



APPENDIX D

Biodiversity Offset Increase Fauna Report

GINKGO MINERAL SANDS MINE
SOUTHERN EXTENSION MODIFICATION
OFFSET INCREASE FAUNA REPORT



PREPARED BY
BIODIVERSITY MONITORING SERVICES

DECEMBER 2015
Project No. CMA-13-03
Document No. 00721482.docx

TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
EXECUTIVE SUMMARY	ES-1
1 INTRODUCTION	1
1.1 OBJECTIVES	1
1.2 EXISTING BIODIVERSITY OFFSET STRATEGY	6
1.3 PROPOSED BIODIVERSITY OFFSET STRATEGY	8
1.3.1 Long-term Security	8
1.3.2 Proposed Management and Management Plan	8
1.3.3 Monitoring	8
2 DATA SOURCES	10
2.1 DATABASE SEARCHES	10
2.2 FAUNA SURVEYS IN THE SUBJECT AREA AND SURROUNDS	10
2.2.1 Fauna Surveys for the Ginkgo Mineral Sands Project Environmental Impact Statement	10
2.2.2 Pre-Clearance Surveys (2005-2015)	10
2.2.3 Fauna Survey of Rehabilitation Areas within ML 1504	12
2.2.4 Fauna Surveys for the Ginkgo Mine 2012 Modification	12
2.2.5 Fauna Surveys for the Snapper Mineral Sands Project	13
2.3 REGIONAL DISTRIBUTION OF THREATENED SPECIES RECORDS	13
3 CHARACTERISTICS OF THE PROPOSED BIODIVERSITY OFFSET AREAS	14
3.1 REGIONAL LOCATION	15
3.2 CLIMATE	15
3.3 HYDROLOGY	15
3.4 TOPOGRAPHY AND SOILS	17
3.5 LAND USE	17
3.6 HABITAT	17
3.6.1 Habitat Types	17
3.6.2 Habitat Trees	18
3.7 FAUNA CHARACTERISTICS	20
3.7.1 Fauna Species	20
3.7.2 Threatened Fauna Species	20
3.8 RECONCILIATION OF THE PROPOSED OFFSET STRATEGY AGAINST OEH OFFSET PRINCIPLES	26
4 CONCLUSION	28
5 REFERENCES	29

TABLE OF CONTENTS (continued)

LIST OF TABLES

Table 1	Proposed Biodiversity Offset Areas
Table 2	Survey Effort Undertaken within the Biodiversity Monitoring Services (2012) Study Area
Table 3	Survey Effort Undertaken within the Biodiversity Monitoring Services (2014) Study Area
Table 4	Percentage Cover within the Two Main Habitat Types in the Subject Area
Table 5	Quantification of Fauna Habitat Types in the Subject Area and Proposed Biodiversity Offset Areas
Table 6	Characteristics of Trees within the Subject Area
Table 7	Tree Cover Characteristics within Ginkgo Mine Area
Table 8	Threatened Fauna Recorded at the Ginkgo Mine
Table 9	Threatened Fauna Habitat in the Subject Area and Offset Areas
Table 10	Reconciliation of the Proposed Biodiversity Offset Strategy against OEH Offset Principles

LIST OF FIGURES

Figure 1	Regional Location
Figure 2a	Existing/Approved Ginkgo Mine (Processing Option 1)
Figure 2b	Existing/Approved Ginkgo Mine (Processing Option 2)
Figure 3	Habitat Types in the Subject Area
Figure 4	Existing Biodiversity Offset Areas
Figure 5	Proposed Biodiversity Offset Areas
Figure 6	Threatened Species in the Subject Area
Figure 7	Threatened Species Recorded in the Ginkgo Mineral Sands Mine Area and Surrounds
Figure 8	Habitat Types and Threatened Fauna Species within the Offset Areas

LIST OF ATTACHMENTS

Attachment A	Fauna Species List for ML 1504 and the Subject Area
--------------	---

EXECUTIVE SUMMARY

This fauna assessment was conducted as part of the Ginkgo Mineral Sands Mine (Ginkgo Mine) Southern Extension Modification (the Modification). The Ginkgo Mine is located approximately 85 kilometres (km) north-east of Wentworth and approximately 170 km to the south-east of Broken Hill in western New South Wales (NSW).

This report provides an assessment on the affects of an approximate 1,255 hectare (ha) extension to the existing Ginkgo Mine Crayfish Deposit Offset area to offset approximately 333 ha of surface development at the Ginkgo Mine that has not been accounted for in previous Ginkgo Mine offset area calculations (the Subject area).

Cristal Mining Australia Limited (Cristal Mining) currently has a number of existing offset areas in the surrounding locality, two of which have been established for the Ginkgo Mine, totalling approximately 2,603 ha. Cristal Mining proposes to extend the existing Ginkgo Mine Crayfish Deposit Offset area, located within the Mallara property approximately 19 km east of the Ginkgo Mine.

Three offset areas are proposed (Offset Areas 1 to 3) which comprise approximately 1,255 ha of native vegetation. The following conclusions are made in relation to the suitability of the proposed offset areas (Offset Areas 1 to 3) to offset the Subject area:

- The proposed offset areas (Offset Areas 1 to 3) are extensions to the existing Ginkgo Mine offset areas (which was most recently augmented as a component of the Planning Assessment Commission's Modification 9 approval in March 2015).
- All of the broad fauna habitat types in the Subject area are represented in the proposed offset areas in greater quantities.
- Habitat characteristics, such as densities of tree hollows and log cover, are similar between the Subject area and the proposed offset areas.
- All threatened fauna species recorded within or immediately adjoining the Subject Area have known or potential habitat in the offset areas.
- All of the threatened fauna species that could have potentially occurred within the Subject Area, could also potentially occur within the proposed offset areas.
- The biodiversity values within the proposed offset areas are likely to improve in the medium to long-term as a result of proposed management actions (e.g. exclusion of grazing and management of feral goats).

The Modification would also include an additional offset (Offset Area 4) for extensions to the existing/approved surface development area for additional development areas for the mine path, overburden emplacement, topsoil stockpile areas and other supporting infrastructure.

In conclusion, the four offset areas proposed as part of the Modification (Offset Areas 1 to 4) are considered to meet the Office of Environment and Heritage *Principles for the Use of Biodiversity Offsets in NSW* and it is likely that fauna biodiversity values would be maintained or improved in the medium to long-term.

1 INTRODUCTION

Cristal Mining Australia Limited (Cristal Mining) operates the Ginkgo Mine, which is located approximately 85 kilometres (km) north-east of Wentworth and approximately 170 km to the south east of Broken Hill in western New South Wales (NSW) (Figure 1).

Cristal Mining is preparing an Environmental Assessment (EA) to support applications to modify the Ginkgo Mine Development Consent (DA 251-09-01). The Modification would include:

1. extensions (approximately 32 hectares [ha]) to the existing/approved surface development area for additional development areas for the mine path, overburden emplacement, topsoil stockpile areas and other supporting infrastructure; and
2. an increase in the Ginkgo Mine biodiversity offset area to account for existing surface development (approximately 333 ha) that has not been accounted for in previous Ginkgo Mine biodiversity offset area calculations.

This report covers the second component, an increase in the Ginkgo Mine biodiversity offset area to account for existing surface development. As part of this Modification, Cristal Mining propose an extension to the existing Ginkgo Mine Crayfish Deposit Offset area to offset approximately 333 ha of surface development at the Ginkgo Mine that has not been accounted for in previous Ginkgo Mine offset area calculations (the Subject area).

A separate report, titled the *Ginkgo Mineral Sands Mine Southern Extension Fauna Assessment* (Biodiversity Monitoring Services, 2015), covers the fauna assessment for the additional surface development area.

The existing/approved general arrangement is shown on Figures 2a and 2b (including both processing options approved as part of the *Ginkgo Mineral Sands Mine November 2012 Modification Modified Request* [Cristal Mining, 2013]). The Subject area is shown on Figure 3.

1.1 OBJECTIVES

The objective of this report is to present the fauna characteristics of the proposed offset areas in comparison to the fauna characteristics of the Subject area. To do this, the following characteristics of both the proposed Biodiversity areas and the Subject area are discussed in this report:

- Relationship to existing offset areas and proximity to the Subject area.
- Quality and quantity of fauna habitats (and vegetation communities mapped by FloraSearch).
- Occurrence of threatened species, populations, ecological communities and critical habitat of the proposed offset areas listed under NSW and Commonwealth legislation (NSW *Threatened Species Conservation Act, 1995* and Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999*).

Separate reports were prepared which documents fauna surveys of the proposed offset areas (Biodiversity Monitoring Services, 2012; 2014).



* MSP Process Waste Transport Route following cessation of operations at the Ginkgo and Snapper Mines

Source: DPI-C&L (CLD) (2011) and Cristal Mining (2013).

Figure 1



Figure 2a

Source: Bemax Resources Limited (2010) and Cristal Mining (2013); Orthophoto: Cristal Mining (2012)



CMA-13-03 EA FMOIR 2030



Source: Bemax Resources Limited (2010) and Cristal Mining (2013); Orthophoto: Cristal Mining (2012)

Figure 2b



- LEGEND**
- Mining Lease Boundary
 - Ore Pipeline (Processing Option 2) (Not Constructed)
 - Mineral Concentrate Transport Route and MSP Process
 - Waste Transport Route
 - Ginkgo Mine Potable Water Pipeline (Not Constructed)
 - Electricity Transmission Line
 - Water Bore
 - Ginkgo Mine General Arrangement (2010)
 - Subject Area
 - Fauna Habitat Type
 - 2 Black Oak - Woodland
 - 3 Chenopod Mallee
 - 4 Grassland/Low Shrubland

Source: Bemax Resources Limited (2010) and Cristal Mining (2013)
 Orthophoto: Cristal Mining (2012)

Figure 3



G I N K G O M I N E

Habitat Types in the Subject Area

1.2 EXISTING BIODIVERSITY OFFSET STRATEGY

Cristal Mining currently has a number of existing offset areas in the surrounding locality. These existing offset areas can be seen in Figure 4. Cristal Mining has established two existing offset areas for the Ginkgo Mine, totalling approximately 2,603 ha.

One offset area for the Ginkgo Mine (the Southern Mallee Offset area) encompasses approximately 521 ha of vegetation communities, including 4 ha of Chenopod Mallee Woodland/Shrubland vegetation communities, and is surrounded by a larger offset area which was established for the Snapper Mine. The Southern Mallee Offset area is adjacent to the south-western section of the Snapper Mine on the Trelega property (Figure 4).

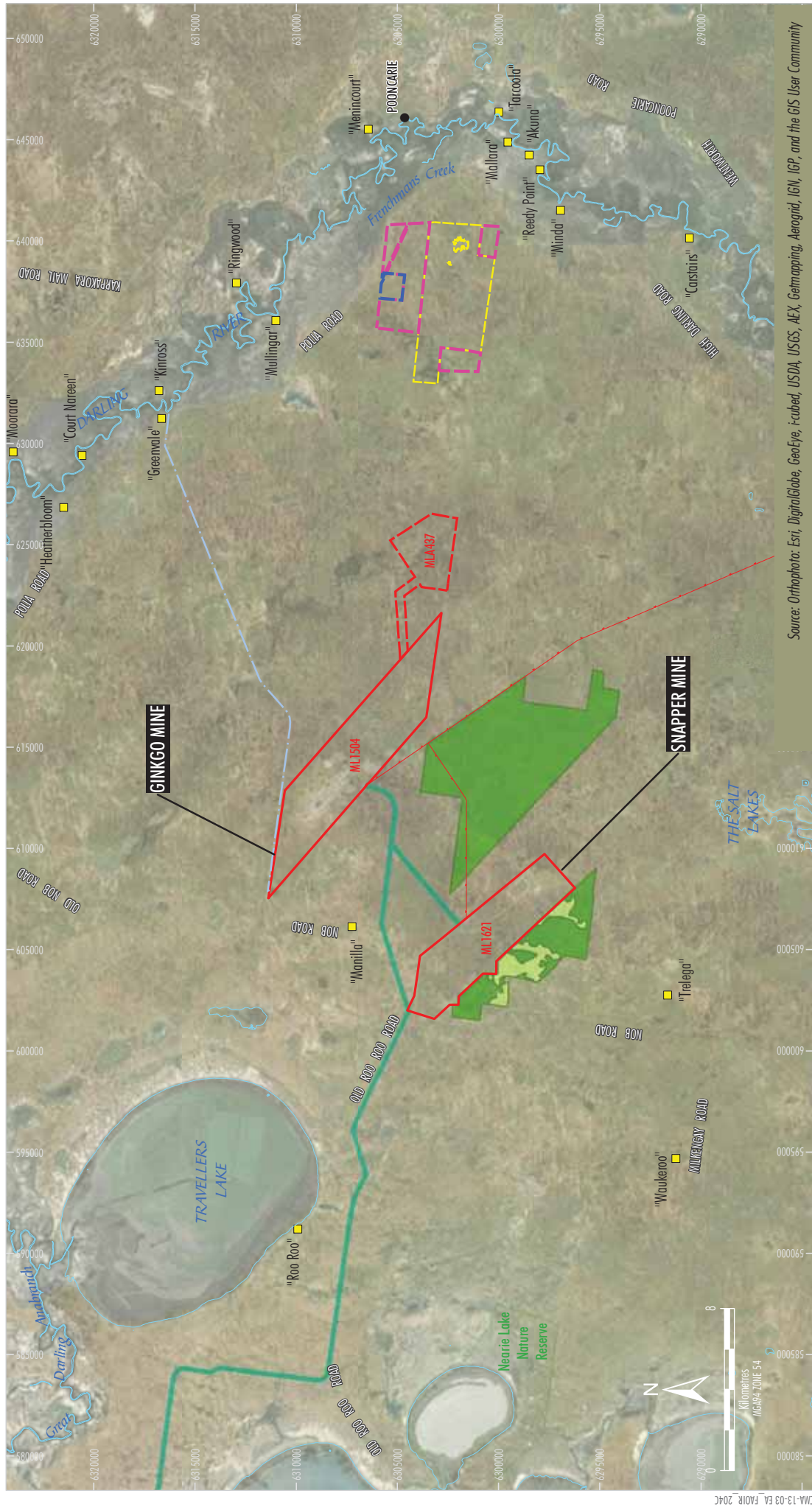
The second offset area for the Ginkgo Mine (the Ginkgo Mine Crayfish Deposit Offset area) is located within the Mallara property, located on a Western Lands Lease, leased to Cristal Mining (Figure 4). The Ginkgo Mine Crayfish Deposit Offset area is 2,082 ha and is dominated by mosaics of Chenopod Mallee Woodland/Shrubland, Black Oak – Western Rosewood Woodland and Dune Mallee Shrubland.

Cristal Mining currently has two existing offset areas for the Snapper Mine (Figure 4). The existing Snapper offset areas encompass a total of approximately 5,470 ha.

Cristal Mining has made arrangements to provide appropriate long term security for the Southern Mallee Offset (except the second offset area for the Ginkgo Mine [Crayfish Deposit Offset area]) by changing the purpose of the Western Lands Lease for conservation. Cristal Mining would also lodge a conservation bond with the NSW Department of Planning and Environment (DP&E).

Management of the Southern Mallee Offset began following approval of Modification 4 in 2006 under an Offset Management Plan. The existing Offset Management Plan was updated to include the Crayfish Deposit Offset and submitted to DP&E for approval in September 2015. The management measures described in the Offset Management Plan would include:

- fencing to exclude grazing;
- incremental destocking;
- removal of unnecessary fencing;
- erosion control;
- signage of the offset areas;
- revegetation of unnecessary access tracks;
- animal pest control;
- weed management;
- fire management;
- threatened species management;
- closure of artificial water sources such that they can no longer hold water;
- vehicle access management;
- an environmental induction for employees and contractors; and
- auditing/monitoring.



G I N K G O M I N E

Existing Biodiversity Offset Areas

Figure 4

1.3 PROPOSED BIODIVERSITY OFFSET STRATEGY

Cristal Mining proposes to extend the existing Ginkgo Mine Crayfish Deposit Offset area (Figures 4 and 5), to include an additional 1,255 ha of native vegetation to accommodate for the Subject area. The proposed offset areas comprise three parcels of land as outlined in Table 1.

Table 1
Proposed Biodiversity Offset Areas

Area	Size
Area 1	926
Area 2	125
Area 3	204
Total	1,255

The additional Biodiversity Offset Area 4 (Figure 5) is proposed to account for the proposed Southern Extension area (i.e. subject to a separate report, titled the *Ginkgo Mineral Sands Mine Southern Extension Modification - Fauna Assessment* [Biodiversity Monitoring Services, 2015]).

The physical attributes and key characteristics of the proposed offset areas are discussed in Section 3. A reconciliation of the proposed offset strategy against the OEH Offset Principles (OEH, 2014) is provided in Section 3.8.

The sub-sections below outline the proposed method of conserving the proposed offset areas in perpetuity, proposed management and monitoring.

1.3.1 Long-term Security

The existing offset areas are located on Western Land Leases held by Cristal Mining. The same method of conservation security for the existing Ginkgo Mine Crayfish Deposit Offset area (change in purpose of the Western Lands Lease) would be applied to the proposed offset areas. Suitable arrangements would be made for the long-term security of the Offset areas within a timeframe to the satisfaction of the NSW Secretary of the DP&E.

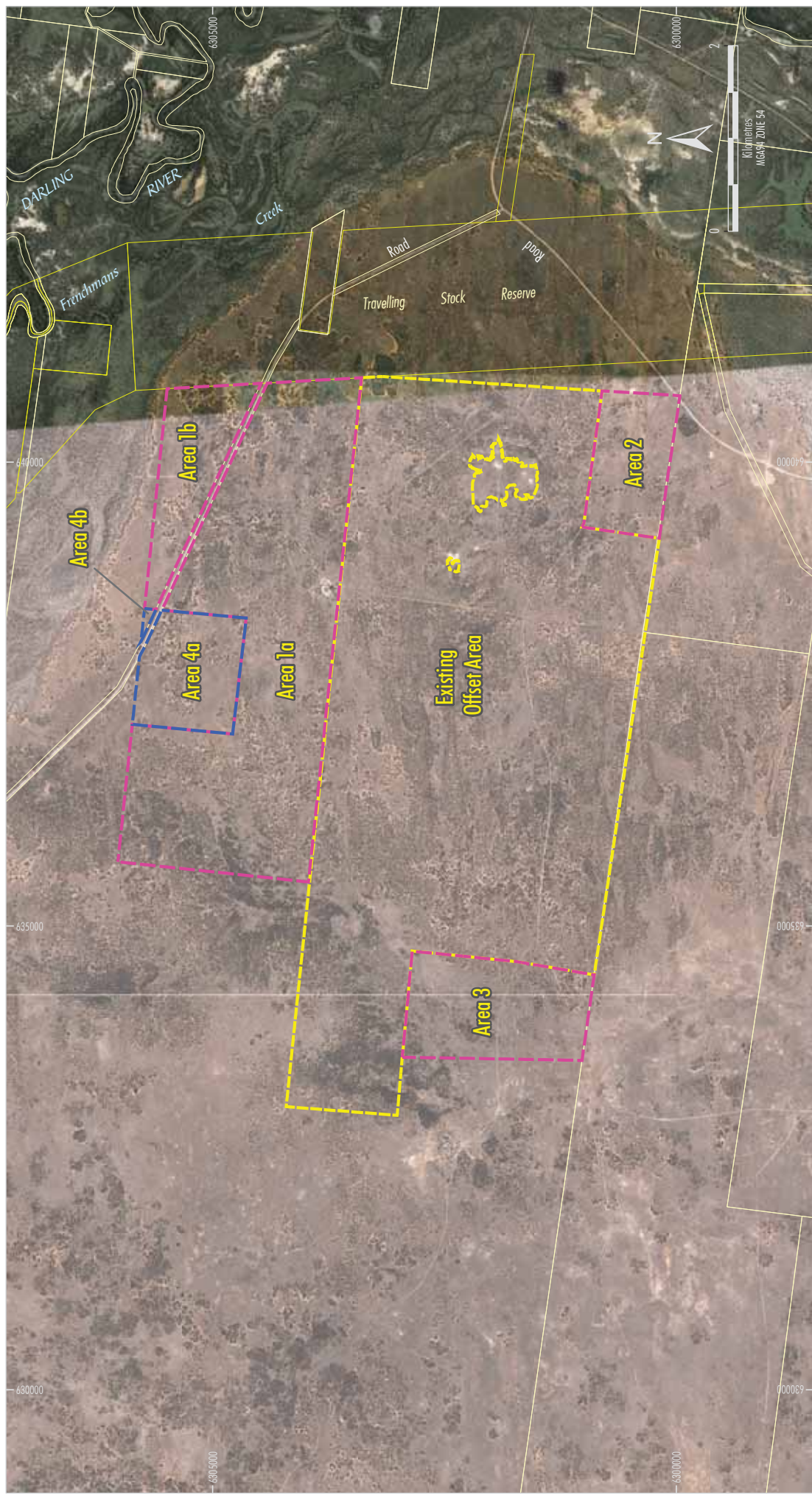
1.3.2 Proposed Management and Management Plan

The management of the proposed offset areas would be described within an updated Offset Management Plan. The plan would cover the management of domestic stock grazing, management of pest species (particularly those listed as invasive) and control of weeds. Access to the area would be limited to authorised personnel.

The proposed offset areas contain a number of access tracks and internal fencing, as well as some small tanks for stock watering.

1.3.3 Monitoring

The existing offset monitoring program on Cristal Mining Offset areas would be expanded to the proposed offset area to monitor and report on the effectiveness of offset management measures. The monitoring would be undertaken by a suitably qualified person(s).



LEGEND

-  Existing Ginkgo Mine - Crayfish Deposit Offset Area
-  Proposed Additional Biodiversity Offset Area (1-3)
-  Proposed Southern Extension Biodiversity Offset Area (4)



G I N K G O M I N E

Proposed Biodiversity Offset Areas

Figure 5

Source: NSW L&PI (2012) and Orthophoto: Google (2013)

2 DATA SOURCES

2.1 DATABASE SEARCHES

Two forms of database searches were necessary to provide sufficient information about the fauna that occurred within the Subject area and the known and potential distributions of threatened species surrounding the Subject area. The first form required searches of previous reports of surveys of the Subject area, whilst the second form of search casts the net wider and documented records of threatened species in a larger area surrounding the Subject area.

2.2 FAUNA SURVEYS IN THE SUBJECT AREA AND SURROUNDS

2.2.1 Fauna Surveys for the Ginkgo Mineral Sands Project Environmental Impact Statement

Fauna surveys of the Ginkgo Mine and associated infrastructure were undertaken by Mount King Ecological Surveys (2001) in 2000 and are described in Appendix H of the *Ginkgo Mineral Sands Project Environmental Impact Statement*. Threatened species recorded by Mount King Ecological Surveys (2001) are shown on Figure 6.

2.2.2 Pre-Clearance Surveys (2005-2015)

Pre-clearance surveys for flora and fauna were conducted on all land in the Subject area. A total of 12 pre-clearance surveys were conducted between 2005 and 2012 by Ogyris Ecological Research. As well as the surveys identifying and mapping the vegetation communities present, Ogyris Ecological Research also inspected a number of trees and identified any habitat trees (i.e. trees containing hollows, cracks and loose bark). Many of these trees were inspected during the clearing operations and any fauna located was documented. The pre-clearance survey reports are:

- *Vegetation Pre-clearance flora and fauna surveys of land at Bemax Resources NL Murray-Darling Basin sand mine sites. 1) Ginkgo Sand Mine, Autumn-Winter 2005.* Ogyris Ecological Research (2005).
- *Vegetation Pre-clearance flora and fauna surveys of land at Bemax Resources NL Murray-Darling Basin sand mine sites. 2) Ginkgo Sand Mine - February 2006.* Ogyris Ecological Research (2006a).
- *Vegetation Pre-clearance flora and fauna surveys of land at Bemax Resources NL Murray-Darling Basin sand mine sites. 3) Ginkgo Sand Mine - September 2006.* Ogyris Ecological Research (2006b).
- *Vegetation Pre-clearance flora and fauna surveys of land at Bemax Resources Ltd Murray-Darling Basin sand mine sites. 4) Ginkgo Sand Mine, February 2007.* Ogyris Ecological Research (2007a).
- *Vegetation Pre-clearance flora and fauna surveys of land at Bemax Resources Ltd Murray-Darling Basin sand mine sites. 5) Ginkgo Sand Mine Stage 2 Extension, May 2007.* Ogyris Ecological Research (2007b).
- *Vegetation Pre-clearance flora and fauna surveys of land at Bemax Resources Ltd Murray-Darling Basin sand mine sites. 6) Ginkgo Sand Mine Stage 3 Extension and northern boundary fenceline. February 2009.* Ogyris Ecological Research (2009a).



LEGEND

- Mining Lease Boundary
- Ore Pipeline (Processing Option 2) (Not Constructed)
- Mineral Concentrate Transport Route and MSP Process Waste Transport Route
- Ginkgo Mine Potable Water Pipeline (Not Constructed)
- Electricity Transmission Line
- Water Bore

Ginkgo Mine General Arrangement (2010)

Subject Area

Threatened Fauna

- Grey Falcon
- Major Mitchell's Cockatoo
- Hooded Robin (south eastern form)
- Bolam's Mouse
- Inland Forest Bat
- Little Pied Bat
- Yellow-bellied Sheathtail-Bat



G I N K G O M I N E

Threatened Species in the Subject Area

Please note that Mount King Ecological Surveys (2001) recorded the Hooded Robin (south-eastern form) and White-fronted Chat, and Ogris Ecological Research (2009-2012) also recorded the Hooded Robin (south-eastern form) however exact locations were not recorded.

Reference:

- 1 Biodiversity Monitoring Services (2012)
- 2 Mount King Ecological Surveys (2001)
- 4 Ogris Ecological Research (2009-2012)
- 5 Biodiversity Monitoring Services (2015)

Source: Bemax Resources Limited (2010) and Cristal Mining (2013); Orthophoto: Cristal Mining (2012)

Figure 6

- *Vegetation Pre-clearance flora and fauna surveys of land at Bemax Resources Ltd Murray-Darling Basin sand mine sites. 8) Ginkgo Sand Mine Stage 4 Northern Extension and expansion of overburden stockpile OB2. May 2009. Ogyris Ecological Research (2009b).*
- *Vegetation Pre-clearance flora and fauna surveys of land at Bemax Resources Ltd Murray-Darling Basin sand mine sites. 9) Ginkgo Sand Mine Stage 4 Northern Extension. Winter 2009. Ogyris Ecological Research (2010).*
- *Vegetation Pre-clearance flora and fauna surveys of land at Bemax Resources NL Murray-Darling Basin sand mine sites. 13) Ginkgo Mine. August 2011. Ogyris Ecological Research (2011).*
- *Vegetation Pre-clearance flora and fauna surveys of land at Bemax Resources NL Murray-Darling Basin sand mine sites. 14) Ginkgo Mine. January 2012. Ogyris Ecological Research (2012a).*
- *Vegetation Pre-clearance fauna report of land at Cristal Mining Australia Ltd Murray-Darling Basin sand mine sites. Ginkgo Mine - Winter 2012. Ogyris Ecological Research (2012b).*
- *Vegetation Pre-clearance vegetation and soils report of land at Cristal Mining Australia Ltd Murray-Darling Basin mineral sand mine sites. Ginkgo Mine - Winter 2012. Ogyris Ecological Research (2012c).*
- *Vegetation Pre-clearance fauna report of land at Cristal Mining Australia Ltd Murray-Darling Basin mineral sand mine sites. Ginkgo Mine. February 2013. Ogyris Ecological Research (2013).*
- *Vegetation Pre-clearance vegetation and soils report of land at Cristal Mining Australia Ltd Murray-Darling Basin mineral sand mine sites. Ginkgo Mine – Winter 2014. Ogyris Ecological Research (2014a).*
- *Vegetation Pre-clearance fauna report of land at Cristal Mining Australia Ltd Murray-Darling Basin mineral sand mine sites. Ginkgo Mine – Autumn – Winter 2014. Ogyris Ecological Research (2014b).*
- *Vegetation Pre-clearance vegetation and soils report of land at Cristal Mining Australia Ltd Murray-Darling Basin mineral sand mine sites. Ginkgo Mine – Autumn 2015. Ogyris Ecological Research (2015a).*
- *Vegetation Pre-clearance fauna report of land at Cristal Mining Australia Ltd Murray-Darling Basin mineral sand mine sites. Ginkgo Mine. July 2015. Ogyris Ecological Research (2015b).*

2.2.3 Fauna Survey of Rehabilitation Areas within ML 1504

The University of Ballarat have been conducting fauna surveys within various stages of rehabilitation associated with the Ginkgo Mine.

2.2.4 Fauna Surveys for the Ginkgo Mine 2012 Modification

Surveys for fauna of the proposed Ginkgo Mine 2012 Modification were undertaken by Biodiversity Monitoring Services in 2012. Part of the area surveyed was within Mining Lease (ML) 1504 on land to be traversed by the proposed route of the haul road from the Crayfish deposit to the processing area at the Ginkgo Mine. The relevant report is *Ginkgo Mineral Sands Mine – Crayfish Modification Fauna Assessment* (Biodiversity Monitoring Services, 2012). Threatened species recorded by Biodiversity Monitoring Services (2012) are shown on Figure 6.

2.2.5 Fauna Surveys for the Snapper Mineral Sands Project

Fauna surveys were undertaken by the Western Research Institute Ltd in 2006 of an area to the south of ML 1504. The results from these surveys are presented in *Snapper Mineral Sands Project Environmental Assessment Appendix D Fauna Assessment* (Western Research Institute and Resource Strategies, 2007).

2.3 REGIONAL DISTRIBUTION OF THREATENED SPECIES RECORDS

A desktop survey was undertaken to determine the threatened ecological communities, populations, species and critical habitat that are known to occur within the wider region. A list of threatened fauna that may potentially occur on the Subject area were compiled from searches of the following databases:

- Atlas of NSW Wildlife search for a 40 x 40 metre (m) area centred on the Subject area (accessed through BioNet, 25 November 2015) (OEH, 2015).
- The Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) Protected Matters Search Tool (40 x 40 m area centred on the Subject area [accessed 25 November 2015]) (Department of the Environment, 2015).
- The results of fauna surveys in Dune Mallee woodlands in the Lower Murray Darling catchment of south-western NSW provide lists of species occurring near ML 1504 (Val *et al.*, 2012).
- Data from surveys undertaken by Biodiversity Monitoring Services within the proposed offset areas in 2012 and 2013. These are reported in the *Ginkgo Mineral Sands Mine – Crayfish Modification Fauna Assessment* (Biodiversity Monitoring Services, 2012) and the proposed offset areas survey report in this assessment, *Mallara Fauna Survey* (Biodiversity Monitoring Services, 2014).
- Species known or predicted to occur in the South Olary Plain, Murray Basin Sands (Part D) Catchment Management Authority (CMA) subregion (OEH, 2015).

3 CHARACTERISTICS OF THE PROPOSED BIODIVERSITY OFFSET AREAS

The fauna of the proposed offset areas are discussed in detail in Biodiversity Monitoring Services (2012) and in Biodiversity Monitoring Services (2014).

Biodiversity Monitoring Services (2012) conducted fauna surveys within a study area containing proposed Offset Area 2 and 3. Biodiversity Monitoring Services (2012) visually inspected the entire study area, and established four detailed survey sites, stratified based on habitat classes, so that all classes were sampled. Survey effort undertaken during the Biodiversity Monitoring Services (2012) surveys is outlined in Table 2.

Table 2
Survey Effort Undertaken within the Biodiversity Monitoring Services (2012) Study Area

Survey Technique	BO01	BO02	BO03	BO04	Biodiversity Offset Area Total
Ground Elliott Traps	100	100	100	0	300
Tree-mounted Elliott Traps	20	20	20	20	80
Tomahawk Traps	0	0	0	24	24
Large Elliott Traps	8	8	8	0	24
Pit Traps	16	16	12	0	44
Glider Funnels	8	8	8	0	24
Hair Funnels	20	20	20	0	60
Remote Cameras	10 camera-days	10 camera-days	10 camera-days	0	30 camera-days
Reptile Search	8 person-days	8 person-days	8 person-days	8 person-days	32 person-days
Bird Counts	8 person-days	8 person-days	8 person-days	8 person-days	32 person-days
Harp Trap	2 days				
Anabat	1 day	1 day	1 day	0	3 days
Spotlighting	65.4 km; 3.5 hrs				

At three of the sites in the Biodiversity Monitoring Services (2012) study area all terrestrial vertebrate groups were surveyed using a wide range of equipment and techniques. Arboreal marsupials were targeted at the BO04 site using tree-mounted cage traps, and micro-bats were targeted using a harp trap at a site between mature trees in the study area. Anabat recorders were also used to detect micro-bats at three sites. In addition, call broadcasting for nocturnal birds was undertaken at numerous sites. Spotlighting transects were undertaken throughout the Biodiversity Monitoring Services (2012) study area, either from vehicle or on foot. Any water bodies (e.g. tanks) were inspected and waterbirds and amphibians searched for.

Biodiversity Monitoring Services (2014) surveyed a total of 15 sites which sampled nine of the vegetation communities mapped by FloraSearch (2014) across a study area containing proposed Offset Areas 1 and 4. Only three survey sites were established within the grassland vegetation communities as this habitat was substantiated by observational methods. Constant traversing of the grassland vegetation communities during the 10 day survey provided an adequate picture of fauna use in this vegetation. Different techniques were used at each site to ensure a complete coverage of fauna use was obtained. In addition, habitat values, in terms of tree hollow presence, were determined at a number of sites and this required a specialised technique that is described in the following section.

The size of each survey site was determined by the techniques used. In general, each site had a diameter of at least 500 m to accommodate the trap lines used. Sites where tree hollows were counted could be larger as walking transects covered a bigger area. Transect lengths ranged from 200 m to over 800 m.

The survey effort across the Biodiversity Monitoring Services (2014) study area is outlined in Table 3.

Sites OS1, OS2, OS4 and OS5 were established to capture a range of fauna and utilised techniques targeting small mammals and reptiles. At each of these sites a line of pit traps were dug into the ground, the pits being either 20 litre buckets or 1 m long tubes. Five Elliott traps were placed at each end of the pit trap line, resulting in 10 Elliott traps per site. Two sites (OS3 and OS6) sampled land that was difficult to dig pits (heavy clay) and reptile funnels were used instead. Each site was sampled with a remote camera and a sand plot was established at four of the sites. Surveys for bats were undertaken at five of the sites, either by use of an Anabat recording device or by a harp trap. Call playback was undertaken at three sites. Calls from the Tawny Frogmouth (*Podargus strigoides*), Barking Owl (*Ninox connivens*), Barn Owl (*Tyto alba*), Masked Owl (*Tyto novaehollandiae*), Grass Owl (*Tyto capensis*), Southern Boobook (*Ninox boobook*), White-throated Nightjar (*Eurostopodus mystacalis*), Australian Owlet-Nightjar (*Aegotheles cristatus*) and Bush Stone-curlew (*Burhinus grallarius*) were broadcast.

Sites OS7 onwards focused on observational surveys, where each site was walked and any fauna sighted was noted. The observational sessions took half to one hour and were undertaken by two observers. Tree hollows were also recorded at Sites OS7, 8 and 9.

3.1 REGIONAL LOCATION

The Ginkgo Mineral Sands Mine which is located approximately 85 km north-east of Wentworth and approximately 170 km to the south-east of Broken Hill in western NSW (Figure 1) between the Darling River and the Darling River Anabranch. The proposed offsets are located within the Murrumbidgee property approximately 19 km east of the Ginkgo Mine.

3.2 CLIMATE

The Subject area and proposed offsets are located in a persistently dry (mean average rainfall of approximately 260 millimetres [mm]), arid climatic zone with mostly uniform rainfall distribution throughout the year. Mild winters, hot summers and warm spring and autumn weather are typically experienced.

3.3 HYDROLOGY

There are no watercourses on the Subject area or proposed offset areas. The aeolian soils readily absorb the generally low rainfall such that there is usually little runoff and no stream formation. Large playa depressions that may fill with water in occasional large rainfall events are scattered through the Subject area, proposed offset areas and surrounds. In addition, depressed claypans may occur in the swales between the larger sand dunes, often with numerous sink holes.

Table 3
Survey Effort Undertaken within the Biodiversity Monitoring Services (2014) Study Area

Site	Ground Elliott	Tree Elliott	Tree Cage	Hair Funnels	Remote Camera	Bird Surveys	Call Broadcasting	Pit Trap	Reptile Funnel	Sand Plot	Anabat Recorder	Harp Trap	Tree Hollow Count	Observation Sessions	Spotlighting
OS1	50 trap days	-	-	-	5 trap days	Yes	Yes	25 trap days	-	5 trap days	1 trap days	5 trap days	Yes	Yes	Yes
OS2	50 trap days	-	-	-	5 trap days	Yes	Yes	25 trap days	-	5 trap days	1 trap days	-	Yes	Yes	Yes
OS3	50 trap days	-	-	-	5 trap days	Yes		-	50 trap days	5 trap days	-	5 trap days	Yes	Yes	Yes
OS4	50 trap days	25 trap days	-	25 trap days	5 trap days	Yes	Yes	20 trap days	-	-	1 trap days	-	Yes	Yes	Yes
OS5	50 trap days	25 trap days	-	25 trap days	5 trap days	Yes	-	25 trap days	-	5 trap days	-	-	Yes	Yes	Yes
OS6	50 trap days	-	30 trap days	-	5 trap days	Yes	-	-	50 trap days	-	-	10 trap days	Yes	Yes	Yes
OS7	-	-	-	-	-	Yes	-	-	-	-	-	-	Yes	Yes	-
OS8	-	-	-	-	-	Yes	-	-	-	-	-	-	Yes	Yes	-
OS9	-	-	-	-	-	Yes	-	-	-	-	-	-	Yes	Yes	Yes
OS10	-	-	-	-	-	Yes	-	-	-	-	-	-	-	Yes	Yes
OS11	-	-	-	-	-	Yes	-	-	-	-	-	-	-	Yes	-
OS12	-	-	-	-	-	Yes	-	-	-	-	-	-	-	Yes	Yes
OS13	-	-	-	-	-	Yes	-	-	-	-	-	-	-	Yes	-
OS14	-	-	-	-	-	Yes	-	-	-	-	-	-	-	Yes	Yes
OS15	-	-	-	-	-	Yes	-	-	-	-	-	-	-	Yes	Yes
Total	300 trap days	50 trap days	30 trap days	50 trap days	30 trap days	30 hours	-	85 trap days	100 trap days	20 trap days	3 trap days	20 trap days	-	15 hours	-

3.4 TOPOGRAPHY AND SOILS

The Subject area is on a gently undulating aeolian sandplain. Elevations vary from approximately 46 to 49 m Australian Height Datum (AHD) (Google Earth, 2015). The proposed offset areas' elevations range from 50 to 68 m, with the highest elevations on the east-west dunes that traverse the centre of the area and the lowest on the sand plain areas in the south-west corner and along the eastern margin (Google Earth, 2015).

The soil types within the proposed offset areas vary with landscape position. The solonised brown soils on sand plains often have high contents of limestone nodules, are sandy loams at the surface and clay loams at depth (Cunningham *et al.*, 1981). Playa or 'run-on' depressions tend to have high surface clay contents forming clay pans that hold water for relatively long periods after rain (Cunningham *et al.*, 1981). Dune soils (red earths) vary in composition with dune height; high dunes tend to have poorly consolidated sandy soils, while lower dunes and thinner sand masses tend to have higher clay contents and more soil coherence (Cunningham *et al.*, 1981).

3.5 LAND USE

ML 1504 is part of Mallara station, a NSW Western Lands grazing lease. Western Lands leases are administered by the NSW Department of Lands (NSW Department of Primary Industries [DPI], 2014) as follows:

Nearly all the land in the Western Division is held under Western Lands Leases granted under the Western Lands Act 1901. The primary purpose of the Western Lands Act is to ensure the appropriate management of this fragile environment ... Conditions are attached to each Western Lands Lease to ensure the land is managed sustainably. That means that land must not be over-grazed, and that approvals must be obtained to cultivate land and to subdivide or transfer the lease. The Western Lands Commissioner has the power to impose notices on lessees to destock areas, refrain from certain activities, or rehabilitate damaged or degraded areas.

Prior to the commencement of the Ginkgo Mineral Sand Mine, ML 1504 (and the Subject area) was used for grazing domestic livestock, mainly sheep and cattle, and for harvesting feral goat populations.

3.6 HABITAT

3.6.1 Habitat Types

The main habitat type within the Subject area was woodland dominated by Black Oak (Belah) and Western Rosewood (FloraSearch, 2015). Other habitat types within the Subject area were shrubland and grassland with a very small patch of mallee habitat. The distribution of these habitat types are shown in Figure 3. The surveys within the Subject area by Mount King Ecological Surveys in 2000 (Mount King Ecological Surveys, 2001) divided the areas into Woodland and Shrubland/ Grassland and provided values for the extent of cover of each habitat's components. These are given in Table 4.

Table 4
Percentage Cover within the Two Main Habitat Types in the Subject Area

Habitat	% Trees	% Shrubs	% Grass	% Forb	% Litter	% Logs
Woodland	64	7	16	99	36	12
Shrubland/Grassland	2	56	84	35	2	4

Adapted from Mount King Ecological Surveys (2001).

The dominant habitat within the Subject area was Woodland, comprising Black Oak and Western Rosewood with Pearl Bush understorey. There was only a very small amount of Mallee Woodland, and Grassland habitat covered about 7 percent (%) of the area. The distribution of habitats within the Subject area is shown in Figure 3 and the extent of the habitats is given in Table 5, along with the extent of each habitat within the proposed offset areas.

FloraSearch (2015) points out that three derived vegetation communities identified in the proposed offset areas (Biodiversity Monitoring Services, 2012; 2014) do not occur on the Subject area: Turpentine Tall Open Shrubland, *Acacia victoriae* Shrubland and Hopbush Shrubland.

Table 5
Quantification of Fauna Habitat Types in the Subject Area and
Proposed Biodiversity Offset Areas

Fauna Habitat Types	Vegetation Type (FloraSearch, 2014)	Subject Area (ha)	Proposed Offset Areas (ha)
1. Black Box Woodland Habitat Type	1. Black Box Woodland	0	37
2. Black Oak Woodland Habitat Type	2. Black Oak – Western Rosewood Woodland	200	288
	3. Black Oak – Pearl Bluebush Woodland		
3. Mallee Habitat Type	4. Chenopod Mallee Woodland / Shrubland	3	511
	5. Dune Mallee Shrubland		
	8. Turpentine Tall Open Shrubland		
4. Grassland/Low Shrubland Habitat Type	6. Pearl Bluebush Shrubland	130	419
	7. <i>Austrostipa</i> – <i>Sida</i> Grassland/Low Shrubland		
	9. <i>Eragrostis</i> Depression Grassland		
	10. <i>Acacia victoriae</i> Shrubland		
	11. Hopbush Shrubland		
Total		333	1,255

Three climax vegetation communities found in the Subject area occur in the proposed offset areas with greater areas, as indicated in Table 6: Black Oak – Western Rosewood, Black Box Woodland and Chenopod Mallee Woodland/Shrubland. Both are inadequately conserved communities (Table 4 of FloraSearch, 2014) that are also well-represented in the adjoining Ginkgo Mine Crayfish Deposit Offset area. The combined offset areas make a significant contribution to the conservation of these communities.

Table 5 gives the quantity of fauna habitat types found within the proposed offset areas. The proposed offset areas measure 1,255 ha. Consequently, the proposed offset areas adequately conserve the habitat types that occurred within the Subject area (Figure 3).

3.6.2 Habitat Trees

Previous surveys of the Subject area by Mount King Ecological Surveys (2001) and Ogyris Ecological Research (2005 – 2012) show that a considerable proportion of the trees within the Subject area contain some form of hollow.

The survey by Mount King Ecological Surveys (2001) within the proposed offset areas showed that a proportion of the 500 trees inspected had some form of hollow and could be classed as ‘habitat trees’. Table 6 gives a summary of the data obtained from the tree survey in the context of the current survey sites (OS1-9). Overall the proportion of different tree species sampled was Mallee 42.1%, Black Oak 36.9%, Black Box 20.0% and Mulga 1%.

Table 6
Characteristics of Trees within the Subject Area

Site	Vegetation Community	Mean Tree Height (m)	Mean DBH (cm)	% Trees with Cracks	% Trees with Small Hollows	% Trees with Medium Hollows	% Trees with Large Hollows	% Stags
OS1	Dune Mallee Poor Condition	5.5	17.5	64	42	32	0	4
OS2	Dune Mallee Good Condition	6.2	15.5	30	2	0	0	2
OS3	Black Oak Poor Condition	7.9	30.7	60	28	26	2	4
OS4	Black Oak Poor Condition	7.5	32.6	54	20	0	0	4
OS5	Dune Mallee Good Condition	6.3	21.4	50	30	14	6	2
OS6	Black Box Good Condition	9.0	41.7	64	71	47	16	13
OS7	Black Oak Good Condition	6.9	21.1	46	18	0	0	8
OS8	Black Oak Good Condition	7.3	35.6	72	30	0	0	4
OS9	Dune Mallee Good Condition	6.8	21.5	60	30	18	2	4
MEAN		7.0	26.4	55.6	30.1	15.2	2.9	5

DBH – Diameter at Breast Height

It can be seen that a proportion of the trees contain hollows of some size, with those trees with small hollows making up the majority. More trees showed cracks in the trunks and/or loose and cracking bark. There is some variation between the sites, with OS6 showing the highest proportion of trees with hollows and cracks. It is also the site with the largest trees suggesting a relationship between larger, older trees and the formation of hollows.

The inspection of many tree hollows by the use of an inspection camera did not reveal much use by fauna. In most cases all that was found were insects. The records of fauna use of tree hollows by Ogyris Ecological Research in the pre-clearing surveys would have come from felled trees where inspection can be more thorough. It is likely that some of the hollows found in the Subject area would be utilized by fauna, particularly tree hollow using bat species. Ogyris Ecological Research found between 2.6% and 4% of tree hollows inspected held bat species in their pre-clearing surveys of the Ginkgo Mine area.

It is difficult to compare the results from the pre-clearing surveys by Ogyris Ecological Research as no proportion of trees with hollows was stated. However, the range of DBH values found in the habitat trees by Ogyris Ecological Research is similar to that found in the Subject area (20 to 40 centimetres [cm] DBH). There is data from the Ginkgo Mine area in the fauna survey report by Mount King Ecological Surveys (2001). Some of the data is given in Table 7.

Table 7
Tree Cover Characteristics within Ginkgo Mine Area

Characteristic	Belah (Black Oak)	Mallee
Tree Density (/ha)	3,079	3,069
Tree Height (m)	7.2	5.5
Tree DBH (cm)	28.3	16
% Hollows	41	55
Stag Density (/ha)	100	67



Table 7 shows that the mean tree height and tree DBH within the Subject area is similar to that found within the proposed offset areas, particularly for the Black Oak trees. Most importantly, the percentage of trees containing hollows within the proposed offset areas is also similar to that found in the trees within the Subject area. No measure of the proportion of trees with cracks and decorticated bark is known for the Subject area, but the present survey showed that more than half of the trees inspected in the Subject area contained suitable roosting sites for small bats.

3.7 FAUNA CHARACTERISTICS

3.7.1 Fauna Species

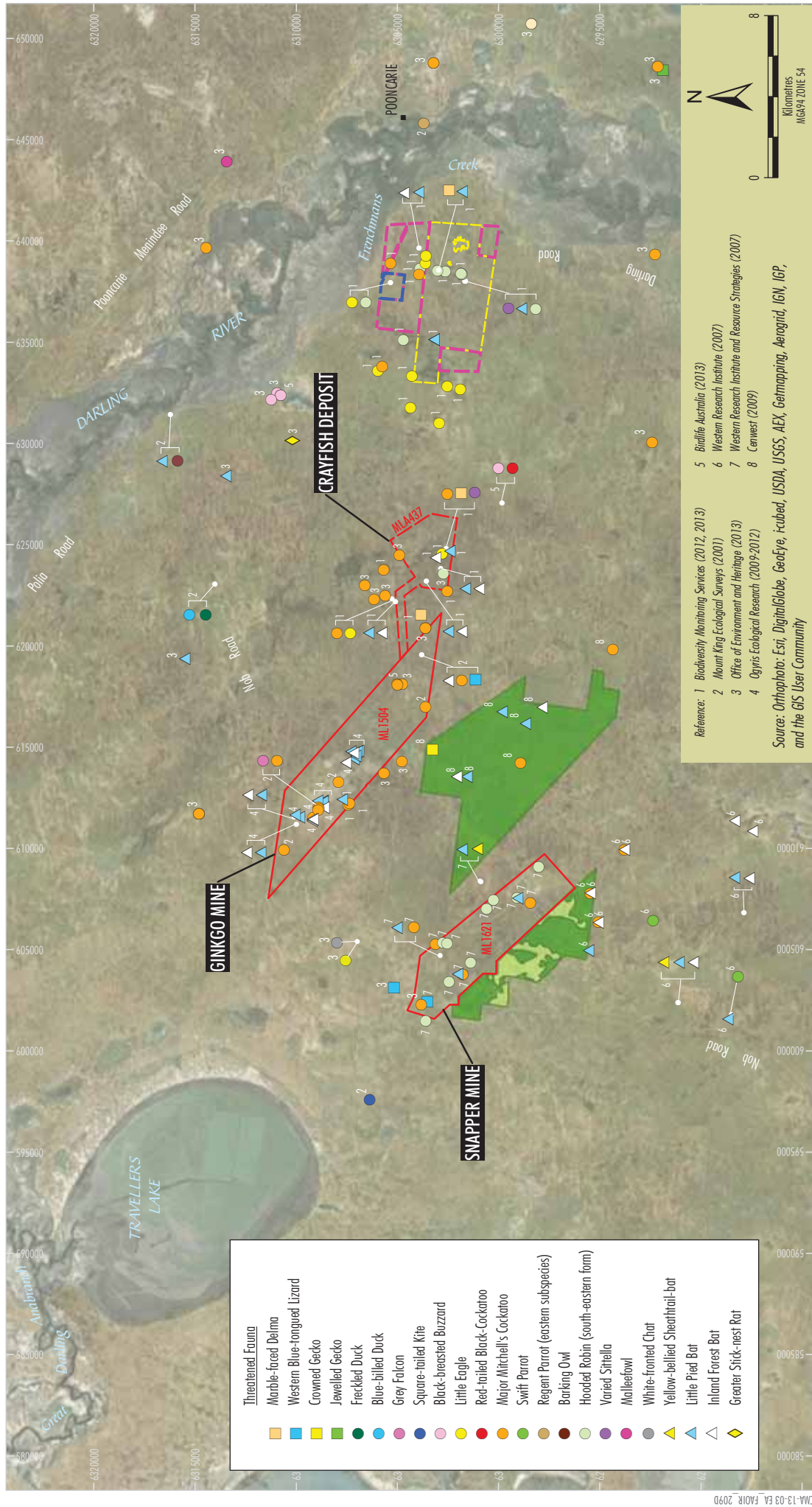
A number of fauna surveys have been undertaken within ML 1504 (and the Subject area) over an 11 year period, including systematic surveys by Mount King Ecological Services (2001) and pre-clearance surveys (Ogyris Ecological Research, 2005-2012). A list of fauna species recorded during these surveys is provided in Attachment A. A total of 70 bird, 16 native mammal (six introduced), 27 reptile and two amphibian species are listed in Attachment A.

Fauna surveys were conducted within the proposed offset areas in 2012 and 2014. Biodiversity Monitoring Services (2012) conducted fauna surveys within a study area containing proposed Offset Areas 2 and 3. During these surveys, 56 birds, 18 mammals (including eight introduced species), four reptiles and three amphibians were recorded (Biodiversity Monitoring Services, 2012). In addition, Biodiversity Monitoring Services (2014) conducted fauna surveys across a study area containing proposed Offset Areas 1 and 4. During these surveys 62 birds, 20 mammals (including eight introduced species) and 20 reptiles were recorded (Biodiversity Monitoring Services, 2014). It is noted that higher numbers of bird and reptile species have been recorded in the Subject area than in the proposed offset areas, however, there was an inconsistency in survey effort between these locations. The surveys conducted within the Subject area have been intensive and over a long period of time (i.e. 11 years). If similar survey efforts were conducted within the proposed offset areas to that which has been conducted within the Subject area, the species' compositions could possibly be more similar between the two locations.

3.7.2 Threatened Fauna Species

Threatened fauna species listed under the *Threatened Species Conservation Act, 1995* (TSC Act) which have been recorded in the wider locality around the Ginkgo Mine are shown on Figure 7. A total of 12 threatened fauna species listed under the TSC Act have been recorded at the Ginkgo Mine (within ML 1504 and MLA 437) (Table 9). Of these, eight have been recorded within or immediately adjoining the Subject Area and are shown on Figure 6¹ and highlighted in Table 8.

¹ The White-fronted Chat record is not shown on Figure 6 because the species was not listed as threatened at the time it was recorded by Mount King Ecological Services (2001).



CRISTAL

G I N K G O M I N E

Threatened Species Recorded in the Ginkgo Mineral Sands Mine Area and Surrounds

Please note that Mount King Ecological Surveys (2001) recorded the Hooded Robin (south-eastern form) and White-fronted Chat, and Ogryns Ecological Research (2009-2012) also recorded the Hooded Robin (south-eastern form) however exact locations were not recorded.

LEGEND

- Existing Ginkgo Mine - Crayfish Deposit Offset Area
- Proposed Additional Biodiversity Offset Area (1-3)
- Proposed Southern Extension Biodiversity Offset Area (4)

Table 8
Threatened Fauna Recorded at the Ginkgo Mine

Scientific Name	Common Name	Conservation Status ¹		Description of the Records within ML 1504 and MLA 437
		TSC Act	EPBC Act	
Reptile				
<i>Delma australis</i>	Marble-faced Delma	E	-	Three Marble-faced Delmas were recorded in MLA 437 by Biodiversity Monitoring Services (2012).
<i>Tiliqua occipitalis</i>	Western Blue-tongued Lizard	V	-	A single Western Blue-tongued Lizard was recorded in ML 1504 by Mount King Ecological Services (2001) during the original surveys for the Ginkgo Mine.
Birds				
<i>Falco hypoleucos</i>	Grey Falcon	E	-	A single Grey Falcon was recorded by Mount King Ecological Services (2001) during the original surveys for the Ginkgo Mine (Figure 7).
<i>Hieraaetus morphnoides</i>	Little Eagle	V	-	A single Little Eagle was recorded in MLA 437 by Biodiversity Monitoring Services (2012).
<i>Cacatua leadbeateri</i>	Major Mitchell's Cockatoo	V	-	Major Mitchell's Cockatoos have been recorded on a number of occasions within ML 1504 and MLA 437 and are relatively abundant in the locality (Biodiversity Monitoring Services, 2012; Ogyris Ecological Research (2014); Mount King Ecological Services, 2001) (Figure 7).
<i>Epthianura albifrons</i>	White-fronted Chat	V		White-fronted Chat were recorded by Mount King Ecological Services (2001) during the original surveys for the Ginkgo Mine, however an exact coordinate was not recorded as the species was not listed as threatened as that time (assumed to be within or immediately adjoining the Subject Area).
<i>Melanodryas cucullata cucullata</i>	Hooded Robin (south-eastern form)	V	-	Hooded Robin (south-eastern form) were recorded by Biodiversity Monitoring Services (2015) (Figure 7) and Ogyris Ecological Research (2005-2012) in ML 1504. This species was also recorded in MLA 437 by Biodiversity Monitoring Services (2012).
<i>Daphoenositta chrysoptera</i>	Varied Sittella	V	-	Varied Sittella were recorded in MLA 437 by Biodiversity Monitoring Services (2012).
Mammals				
<i>Pseudomys bolami</i>	Bolam's Mouse	E	-	The Bolam's Mouse was identified by the University of Ballarat (pers. comm.) during rehabilitation monitoring at the Ginkgo Mine but an exact coordinate was not recorded. Two individuals were also recorded by Biodiversity Monitoring Services (2015).
<i>Verpadelus baverstocki</i>	Inland Forest Bat	V	-	Inland Forest Bats have been recorded on a number of occasions within ML 1504 and MLA 437 and are relatively abundant in the locality (Biodiversity Monitoring Services, 2015; 2012; Ogyris Ecological Research (2014); Mount King Ecological Services, 2001) (Figure 7).
<i>Chalinolobus picatus</i>	Little Pied Bat	V	-	Little Pied Bats have been recorded on a number of occasions within ML 1504 and MLA 437 and are relatively abundant in the locality (Biodiversity Monitoring Services, 2015; 2012; Ogyris Ecological Research (2013-2015); Mount King Ecological Services, 2001) (Figure 7).
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathtail-bat	V	-	The Yellow-bellied Sheathtail-bat was recorded by Biodiversity Monitoring Services (2015) (Figure 6).

¹ Threatened fauna species status under the TSC Act and/or EPBC Act (current at December 2015).

V = Vulnerable; E = Endangered

Highlighted species = Species recorded within or immediately adjoining the Subject Area (Figure 7)

A list of fauna species recorded in ML 1504 and the Subject area is provided in Attachment A.

In regard to Commonwealth listed threatened fauna species, no threatened fauna species listed under the EPBC Act have been previously recorded in the Subject area or immediate surrounds. However, it is considered unlikely that the clearance of the native vegetation in the Subject area had a significant impact on any threatened fauna species.

A total of seven threatened fauna species listed under the TSC Act have been recorded in the proposed offset areas and/or in the existing Ginkgo Mine Crayfish Deposit Offset area (Table 9; Figure 8). Table 9 provides a summary of habitat for threatened fauna species listed under the TSC Act within the Subject area and proposed offset areas.

Table 9
Threatened Fauna Habitat in the Subject Area and Offset Areas

Scientific Name	Common Name	Conservation Status ¹		Habitat within the Subject Area	Habitat within the Offset Areas (Areas 1 to 3)
		TSC Act	EPBC Act		
Reptile					
<i>Delma australis</i>	Marble-faced Delma	E	-	3 ha of Mallee Habitat Type	511 ha of Mallee Habitat Type. This species was recorded in the existing Ginkgo Mine Crayfish Deposit Offset area by Biodiversity Monitoring Services (2014) (Figure 8).
<i>Tiliqua occipitalis</i>	Western Blue-tongued Lizard	V	-	130 ha of Grassland/Low Shrubland Habitat	419 ha of Grassland/Low Shrubland Habitat.
Birds					
<i>Falco hypoleucos</i>	Grey Falcon	E	-	333 ha of habitat	1,255 ha of habitat.
<i>Hieraaetus morphnoides</i>	Little Eagle	V	-	333 ha of habitat	1,255 ha of habitat. This species was recorded in Offset Area 1 by Biodiversity Monitoring Services (2014) (Figure 8).
<i>Cacatua leadbeateri</i>	Major Mitchell's Cockatoo	V	-	333 ha of habitat	1,255 ha of habitat. This species was recorded in Offset Area 1 by Biodiversity Monitoring Services (2014) (Figure 8).
<i>Epthianura albifrons</i>	White-fronted Chat	V	-	130 ha of Grassland/Low Shrubland Habitat	419 ha of Grassland/Low Shrubland Habitat.
<i>Melanodryas cucullata cucullata</i>	Hooded Robin (south-eastern form)	V	-	203 ha of woodland and mallee habitat	836 ha of woodland and mallee habitat. This species was recorded in Offset Area 1 by Biodiversity Monitoring Services (2014) (Figure 8).
<i>Daphoenositta chrysoptera</i>	Varied Sittella	V	-	203 ha of woodland and mallee habitat	836 ha of woodland and mallee habitat. This species was recorded in the existing Ginkgo Mine Crayfish Deposit Offset area by Biodiversity Monitoring Services (2014) (Figure 8).

Table 9 (Continued)
Threatened Fauna Habitat in the Subject Area and Offset Areas

Scientific Name	Common Name	Conservation Status ¹		Habitat within the Subject Area	Habitat within the Offset Areas (Areas 1 to 3)
		TSC Act	EPBC Act		
Mammals					
<i>Pseudomys bolami</i>	Bolam's Mouse	E	-	330 ha of Grassland/Low Shrubland Habitat and Black Oak woodland	707 ha of Grassland/Low Shrubland Habitat and Black Oak woodland
<i>Verpadelus baverstocki</i>	Inland Forest Bat	V	-	203 ha of woodland and mallee habitat	836 ha of woodland and mallee habitat. This species was recorded in Offset Area 1 by Biodiversity Monitoring Services (2014) (Figure 8).
<i>Chalinolobus picatus</i>	Little Pied Bat	V	-	203 ha of woodland and mallee habitat	836 ha of woodland and mallee habitat. This species was recorded in Offset Area 1 and the existing offset area by Biodiversity Monitoring Services (2014) (Figure 8).
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	V	-	203 ha of woodland and mallee habitat	836 ha of woodland and mallee habitat.

¹ Threatened fauna species status under the TSC Act and/or EPBC Act (current at December 2015).

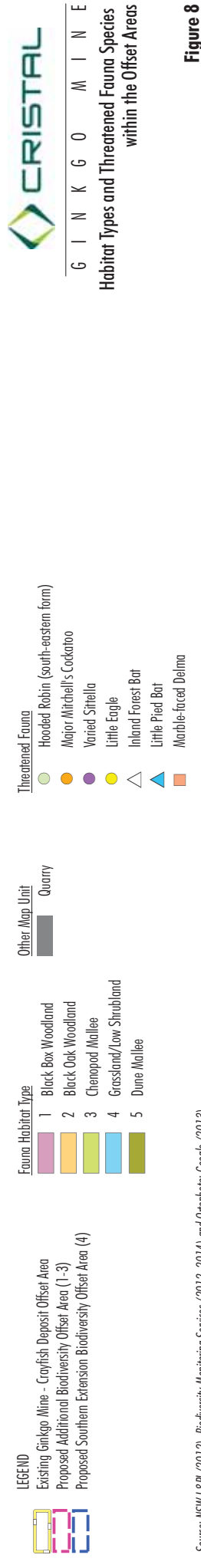
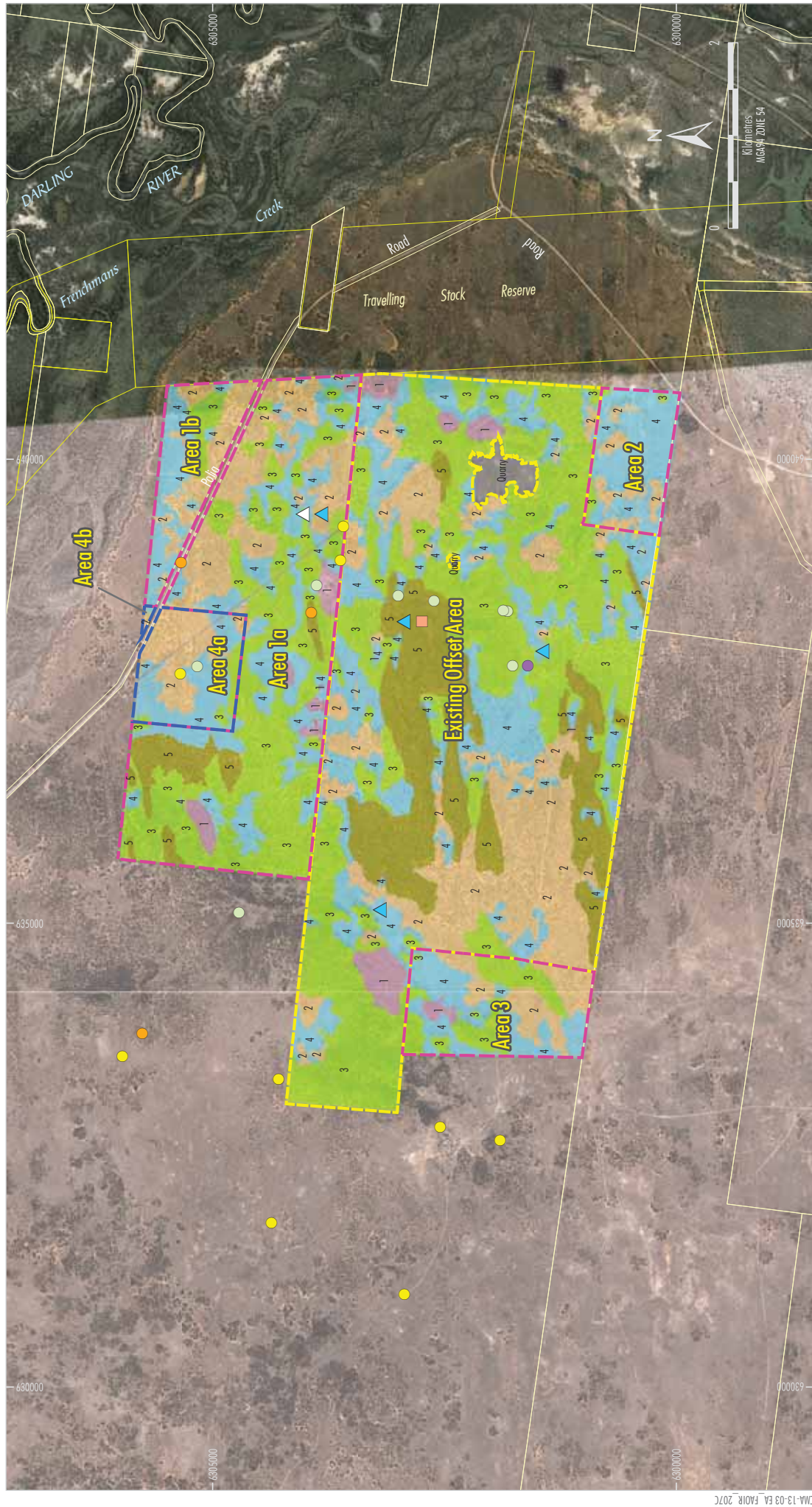
V = Vulnerable; E = Endangered

Highlighted species = Species recorded within or immediately adjoining the Subject Area (Figure 6)

In summary, all threatened fauna species recorded within or immediately adjoining the Subject Area have known or potential habitat in the offset areas, specifically:

- Of the eight threatened fauna species recorded within or immediately adjoining the Subject Area:
 - four are known to occur within the proposed offset areas (Major Mitchell's Cockatoo [*Cacatua leadbeateri*], Hooded Robin [south-eastern form] [*Melanodryas cucullata cucullata*], Little Pied Bat [*Chalinolobus picatus*] and Inland Forest Bat [*Verpadelus baverstocki*]); and
 - four have the potential to occur in the offset areas based on suitable habitat (Grey Falcon [*Falco hypoleucos*], White-fronted Chat [*Epthianura albifrons*], Bolam's Mouse [*Pseudomys bolami*] and Yellow-bellied Sheathtail-bat [*Saccolaimus flaviventris*]).
- Three additional threatened fauna species not recorded within or immediately adjoining the Subject Area are known to occur within the proposed offset areas (Little Eagle [*Hieraaetus morphyoides*], Varied Sittella [*Daphoenositta chrysoptera*] and Marble-faced Delma [*Delma australis*]).
- One other threatened fauna species not recorded within or immediately adjoining the Subject Area has the potential to occur in the offset areas based on suitable habitat (the Western Blue-tongued Lizard [*Tiliqua occipitalis*]).

All of the threatened fauna species that could potentially occur within the Subject Area, could also potentially occur within the proposed offset areas.



Source: NSW L&P (2012), Biodiversity Monitoring Services (2012, 2014) and Onophoro: Google (2013)

Figure 8

3.8 RECONCILIATION OF THE PROPOSED OFFSET STRATEGY AGAINST OEH OFFSET PRINCIPLES

The OEH has developed principles for the use of offsets for Projects other than those that are State significant (OEH, 2014). The proposed biodiversity offset strategy for the Modification provides for residual significant impacts to biodiversity resulting from approximately 333 ha which was disturbed outside of the currently approved surface development area, and the proposed extension (approximately 32 ha) to the currently approved surface development area. The offset strategy incorporates four potential offset areas (Offset Areas 1 to 4). A reconciliation of the Proposed Biodiversity Offset Strategy (Offset Areas 1 to 4) against the *Principles for the Use of Biodiversity Offsets in NSW* (OEH, 2014) is provided in Table 10.

Table 10
Reconciliation of the Proposed Biodiversity Offset Strategy against OEH Offset Principles

OEH Offset Principles (OEH, 2014)	How the Proposed Offset Addresses the OEH Offset Principles
1. <i>Impacts must be avoided first by using prevention and mitigation measures.</i>	The offset strategy addresses residual impacts associated with the Modification.
2. <i>All regulatory requirements must be met.</i>	Cristal Mining is required to meet all statutory requirements and the offset strategy is not proposed to substitute other licence/approval requirements.
3. <i>Offsets must never reward ongoing poor performance.</i>	The offset strategy addresses residual impacts associated with the Modification.
4. <i>Offsets would complement other government programs.</i>	The proposed offset areas (1-4) would complement other lands already conserved by the State government (resulting in a greater area of vegetation conserved in NSW).
5. <i>Offsets must be underpinned by sound ecological principles.</i>	The proposed offset areas (1-4) expand the existing Ginkgo Mine Crayfish Deposit Offset area (Figure 5), thereby resulting in a larger conservation area. The structure, function and compositional elements of biodiversity (including threatened species) have been considered in the selection of the proposed offset areas (Section 3). The proposed offset areas contain a similar suite of fauna species and fauna habitats to those in the Subject and Modification areas. Biodiversity is likely to be enhanced at a range of scales due to the proposed management measures, particularly the exclusion of livestock grazing and closure of artificial watering points such that they can no longer hold water. The proposed enhancement of the habitat would contribute towards protecting the long-term viability and functionality of local biodiversity.
6. <i>Offsets should aim to result in a net improvement in biodiversity over time.</i>	The offset strategy targets threatened fauna species and high conservation priorities in the Subject and Modification areas. A net improvement in biodiversity is likely because: - The proposed offset areas (1-4) adjoin and enhance the existing Ginkgo Mine Crayfish Deposit Offset area, improving its long term viability. - Management of the offset would include a series of measures likely to improve fauna habitat and reduce pressure on native fauna species, including removal of stock, ecological fire management and feral animal control. - The proposed offset area contains a similar suite of habitats to those in the Subject and Modification areas. In relation to Offset Area 4: - The Subject Area, Modification Area and proposed offset area (Offset Area 4) contain comparable densities of old growth vegetation rich in tree hollows and with a large amount of fallen timber on the ground, which may be utilised by threatened fauna species.
7. <i>Offsets must be enduring. They must offset the impact of the development for the period that the impact occurs.</i>	The purpose of the Western Land Lease associated with the proposed offset areas (1-4) would be changed to reflect its conservation purpose at the same time as the existing Ginkgo Mine Crayfish Deposit Offset area (i.e. by 30 June 2016), or within a timeframe to the satisfaction of the NSW Secretary of DP&E.

Table 10 (Continued)
Reconciliation of the Proposed Biodiversity Offset Strategy against OEH Offset Principles

OEH Offset Principles (OEH, 2014)	How the Proposed Offset Addresses the OEH Offset Principles
8. <i>Offsets should be agreed prior to the impact occurring.</i>	The offset strategy addresses residual impacts associated with the Modification.
9. <i>Offsets must be quantifiable. The impacts and benefits must be reliably estimated.</i>	The impacts and benefits have been reliably assessed as follows: • The area of impact and proposed offset is quantified in Table 5 and shown on Figures 3 and 8. • The fauna species known or with potential to occur, and their conservation status are described, mapped and quantified, where relevant; • The potential gain in connectivity of woodland habitat from the proposed offset areas (1-4). • The management actions and security for the proposed offset area are discussed.
10. <i>Offsets must be targeted.</i>	The offset strategy addresses residual impacts associated with the Modification. The proposed offset areas contain a similar suite of fauna species and fauna habitats to those in the Subject and Modification areas. The proposed offset areas were selected in consideration of a range of factors, including: 1. Relationship to existing offset areas. 2. Proximity to the Subject and Modification areas. 3. Regional conservation priorities and vegetation most in need of conservation. 4. The vegetation composition of the Subject and Modification areas relative to the proposed offset areas; meeting the 'like-for-like' criterion. 5. The ecosystem resilience and condition of the proposed offset areas. 6. The presence of similar threatened species records and/or potential habitat to those within the Subject and Modification areas.
11. <i>Offsets must be located appropriately.</i>	The proposed offset area is located in the same region as the Ginkgo Mine in a similar topographic, climatic and geographic environment.
12. <i>Offsets must be supplementary.</i>	The implementation of the offset strategy is beyond existing requirements, in that it is not part of any conservation reserve system.
13. <i>Offsets and their actions must be enforceable through Development Consent conditions, licence conditions, conservation agreements or a contract.</i>	The offset requirement is likely to be a condition of Project approval.



4 CONCLUSION

Cristal Mining proposes to extend the existing Ginkgo Mine Crayfish Deposit Offset area, to include an additional 1,255 ha of native vegetation to account for existing surface development that has not been accounted for in previous Ginkgo Mine biodiversity offset area calculations (i.e. the Subject area). The following conclusions are made in relation to the suitability of the proposed offset areas (Offset Areas 1 to 3) to offset the Subject area:

- The proposed offset areas (Offset Areas 1 to 3) are extensions to the existing Ginkgo Mine offset areas (which was most recently augmented as a component of the Planning Assessment Commission's Modification 9 approval in March 2015).
- All of the broad fauna habitat types in the Subject area are represented in the proposed offset areas in greater quantities.
- Habitat characteristics, such as densities of tree hollows and log cover, are similar between the Subject area and the proposed offset areas.
- All threatened fauna species recorded within or immediately adjoining the Subject Area have known or potential habitat in the offset areas.
- All of the threatened fauna species that could have potentially occurred within the Subject Area, could also potentially occur within the proposed offset areas.
- The biodiversity values within the proposed offset areas are likely to improve in the medium to long-term as a result of proposed management actions (e.g. exclusion of grazing and management of feral goats).

The Modification would also include an additional offset (Offset Area 4) for extensions to the existing/approved surface development area for additional development areas for the mine path, overburden emplacement, topsoil stockpile areas and other supporting infrastructure.

In conclusion, the four offset areas proposed as part of the Modification (Offset Areas 1 to 4) are considered to meet the OEH (2014) *Principles for the Use of Biodiversity Offsets in NSW* and it is likely that fauna biodiversity values would be maintained or improved in the medium to long-term.

5 REFERENCES

- Biodiversity Monitoring Services (2012) *Ginkgo Mineral Sands Mine – Crayfish Modification Fauna Assessment*. Report prepared for Bemax Resources Limited.
- Biodiversity Monitoring Services (2014) *Mallara Fauna Survey*. Report prepared for Cristal Mining Pty Ltd.
- Biodiversity Monitoring Services (2015) *Ginkgo Mineral Sands Mine Southern Extension Modification - Fauna Assessment*.
- Cristal Mining Australia Limited (2013) *Ginkgo Mineral Sands Mine November 2012 Modification Modified Request*.
- Cunningham, G.L., Mulham, W.E., Milthorpe, P.L. and Leigh, J.H. (1981) *Plants of Western New South Wales*. NSW Government Printer. Sydney.
- Department of Primary Industries (2014) *Western Lands Leases*.
Website: http://www.lpma.nsw.gov.au/crown_land/western_region/western_land_leases.
- Department of the Environment (2015). *Protected Matters Search Tool search conducted for the following search area: -33.27, 142.35; -33.45, 142.35; -33.45, 142.13; -33.27, 142.13*.
Website: <http://www.environment.gov.au/epbc/pmst/index.html>
Accessed: 25 November 2015.
- FloraSearch (2014) *Ginkgo Mineral Sands Mine Biodiversity Offset 2013 Modification Flora Assessment*.
- FloraSearch (2015) *Ginkgo Mineral Sands Mine Southern Extension Flora Assessment*.
- Google Earth (2015) Elevation model. Google Earth Pro. Google Inc.
- Mount King Ecological Surveys (2001) *Ginkgo Mineral Sands Project Fauna Assessment Appendix H of the Ginkgo Mineral Sands Project Environmental Impact Statement*.
- Office of Environment and Heritage (2014) *OEH Principles For The Use Of Biodiversity Offsets In NSW*.
Website: <http://www.environment.nsw.gov.au/biodivoffsets/oehoffsetprincip.htm>.
- Office of Environment and Heritage (2015) *NSW BioNet – A Website for the NSW Atlas of Wildlife* search conducted for the following search area: -33.27, 142.35; -33.45, 142.35; -33.45, 142.13; -33.27, 142.13.
Website: <http://www.bionet.nsw.gov.au/>
Accessed: 25 November, 2015.
- Ogyris Ecological Research (2005). *Vegetation Pre-clearance flora and fauna surveys of land at Bemax Resources NL Murray-Darling Basin sand mine sites. 1) Ginkgo Sand Mine, Autumn-Winter 2005*. Report to Bemax Resources Ltd.
- Ogyris Ecological Research (2006a). *Vegetation Pre-clearance flora and fauna surveys of land at Bemax Resources NL Murray-Darling Basin sand mine sites. 2) Ginkgo Sand Mine - February 2006*. Report to Bemax Resources Ltd.

- Ogyris Ecological Research (2006b). *Vegetation Pre-clearance flora and fauna surveys of land at Bemax Resources NL Murray-Darling Basin sand mine sites. 3) Ginkgo Sand Mine - September 2006*. Report to Bemax Resources Ltd.
- Ogyris Ecological Research (2007a). *Vegetation Pre-clearance flora and fauna surveys of land at Bemax Resources Ltd Murray-Darling Basin sand mine sites. 4) Ginkgo Sand Mine, February 2007*. Report to Bemax Resources Ltd.
- Ogyris Ecological Research (2007b). *Vegetation Pre-clearance flora and fauna surveys of land at Bemax Resources Ltd Murray-Darling Basin sand mine sites. 5) Ginkgo Sand Mine Stage 2 Extension, May 2007*. Report to Bemax Resources Ltd.
- Ogyris Ecological Research (2009a). *Vegetation Pre-clearance flora and fauna surveys of land at Bemax Resources Ltd Murray-Darling Basin sand mine sites. 6) Ginkgo Sand Mine Stage 3 Extension and northern boundary fenceline. February 2009*. Report to Bemax Resources NL.
- Ogyris Ecological Research (2009b). *Vegetation Pre-clearance flora and fauna surveys of land at Bemax Resources Ltd Murray-Darling Basin sand mine sites. 8) Ginkgo Sand Mine Stage 4 Northern Extension and expansion of overburden stockpile OB2. May 2009*. Report to Bemax Resources NL.
- Ogyris Ecological Research (2010). *Vegetation Pre-clearance flora and fauna surveys of land at Bemax Resources Ltd Murray-Darling Basin sand mine sites. 9) Ginkgo Sand Mine Stage 4 Northern Extension. Winter 2009*. Report to Bemax Resources NL.
- Ogyris Ecological Research (2011). *Vegetation Pre-clearance flora and fauna surveys of land at Bemax Resources NL Murray-Darling Basin sand mine sites. 13) Ginkgo Mine. August 2011*. Report to Bemax Resources NL.
- Ogyris Ecological Research (2012a). *Vegetation Pre-clearance flora and fauna surveys of land at Bemax Resources NL Murray-Darling Basin sand mine sites. 14) Ginkgo Mine. January 2012*. Report to Bemax Resources NL.
- Ogyris Ecological Research (2012b). *Vegetation Pre-clearance fauna report of land at Cristal Mining Australia Ltd Murray-Darling Basin sand mine sites. Ginkgo Mine - Winter 2012*. Report to Cristal Mining Pty Ltd.
- Ogyris Ecological Research (2012c). *Vegetation Pre-clearance vegetation and soils report of land at Cristal Mining Australia Ltd Murray-Darling Basin mineral sand mine sites. Ginkgo Mine - Winter 2012*. Report to Cristal Mining Pty Ltd.
- Ogyris Ecological Research (2013). *Vegetation Pre-clearance Fauna Report of Land at Cristal Mining Australia Ltd Murray-Darling Basin mineral sand mine sites. Ginkgo Mine. February 2013*. Report to Cristal Mining Pty Ltd.
- Ogyris Ecological Research (2014a). *Vegetation Pre-clearance Vegetation and Soils Report of Land at Cristal Mining Australia Ltd Murray-Darling Basin mineral sand mine sites. Ginkgo Mine – Winter 2014*. Report to Cristal Mining Pty Ltd.
- Ogyris Ecological Research (2014b). *Vegetation Pre-clearance Fauna Report of Land at Cristal Mining Australia Ltd Murray-Darling Basin mineral sand mine sites. Ginkgo Mine – Autumn – Winter 2014*. Report to Cristal Mining Pty Ltd.

- Ogyris Ecological Research (2015a). *Vegetation Pre-clearance Vegetation and Soils Report of Land at Cristal Mining Australia Ltd Murray-Darling Basin mineral sand mine sites. Ginkgo Mine – Autumn 2015*. Report to Cristal Mining Pty Ltd.
- Ogyris Ecological Research (2015b). *Vegetation Pre-clearance Fauna Report of Land at Cristal Mining Australia Ltd Murray-Darling Basin mineral sand mine sites. Ginkgo Mine. July 2015*. Report to Cristal Mining Pty Ltd.
- Val, J., Oliver, D., Pennay, M., McLaughlin, J., Ewin, P. and Foster, E. (2012) The reptile, bird and small mammal fauna of Dune Mallee Woodlands in south-western New South Wales *Aust. Zool.* 36: 29 -48.
- Western Research Institute and Resource Strategies (2007) *Snapper Mineral Sands Project Environmental Assessment Appendix D Fauna Assessment*.

ATTACHMENT A

FAUNA SPECIES LIST FOR ML 1504
AND THE SUBJECT AREA

Scientific Name	Common Name	Conservation Status ¹		EIS ²	Ogyris ³	OEH ⁴
		TSC Act	EPBC Act			
Birds						
Dromaiidae						
<i>Dromaius novaehollandiae</i>	Emu	P		x	x	x
Anatidae						
<i>Chenonetta jubata</i>	Australian Wood Duck	P		x		
Ardeidae						
<i>Egretta pacifica</i>	White-necked Heron	P		x		
Rallidae						
<i>Gallirallus philippensis</i>	Buff-banded Rail	P			x	
Accipitridae						
<i>Elanus axillaris</i>	Black-shouldered Kite	P		x		
<i>Elanus scriptus</i>	Letter-winged Kite	V		x		
Falconidae						
<i>Falco cenchroides</i>	Nankeen Kestrel	P		x		
<i>Falco longipennis</i>	Australian Hobby	P			x	
<i>Falco peregrines</i>	Peregrine Falcon	P		x		
<i>Falco hypoleucos</i>	Grey Falcon	V		x		
<i>Falco subniger</i>	Black Falcon	P			x	
Turnicidae						
<i>Turnix velox</i>	Little Button-quail	P		x		
Columbidae						
<i>Ocyphaps lophotes</i>	Crested Pigeon	P				x
<i>Phaps chalcoptera</i>	Common Bronzewing	P		x	x	
Cacatuidae						
<i>Lophochroa leadbeateri</i>	Major Mitchell's Cockatoo	V		x	x	
<i>Nymphicus hollandicus</i>	Cockatiel	P		x		
<i>Eolophus roseicapillus</i>	Galah	P		x	x	x
Psittacidae						
<i>Barnardius zonarius</i>	Australian Ringneck	P		x	x	
<i>Melopsittacus undulates</i>	Budgerigar	P		x		
<i>Neophema chrysostoma</i>	Blue-winged Parrot	P		x		
<i>Northiella haematogaster</i>	Bluebonnet	P			x	x
<i>Psephotus varius</i>	Mulga Parrot	P		x	x	
<i>Psephotus haematonotus</i>	Red-rumped Parrot	P			x	
Strigidae						
<i>Ninox novaeseelandiae</i>	Southern Boobook	P		x		
Podargidae						
<i>Podargus strigoides</i>	Tawny Frogmouth	P			x	
Caprimulgidae						
<i>Eurostopodus argus</i>	Spotted Nightjar	P			x	
Aegothelidae						
<i>Aegotheles cristatus</i>	Australian Owlet-nightjar	P		x	x	x
Halcyonidae						
<i>Todiramphus pyrrhophus</i>	Red-backed Kingfisher	P			x	
Climacteridae						
<i>Climacteris affinis</i>	White-browed Treecreeper	P			x	
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)	P		x	x	



Scientific Name	Common Name	Conservation Status ¹		EIS ²	Ogyris ³	OEH ⁴
		TSC Act	EPBC Act			
Pardalotidae						
<i>Pardalotus punctatus</i>	Spotted Pardalote	P		x		
<i>Pardalotus striatus</i>	Striated Pardalote	P		x		
Acanthizidae						
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill	P		x		x
<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill	P		x	x	
<i>Acanthiza apicalis</i>	Inland Thornbill	P		x		
<i>Aphelocephala leucopsis</i>	Southern Whiteface	P		x	x	x
<i>Aphelocephala nigricincta</i>	Banded Whiteface	P		x		
<i>Smicronis brevirostris</i>	Weebill	P			x	
Meliphagidae						
<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater	P			x	
<i>Epthianura tricolor</i>	Crimson Chat	P		x		
<i>Epthianura albifrons</i>	White-fronted Chat	V		x		
<i>Lichenostomus ornatus</i>	Yellow-plumed Honeyeater	P		x		
<i>Lichenostomus plumulus</i>	Grey-fronted Honeyeater	P		x		
<i>Lichenostomus virescens</i>	Singing Honeyeater	P			x	x
<i>Manorina flavigula</i>	Yellow-throated Miner	P			x	
Petroicidae						
<i>Melanodryas cucullata</i>	Hooded Robin (south-eastern form)	V			x	
<i>Microeca fascinans</i>	Jacky Winter	P		x		
<i>Petroica goodenovii</i>	Red-capped Robin	P		x		
Pomatostomidae						
<i>Pomatostomus ruficeps</i>	Chestnut-crowned Babbler	P			x	
<i>Pomatostomus superciliosus</i>	White-browed Babbler	P		x	x	
<i>Pomatostomus temporalis rebeculus</i>	Grey-crowned Babbler (western sub-species)	P		x		
Pachycephalidae						
<i>Oreoica gutturalis</i>	Crested Bellbird	P		x	x	
<i>Colluricincla harmonica</i>	Grey Shrike-thrush	P		x		
Dicruridae						
<i>Grallina cyanoleuca</i>	Magpie-lark	P		x	x	
<i>Myiagra inquieta</i>	Restless Flycatcher	P		x		
<i>Rhipidura albiscapa</i>	Grey Fantail	P		x		
<i>Rhipidura leucophrys</i>	Willie Wagtail	P		x	x	
Artamidae						
<i>Artamus cyanopterus</i>	Dusky Woodswallow	P		x		
<i>Artamus superciliosus</i>	White-browed Woodswallow	P		x		
<i>Cracticus nigrogularis</i>	Pied Butcherbird	P				x
<i>Cracticus torquatus</i>	Grey Butcherbird	P		x	x	
<i>Gymnorhina tibicen</i>	Australian Magpie	P		x	x	x
Campephagidae						
<i>Coracina maxima</i>	Ground Cuckoo-shrike	P			x	



Scientific Name	Common Name	Conservation Status ¹		EIS ²	Ogyris ³	OEH ⁴
		TSC Act	EPBC Act			
Corvidae						
<i>Corvus coronoides</i>	Australian Raven	P		x	x	x
<i>Corvus bennetti</i>	Little Crow	P		x	x	
<i>Corvus mellori</i>	Little Raven	P		x	x	
Corcoracidae						
<i>Struthidea cinerea</i>	Apostlebird	P		x		
Sylviidae						
<i>Cincloramphus cruralis</i>	Brown Songlark	P		x		
Alaudidae						
<i>Mirafra javanica</i>	Horsfield's Bushlark	P		x		
Motacillidae						
<i>Anthus australis</i>	Australasian Pipit	P		x		
Reptiles						
Cheluidae						
<i>Chelodina longicollis</i>	Eastern Snake-necked Turtle	P		x		
Agamidae						
<i>Pogona vitticeps</i>	Central Bearded Dragon	P		x	x	
<i>Ctenophorus fordi</i>	Mallee Dragon	P		x		
<i>Tympanocryptis lineate</i>	Lined Earless Dragon	P		x		x
Gekkonidae						
<i>Diplodactylus vittatus</i>	Eastern Stone Gecko	P		x	x	
<i>Gehyra variegata</i>	Tree Dtella	P		x	x	
<i>Lucasium damaeum</i>	Beaded Gecko	P		x		
<i>Heteronotia binoei</i>	Bynoe's Gecko	P			x	x
<i>Diplodactylus stenodactylus</i>	Crowned Gecko	P		x		
<i>Diplodactylus vittatus</i>	Wood Gecko	P				x
<i>Diplodactylus furcosus</i>	Ranges Stone Gecko	P			x	
<i>Rhynchoedura ornata</i>	Beaked Gecko	P		x		x
<i>Underwoodisaurus milii</i>	Thick-tailed Gecko	P				x
Pygopodidae						
<i>Pygopus schraderi</i>	Eastern Hooded Scaly-foot	P		x		
Varanidae						
<i>Varanus gouldii</i>	Gould's Goanna	P		x	x	
Scincidae						
<i>Ctenotus atlas</i>	Southern Mallee Ctenotus	P		x		
<i>Ctenotus leonhardii</i>	Leonhardi's Ctenotus	P		x		
<i>Ctenotus regius</i>	Pale-rumped Ctenotus	P				x
<i>Ctenotus schomburgkii</i>	Barred Wedgesnout Ctenotus	P		x	x	x
<i>Lerista punctatovittata</i>	Eastern Robust Slider	P		x	x	
<i>Morethia adelaidensis</i>	Saltbush Morethia Skink	P		x		
<i>Eremiascincus fasciolatus</i>	Narrow-banded Sand-swimmer	P		x	x	
<i>Tiliqua occipitalis</i>	Western Blue-tongue	V		x		
<i>Morethia boulengeri</i>	South-eastern Morethia Skink	P		x	x	



Scientific Name	Common Name	Conservation Status ¹		EIS ²	Ogyris ³	OEH ⁴
		TSC Act	EPBC Act			
<i>Tiliqua nigrolutea</i>	Blotched Blue-tongued Lizard	P		x		
<i>Tiliqua rugosa</i>	Shingle-back	P			x	x
Elapidae						
<i>Pseudechis australis</i>	Mulga Snake	P			x	
Mammals						
Tachyglossidae						
<i>Tachyglossus aculeatus</i>	Short-beaked Echidna	P		x	x	
Dasyuridae						
<i>Sminthopsis crassicaudata</i>	Fat-tailed Dunnart	P			x	
<i>Sminthopsis murina</i>	Common Dunnart	P		x	x	
Phalangeridae						
<i>Trichosurus vulpecular</i>	Common Brushtail Possum	P			x	
Macropodidae						
<i>Macropus rufus</i>	Red Kangaroo	P		x	x	
<i>Macropus fuliginosus</i>	Western Grey Kangaroo	P		x	x	
Muridae						
<i>Mus musculus</i>	House Mouse	U		x		
<i>Pseudomys bolami</i>	Bolam's Mouse	V				
Molossidae						
<i>Mormopterus planiceps</i>	Southern Freetail Bat	P			x	
Vespertilionidae						
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	P		x	x	
<i>Chalinolobus morio</i>	Chocolate Wattled Bat	P		x		
<i>Chalinolobus picatus</i>	Little Pied Bat	V			x	
<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat	P			x	
<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat	P			x	
<i>Tadarida australis</i>	White-striped Mastiff Bat	P			x	
<i>Vespadelus baverstocki</i>	Inland Forest Bat	V		x	x	
<i>Vespadelus vulturnus</i>	Little Forest Bat	P		x		
Canidae						
<i>Canis lupus</i>	Dingo, domestic dog	U		x		
<i>Vulpes vulpes</i>	Red Fox	U		x	x	
Felidae						
<i>Felis catus</i>	Cat	U		x	x	
Bovidae						
<i>Capra hircus</i>	Goat	U		x	x	
Leporidae						
<i>Oryctolagus cuniculus</i>	Rabbit	U			x	
Amphibians						
Myobatrachidae						
<i>Limnodynastes tasmaniensis</i>	Spotted Marsh Frog	P		x		
<i>Neobatrachus centralis</i>	Trilling Frog	P		x		

¹ Threatened fauna species status under the TSC Act and/or EPBC Act (current at December 2015).

V = Vulnerable; E = Endangered; P=Protected, U=Unprotected

² Mount King Ecological Surveys (2001) *Ginkgo Mineral Sands Project Fauna Assessment*. Appendix H of The Ginkgo Mineral Sands Project Environmental Impact Statement.

³ Indicates data extracted from the pre-clearing surveys undertaken by Ogyris Ecological Research (2005-2012).

⁴ Indicates records from the Wildlife database for the Cuthero 1:100,000 map sheet within two kilometres of the Subject area.