

Level 1 Vertebrate Fauna Risk Assessment for the proposed Mitchell project area



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Front Cover: Habitat in the project area

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EXECUTIVE SUMMARY

Native Vegetation Solutions (NVS) commissioned Terrestrial Ecosystems on behalf of Metals X Limited to complete a Level 1 fauna risk assessment of approximately 519ha for the proposed expansion of an old mining pit (i.e. Mitchell project area; Figure 1).

The project area is approximately 2.5km south-east of the old Higginsville township and approximately 104km south, south-east of Coolgardie and 46km north of Norseman in Western Australia.

Fauna survey data from other projects in the bioregion provide an adequate indication of the fauna assemblages likely to be encountered in the project area. These data are adequate to assess potential impacts on the vertebrate fauna potentially found in the project area and a Level 2 vertebrate fauna survey is not required.

Fauna habitats in the project area are rated as degraded to good. The project area is relatively uniform, but can be divided into two broad fauna habitat types: mixed eucalyptus woodland over mixed chenopod and sclerophyll scrubland, and low Eucalyptus woodland over dense sclerophyll scrubland.

No conservation significant vertebrate fauna were assessed as likely to be significantly impacted by the proposed development. There is a very low possibility that the area supports Southern Death Adder, Western Rosella, Peregrine Falcon, Malleefowl and Fork-tailed Swift. Rainbow Bee-eaters may potentially inhabit the project area on a seasonal basis but is unlikely to be significantly impacted by further vegetation clearing. All other avian species potentially found in the project area are mobile and will readily move to adjacent areas if disturbed.

1 INTRODUCTION

1.1 Background

Native Vegetation Solutions (NVS) commissioned Terrestrial Ecosystems on behalf of Metals X Limited to complete a Level 1 fauna risk assessment of approximately 519ha the proposed expansion of an old mining pit (i.e. Mitchell project area; Figure 1).

The project area is approximately 2.5km south-east of the old Higginsville townsite and approximately 104km south, south-east of Coolgardie and 46km north of Norseman in Western Australia.

1.2 Project objectives

The purpose of this fauna assessment was to provide information to enable an assessment of potential impacts on the vertebrate fauna assemblage of clearing native vegetation to re-open and expand the mining operations around the Mitchell mine. The methodology broadly follows that described in the Environmental Protection Authority's (2016a) *Environmental Factor Guideline Terrestrial Fauna* and its *Technical Guidance Terrestrial Fauna Surveys* (EPA 2016b) and the *Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA / DEC 2010).

The objectives of this fauna assessment were to:

- provide an indication of the vertebrate fauna assemblage (reptiles, amphibians, small mammals and birds) on and near the project area so that potential impacts on the fauna might be adequately assessed;
- assess whether the project area supports active Malleefowl mounds and/or other conservation significant species;
- determine if any additional surveys are required to assess the potential impact on fauna assemblages in the project area, in particular, impacts on species of conservation significance; and
- assess the impact and environmental risks associated with the proposed development on the fauna assemblage.

2 EXISTING ENVIRONMENT

2.1 Eastern Goldfield IBRA subregion

The project area is in the Coolgardie (COO3 – Eastern Goldfield) IBRA sub-region. The relief is subdued and comprise of gently undulating plains interrupted in the west with low hills and ridges of Archaean greenstones and in the east by a horst of Proterozoic basic granulite. The subregion supports large playa lakes in the western half which are remnants of an ancient major drainage system (Cowan 2002).

The vegetation in the IBRA sub-region consists of Mallees, Acacia thickets and shrub heath on sand plains. Diverse eucalypt woodlands occur around salt lakes, on ranges and in valleys. Salt lakes support dwarf shrublands of samphire. Woodlands and *Dodonaea* shrubland occur on basic graninulites of the Fraser Range (Cowan 2002). The area is rich in endemic Acacias.

2.2 Climate

Chart 1 shows the average mean monthly maximum and minimum temperatures and rainfall for Norseman, the closest weather station (~46km south). Temperatures are highest in December – February and most rain comes in winter. Winter rain is the result of low pressure cells that move in an easterly direction from the south-west of the state, whereas, summer rain is often from thunderstorms that move in from either the west or the north-west.

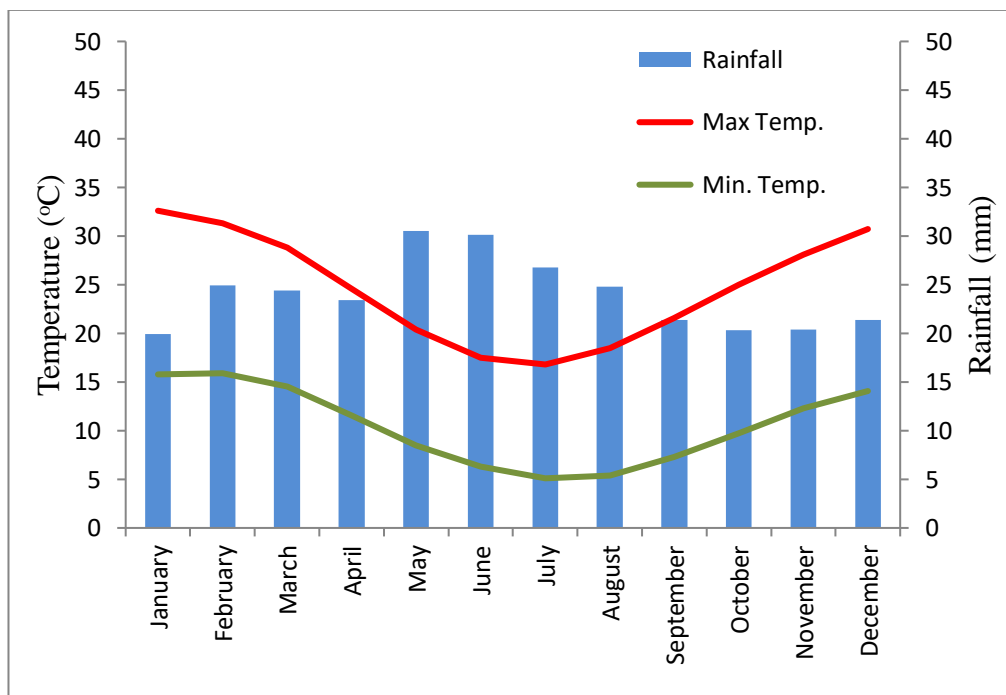


Chart 1. Mean monthly maximum and minimum temperatures and rainfall for Norseman

2.3 Land use history

The dominant land uses in this bioregion are pastoralism, crown reserves and mining. Mining is evident in many areas around Kambalda, Higginsville, Widgiemooltha and Norseman, with numerous small abandoned and operational mines scattered throughout the landscape.

Many of the larger trees in the bioregion were removed decades ago to support the mining and power generation industries and these trees have often not been replaced by replanting programs.

2.4 Great Western Woodlands

The project area is part of the Great Western Woodlands (Watson et al. 2008, pp. vi) that is being promoted by the Wilderness Society because the area contains the 'largest and healthiest temperate woodland remaining on our planet'. The Wilderness Society argued that the fauna and flora diversity in the area has evolved with the landscape during an unbroken biological lineage stretching back 250 million years.

There is pressure from numerous conservation groups for the preservation of the Great Western Woodlands, and it is likely that the Department of Parks and Wildlife (DPaW 2010a) will progressively become more involved in the protection of this areas.

3 EXISTING FERTERBATE FAUNA DATA AND PREVIOUS BIOLOGICAL SURVEYS IN THE REGION

The frogs, reptiles, mammals and birds in the Eastern Goldfields IBRA subregion have been previously surveyed, mostly for Level 2 vertebrate fauna assessments prior to vegetation clearing. The trapping fauna surveys or assessments completed near the project area which contain fauna assemblage data and were reviewed as part of this assessment include:

- ATA Environmental (2006) *Vertebrate Fauna Assessment St Ives Gold Mine*. Unpublished report for Jim's Seeds, Weeds and Trees, Ltd, Kalgoorlie.
- Bamford Consulting Ecologists (2010) *Gold Fields St Ives Gold Mine, Kambalda. Fauna Assessment: impacts of water discharge and general mining activity on vertebrate fauna*. Unpublished report to Gold Fields St Ives Gold Mine, Perth.
- Chapman A; Kealley I; McMillan D; McMillan and Rolland; G (1991). Biological Surveys of Four Goldfields Reserves. *Landnote* 1/91;1-238
- Dames and Moore (1999) *Public Environmental Review Gold Mine Development on Lake Lefroy*. Unpublished report for St Ives Gold Mine; Kalgoorlie.
- Dell, J and How, R. (1984) Vertebrate fauna. In: The Biological Survey of the Eastern Goldfields of Western Australia, *Records of the Western Australian Museum*, Supplement No 18;57-89.
- GHD (2010a) *Report for Chalice Project Area Desktop Biological Assessment and Broad Scale Vegetation Mapping*. Unpublished report for Avoca Resources Ltd, Perth.
- GHD (2010b) *Report for Higginsville Project Area Desktop Biological Assessment and Broad Scale Vegetation Mapping*. Unpublished report for Avoca Resources Ltd, Perth.
- GHD (2014) *Lake Cowan Project Area Desktop Assessment and Broad Scale Mapping*. Unpublished report for Metals X Ltd, Perth.
- GHD (2015) *Musket Project Area Desktop Assessment and Broad Scale Mapping*. Unpublished report for Metals X Ltd, Perth.
- GHD (2015) *Wills Project Area Desktop Assessment and Broad Scale Mapping*. Unpublished report for Metals X Ltd, Perth.
- Halpern Glick Maunsell (1998) *Lake Lefroy Environmental Assessment. Report ES4490C*. Unpublished Report commissioned by WMC Resources Ltd.
- Handley, M.A. (1991). *The Biota of Inland Salt Lakes of the Kambalda Region, and Coastal Salt Lakes of Esperance, Western Australia. A Comparative Study*. Unpublished Honours Thesis, Curtin University of Technology.
- Keith Lindbeck and Associates (2007) *St. Ives Gold Mining Company Tailings Storage Facility (No. 4) Spring Fauna Survey*. Unpublished report for St. Ives Gold Mining Company.
- McKenzie, N.L., Rolfe, J.K., Hall, N.J. and Youngson, W.K. (1993) Vertebrate Fauna. In Hall, N.J. and McKenzie N.L. The Biological Survey of the Eastern Goldfields of Western Australia Part 9. Norseman - Balladonia. *Records of the Western Australian Museum*, Supplement No 42;33-55.
- Newby, K.R., Dell, J., How, R.A. and Hnatiuk, R.J. (1984) The Biological Survey of the Eastern Goldfields of Western Australia - Part 2: Widgiemooltha – Zanthus Study Area. *Records of the Western Australian Museum*, Supplement 18:21–158.
- Ninox Wildlife Consulting (1995) *Assessment of the Vertebrate Fauna within Rehabilitation and a Comparison with Native Vegetation in a Range of Nickel Leases near Widgiemooltha*. Unpublished Report Commissioned by KCGM Western Mining Corporation Pty. Ltd.
- Ninox Wildlife Consulting (1998) *A Vertebrate Fauna Survey of the Randell Timber Reserve (1997 & 1998)*. Unpublished report for Mt Monger Gold Project Pty Ltd, Perth.
- Ninox Wildlife Consulting (2004a) *St Ives Gold Delta Island Vertebrate Fauna Assessment*. Unpublished Report Commissioned by St Ives Gold Mining Company Pty. Ltd.
- Ninox Wildlife Consulting (2004b) *St Ives Gold Mine Vertebrate Fauna Assessment 2004*. Unpublished report for St Ives Gold Mining Co Pty Ltd, Kalgoorlie.
- Western Wildlife (2006) *St Ives Gold Fauna Survey; Spring 2005*. Unpublished report for Jim's Seeds, Weeds and Trees, Kalgoorlie.
- Western Wildlife. (2013). *Mt Henry Study Area Baseline Fauna Survey: Level 2 Fauna Survey 2012 & 2013 - Final Report*. Unpublished report for Panoramic Resources Limited, Perth.

The most relevant fauna survey data come from the Western Australian Museum (WAM)/Department of Environment Conservation (DEC) eastern Goldfields survey of the Widgiemooltha-Zanthus survey area, the ATA Environmental (2006), Bamford Consulting Ecologists (2010), Dames and Moore (1999), Keith Lindbeck and Associates (2007), Ninox Wildlife Consulting (2004b) and Western Wildlife (2006) which are reports for projects on the western side of Lake Lefroy. The McKenzie et al. (1993) report is part of the WAM/DEC's Eastern Goldfields survey undertaken in the mid 1980's and the Chapman et al. (1991) report is the results of fauna surveys of four timber reserves that are all west of Lake Lefroy. All the GHD reports are desktop assessments of the vertebrate fauna.

The trapping effort employed during some of these surveys is now considered inadequate to assess species richness or assemblage structure; however, they provide useful contextual information concerning the project area and compiling a species list.

Taxonomy and nomenclature for fauna species used in this report are generally based on the Atlas of Living Australia (AoLA) except for bats, which follow (Churchill 2008). Terrestrial Ecosystems has presumed that the identifications referred to in the appendices or in reports used to provide local and regional comparative data were correct and we have only corrected obvious records where the nomenclature was known to be incorrect.

4 ASSESSMENT METHOD

4.1 Database searches

Several databases were consulted in the preparation of the potential fauna lists. A review of the *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act 1999)* list of protected species was undertaken to identify species of conservation interest to the Commonwealth Government. A search was undertaken of a 50km radius around a central search coordinate of 31.78055°S and 121.73131°E (Appendix C). In addition, a desktop search of the Terrestrial Ecosystems' fauna survey database was used to develop an appreciation of the vertebrate fauna assemblages in the relevant section of the Eastern Goldfields IBRA subregion. The Department of Parks and Wildlife (DPaW) threatened and priority species database was searched via the records in NatureMap.

Other more general texts were also used to provide supplementary information on vertebrates in the bioregion, including Tyler *et al.* (2000) for frogs; Storr *et al.* (1983, 1990, 1999, 2002) and Thompson and Thompson (2006) for reptiles; Johnstone and Storr (1998b, 2004) for birds; and Van Dyck and Strahan (2008) for mammals.

Collectively these sources of information were used to create lists of species expected to utilise the project area and broader bioregion. It should be noted that these lists will include species that have been recorded in the general region but are possibly vagrants and they will not generally be found in the project area due to a lack of suitable habitat (e.g. shore and fresh water wetland birds). Vagrants can be recorded almost anywhere. Many of the bird, mammal, reptile and amphibian species have specific habitat requirements that may be present in the general area but not in the project area. Also, the ecology of many of these species is often not well understood and it can sometimes be difficult to indicate those species whose specific habitat requirements are not present in the project area. Therefore, many species will be included in the lists produced from database searches but will not be present in the actual project area.

There are errors in most databases, including NatureMap and the WAM collection. These errors occur because of a misidentification of individuals, taxonomic name changes and incorrect coordinates being entered into the database. Terrestrial Ecosystems was unable to verify the primary records, so it has used the information provided. These databases also contain historical records of species that have long since disappeared from the region. Readers should therefore appreciate that species lists and fauna surveys reported in the appendices may include these errors.

4.2 Reconnaissance survey

The project area was searched on foot and by 4WD vehicle for evidence of Malleefowl and other conservation significant fauna. The reconnaissance survey was also used to record fauna habitat types and their condition.

4.3 Fauna habitat assessment

The fauna habitat assessment was undertaken for the entire project area on 18 April 2017. This field assessment had two foci:

- assessing fauna habitat types and their condition; and
- assessing the possible presence of and recording evidence of conservation significant fauna so that mitigation and management strategies might be implemented to reduce potential impacts.

4.3.1 Survey and reporting staff

Dr Scott Thompson undertook the reconnaissance survey and fauna habitat assessment with the assistance of Eren Reid (Native Vegetation Solutions) on 18 April 2017. Dr Graham Thompson prepared this report and Dr Scott Thompson reviewed the report before it was sent to the client. Both senior scientists have appropriate relevant post-graduate qualifications, extensive experience in conducting fauna assessments in the Goldfields, have published research articles on biodiversity, fauna assemblages, conservation significant species, trapping techniques and temporal variations in trapped fauna assemblages based on Goldfields surveys and elsewhere in WA and are therefore appropriately trained and experienced for the task of preparing this assessment.

4.4 Limitations

This fauna risk assessment is based on information contained in the Commonwealth Government database and other published and unpublished fauna survey data for the bioregion and a reconnaissance survey. It is acknowledged that multiple surveys conducted in different seasons, repeated over several years are necessary to fully appreciate the fauna assemblage in the project area.

Lists of species potentially in and around the project area have been compiled from records in NatureMap, the Western Australian Museum records and reports of fauna surveys undertaken in the bioregion. It should be appreciated that some records in NatureMap and the Western Australian Museum are very old and those species are no longer present in the area. Terrestrial Ecosystems has not been able to see the primary data and is therefore not able to vouch for the accuracy of these records. These sources of data are known to contain errors, and this should be considered when reading this assessment.

The EPA's (2016b) *Technical Guidance Terrestrial Fauna Surveys* suggested that fauna surveys may be limited by many variables. Limitations associated with each of these variables are assessed in Table 1.

Table 1. Fauna assessment limitations and constraints

Possible limitations	Constraint (yes/no); significant, moderate or negligible	Comment
Competency and experience of the consultant carrying out this assessment	No	The zoologists that undertook the field survey and prepared this assessment are familiar with the vertebrate fauna of this bioregion and are experienced in these types of assessments.
Scope	No	All aspects of the scope of works have been addressed.
Proportion of fauna identified, recorded and/or collected	No	Not applicable.
Accuracy of previous survey work	Yes, negligible	Terrestrial Ecosystems has reported fauna survey data recorded by various authors, but is not able to vouch for the accuracy of this information. It is acknowledged that the taxonomy of Western Australian vertebrates is continually being revised and the nomenclature of some of the species listed in the appendices may have changed since publication by the authors.
Sources of information	Yes, negligible	Vertebrate fauna information was available from on-line databases and unpublished and published reports of surveys conducted in the bioregion in a variety of habitat types. Many of these surveys employed a low level of trapping effort which significantly impacts on the capacity of these data to represent the fauna assemblages in the areas surveyed.
Timing/weather/season/ cycle	No	Weather was suitable for a reconnaissance survey.
Disturbances which affected results of the survey	No	The project area contained numerous tracks and there was evidence of recent and historical exploration activity in some areas. This minor level of disturbance has been considered in this assessment.
Intensity of survey effort	No	Not applicable.
Resources	No	Adequate resources were available.
Remoteness and/or access problems	No	There was vehicle track access to most the project area. Access was not a limitation or constraint.
Availability of contextual information on the region	No	There is a reasonable quantity of fauna survey data available for this IBRA subregion.

Negligible = less than 20%.

5 RESULTS

5.1 Fauna habitats

The project area was visually assessed on 18 April 2017. The purpose of the reconnaissance survey was to determine fauna habitats and habitat condition and to identify any conservation significant species that may inhabit the area.

The project lies approximately 2.5km east of the Coolgardie Esperance Highway and includes an existing large pit that is approximately 1km by 0.12km in the centre of the project area, and immediately to the east a waste dump created from spoils from the pit (Figure 1). There is a smaller mining pit (160m x 130m) and a waste dump in the north-west corner. There is well used track from the Esperance Coolgardie Highway running south of the Mitchell pit to a mining operation to the east. There are significant and well used tracks running from between the Mitchell pit and the waste dump north to other mining operations. There are numerous old exploration tracks that criss-cross the project area.

Other than for disturbed areas, the project area had a two broad fauna habitat types: mixed eucalyptus woodland over mixed chenopod and sclerophyll scrubland, and low Eucalyptus woodland over dense sclerophyll scrubland. These could be further divided into four fauna habitat types that are closely aligned with the vegetation communities:

- *Eucalyptus griffithsii* over *Acacia acuminata* over sclerophyll shrubland;
- *Eucalyptus salmonophloia* woodland over sclerophyll shrub land;
- *Eucalyptus tortuata* woodland over mixed sclerophyll shrubland; and
- Mixed *Eucalyptus* woodland over mixed sclerophyll shrubland.

In addition to the above habitat types, there are some areas that have been rehabilitated with varying degrees of success, two waste dumps that have minimal vegetation cover and two pits that contain water in the bottom.

Plates 1-6 provide an indication of the habitat types.



Plate 1. Fauna habitat in the project area



Plate 2. Fauna habitat in the project area



Plate 3. Fauna habitat in the project area



Plate 4. Fauna habitat in the project area



Plate 5. Fauna habitat in the project area



Plate 6. Fauna habitat in the project area

5.2 Fauna habitat condition

The project area contains numerous vehicle tracks and there has been historical exploration activity and mining activity in some areas. Fauna habitat condition was rated as degraded to very good. It was rated this way as the project area contains mining and exploration areas with limited rehabilitation, multiple tracks and some areas that have been rehabilitated with varying levels of success.

5.3 Bioregional vertebrate fauna

Appendix A provides a summary of the fauna survey data that are available near the project area. There are appreciable differences in the recorded fauna assemblages within and among fauna surveys shown in Appendix A. These differences are partially due to the low survey effort often deployed and they also reflect variations in soils and vegetation as well as temporal variations in the fauna assemblages.

Tables 2-5 provide a list of vertebrate species potentially found near the project area that have been compiled based on the fauna survey reports listed in Section 3.

Table 2. Birds potentially found near the project area

Family	Species	Common Name
Accipitridae	<i>Lophoictinia isura</i>	Square-tailed Kite
	<i>Haliastur sphenurus</i>	Whistling Kite
	<i>Accipiter fasciatus</i>	Brown Goshawk
	<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk
	<i>Aquila audax</i>	Wedge-tailed Eagle
Anatidae	<i>Hieraaetus morphnoides</i>	Little Eagle
	<i>Cygnus atratus</i>	Black Swan
	<i>Tadorna tadornoides</i>	Australian Shelduck
	<i>Chenonetta jubata</i>	Australian Wood Duck
	<i>Anas gracilis</i>	Grey Teal
Aegothelidae	<i>Anas superciliosa</i>	Pacific Black Duck
	<i>Aythya australis</i>	Hardhead
	<i>Aegothales cristatus</i>	Australian Owlet-nightjar
	<i>Podargus strigoides</i>	Tawny Frogmouth
	<i>Dromaius novaehollandiae</i>	Emu
Charadriidae	<i>Charadrius ruficapillus</i>	Red-capped Plover
	<i>Charadrius australis</i>	Inland Dotterel
	<i>Euseyonis melanops</i>	Black-fronted Dotterel
	<i>Erythronyx cinctus</i>	Red-kneed Dotterel
	<i>Vanellus tricolor</i>	Banded Lapwing
Laridae	<i>Chroicocephalus novaehollandiae</i>	Silver Gull
Recurvirostridae	<i>Recurvirostra novaehollandiae</i>	Red-necked Avocet
	<i>Cladorhynchus leucocephalus</i>	Banded Stilt
Scolopacidae	<i>Tringa nebularia</i>	Common Greenshank
Columbidae	<i>Streptopelia senegalensis</i>	Laughing Dove
	<i>Phaps chalcoptera</i>	Common Bronzewing
	<i>Phaps elegans</i>	Brush Bronzewing

Family	Species	Common Name
	<i>Ocyphaps lophotes</i>	Crested Pigeon
Alcedinidae	<i>Todiramphus pyrrhopygius</i>	Red-backed Kingfisher
	<i>Todiramphus sanctus</i>	Sacred Kingfisher
Meropidae	<i>Merops ornatus</i>	Rainbow Bee-eater
Cuculidae	<i>Chalcites basalus</i>	Horsfield's Bronze-Cuckoo
	<i>Chalcites osculans</i>	Black-eared Cuckoo
	<i>Chalcites lucidus</i>	Shining Bronze-Cuckoo
	<i>Cacomantis pallidus</i>	Pallid Cuckoo
	<i>Cacomantis flabelliformis</i>	Fan-tailed Cuckoo
Caprimulgidae	<i>Eurostopodus argus</i>	Spotted Nightjar
Falconidae	<i>Falco cenchroides</i>	Nankeen Kestrel
	<i>Falco berigora</i>	Brown Falcon
	<i>Falco peregrinus</i>	Peregrine Falcon
Megapodiidae	<i>Leipoa ocellata</i>	Malleefowl
Rallidae	<i>Fulica atra</i>	Eurasian Coot
Acanthizidae	<i>Sericornis frontalis</i>	White-browed Scrubwren
	<i>Hylacola cauta</i>	Shy Heathwren
	<i>Calamanthus campestris</i>	Rufous Fieldwren
	<i>Pyrrholaemus brunneus</i>	Redthroat
	<i>Smicronis brevirostris</i>	Weebill
	<i>Gerygone fusca</i>	Western Gerygone
	<i>Acanthiza robustirostris</i>	Slaty-backed Thornbill
	<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill
	<i>Acanthiza apicalis</i>	Inland Thornbill
	<i>Aphelocephala leucopsis</i>	Southern Whiteface
	<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill
Artamidae	<i>Artamus personatus</i>	Masked Woodswallow
	<i>Artamus cinereus</i>	Black-faced Woodswallow
	<i>Artamus cyanopterus</i>	Dusky Woodswallow
	<i>Cracticus torquatus</i>	Grey Butcherbird
	<i>Cracticus nigrogularis</i>	Pied Butcherbird
	<i>Cracticus tibicen</i>	Australian Magpie
	<i>Strepera versicolor</i>	Grey Currawong
Campephagidae	<i>Coracina maxima</i>	Ground Cuckoo-Shrike
	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-Shrike
	<i>Lalage tricolor</i>	White-winged Triller
Climacteridae	<i>Climacteris rufa</i>	Rufous Treecreeper
Corvidae	<i>Corvus coronoides</i>	Australian Raven
	<i>Corvus bennetti</i>	Little Crow
	<i>Corvus orru</i>	Torresian Crow
Estrildidae	<i>Taeniopygia guttata</i>	Zebra Finch
Hirundinidae	<i>Cheramoeca leucosterna</i>	White-backed Swallow
	<i>Hirundo neoxena</i>	Welcome Swallow
	<i>Petrochelidon nigricans</i>	Tree Martin
	<i>Petrochelidon ariel</i>	Fairy Martin
Maluridae	<i>Malurus splendens</i>	Splendid Fairy-wren
	<i>Malurus leucopterus</i>	White-winged Fairy-wren
	<i>Malurus lamberti</i>	Variegated Fairy-wren
	<i>Malurus pulcherrimus</i>	Blue-breasted Fairy-wren
Meliphagidae	<i>Lichenostomus virescens</i>	Singing Honeyeater
	<i>Lichenostomus leucotis</i>	White-eared Honeyeater
	<i>Lichenostomus flavicollis</i>	Yellow-throated Honeyeater
	<i>Lichenostomus cratitius</i>	Purple-gaped Honeyeater
	<i>Lichenostomus ornatus</i>	Yellow-plumed Honeyeater
	<i>Purnella albifrons</i>	White-fronted Honeyeater
	<i>Manorina flavigula</i>	Yellow-throated Miner
	<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater

Family	Species	Common Name
	<i>Anthochaera carunculata</i>	Red Wattlebird
	<i>Epthianura tricolor</i>	Crimson Chat
	<i>Epthianura albifrons</i>	White-fronted Chat
	<i>Sugomel niger</i>	Black Honeyeater
	<i>Gliciphila melanops</i>	Tawny-crowned Honeyeater
	<i>Lichmera indistincta</i>	Brown Honeyeater
	<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater
	<i>Myiagra inquieta</i>	Restless Flycatcher
	<i>Grallina cyanoleuca</i>	Magpie-Lark
Motacillidae	<i>Anthus novaeseelandiae</i>	Australasian Pipit
Nectariniidae	<i>Dicaeum hirundinaceum</i>	Mistletoebird
Neosittidae	<i>Daphoenositta chrysoptera</i>	Varied Sittella
Pachycephalidae	<i>Pachycephala inornata</i>	Gilbert's Whistler
	<i>Pachycephala pectoralis</i>	Golden Whistler
	<i>Pachycephala rufiventris</i>	Rufous Whistler
	<i>Colluricincla harmonica</i>	Grey Shrike-thrush
	<i>Oreoica gutturalis</i>	Crested Bellbird
Pardalotidae	<i>Pardalotus punctatus</i>	Spotted Pardalote
	<i>Pardalotus striatus</i>	Striated Pardalote
Petroicidae	<i>Microeca fascians</i>	Jacky Winter
	<i>Petroica goodenovii</i>	Red-capped Robin
	<i>Melanodryas cucullata</i>	Hooded Robin
	<i>Eopsaltria australis</i>	Eastern Yellow Robin
	<i>Eopsaltria griseogularis</i>	Western Yellow Robin
	<i>Drymodes superciliaris</i>	Northern Scrub-robin
	<i>Drymodes brunneopygia</i>	Southern Scrub-robin
Pomatostomidae	<i>Pomatostomus superciliosus</i>	White-browed Babbler
Psophodidae	<i>Cinclosoma castanotus</i>	Chestnut Quail-thrush
Rhipiduridae	<i>Rhipidura fuliginosa</i>	Grey Fantail
	<i>Rhipidura leucophrys</i>	Willie Wagtail
Timaliidae	<i>Zosterops lateralis</i>	Silveryeye
Phalacrocoracidae	<i>Microcarbo melanoleucos</i>	Little Pied Cormorant
Podicipedidae	<i>Poliocephalus poliocephalus</i>	Hoary-headed Grebe
Cacatuidae	<i>Eolophus roseicapillus</i>	Galah
	<i>Nymphicus hollandicus</i>	Cockatiel
Psittacidae	<i>Glossopsitta porphyrocephala</i>	Purple-crowned Lorikeet
	<i>Polytelis anthopeplus</i>	Regent Parrot
	<i>Platycercus icterotis</i>	Western Rosella
	<i>Barnardius zonarius</i>	Australian Ringneck
	<i>Psephotus varius</i>	Mulga Parrot
	<i>Melopsittacus undulatus</i>	Budgerigar
	<i>Neophema splendida</i>	Scarlet-chested Parrot
Strigidae	<i>Ninox novaeseelandiae</i>	Southern Boobook

Table 3. Mammals potentially found near the project area

Family	Species	Common Name
Bovidae	<i>Capra hircus</i>	Goat
	<i>Ovis aries</i>	Sheep
Canidae	<i>Canis lupus familiaris</i>	Dog
	<i>Vulpes vulpes</i>	Red Fox
Felidae	<i>Felis catus</i>	House Cat
Molossidae	<i>Auromomus australis</i>	White-striped Free-tail Bat
	<i>Mormopterus planiceps</i>	Southern Free-tail Bat
Vespertilionidae	<i>Chalinolobus gouldii</i>	Gould's Wattled Bat
	<i>Chalinolobus morio</i>	Chocolate Wattled Bat
	<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat

Family	Species	Common Name
	<i>Nyctophilus major</i>	Greater Long-eared Bat
	<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat
	<i>Vespadelus regulus</i>	Southern Forest Bat
Dasyuridae	<i>Ningai ridei</i>	Wongai Ningai
	<i>Ningai yvonneae</i>	Mallee Ningai
	<i>Sminthopsis crassicaudata</i>	Fat-tailed Dunnart
	<i>Sminthopsis dolichura</i>	Little Long-tailed Dunnart
	<i>Sminthopsis gilberti</i>	Gilbert's Dunnart
	<i>Sminthopsis hirtipes</i>	Hairy-footed Dunnart
	<i>Sminthopsis ooldea</i>	Ooldea Dunnart
Burramyidae	<i>Cercartetus concinnus</i>	Southwestern Pygmy Possum
Macropodidae	<i>Macropus fuliginosus</i>	Western Grey Kangaroo
	<i>Macropus irma</i>	Western Brush Wallaby
	<i>Macropus robustus</i>	Wallaroo or Euro
	<i>Macropus rufus</i>	Red Kangaroo
Leporidae	<i>Oryctolagus cuniculus</i>	European Rabbit
Tachyglossidae	<i>Tachyglossus aculeatus</i>	Short-beaked Echidna
Equidae	<i>Equus caballus</i>	Domestic Horse
Muridae	<i>Mus musculus</i>	House Mouse
	<i>Notomys alexis</i>	Spinifex Hopping Mouse
	<i>Notomys mitchellii</i>	Mitchell's Hopping Mouse
	<i>Pseudomys albocinereus</i>	Ash-grey Mouse
	<i>Pseudomys bolami</i>	Bolam's Mouse
	<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse
	<i>Rattus fuscipes</i>	Bush Rat
	<i>Rattus rattus</i>	Black Rat

Table 4. Amphibians potentially found near the project area

Family	Species	Common Name
Limnodynastidae	<i>Limnodynastes dorsalis</i>	Western Banjo Frog
	<i>Neobatrachus albipes</i>	White-footed Trilling Frog
	<i>Neobatrachus centralis</i>	
	<i>Neobatrachus kunapalari</i>	Kunapalari Frog
	<i>Neobatrachus pelobatoides</i>	Humming Frog
	<i>Neobatrachus sutor</i>	Shoemaker Frog
Myobatrachidae	<i>Crinia pseudinsignifera</i>	Bleating Froglet
	<i>Pseudophryne guentheri</i>	Crawling Toadlet
	<i>Pseudophryne occidentalis</i>	Western Toadlet

Table 5. Reptiles potentially found near the project area

Family	Species	Common Name
Agamidae	<i>Ctenophorus adelaidensis</i>	Southern Heath Dragon
	<i>Ctenophorus caudicinctus</i>	Ring-tailed Dragon
	<i>Ctenophorus cristatus</i>	Bicycle Dragon
	<i>Ctenophorus fordii</i>	Mallee Sand Dragon
	<i>Ctenophorus isolepis</i>	Crested Dragon
	<i>Ctenophorus maculatus</i>	Spotted Military Dragon
	<i>Ctenophorus ornatus</i>	Ornate Crevice Dragon
	<i>Ctenophorus reticulatus</i>	Western Netted Dragon
	<i>Ctenophorus salinarum</i>	Salt Pan Dragon
	<i>Ctenophorus scutulatus</i>	
	<i>Moloch horridus</i>	Thorny Devil
	<i>Pogona minor</i>	Bearded Dragon
	<i>Tympanocryptis cephalus</i>	Pebble Dragon
Boidae	<i>Morelia spilota imbricata</i>	Carpet Python

Family	Species	Common Name
Carphodactylidae	<i>Nephrurus laevisissimus</i>	
	<i>Nephrurus vertebralis</i>	
	<i>Underwoodisaurus milii</i>	Barking Gecko
Diplodactylidae	<i>Crenadactylus ocellatus</i>	Clawless Gecko
	<i>Diplodactylus granariensis</i>	
	<i>Diplodactylus pulcher</i>	
	<i>Lucasium maini</i>	
	<i>Oedura reticulata</i>	
	<i>Strophurus assimilis</i>	Goldfields Spiny-tailed Gecko
	<i>Strophurus elderi</i>	
	<i>Strophurus intermedius</i>	
Elapidae	<i>Strophurus strophurus</i>	
	<i>Brachyuropsis fasciolata</i>	
	<i>Brachyuropsis semifasciata</i>	
	<i>Demansia psammophis</i>	Yellow-faced Whipsnake
	<i>Furina ornata</i>	Moon Snake
	<i>Neelaps bimaculatus</i>	Black-naped Snake
	<i>Parasuta gouldii</i>	
	<i>Parasuta monachus</i>	
	<i>Parasuta nigriceps</i>	
	<i>Pseudechis australis</i>	Mulga Snake
	<i>Pseudonaja affinis</i>	Dugite
	<i>Pseudonaja mengdeni</i>	Gwardar
	<i>Pseudonaja modesta</i>	Ringed Brown Snake
	<i>Simoselaps bertholdi</i>	Jan's Banded Snake
	<i>Simoselaps semifasciata</i>	
	<i>Suta fasciata</i>	Rosen's Snake
Gekkonidae	<i>Christinus marmoratus</i>	Marbled Gecko
	<i>Gehyra purpurascens</i>	
	<i>Gehyra variegata</i>	
	<i>Heteronotia binoei</i>	Bynoe's Gecko
	<i>Rhynchoedura ornata</i>	Beaked Gecko
Pygopodidae	<i>Delma australis</i>	
	<i>Delma butleri</i>	
	<i>Delma fraseri</i>	
	<i>Delma nasuta</i>	
	<i>Lialis burtonis</i>	
	<i>Pygopus lepidopodus</i>	Common Scaly Foot
Scincidae	<i>Cryptoblepharus buechananii</i>	
	<i>Ctenotus atlas</i>	
	<i>Ctenotus leonhardii</i>	
	<i>Ctenotus mimetes</i>	
	<i>Ctenotus schomburgkii</i>	
	<i>Ctenotus severus</i>	
	<i>Ctenotus uber</i>	
	<i>Cyclodomorphus branchialis</i>	
	<i>Cyclodomorphus melanops</i>	Slender Blue-tongue
	<i>Egernia carinata</i>	
	<i>Egernia depressa</i>	Southern Pygmy Spiny-tailed Skink
	<i>Egernia formosa</i>	
	<i>Egernia multiscutata</i>	
	<i>Egernia richardi</i>	
	<i>Eremiascincus richardsonii</i>	Broad-banded Sand Swimmer
	<i>Hemiernis initialis</i>	
	<i>Hemiernis millewae</i>	
	<i>Hemiernis peronii</i>	
	<i>Lerista distinguenda</i>	

Family	Species	Common Name
	<i>Lerista dorsalis</i>	
	<i>Lerista kingi</i>	
	<i>Lerista picturata</i>	
	<i>Lerista taeniata</i>	
	<i>Lerista terdigitata</i>	
	<i>Lerista tridactyla</i>	
	<i>Liopholis inornata</i>	
	<i>Menetia greyii</i>	
	<i>Morethia adelaidensis</i>	
	<i>Morethia butleri</i>	
	<i>Morethia obscura</i>	
	<i>Tiliqua occipitalis</i>	Western Bluetongue
	<i>Tiliqua rugosa</i>	
Typhlopidae	<i>Anilius australis</i>	
	<i>Anilius bicolor</i>	
	<i>Anilius bituberculatus</i>	
	<i>Anilius hamatus</i>	
Varanidae	<i>Varanus caudolineatus</i>	
	<i>Varanus gouldii</i>	Bungarra or Sand Monitor
	<i>Varanus rosenbergi</i>	Heath Monitor
	<i>Varanus tristis</i>	Racehorse Monitor

5.4 Conservation significant fauna species recorded or predicted to occur in the project area

Species listed under the *EPBC Act 1999* or the *Wildlife Conservation Act 1950* as being threatened or of conservation significance or are on the DPaW Priority and Threatened Species list and are potentially near the project area are shown in Table 6.

Conservation significant fauna are protected by the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act 1999*), and this list includes species covered by international treaties such as the Japan-Australia Migratory Bird Agreement (JAMBA) and China-Australia Migratory Bird Agreement (CAMBA) and the Western Australia (WA) *Wildlife Conservation Act 1950*. The WA *Wildlife Conservation Act 1950* provides for the publishing of the *Wildlife Conservation (Specially Protected Fauna) Notice* that lists species under multiple categories (see Appendix B). In addition, the DPaW maintains a list of fauna that require monitoring under five priority headings (see Appendix B) based on DPaW's knowledge of their distribution, abundance and threatening processes. The *EPBC Act 1999* and *Wildlife Conservation Act 1950* imply legislative requirements for the management of anthropogenic impacts to minimise the effects of disturbances on species and their habitats. Priority species have no statutory protection, other than the DPaW wishes to monitor potential impacts on these species. Environmental consultants and proponents of developments are encouraged to avoid and minimise impacts on these species. Definitions of the significant fauna under the WA *Wildlife Conservation Act* are provided in Appendix B.

Four threatened species of fauna and six migratory species of birds were identified under the *EPBC Act 1999* as potentially occurring near the project area. There are 11 species listed under the WA *Wildlife Conservation Act 1950*, including six migratory species and five priority species listed on the DPaW's Priority Fauna List that potentially occur in the region. The following is an assessment of the likelihood of each of the species listed in Table 6 being found in the project area and if they are found, the potential for impacting on the species during development. Listed marine species have been excluded from this list as there is no suitable habitat in the project area.

Table 6. Species that are potentially found near the project area and that are listed as being of conservation significance under state or commonwealth government legislation or with DPaW.

Species	Status under the Wildlife Conservation Act / DPaW	Status under the EPBC Act	Comment on potential impact that vegetation clearing will have on conservation significant species
<i>Pezoporus occidentalis</i> Night Parrot	Critically endangered	Endangered	Highly unlikely to be in the project area due to a lack of suitable habitat.
<i>Calidris ferruginea</i> Curlew Sandpiper	Vulnerable	Critically endangered	Highly unlikely to be in the project area due to a lack of suitable habitat.
<i>Leipoa ocellata</i> Malleefowl	Vulnerable	Vulnerable	Potentially near the project area, however, it is unlikely to be impacted as there are no active mounds in the project area, there are limited areas of ideal habitat and they are mobile enough to move away from noise or disturbance.
<i>Dasyurus geoffroii</i> Chuditch	Vulnerable	Vulnerable	Not recently recorded near the project area, and although the habitat may be suitable in some areas, the impact is likely to be very low due to it not being present in the area.
<i>Motacilla cinerea</i> Grey Wagtail	Migratory	Migratory	Highly unlikely to be in the project area due to a lack of suitable habitat.
<i>Actitis hypoleucos</i> Common Sandpiper	Migratory	Migratory	Highly unlikely to be in the project area due to a lack of suitable habitat.
<i>Calidris acuminata</i> Sharp-tailed Sandpiper	Migratory	Migratory	Highly unlikely to be in the project area due to a lack of suitable habitat.
<i>Calidris melanotos</i> Pectoral Sandpiper	Migratory	Migratory	Highly unlikely to be in the project area due to a lack of suitable habitat.
<i>Apus pacificus</i> Fork-tailed Swift	Migratory	Migratory	It is unlikely that vegetation clearing will significantly impact on this species as they are an aerial species and rarely come to the ground. They can also easily move to adjacent undisturbed areas once clearing commences.
<i>Ardea ibis</i> Cattle Egret	Migratory		Highly unlikely to be in the project area due to a lack of suitable habitat.
<i>Falco peregrinus</i> Peregrine Falcon	Specially protected		Low potential to be in the area, but if present, it is unlikely that vegetation clearing will significantly impact on this species because it can easily move to adjacent undisturbed areas once clearing commences.
<i>Aspidites ramsayi</i> Woma	Priority 1		Highly unlikely to be in the project area, so any potential impact on this species is likely to be very low.
<i>Acanthophs antarcticus</i> Southern Death Adder	Priority 3		Not recently recorded near the project area, and although the habitat may be suitable in some areas, any impacts are likely to be very low in a bioregional context.

Species	Status under the Wildlife Conservation Act / DPaW	Status under the EPBC Act	Comment on potential impact that vegetation clearing will have on conservation significant species
<i>Platycercus icterotis xanthogenys</i> (Mallee) Western Rosella	Priority 4		Could be found in the eucalypt woodland, however, it would readily move to adjacent undisturbed areas once clearing commences. Overall potential for impact is low, when considered in a bioregional context.
<i>Nyctophilus major tor</i> Central Long-eared Bat	Priority 4		This species has been recorded in other surveys in the region, however, vegetation clearing associated with exploration is unlikely to significantly impact on this species, as it will readily move away from a disturbance.
<i>Charadrius rubricollis rubricollis</i> Hooded Plover (western subspecies)	Priority 4		A very low probability of being found in the area due to lack of habitat. Potential impacts on this species are assessed as low.

5.4.1 Potential impact on species of conservation significance

Night Parrot (*Pezoporus occidentalis*) – Endangered under the *EPBC Act 1999* and critically endangered under the *Wildlife Conservation Act*

The Night Parrot appears to be a secretive, nocturnal and a ground dwelling species. Its geographical distribution is poorly understood, but it was probably distributed over much of semi-arid and arid Australia (Garnett et al. 2011). Sightings in north-west Queensland in the early 1990s were in a broad cross section of the habitats available (Garnett et al. 1993). There have been recent sightings in the Pilbara in 1980 and 2005, central WA in 1979, north-eastern South Australia in 1979, western Queensland in 1980, 1990, 1993 and 2006 (Garnett et al. 2011). There are recent confirmed records in Pullen Pullen Nature Reserve in western Queensland and in the Diamantina National Park. There have been numerous, mostly futile, investigations to determine the existence and location of this little-known species in Western Australia (Davies et al. 1988, Garnett et al. 1993, Blyth et al. 1996, Blyth and Boles 1997) until it was recently rediscovered in the Muchison/Pilbara. The exact location is not known but it was reported to be found in dense, long-unburnt spinifex near some inland salt lakes. Garnett et al. (2011) suggested that there were between 50-250 mature individuals in less than 5% of its previous range.

Although the Night Parrot's pattern of movement is unknown, it is presumed to be partially nomadic. The Department of Sustainability, Environment, Water, Population and Community (DSEWPoC) Species Profile and Threats Database (SPRAT site www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=59350) indicated that its preferred habitat is *Triodia* grasslands in stony or sandy environments, samphire and chenopod shrub lands. Wilson's (1937) summary of observations provided information on the Night Parrots' preferred habitat and breeding sites. It seems to prefer spinifex, but has been recorded in samphire, comes to water after dark and builds its nest deep in spinifex tussocks. It nests have a runway and a tunnel entrance and it lays clutches of two to four white eggs. The Threatened Species Scientific Committee's advice (<http://www.environment.gov.au/biodiversity/threatened/species/pubs/59350-conservation-advice-15072016.pdf>) indicated that 'ost habitat records are of *Triodia* (Spinifex) grasslands and/or chenopod shrublands (Garnett et al., 2011) in the arid and semi-arid zones, and Higgins (1999) listed *Astrebla* spp. (Mitchell grass), shrubby samphire and chenopod associations, scattered trees and shrubs, *Acacia aneura* (Mulga) woodland, treeless areas and bare gibber as associated with sightings of the species. S. Murphy (pers. comm.) recorded a similar range of habitats used or traversed by individuals in southwestern Queensland: Cretaceous sandstone, claystone, and siltstone residuals; either dominated by *Triodia longiceps* on slopes and margins of duricrust plateaus or with *Sclerolaena* spp., *Maireana* spp. (Saltbush spp.), *Ptilopus* spp. (Mulla Mulla spp.), and small areas of *T. longiceps*; with occasional watercourses with *Acacia cambagei* (stinking gidgee).

Several reasons have been suggested for its decline, including habitat loss and degradation through clearing, grazing, altered fire regimes, predation by feral cats and foxes, erosion and soil loss caused by feral herbivores, reduced availability or quality of watering points and in appropriate fire regimes (Garnett et al. 2011; <http://www.environment.gov.au/biodiversity/threatened/species/pubs/59350-conservation-advice-15072016.pdf>).

There are no Night Parrot records near the project area and no suitable habitat; therefore, it is highly unlikely to be present in the project area.

Curlew Sandpiper (*Calidris ferruginea*) – Vulnerable under the *Wildlife Conservation Act 1950* and the *EPBC Act 1999*.

The Curlew Sandpiper is found along most coasts, including the off-shore islands of the Pilbara and Rottnest and it is also found in coastal brackish lagoons, tidal mud flats, estuaries and salt marshes (Johnstone and Storr 1998a, Garnett and Crowley 2000). It breeds on the arctic coast of Asia and winters in Africa, Madagascar, south Asia, Indo-Australia and occasionally New Zealand (Garnett et al. 2011).

It feeds on polychaetes, molluscs and crustaceans. Garnett et al. (2011) indicated its population has declined 50-70% in three generations.

There is no suitable habitat for this species in the project area, so it will not be impacted by the proposed development.

Malleefowl (*Leipoa ocellata*) – Vulnerable under the *Wildlife Conservation Act 1950* and the *EPBC Act 1999*.

Malleefowl are large, ground-dwelling birds that rarely fly unless alarmed or are perching for the night. Historically, Malleefowl have been found in mallee regions of southern Australia from approximately the 26th parallel of latitude southwards. Recently their range has contracted due to fox predation and land clearance. Their abundance in the Goldfields is low and they are sparsely distributed, favouring those areas that are more densely vegetated. Malleefowl build distinctive nests that comprise a large mound of soil/rock covering a central core of leaf litter. These nest mounds range in diameter but can span more than five metres and may be up to one metre high. Malleefowl are generally monogamous and, once breeding commences, they pair for life. The presence of nest mounds provides an indication of the presence of Malleefowl in the area.

Malleefowl have been recorded in other fauna surveys near the project area (Appendix A). However, no evidence (e.g. tracks or mounds) of Malleefowl were found in the project area, and there is limited suitable habitat available for this species. It is therefore Terrestrial Ecosystems' assessment that Malleefowl may be found in the general vicinity, however any impact on them in the project area would be very low as they are unlikely to nest in the project area and they can easily move away from vegetation clearing or other disturbances.

Chuditch (*Dasyurus geoffroii*) – Vulnerable under the *Wildlife Conservation Act 1950* and the *EPBC Act 1999*.

The Chuditch is the largest carnivorous marsupial in Western Australia (WA). It is usually active from dusk to dawn. Formally known from over 70% of Australia, the Chuditch now has a patchy distribution throughout the Jarrah forest and mixed Karri/Marri/Jarrah forest of south-west WA and other isolated areas. Chuditch are solitary animals for most of their life and den in hollow logs, burrows, culverts, etc and have also been recorded in tree hollows and rock cavities. Chuditch are opportunistic feeders, and forage primarily on the ground at night. Their diet can include other mammals, birds, lizards, bird and reptile eggs but the majority is a mixture of large invertebrates (e.g. spiders, scorpions and crickets).

They have been recorded in similar habitat around Forrestania (i.e. >100km to the west), but there are no recent records near the project area. Based on the available data, it is Terrestrial Ecosystems assessment that any impacts are likely to be very low due to it not being present in the project area.

Grey Wagtail (*Motacilla cinerea*) – Migratory under the *EPBC Act 1999* and *Wildlife Conservation Act*

The Grey Wagtail is a small yellow breasted bird with a grey back and head. Johnstone and Storr (2004) reported this migratory species as breeding in Palearctic from western Europe and north-west Africa to eastern Asia and wintering in Africa, south-east Asia, Indonesia, the Philippines, New Guinea and Australia. It is considered a vagrant in Australia (Birdlife international 2016)

Its preferred habitat in Australia is around the banks and rocks of fast-running fresh water including rivers, streams and creeks where it feeds on insects. It is also found in more lowland watercourses, even canals, where there are artificial waterfalls, weirs, millraces or lock gates. Outside of the breeding season it occupies a wider variety of habitats, including farmyards, sewage farms, forest tracks, tea estates and even town centres (Birdlife international 2016). It feeds mainly on insects but also takes freshwater shrimps (*Gammarus*), terrestrial snails (Mollusca) and spiders (Araneae) (Birdlife international 2016).

The Atlas of Living Australia records two sightings on the south-coast of Western Australia, but none near the project area. It is highly unlikely to be seen in the project area due to a lack of suitable habitat.

Common Sandpiper (*Actitis hypoleucos*) - Migratory under the *EPBC Act 1999* and the *Wildlife Conservation Act 1950*

The Common Sandpiper breeds in Europe and north and central Asia and winters in southern Europe, Africa, Madagascar, south Asia and Australia (Johnstone and Storr 1998a). In Western Australia, it is found along most coasts and off-shore islands and much of the interior as it feeds in fresh or salt water estuaries, mangroves, salt lakes on crustaceans, molluscs, worms, etc that it finds in the shallows.

There is no suitable habitat for this species in the project area, so it will not be impacted by the proposed development.

Sharp-tailed Sandpiper (*Calidris acuminata*) -- Migratory under the *EPBC Act 1999* and the *Wildlife Conservation Act 1950*

The Sharp-tailed Sandpiper is found along most coasts and well-watered parts of the interior. It breeds on the arctic coast of central north Asia and winters from New Guinea to southern Australia (Johnstone and Storr 1998a).

There is no suitable habitat for this species in the project area, so it will not be impacted by the proposed development.

Pectoral Sandpiper (*Calidris melanotos*) - Migratory under the *EPBC Act 1999* and the *Wildlife Conservation Act 1950*

The Pectoral Sandpiper inhabits freshwater swamps, lagoons, river pools, irrigation channels, sewage ponds and samphire flats around estuaries and salt lakes (Johnstone and Storr 1998a).

There is no suitable habitat for this species in the project area, so it will not be impacted by the proposed development.

Fork-tailed Swift (*Apus pacificus*) - Migratory under the *EPBC Act 1999* and the *Wildlife Conservation Act 1950*.

The Fork-tailed Swift breeds in north-east and mid-east Asia and northern Australia and winters in Australia and New Guinea. It arrives in the Kimberley in late September and in central and southern WA in October-November and leaves in late April. The Fork-tailed Swift may be an infrequent visitor to the area although it has not been recorded in previous surveys.

It is Terrestrial Ecosystems' assessment that the Fork-tailed Swift may infrequently be seen near the project area, but is unlikely to be impacted by the proposed developments as it is an aerial species and rarely comes to the ground.

Cattle Egret (*Ardea ibis*) - Migratory under the *EPBC Act 1999* and the *Wildlife Conservation Act 1950*

The smallest of Australian egrets, this species has undertaken an invasion of Australia from the north, where it was originally more common in the Indonesian archipelago than Australia. This invasion may have been assisted by the opening of farming land and irrigation schemes, providing the pasturelands and shallow wetlands that the species prefers to forage in.

It is Terrestrial Ecosystems assessment the Cattle Egret would not be seen in the project area due to a lack of suitable habitat, so any impacts would be very low.

Peregrine Falcon (*Falco peregrinus*) – Specially protected under the *Wildlife Conservation Act 1950*

The Peregrine Falcon is uncommon, although widespread throughout much of Australia excluding the extremely dry areas and has a wide and patchy distribution. It favours hilly or mountainous country and open woodlands and may be an occasional visitor to the project area. Nesting sites include ledges along cliffs, granite outcrops and

quarries, hollow trees near wetlands and old nests of other large bird species. There is no evidence to suggest any change in status in the last 50 years. Peregrine Falcons were recorded during numerous fauna surveys in the goldfields (Appendix A), so they are in the area.

It is Terrestrial Ecosystems' assessment that the Peregrine Falcon may infrequently be observed in the project area; however, vegetation clearing is unlikely to have a significant impact on this species as there are plenty of similar habitats in adjacent areas.

Woma (southern form: *Aspidites ramsayi*) – Priority 1 with DPaW

This python was once common in a crescent shaped distribution from Shark Bay through the wheatbelt to Kitchener. The Atlas of Living Australia has records of them being caught near the Great Eastern Highway from around Southern Cross and east towards Coolgardie and then there is a disjunct population near Zanthus.

Given the lack of records near the project area, Terrestrial Ecosystems has assessed potential impacts on this species as very low.

Southern Death Adder (*Acanthophis antarcticus*) – Priority 3 with DPaW

The Southern Death Adder is a very cryptic snake that is found from the Darling Range, central wheatbelt and from Esperance across the Nullarbor Plain to the South Australian border. It is rarely caught in fauna surveys and only opportunistically encountered on roads and in undisturbed bushland.

The Southern Death Adder is in relatively low densities across the goldfields and there is a very low possibility it is in the project area. However, there are no records in the Atlas of Living Australia near the project area, so the potential impact on the species is very low in a bioregional context.

Western Rosella (*Platycercus icterotis xanthogenys*) – Priority 4 with DPaW.

The mallee form of the Western Rosella is found mostly in Eucalypt and Casuarina woodland and shrublands, especially Wandoo, Flooded Gums and Salmon Gums. This species was sighted by Chapman et al., (1991) near Cave Hill Nature Reserve, but it was not seen in any of the other fauna surveys around the project area (Appendix A). Based on his surveys in the Goldfields, Prof. H. Recher (pers. comm.) suggested that this species is sparse throughout the Great Western Woodland and probably nested in the woodlands.

There is a low probability that the Western Rosella could be found in the eucalypt woodland in low densities, however, it would readily move to adjacent undisturbed areas once vegetation clearing commences. The overall potential for impact is low, however, there may be localised impacts if a hollow containing a nesting bird was disturbed.

Central Long-eared Bat (*Nyctophilus major tor*) – Priority 4 with DPaW

This species is distributed across the southern and central wheatbelt, southern part of the Great Victoria Desert and the Nullarbor coast. The project area is on the boundary of its known distribution. It roosts in tree cavities, foliage and under loose bark.

Given that the proposed vegetation clearing represents a very small fraction of similar habitat in the general area, it is Terrestrial Ecosystems' assessment that the proposed clearing in the project area is unlikely to have a significant impact on this species, as it will readily move to adjacent areas.

Hooded Plover (*Charadrius rubricollis*) – Priority 4 species with DPaW

This species frequents the margins and shallows of salt lakes and along coastal beaches, where it forages for invertebrates. It is found along the southern coast and salt lakes north to Port Gregory, Three Springs, Mt Gibson, Lake Brown, Lake Barlee, Lake Cowan and Eyre. It is an uncommon to common resident on the southern sea beaches from Cape Naturaliste east to Eyre. It probably breeds in the samphire habitat along the boundary of some of the salt lakes in the bioregion.

It is Terrestrial Ecosystems' assessment that the Hooded Plover is not in the project area due to a lack of suitable habitat. The potential for impacting this species is therefore low.

5.5 Risk assessment

Fauna surveys to support Environmental Impact Assessments (EIA) are part of the environmental risk assessment undertaken to consider what potential impacts a development might have on the biodiversity on a particular area and region. Potential impacts on fauna from the proposed development are identified and briefly described above. Tables 7, 8 and 9 provide a summary of the risk assessment associated with this project.

The assessment contained in Table 9 is supported by more detail discussion in sections above and the management recommendations below.

Table 7. Fauna impact risk assessment descriptors

Any risk assessment is a product of the likelihood of an impact occurring and the consequences of that impact. Likelihood and consequences are categorised and described below. These criteria do not fit all circumstances (e.g. adequacy of fauna survey data), however, they are useful in providing the reader with an appreciation of the level of likelihood and consequences of an event. The assessed risk level (likelihood x consequences) is then calculated as the overall risk for the development. This is followed by an assessment of the acceptability of the risk associated with each of the events or impacts. Disturbances and vegetation clearing have an impact on the fauna at multiple scales – site, local, landscape and regional. Each of these is considered in the risk assessment. This assessment should be considered in the context of the summary in Table 9.

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

Table 8. Levels of acceptable risk

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

Table 9. Risk assessment

		Before Management				With Management		
Factor	Potential Impact	Inherent Risk			Risk Controls / Management	Residual Risk		
		Likelihood	Consequence	Significance		Likelihood	Consequence	Significance
Inadequate fauna survey data.	Unknown loss of fauna, fauna of conservation significance, fauna assemblage(s) in development site.	C	2	Low				
Inadequate knowledge of potential impacts.	Unknown or poorly assessed impact(s) on fauna assemblage and conservation significant species.	B	2	Low				
Inadequate bioregional data for contextual purposes.	Incomplete analysis of data and appreciation of impacts on biodiversity values in a regional context.	B	2	Low				
Removal of habitat – site scale.	Almost complete loss of terrestrial fauna in cleared areas, severe impact on local fauna assemblage.	E	1	Low				
Significant reduction of habitats – local scale.	Loss of fauna and fauna habitat and impacts on local fauna assemblage (excluding conservation significant species).	B	1	Low				
Significant reduction of habitats – landscape scale.	Loss of fauna and fauna habitat and impacts on fauna in a landscape context (excluding conservation significant species).	A	1	Low				
Significant reduction of habitats – regional scale.	Loss of fauna and fauna habitat and impacts on fauna in a bioregional context (excluding conservation significant species).	A	1	Low				

		Before Management				With Management		
Factor	Potential Impact	Inherent Risk			Risk Controls / Management	Residual Risk		
		Likelihood	Consequence	Significance		Likelihood	Consequence	Significance
Loss of conservation significant species	Loss of a localised population or a few individuals – <i>Leipoa ocellata</i> .	A	3	Low				
	Loss of a localised population or a few individuals – <i>Platycercus icterotis xanthogenys</i> .	A	3	Low				
	Loss of a localised population or a few individuals – <i>Nyctophilus major tor</i>	B	2	Low				
	Loss of a localised population or a few individuals – <i>Charadrius rubricollis rubricollis</i> .	A	2	Low				
	Loss of a localised population or a few individuals – <i>Falco peregrinus</i> .	A	2	Low				
	Loss of a localised population or a few individuals – <i>Acanthophis antarcticus</i> .	A	2	Low				
Migratory avian species.	Loss of a localised population or a few individuals – <i>Merops ornatus</i> .	A	2	Low				
	Loss of a localised population or a few individuals – <i>Apus pacificus</i> .	A	2	Low				
	Loss of a localised population or a few individuals – <i>Ardea ibis</i> .	A	2	Low				
Anthropogenic activity	Introduced fauna populations increasing.	C	2	Low				
	Altered fire regimes adversely affecting fauna assemblages.	B	2	Low				
	Road kills.	E	2	Low				

6 DISCUSSION

6.1 Adequacy of available vertebrate fauna data

The EPA's (2016a) *Environmental Factor Guideline Terrestrial Fauna* and its *Technical Guidance Terrestrial Fauna Surveys* (EPA 2016b) and the *Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA / DEC 2010) are the three relevant documents to assess the adequacy of the available information and reporting for vertebrate fauna surveys in Western Australia.

The adequacy of the data provided and the resulting assessment of potential impacts of vegetation clearing in the project area on terrestrial fauna should be assessed in the context of whether additional fauna survey data would provide a better understanding of potential impacts and therefore improve how these impacts might be managed. Terrestrial Ecosystems' view is that given the available fauna survey data and the abundance of similar habitat in adjacent areas, there is no justification for undertaking a more detailed Level 2 vertebrate fauna survey in the project area, as there are sufficient data to make an adequate assessment of potential impacts on the terrestrial vertebrate fauna in the project area.

6.2 Fauna assemblages

6.2.1 Amphibians

Amphibians typically found in eucalypt woodlands in the Goldfields are listed in Table 4. All the Limnodynastidae species are burrowing frogs and only come to the surface to feed and breed after substantial rain. *Pseudophryne occidentalis* finds shelter under rocks and in crevices during the dry periods and enter temporary ponds to breed after major rainfall events and *P. pseudinsignifera* is an aquatic species and would only be found around permanent water sources. All species have a wide-spread distribution and are abundant.

6.2.2 Reptiles

Reptile species richness in the project area will be comparable with similar eucalypt woodlands elsewhere in the bioregion. The list provided in Appendix A represents species likely to be found over a large area of diverse habitat types. Eucalypt woodlands would typically support up to 40 species of reptiles, but many of these would be in low abundance (see Table 5).

6.2.3 Birds

Avian species richness in the Goldfields is influenced by rainfall and is generally higher in woodlands compared with chenopod shrublands and more sparsely vegetated areas. The list provided in Table 2 represents species likely to be found over a large area of diverse habitat types. Eucalypt woodlands would typically support up to 50-70 species of birds, but many of these would be in very low numbers (see Appendix A). Birds typically move from an area once vegetation clearing commences, so the impact is relatively low if the area is small. However, eggs and chicks in nests are often lost during the clearing process. The Malleefowl is the most significant species that could be impacted by the proposed mining development, however, the habitat is not ideal and no evidence was found to suggest that they are present.

6.2.4 Mammals

Mammal abundance in the semi-arid areas varies seasonably and from year-to-year depending on the available resources and previous rainfall. Table 3 provides an indication of the mammals that have been recorded in other surveys in the region. Small mammals that retreat to burrows and logs during the day are often lost during the clearing process. There are no known conservation significant mammals likely to be in the project area.

Goats were present in adjacent areas and cats have been recorded on multiple occasions in the vicinity of the project area.

6.3 Biodiversity values of the site

Fauna habitat types represented in the project area are abundant and are rated as degraded to good. Therefore, the fauna assemblage that is present in the project area will also be present and abundant in the adjacent areas. The



available fauna survey data (Appendix A) provides a good indication of the vertebrate fauna that are potentially in the project area.

The listed avian species of conservation significance potentially seen in the project area are the Western Rosella, Peregrine Falcon, Malleefowl and the migratory Rainbow Bee-eater, Fork-tailed Swift and Cattle Egret. All of these avian species are mobile and will readily move to adjacent areas if disturbed. The only potential impact would be clearing a tree or nest that contained eggs or chicks (e.g. Western Rosella), and the likelihood of this happening is assessed as low.

There is a very low possibility that the area supports Southern Death Adders. The Southern Death Adder is a very cryptic species and seldom recorded during surveys when they are present. Given their current known distribution and the low probability of them being present in the project area, any potential impacts are likely to be very low in a bioregional context.

6.3.1 Condition of fauna habitat and extent of habitat degradation

Other than for disturbed areas, the project area had a two broad fauna habitat types: mixed eucalyptus woodland over mixed chenopod and sclerophyll scrubland, and low Eucalyptus woodland over dense sclerophyll scrubland. These could be further divided into four fauna habitat types that are closely aligned with the vegetation communities:

- *Eucalyptus griffithsii* over *Acacia acuminata* over sclerophyll shrubland;
- *Eucalyptus salomonophloia* woodland over sclerophyll shrub land;
- *Eucalyptus tortuata* woodland over mixed sclerophyll shrubland; and
- Mixed *Eucalyptus* woodland over mixed sclerophyll shrubland.

The project area includes two mining pits (1km by 0.12km and 0.16km x 0.13km), two large waste dumps that have little vegetation cover and numerous tracks and some historical exploration activity in the area. Overall the fauna habitat in the project area was rated as degraded to good.

6.3.2 Ecological linkages

The project area currently does not provide any important ecological linkages or fauna movement corridors. There are mining pits, unvegetated waste dumps and exploration tracks that dissect the project area. The tracks are relatively narrow and are unlikely to provide a barrier that would inhibit the movement of fauna within the general area, however, the existing mining pits and waste dumps provide a movement barrier for small vertebrates.

6.3.3 Conservation significant species

There is a very low possibility that the area supports Southern Death Adder, Western Rosella, Peregrine Falcon, Malleefowl and the Fork-tailed Swift. The Rainbow Bee-eater is probably in the area on a seasonal basis. All avian species potentially found in the project area are mobile and will readily move to adjacent areas if disturbed.

As the proposed impact area is small relative to the available similar habitat in the adjacent areas and the broader region, the probability of significantly impacting on any of these species is low.

6.3.4 Great Western Woodland

The project area is within the Great Western Woodland (Department of Environment and Conservation 2010b) which is an area of special interest to various conservation groups and the DPaW. Currently, there are no specific management strategies in place that focus on the vertebrate fauna, however, the proposed state government management strategies for pest and fire will have an indirect impact if and when they are implemented.

Conservation groups are keen for the Great Western Woodland to be preserved and will continually put pressure on DPaW and environmental regulators to limit development in this area.



6.4 Potential impacts on fauna

Clearing of vegetation will potentially affect vertebrate fauna in a number of ways, including:

- death/injury of fauna during clearing, grading and impacts with vehicles;
- loss of habitat;
- fragmentation of habitat;
- increase in feral fauna around the mining development; and
- disturbance of fauna in nearby areas from light, noise and dust.

These impacts are discussed below.

6.4.1 Direct impacts

6.4.1.1 *Animal deaths during the clearing process and displacement of fauna*

Clearing vegetation will result in the loss of most small fauna that retreat to burrows, such as reptiles and mammals. Nocturnal species are unlikely to be active when most of the land clearing is taking place which will inevitably result in these individuals being killed or injured in their burrows or as they attempt to escape. Larger terrestrial animals and avian species will most often move to adjacent areas. These species will be required to establish new activity areas and home ranges, and this could result in the temporary displacement of resident species. However, long-term impacts are likely to be low.

6.4.1.2 *Reduction or loss of activity areas and closure of burrows*

Clearing vegetation is likely to destroy reptile and mammal burrows or foraging habitat that are currently in use, or could be used again. Clearing vegetation that forms part of the activity area of individuals has the potential to force these animals into adjacent areas. These areas may offer fewer resources placing individuals under survival pressure. It could also cause individuals to move into the territories of other individuals increasing competition for resources. Forced relocations could increase the possibility of predation.

6.4.2 Indirect impacts

In addition to the obvious impact of vegetation clearing there can be an equally significant or greater impact in the adjacent areas because of 'edge effects'. Edge effects include disruption to ecological processes such as predation and dispersal, animal movements and can change assemblage structure. The consequence is that the impact area will always be much larger than the cleared area. Vehicle tracks also have the propensity to develop weed infestations which can impact on natural fauna habitats. Cleared corridors in relatively dense vegetation can also provide improved predator access to areas, enhance the invasion of pest species into areas and may act as inhibitors or disrupt fauna migration and movement patterns.

There are numerous potential threats associated with vegetation clearing that could have a significant impact on the vertebrate fauna in the project area. Some of these are discussed below.

6.4.2.1 *Habitat fragmentation*

In addition to vegetation clearing, infrastructure including tracks, has the potential to fragment habitat. Cleared linear tracks of land are 'unnatural' in much of the habitat. These linear structures that partition existing activity areas, isolate sections of established communities and may alter long and medium-term patterns of movement around established home ranges particularly for small mammals and reptiles. A reduction in the population as a result of this infrastructure would be difficult to detect given our current knowledge of the spatial ecology for most of the small mammals known to be in the area.

As most of the tracks within the project area will be relatively narrow; the potential impact associated with habitat fragmentation is likely to be low.

6.4.2.2 Introduced fauna

An increase in human activity is often associated with an increase in the abundance of introduced species such as the house mouse (*Mus musculus*), cat (*Felis catus*) and wild dogs (*Canis lupus*). This increase may be due to a decline in habitat health, increased road kills, poor disposal of waste and easier access to areas via tracks.

House mice and cats are known to be established in the area. In many situations, they have become a ‘naturalised’ species in the Australian bush. Increases in cat numbers can have a detrimental impact on native fauna because they predate on and compete with native species, severely disrupting the natural balance. Goats are also common in the area, with approximately 50 observed during the flora and vegetation survey (Eren Reid, pers comm).

Infrastructure known to support feral species, such as rubbish disposal sites and bins, should be managed to minimise increases in these populations.

6.4.2.3 Road fauna deaths

An increase in road fauna deaths is likely to occur where new roads are constructed or upgraded, in particular, affecting kangaroos, nocturnal birds and ground dwelling large carnivorous predators. Species such as goannas and raptors are attracted to carrion on road verges. Therefore, there is an increased propensity for these species to be killed by vehicles.

6.4.2.4 Anthropogenic activity

Unnatural noises, vibrations, artificial light sources for mining activities and vehicle and human movement in an area may be sufficient to force individuals or fauna species to move from an area, or alter their activity periods.

6.4.3 Summary of impacts

Based on the available information, it is Terrestrial Ecosystems’ view that clearing of the vegetation to enlarge the existing mine will not significantly impact on conservation significant species listed under the Commonwealth *EPBC Act 1999* or WA *Wildlife Conservation Act 1950*. Fauna will be lost during the clearing process, but this impact is unlikely to be significant, as similar fauna habitat supporting similar fauna assemblages are abundant in adjacent areas.

6.5 Native vegetation clearing principles

The *Environmental Protection Act (1986)* provides criteria to judge the potential impact of a development on clearing native vegetation on flora and fauna. These criteria have been listed below with a response to indicate how clearing of the vegetation in the project area might be judged against these principles as they relate to fauna and fauna assemblages.

Table 10. Assessment of impact on fauna and fauna assemblages using the Native Vegetation Clearing Principles

Principle	Response
It comprises a high level of biological diversity.	Clearing vegetation will not compromise a high level of biodiversity.
It comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.	The project area does not contain habitat that is necessary for fauna indigenous to Western Australia
It includes, or is necessary for the continued existence or, rare flora.	Not applicable.
It comprises the whole or a part of, or is necessary for the maintenance of, a threatened ecological community.	The area does not contain a threatened ecological community.
It is significant as a remnant of native vegetation in an area that has been extensively cleared.	The area is not a remnant nor will the proposed clearing create a remnant.

It is growing in, or in association with, an environment associated with a watercourses or wetland.	The area does not contain a watercourse or a wetland.
The clearing of the vegetation is likely to cause appreciable land degradation.	Not applicable.
The clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.	Clearing of vegetation is unlikely to impact on the environmental values of the bioregion.
The clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.	Not applicable.
The clearing of the vegetation is likely to cause, or exacerbate the incidence of flooding.	Not applicable.

7 SUMMARY AND CONCLUSIONS

Native Vegetation Solutions (NVS) commissioned Terrestrial Ecosystems on behalf of Metals X Limited to complete a Level 1 fauna risk assessment of approximately 519ha near Higginsville which will be cleared for the expansion of the Mitchell mine and the construction of infrastructure.

Fauna survey data from other projects in the bioregion provides an adequate indication of the fauna assemblages likely to be encountered in the project area. These data are adequate to assess potential impacts on the vertebrate fauna potentially found in the project area and a Level 2 fauna survey is not required.

Fauna habitats in the project area are rated as degraded to very good. The project area had a two broad fauna habitat types: mixed eucalyptus woodland over mixed chenopod and sclerophyll scrubland, and low Eucalyptus woodland over dense sclerophyll scrubland.

No conservation significant vertebrate fauna were assessed as likely to be significantly impacted by the proposed development. There is a very low possibility that the area supports Southern Death Adder, Western Rosella, Peregrine Falcon, Malleefowl, Fork-tailed Swift and Cattle Egret. Rainbow Bee-eater may potentially inhabit the project area on a seasonal basis but are unlikely to be significantly impacted by further vegetation clearing. All other avian species potentially found in the project area are mobile and will readily move to adjacent areas if disturbed.

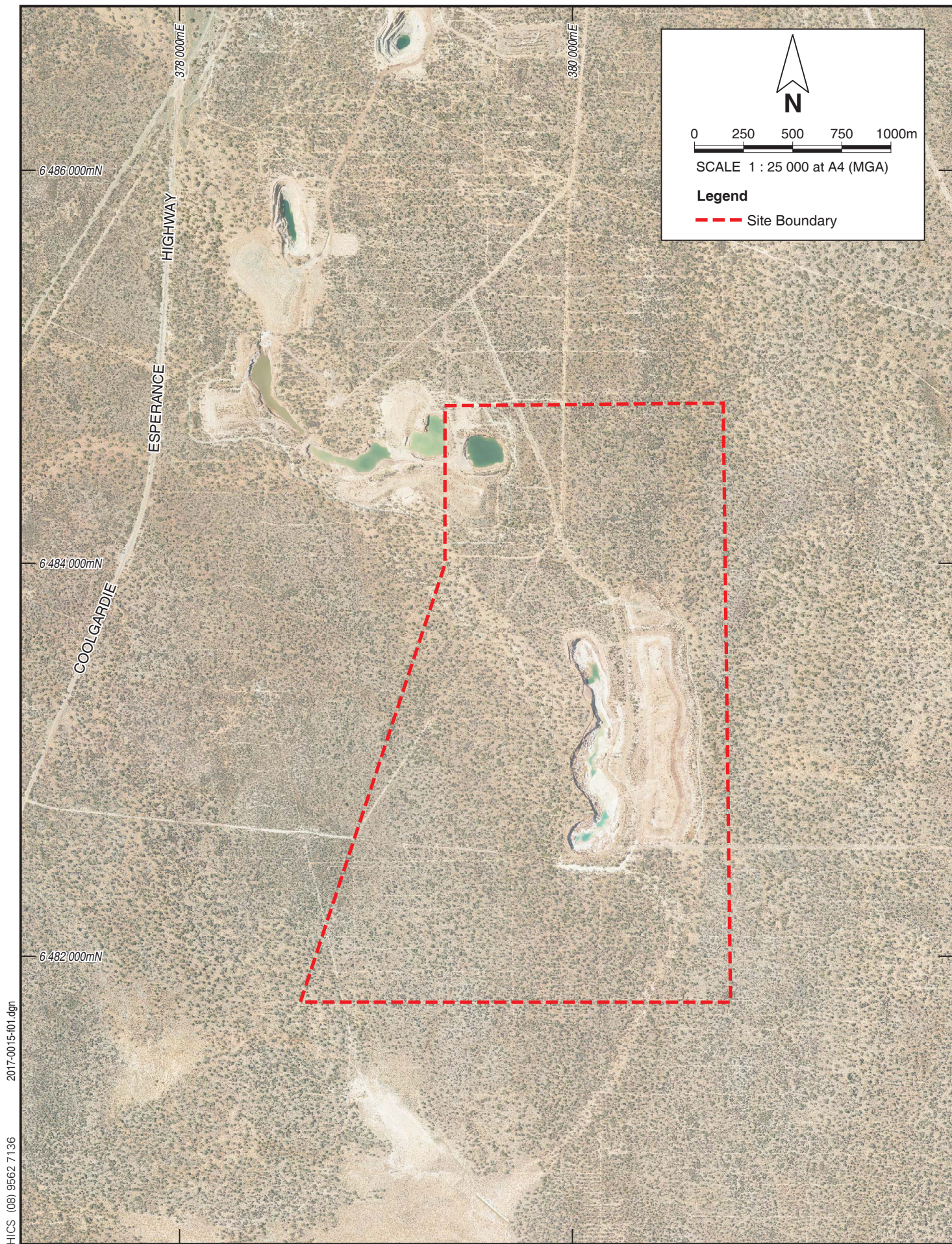
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Figures

Vertebrate Fauna Assessment – Proposed expansion of the Mitchell mine



PINPOINT CARTOGRAPHICS (08) 9562 7136 2017-0015-01.dgn



**TERRESTRIAL
ECOSYSTEMS**

Drawn: S. Thompson

Date: 18 May 2017

Native Vegetation Solutions
LEVEL 1 FAUNA RISK ASSESSMENT
MITCHELL PROJECT AREA

PROJECT LOCATION

Figure 1

Job: 2017-0015

Appendix A

Vertebrate Fauna Recorded in Biological Surveys in the Region

Vertebrate Fauna Assessment – Proposed expansion of the Mitchell mine

Note: Each column of data represents a different habitat type or survey site

Descriptions of the vegetation for each habitat surveyed are contained below

X indicates a presences in the area, V = Vulnerable, E = Endangered, M = Migratory, TH = Threatened

2nd indicates observations of secondary evidence (tracks, scats, diggings etc.)

Numbers denote numbers captured during systematic trapping efforts; X = presence noted.

Appendix A(1). Vertebrate fauna recorded in biological surveys in the region

		Survey	A																																			
Family	Species	Common Name	Camp 1	Camp 1/1	Camp 1/10	Camp 1/11	Camp 1/12	Camp 1/13	Camp 1/2	Camp 1/3	Camp 1/4	Camp 1/5	Camp 1/6	Camp 1/7	Camp 1/8	Camp 1/9	Camp 2	Camp 2/15	Camp 2/16	Camp 2/18	Camp 2/19	Camp 2/20	Camp 2/23	Camp 2/24	Camp 2/25	Camp 2/26	Camp 2/27	Camp 2/28	Camp 4	Camp 4/1	Camp 4/12	Camp 4/14	Camp 4/15	Camp 4/4	Camp 4/5	Camp 4/6	Opportunistic	
Birds																																						
Accipitridae	<i>Lophoictinia isura</i>	Square-tailed Kite	X														X						X															
	<i>Haliastur sphenurus</i>	Whistling Kite	X																																			
	<i>Aquila audax</i>	Wedge-tailed Eagle	X		X								X																									
	<i>Hieraaetus morphnoides</i>	Little Eagle	X														X																					
Aegothelidae	<i>Aegotheles cristatus</i>	Australian Owlet-nightjar	X	X				X									X				X		X							X			X					
Podargidae	<i>Podargus strigoides</i>	Tawny Frogmouth	X	X								X					X													X			X					
Casuariidae	<i>Dromaius novaehollandiae</i>	Emu					X						X			X	X		X											X								
Charadriidae	<i>Vanellus tricolor</i>	Banded Lapwing	X		X	X																								X								
Ardeidae	<i>Ardea pacifica</i>	White-necked Heron																																				1
Columbidae	<i>Columba livia</i>	Rock Dove																																				1
	<i>Streptopelia senegalensis</i>	Laughing Dove																																				1
	<i>Phaps chalcoptera</i>	Common Bronzewing	X										X				X			X			X															
Alcedinidae	<i>Todiramphus pyrrhopygius</i>	Red-backed Kingfisher	X										X				X				X		X															
	<i>Todiramphus sanctus</i>	Sacred Kingfisher	X														X																					
Meropidae	<i>Merops ornatus</i>	Rainbow Bee-eater	X	X								X					X													X			X					
Cuculidae	<i>Chalcites basalus</i>	Horsfield's Bronze-Cuckoo															X				X																	
	<i>Chalcites osculans</i>	Black-eared Cuckoo															X				X				X	X												
	<i>Cacomantis pallidus</i>	Pallid Cuckoo	X														X				X																	
	<i>Cacomantis flabelliformis</i>	Fan-tailed Cuckoo																																				1
Caprimulgidae	<i>Eurostopodus argus</i>	Spotted Nightjar	X		X												X													X			X					
Falconidae	<i>Falco cenchroides</i>	Nankeen Kestrel	X													X	X																					
	<i>Falco berigora</i>	Brown Falcon	X			X				X																												
	<i>Falco longipennis</i>	Australian Hobby	X	X																																		
Megapodiidae	<i>Leipoa ocellata</i>	Malleefowl	X		X																									X								

Family	Species	Common Name	Survey																																			
			Camp 1	Camp 1/1	Camp 1/10	Camp 1/11	Camp 1/12	Camp 1/13	Camp 1/2	Camp 1/3	Camp 1/4	Camp 1/5	Camp 1/6	Camp 1/7	Camp 1/8	Camp 1/9	Camp 2	Camp 2/15	Camp 2/16	Camp 2/18	Camp 2/19	Camp 2/20	Camp 2/23	Camp 2/24	Camp 2/25	Camp 2/26	Camp 2/27	Camp 2/28	Camp 4	Camp 4/1	Camp 4/12	Camp 4/14	Camp 4/15	Camp 4/4	Camp 4/5	Camp 4/6	Opportunistic	
	<i>Hemiergis initialis initialis</i>		X							X							X																					
	<i>Lerista dorsalis</i>		X									X					X	X																				
	<i>Lerista picturata</i>		X	X													X	X	X				X															
	<i>Lerista sp.</i>		X	X											X	X	X		X			X	X															
	<i>Liopholis inornata</i>		X		X												X									X		X	X									
	<i>Menetia greyii</i>		X			X									X	X	X	X	X			X	X			X												
	<i>Morethia butleri</i>		X	X		X			X								X	X	X	X			X	X			X			X			X		X			
	<i>Morethia obscura</i>		X	X													X	X				X								X			X					
	<i>Tiliqua occipitalis</i>	Western Bluetongue	X							X							X						X															
	<i>Tiliqua rugosa</i>		X	X							X						X											X										
Typhlopidae	<i>Ramphotyphlops australis</i>																X																					
Varanidae	<i>Varanus gouldii</i>	Bungarra or Sand Monitor	X							X	X						X		X																			
	<i>Varanus rosenbergi</i>	Heath Monitor	X		X																																	

A McKenzie, N.L., Rolfe, J.K., Hall, N.J. and Youngson, W.K. (1993) Vertebrate Fauna. In Hall, N.J. and McKenzie N.L. The Biological Survey of the Eastern Goldfields of Western Australia Part 9. Norseman - Balladonia. *Records of the Western Australian Museum*, Supplement No 42, 33-55.

X Presence Only

Appendix A(2). Vertebrate fauna recorded in biological surveys in the region

Family	Species	Common Name	Survey	A																				B											
			Lake Finn Rd	Opportunistic	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13	Site 14	Site 15	Site 16	Site 17	Site 18	Site 19	Site 20	Argo Discharge	Beta Hunt Disturbance	Junction Discharge	Junction Reference	Neptune Disturbance	Neptune Reference	Opportunistic	Thunderer Disturbance	Thunderer Reference	West Dunes Reference	
Birds																																			
Accipitridae	<i>Accipiter fasciatus</i>	Brown Goshawk																																X	
	<i>Aquila audax</i>	Wedge-tailed Eagle																												X	2				
Aegothelidae	<i>Aegotheles cristatus</i>	Australian Owlet-nightjar																															X		
Columbidae	<i>Phaps chalcoptera</i>	Common Bronzewing																								10				X					
Columbidae	<i>Ocyphaps lophotes</i>	Crested Pigeon																										2	X						
Meropidae	<i>Merops ornatus</i>	Rainbow Bee-eater																					X	X					2	X			X		
Cuculidae	<i>Chalcites basalis</i>	Horsfield's Bronze-Cuckoo																									1						X		
Falconidae	<i>Falco berigora</i>	Brown Falcon																					2												
Acanthizidae	<i>Calamanthus cautus</i>	Shy Heathwren																																X	
	<i>Pyrholaemus brunneus</i>	Redthroat																					X											X	
	<i>Smicrornis brevirostris</i>	Weebill																					14			14	4	3				10	6		
	<i>Acanthiza apicalis</i>	Inland Thornbill																					1											5	
	<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill																					X										8	X	
Artamidae	<i>Artamus personatus</i>	Masked Woodswallow																																X	
	<i>Artamus cyanopterus</i>	Dusky Woodswallow																									2				X				
	<i>Cracticus torquatus</i>	Grey Butcherbird																																X	2
	<i>Cracticus tibicen</i>	Australian Magpie																																X	
	<i>Strepera versicolor</i>	Grey Currawong																																X	
Campephagidae	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-Shrike																					2	7			7		1				X		
Climacteridae	<i>Climacteris rufa</i>	Rufous Treecreeper																															X	X	
Corvidae	<i>Corvus coronoides</i>	Australian Raven																					2	X			X	X							
Hirundinidae	<i>Cheramoeca leucosterna</i>	White-backed Swallow																					4	X			1	3				3	X		
	<i>Petrochelidon nigricans</i>	Tree Martin																										4							
Maluridae	<i>Malurus leucopterus</i>	White-winged Fairy-wren																					40				4							X	
Meliphagidae	<i>Lichenostomus virescens</i>	Singing Honeyeater																					12	10			1	1				6	5		
	<i>Lichenostomus ornatus</i>	Yellow-plumed Honeyeater																																	
	<i>Purnella albifrons</i>	White-fronted Honeyeater																																2	
	<i>Manorina flavigula</i>	Yellow-throated Miner																					7	2			4	18	7		X	8	3		
	<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater																					9	X			20					X	1		
	<i>Anthochaera carunculata</i>	Red Wattlebird																					2	X			7		X			X	1		
	<i>Lichmera indistincta</i>	Brown Honeyeater																									1						4		
	<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater																										X			X				
Nectariniidae	<i>Dicaeum hirundinaceum</i>	Mistletoebird																																	

Family	Species	Common Name	Survey																				A										B									
			Lake Finn Rd	Opportunistic	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13	Site 14	Site 15	Site 16	Site 17	Site 18	Site 19	Site 20	Argo Discharge	Beta Hunt Disturbance	Junction Discharge	Junction Reference	Neptune Disturbance	Neptune Reference	Opportunistic	Thunderer Disturbance	Thunderer Reference	West Dunes Reference								
Neosittidae	<i>Daphoenositta chrysoptera</i>	Varied Sittella																									2															
Pachycephalidae	<i>Colluricincla harmonica</i>	Grey Shrike-thrush																							1	1				X			X									
	<i>Oreoica gutturalis</i>	Crested Bellbird																							X																	
Pardalotidae	<i>Pardalotus striatus</i>	Striated Pardalote																						1			1	2	2			4	1									
Petroicidae	<i>Petroica goodenovii</i>	Red-capped Robin																												X		1										
Rhipiduridae	<i>Rhipidura leucophrys</i>	Willie Wagtail																							1			X	X			1										
Timaliidae	<i>Zosterops lateralis</i>	Silvereye																											X			X										
Psittacidae	<i>Glossopsitta porphyrocephala</i>	Purple-crowned Lorikeet																							1					X												
	<i>Polytelis anthopeplus</i>	Regent Parrot																							X																	
	<i>Barnardius zonarius</i>	Australian Ringneck																								1		2		19			5									
	<i>Psephotus varius</i>	Mulga Parrot																													X											
	<i>Neophema splendida</i>	Scarlet-chested Parrot																							1																	
Mammals																																										
Canidae	<i>Canis lupus familiaris</i>	Dog																								1																
Felidae	<i>Felis catus</i>	House Cat			1																								2													
Dasyuridae	<i>Ningau sp.</i>				3	2							2	2																												
	<i>Ningau yvonneae</i>	Mallee Ningau																							2		1	2		1			1									
	<i>Sminthopsis crassicaudata</i>	Fat-tailed Dunnart															3			1																						
	<i>Sminthopsis dolichura</i>	Little Long-tailed Dunnart										1							2																							
	<i>Sminthopsis gilberti</i>	Gilbert's Dunnart									1				1						1			1																		
Burramyidae	<i>Cercartetus concinnus</i>	Southwestern Pygmy Possum					4		1		1	1	3		1				1	3							3	1					1									
Macropodidae	<i>Macropus fuliginosus</i>	Western Grey Kangaroo																								1				1												
Leporidae	<i>Oryctolagus cuniculus</i>	European Rabbit																								1																
Muridae	<i>Mus musculus</i>	House Mouse							2					1				1	1						2	1	1	3	4			10	7	2								
	<i>Notomys alexis</i>	Spinifex Hopping Mouse																	1																							
	<i>Notomys mitchellii</i>	Mitchell's Hopping Mouse				1								2					1		1							1														
	<i>Pseudomys bolami</i>	Bolam's Mouse																			1			2		1	2				1		5									
	<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse								3							1		1																							
Amphibians																																										
Limnodynastidae	<i>Neobatrachus kunapalari</i>	Kunapalari Frog																							1	1	1	1		1												
	<i>Neobatrachus sutor</i>	Shoemaker Frog				1	1				1								1																							
Myobatrachidae	<i>Pseudophryne occidentalis</i>	Western Toadlet						5	2																			2														
Reptiles																																										
Agamidae	<i>Ctenophorus cristatus</i>	Bicycle Dragon	8	1			2	1	1	1		4	2		7			1			1	2	7				1	1					1									
	<i>Ctenophorus fordi</i>	Mallee Sand Dragon	1										1	3											1		2															
	<i>Ctenophorus salinarum</i>	Salt Pan Dragon																							4	1					9											

		Survey	A																				B											
Family	Species	Common Name	Lake Finn Rd	Opportunistic	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13	Site 14	Site 15	Site 16	Site 17	Site 18	Site 19	Site 20	Argo Discharge	Beta Hunt Disturbance	Junction Discharge	Junction Reference	Neptune Disturbance	Neptune Reference	Opportunistic	Thunderer Disturbance	Thunderer Reference	West Dunes Reference
	<i>Morethia obscura</i>																																	
	<i>Tiliqua rugosa</i>			1						1				1	1			2				1		1				4						
Typhlopidae	<i>Ramphotyphlops australis</i>																										1							
	<i>Ramphotyphlops bicolor</i>																																	2
Varanidae	<i>Varanus gouldii</i>	Bungarra or Sand Monitor				2													1							2								
	<i>Varanus tristis</i>	Racehorse Monitor					1																											

A ATA Environmental 2006 *Vertebrate Fauna Assessment St Ives Gold Mine*. Unpublished report for Jim's Seeds, Weeds and Trees, Ltd, Kalgoorlie.

B Bamford Consulting Ecologists (2010) *Gold Fields St Ives Gold Mine, Kambalda. Fauna Assessment: impacts of water discharge and general mining activity on vertebrate fauna*. Unpublished report to Gold Fields St Ives Gold Mine, Perth.

X Presence only

Appendix A(3). Vertebrate fauna recorded in biological surveys in the region

[illegible]

Family	Species	Survey Common Name	A			B	C								D																					
			LF	LS	OMT	St Ives	Opportunistic	Site 1a	Site 1b	Site 1c	Site 1d	Site 2a	Site 2b	Site 2c	Site 2d	Site 1	Site 2	Site 20	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13	Site 14	Site 15	Site 16	Site 17	Site 18	Site 19	
	<i>Ctenophorus salinarum</i>	Salt Pan Dragon	X	X		X	1																						2							
	<i>Ctenophorus scutulatus</i>								1																							X			1	
	<i>Moloch horridus</i>	Thorny Devil				X																														
	<i>Pogona minor</i>	Bearded Dragon	X			X	1									X				1								1	1	1						
	<i>Tympanocryptis cephalus</i>	Pebble Dragon				X																														
Carphodactylidae	<i>Nephrurus laevisissimus</i>		X			X										1	5							3		2										
Diplodactylidae	<i>Underwoodisaurus milii</i>	Barking Gecko				X			2									8		2	62						1					2	1		1	
	<i>Crenadactylus ocellatus</i>	Clawless Gecko				X													3												1					
	<i>Diplodactylus granariensis</i>					X										1	1	1	3	2		2								2	3			1		
	<i>Diplodactylus pulcher</i>					X			1		4									3	7	1					4					1	2		4	
	<i>Lucasium damaeum</i>																																			
	<i>Lucasium maini</i>				X	X		2	9	3	3	1		1	1				9		2	1		1											4	
	<i>Oedura reticulata</i>					X				1												1			1	1										
	<i>Strophurus assimilis</i>	Goldfields Spiny-tailed Gecko												1		1								1				1			3					
	<i>Strophurus elderi</i>															3								1		1										
Elapidae	<i>Brachyuropsis fasciolata</i>					X																														
	<i>Brachyuropsis semifasciata</i>																2														1	1				
	<i>Demansia psammophis</i>	Yellow-faced Whipsnake				X												1																		
	<i>Parasuta gouldii</i>					X																						1								
	<i>Parasuta monachus</i>					X																											1			
	<i>Pseudechis australis</i>	Mulga Snake					1											X																		
	<i>Pseudonaja mengdeni</i>	Gwardar				X																														
	<i>Pseudonaja modesta</i>	Ringed Brown Snake																										1								
	<i>Simoselaps bertholdi</i>	Jan's Banded Snake				X											1			1								1								
Gekkonidae	<i>Christinus marmoratus</i>	Marbled Gecko						1																		X										
	<i>Gehyra purpurascens</i>					X									1																					
	<i>Gehyra variegata</i>		X	X		X							1		3	1	1	1			1							1		1	1			2		
	<i>Heteronotia binoei</i>	Bynoe's Gecko	X	X		X	1									2			2		1								2	1			1		6	
Pygopodidae	<i>Delma australis</i>																1	1	1																	
	<i>Delma butleri</i>		X			X											2																			
	<i>Delma fraseri</i>					X											3			1																
	<i>Lialis burtonis</i>					X											2									1						1			3	
	<i>Pygopus lepidopodus</i>	Common Scaly Foot				X																												1		
Scincidae	<i>Cryptoblepharus buechananii</i>																		4				2				1	2		X	2					
	<i>Cryptoblepharus camabyi</i>																																			
	<i>Cryptoblepharus plagioccephalus</i>		X			X																														
	<i>Ctenotus atlas</i>		X	X		X				1		2			2		6								3		11									
	<i>Ctenotus leonhardii</i>					X																														
	<i>Ctenotus schomburgkii</i>			X	X														1											3	1			X	5	

		Survey	A			B	C								D																					
Family	Species	Common Name	LF	LS	OM/T	St Ives	Opportunistic	Site 1a	Site 1b	Site 1c	Site 1d	Site 2a	Site 2b	Site 2c	Site 2d	Site 1	Site 2	Site 20	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13	Site 14	Site 15	Site 16	Site 17	Site 18	Site 19	
	<i>Ctenotus severus</i>											1			2																					
	<i>Ctenotus uber</i>					X																2		1								1	1	1	1	
	<i>Cyclodomorphus melanops</i>	Slender Blue-tongue								1						1																				
	<i>Egernia formosa</i>					X																4					1									
	<i>Egernia multiscutata</i>				X																															
	<i>Eremiascincus richardsonii</i>	Broad-banded Sand Swimmer																				4														
	<i>Hemiergis initialis</i>					X												X		1							1									
	<i>Lerista distinguenda</i>															1	4							1												
	<i>Lerista muelleri</i>				X	X																														
	<i>Lerista picturata</i>				X											1		2	1				5	1	3	1	1	2		1			3	3	1	
	<i>Lerista sp.</i>																		4	4	2		4				2	2	5	1	3	5	3	2	4	
	<i>Liopholis inornata</i>										1					1	1							1												
	<i>Menetia greyii</i>		X		X	X				2		1												1			1			1	1		4	3	2	
	<i>Morethia adelaidensis</i>				X																								1							
	<i>Morethia butleri</i>				X														2		2		1	1			2					1		2		
	<i>Morethia obscura</i>																										2	2			1					
	<i>Tiliqua occipitalis</i>	Western Bluetongue				X																														
	<i>Tiliqua rugosa</i>		X			X	1	1			1				1			X													2					
Typhlopidae	<i>Ramphotyphlops australis</i>				X												1		1	1	2		1	1												
	<i>Ramphotyphlops bituberculatus</i>				X																															
Varanidae	<i>Varanus gouldii</i>	Bungarra or Sand Monitor			X	1						1	1				2																			

A Dames and Moore (1999) *Public Environmental Review Gold Mine Development on Lake Lefroy*. Unpublished report for St Ives Gold Mine; Kalgoorlie.

B Ninox Wildlife Consulting (2004) *St Ives Gold Mine Vertebrate Fauna Assessment 2004*. Unpublished report for St Ives Gold Mining Co Pty LTd, Kalgoorlie.

C Keith Lindbeck and Associates (2007) *St. Ives Gold Mining Company Tailings Storage Facility (No. 4) Spring Fauna Survey*. Unpublished report for St. Ives Gold Mining Company.

D Western Wildlife (2006) *St Ives Gold Fauna Survey; Spring 2005*. Unpublished report for Jim's Seeds, Weeds and Trees, Kalgoorlie.

Appendix A(4). Vertebrate fauna recorded in biological surveys in the region

[illegible]

		Survey	Dell and How (1984)																						
Family	Species	Common Name	WZ13	WZ16	WZ16a	WZ18	WZ18a	WZ2	WZ22	WZ23	WZ24a	WZ25	WZ25a	WZ26	WZ27	WZ3	WZ32a	WZ33	WZ34	WZ34a	WZ37a	WZ40	WZ6	WZ7	WZ7a
	<i>Egernia multiscutata</i>					1			1														1		
	<i>Egernia richardi</i>																								
	<i>Eremiascincus richardsonii</i>	Broad-banded Sand Swimmer			4																				
	<i>Hemiergis initialis</i>								3		12	5	6	1				1					2		
	<i>Hemiergis millewae</i>		8											2			6	2	14	11	14				
	<i>Hemiergis peronii peronii</i>																								
	<i>Lerista dorsalis</i>																								
	<i>Lerista muelleri</i>																								
	<i>Lerista picturata</i>								3		1	1	3						1						
	<i>Lerista sp.</i>					7			5		6	2	6	3		1		2	2		2		3	1	
	<i>Lerista taeniata</i>																								
	<i>Lerista terdigitata</i>				1									1					2						
	<i>Lerista tridactyla</i>																								
	<i>Liopholis inornata</i>										4										2				
	<i>Liopholis striata</i>	Night Skink																							
	<i>Menetia greyii</i>				1	1								3		3	1	2	7	2	5		1	1	
	<i>Morethia adelaidensis</i>																								
	<i>Morethia butleri</i>					4		1		2			2	1		1		1						1	
	<i>Morethia obscura</i>									1				1											
	<i>Tiliqua occipitalis</i>	Western Bluetongue																							
	<i>Tiliqua rugosa</i>			3						1	2	1	1						1	2					
Typhlopidae	<i>Ramphotyphlops australis</i>																								
	<i>Ramphotyphlops bicolor</i>																								
	<i>Ramphotyphlops bituberculatus</i>				1												1								
	<i>Ramphotyphlops hamatus</i>																								
Varanidae	<i>Varanus gouldii</i>	Bungarra or Sand Monitor												1											
	<i>Varanus rosenbergi</i>	Heath Monitor																							
	<i>Varanus tristis tristis</i>																								

Dell, J and How, R. (1984) Vertebrate fauna. In The Biological Survey of the Eastern Goldfields of Western Australia, *Records of the Western Australian Museum*, Supplement No 18, 57-89.

Appendix A(5). Vertebrate fauna recorded in biological surveys in the region

		Survey	B								
Family	Species	Common Name	Dordie Rock NR #1	Dordie Rock NR #2	Dordie Rock NR #3	Dordie Rock NR #4	Kurrawang NR #3	Kurrawang NR #4	Kurrawang NR #5	Kurrawang NR #6	Kurrawang NR #7
Birds											
Accipitridae	<i>Lophoictinia isura</i>	Square-tailed Kite								X	
	<i>Accipiter fasciatus</i>	Brown Goshawk									
	<i>Aquila audax</i>	Wedge-tailed Eagle									
Aegothelidae	<i>Aegotheles cristatus</i>	Australian Owlet-nightjar	X							X	
Podargidae	<i>Podargus strigoides</i>	Tawny Frogmouth								X	
Casuariidae	<i>Dromaius novaehollandiae</i>	Emu	X								X
Columbidae	<i>Phaps chalcoptera</i>	Common Bronzewing									
	<i>Ocyphaps lophotes</i>	Crested Pigeon									X
Meropidae	<i>Merops ornatus</i>	Rainbow Bee-eater			X		X	X	X		
Cuculidae	<i>Chalcites basalis</i>	Horsfield's Bronze-Cuckoo									
Caprimulgidae	<i>Eurostopodus argus</i>	Spotted Nightjar									
Falconidae	<i>Falco cenchroides</i>	Nankeen Kestrel									X
	<i>Falco berigora</i>	Brown Falcon									
	<i>Falco longipennis</i>	Australian Hobby									
Megapodiidae	<i>Leipoa ocellata</i>	Malleefowl	X								
Otididae	<i>Ardeotis australis</i>	Australian Bustard									
Acanthizidae	<i>Pyrrholaemus brunneus</i>	Redthroat		X							
	<i>Smicrornis brevirostris</i>	Weebill	X	X			X	X	X		
	<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill						X	X		
	<i>Acanthiza apicalis</i>	Inland Thornbill		X						X	
	<i>Aphelocephala leucopsis</i>	Southern Whiteface									
	<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill	X	X				X	X		
Artamidae	<i>Artamus personatus</i>	Masked Woodswallow									
	<i>Artamus cinereus</i>	Black-faced Woodswallow							X		
	<i>Artamus cyanopterus</i>	Dusky Woodswallow			X						
	<i>Cracticus torquatus</i>	Grey Butcherbird	X				X	X			X
	<i>Cracticus nigrogularis</i>	Pied Butcherbird			X		X	X			X
	<i>Cracticus tibicen</i>	Australian Magpie									X
	<i>Strepera versicolor</i>	Grey Currawong	X	X						X	X
Campephagidae	<i>Coracina maxima</i>	Ground Cuckoo-Shrike									X
	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-Shrike		X	X						X
Climacteridae	<i>Climacteris rufa</i>	Rufous Treecreeper			X						
Corvidae	<i>Corvus coronoides</i>	Australian Raven	X								
	<i>Corvus bennetti</i>	Little Crow	X								X

		Survey	B								
Family	Species	Common Name	Dordie Rock NR #1	Dordie Rock NR #2	Dordie Rock NR #3	Dordie Rock NR #4	Kurrawang NR #3	Kurrawang NR #4	Kurrawang NR #5	Kurrawang NR #6	Kurrawang NR #7
	<i>Ctenotus atlas</i>							X			
	<i>Ctenotus schomburgkii</i>							X			
	<i>Ctenotus uber</i>										
	<i>Egernia formosa</i>										
	<i>Eremiascincus richardsonii</i>	Broad-banded Sand Swimmer									
	<i>Lerista muelleri</i>										
	<i>Lerista picturata</i>										
	<i>Liopholis inornata</i>				X						
	<i>Menetia greyii</i>										X
	<i>Morethia butleri</i>										
	<i>Morethia obscura</i>				X						
	<i>Tiliqua occipitalis</i>	Western Bluetongue									X
	<i>Tiliqua rugosa</i>										X
Typhlopidae	<i>Ramphotyphlops australis</i>										
	<i>Ramphotyphlops hamatus</i>										
Varanidae	<i>Varanus gouldii</i>	Bungarra or Sand Monitor			X						
	<i>Varanus tristis</i>	Racehorse Monitor									

Chapman A; Kealley I; McMillan D; McMillan and Rolland; G (1991). Biological Surveys of Four Goldfields Reserves. *Landnote* 1/91; 1-238

Appendix A(6). Vertebrate fauna recorded in biological surveys in the region

[illegible]

[illegible]

[illegible]

	<i>Egernia formosa</i>			1			1	3					1	8				1	14	4	8	1								
	<i>Egernia inornata</i>		1	1	1			1										8	71	4	2		2							
	<i>Egernia striata</i>																			2	9		1							
	<i>Eremiascincus richardsonii</i>												2	5		4	4			6	6	3	1							
	<i>Hemiergis initialis initialis</i>													4		5				1		12								
	<i>Lerista muelleri</i>			3	2	2		1						22		4	3	6	6	15		5	2							
	<i>Lerista picturata</i>			2		1							1	18		17	17	5	5	20		14	20							
	<i>Menetia greyii</i>					1							4	19		3	6	23	18	3	17	6	1							X
	<i>Morethia adelaidensis</i>			1																										
	<i>Morethia butleri</i>					2		1				1		14		1		6	17	7	4	4								
	<i>Tiliqua occipitalis</i>											3		1			2				3	5	4							X
	<i>Tiliqua rugosa</i>			2	3	7		5	2			2	1	3	1	1			1		2	2	1							X
Agamidae	<i>Caimanops amphiboluroides</i>							1		1											7									
	<i>Ctenophorus cristatus</i>			3				4					1	3		5	1	10	4			1								X
	<i>Ctenophorus femoralis</i>																													
	<i>Ctenophorus fordi</i>				4		1	4	5	4	1																X			
	<i>Ctenophorus isolepis citrinus</i>																													
	<i>Ctenophorus maculatus</i>																													
	<i>Ctenophorus nuchalis</i>																													
	<i>Ctenophorus ornatus</i>																													
	<i>Ctenophorus reticulatus</i>			5	3		7	8				4	6	4		11	18		18	3	29		3							
	<i>Ctenophorus salinarum</i>																													
	<i>Ctenophorus scutulatus</i>				8			9						2		1	3	1			3		12							
	<i>Moloch horridus</i>				1			2	1	3	2			5									17							X
	<i>Pogona minor</i>					1	1	2	4	1	2	21	11	2	3	14	3	2	2	14	13	23								
	<i>Tympanocryptis cephal</i>															7						1								
Varanidae	<i>Varanus caudolineatus</i>				1		3	4					9	10		15	1		1	11	17	1	9							
	<i>Varanus gouldii</i>			2	1			1		1	1	2	10	1	9	9	3	7	8	1	5									
	<i>Varanus tristis</i>													5		1				3		3								
Typhlopidae	<i>Ramphotyphlops australis</i>												7	8		14		7	2	7		14	6							

[illegible]

[illegible]

Appendix A(7). Vertebrate fauna recorded in biological surveys in the region

Family	Species	Common Name	A																B						C
Casuariidae	<i>Dromaius novaehollandiae</i>	Emu	X			X							X	X					+	X	X	+			X
Megapodiidae	<i>Leipoa ocellata</i>	Malleefowl												X									+		
Anatidae	<i>Anas gracilis</i>	Grey Teal																	+	+					
	<i>Cygnus atratus</i>	Black Swan																	+	+					
	<i>Tadorna tadornoides</i>	Australian Shelduck																	+	+					X
	<i>Chenonetta jubata</i>	Maned Dusck																	+						
	<i>Anas superciliosa</i>	Pacific Black Duck																	+						
	<i>Anas rhynchotis</i>	Australasian Shoveler																	+						
	<i>Malacorhynchus membranaceus</i>	Pink-eared Duck																	+						
Podicipedidae	<i>Poliocephalus poliocephalus</i>	Hoary-headed Grebe																	+						
Phalacrocoracidae	<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant																	+						
	<i>Phalacrocorax melanleucos</i>	Little Pied Cormorant					X					X													
Ardeidae	<i>Ardea pacifica</i>	White-necked Heron																	+						
	<i>Ardea novaehollandiae</i>	White-faced Heron																	+						
Threskiornithidae	<i>Platalea flavipes</i>	Yellow-billed Spoonbill																	+						
Accipitridae	<i>Elanus caeruleus</i>	Black-shouldered Kite																		+	+	+			
	<i>Hamirostra isura</i>	Square-tailed Kite										X								+	+	+	+		
	<i>Haliastur sphenurus</i>	Whistling Kite																		+	+	X	+	X	
	<i>Accipiter fasciatus</i>	Brown Goshawk										X								+	+	+	+	X	
	<i>Accipiter cirrhocephalus</i>	Collared Sparrowhawk				X							X							+	+	+	+	X	
	<i>Aquila audax</i>	Wedge-tailed Eagle				X						X								+	+	+		X	
	<i>Aquila morphnoides</i>	Little Eagle	X			X							X							+	+	+		X	

[illegible]

[illegible]

Appendix B
Definitions of Significant Fauna under the
WA Wildlife Conservation Act 1950

Vertebrate Fauna Assessment – Proposed expansion of the Mitchell mine

APPENDIX B
DEFINITIONS OF SIGNIFICANT FAUNA UNDER THE WESTERN AUSTRALIAN WILDLIFE
CONSERVATION ACT 1950

T	Threatened species
	<p>Published as Specially Protected under the <i>Wildlife Conservation Act 1950</i>, and listed under Schedules 1 to 4 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora (which may also be referred to as Declared Rare Flora).</p> <p>Threatened fauna is that subset of ‘Specially Protected Fauna’ declared to be ‘likely to become extinct’ pursuant to section 14(4) of the Wildlife Conservation Act.</p> <p>Threatened flora is flora that has been declared to be ‘likely to become extinct or is rare, or otherwise in need of special protection’, pursuant to section 23F(2) of the Wildlife Conservation Act.</p> <p>The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.</p>
CR	Critically endangered species
	<p>Threatened species considered to be facing an extremely high risk of extinction in the wild. Published as Specially Protected under the <i>Wildlife Conservation Act 1950</i>, in Schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.</p>
EN	Endangered species
	<p>Threatened species considered to be facing a very high risk of extinction in the wild. Published as Specially Protected under the <i>Wildlife Conservation Act 1950</i>, in Schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.</p>
VU	Vulnerable species
	<p>Threatened species considered to be facing a high risk of extinction in the wild. Published as Specially Protected under the <i>Wildlife Conservation Act 1950</i>, in Schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.</p>
EX	Presumed extinct species
	<p>Species which have been adequately searched for and there is no reasonable doubt that the last individual has died. Published as Specially Protected under the <i>Wildlife Conservation Act 1950</i>, in Schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice for Presumed Extinct Fauna and Wildlife Conservation (Rare Flora) Notice for Presumed Extinct Flora.</p>
IA	Migratory birds protected under an international agreement
	<p>Birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and the Bonn Convention, relating to the protection of migratory birds. Published as Specially Protected under the <i>Wildlife Conservation Act 1950</i>, in Schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice.</p>
CD	Conservation dependent fauna
	<p>Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened. Published as Specially Protected under the <i>Wildlife Conservation Act 1950</i>, in Schedule 6 of the Wildlife Conservation (Specially Protected Fauna) Notice.</p>
OS	Other specially protected fauna

Fauna otherwise in need of special protection to ensure their conservation. Published as Specially Protected under the *Wildlife Conservation Act 1950*, in Schedule 7 of the Wildlife Conservation (Specially Protected Fauna) Notice.

P	Priority species
	<p>Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora or fauna.</p> <p>Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.</p> <p>Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.</p>
1	<p>Priority 1: Poorly-known species</p>
	<p>Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.</p>
2	<p>Priority 2: Poorly-known species</p>
	<p>Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.</p>
3	<p>Priority 3: Poorly-known species</p>
	<p>Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.</p>
4	<p>Priority 4: Rare, Near Threatened and other species in need of monitoring</p>
	<p>(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands.</p>
	<p>(b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for Vulnerable, but are not listed as Conservation Dependent.</p>
	<p>(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.</p>

Appendix C
Results of the *EPBC Act* Protected
Matters Search

Vertebrate Fauna Assessment – Proposed expansion of the Mitchell mine



EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 21/05/17 16:40:20

[Summary](#)

[Details](#)

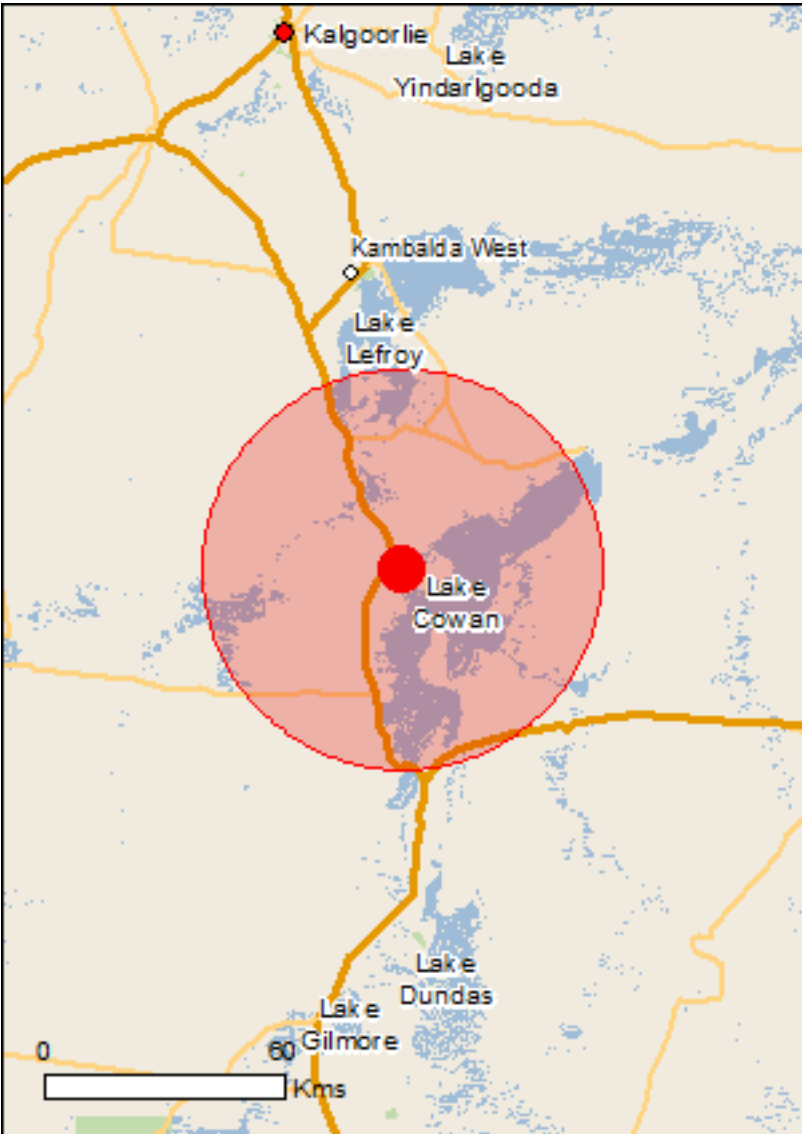
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

[Coordinates](#)

[Buffer: 50.0Km](#)



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	8
Listed Migratory Species:	6

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	10
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	4
Regional Forest Agreements:	None
Invasive Species:	16
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat known to occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Mammals		
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat may occur within area
Plants		
Daviesia microcarpa Norseman Pea [56766]	Endangered	Species or species habitat likely to occur within area
Eucalyptus platydisca Jimberlana Mallee [64575]	Vulnerable	Species or species habitat likely to occur within area
Gastrolobium graniticum Granite Poison [14872]	Endangered	Species or species habitat likely to occur within area
Tecticornia flabelliformis Bead Glasswort [82664]	Vulnerable	Species or species habitat known to occur within area
Listed Migratory Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		

Name	Threatened	Type of Presence
Actitis hypoleucos Common Sandpiper [59309]	Critically Endangered	Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area
Calidris ferruginea Curlew Sandpiper [856]		Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land	[Resource Information]
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The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -

Listed Marine Species	[Resource Information]
-----------------------	--

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]	Critically Endangered	Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area
Calidris ferruginea Curlew Sandpiper [856]		Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within

Name	Status	Type of Presence
		within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Carrichtera annua Ward's Weed [9511]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-31.78055 121.73131

Acknowledgements

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- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Department of Land and Resource Management, Northern Territory](#)
- [-Department of Environmental and Heritage Protection, Queensland](#)
- [-Department of Parks and Wildlife, Western Australia](#)
- [-Environment and Planning Directorate, ACT](#)
- [-Birdlife Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- [-Natural history museums of Australia](#)
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-South Australian Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)
- [-Australian National Herbarium, Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence](#)
- [Forestry Corporation, NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- [-Australian Tropical Herbarium, Cairns](#)
- [-eBird Australia](#)
- [-Australian Government – Australian Antarctic Data Centre](#)
- [-Museum and Art Gallery of the Northern Territory](#)
- [-Australian Government National Environmental Science Program](#)
- [-Australian Institute of Marine Science](#)
- [-Reef Life Survey Australia](#)
- [-American Museum of Natural History](#)
- [-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [-Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- [-Other groups and individuals](#)

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