

**Southern Cross Goldfields Ltd
Marda Gold Project
Targeted Fauna Assessment**



Prepared for: Southern Cross Goldfields Ltd
Unit 16, 162 Colin St
West Perth, WA 6872

Prepared by: Jeff Turpin, Tim Gamblin and Mike Bamford
M.J. & A.R. Bamford Consulting Ecologists
23 Plover Way
Kingsley
WA 6026



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EXECUTIVE SUMMARY

Southern Cross Goldfields Ltd (SXG) is proposing to develop the Marda Gold Project, approximately 115 km north of Southern Cross. In addition to the Marda Central tenement, the project includes satellite deposits at King Brown and Golden Orb. As part of the Environmental Impact Assessment for the Marda Project, Bamford Consulting Ecologists (BCE) was commissioned on behalf of SXG to conduct a Targeted Fauna Assessment of the Marda Project tenements and associated proposed haul roads, camps and airstrips, with a focus on the conservation significant Malleefowl (*Leipoa ocellata*, EPBC Vulnerable).

The targeted survey was conducted from the 26th to the 30th November 2012. Three Malleefowl mounds were recorded; all appeared inactive for some time.

Malleefowl mounds were recorded within dense shrublands, however there was some variation in vegetation types within which mounds were recorded. As expected, mounds were not found on heavy clay soils, such as within the Eucalypt Woodland present in all Project development areas. Mounds were present in sandy-loam, gravelly-loam and even fairly rocky soils.

Approximately 400 ha of Malleefowl breeding habitat (dense litter forming shrublands on sandy-loam to rocky soils) were mapped across the Marda project tenements. However, most of this lies outside the proposed open pit areas. A Malleefowl Management plan should be implemented to minimise any impacts associated with the project on the local Malleefowl population.

Table of Contents

1	INTRODUCTION	4
1.1	Introduction	4
1.2	Targeted Fauna Assessment	4
1.3	Description of Survey Area	4
2	BACKGROUND	7
2.1	Regional Description	7
2.2	Vegetation Overview at Marda Gold Project	7
2.3	Malleefowl	8
3	METHODS	10
3.1	Field survey	10
3.1.1	Overview	10
3.1.2	Targeted searching for conservation significant species	10
3.1.3	Habitat Suitability Mapping	11
3.1.4	Opportunistic observations	12
4	RESULTS	12
4.1	Malleefowl	12
4.2	Other Fauna Observations	Error! Bookmark not defined.
4.3	Vegetation and Soil Associations (VSAs)	Error! Bookmark not defined.
4.4	Malleefowl Habitat Assessment	17
5	Discussion	22
	REFERENCES	24

1 INTRODUCTION

1.1 Introduction

Southern Cross Goldfields Ltd (SXG) is proposing to develop the Marda Gold Project, approximately 115 km north of Southern Cross (see Figure 1). In addition to the Marda Central tenement, the project includes two satellite deposits - King Brown and Golden Orb (see Figure 2). As part of the Environmental Impact Assessment for the Marda Project, Bamford Consulting Ecologists (BCE) was commissioned on behalf of SXG to conduct a Targeted Fauna Assessment of the three tenements and the associated miscellaneous leases (proposed haul roads, camps and airstrips).

1.2 Targeted Fauna Assessment

Due to the presence of Malleefowl in adjacent areas (including Mt Jackson), SXG commissioned BCE to undertake a targeted Fauna Assessment with a focus on the conservation significant Malleefowl, (*Leipoa ocellata*, EPBC Vulnerable).

The BCE targeted survey had the following objectives:

- determine the presence of Malleefowl and their usage of areas for breeding within the King Brown (M77/646 and M77/931), Marda Central (M77/394) and Golden Orb (M77/962 and E77/1320) tenements, and along proposed Haul Roads, Airstrip and Camp(L77/238 to 242) tenements; and
- assess and map habitat with regard to its suitability for the Malleefowl in the same areas.

1.3 Description of Survey Area.

The survey area in which the targeted Fauna Assessment was undertaken (Figure 2) was therefore:

- The three SXG tenements, Marda Central, King Brown and Golden Orb; and
- Areas of suitable Malleefowl habitat along proposed haul roads, access roads, airstrips and camps (see Figure 2).



Figure 1. The location of the SXG Project Area.

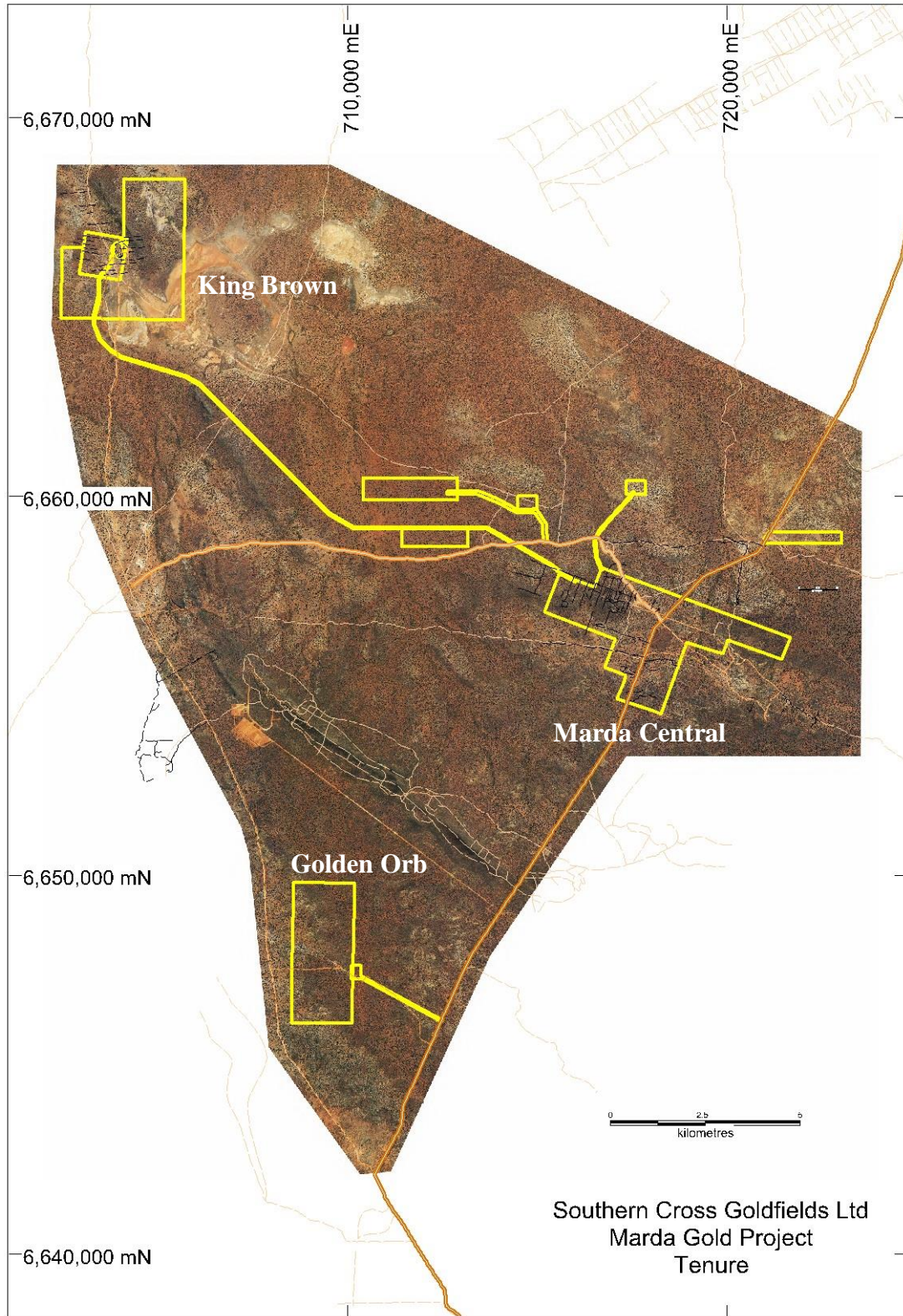


Figure 2. The SXG Marda Gold Project Tenure.

2 BACKGROUND

2.1 Regional Description

The Interim Biogeographic Regionalisation of Australia (IBRA) (Environment Australia, 2000) has identified 26 bioregions in Western Australia. Bioregions are classified on the basis of climate, geology, landforms, vegetation and fauna (Thackway and Cresswell, 1995). IBRA Bioregions are affected by a range of different threatening processes and have varying levels of sensitivity to impact (EPA, 2004).

The Marda Gold Mining Project survey area lies on the Yilgarn Craton in the Southern Cross subregion (C002) within the Coolgardie IBRA Bioregion (Thackway and Cresswell, 1995). The Coolgardie Bioregion falls within the Bioregion Group 2 classification. Bioregions within Group 2 have “*native vegetation that is largely contiguous but is used for commercial grazing*”. The Coolgardie IBRA Southern Cross subregion consists of gently undulating uplands dissected by broad valleys with bands of low greenstone (Cowan *et al.* 2001). Diverse woodlands, rich in endemic eucalypts, occur on low greenstone hills, on alluvial soils on the valley floors, around the saline playas of the region’s occluded drainage system, and on broad plains of calcareous earths (Cowan *et al.* 2001).

2.2 Vegetation Overview at Marda Gold Project

Several vegetation surveys have been conducted within the Marda Project Area (Rapallo 2012, Botanica 2011). Ten major vegetation communities have been identified:

1. **Eucalyptus woodland over mixed open shrubs** - composed of mixed Eucalyptus species (*E. salmonophloia*, *E. salubris*, *E. sheathiana*, and *E. loxophleba*), over mixed Acacia and Eremophila species over open *Maireana*, *Ptilotus*, and/or *Atriplex* species;
2. ***Causaurina pauper* open woodland over mixed Acacia shrubs** - primarily *A. ramulosa* var. *ramulosa* and *A. burkittii*, and *Eremophila* species, particularly *Eremophila oldfieldii*;
3. **Banded Ironstone vegetation complex** - Mixed tall shrubs on banded ironstone or weathered granite ridges and slopes, most commonly dominated by *Grevillea obliquistigma*, *Allocasuarina acutivalvis*, *A. eriochlamys*, *Melaleuca leiocarpa* and *Acacia ramulosa*.
4. **Acacia Woodlands** - dominated by *A. acuminata*, *A. burkittii*, and *A. ramulosa*, usually over *Eremophila* spp. medium shrubs and *Ptilotus obovatus*. Occurs on hill slopes or slight stony rises.
5. ***Melaleuca atroviridis* open woodlands** - Open *Melaleuca atroviridis* low trees over mixed medium shrubs dominated by *Eremophila* and *Acacia* species on rocky hillsides;
6. ***Eucalyptus ewartiana* mallee woodland** - over *Acacia acuminata* shrubs over mixed small shrubs and herbs;

7. **Creepline vegetation complex** - Open woodlands consisting of medium *Eucalyptus corrugata* trees over open *Acacia* and *Eremophila* species.
8. ***Eucalyptus griffithsii* low woodland** - over *Acacia aneura* or *Acacia ramulosa* low woodland over various *Eremophila* species.
9. **Rough-fruited Mallee (*E. corrugata*) / Giant Mallee (*E. oleosa*) woodland** – open mallee woodland over mixed shrubs and rocky rises.
10. **Dense *Allocasuarina* spp. woodland** over mixed shrubs on and stony rises and slopes.

2.3 Malleefowl

The Malleefowl is listed as Vulnerable under the *Environment Protection and Biodiversity Conservation (EPBC) and Wildlife Conservation Acts* (see Appendix 1 and 2). In Western Australia, Malleefowl occur mainly in scrubs and thickets of Mallee (*Eucalyptus* spp.), Boree (*Melaleuca lanceolata*) and Bowgada (*Acacia linophylla*), and also other dense, litter-forming shrublands including Mulga (*Acacia aneura*) Shrublands (Johnstone and Storr, 2004). Nesting is typically restricted to dense shrublands (which provide protection and nesting material) on a range of substrates (such as sand, loam and gravel) while heavy (clayey) soils are avoided. Malleefowl will however forage in open areas adjacent to nesting habitat (Open Eucalypt Woodlands, grasslands, crop fields and around roads, SEWPaC, 2012).

The species' distribution was once larger and less fragmented, but the widespread clearing of suitable habitat, coupled with the degradation of habitat by fire and livestock, and fox predation, have reduced Malleefowl numbers considerably (Johnstone and Storr, 2004).

The Malleefowl Mound

Malleefowl have developed a highly sophisticated method of temperature control for egg incubation. They construct distinctive nests that comprise a large mound covering a central core of leaf litter. The mound is constructed out of sand, pebbles or small rocks, depending on the habitat available. Mounds have a large central depression which is filled with leaf litter and covered with soil. Eggs are laid within the mound, buried and left to incubate by the heat generated from decomposing leaf litter (Malleefowl Preservation Group, 2012). An adult pair maintain the mound temperature of 32 – 34 °C by adjusting soil cover to either retain or expel heat from the egg chamber (Malleefowl Preservation Group, 2012).

Malleefowl are monogamous with pair bonds maintained for life (Priddel and Wheeler, 2003). The mound is constructed and maintained by an adult pair over 9 - 11 months of the year (Malleefowl Preservation Group, 2012). Nest preparation occurs in autumn and the male will tend the nest through summer until temperatures begin to fall.

Malleefowl mounds range in size and diameter, depending on age and activity, however mounds commonly span more than five metres and up to one metre high. A pair of Malleefowl will often

use the same nest over subsequent seasons however nest fidelity is highly variable. Some Malleefowl pairs have been recorded using the same mound for up to nine years while others relocate seasonally between a cluster of two, three or four mounds (Priddel and Wheeler, 2003). Malleefowl mounds used over many generations can attain a size of over 20 metres (Malleefowl Preservation Group, 2012).

Mound construction and breeding rely heavily on rainfall. Malleefowl have been recorded abandoning mound construction or failing to use a mound during seasons of low rainfall (Priddel and Wheeler, 2003). Breeding Malleefowl tend to be sedentary, as they nest and roost in the same area year after year. Breeding males do not stray far from the nest however birds may range over several kilometres outside the breeding season (DEC, 2012). Malleefowl also require large amounts of leaf litter for egg incubation and so are generally restricted to areas of dense vegetation that have not been burnt for many years.

Established pairs generally breed annually with eggs laid from September to January. The average clutch size is 16 (but may range from 5 to 30) and the incubation period lasts for between 62 and 64 days (DEC, 2012a). Malleefowl chicks receive no parental care and as a result chick mortality is high due to predation and exposure (DEC, 2012a).

Priddel and Wheeler (2003) studied the nesting activity of Malleefowl within an isolated remnant of mallee in central New South Wales. The maximum longevity recorded for breeding adults was 12 years with an average of 7.5 years. Over a twenty year period the population declined, with large population decreases coincident with years of low rainfall and unsuccessful breeding.

Mound Profile

The profile of a Malleefowl Mound changes with breeding activity and age (erosion and vegetation growth). A number of profile stages are classified according to age (Benshemesh *et. al.*, 2007) and include:

1. Typical crater with raised rims. This is the typical shape of an inactive nest. However the nest may also be active and open.
2. Nest fully dugout. The characteristic of this profile is that the crater slopes down steeply, and at the base the sides drop vertically to form a box- like structure with side usually 20 to 30 cm deep. Often, litter will have been raked into windrows, and may have started to enter the nest.
3. Nest with litter. This is the next stage after profile 2. Litter will have been raked into the nest by Malleefowl, and thick layers of litter are evident on the surface. There may or may not be sand mixed with the litter at this stage.
4. Nest mounded up (no crater). This is the typical profile of an active but unopened Malleefowl nest. The active mound is closed and dome shaped.

5. Nest a sandy crater with peak in centre. This is a typical profile of an active nest which is in the process of being closed by Malleefowl.
6. Nest low and flat without peak or crater. This mound has not been used for some time and weathering and erosion have ‘flattened’ the original mound.

3 METHODS

3.1 Field survey

3.1.1 Overview

The SXG targeted survey was conducted from the 26th to the 30th November 2012 by:

- Mr Jeff Turpin (B.Sc.Zool);
- Mr Tim Gamblin (B.Sc.Zool.Cert.Env.Man);

The field survey was conducted under DEC Regulation 17 (Licence to take Fauna for Scientific Purposes) licence number SF008949. This fauna assessment document was prepared by Dr Mike Bamford, Mr Jeff Turpin and Mr Tim Gamblin.

The field survey included several components:

1. Targeted searching for the conservation significant EPBC Vulnerable, Malleefowl *Leipoa ocellata*, with a focus on the mounds of this species;
2. Assess the vegetation and fauna habitats present to determine the extent of suitable Malleefowl habitat;
3. Targeted and opportunistic surveying for other fauna of conservation significance; and
4. Opportunistic observations of all fauna encountered.

3.1.2 Targeted searching for conservation significant species

The focus of the survey was to search for the presence of Malleefowl and its mounds in the Marda Central tenement as well as the Project’s two satellite tenements at King Brown and Golden Orb. The areas surveyed included the proposed processing area, deposits (pits), haul roads, camps, airstrips and access roads.

Targeted searching for Malleefowl aimed to locate mounds, or evidence of Malleefowl such as their tracks and feathers. Targeted searching for Malleefowl was conducted in areas considered to be suitable habitat on the basis of aerial imagery and vegetation mapping. These included Banded Ironstone ridges and adjacent plains supporting dense shrublands, dense Acacia shrublands and dense Allocasuarina woodlands on stony hills and slopes (see Figure 3).

In addition areas traversed were identified and mapped as not suitable, suitable or marginal habitat for Malleefowl mounds. Searching was conducted along a series of walked tracks – two personnel spaced 25 m apart in dense shrubland and up to 40-50 m apart in open woodland.

When Malleefowl mounds were located, the location, physical details of the mound and vegetation type were recorded (mound width, height, depth, shape / profile and substrate). The approximate age of each mound was classified according to the criteria listed below (based largely upon pers. obs - J. Turpin and M.Bamford):

Active

- Active: Fresh scratching, loose soil and mound dug out in preparation for the breeding season or mounded for breeding. Mounds containing abundant but weathered plant material and shell fragments have been used regularly over at least the previous few years.

Recently Active

- Recently used (1-5 years): No signs of current activity, such as scratching however mound may still contain large amounts of leaf litter if not excavated. Soil surface compacted however, mound slopes still steep and no plants growing in mound. Well defined central depression.

Inactive

- Moderately old (5-20 years): No recent activity, soil compacted and no plant material. Surface of mound showing some weathering, such as loose soil and debris accumulating in defined central depression, and some plant colonisation possibly present.
- Old (20-100 years): Mound moderately to very weathered, often with a veneer of gravel on the slopes because of removal of fine materials from the surface. Some bushes growing on mound.
- Very old (100+ years): Mound very weathered, with profile low and central depression poorly defined. Bushes and even small trees growing on mound.

3.1.3 Habitat Suitability Mapping

The landscape, vegetation and soils of the tenements and proposed project development areas were classified into Vegetation and Substrate Associations (VSAs) using aerial photographs and ground-truthing. This made it possible to identify VSAs that provide habitat for Malleefowl to construct mounds. Habitat was recorded as either Malleefowl habitat, marginal Malleefowl habitat or not mapped which indicated it was unsuitable. This assessment was based upon the

description of Malleefowl habitat in Section 2.3. Many Malleefowl mounds have been recorded by BCE in the local Mt Jackson area within dense *Acacia* shrublands with a gravelly substrate and also within dense *Allocasuarina* and *Melaleuca* thickets and on gravel, sandy or loamy soils (BCE, 2012). In addition during previous surveys BCE has found mounds are concentrated on the slopes of hills, in gravelly loam soils where the vegetation consists of a dense tall shrubland (BCE, 2008).

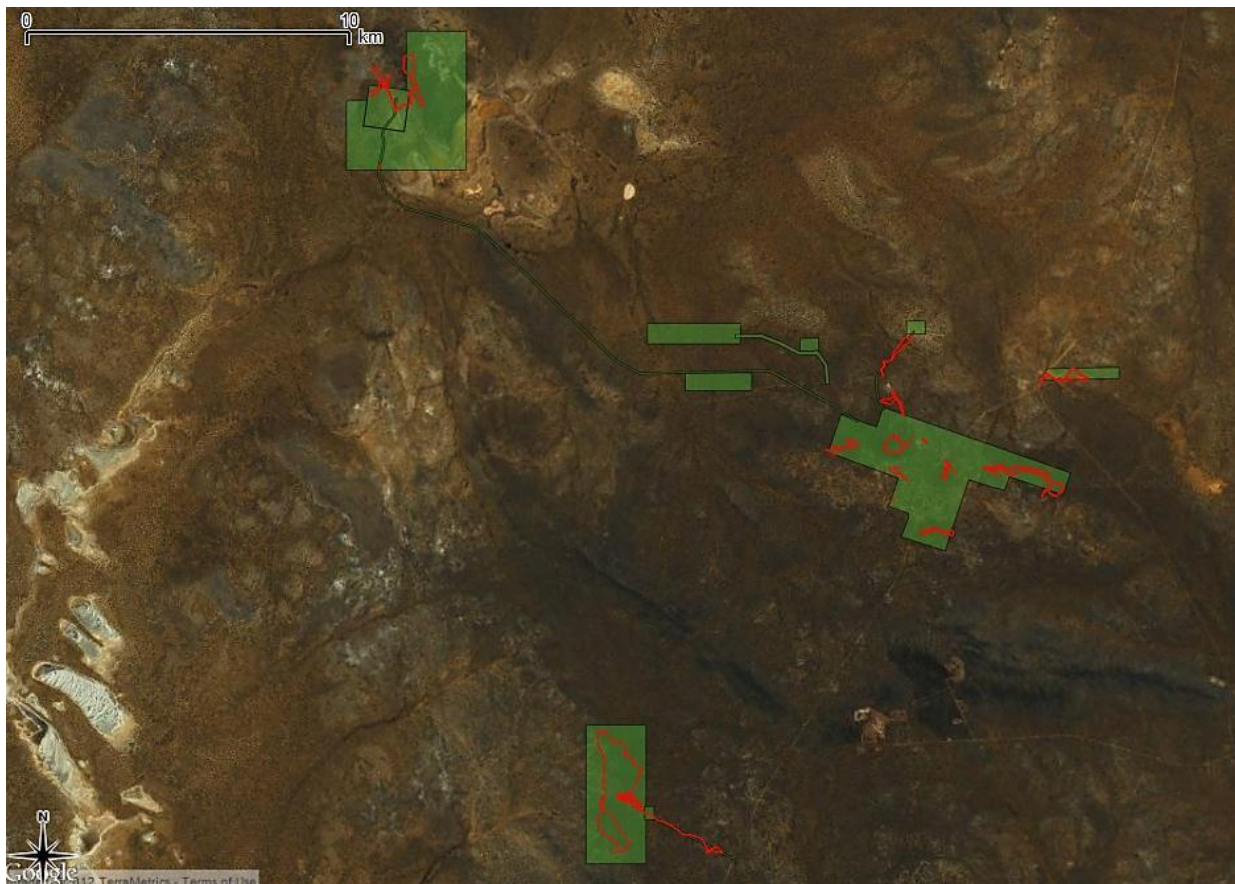


Figure 3. Fauna survey transects (red lines) targeting Malleefowl mounds.

3.1.4 Opportunistic observations

At all times, observations of fauna were noted when they contributed to the accumulation of information on the fauna of the site. These included such casual observations as birds or reptiles seen while travelling through the site.

4 RESULTS

4.1 Malleefowl

No Malleefowl were sited during the survey.

No active (current use) or recently active (1-5 years) Malleefowl mounds were recorded within the three tenements. Three old, inactive Malleefowl mounds were observed within the survey area (see Table 1, Figure 4, Plates 1 - 3). One mound was located in the Marda Central tenement and one in the Golden Orb tenement with a third historical mound along the Golden Orb Haul Road alignment. Additionally, a Malleefowl feather was recorded from the Marda Central tenement indicating the species moves through and utilises habitat within the tenement.



Plate 1. Mound 1. An old inactive mound within the Marda Central tenement.



Plate 2. Mound 2. An old inactive mound within the Golden Orb deposit.



Plate 3. Mound 3. A very old inactive mound within the Golden Orb deposit.

Table 1. Details of Malleefowl records

Mound	Easting	Northing	Height above ground (cm)	Mound Depth (cm)	Mound Diameter (m)	Profile	Estimated Age	Vegetation	Comments
1	715631	6657058	35	10	9	5	Old	Mixed Acacia shrubland and Allocasuarina on gravel	Inactive mound
2	709606	6647776	15	15	5	5	Old	Dense Allocasuarina / Acacia shrubland on ironstone gravel / loam	Inactive mound
3	711737	6646426	10	0	11	6	Very Old 100 years plus	Acacia shrubland on gravel	Inactive mound
Feather	719615	6656447						Acacia shrubland on gravel	



Plate 4. Malleefowl breeding habitat - dense Acacia shrublands on stony rises within the Golden Orb tenement.

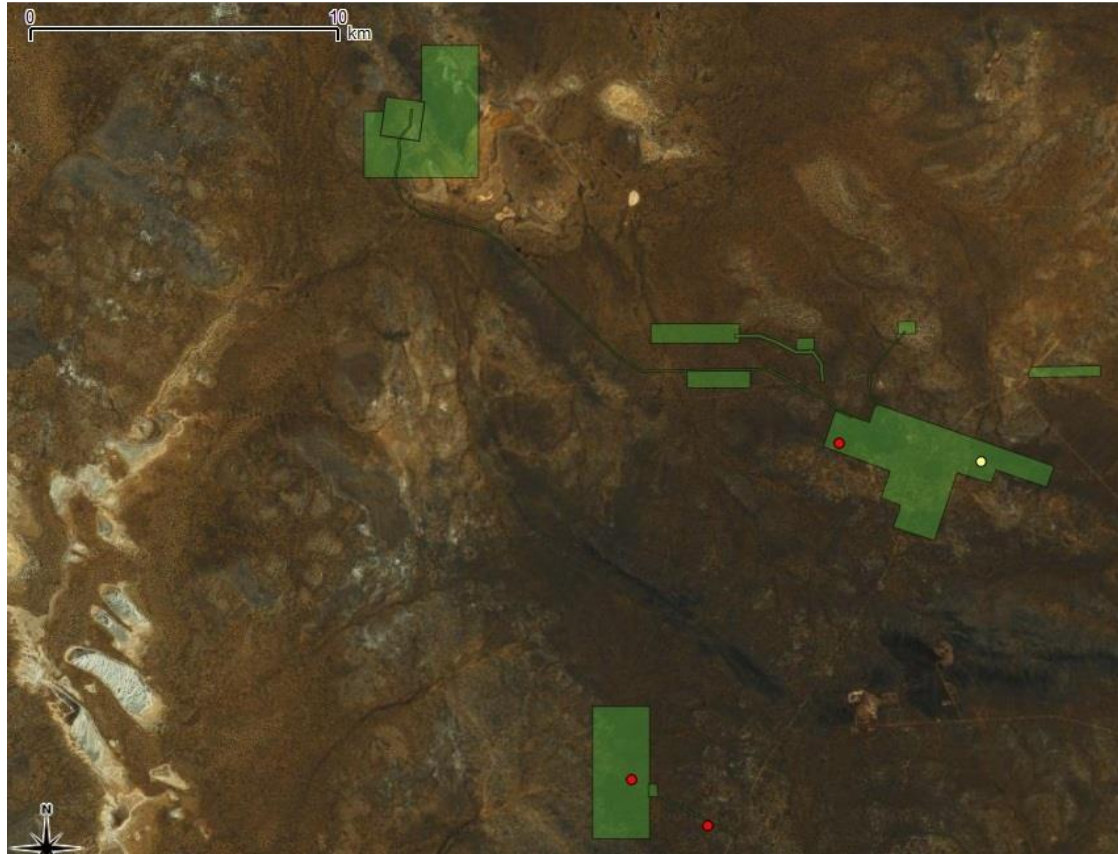


Figure 4. Malleefowl records from the SXG Marda Project. Mounds are shown in red and the feather recorded in yellow.

4.2 Malleefowl Habitat Assessment

As part of the assessment of Malleefowl habitat across the survey area, 11 Vegetation and Substrate Associations (VSAs) were identified. VSAs recognise both vegetation type and substrate (i.e. soil/rock) and thus make it possible to identify areas that provide habitat suitable for the construction of mounds by Malleefowl. The VSAs are:

1. **Eucalypt Woodland** – mixed Eucalypt Woodland (*E. salmonophloia*, *E. salubris*, *E. sheathiana*, and *E. loxophleba*) over mixed shrubs and chenopods and loam flats;
2. **Eucalypt Woodland** - *Eucalyptus oleosa* dominated on stony rises;
3. **Creekline Woodland** - *Eucalyptus corrugata*, *Eucalyptus salubris* Woodland on drainage flats;
4. **Acacia shrublands** (mixed species) with scattered Mallee on stony flats;
5. ***Causaurina pauper* open woodland** over mixed Acacia shrubs - primarily *A. ramulosa* var. *ramulosa* and *A. burkittii*, on stony rises and crests;
6. ***Melaleuca atroviridis* open woodland** - Open *Melaleuca atroviridis* low trees with an open understorey dominated by *Eremophila* and *Acacia* species on rocky hillsides;
7. **Banded Ironstone Formation** – mixed tall shrubs on banded ironstone ridges and slopes, most commonly dominated by *Grevillea obliquistigma*, *Allocasuarina acutivalvis*, *A. eriochlamys*, *Melaleuca leiocarpa* and *Acacia ramulosa*. Ridge crests contain extensive ironstone outcropping;
8. **Mixed Acacia shrubland with areas of dense *Allocasuarina* spp. woodland on hill slopes and stony rises** – dominated by *A. ramulosa* on hill slopes;
9. **Open mixed Acacia shrubland on loam flats** - dominated by *A. acuminata* and *A. burkittii*.
10. **Open Acacia shrubland on sandy granitic flats** with minor outcropping – occurs along the proposed airstrip north of Marda; and
11. **Samphire / Chenopod shrublands** on saline drainage flats;

The breakdown of VSAs present within each survey component is listed in Table 2 below. In addition to the VSAs described above, previously cleared or disturbed areas also occur, particularly where previously mining and exploration has been undertaken.

Of the VSAs recorded, four present within the survey area appear suitable for Malleefowl. These are the dense litter forming shrublands with a suitable substrate (stony or gravelly / loam soils, see Plate 4) and include:

VSA 4. Acacia shrublands (mixed species) with scattered Mallee on stony flats;

VSA 5. *Causaurina pauper* open woodland over mixed Acacia shrubs - primarily *A. ramulosa* var. *ramulosa* and *A. burkittii*;

VSA 7. Banded Ironstone Formation – mixed tall shrubs on banded ironstone ridges and slopes, most commonly dominated by *Grevillea obliquistigma*, *Allocasuarina acutivalvis*, *A. eriochlamys*, *Melaleuca leiocarpa*, and *Acacia ramulosa*;

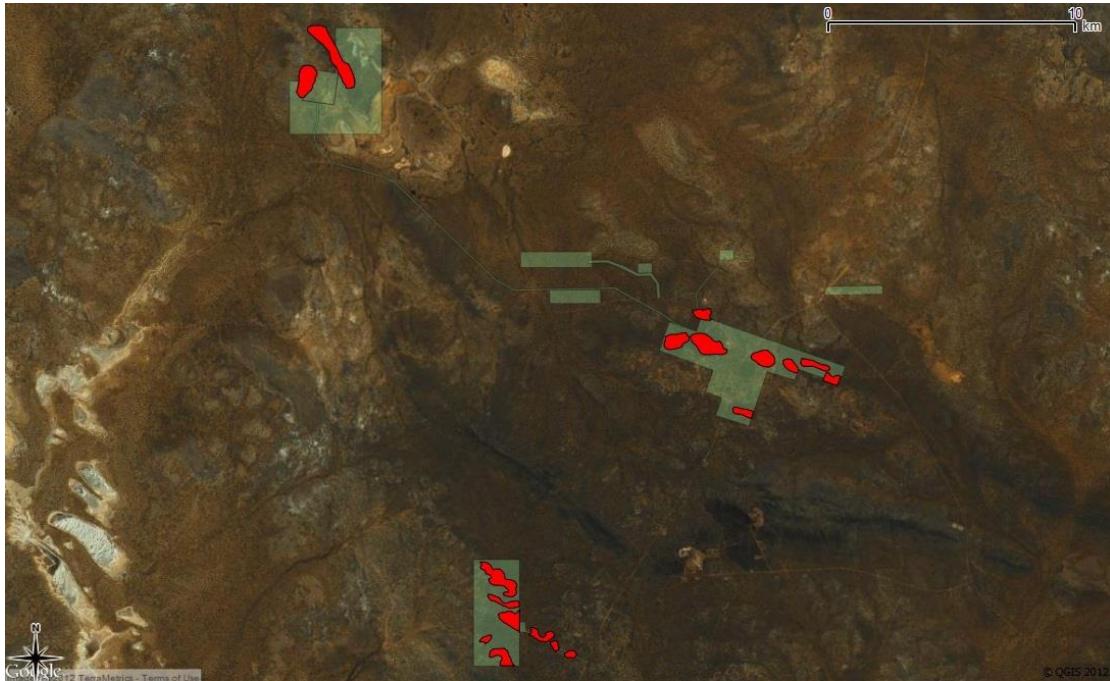
VSA 8. Mixed Acacia shrubland with areas of dense *Allocasuarina* spp. woodland on hill slopes and stony rises – dominated by *A. ramulosa* on hill slopes;

The Malleefowl habitat map (Figure 4) is composed of the above four VSAs mapped as a single unit. This mapping was developed from a combination of high quality aerial photography, vegetation mapping and site observations. Approximately 400 hectares of potential Malleefowl breeding habitat occurs across the project tenements, but most of this lies outside the proposed area of disturbance.

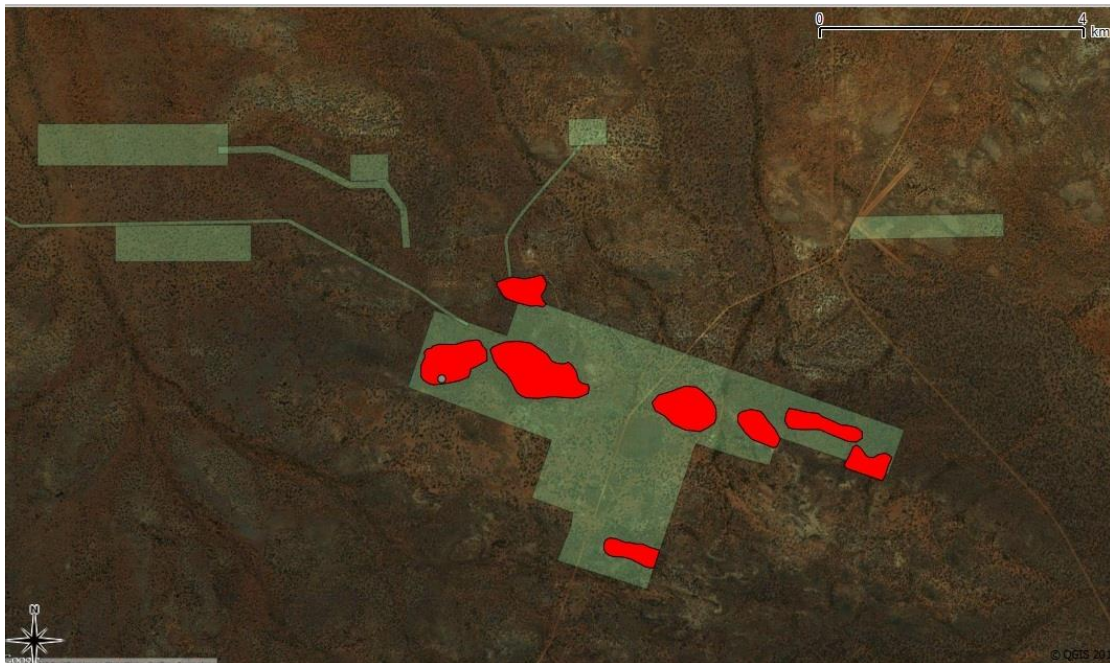
Table 2. VSAs present within each survey component.

Survey Component	VSA 1	VSA 2	VSA 3	VSA 4	VSA 5	VSA 6	VSA 7	VSA 8	VSA 9	VSA 10	VSA 11
	Eucalypt Woodland 1	Eucalypt Woodland 2	Creekline Woodland	Acacia Mallee /	Casuarina Woodland	Melaleuca Woodland	BIF	Dense Acacia, Allocasurina shrubland	Open Acacia shrubland loam flats	Open Acacia shrubland granite soil	Chenopod shrubland
King Brown	X	X		X	X		X	X	X		X
Marda	X	X	X		X	X	X	X	X		
Golden Orb	X	X	X		X	X	X	X	X		
King Brown Haul Rd	X	X		X	X			X	X	X	X
Golden Orb Haul Road	X	X	X	X							
Camp 1	X										
Camp 2	X										
Airstrip 1										X	
Airstrip 2	X										
Airstrip 3	X										
Other tracks											

Figure 5. Malleefowl habitat within the SXG Marda Project tenements. Red polygons show the extent of suitable Malleefowl breeding habitat.



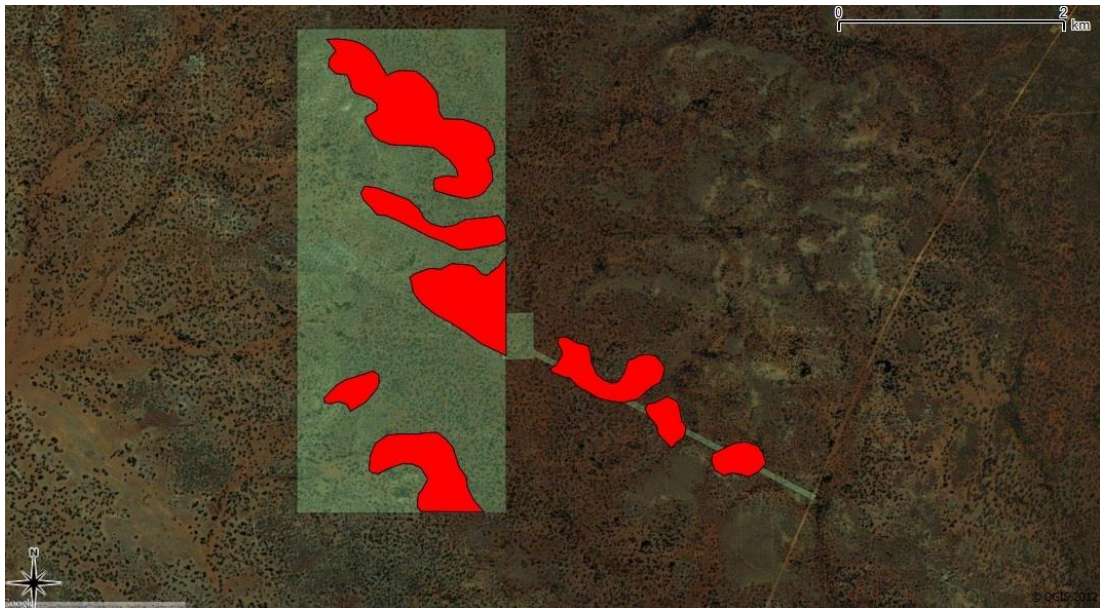
MARDA:



KING BROWN:



GOLDEN ORB:



4.3 Other Fauna Observations

A total of 73 fauna species was recorded during the field survey (see Appendix 3). This comprised 10 reptile, 55 bird, four native mammal and four introduced mammal species. Seven conservation significant fauna species were recorded during the field survey. These were:

- 1) Malleefowl (*Leipoa ocellata*, EPBC Vulnerable);
- 2) Major Mitchell's Cockatoo (*Lophochroa leadbeateri*, Schedule 4).
- 3) Rainbow Bee-eater (*Merops ornatus*, EPBC Migratory)
- 4) Square-tailed Kite (*Lophoictinia isura*, CS3)
- 5) Rufous Tree-creeper (*Climacteris rufus*, CS3)
- 6) Chestnut Quail-thrush (*Cinclosoma castanotus*, CS3)
- 7) Woolley's Pseudantechinus (*Pseudantechinus woolleyae*, CS3)

Locations of significant species recorded are provided in Appendix 4.

5 Discussion

All evidence of Malleefowl was recorded in vegetation considered to be suitable breeding habitat, that is, within dense shrublands on a gravelly/rocky substrate. Three Malleefowl mounds were recorded within the Marda Project tenements from dense shrublands containing mixed Acacia species and dense *Allocasuarina* sp. During previous surveys BCE has found mounds are concentrated on the slopes of hills, in gravelly loam soils where the vegetation consists of a dense tall shrubland (BCE, 2008). As expected, mounds were not found on heavy clay soils, such as within Eucalypt Woodland (heavy clay soils are not favoured for breeding, probably because they are difficult to work).

Although only three long-inactive mounds were found, they were inconspicuous and therefore some other inactive mounds may have been overlooked. The possibility of an active mound having been missed also exists, although searching of suitable habitat was extensive. Furthermore, even long-inactive mounds can become active, as a male bird will have several mounds within its territory but will only use one in any one year (Malleefowl Preservation Group 2012), and the presence of a feather in Marda Central indicates that the species is present even if not currently using the site for breeding.

Within the three tenements, approximately 400 ha of habitat suitable for mound construction were identified. However, much of this lies outside impact areas. The proposed King Brown pit and most of the proposed Marda pits lie within Eucalypt Woodland and outside of Malleefowl breeding habitat. The proposed pit at Golden Orb (approximately 6ha) does occur within Malleefowl breeding habitat. The home range of a male Malleefowl is in the order of 1 km², and thus the breeding habitat in

Golden Orb represents about 6% of the home range of a single male (and contains a single long-inactive mound).

A Malleefowl Management Plan is recommended to minimise impacts associated with the proposed project on the local Malleefowl population. This may require checking of suitable habitat for active mounds before clearing. The greatest threat is probably from roadkill that can result from increased vehicle movements. The Mt Jackson Malleefowl population is small (in work carried out for Cliffs in the Mt Jackson area, BCE estimated a breeding population of up to 27 pairs) and is therefore vulnerable to the death of even just a few individuals.

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Appendix 1. Species of conservation significance

Species of conservation significance are of special importance in impact assessment. The conservation status of fauna species in Australia is assessed under Commonwealth and State Acts such as the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the *Western Australian Wildlife Conservation Act 1950* (Wildlife Conservation Act). In addition, the Western Australian DEC recognises priority levels, while local populations of some species may be significant even if the species as a whole has no formal recognition. Therefore, three broad levels of conservation significance can be recognised and are used for the purposes of this report and are outlined below. A full description of the conservation significance categories, schedules and priority levels mentioned below is provided in Appendix 2.

Conservation Significance (CS) 1: Species listed under State or Commonwealth Acts.

Species listed under the EPBC Act are assigned to categories recommended by the International Union for the Conservation of Nature and Natural Resources (IUCN) and reviewed by Mace and Stuart (1994), or are listed as migratory. Migratory species are recognised under international treaties such as the China Australia Migratory Bird Agreement (CAMBA), the Japan Australia Migratory Bird Agreement (JAMBA), the Republic of South Korea Australia Migratory Bird Agreement (ROKAMBA), and/or the Bonn Convention (The Convention on the Conservation of Migratory Species of Wild Animals). The Wildlife Conservation Act uses a series of Schedules to classify status, but also recognizes the IUCN categories.

Conservation Significance (CS) 2: Species listed as Priority by the DEC but not listed under State or Commonwealth Acts.

In Western Australia, the DEC has produced a supplementary list of Priority Fauna, being species that are not considered threatened under the Wildlife Conservation Act but for which the DEC feels there is cause for concern. Some Priority species are also assigned to the Conservation Dependent category of the IUCN.

Conservation Significance (CS) 3: Species not listed under Acts or in publications, but considered of at least local significance because of their pattern of distribution.

This level of significance has no legislative or published recognition and is based on interpretation of distribution information, but is used here as it may have links to preserving biodiversity at the genetic level (EPA 2002). If a population is isolated but a subset of a widespread (common) species, then it may not be recognised as threatened, but may have unique genetic characteristics. Conservation significance is applied to allow for the preservation of genetic richness at a population level, and not just at a species level. Species on the edge of their range, or that are sensitive to impacts such as habitat fragmentation, may also be classed as CS3, as may colonies of waterbirds. The Western Australian Department of Environmental Protection, now

DEC (2000), used this sort of interpretation to identify significant bird species in the Perth metropolitan area as part of the Perth Bushplan.

Invertebrate species considered to be short range endemics (SREs) also fall within the CS3 category, as they have no legislative or published recognition and their significance is based on interpretation of distribution information. Harvey (2002) notes that the majority of species that have been classified as short-range endemics have common life history characteristics such as poor powers of dispersal or confinement to discontinuous habitats. Several groups, therefore, have particularly high instances of short-range endemic species: Gastropoda (snails and slugs), Oligochaeta (earthworms), Onychophora (velvet worms), Araneae (mygalomorph spiders), Pseudoscorpionida (pseudoscorpions), Schizomida (schizomids), Diplopoda (millipedes), Phreatoicidea (phreatoicidean crustaceans), and Decapoda (freshwater crayfish). The poor understanding of the taxonomy of many of the short-range endemic species hinders their conservation (Harvey 2002).

Introduced species

In addition to these conservation levels, species that have been introduced (INT) are indicated throughout the report. Introduced species may be important to the native fauna assemblage through effects by predation and/or competition.

Appendix 2. Categories used in the assessment of conservation status

IUCN categories (based on review by Mace and Stuart 1994) as used for the *Environment Protection and Biodiversity Conservation Act 1999* and the *Western Australian Wildlife Conservation Act 1950*.

Extinct	Taxa not definitely located in the wild during the past 50 years.
Extinct in the Wild	Taxa known to survive only in captivity.
Critically Endangered	Taxa facing an extremely high risk of extinction in the wild in the immediate future.
Endangered	Taxa facing a very high risk of extinction in the wild in the near future.
Vulnerable	Taxa facing a high risk of extinction in the wild in the medium-term future.
Near Threatened	Taxa that risk becoming Vulnerable in the wild.
Conservation Dependent	Taxa whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent taxon would be classed as Vulnerable or more severely threatened.
Data Deficient (Insufficiently Known)	Taxa suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information.
Least Concern.	Taxa that are not Threatened.

Schedules used in the *WA Wildlife Conservation Act*

Schedule 1	Rare and Likely to become Extinct.
Schedule 2	Extinct.
Schedule 3	Migratory species listed under international treaties.
Schedule 4	Other Specially Protected Fauna

WA Department of Environment and Conservation Priority species (species not listed under the *Wildlife Conservation Act 1950*, but for which there is some concern).

Priority 1	Taxa with few, poorly known populations on threatened lands.
Priority 2	Taxa with few, poorly known populations on conservation lands; or taxa with several, poorly known populations not on conservation lands.
Priority 3	Taxa with several, poorly known populations, some on conservation lands.
Priority 4.	Taxa in need of monitoring. Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change.
Priority 5	Taxa in need of monitoring. Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years (IUCN Conservation Dependent).

Appendix 3. Fauna Recorded within the SXG Survey Area.

Reptiles

Species	Status	King Brown	Marda	Golden Orb	Other
Gekkonidae (geckoes)					
<i>Heteronotia binoei</i> Bynoe's Gecko			X		
Agamidae (dragon lizards)					
<i>Ctenophorus cristatus</i> Crested Dragon			X		
<i>Ctenophorus reticulatus</i>				X	
<i>Tympancryptis cephal</i> Pebble Dragon				X	
Varanidae (monitors or goannas)					
<i>Varanus gouldii</i> Sand Goanna			X	X	
<i>Varanus giganteus</i> Perentie			X		
<i>Varanus tristis</i> Black-headed Monitor					X
Scincidae (skink lizards)					
<i>Lerista timida</i>			X		
<i>Menetia greyii</i> Common Dwarf Skink			X		
Elapidae (front-fanged snakes)					
<i>Pseudechis australis</i> Mulga Snake			X		
Total Species Recorded = 10					

Birds

Species	Status	King Brown	Marda	Golden Orb	Other
CASUARIIDAE (Cassowaries and emus)					
<i>Dromaius novaehollandiae</i>	Emu	X	X		
MEGAPODIIDAE (Megapodes)					
<i>Leipoa ocellata</i>	Malleefowl	CS1	X	X	X
PODARGIDAE (Australian frogmouths)					
<i>Podargus strigoides</i>	Tawny Frogmouth	X	X		
CAPRIMULGIDAE (Nightjars and allies)					
<i>Eurostopodus argus</i>	Spotted Nightjar		X		
AEGOTHELIDAE (Owlet-nightjars)					
<i>Aegotheles cristatus</i>	Australian Owlet-nightjar		X		
ACCIPITRIDAE (Osprey, hawks and eagles)					
<i>Lophoictinia isura</i>	Square-tailed Kite	CS3			X
<i>Accipiter fasciatus</i>	Brown Goshawk	X	X		
<i>Aquila audax</i>	Wedge-tailed Eagle				
FALCONIDAE (Falcons)					
<i>Falco berigora</i>	Brown Falcon				
<i>Falco cenchroides</i>	Nankeen Kestrel		X	X	
CACATUIDAE (Cockatoos)					
<i>Calyptorhynchus banksii</i>	Red-tailed Black-Cockatoo		X		
<i>Eolophus roseicapilla</i>	Galah		X		X
<i>Cacatua leadbeateri</i>	Major Mitchell's Cockatoo	CS1	X		
PSITTACIDAE (Parrots)					
<i>Glossopsitta porphyrocephala</i>	Purple-crowned Lorrikeet		X	X	
<i>Barnardius zonarius</i>	Australian Ringneck	X	X	X	X
STRIGIDAE (Hawk owls)					
<i>Ninox novaeseelandiae</i>	Southern Boobook		X		
<i>Todiramphus pyrrhopygius</i>	Red-backed Kingfisher		X		
MEROPIDAE (Bee-eaters)					
<i>Merops ornatus</i>	Rainbow Bee-eater	CS1		X	X

Species	Status	King Brown	Marda	Golden Orb	Other
CLIMACTERIDAE (Australo-Papuan treecreepers)					
<i>Climacteris rufa</i> Rufous Treecreeper	CS3	X	X	X	
MALURIDAE (Fairy-wrens, emu-wrens and grasswrens)					
<i>Malurus splendens</i> Splendid Fairy-wren		X	X	X	X
<i>Malurus leucopterus</i> White-winged Fairy-wren					X
PARDALOTIDAE (Pardalotes, scrubwrens, thornbills and allies)					
<i>Pardalotus striatus</i> Striated Pardalote			X	X	
<i>Pyrrholaemus brunneus</i> Redthroat		X	X		
<i>Smicromnis brevirostris</i> Weebill		X	X	X	X
<i>Acanthiza apicalis</i> Inland Thornbill		X	X	X	
<i>Acanthiza uropygialis</i> Chestnut-rumped Thornbill		X	X	X	
<i>Acanthiza chrysorrhoa</i> Yellow-rumped Thornbill				X	X
<i>Aphelocephala leucopsis</i> Southern Whiteface		X			X
MELIPHAGIDAE (Honeyeaters)					
<i>Acanthagenys rufogularis</i> Spiny-cheeked Honeyeater			X	X	X
<i>Manorina flavigula</i> Yellow-throated Miner				X	X
<i>Lichenostomus virescens</i> Singing Honeyeater			X		X
<i>Melithreptus brevirostris</i> Brown-headed Honeyeater			X	X	X
<i>Lichmera indistincta</i> Brown Honeyeater			X	X	X
<i>Lichenostomus leucotis</i> White-eared Honeyeater			X		
<i>Lichenostomus ornatus</i> Yellow-plumed Honeyeater			X	X	
POMATOSTOMIDAE (Babblers)					
<i>Pomatostomus superciliosus</i> White-browed Babbler			X	X	
CINCLOSOMATIDAE (Quail-thrushes and allies)					
<i>Cinclosoma castanotum</i> Chestnut Quail-thrush	CS3	X	X	X	X
NEOSITTIDAE (Sittellas)					
<i>Daphoenositta chrysoptera</i> Varied Sittella			X	X	
CAMPEPHAGIDAE (Cuckoo-shrikes and trillers)					
<i>Coracina novaehollandiae</i> Black-faced Cuckoo-shrike			X	X	X
PACHYCEPHALIDAE (Whistlers, shrike-thrushes and allies)					
<i>Oreoica gutturalis</i> Crested Bellbird		X	X	X	

Species	Status	King Brown	Marda	Golden Orb	Other
<i>Pachycephala rufiventris</i> Rufous Whistler		X	X	X	X
<i>Colluricincla harmonica</i> Grey Shrike-thrush			X	X	X
ARTAMIDAE (Woodswallows, butcherbirds and currawongs)					
<i>Artamus cyanopterus</i> Dusky Woodswallow			X	X	
<i>Cracticus torquatus</i> Grey Butcherbird				X	
<i>Cracticus nigrogularis</i> Pied Butcherbird			X		
<i>Gymnorhina tibicen</i> Australian Magpie		X	X		
<i>Strepera versicolor</i> Grey Currawong			X	X	
DICRURIDAE (Monarchs, fantails and drongos)					
<i>Rhipidura albiscapa</i> Grey Fantail		X	X		
<i>Rhipidura leucophrys</i> Willie Wagtail			X		
CORVIDAE (Crows and allies)					
<i>Corvus coronoides</i> Australian Raven			X	X	X
PETROICIDAE (Robins)					
<i>Microeca leucophaea</i> Jacky Winter			X		
<i>Petroica goodenovii</i> Red-capped Robin		X	X	X	
HIRUNDINIDAE (Swallows and martins)					
<i>Hirundo nigricans</i> Tree Martin			X		
DICAEIDAE (Flowerpeckers)					
<i>Dicaeum hirundinaceum</i> Mistletoebird		X	X	X	
MOTACILLIDAE					
<i>Anthus novaeseelandiae</i> Australasian Pipit		X			
Species Recorded: 55					

Mammals

Species	Status	King Brown	Marda	Golden Orb	Other
TACHYGLOSSIDAE (Echidnas)					
<i>Tachyglossus aculeatus</i> Echidna		X			
DASYURIDAE (Dasyurids)					
<i>Pseudantechinus woolleyae</i> Woolley's Pseudantechinus	CS3		X		
MACROPODIDAE (Kangaroos, wallabies)					
<i>Macropus robustus</i> Euro			X		
<i>Macropus rufus</i> Red Kangaroo				X	X
LEPORIDAE (Rabbits and hares)					
<i>Oryctolagus cuniculus</i> Rabbit	INT	X	X	X	X
FELIDAE (Cats)					
<i>Felis catus</i> Cat	INT			X	
BOVIDAE (Horned ruminants)					
<i>Bos taurus</i> Cattle	INT	X	X	X	X
<i>Equus caballus</i> Horse		X	X		
Species recorded: 8					

Appendix 4. Locations of other Conservation Significant Fauna Recorded during the BCE 2012 survey (Note: Zone 50J).

Common Name	Status	Comments	Species Records	
			Easting	Northing
Malleefowl	CS1	Mound 1	715631	6657058
Malleefowl	CS1	Mound 2	709606	6647776
Malleefowl	CS1	Mound 3	711737	6646426
Malleefowl	CS1	Feather	719615	6656447
Rufous Treecreeper	CS3	1 Observed	718067	6657154
Major Mitchell's Cockatoo	CS1	1 Observed	719615	6656447
Major Mitchell's Cockatoo	CS1	1 Observed	718067	6657154
Woolley's Pseudantechinus	CS3	scats	717231	6657126
Rainbow Bee-eater	CS1	1 Observed	718067	6657154
Square-tailed Kite	CS3	1 Observed	704411	6666433
Chestnut Quail-thrush	CS3	Several Observed	717231	6657126
Chestnut Quail-thrush	CS3	Several Observed	711737	6646426