Plan

Conservation Significant Fauna Management Plan

Environment

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100-PL-EN-0022

Fortescue
The New Force in Iron Ore

	Conservation Significant Fauna Management Plan 100-PL-EN-0022		
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1. INTRODUCTION

Fortescue Metals Group (Fortescue) is an integrated business comprised of mine, rail and port operations based in the Pilbara region of Western Australia, with its head office located in Perth.

Detailed background information regarding the timing and nature of Fortescue's environmental approvals under the *Environmental Protection Act 1986* (WA), the *Environment Protection and Biodiversity Conservation Act 1999* (Cth), current operations and plans for future expansion is contained in Appendix 1.

1.1 Requirement for Management Plan

The Conservation Significant Fauna Management Plan (this Plan) is required by the Minister as part of development approval for Fortescues Iron Ore related infrastructure in the Pilbara under Ministerial Statements 690, 707, 862, 899 and EPBC Approval 2005/2205, 2010/5706, 2010/5567 and 2010/5513.

Existing projects and future developments will be required to prepare and implement site-specific Conservation Significant Fauna Management Programs to give effect to this Plan.

The data flow diagram for this Plan is available in Appendix 2.

1.2 Objective and Scope

The objective of this Plan is to identify the potential direct and indirect impacts on conservation significant fauna species and develop management and monitoring measures that maximize the ongoing protection and long term conservation of these species within and adjacent to Fortescue controlled sites[1].

The plan addresses management issues relevant to conservation significant fauna within Fortescue controlled sites.

This management plan will replace the following Environmental Management Plans:

- Additional Rail Infrastructure Project: EPBC Fauna Management Plan (R-PL-EN-0019)
- Bilby (Macrotis lagotis) Management Plan (45-PL-EN-0008)
- Chichester Operations Fauna Management Plan (45-PL-EN-0007)
- Cloudbreak Mine Site and Access Road: Fauna Management Plan (CB-PL-EN-0010)

[1] Fortescue controlled site means sites that are under the legislative control of Fortescue including exploration sites, sites under construction, operational sites (sites that are managed and operated by Fortescue and sites that are managed by Fortescue but operated by contractors) and the Perth offices.

- Christmas Creek Water Management Scheme Fauna Management Plan (CC-PL-EN-0003)
- Night Parrot (Pezoporus occidentalis) Management Plan (CB-PL-EN-0005)
- Night Parrot Survey Plan (CB-PL-EN-0004)
- Railway Corridor Fauna Management Plan (R-PL-EN-0017)
- Solomon Project Fauna Management Plan (45-PL-EN-0027).

The plan was originally developed to meet the requirements of Ministerial Statements 690, 707, 862, 871 and 899 as well as the requirements of EPBC Approval 2005/2205, 2010/5567, 2010/5706 2010/5513 as described in Appendix 3 but is intended to provide guidance on fauna management across all Fortescue Operations.

Invertebrate fauna and subterranean fauna are outside the scope of this Plan. Marine Mammals and Marine Pests are also outside the scope of this Plan as they are addressed in the *Dredging and Reclamation and Monitoring Management Plan* (P-PL-EN-0004) and the *Introduced Marine Pest Management Plan* (P-PL-EN-0017).

1.3 Definition of Conservation Significant Fauna

'Significant fauna' and 'threatened fauna' are defined as those listed as critically endangered, endangered, vulnerable or migratory under the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* or as a Schedule species in accordance with the *Wildlife Conservation Act 1950.* Priority-listed fauna are as listed in the Department of Parks and Wildlife (DPaW) priority and listed fauna as shown on the DPaW website.

Species of national conservation significance listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) are classified as:

- Critically Endangered - If, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future
- Endangered - If, at that time, it is not critically endangered and is facing a very high risk of extinction in the wild in the near future
- Vulnerable - If, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future.

Four classes of rare and endangered fauna are recognised under the *Wildlife Conservation Act 1950*. These are:

- 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 the 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, otherwise than for the reasons mentioned in Schedule 1, 2 or 3.

In addition to the above classification, DPaW also classifies fauna not listed as rare or endangered but considered to be at risk under five different Priority codes:

- 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 as 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.
- 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.

For the purposes of this Plan, conservation significant fauna have been limited to terrestrial vertebrate fauna species that meet the criteria above and have been recorded or are likely to occur within Fortescue controlled sites – see Table 1.

Further details regarding species description, ecological information, distribution and likelihood of occurrence is provided in Appendix 4.

Table 1: Conservation Significant Fauna Species Recorded or Likely to Occur in Fortescue Controlled Sites

Class	Genus	Species	Subspecies	Common Name	EPBC Act 1999	Wildlife Conservation Act 1950	Priority Species	Port	Cloudbreak	Christmas Creek	Solomon	Mainline Corridor (including duplication)	Solomon Rail Corridor
Aves	*Pezoporus*	*occidentalis*		Night Parrot	CR	Sc1			Recorded[3]	Medium[8]		EPBC 2010/5513[2]	Medium[11]
Mammalia	*Dasyurus*	*hallucatus*		Northern Quoll	EN	Sc1			High[2,4,13]	Medium[8]	Recorded[9,10]	Recorded[1]	High[11]
Mammalia	*Rhinonicteris*	*aurantia*		Pilbara Leaf-nosed Bat	VU	Sc1			Recorded[13]	Medium[8]	Medium[10]	High[12]	High[11]
Mammalia	*Dasycercus*	*cristicauda*		Crest-tailed Mulgara[3]	VU	Sc1		High[6]	Medium[4]	Medium[8]		Recorded[1,12]	Recorded[11]
Mammalia	*Dasycercus*	*blythi*		Brush-tailed Mulgara[2]			P4	High[6]	Medium[4,13]	Medium[8]		Recorded[1,12]	Recorded[11]
Mammalia	*Macrotis*	*lagotis*		Greater Bilby	VU	Sc1			Medium[3]	Medium[8]		Recorded[5, 12]	
Reptilia	*Liasis*	*olivaceus*	barroni	Pilbara Olive Python	VU	Sc1			Medium[13]	Recorded[15]	Recorded[9,10]	High[12]	High[11]
Aves	*Falco*	*hypoleucos*		Grey Falcon		Sc1			Recorded[3,7,]	High[7,8]	Medium[9]		Medium[11]
Aves	*Apus*	*pacificus*		Fork-tailed Swift	M	Sc3			Medium[2,13]	Medium[8]	Recorded[9]		
Aves	*Merops*	*ornatus*		Rainbow Bee-eater	M	Sc3			Recorded[3,13]	Recorded[8,1]	Recorded[9,10]	Recorded[1,16]	Recorded[11]
Aves	*Haliaeetus*	*leucogaster*		White-bellied Sea Eagle	M	Sc3			Recorded[7]	High[8]			
Aves	*Ardea*	*alba*		Great egret	M					Recorded[1]			Medium[11]
Aves	*Ardea*	*Ibis*		Cattle egret	M								Medium[11]
Aves	*Ardea*	*modesta*		Eastern Great Egret	M	Sc3			Recorded[14]	Recorded[14]	Medium[9]		
Aves	*Tringa*	*Glareola*		Wood Sandpiper	M	Sc3			Medium[13]	Recorded[7]			
Aves	*Tringa*	*nebularia*		Common Greenshank	M	Sc3			Medium[13]	Recorded[7]			
Aves	*Calidris*	*ruficollis*		Red-necked Stint	M	Sc3			High[13]	High[7]			
Aves	*Falco*	*peregrinus*		Peregrine Falcon		Sc4			Recorded[3,13]	Recorded[8]	Medium[9]	Recorded[1]	High[11]
Reptilia	*Ctenotus*	*nigrilineatus*					P1						Medium[11]
Reptilia	*Ramphotyphlops*	*ganei*					P1		High[13]	High[8]	Recorded[9]		Medium[11]
Aves	*Burhinus*	*grallarius*		Bush Stone-curlew			P4		Recorded[13]	Recorded[8]	High[9,10]	Recorded[1,16]	High[11]
Aves	*Ardeotis*	*australis*		Australian Bustard			P4		Recorded[2,3,13]	Recorded[8,1]	Recorded[9]	Recorded[1, 12, 16]	Recorded[11]
Aves	*Neochmia*	*ruficauda*	subclarescens	Star Finch (western)			P4		Recorded[3]	Recorded[14]	Medium[9]	Recorded[16]	Medium[11]
Mammalia	*Macroderma*	*gigas*		Ghost Bat			P4		Recorded[13]	Medium[8]	Recorded[9,10]		High[11]
Mammalia	*Sminthopsis*	*longicaudata*		Long-tailed Dunnart			P4		Medium[13]	Medium[8]	High[9]		Medium[11]
Mammalia	*Leggadina*	*lakedownensis*		Lakeland Downs Mouse/ Northern Short-tailed Mouse			P4		High[2,13]	Recorded[2,8]		Recorded[1]	High[11]
Mammalia	*Pseudomys*	*chapmani*		Western Pebble-mound Mouse			P4		Recorded[2,3]	High[8]	Recorded[9,10]	Recorded[12]	Recorded[11]
Reptilia	*Notoscincus*	*butleri*		Butler's Skink			P4						Medium[11]
Teleostomi	*Leioptheapon*	*aheneus*		Fortescue Grunter			P4						Medium[11]

Sc1 = Schedule 1, Sc 3 = Schedule 3, Sc4 = Schedule 4,
CR = Critically endangered, EN = Endangered, V = Vulnerable, M = Migratory,
P = Priority species; P1 =Priority 1, P2 = Priority 2, P3 = Priority 3, P4 = Priority
Recorded = species recorded within the survey area, High= species recorded within or in proximity to, the survey area within 50 yrs and suitable habitat occurs, Medium= species recorded outside the survey area, but within 100km; limited suitable habitat occurs;
1 Biota 2004; 2 Biota 2005a; 3 Bamford 2005;4 ATA 2006; 5 ATA 2007; 6 ENV 2008; 7 Bamford 2010; 8 ecologia 2010a; 9 ecologia 2010b; 10 Ecoscape 2010; 11 Coffey 2010; 12 Metcalf and Bamford 2010; 13 ecologia 2011; 14 Bamford 2012; 15 ENV 2012; 16 Ecologia 2013

[2] This species has not been recorded and is not likely to occur along the mainline corridor but Controlled Action EPBC 2010/5513 requires management and monitoring strategies to be implemented.

[3] Fortescue has adopted the precautionary approach for the two Mulgara species listed as distinction between the two species has not been confirmed. Fortescue will consider both species of Mulgara as the higher conservation significant species, *Dasycercus cristicauda*, until species distinction has been verified.

1.4 Legislation and Regulatory Framework

Fortescue employees and contractors are obliged to comply with all relevant environmental Commonwealth and State legislation. Legislation directly relevant to the management of conservation significant fauna in Western Australia is provided in Table 2.

Table 2: Commonwealth and State Legislation Relating to Conservation Significant Fauna

Legislation	Application
Agriculture and Related Resources Protection Act 1976 (WA)	Provides for the management, control and prevention of certain plants and animals, for the prohibition and regulation of the introduction and spread of certain plants and of the introduction, spread and keeping of certain animals, for the protection of agriculture and related resources generally, and for incidental and other purposes.
Conservation and Land Management Act 1984 (WA)	Provides for the vesting or reservation of land for conservation purposes, and the ability to enter into agreements with private landholders and pastoral lessees. It establishes a number of statutory bodies including the Conservation Commission of Western Australia.
Environmental Protection Act 1986 (WA)	State environmental impact assessment and Ministerial approval process.
Environment Protection and Biodiversity Conservation Act 1999 (Cth)	Assesses the conservation significance of fauna species and forms the framework for significant species protection at the Federal level.
Wildlife Conservation Act 1950 (WA)	State process that assesses the conservation significance of fauna species and forms the framework for significant species protection.

The following standards and guidelines are also of relevance to this Plan:

- EPBC Act referral guidelines for the endangered northern quoll, *Dasyurus hallucatus*. EPBC Act Policy Statement 3.25. Australian Government, Department of Sustainability, Environment, Water, Population and Communities (2011)
- EPBC Act Survey Guidelines for Australia's Threatened Bats, Guidelines for Detecting Bats Listed as Threatened Under the EPBC Act 1999. Australia Government. Department of Water, Heritage and the Arts (2010)
- EPBC Act Survey Guidelines for Australia's Threatened Birds, Guidelines for Detecting Birds as Threatened Under the EPBC Act 1999. Australian Government. Department of Water, Heritage and the Arts (2010)
- EPBC Act Survey Guidelines for Australia's Threatened Frogs, Guidelines for Detecting Frogs Listed as Threatened Under the EPBC Act 1999. Australian Government. Department of Water, Heritage and the Arts (2010)
- EPBC Act Survey Guidelines for Australia's Threatened Fish, Guidelines for Detecting Fish Listed as Threatened Under the EPBC Act 1999. Australian Government, Department of Sustainability, Environment, Water, Population and Communities (2011)
- EPBC Act Survey Guidelines for Australia's Threatened Mammals, Guidelines for Detecting Mammals Listed as Threatened Under the EPBC Act 1999. Australian Government, Department of Sustainability, Environment, Water, Population and Communities (2011)

- EPBC Act Survey Guidelines for Australia's Threatened Reptiles, Guidelines for Detecting Reptiles Listed as Threatened Under the EPBC Act 1999. Australian Government, Department of Sustainability, Environment, Water, Population and Communities (2011)
- Guidance Statement No.56 Terrestrial Fauna Surveys for Environmental Impact Assessments in Western Australia (EPA, 2004)
- Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment. Technical Report of the Environmental Protection Authority and the Department of Environment and Conservation (DEC) Edited by B.M. Hyder, J. Dell and M.A. Cowan. September 2010
- Terrestrial Biological Surveys as an Element of Biodiversity Protection. Position Statement No. 3. EPA 2002.

1.5 Internal Management Plans and Procedures

The following Fortescue documents should be read in conjunction with this Plan:

- Bushfire Management Plan (100-PL-EM-0009)
- Environmental Datasets – Data Governance Guidelines (100-GU-EN-0020)
- Environmental Document Standard Terminology (100-GU-EN-0002)
- Exploration Environmental Management Plan (E-PL-EN-0002)
- Explosives Management Procedure (45-PR-SA-0028)
- Fauna Handling, Relocation and Rehabilitation Procedure (100-PR-EN-0026)
- Fortescue Marshes Management Plan (45-PL-EN-0009)
- Ground Disturbance Permit Procedure (100-PR-EN-0004)
- Groundwater Management Plan (45-PL-EN-0029)
- Incident Event Management Procedure (100-PR-SA-0011)
- Marking Out Environmentally Sensitive Areas Procedure (E-EN-PP-1102)
- Mine and Rail Dust Management Plan (100-PL-EN-1005)
- Mine and Rail Noise Management Plan (45-PL-EN-0028);
- Port Facility Dust Environmental Management Plan (P-PL-EN-0010)
- Rehabilitation and Revegetation Management Plan (45-PL-EN-0023)
- Standard 4 – Risk Assessment Criteria (100-ST-RK-0014)
- Surface Water Management Plan (45-PL-EN-0024)

- Vegetation Clearing and Topsoil Management Procedure (45-PR-EN-0013)
- Waste Management Plan (45-PL-EN-0014)
- Weed Management Plan (45-PL-EN-0013).

2. ROLES AND RESPONSIBILITIES

All Fortescue employees and contractors are required to comply with the requirements of this Plan.

Accountability for fulfilling the requirements of this Plan is dependent on the stage of project development (construction, operations, decommissioning) and the project type (port, rail or mine).

During exploration, the Group Manager Resource Geology will be accountable for ensuring the requirements of the Plan are met.

During construction stages, whether activities are undertaken by an external service provider or internal Fortescue personnel, the Project Director (Port/ Rail or Mine) will be accountable for ensuring the requirements of this Plan are met.

During operational, decommissioning and closure stages, the General Manager (Port/ Rail or Mine) will be accountable for ensuring the requirements of this Plan are met.

Where responsibilities are delegated, this must be clearly recorded and communicated.

In Section 6 specific Management Actions have been attributed to the appropriate personnel.

When site specific Conservation Significant Fauna Management Programs are developed to support this Plan, the RASCI framework should be utilised to delegate roles, responsibilities, and review and approval levels. RASCI is used to denote:

R-Responsible	Those who do the work to achieve the task.
A-Accountable	Those who are ultimately accountable for the completion of the deliverable or task and the one to whom the Responsible person is accountable.
S-Supportive	Resources allocated to the Responsible person and who will also assist in completing the task.
C-Consulted	Those whose opinions are sought, two-way communication.
I-Informed	Those whom are kept informed, one-way communication.

3. STAKEHOLDER CONSULTATION

Fortescue has undertaken an extensive stakeholder consultation program whereby landowners, regulators and other relevant parties have been consulted with regard to investigation and design of the mine sites and port and rail infrastructure through the environmental approvals process.

The Department of Environment Regulation (DER), the Office of the Environmental Protection Authority (OEPA) and the Department of the Environment (DoE) were consulted and where required approved the content of the original plans for which this Plan will replace.

This Plan was submitted to the OEPA to satisfy the requirements of Condition 10 of MS899 and was approved in November 2013 (CB-EN-0137.01).

The Plan will also be submitted to the OEPA and DoE for their comment and approval in accordance with other applicable Ministerial Statements and Controlled Actions.

4. KEY ENVIRONMENTAL ACTIVITIES

Many of the activities[4] associated with Fortescue's exploration, construction, operation and decommissioning activities have the potential to impact on the environment.

The key activities in Fortescue's Environmental Document Standard Terminology (100-GU-EN-0002) which have the potential to impact on fauna are described in Appendix 5 and include:

- Vegetation clearing
- Ground disturbance
- Construction and establishment of infrastructure and linear infrastructure
- Open pit mining
- Vehicle movement
- Waste disposal
- Groundwater abstraction and distribution
- Decommission/closure
- Rehabilitation.

[4] Fortescue uses the term 'activities' to refer to 'Environmental Aspects' as defined by ISO14001.

5. POTENTIAL ENVIRONMENTAL IMPACTS

The potential direct and indirect impacts associated with Fortescue's exploration, construction, operation and decommissioning activities (see Section 4 of this Plan) which may affect fauna are presented in Table 3 and include:

- Habitat loss and fragmentation
- Altered fire regimes
- Noise, dust, vibrations, light spillage
- Vehicle collisions
- Biosecurity
- Drill holes and sumps
- Altered hydrological cycles
- Putrescible waste.

Table 3: Potential Environmental Impacts Arising from Fortescue's Activities

Potential Environmental Impact	Details
Habitat loss and fragmentation	Individual animals may potentially be harmed during vegetation clearing. Earthworks alter the topography of an area, often removing foraging areas and retreats, and exposing individuals to increased risk of predation. Linear infrastructure has the potential to separate habitat and create isolated vegetation. These can restrict the movement of animals and can often have long term impacts (e.g. restricting access to foraging areas, animals are killed crossing roads, genetic isolation).
Altered fired regimes	A change in fire regimes is often associated with increased human activity, leading to degradation of natural ecosystems. Fire suppression over a long period may alter natural processes that are essential to the long term survival of fauna in local areas. Altering fire regimes (i.e. more or less frequent, higher or lower intensity) changes habitat conditions which can affect the long-term survival of species at a local scale. Conservation significant species that occur within Fortescue controlled sites have been shown to be directly impacted by fire. Southgate and Carthew (2006) indicated that Bilbies occupy habitat in a variety of conditions including recently burnt to long unburnt vegetation, and seed promoted by fires was an important component of their diet. In contrast, it is thought that Northern Quoll will move away from burnt areas to forage elsewhere. Thompson and Thompson (2007) concluded that recent burning of Spinifex is not sufficient to shift Mulgara out of an area, despite their distribution being mainly confined to habitats dominated by mature Spinifex (Gibson and Cole, 1992; Masters, 2003; Masters et. al., 2003).
Noise, dust, vibration, and light spillage	Mine noise, lights and vibrations may force terrestrial fauna away from existing habitats into new areas increasing the risk of predation or causing conflict with existing fauna assemblages. Continuous mining 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 where they come into conflict with human activities. Alternatively light, noise and vibration pollution may force other species to move away from the area. Both of these outcomes alter the local fauna assemblages.
Vehicle Collisions	Vehicles often unavoidably kill terrestrial fauna and birds. There is also an indirect affect, with carrion resulting from collisions with vehicles attracting raptors and goannas to feed on the carcases. Newly constructed roads and tracks inevitably bisect home ranges for individuals, resulting in a higher than normal number of fauna killed on tracks/roads.
Biosecurity	Predation by introduced cats, foxes and wild dogs has been a contributor to the decline in the critical-mass range mammal species in some parts of their geographic distribution and on an array of other terrestrial reptiles and mammals. This impact may be increased by inappropriate fire regimes and vegetation clearing exposing these taxa to high levels of predation. Donkeys, camels, goats and rabbits are also present on some Fortescue tenements. These species damage the vegetation and soils and negatively impact on fauna habitat. Black rats (Rattus rattus) are frequently found around industrial and residential areas and ports. Introduced predators (e.g. cats, foxes, wild dogs) are recorded as being a major threat to the survival of a number of conservation significant species. Often human activity and habitat disturbance contributes to an increase in these feral predator populations through an increase in available food and water. Introduction of weeds into Fortescue controlled sites can also impact on conservation significant fauna habitat resulting in habitat loss or fragmentation and alteration in fire regimes.

Potential Environmental Impact	Details
Drill Holes/ sumps	An ongoing potential risk to conservation significant fauna is the presence of uncapped drill holes within Fortescue controlled sites (Malnic, 1997). Small mammals and reptiles can be caught in pipe and bucket pit-traps; therefore it is probable that they also could be caught in uncapped drill holes.
Altered hydrological cycles	Mine dewatering has the potential to increase the height of saline ground water and/or lower the freshwater water table in areas adjacent to the Fortescue Marsh, which could impact on the vegetation. Death or a reduction in the vegetation around the Marsh could alter habitat for Bilbies and other terrestrial fauna in the area. Hydrological cycles of the Marshes are important for maintaining vegetation type and quality in the Night Parrot's habitat. Dewatering is also likely to impact on Stygofauna and Troglofauna species and associated habitat.
Putrescibles waste	Poorly managed putrescible waste will attract native fauna, but also pests such as feral dogs and cats and rats and mice to human habitation areas. This can result in an increase in vermin and may alter the normal fauna assemblages in the area.

6. ENVIRONMENTAL MANAGEMENT

A series of environmental management objectives have been developed to mitigate environmental impacts on conservation significant fauna that could potentially be caused by Fortescue's activities (exploration, construction, operation and decommissioning). These are:

1. Establish the potential direct and indirect impacts on conservation significant fauna and their habitats within Fortescue controlled sites;
2. Establish management strategies to minimise the potential impacts on conservation significant fauna and their habitats within Fortescue controlled sites;
3. Develop monitoring programs to detect any impacts on conservation significant fauna and their habitats within Fortescue controlled sites;
4. Establish appropriate review mechanisms regarding the strategies employed to minimise impacts on conservation significant fauna.

For each objective, management actions have been developed to ensure the impacts from Fortescue's operations are managed, and that appropriate monitoring, reporting and corrective action functions are implemented to support the successful implementation of the management actions.

The key elements of the environmental management process associated with each objective are described in Table 4.

Table 4: Description of Key Elements of Environmental Management Process to Achieve Identified Objectives

Element	Definition/Description
Objective	What is intended to be achieved.
Management Action	Tasks undertaken to enable the objective to be met.
Performance Indicators	Metrics for evaluating the outcomes achieved by Management Action.
Reporting/Evidence	Demonstrates that the Management Action has been applied and the outcome evaluated.
Timing	Period during which the Management Action should be undertaken.
Responsibility	Accountability for ensuring management action is completed. The responsible role is dependent on project timing.

The key management actions, performance indicators, evidence, timing and responsibilities for each objective are provided in Table 5. The associated Process Flow Diagram is available in Appendix 6.

Table 5: Key Management Actions for Conservation Significant Fauna Management in Fortescue Controlled Sites

Objective 1	Establish the potential direct and indirect impacts on conservation significant fauna and their habitats within Fortescue Controlled Sites				
Reference	**Management Action**	**Performance Indicators**	**Reporting/Evidence**	**Timing**	**Responsibility**
1.1	Undertake targeted fauna surveys in accordance with applicable EPA and DoE guidance (outlined in Section 1.4 of this Plan) to determine distribution of conservation significant fauna.	• Surveys conducted prior to disturbance	• Survey Reports • Approval documentation	Design	Manager, Environmental Studies
1.2	Record conservation significant fauna and habitat identified during a targeted fauna survey in the Corporate GIS and PIMS in accordance with the *Environmental Datasets – Data Governance Guidelines* (100-GU-EN-0020).	• GIS and PIMS updated	• GIS dataset • PIMS record	Design	Manager Environmental Studies/ GIS Manager
1.3	Conduct a risk assessment to identify high risk areas, including areas where conservation significant fauna species and habitat have been identified and potential impacts are likely in accordance with *Standard 4 – Risk Assessment Criteria* (100-ST-RK-0014).	• Risk assessment conducted • Compliance with the Standard	• Risk assessment outcomes/ report	Design/ Construction/ Operation	Manager Environmental Approvals/ Project Manager/ HSE Manager
1.4	Ensure infrastructure location, design, construction and operation reflects risk assessment outcomes in minimising impacts on conservation significant fauna and associated habitat.[5]	• Conservation significant fauna populations remain similar to baseline levels • Impacts to priority habitat minimised • Management measures implemented in high risk areas	• Project design • Monitoring program and report	Design/ Construction/ Operation	Group Manager Operational Planning/ Project Manager/ Manager Mining or Manager Technical Services/ Manager Infrastructure (Rail)/ Manager Port Operations
1.5	Conduct a desktop fauna assessment for Ground Disturbance Permit (GDP) applications in accordance with the *Ground Disturbance Permit Procedure* (100-PR-EN-0004) for: • exploration activities. When conservation significant fauna are identified during the desktop assessment and the exploration activity is unable to be relocated, ensure a fauna survey is conducted in accordance with EPA and DoE guidance (outlined in Section 1.4 of this Plan). • construction and operational activities when a Level 2 fauna survey (EPA, 2004) of the area has been previously conducted. When a Level 2 survey has not been conducted and conservation significant fauna have been identified during the desktop assessment ensure a fauna survey is conducted in accordance with EPA and DoE guidance (outlined in Section 1.4 of this Plan) and reassess accordingly.	• Assessments conducted prior to disturbance • Compliance with the GDP Procedure	• Survey Reports • Approval documentation	Exploration/ Exploration Development/ Construction/ Operation	Manager Exploration/ Project Manager/ HSE Manager
Objective 2	**Establish management strategies to minimise the potential impacts on conservation significant fauna and their habitats within Fortescue Controlled Sites**				
Reference	**Management Action**	**Performance Indicators**	**Reporting/Evidence**	**Timing**	**Responsibility**
2.1	Ensure staff and contractors are provided with appropriate training to ensure conservation significant fauna and associated habitat are protected.	• Site inductions updated • Toolbox meetings delivered • Role dependent training delivered	• Site induction materials • Toolbox meetings • Training materials/registers	Exploration/ Exploration Development/ Construction/ Operation	Manager Exploration / Project Manager/ HSE Manager
2.2	Design and locate borrow pits to minimise the potential impact on conservation significant fauna and associated habitat in accordance with the *Borrow Pit Management Plan* (45-PL-EN-0018).[6]	• Impacts on conservation significant fauna and associated habitat is minimised	• Survey Reports	Exploration/ Exploration Development/	Manager Exploration/ Group Manager Operational Planning/

[5] See Figure 1 for fauna friendly culvert locations associated with the Solomon Rail.
[6] See Figure 2 for borrow pit locations associated with the Solomon Project.

		• Borrow pits located away from conservation significant fauna and associated habitat	• Development Plans • Borrow pit design and location	Design/ Construction/ Operation	Project Manager/ Manager Mining or Manager Technical Services
2.3	When bore construction and test pumping activities are required and conservation significant species and/or habitat have been identified relocate bore/sump/drill pad locations. If the bore/sump/drill pad location is unable to be relocated, develop and implement management actions in accordance with the *Groundwater Management Plan* (45-PL-EN-0029).	• Impacts on conservation significant fauna and associated habitat minimised	• Internal audit and inspection reports • Ground surveys • GDP application and permit	Exploration/ Exploration Development/ Design/ Construction	Manager Exploration/ Manager Hydrogeology/ Project Manager
2.4	Develop and implement measures (e.g. fauna egress, buoyancy rings, fencing) at open sumps and transfer, settlement and storage ponds to prevent feral animal access and minimise potential impacts on fauna.	• No mortality of conservation significant fauna in active sumps • No significant increase in feral animal records from sightings and road transect counts	• Internal audit and inspection reports	Exploration/ Exploration Development/ Construction/ Operation	Manager Exploration/ Manager Hydrogeology/ Projects Manager/ Manager Mine Services
2.5	Cap all drill holes at or below ground level to ensure fauna are not impacted in accordance with the *Exploration Environmental Management Plan* (E-PL-EN-0002).	• Less than 1% of all drill holes at ground level are uncapped • No mortality of conservation significant fauna as a result of uncapped drill holes	• Register of all drill holes • Survey reports	Exploration	Manager Exploration
2.6	Prior to conducting ground disturbance activities, ensure known locations of environmentally sensitive areas to be retained and protected from disturbance are identified on the ground by appropriate signage, fencing or flagging in accordance with the *Marking Out Environmentally Sensitive Areas Procedure* (E-EN-PP-1102).	• No significant impacts on conservation significant fauna and associated habitat to be retained and protected from disturbance • Signage, fencing and/or flagging installed	• Incident reports • Signage, fencing and/or flagging	Construction/ Operation	Project Manager/ HSE Manager
2.7	When conservation significant fauna species have been recorded within the impact area, ground-truth the area and similar habitats within the area, and where individual animals are present implement mitigation measures, including the relocation of fauna, prior to disturbance and in consultation with DPaW.	• Impact area assessed prior to ground disturbance • BMS/GIS updated • DPaW consulted and mitigation measures implemented • Number of fauna successfully relocated	• BMS record • GIS Table • Audit Compliance Report • Compliance Assessment Report • Consultation records	Construction/ Operation	Project Manager/ HSE Manager
2.8	If conservation significant fauna are identified, other than during a fauna survey for a new works, record the sighting in BMS. Where the sighting is confirmed by a qualified fauna specialist[7], ensure DPaW and/or DoE are notified and update the Corporate GIS, PIMS and BMS accordingly.	• The Corporate GIS, PIMS and BMS are updated • Appropriate Regulators notified, where required	• GIS dataset • BMS record • Regulator notification	Exploration/ Construction/ Operation	Manager Exploration/ Project Manager/ HSE Manager

[7] Fauna specialist is defined by the EPA in the *Guidance for the Assessment of Environmental Factors No.56 – Terrestrial Fauna Surveys for Environmental Impact Assessments.*

2.9	Minimise clearing and vegetation disturbance to ensure conservation significant fauna and associated habitat is minimally impacted. Conduct clearing in accordance with a permit issued under the *Ground Disturbance Permit Procedure* (100-PR-EN-0004) and/or the *Vegetation Clearing and Topsoil Management Procedure* (45-PR-EN-0013).	• No significant impact on conservation significant fauna habitat • Ground disturbance permit obtained for all clearing • Clearing is restricted within specified GDP boundaries • Compliance with Procedure	• Ground disturbance permit and application • Compliance Assessment Report	Exploration/ Exploration Development/ Construction/ Operation	Manager Exploration/ Project Manager/ Manager Mining or Manager Technical Services/ Manager Port Operations/ Manager Infrastructure (Rail)
2.10	Where construction or operational activities generate noise emissions[8] that may result in significant impacts to conservation significant fauna, incorporate mitigation measures into planned activities in accordance with the *Chichester Operations* Noise *and Vibration Management Plan* (CB-PL-EN-0007).	• Noise emissions monitored • No evidence of fauna disturbance • No significant impact on fauna • Compliance with Plan • No exceedance of trigger levels	• Compliance Assessment Report • Maintenance/monitoring records	Construction/ Operations	Project Manager/ Manager Technical Services/ Manager Infrastructure (Rail)/ Manager Maintenance (Mine)/ Manager Mining
2.11	Direct lighting onto active construction and operational areas to minimise the potential for light overspill resulting in fauna disturbance, injuries or deaths.	• No mortality of conservation significant fauna as a result of construction and operation activities • Awareness program included in inductions and toolbox meetings	• Incident reports in BMS • Toolbox meeting minutes • Staff induction materials	Construction/ Operation	Project Manager/ Manager Mining/ Manager Port Operations
2.12	Ensure all vehicles, plant and equipment, including trailered equipment, are clean, inspected and certified prior to entry into Fortescue controlled sites to prevent the degradation of priority fauna habitat in accordance with the *Weed Management Plan* (45-PL-EN-0013).	• Compliance with Weed Management Plan • Degradation of fauna habitat minimised	• Weed Management Plan • Weed monitoring program/ reports	Construction/ Operation	Manager Exploration/ Project Manager/ HSE Manager
2.13	When conducting excavation or trenching activities, develop and implement fauna management measures including exclusion methods, exit structures, shelter and/or excavation/trench inspections to minimise potential impacts on conservation significant fauna.	• No mortality of conservation significant fauna as a result of excavation or trenching activities	• BMS record • Compliance Assessment Report	Construction/ Operation	Project Manager/ Manager Mine Services or Manager Technical Services
2.14	Develop and implement a Feral Animal Program to effectively manage and control feral animals within Fortescue controlled sites to minimise impacts on conservation significant fauna.	• No significant increase in feral animal records from sightings and road transect counts • Awareness material included in site induction programs • All opportunistic feral animal sightings are registered in BMS	• Compliance Assessment Report	Construction/ Operation/ Decommissioning	Project Manager/ HSE Manager
2.15	Manage waste materials and on-site landfill facilities in accordance with the *Waste Management Plan* (45-PL-EN-0014) to minimise potential impacts on fauna and the likelihood of increases in feral animal numbers.	• Compliance with the Waste Management Plan	• Compliance Assessment Report • Internal audit and inspection reports	Construction/ Operation/ Decommissioning	Manager Exploration/ Project Manager/ HSE Manager
2.16	To minimize the potential for dust deposition on vegetation, including on conservation significant fauna habitat, implement dust suppression measures outlined in the *Mine and Rail Dust Management Plan* (45-PL-EN-0030) and the *Port Facility Dust Environmental Management Plan* (P-PL-EN-0010).	• Dust suppression measures implemented • Compliance with Management Plans	• Compliance Assessment Report	Construction/ Operation	Project Manager/ Manager Mining/ Manager Infrastructure (Rail)/ Manager Port Operations

[8] Noise is defined in the *Environmental Protection Act 1986* as “includes vibration of any frequency, whether transmitted through air or any physical medium”.

2.17	When constructing a fire break or carrying out a prescribed burn where conservation significant fauna and habitat have been identified, adhere to the requirements outlined in the *Bushfire Management Plan* (100-PL-EM-0009).	• Compliance with the Bushfire Management Plan • No significant impact on conservation significant fauna or habitat	• Relevant permits • Notice from local authority • Correspondence with relevant Pastoral Lessee	Construction/ Operation	Project Manager/ HSE Manager
2.18	To minimise the potential for fauna injuries or deaths on haul and access roads, implement appropriate mitigation measures such as speed limit restrictions, right of way for fauna and the prohibition of off-road driving.	• Reduction in fauna deaths • Appropriate signage on all roads • Awareness program included in inductions and toolbox meetings	• Incident reports in BMS • Toolbox meeting minutes • Staff induction materials	Construction/ Operation	Project Manager/ HSE Manager
2.19	Develop and implement applicable fauna management and handling procedures (e.g. trench inspections, fauna relocation, injured fauna) in support of this Plan and in consultation with DPaW.	• Procedures developed	• Procedure	Construction/ Operation	Project Manager/ HSE Manager
2.20	Conduct progressive rehabilitation of disturbed areas, particularly those areas with known conservation significant fauna and associated habitat, in accordance with the *Exploration Environmental Management Plan* (E-PL-EN-0002), *Rehabilitation and Revegetation Management Plan* (45-PL-EN-0023) or where applicable a Mine Closure Plan developed in accordance with the Guidelines for Preparing Mine Closure Plans.	• Disturbed areas rehabilitated • Compliance with Management Plan and/or Mine Closure Plan • The Corporate GIS and BMS are up to date	• Compliance Assessment Report • Annual Environment Report • GIS table and BMS record	Exploration/ Exploration Development/ Operation/ Decommissioning/ Closure	Manager Exploration/ Manager Mining
Objective 3	**Develop monitoring programs to detect any impacts on conservation significant fauna and their habitats within Fortescue Controlled Sites**				
Reference	**Management Action**	**Performance Indicators**	**Reporting/Evidence**	**Timing**	**Responsibility**
3.1	Where populations of conservation significant fauna listed under the *Wildlife Conservation Act 1986* or the *Environment Protection and Biodiversity Conservation Act 1999* have been recorded in Fortescue controlled sites, develop and implement a Conservation Significant Fauna Monitoring Program in accordance with the *Conservation Significant Fauna Monitoring Guidelines* (100-GU-EN-0034).	• Monitoring Program implemented	• Monitoring Reports • Annual Environmental Report	Construction/ Operation/ Decommissioning/ Closure	Project Manager/ HSE Manager
3.2	When conducting groundwater dewatering or injection activities, monitor groundwater conditions and where necessary mitigate any changes to groundwater dependent ecosystems, including those systems that support conservation significant fauna, arising from dewatering and injection activities in accordance with the *Groundwater Management Plan* (45-PL-EN-0029).	• No significant impact on conservation significant fauna habitat • Incident reports of vegetation stress potentially attributable to operations investigated • Water levels of groundwater dependent pools are maintained • Monitoring requirements are included in the site specific Groundwater Operating Strategy • Anomalies observed during monitoring are investigated at the end of each monthly cycle	• Internal reports • Groundwater monitoring reports in accordance with 5C Licence conditions • Compliance Assessment Report • Groundwater Operating Strategy	Construction/ Operation	Project Manager/ HSE Manager
Objective 4	**Establish appropriate review mechanisms regarding the strategies employed to minimise impacts on conservation significant fauna**				
Reference	**Management Action**	**Performance indicators**	**Reporting/Evidence**	**Timing**	**Responsibility**
4.1	Where a fauna injury or death has occurred as a result of Fortescue Operations, investigate and report the incident in accordance with the *Incident Event Reporting Procedure* (100-PR-SA-0011) and employ corrective actions in accordance with Section 9 of this Plan.	• Incident reported in BMS • Incident investigated according to Procedure • Incident reported to Regulator within the specified legislative or licensing condition, where required	• Incident Report in BMS • Correspondence with relevant Regulator • Annual reporting	Exploration/ Exploration Development/ Construction/ Operation/ Decommissioning/ Closure	Manager Exploration/ Project Manager/ HSE Manager/ Manager, Governance and Sustainability
4.2	When an incident has occurred, review mitigation measures and monitoring programs and update where require to inform an adaptive management approach for the life of the project.	• Management approach reviewed and updated, where necessary • Monitoring program reviewed and updated	• Updated Management Plan • Updated monitoring program	Construction/ Operation/ Decommissioning/ Closure	Project Manager/ HSE Manager

7. MONITORING GUIDELINES

Guidelines for monitoring conservation significant fauna in Fortescue controlled sites can be found in Appendix 7. This document provides guidance for the development and implementation of site specific Monitoring Programs. By adopting these guidelines, a consistent monitoring approach can be applied across Fortescue controlled sites.

The objectives of Fortescue's conservation significant fauna monitoring programs are:

1. Determine presence (or absence) of conservation significant fauna within Fortescue controlled sites.
2. Measure impacts of Fortescue's activities on conservation significant fauna within Fortescue controlled sites.
3. Monitor and measure the success of management measures to inform an adaptive management approach.
4. Monitor and measure spatial and temporal changes in the abundance and distribution of conservation significant fauna within Fortescue controlled sites.

Baseline and operational monitoring will be informed by the findings of the monitoring itself as they become available. These findings may similarly lead to ongoing refinements to this Plan and its management strategies to ensure an adaptive management approach is undertaken during Fortescue activities.

Changes to the monitoring program will be agreed to by DPaW and/or DoE where required and may be based on the confirmed presence or absence of a conservation significant fauna species.

8. COMPLIANCE

Fortescue ensures compliance with its legal obligations through first party quality assurance by site environment teams with a focus on effective environmental management through the corporate Environmental Management System (EMS).

Fortescue has adopted a risk based approach to monitor compliance with its legal obligations. Site environment teams will monitor their compliance with this Plan and the required site specific management and monitoring programs using the *Self-Verification of High Risk Environmental Legal Obligations Guideline* (100-GU-EN-0030).

Where non-conformance issues or opportunities for improvement are identified these will be documented and tracked via the Business Management System (BMS).

9. CORRECTIVE ACTIONS

Contingency actions will be initiated during construction, operational and decommissioning activities when monitoring indicates that implemented fauna management actions are not successfully mitigating impacts to the targeted species and management objectives are not being achieved. Specifically, contingency measures will be triggered when a death or injury of a conservation significant fauna occurs or where monitoring indicates a reduction in conservation significant fauna abundance and/or distribution (Table 6).

Table 6: Interim Management Triggers

Trigger	Contingency Actions
Conservation significant fauna death	• Enter death in BMS and notify DPaW/DoE. • Identify reason for death and where it is caused by construction, operation or decomissioning activities, implement/change management measures where possible. • Increase monitoring in areas where deaths have occurred.
Conservation significant fauna injury	• Record injury in BMS. • Treat animal where possible. Euthanise where required. • Identify reason for injury and where it is caused by construction, operation or decomissioning activities, implement/change management measures.

These qualitative trigger values should be reviewed after the first and subsequent monitoring events and refined with quantitative values where possible for a robust and effective monitoring program.

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 distribution is caused by impacts from mine activity or due to climatic influences beyond human control. Input from the DPaW 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 the analysis of results. Record keeping will be maintained to enable immediate identification of trigger points of species decline for contingency measures to be effective.

Any incidents resulting from unauthorised activities related to fauna, or with the potential to impact on fauna, shall be reported and investigated as per *Incident Event Management Procedure* (100-PR-SA-0011). Causes of incidents will be determined and management procedures will be modified, with measures taken (as required) to prevent re-occurrence of incidents.

10. REVIEW

It is important that plans and procedures are frequently reviewed and revised as Fortescue's operations change and opportunities for improved management practices are identified.

This Plan will be reviewed every five years, or when significant additional information comes to hand. Upon review, the document will be revised where appropriate and the revision status will be updated in accordance with Fortescue's document control procedures.

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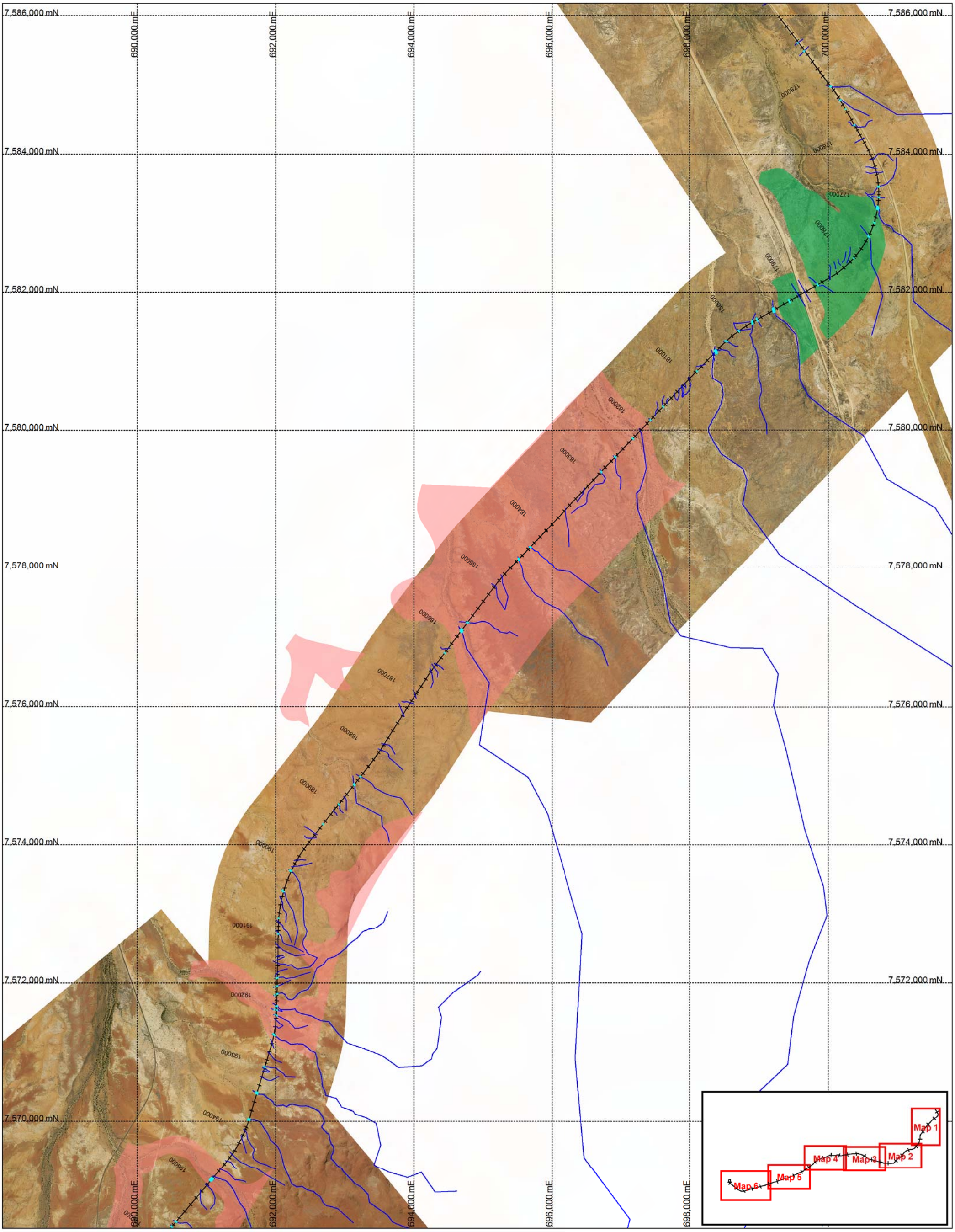
Figure 1: Location of Fauna Friendly Culverts and Potential Northern Quoll and Mulgara Habitat within the Solomon Rail



Location Map

Habitat Area

- Northern Quoll Habitat
- Mulgara Habitat
- Rail Alignment and Chainage
- Stream Paths
- Proposed Culvert Locations

0 0.5 1 2
kilometres

N

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Location of Fauna Friendly Culverts & Potential Northern Quoll & Mulgara Habitat within Solomon Rai
Map 1

Author: S. Grein	Date: 18/08/2011
Drawn By: S. Hendricksen/S.Pottachira	Revision: 2
Dwg No: R_MP_EN_0049.001	Report No: 1
Projection: MGA Zone 50 (GDA 94)	Scale: 1:50000

675,000 mE
680,000 mE
685,000 mE
690,000 mE
7,565,000 mN
7,560,000 mN

Location Map

Habitat Area

Northern Quoll Habitat

Rail Alignment and Chainage

Stream Paths

Proposed Culvert Locations

0 0.5 1 2
kilometres

N

Fortescue Metals Group Ltd

Location of Fauna Friendly Culverts & Potential Northern Quoll & Mulgara Habitat within Solomon Rail Map 2

Author: S. Grein	Date: 18/08/2011
Drawn By: S. Hendricksen/S.Pottachira	Revision: 2
Dwg No: R_MP_EN_0049.002	Report No: 1
Projection: MGA Zone 50 (GDA 94)	Scale: 1:50000

660,000 mE
665,000 mE
670,000 mE
675,000 mE
7,565,000 mN
7,560,000 mN

Location Map

Habitat Area

Northern Quoll Habitat

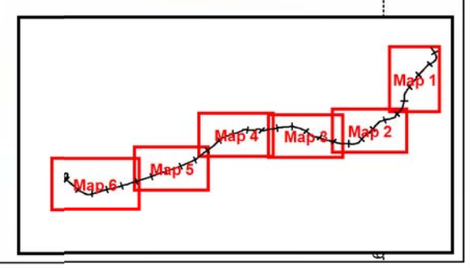
Rail Alignment and Chainage

Stream Paths

Proposed Culvert Locations

0 0.5 1 2
kilometres

N



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Location of Fauna Friendly Culverts & Potential Northern Quoll & Mulgara Habitat within Solomon Rail Map 3

Author: S. Grein	Date: 18/08/2011
Drawn By: S. Hendricksen/S.Pottachira	Revision: 2
Dwg No: R_MP_EN_0049.003	Report No: 1
Projection: MGA Zone 50 (GDA 94)	Scale: 1:50000

640,000 mE

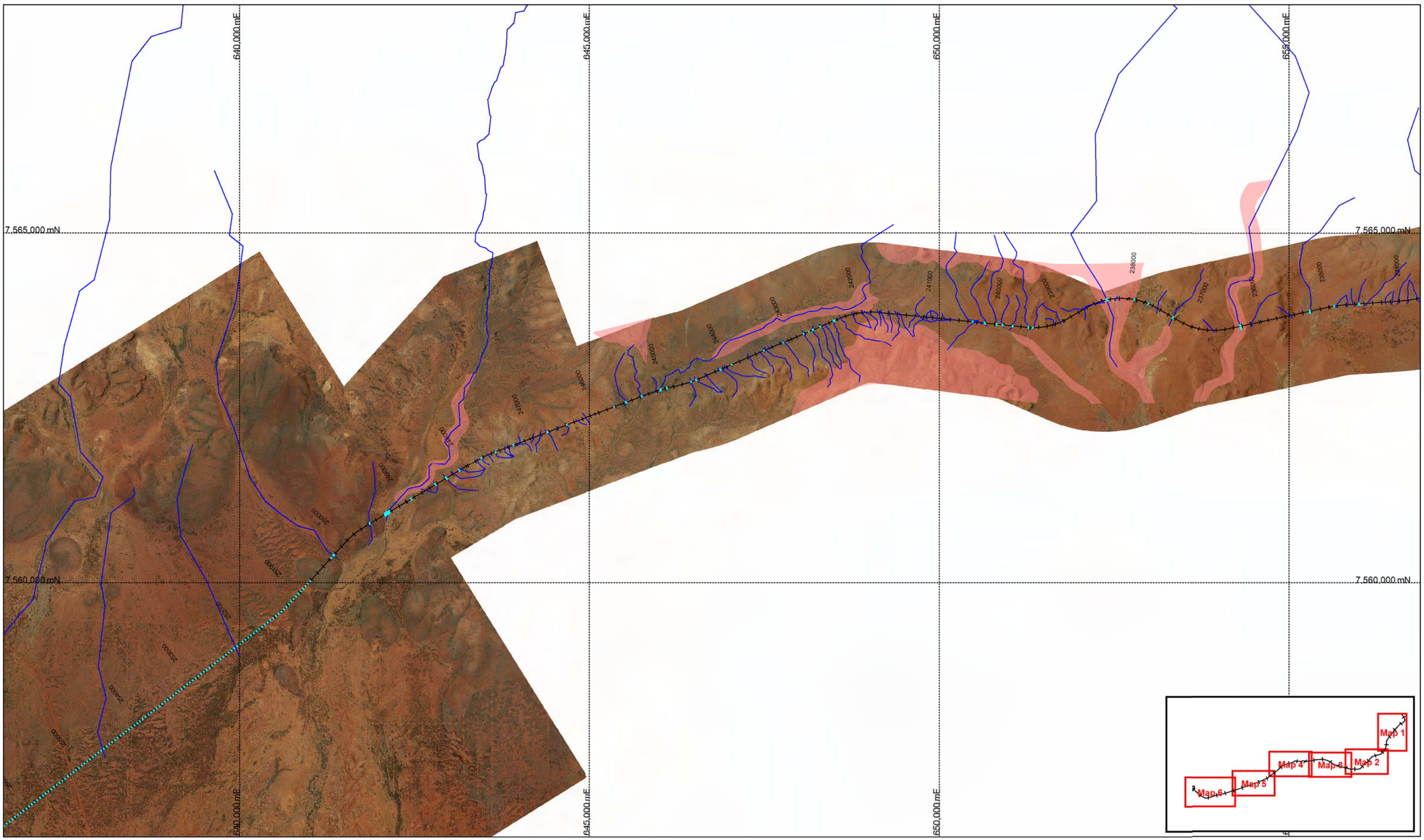
645,000 mE

650,000 mE

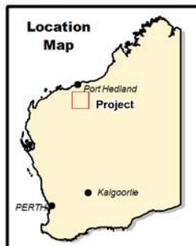
655,000 mE

7,565,000 mN

7,560,000 mN



Location Map



Habitat Area

Northern Quoll Habitat

Rail Alignment and Chainage

Stream Paths

Proposed Culvert Locations

0 0.5 1 2

kilometres

N

Fortescue Metals Group Ltd

Location of Fauna Friendly Culverts & Potential Northern Quoll & Mulgara Habitat within Solomon Rail Map 4

Author: S. Grein	Date: 18/08/2011
Drawn By: S. Hendricksen/S.Pottachira	Revision: 2
Dwg No: R_MP_EN_0049.004	Report No: 1
Projection: MGA Zone 50 (GDA 94)	Scale: 1:50000

620,000 mE
625,000 mE
630,000 mE
635,000 mE
7,555,000 mN
7,550,000 mN

Habitat Area

Northern Quoll Habitat

Rail Alignment and Chainage

Stream Paths

Proposed Culvert Locations

0 0.5 1 2
kilometres

N

Fortescue Metals Group Ltd

Location of Fauna Friendly Culverts & Potential Northern Quoll & Mulgara Habitat within Solomon Rail Map 5

Author: S. Grein	Date: 18/08/2011
Drawn By: S. Hendricksen/S.Pottachira	Revision: 2
Dwg No: R_MP_EN_0049.005	Report No: 1
Projection: MGA Zone 50 (GDA 94)	Scale: 1:50000

600,000 mE
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610,000 mE
615,000 mE
620,000 mE
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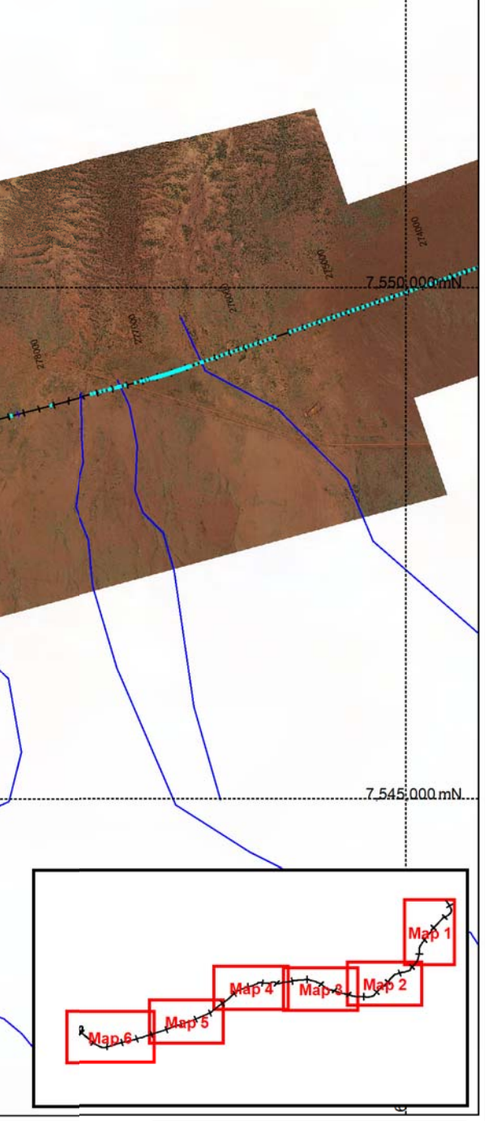
7,550,000 mN
7,545,000 mN



Location Map

Habitat Area

- Northern Quoll Habitat
- Rail Alignment and Chainage
- Stream Paths
- Proposed Culvert Locations

0 0.5 1 2
kilometres

N

Fortescue Metals Group Ltd

Location of Fauna Friendly Culverts & Potential Northern Quoll & Mulgara Habitat within Solomon Rail Map 6

Author: S. Grein	Date: 18/08/2011
Drawn By: S. Hendricksen/S.Pottachira	Revision: 2
Dwg No: R_MP_EN_0049.006	Report No: 1
Projection: MGA Zone 50 (GDA 94)	Scale: 1:60000

Figure 2: Location of Borrow Pits – Solomon Project

7,586,000 mN
7,584,000 mN
7,582,000 mN
7,580,000 mN
7,578,000 mN
7,576,000 mN
7,574,000 mN
7,572,000 mN
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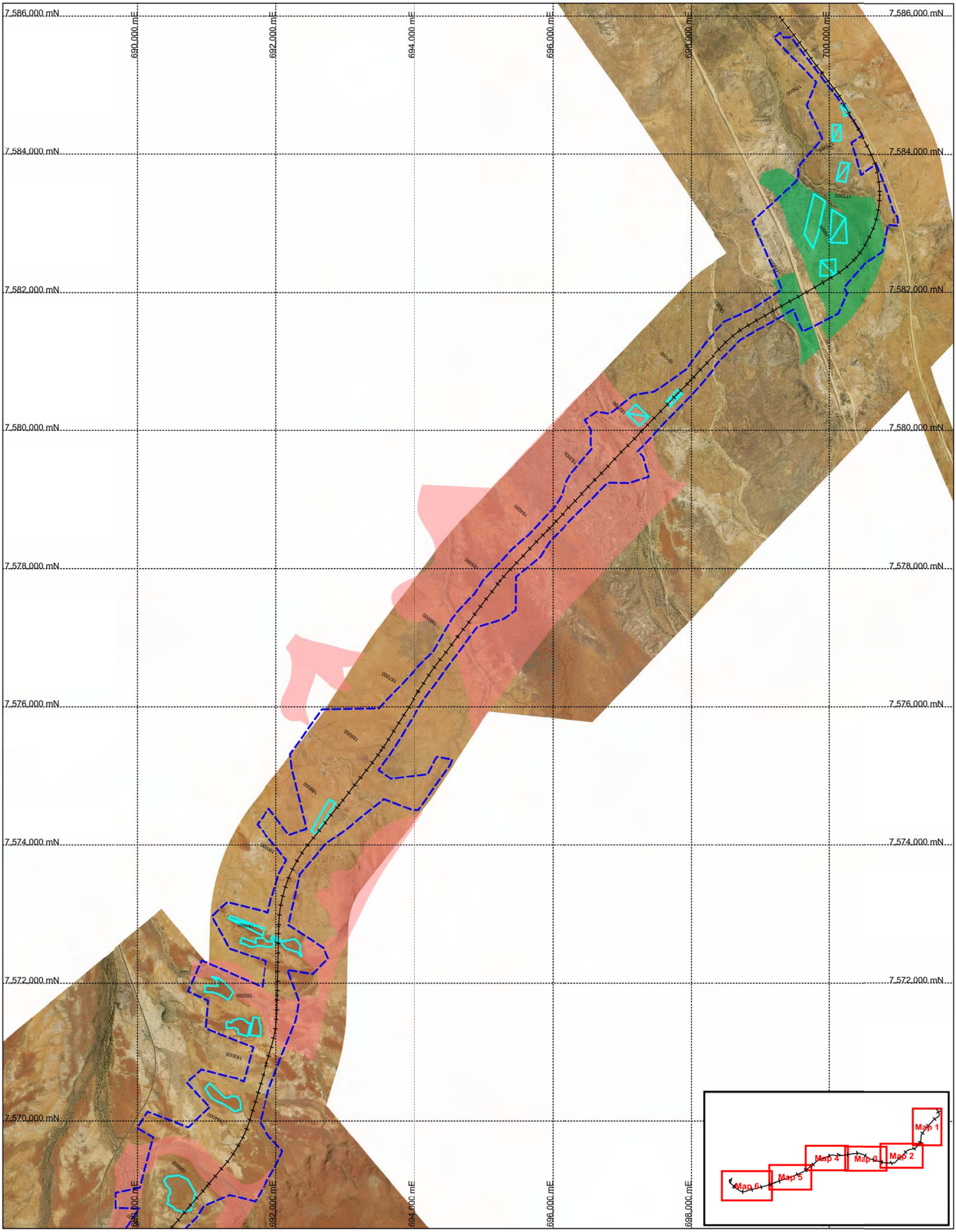
696,000 mE
698,000 mE
700,000 mE



Map 1
Map 2
Map 3
Map 4
Map 5
Map 6

Location Map

Habitat Area

- Northern Quoll Habitat
- Mulgara Habitat
- Rail Alignment and Chainage
- Proposed Borrow Pit Locations
- Special Rail Licence

0 0.5 1 2
kilometres

N

Fortescue Metals Group Ltd

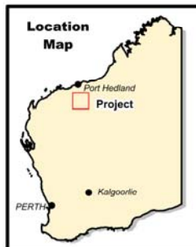
Location of Borrow Pits Relative to Northern Quoll and Mulgara Solomon Rail

Map 1

Author: S. Grein	Date: 01/02/2012
Drawn By: SH/SP/DN	Revision: 3
Dwg No: R_MP_EN_0049.001 r3	Report No: 1
Projection: MGA Zone 50 (GDA 94)	Scale: 1:50000

675,000 mE
680,000 mE
685,000 mE
690,000 mE
7,565,000 mN
7,560,000 mN

Location Map



Habitat Area

- Northern Quoll Habitat
- Mulgara Habitat
- Rail Alignment and Chainage
- Proposed Borrow Pit Locations
- Special Rail Licence

0 0.5 1 2
kilometres

N

Fortescue Metals Group Ltd

Location of Borrow Pits Relative to Northern Quoll and Mulgara Solomon Rail

Map 2

Author: S. Grein	Date: 01/02/2012
Drawn By: SH/SP/DN	Revision: 3
Dwg No: R_MP_EN_0049.002 r3	Report No: 1
Projection: MGA Zone 50 (GDA 94)	Scale: 1:50000

660,000 mE

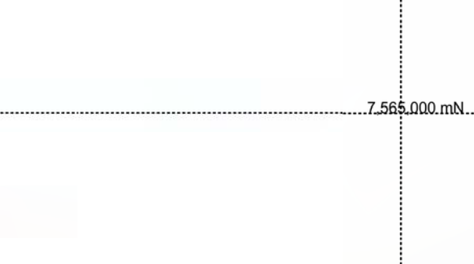
665,000 mE

670,000 mE

675,000 mE

7,565,000 mN

7,560,000 mN



Location Map

Habitat Area

- Northern Quoll Habitat
- Mulgara Habitat
- Rail Alignment and Chainage
- Proposed Borrow Pit Locations
- Special Rail Licence

0 0.5 1 2
kilometres

N

Fortescue Metals Group Ltd

Location of Borrow Pits Relative to Northern Quoll and Mulgara Solomon Rail

Map 3

Author: S. Grein	Date: 01/02/2012
Drawn By: SH/SP/DN	Revision: 3
Dwg No: R_MP_EN_0049.003 r3	Report No: 1
Projection: MGA Zone 50 (GDA 94)	Scale: 1:50000

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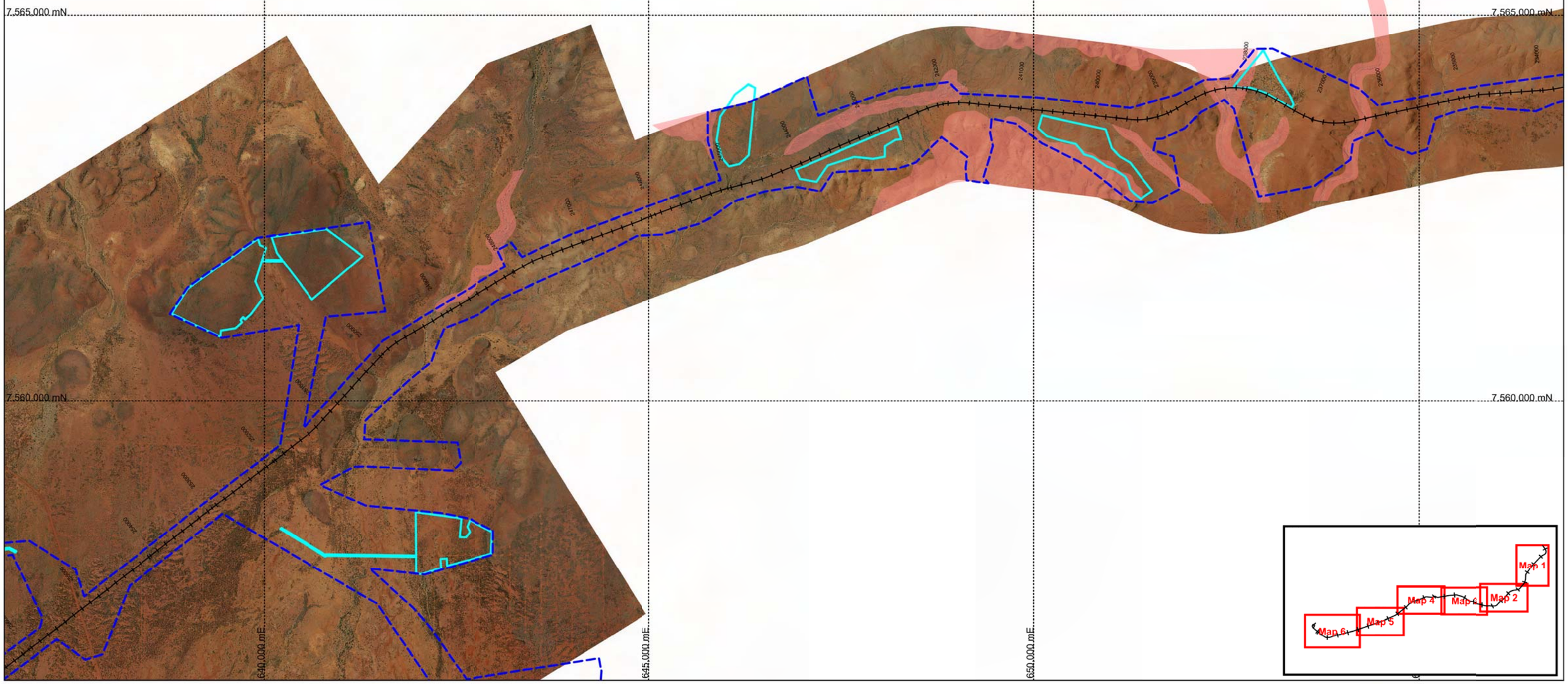
645,000 mE

650,000 mE

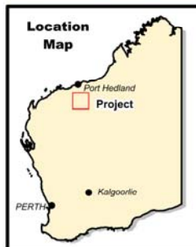
655,000 mE

7,565,000 mN

7,560,000 mN



Location Map



Habitat Area

- Northern Quoll Habitat
- Mulgara Habitat
- Rail Alignment and Chainage
- Proposed Borrow Pit Locations
- Special Rail Licence

0 0.5 1 2
kilometres

N

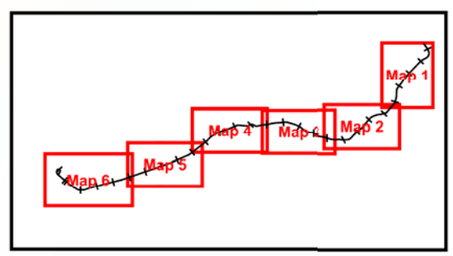
Fortescue Metals Group Ltd

Location of Borrow Pits Relative to Northern Quoll and Mulgara Solomon Rail

Map 4

Author: S. Grein	Date: 01/02/2012
Drawn By: SH/SP/DN	Revision: 3
Dwg No: R_MP_EN_0049.004 r3	Report No: 1
Projection: MGA Zone 50 (GDA 94)	Scale: 1:50000

620,000 mE
625,000 mE
630,000 mE
635,000 mE
7,555,000 mN
7,550,000 mN



Location Map

Habitat Area

- Northern Quoll Habitat
- Mulgara Habitat
- Rail Alignment and Chainage
- Proposed Borrow Pit Locations
- Special Rail Licence

0 0.5 1 2
kilometres

N

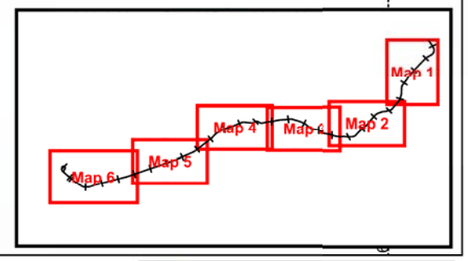
Fortescue Metals Group Ltd

Location of Borrow Pits Relative to Northern Quoll and Mulgara Solomon Rail

Map 5

Author: S. Grein	Date: 01/02/2012
Drawn By: SH/SP/DN	Revision: 3
Dwg No: R_MP_EN_0049.005 r3	Report No: 1
Projection: MGA Zone 50 (GDA 94)	Scale: 1:50000

600,000 mE
605,000 mE
610,000 mE
615,000 mE
620,000 mE
7,555,000 mN
7,550,000 mN
7,545,000 mN



Habitat Area

- Northern Quoll Habitat
- Mulgara Habitat
- Rail Alignment and Chainage
- Proposed Borrow Pit Locations
- Special Rail Licence

0 0.5 1 2
kilometres

N

Fortescue Metals Group Ltd

Location of Borrow Pits Relative to Northern Quoll and Mulgara Solomon Rail

Map 3

Author: S. Grein	Date: 01/02/2012
Drawn By: SH/SP/DN	Revision: 3
Dwg No: R_MP_EN_0049.006 r3	Report No: 1
Projection: MGA Zone 50 (GDA 94)	Scale: 1:50000

Appendix 1: Project Background

Fortescue Metals Group Background

Fortescue Metals Group (Fortescue) is an integrated business comprised of mine, rail and port operations based in the Pilbara region of Western Australia with its head office located in Perth.

Fortescue has commenced operation of the Pilbara Iron Ore and Infrastructure Project (the Project), which consists of several iron ore mines and associated rail and port infrastructure in the Pilbara region of Western Australia.

The Project was granted Major Project Facilitation Status in December 2004 and Fortescue has signed two Agreements with the State of Western Australia:

- The Railway and Port (The Pilbara Infrastructure Pty Ltd) State Agreement for the port and rail infrastructure to transport ore from the mines to the port;
- The Iron Ore (FMG Chichester Pty Ltd) Agreement for the iron ore mines.

The Project has been developed in the following stages:

- Stage A, consisting of a two-berth iron ore export facility at Port Hedland and a north-south railway from the central Pilbara to Port Hedland, approved under Ministerial Statement 690;
- Stage B, consisting of iron ore mines in the eastern Pilbara (Christmas Creek) and an east-west spur rail line connecting to the Stage A railway; approved under Ministerial Statement 707. (Note this approval included the Mindy Mindy mine site but this has not been developed to date);
- Cloudbreak iron ore mine west of the Christmas Creek area, approved under Ministerial Statement 721 and federal approval under the EPBC Act (EPBC 2005/2205);
- Port facility upgrade consisting of a third berth at Anderson Point, Port Hedland, approved under Ministerial Statement 771;
- Port facility upgrade consisting of a fourth berth at Anderson Port, Port Hedland, Not Assessed –Public Advice Given in 2010;
- Solomon iron ore project consisting of two new mines and a railway connecting to the existing Fortescue rail line, approved under Ministerial Statement 862 and federal approval under the EPBC Act (EPBC 2010/5567 and 2010/5513) in 2011;
- Additional rail infrastructure between Herb Elliot Port Facility and Cloudbreak Mine Site, approved under Ministerial Statement 690 and 707 and federal approval under the EPBC Act (EPBC 2010/5513);
- Christmas Creek water management scheme to increase the mine dewatering rate and to inject surplus water into two brackish and one saline injection zones, approved under Ministerial Statement 871;
- Cloudbreak Life of Mine, approved under Ministerial Statement 899 (supersedes the conditions of Ministerial Statement 721).

Changes to Ministerial Statements 690, 707, 721, 771 and 862 were made and approved under Section 45 or 46 of the Environmental Protection Act 1986 (EP Act).

Fortescue is extending its current operations in the Pilbara by developing the Solomon Project, which includes two new mine sites (Firetail and Kings), and a rail line to support the new sites. The Solomon Project area (Solomon) is located approximately 60 kilometres (km) north of Tom Price and is situated on both sides of the rail line operated by Pilbara Iron (Rio Tinto). Access to Solomon is via the public roads running north of Tom Price and also from the Pilbara Iron rail access road.

In addition to the Solomon project, expansion of mining to the west is proposed within the Western Hub Project area which contains approximately 10 ore bodies. Expansion of mining is also proposed east of Solomon at Nyidinghu and north east at North Star.

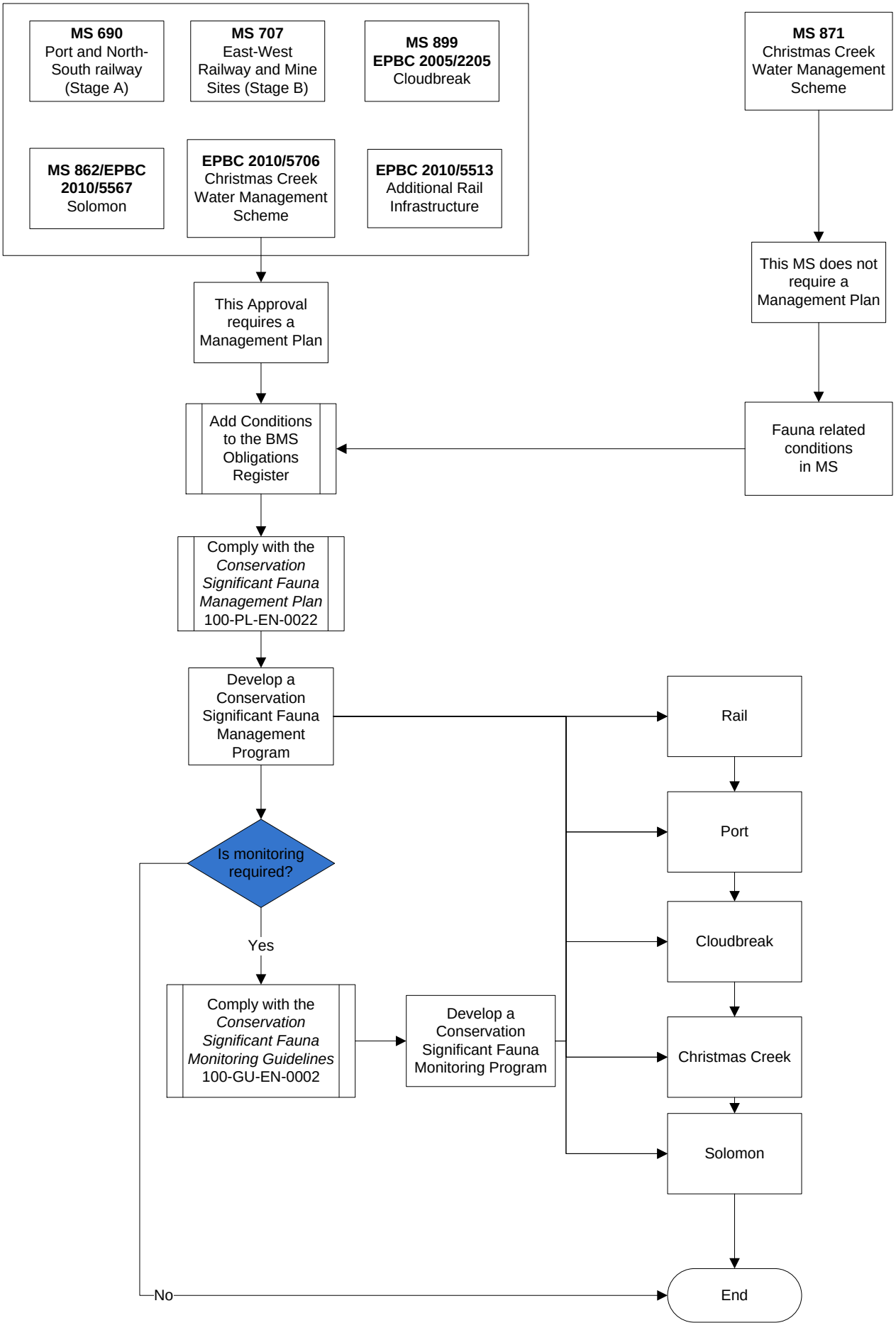
Fortescue is also conducting drilling programmes to further delineate resources and iron ore reserves within tenements surrounding Solomon and in additional locations throughout the Pilbara.

In addition to its wholly owned tenements, Fortescue is party to joint ventures and agreements with other tenement holders within the Pilbara region and is the manager of iron ore exploration operations upon these tenements.

Appendix 2: Data Flow Diagram

Data Flow Diagram

Conservation Significant Fauna Management Plan



Appendix 3: Cross Reference to State and Federal Statutory Requirements

Ministerial Conditions and Commitments		
Ministerial Statement/ Controlled Action	**Requirement or Issue**	**Location in this Plan**
MS690 & 707 & 899	Follow up surveys and delineation of significant populations	– Table 1 – Table 5; Objective 3 – Appendix 4&7
MS 707 & 899	Measures to protect fauna from vegetation clearing, noise, vibration, light overspill and other impacts	– Table 5, Objective 2
MS 707 & 899	Feral animal control	– Table 5, Objective 2
MS 899	Suitable means for ensuring appropriate protection of fauna	– Table 5, Objectives 2, 3 & 4 – Section 7, 8 & 9 – Appendix 7 & 8
MS 862 & 899 EPBC 2010/5567	Monitor and report on success of protection	– Table 5, Objectives 3 & 4 – Section 7 & 9 – Appendix 7
EPBC 2010/5513	Design details of borrow pits that will allow fauna to escape	– Table 5, Objective 2
MS862 EPBC 2010/5567 EPBC 2010/5513 EPBC 2010/5706	Minimise mortality/impacts of EPBC listed threatened fauna	– Table 5, Objectives 1-4 – Sections 7, 8 & 9 – Appendix 7
MS862 EPBC 2010/5567 EPBC 2010/5513 EPBC 2010/5706	Protect habitat of EPBC listed threatened fauna species	– Table 5, Objectives 1-4
EPBC 2010/5567 EPBC 2010/5513 EPBC 2010/5706	Rehabilitate disturbed areas	– Table 5, Objective 2
MS 690 & 707	Identify suitable relocation sites and techniques	– Table 5, Objective 2
MS 690 & 707	Monitor and report on success of relocation	– Table 5, Objective 2 & 3 – Section 7 – Appendix 7
MS 707	Review plan every 5 years	– Section 10
EPBC 2005/2205	Prepare a Night Parrot Survey Plan	– Section 1.2 – Table 5, Objective 3 – Section 7 – Appendix 7
MS862 EPBC 2010/5567 EPBC 2010/5706 EPBC 2010/5513	Develop and implement a fauna monitoring program	– Table 5, Objective 3 – Section 7 – Appendix 7
EPBC 2010/5567	Plans showing fauna friendly culverts along the rail at locations to maximize benefits to EPBC listed species	– Figure 1
EPBC 2010/5567	Plans showing borrow pit locations/design to minimize impacts on EPBC listed species and their habitats	– Figure 2

Ministerial Conditions and Commitments		
EPBC 2010/5567 EPBC 2010/5513 EPBC 2010/5706	Annual report on milestones and compliance with plan	– Annual Compliance Report
EPBC 2010/5706	Design details of trenches to allow fauna to escape	– Table 5, Objective 2
EPBC 2010/5706	The results of the monitoring program and compliance with the plan must be published on the website	– Annual Compliance Report
EPBC 2005/2205	Adopt and implement the Night Parrot Management Plan	– Section 1.2, – Table 5, Objective 1-4 – Section 7, 8 & 9 – Appendix 7
EPBC 2005/2205	Adopt and implement the Bilby Management Plan	– Section 1.2 – Table 5, Objective 1-4 – Section 7, 8 & 9 – Appendix 7

Appendix 4: Conservation Significant Fauna Descriptions

Species	Conservation Status (EPBC Act 1999)	Conservation Status (Wildlife Conservation Act 1950)	Priority Species	Distribution and Habitat	Discussion on Potential Occurrence in Fortescue Controlled Sites
Night Parrot (*Pezoporous occidentalis*)	Critically Endangered	Schedule 1		Reports of the Night Parrot are few but scattered over a vast area of inland Australia, with unconfirmed reports from all mainland states and territories, but most confirmed reports are from north-eastern South Australia/south-western Queensland and the eastern Pilbara of Western Australia. Preferred habitat is dense, low vegetation usually associated with Triodia hummock grassland and occasionally in low chenopod shrubland.	Three Night Parrots were observed in April 2005 at Cloudbreak (Bamford 2005).
Northern Quoll (*Dasyurus hallucatus*)	Endangered	Schedule 1		The Northern Quoll is found in east and north Queensland, northern parts of the Northern Territory, the Kimberley and the Pilbara. Van Dyck and Strahan (2008) suggested that they were most abundant in broken country, rocky areas and open eucalypt forest within 150km of the coast. They are reported to den in hollow tree trunks, but will use other spaces such as rock crevices and openings in old termite mounds. In the Pilbara, the geographic distribution of Northern Quolls is considered fragmented, with its numbers in decline.	Suitable habitat for the Northern Quoll is present along the existing rail corridor from Port Hedland to Cloudbreak, in the Cloudbreak to Christmas Creek railway corridor, at Solomon, Serenity Valley, Glacier Valley, Farquhar, Sheila East and West and in sections of the Solomon rail corridor. They have been recorded during trapping surveys at Solomon.
Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*)	Vulnerable	Schedule 1		Armstrong (2001) reported populations of R. aurantius around Marble Bar, Nullagine, Hillside station, Soansville, Tom Price, Paraburdoo, Red Hill, Millstream, Fortescue and the Barlee Range. Its geographic distribution appears to be divided into three distinct areas: mines of the eastern Pilbara – George Ranges, Hamersley Ranges in small colonies, and in the Gascoyne Ranges (Armstrong, 2001). Armstrong (2001) reported microhabitat conditions in two caves in the Barlee Ranges occupied by R. aurantius as having ambient temperatures of 22-28oC in winter and 25-34oC in spring and humidity varied appreciably from 26-94% in winter and 11-74% in summer.	The Pilbara Leaf-nosed Bat was not observed by Biota (2005a) in the vicinity of Cloudbreak; however, it is possibly present in the vicinity of proposed mining development in the Hamersley Ranges (e.g. Solomon and Serenity Valley) as there is an abundance of caves in the gorges in this area. Destruction of roosts through ground disturbing activities and changing the water table and humidity in roost caves may have a significant impact on this species. As they have a propensity to fly into the light of vehicles there is also the possibility of collisions with vehicles at night.

Species	Conservation Status (EPBC Act 1999)	Conservation Status (Wildlife Conservation Act 1950)	Priority Species	Distribution and Habitat	Discussion on Potential Occurrence in Fortescue Controlled Sites
Crest-tailed Mulgara (*Dasycercus cristicauda*)	Vulnerable	Schedule 1		Woolley (2005) has recently recognised two species of 'Mulgara'; Dasycercus blythi and D. cristicauda. Currently, there are insufficient data to separate the spatial ecology, burrows and reproductive biology of these two species. Mulgara are distributed in the inland spinifex covered sandy desert and spinifex vegetated areas in the Pilbara and northern goldfields. Within these areas their distribution is patchy and it is most frequently confined to mature spinifex dominated habitat (Gibson and Cole, 1992; Masters, 2003; Masters et al., 2003). The geographic distribution of these two Mulgara species in the Pilbara has not been clearly delineated.	Mulgara diggings, scats and tracks were observed by Biota (2004) at its site FMG105 near Cloudbreak. Surveys by Coffey Environments (ATA Environmental, 2007) of the Port Hedland to Cloudbreak railway line corridor recorded active Mulgara burrows in numerous areas, most of which were on sandy-clay soils with a vegetation cover of mature spinifex.
Greater Bilby (*Macrotis lagotis*)	Vulnerable	Schedule 1		The Bilby's distribution has contracted to a few small populations in southern Northern Territory and south-eastern Queensland, and the Pilbara and Sandy Deserts of Western Australia. Bilby distribution is now largely restricted to the inland sandy deserts in two broad habitat types; mulga woodlands with lateritic red earth and spinifex grassland with high fire frequency, again with the red earth (Johnson, 1989; Southgate, 1990).	The Bilby has been recorded in the Chichester subregion, Fortescue Plain subregion and Roebourne subregion. Potential Bilby burrows were recorded on the northern fringe of the Fortescue Marsh in 2005 (Davies et al. 2005; Bamford 2005). Active Bilby burrows were recorded in 2007 either side of the rail corridor access road to the north of the Marble Bar Road and potential Bilby diggings have been recorded near Cloudbreak, Christmas Creek and on the Elazac Quarry access track, although the presence of Bilbies was never confirmed.

Species	Conservation Status (EPBC Act 1999)	Conservation Status (Wildlife Conservation Act 1950)	Priority Species	Distribution and Habitat	Discussion on Potential Occurrence in Fortescue Controlled Sites
Pilbara Olive Python (*Liasis olivaceus barroni*)	Vulnerable	Schedule 1		Pilbara Olive Pythons are found throughout the Pilbara and east to Mt Augustus and north to the Gregory Range. 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 (Burbidge, 2004; Pearson, 2007).	Coffey Environments recorded a Pilbara Olive Python near the Solomon camp and others have been recorded near Glacier Valley. Numerous individuals have been seen in Karajini National Park and near the Millstream homestead. Pilbara Olive Pythons have also been recorded at Christmas Creek (ENV 2012).
Grey Falcon (*Falco hypoleucos*)		Schedule 1		Johnstone and Storr (1998) recorded the geographic distribution of the Grey Falcon as the northern half of Western Australia, excluding the coastal area of the Pilbara. They went on to suggest that it is mostly found in lighted wooded coastal and riverine plains.	A pair of Grey Falcons was recorded in eucalypt woodland along Sandy Creek near Cloudbreak (Davis et al., 2005, Bamford 2005/2010) and by Coffey Environments on multiple occasions in the same area since July 2006. Biota (2004) recorded individuals (one adult and two immature) over cracking clay adjacent to its survey site FMG20f in March 2004. The pair of Grey Falcons frequently seen east of the Cloudbreak mine site probably has a nest along the creek line in that area.
Peregrine Falcon (*Falco peregrinus*)		Schedule 4		Johnstone and Storr (1998) reported the Peregrine Falcon as being widespread including some off-shore islands. They are known to occur on a variety of habitats including cliffs along coasts, rivers and ranges and wooded watercourses and lakes.	A single Peregrine Falcon was sighted at Minga Well (Davis et al., 2005) and another by Biota (2005a) at its study site FMG20f, and Fortescue and Coffey Environments' staff have occasionally seen Peregrine Falcons around the Cloudbreak mine site.

Species	Conservation Status (EPBC Act 1999)	Conservation Status (Wildlife Conservation Act 1950)	Priority Species	Distribution and Habitat	Discussion on Potential Occurrence in Fortescue Controlled Sites
Ctenotus nigrilineatus			Priority 1	C. nigrilineatus has been recorded in the Abydos Plains survey by How and Dell (2004) but they were not caught in the Hope Downs survey or any of the Fortescue mine sites or previous Fortescue rail corridor assessments.	Three specimens were recently caught by Coffey Environments at Serenity Valley. So, although it has been infrequently caught, it is found on one and possibly a second Fortescue tenement. This species may be more widely distributed than the existing data would suggest.
Ramphotyphlops ganei			Priority 1	*Ramphotyphlops ganei* is a moderately robust blind snake	This species has been recorded near Newman, Pannawonica and Millstream, so could potentially be caught in any of the Fortescue project areas.
Bush Stone-curlew (*Burhinus grallarius*)			Priority 4	Johnstone and Storr (1998) reported the Bush Stone-curlew as being found in the western half of Western Australia and the Kimberley and prefers lightly wooded areas, but it is absent from the sandy deserts and the interior east of Leonora and Southern Cross.	Biota (2004) sighted one adult and a chick north of Redmont Camp along the rail access road and one during the Hope Downs survey. Two individuals were recorded by Coffey Environments (July 2006) in a survey near the Cloudbreak camp. Coffey Environments recorded an individual killed on the Great Northern Highway about 100km south of Port Hedland.

Species	Conservation Status (EPBC Act 1999)	Conservation Status (Wildlife Conservation Act 1950)	Priority Species	Distribution and Habitat	Discussion on Potential Occurrence in Fortescue Controlled Sites
Australian Bustard (*Ardeotis australis*)			Priority 4	Johnstone and Storr (1998) reported the Australian Bustard as occurring in most parts of Western Australia, and often found in lightly wooded grassland, sand plains vegetated with spinifex, chenopod flats, low heath and farming country.	The Australian Bustard has been frequently sighted in tenements (Biota, 2005a, b; Davis et al., 2005; ATA Environmental, 2007) in the Cloudbreak, Christmas Creek and Mt Nicholas areas and also in the Hamersley Ranges (Texasgulf, 1979; Johnstone, 1980; Ninox Wildlife Consulting, 1992). Coffey Environments frequently recorded Australian Bustards between 2006-2008 around the Cloudbreak mine site and in the vicinity of the Cloudbreak to Christmas Creek rail corridor.
Star Finch (western) (*Neochmia ruficauda subclarescens*)			Priority 4	Johnstone and Storr (1998) recorded the Star Finch being found around the western end of the Ashburton Fortescue and DeGrey Rivers in the Pilbara, and having a preference for long grass, rushes and shrubs around swamps, lagoons and permanent water bodies.	Davis et al. (2005) recorded Star Finches at Minga Well so it could be occasionally sighted in suitable habitat in any of the Fortescue tenements. Johnstone and Storr (1998) reported the Star Finch to be locally common in the Pilbara, but patchily distributed.

Species	Conservation Status (EPBC Act 1999)	Conservation Status (Wildlife Conservation Act 1950)	Priority Species	Distribution and Habitat	Discussion on Potential Occurrence in Fortescue Controlled Sites
Ghost Bat (*Macroderma gigas*)			Priority 4	Ghost Bats in the Pilbara have been reported by Armstrong and Anstee (2000) as present in the Abydos Plain, Chichester Plateau, Gascoyne Ranges, George Ranges, Hamersley Plateau and Oakover Valley.	A Ghost Bat was caught in a mist net south of the Cloudbreak mine site. Its diurnal roost is therefore likely to be in the caves and overhangs in the low ranges to the north of the Fortescue Marsh. Dunlop and Swale (1980), Texasgulf (1979) and Ninox Wildlife Consulting (1992) reported M. gigas in the Hamersley Ranges, Biota (2005b) recorded one at Robe Rivers Mesa A and Coffey Environments observed a single individual near the Solomon camp in March 2008.
Brush-tailed Mulgara (*Dasycercus blythi*)			Priority 4	Woolley (2005) has recently recognised two species of 'Mulgara'; *Dasycercus blythi* and *D. cristicauda*. Currently, there are insufficient data to separate the spatial ecology, burrows and reproductive biology of these two species. Mulgara are distributed in the inland spinifex covered sandy desert and spinifex vegetated areas in the Pilbara and northern goldfields. Within these areas their distribution is patchy and it is most frequently confined to mature spinifex dominated habitat (Gibson and Cole, 1992; Masters, 2003; Masters et al., 2003). The geographic distribution of these two Mulgara species in the Pilbara has not been clearly delineated.	Mulgara diggings, scats and tracks were observed by Biota (2004) at its site FMG105 near Cloudbreak. Surveys by Coffey Environments (ATA Environmental, 2007) of the Port Hedland to Cloudbreak railway line corridor recorded active Mulgara burrows in numerous areas, most of which were on sandy-clay soils with a vegetation cover of mature spinifex.
Long-tailed Dunnart (*Sminthopsis longicauda*)			Priority 4	Van Dyck and Strahan (2008) recorded the geographic distribution of the Long-tailed Dunnart to include the Pilbara, the Great Victoria Desert and south-western Northern Territory. McKenzie et al. (2000) caught a number during their Carnarvon Basin regional survey, extending its geographic distribution in a westerly direction. Terrestrial Ecosystems fauna database has a record of them being caught in PIL1 and PIL3. Van Dyck and Strahan (2008) recorded individuals being caught on plateaus of boulders and stones near breakaways and scree slopes, vegetated with mulga and spinifex.	Biota (2005) caught a single Long-tailed Dunnart at the Mt Nicholas mine site in spinifex grassland. As its preferred habitat is present along the proposed Cloudbreak to Christmas Creek railway line corridor, and the Solomon and Serenity Valley developments, it is possible that the Long-tailed Dunnart is on numerous Fortescue tenements.

Species	Conservation Status (EPBC Act 1999)	Conservation Status (Wildlife Conservation Act 1950)	Priority Species	Distribution and Habitat	Discussion on Potential Occurrence in Fortescue Controlled Sites
Lakeland Downs Mouse (*Leggadina lakedownensis*)			Priority 4	Van Dyck and Strahan (2008) indicated that the Northern Short-tailed Mouse predominantly occurs in the Pilbara, sandy deserts north of the Pilbara and the Kimberley. Van Dyck and Strahan (2008) reported that little is known of the biology and abundance of this species. Because of the paucity of data on this species' ecology and preferred habitat type, it is difficult to indicate areas where it might be significantly impacted on. As with all small mice, vegetation clearing, habitat fragmentation, changed fire regimes and introduced predators are the major threatening processes. Terrestrial Ecosystems' fauna survey database records indicate that the Northern Short-tailed Mouse has been caught in the Hamersley Range, along the Fortescue River to the north and south of the Fortescue Marsh.	The species was recorded by Biota (2005) and ecologia (2010a) along the mainline corridor and within Christmas Creek.
Western Pebble-mound Mouse (*Pseudomys chapmani*)			Priority 4	Van Dyck and Strahan (2008) recorded the Pebble-mound Mouse as endemic to the Pilbara of Western Australia. Biota (2005a) recorded active mounds on Triodia hill slopes (sites FMG01, FMG06, FMG07, FML02) and Triodia stony plains (FML03).	Davis et al. (2005) recorded Pebble-mound Mice mounds at Sites D and E near the Cloudbreak mine. Coffey Environments has recorded numerous inactive and active mounds in the vicinity of the Cloudbreak mine, the Cloudbreak to Christmas Creek rail corridor, along the Port Hedland to Cloudbreak rail corridor, particularly in the Chichester Ranges (ATA Environmental, 2007), and in the rocky areas around the Solomon development area.
Butler's Skink *(Notoscincus butleri)*			Priority 4	Storr et al. (1999) recorded the geographic distribution of N. butleri as the Dampier and Harding River dam. The Terrestrial Ecosystems fauna database records N. butleri in the western and central areas of the Hamersley Ranges.	Coffey Environments caught nine *N. butleri* in Serenity Valley during its March and November 2008 fauna surveys.

Species	Conservation Status (EPBC Act 1999)	Conservation Status (Wildlife Conservation Act 1950)	Priority Species	Distribution and Habitat	Discussion on Potential Occurrence in Fortescue Controlled Sites
Fortescue Grunter (*Leioptheapon aheneus*)			Priority 4	Merrick and Schmida (1984) described the Fortescue Grunter as a small species with a restricted geographic distribution. Morgan and Gill (2004) reported Fortescue Grunter being found in the Fortescue, Ashburton and Robe Rivers of the Pilbara.	This fish is likely to be found throughout each of the Fortescue, Ashburton and Robe River systems, including isolated pools that are infrequently joined after major rainfall events.
Fork-tailed Swift (*Apus pacificus*)	Migratory			The Fork-tailed Swift breeds in north-east and mid-east Asia and winters in Australia and south New Guinea (Johnstone and Storr, 1998). They arrive in the Kimberley in late September and in the Pilbara in November and the south-west in December, leaving late in April. Johnstone and Storr (1998) reported them as common in the Kimberley and uncommon to moderately common along the north-west, west and south-east coasts and scarce elsewhere.	A large number of Fork-tailed Swifts were sighted by Biota (2005a) to the west of Cloudbreak. Biota (2004) described them as common but patchy and seen along the storm front associated with ex-tropical cyclone Fay, primarily south of the Fortescue Marshes. They were seen flying over a variety of habitats including creek lines, Triodia hill slopes and sand plains.
Rainbow bee-eater (*Merops ornatus*)	Migratory			The rainbow bee-eater occurs in un-forested areas in southern Australia during summer then migrate north during the winter into northern 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.	This species is frequently seen in surveys on Fortescue tenements in a variety of habitats (Biota, 2005a; Davis et al., 2005). Coffey Environments has regularly seen Rainbow Bee-eaters in creek lines near Cloudbreak, along the Port Hedland to Cloudbreak rail corridor and in the vicinity of the Solomon development. Nest burrows have been located adjacent to and in creek lines.

Species	Conservation Status (EPBC Act 1999)	Conservation Status (Wildlife Conservation Act 1950)	Priority Species	Distribution and Habitat	Discussion on Potential Occurrence in Fortescue Controlled Sites
White-bellied Sea eagle (*Haliaeetus leucogaster*)	Migratory			The White-bellied Sea–Eagle is considered moderately common in the Houtman Abrolhos Islands off Geraldton and in addition to Australia, the species is found in New Guinea, Indonesia, China, south-east Asia and India. This species is also found in coastal and near coastal areas across Australia inhabiting most types of habitats except closed forest. The White-bellied Sea-Eagle feeds mainly off aquatic animals, such as fish, turtles and sea snakes but it takes birds and mammals as well. It breeds wholly on islands, building a large stick nest, which is used for many seasons in succession (Johnstone and Storr 1998). The breeding season ranges from May to September in the north and in winter and spring in Australia's south (Morcombe 2000).	In 2009-2010 there were two sightings within the Cloudbreak mine area (Bamford 2009) and Fortescue Marsh within the Christmas Creek area (Bamford 2010). The White-bellied Sea-eagle is uncommon as far inland as the Fortescue Marsh but will occasionally hunt in the area, particularly when creeks and rivers contain water.
Great Egret (*Ardea alba*)	Migratory			Herons and egrets all depend to some extent upon surface water for hunting. The Great Egret is the largest of the Australian egrets, and is an elegant, white wader dependent upon floodwaters, rivers, shallow wetlands and intertidal mudflats. Its diet consists of a range of small, aquatic invertebrates and small vertebrates (Frith, 1976). Given the dependence of the Great Egret upon restricted habitats, impacts of land clearing and development of these habitats are likely to have a local impact on this species. The species is also likely to be susceptible to secondary impacts, particularly changes in local hydrology, where this changes the water levels in local wetlands.	The Great Egret was recorded in the Christmas Creek area (Biota 2004).
Cattle Egret (*Ardea ibis*)	Migratory			The smallest of the 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 (Simpson and Day, 2004). Johnstone and Storr (1998) noted the species distribution in Western Australia as being confined to the irrigation areas surrounding Kununurra, however, its migratory nature, and current invasive tendencies suggest that it may occur elsewhere in the state, and may still be expanding its distribution. Given the dependence of the Cattle Egret upon restricted habitats, impacts of land clearing and development of these habitats are likely to have a local impact on the species. The species is also likely to be susceptible to secondary impacts, particularly changes in local hydrology, where this changes the water levels in local wetlands or creeks.	There are small areas of suitable habitat for this species within the Solomon Rail Project (Coffey 2010).

Species	Conservation Status (EPBC Act 1999)	Conservation Status (Wildlife Conservation Act 1950)	Priority Species	Distribution and Habitat	Discussion on Potential Occurrence in Fortescue Controlled Sites
Eastern Great Egret (*Ardea modesta*)	Migratory			Eastern Great Egrets mainly inhabit shallow water bodies, both fresh and saline. They occur across a large part of Western Australia, including the south-west, Kimberley and Pilbara. The Great Egret is common to very common in the well-watered Kimberley flatlands, and scarce to moderately common elsewhere within its range (Johnstone and Storr 1998). This species' diet consists predominately of small fish and crustaceans. They breed colonially in trees standing in water around wooded swamps and river pools, 4-13m above water (Morcombe 2000). The nest is built as a rough, loose, shallow platform. Four eggs are laid in summer in the Kimberley and during the spring in regions further south (Johnstone and Storr 1998).	The Eastern Great Egret has been recorded from creeks and water bodies surrounding Coudbreak (Bamford 2006, 2009, Biota 2005). Recorded at Roy Hill (Bamford 2010) and several records from Fortescue River. Several records from Fortescue River and water bodies within Karijini National Park and the Hamersley Range (ecologia 2010b). They are likely to hunt along creeks and the Fortescue Marsh when they contain water.
Wood Sandpiper (*Tringa glareola*)	Migratory			The Wood Sandpiper is a trans-equatorial migrant, breeding in north Europe and Asia and spending the non-breeding months in Africa, south Asia and Australia. Generally uncommon, particularly in the interior, they arrive in Australia in August and leave again in May (Johnstone and Storr 1998). The Wood Sandpiper occurs singly, in pairs or small parties. Preferred habitat consists of shallows of wooded fresh waters, lakes, flooded pasture and occasionally in mangroves (Morcombe 2000).	The Wood Sandpiper has been recorded foraging along pools on the Fortescue River approximately 22 km south-east of Cloudbreak (Bamford 2009). It is likely to forage within the Cloudbreak area along creeks and the Fortescue Marsh when they contain water. Record from Fortescue Marsh, within Christmas Creek site (Bamford 2010).
Common Greenshank (*Tringa nebularia*)	Migratory			The Common Greenshank is a non-breeding visitor to well-watered regions of Australia that can be observed in all months. It is uncommon to moderately common on coasts and coastal plains and rare to scarce elsewhere (Johnstone and Storr 1998). It can be found in shallow fresh waters and salt waters. Like most waders they feed on small invertebrates but will also take small fish.	The Common Greenshank has been recorded foraging along pools on the Fortescue River approximately 22 km south-east of Cloudbreak (Bamford 2009). It is likely to forage within the survey area along creeks and the Fortescue Marsh when they contain water. Record from Fortescue Marsh, within Christmas Creek site (Bamford 2010).

Species	Conservation Status (EPBC Act 1999)	Conservation Status (Wildlife Conservation Act 1950)	Priority Species	Distribution and Habitat	Discussion on Potential Occurrence in Fortescue Controlled Sites
Red-necked Stint (*Calidris ruficollis*)	Migratory			Red-necked Stints are primarily coastal, occurring on the edge of sheltered estuaries, beaches and salt lakes both on the mainland and on offshore islands. They can also occasionally occur on inland salt lakes and freshwater swamps. The species is a non-breeding migrant, arriving from Siberia and Alaska in October and returning in March. They are common to very common on most coasts, rare in the northern interior and moderately common in the southern interior. The species typically occur in small flocks and is highly gregarious with other species. They are omnivorous, feeding on insects and molluscs captured from exposed mudflats as well as seeds and plant matter.	The species is rare in the Pilbara interior with only a single record from within 100km of the survey area. A single individual was recorded from 'a big pool on Roy Hill' in May 2005. Record from Fortescue Marsh, within 10km of Christmas Creek site (Bamford 2010). The species may occasionally forage within the survey area during spring/summer along creeks and the Fortescue Marsh when they contain water (ecologia 2010).

Appendix 5: Key Activities

Key Activity	Description
Vegetation clearing	Causing substantial damage to native vegetation. This includes: • the killing or removing of native vegetation; • the severing or ringbarking of trunks or stems; • the draining or flooding of the land; • the burning of vegetation; • the grazing of stock; or • any other activity that kills or damages native vegetation. A guide to clearing permits under the *Environmental Protection Act 1986*. The definition includes all types of native vegetation, including those found in aquatic and marine environments. It includes all native grasses, shrubs and trees but does not include intentionally sown native vegetation.
Ground disturbance	Disturbance of the topsoil or surface rock layer of the ground, or a waterway, by machinery in the course of grading, excavating, digging, dredging or deep ripping. Includes: • Top soil removal; • Growth medium recovery; and • Earthworks.
Construction/ establishment of infrastructure	Construction and completion of substantial permanent structures.
Construction/ establishment of linear infrastructure	Construction and completion of linear infrastructure, which has the potential to interrupt sheet water flows e.g. rail lines, roads.
Open pit mining	Includes: • First blast; • Excavation; • Free digging; • Other in-pit activities; • Until loaded onto haul trucks for transport to Ore Processing Facility. Excludes construction of waste rock dumps or stockpiles.
Vehicle movement	Movement of freight trucks, light vehicles, buses, airplanes.
Waste disposal	Disposal of waste materials including sewage; rubbish; tyres; brine but excluding waste rock and dredge spoil.
Ground water abstraction and distribution	Removal of ground water from underground aquifer.
Ground water injection	Re-injection of previously abstracted groundwater to underground aquifer.
Decommissioning /closure	The process that begins near or at the cessation of mineral production and ends with the removal of all unwanted infrastructure and services.
Rehabilitation	Process used to repair the impacts of mining on the environment, including landform design and revegetation.

Appendix 6: Process Flow Diagram

New Approval

Undertake fauna surveys in accordance with applicable guidance (See Section 1.3 of Plan)

Record survey data in GIS and BMS

Conduct a risk assessment in accordance with 100-ST-RK-0014

Locate, design, construct and operate infrastructure according to risk outcomes

Design and locate burrow pits according to 45-PL-EN-0018

Exploration

Start

Conduct a desktop assessment for GDP permit applications

Undertake fauna surveys in accordance with applicable guidance (See Section 1.3 of Plan)

Review design against survey data and where practicable avoid/ minimise clearing or fragmentation

Cap all exploration drill holes at or below ground level

Raise awareness and provide training to ensure fauna and habitat are protected

Adopt measures at open sumps to prevent fauna access and minimise potential impacts on fauna

Record fauna sighting in BMS and where confirmed by a fauna specialist update GIS/ BMS and notify accordingly.

Conduct vegetation clearing in accordance with a permit issued under 100-PR-EN-0004

End

Are conservation significant fauna and/ or habitat present?

Yes

Can the activity be relocated?

No

Yes

Relocate the exploration activity

Relocate bore/ sump/pad locations where possible

No

Conduct progressive rehabilitation in accordance with E-PL-EN-0002, 45-PL-EN-0023 or a Mine Closure Plan

Where a fauna death or injury has occurred investigate and report in accordance with 100-PR-SA-0011

Construction to Decomissioning

Start

Conduct a risk assessment in accordance with 100-ST-RK-0014

Locate, design, construct and operate infrastructure according to risk outcomes

Incorporate design measures where linear infrastructure may result in significant impacts

Design and locate burrow pits according to 45-PL-EN-0018

Are conservation significant fauna and/or habitat present in the GDP area?

Yes

Has a Level 2 survey been conducted for the GDP area?

No

Yes

Conduct a desktop assessment for GDP applications in accordance with 100-PR-EN-0004

No

Direct applicant to undertake fauna surveys in accordance with applicable guidance (See Section 1.3 of Plan)

Reassess

Raise awareness and provide training to ensure fauna and habitat are protected

Clean, inspect and certify all vehicles to avoid weed spread according to 45-PL-EN-0013

Identify ESAs on the ground prior to disturbance according to E-EN-PP-1102

Ground truth the area before ground disturbance and implement mitigation measures where animals present

Record fauna sighting in BMS and where confirmed by a fauna specialist update GIS/ BMS and notify accordingly.

Conduct vegetation clearing in accordance with a permit issued under 100-PR-EN-0004

Adopt measures at open sumps to prevent fauna access

Include management measures for excavation and trenching activities to minimise potential impacts on fauna

Where noise emissions may impact fauna manage according to 45-PL-EN-0028

Direct lighting onto active construction/ operational area to avoid light overspillage

Manage waste according to 45-PL-EN-0014

Develop a Feral Animal Program

Carry out prescribed burns according to 45-PL-EN-0020

Minimise dust according to 45-PL-EN-0030 and P-PL-EN-0010

Implement measures on haul and access roads to minimise injuries and deaths

Develop fauna management and handling procedures to support the Plan

Conduct progressive rehabilitation according to 45-PL-EN-0023 or a Mine Closure Plan

When dewatering or reinjecting, monitor groundwater conditions and mitigate where necessary according to 45-PL-EN-0029

Develop and implement a Fauna Monitoring Program in accordance with 45-GU-EN-0002

Where a fauna death or injury has occurred investigate and report in accordance with 100-PR-SA-0011

Review mitigation measures and monitoring programs

End

Shared between New Approval and Construction to Decomissioning

Shared between Exploration and Construction to Decomissioning

Appendix 7: Conservation Significant Fauna Monitoring Guidelines

Guideline

Conservation Significant Fauna Monitoring Guidelines

Environment

December 2013
100-GU-EN-0034

Fortescue
The New Force in Iron Ore

	Conservation Significant Fauna Monitoring Guidelines		**100-GU-EN-0034**
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1. INTRODUCTION

The Conservation Significant Fauna Monitoring Guidelines (the Guidelines) have been developed to incorporate best practice methods to address the goals and objectives in the *Conservation Significant Fauna Management Plan* (100-PL-EN-0022). They are applicable to Fortescue controlled sites[1] and provide the basis for achieving consistency in fauna monitoring across Fortescue operations.

The Guidelines describe:

- fauna monitoring goals and objectives
- selection of monitoring parameters suitable for target fauna
- monitoring program design, including the selection of monitoring sites
- specific monitoring methodologies and techniques employed by Fortescue for targeted Conservation Significant Fauna
- data management, reporting and review.

The Guidelines have been designed to measure the effectiveness of the broad management actions outlined in the *Conservation Significant Fauna Management Plan* (100-PL-EN-0022). The outcomes of the monitoring programs for each site will contribute to ongoing improvements in management actions to ensure an adaptive management approach is adopted.

The implementation of the Guidelines will address the monitoring conditions outlined in Ministerial Statements 690, 707, 862 and 899 and EPBC approvals 2005/2205, 2010/5706, 2010/5513, 2010/5567 and 2010/5696.

[1] Fortescue controlled sites are sites that are under Fortescue's legal control including exploration sites, project sites, operational sites (sites that are managed and operated by Fortescue and sites that are managed by Fortescue but operated by contractors) and the Perth offices.

2. OBJECTIVE AND SCOPE

The overall objective of Fortescue's fauna monitoring programs is to monitor and measure the success of management actions to protect conservation significant fauna species and ensure compliance with applicable State and Commonwealth approval conditions.

The objective of the Guidelines is to provide guidance for the development of monitoring programs. The guiding objectives of the monitoring programs are:

1. Determine presence (or absence) of conservation significant fauna within Fortescue controlled sites.
2. Measure impacts of Fortescue's activities on conservation significant fauna within the Fortescue controlled sites.
3. Monitor and measure the success of management measures to inform an adaptive management approach.
4. Monitor and measure spatial and temporal changes in the abundance and distribution of conservation significant fauna within Fortescue controlled sites.

The scope of Fortescue's fauna monitoring programs include some conservation significant fauna species that are cryptic, have low detectability or are only likely to be present in low densities. Where a species is known to occur within a monitoring area, the monitoring program should include a detection assessment to estimate the likelihood of detection when the species is present and to inform interpretation when the species is not recorded. Additionally, where species are identified at low densities, comparisons of habitat usage and spatial distribution between control and impact sites will be necessary to detect potential impacts rather than population or density as stated in Section 9.2 of these Guidelines.

For the purposes of the Guidelines, conservation significant fauna is limited to conservation significant fauna species listed under the *Wildlife Conservation Act 1950* and the *Environment Protection and Biodiversity Conservation Act 1999* that have been recorded within Fortescue controlled sites as specified in Table 1 of the *Conservation Significant Fauna Management Plan (*100-PL-EN-0022*)* or where monitoring requirements have been specified in State and Commonwealth approval conditions (see Table 3).

3. CONSTRAINTS AND LIMITATIONS

Fortescue's fauna monitoring programs include some conservation significant fauna species that are cryptic, have low detectability or are only likely to be present in low densities. Combined with the 'boom and bust' ecological cycles experienced in arid Australia obtaining a statistically rigorous data set for a monitoring program is challenging.

Monitoring programs are also limited by seasonality, resources (including expertise) and baseline information. In some instances, land access or on-ground activities may be restricted by site conditions (i.e. flooding and general access issues with lack of roads), land tenure and regulatory requirements. These limitations require careful consideration prior to planning and implementation of monitoring programs for a given operations area. Due to the very specialised and technical nature of fauna monitoring, external personnel/resources will be required and should be identified early in the planning process.

The type and extent of data collected may potentially be limited by the resources and techniques available and the degree of bias and variability of those techniques. However, every attempt should be made in the planning process to ensure that the minimum requirements outlined in the State and Commonwealth survey guidelines and guidance statements are met in order to obtain the maximum amount of information possible and comply with the recommended guidelines.

4. MONITORING SITE SELECTION

An effective fauna monitoring program should be based on replicable sampling at impact and control (reference) sites. Control sites are sites that are not directly or indirectly impacted by disturbance activities (away from disturbance) while impact sites are sites that are in close proximity to disturbance activities that may be exposed to the direct or indirect effects of proximal ground disturbance such as noise, dust, vibrations, vehicles strikes, artificial lighting etc. (close to disturbance).

Appropriate monitoring sites should be located within areas of suitable habitat for each of the targeted species, using the following as guidance:

- The type and variety of substrate, vegetation, topography, geographic extent and habitat variation will help determine the number and location of control and impact sites required. The control and impact sites should correspond with habitat type, quality and extent, as well as numbers of each site for each monitoring program. A ratio of 1:1 should be maintained i.e. there should be the same number of control sites and impact sites in the target area.
- As many of the preferred habitat types for each target species should aim to be represented in the monitoring program, with at least one monitoring site per representative habitat type, where possible. This should be reflected both in impact sites and control sites (1:1).
- The monitoring sites should be in areas of habitat suitable for conservation significant fauna that have been identified from previous baseline and targeted surveys.
- As outlined in State and Commonwealth terrestrial vertebrate fauna assessment guidelines and guidance statements, seasonality of monitoring is critical for each of the targeted species. Timing of monitoring for each of the target species is variable and based on the period of highest activity whilst avoiding the reproductive season and avoiding undue stress to breeding individuals. Therefore, seasonality should be considered prior to implementation of monitoring programs (see Table 3).
- The same design and monitoring techniques should be employed at both control and impact sites, and monitoring should be conducted concurrently at both control and impact sites.
- Availability of access to monitoring sites should be taken into account prior to their selection. This includes any potential land access problems such as their locations within pastoral leases, national parks/government land, third party tenement etc. All sites will need to to be accessed at all times during monitoring and under all conditions (i.e. irrespective of climate and logistical issues). Once a monitoring program commences, sites will need to be able to be accessed daily in order to check traps. Site reconaissance may be necessary prior to the beginning of the next annual monitoring program, in order to determine accessibility to sites in successive years of monitoring.
- Heritage sites should be considered when selecting monitoring sites to avoid access issues and potential impacts.

- Monitoring should adopt recommended techniques and methodology as described in the *Environmental Protection Authority* (EPA) Guidance Statement No.56 (EPA 2004), *Technical Guide–Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA 2010) and the Environment Protection and Biodiversity Conservation (EPBC) Act survey guidelines for Australia's Threatened Bats, Frogs, Mammals, Reptiles and Fish (DWHA 2010a, 2010b, 2010c; DSEWPaC, 2011b, 2011c, 2011d).

5. MONITORING PROGRAM DESIGN

The monitoring program design may need to be adaptive over time, dependent on the quality and quantity of data collected from each site over time, and incorporate any innovations in monitoring techniques and methodologies over time.

Monitoring design options include point or quadrat designs, grid formations, transect design or web design (Freegard 2009). These techniques are summarised in Table 1 below.

Table 1: Conservation Significant Fauna Monitoring Program Design Options

Design Options	Design Descriptions
Point or quadrat	Used when observing species presence or assessing the distribution of a species. This sampling method is frequently combined with other methods including transect design.
Grid formation	Used as a means of measuring or monitoring a population size, habitat use or distribution within a given area. Grid formations are preferred when targeting small, less mobile species or sampling a small area (<5ha). A trapping grid can include a range of trapping methods and should be designed to best meet the objectives of the monitoring program.
Transect	Used for invasive and non-invasive monitoring methods to measure relative abundance of wide ranging species in a small or medium sized area (>5ha). A trapping transect can include a range of trapping methods and should be designed to best meet the objectives of the monitoring program.
Web design	Used for measuring density and relative abundance in a small or medium sized area (>5ha). A web design has good detectability of targeted species but requires additional resources to cope with the demanding logistics.

6. MONITORING PARAMETERS

A set of monitoring parameters have been selected to provide broad coverage of changes to fauna population and distribution and associated habitat that can be expected under a range of different mining related impacts. The number of monitoring parameters will vary depending on the species and site specific conditions.

Table 2: Conservation Significant Fauna Monitoring Parameters

Monitoring Parameters	Method of recording	Information obtained
Individual data/biometric data	Direct results from trapping and observation monitoring methods	Individual animal biometric data such as sex, body condition, location of individuals, movements of individuals, and breeding status.
Population	Cumulative results from single season monitoring programs, as well as over annual programs	Sex ratios of a population, Geographic extent of population and geographic movement of individuals and populations. Fluctuations of numbers annually, sex ratios, recaptures, etc.
Habitat characteristics	Observation, habitat mapping, photographs etc.	Changes in quality of habitat over time through cumulative results. Identified habitats that are targeted for monitoring are to be mapped and monitored for extent and quality.
Meteorological data	Data from Weather Stations installed near monitoring site locations	Fluctuations in weather and rainfall on a daily/weekly/annual basis. Temperature and relative humidity. Degree of influence of weather variables that impact on monitoring data.
Environmental threats	Observation, mapping, photographs etc.	Influence of a threat (i.e. fire, flooding, weeds, overgrazing, feral animals etc.) on other measured parameters.

7. METHODOLOGY

The following sections describe monitoring methodologies and techniques to be used to measure the conservation significant fauna monitoring parameters identified in Table 2. These are intended to serve as a guide rather than rigid prescriptions. However, it is important to ensure standardisation across all monitoring programs to enable the use of consistent data analysis methods, comparisons across company operations and reporting. These issues should be considered during the monitoring program design phase.

Fauna monitoring is an evolving field and should be reviewed regularly to ensure the most appropriate methods and design are utilised.

7.1 Monitoring Methods for Mammals and Reptiles

The following recommended monitoring methods for mammals and reptiles have been adapted from recommended survey techniques and methodology from the *Survey Guidelines for Australia's Threatened Mammals* (DSEWPaC 2011c), *Survey Guidelines for Australia's Threatened Reptiles* (DSEWPaC 2011d), the *Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA 2010) and Fortescue's *Terrestrial Vertebrate Fauna Assessment Guidelines* (100-GU-EN-0006).

7.1.1 Trapping methods

Pitfall traps

Pitfall trapping is a simple and productive method for broadscale sampling of small to medium-sized ground-dwelling species. Standardised design of trap configurations and timing permit more robust analyses of data than less quantitative methods such as hand collecting. Pitfall trapping is non-species specific and is useful in the capture of a wide range of species and to determine faunal assemblages of a habitat type.

Pitfall traps generally comprise of a combination of plastic buckets and/or PVC piping buried into the ground, with the open top flush to the ground.

Pit traps should include the use of "drift fences" constructed of a fine mesh such as flywire, or shade cloth, running over the centre of a pit and often linking together a number of equidistantly spaced pits (Webb 1999). These fences are buried at their base and are usually 20 to 30 cm in height. Drift fences direct animal movement towards the pits thus increasing the likelihood of capture.

The recommended monitoring methods for pit traps include:

- Pits should be constructed using either PVC pipe (minimum 600mm deep x 150mm wide) or plastic buckets (minimum 400mm deep x 280mm wide), or a combination or both, with preference given to PVC piping as they are deeper (to prevent agile species from jumping or climbing out) and generally provide more protection than buckets.

- Sampling design will vary with the nature of the environment being investigated, its spatial extent and the species targeted. Sampling design will need to be assessed independently at each sampling site to be effective.
- Place at least three sampling sites per representative habitat.
- Set traps for a minimum of seven consecutive nights.
- Check traps early in the morning and cover during the day if targeting only mammal species.

Animal care and ethics issues related to pit traps include:

- minimise the possibility that more than one animal is trapped at one time by using a selective barrier over the entrance;
- prevent hypothermia by providing leaf litter or other suitable bedding material and shading the trap;
- check traps within 2-3 hours of sunrise and then closed until sunset;
- prevent drowning by covering traps during rain, not setting them in low-lying areas or wetlands where they may fill with water;
- avoid deprivation of food and water (by providing a water saturated sponge);
- cover up or dig up traps when they are not required;
- construct traps of an appropriate size;
- consider the affects of catching non-target species;
- protect trapped animals from ants or other insects by using an ant deterring powder around the rim of the entrance.

Funnel Traps

Funnel traps are generally made from a mesh-type material (e.g. dense shade cloth) covering a wire framed rectangular prism with small opening funnels at either end. Laid parallel to a drift fence, animals may enter the funnel trap through the funnels at either end, but not be able get out. Most monitoring programs using funnels have involved the placement of pairs of funnels, one either side of a drift fence, alternating with pitfall traps along the fence.

Funnels are effective in capturing reptiles that readily escape from pit traps but are generally not effective in capturing mammals.

Animal care and ethics issues relating to funnel traps include:

- Their use in hot conditions should be carefully considered or avoided where possible.
- Position the traps under natural shade or provide adequate shade and insulation through covering with grass, Spinifex or leaves etc.

- Leave traps closed during the day, returning late afternoon to re-set and open to ensure animal deaths do not occur from daytime exposure.

Elliott Traps

Elliot traps are a brand of aluminium box traps that are used to capture small-sized ground-dwelling species by a trigger plate on the floor of the trap causing the hinged door to snap shut when an animal is enticed into the open trap door with the use of bait.

Elliott traps are available in a range of sizes, the uses of which is dependent on the size of the species being targeted:

- Elliott B – Large (460mm x 1555mm x 150mm). Used to catch the largest of the small-sized ground dwelling and arboreal mammals, whose long tails can get caught in the door of the small Elliott traps as they snap shut (i.e. Northern Quoll).
- Elliott A – Medium (330mm x 100mm x 90mm), and
- Elliott E – Small (230mm x 90mm x 80mm). Elliott traps A and E are used to capture small-sized ground-dwelling species, particularly small to medium sized dasyurids, and rodents.

When placed in arrays or along transects, Elliott traps are a very effective way of capturing small-bodied mammals, particularly small to medium sized Dasyurid species (i.e. Mulgara and Northern Quoll). The recommended distance between individual traps ranges from 10 to 20 metres and the overall layout may incorporate a combination of different size Elliott traps.

A universal bait, made up of rolled oats, peanut butter and honey should be placed inside the trap to attract animals. The amount of bait used should be generous so as to supplement the diet of an animal trapped overnight that has otherwise lost the opportunity to forage. Sardines can be mixed into the bait mixture for extra enticement for Dasyurid species, particularly for Northern Quoll and Mulgara.

The recommended monitoring methodology for Elliott traps involves:

- Sampling design will vary with the nature of the environment being investigated, its spatial extent and the species being targeted. Sampling design will need to be assessed independently at each sampling site to be effective.
- Ensure at least three sampling sites per representative habitat.
- Traps to be set for seven consecutive nights.
- Check traps within two to three hours of sunrise then close until sunset.
- Bait traps with universal bait and rebait and open the traps in the late afternoon.
- Consider placing two traps at each trap station to saturate trapping effort if common species are likely to limit the detection of the target species.
- Provide nesting material to provide shade or warmth to captured fauna.

Animal care and ethics considerations for Elliot traps include:

- Provide bedding material for shelter and to prevent hypothermia.
- Place traps in locations where they are protected from climatic conditions, taking advantage of natural cover and insulation. Install shadecloth where necessary.
- Traps placed on slopes on rocky outcrops should be firmly secured to avoid the trap becoming dislodged when an animal is captured.
- Use universal baits and ensure enough bait is available to supplement the animal's diet from loss of time foraging while trapped.
- Traps need to be checked twice daily to ensure ants do not become an animal welfare issue or where climatic conditions such as significant heat could result in fauna deaths.
- Baits should be replaced every day to reduce the likelihood of an ant infestation and the possibility of a health risk to the captured fauna.
- Timing of fauna monitoring must consider animals that are breeding, lactating or have dependent young to ensure they are not unduly stressed (EPA 2010)(Table 3).
- Leave traps closed during the day, returning late afternoon to re-set and open to ensure animal deaths do not occur from daytime exposure.
- Trap for a maximum of seven consecutive nights to reduce potential recapture.

Cage Traps

Cage traps are made of wire mesh and are available in a variety of sizes. They operate through a treadle and wire link holding open a door. To access the bait the animal must cross a treadle which causes the trap door to be released and locked in a closed position.

Cage traps may be used as the sole trap type, usually for species-specific projects, or in combination with other types such as Elliot traps where larger mammal species are expected to occur. The trap layout may be along a transect, or as part of an array or grid design, and placed further apart than Elliot traps as the target species are usually larger and have greater home ranges.

Species appropriate bait should be placed inside the trap to attract animals that may be in the vicinity. The amount of bait used should be generous so as to supplement the diet of an animal trapped overnight that has otherwise lost the opportunity to forage.

The recommended monitoring method for the use of cage traps involves:

- Sampling design will vary with the nature of the environment being investigated, its spatial extent and the species targeted. Sampling design will need to be assessed independently at each sampling site to be effective.
- Three sampling sites per representative habitat.

- Set traps for seven consecutive nights.
- Check traps within 2-3 hours of sunrise then close until sunset.
- Freshly bait traps with universal bait and open traps in the late afternoon.
- Consider placing two traps at each trap station to saturate trapping effort if common species are likely to limit the detection of target species.

Animal care and ethics considerations related to cage traps include:

- Provision of bedding material for shelter and to prevent hypothermia.
- Place traps in locations where they are protected from climatic conditions, taking advantage of natural cover and insulation. Install shadecloth where necessary.
- Traps placed on slopes or rocky outcrops should be firmly secured to avoid the trap becoming dislodged when an animal is captured.
- When baiting traps, ensure sufficient bait is available to supplement the animal's diet from loss of time foraging while trapped.
- Baits should be replaced every day to reduce the likelihood of an ant infestation and the possibility of a health risk to the captured fauna.
- Timing of fauna monitoring must consider animals that are breeding, lactating or have dependent young to ensure they are not unduly stressed (EPA 2010) (Table 3). Leave traps closed during the day, returning late afternoon to re-set and open to ensure animal deaths do not occur from daytime exposure.

7.1.2 Observation/Active Searches

Observation activities are required for effective fauna monitoring as other invasive techniques such as trapping are unlikely to maximise species detection in an area. Observation methods may include:

Spotlighting

Spotlighting may be useful for a variety of species including mammals, nocturnal birds, snakes and amphibians. Spotlighting can be done from a vehicle which allows for coverage of large distances along roads and tracks. Portable spotlights can be used while walking to investigate at a finer scale or in areas where vehicle access is not possible.

Spotlighting from a vehicle may involve a number of people searching with a spotlight, recording and catching fauna as required. Fauna observations are made as the vehicle is driven at low speed, along a predetermined transect.

The following recommendations are suggested for spotlight monitoring:

- Use a lightweight battery powered, hand-held spotlight (minimum of 30 watt) that is easily carried and battery powered.
- Monitor at least two 200m transects per 5 hectare site and maintain at least 100m between each transect.
- Move at a speed of 10m per minute (this will vary according to observers experience and the vegetation density of the site).
- The spotlight should be held near the observer's line of vision to maximise the chance of detecting eye shine (light reflected from animals' eyes).
- The spotlight beam should be moved slowly at a consistent speed over the relevant habitat.
- If necessary, binoculars may be used once an animal has been spotted to confirm the species identity and to record any distinguishing features.
- The direction of travel should be decided in advance, either by locating a track or by marking out a transect with flagging tape. In this way the observer moves a known distance at a set speed or approximately 5 kilometres per hour in a vehicle to ensure that the planned monitoring effort is achieved.
- Spotlighting should be conducted as quietly as possible. This is so that animals are less likely to be disturbed and carry on with their normal activities rather than hiding or fleeing before they can be seen.
- Transect monitoring should be repeated for a minimum of two separate nights where possible.
- Avoid windy or rainy nights which can reduce fauna activity and the ability to detect fauna.

Animal care and ethics considerations for spotlight monitoring include:

- Minimise the amount of time that a spotlight is shone directly on fauna.
- Use a narrow beam to reduce the blinding effect that the light may have on the animal's vision once the animal has been spotted.
- Use a red or preferably a dimmer switch to reduce light intensity for prolonged observations once the animal has been spotted.

Active Diurnal Searching

Diurnal monitoring will involve searching particular habitats and may include active searches of burrows, turning over rocks and raking soil and leaf litter. Diurnal monitoring requires a good knowledge of which species could be present in an area and their specific habitat preferences. This method can be used to provide supplementary information to trapping programs as many species that may have low capture rates in traps, may be readily caught by hand.

Diurnal hand searches may be used for reptiles that shelter in or under particular microhabitats. For reptile species that are relatively inactive, visual searches of suitable microhabitats with the assistance of a torch may be suitable. This monitoring method can be useful when habitat disturbance is an issue for the target species.

As a guide, diurnal monitoring conducted on foot should be conducted at approximately 10m per minute. The recommended monitoring effort for diurnal searches is a two hour search time for each hectare (DSEWPaC, 2011b). For small sites, transects spaced at 50-100m intervals across the sample site or in quadrats in representative habitats, may be necessary to ensure an area is systematically searched.

Diurnal searches for tracks and other signs (secondary)

Searching for tracks, diggings, nests, scats, claw marks on tree trunks and other signs are useful for detecting species that are not readily trapped. Species with clumped distributions are often difficult to detect with standardised trapping regimes but may be readily detectable through observation as much larger areas can be assessed than just the specific trapping locations.

Consideration of animals being flushed from their shelter during diurnal searches should be considered if potential predators are present.

This monitoring method should be used in conjunction with targeted trapping or some other form of confirmation such as spotlight monitoring to be certain of correct identification and determine the continued presence of the target species. This technique can also be used to determine whether target fauna species are utilising fauna friendly culverts to traverse linear infrastructure such as the rail.

The recommended monitoring effort is approximately two hours search time for each hectare (DSEWPaC, 2011c).

7.2 Supplementary Monitoring Methods

Supplementary techniques can be used to provide evidence of a species present in an area where they were not recorded through the primary detection methods.

7.2.1 Remote cameras

Remote camera methods include motion sensors that only activate the camera when an animal is in the field of view and close to the camera. Cameras can be left to operate for many days/months, depending on batteries. Locations that are suitable for camera use include along tracks and runways where there are signs of activity, focused on burrow entrances or on some form of lure or bait.

This technique can also be used to determine if management measures, such as fauna friendly culverts are being used by targeted fauna species, as well as their use by feral animals.

The recommended monitoring method for use of remote cameras includes:

- Deploy cameras for at least 12 nights within areas of suitable habitats for target species.
- Where using baited remote cameras use universal bait.
- Choose a suitable camera based on target species and size of target area.
- Use a very firm support to avoid false triggers and set sensor height according to target species.
- Place the sensor in a position where there is no vegetation in the foreground.
- Set the camera 2–5 metres from the target area to avoid out of focus pictures.
- Ensure all cords are reinforced with duct tape or similar materials to help reduce cord loss due to animals chewing them (Swann *et al*., 2004).
- Camera traps should not be used as the only monitoring method and should always be used in conjunction with other standard monitoring techniques (for example, spotlighting, hair tubes, Elliot traps, cage traps etc). Failure to detect a species following a monitoring using a camera trap does not mean the species is absent from the study area.

7.2.2 Sand pads

Pads can be small grids of approximately one square metre of smoothed sand or larger areas which are “brushed” along a sand track or fire break. Where small pads are established use bait to entice animals to cross the sand while long “drags” rely on covering large areas thus increasing the likelihood that animals may cross.

These techniques are most useful for targeted species assessment rather than as a general monitoring methodology, as there is often a high degree of uncertainty with smaller animals about the species identification. Sand pad data can be used reliably as an indication of presence and activity levels, but is less useful for estimates of abundance. This monitoring technique could be useful for determining usage of fauna culverts.

The recommended methods for sand pads include:

- Establish at least two one metre wide soil plots (raked substrate with fine grain sand added if required) across vehicle tracks, animal pads or other suitable areas per monitoring site.
- Set soil plots for three consecutive nights.
- Rake plots smooth each morning after the tracks have been identified and recorded, taking plaster casts or photographs of prints that cannot be distinguished in the field (provide a scale for all photographs).
- Ensure that the investigator is capable of accurately distinguishing species tracks (for example, demonstrated experience) and is familiar with the tracks of the target fauna.

- Consider having a cast of the target species tracks made from museum specimens in advance to help distinguish tracks in the field by comparing against the cast (S Ingleby pers. comm.).

7.2.3 Predator scat and pellet analysis

Predator scats and regurgitated pellets from owls can provide valuable information on the presence of other vertebrate species. The best location for finding material are below nests or perches of raptors, along breakaways and under rock overhangs or in cave entrances. This monitoring technique has been effective in detecting small-sized mammal species and helping to define the distribution ranges for a number of the small arid-zone species. Where this technique is used, advice and cooperation should be sought by an expert for instructions on appropriate collection and preservation methods. Analysis and species identification from predator scats and regurgitated pellets is specialised and should be undertaken by a technical expert.

7.2.4 Hair sampling devices

Hair sampling devices are designed either as a tube through which the target animal can fit or as a funnel in which just the head of the animal will fit. Within the tube or funnel there is some form of adhesive tape exposed, usually on the top and sides, on which a sample of hair is caught. Avoid placing tape on the bottom of the tube to minimise the chance of catching non-target species (e.g. small reptiles). Baiting the tube/funnel at the narrow end of the funnel will increase the success rate of this method. A range of tube and funnel sizes should be used to maximise the likelihood of species detection.

Hair sampling devices can be easily positioned in a variety of habitats and can be left on site for considerable lengths of time without the need for daily checking and allow broad areas to be examined. The devices should be located where animal movement is concentrated such as in runnels in dense vegetation. Studies show considerable variation in the effectiveness of hair tubes and funnels for different taxa and geographic locations (Lindenmayer *et al.* 1999; Mills *et al.* 2002) and may not reveal the presence of all mammals present. They do not provide information on abundance, unless genetic analysis of samples is undertaken.

Hair analysis and species identification is specialised and should be undertaken by a technical expert.

The recommended monitoring design for hair sampling devices is as follows:

- Place 20 devices at each sampling site.
- Place devices 20 metres apart in two parallel transects separated by 25 metres (this is dependent on species and those with a large home range will differ).
- One sampling site per representative habitat, with at least two sampling sites per 5 hectares (replication across habitat types in areas greater than 5 hectares).

- Set devices for 14 consecutive nights.
- Bait should target the species monitoring or alternate devices with a meat based bait and a standard bait.
- Re-bait the devices if possible, unless targeting a “shy” species.

Animal care and ethics issues to address when using this monitoring method include:

- The floor of the tube is free of adhesive tape to prevent small lizards and frogs becoming stuck and potentially harmed.
- Angle the tube with the entrance pointing slightly downwards for drainage.
- If an animal does become stuck to the tape, carefully trim the tape on the animal to as small a size as possible or gently ease with vegetable oil under the tape and slide it off.

7.3 Monitoring Methods for Bats

The following monitoring methods for bats have been adapted from the *Survey Guidelines for Australia’s Threatened Bats* (DWHA 2010a) and the *Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA 2010).

7.3.1 Echolocation call detection

Bat detection devices, such as the SM2Bat and ANABAT systems, have become critical tools in the detection and identification of bats. Recording echolocation calls is the most effective, non-invasive monitoring method which ensures a greater detection of species/individuals. Echolocation recording can also provide data on the relative activity of bats in a particular site to help ascertain whether an area is likely to be utilised as a foraging site, or if bat calls are recorded at a more intensive level, it may be suggestive of a roosting site.

These systems work through converting ultrasonic frequencies into audible signals that can be recorded. Call structure is then analysed by a professional using specialised software.

The Department of the Environment (DoE) (DWHA 2010a) recommends that rather than relying solely on stationary monitoring stations, a combination of real-time monitoring using transects and other bat detection methods (as described below) will yield the most useful results for detection and monitoring.

7.3.2 Roost/Cave searches

Roost/Cave searches comprise of invasive or non-invasive observation techniques. Non-invasive techniques involve:

- observation and recording of bats from the entrance of a cave as they enter and leave a roost/cave area,

- the use of echolocation detectors set up at the entrance of caves,
- using cameras/video recorders, or
- entering a roost/cave at night (when the bats have vacated the area) and actively searching for signs of bat activity (urine stains, guano etc.)

The alternative, more invasive technique involves entering a roost/cave during the day and observing bats directly. This technique is not recommended as it is highly invasive, and could result in significant disturbance to the roost and result in the bats vacating the roost for several weeks/ months and even permanently for very sensitive species. If this method is deemed necessary for bat identification and roost location, consultation with the Department of Parks and Wildlife (DPaW) or DoE will be necessary.

Roost searches are not an approved monitoring method for the Pilbara Leaf Nosed Bat as it may cause significant disturbance.

If roost/cave searches are required, these should be conducted in accordance with Fortescue's *Terrestrial Vertebrate Fauna Assessment Guidelines* (100-GU-EN-0006), the *Survey Guidelines for Australia's Threatened Bats* (DEWHA 2010), *Guidance Statement* 56 (EPA 2004) and the *Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA 2010).

7.4 Monitoring Methods for Avifauna

Avifauna monitoring should ideally be conducted during periods of optimal activity following summer and autumn rain events (EPA 2010; DWHA 2010b, EPA 2004). Typically this may be post-dawn and before dusk, but in hot climates in very open habitats monitoring may need to begin before dawn, which is often the only time that some species can be readily detected. Bird activity is generally lower during wet, windy or extremely hot conditions.

Bird monitoring, particularly observation methods, are highly observer dependent and different individuals will have varying degrees of success. To reduce these biases it is important to record sites a number of times and, where multiple observers are involved, rotate the skill levels across all sites to ensure consistency.

The following monitoring methods for birds have been adapted from *the Survey Guidelines for Australia's Threatened Birds* (DSEWPaC 2010) and the *Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA 2010).

7.4.1 Area searches

Area searches usually involve searching a targeted area for a set period of time. Each selected area is searched systematically, while stopping or moving to investigate sightings, calls or signs of presence (Loyn 1986; Recher 1988; Hewish & Loyn 1989; Bibby et al. 1992).

Area searches are typically conducted over plots of about 1–3 ha, for 10–20 min, though larger plots may be monitored over hours, days and even months. The Birds Australia Atlas project uses 20 minute surveys where an experienced ornithologist records numbers of each species seen while actively searching a 2 ha area.

Area searches allow opportunistic hunts and searches of secondary signs, targeted habitat searches and exploration of calls and noises. Area searches are considered less sensitive to biases resulting from environmental influences such as weather and time of day, because of the more active approach to monitoring and a reduced reliance on calls for detection (Loyn 1986; Hewish & Loyn 1989).

Area searches are a useful way of obtaining individual data, population data and habitat data.

7.4.2 Transect monitoring

Transect monitoring usually involve recording birds that are observed or heard while travelling a pre-determined path between two fixed points of known distance apart. Transects typically follow a straight path but can follow roads, rivers, coastlines or contours. They are usually done on foot, though slow travel by motor vehicle may be appropriate where target species are conspicuous (Recher 1988; Bibby et al. 1992) and large areas need to be covered.

The optimal length of transects will depend on the aim of the monitoring program (Recher 1988; Bibby *et al.* 1992). For monitoring programs that aim only to detect particular taxa, transect lengths may vary and be dictated by the dimensions of patches of habitat favoured by the target species.

By motor vehicle, transects should be travelled at a speed that is appropriate for the habitat and purpose of the study. Generally, the number of detected taxa will increase with slower speed (Harden et al. 1986; Er et al. 1995, 2003). Consequently, the optimal travel speed will be a trade-off between covering as much terrain as possible and detecting individuals of the target taxa. Conspicuous taxa can be detected in open habitat at speeds well above walking pace and may reliably be detected by transect monitoring using vehicles or boats if transects are over waterways. Even when conducted on foot, transects may sometimes be better than area searches for detecting conspicuous or highly audible species in extensive areas because of the greater area that can be monitored over time.

Transect monitoring can be used to measure individual and population parameters, or when targeting a wide ranging species or a wide range of habitats over a large area.

7.4.3 Point monitoring

Point monitoring involves recording the presence, and usually number of individuals, of each taxon detected at a series of specified locations. The sampling points are usually pre-determined and selected either randomly or systematically within the study area.

Before starting a point sampling monitoring program, a range of variables are usually specified, including the amount of time spent at each point and the distance between points. The amount of time allocated to each point is usually 5–20 min, although intervals ranging from 2–60 min have been used. Generally, points should be spaced far enough apart so that individuals of the target taxa would not be detected from multiple points (Recher 1988; Bibby *et al.* 1992).

In general, point monitoring is used when observing species presence or assessing the distribution of a species. Point monitoring may be unsuitable for detecting threatened species due to the limited number of individual animals, however, when combined with other methods such as transect monitoring may be more useful.

7.4.4 Transect-point monitoring

Transect and point monitoring may be combined to produce a method that is well-suited to some detection studies. This involves conducting a series of point samples at specific positions along a transect line. This approach combines the strengths of both methods (Recher 1988; Resources Inventory Committee 1999) and may be useful for targeting a range of taxa with varying degrees of detectability.

7.4.5 Broadcast monitoring

Broadcast monitoring involves playing a recording of the vocalisations of the target species over a loudspeaker and detecting individuals of that species that respond to the call vocally, or are attracted by the call and observed as a result. Broadcast monitoring is commonly used for nocturnal taxa but is also useful for detecting secretive diurnal species and taxa active at dawn or dusk.

Recorded vocalisations are generally broadcast from a series of positions which are systematically selected with suitable habitat. Broadcast stations should be spaced far enough apart that the same birds cannot be heard from adjacent stations. For wetland birds, about 250m is recommended (Gibbs & Melvin 1993), while for some raptors about 1 km is usually advisable (Debus 1995; Loyn et al. 2001; Resource Inventory Committee 2001). Spacing of broadcast stations will vary in relation to the volume of the call and the environmental conditions.

7.4.6 Aerial monitoring

Aerial monitoring is typically performed for counts of waterbirds, shorebirds, seabirds and the nests of some large raptors, and are usually conducted from helicopters, fixed-wing or ultra-light aircraft. Aerial monitoring usually involves flying along systematically or randomly-placed, straight-line routes (similar to ground-based transect monitoring), or along shorelines, rivers, cliffs or other natural features where birds may occur.

Aerial monitoring can provide information on taxon presence and their abundance, and also reveal the location of particular habitat types or nest sites for follow-up ground monitoring. The

best coverage and accuracy is achieved with two observers recording from each side of the aircraft (Komdeur et al. 1992). The altitude at which the monitoring is done should be chosen to maximise ease of bird detection and identification (typically well below 100 m) (Howes & Bakewell 1989). For aerial monitoring of waterbirds, transects are typically 50–100 m wide (for example, Kingsford et al. 1994; Reid & Jaensch 2004).

Aerial monitoring is well suited to detecting the presence of target species when the study area is very large, the density of individuals or aggregations of individuals is low, and the species are large and easily detected from the air. Aerial monitoring may also be of value for identifying the location of particular habitat types or landscape features, favoured by the target taxon, which can be subsequently searched on the ground.

7.4.7 Targeted resource and habitat searches

Many birds seek out particular resources or habitat features for at least some part of the day or season. A particular resource or habitat feature can be observed at appropriate times to detect use or visitation by target species.

Targeted searches are particularly useful for detecting some threatened species because the method focuses on specific habitat requirements of a target species, and targets areas where the species will most likely be found. This is most useful for highly mobile species that occur at low abundance and/or have a highly localised distribution.

Environmental and meteorological fluctuations may have a large influence on the use and visitation of resources by birds therefore it will be imperative to collect this type of data in order to demonstrate the correlation between climatic data and species recordings.

7.4.8 Flushing

Flushing involves a group of observers walking parallel at a short spacing between each other, across an area of suitable habitat in an attempt to flush any birds that may be present (Robertson & Liley 1998). A fast pace may be required to avoid birds fleeing without breaking cover. Similarly, a rope can be dragged across the top of the vegetation in some grasslands to flush birds. The rope should be thick enough to disturb the vegetation without being too heavy to drag.

This method is recommended for the detection of cryptic species, especially when Call Broadcasting methods have failed or are unsuitable. Care should be taken to minimise damage to the vegetation. Flushing is a seasonal method of detection and should not be used during breeding periods as it has the potential to cause abandonment of nests (see Table 3).

7.4.9 Mist netting

Trapping birds can be a useful method to determine the presence of some taxa with mist-netting the most commonly used method. Mist-netting is most useful in densely vegetated habitat where

visibility of nets will be low, and for the detection of highly secretive species (Karr 1981; Robertson & Liley 1998; Pagen et al. 2002).

Typically, early morning is the most appropriate time to use mist-nests, though some groups of birds are more likely to be trapped at other times of the day (Robertson & Liley 1998). Open nets should be checked at least every half hour or more frequently if temperatures are unusually hot or cold, drizzle occurs or a likely predator is spotted nearby. Nets should be closed immediately at the onset of rain. Netting will be most useful in conjunction with other monitoring methods.

Mist-netting and most other forms of trapping require specialised equipment, expertise and permits. Any technique that involves the capture of birds requires a Regulation 17 licence from DPaW (EPA 2010).

7.4.10 Drift fences and walk-in traps

Walk-in traps are Elliott-style traps (see Section 7.1.1) that are used to capture small-sized ground-dwelling birds (e.g. Night Parrot). Walk-in traps should include the use of drift fences constructed of fine mesh such as flywire, or shade cloth, often linking together a number of traps. These fences are buried at their base and are usually 20 to 30 cm in height. Drift fences direct bird movement towards the traps, increasing the likelihood of capture.

The walk-in traps can be with or without baiting of grass-seeds and with or without grass-seed trails along the drift fences leading to the traps (Blyth 1996).

Walk-in traps require specialised equipment, expertise and permits. Any technique that involves the capture of birds requires a licence from DPaW (EPA 2010).

7.4.11 Sniffer Dog monitoring

Ground-dwelling birds that live in thick or dense habitats may be located using properly trained sniffer or ‘pointing’ dogs.

This monitoring technique requires substantial expertise and care, may require ethics committee approval and special access arrangements. Sniffer dog monitoring should only be conducted under exceptional circumstances by experienced personnel.

7.5 Supplementary Monitoring Methods for Birds

Supplementary techniques can be used to provide evidence of a species present in an area where they were not recorded through the primary detection methods.

7.5.1 Recording Bird calls

Birds produce audible calls and recording (e.g. SM2 recorders) of these will often produce information in addition to that gathered through other monitoring techniques.

The optimum time for listening for bird calls is at dawn and over the following few hours, particularly on still mornings. Listening for calls at night is a useful way to detect presence of many nocturnal species, particularly in the breeding season.

As with visual observation for birds, it is important to accurately record the location of individuals of interest to ensure they are assigned the actual habitat in which they occurred.

7.5.2 Spotlighting

Spotlighting may be useful for a variety of species including nocturnal birds. Spotlighting can be done from a vehicle which allows for coverage of large distances along roads and tracks. Portable spotlights can be used while walking to investigate at a finer scale or in areas where vehicle access is not possible.

Spotlighting from a vehicle may involve a number of people searching with a spotlight, recording birds. Fauna observations are made as the vehicle is driven at low speed, along a predetermined transect. See Monitoring Methods for Mammals (Section 8.1.2) for a full description of this monitoring method.

7.5.3 Remote cameras

Remote camera methods include motion sensors that only activate the camera when an animal is in the field of view and close to the camera. Cameras can be left to operate for many days/months, depending on batteries. Locations that are suitable for camera use include waterholes, identified habitat features and active nests or burrow entrances.

See Supplementary Monitoring Methods for Mammals (Section 7.2) for a full description of this monitoring method.

8. SPECIES SPECIFIC MONITORING GUIDELINES

The scope of Fortescue's conservation significant fauna monitoring programs will be limited to conservation significant fauna listed under the *Wildlife Conservation Act 1950* and the *Environment Protection and Biodiversity Conservation Act 1999* that have been recorded within Fortescue controlled sites. These conservation significant fauna species are listed in Table 3 with species specific monitoring guidelines provided below.

8.1 All Conservation Significant Species

The monitoring methodologies and techniques outlined in the species specific monitoring guidelines below have been provided as a guide rather than firm prescriptions. However, it is important to ensure all monitoring programs are standardised to enable the use of consistent data analysis methods, comparisons across all Fortescue operations and reporting. In addition, fauna monitoring is an evolving field and monitoring methodologies should be reviewed regularly to ensure the most appropriate methods and design are utilised.

The timing of monitoring programs for each species is variable and based on the period of highest activity for each species whilst avoiding the reproductive season and undue stress to breeding individuals (see Table 3). Therefore, monitoring programs for each species should be planned well in advance.

Initial baseline survey(s) should be conducted during the pre-construction phase to obtain accurate baseline data on the presence of habitat and species and population and distribution in accordance with the relevant EPBC Act Referral Guidelines (DWHA 2010a, 2010b, 2010c) and DoE (2011a, 2011b, 2011c) and Level 2 terrestrial vertebrate fauna surveys (EPA, 2004 and 2010, Fortescue 2011).

Where baseline survey results are available, monitoring sites should be established at locations where species have been previously recorded (through direct or indirect methods), in suitable habitat and denning/shelter zones outside of direct impact areas (control sites), within impact areas (impact sites) and where available rehabilitated areas to allow for replication of results.

Relevant environmental data, such as annual rainfall and vegetation condition should be collected so that this information can be correlated with the monitoring results and allow suitable interpretation of results which can be affected by seasonal changes to the environment and thus population densities.

All species sightings, injuries and fatalities must be investigated in accordance with the *Conservation Significant Fauna Management Plan* (100-PL-EN-0022) and where necessary management and monitoring strategies should be implemented.

Monitoring methodologies relevant to all conservation significant species include:

- Monitoring sites will be established in areas of suitable habitat outside of direct impact areas, within impact areas and in rehabilitation areas (where applicable) within Fortescue controlled sites.
- Suitable control sites will be established at known population locations in similar habitat type which occurs outside of Fortescue controlled sites.
- Monitoring effort will be similar to that used during the baseline targeted survey in both the impact and control sites. The adequacy of the monitoring effort will be reviewed at least every five years to account for variables unknown at the beginning of the monitoring program (Freegard 2009).
- Pre-impact baseline data will be reviewed for adequacy and limitations prior to the first annual monitoring event being undertaken. The limitations of the baseline data will be discussed in the first annual monitoring reports.
- Wherever possible, monitoring programs will be designed to provide evidence of the effectiveness of any management actions undertaken to mitigate impacts or aimed to enhance habitat quality.

8.2 Night Parrot (*Pezoporous occidentalis*)

Based on the baseline survey results, monitoring sites should be established where species have been previously recorded (through direct or indirect methods) and in suitable habitat outside of direct impact areas (control site), within impact areas (impact sites) and where available rehabilitated areas to allow for replication of results. Where monitoring is conducted in accordance with EPBC 2005/2205 monitoring sites should also be established in proximity to the northern shoreline of the Fortescue Marsh.

To date, a reliable monitoring method for the Night Parrot is yet to be developed. This bird is very cryptic in its behaviour and has proven difficult to locate. Ongoing annual monitoring undertaken by Fortescue near its Cloudbreak site have utilised a number of different methods and techniques but have not been successful in locating any evidence of the Night Parrot.

As a general approach, it is thought that Night Parrots may be attracted to waterholes when either seeding spinifex is abundant (e.g after heavy rains) or during hot summer months when they may be attracted to water. It is presumed that this would typically occur after heavy rains or during hot, dry weather, and particularly after drought periods. On this basis, annual monitoring should focus on periods of the year when conditions are hot and dry, usually late in the dry season (October to December, Table 3), but could include January to April in years when no summer rains are experienced or following heavy rains when seeding spinifex is abundant. Point monitoring methods should be used, targeting as many waterholes as possible (both at sunset and sunrise), in conjunction with other monitoring activities that don't conflict with this core activity, such as flushing and transect monitoring.

As none of the on-going annual targeted monitoring for this species have resulted in the detection of this species to date, any monitoring for the Night Parrot will endeavour primarily to determine the presence of this species. Non-invasive monitoring techniques include, spotlighting during

dusk and night and listening for post-sunset and pre-dawn calls can also be employed at isolated waterholes. Additionally, drift fences and walk-ins, flushing, the use of remote motion cameras and searches for entrances in spinifex clumps and secondary evidence such as feathers, tracks and feeding evidence may also be considered within areas of suitable habitat (Bamford 2006, 2009), as well as broadcasting methods to potentially attract any nearby individuals and/or entice a return call to the recording.

The *Survey Guidelines for Australia's Threatened Birds* (DSEWPaC 2010b) also state that area searches and the usage of sniffer dogs (highly trained dogs and handlers necessary) may be useful.

Monitoring methodologies relevant to the Night Parrot include:

- Monitoring effort will be similar to that used during the baseline survey (standardised sampling) in both the impact and control sites. Where walk-in traps are used, trapping should be conducted for a minimum of 7 nights.
- Targeted searches around resources such as waterholes and wells, during hot, dry periods, particularly following drought periods or long spans of time between rain periods. Searches should be intensified at waterholes and wells at times when seeding spinifex is abundant.
- Active searches in suitable habitat including transect/point monitoring, area seaches, spotlighting, flushing, drift fences and walk-in etc. (as described in Section 7.4).
- Passive methods, such as call broadcasting, remote detection through recording of ambient noise via remote logging methods, and remote cameras set up in areas of expected visitation (ie waterholes, wells, burrow entrances etc).
- Remote cameras should be used as a primary monitoring technique, and set around targeted resources to confirm activity and define broad patters of distribution. The use of remote cameras for the purpose of monitoring Night Parrot will be as a supplementary technique to record presence (in the absence of trapping individuals utilising the methodology described above) as well as behavioural and potentially population data where numerous identifiable individuals are recorded on camera. The cameras should be deployed for a minimum12 night period (Paull et al. 2011).
- Searches for secondary evidence, such as feathers, scats, footprints etc.
- As there have been no recent captures or confirmed recordings of this species in the Pilbara since 2005 (Bamford 2005), any captured or recorded individuals will be highly valuable records for the region, and as much biological information as possible from this species should be collected, if possible without causing undue stress to the bird. Important Biological and biometric data to be recorded should inlude:
    - Location of record (coordinates should be taken from as close as possible to location of bird)
    - Description of the bird (photos should be taken if possible)

- If bird has been captured (may be the product of a by-catch during monitoring for other species), with as little stress to the animal, biometric measurements should be recorded such as:
  - Weight
  - Body length (crown of head to feet and tip of tail)
  - Wing measurements (carpus to tip of the longest primary feather, and wingspan measuring from tip to tip of wings, across the back of the bird)
  - Tail length
  - Tarsus length
  - If available, leg banding should be undertaken
  - Collection of a feather clipping for genetic studies

- Monitoring should be undertaken annually, with a review of the program after the first two years of monitoring data is recorded. Should the monitoring results indicate species absence or an unexpected decline in the local population abundance and/or spatial distribution, the frequency of future monitoring will be reassessed

The monitoring methodology may be adapted over time based on the results of ongoing Night Parrot monitoring.

8.3 Northern Quoll (*Dasyurus hallucatus*)

Wire cage traps and large Elliott traps, baited with universal bait, are to be used at a density of $y = 50x^{0.5}$ (y= number trap-nights, x = area of potential Northern Quoll Habitat in each monitoring site in hectares). For linear habitats such as gorges and major drainage lines, a trapping rate of 1 trap per 100 linear metres is recommended (DSEWPaC, 2011a). Trapping should be conducted for seven consecutive nights (unless two or more individuals are caught more than twice, in which case the traps should be closed after 4 nights). Trapping for Northern Quoll is highly seasonal, and needs to be conducted at the right time to ensure highest activity levels but also to avoid undue stress to Northern Quolls during their breeding season. Trapping should be conducted from May to August (Table 3).

Traps should be baited with universal bait, or as an alternative, chicken wings and diced bacon can be used (DSEWPaC, 2011a). Other options for attracting Northern Quoll to a trapping location involves spraying a purified solution of low fat red meat and water on to shrubs and the ground within a 150 centimetre radius of each trap and reapplied on a daily basis. Traps should be baited at least every second day as baits should remain fresh.

Baited remote cameras can be used as a supplementary monitoring technique, and set on active nesting areas and areas of suspected high activity to confirm activity and help define broad patters of distribution. The use of remote cameras for the purpose of monitoring Northern Quoll will be as a supplementary technique to record presence (in the absence of trapping individuals utilising the methodology described above) as well as behavioural and potentially population data

where numerous identifiable individuals are recorded on camera. The cameras should be deployed for a minimum 12 night period (Paull et al. 2011). This monitoring technique must be used in conjunction with other monitoring methods as failure to detect species using a camera trap does not mean the species is absent from the study area.

Non-invasive techniques such as hair funnels can also be used in suitable habitat areas as a means of determining presence of this species. Broad habitat assessment and daytime monitoring for scats and signs of activity can be utilised for defining broad patters of distribution.

Monitoring methodologies relevant to the Northern Quoll include:

- Biometric data to be collected from captured individuals should include the following:
    - Sex
    - Weight
    - Pes length (left hindfoot length)
    - Head length (back of crown to tip of nose)
    - Tail diameter/circumference
    - Breeding status/reproductive condition
    - General body condition (presence of parasites, fur loss, signs of fighting etc.)
    - Tissue samples collected from ear notching
- Monitoring may involve the mark and recapture of individuals e.g. using numbered tags, tattoos, or ear notching (ethics clearance is required for this procedure). The mark and recapture of fauna is only to be implemented by qualified specialists.
- Radio tracking may also be employed to capture information such as daily movements, use of suspected habitat etc. Ethics clearance is required for this procedure.
- Remote cameras can be used as a supplimentary monitoring technique, and set around targeted resources to confirm activity and define broad patters of distribution. The use of remote cameras for the purpose of monitoring Northern Quoll will be as a supplementary technique to record presence (in the absence of trapping individuals utilising the methodology described above) as well as behavioural and potentially population data where numerous identifiable individuals are recorded on camera. Individual spot patterns may be analysed for potential identification of individual animals. The cameras should be deployed for a minimum 12 night period (Paull *et al*. 2011).
- Monitoring effort will be similar to that used during the baseline survey (standardised sampling) in both the impact and control sites. Trapping should be conducted for a minimum 7 nights.
- Each trap point should be permanently labelled with metal marking pegs to allow suitable replication of trapping sites.

- Monitoring should be undertaken annually in the non-breeding season (Table 3), with a review of the program after the first two years of monitoring data is recorded. Should the monitoring results indicate species absence or indicate an unexpected decline in the local population size and/or spatial distribution, the frequency of future monitoring will be reassessed as well as the methodology and effort on annual monitoring of local species.
- The monitoring program should employ methodologies used in the regional monitoring program undertaken by DPaW.

8.4 Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*)

Baseline surveys for the Pilbara Leaf-nosed Bat will include systematic aural surveys (e.g. SM2Bat systems) to determine if and where the species is present and where present to locate significant sites such as roost caves. Acoustic bat detection equipment should be set in suitable habitat including gorges, water sources including creeks and pools and cave entrances.

Permanent monitoring sites should be established using non-invasive monitoring techniques such as passive acoustic bat call recorders (e.g. SM2Bat or Songmaster systems) left at each monitoring site for a minimum of seven nights annually (Table 3). At sites where the Pilbara Leaf-nosed Bat has been previously recorded, or is considered more likely to occur, the bat call recorder should be left for longer periods. While call frequency will not give an accurate population size estimate it will provide an indication of relative abundance for comparison with environmental variables. Surveillance monitoring will assist with call interpretation but caution should be taken when using this monitoring method to estimate relative abundance as a higher number of calls may not indicate a larger number of individuals rather a small number of individuals making repeat passes. Bats in flight can be detected by conducting night transects with a hand-held detector beginning at dusk for a minimum of two hours.

Due to the sensitivity of this species to disturbance and fragile physiology (quickly declines due to water loss and stress if captured) roost searches are not an accepted monitoring method for the Pilbara Leaf -nosed Bat.

Monitoring methodologies relevant to the Pilbara Leaf-nosed Bat include:

- Monitoring effort will be similar to that used during the baseline survey (standardised sampling) in both the impact and control sites. Non-invasive monitoring techniques should be undertaken for a minimum of seven nights. This can be undertaken at the right season during concurrent monitoring for other target conservation significant species that may share the same habitat areas, such as the Northern Quoll and the Pilbara Olive Python.
- Surveillance monitoring using passive acoustic bat call recorders will be conducted in areas where the Pilbara Leaf-nosed Bat has been previously recorded or is considered more likely to occur.
- Monitoring will be conducted annually (unless an approval condition stipulates a specified monitoring period), with a review of the program after the first two years of monitoring data is recorded. Should the results from the initial monitoring period indicate

species absence or an unexpected decline in the local population size and/or spatial distribution, the frequency of future monitoring will be reassessed.

- Monitoring programs will employ specific methodologies developed in consultation with regulatory bodies and in accordance with published guidance.

8.5 Mulgara (*Dasycercus cristicauda/D. blythii*)

Based on the baseline survey results, permanent grids of pitfall traps (60cm deep PVC pipes) and Elliott traps should be established in areas where there is evidence the species is present. Where pitfall traps are not used in conjunction with Elliott trapping, double the monitoring effort (four sites instead of two within a 5 hectare area).

Trapping is highly seasonal and should take place between May and August to ensure the highest activity levels but also to avoid high temperatures and to avoid stress on individuals during breeding season (Table 3). Trapping is highly seasonal, and needs to be conducted at the right time to ensure highest activity levels but also to avoid undue stress during breeding season (Table 3).Trapping should be conducted annually over seven consecutive nights.

Hair funnels may also be used in habitat areas as a non-invasive means of determining presence of this species.

Daytime monitoring will be based on a transect search approach – looking for burrows, foraging holes, tracks and scats in suitable habitats. Experienced zoologists familiar with the distinctive burrows, tracks and foraging holes of the Mulgara should undertake daytime monitoring.

Baited remote cameras can be used as a supplementary monitoring technique, and set on active burrows to confirm activity and define broad patters of distribution. The use of remote cameras for the purpose of monitoring Mulgara will be as a supplementary technique to record presence (in the absence of trapping individuals utilising the methodology described above) as well as behavioural and potentially population data where numerous identifiable individuals are recorded on camera. The cameras should be deployed for a minimum of 12 night period (Paull *et al.* 2011). This monitoring technique must be used in conjunction with other monitoring methods as failure to detect species using a camera trap does not mean the species is absent from the study area.

General population changes can be measured through trapping records and impacts attributed to operational activities can be measured through distribution of transects close to and distant from impact areas.

Use of control sites may assist in quantifying population changes over time.

Monitoring methodologies relevant to Mulgara include:

- Establish permanent grids of Elliott traps in areas where there is evidence the species is present to determine change in population densities.
- Monitoring may involve the mark and recapture of individuals e.g. using numbered tags, tattoos, or ear notching (ethics clearance is required for this procedure). Tissue samples

are required to clarify taxonomy. The mark and recapture of fauna is only to be implemented by qualified specialists.

- Biometric data to be collected from captured individuals should include the following:
  - Sex
  - Weight
  - Pes length (left hindfoot length)
  - Head length (back of crown to tip of nose)
  - Tail diameter/circumference
  - Breeding status/reproductive condition
  - General body condition (presence of parasites, fur loss, signs of fighting etc.)
  - Tissue samples collected from ear notching
- Monitoring effort will be similar to that used during the baseline survey (standardised sampling) in both the impact and control sites. Trapping should be conducted for a minimum of 7 nights (Table 3).
- Each trap point should be permanently labelled with metal marking pegs to allow suitable replication of trapping sites.
- Monitoring should be conducted annually (unless an approval condition stipulates a specified monitoring period), with a review of the program after the first two years of monitoring data is recorded. Should the monitoring results indicate species absence or an unexpected decline in the local population size and/or spatial distribution of Mulgara, the frequency of future monitoring will be reconsidered.

8.6 Greater Bilby (*Macrotis lagotis*)

Trapping techniques for the Greater Bilby may include the establishment of permanent trapping locations in areas of suitable habitat and monitoring annually for seven consecutive nights (EPA, 2010) to determine the abundance of local Bilby populations in the area and allow for detection of any changes and fluctuations in population densities.

Non-invasive techniques such as diurnal monitoring using a transect active search approach can be used in addition to trapping to identify signs of activity including use of burrow, tracks, scats and diggings. Daytime searches should be undertaken by experienced zoologists familiar with the distinctive burrows, tracks and foraging holes of the Bilby.

Baited remote cameras can be used as a supplementary monitoring technique, and set on active burrows and areas of suspected Bilby activity to confirm activity and define broad patters of distribution. The use of remote cameras for the purpose of monitoring Greater Bilby will be as a supplementary technique to record presence (in the absence of trapping individuals utilising the methodology described above) as well as behavioural and potentially population data where numerous identifiable individuals are recorded on camera. The cameras should be deployed for a

minimum 12 night period (Paull et al. 2011). This monitoring technique should be used in conjunction with other monitoring methods. Failure to detect species using a camera trap does not mean the species is absent from the study area.

Where confirmation of the species is required, spotlight monitoring, along with remote camera use focussed on the entrance of burrows after dusk, are the most time and cost effective methods rather than trapping. Hair funnels may also be used in habitat areas as a non-invasive means of determining presence of this species.

Monitoring methodologies relevant to the Greater Bilby include:

- Permanent trap techniques including cage traps which can be set up in areas of highly suitable habitat and monitoredannually. Targeted trapping is to confirm species presence. Trapping is to be conducted for a minimum of 7 nights.
- Each trap point should be permanently labelled with metal marking pegs to allow suitable replication of trapping sites.
- Monitoring may involve the mark and recapture of individuals e.g. using numbered tags, tattoos, or ear notching (ethics clearance is required for this procedure).
- Biometric data to be collected from captured individuals should include the following (to be collected by specialized zoologists only):
    - Sex
    - Weight
    - Pes length (left hindfoot length)
    - Head length (back of crown to tip of nose)
    - Breeding status/reproductive condition (pouch check)
    - General body condition (presence of parasites, fur loss, scars, signs of fighting etc.)
    - Tissue samples collected from ear notching
- Monitoring effort will be similar to that used during the baseline survey (standardised sampling) in both the impact and control sites. A minimum of 7 nights of trapping should be undertaken at the same time of year (Table 3).
- Monitoring should be conducted annually, with a review of the program after the first two years of monitoring data is recorded. Should the monitoring results indicate species absence or an unexpected decline in the local population abundance and/or spatial distribution, the frequency of future monitoring will be reassessed.
- Animal care and ethical issues associated with monitoring techniques should be considered during the planning stages of the monitoring program to ensure animal welfare is maintained.

8.7 Pilbara Olive Python (*Liasis olivaceus barroni*)

Baseline surveys for the Pilbara Olive Python will include systematic surveys of potential habitat (including rocky outcrops and breakaways) to determine the location and extent of the local population. The Pilbara Olive Python is notoriously cryptic in its behaviour and is found in very low abundance throughout the Pilbara. Searches for this species can be an unreliable indication of their presence and relative abundance.

As a general approach, targeted searches in suitable habitat will comprise spotlighting during dusk and dawn (especially during the wet season), road spotting at night through rocky areas near permanent water if roads are present and searches during daylight hours, through suitable habitat looking for secondary evidence such as faecal pellets or sloughed skin at rocky outcrops and breakaways (DSEWPaC 2011d). During cooler winter months searches along north-facing cliffs may be useful as Pilbara Olive Pythons are more likely to visit these areas to bask in the sun.

Monitoring methodologies relevant to the Pilbara Olive Python include:

- Monitoring effort should be similar to that used during the baseline survey (standardised sampling) in both control and impact sites. Monitoring should be undertaken for a minimum of 10 days. This can be undertaken at the right season (Table 3) during concurrent monitoring for other target conservation significant species that may share the same habitat areas, such as the Northern Quoll and the Pilbara Leaf-nosed Bat.
- Where individuals are captured through by-catch during monitoring programs for other target species, or by hand during targeted Pilbara Olive Python monitoring, biometric information should be collected for all Pilbara Olive Python individuals. This should include, where possible:
    - Weight
    - Length (snout-vent length)
    - General body condition (presence of parasites, body mass and condition, scarring, etc.)
    - Tissue samples to clarify taxonomy
    - Captured individuals should be marked for future identification. This can be done either via micro chipping, or ventral or sub-caudal scale clipping. This should only be done by a qualified specialist with the necessary approvals.
- Monitoring should be conducted annually with a review after two years worth of monitoring data is recorded. Should the results from the initial monitoring period indicate species absence or an unexpected local decline in the population size and/or spatial distribution the frequency of future monitoring should be reconsidered.

8.8 Grey Falcon (*Falco hypoleucos*)

An initial survey should be conducted to obtain baseline data on the presence of habitat and species (population and distribution) in accordance with a Level 2 vertebrate fauna survey (EPA_2004 and 2010, Fortescue 2011) and the Survey Guidelines for Australia's Threatened Birds (DSEWPaC 2010b).

Baseline surveys may include targeted search methods such as area searches and transect point surveys to determine the location and extent of the population and identify significant sites such as breeding locations.

Based on the baseline survey results, monitoring sites should be established where species have been previously recorded (through direct and indirect methods), in areas with suitable habitat outside of direct impact areas (control sites), within impact areas (impact sites) and in rehabilitated areas where available to allow for replication of results.

The availability of prey is important in determining distribution and should be considered when establishing monitoring sites.

Daytime searches and monitoring should be based on area or transect search approaches – looking for flying or perched birds and nests in suitable habitats.

All species sighting, injuries and fatalities will be investigated in accordance with the Conservation Significant Fauna Management Plan and where necessary management and monitoring strategies will be implemented.

Monitoring methods for the Grey Falcon may include:

- Monitoring sites should be established where the species has been previously recorded (through direct and indirect methods) and in suitable habitat (and where prey is readily available) outside of direct impact areas (control sites) within impact areas (impact sites) and in rehabilitation areas (where applicable).
- Suitable control sites should be established at known population locations in similar habitat types, which occur outside of the project area. Concurrent monitoring at control sites will assist with determining if natural variations in environmental factors are having an influence on results of population monitoring.
- Monitoring effort should be similar to that used during the baseline survey (standardised sampling) in both control and impact sites. Non-invasive monitoring should be undertaken at the same time of year over a minimum 10 day period.
- Area searches should be conducted on foot in suitable habitat to detect species through sighting, calls or signs of activity.
- Transect-Point monitoring should be conducted by vehicle to detect soaring species over suitable habitat or perched birds and nests.

- Monitoring should be conducted annually with a review after two years of monitoring data is recorded. Should the results from the initial monitoring period indicate species absence or an unexpected local decline in the population size and/or spatial distribution, frequency of future monitoring should be reconsidered.

8.9 Migratory Birds

There are several listed migratory bird species recorded or likely to occur in Fortescue controlled sites. These species include:

- Fork-tailed Swift (*Apus pacificus*)
- Rainbow Bee-eater (*Merops ornatus*)
- White-bellied Sea Eagle (*Haliaeetus leucogaster*)
- Great egret (*Ardea alba*)
- Eastern Great Egret (*Ardea modesta*)
- Wood Sandpiper (*Tringa glareola*)
- Common Greenshank (*Tringa nebularia*)

An initial survey(s) should be conducted to obtain baseline data on the presence of suitable habitat and species (population and distribution) in accordance with a Level 2 vertebrate fauna survey (EPA 2004 and 2010, Fortescue 2011) and the *Significant Impact Guidelines for 36 Migratory Shorebirds Species* (DEWHA 2009).

The timing of monitoring is often critical to the likelihood of detecting migratory birds. To maximise the chance of detection, monitoring activities should be done at the time of day or night when the species is most vocal or behaviourally active. In addition, the timing of monitoring must take into account potential daily changes in habitat use (feeding vs. roosting sites); seasonal changes in habitat use due to the migratory nature of the species (Table 3); and variation in behaviour and habitat condition between seasons. In addition, many of the non-tidal areas used by migratory birds in Australia are ephemeral so monitoring should be conducted when water is present.

Monitoring programs should involve the review of existing data including usage of the site and established monitoring methods. Where possible, monitoring methodologies should be consistent to allow comparison between data sets.

Weather conditions such as wind velocity, precipitation, temperature, cloud cover and light intensity all affect bird behaviour and observer performance. DoE (DEWHA 2010b) states bird monitoring may be compromised when:

- wind velocity exceeds 10 km per hour;
- rainfall intensity is above a drizzle;

- conditions are misty or foggy, especially for species that are usually detected by sight; and
- temperatures are either well below or above the seasonal average.

The monitoring program for migratory birds should be conducted in accordance with recommendations from DoE guidance, *Significant Impact Guidelines for 36 Migratory Shorebirds Species* (DEWHA 2009) as indicated below:

- Area searches are the preferred technique for migratory birds. Use 20 minute searches to record numbers of each species seen while actively searching a 2 ha area. Larger areas can be monitored over hours, days or even months depending on the habitat and species richness. Monitoring large water bodies may require the use of aerial monitoring to be effective.
- Conduct monitoring when the majority of the migratory birds are present in the area and when habitat conditions are suitable (typically when water is present with a minimally vegetated exposed margin). Key staging areas used during inbound and outbound migration should be monitored at the beginning or the end of the non-breeding season.
- Monitoring should not be undertaken during periods of high rainfall, strong winds or when activities are taking place which cause disturbance to birds.
- For large sites or sites where a large number of birds are expected two people should undertake the counts.
- Monitoring should make note of any shorebird habitats outside the study site and attempt to place the study site in the context of the larger wetland environment.
- Wetland species can also be monitored by observation of foraging habitat of the target species within wetlands in the early morning or evening. Detection by sightings and unsolicited calls.

Table 3: Summary of Conservation Significant Fauna Monitoring Programs

Fauna Species	EPBC Act 1999	Wildlife Conservation Act 1950	Fortescue Sites	Methodology	Monitoring Parameters	Minimum Annual Monitoring Effort	Timing
Night Parrot (*Pezoporous occidentalis*)	CR	Sc1	Cloudbreak Mainline Corridor (EPBC 2010/5513)[2] Christmas Creek (EPBC 2010/5706) [2]	**Non-invasive**: Point monitoring, targeted habitat searches, spotlighting, bird calls, area searches, sniffer dogs, motion cameras **Invasive**: Drift fences and walk-in traps. Replicated in control and impact sites.	Presence Habitat characteristics Meteorological data Environmental threats	**Point surveys**: 10 minute search time for each sampling point. 10 nights **Bird calls:** 1 SM2Bat recorder per sampling site. 2 months. **Spotlighting**: two 200m transects per 5 hectare site, 10m per minute. Repeat same transects for a minimum of two separate nights. 10 nights **Areas searches**: 20 minute search time for every 2 hectare sampling site. 10 nights **Motion cameras**: 10 cameras per hectare sampling site. One sampling site per representative habitat. 120 camera nights per sampling site. 12 nights. **Drift fences and walk-in traps:** 1 drift fence and walk-in trap per sampling site. 7 nights.	October to March
Northern Quoll (*Dasyurus hallucatus*)	EN	Sc1	Solomon Mainline Corridor (EPBC 2010/5513)[2] Christmas Creek (EPBC 2010/5706)[2]	**Non-invasive**: Hair funnels, active searches and searches for scats and other signs, motion cameras **Invasive**: Cage traps and Elliott traps. Replicated control and impact sites.	Individual data/ biometric data • Sex • Body measurements • Health • Breeding status/ Reproductive condition • Behaviour Area of occupancy Habitat characteristics Meteorological data Environmental threats	**Hair funnels**: 20 devices at each sampling site. One sampling site per representative habitat, with at least two sampling sites per 5 hectares, replicate across habitat types in areas > 5 hectares. 200 sampling nights per sampling site. 10 nights. **Active searches and searches for scats and other signs**: two hour search time for each one hectare sampling site. 10 nights **Motion cameras:** 10 cameras per hectare sampling site. One sampling site per representative habitat. 120 camera nights per sampling site. 12 nights. **Elliott and Cage Traps**: Trapping density of $y = 50x^{0.5}$ (y= number trap-nights, x = area of potential Northern Quoll Habitat in each monitoring site in hectares). 7 nights.	May to August
Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*)	VU	Sc1	Mainline Corridor (EPBC 2010/5513)[2] Solomon Rail Corridor (EPBC 2010/5567, MS862)[2] Christmas Creek (EPBC 2010/5706)[2]	**Non-invasive**: SM2Bat recorders **Invasive**: No trapping or entering roost caves	Presence Habitat characteristics Meteorological data Environmental threats	**SM2Bat recorders**: 4 recorders per 50 hectare sampling site. 28 detector nights per sampling site. 7 nights.	November to May
Mulgara (*Dasycercus cristicauda/D. blythii*)	VU	Sc1	Mainline Corridor Solomon Rail Corridor Christmas Creek (EPBC 2010/5706)[2]	**Non-invasive**: Active searches and searches for tracks and other signs, motion cameras positioned on burrows, hair funnels **Invasive**: Cage traps and Elliott traps. Replicated control and impact sites.	Individual data/biometric data • Sex • Body measurements • Health • Breeding status/ Reproductive condition • Behaviour Area of occupancy Habitat characteristics Meteorological data Environmental threats	**Active searches and searches for tracks and other signs**: two hour search time for each one hectare sampling site. 10 nights. **Hair funnels**: 20 devices at each sampling site. One sampling site per representative habitat, with at least two sampling sites per 5 hectares, replicate across habitat types in areas > 5 hectares. 200 sampling nights per sampling site. 10 nights **Motion cameras:** 10 cameras per hectare sampling site. One sampling site per representative habitat. 120 camera nights per sampling site. 12 nights. **Elliott Traps**: 20 traps at each sampling site, 10m spacing along two transects. Three sampling sites per representative habitat. 140 trap night per sampling site. 7 nights. **Cage traps:** 10 traps at each sampling site, 50m spacing along two transects. Three sampling sites per representative habitat. 70 trap nights per sampling site. 7 nights.	May-August

[2] The species has not been recorded at this site but a Ministerial Statement or Controlled Action specifies monitoring for this species.

Fauna Species	EPBC Act 1999	Wildlife Conservation Act 1950	Fortescue Sites	Methodology	Monitoring Parameters	Minimum Annual Monitoring Effort	Timing
Greater Bilby (*Macrotis lagotis*)	VU	Sc1	Cloudbreak Mainline Corridor Christmas Creek (EPBC 2010/5706)[2]	**Non-invasive**: Diurnal monitoring and diurnal searches for tracks and other signs, motion cameras on burrows, spotlighting, hair funnels **Invasive**: Cage traps. Replicated control and impact sites.	Individual data/ biometric data • Sex • Body measurements • Health • Breeding status/ Reproductive condition • Behaviour Area of occupancy Habitat characteristics Meteorological data Environmental threats	**Diurnal** monitoring **and diurnal searches for tracks and other signs**: 2 hour search time for every one hectare sampling site. 10 nights. **Spotlighting:** two 200m transects per 5 hectare site, 10m per minute. Replicate across habitat types in areas > 5 hectares. Repeat same transects for a minimum of two separate nights. 10 nights. **Hair funnels:** 20 devices at each sampling site. One sampling site per representative habitat, with at least two sampling sites per 5 hectares, replicate across habitat types in areas > 5 hectares. 200 sampling nights per sampling site. 10 nights. **Motion cameras:** 10 cameras per hectare sampling site. One sampling site per representative habitat. 120 camera nights per sampling site. 12 nights. **Elliott Traps**: 20 traps at each sampling site, 10 m spacing along two transects. Three sampling sites per representative habitat. 140 trap night per sampling site. 7 nights. **Cage traps:** 10 traps at each sampling site, 50 m spacing along two transects. Three sampling site per representative habitat. 70 trap nights per sampling site. 7 nights.	No specified time.
Pilbara Olive Python (*Liasis olivaceus barroni*)	VU	Sc1	Christmas Creek Solomon Mainline Corridor (EPBC 2010/5513)[2]	**Non-invasive**: Searches for signs, spotlighting	Individual data/biometric data • Weight • Length • General body condition Area of occupancy Habitat characteristics Meteorological data Environmental threats	**Searches for signs**: 2 hour search time for each hectare sampling site. 7 nights. **Spotlighting:** monitor two 200m transects per 5 hectare site, replicate across habitat types in areas > 5 hectares. Repeat same transects for a minimum of two separate nights. 7 nights.	December to February
Grey Falcon (*Falco hypoleucos*)		Sc1	Cloudbreak	**Non-invasive**: Area searches, transect point monitoring **Invasive:** N/A	Area of occupancy Habitat characteristics Meteorological data Environmental threats	**Area searches**: 20 minute search time for every 2 hectare sampling site. **Transect point** monitoring: Vehicle searches at speeds <20kph. 10 days.	December to February
Fork-tailed Swift (*Apus pacificus*)	M	Sc3	Solomon	**Non-invasive**: Area searches, targeted resource and habitat searches, bird calls **Invasive**: N/A	Numbers of birds Habitat characteristics Meteorological data Environmental threats	**Area searches:** 20 minute search time for every 2 hectare sampling site	December to February
Rainbow bee-eater (*Meropsornatus*)	M	Sc3	Cloudbreak Christmas Creek Solomon Mainline Corridor Solomon Rail	**Non-invasive**: Area searches, targeted resource and habitat searches, bird calls **Invasive**: N/A	Number of birds Habitat characteristics Meteorological data Environmental threats	**Area searches:** 20 minute search time for every 2 hectare sampling site	December to February
White-bellied Sea eagle (*Haliaeetus leucogaster*)	M	Sc3	Cloudbreak	**Non-invasive**: Area searches, targeted resource and habitat searches, bird calls **Invasive**: N/A	Number of birds Habitat characteristics Meteorological data Environmental threats	**Area searches:** 20 minute search time for every 2 hectare sampling site	December to February
Great Egret (*Ardea alba*)	M	Sc3	Christmas Creek	**Non-invasive**: Area searches, targeted resource and habitat searches, bird calls **Invasive**: N/A	Number of birds Habitat characteristics Meteorological data Environmental threats	**Area searches**: 20 minute search time for every 2 hectare sampling site	December to February

Fauna Species	EPBC Act 1999	Wildlife Conservation Act 1950	Fortescue Sites	Methodology	Monitoring Parameters	Minimum Annual Monitoring Effort	Timing
Eastern Great Egret (*Ardea modesta*)	M	Sc3	Cloudbreak Christmas Creek	**Non-invasive**: Area searches, targeted resource and habitat searches, bird calls **Invasive**: N/A	Number of birds Habitat characteristics Meteorological data Environmental threats	**Area searches:** 20 minute search time for every 2 hectare sampling site	December to February
Wood Sandpiper (*Tringa glareola*)	M	Sc3	Christmas Creek	**Non-invasive**: Area searches, targeted resource and habitat searches, bird calls **Invasive**: N/A	Number of birds Habitat characteristics Meteorological data Environmental threats	**Area searches:** 20 minute search time for every 2 hectare sampling site	December to February
Common Greenshank (*Tringa nebularia*)	M	Sc3	Christmas Creek	**Non-invasive**: Area searches, targeted resource and habitat searches, bird calls **Invasive**: N/A	Number of birds Habitat characteristics Meteorological data Environmental threats	**Area searches:** 20 minute search time for every 2 hectare sampling site	December to February

9. DATA ANALYSIS AND INTERPRETATION

9.1 Change in Population Trends

All known records of conservation significant fauna recorded from Fortescue controlled sites prior and during the monitoring program are to be collated in the Fortescue Environmental Database. This database will be used to store geographic information on individuals, as well as geometric data for each recorded species, which can be used to investigate any changes in distribution/habitat use/individual records and the factors associated with any such change.

For every record, a set of environmental characteristics will be documented for each monitoring site:

- elevation
- habitat type, description and quality
- soil type and colour
- aspect
- geology
- landform
- degree of land modification due to project development
- bushfire history
- feral animal abundance
- mean annual rainfall
- rainfall seasonality
- daily temperature/rainfall/humidity during monitoring period

For every record, a set of fauna characteristics will be documented for each fauna recorded:

- family, genus, species and common name
- conservation status
- introduced status
- abundance/population size
- Western Australian Museum lodgement number (if applicable)
- Sampling type
- Sampling point number
- Fortescue sampling number

- Brief description
- Coordinates
- Photograph
- Notes
- Brief location
- Full habitat description of location of observed fauna

9.1.1 Data Analysis and Interpretation

Appropriate data analysis and interpretation is a function of the monitoring program design and should be identified and selected during the monitoring program design phase. Once the monitoring program is implemented, the analysis methods can be reviewed and refined as appropriate.

Statistical analysis of data, including using Kruskal-Wallis-ANOVA or an ANOVA (in dependency of the nature of the data) methodology may be undertaken to determine whether there is any statistical variation in the values of these attributes linked to records across the monitoring period.

Univariate statistical analysis can be used for comparing differences in individual parameter values between monitoring sites, for example using the T-test (and its variants) and Analysis of Variance (ANOVA). This type of analysis involves the comparison of parameter means and variance between monitoring sites. Careful selection of replicates is important to minimise selection bias and other sources of potential error. Without adequate replication the chance of obtaining a good estimate of the mean and variance or distribution of a parameter is low (Bradshaw & Book 2010). Univariate analysis assumes that the parameter datasets satisfy conditions of normality; if investigations indicate that this is not the case then further manipulation of the data (such as log transformation) may be required. Alternatively, non-parametric methods can be used which do not include normality assumptions, may be warranted (for example the Wilcox Mann-Whitney test, and Kruskal–Wallis test).

Linear regression analysis can be used for modelling and testing relationships between two or more measured parameters. Regression models can be used to identify if fauna at different monitoring sites respond differently to environmental conditions and disturbances, and can potentially enable predictions of how fauna might respond to future disturbance scenarios. This type of analysis assumes that the parameter datasets satisfy conditions of normality; if investigations indicate that this is not the case then further manipulation of the data, such as log transformation, may be required. Alternatively a number of non-parametric correlation coefficients can be used (e.g. Spearman correlation or Pearson linear correlation coefficient), but these depend strongly on number of sample sites with generally >30 sites being required to provide a reliable characterisation of a relationship (Bradshaw & Brook 2010).

A variety of more complex statistical techniques are available for the analysis of multiple parameter datasets (e.g. parametric and non-parametric multivariate analysis). These may be useful where the objective is to classify fauna responses based on multiple factors (e.g. using classification and ordination techniques), and explore the relative importance of the factors influencing these groupings (e.g. Principal Component Analysis). Advice on the potential application of multivariate analysis should be sought from an expert biometrician where required; generally this type of analysis requires the use of specialised statistical software packages.

9.1.2 Error Analysis

For data interpretation purposes it is important to understand the accuracy of the monitoring results and the sensitivity of the results to potential sources of error.

Two types of error relating to fauna monitoring should be considered:

Detection error – probability of detecting a sign or individual animal can vary over space and time, for example with habitat type, time of day or with different observers. Monitoring programs that fail to account for probability of detection will result in biased population estimates and therefore are an unreliable tool for monitoring true changes in population over time.

Sampling error – fauna populations are usually too large or cryptic to attempt to monitor all of its members. A sample group is used to represent the characteristics of the broader population. There is often considerable spatial heterogeneity in natural systems which if not accounted for in sampling programs can introduce substantial bias in measures of the target population (Dixon, 1998; Yoccoz et.al., 2001; Pollock & Farnsworth, 2002).

The ability of the monitoring program to detect changes in fauna population/distribution is subject to the nature and magnitude of these errors. A structured analysis of error should be undertaken following each phase of monitoring data collection. The error analysis will provide the basis for critically interpreting the monitoring results, which in many cases will be used to guide management actions and compliance reporting. Error analysis is also useful for critically evaluating the design of the monitoring program and its methodologies to become an adaptive process that will optimise the future outcomes of the program.

9.2 Adaptive Management Approach

Fortescue will calculate the success of management measures to inform an adaptive management approach to minimise impact on conservation significant fauna. There will be three hypotheses tested by the data gathered during the monitoring program:

(i) Hypothesis One: There will be no statistically significant reduction in the spatial distribution of conservation significant species across impact sites compared to control sites.

Where fauna species have been identified at low densities within the monitoring area, temporal statistical comparison may not be possible. Comparisons of habitat usage and spatial distribution of species between control and impact sites may be more appropriate in detecting a potential change in species distribution rather than population or density. The monitoring methods proposed for the conservation significant species listed in Section 9 will be sufficient to test this hypothesis and detect any potential change in species distribution at impact sites.

Where standardised monitoring methods include trap and release programs, adequate population data may not be obtained given the elusive nature of some conservation significant species such as the Northern Quoll, Mulgara, Greater Bilby and the Night Parrot that occur in low densities. Utilising alternative methods such as camera traps and burrow observations may give a better indication of species distribution.

When conservation significant species are actually present, they may not have adequate population numbers to allow statistical comparison over time. Evidence of habitat usage may be more appropriate than recording population numbers when measuring what level of impact Fortescue operations may have on species distribution.

To increase the likelihood of detection of low density species, count variation will be minimised by conducting annual monitoring programs at the same locations, at the appropriate time of year and during appropriate weather conditions. The same observers will also be used where possible to further reduce count variation.

Standardised sampling methods will be employed to ensure detectability, abundance and distribution can be compared over time. Analytical tests and power levels will be set at appropriate levels to detect change in spatial distribution of low density species.

Failure to locate conservation significant species where they have been previously recorded should be considered in light of environmental factors, which can have significant impacts on species distribution and relative local abundance. Depending on the environmental variables, a failure to record the species in an area should not be interpreted as site activities having a detrimental impact to any local fauna populations. All variables including environmental conditions and population trends at control sites should be considered before determining whether the site activities are impacting on local fauna populations. Species abundance at control sites relative to impact sites will provide a basis for accounting for these factors over time.

(ii) Hypothesis Two: There will not be a statistically significant decline in the relative abundance of conservation significant species across impact sites compared to control sites.

The monitoring methodologies identified in these guidelines will be sufficient to estimate relative abundance of high density fauna species at control and impact sites. This data can then be used in considering species population change over time between control and impact sites. This approach will be more effective at detecting any potential population changes at impact

sites, rather than making a simple comparison of populations to a baseline snapshot in a system where population numbers can vary considerably and unpredictably in space and time.

Where monitoring methods include trap and release programs, adequate population data may not be obtained given the elusive nature of some conservation significant species such as the Northern Quoll, Mulgara, Greater Bilby and the Night Parrot that occur in low densities . Utilising alternative methods such as camera traps and burrow observations may give a better indication of relative abundance.

When conservation significant species are actually present, they may not have adequate population numbers to allow statistical comparison over time. Evidence of habitat usage may be more appropriate than recording population numbers when measuring what level of impact Fortescue operations may have on the relative abundance of these species.

Variation in environmental factors may influence the results of population and abundance monitoring and it may take several years of monitoring before any changes in local population numbers can be quantified. Depending on the environmental variables, a failure to record the species in an area should not be interpreted as the project having a detrimental impact to any local fauna populations. All variables including environmental conditions and population trends at control sites should be considered before determining whether the site activities are impacting on local fauna populations. Species abundance at control sites relative to impact sites will provide a basis for accounting for these factors over time.

(iii) Hypotheses Three: Conservation significant species recorded within the area of impact for the project will continue to have an ongoing presence.

If conservation significant fauna are found to be present in impact sites and they continue to be recorded during the monitoring program, it may indicate that the implemented management measures are effective. Failure to locate the species where they have been previously recorded should be considered in light of secondary monitoring parameters including environmental pressures and meteorological pressures, which may result in changes to species distribution and local abundance. Concurrent monitoring of species presence/absence in control sites relative to impact sites will assist in providing a baseline to assist in accounting for these factors over time.

Contingency actions will be initiated during construction, operational and decommissioning activities when monitoring indicates that implemented fauna management actions are not successfully mitigating impacts to the targeted species and management objectives are not being achieved (Table 3). These qualitative trigger values should be reviewed after the first and subsequent monitoring events and refined with quantitative values where possible for a robust and effective monitoring program.

As part of the adaptive management process, Fortescue will consult with specialist consultants, DPaW and/or DoE as required to ensure continual improvement in fauna management and monitoring practices.

Table 4: Contingency Measures

Trigger	Contingency Actions
Conservation significant fauna death	• Arrange for the species to be verified by appropriately qualified personnel • Enter death in BMS and notify DPaW/DoE • Identify reason for death and where it is caused by construction, operation or decomissioning activities, implement/change management measures
Conservation significant fauna injury	• Record injury in BMS • Appropriately qualified personnel to treat animals where possible and euthanaze where required • Identify reason for injury and where it caused by construction, oepration or decomissioning activities, implement.change management measures

10. REPORTING AND INFORMATION DISSEMINATION

Monitoring results that have been interpreted and subject to quality assurance processes will generally be required to meet Fortescue's reporting obligations. This could include:

- Internal reporting to inform management planning and future monitoring program designs.
- A summary of findings relating to the monitoring program objectives/results in relevant company Environmental Reports.
- Reporting against legislative compliance requirements (for example against project level Ministerial Conditions under Part IV of the *Environmental Protection Act 1986*).

The utility of disseminating monitoring report findings to other stakeholders and information users, such as DPaW, should also be identified.

11. REVIEW

These Guidelines will be used to scope and design site-specific monitoring programs. The first review and revision will be conducted after the initial baseline monitoring program for each site and biennially thereafter to ensure the most effective monitoring strategies are used for continuous improvement in fauna management outcomes.

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