifex. Fauna of conservation significance such as the Spectacled Hare-wallaby and the Australian Bustard rely on the spinifex cover present (Menkhorst and Knight 2010, Pizzey and Knight 2007), and the Western Pebble-mound mouse relies on the abundance of small, evenly sized stones present in this habitat type. Each of these species has been recorded in the Study Area in this habitat type during previous surveys, as has the Bush Stone-curlew (**Section 4.3**). Although the Mulgara is more commonly associated with the Spinifex Sandplain habitat type, it has also been reported from Spinifex Stony Plain habitats (eg see Biota 2002).

Spinifex Stony Plain habitat is widespread within the Study Area (45.9% of the Study Area) and in the broader landscape. As with Spinifex Sandplain habitat, this habitat type is well connected in the broader landscape and progressive clearing of vegetation is likely to allow fauna occurring within the proposed Application Area to disperse to adjacent areas of equivalent habitat. Furthermore, the broad nature of these habitats suggests that they are unlikely to be significantly impacted by the proposed Project.

5.3. Impacts On Terrestrial Vertebrate Faunal Assemblages

This Study identified a total of 388 species of terrestrial vertebrate fauna that may occur within the Study area, consisting of 39 native mammals, eight introduced mammals, 216 birds, 110 reptiles, ten amphibians and five fishes.

The majority of these species form assemblages that occur across a variety of the habitats present within and surrounding the Study area. These assemblages are similar to those found in the surrounding landscape, as determined by previous surveys. Land clearance is likely to result in the direct loss of individuals during initial clearance 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. Impacts to fauna assemblages may be reduced by considering the timing of land clearing activities and other proposed works.

5.4. Impacts On Fauna Species Of Conservation Significance

The literature review and database searches identified 64 species of fauna of conservation significance that potentially occur in the Study Area (**Section 4.3**). Of these, 43 species are considered unlikely to occur in the Study Area. The other 21 species, which possibly occur or are likely, very likely or known to occur within the Study Area are:

- the Northern Quoll (*Dasyurus hallucatus*), which is listed as Endangered (EPBC Act) and Schedule 1 (WC Act);
- the Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*), Pilbara Olive Python (*Liasis olivaceus barroni*) and Greater Bilby (*Macrotis lagotis*), which are listed as Vulnerable (EPBC Act) and Schedule 1 (WC Act);
- the Brush-tailed Mulgara (*Dasycercus blythi*), which is listed as Vulnerable (EPBC Act) and Priority 4 (DEC Priority Fauna list);
- the Peregrine Falcon (*Falco peregrinus*) and Woma (*Aspidites ramsayi*), which are listed as Schedule 4 (WC Act);
- a species of blind snake (*Ramphotyphlops ganei*), which is listed as Priority 1 (DEC Priority Fauna list);
- the Spectacled Hare-wallaby (*Lagorchestes conspicillatus leichardti*), which is listed as Priority 3 (DEC Priority Fauna list);
- the Ghost Bat (*Macroderma gigas*), Long-tailed Dunnart (*Sminthopsis longicaudata*), Shorttailed Mouse (*Leggadina lakedownensis*), Western Pebble-mound Mouse (*Pseudomys*)

chapmani), Australian Bustard (*Ardeotis australis*), Grey Falcon (*Falco hypoleucos*), Flock Bronzewing (*Phaps histrionica*) and Bush Stone-curlew (*Burhinus grallarius*), which are listed as Priority 4 (DEC Priority Fauna list); and

• the Fork-tailed Swift (*Apus pacificus*), Oriental Plover (*Charadrius veredus*), Rainbow Beeeater (*Merops ornatus*) and White-bellied Sea-eagle (*Haliaeetus leucogaster*), which are listed as Migratory (EPBC Act) and Schedule 3 (WC Act).

Predetermined categories (**Table 11**) were used to rank the likely impacts of the Project on these fauna, from both local and regional perspectives (**Table 12**). Impacts were ranked based on the assumption that no management actions or mitigation strategies were to be implemented. The species in this section have been assessed in approximate order of conservation significance and level of impact (highest to lowest).

Recommended management actions and strategies to manage the impacts of the Project on conservation significant fauna were also formulated (**Table 12**). The level of impact on conservation significant fauna is likely to be reduced should the recommended actions and strategies be implemented. More general management recommendations for fauna habitats and native fauna assemblages are provided later in this report (**Section 6**).

	Description						
Impact	Localised impact (in the Application Area or surrounding 10 km)	Regional impact (in the surrounding 150 km)					
Negligible	No perceived effect on population	No perceived effect on species					
Minimal	No population decline expected	No species decline expected					
Low	Short-term population decline expected within Application Area (recovery expected after life of the Project)	Short-term species decline expected within the region (recovery expected after life of the Project)					
Moderate	Permanent population decline expected – no perceived threat to population persistence	Permanent species decline expected – no perceived threat to regional conservation status of species					
High	Permanent population decline expected – persistence of local population threatened	Permanent species decline expected – resulting in a change in conservation status of species					
Extreme	Local population extinction likely	Regional extinction likely					

Table 11: Ranking criteria for Project impacts on fauna of conservation significance

Common name	Species name	Conservation status		Likelihood of occurrence in
Common name	opecies name	EPBC ¹	In WA ²	Study Area
Northern Quoll	Dasyurus hallucatus	EN	S1	Likely
Localised impact: MINIMAL	Regional impact: MINIMAL		Suggested mar	nagement actions
 Optimal habitat for the Northern comprises deep gullies and gorges, ofter permanent water; a small amount of habitat type (Ironstone Ridge) occurs the Study Area, but it is not withit Application Area The Major Drainage Line and Stony habitat types within the Application particular within the southern portion. Study Area, are unlikely to support permiters of this species but do represuitable foraging habitat Clearing of the Indicative Project Forwould result in loss of 24 ha of porforaging habitat within the Application area have implications for the quality of Major Drainage Line habitat and for habitat that this species utilises There is increased potential for road individuals during night-time hours, espiwhere haul road infrastructure inter Major Drainage Line habitat and runs prostory Rise habitat 	Quoll Extent of habitat within Study A relative to available habitat in the volta finance of this Potential Northern Quoll habitat within the Study Area is relative to available habitat in the volta within the Study Area is relative to available habitat in the volta within the Study Area is relative to available habitat in the volta within the Study Area is relative to available habitat in the volta within the Study Area is relative to available habitat in the volta within the Study Area is relative to available habitat in the volta within the Study Area is relative to available habitat within the Study Area is relative to available habitat within the Study Area is relative to available habitat within the Study Area is relative to available habitat within the Study Area is relative to available habitat within the Study Area is relative to available habitat within the Study Area is relative to available habitat within the Study Area is relative to available habitat within the Study Area is relative to available habitat within the Study Area is relative to available habitat within the Study Area is relative to available habitat within the Study Area is relative to available habitat within the Study Area is relative to available habitat in the volta and the product of the optimal for supporting populations. Quolls (Ironstone Ridge) Notprint Outprint Notprint Outprint <td>rea is small wider region at identified atively well- indscape oject will not dentified as s of Northern</td> <td> Minimise foraging ha Stony Rise) Enforce veltheta Monitor an predators Educate so regarding Northern Question Any incider of a Northeta DEC, and (frozen) for and the WA </td> <td>destruction of Northern Quoll abitats (Major Drainage Line and within the Application Area nicle speed limits on Project roads d control feral animals and feral site personnel and contractors the conservation status of the uoll nt that results in injury to or death rn Quoll should be reported to the specimens should be retained further examination by the DEC M</td>	rea is small wider region at identified atively well- indscape oject will not dentified as s of Northern	 Minimise foraging ha Stony Rise) Enforce veltheta Monitor an predators Educate so regarding Northern Question Any incider of a Northeta DEC, and (frozen) for and the WA 	destruction of Northern Quoll abitats (Major Drainage Line and within the Application Area nicle speed limits on Project roads d control feral animals and feral site personnel and contractors the conservation status of the uoll nt that results in injury to or death rn Quoll should be reported to the specimens should be retained further examination by the DEC M

Table 12:	Project impacts on	fauna of conserv	vation significance.	with suggested ac	ctions
	i i ejeet inipaete en		ranon orginitoanoo,	min ouggoolou u	

Common name		Species name		tion status	Likelihood of occurrence in
Common name	Specie		EPBC ¹	In WA ²	Study Area
Pilbara Leaf-nosed Bat	Rhinor	nicteris aurantia	VU	S1	Very likely
Localised impact: LOW		Regional impact: LOW		Suggested man	agement actions
 Only a small amount of habitat with Study Area is likely to contain complex systems capable of supporting roosts Pilbara Leaf-nosed Bat (Ironstone Ridge this is not within the Application Area The Pilbara Leaf-nosed Bat roos abandoned shafts of the Lalla Rookh mi the boundary of the Study (approximately 519 m from the Appli Area and 544 m from the Indicative F Footprint, Figure 11), and individuals be expected to forage widely within the Area. The Project would therefore be like result in clearing of habitat used b species for foraging, but not for roosting There is increased potential for road individuals during night operations Artificial light may influence Pilbara nosed Bats, as they are thought attracted to light sources Human interest in the abandoned workings at Lalla Rookh may res disturbance to roosting bats 	n the cave of the), and ts in ne, on Area cation Project would Study kely to y this kill of Leaf- to be mine ult in	 Foraging habitat within the Applic small relative to available foragi the wider region The Lalla Rookh roost of Pilbara Bats is regionally significant; it is four confirmed roosts in the eas (DSEWPaC 2012b) Localised impacts (see left) m temporary reduction in size of the colony; however, at the end operations, the size of the colo expected to return to pre-disturt (assuming no permanent changes) 	cation Area is ng habitat in a Leaf-nosed s one of only stern Pilbara ay result in e Lalla Rookh of haulage ony could be bance levels hydrological	 To reduce a species du illuminate a rather than Educate pe the conservation nosed Bat Access to Lalla Rool restricted to for access, at key ent 2007) Enforce ver Any incident of a Pilbar reported to be retained the DEC and the DEC and	the impact of artificial light on this ring the night, position lights to reas such as pathways and roads, the habitat and night sky rsonnel and contractors regarding vation status of the Pilbara Leaf- within 500 m of the abandoned ch mine workings should be personnel with legitimate reasons by means of appropriate signage ry points (eg MOLHAR Pty Ltd nicle speed limits on Project roads t that results in injury to or death ara Leaf-nosed Bat should be the DEC, and specimens should (frozen) for further examination by d the WAM

Common name		Species name		tion status	Likelihood of occurrence in
Common name	opecies name		EPBC ¹	In WA ²	Study Area
Pilbara Olive Python	Liasis d	olivaceus barroni	VU	S1	Likely
Localised impact: NEGLIGIBLE		Regional impact: NEGLIGIBLE		Suggested man	agement actions
 Optimal habitat for the Pilbara Olive F comprises deep gullies and gorges permanent water; a small amount of habitat type (Ironstone Ridge) occurs the Study Area, but it is not withit Application Area The Major Drainage Line habitat with Application Area is not optimal habitat unlikely to support permanent residents species, but it is suitable foraging habitat Alteration of the quality of Major Dra Line habitat within the Application area have implications for the quality of ad Major Drainage Line habitat and sources that this species relies upon There is increased potential for road individuals during night-time hours, esp 	Python with of this within n the in the and is of this t ainage a may jacent water kill of ecially	 Although it is patchily distributed Olive Python is widespread acros Although optimal habitat for the Python occurs at intermitte locations, it is not uncommon region Localised habitat loss will occur Drainage Line habitat type, but this habitat type within the Applic small relative to available habit wider region 	d, the Pilbara ss the Pilbara Pilbara Olive ent, isolated in the wider in the Major the extent of cation Area is tat within the	 Minimise de the hydrolo Ironstone R Enforce veh Educate s regarding Pilbara Oliv Any inciden of a Pilbara to the DE retained (fr the DEC an When end infrastructur should relo undisturbed 	estruction of, and interference with gy of, Major Drainage Line and idge habitats hicle speed limits on Project roads ite personnel and contractors the conservation status of the e Python t that results in injury to or death olive Python should be reported iC, and specimens should be ozen) for further examination by d the WAM countered in areas close to re, authorised snake handlers boate Pilbara Olive Pythons to areas of suitable habitat
where haul road infrastructure inte Major Drainage Line habitat	rsects				

Common namo	Species name	Conserva	tion status	Likelihood of occurrence in
Common name	Species name	EPBC ¹	In WA ²	Study Area
Greater Bilby	Macrotis lagotis	VU	S1	Possible
Localised impact: NEGLIGIBLE	Regional impact: NEGLIGIBLE		Suggested mar	nagement actions
• There is increased potential for road	kill of • Habitat within the Applicati	n Area is small	Minimise	clearing of old-growth spinifex
individuals during night-time hours	relative to available habitat in	the wider region	habitats wit	hin the Application Area
• The Greater Bilby, if present within the	Study		Implement	fire management where possible,
Area, is likely to be sparsely distributed			ie reduce th	ne scale, frequency and intensity of
Due to the Greater Bilby's behave	vioural		fires within	spinifex habitat
characteristics (nocturnal and see	cretive		Monitor an	d control feral animals and feral
habits) it is considered that there would	uld be		predators	
minimal risk of individual mortality d	despite		Remove or	reduce, and/or lower speed limits
increased hazard of vehicular collision			of, nocturna	al traffic in Application Area
			• Educate s	site personnel and contractors
			regarding	the conservation status of the
			Greater B	liby, and train personnel to
			recognise	the distinctive burrows of this
			species	
			Report sigh to the DEC	tings of this species or its burrows

Common namo	Spacios namo	Conservation status		Likelihood of occurrence in	
Common name	Species name	EPBC ¹	In WA ²	Study Area	
Brush-tailed Mulgara	Dasycercus blythi	VU	P4	Very likely	
Localised impact: LOW	Regional impact: MINIMAL		Suggested management actions		
 The presence of Mulgara burrows with Spinifex Sandplain habitat suggests presence of the Mulgara (Biota 2007). I on knowledge of the distributions of the species, if individuals exist in the Study they are most likely to be Brush Mulgaras The burrows recorded are within Application Area, adjacent to the exaccess track Clearing of the Indicative Project Forwould result in loss of 172 ha of pohabitat within the Application area During clearing operations, there is pofor direct mortality of individuals There is increased potential for road individuals, particularly during nighhours, but also during the day 	 in the The Study Area is toward the n of the western extremity of the of Based the Brush-tailed Mulgara (Varial et wo Strahan 2008) Mortality due to localised represent a negligible decline in within the region Habitat within the Application A relative to available habitat in the Habitat is well connected, within the tential life of the Project Recovery of regional population expected following conclusion of the tential 	orthern edge distribution of Dyck and impacts will the species area is small wider region which would uals after the on could be the Project	 Minimise habitats wit Perform pre- the Brush exclusion appropriate Implement ie reduce the fires within Create and Manageme manageme Monitor an predators Enforce vel Educate se regarding Brush-tailed recognise species Report sight to the DEC 	clearing of old-growth spinifex hin the Application Area e-clearing searches for burrows of h-tailed Mulgara and perform trapping and translocation as fire management where possible, he scale, frequency and intensity of spinifex habitat implement a Significant Species nt Plan that contains specific nt actions for the Mulgara d control feral animals and feral hicle speed limits on Project roads the conservation status of the d Mulgara, and train personnel to the distinctive burrows of this tings of this species or its burrows	

Common name	Species name	Conservation status		Likelihood of occurrence in		
		EPBC ¹	In WA ²	Study Area		
Peregrine Falcon	Falco peregrinus		S4	Likely		
 Localised impact: NEGLIGIBLE Although the species may forage widely over the Study Area, the Application Area is unlikely to contain suitable nest sites (optimal nesting locations are cliff faces, none of which are within the Application Area; tree hollows may also be used, however) The Peregrine Falcon is unlikely to be solely reliant on the foraging habitats provided by 				 Suggested management actions Minimise destruction of mature trees with hollows, or potential to bear hollows, whenever possible Report sightings of this species to the DEC 		
the Application Area	Aspiditos romani		Ç 1	Passible		
			S4			
 There is increased potential for road individuals, particularly during nigh hours, but also during the day There will be some localised habitat lo the Woma, with direct mortality possible 	 Habitat within Application Are relative to available habitat in the The species is thought to be we the Pilbara region, and it is the s (Wheatbelt) population that is the rare 	 Habitat within Application Area is small relative to available habitat in the wider region The species is thought to be widespread in the Pilbara region, and it is the south-western (Wheatbelt) population that is thought to be rare 		 Lower speed limits of daytime traffic in the Application Area Remove or reduce, and/or lower speed limits of, nocturnal traffic in Application Area Educate site personnel and contractors regarding the conservation status of the Woma When encountered in areas close to infrastructure, authorised snake handlers should relocate Womas to undisturbed areas of suitable habitat 		
A species of blind snake	Ramphotyphlops ganei		P1	Possible		
	Regional impact: NEGLIGIBLE		Suggested man	agement actions		
 Only a small amount of habitat with Study Area is suitable for this species Clearing impacts to this habitat type are to be minimal 	in the • No regional impact upon this expected e likely	species is	None			

Common name	Species name	Conservation status		Likelihood of occurrence in				
	Species name	EPBC ¹	In WA ²	Study Area				
Spectacled Hare-wallaby	Lagorchestes conspicillatus leichardti		P1	Confirmed				
Localised impact: MINIMAL	Regional impact: NEGLIGIBLE	:	Suggested management actions					
 There is increased potential for road individuals, particularly during nigh hours, but also during the day Potential habitat loss is minimal and su habitats are well represented outsid Application Area 	 kill of This species has dispersal capability to remove itself from the App when necessary uitable Habitat within Application Are relative to available habitat in the 	ility sufficient lication Area ea is small wider region	 Minimise habitats with Implement ie reduce the fires within and predators Lower speet of suitable here Remove or of nocturna for this speet Educate so regarding Spectacled 	clearing of old-growth spinifex hin the Application Area fire management where possible, he scale, frequency and intensity of spinifex habitat d control feral animals and feral ed limits of daytime traffic in areas habitat for this species reduce, and/or lower speed limits I traffic in areas of suitable habitat cies lite personnel and contractors the conservation status of the Hare-wallaby				
			 Report sigh 	tings of this species to the DEC				
Common name	Species name		Conserva	ation status	Likelihood of occurrence in			
--	---	--	--	---	--	--	--	--
Common name	Species In		EPBC ¹	In WA ²	Study Area			
Ghost Bat	Macrodern	ma gigas		P4	Very likely			
Localised impact: LOW	Reg	gional impact: LOW		Suggested man	agement actions			
 Only a small amount of habitat within Study Area is likely to contain complex systems to support roosts of the Ghost (Ironstone Ridge), and this is not comwithin the Application Area A Ghost Bat maternity roost exists in abandoned shafts of the Lalla Rookh mint the boundary of the Study (approximately 519 m from the Appli Area and 544 m from the Indicative F Footprint, Figure 11), and individuals be expected to forage widely within the Area The Project would therefore be likely to in clearing of habitat used by this speciforaging, but not for roosting There is increased potential for road individuals during night operations There is risk of entanglement of Ghost E barbed-wire fencing, if this is used or construction or operation of the Project Human interest in the abandoned workings at Lalla Rookh may rest disturbance to roosting bats 	n the • cave st Bat tained • n the ne, on Area cation • Project would Study result es for kill of Bats in during mine ult in	Foraging habitat within the Applic small relative to available foragin the wider region The Lalla Rookh maternity colo Bats is regionally significant; it is largest known in the Pilbara, and ten such colonies have been (Bamford Consulting Ecologists 2 Localised impacts (left) may temporary reduction in size of th colony; however, after comple Project it is likely that the size of would return to pre-disturbat (assuming no permanent changes)	eation Area is ing habitat in any of Ghost is one of the d fewer than documented 2001) y result in his maternity etion of the of the colony ance levels hydrological	 To reduce a species, designated roads, rathe Educate as regarding Ghost Bat Access to Lalla Rookh to personn access, by key entry po Remove or of, nocturr (especially I Avoid use suggested b Any inciden of a Ghost DEC, and (frozen) for and the WA 	the impact of artificial light on this position lights to illuminate areas such as pathways and er than the habitat and night sky ite personnel and contractors the conservation status of the within 500 m of the abandoned mining area should be restricted nel with legitimate reasons for means of appropriate signage at bints (eg MOLHAR Pty Ltd 2007) reduce, and/or lower speed limits nal traffic in Application Area between dusk and midnight) of barbed wire; alternatives are by MOLHAR Pty Ltd (2007) at that results in injury to or death t Bat should be reported to the specimens should be retained further examination by the DEC			

Common nomo	Species name	Conserva	tion status	Likelihood of occurrence in		
Common name	Species name	EPBC ¹	In WA ²	Study Area		
Long-tailed Dunnart	Sminthopsis longicaudata		P4	Possible		
Localised impact: NEGLIGIBLE	Regional impact: NEGLIGIBLE		Suggested mar	agement actions		
Only a small amount of habitat with	in the	w for ready	None			
Study Area is suitable for this species	movement of individuals betwee	en the Study				
Clearing impacts to this habitat are likely	y to be Area and the wider region					
minimal						
Short-tailed Mouse	Leggadina lakedownensis		P4	Possible		
Localised impact: NEGLIGIBLE	Regional impact: NEGLIGIBLE		Suggested mar	agement actions		
Many habitats within the Study Are	ea are Habitat within Application Are 	ea is small	• Implement	fire management where possible,		
capable of supporting this species, but	t there relative to available habitat in the	wider region	ie reduce th	e scale, frequency and intensity of		
is only an outside chance of its occu	Irrence		fires within spinifex habitat			
within the Study Area/Application Area			Monitor an	d control feral animals and feral		
			predators			
			Report sigh	tings of this species to the DEC		
Western Pebble-mound Mouse	Pseudomys chapmani		P4	Confirmed		
Localised impact: MINIMAL	Regional impact: NEGLIGIBLE		Suggested mar	agement actions		
The Western Pebble-mound	Mouse Habitat within Application Are 	ea is small	Avoid clear	ng of pebble-mounds		
presumably has low ability to disperse	ahead relative to available habitat in the	wider region	Record loc	cation and status (ie active or		
of clearing activities (even progr	essive • The species is widespread in su	itable habitat	inactive) of	mounds encountered		
clearing)	outside of the Study Area		• Demarcate	mounds encountered and educate		
Mounds are scattered within suitable habitat site personnel as to their importance						
in the Application Area, and it is assume	ed that					
the likelihood of individual mounds	being					
cleared is low						

Common name	Species name	Conserva	ation status	Likelihood of occurrence in					
Common name	Species name	EPBC ¹	In WA ²	Study Area					
Australian Bustard	Ardeotis australis		P4	Confirmed					
Localised impact: LOW	Regional impact: MINIMAL		Suggested mar	agement actions					
 There is increased potential for road individuals, particularly during daytime but also during the night Potential habitat loss is minimal and su habitats are well represented outsid Study Area 	 kill of This species is relatively common Pilbara region This species has dispersal capable to remove itself from the App when necessary Habitat within Application Ar relative to available habitat in the part of the part o	on within the bility sufficient lication Area ea is small wider region	 Educate site personnel and contrarregarding the conservation status of Australian Bustard Implement measures to reduce road kill Lower speed limits of daytime traffic i Application Area Remove or reduce, and/or lower speed of, nocturnal traffic in Application Area 						
Grey Falcon	Falco hypoleucos		P4	Possible					
Localised impact: NEGLIGIBLE	Regional impact: NEGLIGIBLE	•	Suggested mar	agement actions					
 The Grey Falcon has not been reported Study Area previously This is a wide-ranging species that is u to be dependent on habitat withi Application Area 	in the • Overall habitat disturbance for the likely to be minimal nlikely n the	nis species is	• None						
Flock Bronzewing	Phaps histrionica		P4	Possible					
Localised impact: NEGLIGIBLE	Regional impact: NEGLIGIBLE		Suggested mar	agement actions					
 The Flock Bronzewing is nomadic and to move according to conditions This species would not be expected to habitat within the Study Area for a sign period of time 	 Habitat is widespread and comm Habitat within Application Ar relative to available habitat in the hificant 	on ea is small wider region	None						

Common name	Species name	Conserva	ation status	Likelihood of occurrence in			
Common name		EPBC ¹	In WA ²	Study Area			
Bush Stone-curlew	Burhinus grallarius		P4	Confirmed			
Localised impact: LOW	Regional impact: MINIMAL		Suggested mar	nagement actions			
• There is increased potential for road	kill of • Overall habitat loss is likely to be m	ninimal	 Educate s 	site personnel and contractors			
individuals, particularly during	night • There is suitable habitat available	in the wider	regarding th	ne conservation status of the Bush			
operations	surrounds of the project		Stone-curle	W			
Potential for localised disturbance	e near	/ for ready	Implement	measures to reduce road kill			
operations in the Application Area of	due to movement of individuals between	n the Study	 Remove or 	reduce, and/or lower speed limits			
noise	Area and the wider region		of, nocturna	al traffic in Application Area			
Fork-tailed Swift	Apus pacificus	М	S3	Likely			
Localised impact: NEGLIGIBLE	Regional impact: NEGLIGIBLE		Suggested mar	nagement actions			
• The Fork-tailed Swift is almost entirely	erial; • No overall impact on this species is	s expected	None				
it is therefore not expected to be e	entirely						
reliant on habitat within the Study Area							
Oriental Plover	Charadrius veredus	М	S3	Likely			
Localised impact: NEGLIGIBLE	Regional impact: NEGLIGIBLE		Suggested mar	nagement actions			
The Oriental Plover is nomadic and te	ends to Habitat is widespread and commor 	n	None				
move according to conditions	 Habitat within Application Area 	a is small					
This species would not be expected to	o utilise relative to available habitat in the w	vider region					
habitat within the Study Area for a sigr	nificant						
period of time							
Rainbow Bee-eater	Merops ornatus	М	S3	Confirmed			
Localised impact: NEGLIGIBLE	Regional impact: NEGLIGIBLE		Suggested mar	nagement actions			
The Rainbow Bee-eater is known	to be • Widespread and common throu	ughout the	None				
widespread and common throughou	ut the region						
Study Area and surrounds	 No overall impact on this species is 	s expected					
The species occupies a wide varie	iety of No change to conservation status	as a result					
habitats within the region	of the Project						

Common name	Spacios namo	Conserva	tion status	Likelihood of occurrence in
Common name	Species name	EPBC ¹	In WA ²	Study Area
White-bellied Sea-eagle	Haliaeetus leucogaster	М	S3	Likely
Localised impact: NEGLIGIBLE	Regional impact: NEGLIGIBLE		Suggested man	agement actions
 The White-bellied Sea-eagle has not reported in the Study Area previously This is a wide-ranging species that is u to be dependent on habitat within Application Area 	 Overall habitat disturbance for t likely to be minimal nlikely n the 	his species is	 Avoid creat sources whe this species Where creat required, mit 	tion of permanent artificial water erever possible, to avoid attracting to the Project area ation of artificial water sources is mimise surface exposure of water

Status under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 – EN, Endangered, VU, Vulnerable, M, Migratory; Status under the Western Australian Wildlife Conservation Act 1950 or DEC Priority Fauna List – S1, Schedule 1, S3, Schedule 3, S4, Schedule 4 (WC Act) and P1, Priority 1 Fauna, P2, Priority 2 Fauna, P3, Priority 3 Fauna, P4, Priority 4 Fauna (DEC Priority Fauna List); see **Appendix B** for full definitions of conservation status



Figure 11: Location of Lalla Rookh Mine with respect to the proposed Indicative Project Footprint and Application Area

5.5. Impacts On Terrestrial Short Range Endemic Invertebrate Fauna

The paucity of data available for SRE invertebrates within the Study area makes determination of impacts difficult; but, given the low probability that each species of SRE invertebrate identified occurs within the Study Area, it is unlikely that the Project would have significant impacts on SRE fauna. Land clearance and other disturbance of those habitats identified as having the potential to support SRE species, including Major Drainage Line and Ironstone Ridge (**Table 8**), would have the greatest impact on any individuals restricted to these areas. The current plan for development of the Project allows for relatively little disturbance of these areas (**Table 10**), and as these habitats are well-represented within the surrounding landscape, and are well connected to equivalent habitats outside of the Study Area, the regional impact of the Project on SRE fauna is likely to be negligible.

6. 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 previously in this report (**Table 12**).

6.1. 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 conservation significant species (eg Major Drainage Line habitat and long unburnt Spinifex Sandplain habitat containing mature spinifex hummocks); and
- artificial lighting should be designed to illuminate designated operations areas and limit illumination of the surrounding landscape. Ensure that transport and haulage routes are designed to avoid inadvertent illumination of important habitat features such as riverine pools and substantial rocky outcrops. Consider the principles behind methods used for protecting marine turtles from light impacts (EPA 2010; although methods themselves differ, the principles are consistent between aquatic and terrestrial environments).

6.2. Land Disturbance And Clearing Activities

- Where practicable, minimise land disturbance and clearing activities in habitat known to or likely to support species of conservation significance, such as Major Drainage Line and long unburnt Spinifex Sandplain habitat containing mature spinifex hummocks;
- clearing boundaries should be demarcated in the field by 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 quality of Major Drainage Line habitat is maintained and to minimise potential for waterbirds to be attracted to artificial water sources. Roads and borrow pits should be designed to minimise hydrological impacts; and
- if possible, undertake clearing progressively over time to allow fauna to disperse to other suitable habitats within the surrounds. This can also be facilitated by retaining corridors or linkages (eg culverts underneath roads in key habitat areas) so that individuals can move between remaining habitat patches. Consider timing of clearing activities to reduce the impact on nesting birds.

6.3. Project Operation

- implement dust suppression measures to reduce the effects of dust on vegetation and hence on fauna habitats and assemblages. This should include management of vehicle speed on unsealed roads;
- prepare and implement a weed management strategy to prevent the spread of existing weed species and the establishment of new weeds;
- conduct monitoring and control of feral animals in participation with surrounding land managers such as pastoralists and DEC. Additional management measures to prevent the increase of feral species numbers and control the attraction of any new feral species to the Project should be implemented, including proper hygiene practices and appropriate disposal of waste;
- prepare and implement a strategy for prevention of unplanned fires, which should include all vehicles being fitted with fire extinguishers and all personnel being trained in their use
- prepare and implement a fire management strategy to reduce the scale, frequency and intensity of fires within fauna habitats (especially Spinifex Sandplain and Spinifex Stony Plain habitats);
- educate personnel and implement measures to minimise road kill, especially for nocturnal species or those prone to vehicle collisions (eg reduce the speed and times at which vehicles travel and/or erecting fences, barriers or alternative routes for fauna in strategic areas where fauna are known to cross major transport routes); and
- investigate strategies to reduce impacts of high frequency traffic on fauna and barriers to fauna dispersal created by the haul road corridors.

6.4. Rehabilitation And Closure

- Implement a progressive rehabilitation and closure plan to ensure disturbed areas are rehabilitated as soon as practicable; and
- reconstruct linkages among fragmented fauna habitats.

7. CONCLUSION

The inventory of fauna obtained during this desktop assessment suggests that vertebrate fauna assemblages and habitats within the Study Area are fairly representative of those present within equivalent parts of the wider Pilbara bioregion, and that the Study Area does not represent an area of particularly high biodiversity from a regional point of view. Previous surveys in the area do, however, provide recent, confirmed records of fauna of conservation significance occurring within the Application Area, including (but not limited to) burrows of the Mulgara and sightings of the Spectacled Hare-wallaby (Biota 2007). Local impacts to Mulgara and Spectacled Hare-wallaby are expected to be low and minimal, respectively. In addition, the abandoned mine workings of Lalla Rookh, widely recognised as a highly important roost location for the Pilbara Leaf-nosed Bat and the Ghost Bat, are on the boundary of the current Study Area (Bamford Consulting Ecologists 2001, DSEWPaC 2012b, MOLHAR Pty Ltd 2007). Lalla Rookh is 544 m from the Application Area, however, and is unlikely to be directly impacted by the project. These (and other) fauna of conservation significance should be carefully considered when planning and operating the Project.

The Project will impact on vertebrate faunal assemblages both directly and indirectly. Of the indirect impacts, the spread of invasive weed species is possibly the most likely to affect the faunal assemblages of the Study Area. The length of the proposed haul route and the volume of vehicular traffic necessary for development and operation of the Project will impose high risk of transport of invasive weeds and their seeds. Given that vegetation communities in the Study Area are largely in good condition at present, measures should be taken to limit the spread of weeds. Of the direct impacts of the Project, direct loss of fauna habitat via clearing of native vegetation is likely to have the greatest impact on fauna habitats and assemblages. Wherever possible, use of existing tracks and access roads should be promoted and further clearing of vegetation for the purposes of haul road construction should be minimised.

The desktop study identified 30 SRE invertebrate species known to occur within the broader region of the Study Area. Of these, four species have been collected in close proximity to the Study area comprising the millipedes *Antichiropus* DIP005' and *Antichiropus* DIP034', the slater *Buddelundia* sp 11 and the pseudoscorpion *Feaella* sp. 'PSE007'. Although these species have been collected in close proximity to the Study Area they are unlikely to occur within the Study Area due to a lack of suitable habitat. The other species identified during the desktop search were unlikely to occur due to a lack of suitable habitat or a lack of connecting habitat.

Habitats found in the Study Area were consistent with habitats known to occur elsewhere in the Pilbara bioregion. The Ironstone Ridge habitat type is of limited extent within the Study Area and is known to be an important habitat for vertebrate and SRE invertebrate fauna, but it is not present within the Application Area. The Major Drainage Line habitat type is also known to be an important habitat type, and it is present within the Application Area (although in small quantities). This habitat type is the only type present within the Application Area that is likely to support foraging individuals of the Northern Quoll, Ghost Bat and Pilbara Leaf-nosed Bat, and could also support resident individuals

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of the Pilbara Olive Python and Bush Stone-curlew. Disturbance to this habitat type should be minimised wherever possible. Other vertebrate fauna of conservation significance are not likely to be bound tightly to particular habitat patches within the Study Area, and the regional impacts of habitat clearing on species of conservation significance, including SRE invertebrates, are likely to be small. Two other habitat types, Spinifex Stony Plain and Spinifex Sandplain (in particular) are also important habitat types within the Study Area and care should be taken to minimise their disturbance. Both of these habitat types are more widespread regionally and clearing within these areas is less likely to impact vertebrate fauna at a regional scale.

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Appendix A

Vertebrate Species Recorded in the Study Area and Surrounds

LegendXSpecies recorded*Introduced speciesEPBCCommonwealth Environmental Protection and Biodiversity Conservation Act 1999: EN
Endangered, VU Vulnerable M MigratoryWCWestern Australian Wildlife Conservation Act 1950 Threatened and Priority Fauna Rankings:
S1 Schedule 1 Rare or likely to become extinct, S3 Migratory birds protected under an
international agreement, S4 In need of special protectionDEC PriorityDepartment of Environment and Conservation's Threatened and Priority Fauna Rankings P1
Priority 1 Fauna, P2, P3, P4, P5

Literature Review

- A Abydos DSO Project Terrestrial Vertebrate Fauna Baseline Survey (Outback Ecology 2011b)
- B Fauna Assessment of the Abydos DSO Project (Bamford Consulting Ecologists 2009)
- C Panorama Project: Mine Site and Haul Road Corridor Targeted Fauna Survey prepared for CBH Resources (Biota 2007)
- D Panorama Project Area: Baseline Fauna Study as Part of the Sulphur Springs Feasibility Study prepared for Astron Environmental (Bamford Consulting Ecologists 2001)

Database Searches

- E DEC Threatened & Priority Fauna Database Search (extracts information from NatureMap)
- F Protected Matters Database Search
- G BirdLife Atlas Database Search

Scientific Name	Common Name	Co	Conservation Status			evious	Surve	eys	Database searches		
		EPBC Act	WA Act	DEC Priority	Α	В	С	D	Е	F	G
Mammals											
BOVIDAE											
Bos taurus*	European Cattle					Х	Х		Х		
CAMELIDAE											
Camelus dromedarius*	Dromedary					Х		Х	Х		
CANIDAE											
Canis lupus*	Dingo				Х	Х		Х	Х		
Vulpes vulpes*	Fox								Х		
DASYURIDAE											
Dasycercus blythei	Brush-tailed Mulgara			P4					Х		
Dasycercus cristicauda	Crest-tailed Mulgara	EN	VU				Х		Х	Х	
Dasykaluta rosamondae	Kaluta							Х	Х		
Dasyurus hallucatus	Northern Quoll	EN	S1	Т	Х	Х	Х	Х	Х	Х	
Ningaui timealeyi	Pilbara Ningaui						Х	Х	Х		
Planigale ingrami	Long-tailed Planigale				Х			Х	Х		
Planigale maculata	Common Planigale								Х		
Pseudantechinus roryi	Tan False Antechinus					Х		Х			
Pseudantechinus woolleyae	Woolley's Pseudantechinus				Х				Х		
Sminthopsis longicaudata	Long-tailed Dunnart			P4					Х		
Sminthopsis macroura	Stripe-faced Dunnart						Х		Х		
Sminthopsis ooldea	Ooldea Dunnart								Х		
Sminthopsis youngsoni	Lesser hairy-footed Dunnart								Х		
EMBALLONURIDAE											
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat				Х				Х		
Taphozous georgianus	Common Sheathtail-bat				Х	Х		Х	Х		

Vertebrate species recorded in the Study Area and surrounds

Scientific Name	Common Name	Co	onservation	Status	Pr	evious	Surve	eys	Database searches		
		EPBC Act	WA Act	DEC Priority	Α	В	С	D	Е	F	G
EQUIDAE											
Equus asinus*	Donkey								Х		
FELIDAE											
Felis catus*	Cat					Х		Х	Х		
HIPPOSIDERIDAE											
Rhinonicteris aurantius (Pilbara form)	Pilbara Leaf-nosed Bat	VU			Х	Х	Х	Х	Х	Х	
LEPORIDAE											
Oryctolagus cuniculus*	Rabbit								Х		
MACROPODIDAE											
Lagorchestes conspicillatus leichardti	Spectacled Hare-wallaby (mainland)			P3			Х		Х		
Macropus robustus	Common Wallaroo				Х	Х	Х	Х	Х		
Macropus rufus	Red Kangaroo								Х		
Petrogale rothschildi	Rothschild's Rock-wallaby				Х	Х		Х	Х		
MEGADERMATIDAE											
Macroderma gigas	Ghost Bat			P4	Х	Х		Х	Х		
MOLOSSIDAE											
Austronomus australis	White-striped Freetail-bat					Х		Х	Х		
Chaerephon jobensis	Northern Freetail-bat								Х		
MURIDAE											
Leggadina lakedownensis	Lakeland Downs Mouse			P4					Х		
Mus musculus*	House Mouse						Х	Х	Х		
Notomys alexis	Spinifex Hopping-mouse								Х		
Pseudomys chapmani	Pebble-mound Mouse			P4		Х	Х	Х	Х		
Pseudomys delicatulus	Delicate Mouse							Х	Х		
Pseudomys desertor	Desert Mouse						Х	Х	Х		
Pseudomys hermannsburgensis	Sandy Inland Mouse				Х		Х	Х	Х		

Scientific Name	Common Name	Co	Conservation Status			evious	Surve	eys	Database searches		
		EPBC Act	WA Act	DEC Priority	Α	В	С	D	E	F	G
Zyzomys argurus	Common Rock-rat				Х	Х	Х	Х	Х		
NOTORYCTIDAE											
Notoryctes caurinus	Northern Marsupial Mole	EN	S1							Х	
PHALANGERIDAE											
Trichosurus vulpecula arnhemensis	Northern Common Brushtail Possum								Х		
PTEROPODIDAE											
Pteropus scapulatus	Little Red Flying-fox								Х		
TACHYGLOSSIDAE											
Tachyglossus aculeatus	Short-beaked Echidna				Х	Х		Х	Х		
THYLACOMYIDAE											
Macrotis lagotis	Greater Bilby	VU	S1						Х	Х	
VESPERTILIONIDAE											
Chalinolobus gouldii	Gould's Wattled Bat				Х				Х		
Nyctophilus geoffroyi	Lesser Long-eared Bat								Х		
Scotorepens greyii	Little Broad-nosed Bat				Х	Х	Х		Х		
Vespadelus finlaysoni	Inland Cave Bat				Х	Х		Х	Х		
Birds											
ACANTHIZIDAE											
Gerygone fusca	Western Gerygone							Х	Х		Х
Gerygone tenebrosa	Dusky Gerygone								Х		Х
Smicrornis brevirostris	Weebill				Х			Х	Х		Х
ACCIPITRIDAE											
Accipiter cirrocephalus	Collared Sparrowhawk							Х	Х		Х
Accipiter fasciatus	Brown Goshawk				Х	Х	Х	Х	Х		Х
Aquila audax	Wedge-tailed Eagle				Х	Х	Х	Х	Х		Х
Circus approximans	Swamp Harrier								Х		Х

Scientific Name	Common Name	C	Conservation Status			revious	Surve	eys	Database searches		
		EPBC Act	WA Act	DEC Priority	Α	В	С	D	Е	F	G
Circus assimilis	Spotted Harrier					Х		Х	Х		Х
Elanus axillaris	Black-shouldered Kite							Х	Х		Х
Haliaeetus leucogaster	White-bellied Sea-Eagle	М							Х	Х	Х
Haliastur indus	Brahminy Kite								Х		Х
Haliastur sphenurus	Whistling Kite					Х		Х			Х
Hamirostra melanosternon	Black-breasted Buzzard					Х			Х		Х
Hieraaetus morphnoides	Little Eagle							Х	Х		Х
Lophoictinia isura	Square-tailed Kite								Х		Х
Milvus migrans	Black Kite					Х			Х		Х
Pandion cristatus	Eastern Osprey								Х		Х
ACROCEPHALIDAE											
Acrocephalus australis	Australian Reed-Warbler								Х		Х
AEGOTHELIDAE											
Aegotheles cristatus	Australian Owlet-nightjar					Х		Х	Х		Х
ALAUDIDAE											
Mirafra javanica	Horsfield's Bushlark								Х		Х
ANATIDAE											
Anas gracilis	Grey Teal					Х					Х
Anas superciliosa	Pacific Black Duck					Х		Х	Х		Х
Aythya australis	Hardhead								Х		Х
Chenonetta jubata	Australian Wood Duck								Х		Х
Cygnus atratus	Black Swan								Х		Х
Dendrocygna eytoni	Plumed Whistling-Duck					Х			Х		Х
Malacorhynchus membranaceus	Pink-eared Duck								Х		Х
ANHINGIDAE											
Anhinga novaehollandiae	Australasian Darter							Х	Х		Х

Scientific Name	Common Name	C	onservation	Status	Pr	Previous Surveys				Database searches		
		EPBC Act	WA Act	DEC Priority	Α	В	С	D	Е	F	G	
APODIDAE												
Apus pacificus	Fork-tailed Swift	М							Х	Х	Х	
Ardea ibis	Cattle Egret	М								Х		
Ardea intermedia	Intermediate Egret								Х		Х	
Ardea modesta	Eastern Great Egret							Х	Х	Х	Х	
Ardea pacifica	White-necked Heron					Х		Х	Х		Х	
Butorides striata	Striated Heron								Х		Х	
Egretta garzetta	Little Egret								Х		Х	
Egretta novaehollandiae	White-faced Heron					Х	Х	Х	Х		Х	
Egretta sacra	Eastern Reef Egret	М							Х		Х	
Ixobrychus flavicollis	Black Bittern								Х			
Nycticorax caledonicus	Nankeen Night Heron						Х	Х	Х		Х	
ARTAMIDAE												
Artamus cinereus	Black-faced Woodswallow				Х	Х	Х	Х	Х		Х	
Artamus leucorynchus	White-breasted Woodswallow								Х		Х	
Artamus minor	Little Woodswallow					Х	Х	Х	Х		Х	
Artamus personatus	Masked Woodswallow					Х	Х		Х		Х	
Cracticus nigrogularis	Pied Butcherbird				Х	Х	Х	Х	Х		Х	
Cracticus tibicen	Australian Magpie					Х	Х	Х	Х		Х	
Cracticus torquatus	Grey Butcherbird								Х		Х	
BURHINIDAE												
Burhinus grallarius	Bush Stone-curlew			P4		Х		Х	Х		Х	
Esacus magnirostris	Beach Stone-curlew								Х		Х	
CACATUIDAE												
Cacatua sanguinea	Little Corella				Х	Х		Х	Х		Х	
Eolophus roseicapillus	Galah				Х	Х	Х	Х	Х		Х	

Scientific Name	Common Name	C	Conservation Status			evious	Surve	eys	Database searches		
		EPBC Act	WA Act	DEC Priority	Α	В	С	D	E	F	G
Nymphicus hollandicus	Cockatiel				Х	Х	Х	Х	Х		Х
CAMPEPHAGIDAE											
Coracina maxima	Ground Cuckoo-shrike								Х		Х
Coracina novaehollandiae	Black-faced Cuckoo-shrike				Х	Х	Х	Х	Х		Х
Lalage sueurii	White-winged Triller					Х	Х	Х	Х		Х
CASUARIIDAE											
Dromaius novaehollandiae	Emu								Х		Х
CHARADRIIDAE											
Charadrius leschenaultii	Greater Sand Plover	М							Х		Х
Charadrius mongolus	Lesser Sand Plover	М							Х		Х
Charadrius ruficapillus	Red-capped Plover								Х		Х
Charadrius veredus	Oriental Plover	М							Х	Х	х
Elseyornis melanops	Black-fronted Dotterel					Х		Х	Х		Х
Erythrogonys cinctus	Red-kneed Dotterel								Х		Х
Pluvialis fulva	Pacific Golden Plover	М							Х		
Pluvialis squatarola	Grey Plover	М							Х		Х
Vanellus miles	Masked Lapwing								Х		Х
Vanellus tricolor	Banded Lapwing								Х		
CICONIIDAE											
Ephippiorhynchus asiaticus	Black-necked Stork					Х		Х	Х		х
CLIMACTERIDAE											
Climacteris melanura	Black-tailed Treecreeper								Х		Х
COLUMBIDAE											
Geopelia cuneata	Diamond Dove					Х	Х	Х	Х		Х
Geopelia humeralis	Bar-shouldered Dove								Х		Х
Geopelia striata	Peaceful Dove				Х	Х		Х	Х		Х

Scientific Name	Common Name	C	Conservation Status			revious	Surve	eys	Database searches		
		EPBC Act	WA Act	DEC Priority	Α	В	С	D	E	F	G
Geophaps plumifera	Spinifex Pigeon				Х	Х	Х	Х	Х		Х
Ocyphaps lophotes	Crested Pigeon					Х	Х	Х	Х		Х
Phaps chalcoptera	Common Bronzewing				Х	Х	Х	Х	Х		Х
Phaps histrionica	Flock Bronzewing			P4					Х		
CORVIDAE											
Corvus bennetti	Little Crow								Х		Х
Corvus coronoides	Australian Raven								Х		
Corvus orru	Torresian Crow				Х	Х	Х	Х	Х		Х
CUCULIDAE											
Cacomantis pallidus	Pallid Cuckoo					Х	Х	Х	Х		Х
Centropus phasianinus	Pheasant Coucal					Х	Х	Х	Х		Х
Chalcites basalis	Horsfield's Bronze-Cuckoo					Х	Х	Х	Х		Х
Chalcites osculans	Black-eared Cuckoo								Х		Х
ESTRILDIDAE											
Emblema pictum	Painted Finch				Х	Х	Х	Х	Х		Х
Heteromunia pectoralis	Pictorella Mannikin			P4					Х		Х
Neochmia ruficauda	Star Finch								Х		Х
Taeniopygia guttata	Zebra Finch				Х	Х	Х	Х	Х		Х
EUROSTOPODIDAE											
Eurostopodus argus	Spotted Nightjar				Х	Х		Х	Х		Х
FALCONIDAE											
Falco berigora	Brown Falcon				Х	Х	Х	Х	Х		Х
Falco cenchroides	Nankeen Kestrel				Х	Х		Х	Х		Х
Falco hypoleucos	Grey Falcon			P4					Х		Х
Falco longipennis	Australian Hobby								Х		Х
Falco peregrinus	Peregrine Falcon		S4	S					Х		Х

Scientific Name	Common Name	C	onservation	Status	Pr	eys	Database searches				
		EPBC Act	WA Act	DEC Priority	Α	В	С	D	E	F	G
Falco subniger	Black Falcon								Х		Х
FREGATIDAE											
Fregata ariel	Lesser Frigatebird	М							Х	Х	
GLAREOLIDAE											
Glareola maldivarum	Oriental Pratincole	М							Х	Х	Х
Stiltia isabella	Australian Pratincole								Х		Х
GRUIDAE											
Grus rubicunda	Brolga								Х		Х
HAEMATOPODIDAE											
Haematopus fuliginosus	Sooty Oystercatcher								Х		Х
Haematopus longirostris	Australian Pied Oystercatcher								Х		Х
HALCYONIDAE											
Dacelo leachii	Blue-winged Kookaburra				Х	Х	Х	Х	Х		Х
Todiramphus pyrrhopygius	Red-backed Kingfisher				Х	Х	Х	Х	Х		Х
Todiramphus sanctus	Sacred Kingfisher				Х	Х		Х	Х		Х
HIRUNDINIDAE											
Cheramoeca leucosterna	White-backed Swallow								Х		Х
Hirundo neoxena	Welcome Swallow								Х		Х
Hirundo rustica	Barn Swallow	М							Х	Х	Х
Petrochelidon ariel	Fairy Martin					Х			Х		Х
Petrochelidon nigricans	Tree Martin							Х	Х		Х
LARIDAE											
Chlidonias hybrida	Whiskered Tern								Х		Х
Chlidonias leucopterus	White-winged Black Tern	М							Х		Х
Chroicocephalus novaehollandiae	Silver Gull								Х		Х
Gelochelidon nilotica	Gull-billed Tern								Х		Х

Scientific Name	Common Name	C	onservation	Status	Pr	Surve	eys	Database searches			
		EPBC Act	WA Act	DEC Priority	Α	В	С	D	Е	F	G
Hydroprogne caspia	Caspian Tern	М							Х		Х
Sterna hirundo	Common Tern	М							Х		Х
Sternula albifrons	Little Tern	М							Х		Х
Thalasseus bengalensis	Lesser Crested Tern	М							Х		Х
Thalasseus bergii	Crested Tern								Х		Х
MALURIDAE											
Amytornis striatus	Striated Grasswren				Х	Х		Х	Х		Х
Malurus lamberti	Variegated Fairy-wren				Х	Х	Х	Х	Х		Х
Malurus leucopterus	White-winged Fairy-wren					Х					Х
Stipiturus ruficeps	Rufous-crowned Emu-wren							Х	Х		Х
MEGALURIDAE											
Cincloramphus cruralis	Brown Songlark							Х	Х		Х
Cincloramphus mathewsi	Rufous Songlark							Х	Х		Х
Eremiornis carteri	Spinifexbird				Х	Х		Х	Х		Х
Megalurus gramineus	Little Grassbird								Х		Х
MELIPHAGIDAE											
Acanthagenys rufogularis	Spiny-cheeked Honeyeater								Х		Х
Certhionyx variegatus	Pied Honeyeater				Х			Х	Х		Х
Conopophila whitei	Grey Honeyeater				Х				Х		
Epthianura aurifrons	Orange Chat								Х		Х
Epthianura tricolor	Crimson Chat							Х	Х		Х
Lichenostomus keartlandi	Grey-headed Honeyeater				Х	Х	Х	Х	Х		Х
Lichenostomus penicillatus	White-plumed Honeyeater				Х	Х	Х	Х	Х		Х
Lichenostomus plumulus	Grey-fronted Honeyeater							Х	Х		
Lichenostomus virescens	Singing Honeyeater				Х	Х	Х	Х	Х		Х
Lichmera indistincta	Brown Honeyeater				Х	Х	Х	Х	Х		Х

Scientific Name	Common Name	Co	onservation	Status	Pr	ys	Database searches				
		EPBC Act	WA Act	DEC Priority	Α	В	С	D	Е	F	G
Manorina flavigula	Yellow-throated Miner				Х	Х	Х	Х	Х		Х
Melithreptus gularis	Black-chinned Honeyeater					Х	Х	Х	Х		Х
Philemon citreogularis	Little Friarbird								Х		Х
Sugomel niger	Black Honeyeater								Х		Х
MEROPIDAE											
Merops ornatus	Rainbow Bee-eater	М			Х	Х	Х	Х	Х	Х	Х
MONARCHIDAE											
Grallina cyanoleuca	Magpie-lark				Х	Х	Х	Х	Х		Х
MOTACILLIDAE											
Anthus novaeseelandiae	Australasian Pipit					Х			Х		Х
NECTARINIIDAE											
Dicaeum hirundinaceum	Mistletoebird					Х		Х	Х		Х
NEOSITTIDAE											
Daphoenositta chrysoptera	Varied Sittella								Х		Х
OTIDIDAE											
Ardeotis australis	Australian Bustard			P4		Х		Х	Х		Х
PACHYCEPHALIDAE											
Colluricincla harmonica	Grey Shrike-thrush				х	Х	Х	Х	Х		Х
Oreoica gutturalis	Crested Bellbird				Х	Х		Х	Х		Х
Pachycephala lanioides	White-breasted Whistler								Х		Х
Pachycephala melanura	Mangrove Golden Whistler								Х		Х
Pachycephala rufiventris	Rufous Whistler							Х	Х		Х
PARDALOTIDAE											
Pardalotus rubricatus	Red-browed Pardalote					Х	Х	Х	Х		Х
Pardalotus striatus	Striated Pardalote					Х		Х	Х		Х
PELECANIDAE											

Scientific Name	Common Name	C	onservation	Status	Previous Surveys				Database searches		
		EPBC Act	WA Act	DEC Priority	Α	В	С	D	Е	F	G
Pelecanus conspicillatus	Australian Pelican							Х	Х		Х
PETROICIDAE											
Melanodryas cucullata	Hooded Robin								Х		Х
Petroica goodenovii	Red-capped Robin								Х		Х
PHALACROCORACIDAE											
Microcarbo melanoleucos	Little Pied Cormorant							Х	Х		Х
Phalacrocorax carbo	Great Cormorant								Х		Х
Phalacrocorax sulcirostris	Little Black Cormorant							Х	Х		Х
Phalacrocorax varius	Pied Cormorant								Х		Х
PHASIANIDAE											
Coturnix pectoralis	Stubble Quail								Х		Х
Coturnix ypsilophora	Brown Quail					Х		Х	Х		Х
PODARGIDAE											
Podargus strigoides	Tawny Frogmouth				Х	Х	Х	Х	Х		Х
PODICIPEDIDAE											
Podiceps cristatus	Great Crested Grebe								Х		
Poliocephalus poliocephalus	Hoary-headed Grebe								Х		Х
Tachybaptus novaehollandiae	Australasian Grebe								Х		Х
POMATOSTOMIDAE											
Pomatostomus temporalis	Grey-crowned Babbler					Х			Х		Х
PSITTACIDAE											
Barnardius zonarius	Australian Ringneck				Х	Х		Х	Х		Х
Melopsittacus undulatus	Budgerigar					Х	Х	Х	Х		Х
Neopsephotus bourkii	Bourke's Parrot								Х		Х
Purpureicephalus spurius	Red-capped Parrot								Х		
Trichoglossus haematodus	Rainbow Lorikeet								Х		

Scientific Name	Common Name	C	onservation	Status	Pr	eys	Database searches				
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PSOPHODIDAE											
Cinclosoma castaneothorax	Chestnut-breasted Quail-thrush								Х		
PTILONORHYNCHIDAE											
Ptilonorhynchus guttatus	Western Bowerbird				Х	Х	Х	Х	Х		Х
Ptilonorhynchus maculatus	Spotted Bowerbird								Х		
RALLIDAE											
Fulica atra	Eurasian Coot								Х		Х
Gallirallus philippensis	Buff-banded Rail								Х		Х
Porphyrio porphyrio	Purple Swamphen								Х		Х
Porzana tabuensis	Spotless Crake								Х		Х
Tribonyx ventralis	Black-tailed Native-hen								Х		Х
RECURVIROSTRIDAE											
Cladorhynchus leucocephalus	Banded Stilt								Х		Х
Himantopus himantopus	Black-winged Stilt								Х		Х
Recurvirostra novaehollandiae	Red-necked Avocet								Х		Х
RHIPIDURIDAE											
Rhipidura albiscapa	Grey Fantail								Х		Х
Rhipidura leucophrys	Willie Wagtail				Х	Х	Х	Х	Х		Х
Rhipidura phasiana	Mangrove Grey Fantail								Х		Х
SCOLOPACIDAE											
Actitis hypoleucos	Common Sandpiper	М							Х		Х
Arenaria interpres	Ruddy Turnstone	М							Х		Х
Calidris acuminata	Sharp-tailed Sandpiper	М							Х		Х
Calidris alba	Sanderling	М							Х		Х
Calidris canutus	Red Knot	М							Х		Х
Calidris ferruginea	Curlew Sandpiper	М							Х		Х

Scientific Name	Common Name	C	onservation	Status	Previous Surveys				Database searches		
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Calidris melanotos	Pectoral Sandpiper	М							Х		Х
Calidris ruficollis	Red-necked Stint	М							Х		Х
Calidris subminuta	Long-toed Stint	М							Х		
Calidris tenuirostris	Great Knot	М							Х		Х
Limicola falcinellus	Broad-billed Sandpiper	М							Х		Х
Limnodromus semipalmatus	Asian Dowitcher	М							Х		Х
Limosa lapponica	Bar-tailed Godwit	М							Х		Х
Limosa limosa	Black-tailed Godwit	М							Х		Х
Numenius madagascariensis	Eastern Curlew	М		P4					Х		Х
Numenius phaeopus	Whimbrel	М							Х		Х
Phalaropus lobatus	Red-necked Phalarope	М							Х		Х
Tringa brevipes	Grey-tailed Tattler	М							Х		Х
Tringa glareola	Wood Sandpiper	М							Х		Х
Tringa nebularia	Common Greenshank	М							Х		Х
Tringa stagnatilis	Marsh Sandpiper	М							Х		Х
Xenus cinereus	Terek Sandpiper	М							Х		Х
STRIGIDAE											
Ninox connivens	Barking Owl					Х			Х		Х
Ninox novaeseelandiae	Southern Boobook Owl					Х		Х	Х		Х
THRESKIORNITHIDAE											
Platalea flavipes	Yellow-billed Spoonbill								Х		Х
Platalea regia	Royal Spoonbill								Х		Х
Plegadis falcinellus	Glossy Ibis	М							Х		Х
Threskiornis molucca	Australian White Ibis								Х		Х
Threskiornis spinicollis	Straw-necked Ibis							Х	Х		Х
TIMALIIDAE											

Scientific Name	Common Name	C	onservation	Status	Previous Surveys				Database searches			
		EPBC Act	WA Act	DEC Priority	Α	В	С	D	Е	F	G	
Zosterops luteus	Yellow White-eye								Х		Х	
TURNICIDAE												
Turnix pyrrhothorax	Red-chested Button-quail								Х			
Turnix velox	Little Button-quail					Х		Х	Х		Х	
TYTONIDAE												
Tyto javanica	Eastern Barn Owl								Х		Х	
Reptiles												
AGAMIDAE												
Amphibolurus longirostris	Long-nosed Dragon				Х	Х		Х	Х			
Ctenophorus caudicinctus	Ring-tailed Dragon				Х	Х	Х	Х	Х			
Ctenophorus isolepis	Central Military Dragon					Х			Х			
Ctenophorus nuchalis	Central Netted Dragon								Х			
Ctenophorus reticulatus	Western Netted Dragon								Х			
Ctenophorus rubens									Х			
Ctenophorus scutulatus	Lozenge-marked Dragon								Х			
Diporiphora valens	Pilbara Two-line Dragon								Х			
Diporiphora winneckei	Canegrass Dragon								Х			
Pogona minor minor	Dwarf Bearded Dragon								Х			
Pogona minor mitchelli									Х			
CHELIDAE												
Chelodina steindachneri	Flat-shelled Turtle								Х			
ELAPIDAE												
Acanthophis pyrrhus	Desert Death Adder								Х			
Acanthophis wellsi	Pilbara Death Adder					Х			Х			
Brachyurophis fasciolatus	Narrow-banded Snake								Х			
Demansia psammophis	Yellow-faced Whip Snake								Х			

Scientific Name	Common Name	Co	onservation	Status	Previous Surveys				Database searches			
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Demansia rufescens	Rufous Whipsnake				Х			Х	Х			
Ephalophis greyi	Mangrove Seasnake								Х			
Furina ornata	Orange-naped Snake								Х			
Parasuta monachus	Monk Snake								Х			
Pseudechis australis	King Brown Snake								Х			
Pseudonaja modesta	Ringed Brown Snake					Х			Х			
Pseudonaja nuchalis	Western Brown Snake								Х			
Simoselaps anomalus	Desert Banded Snake								Х			
Suta fasciata	Rosen's Snake								Х			
Suta punctata	Little Spotted Snake								Х			
Vermicella snelli					Х		Х					
GEKKONIDAE												
Crenadactylus ocellatus	Clawless Gecko							Х	Х			
Diplodactylus conspicillatus	Fat-tailed Diplodactylus								Х			
Diplodactylus savagei	Yellow-spotted Pilbara Gecko				Х	Х	Х	Х	Х			
Gehyra pilbara	Pilbara Dtella				Х			Х	Х			
Gehyra punctata	Spotted Dtella				Х	Х		Х	Х			
Gehyra purpurascens	Purplish Dtella								Х			
Gehyra variegata	Tree Dtella				Х	Х	Х	Х	Х			
Heteronotia binoei	Bynoe's Gecko				Х	Х		Х	Х			
Heteronotia planiceps	Bynoe's Prickly Gecko								Х			
Heteronotia spelea	Desert Cave Gecko				Х				Х			
Lucasium squarrosum	Mottled Ground Gecko								Х			
Lucasium stenodactylum	Crowned Gecko				Х	Х	Х		Х			
Lucasium wombeyi	Pilbara Ground Gecko				Х	Х	Х		Х			
Nephrurus levis	Three-lined Knob-tail								Х			

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		EPBC Act	WA Act	DEC Priority	Α	В	С	D	Е	F	G
Oedura marmorata	Marbled Velvet Gecko				Х	Х			Х		
Rhynchoedura ornata	Beaked Gecko								Х		
Strophurus ciliaris	Spiny-tailed Gecko								Х		
Strophurus elderi	Jewelled Gecko						Х	Х	Х		
Strophurus jeanae	Southern Phasmid Gecko								Х		
PYGOPODIDAE											
Delma borea	Rusty-topped Delma								Х		
Delma butleri	Unbanded Delma								Х		
Delma elegans	Pilbara Delma				Х			Х	Х		
Delma fraseri	Fraser's Delma								Х		
Delma haroldi	Neck-barred Delma								Х		
Delma nasuta	Sharp-snouted Delma				Х	Х		Х	Х		
Delma pax	Peace Delma				Х		Х	Х	Х		
Delma tincta	Excitable Delma				Х				Х		
Lialis burtonis	Burton's Snake-lizard							Х	Х		
Pygopus nigriceps	Hooded Scaly-foot								Х		
PYTHONIDAE											
Antaresia perthensis	Pygmy Python							Х	Х		
Antaresia stimsoni	Stimson's Python				Х	Х			Х		
Aspidites melanocephalus	Black-headed Python					Х			Х		
Aspidites ramsayi	Woma		S4	S					Х		
Liasis olivaceus barroni	Olive Python (Pilbara)	VU	S1	Т	Х	Х			Х	Х	
SCINCIDAE											
Carlia munda	Shaded-litter Rainbow-skink				Х	Х	Х	Х	Х		
Carlia triacantha	Desert Rainbow-skink								Х		
Cryptoblepharus buchananii							1		Х		

Scientific Name	Common Name	Co	onservation	Status	Previous Surveys				D se	atabas earche	ie Is	
		EPBC Act	WA Act	DEC Priority	Α	В	С	D	E	F	G	
Cryptoblepharus plagiocephalus	Callose-palmed Shinning-skink							Х	Х			
Cryptoblepharus ustulatus					Х	Х			Х			
Ctenotus duricola					Х		Х		Х			
Ctenotus grandis	Grand Ctenotus				Х				Х			
Ctenotus hanloni	Nimble Ctenotus								Х			
Ctenotus helenae	Clay-soil Ctenotus								Х			
Ctenotus leonhardii	Leonhardi's Ctenotus								Х			
Ctenotus nigrilineatus	Pin-striped Finesnout Ctenotus			P1					Х			
Ctenotus pantherinus	Leopard Ctenotus				Х	Х			Х			
Ctenotus piankai	Coarse Sands Ctenotus								Х			
Ctenotus robustus	Robust Ctenotus								Х			
Ctenotus rubicundus	Ruddy Ctenotus				Х	Х		Х	Х			
Ctenotus rufescens	Rufous Finesnout Ctenotus								Х			
Ctenotus saxatilis	Stony-soil Ctenotus				Х	Х	Х	Х	Х			
Ctenotus schomburgkii	Barred Wedgesnout Ctenotus								Х			
Ctenotus serventyi	North-western Sandy-loam Ctenotus								Х			
Cyclodomorphus melanops	Spinifex Slender Blue-tongue				Х		Х	Х	Х			
Egernia depressa	Pygmy Spiny-tailed Skink								Х			
Egernia formosa	Goldfields Crevice-skink				Х	Х	Х	Х	Х			
Eremiascincus fasciolatus	Narrow-banded Sand-swimmer								Х			
Eremiascincus richardsonii	Broad-banded Sand-swimmer								Х			
Lerista bipes	North-western Sandslider				Х				Х			
Lerista clara					Х				Х			
Lerista jacksoni					Х				Х			
Lerista muelleri	Wood Mulch-slider					Х	Х	Х	Х			
Lerista separanda	Dampierland Plain Slider			P2					Х			
Scientific Name	Common Name	C	Conservation Status			Previous Surveys				Database searches		
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		EPBC Act	WA Act	DEC Priority	Α	В	С	D	Е	F	G	
Lerista verhmens									Х			
Liopholis kintorei	Great Desert Skink	VU								Х		
Menetia greyii	Common Dwarf Skink				Х				Х			
Menetia surda	Western Dwarf Skink							Х	Х			
Morethia ruficauda	Lined Firetail Skink				Х	Х	Х	Х	Х			
Notoscincus ornatus	Ornate Soil-crevice Skink				Х		Х	Х	Х			
Proablepharus reginae	Western Soil-crevice Skink				Х			Х	Х			
Tiliqua multifasciata	Centralian Blue-tongue								Х			
TYPHLOPIDAE												
Ramphotyphlops ammodytes					Х	Х			Х			
Ramphotyphlops ganei				P1					Х			
Ramphotyphlops grypus	Long-beaked Blind Snake				Х				Х			
Ramphotyphlops pilbarensis									Х			
VARANIDAE												
Varanus acanthurus	Ridge-tailed Monitor				Х	Х		Х	Х			
Varanus brevicauda	Short-tailed Pygmy Monitor								Х			
Varanus eremius	Pygmy Desert Monitor						Х		Х			
Varanus giganteus	Perentie				Х	Х		Х	Х			
Varanus gouldii	Gould's Goanna					Х			Х			
Varanus panoptes	Yellow-spotted Monitor					Х			Х			
Varanus pilbarensis	Pilbara Rock Monitor				Х				Х			
Varanus tristis	Black-headed Monitor				Х	Х	Х		Х			
Amphibians												
HYLIDAE												
Cyclorana australis	Giant Frog				Х				Х			
Cyclorana maini	Main's Frog								х			

Scientific Name	Common Name	Conservation Status			Previous Surveys				Database searches		
		EPBC Act	WA Act	DEC Priority	Α	В	С	D	Е	F	G
Litoria rubella	Desert Tree Frog				Х	Х	Х	Х	Х		
LIMNODYNASTIDAE											
Neobatrachus aquilonius	Northern Burrowing Frog								Х		
Neobatrachus sutor	Shoemaker Frog								Х		
Notaden nichollsi	Desert Spadefoot Toad								Х		
Platyplectrum ornatus	Ornate Burrowing Frog								Х		
Platyplectrum spenceri	Spencer's Burrowing Frog					Х					
MYOBATRACHIDAE											
Uperoleia glandulosa	Glandular Toadlet					Х			Х		
Uperoleia russelli	Russell's Toadlet				Х	Х	Х	Х	Х		
Fish											
CLUPEIDAE											
Nematalosa erebi	Bony Bream							Х			
MELANOTAENIIDAE											
Melanotaenia australis	Western Rainbowfish				Х	Х		Х			
PLOTOSIDAE											
Neosilurus hyrtlii	Hyrtl's Catfish				Х			Х			
TERAPONTIDAE											
Amniataba percoides	Barred Grunter							Х			
Leiopotherapon unicolor	Spangled Perch				Х	Х		Х			
Total					102	125	73	141	374	16	200

APPENDIX B

Definitions of codes and terms used to describe conservation significance

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Status	Code	Description				
Categories used in EPB	C Act Pr	otected Matters Report				
Endangered	EN	A taxon is Endangered when the best available evidence indicates that it is				
		considered to be facing a very high risk of extinction in the wild.				
Vulnerable	VU	A taxon is Vulnerable when the best available evidence indicates that it is				
		considered to be facing a high risk of extinction in the wild.				
Migratory	М	Species migrate to, over and within Australia and its external territories.				
Schedules of the Wester	rn Austra	alian Wildlife Conservation Act 1950				
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, otherwise than for the reasons				
		mentioned above				
Priority Fauna Codes us	ed by th	e Western Australian DEC				
Priority 1	P1	Taxa which are known from few specimens or sight records from one or a few				
Taxa with few, poorly		localities on lands not managed for conservation, e.g. agricultural or pastoral				
known populations on		lands, urban areas, active mineral leases. The taxon needs urgent survey and				
threatened lands.		evaluation of conservation status before consideration can be given to				
		declaration as threatened fauna.				
Priority 2	P2	Taxa which are known from few specimens or sight records from one or a few				
Taxa with few, poorly		localities on lands not under immediate threat of habitat destruction or				
known populations on		degradation, e.g. national parks, conservation parks, nature reserves, State				
conservation lands.		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 which are known from few specimens or sight records from several				
Taxa with several, poorly		localities, some of which are on lands not under immediate threat of habitat				
known populations, some		destruction or degradation. The taxon needs urgent survey and evaluation of				
on conservation lands		conservation status before consideration can be given to declaration as				
		threatened fauna.				
Priority 4	P4	Taxa which are considered to have been adequately surveyed, or for which				
Taxa in need of		sufficient knowledge is available, and which are considered not currently				
monitoring		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 which are not considered threatened but are subject to a specific				
Taxa in need of		conservation program, the cessation of which would result in the species				
monitoring		becoming threatened within five years.				

Threatened fauna definitions