



Significant Fauna Species Management Plan

Flinders Mines Limited

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Significant Fauna Species Management Plan

Our Reference:

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acronyms

Acronyms used in this report are listed below.

BOM – Bureau of Meteorology

DAFWA – Department of Agriculture and Food Western Australia

DEC – Western Australian Department of Environment and Conservation

DEWHA – Commonwealth Department of the Environment, Water, Heritage and the Arts

DSEWPAC – Commonwealth Department of Sustainability, Environment, Water, Populations and Communities (formerly DEWHA)

EPA – Environmental Protection Authority

EPBC Act – *Environment Protection and Biodiversity Conservation Act (1999)*

FML – Flinders Mines Limited

IBRA - Interim Biogeographical Regionalisation for Australia

WAM – Western Australian Museum

WC Act – *Wildlife Conservation Act (1950)*

1.0 introduction

1.1 background

The Flinders Mines Limited (Flinders) iron ore exploration tenement (E47/882) is located in the Shire of Ashburton in the Pilbara region of Western Australia (**Figure 1**). It contains five sites, which Flinders propose to mine on the tenement it refers to as Blacksmith (**Map 1, Appendix One**). Worley Parsons Pty Ltd was engaged by Flinders to undertake a study to determine the feasibility of obtaining the necessary engineering and environmental approvals to mine these sites.

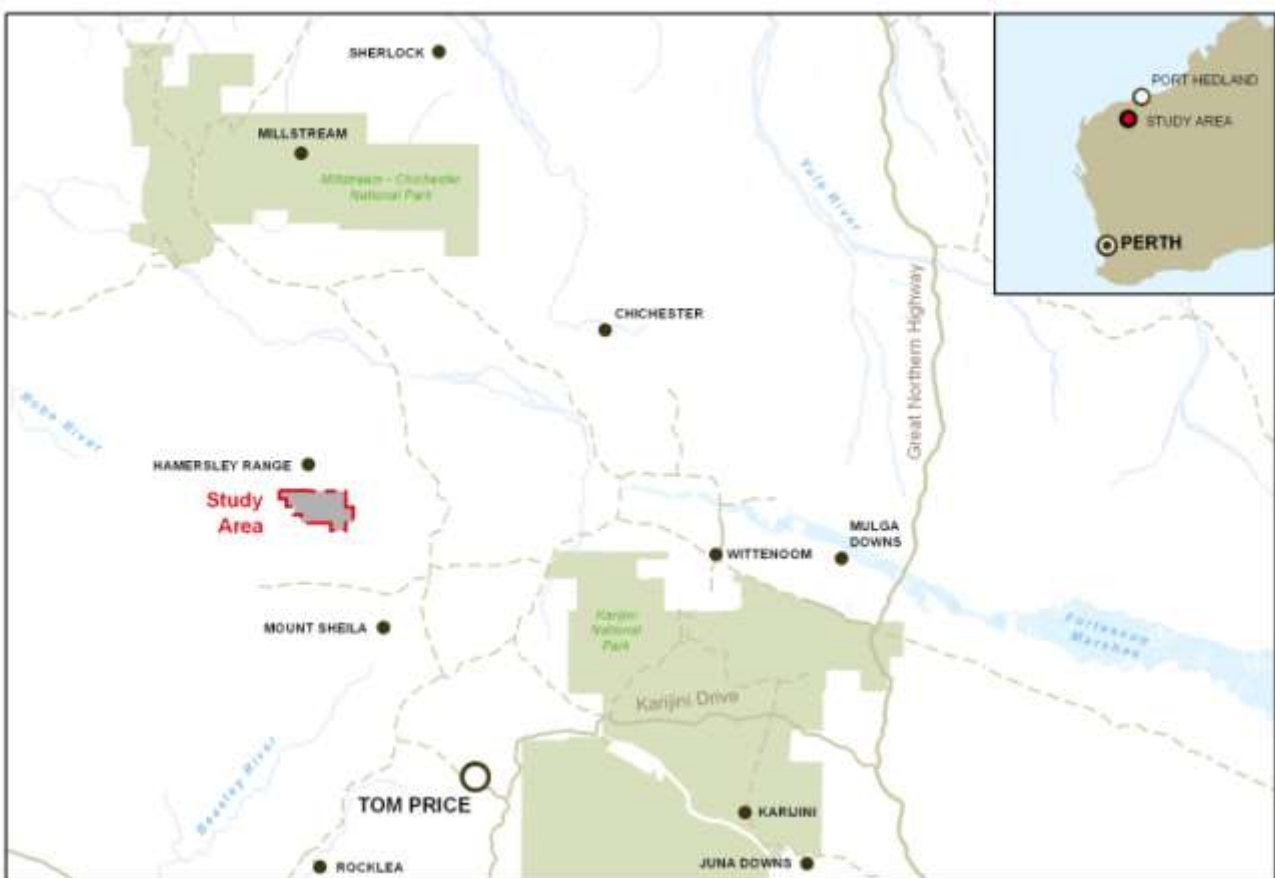


Figure 1: Location of Study Area.

Ecoscape undertook Terrestrial Fauna Surveys, at EPA Level 2, to determine the suite of fauna assemblages present within the Tenement, map and assess fauna habitats and search for the presence of conservation significant fauna species. Fauna habitats were mapped (**Map 1, Appendix One**) as were locations of conservation significant fauna species (**Map 2**).

Sixteen conservation significant fauna species were identified through database searches as potentially occurring within the study area (**Table 1**). Six of these species (*Ramphotyphlops ganeii*, *Dasyurus hallucatus*, *Liasis olivaceus barroni*, *Pseudomys chapmani*, *Macroderma gigas* and *Merops ornatus*) were recorded during surveys conducted between April and October, 2010. No significant short range endemic species were recorded from the surveys (Ecoscape 2010). **Table 1** lists the conservation significant fauna species recorded and their status with respect to the *Wildlife Conservation Act (1950)* and the *Environment Protection and Biodiversity Conservation Act (1999)*.

Table 1: Conservation significant fauna species as identified by WC Act and EPBC Act.

Species	Common Name	EPBC Act	WC Act	DEC Listing
<i>Dasyurus hallucatus</i>	Northern Quoll	Endangered	Schedule 1	-
<i>Liasis olivaceus barroni</i>	Pilbara Olive Python	Endangered	Schedule 1	-
<i>Rhinonictes aurantius</i>	Pilbara Leaf-nosed Bat	Vulnerable	Schedule 1	-
<i>Lagorchestes conspicillatus leichardti</i>	Spectacled Hare-wallaby (mainland)	Vulnerable	P3	P3
<i>Ramphotyphlops ganeii</i>	Blind Snake	-	P1	P1
<i>Pseudomys chapmani</i>	Western Pebble-mound Mouse	-	P4	P4
<i>Macroderma gigas</i>	Ghost Bat	-	P4	P4
<i>Sminthopsis longicaudata</i>	Long-tailed Dunnart	-	P4	P4
<i>Leggadina lakedownensis</i>	Lakeland Downs Mouse, Kerakenga	-	P4	P4
<i>Notoscincus butleri</i>	Ngadji	-	P4	P4
<i>Merops ornatus</i>	Rainbow Bee-eater	Migratory	-	-
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	Migratory	-	-
<i>Ardea alba</i>	Great Egret, White Egret	Migratory	-	-
<i>Ardea ibis</i>	Cattle Egret	Migratory	-	-
<i>Charadrius veredus</i>	Oriental Plover, Oriental Dotterel	Migratory	-	-
<i>Apus pacificus</i>	Fork-tailed Swift	Migratory	-	-

Conservation significant fauna species or habitats recorded on the Flinders tenement were:

1. Northern Quoll (*Dasyurus hallucatus*)
2. Pilbara Leaf-nosed Bat (*Rhinonictes aurantius*)
3. Pilbara Olive Python (*Liasis olivaceus barroni*)
4. Western Pebble-Mound Mouse (*Pseudomys chapmani*)
5. Ghost Bat (*Macroderma gigas*)
6. Rainbow Bee-eater (*Merops ornatus*)
7. Blind Snake (*Ramphotyphlops ganeii*)

1.1.1 REGIONAL CONTEXT

The study area predominantly lies within the Hamersley subregion (PIL3). This subregion is part of the Pilbara Bioregion of the IBRA classification system (Environment Australia 2000; McKenzie *et al.* 2003). The Pilbara Bioregion falls within the Bioregion Group 2 classification of EPA (2004). This group is described as:

“Bioregions of the Eremaean Botanical Province, native vegetation is largely contiguous but is used for commercial grazing.”

Key threatening processes identified for fauna species at risk include habitat changes associated with land use, feral predators and grazing. Various other plant, mammal, reptile and bird species are listed as priority species and have similar processes threatening them with the addition of mining, changes to hydrology, weeds and changed fire regimes (McKenzie *et al.* 2003).

1.1.2 CLIMATE

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

The Pilbara lies south of the area normally penetrated by the northwest monsoon in the summer months, and is only occasionally influenced by weather systems of the westerly circulation in the winter months. Rainfall is therefore low and variable, with an annual average of 200-350mm. The majority of rainfall occurs between December and March, as the result of moist tropical storms and cyclones originating in the north, with a pronounced dry period between August and November. Tropical cyclones contribute 40% - 60% of the rainfall on the northern coast, with falls reducing to as little as 30% in the south and east of the region.

1.1.3 LAND SYSTEMS

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

Table 2 Land systems within the FML tenements.

Land Type	Land System Name and Description
Land type 1 - Hills and ranges with spinifex grasslands	Newman - Rugged ironstone ridges, plateaux and mountains; hard spinifex pastures in good to excellent condition; no erosion.
Land type 5 - Dissected plains with spinifex grasslands	Platform - Dissected slopes and raised plains supporting hard spinifex grasslands.
Land type 8 - Stony plains with spinifex grasslands	Boolgeeda - Stony lower slopes and plains below hill systems; not degraded or eroded.

Regionally, the study area represents only a minimal proportion of the land systems that it encompasses, with all systems represented by less than 0.5% of their regional extent.

Similar land systems are grouped into land types on the basis of a combination of landform, soil, vegetation and drainage characteristics. This grouping allows for more accurate interpretation of information when considered at a regional scale.

1.1.4 GEOLOGY

The rocks of the Pilbara craton are predominantly Archaean to Proterozoic in age and include igneous (granite, greenstone etc.) formations as well as the sedimentary Hamersley Group. The Hamersley Group is approximately 2.5 km thick and contains Banded Iron Formations where iron was chemically precipitated as magnetite; these BIF have subsequently been eroded and chemically weathered to produce more concentrated iron ore deposits (enriched in iron minerals including goethite and haematite) in channels, mesas, and valley floors.

1.1.5 DRAINAGE

There are numerous small ephemeral drainage channels occurring within the study area, none can be considered major watercourses. There is a permanent channel in Ajax that supports water holes and is therefore significant as a source of shelter and food resources for fauna (**Map 1**).

1.1.6 FLORA AND VEGETATION

The Pilbara biogeographic region includes four major components; the Hamersley, Fortescue Plains, Chichester and Roebourne subregions (Thackway and Cresswell 1995). According to this subregional mapping, the Study area is located within the Hamersley subregion (**Figure 1**). Descriptions of this subregion, as outlined in the 2002 Biodiversity Audit of Western Australia's 53 Biogeographical Subregions (McKenzie *et al.* 2003), is provided below.

Hamersley subregion (PIL3):

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

DOMINANT VEGETATION

Beard's Vegetation Mapping

The Study area lies entirely within the Fortescue Botanical District of the Eremaean Botanical Province as defined by Beard (1975). Beard recognised eight different physiographic units within the Fortescue Botanical District, two of which occur within the study area:

- Hamersley Plateau: a compact unit defined by the outcrop of Lower Proterozoic rocks, predominantly jaspilite and dolomite with some shale, siltstone and volcanic rock. It is bounded by a well-marked abrupt escarpment on its northern, eastern and western flanks, whereas the outcrop on the southern side is more irregular.

Hopkins et al's (2001) vegetation mapping of Pre-European extent, compiled primarily from Beard's (1975) mapping of the Pilbara, outlines that the Study area contains the following vegetation association, grouped according to physiographic unit:

- Hamersley Plateau: Veg Association 82 comprising hummock grasslands, low tree steppe, and snappy gum over *Triodia wiseana*.

2.0 Objectives and Scope

2.1 objectives and scope of the plan

The purpose of this management plan is to identify the potential direct and indirect impacts of mine development and operation on fauna species within the Blacksmith tenement. In addition, the plan provides guidelines on fauna monitoring that could be utilised to determine the level of impact on fauna species. The plan addresses management issues relevant to the potential fauna species including conservation significant species at operational project areas.

Objectives of the plan:

- Objective 1: To adhere to all Ministerial directives, conditions and Flinders commitments made in the approval documentation
- Objective 2: Establish the potential direct and indirect impacts on conservation significant fauna, including EPBC listed threatened fauna species, and their habitats within the project area
- Objective 3: Establish management and monitoring strategies to minimise the potential impacts on conservation significant fauna species, and their habitats within the project area
- Objective 4: Establish appropriate review mechanisms regarding the strategies employed to minimise impacts on fauna
- Objective 5: Ensure better protection and long term conservation of EPBC listed threatened fauna species in the Pilbara region of Western Australia

2.2 relevant legislation

Flinders employees and contractors are obliged to comply with all relevant environmental Commonwealth and State legislation (**Table 3**).

Table 3: Commonwealth and State Legislation Relevant to this Management Plan

Legislation	Application
Environmental Protection Act 1986	State environmental impact assessment and Ministerial approval process.
WA Wildlife Conservation Act 1950	State process that assesses the conservation significance of fauna species and forms the framework for protection of significant species.
Environmental Protection and Biodiversity Conservation Act 1999	Federal process that assesses the conservation significance of fauna species and forms the framework for protection of significant species.

3.0 Roles and responsibilities

Accountability for fulfilling the requirements of this Significant Fauna Species Management Plan (The Plan) is dependent on the stage of project development (exploration, construction, operations, decommissioning).

During exploration, the Head of Exploration is accountable for fulfilling requirements of The Plan, although aspects of The Plan may be delegated to other company personnel.

Irrespective of whether construction activities are undertaken by an external service provider or internal Flinders personnel, the Project Manager will be accountable for ensuring the requirements of The Plan are met. Responsibility may be delegated to the Environmental Manager or other personnel.

During operational stages, the General Manager is accountable for ensuring the requirements of The Plan are met. Responsibility for specific tasks may be delegated. **Table 4** attributes specific management actions to the appropriate personnel.

Table 4: Roles and Responsibilities

Position	Responsibility
General Manager – HSEC and HR	To formulate, implement and report on fauna monitoring and assessment work. Provide guidance in the approach to fulfilling commitments of the Significant Fauna Species Management Plan.
Site HSE Manager	Audits conformance of activities against the management actions of the Conservation Significant Species Fauna Management Plan. To maintain site records of surveys and arrange monitoring programs as required. To provide staff with the tools and resources to meet objectives.
Site Environmental Officers	To provide technical support and advice to site staff.
Construction/Operational Managers	To ensure Flinders conditions and policies are followed on-site.
All Flinders personnel, contractors and visitors	Reduce any impacts on fauna resulting from the construction and operation of the project. Report sightings, vehicle strikes or any encounters with recognisable conservation significant fauna species.

4.0 Potential Impacts

4.1 Land disturbances

Land disturbances can directly impact animals if they are killed during the clearing process. Individuals can also be indirectly affected when clearing removes vegetation used as shelter to avoid predation. Loss of habitat can adversely affect population survival through fragmentation, particularly if the impacted habitat is linear and distinctive. This can occur in substantially intact landscapes where there are distinctive habitats along watercourses or associated with geological features. Habitat fragmentation can restrict species dispersal, leading to genetic isolation. The predicted impacts of mining activities on short range endemic species are low as no significant species were recorded in the project area (Ecoscape 2010).

4.2 Introduced flora

Increased vehicular traffic, combined with increased ground disturbance and disposal of water from drilling and domestic operations provide the opportunity for the spread and establishment of environmental weed species. Soil stockpiles also provide an opportunity for weed invasion.

Introduction of weed species can modify natural processes, often resulting in the decline of the invaded community. Consequently, weed species can impact conservation significant fauna through habitat degradation and altered fire regimes, resulting from changes in vegetation structure.

4.3 Introduced fauna

Introduced species, including the Feral Cat and Dingo may have adverse impacts upon native species, and the abundance of these species can alter during development projects. In particular, some mammal species are very sensitive to introduced predators and the decline of many mammals in Australia has been linked to predation by feral predators (Burbidge and McKenzie 1989). Changes in the abundance of some native species can also be a concern, such as the increase in abundance of some birds, at the expense of others, due to the provision of watering points. As both the Feral Cat and Dingo are already established in the study area, careful control and monitoring can maintain the current level of impact and perhaps reduce it through good house-keeping and waste management measures.

4.4 Fire

Fire is a natural feature of the environment but frequent, extensive fires may adversely impact some fauna, particularly mammals and short-range endemic species. Long-unburnt habitats are an important refuge for fauna, but some species require occasional fires, while a mosaic of fire ages may be important to provide both shelter and food resources within a home range. The occurrence of

wildfires may be reduced as vegetation is cleared from the site and while this is not seen as a significant impact, there is a possibility that increased activity can be an ignition source resulting in an increase in small frequent fires. It is very important to minimize the possibility of extensive fire.

4.5 Vehicle collisions

Vehicles can often directly kill terrestrial fauna, and sometimes birds, crossing roads and tracks, which bisect home ranges. These deaths can then indirectly lead to the deaths of other species, such as raptors and goannas, attracted to the road to feed on carcasses, and in turn being killed by passing vehicles.

4.6 Drill holes

Uncapped drill holes within the project area present a potential risk to terrestrial fauna (Malnic 1997), as small mammals and reptiles may become caught in them. Therefore, drill holes need to be closed as soon as possible.

4.7 Powerlines, Fences and Trenches

Powerlines, fences and trenches can pose significant risk to fauna as these structures can result in, bird strikes through powerlines being built across bird flight paths; bat entanglements through the use of barb wire fences; and ground dwelling fauna entrapment due to animals falling into open trenches. Therefore, barbed wire should be removed from fences where possible and trenches should be inspected regularly and any entrapped fauna removed.

4.8 Noise, Light and Dust

Activities associated with mining such as noise and lighting can impact on nearby resident fauna. The noise and vibrations associated with blasting and drilling may force some animals to move from the area. Continuous operations mean that much of the site will be lit 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.

4.9 Waste

Poorly managed waste may attract native fauna, and introduced fauna such as, dingoes, feral dogs, cats, rats and mice, to human habitation areas. This may result in an increase in pest species and may alter normal fauna assemblages.

5.0 Management Strategy

Table 5: Key Management Actions for Conservation Significant Fauna Species in the Project Area

Objective 1 To adhere to all Ministerial directives, conditions and Flinders commitments made in the approval documentation.					
Reference	Management Action	Performance Indicators	Reporting/Evidence	Timing	Responsibility
1	Compliance with all directives, conditions and Flinders Environmental commitments	<ul style="list-style-type: none"> 100% compliance 	<ul style="list-style-type: none"> Annual compliance audit Annual Environmental Report 	Annual	Site HSE Manager
Objective 2 Establish the potential direct and indirect impacts on conservation significant fauna, including EPBC listed threatened fauna species, and their habitats within the project area					
Reference	Management Action	Performance Indicators	Reporting/Evidence	Timing	Responsibility
2	Undertake targeted fauna surveys that are consistent with the EPA's <i>Guidance for the Assessment of Environmental Factors No. 56 – Terrestrial Fauna Surveys for Environmental Impact Assessments in Western Australia</i> , to determine distribution of conservation significant fauna	<ul style="list-style-type: none"> Conduct and complete assessments prior to disturbance Surveys to be undertaken in all three areas as per Objective 2 with one replicate for each area Trap effort replicated for all survey sites for comparison and statistical analysis Consultation with relevant DEC specialists to identify/confirm timing of surveys 	<ul style="list-style-type: none"> Registered in the Conservation Significant Fauna Register All locations and habitats recorded in the GIS Database Survey Reports and permit licensing to DEC requirements Annual Environmental Report 	Prior to ground disturbance	Consultants
3	If additional surveys are required for ground disturbance purposes, conduct a pre-clearance risk assessment and survey accordingly.	<ul style="list-style-type: none"> Conduct and complete assessments prior to disturbance Fauna Management Plan approved and implemented on-site 	<ul style="list-style-type: none"> Record conservation significant fauna All locations and habitats recorded in the GIS Database Survey Reports Fauna Management Plan Annual Environmental Report 	Prior to ground disturbance	Consultants Site HSE Manager

4	Map locations and habitats of known conservation significant species. Development plans formulated to avoid and reduce clearing of known habitat.	<ul style="list-style-type: none"> Conduct mapping assessments prior to disturbance Formulation of development plans that avoid and reduce clearing of mapped conservation significant habitat 	<ul style="list-style-type: none"> Survey Reports Development Plans Annual Environmental Report All locations and habitats recorded in the GIS Database 	Where applicable	Consultants Site HSE Manager
5	Locate borrow pits to minimise impacts on conservation significant fauna habitat.	<ul style="list-style-type: none"> Conduct mapping assessments prior to disturbance, preference is to locate pits in previously disturbed areas outside of significant fauna habitat Formulation of development plans that locate borrow pits to minimise impacts on conservation significant fauna habitat 	<ul style="list-style-type: none"> Survey Reports Development Plans Mapping of significant fauna habitat 	Where applicable	Consultants
6	Assess all project areas, including borrow pits, prior to ground disturbance to determine the presence of conservation significant species (GDP System).	<ul style="list-style-type: none"> 100% compliance Conduct and complete assessments prior to ground disturbance consistent with EPA Guidance 	<ul style="list-style-type: none"> Annual Environmental Report Survey Reports 	Where applicable	Site HSE Manager Consultants
7	Survey priority habitat areas for presence of known conservation significant species, consistent with EPA and SEWPaC Guidance.	<ul style="list-style-type: none"> Conduct and complete assessments prior to disturbance Targeted surveys conducted, where possible, using non-invasive techniques i.e. motion sensitive cameras Records of survey effort and limitations to be maintained Consultation with relevant DEC specialists to identify/confirm timing of surveys 	<ul style="list-style-type: none"> Survey Reports Annual Environmental Report Mapping of significant fauna observations and abundance 	Where applicable	Site HSE Manager Consultants
8	If conservation significant species are recorded within the project footprint, implement mitigation measures, including the relocation of the fauna, developed in consultation with DEC.	<ul style="list-style-type: none"> Implement mitigation measures Conduct relocation with DEC consultation and approval Register conservation significant fauna species and map locations 	<ul style="list-style-type: none"> Consultant Report Conservation Significant Fauna Register Survey map of fauna locations Audit Compliance Report Annual Environmental Report 	Prior to ground disturbance	Consultants Site HSE Manage
Objective 3	Establish management and monitoring strategies to minimize the potential impacts on conservation significant fauna species, including EPBC listed threatened fauna species, and their habitats within the project area				

Reference	Management Action	Performance indicators	Reporting / Evidence	Timing	Responsibility
9	Where there are known populations of conservation significant species in the Project Area, conduct fauna monitoring in accordance with Section 7 of this Plan.	<ul style="list-style-type: none"> Monitoring Program implemented Corrective measures identified 	<ul style="list-style-type: none"> Monitoring Reports Annual Environmental Report 	See Section 7	Site HSE Manager
10	Vegetation clearing will only proceed once a vegetation clearing permit has been issued.	<ul style="list-style-type: none"> Ground disturbance permits issued 	<ul style="list-style-type: none"> Ground disturbance permits Annual Environmental Report 	Prior to ground disturbance	Site HSE manager Construction Manager
11	Clearing zones will be clearly marked on a map prior to clearing and demarcated in the field to ensure clearing only in designated areas.	<ul style="list-style-type: none"> Conduct vegetation mapping assessments prior to disturbance Formulation of development plans that show clearing zones. No vegetation clearing undertaken outside of surveyed and approved areas during construction and operation. 	<ul style="list-style-type: none"> Survey Reports Vegetation maps Development Plans 	Prior to ground disturbance	Consultants Site HSE Manager Construction Manager
12	Where possible, cleared vegetation will be returned to rehabilitation areas to provide shelter and microhabitat.	<ul style="list-style-type: none"> Return cleared vegetation to rehabilitation areas 	<ul style="list-style-type: none"> Annual Environmental Report 	Where applicable	Site HSE Manager
13	Progressive rehabilitation of disturbed areas will be undertaken.	<ul style="list-style-type: none"> Disturbed areas rehabilitated 	<ul style="list-style-type: none"> Annual Environmental Report 	Where applicable	Site HSE Manager Operations Manager
14	Construction of fauna friendly culverts in selected creeklines, rivers and other corridor features to allow fauna to pass under roadways or railways.	<ul style="list-style-type: none"> Fauna utilising underpass structures/culverts Measure fauna traffic through underpass structures/culverts with motion sensitive cameras 	<ul style="list-style-type: none"> Survey reports Database of fauna encounters Annual Environment Report 	Where applicable	Construction Manager Site HSE Manager
15	All drill holes at ground level to be (temporarily) capped.	<ul style="list-style-type: none"> Less than 1% of all drill holes at ground level are uncapped 	<ul style="list-style-type: none"> Register of all drill holes 	As part of drilling program	Site Environmental Officer

16	Where possible, position equipment on previously disturbed or cleared areas rather than freshly clearing new areas.	<ul style="list-style-type: none"> • Conduct mapping assessments prior to disturbance • Formulation of development plans that show where equipment should be positioned 	<ul style="list-style-type: none"> • Survey Reports • Development Plans 	Where applicable	Consultants
17	Manage weeds in the project area to prevent degradation of priority fauna habitat.	<ul style="list-style-type: none"> • Compliance with Weed Management Plan 	<ul style="list-style-type: none"> • Weed Management Plan 	Ongoing	Site HSE Manager
18	Where practical, erect fencing around ponds Minimise speed limits on all roads Prohibit driving off-road Right of way for all fauna	<ul style="list-style-type: none"> • Reduction in fauna deaths in Project areas • Appropriate signage on all roads • Awareness program incorporated into all induction programs 	<ul style="list-style-type: none"> • Database of fauna encounters • Annual Environment Report 	In accordance with project construction	Site HSE Manager
19	Construction of a ring-lock (mesh) fence around lined dewatering infrastructure to prevent medium and large animals becoming trapped and to prevent feral animals accessing water resources.	<ul style="list-style-type: none"> • Fence constructed after dewatering infrastructure constructed 	<ul style="list-style-type: none"> • Annual Environmental Report 	Where applicable	Site HSE Manager
20	Mesh or 'self rescue mats' placed around edge of all plastic lined dams to allow entrapped animals to escape	<ul style="list-style-type: none"> • Mesh construction after dam construction 	<ul style="list-style-type: none"> • Annual Environmental Report 	Where applicable	Site HSE Manager
21	Reduce and maintain feral animal numbers below a level that they can impact on conservation significant fauna	<ul style="list-style-type: none"> • Feral animal records from sightings and road transect counts • Sightings of conservation significant fauna species • Trapping/ baiting of feral animals • No feral animals to be brought onto any Flinders site • No feral animals to be fed or sheltered on Flinders sites 	<ul style="list-style-type: none"> • Annual Environmental Report • Monthly Environmental Report 	Annual	Site HSE Manager
22	Participate in regional feral animal control programs	<ul style="list-style-type: none"> • Participation in regional programme 	<ul style="list-style-type: none"> • Annual Environmental Report 	Upon consultation with DEC	Site HSE Manager

23	Prevent feeding of animals at camps and in the Project area and pets on site	<ul style="list-style-type: none"> Awareness material included into site induction programs 	<ul style="list-style-type: none"> Annual Environmental Report 	Annual or as required	Site Environmental staff
24	Ensure appropriate putrescibles waste disposal facilities are supplied in all major eating and work areas.	<ul style="list-style-type: none"> Install appropriate putrescibles waste disposal facilities at all major eating and work areas 	<ul style="list-style-type: none"> Annual Environmental Report 	Annual	Site HSE Manager
25	Putrescibles dumps covered/ fenced and gated to prevent feral animal access.	<ul style="list-style-type: none"> Fence construction after installing each putrescibles waste disposal facility 	<ul style="list-style-type: none"> Annual Environmental Report 	After installation	Site HSE Manager
26	Record all sightings of conservation significant fauna in the project area.	<ul style="list-style-type: none"> Records database 	<ul style="list-style-type: none"> Register of all fauna sightings Register of all fauna incidents 	Ongoing	Site Environmental Officer Employees, contractors and visitors
27	Report all incidental mortalities of Scheduled fauna (mortalities that were unable to be predicted to occur as likely consequence of project implementation)	<ul style="list-style-type: none"> Incident reported to DEC within 21 days of an incident occurring Where there is a known likelihood of impacts on Scheduled fauna a licence has been obtained under the Wildlife Conservation Act 1950 	<ul style="list-style-type: none"> Incident report including: <ul style="list-style-type: none"> Location of death Vegetation type Date and time of incident Other fauna of the same species that may have been sited in the area Possible cause/s of fauna incident Appropriate and timely contingency measures implemented 	Ongoing	Site Environmental Officer Employees, contractors and visitors
28	Procedures established for the management of any injured fauna, specifically conservation significant fauna.	<ul style="list-style-type: none"> Implement Procedures Manual 	<ul style="list-style-type: none"> Conservation Significant Fauna register Annual Environmental Report 	Annual	Site Environmental Officer
29	Incorporate a species awareness component into site inductions. Train staff on reporting protocols	<ul style="list-style-type: none"> Established site induction Preparation of reference material for the identification of significant species 	<ul style="list-style-type: none"> Annual reporting Identification booklet/profiles 	Ongoing	Site Environmental Officer

Objective 4 Establish appropriate review mechanisms regarding the strategies employed to minimize impacts on fauna

	Management Action	Performance Indicators	Reporting/Evidence	Timing	Responsibility
30	If an incident occurs, corrective actions will be employed	<ul style="list-style-type: none"> Incident reported 	<ul style="list-style-type: none"> Incident Report Annual reporting 	When an incident occurs	Site Environmental Officer
31	Review mitigation measures and monitoring programs for conservation significant fauna to inform an adaptive management approach for the life of the mine	<ul style="list-style-type: none"> Review and update management approach 	<ul style="list-style-type: none"> Updated Management Plan 	When an incident has occurred. See Section 7	Site HSE Manager Consultants
Objective 5	Ensure better protection and long term conservation of EPBC listed threatened fauna species in the Pilbara region of Western Australia				
	Management Action	Performance Indicators	Reporting/Evidence	Timing	Responsibility
32	Fund research programs into Northern Quoll ecology, distribution and abundance in the Hamersley Ranges.	<ul style="list-style-type: none"> Agreement with DEC Payment of funds University PhD Stipend 	<ul style="list-style-type: none"> Annual compliance audit Annual reporting Published results of research 	In accordance with approval conditions	General Manager – HSEC and HR
33	Prepare and implement threatened fauna offset plan. Flinders are currently managing suitable habitat that could form a component of an offset package	<ul style="list-style-type: none"> Approval of plan 	<ul style="list-style-type: none"> Specific threatened fauna offset plan 	In accordance with approval conditions	General Manager – HSEC and HR
34	Strategic management of land to minimise threats to EPBC Act listed fauna habitat. Land management practices to be aligned with an approved DMP mine closure plan	<ul style="list-style-type: none"> Strategic land management plan Approved DMP Mine Closure Plan in place 	<ul style="list-style-type: none"> Specific strategic land management plan Alignment with DMP Mine Closure Plan and reporting requirements 	In accordance with approval conditions	Manager, Governance and Sustainability Manager, Environmental Compliance

6.0 Fauna Monitoring Guidelines

These monitoring guidelines have been prepared as part of the Significant Fauna Management Plan to incorporate leading practice methods to address the goals and objectives addressed in The Plan.

These guidelines describe:

- Goals and Objectives of each type of monitoring to be undertaken
- Key personnel responsible for each component of fauna monitoring
- Triggers for the review and amendment of the monitoring program

Table 6 addresses the Fauna Monitoring Guidelines. The focus for fauna monitoring is primarily on species listed under the EPBC Act. These are the Northern Quoll, Pilbara Olive Python, Rainbow Bee-eater, and Pilbara Leaf-nosed Bat. Species listed as Priority by DEC are also addressed.

Baseline and operational monitoring will also be informed by the findings of the monitoring itself as they come to hand. The findings may similarly lead to ongoing refinements to The Plan and its management strategies to ensure an adaptive management approach is undertaken during construction and life of the mine.

Changes to the monitoring program of conservation significant species should be agreed to be DEC and SEWPaC and may be based on the confirmed presence or absence of a population.

Key responsibilities for Flinders Environmental Staff are to document the location and occurrence of conservation significant fauna species in a fauna database.

Table 6: Management Procedures for conservation significant fauna species.

Species	Objectives	Monitoring Procedures	Triggers for Review	Responsible Personnel
Northern Quoll (<i>Dasyurus hallucatus</i>)	<p>Determine presence and potential habitat in Project area. Surveys to follow methods as outlined in SEWPaC draft Northern Quoll Policy Statement where appropriate.</p> <p>Monitor and measure the success of the management measures and adapt where actions are ineffective.</p>	<ul style="list-style-type: none"> Conduct an initial survey to obtain baseline data on presence of habitat and species (population and distribution). Because of considerable annual variation in the abundance of this species, accurate mapping of suitable habitat is important. SEWPaC guidance for sampling of Northern Quoll are in draft form only and may not be appropriate for broad scale habitat and presence/distribution assessment. Habitat assessment, searching for scats and setting of motion-sensitive cameras are most useful for defining broad patterns of distribution. When used this way, need large number of cameras (20-30) set at 100-200m spacing across suitable habitat. Trapping for more targeted population work and impact monitoring (see below). Provide map of areas of suitable habitat based on baseline survey results. Develop an ongoing monitoring programme based on replicated impact and control trapping sites, with each site consisting of 50 traps (alternating cage and large Elliott traps) set at 30-50m spacing in suitable habitat where species' presence previously confirmed by scat and/or camera surveys. Trapping annually in non-breeding season (May to August), to be reviewed after two years subject to results. Annual conditions will need to be considered in this review. DEC specialists should be consulted to identify/confirm appropriate timing of surveys. Individuals to be marked with passive identification tags and tissue samples taken for DNA analysis by WAM. Monitoring programme to be reviewed when SEWPaC Draft Northern Quoll survey guidelines are finalised. Relocation may need consideration and approval by DEC should Quolls be located within impact area. Species sightings, road strikes and encounters reported, investigated and where necessary mitigation measures implemented. All Northern Quoll sightings will be mapped and reported to DEC. Where management measures are deemed ineffective, amend management strategies based on ongoing survey outcomes and/or faunal impacts documented. 	<p>Presence within impact area.</p> <p>Ongoing survey outcomes</p> <p>Faunal sightings, strikes and/or encounters documented</p> <p>Reduction in abundance not obviously related to climate or natural population fluctuations</p>	On-site Flinders Environmental staff and Specialists

Species	Objectives	Monitoring Procedures	Triggers for Review	Responsible Personnel
Pilbara Olive Python (<i>Liasis olivaceus barroni</i>)	<p>Determine presence and monitor key areas.</p> <p>Monitor and measure the success of the management measures and adapt where actions are ineffective.</p> <p>Translocation and monitoring</p>	<ul style="list-style-type: none"> Conduct an initial survey to obtain baseline data on habitat and species presence within the impact areas (presence and distribution). Species presence can be determined through presence of scats, sloughed skins, searching and spotlighting roads near to habitat and creeks (especially during the wet season). Provide map of areas of suitable habitat based on baseline survey results. Monitoring; discuss with DEC the practicality and value of monitoring for this species. May be very difficult to obtain statistically robust data to measure impacts, but opportunistic records from staff may be valuable if well-publicised and organised. The use of motion sensitive cameras is considered useful set on waterholes and pools. If translocation is required consult with DEC on relevance and method. Species sightings, road strikes and encounters reported, investigated and where necessary mitigation measures implemented. All Pilbara Olive Python sightings will be mapped and reported to DEC. Where management measures are deemed ineffective, amend management strategies based on ongoing survey outcomes and/or faunal impacts documented. 	<p>Presence in area to be disturbed.</p> <p>Ongoing survey outcomes</p> <p>Faunal sightings, strikes and/or encounters documented.</p>	Flinders Environmental staff and Specialists
Blind Snake (<i>Ramphotyphlops ganeji</i>)	<p>Determine presence and monitor key areas</p> <p>Monitor and measure the success of the management measures and adapt where actions are ineffective.</p>	<ul style="list-style-type: none"> Surveys and monitoring to be based on hand searches, raking, spotlighting and pit trapping, during the Wet season. DEC specialists should be consulted to identify/confirm appropriate timing of surveys. Fauna sightings, road strikes and encounters reported, investigated and where necessary mitigation measures implemented. All Blind Snake sightings will be mapped and reported to DEC. Where management measures are deemed ineffective, amend management strategies based on ongoing survey outcomes and/or faunal impacts documented. 	<p>Presence within impact area.</p> <p>Ongoing survey outcomes.</p> <p>Faunal sightings, strikes and/or encounters documented.</p>	On-site Environmental staff and Specialists
Rainbow Bee-eater (<i>Merops ornatus</i>)	<p>Determine presence and monitor key areas</p>	<ul style="list-style-type: none"> Conduct an initial survey to obtain baseline data (population and distribution). DEC specialists should be consulted to identify/confirm appropriate timing of surveys. Fauna sightings, road strikes and encounters reported, investigated and where necessary mitigation measures implemented. All Rainbow Bee-eater sightings will be mapped and reported to DEC. If required, management strategies amended based on survey outcomes 	<p>Presence within impact area</p> <p>Ongoing survey outcomes</p>	On-site Environmental staff and Specialists

Species	Objectives	Monitoring Procedures	Triggers for Review	Responsible Personnel
<p>Pilbara Leaf-nosed Bat (<i>Rhinonicteris aurantius</i>)</p>	<p>Determine presence and potential habitat in Project area.</p> <p>Monitor and measure the success of the management measures and adapt where actions are ineffective.</p>	<ul style="list-style-type: none"> Conduct an initial survey (if not already available from prior studies) to define the extent of potential habitat. Provide map of areas of suitable habitat based on baseline survey results. Conduct systematic aural surveys (eg. Anabat and Songmaster systems) to determine if and where the species is present, and (if the species is present) to locate significant sites such as roost caves. Bat detecting equipment to be set in gorges and cave entrances. These surveys would provide baseline data on distribution and abundance. Seek advice from specialists on sampling protocols, but approach would broadly consist of replicated recording stations in near-impact and control locations. DEC specialists should be consulted to identify/confirm appropriate timing of surveys. Based on baseline data, develop an ongoing monitoring program including monitoring of all caves within the project area where the species recorded and also monitor any potentially suitable caves. Monitoring to be based on echo-location (aural) surveys with minimal disturbance of caves. Monitoring programme should include sites close to impact areas and control sites that are not close to impact areas. Seek advice from specialists on sampling protocols. Species sightings, road strikes and encounters reported, investigated and where necessary mitigation measures implemented. All Pilbara Leaf-nosed Bat sightings will be mapped and reported to DEC. Where management measures are deemed ineffective, amend management strategies based on ongoing survey outcomes and/or faunal impacts documented. 	<p>Presence within area to be impacted.</p> <p>Ongoing survey outcomes</p> <p>Faunal sightings, strikes and/or encounters documented.</p>	<p>Specialists with assistance from Fortescue Environmental Staff</p>

Species	Objectives	Monitoring Procedures	Triggers for Review	Responsible Personnel
Ghost Bat (<i>Macroderma gigas</i>)	<p>Determine presence and potential habitat in Project area.</p> <p>Monitor and measure the success of the management measures and adapt where actions are ineffective.</p>	<ul style="list-style-type: none"> Conduct an initial survey (if not already available from prior studies) to define the extent of potential habitat. Provide map of areas of suitable habitat based on baseline survey results. Conduct systematic aural surveys (eg. Anabat and Songmaster systems) to determine if and where the species is present, and (if the species is present) to locate significant sites such as roost caves. Bat detecting equipment to be set in gorges and cave entrances. These surveys would provide baseline data on distribution and abundance. Seek advice from specialists on sampling protocols, but approach would broadly consist of replicated recording stations in near-impact and control locations. DEC specialists should be consulted to identify/confirm appropriate timing of surveys. Based on baseline data, develop an ongoing monitoring program including monitoring of all caves within the project area where the species recorded and also monitor any potentially suitable caves. Monitoring to be based on echo-location (aural) surveys with minimal disturbance of caves. Monitoring programme should include sites close to impact areas and control sites that are not close to impact areas. Seek advice from specialists on sampling protocols. Species sightings, road strikes and encounters reported, investigated and where necessary mitigation measures implemented. All Ghost Bat sightings will be mapped and reported to DEC. Where management measures are deemed ineffective, amend management strategies based on ongoing survey outcomes and/or faunal impacts documented. 	<p>Presence within area to be impacted.</p> <p>Ongoing survey outcomes</p> <p>Faunal sightings, strikes and/or encounters documented.</p>	<p>Specialists with assistance from Fortescue Environmental Staff</p>

Species	Objectives	Monitoring Procedures	Triggers for Review	Responsible Personnel
Western Pebble-Mound Mouse (<i>Pseudomys chapmani</i>)	Determine presence and monitor key areas Monitor and measure the success of the management measures and adapt where actions are ineffective.	<ul style="list-style-type: none"> Conduct transect searches to determine locations of pebble mounds in the project area Field surveys will use (Anstee 1996) (Anstee 1996) method to determine presence of Western Pebble-Mound Mouse based on external mound structure. DEC specialists should be consulted to identify/confirm appropriate timing of surveys. Motion sensitive cameras set on active mounds to estimate abundance of Western Pebble-Mound Mice in the area. Fauna sightings, road strikes and encounters reported, investigated and where necessary mitigation measures implemented. All Western Pebble-Mound Mouse sightings will be mapped and reported to DEC. Where management measures are deemed ineffective, amend management strategies based on ongoing survey outcomes and/or faunal impacts documented. 	<p>Presence within impact area.</p> <p>Ongoing survey outcomes.</p> <p>Faunal sightings, strikes and/or encounters documented.</p>	On-site Environmental staff and Specialists
Spectacled Hare-wallaby (mainland)(<i>Lagorchestes conspicillatus leichardti</i>)	Determine presence and monitor key areas Monitor and measure the success of the management measures and adapt where actions are ineffective.	<ul style="list-style-type: none"> Surveys and monitoring involve the use of motion sensitive cameras, set up in suitable habitat areas (<i>Spinifex</i> grasslands) Conduct transect searches looking for evidence of Spectacled Hare-wallaby presence (tracks, scats, diggings) DEC specialists should be consulted to identify/confirm appropriate timing of surveys. Fauna sightings, road strikes and encounters reported, investigated and where necessary mitigation measures implemented. All Spectacled Hare-wallaby sightings will be mapped and reported to DEC. Where management measures are deemed ineffective, amend management strategies based on ongoing survey outcomes and/or faunal impacts documented. 	<p>Presence within impact area.</p> <p>Ongoing survey outcomes.</p> <p>Faunal sightings, strikes and/or encounters documented.</p>	On-site Environmental staff and Specialists
Fork-tailed Swift (<i>Apus pacificus</i>)	Determine presence and monitor key areas	<ul style="list-style-type: none"> Conduct and initial survey to obtain baseline data (population and distribution). DEC specialists should be consulted to identify/confirm appropriate timing of surveys. Fauna sightings, road strikes and encounters reported, investigated and where necessary mitigation measures implemented. All Fork-tailed Swift sightings will be mapped and reported to DEC. If required, management strategies amended based on survey outcomes 	<p>Presence within impact area</p> <p>Ongoing survey outcomes</p>	On-site Environmental staff and Specialists

Species	Objectives	Monitoring Procedures	Triggers for Review	Responsible Personnel
Long-tailed Dunnart (<i>Sminthopsis longicaudata</i>)	Determine presence and monitor key areas Monitor and measure the success of the management measures and adapt where actions are ineffective.	<ul style="list-style-type: none"> Surveys and monitoring involve the use of pit traps, Elliot traps and motion sensitive cameras Conduct transect searches looking for evidence of Long-tailed Dunnart presence (tracks, scats, diggings) DEC specialists should be consulted to identify/confirm appropriate timing of surveys. Fauna sightings, road strikes and encounters reported, investigated and where necessary mitigation measures implemented. All Long-tailed Dunnart sightings will be mapped and reported to DEC. Where management measures are deemed ineffective, amend management strategies based on ongoing survey outcomes and/or faunal impacts documented. 	<p>Presence within impact area.</p> <p>Ongoing survey outcomes.</p> <p>Faunal sightings, strikes and/or encounters documented.</p>	On-site Environmental staff and Specialists
Lakeland Downs Mouse (<i>Leggadina lakedownensis</i>)	Determine presence and monitor key areas Monitor and measure the success of the management measures and adapt where actions are ineffective.	<ul style="list-style-type: none"> Surveys and monitoring involve the use of pit traps, Elliot traps and motion sensitive cameras Conduct transect searches looking for evidence of Lakeland Downs Mouse presence (tracks, scats, diggings) DEC specialists should be consulted to identify/confirm appropriate timing of surveys. Fauna sightings, road strikes and encounters reported, investigated and where necessary mitigation measures implemented. All Lakeland Downs Mouse sightings will be mapped and reported to DEC. Where management measures are deemed ineffective, amend management strategies based on ongoing survey outcomes and/or faunal impacts documented. 	<p>Presence within impact area.</p> <p>Ongoing survey outcomes.</p> <p>Faunal sightings, strikes and/or encounters documented.</p>	On-site Environmental staff and Specialists
Ngadji (<i>Notoscincus butleri</i>)	Determine presence and monitor key areas Monitor and measure the success of the management measures and adapt where actions are ineffective.	<ul style="list-style-type: none"> Surveys and monitoring to be based on hand searches, raking, spotlighting and pit trapping, during the Wet season. DEC specialists should be consulted to identify/confirm appropriate timing of surveys. Fauna sightings, road strikes and encounters reported, investigated and where necessary mitigation measures implemented. All Ngadji sightings will be mapped and reported to DEC. Where management measures are deemed ineffective, amend management strategies based on ongoing survey outcomes and/or faunal impacts documented. 	<p>Presence within impact area.</p> <p>Ongoing survey outcomes.</p> <p>Faunal sightings, strikes and/or encounters documented.</p>	On-site Environmental staff and Specialists

Species	Objectives	Monitoring Procedures	Triggers for Review	Responsible Personnel
White-bellied Sea-Eagle (<i>Haliaeetus leucogaster</i>)	Determine presence and monitor key areas	<ul style="list-style-type: none"> Conduct and initial survey to obtain baseline data (population and distribution). DEC specialists should be consulted to identify/confirm appropriate timing of surveys. Fauna sightings, road strikes and encounters reported, investigated and where necessary mitigation measures implemented. All White-bellied Sea Eagle sightings will be mapped and reported to DEC. If required, management strategies amended based on survey outcomes 	Presence within impact area Ongoing survey outcomes	On-site Environmental staff and Specialists
Great Egret (<i>Ardea alba</i>)	Determine presence and monitor key areas	<ul style="list-style-type: none"> Conduct and initial survey to obtain baseline data (population and distribution). DEC specialists should be consulted to identify/confirm appropriate timing of surveys. Fauna sightings, road strikes and encounters reported, investigated and where necessary mitigation measures implemented. All Great Egret sightings will be mapped and reported to DEC. If required, management strategies amended based on survey outcomes 	Presence within impact area Ongoing survey outcomes	On-site Environmental staff and Specialists
Cattle Egret (<i>Ardea ibis</i>)	Determine presence and monitor key areas	<ul style="list-style-type: none"> Conduct and initial survey to obtain baseline data (population and distribution). DEC specialists should be consulted to identify/confirm appropriate timing of surveys. Fauna sightings, road strikes and encounters reported, investigated and where necessary mitigation measures implemented. All Cattle Egret sightings will be mapped and reported to DEC. If required, management strategies amended based on survey outcomes 	Presence within impact area Ongoing survey outcomes	On-site Environmental staff and Specialists
Oriental Plover (<i>Charadrius veredus</i>)	Determine presence and monitor key areas	<ul style="list-style-type: none"> Conduct and initial survey to obtain baseline data (population and distribution). DEC specialists should be consulted to identify/confirm appropriate timing of surveys. Fauna sightings, road strikes and encounters reported, investigated and where necessary mitigation measures implemented. All Oriental Plover sightings will be mapped and reported to DEC. If required, management strategies amended based on survey outcomes 	Presence within impact area Ongoing survey outcomes	On-site Environmental staff and Specialists

Species	Objectives	Monitoring Procedures	Triggers for Review	Responsible Personnel
Feral fauna	Determine feral fauna abundance	Targeted surveys can be used to provide measures of abundance and indices that can be monitored: <ul style="list-style-type: none"> • Motion-sensitive cameras set on bait stations (Fox, Cat, Dingo); • Track counts (number of sets of footprints per kilometre of sandy track – Fox, Cat, Dingo, Cattle, Donkey, Camel, Rabbit) • Opportunistic counts when working in area and provided by FMG staff. 	Change in feral fauna abundance	On-site Environmental Staff
All EPBC threatened species	Determine usage and success of culverts and adapt where actions are ineffective.	Monitor culvert usage by fauna using motion-sensitive cameras and sand pads (for tracks). Carry out monitoring on a seasonal basis (one week per three months) for first two years following culvert installation.	Mortality or injury in proximity to culverts. Ongoing survey outcomes.	Fortescue Environmental staff and Specialists
All conservation significant fauna	Determine establishment in rehabilitation areas	Surveys to be carried out targeting species for which rehabilitation areas are likely to provide habitat. Thus, rehabilitation areas need to be assessed for suitability before any surveys take place. Juxtaposition of nearby suitable habitat for significant species also a consideration	No establishment of faunal assemblage	Specialists

7.0 Corrective Actions

This Significant Fauna Species Management Plan will be modified if the presence of any conservation significant species and associated habitat is detected in pre-clearing surveys or in the event of two or more survey events revealing significant decline in abundance of any significant fauna species or significant increase in feral abundance from the monitoring programs. The modified plan will include appropriate actions for the relevant significant fauna, including trigger levels, management and mitigation responses. The plan will also incorporate results of the relevant surveys.

Expert opinion will be sought if and when required, to guide contingency measures which will include further survey work to better understand influences causing those changes in the environment. By understanding why certain management strategies or monitoring does not work, specialist advice can be used to modify these and develop new mitigation strategies. Expert advice will be needed to determine when a decline in species abundance is caused by impacts from mine activity or due to climatic influences beyond human control. Input from DEC is required to assist in determining regional population declines and trends.

Monitoring programs will be consistent in approach and effort to maintain scientific rigour under analysis of results. Record keeping will be maintained to enable immediate identification of trigger points of species decline for contingency measures to be effective. Should incidental mortalities of Schedule 1 and Schedule 2 fauna occur, the incident will be reported to DEC within 21 days of the incident occurring.

Any incidents arising from unauthorised activities relating to fauna, or with the potential to impact on fauna, shall be considered an incident and reported and investigated. Causes of incidents will be determined and management procedures will be modified, and measures taken (as required) to prevent re-occurrence of incidents

Appendix Two: Conservation Significant Fauna Species

'Significant fauna and threatened fauna' are defined as those that are listed as critically endangered, endangered, vulnerable or migratory under the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* (**Table 7**) or as a Schedule species in the *Wildlife Conservation Act 1950* (**Table 8**). Priority-listed fauna are as listed in the DEC Threatened and Priority Fauna database (**Table 9**).

Table 7: Categories of rare and endangered fauna recognised under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Categories	Description
Critically Endangered	If a species is facing an extremely high risk of extinction in the wild in the immediate future
Endangered	If a species is not critically endangered and if facing a very high risk of extinction in the wild in the near future
Vulnerable	If a species is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future
Migratory	Those animals that migrate to Australia and its external territories, or pass through Australian water during their annual migration

Table 8: Categories of species of national conservation significance listed under the *WA Wildlife and Conservation Act 1950*.

Categories	Description
Schedule 1	Fauna which are rare or likely to become extinct and are declared to be fauna in need of special protection
Schedule 2	Fauna which are presumed to be extinct and are declared to be fauna in need of special protection
Schedule 3	Birds which are subject to an agreement between governments of Australia and Japan relating to the protection of migratory birds and birds in danger of extinction which are declared to be fauna in need of special protection
Schedule 4	Fauna that are in need of special protection, for reasons other than those mentioned in Schedule 1, 2 or 3

Table 9: Categories of species at risk, but not rare or endangered, in the DEC priority and listed fauna database.

Categories	Description
Priority One	Taxa with few, poorly known populations on threatened lands. Taxa which are known from few specimens or sight records from one of a few localities on lands not managed for conservation. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration a threatened species.
Priority Two	Taxa with few, poorly known populations on conservation lands, or taxa with several, poorly known populations not on conservation lands. 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. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.
Priority Three	Taxa with several, poorly known populations, some on conservation lands. 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.

Categories	Description
Priority Four	Taxa in need of monitoring. 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. Taxa which are declining significantly but are not yet threatened.
Priority Five	Taxa in need of monitoring. 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.

Conservation significant species recorded on the Flinders tenement are:

8. Northern Quoll (*Dasyurus hallucatus*)
9. Pilbara Leaf-nosed Bat (*Rhinoicteris aurantius*)
10. Pilbara Olive Python (*Liasis olivaceus barroni*)
11. Western Pebble-Mound Mouse (*Pseudomys chapmani*)
12. Ghost Bat (*Macroderma gigas*)
13. Rainbow Bee-eater (*Merops ornatus*)
14. Blind Snake (*Ramphotyphlops ganei*)

Details regarding the current conservation status, ecology, distribution and habitat of each of these species, as well as the threatening processes affecting each and previous surveys on each are provided below.

Northern Quoll (*Dasyurus hallucatus*)

DESCRIPTION

The Northern Quoll is listed as Schedule 1 (rare or likely to become extinct) under the WA Wildlife Conservation Act and Endangered under the EPBC Act.



Figure 2: Northern Quoll (Source: Hill & Ward 2010)

Classification	Family Dasyuridae <i>Dasyurus hallucatus</i>
Head and Body Length	123 – 310 mm (males), 125 – 300 mm (females)
Tail Length	127 – 308 mm (males), 200 – 300 mm (females)
Weight	400 – 900 g (males), 300 – 500 g (females)

Identification	Smallest member of the genus Grey-brown / brown above with large white spots, cream / white below Unspotted tail Striated pads on five-toed hindfoot
Other names	Little Northern Native Cat, Satanelus, North Australian Native Cat, Njanmak (Mayali)

Source: (Strahan 1995)

DISTRIBUTION AND HABITAT

How et al. (1991) found this species at numerous locations on the Abydos Plains about 130km to the north-east. Coffey Environments' recent surveys along the rail line corridor from Cloud Break to Port Hedland found additional evidence of Northern Quoll in the vicinity of rocky outcrops, escarpments and vegetated plains. Fresh scats and tracks and possible den sites were seen along the base of gorges and under rock overhangs. The Northern Quoll was not recorded by Biota (2005) at the Brockman Syncline 4 Project area but a skull was found in a cave at Mesa A Project area. It was not recorded at Marandoo by Ninox Wildlife Consulting (1992).

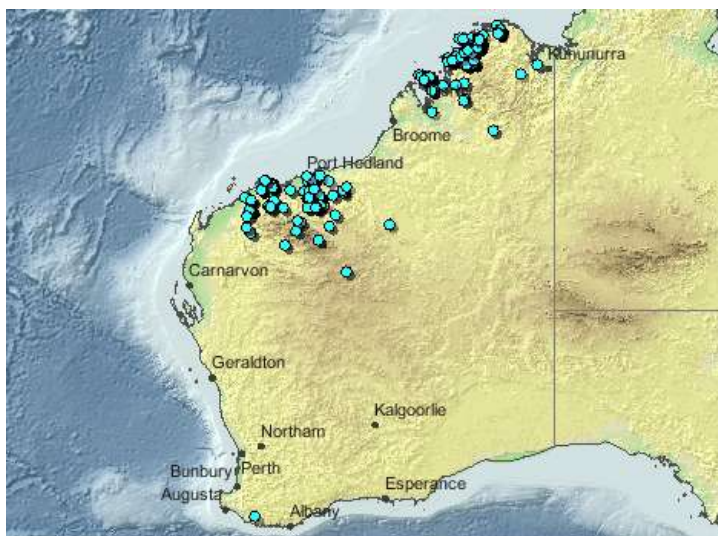


Figure 3: Distribution of Northern Quoll (*Dasyurus hallucatus*) (Source: NatureMap)

ECOLOGY

The Northern Quoll is a medium-sized carnivorous marsupial, occurring in a variety of habitats across its range. Rocky areas provide prime habitat as they offer shelter and protection from predators and weather (Hill & Ward 2010).

Northern Quoll are opportunistic foragers, feeding on a wide range of items, switching dietary resources according to season and availability (Hill and Ward 2010).

In Northern Quoll, mating occurs in late June and a single litter of one to eight young are born in July or August (Strahan 1995; (Schmitt *et al.* 1989). By September females are either carrying pouch young or lactating, with lactation ceasing in April (Schmitt *et al.* 1989).

THREATENING PROCESSES

Assessing the potential risk associated with the proposed mining activity on the Northern Quoll is difficult in the absence of any published data on the spatial ecology of this species in the Pilbara. However, it might be anticipated that vegetation clearing in the valleys and scree slopes could result in numerous individuals being displaced.

The identification of Northern Quoll scats from the study area is significant due to the Conservation status of the species and the unknown potential impacts that the introduced Cane Toad may have on the population.

PREVIOUS SURVEYS

Northern Quoll records for the study area are from fresh scats collected by Ecoscape from caves and overhangs along the creek walls, there were no recorded captures from the trapping sites. Coffey Environments however, reported an observation and three records from the Solomon Project area. Ecologia also recorded an observation for the Kings Project area.

Pilbara Olive Python (*Liasis olivaceus barroni*)

DESCRIPTION

The Pilbara Olive Python is listed as Schedule 1 (rare or likely to become extinct) under the WA Wildlife Conservation Act and Endangered under the EPBC Act.



Figure 4: Pilbara Olive Python (Source: Ecoscape Blacksmith Vertebrate Fauna and Short Range Endemic Survey 2010)

Classification	Family Pythonidae <i>Liasis olivaceus barroni</i>
Midbody scale rows	58 – 63
Average Length	2.5 m
Identification	Dull olive-brown / pale fawn or rich brown colour with white / cream belly Fewer midbody scale rows than Olive Python (<i>Liasis olivaceus</i>) Females slightly longer than males

Source: (Cogger 2000); (Shine and Slip 1990); (Wilson and Swan 2008)

DISTRIBUTION AND HABITAT

The species is restricted to ranges within the Pilbara region, north-western Western Australia, such as the Hamersley Range, and islands of the Dampier Archipelago. It is known to occur at 17 locations within the Pilbara (Pearson 1993). Four populations occur at Pannawonica, Millstream, Tom Price and Burrup Peninsula (Pearson 2003). Kendrick (2001) reported this species as common and widespread in the Pilbara and one that should not be listed as threatened or declining. The species is considered stable and in sizable numbers at some known sites (Pearson 2003).

They are most often seen at night and are generally found around rocky areas, rocky outcrops and cliffs, particularly in the vicinity of watercourses and water holes, but they also shelter in logs, flood

debris, caves, tree hollows and thick vegetation. Habitat for this species is present within the Firetail study area.

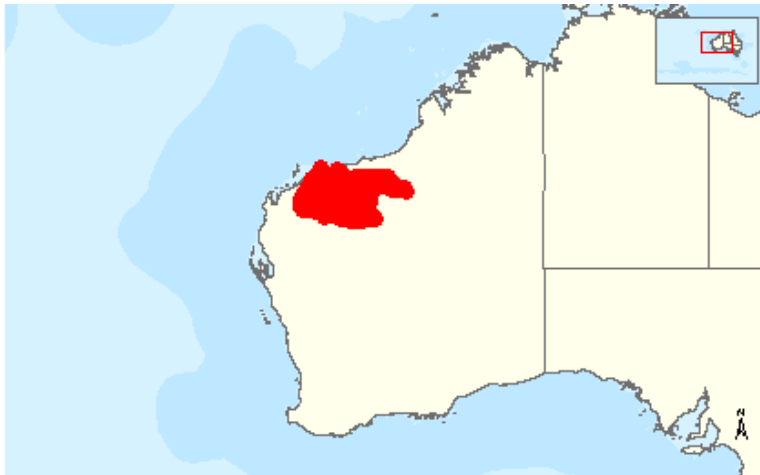


Figure 5: Distribution of Pilbara Olive Python (*Liasis olivaceus barroni*) (Source: EPBC)

ECOLOGY

The Olive Python (Pilbara subspecies) is a dull olive-brown to pale fawn or rich brown python with a white/cream belly. The Pilbara Olive Python can grow to 4 m, but has an average size of 2.5 m (Cogger 2000). Females are slightly longer than males (Shine and Slip 1990).

THREATENING PROCESSES

Mining activity has the potential to impact on this species by loss of habitat through clearing.

PREVIOUS SURVEYS

Ecoscape recorded one individual at Ajax Creek. This species is likely to occur in other similar sites within the study area.

Blind Snake (*Ramphotyphlops ganeii*)

DESCRIPTION

This Blind Snake is listed as Priority 1 (taxa with few, poorly known populations on threatened lands) by the DEC in the Threatened and Priority Fauna database.



Figure 6: *Ramphotyphlops ganeii* (Source: Ecoscape Blacksmith Vertebrate Fauna and Short Range Endemic Survey 2010).

Classification	Family Typhlopidae <i>Ramphotyphlops ganeii</i>
Midbody scale rows	24
Average Length	335 mm
Identification	Snout rounded from above and in profile Greyish-brown above and cream below with ragged junction between dark lateral and pale ventral colours

DISTRIBUTION AND HABITAT

This species is known from widely separated populations between Newman and Pannawonika in Western Australia (Wilson & Swan 2008).

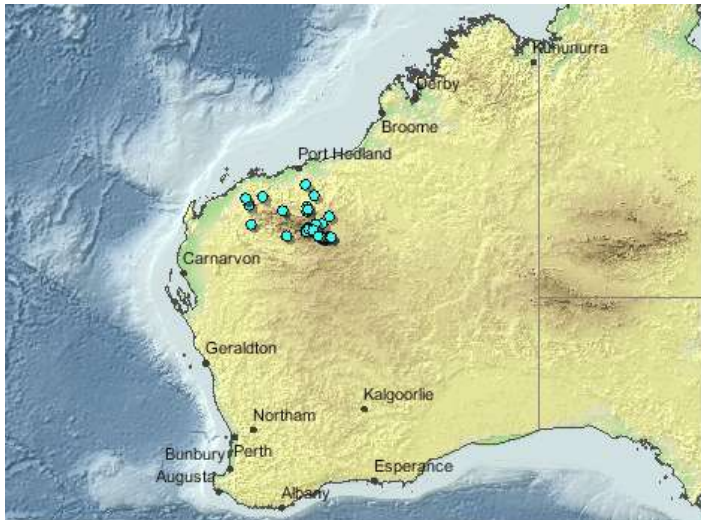


Figure 7: Distribution of Blind Snake (*Ramphotyphlops ganei*) (Source: NatureMap)

ECOLOGY

Little information is available on this species but it is believed to be associated with moist gorges and gullies (Wilson & Swan 2008).

THREATENING PROCESSES

Mining activity may have the potential to impact on this species by loss of habitat through clearing.

PREVIOUS SURVEYS

A single specimen of *Ramphotyphlops ganei* was recorded at the Flinders Blacksmith camp site by (Ecoscape 2010).

Rainbow Bee-eater (*Merops ornatus*)

DESCRIPTION

The Rainbow Bee-eater is listed as Migratory under the EPBC Act.

Classification	<i>Merops ornatus</i>
Total Length	22 – 25 cm (including streamers)
Voice	Melodious trilling in flight
Identification	Black bill, red eye, black eye stripe, black band on yellow throat Back light green, rump light blue Black tail, extended thin central feathers

Source: (Simpson and Day 2004)

DISTRIBUTION AND HABITAT

Rainbow Bee-eaters are found in most habitats throughout the Pilbara during the summer breeding season. They are scarce to common throughout much of Western Australia except for the arid interior, preferring lightly wooded, sandy country near water.

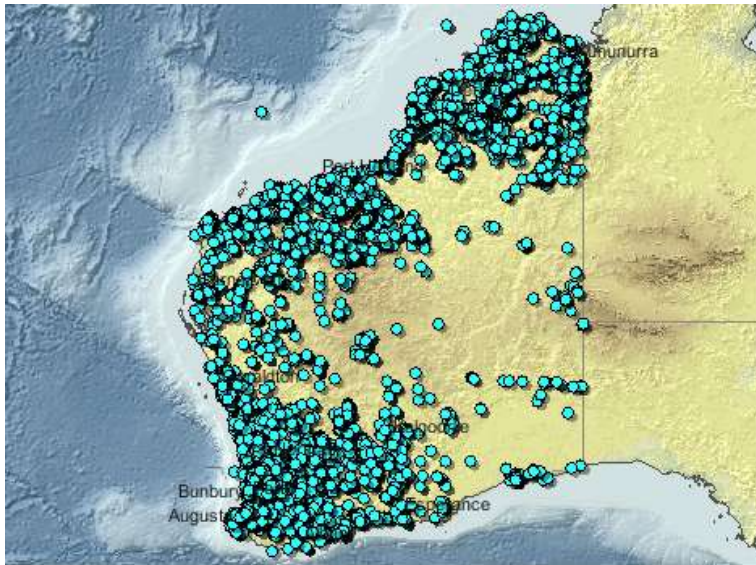


Figure 8: Distribution of Rainbow Bee-eater (*Merops ornatus*) (Source: NatureMap)

ECOLOGY

This species migrates between Australia and Indonesia, moving south over summer and breeding in Australia. It nests in burrows dug usually at a slight angle on flat ground, sandy banks or cuttings, and often at the margins of roads or tracks.

THREATENING PROCESSES

The Rainbow Bee-eater is abundant in many areas of Australia therefore Ecoscape considers it unlikely that the construction or operation of the proposed infrastructure and numerous mine sites will significantly impact on this species.

PREVIOUS SURVEYS

This species was identified frequently and seen throughout the study area.

Pilbara Leaf-nosed Bat (*Rhinonictoris aurantius*)

DESCRIPTION

The Pilbara Leaf-nosed Bat is listed as Schedule 1 (rare or likely to become extinct) under the WA Wildlife Conservation Act and Vulnerable under the EPBC Act.



Source: (Australian Museum 2010)

Classification	Family Hipposideridae <i>Rhinonictoris aurantius</i>
Head and Body Length	45 – 53 mm
Tail Length	24 – 28 mm
Forearm Length	47 – 50 mm
Weight	8 – 10 g
Identification	Orange fur, occasionally with brown-tipped hairs Noseleaf complex; lower part broad with central gap at front; upper part scalloped Deep nasal pits Ears small and acutely pointed
Other names	Orange Leaf-nosed Bat Golden Horseshoe Bat

Source: (Strahan 1995)

DISTRIBUTION AND HABITAT

The Pilbara Leaf-nosed Bat occurs in the Kimberley region of Western Australia and in northern parts of the Northern Territory (Strahan 1995).

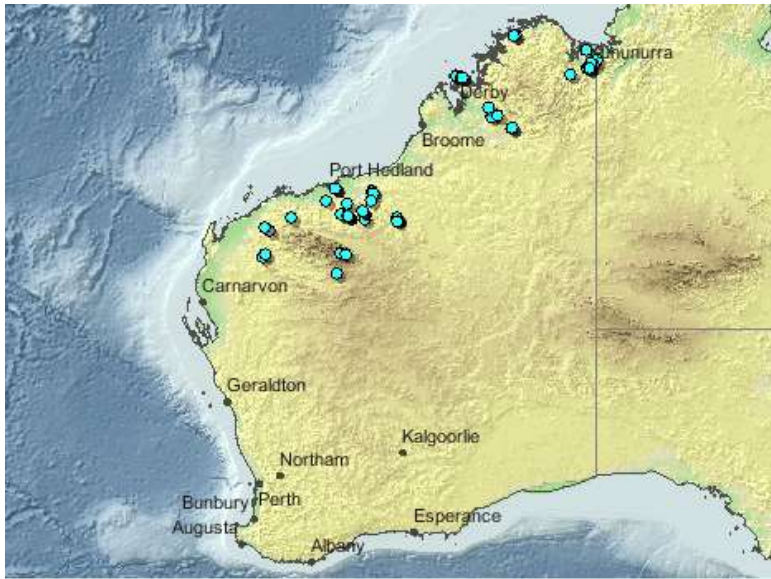


Figure 9: Distribution of Pilbara Leaf-nosed Bat (*Rhinonictis aurantius*)

ECOLOGY

Due to the inability of the Pilbara Leaf-nosed Bat to maintain a high body temperature, it usually chooses to roost in sites that are very warm and humid, such as deep caves. This species emerges at dusk to feed, mostly on moths but also on other insects, such as beetles, parasitic wasps and ants (Strahan 1995).

THREATENING PROCESSES

This species is very sensitive to even slight human disturbances. If subject to continual human interference it may completely abandon a roost (Strahan 1995).

Ghost Bat (*Macroderma gigas*)

DESCRIPTION

The Ghost Bat is listed as Priority 4 (taxa in need of monitoring) by the DEC in the Threatened and Priority Fauna database.



Source: (Australian Museum 2009)

Classification	Family Megadermatidae <i>Macroderma gigas</i>
Head and Body Length	100 – 130 mm
Forearm Length	102 – 112 mm
Weight	140 – 165 g
Identification	Light to dark grey above, paler below Long ears joined together, large eyes, simple noseleaf, no tail
Other Names	False Vampire

Source: (Strahan 1995)

DISTRIBUTION AND HABITAT

The Ghost Bat is found predominantly in coastal areas and up to 400 km inland, throughout northern Australia, generally north of the Tropic of Capricorn. The Ghost Bat is also found in the Pilbara in Western Australia (Richards and Hand 1995), however, their range appears to have contracted northwards in relatively recent times, especially in Central Australia (Churchill and Helman 1990).

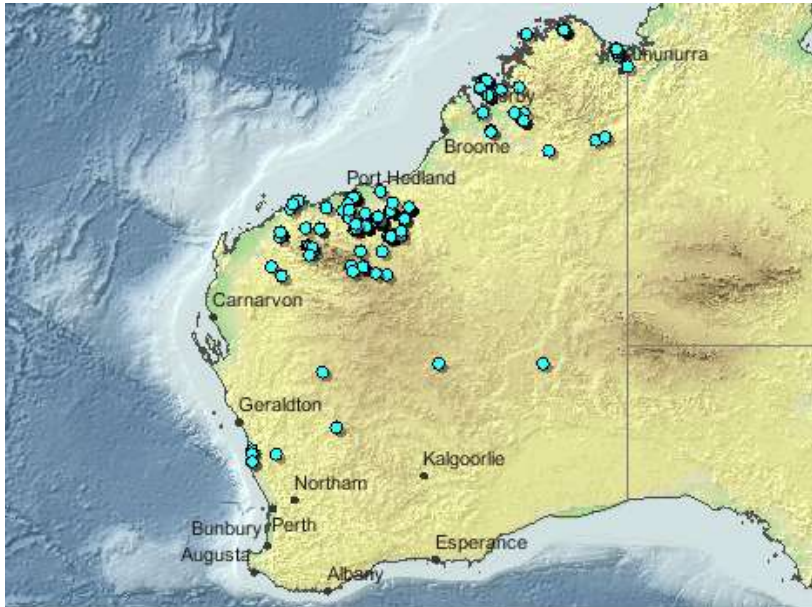


Figure 10: Distribution of Ghost Bat (*Macroderma gigas*)

ECOLOGY

This is Australia's only carnivorous bat, eating large insects, frogs, lizards, small birds and mammals. Tideman et al. (1985) reported Ghost Bats in the Northern Territory foraged, on average, 1.9km from their day roost, with a mean size of foraging area of 61ha. Their hunting behaviour utilised vantage points to detect prey with their eyes and ears, rather than using echolocation. These vantage points were changed about every 15 minutes during foraging periods, with a mean distance of 360m between them. The Ghost Bat is an obligate troglodyte, and its survival is critically dependent on finding natural roosts in caves, crevices, deep overhangs and artificial roosts such as abandoned mines (adits).

THREATENING PROCESSES

Known threats to the Ghost Bat are disturbance to roost sites from mining operations, collapse of old mine adits, barbed wire fences and human disturbance. Also suspected as threats are reduction in prey populations related to predation from cats and foxes, and changed fire regimes. The impact of the proposed mine is likely to be minimal providing activities are focussed on the valley floors and the mine is managed to prevent an increase in introduced predators.

PREVIOUS SURVEYS

A single dried corpse of a Ghost Bat was recorded during the survey in a cave just outside of the Study Area. Ghost Bats have been recorded in the Karijini National Park gorges and mine adits by Ninox Wildlife Consulting (1992) at Marandoo and by Biota (2005) during its Mesa A and G survey, but not at Brockman Syncline 4. It therefore appears that they are relatively common and widespread in the Pilbara as they are in the Kimberley. Given their preference for roosting in caves and the abundance of suitable caves and rock overhangs in the gorges, it is probable that the study area could support a population of Ghost Bats.

Western Pebble-Mound Mouse (*Pseudomys chapmani*)

DESCRIPTION

The Western Pebble-Mound Mouse is listed as Priority 4 (taxa in need of monitoring) by the DEC in the Threatened and Priority Fauna database.

Classification	Family Muridae <i>Pseudomys chapmani</i>
Head and Body Length	52 – 67 mm
Tail Length	73 – 79 mm
Weight	10 – 15 g
Identification	Head, back and sides buff brown, with white below Similar to <i>Pseudomys hermannsburgensis</i> but shorter tail, ears and feet

Source: (Strahan 1995)

DISTRIBUTION AND HABITAT

Western Pebble-mound Mice are common in many parts of the Pilbara. The species is restricted to the non-coastal, central and eastern parts of the Pilbara, Western Australia, although it was formerly more widespread (IUCN 2007). The preferred habitat is gentle slopes of rocky ranges sparsely vegetated by *Triodia* grasses, *Senna*, *Acacia* and *Ptilotus* species.

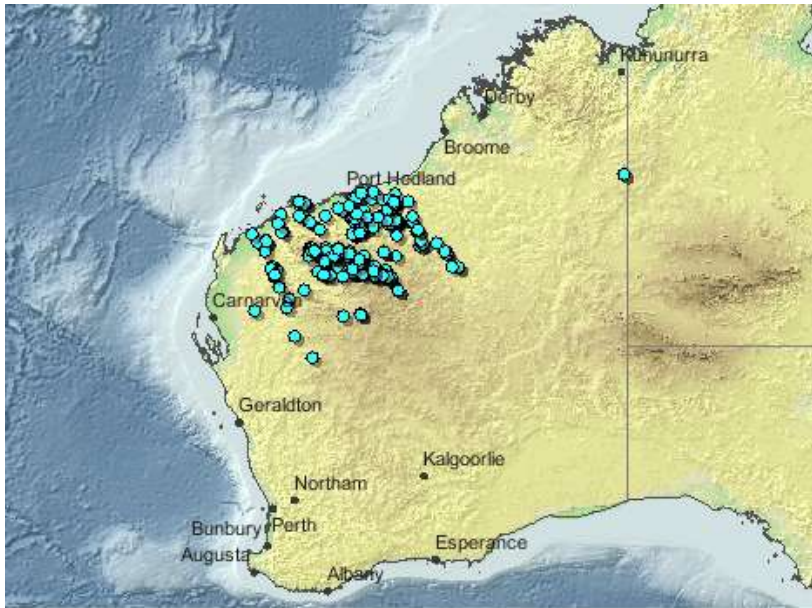


Figure 11: Distribution of Western Pebble-Mound Mouse (*Pseudomys chapmani*)

ECOLOGY

This species has recently been shown to have a reduced distribution, most likely due to fox and feral cat predation. Abandoned mounds found in Gascoyne and Murchison indicate a recent decline in distribution. The species does however appear secure in its remaining range (Start 2008). This species occurs across the central and southern Pilbara and into smaller ranges of the Little Sandy Desert.

THREATENING PROCESSES

The impacts from mining are considered not significant for the persistence of populations in the Pilbara due to the known spatial distribution across the region. Avoidance of lower and mid-slope regions will reduce potential impact to this species at a local scale.

PREVIOUS SURVEYS

The species is considered to occur in the study area as active and inactive mounds were observed during the surveys. Numerous mounds were recorded in Delta and Champion Valleys on the mid-slopes.

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