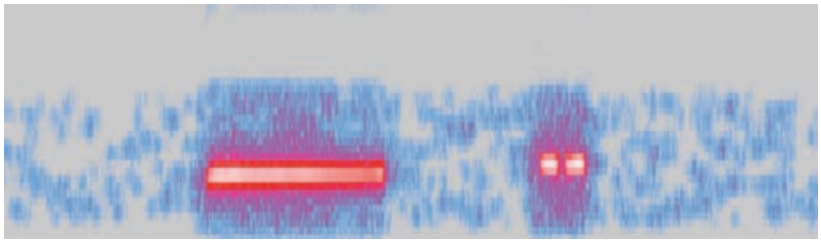
Biota Environmental Sciences

Mt Keith Satellite Proposal Night Parrot Survey



Prepared for BHPB Nickel West

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Biota Environmental Sciences

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Mt Keith Satellite Night Parrot Survey

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1.0 Executive Summary

BHP Billiton Nickel West (BHPB) proposes to develop the Mt Keith Satellite Proposal approximately 80 km north of Leinster in the Shire of Leonora. The Proposal has a Development Envelope of 1,259 ha and involves the development of two mine pits (Six Mile Well and Goliath), a waste rock landform, associated support infrastructure and a 20 km transport corridor north to the existing Mt Keith Mine.

Biota Environmental Sciences (Biota) was commissioned to conduct a habitat description and targeted survey for the Night Parrot (*Pezoporus occidentalis*) and to use this information to assess the Proposal's potential risk to the Night Parrot. The Night Parrot (*Pezoporus occidentalis*) is listed as Schedule 1 under the *Wildlife Conservation Act 1950* and Endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act 1999).

The study focused effort within the most prospective Night Parrot habitat available within a 5,310 ha Study Area boundary, representing a buffer on the Development Envelope. This Study Area has previously been the subject of detailed vegetation mapping and vertebrate fauna habitat mapping facilitating site selection. A Wider Area around the Study Area for which broader-scale vegetation mapping is available was also surveyed for Night Parrot where the most prospective habitat was found.

Using the vegetation mapping of the Study Area and Wider Area, potential roosting/nesting and foraging habitat was delineated and mapped. The potential roosting/nesting habitat polygon comprised spinifex-dominated vegetation units and the foraging polygon included various shrubs, grasses and chenopods. A total of 351.1 ha of potential roosting/nesting spinifex habitat was mapped inside the Study Area of which 36.7 ha occurs within the Development Envelope (0.07% of the spinifex habitat mapped in the Wider Area). The spinifex within the Development Envelope was ground-truthed by an ornithologist and while areas of unburnt ring-forming spinifex were found they were assessed as likely unsuitable for Night Parrot roosting/nesting because the hummocks were structurally too small for nesting (30 – 50 cm), occurred in small patches and often with a shrubland or woodland overstorey which was thought to reduce suitability for the Night Parrot. A total of 365.9 ha foraging habitat was mapped inside the Development Envelope representing 0.5% of the foraging habitat mapped in the Wider Area.

A field survey targeting the Night Parrot was conducted, consisting of 56 nights of automatic sound recording across nine sites (six within the Study Area and three in the Wider Area) in potential roosting/nesting habitat together with 9.7 hours of targeted listening surveys. No evidence of the Night Parrot was recorded. The field survey was conducted under ideal conditions, with confidence that the best potential habitat for roosting/nesting was surveyed and using appropriate methods recommended by the Department of Parks and Wildlife.

Risk to both roosting/nesting habitat and foraging habitat was assessed as low due to the small area of habitat to be impacted by the Proposal and its marginal suitability for Night Parrot. Assessing the Proposal against the EPBC Act Significant Impact Guidelines, it was concluded that none of the significant impact criteria would be triggered, and the adverse effects on potential core (roosting/nesting) habitat are localised and minor in scale. As a result, the impacts to the Night Parrot arising from the action of implementing the Mt Keith Satellite Proposal do not appear to be significant.

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2.0 Introduction

2.1 The Proposal

BHP Billiton Nickel West (BHPB) proposes to develop the Mt Keith Satellite Proposal (the Proposal), approximately 80 km north of Leinster in the Shire of Leonora (Figure 2.1). The Proposal has a Development Envelope of 1,259 ha and involves the development of two mine pits (Six Mile Well and Goliath), a waste rock landform, associated support infrastructure and a 20 km transport corridor north to the existing Mt Keith Mine.

2.2 Study Aims

BHPB commissioned Biota Environmental Sciences (Biota) to conduct a risk assessment in relation to the Night Parrot (*Pezoporus occidentalis*). The assessment, as detailed in this report, consisted of:

1. an appraisal of potential habitat availability and quality based on vegetation mapping and ground truthing; and
2. a targeted field survey for the Night Parrot.

The Night Parrot represents one of Australia's rarest and least-known birds, and consequently any risk assessment is currently limited by a lack of information on the species' biology. Here, however, we apply the precautionary principle in making an assessment of potential risk to the species based on likelihood of occurrence and the extent of impact to potential habitat. The field survey component of this study was conducted with reference to, and to meet the standards of, the recently published "Interim guideline for preliminary surveys of night parrot (*Pezoporus occidentalis*) in Western Australia" (Department of Parks and Wildlife, May 2017). The risk assessment was conducted giving due consideration to the EPA's Statement of Environmental Principles, Factors and Objectives (2016).

2.3 Scale of Study

This study considered potential impact to the Night Parrot within the context of three spatial scales:

- Development Envelope: the maximum area within which the Proposal footprint will be located (1,259 ha) (Figure 2.1);
- Study Area: a 5,310 ha area buffering the Development Envelope, the subject of detailed vegetation mapping (Western Botanical 2017) and vertebrate fauna survey (Biota 2017) (Figure 2.1); and
- Wider Area: a 142,197 ha (1,422 km^2) area surrounding the Study Area for which broad-scale vegetation mapping was available as a composite derived from a number of studies.

The study focused effort within the Development Envelope and Study Area and detailed mapping of potential habitat for the species was defined at this scale. The Wider Area was not surveyed intensively but some areas of prospective habitat were found and surveyed.

2.4 The Night Parrot

The Night Parrot (*Pezoporus occidentalis*) is listed as Schedule 1 under the *Wildlife Conservation Act 1950* (WC Act) and Endangered under the *EPBC Act 1999* (EPBC Act) (DEC 2012, Department of the Environment 2014).

The Night Parrot is a small ground-dwelling Parrot endemic to Australia and occurring in arid to semi-arid regions where it requires dense, low vegetation, under or in which they hide during the day. Historical records indicate that the Night Parrot was once widespread and relatively common in the arid zone until late in the 19th Century (Murphy et al. 2017) but then a hiatus in records of almost 100 years followed despite considerable search effort. Then in 1990 and 2006 two specimens were collected in south-west Queensland with the first photographic evidence presented in 2013 (Dooley 2013). In March this year (2017) there was a confirmed record from the Murchison (Jones 2017). A published article also details a number of sightings in the Lorna Glen and Millrose Station area, which straddles the Murchison/Gascoyne bioregions (Hamilton et al. 2017).

The current descriptions of the species' habitat preferences are broad, reflecting the wide variety of habitats the species was historically known from. The Department of Parks and Wildlife (2017) guideline details old-growth spinifex (*Triodia* spp.) as habitat for roosting and nesting as has been recorded in western Queensland (Murphy et al. 2017). Foraging habitats are broadly described as grasses and herbs that may or may not contain shrubs or low trees. Johnstone and Storr (1998) mention sparsely-wooded *Triodia* spp. near water as the habitat preferred by this species, while Pizzey and Knight (2007) list the following additional habitats: seeding spinifex on stony rises, breakaway country, sandy lowlands, shrubby glasswort, chenopods, succulents on flats around salt lakes, flooded claypans, saltbush, bluebush and bassia associations.

There is little information available on the Night Parrot, making it difficult to quantify the direct cause of decline in this species. The following potential threats have been suggested: predation by feral cats and foxes, degradation of habitat due to fire, grazing or rabbits, reduction in the availability of water due to consumption by feral camels and reduced maintenance of waterholes (Department of the Environment 2016). It is assumed that, like other arid zone birds, the Night Parrot is sedentary during good conditions, but becomes nomadic when necessary (Department of the Environment 2016). The extent and seasonality of its movements are unknown.

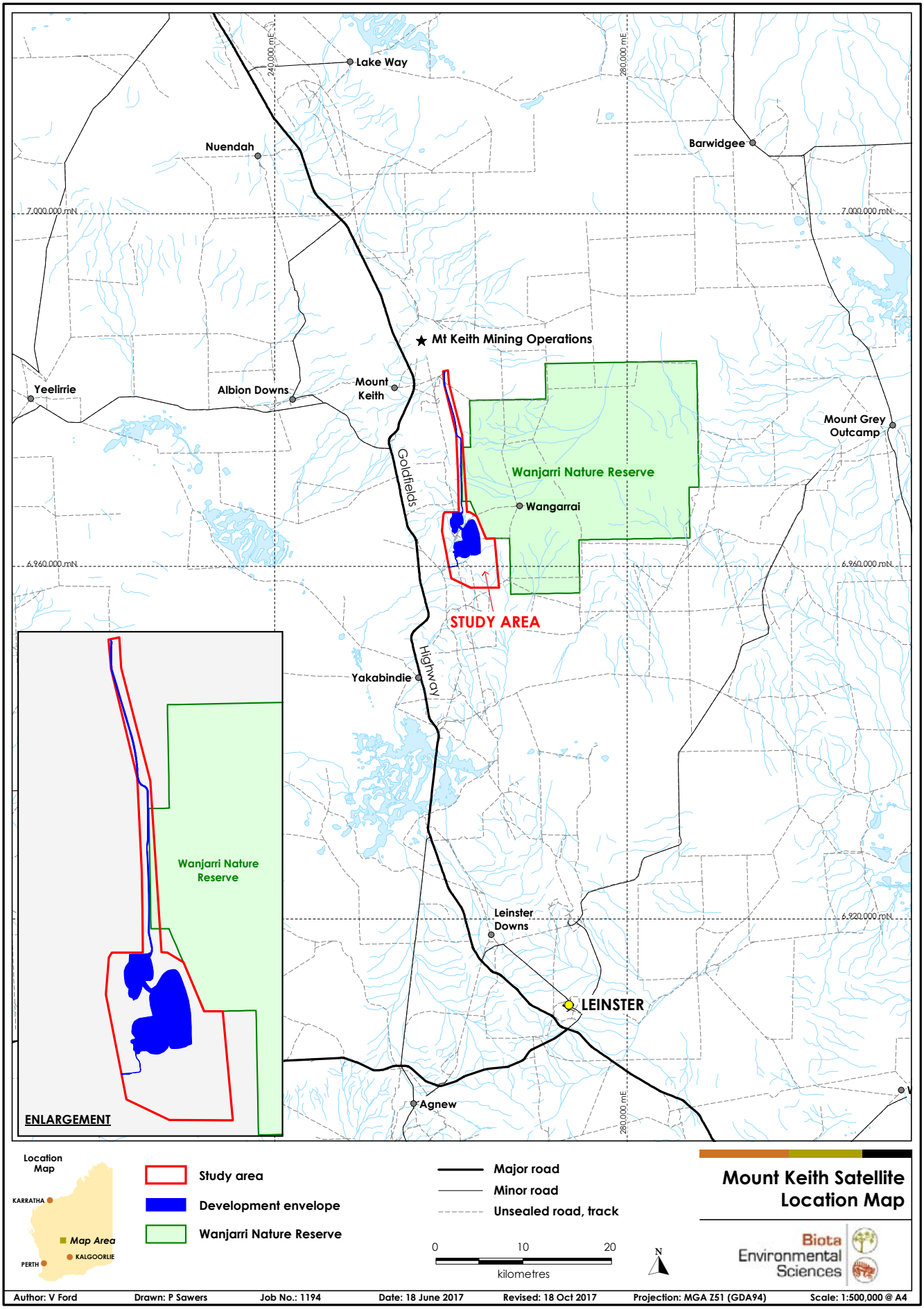

Figure 2.1: Location of the Mt Keith Satellite Proposal

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3.0 Methods

3.1 Guidance

The assessment of potential habitat and the field survey for the Night Parrot were conducted following the Interim guideline for preliminary surveys of night parrot (*Pezoporus occidentalis*) in Western Australia (Department of Parks and Wildlife 2017). The recommendations of the guideline are summarised in Table 3.1 together with how each recommendation was applied in this study.

Table 3.1: Recommended survey techniques as detailed in Department of Parks and Wildlife (2017) and their application in this study.

Guideline recommendation	Guideline notes	Survey application
Survey Timing.	Optimum timing for surveys would be in the few months following significant rainfall events, when breeding is more likely to be occurring and therefore detectability of the species is expected to be higher.	Survey was conducted followed significantly higher than average rainfall (Figure 3.2) and at a time of widespread spinifex seeding.
Passive acoustic surveys recommended as most effective survey method.	The number of sound recording units required will depend on the area to be surveyed. Programming units to record throughout the night is required to provide the most effective survey effort.	Nine devices were deployed in the best potential roosting/nesting habitat and were set to record from half an hour before sunset to half an hour after sunrise.
Limit call playback.	It is best to listen first – if calls are heard, then call broadcast may not be necessary. If spontaneous calls are not heard within a 30 minute listening session, call broadcast could then be used for a fixed amount of time.	If no calls were heard within an hour, a single call was played once every half hour.
Camera traps not effective in surveying roosting or feeding areas.	Could be used as a supplementary technique at potential drinking sites, especially during times of high temperatures and high water stress, such as droughts.	Not used this survey as water sites were plentiful and conditions were ideal for breeding, therefore effort was focused in roosting/nesting habitat.
Transect foot surveys that seek to flush out birds are not recommended.	Very low chance of success, and may disturb nesting or roosting birds, degrade their habitat and potentially make them more prone to predation if they are unable to rapidly find new cover.	Listening was conducted from a stationary position. No foot transects undertaken.
Habitat assessment critically important.	Where habitat is suitable, even if the species was not confirmed as being present, it might be present at another time of year or in another year. In such cases, impact assessments should indicate the likelihood of occurrence based on the quality of the habitat at the site, focus on the risk of a project to the species on the assumption that it is present, and assess any threatening processes that may occur as a result (e.g. reduction of the extent or quality of habitat, increase in numbers of feral predators, increase (or decrease) in grazing pressure, or changed fire regime).	Habitat has been assessed using the precautionary principle, with all spinifex included in the habitat mapping as potential roosting/nesting. Ground-truthing was conducted to further assess the quality of this habitat.

3.2 Personnel and Permits

This study was conducted with a Department of Parks and Wildlife Licence to take fauna for scientific purposes, Licence number 08-000754-1 (Appendix 1).

The qualifications and roles of those conducting this study are provided in Table 3.2.

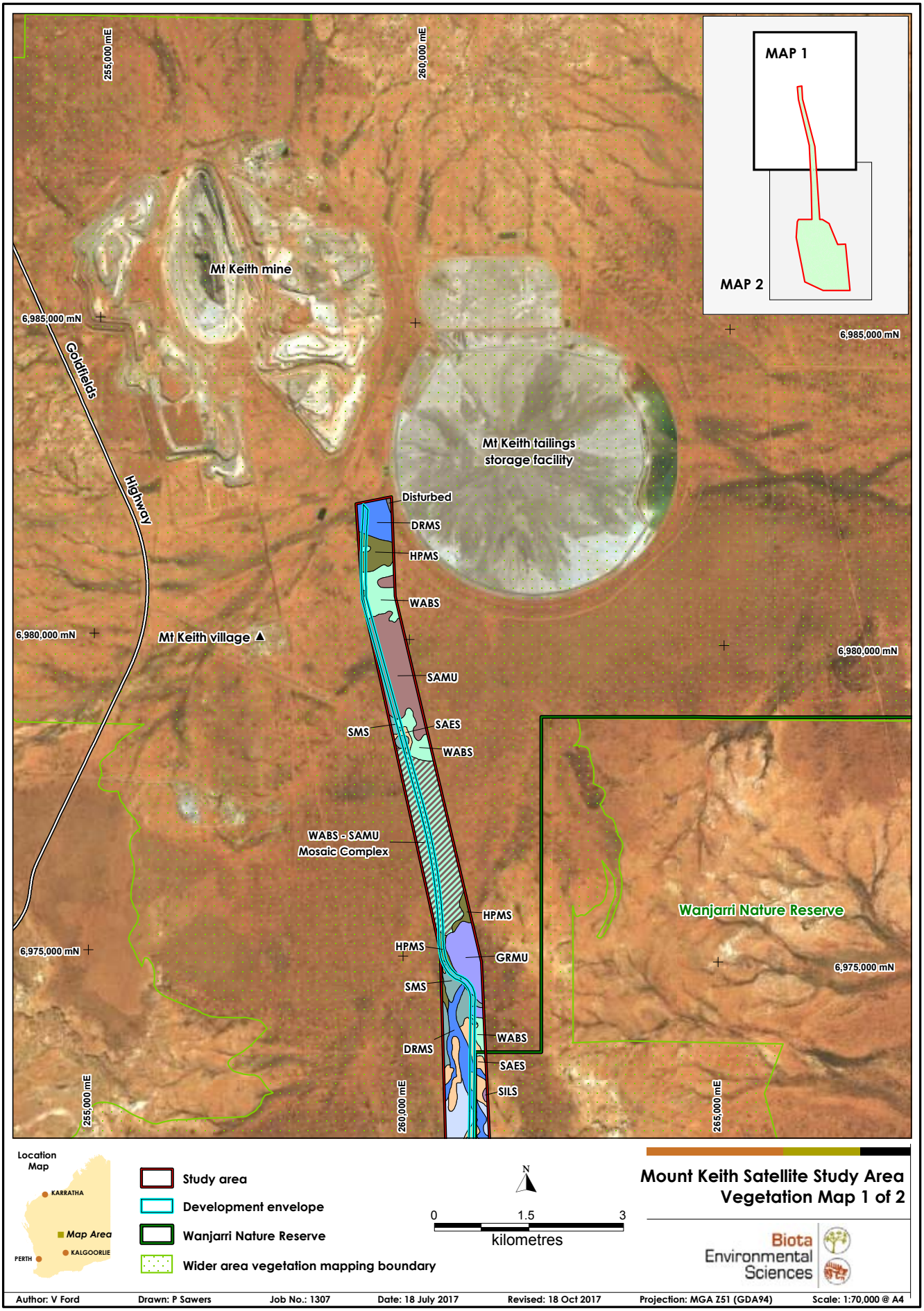
Table 3.2: Personnel conducting the study.

	Biota Title	Qualification	Study Role
Daniel Kamien	Senior Zoologist	BSc. Hons.	Deployment of ASRs, habitat assessment.
Stewart Ford	Senior Zoologist	BSc. Hons., PhD (Zoology).	Specialist Ornithologist. Deployment of ASRs, listening surveys, habitat assessment. Report review.
Jacinta King	Zoologist	B.Env.Sc.	Deployment of ASRs, listening surveys, habitat assessment and reporting
Victoria Ford	Zoologist	B.Sc. Hons., PhD (Zoology).	Reporting
Roy Teale	Zoologist/Director	B.Sc. Hons.	Report review
Garth Humphreys	Ecologist/Director	B.Sc. Hons.	Report review
Paul Sawers	GIS Manager	Dip. Cartography	All mapping and related GIS calculations

3.3 Habitat Assessment

The Department of Parks and Wildlife (2017) broadly defines the habitat requirements of the Night Parrot as including areas of old-growth spinifex (*Triodia* spp.) for roosting and nesting, and forbs, grasses (including spinifex at times of mass flowering and seeding), *Sclerolaena* spp. and other chenopods for foraging.

The vegetation of the Study Area has been mapped in detail by Western Botanical (2017) as shown in Figure 3.1. In addition, a Wider Area surrounding the Study Area has been mapped as part of the Mt Keith Satellite work together with other studies and these data were provided to Biota as a composite vegetation layer. The area encompassed by this composite vegetation mapping layer is termed "Wider Area" throughout this report. Both vegetation within the Study Area and the Wider Area was examined with reference to the Department of Parks and Wildlife (2017) guideline and vegetation units containing habitat elements were combined to form two habitat layers; one for roosting/nesting and one for foraging.


MAP 1
MAP 2
255,000 mE
260,000 mE
265,000 mE
6,985,000 mN
6,980,000 mN
6,975,000 mN
Mt Keith mine
Mt Keith tailings storage facility
Goldfields Highway
Mt Keith village
Disturbed
DRMS
HPMS
WABS
SAMU
SMS
SAES
WABS - SAMU Mosaic Complex
GRMU
SILS
Wanjarri Nature Reserve
Location Map
KARRATHA
Map Area
KALGOORLIE
PERTH
Study area
Development envelope
Wanjarri Nature Reserve
Wider area vegetation mapping boundary
N
0
1.5
3
kilometres
Mount Keith Satellite Study Area
Vegetation Map 1 of 2
Biota Environmental Sciences
Author: V Ford
Drawn: P Sawers
Job No.: 1307
Date: 18 July 2017
Revised: 18 Oct 2017
Projection: MGA Z51 (GDA94)
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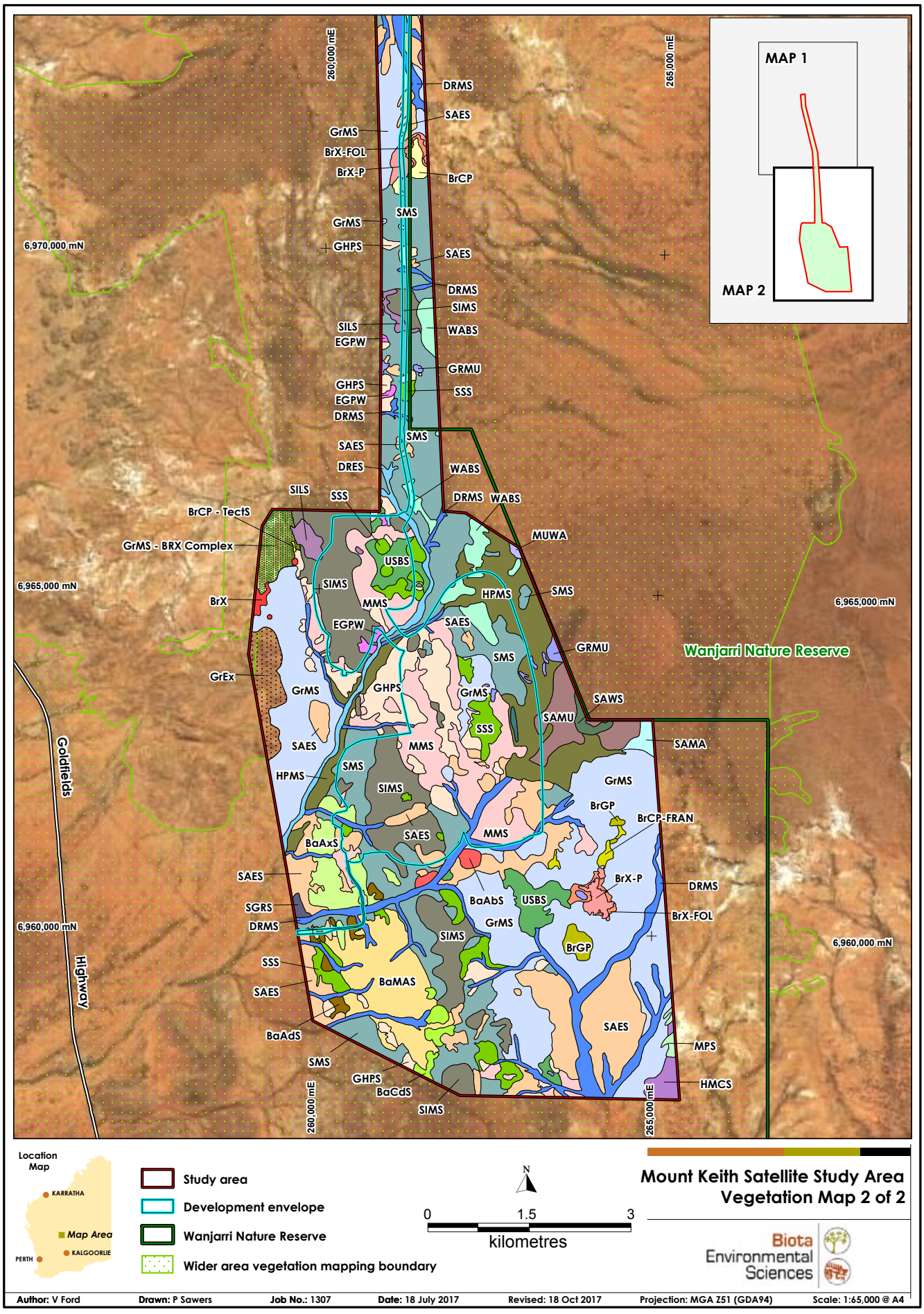

Figure 3.1: Vegetation of the Mt Keith Satellite Study Area from Western Botanical (2017).

Vegetation of Mount Keith Satellite Study Area

BaAbS	Basalt, *Acacia burkittii* Shrubland (component of the BaMAS complex)
BaAdS	Basalt, *Acacia* aff. *doreta* Shrubland (component of the BaMAS complex)
BaAxS	Basalt, *Acacia* aff. *xanthocarpa* Shrubland (component of the BaMAS complex)
BaCdS	Basalt, *Calytrix desolata* low Shrubland
BaMAS	Basalt, mixed *Acacia* species Shrubland Complex
BrCP	Breakaway Chenopod Plain Complex
BrCP - TectS	Breakaway Chenopod Plain Complex - *Tecticornia* Shrubland (component of the BrCP Complex)
BrCP-FRAN	Breakaway Chenopod Plain Complex - *Frankenia* shrubland (component of the BrCP Complex)
BrGP	Breakaway Grassy Plain
BrX	Archaean Granite Breakaway
BrX-FOL	Archaean Granite Breakaway Footslope
BrX-P	Archaean granite geology
DRES	Drainage Line Eucalypt Woodland
DRMS	Drainage Line Mulga Shrubland
EGPW	Weathered Basalt, *Eucalyptus gypsophila - Eremophila pantonii* Woodland
GHPS	Weathered Basalt, *Hakea leucoptera* subsp. *sericipes - Eremophila pantonii* Shrubland
GrEx	Granite, Exfoliating granite outcrops
GrMS	Granitic Mulga Shrubland
GrMS - BRX Complex	Granite Mulga Shrubland - Granite Breakaway Plateaux Complex
GRMU	Groved Mulga Woodland
HMCS	Mulga Shrubland with scattered low Chenopod Shrubs
HPMS	Hardpan Mulga Shrubland
HPMS THOMA	Hardpan Mulga (*Acacia thoma*) Shrubland
MMS	Mulga over *Maireana triptera* Shrubland
MPS	*Maireana pyramidata* Shrubland
MUWA	Mulga - Wanderrie Grassland
SAES	Stony *Acacia - Eremophila* Shrubland
SAMA	Sandplain, Mallee, *Acacia* species Spinifex Shrubland
SAMU	Sandplain Mulga Spinifex Shrubland
SAWS	Sandplain, *Acacia* species Spinifex Shrubland
SGRS	Sandy Granitic Mulga Shrublands
SILS	Stony Ironstone Low Shrubland
SIMS	Stony Ironstone Mulga Shrubland
SMS	Stony Mulga Shrubland
SSS	Stony *Senna* Shrubland
USBS	Upland Small Bluebush Shrubland
WABS	Wanderrie Bank Grassy Shrublands
WABS-SAMU Mosaic Complex	Wanderrie Bank Grassy Shrublands/ Sandplain Mulga Spinifex Shrubland
Ponded Water	
Disturbed	

Vegetation Type Descriptions for the Mount Keith Satellite Vegetation Maps

Legend Sheet 1

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3.4 Field survey

3.4.1 Survey Timing and Conditions

Automatic Sound Recorders (ASRs) were deployed in the field on 14 June 2017 and were left recording to 20/21 June 2017. Active listening surveys were conducted over the nights and early mornings of 19 – 21 June 2017. Weather data from Mt Keith spanning the days the ASRs were deployed in the field and listening surveys conducted is summarised in Table 3.3. Weather conditions for recordings and listening survey were excellent with very little wind and no rainfall.

Table 3.3: Daily weather observation from Mt Keith (BoM station 512019) for the duration of the survey.

Date	Minimum temperature (°C)	Maximum temperature (°C)	Rainfall (mm)	3pm wind speed (km/h)
14/06/17	12.8	25.1	0	15
15/06/17	13.4	22.5	0	15
16/06/17	8.5	21.1	0.2	15
17/06/17	7	18.8	0	15
18/06/17	5.1	20.6	0	11
19/06/17	3.5	22.1	0	9
20/06/17	3.6	22.3	0	9
21/06/17	10.1	24.4	0	19

The local area received much higher rainfall than average in the months leading up to the survey, particularly January 2017 with 84.5 mm and March 2017 with 155.1 mm (Figure 3.2). As a result conditions were very favourable for Night Parrot activity at the time of the survey, most notably the seeding of *Triodia*.

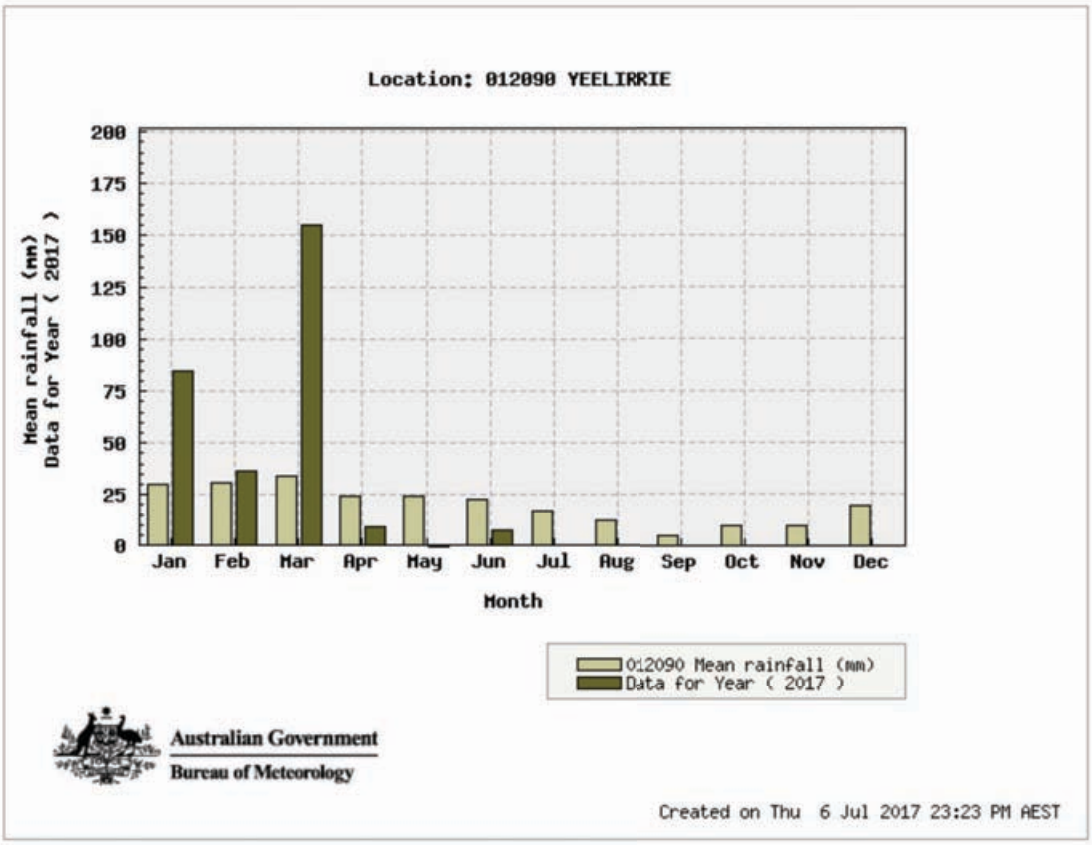

Figure 3.2: Monthly average rainfall and year to date for Yeelirrie (BoM station 012090). Graph plotted in www.bom.gov.au.

3.4.2 Automatic Sound Recorders

SM2Bat SongMeters (Wildlife Acoustic Inc.), fitted with SMX-II acoustic microphones, were utillised as ASRs for this study and units set to begin recording 30 minutes before sunset until 30 min after sunrise. The SongMeters were set to record in the frequency band 3 Hz – 16 kHz to prevent extraneous recording of invertebrates and other sources of high frequency sound beyond the typical range of bird calls, including the reference calls of the Night Parrot.

Potential roosting/nesting habitat was mapped prior to the field survey, based on vegetation units, and this habitat was then reconnoitred in the field, with areas containing the largest spinifex selected as recording sites. The units were placed within areas of potential roosting/nesting habitat as the birds are known to call in this habitat, while their behaviour in foraging habitat is less well known (Murphy et al. 2017).

Nine ASRs were deployed: six were placed in the Study Area and three in the adjacent Wanjarri Nature Reserve in the Wider Area (Table 3.4 and Plate 3.1 - Plate 3.9). Within the Study Area, 351.1 ha of potential roosting/nesting habitat has been mapped, so six ASRs in this habitat represents a sampling density of one recording unit per 58.5 ha. Seven of the ASRs recorded for six nights and two recorded for seven nights (Table 3.4).

Audio files were analysed by Jacinta King using a combination of visual scanning of spectrograms in Kaleidoscope (version 4.3.2) and manual listening. Spectrograms of reference calls of the Night Parrot from both western Queensland and Western Australia were imported into the software for comparison. Calls are available at https://nightparrot.com.au/index.php/resources/night-parrot-calls/

Most bird species recorded were easily identifiable from their call spectrogram. For any call that could not initially be identified by Jacinta King, further analysis was conducted by specialist ornithologist Stewart Ford.

Table 3.4: Description of sites where automatic sound recorders were placed. Vegetation description and veg codes from Western Botanical (2017) and shown in Figure 3.1

Location	Site ID	Latitude	Longitude	Veg Description	Veg code	Start Date	End Date	Nights
Study Area	MKSNP314-01	-27.27961717	120.5708284	Sandplain Mulga Spinifex Shrubland	SAMU	14/06	20/06	6
Study Area	MKSNP654-11	-27.28478079	120.5704977	Sandplain Mulga Spinifex Shrubland	SAMU	14/06	20/06	6
Study Area	MKSNP685-08	-27.31004872	120.5808262	Wanderrie Bank Grassy Shrublands / Sandplain Mulga Spinifex Shrubland	WABS - SAMU Mosaic Complex	14/06	21/06	7
Study Area	MKSNP724-10	-27.28965429	120.5722535	Sandplain Mulga Spinifex Shrubland	SAMU	14/06	20/06	6
Study Area	MKSNP747-02	-27.43465162	120.6056707	Sandplain Mulga Spinifex Shrubland	SAMU	14/06	20/06	6
Study Area	MKSNP844-09	-27.30539626	120.5778302	Wanderrie Bank Grassy Shrublands / Sandplain Mulga Spinifex Shrubland	WABS - SAMU Mosaic Complex	14/06	21/06	7
Wanjarri NR	MKSNP781-06	-27.40903113	120.6073774	Sandplain Mulga Spinifex Shrubland	SAMU	14/06	20/06	6
Wanjarri NR	MKSNP827-04	-27.43427369	120.6343366	Sandplain Mulga Spinifex Shrubland	SAMU	14/06	20/06	6
Wanjarri NR	MKSNP897-05	-27.42200088	120.6398613	Sandplain Mulga Spinifex Shrubland	SAMU	14/06	20/06	6

Plate 3.1: MKSNP314-01.

Plate 3.2: MKSNP654-11.

Plate 3.3: MKSNP685-08.

Plate 3.4: MKSNP724-10.

Plate 3.5: MKSNP747-02.

Plate 3.6: MKSNP844-09.

Plate 3.7: MKSNP781-06.

Plate 3.8: MKSNP827-04.

Plate 3.9: MKSNP897-05.

3.4.3 Ground-truthing Habitat

Prospective roosting/nesting habitat was identified using GIS information before mobilisation to site, and was visited immediately prior to the listening surveys to ascertain areas with highest likelihood of Night Parrot occurrence. Specifically, the field team searched for areas that:

- were open, with few trees;
- consisted of expansive areas of long-unburnt spinifex;
- were in close proximity to feeding locations such as chenopods;
- had minimal grazing evident; and,
- were not dissected by tracks that would facilitate predator access.

No habitat meeting all these criteria were observed; most of the areas of spinifex were also vegetated by taller shrubs and trees at a higher density than ideal. Nevertheless the most prospective locations available were selected for the listening surveys.

3.4.4 Listening Surveys

A total of 170 min (2.8 hr) of listening was conducted within the Study Area over three sites, and a further 410 min (6.8 hr) of listening was conducted at five sites in the Wider Area (Table 3.5; Figure 4.1).

Listening was conducted from a stationary position by specialist ornithologist Stewart Ford and zoologist Jacinta King who were both familiar with the calls of the Night Parrot (Queensland and Western Australian populations). Surveys were conducted between the hours of 17:15 – 22:25 in the evening and 04:46 – 06:50 in the morning. Site MKS-NIPA-08 was surveyed twice as it represented the most prospective habitat identified in the Study Area.

If no Night Parrot calls were heard within the first hour of listening then call playback was used. A single "two-note whistle" call was played once every half hour after the first hour of listening.

A list of bird species heard at each site was maintained.

Table 3.5: Description of sites where listening surveys were conducted. "VegCode" as in Figure 3.1

Location	Site ID	Latitude	Longitude	Ambient conditions	VegCode	Habitat Description	Date	Start	Finish	Total Time
Study Area	MKS-NIPA-01	-27.43515362	120.6088902	Excellent listening conditions	SAMU	Low ring spinifex in woodland	19/06	17:30	18:30	60 min
Study Area	MKS-NIPA-04	-27.35824042	120.5862528	Excellent listening conditions	BrX-FOL	Breakaway foraging area	19/06	22:05	22:25	20 min
Study Area	MKS-NIPA-07	-27.28159362	120.572096	20 °C, excellent listening conditions	SAMU	Good low-medium ring type spinifex in open mulga woodland	20/06	17:15	18:45	90 min
										170 min
Wider Area	MKS-NIPA-02	-27.42857536	120.6383673	Excellent listening conditions	SAMU	Good ring forming low spinifex below woodland	19/06	19:00	20:00	60 min
Wider Area	MKS-NIPA-03	-27.41117531	120.6444402	Excellent listening conditions	SAMU	Good low to medium height ring type spinifex in a more open area; probably the most prospective location so far but still fairly treed relative to known habitat.	19/06	20:21	21:21	60 min
Wider Area	MKS-NIPA-06	-27.28393802	120.5833688	Very light breeze. 3 °C	WABS	Good low-medium ring type spinifex in open mulga woodland	20/06	04:46	5:56	60 min
Wider Area	MKS-NIPA-05	-27.28795212	120.5897118	3 °C, very light breeze	SAMU	Good low-medium ring type spinifex in open mulga woodland	20/06	05:49	6:09	20 min
Wider Area	MKS-NIPA-08	-27.35834738	120.5582662	Excellent listening conditions	SAMU	Extensive open spinifex plain. Low to medium size spinifex hummocks in rings.	20/06	19:47	21:17	90 min
				8 °C, excellent listening conditions	SAMU		21/06	4:50	6:50	120 min
										410 min

3.5 Limitations

While analysing the sound files from the ASRs, it was noted that if numerous birds were calling at once it was theoretically possible that the call of a Night Parrot may not be discernable. However, this issue is likely restricted to the time of the dawn chorus and given that the Night Parrot is unlikely to call only during the dawn chorus and not other times of the evening/night this issue is unlikely to prevent detection of the species.

4.0 Results

4.1 Habitat Assessment

Two habitat types were defined and mapped; one for potential roosting/nesting habitat and one for potential foraging habitat. The vegetation units selected to represent each of these habitat types are detailed in Table 4.1 including their area within the Study Area and Development Envelope (i.e. the area to which the Proposal must be constrained). Occurrence of the two habitat types is shown in Figure 4.1.

4.1.1 Roosting/nesting Habitat

Potential roosting/nesting habitat was defined using the spinifex-dominated vegetation units (see Plate 3.1 - Plate 3.9). Generally, the spinifex present occurred with an overstorey of shrubland (Table 4.1), which is thought to likely reduce the suitability of the habitat for Night Parrot.

Areas of ring-forming long-unburnt spinifex were found within the Development Envelope but were 30 – 40 cm in height, which we estimate to be functionally too small for nesting by extrapolating from the available information on Night Parrot nest characteristics. The study of Murphy et. al. (2017) describes three nests each consisting of a hollow chamber ranging in size from 20 – 28 cm in a spinifex hummock with each chamber leading to the outside via a tunnel of length 20 – 33 cm. The size of the hummocks was not stated but we infer that they must have been least 40 - 50 cm in size. We assume, based on this information, that the structural elements of a chamber and tunnel are required for nest success and although perhaps the tunnel and chamber size may be tailored somewhat to the size of hummock, a minimum size of hummocks of 40 – 50 cm seems reasonable. Very little spinifex of this size was found within the Development Envelope or Study Area, although it is possible that the *T. basedowii* present would grow to a sufficient size in time.

The potential roosting/nesting habitat within the Development Envelope is part of a continuous extent of the same habitat both with the Study Area and the Wider Area (Figure 4.1). The examples of this habitat that appeared more suitable for Night Parrot nesting were found in the Wider Area; in Wanjarri Nature Reserve and where listening surveys sites MKS-NIPA-05, MKS-NIPA-06 and MKS-NIPA-08 were located. Particularly MKS-NIPA-08 which was located within a large and relatively open area of low-medium dense spinifex grassland Figure 4.1.

Using the broadest definition of potential roosting/nesting habitat as that containing spinifex, the Wider Area supports 55,430.7 ha, the Study Area supports 351.1 ha, and the Development Envelope intersects a much smaller subset of this (36.7 ha) (Table 4.1). This represents 0.07% of the occurrence of this habitat type in the Wider Area.

4.1.2 Foraging habitat

Spinifex would itself represent potential foraging habitat at times of seeding and may represent an important food source during times of breeding. Breeding has been found to occur opportunistically following large rainfall events in the best studied Night Parrot population in western Queensland (Murphy et al. 2017) and large rainfall events also give rise to mass seeding events in *Triodia*. Many *Triodia* species including the *T. basedowii* of the Study Area (Western Botanical 2017) form seed banks within the hummock and soil (Westoby et al. 1988) which may represent an ongoing food source in this habitat for the breeding birds. Therefore, the areas of potential roosting/nesting habitat have also been included in calculations of available foraging habitat.

Potential foraging habitat within the Study Area was defined using those vegetation units supporting other grasses (including spinifex), and chenopods. Foraging habitat occurs in association with a large number of vegetation units comprising areas of Wanderrie Bank grassy

shrublands, spinifex shrublands, bluebush shrublands and chenopod plains (see Table 4.1 for vegetation unit descriptions). These vegetation units occur broadly across the Study Area including within the Development Envelope (Figure 4.1).

The Study Area was mapped as containing 981.2 ha of potential foraging habitat of which 365.9 ha is intersected by the Development Envelope, which represents 0.5% of its occurrence in the Wider Area (Table 4.1).

Table 4.1: Vegetation units used to define habitat polygons for the Night Parrot.

Study Area - Western Botanical 2017 Vegetation Layer			
Roosting/Nesting (and foraging)			
Veg Code	**Description**	**Study Area (ha)**	**Development Envelope (ha)**
WABS - SAMU Mosaic Complex	Wanderrie Bank Grassy Shrublands / Sandplain Mulga Spinifex Shrubland	153.9	20.6
SAMA	Sandplain, Mallee, *Acacia* species Spinifex Shrubland	13.3	0.0
SAMU	Sandplain Mulga Spinifex Shrubland	172	16.2
SAWS	Sandplain, *Acacia* species Spinifex Shrubland	11.9	0.0
	Total (percent of "Wider Area")	**351.1 (0.6%)**	**36.7 (0.07%)**
Foraging			
Veg Code	**Description**	**Study Area (ha)**	**Development Envelope (ha)**
BrCP	Breakaway Chenopod Plain Complex	12.2	0.41
BrCP - TectS	Breakaway Chenopod Plain Complex - *Tecticornia* shrubland (component of the BrCP Complex)	0.58	0.0
BrCP-FRAN	Breakaway Chenopod Plain Complex - *Frankenia* shrubland (component of the BrCP Complex)	8.5	0.0
BrGP	Breakaway Grassy Plain	18.7	0.0
HMCS	Mulga Shrubland with scattered low Chenopod Shrubs	24	0.0
MMS	Mulga over *Maireana triptera* Shrubland	330	259.8
MUWA	Mulga - Wanderrie Grassland	2.8	0.0
USBS	Upland Small Bluebush Shrubland	92.9	32.7
WABS	Wanderrie Bank Grassy Shrublands	140.5	36.3
	Foraging Only	**630.1**	**329.2**
	All Foraging including Spinifex (percent of "Wider Area")	**981.2 (1.4%)**	**365.9 (0.5%)**

Wider Area - BHPB Composite Vegetation Layer		
Roosting/Nesting (and foraging)		
Veg Code	**Description**	**Wider Area (ha)**
SAMA	Sandplain Mulga - Mallee Shrubland	5,405.0
SAMU	Spinifex Mulga Shrubland	21,662.8
SAMU + CP Mosaic	Spinifex Mulga Shrubland within small Playa communities	222.1
SAWS	*Acacia effusifolia* & Spinifex hummocked Grassland	24,026.3
SAWS-AI	*Acacia ligulata* & Spinifex hummocked Grassland	13.5
SAWS-M	*Acacia effusifolia*, Mallees & Spinifex hummocked Grassland	4,101.0
	Total	**55,430.7**
Foraging		
Veg Code	**Description**	**Wider Area (ha)**
BRGP	Breakaway Grassy Plains	102.1
HMCS	Chenopod Shrublands	630.1
MUWA	Mulga Wanderrie Grassy Shrublands	742.4
USBS	Upper Slope Bluebush Shrublands	24.1
WABS	Wanderrie Bank Grassy Shrubland	13,146.4
	Foraging only	**14,645.1**
	All Foraging including Spinifex	**70,075.8**

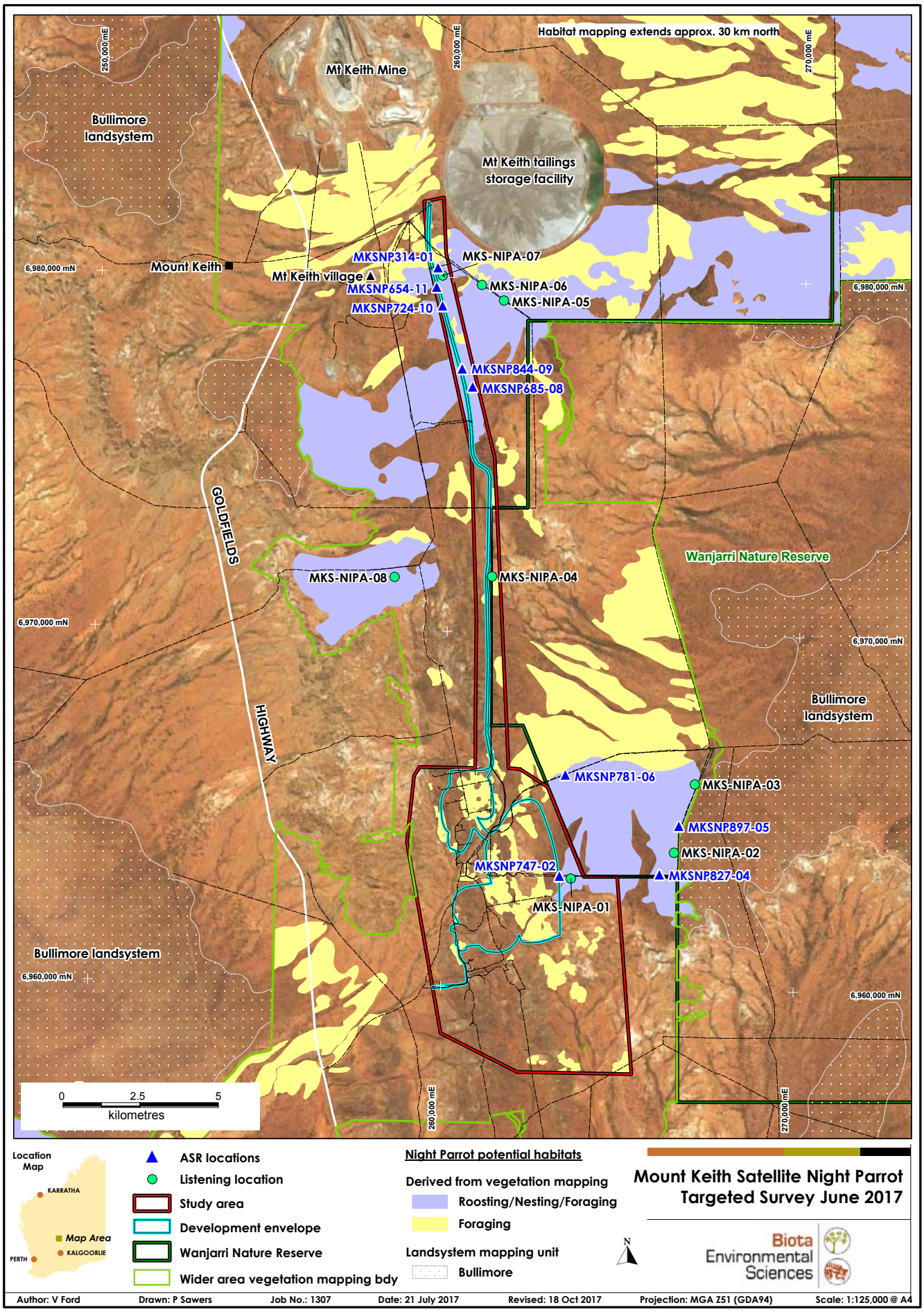

Figure 4.1: **Potential habitat for the Night Parrot in the Mt Keith Satellite Study Area and wider locality. Field survey effort is shown.**

4.2 Automatic Sound Recorders

No Night Parrot calls were identified in the recordings. Avifauna identified in the ASR recordings are listed in Appendix 2, and none of the species identified were of conservation significance.

In total, 56 nights of recording were collected in this study; 38 nights from the six recording units within the Study Area and 18 nights from three units in the Wanjarri Nature Reserve (Table 4.2). Over the 56 recording-nights, 8681 recording events were triggered (Table 4.2).

Table 4.2: Summary of data retrieved from automatic sound recorders.

Site ID	Location	No. Files recorded	Nights recording
MKSNP314-01	Study Area	843	6
MKSNP724-10	Study Area	764	6
MKSNP747-02	Study Area	399	6
MKSNP654-11	Study Area	644	6
MKSNP685-08	Study Area	3566	7
MKSNP844-09	Study Area	931	7
MKSNP827-04	Wanjarri NR	702	6
MKSNP897-05	Wanjarri NR	692	6
MKSNP781-06	Wanjarri NR	140	6
	Total	**8681**	**56**

4.3 Listening Surveys

No Night Parrots were heard during listening surveys. A list of the avifauna heard during the listening surveys is included in Appendix 2. None of the species identified were of conservation significance.

Conditions during the listening surveys were excellent, with no or very limited breeze and cool temperatures providing excellent audible clarity. Most species were heard up to several hundred metres away.

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5.0 Discussion and Risk Assessment

No evidence of the Night Parrot was recorded during this survey. The probability of recording the species is presumed low given its cryptic nature and rarity. However, to maximise the probability of recording the species, the survey was conducted under ideal conditions, with confidence that the best potential habitat for roosting/nesting was identified and with appropriate methods as recommended by the Department of Parks and Wildlife (2017). The timing of the targeted survey for the Night Parrot was considered ideal due to the higher than average rainfall in the months preceding the survey (Figure 3.2) and the prevalence of seeding *Triodia* at the time of the survey. Research of a known breeding population of Night Parrots in the Pullen Pullen Reserve in Queensland has found breeding in the species to be opportunistic in response to large rainfall events, for example, breeding was found to commence in April following much higher than average rainfall in March 2016 (Murphy et al. 2017).

The Night Parrot has also not been recorded during the considerable previous fauna survey work in the Study Area and Wider Area (see Biota 2017). Intensive surveying for the Brush-tailed Mulgara has occurred in the *Triodia* sandplain habitat that is likely to also represents the best potential nesting/roosting habitat for the Night Parrot (Halpern Glick Maunsell 1997, 1999, 2000, Sinclair Knight Merz 2005). These studies did not target the Night Parrot, and at the time their call characteristics were not known, however unintentional flushing has occurred in other studies (Murphy et al. 2017) and may have been possible during past work in the Wider Area.

Given the difficulties associated with recording the Night Parrot, habitat assessment becomes integral as both an indicator of likelihood of occurrence and potential impact of the Proposal. Below is a summary of the overall assessment of the habitat available within the Development Area, Study Area and Wider Area and potential impacts presented by the clearing of this habitat for the Proposal:

Roosting/nesting habitat: 36.7 ha of spinifex habitat occurs within the Development Envelope, however, very few patches of larger spinifex suitable for roosting were found. Additionally, most of the areas of spinifex grassland had an overstorey of mulga woodland of varying density, further reducing the suitability of the habitat for Night Parrot.

The Proposal has potential to displace individuals where clearing of roosting/nesting habitat may occur and further, the introduction of a transport corridor may also result in death to individuals that might occur via vehicle impact. However, very little roosting/nesting habitat occurs within the Development Envelope and no evidence of the species occurring within this habitat was found during targeted surveying.

As a result the risk to Night Parrot roosting/nesting habitat is assessed as low and, on current evidence, the likelihood of roosting or nesting activity within the Study Area is very unlikely.

Foraging habitat: Using a conservative approach, and including all vegetation units containing potential foraging plants such as herbs, forbs and succulents, 365.9 ha of potential foraging habitat occurs within the Development Envelope, most of which is within the mine pit footprints. This represents 0.5% of the vegetation units containing foraging habitat mapped in the Wider Area.

Foraging habitat is likely to be more attractive to the parrots if it is adjacent to roosting/nesting habitat, for example, where spinifex habitat abuts salt lake edge habitat. This close association of habitat types is largely absent from the Study Area and more common in the wider region where salt lakes occur. None of the salt-lake associated mixed spinifex-chenopod habitat described from where the species has been recorded in Western Australia was observed within the Study Area.

As a result, the risk to Night Parrot foraging habitat is assessed as low and the likelihood of foraging Night Parrots occurring is also low.

5.1 Matters of National Environmental Significance Impact Criteria

Based on the assessment of habitat and likelihood of occurrence, an assessment of whether the Proposal is likely to cause significant impact to the Night Parrot was made against the Matters of National Environmental Significance, Significant impact guidelines 1.1, *Environment Protection and Biodiversity Conservation Act 1999* (Department of the Environment 2013) using the criteria for critically endangered and endangered species. The results of this assessment are detailed in Table 5.1.

An impact is defined as 'significant' under guidelines if it is "…*important, notable, or of consequence, having regard to its context or intensity*." (Department of the Environment 2013). Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment, which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts (Department of the Environment 2013).

We conclude that none of the significant impact criteria would be triggered, and the adverse effects on potential core (roosting/nesting) habitat for the species are localised and minor in scale. As a result, the impacts to the Night Parrot arising from the action of implementing the Mt Keith Satellite Proposal do not appear to be significant.

Table 5.1: Assessment against Matters of National Environmental Significance (EPBC Act 1999) significant impact criteria.

Impact Criteria	Likelihood	Risk of Significant Impact
Lead to a long-term decrease in the size of a population	The roosting/nesting habitat within the Study Area is marginal, and unlikely to support a resident population of Night Parrot. Some potential feeding habitat is present in the Study Area, but equivalent habitat is also widespread in the region and there are much higher quality potential foraging locations elsewhere. Consequently the likelihood of a long-term impact on a population is considered remote.	Negligible
Reduce the area of occupancy of the species	As Night Parrot is not expected to reside within the Study Area, the species' area of occupancy will not be reduced.	Negligible
Fragment an existing population into two or more populations	No population is known from the Study Area and there are no nearby areas of high quality Night Parrot habitat that could be separated by the proposed development.	Negligible
Adversely affect habitat critical to the survival of a species	While potential roosting/nesting habitat was noted, none was deemed suitable for breeding or roosting at the time of survey because the spinifex was functionally too small.	Very low
Disrupt the breeding cycle of a population	As Night Parrot is not expected to reside or breed within the Study Area, the species' breeding cycle will not be disrupted.	Negligible
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The Development Envelope contains 36.7 ha of spinifex habitat but this was not of high roosting/nesting quality; the likelihood that the species will decline as a result of the Proposal is remote.	Negligible
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	While potential roosting/nesting habitat was noted, none was deemed suitable for breeding or roosting at the time of survey, because the spinifex was functionally too small. The establishment of weeds within these habitats could be detrimental to their future potential suitability. The introduction of a haul road between the existing Mt Keith operations and the MKS Proposal could also aid movement of feral predators (cats/foxes) in the landscape.	Very Low
Introduce disease that may cause the species to decline.	The likelihood of disease transmission to an individual arising from activities associated with the Proposal is negligible.	Negligible
Interfere with the recovery of the species.	Because of the reasons discussed, it is very unlikely that the Proposal will interfere with the recovery of the Night Parrot.	Negligible

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6.0 References

Biota (2017). Mt Keith Satellite Proposal Vertebrate Fauna Review. Unpublished report prepared for BHP Billiton Nickel West, Biota Environmental Sciences.

DEC (2012). Wildlife Conservation Act 1950. *Wildlife Conservation (Special Protected Fauna) Notice 2012*. Department of Environment and Conservation. Retrieved May 12, 2012, .

Department of Parks and Wildlife (2017). Interim guideline for preliminary surveys of night parrot (*Pezoporus occidentalis) in Western Australia* .

Department of the Environment (2013). Matters of National Environmental Significance - Significant Impact Guidelines 1.1 *Environment Protection and Biodiversity Conservation Act 1999*. Department of the Environment: Commonwealth of Australia.

Department of the Environment (2014). *Environment Protection and Biodiversity Conservation Act 1999* Protected Matters Search Tool [WWW Document]. Retrieved from http://www.environment.gov.au/topics/about-us/legislation/environment-protection-and-biodiversity-conservation-act-1999/protected.

Department of the Environment (2016). *Pezoporus occidentalis* — Night Parrot SPRAT Profile [WWW Document]. Retrieved from http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=59350.

Dooley, S. (2013). Out of the shadows. Australian Birdlife. *Australian Birdlife* 2:26–30.

EPA (2016). *Statement of Environmental Principles, Factors and Objectives*. Environmental Protection Authority, Western Australia.

Halpern Glick Maunsell (1977). Western Mining Corporation Mt Keith Mulgara *Dasycercus cristicauda* Survey.

Halpern Glick Maunsell (1997). Mt Keith Mulgara <i>Dasycercus cristicauda<i> Survey. Halpern Glick Maunsell Pty Ltd.

Halpern Glick Maunsell (1999). Mulgara *Dasycercus cristicauda* Confirmation Survey. Halpern Glick Maunsell Pty Ltd.

Halpern Glick Maunsell (2000). Lease Wide Mulgara *Dasycercus cristicauda* Survey.

Hamilton, N., M. Onus, B. Withnell, and K. Withness (2017). Recent sightings of the Night Parrot *Pezoporus occidentalis* from Matuwa (Lorna Glen) and Millrose Station in Western Australia. *Australian Field Ornithology* 34:71–75.

Johnstone, R. E., and G. M. Storr (1998). *Handbook of Western Australian Birds Volume I - Non-Passerines (Emu to Dollarbird)*. Western Australian Museum, Perth.

Jones, A. (2017, March 23). Night parrot sighting in Western Australia shocks birdwatching world. *ABC News*. Perth, Western Australia. Retrieved from http://www.abc.net.au/news/2017-03-23/night-parrot-sighting-in-wa-shocks-birdwatching-world/8377624.

Murphy, S., J. Austin, R. Murphy, J. Silcock, L. Joseph, S. Garnett, N. Leseberg, J. Watson, and A. Burbidge (2017). Observations on breeding Night Parrots (*Pezoporus occidentalis*) in western Queensland. *EMU Austral Ornithology* 117:107–113.

Pizzey, G., and F. Knight (2007). *The Field Guide to the Birds of Australia*. Page (P. Menkhorst, Ed.), 8th edition. Harper Collins Publishers, Sydney.

Sinclair Knight Merz (2005). Mulgara (*Dasycercus cristicauda*) Fauna Assessment Western Mining Corporation, Yakabindie - version 1 report # 2004/263.

Western Botanical (2017). Flora and Vegetation Assessment of the Mt Keith Satellite Proposal Study Area. Unpublished Report Prepared for BHP Billiton, Nickel West Pty Ltd, Western Botanical.

Westoby, M., B. Rice, G. Griffin, and M. Friedel (1988). The soil seed bank of *Triodia basedowii* in relation to time since fire. *Austral Ecology* 13:161–169.

Appendix 1

Regulation 17 Licence

DEPARTMENT OF PARKS AND WILDLIFE

Department of Parks and Wildlife

Enquiries: 17 DICK PERRY AVE, KENSINGTON, WESTERN AUSTRALIA
Telephone: 08 9219 9000
Facsimile: 08 9219 8242
Web Site: https://wildlifelicensing.dpaw.wa.gov.au
Correspondance: **Locked Bag 30**
Bentley Delivery Centre WA 6983

Wildlife Conservation Act 1950

REGULATION 17

Regulation 17 – Licence to take fauna for scientific purposes (Regulation 17 - Standard)

The undermentioned person may take fauna for research or other scientific purposes and where authorised, keep it in captivity, subject to the following and attached conditions, which may be added to, suspended or otherwise varied as considered fit.

Director General

Conditions

1 The licensee shall comply with the provisions of the Wildlife Conservation Act 1950, Wildlife Conservation Regulations 1970 and any Notices in force under this legislation.

2 The licensee shall take fauna only in the manner stated on the endorsed Regulation 17 licence application form and endorsed related correspondence.

3 Unless specifically authorised in the conditions of this Licence or otherwise in writing by the Director General, species of fauna declared as likely to become extinct, rare or otherwise in need of special protection shall not be taken.

4 Any by-catch of fauna, which is declared to be rare, likely to become extinct, or otherwise in need of special protection shall be released immediately at the point of capture. Where such fauna taken under this licence is injured or deceased, the licensee shall contact the Department's Wildlife Licensing Section for advice on disposal. Records must be kept of any such fauna so captured and details are to be included in the report required under further condition below.

5 Any interaction involving Gazetted Threatened Fauna that may be harmful to the fauna and/or invasive may require approval from the Commonwealth Department of the Environment ph 02 6274 1111. Interaction with such species is controlled by the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 and Environment Protection and Biodiversity Conservation Regulations 2000 as well as the Wildlife Conservation Act 1950 and Wildlife Conservation Regulations 1970.

6 No fauna shall be taken in areas where it would impinge on pre-existing scientific research programs.

7 Except in the case of approved lethal traps, the licensee shall ensure that measures are taken in the capture and handling of fauna to prevent injury or mortality resulting from that capture or handling. Where traps or other mechanical means or devices are used to capture fauna these shall be deployed so as to prevent exposure of trapped animals to ants and debilitating weather conditions and inspected at regular intervals throughout each day of their use. At the conclusion of research all markers used, and signs and structures erected by the licensee shall be removed and the environment returned to its original condition.

8 Not more than ten specimens of any one protected species of fauna shall be taken and removed from any location less than 20km apart. Where exceptional circumstances make it necessary to take a larger number of specimens from a particular location in order to obtain adequate statistical data, the collector must proceed with circumspection and justify their actions to the Director General in advance.

9 The licensee shall not release any fauna or their progeny in any area where it does not naturally occur, nor hand such fauna over to any other person or authority unless approved by the Director General, nor dispose of the remains of such fauna in any manner likely to confuse the natural or present day distribution of the species.

10 Bioprospecting involving the removal of sample aquatic and terrestrial organisms for chemical extraction and bioactivity screening shall not be conducted without specific written approval by the Director General.

11 No fauna shall be taken from any CALM land, as defined in the Conservation and Land Management Regulations 2002, without prior written approval of the Director General. No fauna shall be taken from any public land without the prior written approval of the Government Authority managing that land.

12 The licensee shall not enter upon any private property or pastoral lease for the purposes of this licence, nor take any fauna from any private land or pastoral lease without the prior consent in writing of the owner or occupier. Similarly, in the case of Aboriginal lands, the licensee must not enter upon or take fauna from such lands without the written approval of the Department of Aboriginal Affairs and/or the relevant native title holders or applicants.

13 Copies of this licence and any written approval or consent required by conditions of this licence must be carried by the licensee and any person/s authorised under the licence at all times when conducting activities relevant to the licence

Department of Parks and Wildlife

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and must be presented to an authorised officer of the Department upon request.

14 All holotypes and syntypes and a half share of paratypes of species or subspecies permitted to be permanently taken under this licence shall be donated to the Western Australian Museum. Duplicates (one pair in each case) of any species collected, which represents a significant extension of geographic range shall upon request be donated to the Western Australian Museum.

15 To prevent any unnecessary collecting in this State, all specimens and material taken and retained under the authority of this license shall, upon request, be loaned to the Western Australian Museum. Any unused portion or portions of any specimen collected under the authority of this license shall be offered to the Western Australian Museum for inclusion in its collection or made available to other scientific workers if so required.

16 Within one month of the expiration of this licence, the holder shall submit an electronic return into the department's Wildlife Licensing System, detailing the locality, site, geocode, date and number of each species of fauna captured, sighted or vouchered during the currency of the licence. A copy of any paper, report or thesis resulting from the research shall upon completion be lodged with the Director General.

Purpose

Targeted survey for Pezoporus occidentalis (Night Parrot) using of SM2 acoustic recorders to conduct passive recording or sites where Night Parrot may potentially occur to determine presence.

Locations

Mount Keith mine tenement and Camelot mine tenement Wanjarri Nature Reserve

Authorised Person

Surname	**Given name(s)**
Ford	Stuart
King	Jacinta

Original Date of Issue	12/06/2017
Date of Issue	12/06/2017
Valid From	14/06/2017
Date of Expiry	28/06/2017

Licensee:	Mr Daniel Kamien
Address	Biota Environmental Sciences Pty Ltd PO Box 155 Leederville WA 6903 Australia

Issued by a Wildlife Licensing Officer of the Department of Parks and Wildlife under delegation from the Minister for Environment pursuant to section 133(1) of the Conservation and Land Management Act 1984.

Appendix 2

Avifauna Recorded

Common name	Listening	Automatic Sound Recorder
Australian Owlet-nightjar	•	•
Bourke's Parrot	•	
Brown Falcon		•
Budgerigar	•	•
Chestnut-rumped Thornbill	•	•
Common Bronzewing	•	
Crested Bellbird	•	•
Grey Butcherbird	•	
Grey-crowned Babbler	•	
Hooded Robin	•	
Little Crow	•	•
Mulga Parrot	•	
Pallid Cuckoo	•	•
Pied Butcherbird	•	•
Red-capped Robin	•	•
Redthroat	•	
Rufous Songlark		•
Rufous Whistler	•	
Singing Honeyeater	•	•
Southern White-face	•	•
Spiny-cheeked Honeyeater	•	•
Splendid Fairy-wren	•	•
Tawny Frogmouth		•
White-browed Babbler		
White-fronted Honeyeater	•	•
White-winged Fairy-wren	•	
White-fronted Honeyeater		•
White-winged Triller		•
Willie Wagtail	•	•
Yellow-throated Miner	•	•
Zebra Finch		•
Total	**24**	**19**