

# Appendix C

**Environmental Referral, North West infrastructure Multi User Iron Ore Export  
(Landside) Facility**

**Fauna Level 1 Survey**

**LEVEL 1 TERRESTRIAL FAUNA SURVEY  
FOR THE MULTI-USER IRON ORE  
EXPORT FACILITY: PORT  
INFRASTRUCTURE PROJECT**

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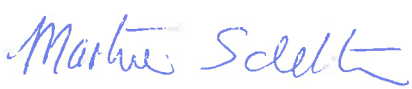
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## EXECUTIVE SUMMARY

North West Infrastructure (NWI) commissioned Coffey Environments to undertake a Level 1 Terrestrial Fauna Survey of the Multi-user Iron Ore Export Facility: Port Infrastructure Project at Port Hedland. The Level 1 Fauna Survey addresses the terrestrial vertebrate fauna on site which require investigation and management to meet legal obligations. The survey will be used to determine the likely impact of constructing and operating the proposed Multi-user Iron Ore Export Facility: Port Infrastructure Project on fauna within the project area.

The objectives of this Level 1 Terrestrial Vertebrate Fauna Survey were to;

- provide an indication of the reptile, amphibian, mammal and bird assemblages in the vicinity of the project area so that potential impacts of the project on the fauna and on the functional value of ecosystems could be adequately assessed;
- assess the fauna habitat types and quality available within the project area;
- identify species of conservation significance that are present or likely to be present in the project area;
- assess the potential impact and environmental risks associated with the proposed development on the fauna assemblage; and
- make recommendations to minimise the potential impacts of the project on resident fauna.

Coffey Environments identified a total of ten fauna habitats in the project area including Low Acacia Heath with Spinifex, Acacia-Spinifex on Sandplain, Mosaic of Heath on Sandplain, Moist Eucalypt Depressions, Mangrove Forest/Woodland, Maritime Grassland, Salt Flats, Coastal Floodplain, Drainage Line Tidal and Drainage Line Coastal. Two habitat types were dominant: Low Acacia Heath with Spinifex and Mosaic of Heath on Sandplain. All fauna habitats in the project area were in good condition, reflecting some impact of previous pastoral activities and fire. There were no significant features or specific habitat within the project area that would indicate it possesses ecological function values that are significantly different to many other areas surrounding it.

Thirty six of the conservation significant fauna species listed under Commonwealth or State government legislation are possible visitors to the project area (26 migratory birds, 5 mammals, 2 reptiles and 3 other bird species). However, none of these species are anticipated to be significantly affected by the proposed Multi-user Iron Ore Export Facility: Port Infrastructure Project. It is Coffey Environments' view that clearing associated with the project is unlikely to substantially modify, destroy or isolate an area of important habitat for these species, or seriously disrupt the life cycle of an ecologically significant proportion of the population of any of these species.

Coffey Environments' assessment of the Multi-user Iron Ore Export Facility: Port Infrastructure Project proposed for Port Hedland is that clearing of vegetation or disturbance associated with the port facilities and associated infrastructure may have an impact on individual species, species assemblages and the functional value at the site level. However, it is unlikely to have a significant impact on;

- terrestrial fauna in a regional context;
- species of conservation significance;
- an ecosystem of high functional value; and
- an ecosystem that is important in a regional context.



## EXECUTIVE SUMMARY

It is recommended that NWI:

- takes into account the potential impact of the Multi-user Iron Ore Export Facility: Port Infrastructure Project on fauna in areas adjacent to the project when developing its fauna management plan;
- includes issues relating to the protection and preservation of fauna on the site in the staff induction program;
- conducts a feral fauna control program to reduce their impacts on native fauna;
- considers incorporating underpasses along the rail line to allow movement of fauna between habitats; and
- implements a speed limit of 80km / hr or less on site.

# **1 INTRODUCTION**

## **1.1 Background**

The NWI has completed a detailed feasibility study for the Multi-user Iron Ore Export Facility at the Port of Port Hedland (Figure 1). The Multi-user Iron Ore Export Facility involves the development of two berths in South West Creek in the inner Port Hedland Harbour, the development of land based port facilities and associated infrastructure (termed land side) and a rail spur linking the port facilities with existing rail (termed rail side).

The dredging campaign and onshore disposal of dredged material associated with the development of eight berths in South West Creek, including the two berths proposed allocated to NWI, was referred to the Environmental Protection Authority (EPA) on 8 November 2010. The South West Creek Dredging and Reclamation Project were assessed by the EPA at the level of Assessed on Referral Information (ARI), and received ministerial approval on 15 March 2011 (Ministerial Statement 859).

The Multi-user Iron Ore Export Facility: Port Infrastructure project involves the development of port and associated infrastructure within the precincts of Port Hedland Port Authority. It includes two berths within South West Creek to provide for the export capacity of 50 million tonnes per year, along with supportive infrastructure incorporating stackers and loaders, conveyors, stockyard, rail car dumper and rail loop.

Subsequently, NWI have commissioned Coffey Environments to undertake a Level 1 Terrestrial Fauna Survey for the Multi-user Iron Ore Export Facility: Port Infrastructure Project. The objective of the terrestrial fauna assessment is to describe and map the fauna habitat within the study area and assess the likelihood for the presence of conservation significant fauna predicted to occur within the region. The fauna assessment also discusses the potential impacts of the proposed development for use in the environmental approval process. This report details the findings of the Multi-user Iron Ore Export Facility: Port Infrastructure Project (Land Side) fauna assessment.

A number of options are being considered for the alignment of the rail spur connecting the southern end of the proposed NWI rail loop to the existing BHP Billiton or Fortescue Metal Group rail lines. The alignment of the rail spur is currently subject to commercial negotiations and is therefore not included in the Multi-User Iron Ore Export Facility: Port Infrastructure Project.

## **1.2 Objectives**

The objectives of this Level 1 Terrestrial Fauna Survey were to:

- Provide an indication of the reptile, amphibian, mammal and bird assemblages in the vicinity of the project area so that potential impacts on the fauna and on the functional value of ecosystems could be adequately assessed;
- Assess the fauna habitat types and quality available within the project area;
- Identify species of conservation significance that are present or likely to be present in the project area;
- Assess the potential impact and environmental risks associated with the proposed development on the fauna assemblage; and
- Make recommendations to minimise potential impacts on resident fauna.

### 1.3 Scope of Works

This report addresses all of the project area shown in Figure 2. This report includes:

- A review of available records from the WA Museum (WAM), NatureMap and Department of Environment and Conservation (DEC) to identify potential vertebrate fauna previously recorded in the area;
- A search of the DEC's Threatened and Priority Species database to identify potential scheduled and threatened species within the region;
- A search of the Commonwealth Government's database for matters of national environmental significance to identify vertebrate fauna species potentially occurring within the area that are protected under the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* or international migratory bird agreements (JAMBA/CAMBA);
- A three-day field investigation of the area;
- A review of previous fauna surveys conducted in the region;
- An assessment of the potential impacts and risks to fauna from the proposed vegetation clearing and construction of facilities;
- A desktop assessment of the likely impact on Short Range Endemic Invertebrates (SREs) in the area; and
- Recommendations on:
  - Any species-specific searches that may be required for conservation significant species such as Northern Quolls within the site;
  - Any follow-up fauna surveys required to quantify information on conservation significant species or fauna assemblages that are likely to be impacted; and
  - Strategies to minimise or mitigate impacts on conservation significant fauna or fauna-habitat.

This report does not include an assessment of the impact of the project on subterranean fauna such as stygofauna and troglafauna.

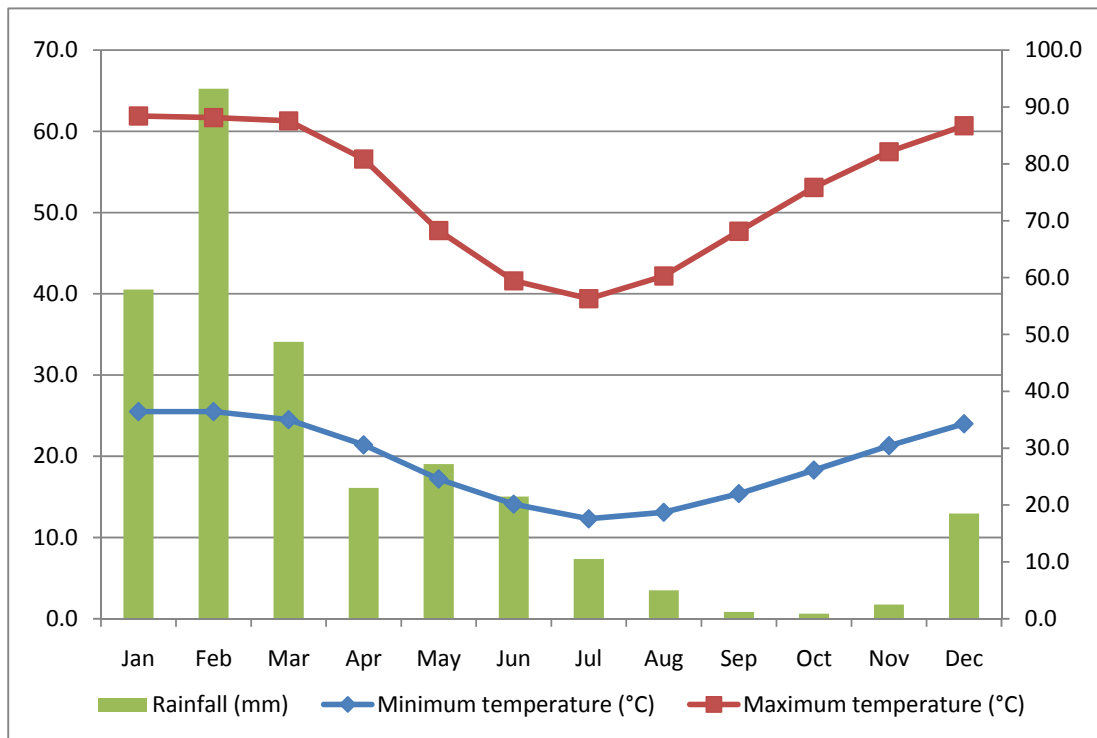
### 1.4 Climate

The Port Hedland climate is classified as sub-tropical and becomes arid the further inland travelled (BOM, 2010). The region is characterised by very hot weather during the summer months with the highest monthly maxima occurring in December (Table 1; Chart 1). Winter months are somewhat cooler with the average maximum temperature dropping to 27.1°C in July (Table 1; Chart 1). Frosts rarely occur in the Port Hedland area with average minimum temperatures greater than 12°C.

Pilbara average annual rainfall varies between 250 mm and 400 mm, with many years reporting no significant rainfall events. The majority of rain falls during the summer months and is generally associated with scattered thunderstorms and tropical cyclones. The coast extending from Port Hedland to Exmouth Gulf is considered to be the most cyclone prone area in Australia (BOM, 2010). These cyclones typically develop in ocean waters north of Port Hedland and head south west, parallel to the coastline where they often change to a south easterly course and move inland bringing heavy rainfall. Peak rainfall in Port Hedland occurs during the summer months from January to March and is associated with the cyclone season (November to April) (Table 1; Chart 1). Port Hedland is usually dry from August to November.

**TABLE 1**  
**CLIMATIC DETAILS FOR PORT HEDLAND (STATION 4032) 1948 – 2010**

Port Hedland (Station 4032)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Minimum temperature (°C)	25.5	25.5	24.5	21.4	17.2	14.1	12.3	13.1	15.4	18.3	21.3	24.0	19.4
Maximum temperature (°C)	36.4	36.2	36.8	35.2	30.6	27.5	27.1	29.1	32.3	34.8	36.2	36.7	33.2
Rainfall (mm)	57.9	93.2	48.7	23.0	27.2	21.5	10.5	5.0	1.2	0.9	2.5	18.5	310.4



**CHART 1.**  
**CLIMATIC CONDITIONS FOR PORT HEDLAND**

## 1.5 Geology and Soils

The Port Hedland area is located within the Pilbara Craton, which is described as a metamorphosed basement of granitoid rocks and gneiss. The Pilbara Craton is overlain by the Hamersley Basin, a Late Archean volcanic sedimentary sequence characterised as basal basic lavas overlain with clastic sedimentary sequences and banded iron formations.

Quaternary sedimentary units overlay the tertiary deposits of the Hamersley Basin. The Quaternary sediments of the Pleistocene epoch are generally identified as clastic rocks forming sedimented clayey sandstones and conglomerates.

The stratigraphic units in and around the inner harbour would be expected to be clayey calcareous conglomerate and clayey calcareous sandstone overlain in some cases by 'red beds' (strata of reddish-coloured sedimentary rock), which are subsequently overlain by unconsolidated sediments, calcareous sand, silt or clay (BHPBIO, 2008).

No geotechnical data has been collected from the project area.

## 1.6 Topography and Surface Hydrology

The topography of the Port Hedland area is predominantly influenced by the Abydos Plain, which rises from the coastal lowlands to around 300 to 400m above mean sea level adjacent to the Chichester Range. The topography of the Port Hedland coastal area varies from open harbour to tidal creeks, intertidal mudflats, bare coastal mudflats and sandy lowlands (van Vreeswyk *et al.*, 2004).

Several creeks converge at Port Hedland Harbour, including Stingray Creek, South Creek, South East Creek, South West Creek and West Creek. South West Creek and South Creek are the dominant watercourses draining into Port Hedland Harbour (SKM, 2008). Both of these creeks flow northwards and cross under BHP Billiton Iron Ore's Port Hedland–Shay Gap Railway to enter the harbour area.

The creeks in the Port Hedland region are predominantly dry. However, significant runoff is generated after heavy rainfall, with water often overflowing from these creeks and inundating the coastal plain. Coastal inundation also occurs as a result of storm surge when South West and South East creeks overflow during more extreme storm events.

## 1.7 Bioregional Context of Project Area

### 1.7.1 Bioregional Assessment

The Interim Biogeographic Regionalisation for Australia divides Australia into 85 bioregions based on major biological and geographical or geological attributes (Thackway & Cresswell, 1995). The bioregions have been further divided into 404 subregions (DEWHA, 2011). The project area is located within the Pilbara bioregion and Roebourne subregion.

The Pilbara bioregion is considered to be a region of significant biodiversity based on the geological, altitudinal and climatic diversity. The Roebourne subregion is characterised by alluvial plains, low stony hills and granite outcrops, comprising largely granitic soils with Quaternary alluvial and older colluvial coastal and subcoastal plains interspersed with resistant linear ranges of basalt.

### 1.7.2 Native Vegetation

The vegetation fringing Port Hedland Harbour is comprised of nine mangrove communities (Paling *et al.*, 2001). At higher elevations, the port area vegetation is comprised of mixed salt-tolerant shrubs and grasses interspersed with areas of algal mats (Biota, 2004a). Further inland, the vegetation changes to a shrubland/grassland mosaic.

Two vegetation types were identified in DMMA A, located immediately west of the Port Hedland–Goldsworthy Railway and in close proximity to the project area (Biota, 2008; Ecologia, 2008, cited in BHPBIO, 2008):

- *Triodia epactia*/*Tridia pungens* (*Triodia secunda*) closed hummock grassland over *Cenchrus ciliaris* and *Sporobolus virginicus* open tussock to tussock grassland on the low sandy islands occurring within the bare tidal mudflats.
- *Halosarcia halocnemoides* subsp. *Tenuis*/*Halosarcia indica* subsp. *Leistachya* (samphires) low open shrubland to low open heath on bare tidal mudflats.

Mangal habitat harbours a high diversity of vertebrate and invertebrate fauna. This includes guilds of bird and bat species that appear to be largely restricted to mangal and associated littoral habitats (Hutchings and Recher 1982, Johnstone 1990, Churchill 1998). The Port Hedland area contains several species such *Avicennia marina*, *Rhizophora stylosa*, *Ceriops tagal*, *Aegialitis annulata* and *Aegiceras corniculatum* which are more structurally complex and species rich in areas closer to the margins of major and minor creeks (Biota, 2004d). Bird fauna specialised in utilising mangroves in the Port Hedland area include species such Mangrove Golden Whistler, Dusky Gerygone, Mangrove Robin, Bar-shouldered Dove and the Mangrove Fantail (Biota 2002a). A number of wader species have been recorded from the mudflat habitats associated with West Creek, including the Whimbrel, Eastern Curlew, Common Sandpiper and Grey-tailed Tattler (Biota 2002a). Mangal habitat in the Port Hedland area also contained bat specialists such as Little North-western Mastiff Bat *Mormopterus loriae* (Biota 2002a).

The samphire shrub lands are considered to be of moderate conservation significance as they are restricted to the narrow saline mudflats and are susceptible to disturbance.

The vegetation at the proposed location of the car dumper, rail loop, base case stockyard and part of conveyor is likely to be an *Acacia* shrubland over *Triodia epactia* grassland. This vegetation type is widespread throughout the locality and is of low conservation significance.

### 1.7.3 Fauna Species of Conservation Significance

The Commonwealth Department of Environment, Water, Heritage and Arts (DEWHA), DEC and WAM have reported a number of fauna species at risk in the Roebourne subregion. This report assesses the potential for these species to be found in the project area and the potential impact of the proposed development on these species.

## 1.8 Previous Biological Assessments

There have been numerous environmental assessments conducted within the project area and in the greater Port Hedland area. The findings from the following surveys and assessments have been utilised for this assessment:

ATA Environmental. (2007). *Great Northern Pipeline project – Level 1 Vertebrate Fauna Assessment*. Unpublished report for Arc Energy.

Bamford Consulting Ecologists. (2005). *Fauna Survey of Proposed Iron Ore Mine, Cloudbreak*. Unpublished report for Fortescue Metals Group Ltd.

Bamford, M.J. (2008). *Fauna Assessment of the Wodgina Tailings Storage Facility 3*. Unpublished report for Talison Minerals Pty Ltd.

Bamford Consulting Ecologists. (2009). *Fauna Assessment of the Black Cockatoos Iron Nullagine Iron Ore Project*. Unpublished report prepared by Astron Environmental Services for Black Cockatoos Iron.

BHPBIO. (2008). *Port Hedland Finucane Island Dredging: Environmental Referral Document*. Report prepared by BHP Billiton Iron Ore, Perth, Western Australia.

BHPBIO. (2009a). *Port Hedland Nelson Point Dredging: Environmental Referral Document*. Report prepared by BHP Billiton Iron Ore, Perth, Western Australia.

BHPBIO. (2009b). *Rail Operations: Chichester Deviation Significant Species Management Plan*. Report prepared by BHP Billiton Iron Ore, Perth, Western Australia.

Biota. (2002a). *Proposed Hope Downs Rail Corridor from Weeli Wolli Siding to Port Hedland - Vertebrate Fauna survey*. Unpublished report for Hope Downs Management Services Pty. Ltd.

Biota. (2002b). *Hope Downs Rail Corridor Mulgara Dasycercus cristicauda and Bilby Macrotis lagotis Surveys*. Unpublished report for Hope Downs Management Services Pty. Ltd.

Biota. (2004a). *Fauna Habitats and Fauna Assemblage of the Proposed FMG Stage A Rail Corridor*. Report prepared by Biota Environmental Sciences for Fortescue Metals Group Ltd, Western Australia.

Biota. (2004b). *Hope Downs Rail Corridor Extension – Hamersley Range: Vertebrate Fauna Survey*. Unpublished report for Hope Downs Management Services Pty. Ltd.

Biota. (2004c). *Hope Downs Additional Rail Corridor – Chichester Range: Vertebrate Fauna Survey*. Unpublished report for Hope Downs Management Services Pty. Ltd.

Biota. (2005). *Fauna Habitats and Fauna Assemblage of Mesa A and G, near Pannawonica*. Report prepared by Biota Environmental Sciences for Robe River Iron Associates.

Biota. (2007). *A Biodiversity Assessment of the Utah Point Berth Development, Port Hedland*. Report prepared by Biota Environmental Sciences for Sinclair Knight Merz and the Port Hedland Port Authority, Port Hedland, Western Australia.

Biota. (2008a). *Cape Lambert Port B Development Seasonal Fauna Survey*. Report prepared by Biota Environmental Sciences for Pilbara Iron Pty Ltd.

Biota. (2008b). *A Flora and Fauna Assessment of RGP5 Spoil Areas A and H, Port Hedland Harbour*. Report prepared by Biota Environmental Sciences for Sinclair Knight Merz, Perth, Western Australia.

Biota. (2008c). *A Flora and Fauna Assessment of RGP5 DMMA A, Port Hedland Harbour*. Report prepared by Biota Environmental Sciences for Sinclair Knight Merz, Perth, Western Australia.

Biota. (2009a). *Port Hedland Nelson Point Dredging Approvals Flora and Fauna Review of DMMA H*. Report prepared by Biota Environmental Sciences for Sinclair Knight Merz, Perth, Western Australia.

Biota. (2009b). *Hope Downs IV Targeted Northern Quoll Survey*. Report prepared by Biota Environmental Sciences for Rio Tinto Iron Ore.

Biota and Trudgen, M.E. (2002). *Proposed Hope Downs Rail Corridor from Weeli Wolli Siding to Port Hedland – Flora and Vegetation Survey*. Unpublished report for Hope Downs Management Services, Perth.

Coffey Environments. (2010). *Prefeasibility Study (Environmental): Multi-user Iron Ore Export Facility*. Unpublished report for North West Iron Ore Alliance.

Ecologia. (1997). *Hope Downs Biological Survey*. Unpublished report by ecologia Environmental Consultants prepared for Hope Downs Management Services, Perth.

*ecologia* Environment. (1995). *Ore Body 18 Biological Assessment Survey*. Unpublished report commissioned by BHP Iron Ore Pty. Ltd.

*ecologia* Environment. (1998). *West Angelas ERMP: Vertebrate Fauna Assessment Survey*. Unpublished Report for Robe River Iron Associates.

*ecologia* Environmental Consultants. (1999). *Jimblebar Flora and Soil Survey*. Unpublished Report for BHP Iron Ore Pty Ltd.

*ecologia* Environment. (2004a). *Orebody 24 Biological Expansion Survey*. Unpublished report for BHP Billiton Iron Ore Pty Ltd.

*ecologia* Environment. (2004b). *Eastern Ophthalmia Range Expansion Biological Survey*. Unpublished report for BHP Billiton Iron Ore Pty Ltd.

*ecologia* Environment. (2004c). *Area C: Deposits D, E, and F*. Unpublished report for BHP Billiton Iron Ore Pty Ltd.

*ecologia* Environment. (2004d). *Jimblebar – Wheelarra Hill Expansion Biological Survey*. Unpublished report for BHP Billiton Iron Ore Pty Ltd.

*ecologia* Environment. (2006). *Terrestrial vertebrate fauna assessment*. Unpublished report for Roy Hill Iron Ore.

*ecologia* Environment. (2008). *RGP5 level 2 fauna survey Chichester deviation*. Unpublished report for BHP Billiton.

ENV Australia. (2009). *Port Hedland and Nelson Point Dredging Approvals: Targeted Species Assessment of DMMA H*. Report prepared by ENV Australia for Sinclair Knight Merz.

Fortescue Metals Group. (2004). *Pilbara Iron Ore and Infrastructure Project: Port and North-South Railway (Stage A), Public Environmental Review*. Fortescue Metals Group Limited, Perth.

Graham, G. (Ed.) (1999). *A Land Management Assessment of Mandora Marsh and Its Immediate Surrounds*. Unpublished survey report prepared by the Department of Conservation and Land Management, Perth.

Hope Downs Management Services. (2000). *Hope Downs Iron Ore Mine*. Public Environmental Review prepared for Hope Downs Management Services, Perth.

Hope Downs Management Services. (2002). *Hope Downs Iron Ore Mine: Port and Rail Development*. Public Environmental Review prepared for Hope Downs Management Services, Perth.

Ninox Wildlife Consulting. (2008). *A Vertebrate Fauna Survey of the Proposed Hope Downs 4 Infrastructure Corridor, near Newman, Western Australia*.

Terrestrial Ecosystems. (2010). *Fauna Risk Assessment for Roy Hill Iron Ore Pty Ltd Proposed Hillside South Railway Corridor*. Unpublished report for Roy Hill Iron Ore.

VSCRG. (2007). *The Mangroves of Utah Point, Port Hedland*. Report prepared by V & C Semeniuk Research Group for the Port Hedland Port Authority, Port Hedland, Western Australia.

The data from several of these surveys have been collated and utilised in this assessment (Appendix A). A brief synopsis of the most pertinent reports is also provided below.

Graham's (1999) report is the result of an on-site assessment of the Mandora Marsh assessing the existing management and defining the boundaries of the proposed conservation reserve. Field work was undertaken by a team with expertise in a range of areas. The terrestrial vertebrate fauna were assessed using pit-traps, Elliott traps and searching by hand. Bird surveys were undertaken during one



hour counts in the first two hours from dawn. The fauna assessment was undertaken in sand dune, flat sand plain, loam, calcrete and samphire habitats. Some of these habitats are found in the project area which makes the results from this survey relevant.

Surveys conducted by Biota (2004a) reported the on-site assessment of the FMG Stage A rail assessment. Fieldwork was undertaken by a team with a range of expertise using pit-traps, Elliot traps, funnel traps, cage traps and hand searching. Several bird surveys were conducted and the fauna assessment occurred in stony hills and plains, sand dunes and sheets and creek lines and flood plains. Some of these habitats are found in the project area which makes the results from this survey relevant.

Surveys conducted by Biota (2002a, b; 2004b, c) and Ninox (2008) assessed the Hope Downs rail and port facility. Fieldwork was undertaken by a team of people with a range of expertise using pit-traps, Elliot traps, cage traps and hand searching. Several bird surveys were conducted and the fauna assessment occurred in mangroves, sand dunes, cracking clay communities and mulga woodlands. Some of these habitats are found in the project area which makes the results from this survey relevant to the current study.

A survey conducted by Biota (2008a, b) assessed the Cape Lambert port facility. Fieldwork was undertaken by a team of people with a range of expertise using pit-traps, Elliot traps, cage traps, funnel traps and hand searching. Several bird surveys were conducted and the fauna assessment occurred in mangroves, mixed hummock grasslands, shrubby samphire, marine couch, wirewood shrubland. Some of these habitats are found in the project area which makes the results from this survey relevant for the current study.

Studies conducted by Ecologia (1995; 1998a, b; 2004a, b, c, d; 2005) assessed the West and East Angelas mine. Fieldwork was undertaken by a team of people with a range of expertise using pit-traps, Elliot traps, cage traps, funnel traps and hand searching. Several bird surveys were conducted and the fauna assessment occurred in spinifex hummock grasslands, acacia shrubland and drainage lines. Some of these habitats are found in the project area which makes the results from this survey relevant for the current study.

Studies conducted by Ninox (1985; 1986; 1992; 1995, all cited in Ninox, 2008) assessed the Mt Channar and Marrandoo projects. Fieldwork was undertaken by a team of people with a range of expertise using pit-traps, Elliot traps, cage traps, and hand searching. Several bird surveys were conducted and the fauna assessment occurred in rocky outcrops, spinifex hummock grasslands and acacia shrubland. Some of these habitats are found in the project area which makes the results from this survey relevant for the current study.

A survey conducted by Bamford (2005) assessed the Cloudbreak mine area. Fieldwork was undertaken by a team of people with a range of expertise using pit-traps, Elliot traps, funnel traps, cage traps, and hand searching. Several bird surveys were conducted and the fauna assessment occurred in samphire flats, spinifex hummock grasslands, mulga woodlands and drainage lines. Some of these habitats are found in the project area which makes the results from this survey relevant for the current study.

## **2 METHODOLOGY**

### **2.1 Database Searches**

A desktop search of DEC's NatureMap online database was undertaken to develop a list of bird, reptile, mammal and amphibians recorded in previous surveys the region. A review of the DEC's list of Threatened and Priority fauna was undertaken to identify potential scheduled and threatened species in the region. A review of the Commonwealth *EPBC Act 1999* list of protected species was also undertaken to identify species of conservation interest to the Commonwealth Government. The search area for all database searches was bounded by a 50km buffer area for the coordinates 118°33' 27" E, 20°26' 29" S.

General texts were also used to provide supplementary information including Tyler *et al.* (2000) for frogs; Storr *et al.* (1983, 1990, 1999, 2002) and Thompson and Thompson (2006) for reptiles; Johnstone and Storr (1998; 2004) for birds; and van Dyck and Strahan (2008) for mammals. In addition, a number of published and unpublished reports for fauna surveys in the project vicinity have been used to provide a regional context for the small vertebrate assemblages sampled in the survey area.

These sources of information were used to create lists of species expected to utilise the survey area. It should be noted that these lists include species that have been recorded in the general region, but are vagrants, as suitable habitat is lacking. Vagrants can be recorded almost anywhere. Many of the bird, mammal, reptile and amphibian species have specific habitat requirements that may be present in the general area but not in the specific survey area. As the ecology of many of these species is often not well understood, it can sometimes be difficult to indicate the species whose specific habitat requirements are not present in the survey area. As a consequence some species will be included in the list produced from these database searches that will not be present in the actual survey area.

### **2.2 Taxonomy and Nomenclature**

Taxonomy and nomenclature for fauna species used in this report is based on WA Museum 2008 records which are adapted from Aplin and Smith (2001) for amphibians and reptiles, How *et al.* (2001) for mammals, and Johnstone and Storr (1998, 2004) and Christidis and Boles (2008) for birds. Where data has been referred to in the Appendice or purchased as a database search, Coffey Environments has presumed that the identification and nomenclature were correct at the time of printing these reports. Where possible, Coffey Environments have verified the taxonomy and nomenclature of any of these listed species with the Western Australian Museum.

### **2.3 Site assessment**

The field survey was conducted by Paul Mitrovski and Graeme Finlayson on 21 June to the 23 June 2010 to examine the habitat types available for amphibians, reptiles, mammals and birds. Paul and Graeme have previous experience conducting Level 1 Vertebrate Fauna Surveys throughout Western Australia and have previously conducted assessments in the Pilbara bioregion. The site was traversed by vehicle and on foot. No trapping was conducted as part of this assessment. The weather was fine and mild for the duration of the site visit.

### **2.4 Habitat Type and Quality**

The fauna habitat was assessed at multiple locations, whilst traversing the project area. Fauna habitat types in the project area were identified during the site assessment.

The quality of the fauna habitat was assessed using the following criteria:

*High quality fauna habitat* – These areas closely approximate the vegetation mix and quality that would have been in the area prior to any disturbance. The habitat has connectivity with other habitats and is likely to contain the most natural vertebrate fauna assemblage.

*Very good fauna habitat* – These areas show minimal signs of disturbance (e.g. grazing, clearing, fragmentation, weeds) and generally retain many of the characteristics of the habitat if it had not been disturbed. The habitat has connectivity with other habitats and fauna assemblages in these areas are likely to be minimally effected by disturbance.

*Good fauna habitat* – These areas showed signs of disturbance (e.g. grazing, clearing, fragmentation, weeds) but generally retain many of the characteristics of the habitat if it had not been disturbed. The habitat has connectivity with other habitats and fauna assemblages in these areas are likely to be affected by disturbance.

*Disturbed fauna habitat* – These areas showed signs of significant disturbance. Many of the trees, shrubs and undergrowth are cleared. These areas may be in the early succession and regeneration stages. Areas may show signs of significant grazing contain weeds or have been damaged by vehicle or machinery. Habitats are fragmented or have limited connectivity with other fauna habitats. Fauna assemblages in these areas are likely to differ significantly from what might be expected in the area had the disturbance not occurred.

*Highly degraded fauna habitat* – These areas often have a significant loss of vegetation, an abundance of weeds, and a large number of vehicle tracks or are completely cleared. They have limited or no fauna habitat connectivity. Faunal assemblages in these areas are likely to be significantly different to what might have been in the area pre-disturbance.

## 2.5 Reporting

This report was written by Dr Paul Mitrovski who has extensive experience in fauna surveys and has conducted previous surveys in the Pilbara.

## 2.6 Limitations

This assessment is primarily based on fauna species records made available through NatureMap (WA fauna returns, WAM), unpublished information from surveys surrounding the project area, a search of DEC's threatened species database, the EPBC protected matters online database and habitat preferences for each species. These databases do not provide comprehensive coverage of the State and are not adequate to provide species lists for small scale sites. Large search areas are generally used in order to generate lists for small sites. Species lists are therefore likely to include numerous species not likely to be found at any specific location within the search area. Species that will obviously not generally be found in the area have been omitted.

Conclusions and management recommendations about the vertebrate faunal diversity in the region have been made based on results from surveys in the bioregion including and surrounding the project area and comparisons of results from searches of available databases and regional reports. Multiple surveys in each habitat type, conducted in different seasons, repeated over several years are necessary to cater for seasonal and temporal variations in the faunal assemblage.

This survey was undertaken in accordance with a Level 1 survey as suggested in the Environmental Protection Authority (EPA) *Position Statement No. 3 Terrestrial Biological Surveys as an Element of Biodiversity Protection* (EPA, 2002), Coffey Environments' interpretation of the EPA *Guidance for Assessment of Environmental Factors: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia, No. 56* (EPA, 2004), *Guidance for the Assessment of Environmental Factors No 20: Sampling of Short Range Endemic Invertebrate Fauna for Environmental Impact Assessment in Western Australia* (EPA, 2009) and as described in the literature (Thompson, 2007).

The EPA *Guidance for Assessment of Environmental Factors: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia, No. 56* (EPA, 2004) suggests that fauna surveys may be limited by many variables. Limitations associated with each of these variables are assessed in Table 2.

**TABLE 2**  
**FAUNA SURVEY LIMITATIONS AND CONSTRAINTS**

Possible limitations	Constraint (yes/no); significant, moderate or negligible	Comment
Competency and experience of the consultant carrying out the survey	No	The scientists who conducted this survey have appropriate training and experience in conducting Level 1 Vertebrate Fauna Survey.
Scope	No	All components required for a Level 1 Vertebrate Fauna Survey have been completed.
Proportion of fauna identified, recorded and/or collected	Yes Negligible	An on-site terrestrial fauna trapping survey has not been undertaken within the project area; however, fauna surveys have been recently conducted in nearby areas and in the region. Numerous terrestrial fauna surveys have been undertaken in the bioregion which include habitat similar to that within the Port Hedland project area. While the terrestrial fauna in the project area has not been directly surveyed, there is sufficient data to assess the potential impact of the project.
Sources of information	No	Vertebrate fauna information was available from government databases (State and Commonwealth) – and unpublished reports conducted in the region.
Proportion of the task achieved	No	The survey fulfils all of the objectives.
Timing/weather/season/cycle	No	The reconnaissance site visit was undertaken in June in mild weather which was appropriate for this type of survey.
Disturbances which affected results of the survey	No	Some of the area had been disturbed by previous anthropogenic and pastoral activities. This impact has been taken into account in this survey.
Intensity of survey effort	No	The intensity of the survey is sufficient for a Level 1 Vertebrate Fauna Survey.
Completeness	No	All major habitat types were visited.
Resources	No	Adequate resources were available.
Remoteness and/or access problems	No	There were no access problems.
Availability of contextual information for the region	No	Extensive surveys have been conducted in the region and in similar habitats that occur within the project area.

Negligible – less than 20%; Moderate – 20-60%; significant – greater than 60%

### 3 RESULTS

#### 3.1 Fauna Habitat

##### 3.1.1 Fauna Habitat in the Project Area

Seven fauna habitats were identified within the project area (Figure 2). The seven fauna habitats are:

1. Low Acacia Heath with Spinifex (Plate 1) – This contains a variety of low acacia shrubs at mixed densities with spinifex understorey;
2. Moist Eucalypt Depressions (Plate 2) – This contains eucalypt trees bordering a natural ephemeral depression;
3. Mangrove Forest/Woodland (Plate 3) – This contains a variety of mangrove species at mixed densities on a silty substrate within the intertidal zone;
4. Maritime Grassland (Plate 4) – This contains spinifex and low herbaceous species at mixed densities;
5. Salt Flats (Plate 5) – This contains no vegetation and is characterised by a salt crust on the substrate surface;
6. Coastal Floodplain (Plate 6) – This contains eucalypt trees, acacia shrubs and some grasses within a wide drainage line; and
7. Drainage Line Tidal (Plate 7) – This contains intertidal drainage lines with no vegetation.

Within the southern section of the project area, one fauna habitat type was dominant (Low Acacia Heath with Spinifex). A further two fauna habitat types were also recorded in small patches in the southern section of the project area (Moist Eucalypt Depressions and Coastal Floodplain) (Figure 2).

Mangrove Forest/Woodland, Maritime Grassland and Salt Flats were recorded along the coastal areas of the project area with small areas of Drainage Line Tidal also present (Figure 2).

##### 3.1.2 Habitat Condition

All fauna habitats within the project area were assessed as Good quality with some disturbance as a result of previous pastoral activity and fire. The habitat type and condition were considered to be typical to those found in the vicinity of the project area.



Plate 1. Low Acacia Heath on Spinifex



Plate 2. Moist Eucalypt Depressions



Plate 3. Mangrove Forest/Woodland



Plate 4. Maritime Grassland



Plate 5. Salt Flats



Plate 6. Coastal Floodplain



Plate 7. Drainage Line Tidal

### **3.2 Potential Vertebrate Fauna in the Project Area**

Appendix A lists species recorded in fauna surveys undertaken in the region. Up to 609 vertebrate species are predicted to occur in the region.

#### **3.2.1 Amphibians**

Drainage lines occur throughout the site. The amphibians predicted to occur on site (Appendix A) are likely to be present when these drainage lines contain water. Most frog species recorded in previous

surveys in the region are arid-adapted species and are not dependent on drainage lines. Up to 20 species of amphibians are predicted to occur in the project area.

### **3.2.2 Reptiles**

The reptile species listed in Appendix A have been recorded in the general vicinity of the project area. However, many of these species have specific habitat requirements and are unlikely to be present on site. Although up to 177 species have been recorded in the region based on database searches, not all these species would be predicted to be present as a number of habitats that occur in the region such as granite outcrops and sand dunes are not present in the project area.

### **3.2.3 Mammals**

The abundance of small mammals within the project area is likely to be typical of previous surveys conducted in similar habitats within the region. Of the 81 species predicted to potentially occur in the vicinity of the project area, a number are unlikely to occur on site due to a lack of suitable habitat. This is particularly the case for species that are found in granite outcrops and dunes that are elsewhere in the region. The mammal species predicted to occur in the project area also includes several species of introduced mammals.

### **3.2.4 Avifauna**

Bird species recorded in surveys in the general area are shown in Appendix A. Some of these species are unlikely to be observed, forage or nest in the project area because of a lack of suitable habitat. A number of bird species predicted to occur are also likely to be seasonal visitors to the project area after rainfall. There are always going to be vagrants present in an area because of unusual weather (e.g. cyclones). Up to 331 bird species are predicted based on the database searches.

### **3.2.5 Fauna Assemblage**

The fauna assemblage predicted to occur within the project area would be typical for the seven habitat types recorded, which are well-represented in the region and have been well-surveyed in previous fauna assessments conducted throughout the Pilbara.

## **3.3 Short Range Endemic (SRE) Invertebrates**

Invertebrates are a highly diverse group. However, this diversity has meant that taxonomically many species are poorly understood. Short-range endemic species are a group of invertebrates that have common life history characteristics such as poor powers of dispersal or confinement to discontinuous habitats or usually highly seasonal and only active during cooler, wetter periods or low levels of fecundity (Harvey, 2002). Therefore, several groups have particularly high instances of short-range endemic species: Gastropoda (snails and slugs), Oligochaeta (earthworms), Onychophora (velvet worms), Araneae (mygalomorph spiders), Schizomida (schizomids; spider-like arachnids), Diplopoda (millipedes), Phreatoicidea (Phreatoicidae crustaceans), and Decapoda (freshwater crayfish).

There have been several surveys conducted for short-range endemic invertebrates in the Pilbara. Millipede species have been recorded from the Spirobolid genus (Burrup Peninsula; Hoffman 2003) and the Paradoxosomatidae family (Mesa J and Mt Brockman; Biota 2005). Land snail species from the Rhagada, Quistrachia and Bothriembryon genera have been recorded Mesa A and G surveys and FMG Stage B railway corridor (Biota 2005). Biota (2005) reported Mygalomorph spiders from the Aganippe, Synothele and Missulena nearra at the FMG Stage B railway corridor. ecologia (2007) recorded a new Trap-door spider species from the *Aurecocypta* genus.

Limited sampling for short range endemic species has been undertaken in the Port Hedland area. Sampling for potential short range endemic taxa was undertaken in BHP Billiton Iron Ore's DMMA A, which adjoins the project area, with trapdoor spiders, pseudoscorpions and terrestrial snails targeted. No potential short range endemic taxa were recorded within DMMA A (BHPBIO, 2008).

Given that no potential short range endemic taxa were recorded adjacent to the project area and that the seven habitat types recorded within the project area are well-represented in the region, it is considered unlikely that potential short range endemics would occur within the project area.

### 3.4 Conservation Significant Vertebrate Fauna Species Predicted to Occur in the Project Area

A total of 36 listed conservation significant vertebrate fauna species could potentially occur within the project area due to the presence of suitable habitat (Table 3). Another 11 species of conservation significance have been recorded in the region but were assessed to be unlikely to occur in the project area due to a lack of suitable habitat (Table 3).

**TABLE 3**  
**CONSERVATION SIGNIFICANT FAUNA SPECIES POTENTIALLY OCCURRING**  
**IN THE PROJECT AREA**

Species	Common Name	DEC Schedule / Priority	Status under Commonwealth EPBC Act	Likely Presence and reason
<i>Dasyurus hallucatus</i>	Northern Quoll	Schedule 1	Endangered	Unlikely – inappropriate habitat
<i>Dasycercus cristicauda</i>	Crest-tailed Mulgara	Schedule 1	Vulnerable	Possible – Spinifex habitat
<i>Lagostrophus fasciatus</i>	Banded Hare-wallaby	Schedule 1	Vulnerable	Unlikely – inappropriate habitat
<i>Macrotis lagotis</i>	Bilby	Schedule 1	Vulnerable	Unlikely – inappropriate habitat
<i>Rhinonicteris aurantius</i>	Orange Leaf-nosed Bat	Schedule 1	Vulnerable	Possible – flying through site
<i>Liasis olivaceus barroni</i>	Pilbara Olive Python	Schedule 1	Vulnerable	Possible – coastal drainage lines
<i>Aspidites ramsayi</i>	Woma	Schedule 4		Possible – coastal drainage lines
<i>Mormopterus loriae</i>	Little North-western Mastiff Bat	Priority 1		Possible – mangrove habitat
<i>Ctenopus nigrilineatus</i>		Priority 1		Unlikely – inappropriate habitat
<i>Lagorchestes conspicillatus</i>	Spectacled Hare-wallaby	Priority 3		Unlikely – inappropriate habitat
<i>Casycercus blythi</i>	Brush-tailed Mulgara	Priority 4		Possible – spinifex habitat
<i>Macroderma gigas</i>	Ghost Bat	Priority 4		Possible – flying through site
<i>Leggadina lakedownensis</i>	Lakeland Downs Mouse	Priority 4		Unlikely – inappropriate habitat
<i>Pseudomys chapmani</i>	Western Pebble-mound Mouse	Priority 4		Unlikely – inappropriate habitat
<i>Ardeotis australis</i>	Australian Bustard	Priority 4		Possible – heath/spinifex habitat
<i>Burhinus grallarius</i>	Bush Stonecurlew	Priority 4		Possible – heath/spinifex habitat
<i>Neochmia ruficauda</i>	Star Finch	Priority 4		Possible – coastal drainage lines
<i>Haliaeetus leucogaster</i>	White-bellied Sea-eagle		Migratory	Possible – mangrove habitat
<i>Hirundo rustica</i>	Barn Swallow		Migratory	Possible – heath/Spinifex habitat



**TABLE 3**  
**CONSERVATION SIGNIFICANT FAUNA SPECIES POTENTIALLY OCCURRING**  
**IN THE PROJECT AREA (CONT'D)**

Species	Common Name	DEC Schedule / Priority	Status under Commonwealth EPBC Act	Likely Presence and reason
<i>Merops ornatus</i>	Rainbow Bee-eater		Migratory	Possible – coastal drainage lines
<i>Actitis hypoleucos</i>	Common Sandpiper		Migratory	Possible – mangrove habitat
<i>Ardea alba</i>	Great Egret		Migratory	Possible – mangrove habitat
<i>Ardea ibis</i>	Cattle Egret		Migratory	Unlikely – inappropriate habitat
<i>Arenaria interpres</i>	Ruddy Turnstone		Migratory	Unlikely – inappropriate habitat
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper		Migratory	Possible – mangrove habitat
<i>Calidris alba</i>	Sanderling		Migratory	Unlikely – inappropriate habitat
<i>Calidris canutus</i>	Red Knot		Migratory	Possible – mangrove habitat
<i>Calidris ferruginea</i>	Curlew Sandpiper		Migratory	Possible – mangrove habitat
<i>Calidris ruficollis</i>	Red-necked Stint		Migratory	Possible – mangrove habitat
<i>Calidris tenuirostris</i>	Great Knot		Migratory	Possible – mangrove habitat
<i>Charadrius leschenaultia</i>	Greater Sand Plover		Migratory	Possible – mangrove habitat
<i>Charadrius mongolus</i>	Lesser Sand Plover		Migratory	Possible – mangrove habitat
<i>Charadrius veredus</i>	Oriental Plover		Migratory	Possible – acacia heath/Spinifex
<i>Glareola maldivarum</i>	Oriental Pratincole		Migratory	Possible – eucalypt depression
<i>Heteroscelus brevipes</i>	Grey-tailed Tattler		Migratory	Unlikely – inappropriate habitat
<i>Limicola falcinellus</i>	Broad-billed Sandpiper		Migratory	Possible – mangrove habitat
<i>Limosa lapponica</i>	Bar-tailed Godwit		Migratory	Possible – mangrove habitat
<i>Limosa limosa</i>	Black-tailed Godwit		Migratory	Possible – mangrove habitat
<i>Numenius madagascariensis</i>	Eastern Curlew		Migratory	Possible – mangrove habitat
<i>Numenius minutes</i>	Little Curlew		Migratory	Possible – mangrove habitat
<i>Numenius phaeopus</i>	Whimbrel		Migratory	Possible – mangrove habitat
<i>Pluvialis fulva</i>	Pacific Golden Plover		Migratory	Possible – mangrove habitat
<i>Pluvialis squatarola</i>	Grey Plover		Migratory	Possible – mangrove habitat
<i>Tringa glareola</i>	Wood Sandpiper		Migratory	Possible – eucalypt depression
<i>Tringa stagnatilis</i>	Marsh Sandpiper		Migratory	Possible – eucalypt depression
<i>Xenus cinereus</i>	Terek Sandpiper		Migratory	Possible – mangrove habitat
<i>Apus pacificus</i>	Fork-tailed Swift		Migratory	Possible – entire project area

*WC Act Conservation Status Definitions:*

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.

Level 1 Terrestrial Fauna Survey for the Multi-user Iron Ore Export Facility:

Port Infrastructure Project

- Priority 1 (P1) Taxa which are known from few specimens or sight records from one or a few localities on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, active mineral leases. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.
- Priority 2 (P2) Taxa which are known from few specimens or sight records from one or a few localities on lands not under immediate threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.
- Priority 3 (P3) Taxa which are known from few specimens or sight records from several localities, some of which are on lands not under immediate threat of habitat destruction or degradation. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.
- Priority 4 (P4) Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands.
- Priority 5 (P5) Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

*EPBC Act Conservation Status Definitions:*

- 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 (M) Species migrate to, over and within Australia and its external territories

The following species descriptions provide a commentary on fauna of conservation significance listed in the DEC's Threatened Fauna Database and DSEWPC *EPBC Act 1999* database as being potentially found in the project area (Table 4) and the potential for species to be significantly impacted by the the proposed activities.

**TABLE 4.**  
**DESCRIPTION OF DISTRIBUTION, HABITAT AND LIKELIHOOD OF OCCURRENCE OF CONSERVATION SIGNIFICANT**  
**VERTEBRATE FAUNA IN THE PROJECT AREA**

Species	Status	Description	Distribution, Habitat and Likelihood of Occurrence
Northern Quoll ( <i>Dasyurus hallucatus</i> )	S1, E	The Northern Quoll weighs up to 1 kg and is 20 to 31 cm head-body length. It is characterised by above grey-brown to brown coloured fur with large white spots which do not occur on the tail.	<p>Northern Quolls in the Pilbara are thought to have a relatively large geographic distribution and inhabit gullies and creek lines and rocky ranges. Although Northern Quolls are nocturnal, secretive, and have a large home range, they have been captured in numerous surveys in the Pilbara and have been recorded in the Port Hedland area.</p> <p>Due to a lack of suitable habitat, the project area is unlikely to support the Northern Quoll.</p>
Crested-tailed Mulgara ( <i>Dasyercus cristicauda</i> )	S1, V	Crested-tailed Mulgara is a small Dasyurid that is 12.5 to 20 cm head-body length and weighs up to 170g. It is characterised by being stocky and short-limbed with above sandy-brown or rufous coloured fur. The tail is bright rufous at base tapering to tuft of longer black hairs and is thick.	<p>The Mulgara inhabits the arid regions of Australia and is most commonly found on sandy soils vegetated with spinifex. The most striking feature of these small, robustly built animals is the crest of black hairs on the tail of <i>D. cristicauda</i>. Mulgara is nocturnal and eat insects, arthropods and small vertebrates. Individual Mulgara are mostly solitary, utilising 3-5 burrows each night within an activity area of 1.0 - 14.4ha (Masters <i>et al.</i>, 2003).</p> <p>The distribution of Mulgara includes spinifex vegetated areas in the Pilbara and inland sand desert covered with spinifex. Within these areas, their distribution is patchy and frequently confined to mature spinifex habitat. Mulgara have been recorded in the Port Hedland area by Thompson and Thompson (2007, 2008). During the level 1 survey no active mounds were recorded. However Mulgara possibly occurs in neighbouring areas and may potentially forage in the area.</p> <p>Habitat available in the project area potentially supports the Crested-tailed Mulgara.</p>
Banded Hare-wallaby ( <i>Lagostrophus fasciatus</i> )	S1, V	The Banded Hare-wallaby has thick, long, shaggy grey above fur with diagnostic traverse dark bars from mid-back to base of tail. It weighs up to 3 kg and is 40 to 45 cm head-body length.	The Banded Hare-wallaby is restricted to Bernier and Dorre Islands in Shark Bay. Given their restricted distribution, the project area is highly unlikely to support the Banded Hare-wallaby.

**TABLE 4.**  
**DESCRIPTION OF DISTRIBUTION, HABITAT AND LIKELIHOOD OF OCCURRENCE OF CONSERVATION SIGNIFICANT**  
**VERTEBRATE FAUNA IN THE PROJECT AREA (CONT'D)**

Species	Status	Description	Distribution, Habitat and Likelihood of Occurrence
Bilby ( <i>Macrotis lagotis</i> )	S1, V	The Bilby is a long-tailed, long-eared, burrowing desert bandicoot. Their fur is long and silky; blue-grey tinged with rufous brown. The tail is uniquely long, tricoloured – basal third similar to back, mid third black, terminal third white – and crested. Adult Bilbies weigh between 800 to 2400 g and are 30 to 55cm in head-body length.	The Bilby inhabits the semi-arid areas of Western Australia where it is most commonly found on sandy soils in acacia shrubland and hummock grassland. The Bilby is nocturnal and eat arthropods tubers and small fungi. They have been recorded in the Port Hedland area. Due to a lack of suitable habitat, the project area is unlikely to support the Bilby.
Orange Leaf-nosed bat ( <i>Rhinonictis aurantius</i> )	S1, V	The Orange Leaf-nosed bat is a small microbat weighing 7 to 11 g. Their fur is uniformly rich golden orange, although, some individuals are brownish yellow. Orange Leaf-nosed bats have short, finely pointed ears and no obvious forward projections in their noseleaf.	The Orange Leaf-nosed bat forages low, in open habitats such as grasslands and along roads feeding on insects and flying termites. They roost in humid caves and mines but little is known on their maternity roosts. The Orange Leaf-nosed bat has been recorded in the Port Hedland area.  Due to a lack of suitable habitat, the project area is unlikely to support the Orange Leaf-nosed bat.
Pilbara Olive Python ( <i>Liasis olivaceus barroni</i> )	S1, V	The Pilbara Olive Python is a large python growing up to 6.5 m long. It is coloured dark olive, yellowish brown to olive brown with pearly sheen. The ventral surfaces white to cream.	The Pilbara Olive Python is often found around gullies, creeklines and vegetated water sources. It has been recorded in the Port Hedland area.  Habitat available in the project area potentially supports the Pilbara Olive Python.
Woma ( <i>Aspidites ramsayi</i> )	S4	The Woma is a python growing up to 2.3 m long. It is coloured pale brown, yellowish brown, reddish brown to olive with numerous irregular darker bands.	The Woma inhabits woodlands, heaths and shrublands, often with Spinifex, in the arid areas of Australia. They shelter in abandoned monitor and mammal burrows or soil cracks. The Woma has been recorded in the Port Hedland area.  Habitat available in the project area potentially supports the Woma.
Little North-western Mastiff Bat ( <i>Mormopterus loriae</i> )	P1	The Little North-western Mastiff Bat weighs 6.2 to 9 g and has an average head-body length of 50.5 mm. The fur upper parts is mid-brown to grey brown in colour with a grey-lemon throat and chin.	The Little North-western Mastiff Bat is restricted to Mangroves and adjacent vegetation in narrow coastal strip between Derby and Exmouth Gulf, Western Australia. The Little North-western Mastiff Bat has been recorded in the Port Hedland area.  Habitat available in the project area potentially supports the Little North-western Mastiff Bat.

**TABLE 4.**  
**DESCRIPTION OF DISTRIBUTION, HABITAT AND LIKELIHOOD OF OCCURRENCE OF CONSERVATION SIGNIFICANT**  
**VERTEBRATE FAUNA IN THE PROJECT AREA (CONT'D)**

Species	Status	Description	Distribution, Habitat and Likelihood of Occurrence
<i>Ctenotus nigrilineatus</i>	P1	<i>Ctenotus nigrilineatus</i> is a skink that grows up to 49 mm snout-vent length. It is a slender skink with a simple pattern of eight pale stripes.	<i>Ctenotus nigrilineatus</i> are known only from Spinifex at the base of rocky outcrops. They have been captured in the Abydos Plain, Hamersley Range and Meethena but no records occur in the Port Hedland area.  Due to a lack of suitable habitat, the project area is unlikely to support the <i>C. nigrilineatus</i> .
Spectacled Hare-wallaby ( <i>Lagorchestes conspicillatus</i> )	P3	The Spectacled Hare-wallaby is a stocky, thickset wallaby with a short, broad muzzle. The fur is coloured grey-brown broadly tipped with straw giving a highly grizzled appearance. The Spectacled Hare-wallaby has a distinctive orange eye-patch extending back to below the ear and a white moustache which contrasts with black rhinarium. They weigh between 1.6 to 4.5 kg and grow up to 52 cm head-body length.	The Spectacled Hare-wallaby inhabits tropical tussock or hummock grassland. There has been a dramatic decline in the species distribution in Western Australia. There have been no records of the Spectacled Hare-wallaby in the Port Hedland area.  Habitat available in the project area is unlikely to support the suitable Spectacled Hare-wallaby.
Brush-tailed Mulgara ( <i>Dasyurus blythi</i> )	P4	Brush-tailed Mulgara is a small Dasyurid that is 12.5 to 20 cm head-body length and weighs up to 170g. It is characterised by being stocky and short-limbed with above sandy-brown or rufous coloured fur. The tail is bright rufous at base tapering to tuft of longer black hairs and is thick.	The Brush-tailed Mulgara inhabits the arid regions of Australia and is most commonly found on sandy soils vegetated with spinifex. Currently there is insufficient information to separate the spatial ecology, burrow and breeding biology with the closely related Crested-tailed Mulgara. In addition, the two species have a wide and an overlapping distribution. The Brush-tailed Mulgara is nocturnal and eats insects, arthropods and small vertebrates. Individual Mulgara are mostly solitary, utilising 3-5 burrows each night within an activity area of 1.0 - 14.4ha (Masters <i>et al.</i> , 2003).  Mulgara have been recorded in the Port Hedland area by Thompson and Thompson (2007, 2008). During the level 1 survey no active mounds were recorded. However Mulgara possibly occurs in neighbouring areas and may potentially forage in the area.  Habitat available in the project area is unlikely to support the Brush-tailed Mulgara.

**TABLE 4.**  
**DESCRIPTION OF DISTRIBUTION, HABITAT AND LIKELIHOOD OF OCCURRENCE OF CONSERVATION SIGNIFICANT**  
**VERTEBRATE FAUNA IN THE PROJECT AREA (CONT'D)**

Species	Status	Description	Distribution, Habitat and Likelihood of Occurrence
Ghost Bat ( <i>Macroderma gigas</i> )	P4	The Ghost Bat is Australia's largest microbat and grows up to 12 cm head-body length and weighs 75 to 145 g. It has long very long, fluted ears joined along inner margin for about half their length. Ghost Bats have an elongated but simple noseleaf, no tail but a full tail membrane between long legs. Their fur is mid to pale grey above and whitish below.	This is Australia's only carnivorous bat. The Ghost Bat lives in undisturbed roost caves or mineshafts, usually with multiple openings. They feed on large insects, geckoes, frogs, small birds and mammals.  Due to a lack of suitable habitat, the project area is unlikely to support the Ghost bat.
Lakeland Downs Mouse ( <i>Leggadina lakedownensis</i> )	P4	The Lakeland Downs Mouse weighs 15 to 25 g and grows up to 78 mm head-body length. It has upper brindled grey-brown fur grading to whitish underparts and feet. Occasionally, a faint darker stripe between ears and a pale eye-ring occurs.	Little is known about the Lakeland Downs Mouse but it inhabits stony hummock grassland in the Pilbara.  Due to a lack of suitable habitat, the project area is unlikely to support the Lakeland Downs Mouse.
Western Pebble-mound Mouse ( <i>Pseudomys chapmani</i> )	P4	The Western Pebble-mound Mouse is a small mouse that weighs 8 to 17 g and grows to 68 mm head-body length. It has a long, flat head, small eyes, narrow muzzle and short ears. Their upper fur is uniformly pale pinkish-brown with whitish underparts and tail is larger than head-body length.	The Western Pebble-mound Mouse shelters in complex burrow systems built beneath mounds of pebbles collected from the surface. The species is confined to the central and east Pilbara region. The Western Pebble-mound Mouse has not been recorded in the Port Hedland area.  Given their restricted distribution, the project area is highly unlikely to support the Western Pebble-mound Mouse.
Australian Bustard ( <i>Ardeotis australis</i> )	P4	The Australian Bustard is a large, heavily built ground bird that weighs 3.4 to 4.1 kg in females and 7.3 kg in males. Males have head and long nape feathers that are black while their face and throat are white with fine black bars. Females have a blackish brown cap which is narrower and their black breast band is also narrower and often ill defined.	Australian Bustards are tall birds that live on open grassy plains and low shrubby areas in northern Australia. Although not flightless, Bustards spend the greater proportion of the time on the ground and tend to run from danger. They are omnivorous and tend to seek out foraging areas following rainfall, which may also herald breeding. Predation by introduced species, including anthropogenic hunting, and habitat loss has caused the population to decline. The species has been recorded in the Port Hedland area.  Habitat available in the project area potentially supports the Australian Bustard.

**TABLE 4.**  
**DESCRIPTION OF DISTRIBUTION, HABITAT AND LIKELIHOOD OF OCCURRENCE OF CONSERVATION SIGNIFICANT**  
**VERTEBRATE FAUNA IN THE PROJECT AREA (CONT'D)**

Species	Status	Description	Distribution, Habitat and Likelihood of Occurrence
Bush Stone-curlew ( <i>Burhinus grallarius</i> )	P4	The Bush Stone-curlew is a large nocturnal ground bird with thick bill, long legs and short toes. Growing to 57 cm in length and weighing up to 719 g, they have a grey rump, back neck and crown. Their feathers shaft have a streak that are coloured blackish brown.	Bush Stone-curlews are nocturnal and inhabit open woodlands, and live in small groups. The tendency of this species to freeze when in danger makes them vulnerable to feral predators. The Bush Stone-curlew is becoming rare in the several sections of its range, a possible result of habitat loss or feral predation. This species has been recorded in the Port Hedland area.  Habitat available in the project area potentially supports the Bush Stone-curlew.
Star Finch ( <i>Neochmia ruficauda</i> )	P4	The Pilbara population of Star Finches weigh 10 to 12 g and grow up to 125 mm in length. Their forehead, crown front, sides of face, chin and upper throat are bright red. The crown, hindneck sides of neck, back scapular and rump are variable in colour but range from yellowish olive, greenish olive, greyish olive and dull greyish olive.	The Star Finch inhabits tall grass beside swamps and rivers. This species has been recorded at Cape Lambert.  Habitat available in the project area potentially supports the Star Finch.
White-bellied Sea Eagle ( <i>Haliaeetus leucogaster</i> )	M	The White-bellied Sea Eagle is a large eagle. Males grow 73 to 78 cm in length and weigh up to 2.2 kg while females grow 82 to 84 cm in length and weigh up to 3.3 kg. Adults have a head, neck, terminal third of tail and underparts that is white. Back and most of wing is brownish grey or slaty grey.	White-bellied Sea Eagles are most commonly found around the coastline; however, they have been reported many kilometres inland. The White-bellied Sea Eagle has been recorded in the Pilbara region at places such as Mandora Marsh and Cape Lambert.  Habitat available in the project area potentially supports the White-bellied Sea Eagle.
Barn Swallow ( <i>Hirundo rustica</i> )	M	The Barn Swallow weighs up to 17 g and grows 135 to 156 mm in length. They have a dark chestnut or rufous chestnut forehead. The rest of the upper parts including ear coverts, scapulars and upper wing coverts are black glossed with blue. Their chin and throat is rufous chestnut and they have a long and deeply forked tail.	The Barn Swallow forages in open country, cultivated land and urban areas. However, it has not been recorded in the Port Hedland area.  Habitat available in the project area potentially supports the Barn Swallow.

**TABLE 4.**  
**DESCRIPTION OF DISTRIBUTION, HABITAT AND LIKELIHOOD OF OCCURRENCE OF CONSERVATION SIGNIFICANT**  
**VERTEBRATE FAUNA IN THE PROJECT AREA (CONT'D)**

Species	Status	Description	Distribution, Habitat and Likelihood of Occurrence
Rainbow Bee-eater ( <i>Merops ornatus</i> )	M	The Rainbow Bee-eater is a small bird weighing 20 to 25 g and growing up to 24 cm in length. Adults have a pale green forehead extending back as a line over the eye. The crown and nape are orange-brown or cinnamon rufous with the crown sometimes washed with green. A black stripe runs from the bill through eye to ear coverts bordered below with pale blue. Their lower back is pale blue and becomes darker on tail coverts. The tail is black.	The Rainbow Bee-eater is found across the better-watered parts of Western Australia. It prefers lightly wooded habitats, preferably on sandy soils near water. Rainbow Bee-eaters are scarce to very common across their range depending on suitable habitat conditions. Rainbow Bee-eaters have been observed on multiple occasions in other surveys in the Port Hedland area and were seen in adjacent areas to the project area.  Habitat available in the project area potentially supports the Rainbow Bee-eater.
Common Sandpiper ( <i>Calidris ferruginea</i> )	M	The Common Sandpiper weighs 37 to 50g and grows up to 21 cm in length. Their head and neck is olive brown with a long white superciliary stripe. They have a black spot in front of their eye and a whitish ring around their eye. Their back, scapulars and upper tail coverts are olive brown.	The Common Sandpiper inhabits coastal areas and inland mud-flats.  Habitat available in the project area potentially supports the Common Sandpiper.
Great Egret ( <i>Ardea alba</i> )	M	The great egret is a large bird with all-white plumage that can reach one meter in height, weigh up to 950 grams and a wingspan of 165 to 215 cm.	Hérons and egrets all depend, to some extent upon surface water for hunting. The largest of the Australian egrets, the Great Egret is a large, elegant, white wader dependent upon floodwaters, rivers, shallow wetlands and intertidal mudflats. This species is found in areas with permanent water and has been recorded in the Port Hedland area.  Habitat available in the project area potentially supports the Great Egret.
Cattle Egret ( <i>Ardea ibis</i> )	M	Cattle Egret is a stocky white bird with buff plumes in the breeding season. The species nests in colonies, usually near bodies of water and often with other wading birds. The nest is a platform of sticks in trees or shrubs.	The smallest of Australian egrets, this species has undertaken an invasion of Australia from the north, where it was originally more common in the Indonesian archipelago than Australia. This invasion may have been assisted by the opening up of farming land and irrigation schemes, providing the pasturelands and shallow wetlands, within which this species prefers to forage.  Due to a lack of suitable habitat, the project area is unlikely to support the Cattle Egret.



**TABLE 4.**  
**DESCRIPTION OF DISTRIBUTION, HABITAT AND LIKELIHOOD OF OCCURRENCE OF CONSERVATION SIGNIFICANT**  
**VERTEBRATE FAUNA IN THE PROJECT AREA (CONT'D)**

Species	Status	Description	Distribution, Habitat and Likelihood of Occurrence
Ruddy Turnstone ( <i>Arenaria interpres</i> )	M	The Ruddy Turnstone weighs 100 to 104 g and grows up to 24 cm in length. The forehead and lores are grey, greyish brown or whitish with and indistinct blackish line from top of upper mandible to eye and down to cheek. Their cheeks are blackish and often pale streaked. The upper back and scapulars are dark brown or blackish but lower back is white.	The Ruddy Turnstone forages primarily on rocky shores. This species has been recorded in the Pilbara region at areas such Mandora Marsh and Cape Lambert.  Due to a lack of suitable habitat, the project area is unlikely to support the Ruddy Turnstone.
Sharp-tailed Sandpiper ( <i>Calidris acuminata</i> )	M	Sharp-tailed Sandpiper grows up to 23.5 cm in length and weighs 51 to 86 g. Their crown is dark brown or blackish with a white supercilium that is finely streaked brown and extends behind the eye. The neck, upper back and scapulars are blackish brown and they have a white throat, belly and flanks.	The Sharp-tailed Sandpiper inhabits coastal areas and inland waters. This species has been recorded in the Pilbara region at Mandora Marsh.  Habitat available in the project area potentially supports the Sharp-tailed Sandpiper.
Sanderling ( <i>Calidris alba</i> )	M	The Sanderling grows up to 20 cm in length and weigh 53 to 76 g. Their crown, ear coverts and neck are pale grey while the forehead and supercilium are white. They have a dark line in front and below eye with a white cheek. The upper back and scapulars are pale grey or pale brownish grey. Underparts are white except for grey or greyish brown patch on side of breast.	The Sanderling is predominantly found on beaches and rarely occurs inland.  Due to a lack of suitable habitat, the project area is unlikely to support the Sanderling.
Red Knot ( <i>Calidris canutus</i> )	M	The Red Knot weighs 72 to 126 g and grows up to 26 cm in length. They have a greyish brown head finely streaked with blackish brown. Supercilium from upper mandible to ear coverts white finely flecked greyish brown. Their belly and undertail is white with greyish brown neck, back and scapulars.	The Red Knot forages predominantly on tidal mud-flats. This species has been recorded in the Pilbara region at Mandora Marsh.  Habitat available in the project area potentially supports the Red Knot.
Curlew Sandpiper ( <i>Calidris ferruginea</i> )	M	The Curlew Sandpiper weighs 45 to 74 g and grows up to 22.5 cm. The neck, upper back and scapulars are greyish brown with lower back and rump greyish brown or dark brown.	Curlew Sandpipers are found on coastal areas and inland mud-flats.  Habitat available in the project area potentially supports the Curlew Sandpiper.
Red-necked Stint ( <i>Calidris ruficollis</i> )	M	The Red-necked Stint weighs 23 to 35 g and grows up to 17 cm in length. They have a greyish brown neck, crown, upper back and scapulars. Underparts are white except for greyish brown patch on side of breast.	The Red-necked Stint inhabits coastal areas and inland shorelines. This species has been recorded in the Port Hedland area.  Habitat available in the project area potentially supports the Red-necked Stint.

**TABLE 4.**  
**DESCRIPTION OF DISTRIBUTION, HABITAT AND LIKELIHOOD OF OCCURRENCE OF CONSERVATION SIGNIFICANT**  
**VERTEBRATE FAUNA IN THE PROJECT AREA (CONT'D)**

Species	Status	Description	Distribution, Habitat and Likelihood of Occurrence
Great Knot ( <i>Calidris tenuirostris</i> )	M	The Great Knot weighs 128 to 216 g and grow up to 29.5 cm. Their crown and neck are whitish or pale greyish brown with dark streaks that are dark brown or blackish brown. They have greyish brown upper back and scapulars. Their throat is white and tail is grey to brownish grey.	The Great Knot forages predominantly on tidal mud-flats. This species has been recorded in the Pilbara region at Mandora Marsh.  Habitat available in the project area potentially supports the Great Knot.
Greater Sand Plover ( <i>Charadrius leschenaultii</i> )	M	The Greater Sand Plover weighs 56 to 85 g and grows up to 21.5cm in length. They have a greyish brown crown, neck, back, scapulars and upperwing coverts. Their forehead and supercilium is white with a blackish mark in front of the eye and a lore and stripe below eye to ear coverts is greyish brown.	The Greater Sand Plover is primarily found along shores and marshes. This species has been recorded at several sites in the Pilbara region.  Habitat available in the project area potentially supports the Greater Sand Plover.
Lesser Sand Plover ( <i>Charadrius mongolus</i> )	M	The Lesser Sand Plover grows up to 20 cm in length and weighs 75 to 90 g. They have a white forehead (except for median greyish brown line), narrow supercilium and patch behind eye. They also have a blackish mark in front of eye. Their underparts are white except for a greyish brown to pale reddish brown breast band.	The Lesser Sand Plover inhabits shore lines and marshes but occasionally occur inland. This species has been recorded at Mandora Marsh in the Pilbara region.  Habitat available in the project area potentially supports the Lesser Sand Plover.
Oriental Plover ( <i>Charadrius veredus</i> )	M	The Oriental Plover weighs 60 to 95 g and grows up to 26 cm in length. Their crown, neck, rump, uppertail, scapulars, upper wings are coloured greyish brown and they have a blackish spot in front of their eye.	Oriental Plovers primarily inhabit inland plains but are occasionally found in coastal areas.  Habitat available in the project area potentially supports the Oriental Plover.
Oriental Pratincole ( <i>Glareola maldivarum</i> )	M	The Oriental Pratincole weighs 65 to 118 g and grows up to 24 cm in length. They are coloured olive brown on the head, neck, back, scapulars and rump. Their throat is buffy brown or pale reddish brown bordered by white line then black line.	The Oriental Pratincole forages on open plains, bare ground around swamps and claypans. The species has been recorded in the Pilbara region including the Mandora Marsh area.  Habitat available in the project area potentially supports the Oriental Pratincole.
Grey-tailed Tattler ( <i>Heteroscelus brevipes</i> )	M	The Grey-tailed Tattler weigh 86 to 135 g and grow up to 27.5 cm in length. They are coloured brownish grey or grey on the head, back, scapulars, rump and upper tail. They also have a white superciliary stripe from upper mandible to ear coverts and a white throat.	Grey-tailed Tattlers are found in estuaries, rocky coasts or reefs.  Habitat available in the project area is unlikely to support the Grey-tailed Tattler.

**TABLE 4.**  
**DESCRIPTION OF DISTRIBUTION, HABITAT AND LIKELIHOOD OF OCCURRENCE OF CONSERVATION SIGNIFICANT**  
**VERTEBRATE FAUNA IN THE PROJECT AREA (CONT'D)**

Species	Status	Description	Distribution, Habitat and Likelihood of Occurrence
Broad-billed Sandpiper ( <i>Limicola falcinellus</i> )	M	The Broad-billed Sandpiper weighs 34 to 65 g and grows up to 19 cm in length. They have a greyish brown crown, neck, upper back and scapulars. Their underparts are white. They have blackish spot in front of eye and cheeks are white but finely streaked greyish brown.	Broad-billed Sandpipers forage in coastal mud-flats and occasionally may be found inland.  Habitat available in the project area potentially supports the Broad-billed Sandpiper.
Bar-tailed Godwit ( <i>Limosa lapponica</i> )	M	The Bar-tailed Godwit grows 37 to 44 cm in length and weighs up to 270 g. They have a greyish brown head, neck, upper back and scapulars. Their lower back is white with a barred dark brown tail.	Bar-tailed Godwits forage on tidal flats and rarely go inland.  Habitat available in the project area potentially supports the Bar-tailed Godwit.
Black-tailed Godwit ( <i>Limosa limosa</i> )	M	The Black-tailed Godwit grows 33 to 41 cm in length. They have a white spot below eye, white supercilium from base of upper mandible to just below eye with the rest of the head greyish brown. Neck, upper back and scapulars are greyish brown. Their tail is black and lower back is black or blackish brown.	Black-tailed Godwits forage on tidal flats and are occasionally found inland.  Habitat available in the project area potentially supports the Black-tailed Godwit.
Eastern Curlew ( <i>Numenius madagascariensis</i> )	M	The Eastern Curlew is a medium sized bird that is 50 to 60cm in length. It is a visitor to Australia and migrates to east Siberia and northeast China to breed.	This species breeds on open mossy or transitional bogs, moss-lichen bogs and wet meadows, and on the swampy shores of small lakes. In the non-breeding season it is essentially coastal, occurring at estuaries, mangrove swamps, saltmarshes and intertidal flats, particularly those with extensive seagrass meadows.  Habitat available in the project area potentially supports the Eastern Curlew.
Little Curlew ( <i>Numenius minutes</i> )	M	The Little Curlew grows up to 32 cm and weighs 120 to 178 g. They have a small, dark patch in front of eye and a dark line from below eye to ear coverts. The crown, back and scapulars are dark brown. A buff median stripe occurs on the crown. The neck is buff with fine streaks of dark brown.	The Little Curlew inhabits estuaries, mud-flats, mangroves, and sandspits. This species has been recorded in the Port Hedland area.  Habitat available in the project area potentially supports the Little Curlew.
Whimbrel ( <i>Numenius phaeopus</i> )	M	The Whimbrel has a dark brown head with a white or buff median stripe. A superciliary white stripe occurs from the bill base to nape is white. Their cheeks and neck are whitish with fine brown streaks. Upper back and scapulars are dark brown with lower back and uppertail white or greyish white. Whimbrels weigh 300 to 490 g and grow up to 46 cm length.	The Whimbrel forages on estuaries, mud-flats, mangroves, and sandspits. This species has been recorded in the Port Hedland area.  Habitat available in the project area potentially supports the Whimbrel.

**TABLE 4.**  
**DESCRIPTION OF DISTRIBUTION, HABITAT AND LIKELIHOOD OF OCCURRENCE OF CONSERVATION SIGNIFICANT**  
**VERTEBRATE FAUNA IN THE PROJECT AREA (CONT'D)**

Species	Status	Description	Distribution, Habitat and Likelihood of Occurrence
Pacific Golden Plover ( <i>Pluvialis fulva</i> )	M	The Pacific Golden Plover grows 24 to 26 cm in length. They have a dull white, buff or golden buff forehead, lore and supercilium with a white eye ring and a dark spot in front of the eye. Their back and rump is black or brownish black.	The Pacific Golden Plover is a bird which inhabits beaches and mud-flats.  Habitat available in the project area potentially supports the Pacific Golden Plover.
Grey Plover ( <i>Pluvialis squatarola</i> )	M	The Grey Plover grows 25 to 31 cm in length. It is coloured greyish brown on the crown, neck, back scapulars, marginal and lesser upper wings. They contain a small blackish patch in front of the eye and a small white patch below the eye.	The Grey Plover forages in beaches and mud-flats and has been recorded in the Pilbara region.  Habitat available in the project area potentially supports the Grey Plover.
Wood Sandpiper ( <i>Tringa glareola</i> )	M	The Wood Sandpiper grows up to 23 cm in length and weighs 49 to 62 g. Adults are coloured dark greyish brown on their head, neck, back and ear coverts with a long white supraciliary stripe from the base of bill to above ear coverts. Underparts are white.	Wood Sandpipers are found in freshwater marshes with light vegetative cover.  Habitat available in the project area potentially supports the Wood Sandpiper.
Marsh Sandpiper ( <i>Tringa stagnatilis</i> )	M	The Marsh Sandpiper grows up to 26 cm in length and weighs 52 to 80 g. Their crown, neck and upper back are greyish brown with whitish underparts, tail and lowerback.	The Marsh Sandpiper inhabits coastal areas and inland lakes.  Habitat available in the project area potentially supports the Marsh Sandpiper.
Terek Sandpiper ( <i>Xenus cinereus</i> )	M	The Terek Sandpiper grows up to 22 cm in length and weighs 34 to 81 g. Adults are coloured grey on their neck, head and back with whitish underparts.	The Terek Sandpiper is found in coastal mud-flats and occasionally inland.  Habitat available in the project area potentially supports the Terek Sandpiper.
Fork-tailed Swift ( <i>Apus pacificus</i> )	M	The Fork-tailed Swift grows up to 19 cm in length and weighs 35 to 40 g. Adults are coloured blackish brown on the forehead, crown, hindneck, cheeks and ear coverts. Rump is white.	This species breeds in the northeast and mid-east Asia and winters in Australia and southern New Guinea. It is a visitor to most parts of Western Australia, beginning to arrive in the Kimberley in late September, in the Pilbara in November and in the southwest land division in mid-December, and leaving by late April. The Fork-tailed swift is an almost exclusively aerial species, foraging and sleeping on the wing. It rarely comes to earth, usually only for breeding. It is common in the Kimberley, uncommon to moderately common near northwest, west and southeast coasts and rare to scarce elsewhere. Usually flocks (up to 2000) occur when changed weather conditions (e.g., storms and cyclones) occur. Fork-tailed Swifts have been recorded in the Port Hedland area.  Habitat available in the project area potentially supports the Fork-tailed Swift.

### **3.5 Adequacy of the Available Fauna Survey Data**

The EPA has indicated that the level of terrestrial fauna survey (ie. Level 1 or Level 2) required for a development area is assessed on a consideration of ten characteristics (EPA, 2004). Coffey Environments' view is that for three of these characteristics, the proposed project would be considered to have a low impact, six are considered to have a moderate impact and one is a high impact.

In addition, several Level 2 terrestrial fauna surveys have been conducted in the Port Hedland area, which provide detailed information on the fauna assemblages in the region. The EPA *Guidance for the Assessment of Environmental Factors No 56* suggests either a Level 1 or Level 2 terrestrial fauna survey should be conducted if the majority of characteristics are low or moderate.

It is Coffey Environments' opinion that on the completion of a Level 1 fauna assessment of the project area, adequate information is available to assess the risk of development on fauna assemblages and conservation significant species. Therefore, Coffey Environments is of the opinion that a Level 1 fauna assessment will be sufficient for assessing the impact of the proposed development on fauna in the project area.

It is Coffey Environments' assessment that the fauna assemblage predicted to occur within the project area is unlikely to be unique for the available habitat types.

### **3.6 Impact on Species of Conservation Significance**

Coffey Environments' view is that vegetation clearing associated with the proposed Multi-user Iron Ore Export Facility: Port Infrastructure Project at Port Hedland is unlikely to significantly impact on any terrestrial species listed as conservation significant under the *EPBC Act 1999* or the *WA Wildlife Conservation Act 1950*, particularly if the recommendations outlined below are followed.

### **3.7 Biodiversity Value**

The EPA Position Statement No. 3 indicates an ecological assessment of a site must consider its biodiversity value at the genetic, species and ecosystem levels, and its ecological functional value at the ecosystem level (EPA, 2002).

Fauna habitat available on site is in good condition and is typical for the region although previous anthropogenic activities, such as the grazing, railway construction and tree clearing, has degraded some areas of the site.

All vertebrate species likely to occur within the project area are distributed widely throughout the region and have been recorded in various other surveys in the bioregion (Appendix A) and are unlikely to be impacted at a regional level should the project proceed.

Due to lack of data it is not possible to comment on the biodiversity value at the genetic level.

It is Coffey Environments' view that the species of mammals, reptiles, birds and invertebrates present or likely to visit the project area would most likely be well represented or visit other similarly vegetated areas in the region. Therefore, vegetation clearing associated with the Multi-user Iron Ore Export Facility: Port Infrastructure project is unlikely to have a significant impact on the biodiversity value at the genetic, species, and ecosystem levels in this region.

### **3.8 Ecological Functional Value at the Ecosystem Level**

Terrestrial vertebrate fauna species present or likely to be present in the project area are generally present elsewhere in the region. Nothing in this Level 1 Fauna Survey indicates that the terrestrial

fauna assemblages predicted to occur in the project area are unique; however, no fauna trapping was conducted as part of this assessment.

Thirty six of the 47 species of conservation significance were considered to possibly occur within the project area. However, the likelihood of these species relying on the project area for survival is low, given the majority are considered migratory birds (26 species) which rely on mangrove habitats or require favourable weather conditions (e.g. wetlands or flowing drainage lines). The project area contains a small portion of mangrove habitat and species are likely to move to adjacent areas. Coffey Environments' view is that clearing associated with the project is unlikely to have a significant impact on an ecosystem of high functional value or is important in a regional context.

### **3.9 Risk Assessment**

Fauna surveys to support Environmental Impact Assessments (EIA) are part of the environmental risk assessment undertaken to consider what potential impacts a development might have on the biodiversity on a particular area and region. Potential impacts to fauna from the proposed development are identified and briefly described above. The tables below provide a summary of the risk assessment associated with this project.

Results from this assessment indicate that the risks of the terrestrial component of the Multi-user Iron Ore Export Facility: Port Infrastructure Project impacting on native fauna and fauna habitat are low when placed in a regional context.

**TABLE 5**  
**FAUNA IMPACT RISK ASSESSMENT DESCRIPTORS**

Any risk assessment is a product of the likelihood of an impact occurring and the consequences of that impact. Likelihood and consequences are categorised and described below. The assessed risk level (likelihood x consequences) is then calculated as the overall risk for the development. This is followed by an assessment of the acceptability of the risk associated with each of the events or impacts. Disturbances and vegetation clearing have an impact on the fauna at multiple scales – site, local, landscape and regional. Each of these is considered in the risk assessment. This assessment should be considered in the context of the summary in the tables below.

<b>Likelihood</b>		
<b>Level</b>	<b>Description</b>	<b>Criteria</b>
A	Rare	The environmental event may occur in exceptional circumstances.
B	Unlikely	The environmental event could occur at sometime.
C	Moderate	The environmental event should occur at sometime.
D	Likely	The environmental event will probably occur in most circumstances.
E	Almost certain	The environmental event is expected to occur in most circumstances.
<b>Consequences</b>		
<b>Level</b>	<b>Description</b>	<b>Criteria</b>
1	Insignificant	Insignificant impact on fauna of conservation significance or regional biodiversity, and the loss of individuals will be insignificant in the context of the availability of similar fauna assemblages in the area.
2	Minor	Impact on fauna localised and no significant impact on species of conservation significance in the project area. Loss of species at the local scale.
3	Moderate	An appreciable loss of fauna in a regional context or an impact on species of conservation significance in the project area.
4	Major	Significant impact on conservation significant fauna or their habitat in the project area and/or regional biodiversity and/or a significant loss in the biodiversity at the landscape scale.
5	Catastrophic	Loss of species at the regional scale and/or a significant loss of species categorised as 'vulnerable' or 'critical' under the <i>EPBC Act 1999</i> at the local or regional scale.
<b>Acceptability of Risk</b>		
<b>Level of risk</b>		<b>Management of Risk</b>
Low		no action required.
Moderate		avoid if possible, routine management with internal audit and review of monitoring results annually
High		externally approved management plan to reduce risks, monitor major risks annually with external audit and review of management plan outcomes annually.
Extreme		unacceptable, project should be redesigned or not proceed.

**TABLE 6**  
**LEVEL OF ACCEPTABLE RISK**

Likelihood						
		A Rare or very low	B Unlikely or low	C Moderate	D Likely	E Almost certain
Consequences	1 – Insignificant	Low	Low	Low	Low	Low
	2 – Minor	Low	Low	Low	Moderate	Moderate
	3 – Moderate	Low	Moderate	Moderate	High	High
	4 – Major	Moderate	Moderate	High	High	Extreme
	5 – Catastrophic	Moderate	High	High	Extreme	Extreme



**TABLE 7**

**RISK ASSESSMENT OF THE IMPACT OF CLEARING FOR THE MULTI-USER IRON ORE EXPORT FACILITY PROJECT**

			Before Management				With Management		
Risk Issue	Aspect or Issue	Impact	Inherent Risk			Risk Controls	Residual Risk		
			Likelihood	Consequence	Significance		Likelihood	Consequence	Significance
Fauna survey	Inadequate survey	Unknown loss of fauna, fauna of conservation significance, and fauna assemblages, and an incomplete fauna assessment.	A	3	Low	Addressed through this assessment			
Fauna assessment	Inadequate data analysis	Unknown impact on fauna assemblage and significant species.	A	3	Low				
	Inadequate data from survey	Unknown impact on fauna assemblage and significant species.	A	3	Low				
	Inadequate regional data	Incomplete analysis of data and appreciation of impact on biodiversity values.	A	3	Low	Minimise the areas to be cleared.			
Clearing vegetation	Removal of habitat – site scale	Almost complete loss of terrestrial fauna on site, severe impact on localised communities.	E	1	Low	Minimise the areas to be cleared			

**TABLE 7**

**RISK ASSESSMENT OF THE IMPACT OF CLEARING FOR THE MULTI-USER IRON ORE EXPORT FACILITY PROJECT (CONT'D)**

			Before Management				With Management		
Risk Issue	Aspect or Issue	Impact	Inherent Risk			Risk Controls	Residual Risk		
			Likelihood	Consequence	Significance		Likelihood	Consequence	Significance
Clearing vegetation (Cont'd)	Removal of habitat – local scale	Loss of good quality habitat and some impact on local fauna and fauna assemblages.	C	1	Low	Minimise the areas to be cleared			
	Removal of habitat – landscape scale	Impact on fauna and fauna assemblage.	C	1	Low				
	Removal of habitat – regional scale	Minimal impact on fauna and faunal communities.	B	1	Low				
Death or loss of conservation significant fauna	Conservation significant birds	Conservation significant birds are killed or significantly impacted on by construction activities	A	3	Low				
	Other conservation significant fauna	Conservation significant terrestrial fauna with potential habitat in project area are killed or significantly impacted on by construction activities	C	2	Low				
Increased human activity	Increase in feral fauna	Increased predation pressure on native fauna.	C	2	Low	Fauna Management Plan			

**TABLE 7**

**RISK ASSESSMENT OF THE IMPACT OF CLEARING FOR THE MULTI-USER IRON ORE EXPORT FACILITY PROJECT (CONT'D)**

			Before Management				With Management		
Risk Issue	Aspect or Issue	Impact	Inherent Risk			Risk Controls	Residual Risk		
			Likelihood	Consequence	Significance		Likelihood	Consequence	Significance
Increased human activity (cont'd)	Spread of weeds	Damage to vegetation resulting in loss of fauna habitat.	C	1	Low				
	Wildfire	Degradation of fauna habitat and populations.	C	1	Low				
Construction Activity	Dust	Loss of fauna habitat	C	1	Low				
	Noise	Shifting fauna out of the area	B	1	Low				
	Vibration	Shifting fauna out of the area	B	1	Low				
	Road deaths	Loss of native fauna	D	2	Low	Speed restrictions and limit new roads			

## **4 ENVIRONMENTAL IMPACTS**

### **4.1 Unique Fauna Assemblages**

A review of previous fauna surveys conducted in the region identified in the database searches performed for this assessment suggest that there are unlikely to be any characteristics of the reptile, bird and mammal assemblages that are of particular significance in the region.

### **4.2 Clearing Vegetation**

The clearing of vegetation within the project area will result in the loss of terrestrial vertebrate species in specific locations. This impact, in most cases, is unavoidable unless a trapping program is instigated to catch and translocate species. Such action does not seem necessary as terrestrial species likely to be present will also be abundant in adjacent areas.

Sampling for potential short range endemic taxa was undertaken in the DMMA A area, which adjoins the project area. No potential short range endemic taxa were recorded within DMMA A (BHPBIO, 2008). Given that no potential short range endemic taxa were recorded adjacent to the project area and that the seven habitat types recorded within the project area are well-represented in the region, it is considered unlikely that potential short range endemics would occur within the project area.

Coffey Environments' opinion is that the fauna habitats represented within the project area are typical to the region and therefore do not have high ecosystem functional value.

#### **4.2.1 Loss or Degradation of Fauna Habitat**

The most significant environmental impact arising from the proposed activities associated with the terrestrial component of the Multi-user Iron Ore Export Facility: Port Infrastructure Project will be the clearing of native vegetation and consequent loss and alteration of fauna habitat. Beside the initial mortality of fauna during the clearing process there will also be an ongoing indirect impact, largely consisting of the loss and degradation of feeding and shelter sites. Habitat degradation may also occur through factors associated with the construction processes (e.g. noise, vibration, dust, etc) or the increased level of human activity (e.g. feral animals, rubbish, etc.). These potential impacts are discussed in more detail below.

#### **4.2.2 Habitat Fragmentation**

Construction of the Multi-user Iron Ore Export Facility: Port Infrastructure project will involve clearing for infrastructure, linear clearing for roads, power lines and rail, which have the potential to fragment habitat. This can result in restricting the movement of animals and has the potential to cause an impact on the fauna community that is often understated. This impact can be minimised by locating infrastructure close together, or by utilising existing infrastructure corridors (e.g. previous exploration tracks/roads).

### **4.3 Increased Human Activity**

#### **4.3.1 Feral Fauna**

An increase in human activity is often associated with an increase in the abundance of feral species such as the house mouse (*Mus musculus*), feral cat (*Felis catus*) and fox (*Vulpes vulpes*). This increase may be due to a decline in habitat health, increased road kills and poor waste disposal practices.

The house mouse and cat were recorded in fauna surveys conducted in the region. The cat is a particularly damaging predator on native fauna and any increase in their numbers could have a detrimental effect of local native fauna (Kinnear, 1993; Bamford, 1995); hence it is important to ensure that populations of the feral predators are controlled. Without appropriate management these species can become abundant around areas of human habitation and infrastructure associated with mine sites.

Minimising road kills, removing carcasses, and good rubbish management practices around the Multi-user Iron Ore Export Facility: Port infrastructure Project will assist in reducing these problems.

## **4.4 Construction and Rail Activity**

### **4.4.1 Dust**

Dust generated from cleared areas, waste dumps/spoil areas and vehicle traffic can potentially degrade surrounding vegetation, reducing its ability to absorb sunlight and influencing photosynthetic rates. Degradation of these areas will potentially render habitat unsuitable for fauna. Dust suppression and management programs are an essential component of minimising mining impacts on fauna in areas adjacent to the mine.

### **4.4.2 Dredge and Spoil Area**

Dredge and spoil areas can become toxic to migratory birds if tailings water builds up in areas and concentrates heavy metals or other harmful chemicals. Physically limiting access to these areas will largely avoid the problem of animal death and having effective strategies to deal with animals when it occurs will reduce the severity of the impact. Devices that scare birds or prevent them from inhabiting the facilities may be necessary.

### **4.4.3 Noise, Lighting and Vibration**

Activities associated with the Multi-user Iron Ore Export Facility: Port Infrastructure such as noise, lighting and vibration can impact on nearby resident fauna. The noise and vibrations associated with construction and rail are likely to force some animals to move from the area. Construction of the facility may require continuous light at night. Lights have the potential to attract species that forage nocturnally on invertebrates that are attracted to the light and force other species to move away from the area. Both of these outcomes may alter the local fauna assemblages.

### **4.4.4 Road/Rail Fauna Deaths**

An increase in road and rail fauna deaths is likely to occur with increased vehicle traffic; in particular impacting on kangaroos, nocturnal birds and terrestrial fauna. This can be minimised by limiting speed and the construction of fauna underpasses under new roads.

## **5 MANAGEMENT STRATEGIES TO MINIMISE ENVIRONMENTAL IMPACTS**

Vegetation clearing for the construction of the terrestrial component of the Multi-user Iron Ore Export Facility: Port Infrastructure Project will impact on the terrestrial fauna in these areas during the development process; however, this will not have a significant effect on the vertebrate fauna for the bioregion.

There are no known vertebrate fauna of conservation significance that are likely to depend on the project area for survival. The vertebrate fauna assemblages that are likely to be recorded within the project area are likely to be similar to those found in neighbouring areas due to the availability of fauna habitats in surrounding areas. The fauna species predicted to occur at a local level are unlikely to be regionally significant.

Management strategies outlined below will minimise the impact of mining on the local vertebrate fauna. The EPA's objective for terrestrial fauna is to maintain the abundance, species diversity and geographic distribution of terrestrial fauna and protect specially protected (Threatened) fauna consistent with the provisions of the *Wildlife Conservation Act 1950*. If management procedures proposed below are adopted the potential impact to terrestrial fauna and the effect on the conservation status of specially protected and significant species will be minimised.

### **5.1 Clearing Vegetation**

#### **5.1.1 Minimise the Areas to be Cleared**

Clearing vegetation kills much of the local terrestrial fauna and destroys fauna habitat. The areas to be cleared should therefore be minimised, particularly in the mangal habitat where high biodiversity occurs. The retention of larger trees, where possible, will maintain the presence of small hollows that were identified during the site survey, which provide shelters for hollow utilising fauna such as birds and bats.

#### **5.1.2 Habitat Fragmentation**

In addition to the initial loss of fauna, habitat clearing associated with the Land Side Multi-user Iron Ore Export Facility has the potential to fragment habitat. The restricted faunal movement is often an understated impact on the faunal community and can be significant in the longer term. It also increases the occurrence of 'edge-effects' and the associated change in assemblage structure (Bragg *et al.*, 2005; Harding and Gomez, 2006). Where possible, underpasses should be considered along the rail line to allow a number of fauna to move between habitats on either side of the rail (e.g. Mulgara).

Where possible, access routes should be aligned to existing roads, tracks and other barriers or follow the boundaries of broad-scale vegetation associations in the area. If isolated or restricted habitats must be cleared, clearing should be kept to a minimum.

### **5.2 Control of Feral and Pest Species**

The populations of feral fauna located within the project area have the potential to increase as a result of the proposed development. In particular, populations of house mice and feral cats tend to increase near areas of human habitation and activity. Implementation of a Fauna Management Plan should address this issue, which will describe the appropriate remedial action to be taken.

#### **5.2.1 Road and Rail Fauna Deaths**

Increased activity will result in increased traffic and a consequentially an increase in the fauna deaths on roads and tracks associated with the project.

To minimise the impact of road fauna deaths on large animals (such as kangaroos and emus) and ground dwelling fauna (such as reptiles, frogs and mammals) it is important to ensure that low speeds are maintained along all internal roads. A maximum speed limit of 80km/h (or less) is recommended. Signage should be erected to indicate appropriate travelling speeds and should also indicate the possible presence of wildlife crossing roads. These problems are particularly acute at night when kangaroos are actively foraging.

#### **5.2.2 Induction and Awareness**

Staff and contractors involved in the development and operations of the Land Side Multi-user Iron Ore Export Facility should be made aware of NWI policy to protect fauna and minimise disturbance effects. Protection of fauna should be a publicly stated policy and incorporated into all staff induction programs.

## 6 CONCLUSIONS AND RECOMMENDATIONS

Coffey Environments has reviewed the available published and unpublished literature that it could access and undertaken a site assessment to complete a Level 1 Vertebrate Fauna Survey of the project area. Although there has been no comprehensive terrestrial fauna survey for the project area, there are data available on the terrestrial fauna assemblages in similar habitats in the adjacent areas and bioregion. Coffey Environments believe these data are adequate to assess the potential impact of vegetation clearing from the Multi-user Iron Ore Export Facility: Port Infrastructure Project on terrestrial fauna.

Seven fauna habitats including Low Acacia Heath with Spinifex, Moist Eucalypt Depressions, Mangrove Forest/Woodland, Maritime Grassland, Salt Flats, Coastal Floodplain and Drainage Line Tidal were identified. The southern section of the project area was dominated by Low Acacia Heath with Spinifex fauna habitat. In comparison, Mangrove Forest/Woodland, Maritime Grassland and Salt Flats fauna habitat types were recorded in the northern section. There were no significant features or specific habitat within the project area that would indicate it possesses ecological function values that are significantly different to many other areas surrounding it.

Thirty six of the conservation significant fauna species listed under Commonwealth or State government legislation are possible visitors to the project area (26 migratory birds, 5 mammals, 2 reptiles and 3 other bird species). However, none of these species are anticipated to be significantly affected by the proposed Multi-user Iron Ore Export Facility: Port Infrastructure Project. It is Coffey Environments' view that clearing is unlikely to substantially modify, destroy or isolate an area of important habitat for these species, or seriously disrupt the life cycle of an ecologically significant proportion of the population of any of these species.

Coffey Environments' assessment of the Multi-user Iron Ore Export Facility: Port Infrastructure Project proposed for Port Hedland is that clearing of vegetation or disturbance associated with rail and export activities may have an impact on individual species, species assemblages and the functional value at the site level. However, it is unlikely to have a significant impact on:

- Terrestrial fauna in a regional context;
- Species of conservation significance;
- An ecosystem of high functional value; and
- An ecosystem that is important in a regional context.

It is recommended that NWI:

- Takes into account the potential impact of the Multi-user Iron Ore Export Facility: Port Infrastructure Project on fauna in the adjacent areas when developing its fauna management plan;
- Includes issues relating to the protection and preservation of fauna on the site in the staff induction program;
- Conduct a feral fauna control program to reduce their impacts on native fauna;
- Consider incorporating underpasses along the rail line to allow movement of fauna between habitats; and
- Implements a speed limit of 80km / hr or less on site.



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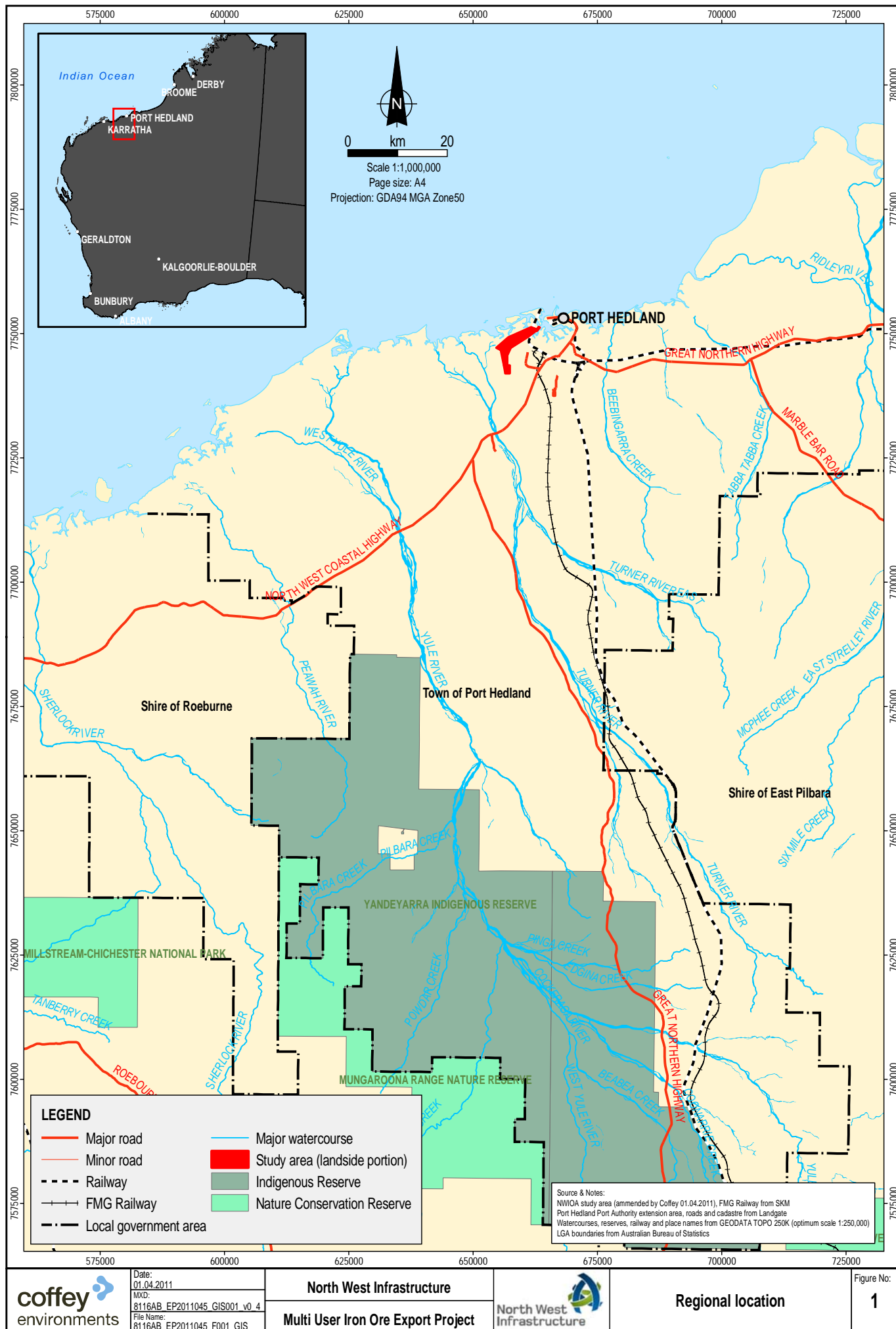
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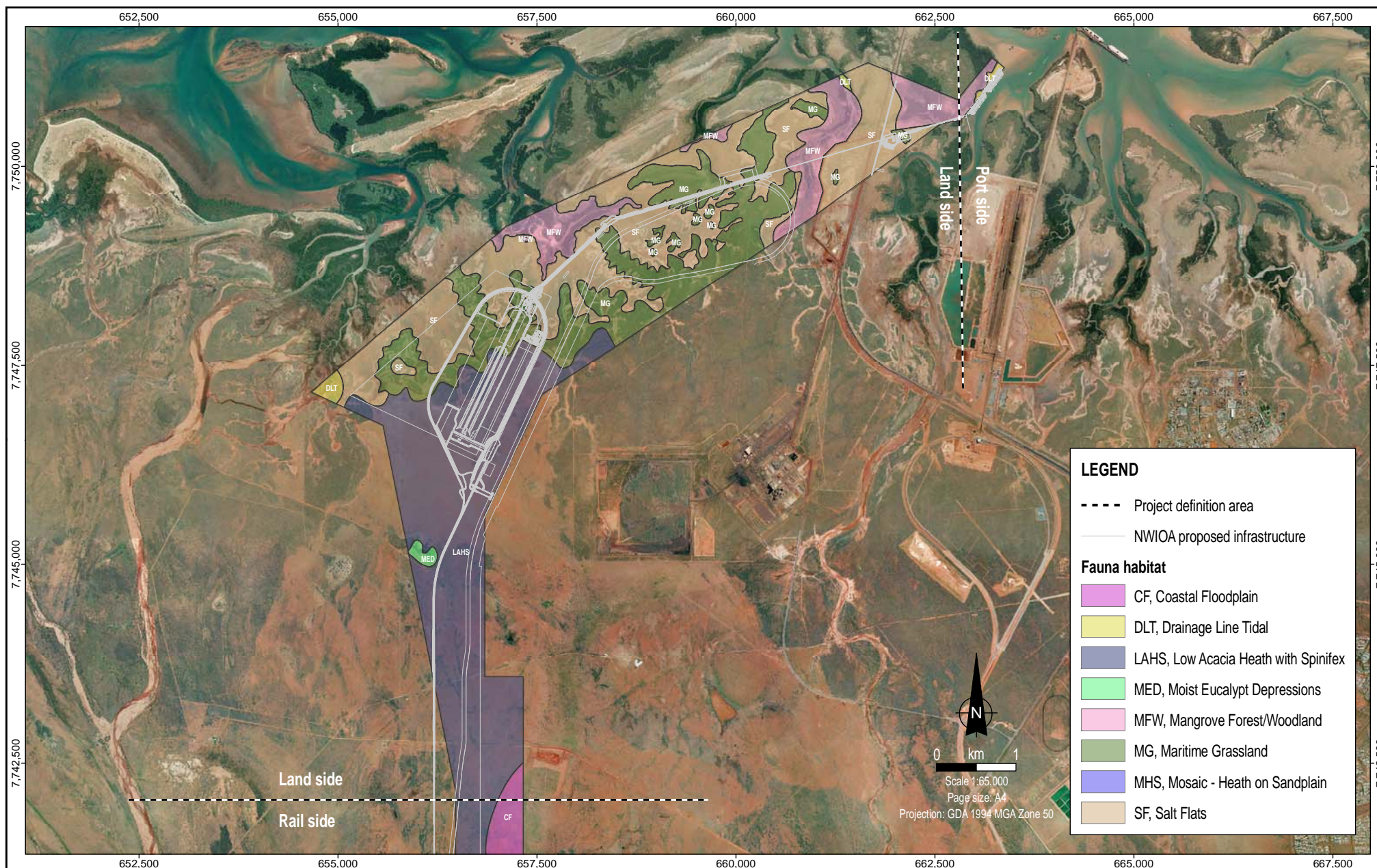
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## Figures

**Level 1 Terrestrial Fauna Survey for the Multi-user Iron Ore Export Facility:  
Port Infrastructure Project**







Source & Notes:  
 NWIOA study area (amended by Coffey 07.01.2011), NWIOA proposed infrastructure (Feb 2011)  
 and imagery (2010) from SKM.  
 Fauna habitats from Coffey Environments



Date:  
01.04.2011  
 MXD:  
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 File Name:  
8116AB\_EP2011045\_F002\_GIS

North West Infrastructure  
 Multi User Iron Ore Export Project



Fauna habitat type

Figure No:  
2



# Appendix A

## Survey Data from the Greater Port Hedland Area

**Level 1 Terrestrial Fauna Survey for the Multi-user Iron Ore Export Facility:  
Port Infrastructure Project**

## Survey Data from the Greater Port Hedland Area

Family/Species Name	Conservation Status1	DEC NatureMap	Graham 1999. Mandora Marsh	Biota 2004 & 2005 FMG Stage A & B rail corridor	Biota 2002 Rail Corridor for Hope Downs	Biota 2008 Cape Lambert	Ninox 1985, 1986, 1992 & 1995 Mt Channar	ecologia 1995; 1998a & b; 2004a,b,c,d West and East Angelas	Cloudbreak Mine 2005 Bamford et al.	Ninox 2008 Hope Downs
<b>AMPHIBIANS</b>										
<b>Hylidae</b>										
<i>Cyclorana australis</i>		X		X	X					
<i>Cyclorana longipes</i>										
<i>Cyclorana maini</i>		X	X	X		X	X	X		
<i>Cyclorana platycephala</i>							X			
<i>Litoria caerulea</i>			X							
<i>Litoria nasuta</i>			X							
<i>Litoria rubella</i>		X	X	X			X	X	X	
<b>Limnodynastidae</b>										
<i>Neobatrachus aquilonius</i>		X								
<i>Neobatrachus centralis</i>								X		
<i>Neobatrachus sutor</i>										
<i>Notaden nichollsi</i>		X	X	X		X		X		
<i>Platypsectrum spenceri</i>		X		X			X	X		
<b>Myrobatrachidae</b>										
<i>Uperoleia aspera</i>										
<i>Uperoleia glandulosa</i>		X								
<i>Uperoleia russelli</i>		X	X	X	X		X	X		
<b>REPTILES</b>										
<b>Agamidae</b>										
<i>Amphibolurus gilberti</i>						X				
<i>Amphibolurus longirostris</i>		X	X	X	X	X	X	X	X	X
<i>Caimanops amphiboluroides</i>				X			X	X		X
<i>Ctenophorus caudicinctus</i>		X	X		X	X	X	X	X	X
<i>Ctenophorus isolepis</i>		X	X	X	X	X	X	X		
<i>Ctenophorus nuchalis</i>		X	X		X		X	X		
<i>Ctenophorus reticulatus</i>				X			X	X	X	
<i>Diporiphora valens</i>							X	X		



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<b>REPTILES Cont'd</b>										
<b>Elapidae Cont'd</b>										
<i>Parasuta monachus</i>							X	X		
<i>Pseudechis australis</i>		X	X	X			X	X		
<i>Pseudonaja modesta</i>		X					X			
<i>Pseudonaja nuchalis</i>		X				X	X	X		
<i>Simoselaps anomalus</i>		X								
<i>Simoselaps bertholdi</i>							X			
<i>Suta fasciata</i>				X	X		X	X		
<i>Suta punctata</i>		X		X	X					
<i>Vermicella snelli</i>						X	X			
<b>Gekkonidae</b>										
<i>Gehyra pilbara</i>		X					X	X		
<i>Gehyra punctata</i>		X	X		X	X	X	X		
<i>Gehyra purpurascens</i>		X	X				X			
<i>Gehyra variegata</i>		X	X	X	X	X	X	X	X	X
<i>Heteronotia binoei</i>		X	X	X	X	X	X	X	X	
<i>Heteronotia spelea</i>				X	X		X	X	X	
<i>Lucasium squarrosum</i>							X			
<i>Lucasium stenodactylum</i>		X	X	X	X	X	X	X		
<i>Lucasium wombeyi</i>				X			X	X		
<i>Oedura marmorata</i>					X		X	X		
<i>Rhynchoedura ornata</i>		X					X	X		
<i>Strophurus ciliaris</i>		X	X			X	X			
<i>Strophurus elderi</i>		X		X			X	X		
<i>Strophurus jeanae</i>		X		X		X	X			
<i>Strophurus wellingtonae</i>				X	X		X	X		X



[illegible]

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<b>REPTILES Cont'd</b>										
<b>Scincidae Cont'd</b>										
<i>Menetia greyii</i>		X	X	X	X	X	X	X		
<i>Menetia surda</i>							X	X		
<i>Morethia ruficauda</i>		X	X		X	X	X	X	X	
<i>Notoscincus ornatus</i>			X				X			
<i>Proablepharus reginae</i>				X	X		X			
<i>Tiliqua multifasciata</i>		X	X	X	X	X	X	X	X	X
<b>Typhlopidae</b>										
<i>Ramphotyphlops ammodytes</i>		X	X	X			X		X	
<i>Ramphotyphlops braminus</i>		X								
<i>Ramphotyphlops diversus</i>			X							
<i>Ramphotyphlops grypus</i>		X		X		X	X	X	X	
<i>Ramphotyphlops hamatus</i>							X	X		
<i>Ramphotyphlops pilbarensis</i>		X								
<i>Ramphotyphlops waitii</i>							X			
<b>Varanidae</b>										
<i>Varanus acanthurus</i>		X	X	X	X	X	X	X	X	X
<i>Varanus brevicauda</i>		X	X	X			X	X	X	
<i>Varanus bushi</i>					X					
<i>Varanus caudolineatus</i>							X	X	X	
<i>Varanus eremius</i>		X	X	X	X	X				
<i>Varanus giganteus</i>						X	X	X		
<i>Varanus gilleni</i>							X	X		
<i>Varanus gouldii</i>		X	X				X			
<i>Varanus panoptes</i>				X			X	X	X	
<i>Varanus pilbarensis</i>							X	X		
<i>Varanus scalaris</i>										
<i>Varanus tristis</i>					X		X	X	X	

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<b>BIRDS</b>										
<b>Acanthizidae</b>										
<i>Acanthiza apicalis</i>				X						
<i>Acanthiza robustirostris</i>				X						
<i>Acanthiza uropygialis</i>				X	X					
<i>Gerygone fusca</i>				X	X					
<i>Gerygone levigaster</i>			X							
<i>Gerygone albogularis</i>			X							
<i>Gerygone tenebrosa</i>		X	X			X				
<i>Pyrrholaemus brunneus</i>				X						
<i>Smicromis brevirostris</i>		X	X	X	X	X				
<b>Accipitridae</b>										
<i>Accipiter cirrocephalus</i>			X	X						
<i>Accipiter fasciatus</i>			X	X	X					
<i>Aquila audax</i>			X	X	X					
<i>Circus approximans</i>			X							
<i>Circus assimilis</i>			X	X	X					
<i>Elanus axillaris</i>		X	X	X	X	X				
<i>Elanus scriptus</i>			X							
<i>Haliaeetus leucogaster</i>		X	X			X				
<i>Haliastur indus</i>		X	X		X	X				
<i>Haliastur sphenurus</i>			X	X	X					
<i>Hamirostra melanosternon</i>			X		X					
<i>Hieraaetus morphnoides</i>			X	X	X					
<i>Lophoictinia isura</i>			X							
<i>Milvus migrans</i>			X		X					
<i>Pandion cristatus</i>		X	X			X				
<b>Acrocephalidae</b>										
<i>Acrocephalus australis</i>					X					
<b>Aegothelidae</b>										
<i>Aegotheles cristatus</i>			X	X	X					



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<b>BIRDS Cont'd</b>										
<b>Alaudidae</b>										
<i>Mirafra javanica</i>			X	X	X	X				
<b>Anatidae</b>										
<i>Anas gracilis</i>			X		X					
<i>Anas superciliosa</i>			X	X	X					
<i>Aythya australis</i>			X							
<i>Chenonetta jubata</i>					X					
<i>Dendrocygna arcuata</i>			X							
<i>Dendrocygna eytoni</i>			X							
<b>Anhingidae</b>										
<i>Anhinga novaehollandiae</i>			X	X						
<b>Anseranatidae</b>										
<i>Anseranas semipalmata</i>			X							
<b>Apodidae</b>										
<i>Apus pacificus</i>			X	X						
<b>Ardeidae</b>										
<i>Ardea intermedia</i>			X							
<i>Ardea modesta</i>			X	X	X	X				
<i>Ardea pacifica</i>			X		X					
<i>Ardea sumatrana</i>			X							
<i>Butorides striata</i>			X		X					
<i>Egretta garzetta</i>		X	X		X	X				
<i>Egretta novaehollandiae</i>			X	X	X					
<i>Egretta sacra</i>			X							
<i>Nycticorax caledonicus</i>		X	X		X					

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<b>BIRDS Cont'd</b>										
<b>Artamidae</b>										
<i>Artamus cinereus</i>		X	X	X	X	X				
<i>Artamus leucorhynchus</i>		X	X			X				
<i>Artamus minor</i>			X		X					
<i>Artamus personatus</i>			X	X	X					
<i>Artamus superciliosus</i>					X					
<i>Cracticus nigrogularis</i>			X	X	X	X				
<i>Cracticus tibicen</i>				X	X					
<i>Cracticus torquatus</i>				X	X					
<b>Burhinidae</b>										
<i>Burhinus grallarius</i>			X	X	X					
<i>Esacus magnirostris</i>			X							
<b>Cacatuidae</b>										
<i>Cacatua sanguinea</i>				X	X	X				
<i>Calyptrorhynchus banksii</i>			X							
<i>Eolophus roseicapillus</i>		X	X	X	X	X				
<i>Nymphicus hollandicus</i>			X	X	X					
<b>Campephagidae</b>										
<i>Coracina novaehollandiae</i>			X	X	X	X				
<i>Lalage sueurii</i>			X	X	X	X				
<b>Casuariidae</b>										
<i>Dromaius novaehollandiae</i>			X	X	X					
<b>Charadriidae</b>										
<i>Charadrius leschenaultii</i>			X			X				
<i>Charadrius mongolus</i>			X							
<i>Charadrius ruficapillus</i>			X		X	X				
<i>Charadrius veredus</i>			X							
<i>Elseyornis melanops</i>			X	X	X					
<i>Erythronyx cinctus</i>			X							
<i>Pluvialis squatarola</i>			X							
<i>Vanellus miles</i>			X							

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<b>BIRDS Cont'd</b>										
<b>Ciconiidae</b>										
<i>Ephippiorhynchus asiaticus</i>			X	X	X					
<b>Cisticolidae</b>										
<i>Cisticola exilis</i>			X							
<b>Climacteridae</b>										
<i>Climacteris melanura</i>			X							
<b>Columbidae</b>										
<i>Geopelia cuneata</i>			X	X	X					
<i>Geopelia humeralis</i>			X		X	X				
<i>Geopelia striata</i>			X	X	X	X				
<i>Geophaps plumifera</i>		X		X	X	X				
<i>Ocyphaps lophotes</i>		X	X	X	X	X				
<i>Phaps chalcoptera</i>			X	X	X					
<i>Phaps histrionica</i>			X							
<i>Ptilinopus regina</i>			X							
<b>Coraciidae</b>										
<i>Eurystomus orientalis</i>			X							
<b>Corvidae</b>										
<i>Corvus bennetti</i>		X	X	X	X					
<i>Corvus orru</i>		X	X	X	X	X				
<b>Cuculidae</b>										
<i>Cacomantis variolosus</i>			X							
<i>Centropus phasianinus</i>			X	X	X	X				
<i>Chalcites basalis</i>			X	X	X	X				
<i>Chalcites lucidus</i>			X							
<i>Chalcites minutillus</i>			X							
<i>Chalcites osculans</i>					X					
<b>Cuculidae</b>										
<i>Cacomantis pallidus</i>			X	X	X					
<i>Cuculus optatus</i>			X							

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<b>BIRDS Cont'd</b>										
<b>Estrildidae</b>										
<i>Emblema pictum</i>			X	X	X	X				
<i>Erythrura gouldiae</i>			X							
<i>Heteromunia pectoralis</i>										
<i>Lonchura castaneothorax</i>			X							
<i>Neochmia ruficauda</i>	P4	X				X				
<i>Poephila acuticauda</i>			X							
<i>Taeniopygia bichenovii</i>			X							
<i>Taeniopygia guttata</i>		X	X	X	X	X				
<b>Eurostopodidae</b>										
<i>Eurostopodus argus</i>			X	X	X					
<b>Falconidae</b>										
<i>Falco berigora</i>			X	X	X	X				
<i>Falco cenchroides</i>		X	X	X	X	X				
<i>Falco hypoleucos</i>			X	X						
<i>Falco longipennis</i>		X		X	X					
<i>Falco peregrinus</i>				X	X					
<b>Fregatidae</b>										
<i>Fregata ariel</i>			X							
<b>Glareolidae</b>										
<i>Glareola maldivarum</i>			X							
<i>Stiltia isabella</i>			X							
<b>Gruidae</b>										
<i>Grus rubicunda</i>			X							
<b>Haematopodidae</b>										
<i>Haematopus fuliginosus</i>			X			X				
<i>Haematopus longirostris</i>			X		X	X				
<b>Halyconidae</b>										
<i>Dacelo leachii</i>			X	X	X					
<i>Todiramphus chloris</i>			X			X				
<i>Todiramphus pyrrhopygius</i>		X	X	X	X	X				
<i>Todiramphus sanctus</i>			X	X	X	X				

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<b>BIRDS Cont'd</b>										
<b>Hirundinidae</b>										
<i>Hirundo neoxena</i>		X								
<i>Petrochelidon ariel</i>			X	X	X					
<i>Petrochelidon nigricans</i>			X		X					
<b>Laridae</b>										
<i>Anous stolidus</i>			X							
<i>Chlidonias hybrida</i>			X							
<i>Chlidonias leucopterus</i>		X								
<i>Chroicocephalus novaehollandiae</i>		X	X		X	X				
<i>Gelochelidon nilotica</i>			X		X					
<i>Hydroprogne caspia</i>		X	X		X	X				
<i>Onychoprion anaethetus</i>			X							
<i>Sterna dougallii</i>			X							
<i>Sternula albifrons</i>			X							
<i>Thalasseus bengalensis</i>			X			X				
<i>Thalasseus bergii</i>			X		X	X				
<b>Maluridae</b>										
<i>Amytornis striatus</i>				X						
<i>Malurus lamberti</i>		X	X	X	X	X				
<i>Malurus leucopterus</i>		X		X	X	X				
<i>Malurus melanocephalus</i>			X							
<i>Stipiturus ruficeps</i>					X					
<b>Megaluridae</b>										
<i>Cincloramphus cruralis</i>			X	X	X					
<i>Cincloramphus mathewsi</i>		X	X	X	X					
<i>Eremiornis carteri</i>				X	X					
<i>Megalurus timoriensis</i>			X							
<b>Meliphagidae</b>										
<i>Acanthagenys rufogularis</i>				X	X					
<i>Cissomela pectoralis</i>			X							
<i>Conopophila rufogularis</i>			X							
<i>Epthianura tricolor</i>			X	X	X					

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<b>BIRDS Cont'd</b>										
<b>Meliphagidae Cont'd</b>										
<i>Lichenostomus flavescens</i>			X							
<i>Lichenostomus keartlandi</i>				X	X					
<i>Lichenostomus penicillatus</i>		X		X	X					
<i>Lichenostomus unicolor</i>			X							
<i>Lichenostomus virescens</i>		X	X	X	X	X				
<i>Lichmera indistincta</i>		X	X	X	X	X				
<i>Manorina flavigula</i>		X	X	X	X	X				
<i>Melithreptus albogularis</i>			X							
<i>Melithreptus gularis</i>			X							
<i>Myzomela erythrocephala</i>			X							
<i>Philemon argenticeps</i>			X							
<i>Philemon citreogularis</i>			X							
<i>Sugomel niger</i>			X		X					
<b>Meropidae</b>										
<i>Merops ornatus</i>	M			X	X	X				
<b>Monarchidae</b>										
<i>Grallina cyanoleuca</i>		X	X	X	X	X				
<i>Myiagra alecto</i>			X							
<i>Myiagra inquieta</i>			X							
<i>Myiagra rubecula</i>			X							
<i>Myiagra ruficollis</i>			X							
<b>Motacillidae</b>										
<i>Anthus novaeseelandiae</i>			X	X	X	X				
<i>Motacilla alba</i>			X							
<i>Motacilla tschutschensis</i>		X	X							
<b>Nectariniidae</b>										
<i>Dicaeum hirundinaceum</i>			X	X	X					
<b>Neositidae</b>										
<i>Daphoenositta chrysoptera</i>			X	X						
<b>Oceanitidae</b>										
<i>Oceanites oceanicus</i>		X	X							

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<b>BIRDS Cont'd</b>										
<b>Oriolidae</b>										
<i>Oriolus sagittatus</i>			X							
<b>Otididae</b>										
<i>Ardeotis australis</i>	P4	X		X	X					
<b>Pachycephalidae</b>										
<i>Colluricincla harmonica</i>			X	X	X					
<i>Oreoica gutturalis</i>			X	X	X	X				
<i>Pachycephala lanioides</i>		X	X							
<i>Pachycephala melanura</i>		X			X					
<i>Pachycephala rufiventris</i>			X	X	X					
<b>Paradalotidae</b>										
<i>Pardalotus rubricatus</i>				X	X					
<i>Pardalotus striatus</i>			X							
<b>Passeridae</b>										
<i>Passer montanus</i>		X								
<b>Pelecanidae</b>										
<i>Pelecanus conspicillatus</i>					X					
<b>Petroicidae</b>										
<i>Melanodryas cucullata</i>			X	X	X					
<i>Microeca fascians</i>			X							
<i>Microeca flavigaster tormenti</i>			X							
<i>Peneonanthe pulverulenta</i>		X	X		X					
<i>Petroica goodenovii</i>			X	X	X					
<b>Phalacrocoracidae</b>										
<i>Microcarbo melanoleucos</i>					X					
<i>Phalacrocorax sulcirostris</i>					X					
<i>Phalacrocorax varius</i>					X					
<b>Phasianidae</b>										
<i>Coturnix ypsilophora</i>			X	X		X				
<b>Podargidae</b>										
<i>Podargus strigoides</i>			X	X	X					

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<b>BIRDS Cont'd</b>										
<b>Podicipedidae</b>										
<i>Tachybaptus novaehollandiae</i>					X					
<b>Pomatostomidae</b>										
<i>Pomatostomus superciliosus</i>				X	X					
<i>Pomatostomus temporalis</i>			X	X	X					
<b>Procellariidae</b>										
<i>Ardenna tenuirostris</i>			X							
<b>Psittacidae</b>										
<i>Aprosmictus erythropterus</i>			X							
<i>Barnardius zonarius</i>				X	X					
<i>Melopsittacus undulatus</i>		X	X	X	X	X				
<i>Psitteuteles versicolor</i>			X							
<i>Psephotus varius</i>				X	X					
<i>Purpureicephalus spurius</i>		X								
<i>Trichoglossus haematodus</i>			X							
<b>Psophodidae</b>										
<i>Cinclosoma castaneothorax</i>				X						
<b>Ptilonorhynchidae</b>										
<i>Ptilonorhynchus guttatus</i>					X					
<i>Ptilonorhynchus maculatus</i>		X								
<i>Ptilonorhynchus nuchalis</i>			X							
<b>Rallidae</b>										
<i>Gallirallus philippensis</i>		X								
<b>Recurvirostridae</b>										
<i>Himantopus himantopus</i>			X	X	X	X				
<i>Recurvirostra novaehollandiae</i>			X							
<b>Rhipiduridae</b>										
<i>Rhipidura albiscapa</i>					X					
<i>Rhipidura fuliginosa</i>			X							
<i>Rhipidura leucophrys</i>		X	X	X	X	X				
<i>Rhipidura phasiana</i>		X			X	X				
<i>Rhipidura rufiventris</i>			X							



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<b>BIRDS Cont'd</b>										
<b>Scolopacidae</b>										
<i>Actitis hypoleucos</i>			X		X					
<i>Arenaria interpres</i>		X	X			X				
<i>Calidris acuminata</i>			X							
<i>Calidris alba</i>			X							
<i>Calidris canutus</i>			X							
<i>Calidris ferruginea</i>			X							
<i>Calidris ruficollis</i>		X	X			X				
<i>Calidris tenuirostris</i>			X							
<i>Gallinago stenura</i>		X								
<i>Limicola falcinellus</i>			X							
<i>Limnodromus semipalmatus</i>		X								
<i>Limosa lapponica</i>			X			X				
<i>Limosa limosa</i>			X							
<i>Numenius madagascariensis</i>	P4	X	X		X	X				
<i>Numenius minutus</i>			X			X				
<i>Numenius phaeopus</i>			X		X	X				
<i>Tringa brevipes</i>		X	X		X	X				
<i>Tringa nebularia</i>			X			X				
<i>Xenus cinereus</i>		X	X							
<b>Strigidae</b>										
<i>Ninox connivens</i>			X							
<i>Ninox novaeseelandiae</i>				X	X					
<b>Sulidae</b>										
<i>Sula leucogaster</i>			X							
<b>Threskiornithidae</b>										
<i>Platalea regia</i>			X							
<i>Plegadis falcinellus</i>			X							
<i>Threskiornis molucca</i>			X		X					
<i>Threskiornis spinicollis</i>			X		X					
<b>Timaliidae</b>										
<i>Zosterops luteus</i>					X	X				

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<b>BIRDS Cont'd</b>										
<b>Turnicidae</b>										
<i>Turnix pyrrhotorax</i>			X							
<i>Turnix velox</i>		X	X	X	X					
<b>Tytonidae</b>										
<i>Tyto javanica</i>		X	X							
<i>Tyto longimembris</i>			X							
<i>Tyto novaehollandiae</i>			X							
<b>MAMMALS</b>										
<b>Bovidae</b>										
<i>Capra hircus</i>						X				
<b>Camelidae</b>										
<i>Camelus dromedarius</i>				X						
<b>Canidae</b>										
<i>Canis lupus</i>		X	X	X	X		X	X		X
<i>Vulpes vulpes</i>		X	X		X	X				
<b>Dasyuridae</b>										
<i>Antechinomys laniger</i>		X								
<i>Dasyercus blythei</i>	P4	X								
<i>Dasyercus cristicauda</i>	S1, V	X		X	X					
<i>Dasykaluta rosamondae</i>		X		X	X	X	X	X	X	X
<i>Dasyurus hallucatus</i>	S1, E	X		X	X					
<i>Ningauia timealeyi</i>				X	X	X	X	X	X	X
<i>Planigale ingrami</i>			X	X		X				
<i>Planigale maculata</i>			X				X	X	X?	
<i>Pseudantechinus woolleyae</i>							X			
<i>Sminthopsis longicauda</i>							X			
<i>Sminthopsis macroura</i>			X	X	X	X	X	X	X	
<i>Sminthopsis ooldea</i>								X		X
<i>Sminthopsis youngsoni</i>		X	X	X	X	X				
<b>Emballonuridae</b>										
<i>Saccolaimus flaviventris</i>						X	X	X	X	X
<i>Taphozous georgianus</i>		X	X			X	X	X	X	X
<i>Taphozous hilli</i>							X	X		

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<b>MAMMALS Cont'd</b>										
<b>Equidae</b>										
<i>Equus asinus</i> *				X	X					
<i>Equus caballus</i> *				X						
<b>Felidae</b>										
<i>Felis catus</i> *		X	X	X	X					
<b>Hipposideridae</b>										
<i>Rhinonictis aurantius (Pilbara form)</i>	S1, V	X								X
<b>Macropodidae</b>										
<i>Macropus agilis</i>			X							
<i>Macropus robustus</i>		X		X	X	X	X	X	X	
<i>Macropus rufus</i>		X	X	X	X	X	X	X	X	X
<i>Petrogale rothschildi</i>					X		X?	X		
<b>Megadermatidae</b>										
<i>Macroderma gigas</i>	P4	X			X		X	X		
<b>Molossidae</b>										
<i>Austronomus australis</i>					X					
<i>Chaerephon jobensis</i>		X	X	X	X		X	X	X	X
<i>Mormopterus beccarii</i>							X	X		
<i>Mormopterus loriae cobourgiana</i>	P1	X				X				
<i>Mormopterus planiceps</i>								X		
<i>Tadarida australis</i>							X	X	X	X
<b>Muridae</b>										
<i>Leggadina lakedownensis</i>				X	X					
<i>Mus musculus</i>		X	X	X	X	X				
<i>Notomys alexis</i>		X	X				X	X		
<i>Pseudomys chapmani</i>	P4	X			X		X	X	X	X
<i>Pseudomys delicatulus</i>		X		X						
<i>Pseudomys desertor</i>			X	X	X	X		X	X	
<i>Pseudomys hermannsburgensis</i>		X	X	X	X	X	X	X		
<i>Pseudomys nanus</i>		X	X							
<i>Zyomys argurus</i>				X	X		X	X	X	

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<b>MAMMALS Cont'd</b>										
<b>Tachyglossidae</b>										
<i>Tachyglossus aculeatus</i>		X		X	X		X	X		
<b>Thylacomyidae</b>										
<i>Macrotis lagotis</i>	S1, V	X	X	X	X		X	X		
<b>Vespertilionidae</b>										
<i>Chalinolobus gouldii</i>				X	X		X	X	X	X
<i>Nyctophilus amhemensis</i>		X								
<i>Nyctophilus bifax</i>							X?	X		
<i>Nyctophilus geoffroyi</i>		X	X			X	X	X	X	
<i>Scotorepens balstoni</i>								X		
<i>Scotorepens greyii</i>				X	X		X		X	X
<i>Vespadelus finlaysoni</i>		X		X	X	X	X	X	X	X

**1. Conservation Status Key**

*	Represents introduced species
X	Represents species present during survey or database searches
X?	Specimen identification that is not 100% verified
E	Endangered species under the EPBC Act 1999
V	Vulnerable species under the EPBC Act 1999
S	Schedule species under Wildlife Conservation Act 1950 (Schedule 1, 2 and 4)
P	Priority species under Wildlife Conservation Act 1950 (P1, P2, P3 and P4)