



Kanmantoo Mine Fauna Monitoring

November 2017

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EXECUTIVE SUMMARY

A total of 1042 bird observations of 52 bird species were recorded across both the ML bird roaming and SEB transects. The most abundant species present during the 2017 survey were: Black-faced Woodswallow (*Artamus cinereus*) (260 individuals); State vulnerable Yellow-tailed Black Cockatoo (*Calyptorhynchus funereus*) (65 individuals), Adelaide Rosella (*Platycercus elegans adalaidae*) (65 individuals), Australian Raven (*Corvus coronoides*) (65 individuals) and Australian Magpie (*Gymnorhina tibicen*) (65 individuals). In comparison, a total of 530 observations of 42 bird species were recorded during the 2016 spring survey.

Five bird species of conservation significance were recorded within the during the 2017 spring survey, three of these species were observed within both the ML and SEB areas, one species was observed only in the ML, and another single species was observed only in the SEB area. The bird species of conservation significance observed during the 2017 spring survey were:

- State vulnerable Yellow-tailed Black Cockatoo (*Calyptorhynchus funereus*) (65 individuals);
- State rare White-winged Chough (*Corcorax melanorhamphos*) (45 individuals);
- Nationally listed marine Rainbow Bee-eater (*Merops ornatus*) (4 individuals);
- State rare Elegant Parrot (*Neophema elegans*) (28 individuals), and
- State vulnerable Diamond Firetail (*Stagonopleura guttata*) (4 individuals).

Bird diversity of the conservation rated species in 2017 was similar to recent years however 2017 recorded the highest abundance, which can largely be attributed to the 65 individual Yellow-tailed Black Cockatoos being recorded.

Six mammal species and a total of 76 observations were recorded during the 2017 spring survey. The State rare Common Brushtail Possum (*Trichosurus vulpecula*) was targeted during spotlighting within the SEB areas (09/10/17) with no observations recorded, and on the Mining Lease (10/10/17) with 30 observations recorded. The number of possums continues to fluctuate across years, with a two-fold increase in numbers in 2017 compared to the previous year. Common Brushtail Possums have not been observed in the SEB area since the monitoring program began in 2011.

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1 INTRODUCTION

EBS Ecology has been commissioned by Hillgrove Resources for the past six years (since 2011) to undertake an annual fauna monitoring program across the Kanmantoo Copper Mining Lease. The year 2017 was also the fourth year that EBS has undertaken annual fauna monitoring within the new Significant Environmental Benefit (SEB) areas, adjacent to the Kanmantoo Copper Mine project site.

This ongoing monitoring within both the mining lease and SEB areas, assists in satisfying some of the Avoidance, Mitigation and Management Measures set out in the Kanmantoo Copper Program for Environment Protection and Rehabilitation (PEPR) (Coffey 2012). The PEPR is the key operational document for the mining project and details information on environmental control measures and outcome-based performance criteria. Fauna monitoring, in association with a series of other mitigation measures, has been identified in the document to be undertaken annually and be repeatable at the same time every year.

1.1 Objectives

Objectives of the fauna monitoring program (as outlined in the PEPR document) within the mining lease include:

- Annual abundance and diversity surveys;
- Targeted surveys for threatened species;
- Visual inspections for wetland species; and
- Database and document reviews, including a search for all incidents of fauna mortalities.

Targeted surveys have primarily focused on (but are not limited to) threatened species including Diamond Firetail (*Stagonopleura guttata*) (State vulnerable) and the Common Brushtail Possum (*Trichosurus vulpecula*) (State rare). These species are thought to be indicator species, whose presence or absence in a given environment is a sign of the overall health of its ecosystem (The American Heritage Dictionary of Student Science 2014).

Hillgrove Resources have an overall target that 'operations must not result in a net loss of biodiversity'. The objective of this fauna survey report is to report on variations in observed species against the pre-mining benchmark (Coffey 2012), with reference to the fauna of conservation significance as well as other species observed during annual surveys completed by Environmental Biodiversity Services (EBS). This document also aims to report against the total number of individuals observed for each species (during the October 2017 survey).

This report sets out the findings of the 2017 spring survey, which also targeted the following species:

- Yellow-tailed Black Cockatoo (*Calyptorhynchus funereus*) (State vulnerable);
- White-winged Chough (*Corcorax melanorhamphos*) (State rare);
- Rainbow Bee-eater (*Merops ornatus*) (nationally marine-listed); and

- Elegant Parrot (*Neophema elegans*) (State rare).

The aim of the SEB project is to identify, protect and enhance any native vegetation remnants within the new areas of farming land allocated to SEB-offset establishment for the life of the mine extension. One of the overall objectives is to survey for native birds and other animals which will be used to establish future control programs.

1.2 Project area

The project area is located approximately 45 km south-east of Adelaide in the southern Mount Lofty Ranges of South Australia and 1.5 km south-west of the Kanmantoo township (Figure 1). The area is representative of a transitional zone on the eastern face of the Mount Lofty Ranges, between the Adelaide Hills woodland regions and the Murray River Plains mallee. It has a long term average rainfall of 349.4mm (Figure 2) and encompasses a variety of soil types and geological structures, conducive to an assortment of vegetation types and habitat niches.

The project area has been used previously for mining activities; this was originally during the mid-nineteenth century, and then again from 1971 to 1976 (Hillgrove Resources 2007). Over the past 150 years, much of the Mining Lease (ML) has been extensively cleared for cropping, whilst most of the vegetated areas have been grazed by domestic stock. As a result, only small remnant patches of native vegetation in the mining lease have persisted, including native grasslands and woodland communities.

The new SEB offset areas are adjacent to the Kanmantoo Mine. SEB offset areas associated with the Life of Mine (LOM) extension, have been located as near as possible to the Mine Lease (ML) on suitable Hillgrove-owned land parcels. The new SEB project area is approximately 109.5 hectares and is comprised of five properties. All properties within the new SEB areas have been managed under a mixed cropping / sheep grazing regime for over 100 years. Cropping has been confined to the flats and grazing has been on crop stubble and the higher/rockier areas. As a result, there are only small remnant patches of native vegetation remaining in the new SEB areas which have persisted, including native grasslands and a mallee community.

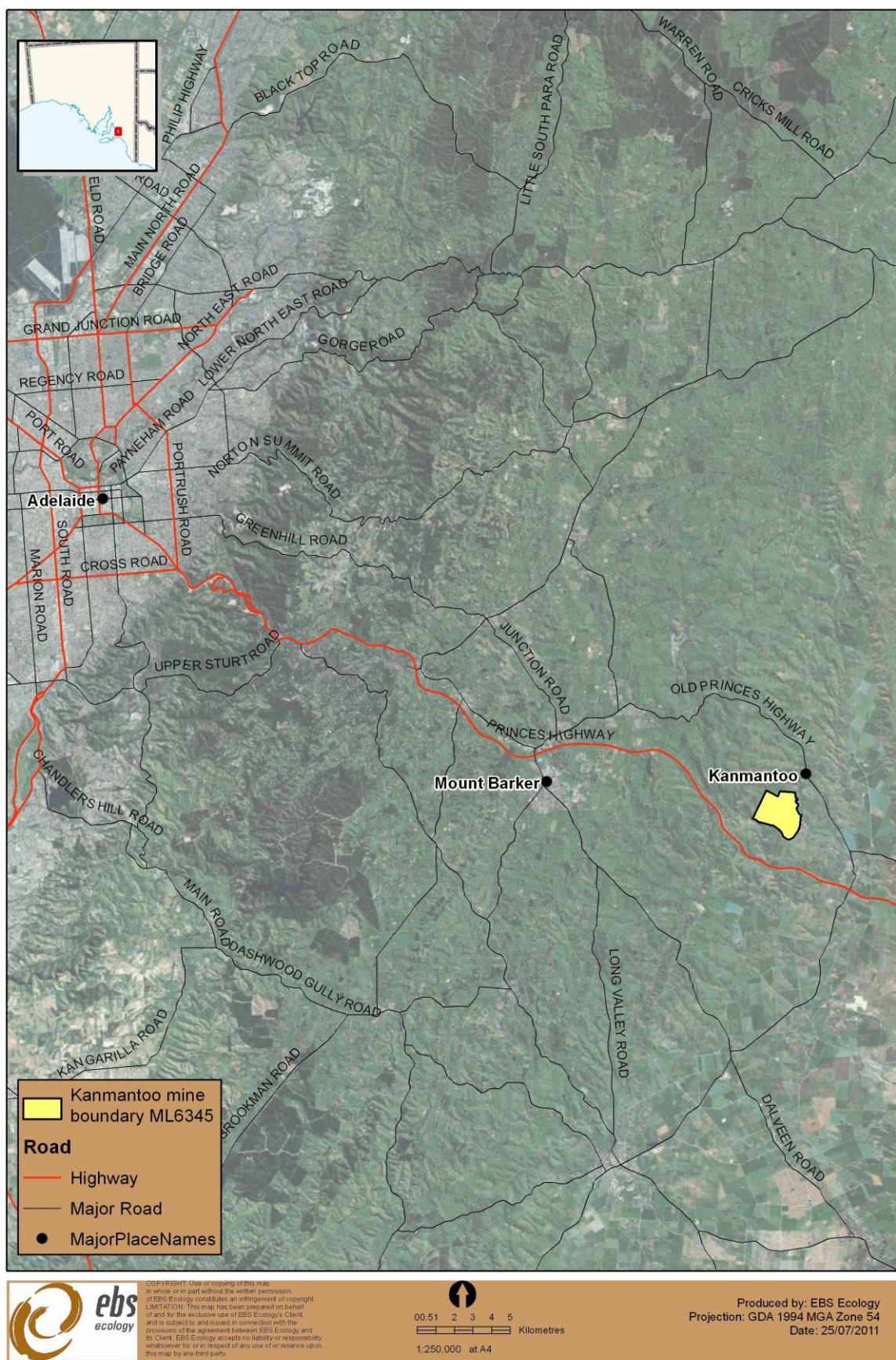


Figure 1. Location of Kanmantoo Copper Mine.

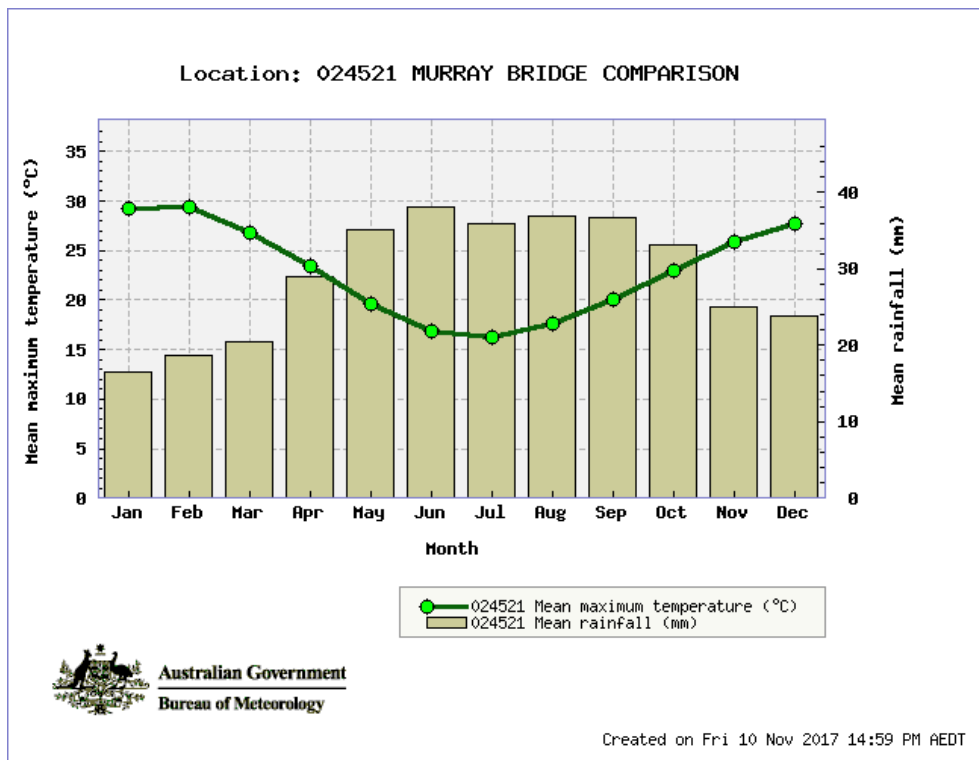


Figure 2. Mean annual rainfall and temperature statistics, Murray Bridge Weather Station (Source: Bureau of Meteorology 2017).

Much of the remaining remnant vegetation will now be set aside and managed for conservation as part of the SEB requirements. This includes areas that have been impacted by mining activities in the past and have recently been decommissioned and rehabilitated. The areas vary from good quality remnant vegetation to open, cleared ex-cropping and mining land with little or no native vegetation remaining. Revegetation programs have been proposed to restore the disturbed landscapes to pre-European condition.

2 METHODS

2.1 Field survey

2.1.1 Weather conditions during the survey

Weather conditions for the survey were mild to warm with moderate winds throughout the day. The second night (10/10/2017) was particularly cool, which was when spotlighting for possums was conducted within the Mining Lease; this did not impact on the numbers recorded relative to previous years. No rainfall was recorded during the survey (Table 1).

Table 1. Daily weather observations during the spring survey 2017, Murray Bridge Weather Station.

Date	Min temp	Max temp	Rain	Time	Temp	Rel humid	Wind direction	Wind speed	Activity
	°C	°C	mm		°C	%		km/h	
09/10/2017	11.2	22.0	0	9:00	16.0	58	WSW	24	Spotlighting for possums SEB area
				15:00	-	-	SSW	13	
10/10/2017	4.5	28.0	0	9:00	12.5	71	NNE	20	Bird surveys and spotlighting for possums ML
				15:00	-	-	N	20	
11/10/2017	12.0	26.0	0	9:00	24.3	44	N	26	Bird surveys SEB area
				15:00			WSW	20	

Source: Bureau of Meteorology. www.bom.gov.au

2.1.2 Bird survey

The spring 2017 survey was undertaken across three days: 9-11th October 2017. A roaming process was used to survey for birds both within the ML and the SEB areas. The ML was surveyed for birds (during the day) and possums (during the evening) on the 10th October. The SEB area was surveyed for birds on the 11th October and for possums on the evening of the 9th October. A single surveyor undertook the roaming surveys for the equivalent of one hour and habitat usage by birds was also recorded whilst surveying these areas. Repeated locations from previous surveys was used covering main habitat types across the site; 14 roaming locations were surveyed within the ML and nine locations within the SEB area, to ensure an even spread across the project areas (Figure 3).

The Diamond Firetail (*Stagonopleura guttata*) was surveyed as part of the roaming process which was undertaken within its preferred habitat type of *Eucalyptus odorata* (Peppermint Box) Woodland. Other bird species which were targeted within this vegetation community were the Rainbow Bee-eater (*Merops ornatus*), White-winged Cough (*Corcorax melanorhamphos*), Peregrine Falcon (*Falco peregrinus*) and the Elegant Parrot (*Neophema elegans*).

2.1.3 Fauna

Spotlighting along established transects within *E. odorata* (Peppermint Box) Woodland habitats was undertaken in search of the Common Brushtail Possum (*Trichosurus vulpecular*). Transects were surveyed over a two-night period (one night in the ML and one night in the SEB area) for two hours commencing approximately one hour after dusk. Any other species observed opportunistically were also recorded.

2.2 Limitations

Although effort was taken to ensure all visibly present species were observed and recorded, it is likely that not all species present were observed in the three-day survey window. The observer was able to access all areas during the day as well as during spotlighting; the 2017 survey was undertaken at an optimal time during spring which was consistent with the 2016 survey period.



Figure 3. Locations of bird roaming transects and patches across Kanmantoo Mining Lease and SEB areas (repeated from 2016 and 2015).

3 RESULTS

3.1 Bird survey

A total of 1042 bird observations of 52 bird species were recorded across both the ML bird roaming and SEB transects (Table 2). Out of the 52 bird species recorded, only three of these were introduced species. The bird observations included both those taken at set locations as well as those recorded opportunistically. These locations were a repeat of where surveys had previously been undertaken since monitoring began, both in the ML and SEB areas. The most abundant species present during the 2017 survey were: Black-faced Woodswallow (*Artamus cinereus*) (260 individuals); State vulnerable Yellow-tailed Black Cockatoo (*Calyptorhynchus funereus*) (65 individuals), Adelaide Rosella (*Platycercus elegans adalaidae*) (65 individuals), Australian Raven (*Corvus coronoides*) (65 individuals) and Australian Magpie (*Gymnorhina tibicen*) (65 individuals). In comparison, a total of 530 observations of 42 bird species were recorded during the 2016 spring survey.

Five bird species of conservation significance were recorded within the during the 2017 spring survey, three of these species were observed within both the ML and SEB areas, one species was observed only in the ML, and another single species was observed only in the SEB area (Figure 4). The bird species of conservation significance observed during the 2017 spring survey were:

- State vulnerable Yellow-tailed Black Cockatoo (*Calyptorhynchus funereus*) (65 individuals);
- State rare White-winged Chough (*Corcorax melanorhamphos*) (45 individuals);
- Nationally listed marine Rainbow Bee-eater (*Merops ornatus*) (4 individuals);
- State rare Elegant Parrot (*Neophema elegans*) (28 individuals), and
- State vulnerable Diamond Firetail (*Stagonopleura guttata*) (4 individuals).

Bird diversity of the conservation rated species in 2017 was similar to recent years however 2017 recorded the highest abundance, which can largely be attributed to the 65 individual Yellow-tailed Black Cockatoos being recorded. A summary of the bird species of conservation significance observed between 2011 and 2017, is presented in Table 3.

These species are discussed further below. Consistent with other surveys completed at the site, bird species of conservation significance were concentrated north of the pit within the ML. This can be attributed to the area containing the largest patches of remnant vegetation and revegetated areas.

Table 2. Total bird species observed during the 2017 spring survey in both the ML and SEB areas (point counts and opportunistic).

SPECIES NAME	COMMON NAME	EPBC	SA	Exotic	2016	2017
<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater				2	-
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill				43	38
<i>Aegotheles cristatus</i>	Australian Owlet-nightjar				-	1
<i>Alauda arvensis</i>	Eurasian Skylark			*	-	1
<i>Anas gracilis</i>	Grey Teal				6	10
<i>Anas superciliosa</i>	Pacific Black Duck				10	9
<i>Anthochaera carunculata</i>	Red Wattlebird				1	27
<i>Anthus australis</i>	Australian Pipit				0	6
<i>Aphelocephala leucopsis</i>	Southern Whiteface				0	3
<i>Aquila audax</i>	Wedge-tailed Eagle				1	-
<i>Artamus cinereus</i>	Black-faced Woodswallow				-	260
<i>Artamus cyanopterus</i>	Dusky Woodswallow				5	3
<i>Aythya australis</i>	Hardhead				-	4
<i>Cacatua galerita</i>	Sulphur-crested Cockatoo				1	3
<i>Cacatua sanguinea</i>	Little Corella				2	9
<i>Calyptrorhynchus funereus</i>	Yellow-tailed Black Cockatoo		V		-	65
<i>Chalcites basalis</i>	Horsfield's Bronze Cuckoo				-	2
<i>Chenonetta jubata</i>	Australian Wood Duck				-	2
<i>Climacteris picumnus</i>	Brown Treecreeper				11	5
<i>Colluricincla harmonica</i>	Grey Shrike-thrush				13	4
<i>Columba livia</i>	Feral Pigeon [Rock Dove]			*	-	2
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike				-	6
<i>Corcorax melanorhamphos</i>	White-winged Chough		R		36	45
<i>Corvus coronoides</i>	Australian Raven				11	65
<i>Daphoenositta chrysoptera</i>	Varied Sittella				5	-
<i>Egretta novaehollandiae</i>	White-faced Heron				1	1
<i>Elseyornis melanops</i>	Black-fronted Dotterel				-	5
<i>Eolophus roseicapilla</i>	Galah				18	43
<i>Falco berigora</i>	Brown Falcon				2	4
<i>Falco cenchroides</i>	Nankeen Kestrel				3	1
<i>Falco peregrinus</i>	Peregrine Falcon		R		1	-

SPECIES NAME	COMMON NAME	EPBC	SA	Exotic	2016	2017
<i>Gavicalis virescens</i>	Singing Honeyeater				12	4
<i>Glossopsitta concinna</i>	Musk lorikeet				2	18
<i>Grallina cyanoleuca</i>	Magpie-lark				1	2
<i>Gymnorhina tibicen</i>	Australian Magpie				48	65
<i>Hirundo neoxena</i>	Welcome Swallow				37	32
<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater				3	18
<i>Merops ornatus</i>	Rainbow Bee-eater	Ma			1	4
<i>Neophema elegans</i>	Elegant Parrot		R		55	28
<i>Ocyphaps lophotes</i>	Crested pigeon				4	2
<i>Pachycephala rufiventris</i>	Rufous Whistler				6	9
<i>Pardalotus striatus</i>	Striated Pardalote				9	26
<i>Petrochelidon nigricans</i>	Tree Martin				4	41
<i>Phaps chalcoptera</i>	Common Bronzewing				2	1
<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater				12	13
<i>Platycercus elegans</i>	Adelaide Rosella				58	65
<i>Podargus strigoides</i>	Tawny Frogmouth				-	1
<i>Pomatostomus superciliosus</i>	White-browed Babbler				1	5
<i>Psephotus haematonotus</i>	Red-rumped Parrot				15	25
<i>Ptilotula penicillata</i>	White-plumed Honeyeater				8	20
<i>Rhipidura leucophrys</i>	Willie Wagtail				13	11
<i>Smicronis brevirostris</i>	Weebill				15	8
<i>Stagonopleura guttata</i>	Diamond Firetail		V		-	4
<i>Sturnus vulgaris</i>	Common Starling			*	37	11
<i>Tachybaptus novaehollandiae</i>	Australasian Grebe				-	4
<i>Tadorna tadornoides</i>	Australian Shelduck				13	-
<i>Tyto delicatula</i>	Eastern Barn Owl				-	1
<i>Vanellus miles</i>	Masked Lapwing				2	-
		Total Abundance			530	1042
		Total Diversity			42	52

SA: South Australia (National Parks and Wildlife Act 1972). VU/V: Conservation Codes: V: Vulnerable. R: Rare.

EPBC: Environment Protection and Biodiversity Conservation Act 1999. Conservation Codes: Ma: Marine

*Denotes introduced species

- Not recorded

Table 3. Bird species of conservation significance recorded between 2011 and 2017.

SPECIES NAME	COMMON NAME	EPBC	SA	2011	2012	2013	2014	2015	2016	2017
<i>Calyptorhynchus funereus</i>	Yellow-tailed Black Cockatoo		V	0	7	0	0	8	0	65
<i>Corcorax melanorhamphos</i>	White-winged Chough		R	22	24	16	34	97	36	45
<i>Falco peregrinus</i>	Peregrine Falcon		R	2	2	0	0	4	1	0
<i>Merops ornatus</i>	Rainbow Bee-eater	Ma		7	7	1	0	3	1	4
<i>Melanodryas cucullata cucullata</i>	Hooded Robin		R	2	0	0	0	0	0	0
<i>Microeca fascinans fascinans</i>	Jacky Winter		R	0	0	1	0	0	0	0
<i>Neophema elegans</i>	Elegant Parrot		R	7	16	12	9	19	55	28
<i>Stagonopleura guttata</i>	Diamond Firetail		V	6	16	4	0	5	0	4
		Total Abundance		46	72	34	43	134	93	142
		Total Species		8	8	5	2	6	4	5

SA: South Australia (*National Parks and Wildlife Act 1972*). **VUV:** Conservation Codes: V: Vulnerable. R: Rare.
EPBC: Environment Protection and Biodiversity Conservation Act 1999. **Conservation Codes:** Ma: Marine

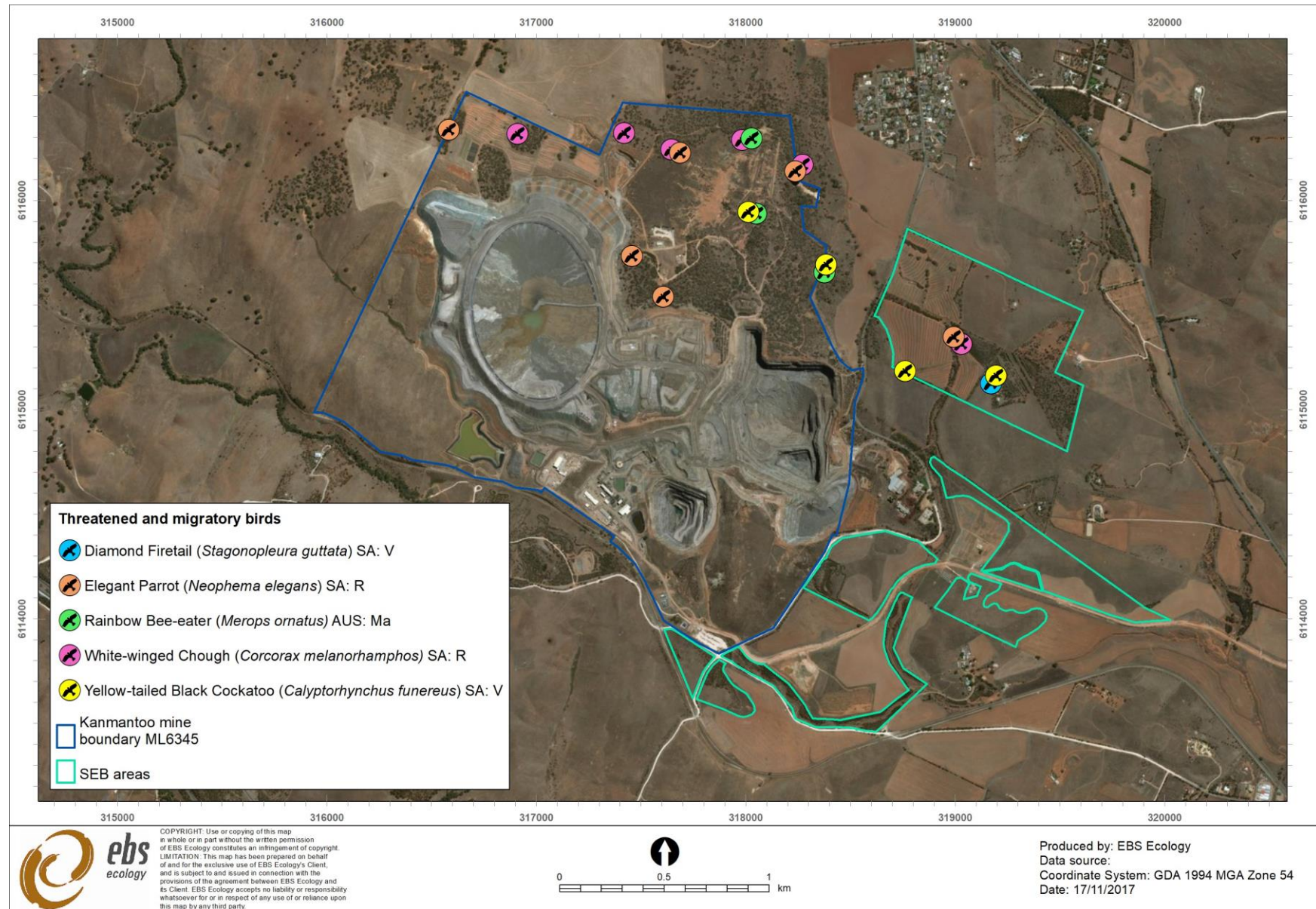


Figure 4. Locations of threatened birds recorded during the 2017 spring survey.

The conservation significant species that were recorded during the 2017 spring survey are described in further detail below.

3.1.1 Yellow-tailed Black Cockatoo (*Calyptorhynchus funereus*)

A record number of the State vulnerable Yellow-tailed Black Cockatoo were observed during the 2017 survey (a total of 65 observations). This is largely attributed to two flocks observed in pine trees in the SEB area (35 individuals and 25 individuals respectively) (Figure 5). This species has only been observed during two previous years either within the ML or SEB area (Table 3).

3.1.2 White-winged Chough (*Corcorax melanorhamphos*)

White-winged choughs were observed over five different locations within the ML and one location within the SEB area (with a total of 45 observations). Eight nests were observed at five locations within the ML area (Figure 6), which shows that White-winged Choughs are actively breeding within the ML area.

3.1.3 Rainbow Bee-eater (*Merops ornatus*)

Four individual Rainbow Bee-eaters were observed in three separate woodland patches within the ML. The number of Rainbow Bee-eaters has fluctuated across the years at this site (Table 3). Its ability to undertake long-distance movements makes this species highly mobile, and therefore fluctuations in numbers on site are to be expected.

3.1.4 Elegant Parrot (*Neophema elegans*)

The State rare Elegant Parrot was observed at six locations across the site, five within the ML and at one location within the SEB area (Figure 7). A total of 28 individuals were recorded during the 2017 spring survey. This is the second highest number recorded across all previous years, following a total of 55 individuals recorded in 2016 (Table 3).

3.1.5 Diamond Firetail (*Stagonopleura guttata*)

Four individual Diamond Firetails were observed at a single location in the SEB area, namely the pine plantation where the Yellow-tailed Black Cockatoo were also recorded. One individual was observed preening within the pine plantation (Figure 8). Diamond Firetails live in a wide range of eucalypt dominated vegetation communities that typically have a grassy understorey, including woodland, forest and mallee. This preferred habitat type correlates with the grassy understorey/Blue Gum Woodland upper storey habitat where the Diamond Firetails were observed. Fluctuation in numbers as per figures shown in Table 3 may be indicative of food supply across both the ML and SEB areas.

3.1.6 Other species of conservation significance

Species not recorded in 2017 which have previously been recorded in the project area were Peregrine Falcon (*Falco peregrinus*), Hooded Robin (*Melanodryas cucullata cucullata*) and Jacky Winter (*Microeca fascinans fascinans*). Table 3 shows the numbers of these species recorded across previous years. Continued monitoring will assist in identifying any fluctuations in the abundance of these and other species of conservation significance in both the ML and SEB areas.



Figure 5. Yellow-tailed Black Cockatoos were observed in pine trees in the SEB area.



Figure 6. White-winged Chough in mud nest within the ML.



Figure 7. Elegant parrot observed perched on a dead tree within the ML.



Figure 8. Diamond Firetail observed perched in pine plantation within the SEB area.

3.2 Mammal and nocturnal fauna survey

Six mammal species and a total of 76 observations were recorded during the 2017 spring survey. This included three native and three introduced species (Table 4).

Table 4. Mammal species recorded during the 2017 spring survey.

SPECIES NAME	COMMON NAME	SA	Introduced	Total number recorded
<i>Felis catus</i>	Domestic Cat		*	1
<i>Lepus europaeus</i>	European Brown Hare		*	2
<i>Macropus fuliginosus</i>	Western Grey Kangaroo			38
<i>Pseudocheirus peregrinus</i>	Common Ringtail Possum			4
<i>Oryctolagus cuniculus</i>	Rabbit (European Rabbit)		*	1
<i>Trichosurus vulpecula</i>	Common Brushtail Possum	R		30
		Total Abundance:		76
		Total Diversity:		6

SA: South Australia (National Parks and Wildlife Act 1972). Conservation Codes: CE: Critically Endangered. EN/E: Endangered. VU/V: Vulnerable. Ma: Marine. R: Rare.

3.2.1 Common Brushtail Possum (*Trichosurus vulpecula*)

The State rare Common Brushtail Possum (*Trichosurus vulpecula*) was targeted during spotlighting within the SEB areas (09/10/17) with no observations recorded, and on the Mining Lease (10/10/17) with 30 observations recorded (Figure 9). The number of possums continues to fluctuate across years (Table 5), with a two-fold increase in numbers in 2017 compared to the previous year. Common Brushtail Possums have not been observed in the SEB area since the monitoring program began in 2011.

Table 5. Observations of Common Brushtail Possums 2011-2017.

2011	2012	2013	2014	2015	2016	2017	Area observed
43	88	53	9	21	14	30	ML

It is expected that the Common Brushtail Possum has not been recorded within the SEB areas based on the lack of preferred habitat and suitable hollows for protection. This species prefers eucalypt and sheoak woodlands where they often use tree hollows as preferred den sites. Brushtail Possums typically use hollows that are approximately 10 cm in diameter (Ecological Associates 2006). They have strong site fidelity, limited mobility across fragmented landscapes and are vulnerable to fox and cat predation which inhibits their ability to relocate to other suitable areas (Ecological Associates 2006). It is anticipated that over time, regeneration of the SEB areas may produce suitable habitat for this species.

Whilst three other years (2011-2013) recorded higher numbers compared to 2017, this was the highest number of the Common Brushtail Possum that has been recorded since 2013. It may be that this was attributed to the timing of the 2017 survey, conditions on the night of spotlighting and/or the availability of food resources within the area. The availability of hollows to possums has remained consistent particularly in relation to vegetation located north-west of the pit, which is where most possums are recorded (Figure 9).

3.2.2 Other fauna species

Thirty-eight individuals of the Western Grey Kangaroo (*Macropus fuliginosus*) were recorded across the ML and SEB areas; predominantly within the ML (Table 5). A Common Ringtail Possum female with three young was observed within the ML. Pest species recorded during the 2017 survey included two European Hare (*Lepus europaeus*), one European Rabbit (*Oryctolagus cuniculus*) within the ML, and one Domestic Cat (*Felis catus*) recorded in the SEB area.

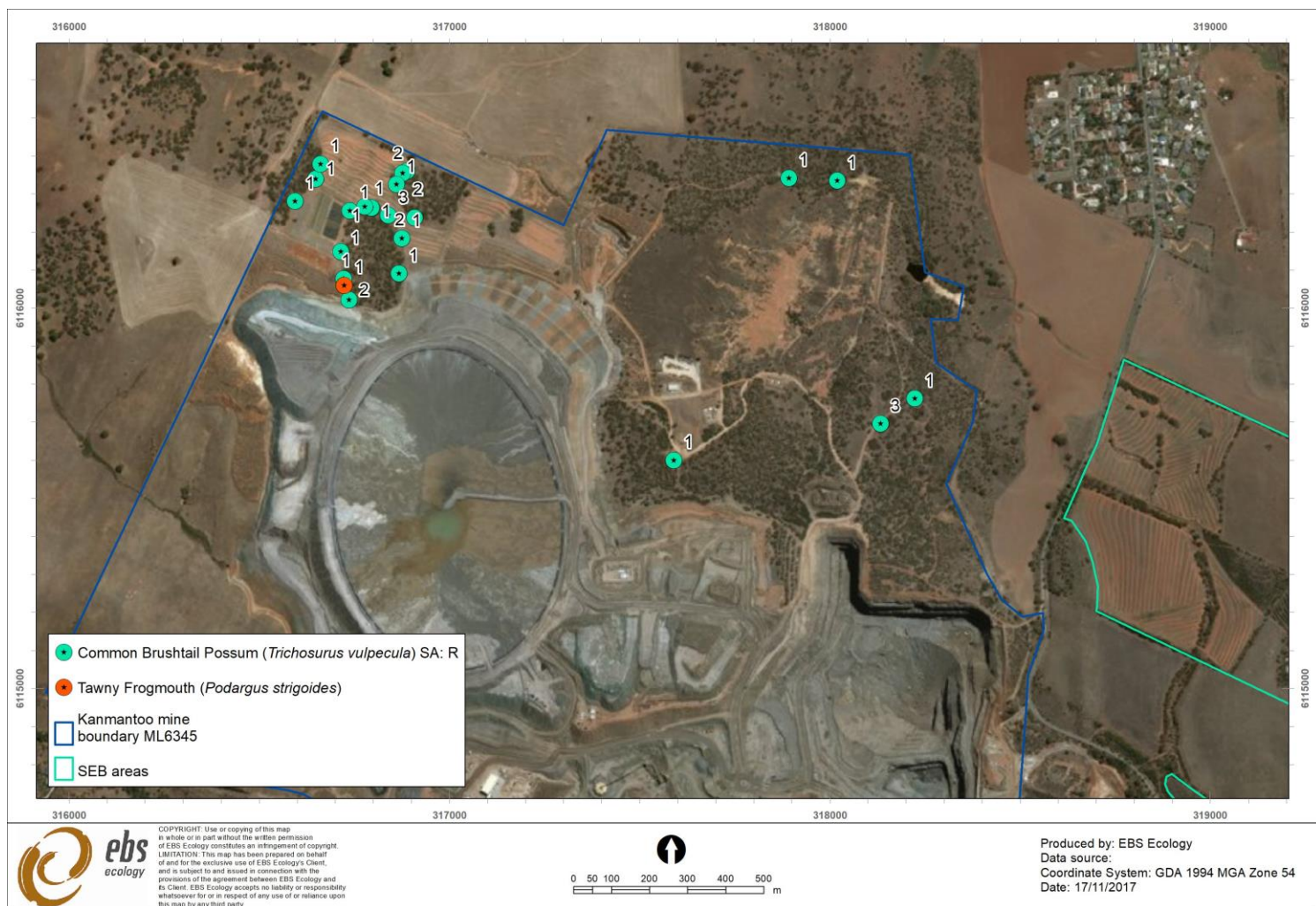


Figure 9. Locations of Common Brushtail Possums and a Tawny Frogmouth observed whilst spotlighting in the ML area.

4 DISCUSSION

4.1 Bird guilds

Bird guilds can provide an understanding of the types of bird groups that utilise an ecosystem over time. The 2017 spring survey showed that a diverse number of bird groups were utilising varied habitat resources across different habitat types within the combined ML and SEB areas during the spring period.

In 2017, 52 bird species totalling 1042 individuals were recorded at the site. This is a substantial increase in abundance, and a moderate increase in diversity since 2016. In 2016, 42 bird species totalling 530 individuals were recorded. In 2015, 50 bird species totalling 998 individuals were recorded. In 2014, 31 bird species totalling 381 were recorded; in 2013, 48 bird species and 575 individuals were recorded; in 2012, 58 species and 668 individuals were recorded and in 2011, 40 species and 305 individuals were recorded (Table 3). The results continue to show a fluctuation in abundance and diversity.

It is worth noting that during the spring 2017 survey, that a large number of lerps were observed within woodland areas directly north of the pit (particularly around bird roaming sites 5-7) (Figure 10). This may have influenced the bird abundance and diversity recorded during the 2017 survey e.g. Brown-headed Honeyeater (*Melithreptus brevirostris*) and White-plumed Honeyeater (*Ptilotula penicillata*), both of which experienced higher numbers during the current survey.



Figure 10. Lerps recorded within the ML, north-east of the pit.

Different guilds require different habitats, with more guilds providing an indication of habitat diversity. Species per guild can indicate habitat quality, abundance or possibly complexity. Guilds have been divided below to demonstrate species diversity across the project area.

4.1.1 Woodland birds

The woodland area north of the pit (within the ML) continues to support a good diversity of woodland birds including the Yellow-rumped thornbill (*Acanthiza chrysorrhoa*), Australian Owlet-nightjar (*Aegotheles cristatus*), Grey Shrike-thrush (*Colluricincla harmonica*), Black-faced Cuckoo-shrike (*Coracina novaehollandiae*), Dusky Woodswallow (*Artamus cyanopterus*), Rufous Whistler (*Pachycephala rufiventris*), Southern Whiteface (*Aphelocephala leucopsis*), Striated Pardalote (*Pardalotus striatus*), Tree Martin (*Petrochelidon nigricans*), Willie Wagtail (*Rhipidura leucophrys*) and Weebill (*Smicromis brevirostris*). Species not seen in this area, but in other vegetated areas within the ML included the Brown Treecreeper (*Climacteris picumnus*) (Patch 1, 2, 4), and Horsfield's Bronze Cuckoo (*Chalcites basal*) (Patch 1).

Other birds that favoured good vegetation cover, that were present during the 2017 spring survey, included: White-browed Babbler (*Pomatostomus superciliosus*) (SEB patch 18) and the Common Bronzewing (*Phaps chalcoptera*) (SEB patch 18). The Black-faced Woodswallow (*Artamus cinereus*) was recorded in large numbers (260 individuals) flying high over two patches within the ML (patch 6 and patch 13). This species has not been recorded on site in recent years.

4.1.2 Seed eaters

Both the ML and SEB areas supported several species of seed eaters, including the threatened Elegant Parrot, threatened Diamond Firetail, and vulnerable Yellow-tailed Black Cockatoo. Other seed eaters observed during the current survey were the Sulphur crested Cockatoo (*Cacatua galerita*), Little Corella (*Cacatua sanguinea*), Red-rumped Parrot, Adelaide Rosella (*Platycercus elegans*) and Galah (*Eolophus roseicapilla*).

4.1.1 Honeyeaters/nectar feeders

A good diversity of honeyeaters was observed within the ML and SEB areas. This included the Singing Honeyeater (*Gavicalis virescens*), Brown-headed honeyeater (*Melithreptus brevirostris*), New Holland Honeyeater (*Phylidonyris novaehollandiae*), White-plumed Honeyeater (*Ptilotula penicillata*) and Red Wattlebird (*Anthochaera carunculata*), which were also all recorded in the 2016 spring survey.

4.1.2 Waterbirds

A range of waterbird species were recorded near the dam situated within the Mining Lease during the 2017 spring survey. This includes the Pacific Black Duck (*Phylidonyris novaehollandiae*), White-faced Heron (*Egretta novaehollandiae*), Grey Teal (*Anas gracilis*), Hardhead (*Aythya australis*), Australian Wood Duck (*Chenonetta jubata*), Black-fronted Dotterel (*Elseyaornis melanops*), and Australasian Grebe (*Tachybaptus novaehollandiae*).

4.1.3 Bird of prey

A total of four Brown Falcon (*Falco berigora*) were observed on the ML during the 2017 spring survey. A single Nankeen Kestrel (*Falco cenchroides*) was observed in the SEB area in 2017. There were no

sightings of the Peregrine Falcon (*Falco peregrinus*) or the Wedge-tailed Eagle (*Aquila audax*) in 2017; both species were observed in the 2016 spring survey.

4.2 Common Brushtail Possum

Spotlighting along established transects within *E. odorata* (Peppermint Box) Woodland habitats were undertaken in search of the Common Brushtail Possum. During the 2017 spring survey, 30 observations of the Common Brushtail Possum were recorded within the Mining Lease. This number is a substantial increase from the 2016 survey whereby 14 were recorded and is the highest number recorded since 2013 (Table 5). This year was the fourth-year possums have been targeted (through spotlighting) within the SEB area, with none recorded to date. This is to be expected, based on the fact that woodland patches are scattered and do not provide suitable habitat for possums at present.

4.3 Pest species

Three introduced mammal species (other than sheep and cattle) were recorded during the spring 2017 survey. These were the European Rabbit, European (Brown) Hare, and Domestic Cat. The cat was observed during spotlighting in the SEB area. Hares and rabbits have previously been recorded in the ML area. The number of rabbits observed within the ML continues to decline after the setup of rabbit bait stations by EBS within the ML in 2015. A total of 27 rabbits were recorded in 2015, eight rabbits were recorded in 2016, and a single rabbit was recorded in 2017.

4.4 Rehabilitation and Revegetation

To date, Hillgrove Resources has made a positive contribution toward woodland enhancement and the planned rehabilitation of the site at the time of the mine's closure. Rehabilitation operations continue to see areas of native woodland and grassland expand within the Mining Lease area and SEB areas.

A commercial-scale seed production area (SPA) continues to be maintained on site. This coupled with the seed multiplication area (SMA), the harvesting of direct seeded strips and the collection of wild species, has produced large quantities of local provenance seed for the re-establishment of native grassland / woodlands within and adjacent to the mining lease. Over time these areas will become self-sustaining and will offset mining production and clearance. Maintenance and direct seeding will continue in 2018.

Woodland areas in the north-west corner (previously fragmented through agricultural and grazing) have undergone revegetation to enhance the area and provide links to allow fauna to move through increased corridors. As part of SEB requirements, 130 ha within the mining lease area and in adjacent properties, are being rehabilitated.

Over time, the SEB areas will regenerate and provide habitat similar to the ML, and therefore it would be expected that bird guilds will increase in diversity. In addition, it is anticipated that the SEB will eventually provide habitat for mammal species such as the Common Brushtail Possum. Given that the control of pest species such as rabbit have also been targeted, a reduction of species such as Hare and European rabbit, will hopefully see less grazing pressure and increase the regeneration in rehabilitated areas.

5 RECOMMENDATIONS

- Continued annual abundance and diversity surveys of fauna species (birds and mammals) at the same time each year (preferably early spring / October of each year);
- Continued targeted surveys for indicator species such as the Diamond Firetail, Common Brushtail Possum, Peregrine Falcon, Yellow-tailed Black Cockatoo, Rainbow Bee-eater, Elegant Parrot and White-winged Chough;
- Visual inspections for wetland species (opportunistically as well as targeted at the dam located within the ML); and
- Database and document reviews, including a search for all incidents of fauna mortalities.

6 REFERENCES

Coffey (2012) *Program for Environment Protection and Rehabilitation*, Hillgrove Copper Pty Ltd. Kanmantoo Copper Project ML 6345.

Ecological Associates (2006) Distribution and status of Brushtail Possums on the Lower Eyre Peninsula following the January 2005 bushfire. Prepared for the Department for Environment and Heritage.

Editors of the American Heritage Dictionaries (2014) *The American Heritage® Student Science Dictionary, Second Edition*.

Hillgrove Resources (2007) *Kanmantoo Copper Project Mining Lease Proposal, Main Report*.

