Sandhill Dunnart Monitoring

Spring 2023 SUMMARY REPORT

Top: Sand Dune Vegetation, Eastern Goldfields Pipeline. Bottom: Sandhill Dunnart and Lesser Hairy-footed Dunnart.

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EXECUTIVE SUMMARY

APA Group (APA) owns and operates the Eastern Goldfields Pipeline, situated within the Murchison and Great Victoria Desert regions of Western Australia. Due to the occurrence of the nationally endangered Sandhill Dunnart, APA commissioned Kingfisher Environmental to develop a Sandhill Dunnart Monitoring Plan. Specifically, to fulfil requirements under Native Vegetation Clearing Permit CPS 6361/2 and to address the "Significant Impact Guidelines" on Matters of National Environmental Significance. The Sandhill Dunnart Monitoring Plan was developed in consultation with the Department of Parks and Wildlife (DPaW, now Department of Biodiversity, Conservation and Attractions, DBCA), and baseline field surveys were initiated in 2015. As the species has a highly restricted range and is vulnerable to several threatening processes, subsequent monitoring has been conducted bi-annually to determine the Sandhill Dunnart's status along the pipeline corridor.

The Sandhill Dunnart Monitoring Programme assesses a series of fragmented populations at the species' northern known extent in Western Australia. The species occurrence, movements and breeding along the Eastern Goldfields Pipeline are monitored to assess population stability, habitat fragmentation and the use of rehabilitated and disturbed areas. Monitoring aims to highlight important areas of habitat, investigate the associated impacts of predation and fire, and document the species recovery post-disturbance. This report summarises the results of the field survey conducted during September and October 2023. Field sampling included:

- Systematic trapping (to verify species occurrence, breeding, genetic viability);
- Motion-activated cameras (to monitor presence, locate additional populations);
- Predator scat collection and analysis (to evaluate predation, new populations);
- Habitat and shelter assessments: measures of vegetation, re-growth, and colonisation post-disturbance (clearing and fire);
- Assessment of fauna within rehabilitated and disturbed areas; and
- Searches for, and monitoring of, additional taxa of conservation significance.

A total of 127 vertebrate taxa were recorded during the field survey, comprising 50 reptiles, 59 birds, 13 native mammal and five introduced mammal species. Fifty five species were trapped at the permanent monitoring sites and 37 taxa were recorded via motion-activated camera. Six species of conservation significance were recorded including the Sandhill Dunnart (EPBC Endangered), Malleefowl (EPBC Vulnerable), Brush-tailed Mulgara (DBCA Priority 4), Striated Grasswren (DBCA Priority 4), Long-tailed Dunnart (DBCA Priority 4) and the locally restricted Southern Scrub-robin. Introduced fauna were widely recorded via tracks, scats and on camera.

The Sandhill Dunnart was recorded during the 2023 field survey from areas of long-unburnt vegetation, which provide the range and abundance of sites required for shelter. Individuals were recorded from monitoring sites where the species has been regularly recorded and also from a site appearing to support suitable habitat (occurring adjacent to Tropicana Gold Mine), but from which the species had not

been previously recorded. The consistent number of records is indicative of a stable population despite the dry conditions experienced during the preceding years. The species was recorded via pitfall trapping, motion cameras, and within predator scats collected (Feral Cat, Dingo and Red Fox).

Ten cameras were established west of the species current known range, aiming to determine if the species has a wider occurrence along the EGP. Suitable habitat in this area has been previously highlighted, however had not been surveyed since a large wildfire removed significant areas of habitat in 2019. While the Sandhill Dunnart was not recorded, the area is proposed to be surveyed further during 2024.

The Sandhill Dunnart has a highly fragmented occurrence along the Eastern Goldfields Pipeline, attributable to the complex interactions of predation, rainfall, and fire. While monitoring has revealed new populations, low rainfall and the destructive effects of large bushfires have impacted large areas of habitat in preceding years. The species inhabits discrete areas of mature vegetation (late seral stages of vegetation, comprising spinifex dominated shrublands, woodlands and mallee), which occur intermittently along the pipeline corridor. Post-burn monitoring has failed to detect the Sandhill Dunnart at formerly occupied sites, and it is likely to take several years after disturbance before habitat matures to a suitable stage to provide shelter and protection from predation.

The Sandhill Dunnart Monitoring has identified several areas where the species persists, but also areas of population decline, and has not yet recorded the species utilisation of the pipeline corridor. Recent rainfall has assisted the rehabilitation of vegetation, with habitat metrics revealing an increase in the size and cover of potential habitat. However, while the pipeline corridor is regenerating, rehabilitation has not matured to a stage suitable to support the Sandhill Dunnart.

Monitoring along the Eastern Goldfields Pipeline is proposed to continue during 2024. Existing populations will be re-assessed, and areas of suitable habitat surveyed for the species presence. As vegetation cover is expected to increase post-disturbance, it is hoped that further monitoring will confirm the Sandhill Dunnart's use of rehabilitation and colonisation post-fire. Research to date along the Eastern Goldfields Pipeline has revealed the Sandhill Dunnart exhibits a unique series of traits (physiology, diet, movement and burrowing capabilities) which enable it to survive adverse desert conditions such as droughts, and persist in desert landscapes fragmented by bushfire.

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1. INTRODUCTION

APA Group (APA) owns and operates the Eastern Goldfields Pipeline, located in the Murchison and Great Victoria Desert regions of Western Australia. In 2014, prior to pipeline construction, Kingfisher Environmental Consulting (KEC) conducted a fauna assessment of the pipeline corridor and several conservation significant fauna species were identified. This included the nationally threatened Sandhill Dunnart, recorded near the Tropicana Gold Mine.

Due to the presence of the Sandhill Dunnart (*Sminthopsis psammophila*) and extent of suitable habitat, APA commissioned Kingfisher Environmental Consulting to develop a Sandhill Dunnart Monitoring Plan to fulfil the requirements under Native Vegetation Clearing Permit CPS 6361/2. The Sandhill Dunnart Monitoring Plan assesses the significance of any impacts associated with the Eastern Goldfields Pipeline upon the local Sandhill Dunnart population. The "Significant Impact Guidelines on Matters of National Environmental Significance" (DoTE, 2013) provide a framework for the assessment of impact:

- Will the action lead to a long-term decrease in the size of a population?
- Will the action reduce the area of occupancy of the species?
- Will the action fragment an existing population?
- Will the action adversely affect habitat critical to the survival of a species?
- Will the action disrupt the breeding cycle of a population?
- Will the action modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the species is likely to decline?
- Will the action result in introducing invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat?
- Will the action introduce disease that may cause the species to decline?
- Will the action interfere with the recovery of the species?

<u>Sandhill Dunnart Monitoring Plan</u>

The Sandhill Dunnart Monitoring Plan (KEC, 2015a) was developed in consultation with the Department of Parks and Wildlife (DPaW) and included:

1. Baseline surveys to collect data on the local population and to record the species over a wider range;
2. Monitoring along the Eastern Goldfields Pipeline to assess species presence, extent, breeding, and movements;
3. Tracking to collect detailed ecological and habitat information and determine the use of impact and rehabilitated areas;
4. An assessment of pipeline impacts associated with threatened fauna, introduced predators and fire; and
5. Monitoring of other significant fauna (including the EPBC listed Malleefowl) and the associated vegetation.

The initial field survey and assessment was conducted during 2014 (KEC, 2015b) with monitoring surveys subsequently conducted since 2015 (KEC, 2020). This report summarises the results from the monitoring conducted during September and October 2023.

2. BACKGROUND

2.1 Great Victoria Desert

The Great Victoria Desert is Australia's largest desert but is remote and the region's fauna is poorly sampled and little understood. Despite this, the region supports a diverse assemblage of plants and animals, containing a unique mix of species from the temperate south-west and arid interior. A number of atypical desert species occur at the arid extremes of their range, in small, restricted populations (e.g. Southern Scrub-robin, Western Pygmy Possum, Sandhill Dunnart). Like much of arid Australia, the region's mammalian fauna has suffered significant declines (Woinarski *et al*. 2014). A number of mammals are considered regionally extinct, while several others have suffered significant range reductions and occur in small and vulnerable populations. This includes the Sandhill Dunnart.

2.2 Sandhill Dunnart

The Sandhill Dunnart (*Sminthopsis psammophila*) is listed as Endangered under the EPBC Act (Environment Protection and Biodiversity Conservation Act 1999) and BC Act (Biodiversity Conservation Act 2016, see KEC 2015). It has a highly restricted range with small, disjunct populations in Western Australia and South Australia (Churchill, 2001, DPaW, 2015).

The Sandhill Dunnart is a large dunnart, with an adult's body weight ranging from 30 – 55g (Churchill, 2001). Due to its large size, it is one of only two dunnart species that fall within the "critical weight range" of mammals sensitive to a number of threatening processes, exacerbated by its desert sandplain habitation (Woolley *et al.* 2017). The species is identified from other dunnarts by its large size, distinctive bi-coloured tail (with a crest of stiff black hairs along the ventral surface of the distal portion), large ears and dark forehead.

In Western Australia, the Sandhill Dunnart appears to be restricted to the south western fringe of the Great Victoria Desert. The species inhabits yellow sand dune systems with mature hummock grasslands (*Triodia* spp.) and often in association with Mallee (*Eucalyptus* spp.) or Marble Gum (*Eucalyptus gongylocarpa*), Callitris (Callitris spp.) and an associated complex shrub understorey (KEC, 2014). There is also a disjunct population in southern South Australia, in which the species appears to occupy a broader range of habitats (GHD 2010).

Sandhill Dunnarts require habitat that is long unburnt, as mature vegetation contains the range and abundance of sites required for shelter. Such habitat includes mature hummocks of spinifex (and other dense hummocks such as *Lepidobolus*) and a complex shrub layer which develops in the absence of fire. Summer fires in the Great Victoria Desert can be extensive and destroy large areas of land, rendering them unsuitable for the species.

<u>Sandhill Dunnarts at Tropicana</u>

The Sandhill Dunnart was recorded at four locations by Kingfisher during the initial assessment of the pipeline project in 2014 (KEC, 2015). At all four locations,

vegetation comprised long-unburnt and mature spinifex with a variable and complex shrub layer and in association with a yellow sand dune. Vegetation included Marble Gum (*E. gongylocarpa*), *Callitris preissii*, mixed Acacia (including *Acacia ramulosa*, *Acacia ligulata*), *Grevillea juncifolia, Anthotroche pannosa, Daviesia grahamii* and *Triodia desertorum* (see Figure 1).

Figure 1. Sandhill Dunnart habitat at Tropicana.

Since the Sandhill Dunnart was initially recorded at Tropicana, the species has been detected over a wider area. However, the known distribution for the species in Western Australia remains highly restricted and extends over approximately 200 km from Queen Victoria Spring Nature Reserve to the Tropicana Gold Mine (KEC, 2015). Within this range, the Sandhill Dunnart's occurrence is highly fragmented, owing to the intermittent occurrence of suitable habitat arising from the region's fire regime. Along the Eastern Goldfields pipeline the Sandhill Dunnart is known only from disjunct areas of long unburnt vegetation within approximately 100km of Tropicana Gold Mine (recorded from near Tropicana to near Hope Campbell Lake). Of the four initial locations where the species was recorded along the Eastern Goldfields Pipeline, two sites no longer support the species, due to the removal of critical habitat by wildfire.

2.3 Other Conservation Significant Fauna

Additional species of conservation significance occur along the Eastern Goldfields Pipeline in small and restricted populations. These include the Malleefowl (*Leipoa ocellata*, Vulnerable under the EPBC Act), Brush-tailed Mulgara (*Dasycercus blythi*, DBCA Priority 4), Striated Grasswren (*Amytornis striatus*, DBCA Priority 4) and the

regionally significant and isolated Southern Scrub-robin (*Drymodes brunneopygia*) and Western Pygmy Possum (*Cercartetus concinnus*). The Malleefowl and Southern Scrub-robin are restricted to areas of dense Mulga while the Brush-tailed Mulgara and Striated Grasswren inhabit long-unburnt spinifex sandplains. All species have a fragmented occurrence with few known regional populations.

Monitoring of these species, particularly the EPBC listed Malleefowl, was incorporated into the field survey to assess the pipeline's influences over a wider context and to enhance local knowledge of the region's poorly known biodiversity. While not known from the pipeline corridor, the Great Desert Skink (*Liopholis kintorei*, EPBC Vulnerable) occurs nearby and so surveying also aimed to determine the species status along the corridor.

2.4 Survey Techniques

The optimisation of detection is important when designing monitoring programs for rare species, such as the endangered Sandhill Dunnart (Read *et al*., 2016). Important considerations for survey design include:

- timing (season and moon phase);
- sampling duration;
- location and frequency of sampling;
- the detectability of the target species; and
- the modes of detection (the type of traps used).

Optimal Sandhill Dunnart surveys and monitoring programs need to account for their relatively low detectability (Read *et al*., 2016). A summary of the optimal detection methods employed for the Sandhill Dunnart and other significant fauna is listed in the initial Sandhill Dunnart Monitoring Plan (KEC, 2014). A combination of deep pitfall traps, motion-activated cameras, and long sampling periods with repeated seasonal sampling visits maximises the effectiveness of monitoring (Churchill, 2001; KEC 2014; Gaikhorst and Lambert 2008; Read *et al*., 2016).

3. SANDHILL DUNNART MONITORING

3.1 Approach

The Sandhill Dunnart Monitoring Plan comprises a series of sampling events aiming to collect information on the Sandhill Dunnart population (and other threatened species), both within and away from areas of disturbance. Key population indicators of change include species presence, relative abundance, area of occupancy and trap success both within and away from disturbance areas. Other indicators include habitat availability, home range size and shape, activity, and movement patterns. As a result, sampling includes both systematic and repeatable trapping (at monitoring sites), the use of motion cameras (across a broader area) and the tracking of fauna movements (see KEC, 2015b).

3.2 Sampling

Monitoring incorporates several sampling components at established monitoring sites (see KEC, 2015). Sampling includes:

- Systematic trapping (to verify species occurrence, breeding, genetic viability);
- Motion-activated cameras (to monitor presence, locate additional populations, and detect other fauna, including the abundance of predators);
- Predator scat collection and analysis (to investigate predation and locate additional Sandhill populations);
- Sandhill Dunnart scat collection and analysis (to investigate diet);
- Sandhill Dunnart tracking (radio / GPS tracking to assess species movements, to determine the impact of a pipeline as a potential barrier and to determine the use of impact and rehabilitated areas);
- Habitat and shelter descriptions: measures of vegetation, vegetation cover, re-growth, and colonisation post-disturbance (clearing and fire):
    - Vegetation description (dominant species, cover, fire history);
    - Triodia assessment (life stage, size, cover, isolation calculated);
    - Microhabitat assessment (presence of logs, burrows);
    - Fire Assessment: measures of regrowth, fauna usage after fire;
- Assessment of fauna within rehabilitated and disturbed areas; and
- Searches for, and monitoring of, additional taxa of conservation significance.

3.3 Survey Area

The survey area corresponds to known Sandhill Dunnart distribution near Tropicana. Prior to the April 2015 survey, there were six known records of the species within 100 km of Tropicana. These were the four Sandhill Dunnart locations along the proposed pipeline route (recorded by Kingfisher in 2014) and two records near the Pinjin Access Road (approximately 50 km south-west of Tropicana, J Turpin, pers. obs.).

3.4 Other Significant Fauna

While populations of the Sandhill Dunnart are assessed, the influences of the pipeline on additional fauna (threatened species) and ecological processes such as predation are also monitored. The fauna use of rehabilitation is assessed, and vegetation regrowth associated with rehabilitation and fire is also measured. Monitoring therefore includes:

1. Significant Fauna:
    a. Sandhill Dunnart (EPBC Vulnerable): the focus of monitoring along the pipeline;
    b. Great Desert Skink (EPBC Vulnerable): few records for the GVD however has the potential to occur along the pipeline corridor;
    c. Malleefowl (EPBC Vulnerable): as several breeding sites occur along the pipeline, the species presence and breeding activity along the pipeline is monitored;
    d. Brush-tailed Mulgara (DBCA Priority 4): occurs at several locations along the pipeline and is monitored by the use of motion-activated cameras;
    e. Striated Grasswren (DBCA Priority 4): sparse occurrence in the region and the few known populations along the pipeline are monitored with motion cameras and bird census;
    f. Southern Scrub-robin (regionally significant, isolated population): as the species is highly sedentary and is restricted to a few small areas along the pipeline, known populations are monitored;
2. Rehabilitation after disturbance: monitoring of vegetation growth and colonisation after land clearance and fire events;
3. Fauna usage of rehabilitation. The Sandhill Dunnart and other dunnart species along the pipeline have the potential to forage and shelter within the rehabilitated areas along the pipeline corridor. To verify the success of rehabilitation along the Eastern Goldfields Pipeline Corridor fauna movements in the area are monitored.

4. FIELD SURVEY METHODOLOGY

4.1 Personnel and Timing

The 2023 survey was conducted from the 23rd September till the 7th October 2023. The survey team comprised:

- Jeff Turpin (Supervising Zoologist, B.Sc. Zoology);
- Ray Lloyd (Senior Ecologist, B.Sc. Hons. Zoology);
- Joanna Riley (Senior Ecologist, B.Sc. Hons. Zoology, PhD, Biological Science);
- Harriet Crate (Field Assistant).

This report was prepared by Jeff Turpin and Joanna Riley (PhD, Biological Science).

4.2 Licencing

The field survey was conducted under the Department of Biodiversity, Conservation and Attractions (DBCA) Regulation 25 (Biodiversity Conservation Regulations 2018), licensed to J.M. Turpin, FO25000057-7 (valid to 31/03/2025) and an "Authorisation to Take or Disturb Threatened Species" under Section 40 of the Biodiversity Conservation Act 2016, TFA 2021-0121-2.

4.3 Survey Techniques

The field survey included the following components (Appendices A-E):

- Systematic trapping – nineteen monitoring sites established;
- Motion-activated Cameras – established at trapping sites and additional areas;
- Predator scat collection and analysis;
- Sandhill Dunnart scat collection and analysis;
- Assessment of other significant fauna including Malleefowl breeding;
- Fauna usage of rehabilitation; and
- Vegetation and Habitat assessment – including vegetation, fire, soil, landform, and the effects of fire on local fauna (focusing on the Sandhill Dunnart).

4.3.1 Systematic Trapping

Twenty two Sandhill Dunnart monitoring sites were sampled during the field survey (Table 1). Each monitoring site consisted of:

- Pitfall Traps (20 sites) – two lines of six pitfall traps (at least 620 mm deep and 225 mm diameter) spaced along a 50 m drift fence. Pitfalls were spaced eight metres apart and placed centrally under a 300 mm high flywire fence. A third line of six pitfall traps was established within the disturbed pipeline corridor at five sampling sites to assess the effects of, and fauna usage (particularly the Sandhill Dunnart) of, the pipeline's rehabilitating corridor; and
- Motion-activated cameras (41 sites) placed at each trapping site to supplement capture data (1 per site) and also elsewhere to sample fauna. Each motion camera also baited with "universal bait".

Sampling was conducted over 1834 trap nights with survey effort detailed in Tables 1 and 2 and site descriptions listed in Table 3. Photos of survey sites are displayed in

Appendix A. In total, 32 permanent trapping sites have been established totalling 358 pit fall traps (Table 1). However, 42 pit-fall traps have been removed due to access limitations and fire (Table 1).

Table 1. Survey Effort at Sandhill Dunnart Trapping Sites.

Site	Easting	Northing	Pits Traps	Camera Traps	Nights Sampled	Rehab Pits	Trap Nights	Sampled																	
								2015 A	2015 B	2016 A	2016 B	2017 A	2017 B	2018 A	2018 B	2019 A	2019 B	2020 A	2020 B	2021 B	2021 B	2022 A	2022 B	2023 A	2023 B
1	641234	6763205	12	1	7		84	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2	641811	6763078	12	1	7		84	X	X	X	X	X		X	X		X		X	X	X	X	X	X	X
3	640804	6763212	Not sampled					X	X	X															
4	606034	6729480	Not sampled					X	X	X	X			X											
5	601839	6729764	Not sampled					X	X	X	X			X											
6	646101	6763194	6	1	7		42	X			X	X		X	X	X	X	X	X	X	X	X	X	X	X
7	621440	6762911	12	1	7	6	126	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
8	621873	6762857	Not sampled					X																	
9	625003	6762719	12	1	7		84		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
10	626818	6762870	12	1	7	6	126		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
10B	626810	6763357	12	1	7		84						X	X	X	X	X	X	X	X	X	X	X	X	X
11	603037	6729852	Not sampled						X	X	X			X											
12	606136	6763323	12	1	7		84			X	X	X	X	X	X	X	X	X	C	X	X	X	X	X	X
13	608822	6763296	12	1	7	6	126			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
14	634312	6763442	12	1	7		84			X	X	X	X	X	X	X	X	C	C	X	X	X	X	X	X
15	623425	6762898	10	1	7		70			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
16	639811	6764494	Removed (due to rehabilitation of track)								X														
17	619212	6738684	Not sampled								X			X											
18	628037	6743144	Not sampled								X														
19	643132	6763279	6	1	7		42				X	X		X	X	X	X	C	X	X	X	X	X	C	X
20	595291	6764675	12	0	0		0					X	X		X	X	X	C	C	C	C	C	C		
21	640281	6763563	6	1	7		42						X	X	X	X	X	X	X	X	X	X	X	X	X
22	639353	6763759	12	1	7		84						X	X	X	X	X	C	X	X	X	X	X	X	X
23	614745	6763088	12	1	7	6	126							X	X	X	X	X	X	X	X	X	X	X	X
24	611831	6763382	12	1	7		84								X	X	X	C	C	X	X	X	X	X	X
25	637051	6763604	6	0	7		42								C									X	X
26	646935	6763687	6	1	0		0									X	X	X	X	X	X	X	C		
27	645203	6763227	12	1	7		84									X	X	X	X	X	X	X	X	X	X
28	646887	6763245	12	1	7		84													X	X	X	C	X	X
29	647544	6763463	12	1	0		0														X	X	C	X	
30	602025	6763984	12	1	7		84																	X	X
31	589268	6765391	12	1	7		84																		X
32	584155	6765591	12	1	7		84																		X
Total			268	23	154	24	1834	8	9	12	17	12	12	19	17	18	19	18	19	20	20	20	17	20	22

Note: "X" denotes sampling by a combination of trapping and cameras, "C" denotes sampling by camera only.

4.3.2 Motion-activated Cameras

Motion cameras were placed targeting the Sandhill Dunnart and other significant fauna. Cameras were placed at each trapping site and at an additional 33 locations (see Appendix A, Tables 1 and 2). All cameras were baited with "universal bait", a mixture of peanut butter, sardines and oats (a known attractant for the Sandhill Dunnart). Ten cameras were established west of the species current known range, aiming to determine if the Sandhill Dunnart has a wider occurrence along the EGP.

Table 2. Sandhill Dunnart Camera Monitoring Sites.

Easting	Northing	Camera	Comments	Burnt	SHD	2016	2017	2019A	2019B	2020A	2020B	2021A	2021B	2022A	2022B	2023 A	2023
555982	6768513	18657	Cage Dune		Yes											X	X
560648	6767542	18852	West Dune 1										X	X	X	X	X
561998	6767686	18642	West 1B											X	X	X	X
575090	6766012	FB5	West 2 RRise		Yes			X	X	X	X	X	X	X	X	X	X
577459	6765759	K6	West Marble		Yes			X	X	X	X	X	X	X	X	X	X
578251	6765629	B4	GWren		Yes							X	X	X	X	X	X
578767	6765525	BC01	West T2		Yes				X	X	X	X	X	X	X	X	X
579438	6765525	Newer	Allocas		Yes						X		X	X	X	X	X
583452	6765487	K8	Trench Site		Yes					X	X	X	X	X	X	X	X
584154	6765590	B2	Trench dune		Yes	X	X	X	X	X	X	X	X	X	X	X	X
586320	6765490	3991	ZS/JR SHD		Yes		X	X		X	X	X	X	X	X	X	X
589270	6765393	M03	JT/JR		Yes			X	X	X	X	X	X	X	X	X	X
591472	6765041	18843	West of 20		Yes				X	X	X	X	X	X	X	X	X
595213	6764697		20		Yes					X		X	X	X	X		
596698	6764563	03673	Banksias		Yes					X	X	X	X	X	X	X	X
600391	6764246		MMitch								X			X	X		
602015	6763983	FB6	30		Yes					X	X	X	X	X	X	X	X
612542	6763421	18834	23/24		Yes							X	X	X	X	X	X
617545	6763110	K9	23/7							X	X	X	X	X	X	X	X
616748	6763077	A4	23/7 B														X
619457	6763139	18601	Old Camp		Yes									X	X	X	X
629172	6762311		10 East			X	X	X	X	X		X	X	X	X	X	
647682	6763751	18668	TGM Dune		Yes			X	X	X	X	X	X	X	X	X	X
648088	6764188	FT13	TGM Dune 2		Yes												X
647157	6763447		26B													X	
472874	6781256	M01	Far West 1														X
473726	6781457	A01	Far West 2														X
474360	6780845	B03	Far West 3														X
476921	6781237	18966	Far West 4														X
510775	6772624	A11	Irwin Plains 1														X
512897	6772239	18837	Irwin Plains 2														X
513516	6772185	Browning	Irwin Plains 3														X
520546	6771797	K2	Laverton Rd														X
547392	6770526	18836	Hope Cambell														X
555009	6767808	3920	Cage Dune 2														X
503157	6775354	A21	Irwin Hills														X
502954	6775594	New	Irwin Hills														X
580998	6765565		West T 1	2019	Yes		X	X			X						
561767	6767208		West Dune 1	2019	Yes		X				X						
581862	6765475		NS Track							X	X						
647011	6764793		TGM N		Yes					X	X						
594455	6765006		East 20								X						
607640	6763584		Mid 12,13								X						
641909	6763363		2 North								X						
613235	6763464		Mid 23, 24								X						
634125	6763179		14 South								X						
622327	6762981		7 East								X						
619471	6763063		W7b								X						
610244	6763465		East 13								X						
569224	6766788		West Dune 2	2019	Yes		X				X		X				
580700	6765715		Burn edge										X				

4.3.3 Predator Scat Analysis

Searches for predator scats (feral cat, fox, dingo) and pellets (owls, birds of prey) were conducted at known Sandhill Dunnart sites and elsewhere (aiming to locate the species at additional locations). A number of dingo, feral cat and fox scats were collected and forwarded to Scats About (Georgeanna Storey) for analysis.

4.3.4 Sandhill Dunnart Scat Analysis

Sandhill Dunnart scats were collected from trapped individuals and subsequently analysed with the Western Australian Museum to collect information on the species' diet.

Table 3. Sandhill Dunnart Monitoring Site Descriptions.

Site	Habitat	Vegetation	Burn Age (Y)	Triodia Stage
1	Dune	Marble Gum and mixed shrubs over *Triodia desertorum*	4.5	1
2	Dune	Mixed Eucalypt and *C. preissii,* over *Triodia desertorum*	4.5	1
4	Dune	Mallee Allocasuarina and Melaleuca *over T. desertorum*	4.5	2
5	Dune	Marble Gum and mixed shrubs over *Triodia desertorum*	4.5	2
6	Dune	Mixed shrubland over *Triodia desertorum*	24.5	3-5
7	Dune	Mixed shrubland *over Triodia desertorum*	19.5	2-3
9	Dune	Mixed Eucalypt and *C. preissii* over *T. desertorum / T. basedowii*	40+	4-5
10	Dune	Mixed shrubland over *Triodia desertorum*	40+	4-5
11	Dune	Mixed Eucalypt and *C. preissii* over *Triodia desertorum*	4.5	2
12	Plain	Mixed Eucalypt and *C. preissii* over*T. desertorum / T. basedowii*	40+	3-5
13	Dune	Marble Gum and mixed shrubs over *T. desertorum / T. basedowii*	40+	4-5
14	Plain	Regenerating Mallee and Mulga (post-fire)over *T. rigidissima*, *T. basedowii.*	4.5	1
15	Dune	Mallee and Allocasuarina *over T. desertorum*	40+	4-5
16	Dune	Mixed Eucalypt and *C. preissii,* over *Triodia desertorum*	40+	4-5
17	Dune	Mixed Eucalypt and *C. preissii,* over *Triodia desertorum*	14/40+	3-4-5
18	Plain	Regenerating Mallee and Mulga (post-fire)over *T. desertorum / T. basedowii*	14	3-3.5
19	Swale	Marble Gum, *Callitris preissii* and mixed shrubs over *Triodia desertorum*	40+	4-5
20	Plain	Marble Gum, *Callitris preissii* and mixed shrubs over *Triodia desertorum*	3	1
21	Dune	Marble Gum, *Callitris preissii* and mixed shrubs over *Triodia desertorum*	4.5	1
22	Dune	Marble Gum, *Callitris preissii* and mixed shrubs over *Triodia desertorum*	40+	5
23	Dune	Mallee and Allocasuarina *over T. desertorum / T. basedowii*	19.5	5
24	Plain	Marble Gum, *Callitris preissii* and mixed shrubs over *Triodia desertorum*	19.5	3-5
MP	Plain	*Xanthorrhoea thorntonii* and mixed Acacia over *T. desertorum / T. basedowii*	4	1
26	Dune	Marble Gum, *Callitris preissii* and mixed shrubs over *Triodia desertorum*	40+	3-5
27	Swale	Regenerating Mallee and Mulga (post-fire)over *T. rigidissima*, *T. basedowii.*	24.5	3-4
28	Dune	Marble Gum, *Callitris preissii* and mixed shrubs over *Triodia desertorum*	40+	3-5
29	Dune	Marble Gum, *Callitris preissii* and mixed shrubs over *Triodia desertorum*	40+	3-5
30	Rise	Mallee *over T. desertorum*	40+	3-5
31	Dune	Marble Gum, *Callitris preissii* and mixed shrubs over *Triodia desertorum*	40+	3-5
32	Rise	Marble Gum, *Callitris preissii* and mixed shrubs over *Triodia desertorum*	40+	3-5

4.3.6 Habitat Assessment

Sandhill Dunnart habitat was described at shelter sites (located during previous radiotracking) and compared with vegetation along the rehabilitating pipeline corridor. As the species is highly mobile and individuals have large home ranges, shelters can be located away from trap locations (up to 2 km recorded). Due to the heterogeneity of vegetation, habitat can vary throughout an individual's home range. As such, habitat considered critical to the species' survival, was considered to comprise the vegetation necessary for shelter. When shelter sites (typically burrows under spinifex) were located, the following habitat parameters were measured:

- Dominant vegetation (upper-storey, mid-storey, and lower-storey vegetation);
- Fire history (time since last fire, calculated using aerial imagery dating to 1984 (Google Timelapse, 2016);
- Landform;
- Soil;
- Presence and abundance of logs;

At each Sandhill Dunnart shelter, vegetation was systematically measured throughout a 5 x 5 m quadrat, placed centrally over the shelter site. Measurements included:

- Spinifex (*Triodia* spp.) type, cover, size (height, width, and length), life stage, and separation;
- Percentage cover of vegetation (divided into spinifex, shrubs above 2m, shrubs 1-2m, shrubs below 1m, litter, bare ground);
- Slope;
- Spoil-type;
- Species richness; and
- Vegetation height.

4.3.7 Rehabilitation Assessment

Critical habitat for the Sandhill Dunnart is mature spinifex dominated shrublands, as these provide the range and abundance of sites required for shelter and protection from predators. The Sandhill Dunnart shelters within or under large, mature hummocks of vegetation (especially spinifex - *T. desertorum* or *T. basedowii*, and also *Lepidobolus* or *Schoenus*). A diverse shrub layer is also typically present at sites supporting the Sandhill Dunnart as a mature, structurally complex habitat provides protection from predators. Clearing for the pipeline corridor resulted in the loss of such habitat, however, since the pipeline's construction in 2015, the pipeline corridor has undergone rehabilitation (both assisted and natural). Regenerating vegetation is within the early stages of succession, and while species present include pioneer species (e.g. *Dubosia*, *Dicrastylis* spp.), some taxa indicative of Sandhill Dunnart habitat (particularly spinifex hummocks) are also present.

To assess the development of rehabilitation and its potential to provide habitat for the Sandhill Dunnart, measures of vegetation (species type, richness, density, cover) were conducted via standardised vegetation quadrats and compared to tracking and trapping data. The same habitat parameters recorded at Sandhill Dunnart Shelters (described in Section 4.3.6) were measured within a total of 39 quadrats (5 x 5m) located within the rehabilitating pipeline corridor. Habitat parameters were then compared to intact, mature vegetation, supporting the Sandhill Dunnart at shelter sites. To further investigate the usage of rehabilitation (by local fauna and its potential to provide habitat for the Sandhill Dunnart), pitfall traps were also installed at five sites (see Table 1). Each rehabilitation site contained one line of six pitfall traps, giving a total of 30 traps within rehabilitation.

4.3.8 Other Significant Fauna

To assess the suitability of rehabilitated vegetation for other fauna, pipeline vegetation measures (described in Section 4.3.7) were also compared with equivalent parameters at Brush-tailed Mulgara burrows. The same parameters measured at Sandhill Dunnart burrows, were also measured at Brush-tail Mulgara burrows, and then compared with the vegetation assessment along the rehabilitating pipeline corridor.

Known breeding sites of the Malleefowl were also visited to assess the species breeding activity in the area and searches were undertaken to verify the species presence along the Eastern Goldfields pipeline. Additionally, opportunistic searches were undertaken for the Great Desert Skink and at sites known to support the Striated Grasswren and Southern Scrub-robin and motion-activated cameras were placed at sites known to support the Brush-tailed Mulgara.

4.3.9 Effects of Fire

Wildfire has burned a total of eleven Sandhill Dunnart Monitoring Sites since the commencement of monitoring in 2015. Five survey sites were burned during the summers of 2016/2017 (Site 10 and 10B) and 2017/ 2018 (4, 5 and 11). A further five sites were burned during the summer of 2018/2019 (Sites 1, 2, 21, 22, 14) and one site (20) burned during the summer of 2019/2020. To investigate the effects of fire on fauna (including the Sandhill Dunnart), six recently burned survey sites (Sites 10, 10B, 1, 2, 14, 21) were trapped and an additional site (20) was surveyed by camera, to sample recently burnt habitats. All sites were sampled prior to fire and then subsequently sampled to determine the differences in the fauna assemblage present. To assess habitat suitability (post-fire) and measure the regrowth of native vegetation, 10 randomly selected Mulga (*Acacia aneura* or *Acacia caesaneura*), Spinifex (*Triodia desertorum*), Bertya (*Bertya dimerostigma*) and Aluta (*Aluta maisonneuvei*) plants in the early stages of regrowth (post fire) were measured (height, width and location recorded, Appendix C).

5. SURVEY RESULTS

5.1 Vertebrate Fauna Summary

In total, 127 vertebrate taxa were recorded during the field survey, comprising 50 reptiles, 59 birds, 13 native mammal and five introduced mammal species (see Appendix A, B, D and E). Fifty five species were trapped at the permanent monitoring sites and 37 taxa were recorded via motion-activated camera. Several species of conservation significance were recorded (Table 4). The Sandhill Dunnart was trapped at three monitoring sites and on camera elsewhere (Table 4). The species was not recorded west of Hope Campbell Lake, where cameras were established west of the species current known range. The Striated Grasswren and Malleefowl were recorded adjacent to the pipeline corridor. Several additional locally significant species were recorded opportunistically or during transit during the survey period (Table 4).

Table 4. Conservation Significant Fauna recorded during the survey (UTM Zone 51).

Common Name	Status	Easting	Northing	Comments
Sandhill Dunnart	Endangered	621441	6762906	Trapped: Site 7 (27/09/23)
Sandhill Dunnart	Endangered	621445	6762895	Trapped: Site 7 (03/10/23)
Sandhill Dunnart	Endangered	645302	6763144	Trapped: Site 27 (25/09/23)
Sandhill Dunnart	Endangered	584155	6765591	Trapped: Site 32 (06/10/23)
Sandhill Dunnart	Endangered	646077	6763186	Recorded on motion camera Site 6
Sandhill Dunnart	Endangered	640173	6763567	Recorded on motion camera Site 21
Sandhill Dunnart	Endangered	639172	6763813	Recorded on motion camera Site 22
Sandhill Dunnart	Endangered	645206	6763231	Recorded on motion camera Site 27
Sandhill Dunnart	Endangered	647682	6763751	Recorded on motion camera (TGM Dune)
Sandhill Dunnart	Endangered	648088	6764188	Recorded on motion camera (TGM Dune2)
Sandhill Dunnart	Endangered	619457	6763139	Recorded on motion camera (old camp)
Sandhill Dunnart	Endangered	583452	6765487	Recorded on motion camera (trench)
Sandhill Dunnart	Endangered	578767	6765525	Recorded on motion camera (West T2)
Sandhill Dunnart	Endangered	578251	6765629	Recorded on motion camera (Grasswren)
Sandhill Dunnart	Endangered	577459	6765759	Recorded on motion camera (West Marble)
Sandhill Dunnart	Endangered	579438	6765525	Recorded on motion camera (Allocas)
Malleefowl	Vulnerable	645876	6763450	Active Mound
Malleefowl	Vulnerable	505649	6776313	Active Mound (Irwin Hills)
Malleefowl	Vulnerable	638889	6751453	Recently used mound
Malleefowl	Vulnerable	641323	6761159	Old Mound
Malleefowl	Vulnerable	643938	6762983	Old Mound
Malleefowl	Vulnerable	604082	6729288	Old Mound
Malleefowl	Vulnerable	622894	6762128	Old Mound
Malleefowl	Vulnerable	641657	6760802	Fresh tracks
Brush-tailed Mulgara	P4	560648	6767542	Recorded on Camera (West Dune 1)
Brush-tailed Mulgara	P4	512897	6772239	Recorded on Camera (Irwin Plains 2)
Brush-tailed Mulgara	P4	621457	6762990	Recorded on Camera (Site 7)
Brush-tailed Mulgara	P4	472874	6781256	Recorded on Camera (Far West 1)
Brush-tailed Mulgara	P4	473726	6781457	Recorded on Camera (Far West 2)
Brush-tailed Mulgara	P4	473779	6781298	Burrow observed
Brush-tailed Mulgara	P4	512899	6772238	Burrow observed
Brush-tailed Mulgara	P4	621487	6763000	Burrow observed
Brush-tailed Mulgara	P4	621514	6762974	Burrow observed
Brush-tailed Mulgara	P4	474380	6781026	Burrow observed
Brush-tailed Mulgara	P4	556081	6768231	Burrow observed
Brush-tailed Mulgara	P4	555957	6768345	Burrow observed
Striated Grasswren	P4	555935	6768475	Two birds seen on pipeline corridor
Long-tailed Dunnart	P4	503157	6775354	Recorded on Camera
Long-tailed Dunnart	P4	502954	6775594	Recorded on Camera
Gilbert's Whistler	Local	575090	6766012	Recorded on Camera FB5

5.2 Trapping Results

A total of 55 species were recorded from 495 captures (47 reptile, seven mammal and one bird species, Table 5). Additional species were recorded opportunistically, or via motion cameras (Appendix B).

Table 5. Species Trapped During the Survey Period from each Monitoring Site.

Species	1	2	6	7	9	10	12	13	14	15	19	21	22	23	24	25	27	28	30	31	32	10B	10R	13R	23R	7R	Total
Anilios bicolor																1											1
Anilios waitii	1																					1					2
Brachyurophis fasciolatus																					1						1
Cryptoblepharus australis										1										1							2
Ctenophorus clayi																						6	1				7
Ctenophorus cristatus		2										1															3
Ctenophorus fordi																						1					1
Ctenophorus isolepis							1		2							3											6
Ctenophorus nuchalis	1								1																		2
Ctenotus brooksi		1			1						1							1				3					7
Ctenotus calurus																			2								2
Ctenotus dux													1														1
Ctenotus kutjupa					3	3				1							1					2	1			3	14
Ctenotus pantherinus				1																							1
Ctenotus quattaurodecimlineatus				2				1						1	2	1			1	1	1						10
Ctenotus schomburgkii										2			1				1			2	3						9
Cyclodomorphus melanops														1													1
Delma butleri																		1									1
Delma petersoni															1												1
Demansia cyanochasma																					1						1
Diplodactylus laevis		1																									1
Diplodactylus wiru							1				1																2
Diporiphora reginae														1													1
Eremiascincus richardsoni											1																1
Gehyra purpurescens	1			1				2		3							1				1	1					10
Lerista bipes	2	6		5	7	7		2	5	3	1	2	6		2		2	3		5	2	5		1			66
Lerista desertorum																					1						1
Lerista taeniata													1												1		2
lerista timida																					1						1
Lialis burtonis														1													1
Liopholis inornata	2				1	3	2			1				3	2	1	3	1				3	1		1		24
Liopholis striata									1																		1
Lucasium dameum	8	3		1	9	7		6	5	4		2	2	1	3						1	8					60
Menetia greyi										1																	1
Moloch horridus								1																			1
Morethia butleri							1	1					1								1						4
Nephrurus laevissimis	4	10			3	1		1	1	1	9	1	2			1	5	6	1	6		1		1	1	2	57
Nephrurus levis																2											2
Ningaui ridei			4	4	7		8			9	2	8		4	2			1	7	7	4		1	5			73
Ningaui yvonnae							1	2						3				1									7
Notomys alexis		3				1				1											3						8
Owlet Nightjar																							1				1
Parasuta monachus													2														2
Pogona minor														1													1
Proablepharus reginae			1															1									2
Pseudomys hermannsburgensis	1						1												4	4						1	11
Pygopus nigriceps	1									1			1												1		4
Rhynchoedura ornata					1				8	2		1										1	2	1			16
Simoselaps bertholdi							1																				1
Sminthopsis dolichura		1					4	4	1	1			1		1	1		1		2	2			6			25
Sminthopsis hirtipes	1							1	4				1			1	3	3	3	4	2	1	2				26
Sminthopsis psammophila				2													1				1						4
Tiliqua multifasciata															1												1
Varanus eremius				1																							1
Varanus tristis																		1	1	1							3
Total	**22**	**27**	**5**	**17**	**32**	**22**	**20**	**21**	**28**	**30**	**16**	**15**	**19**	**16**	**14**	**11**	**17**	**20**	**19**	**33**	**25**	**33**	**9**	**14**	**4**	**6**	**495**

Each mammal captured was individually marked using a hair clipping code (small areas of fur were temporarily clipped above the base of the tail). Therefore, the number of individual mammals trapped at each survey site was recorded (Table 6). Overall, 134 individuals were recorded from 154 captures, with 20 recaptures.

Table 6. Mammals recorded from survey sites.

Species	1	2	6	7	9	10	12	13	14	15	19	21	22	23	24	25	27	28	30	31	32	10B	10R	13R	7R	Total
Ningaui ridei			4	4	6		6			7	1	7		3	2			1	6	6	3		1	5		62
Ningaui yvonnae							1	2						3				1								7
Notomys alexis		3				1				1											3					8
Pseudomys hermannsburgensis	1						1												3	3					1	9
Sminthopsis dolichura		1					2	4	1	1			1		1	1		1		2	1			6		22
Sminthopsis hirtipes	1							1	4				1			1	2	2	2	4	1	1	2			22
Sminthopsis psammophila				2													1				1					4
Total	**2**	**4**	**4**	**6**	**6**	**1**	**10**	**7**	**5**	**9**	**1**	**7**	**2**	**6**	**3**	**2**	**3**	**5**	**11**	**15**	**9**	**1**	**3**	**11**	**1**	**134**

5.3 Breeding and Shelter Observations

Breeding was observed to be widespread within the rodents and Dasyurids. Two species of Dasyurid (*Sminthopsis hirtipes* and *S. dolichura*) were recorded sheltering in regenerating areas post disturbance (fire and land clearance).

5.4 Sandhill Dunnart

The Sandhill Dunnart was trapped during the field survey from three sites (Tables 5 and 6). All sites comprised mature vegetation that had not experience wildfire for many years. Additional records came from the camera monitoring sites including where the species has been regularly recorded (e.g. Site 7), from sites where the species is rarely recorded (e.g. Site 27, Figures 2 and 3) and from sites appearing to support suitable habitat, but from which the species had not been previously recorded (Sites TGM Dune 2, see Table 4). Most sites supporting the Sandhill Dunnart are situated within large habitat patches. However three sites situated within fragmented habitat (by wildfire) appear to have been recently re-colonised as post-fire regeneration in surrounding areas has elevated habitat connectivity, allowing for the movement of individuals.

Figure 2. Sandhill Dunnart recorded during the survey.

Figure 3. Sandhill Dunnart identified on camera, note the large head, ears, tail, head stripe.

Ten cameras were established west of the species current known range, aiming to determine if the species has a wider occurrence along the EGP (e.g. between Lake Carey and Hope Campell Lake, Figure 4). Suitable habitat in this area has been previously highlighted (Riley et al. 2020) however had not been surveyed since a large wildfire removed significant areas of habitat in 2019. While the Sandhill Dunnart was not recorded the area is proposed to be surveyed further during 2024.

A summary of all Sandhill Dunnarts captured along the Eastern Goldfields Pipeline is presented in Table 7. Figure 4 displays the species extent along the Eastern Goldfields Pipeline and the surrounding area.

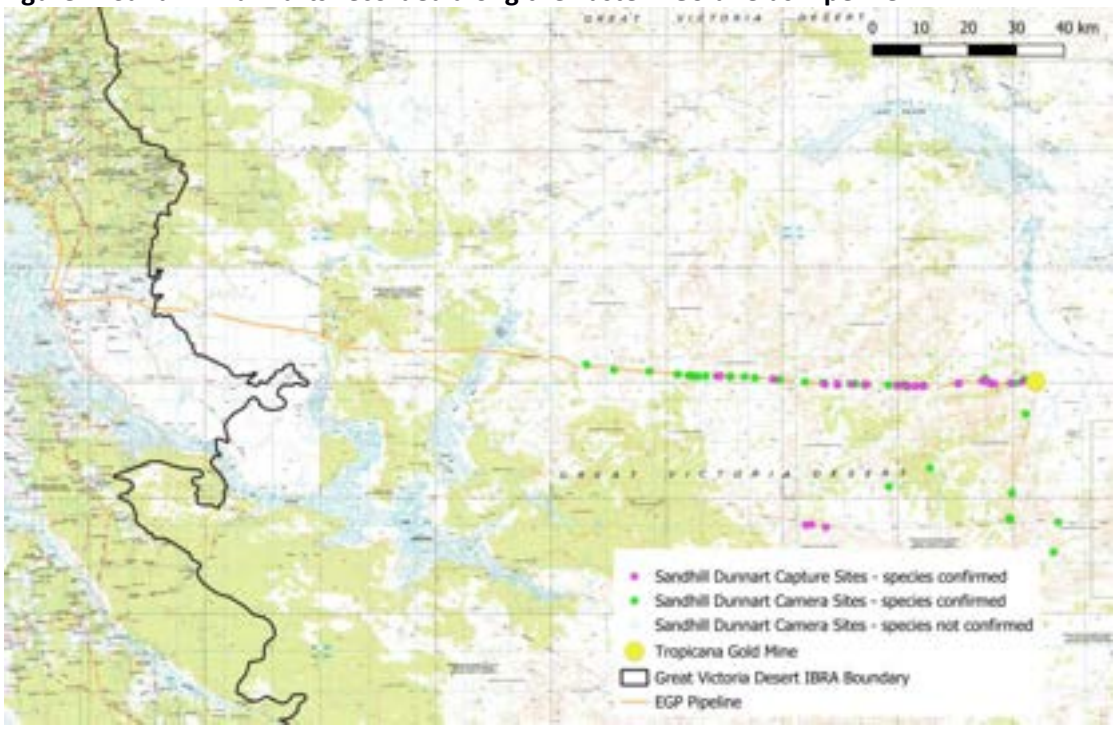
Table 7. Sandhill Dunnart Measurements from Tropicana.

Year (Site)	Date	SHD #	Weight (g)	Tail-length (mm)	Head (mm)	PES short (mm)	PES long (mm)	Sex	Age	Notes / collections
2014 (1)	26/5/15	-	47	93	43.4	19.3	24.3	Male	Adult	Hair, tissue & scat collected
2015 (1)	17/4/15	-	40	104	Esc	20.36	-	Male	Adult	N010 – DNA sample
2015 (5)	21/4/15	1	29	115	38.37	20.25	-	Male	Sub adult	N125 – DNA sample
2015 (T1)	6/7/15	-	33	111.93	39.84	20.69	26.92	Male	Adult	Hair, tissue collected
2015 (T2)	13/7/16	2	27	104	-	19.2	23.5	Female	Sub Adult	Hair, tissue & scat collected
2015 (10)	16/9/16	3	35	104	-	20.1	-	Male	Adult	Testes (10.3x7)
2015 (11)	17/9/16	1	39	120	35	20.7	-	Male	Adult	Testes (11x9.3)
2016 (10)	6/3/16	4	32	108	32	15.35	20.46	Male	Adult	DNA, scat collected
2016 (9)	6/3/16	5	28	96	39	19.57	23.65	Female	Sub adult	Undeveloped pouch, DNA, scat
2016 (14)	9/3/16	6	32	91	36.5	20.5	22.08	Female	Sub adult	Undeveloped pouch, DNA, scat
2016 (15)	13/3/16	7	23	91.1	26.5	14.5	19.0	Female	Sub adult	Undeveloped pouch, DNA, scat
2016 (4)	18/3/16	-	25.3	101	33.4	19.6	23.6	Female	Sub adult	Undeveloped pouch, DNA, scat
2016b (7)	28/9/16	8	39	123	37	21.0	24.88	Male	Adult	DNA, scat collected
2016b (7)	28/9/16	-	32	114	30.2	18.96	22.73	Female	Adult	Pouch young: Stage 4, DNA, scat
2016b (10)	30/9/16	-	27	87.7	31.9	19.99	23.01	Female	Adult	Pouch young: Stage 4, DNA, scat
2016b (12)	30/9/16	-	37.5	82.5	31.6	20.2	24.7	Female	Adult	Pouch (4), scat, re-trapped 2/10
2016b (14)	1/10/16	-	34.5	97.4	36.6	19.6	23.4	Female	Adult	Pouch young: Stage 4, DNA, scat
2016b (10)	5/10/16	9	36	115.0	38.18	21.17	26.65	Male	Adult	DNA, scat collected
2016b (11)	9/10/16	10	42	100.57	-	21.9	25.03	Male	Adult	DNA, scat collected
2017 (15)	12/3/17	11	32	109	37	20.8	25.0	Male	Sub Adult	(Testes 5.1x5.1mm), DNA, Scat

Year (Site)	Date	SHD #	Weight (g)	Tail-length (mm)	Head (mm)	PES short (mm)	PES long (mm)	Sex	Age	Notes / collections
2017 (7)	16/3/17	12	38	106	36	20.9	25.1	Male	Adult	(Testes 6.3x7.9mm), DNA, Scat
2017 (20)	17/3/17	13	31	108.1	36.6	21.5	26.4	Male	Sub Adult	(Testes 4.7x7.1mm), DNA, Scat
2017 (13)	20/3/17	14	26	104	38.5	20.11	25.11	Female	Sub Adult	DNA, scat, pouch inactive
2017 (7)	9/10	15	26.3	97.7	-	18.45	25.7	F	Adult	Pouch Young (rice)
2017 (7)	9/10	16	36.7	125.5	38.4	21.8	27.35	F	Adult	Pouch Young (bean)
2017 (14)	10/10	17	34.5	95	43.6	18.85	22.97	M	Adult	DNA, scat collected
2017 (15)	13/10	18	34	120.13	38.84	22.27	25.79	M	Adult	DNA, scat collected
2017 (10)	14/10	F	41.2	Released due to the size of pouch young				F	Adult	Pouch Young (large)
2017 (21)	15/10	19	37.8	106	-	20.6	25.83	M	Adult	Testes: 10.67 x 9.12
2017 (12)	15/10	20	41.5	109.5	-	24.15	28.6	M	Adult	Testes: 8.31 x 9.05
2018 (10)	04/03	21	26	99.9	37.4	20.12	24.6	F	Adult	Clean pouch (Stage 1), scats
2018 (10)	04/03	22	45.5	113.8	38.8	21.5	28.1	M	Adult	Testes: 10.61 x 10.92
2018 (14)	04/03	23	32.6	113.2	37.11	20.9	25.1	M	Adult	Testes: 7.7 x 7.02
2018 (21)	06/03	24	29.5	107.1	36.9	20.5	23.6	M	Adult	Testes: 6.3 x 6.3
2018 (9)	06/03	25	30.5	108.5	36.8	20.05	24.32	M	Adult	Testes: 6.2 x 4.9
2018 (9)	07/03	26	31.03	106.02	35.72	21.42	24.9	M	Adult	Testes: 6.92 x 6.2
2018 (15)	08/03	27	34.32	105.1	37	20.4	25.9	M	Adult	Testes: 8.5 x 6.8
2018 (23)	08/03	28	35.44	107.7	36.6	21.6	26.2	M	Adult	Testes: 6.6 x 6.6
2018 (13)	08/03	29	27.91	108.6	35.6	20.1	25	F	Adult	Clean pouch (Stage 1)
2018 (4)	13/03	M	36.5	102	34.5	19.9	24.5	M	Adult	Testes: 6.1 x 5.7
2018 (10)	07/09	30	27	65.9	38.9	18.4	23.5	F	Adult	Pouch stage 2
2018 (15)	08/09	31	25.5	122.2	39.1	21.6	27.1	M	Adult	Testes: 11.0 / 8.9
2018 (7)	08/09	32	42.8	105.2	40.6	20.1	24.2	M	Adult	Testes: 11.0 / 13.0
2018 (20)	09/09	33	23.32	93.53	37.2	20.3	24.1	F	Adult	Pouch stage 2
2018 (20)	09/09	34	26.13	109.1	38.6	20.9	26.4	F	Adult	Pouch stage 2
2018 (12)	09/09	35	42	111.7	40.8	21.6	27.7	M	Adult	Testes: 10.6 / 10.7
2018 (15)	11/09	36	27.68	98	NA	20.1	24.5	F	Adult	Pouch stage 2
2018 (7)	11/09	37	36.2	120	38.3	20.3	25.2	M	Adult	DNA, scat collected
2018 (23)	12/09	38	41.3	108.2	36.6	21.0	24.3	M	Adult	DNA, scat collected
2018 (13)	13/09	39	41.7	104.4	43	20.8	23.2	M	Adult	DNA, scat collected
2018 (9)	15/09	40	36.86	105.8	37.1	21.5	27.1	M	Adult	Testes: 10.2 / 10.5
2019 (10)	10/5	41	22.52	102.4	-	21.3	23.8	F	Adult	Clean pouch (Stage 1)
2019 (10)	10/5	42	27.12	115	-	19.6	23	M	Adult	Testes: 7.4 / 11
2019 (7)	10/5	43	22.5	90.5	-	20.3	23.5	F	Adult	Clean pouch (Stage 1)
2019 (9)	13/5	44	26.13	112.5	-	24.6	20.4	M	Adult	Testes: 9.7 / 6.5
2019 (13)	17/5	45	24.12	112.4	-	25.2	20.9	M	Adult	Testes: 10.21/ 6.2
2019 (9)	26/9	-	34.7	101.5	-	20	23.1	M	Adult	Testes: 10.2x12.5
2020 (7)	16/6	-	24.5	110.1	-	21.1	25.2	F	Adult	Clean pouch (Stage 1)
2020 (15)	16/6	-	27.0	96.14	-	18.5	22.5	F	Adult	Clean pouch (Stage 1)
2021 (7)	9/5	-	28.24	103.7	-	19.8	25.9	F	Adult	Clean pouch (Stage 1)
2021 (15)	11/5	-	32.6	113	-	20.6	24.6	M	Adult	Testes: 11.2 x 9.3
2021 (22)	13/5	-	35.8	105.2	-	20.5	25.1	M	Adult	Testes: 8.6 x 9.4
2021 (24)	14/5	-	28.5	107.4	-	19.3	24.3	F	Adult	DNA, scat collected
2021 (15)	27/08	-	25.7	93.7	36.6	18.9	23.6	F	Adult	DNA, scat collected, NSA
2021 (7)	30/08	-	37.5	104.5	38.9	21.1	25.5	M	Adult	Testes: 10.9 x12.5

Year (Site)	Date	SHD #	Weight (g)	Tail-length (mm)	Head (mm)	PES short (mm)	PES long (mm)	Sex	Age	Notes / collections
2021 (2)	01/09	-	43.8	101.2	38.0	20.1	24.5	M	Adult	DNA, Testes 11.1 x 12.9
2022 (7)	12/05	-	28	104.2		20.0	24.4	M	Adult	DNA, Testes 10.2 x 8.4
2022 (9)	10/05	-	28.7	109.7	38.1	20.1	23.4	M	Adult	DNA, Testes 10 x 8
2022 (12)	13/05	-	27.5	106.5		21.6	23.7	F	Adult	Clean pouch (Stage 1)
2022 (15)	10/05	-	29.4	107.1		20.5	24.9	M	Adult	DNA, Testes 10.2 x 8.4
2022 (7)	23/10	-	35.5	110.4	33.7	20.2	26.5	F	Adult	DNA, scat collected
2023 (12)	3/4	-	25	104.2		19.8	24.0	F	Adult	DNA, used pouch
2023 (15)	3/4	-	31.7	95	36.5	20.7	24.8	M	Adult	DNA, Testes 5.0 x 6.3
2023 (7)	4/4	-	50.42	94.4	40.0	22.2	27.4	M	Adult	DNA, Testes 7.2 x 8.3
2023 (10)	4/4	-	15	94.8	33.4	19.5	22.3	M	Sub	DNA, Testes 3.4 x 3.4
2023 (10)	8/4	-	32	106		20.1	22.2	M	Adult	DNA, Testes 7.0 x 9.5
2023 (22)	5/4	-	27.7	102	37.8	20.1	24.1	M	Adult	DNA, Testes 7.1 x 5.6
2023 (21)	10/4	-								Escaped no measurements
2023 (29)	12/4	-	30.5	119.8	33.9	20.9	24.5	M	Adult	DNA, Testes 6.4 x 7.3
2023 (7)	27/9	-	38.5	106.9	40.5	20	24.6	M	Adult	DNA, scat collected
2023 (7)	3/10	-	32.2	95.5		19.5	25	F	Adult	Very small pouch young
2023 (27)	25/9	-	29.45	100.3		18.7	21.5	F	Adult	DNA
2023 (32)	6/10	-	38.8	101.4	36.1	20.9		F	Adult	Very small pouch young

Figure 4. Sandhill Dunnarts recorded along the Eastern Goldfields Pipeline.



The Sandhill Dunnart has been recorded across approximately 100 km of the Eastern Goldfields Pipeline, in the vicinity of Tropicana Gold Mine (Figure 5). It has been trapped at 17 monitoring sites along the pipeline and at three sites to the south. Additional motion camera records have come from the pipeline corridor (15 spatially independent sites) and also at a few scattered sites to the south. The species has not been recorded to the north of the pipeline, and as such, the pipeline corridor lies at the species north-eastern range extent.

The Sandhill Dunnart has been recorded within long-unburnt Eucalypt woodland, mallee and mature spinifex (typically *T. desertorum* or *T. basedowii*, less commonly *T. rigidissima*) with a variable and complex shrub layer and often in association with a sand dune. Vegetation supporting the Sandhill Dunnart is summarised in Tables 9 - 11. Spinifex cover ranges from 11% to 37% and with spinifex hummocks typically of Stage 5 (although ranging from stages 2-5 at some sites) and 30 – 50 mm high. In total, 88 taxa have been recorded at sites occupied by the Sandhill dunnart. Most sites supporting the Sandhill Dunnart are long unburnt and include:

- Spinifex (*Triodia desertorum* and *Triodia basedowii*);
- Eucalypts (*E. gongylocarpa*, *E. youngiana*, *E. leptopoda*, *E. trivalva*, *E. glomerosa,E. concinna, E. ceratocorys*);
- Variable and fire-sensitive shrub-layer indicative of late seral stages including *G. juncifolia, G. didymobotrya, C. preissii, H. francisiana, A. acutivalvis, A. spinosissima, B. dimerostigma, A. maisonneuvei, T. biseriata, L. fastigiatum,* several *Acacias,C. gilesi, S. acuminatum, X. thorntonii, P. coriacea, D.grahamii.*
- Densely vegetated ground cover: *L. deserti, L. leucocephala, L. chambersii.*

Occupied sites support a diverse and dense vegetation that develops in the absence of fire. Late seral stages of vegetation include large, densely packed spinifex (or other ground cover) hummocks, thickets of shrubs and an abundance of litter and logs. As such, the Sandhill Dunnart inhabits long-unburned vegetation that provides the range and abundance of sites required for protection and shelter. Most sites supporting the Sandhill Dunnart along the Eastern Goldfields Pipeline comprise mature vegetation (Tables 9 - 11). Despite ongoing monitoring, the Sandhill Dunnart has not been recorded at previously occupied sites after a fire event (e.g. Sites 1, 2, 10B, 5, 20 and 11, no longer support the species after experiencing high intensity fire). The youngest age of vegetation supporting the species is 14 years post-fire.

Table 8. Sandhill Dunnart habitat characteristics.

Site	Burnt	Burn Age	Triodia Stage	Shrub Cover	Dominant Shrubs
1	Jan 2019	4	1	0 - 5 %	Recently burnt, *A pannosa, C cotinifolius*
22	No	40+	5 (1-5)	20 %	*Acacia, Aluta maisonneuvei, Thryptomene*
21	Jan 2019	4	1	0 - 5 %	Recently burnt
14	Jan 2019	4	1	0 - 5 %	Recently burnt
10	Dec 2016	40+ / 7	5 (1-5)	19 %	*Allocasuarina, Acacia*
10B	Dec 2016	7	1 or 2	2 %	Recently burnt*, Bertya*
9	No	40+	5 (1-5)	19 %	*A spinosissima*, *G. didymobotrya*, *C. giles*i
15	No	40+	5 (3-5)	19 %	*Acacia, Aluta maisonneuvei, G. didymobotrya*
7	Dec 2001	22	3 (1-5)	23 %	Acacia, *A spinosissima, L. fastigiatum*
23	Dec 2001	22 / 40+	5 (3-5)	NA	*Hakea, Grevillea,* mixed *Acacia*
24	Dec 2001	22	4 (3-5)	NA	*Hakea francisiana, Grevillea juncifolia*
13	No	40+	5 (3-5)	20 %	Acacia species, *Grevillea* species, Hakea, Bertya
12	No	40+	5 (3-5)	20 %	Acacia species, *Grevillea* species, Hakea, Bertya
20	No	40+	5 (3-5)	NA	*Hakea, Grevillea,* mixed *Acacia*
5	Dec 2016	7	1-2	18 %	*Hakea, Grevillea,* mixed *Acacia*
11	Dec 2016	7	1-2	NA	*Hakea francisiana, Grevillea juncifolia*
4	Dec 2016	40+ / 7	1-2	NA	*H. francisiana, G. juncifolia, M. hamata*
6	Jan 1997	26	4 (3-5)	NA	*Hakea, Grevillea,* mixed *Acacia*
27	Jan 1997	26	4 (3-5)	NA	*Hakea, Grevillea,* mixed *Acacia*

Table 9. *Triodia* Measurements at monitoring sites (Percentage Cover listed under %).

Site	Triodia Species	%	Height	Width	Separation	Stage	Dominant	Canopy
1	*T. desertorum*	37	38	54	8	3-5	5	-
14	*T. rigidissima, T. basedowii*	21	41	83	36	2-4	3	65
9	*T. desertorum*	11	33	42	34	1-5	5	40
10	*T. desertorum*	22	37	57	13	2-5	5	-
15	*T. desertorum (dune), T. basedowii (swale)*	22	37	58	13	3-5	5	41
7	*T. desertorum (dune), T. basedowii (swale)*	29	35	51	10	1-5	3	-
5	*T. desertorum*	25	34	50	12	1-5	2	-
11	*T. desertorum (dune), T. basedowii (swale)*	16	34	55	11	1-5	5	-
4	*T. desertorum*	20	35	30	16	3-5	5	-

Table 10. Dominant Vegetation at Sandhill Dunnart Sites.

Dominant Vegetation	1	1R	21	22	14	10	10B	9	15	7	23	24	13	12	20	5	11	4	6
Triodia desertorum	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Triodia basedowii	X	X		X	X				X	X	X		X	X	X		X		
Triodia rigidissima					X														
Lepidobolus deserti			X	X			X	X	X	X	X							X	
Schoenus hexandrus				X		X		X		X					X				
Eucalyptus gongylocarpa	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
Eucalyptus youngiana		X		X		X	X		X	X	X	X	X		X	X		X	X
Eucalyptus leptopoda					X	X			X	X									
Eucalyptus trivalva													X				X		
Eucalyptus glomerosa	X		X	X					X										
Eucalyptus concinna								X	X				X	X	X				

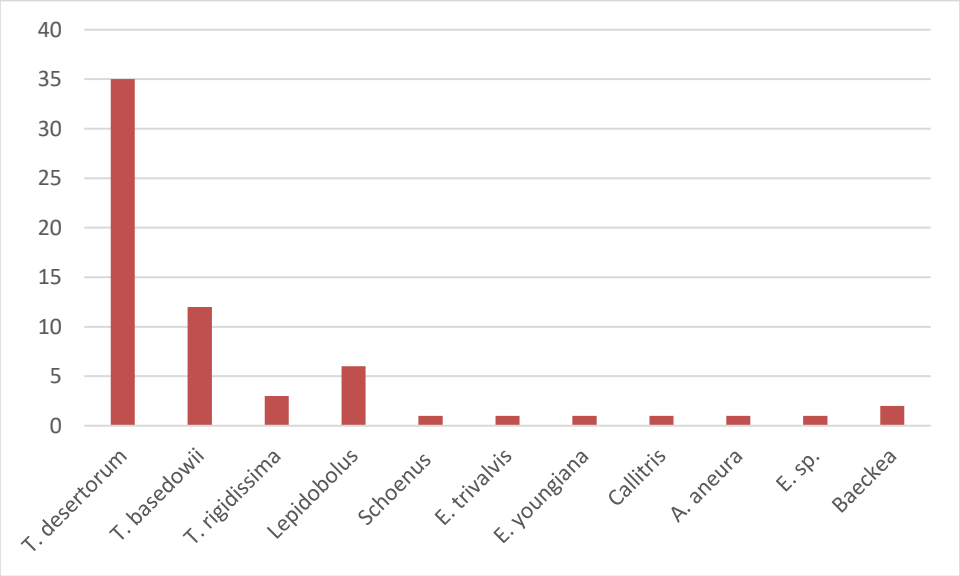
Dominant Vegetation	1	1R	21	22	14	10	10B	9	15	7	23	24	13	12	20	5	11	4	6
Eucalyptus ceratocorys						X		X			X		X		X				
Eucalyptus oleosa			X										X						
Eucalyptus horistes									X										
Callitris preissii	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Grevillea juncifolia	X		X				X		X	X	X	X	X	X		X	X		
Grevillea didymobotrya			X	X		X	X	X	X	X	X		X					X	
Grevillea nematophylla								X						X					
Grevillea sarissa																			
Grevillea secunda											X								
Grevillea stenobotrya				X				X			X		X	X					
Hakea francisiana				X		X		X	X	X	X	X	X	X	X	X	X		
Calothamnus gilesi								X	X										
Allocasuarina acutivalvis									X		X				X				
Allocasuarina spinosissima						X		X	X	X	X								
Bertya dimerostigma	X	X		X		X	X	X	X	X			X	X	X	X	X	X	
Aluta maisonneuvei	X		X	X	X	X	X	X	X	X			X					X	
Thryptomene biseriata	X	X	X	X	X	X		X	X	X	X		X			X		X	
Baeckia sp. GVD			X	X	X	X			X	X								X	
Homalocalyx thryptomenoides				X	X	X		X	X	X	X				X				
Enekbatus eremaeus																			
Cryptandra distigma					X				X					X	X				
Micromyrtus flaviflora			X		X														
Micromyrtus stenocalyx			X	X				X	X							X		X	X
Lomandra leucocephala	X	X		X		X	X	X	X	X	X		X						
Anthotroche pannosa	X	X	X				X	X	X	X			X						
Microcorys macredieana			X	X							X								
Conospermum toddii			X	X				X											
Caesia rigidifolia			X					X											
Acacia acanthoclada			X	X					X	X	X				X				
Acacia burkittii														X					
Acacia colletioides	X				X														
Acacia desertorum var. desertorum						X		X		X	X				X				
Acacia eremophila									X	X	X								
Acacia gilesiana															X				
Acacia helmsiana			X	X									X	X	X	X			
Acacia jamesiana		X	X	X		X			X	X	X				X				
Acacia ligulata	X	X						X	X	X	X		X	X					
Acacia prainii		X	X	X					X	X			X		X				
Acacia rigens						X				X									
Acacia aneura complex	X	X	X		X	X		X	X										
Acacia ramulosa	X		X			X			X										
Acacia sibina			X			X	X								X				
Santalum acuminatum				X				X	X						X				
Santalum murrayanum														X					
Xanthorrhoea thorntonii						X	X		X		X		X			X			
Persoonia coriacea						X	X	X	X	X	X		X		X			X	
Leptospermum fastigiatum				X		X	X	X	X	X						X		X	
Leptosema chambersii				X				X		X	X		X	X	X				
Daviesia grahamii		X	X			X	X	X	X										
Daviesia purpurascens / ulicifolia					X		X	X		X	X			X					
Melaleuca hamata										X								X	
Melaleuca leiocarpa										X									
Dodonaea viscosa	X	X	X																
Eremophila platythamnos	X	X	X	X															
Pityrodia loricata		X	X				X		X	X	X								
Westringia rigida	X								X		X		X	X					
Chrysocephalum puteale			X	X			X		X	X	X		X						
Halgonia erecta							X	X					X	X					
Senna pleurocarpa				X										X					
Seringia elliptica					X														

Dominant Vegetation	1	1R	21	22	14	10	10B	9	15	7	23	24	13	12	20	5	11	4	6
Caustis deserti							X			X	X								
Gyrostemon ramulosus		X						X			X								
Brachychiton gregorii	X										X				X				
Gompholobium gompholobioides								X											
Olearia arida	X			X															
Dampiera eriantha						X		X	X	X									
Alyxia buxifolia													X	X					
Goodenia xanthosperma								X	X										
Brunonia australis	X																		
Stylidium limbatum								X											
Keraudrenia velutina					X		X												
Dubosia hopwoodii							X												
Scaevola basedowii		X					X	X											
Dianella revoluta									X						X				
Newcastelia hexarrhena											X								
Codonocarpus cotinifolius		X					X												
Solanum lasiophyllum		X					X												

5.5 Radiotracking

Radiotracking of Sandhill Dunnarts is conducted to collect information on sheltering and movement patterns and also to determine the usage of rehabilitation. Across all surveys, Sandhill Dunnart shelter sites have been located in a range of soil types both on sand dune crests, slopes and interdunal plains. Shelters were recorded amongst spinifex hummock grassland on both open sandplain and sand dunes and also on the margins of Mulga. While most shelters were burrows, these were often constructed under a spinifex hummock or within a spinifex ring. Most dunnarts tracked had shelters associated with *Triodia desertorum*, although *Triodia basedowii* and occasionally *T. rigidissimq,* were also used. Logs were used by five dunnarts, each one using a different species (*Callitris preissii, Eucalyptus trivalva, Eucalyptus youngiana, Acacia aneura, Eucalyptus sp.*). Six dunnarts were also recorded using burrows constructed within *Lepidobolus deserti* and one dunnart utilised *Schoenus hexandrus* (see Figure 5, Riley 2019).

Figure 5. Number of Sandhill Dunnarts using shelters associated with vegetation.



Shelter Habitat within the Pipeline Corridor

The Sandhill Dunnart has not been recorded sheltering or foraging within the rehabilitating pipeline corridor. However, three dunnarts have been previously captured in pitfall traps established within the pipeline corridor (during 2019 at Sites 13 and 10 and during 2023 at Site 10). As dunnarts' home ranges extended across both sides of the pipeline corridor, they were likely to have been trapped during transit.

Similarly, the Sandhill Dunnart has been trapped at Site 2 after a large scale wildfire. The species has not been recorded there since (either by camera or by trapping) and therefore is unlikely to reside in the local area. As such, the species is likely to forage and move across recently burnt areas, but due to the absence of vegetation, shelter sites are mostly absent.

5.6 Motion-activated Camera results

In total 53 motion-activated cameras were installed at monitoring sites and elsewhere, aiming to detect the Sandhill Dunnart across a wider range. The Sandhill Dunnart was recorded on camera at 12 locations (four trapping sites and eight camera sites, see Figures 2 and 3, Tables 4, 12, Appendix A). A wide range of additional fauna was also recorded on camera, with the Spinifex Hopping Mouse (*Notomys alexis*), Western Grey Kangaroo (*Macropus fuliginosus*) and Sandy Inland Mouse (*Pseudomys hermannsburgensis*) also widely recorded (Table 12, Figures 6 and 7).

Table 11. Fauna recorded on motion camera along the pipeline corridor.

Birds and Reptiles	Sites Recorded	Native Mammals	Sites Recorded
Tawny Frogmouth	1	*Dasycercus blythi*	5
Australian Owlet-nightjar	1	*Sminthopsis species*	23
Grey Butcherbird	1	*Sminthopsis hirtipes*	11
Pied Butcherbird	5	*Sminthopsis dolichura*	1
Crested Bellbird	2	*Sminthopsis psammophila*	12
Chestnut Quail-thrush	1	*Ningaui species*	11
Crow species	11	*Notomys alexis*	27
Inland Thornbill	1	*Pseudomys hermannsburgensis*	18
Red-capped Robin	2	*Rodent species*	12
Gilbert's Whistler	1	*Mus musculus*	1
Southern Scrub-robin	2	*Macropus fuliginosus*	10
Malleefowl	1	*Pseudantechinus woolleyae*	5
Splendid Wren	1	*Sminthopsis longicaudata*	2
White-browed Babbler	1	**Introduced Taxa**	
Black-faced Woodswallow	2	*Felis catus*	6
Ctenpohorus cristatus	1	*Vulpes Vulpes*	1
Varanus gouldii	2	*Canis familiaris*	8
Tiliqua occipitalis	1	*Oryctolagus cuniculus*	1
Varanus giganteus	1	*Camelus dromedarius*	1

Figure 6. Examples of fauna recorded on motion camera (Brush-tailed Mulgara).

Figure 7. Examples of fauna recorded on motion camera (Gilbert's Whistler and Camel).

5.7 Introduced Mammals

Six introduced mammals were recorded during the survey (summarised in Table 13). The Dingo, Camel, Fox, Feral Cat and House Mouse have been widely recorded in the local Tropicana area. The Rabbit is rarely observed in the local area; however, tracks and scats were recorded along the pipeline corridor and the species was detected via camera. The Feral Cat, Camel, Fox, and Dingo were widely recorded across the survey area during the survey period (Table 13).

Table 12. Introduced Mammals recorded during the survey.

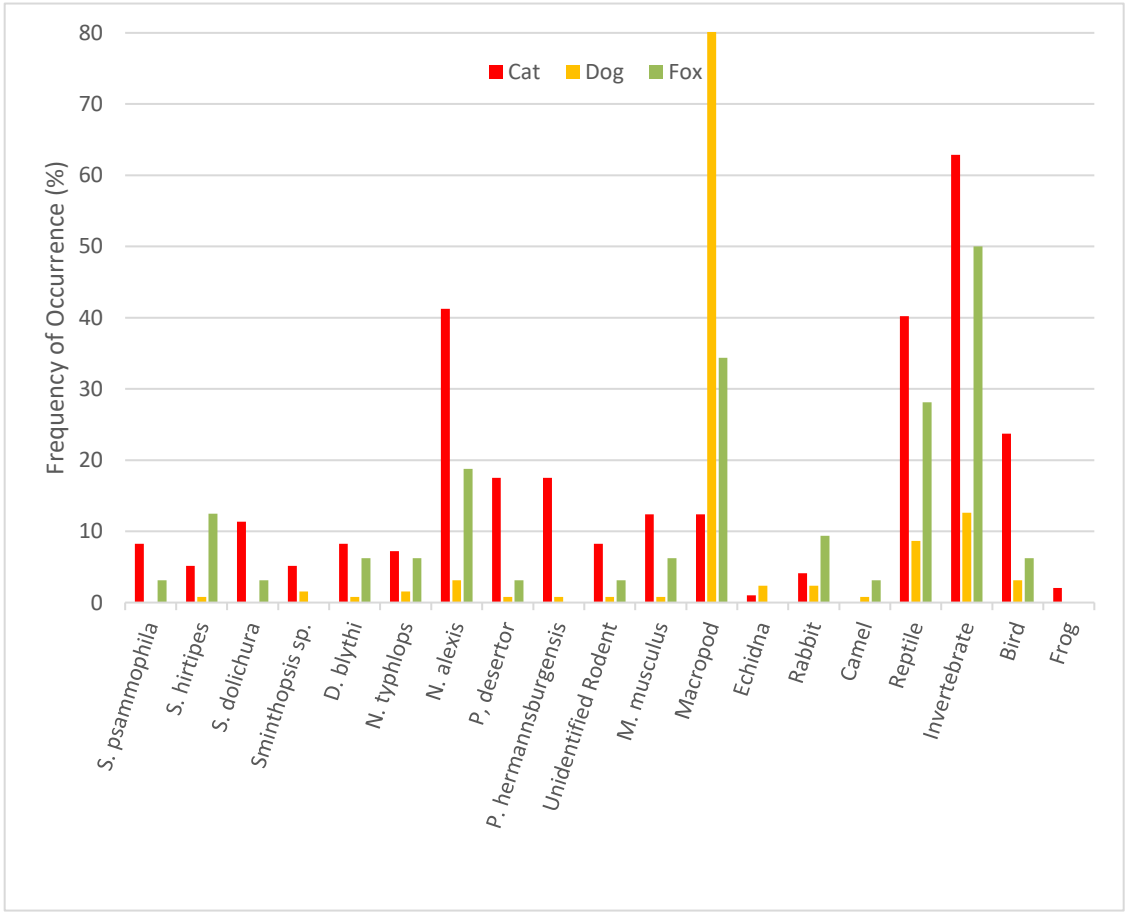
Species	1	2	6	7	9	10	12	13	14	15	19	20	21	22	23	24	26	27	28	29	32	Total
Fox (*Vulpes vulpes*)															S				S		S	3
Cat (*Felis catus*)							C															1, Opp
Dingo (*Canis lupus*)	T	T		S					1	S	C					S		T	T	T		10
Camel (*Camelus dromedarius*)	T	T		T	T	T	T		T		T	T		T	T		T	T		T	T	15
Rabbit (*Oryctolagus cuniculus*)																						Opp
House mouse *(Mus musculus)*																						Opp

Note: Opportunistic records listed under "Opp", Camera (C), Scat (S) and Track (T) records also listed.

5.8 Predator Scat Analysis

A total of 265 predator scats from the Dingo (127), Feral Cat (97), Fox (32), Goanna (*Varanus* sp., 7) and Raptors (Birds of Prey, 2) were collected and analysed (Scats About; Storey 2008, see Appendix D). Most scats contained some native mammal content and also reptile, bird and invertebrate remains (see Appendix D). The remains of 13 mammal species were identified, including three dunnarts (*S. psammophila, S. dolichura* and *S. hirtipes*), the Brush-tailed Mulgara, Southern Marsupial Mole, Spinifex Hopping Mouse, Sandy Inland Mouse, Desert Mouse and the three Macropods occurring in the area (*M. rufus, M. robustus* and *M.fuliginosus*). Macropods were a major dietary component of the Dingo, with over 80% of Dingo scats containing Kangaroo remains. A diverse assemblage was recorded from the scats of the Feral Cat and Fox which exhibited a varied diet (Figure 8). Major mammalian prey items of the Feral Cat included the Spinifex Hopping-mouse, which were present in over one third of all scats analysed. Reptile and invertebrate remains were also present in high proportions in both Feral Cat and Fox scats. A wide range of native species were recorded from Feral Cat scats (the Feral Cat exhibiting the broadest diet and consuming the most mammals). This included the Sandhill Dunnart, Brush-tailed Mulgara, and the Southern Marsupial Mole, which were recorded in much lower proportions.

Figure 8. Scat Analysis - prey species of Feral Cats, Foxes and Dingos at Tropicana. Predation is expressed as the percentage of predator scats containing each species.



5.9 Other Species of Conservation Significance

Several additional species of conservation significance have been recorded along the Eastern Goldfields Pipeline. The Malleefowl (EPBC Vulnerable) and Brush-tailed Mulgara (DBCA Priority 4) were recorded during the current survey, while the Great Desert Skink (EPBC Vulnerable), Striated Grasswren (DBCA Priority 4) and locally significance taxa have been located on preceding surveys. They are discussed below.

Great Desert Skink

The Great Desert Skink (*Liopholis kintorei*, listed as Vulnerable under the EPBC Act) has a poorly known and declining distribution (TSSC, 2016). Altered fire regimes and the introduction of the Fox and Feral Cat are key factors that have led to the species' decline, as well as habitat decay from feral herbivores (McAlpin 2001). Historically the species has been recorded from widely scattered localities across central Australia, including several records from the margins of the Great Victoria Desert (one record from 40 km east of Laverton by Pianka in 1967, DCBA, 2018; and also records from Warburton and near Baker Lake, DBCA, 2020). However, its range appears to have significantly contracted with surveys failing to detect the species in former strongholds of the Gibson and Great Victoria Deserts (McAlpin, 2001; Pearson *et al.,* 2001). In Western Australia, the species is currently known from the Tanami Desert, an area of the Gibson Desert north of Warburton, the Kiwirrkurra and Ngaanyatjarra Indigenous Protected Areas and Karlamilyi National Park (TSSC, 2016). Due to the species fragmented range, populations from three broad regions are genetically distinct and are recommended to be treated as separate management units (Dennison *et al*., 2015). The Great Desert Skink is a culturally important species to traditional Aboriginal groups (Pearson et al., 2001), and this combined with its threatened status makes its conservation a high priority for land managers across arid and central Australia.

Great Desert Skinks occupy a variety of habitats, although most populations inhabit sandplains vegetated with Triodia and scattered shrubs on red sandy soils (McAlpin 2001). They often occur on broad spinifex dominated sand plains and adjacent dunefield swales supporting *Triodia basedowii*, *T. pungens* and / or *T. schinzii* (TSSC, 2016). However, in parts of the Tanami and Great Sandy Deserts they also inhabit paleodrainage lines and in the Gibson Desert they inhabit the sandy, lateritic hilltops and slopes of rira habitats (with *Triodia*, scattered *Acacia pruinocarpa* and *A. aneura,* McAlpin 2011). In northern South Australia (Watarru) an isolated population occurs in open mulga (*Acacia aneura* complex) and minyura (*Acacia minyura*) shrubland over woollybutt grass (*Eragrostis eriopoda*) and spinifex (McAlpin 2001). Great Desert Skinks generally occupy habitat that have been burnt within the previous 3- 15 years, although can also occupy older habitat (McAlplin 2011).

The status of the Great Desert Skink in the region is unknown. The species was known from a few historical records on the desert's fringe (DBCA 2020) however recent surveys have failed to detect the species in former strongholds (McAlpin 2001, 2011; Pearson et al., 2001). Across the region, the species appears to be highly fragmented and restricted to a few isolated locations.

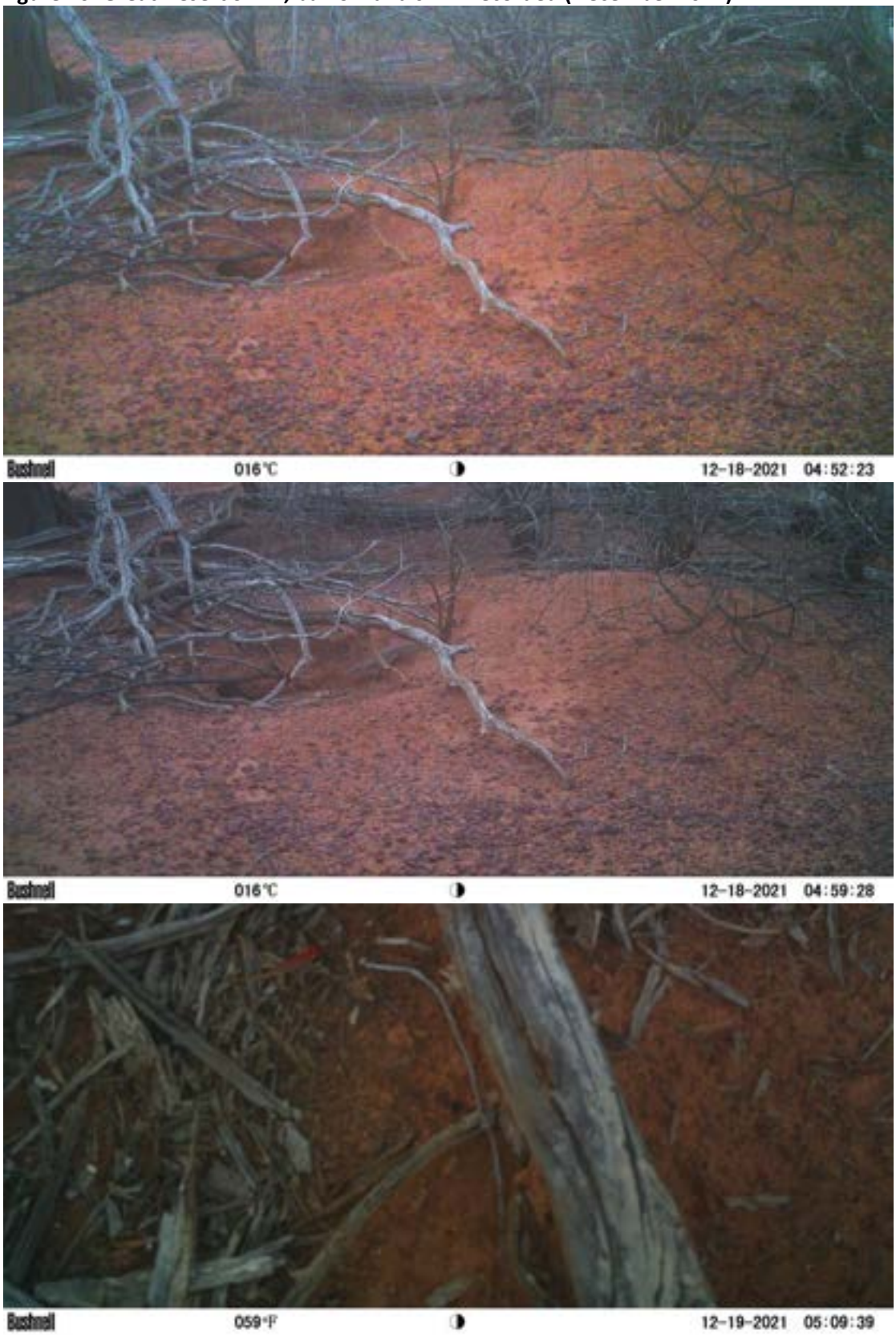
Great Desert Skinks communally inhabit large, permanent burrow complexes, (up to 13 m in diameter and over 1 m deep), with as many as twenty entrances (McAlpin *et al.* 2011). Family groups of up to four generations may co-inhabit a burrow system, with occupation and use influenced by resource availability (McAlpin *et al.* 2001). Burrows may be used continuously for over 7 years and due to the species limited dispersal capabilities, site fidelity is high (McAlpin, 2011). On the surface, burrow systems are readily identifiable by the presence of at least one large external latrine which may accumulate over an area of one to three square metres (McAlpine 2001).

The Great Desert Skink was initially recorded in the Tropicana area in 2019 (Figure 9). Fresh scats were observed at an active burrow approximately 10 km south of the pipeline, from within long unburnt Mulga (*Acacia aneura* complex) shrubland on a sandy, lateritic gravel slope. The burrow contained at least three entrances and a large, diagnostic scat latrine (with over 30 scats, Figure 10). The burrow system measured over 16m^2 and was situated amongst vegetation that had not experienced fire for over 50 years. Dominant shrubs included *A. caesaneura*, A*. incurvaneura* and *E. latrobei* subsp. *filiformis* (with *G. nematophylla*, *E. punctata*, *S. spinescens* and *P. suaveolens*) over the grasses *Monachather paradoxus* and *Eragrostis eriopoda* (with scattered *T. basedowii*).

The Great Desert Skink at Tropicana represents one of few regional records since 1970 (ALA, 2020) and is therefore of high conservation significance. It is the most southerly record for the arid zone, one of few regional populations and the only one known to inhabit long unburnt Mulga. Due to the presence of suitable habitat, the species may potentially occur along the Eastern Goldfields Pipeline (Figure 9). Target surveys did not locate further populations during 2023.

Figure 9. Great Desert Skink records, potential habitat on the Eastern Goldfields Pipeline.

Figure 10. Great Desert Skink, burrow and skink recorded (December 2021).



Malleefowl

The Malleefowl is listed as Vulnerable under the EPBC Act. The species is sparsely distributed across the Great Victoria Desert and occurs in the region at the arid extreme of its range. As Malleefowl are typically restricted to areas of dense vegetation, the species generally occurs in the Great Victoria Desert within areas of dense Mulga shrubland. Due to the effects of fire, suitable habitat is extremely uncommon and highly fragmented. The Malleefowl was recorded during the survey with mounds recorded in various state of activity (Table 4, Figures 11, 12, 13).

The Malleefowl is highly vulnerable to fire and large areas of habitat (the dense Mulga shrublands on which the species lies on for breeding) were burned during January 2019. This included the location of a formerly active mound (Figure 12, active 2016 - 2018). As Malleefowl require dense, mature shrublands for roosting and protection, and an abundance of leaf-litter for egg incubation, it is likely to be many years before the site regenerates to an age suitable for breeding. Known breeding sites are regionally very uncommon and therefore of high conservation significance. Four main areas supporting breeding Malleefowl have been recorded along the pipeline, and in the vicinity of Tropicana Gold Mine (Figures 11 and 12). These areas are monitored annually for breeding activity. Overall, five active mounds, seven recently active mounds and many old and inactive mounds have been recorded along the pipeline corridor. Active mounds recorded adjacent to the pipeline reveal the species persistence in the local area (Figures 13, 14).

Figure 11. Malleefowl records along the Eastern Goldfields Pipeline.

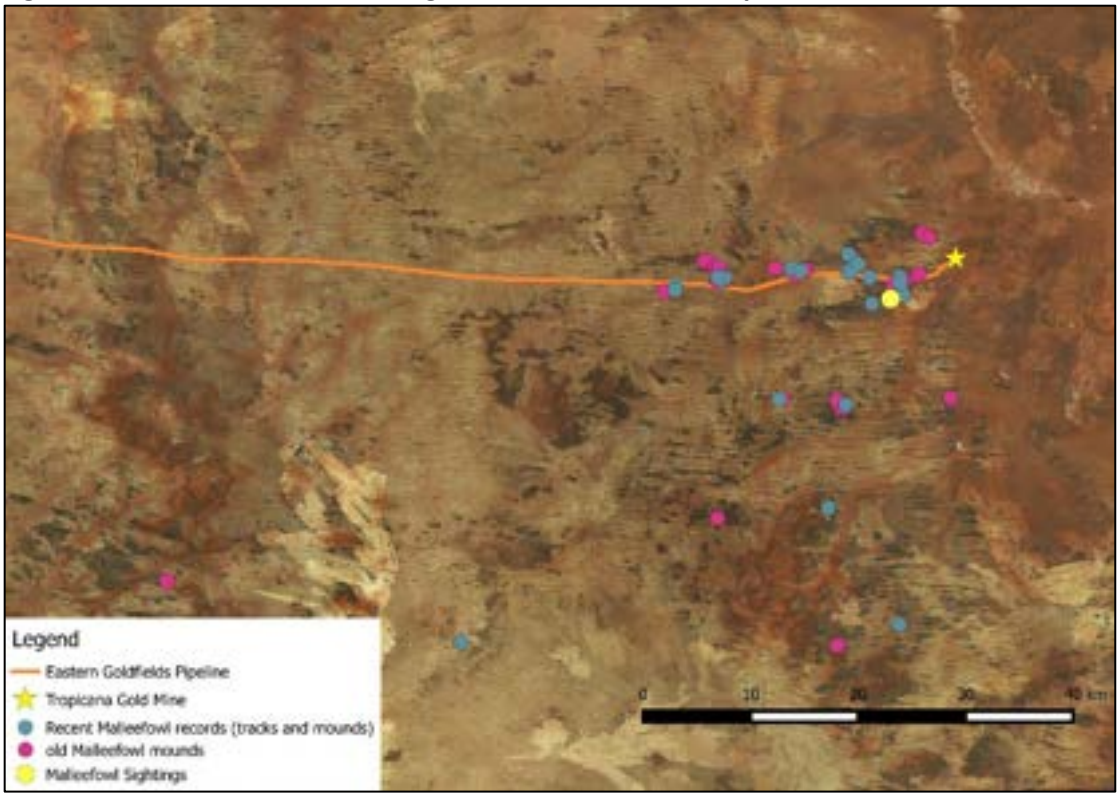


Figure 12. A formerly active Malleefowl mound (2018) burned during January 2019.

Figure 13. Malleefowl mound located during October 2023.

Figure 14. Malleefowl mound located during October 2023.

Brush-tailed Mulgara

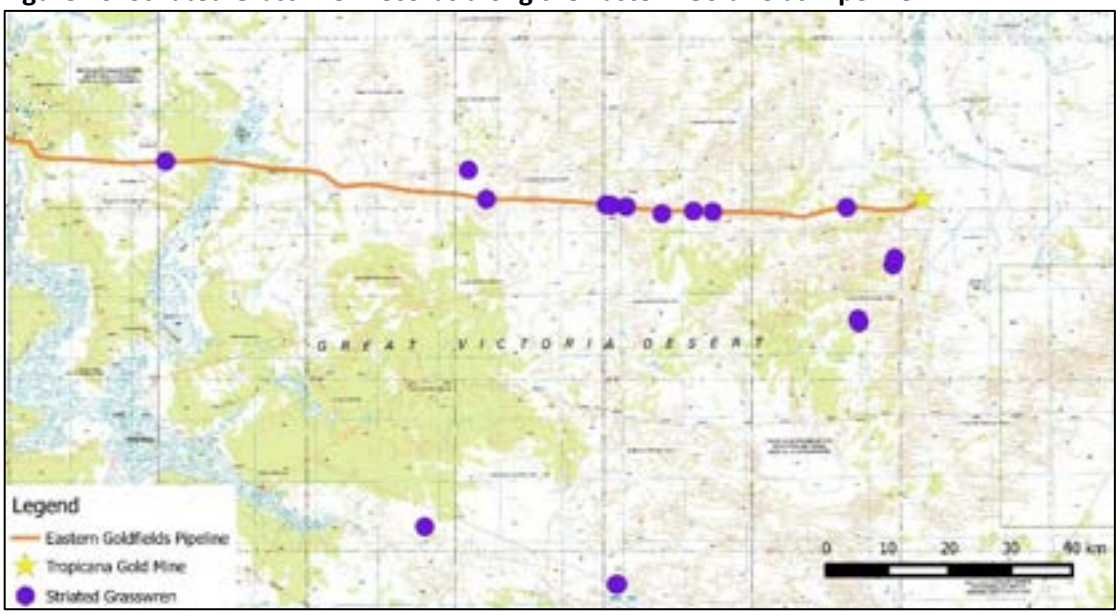
The Brush-tailed Mulgara is listed as Priority 4 by DBCA and has a scattered occurrence across the GVD with few regional records. While the species has been recorded near Lake Minigwal, there are few records near Tropicana (see Figure 15). The Brush-tailed Mulgara was trapped in the Tropicana area for the first time during the March 2018 survey and was also recorded during the 2023 survey. A number of active burrows were located along the pipeline (Figure 15). The species was recorded during the current survey via motion camera (Table 4).

Figure 15. Brush-tailed Mulgara records along the Eastern Goldfields Pipeline.

Striated Grasswren

The Striated Grasswren is listed as Priority 4 by DBCA and has a scattered occurrence across the GVD with few regional records. The species favours long unburnt spinifex grasslands, typically with a taller shrub layer. Due to the effects of fire, suitable habitat is uncommon and highly fragmented. There are few records near Tropicana with the species recorded from eight locations along the pipeline (see Figure 16). However, wide-scale fires over summer 2016 / 2017 and 2018 / 2019 have removed vegetation from at least three sites known to previously support the species. The species was recorded during 2023 (Table 4).

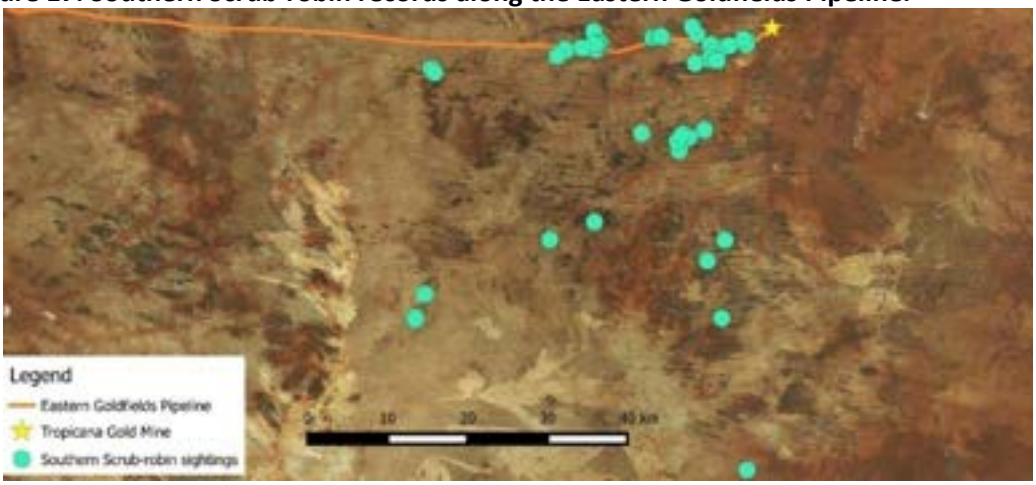
Figure 16. Striated Grasswren records along the Eastern Goldfields Pipeline.



Southern Scrub-robin

The Southern Scrub-robin occurs in the semi-arid woodlands and mallee of south-western Australia, with an isolated population in the Great Victoria Desert (including along the Eastern Goldfields Pipeline, Turpin and Johnstone 2017). Similar to the Sandhill Dunnart, the species is vulnerable to a number of threatening process including predation by the Feral Cat (Woinarski *et al*., 2017). The species has a low reproductive rate (a clutch of one egg – characteristic of arid, ground nesting birds, Holyoak 2001) and movements and dispersal appear limited (Brooker 2001; Johnstone and Storr 2004). The species is restricted to very few, scattered areas of dense Mulga shrubland with a dense understorey of *Aluta* shrubs. Occupied sites were re-surveyed and several were confirmed to support the same individuals recorded during previous visits (see Figure 17). However, wildfires since 2015 have removed large areas of habitat, resulting in population decline.

Figure 17. Southern Scrub-robin records along the Eastern Goldfields Pipeline.



Habitat regeneration (post fire) has been recorded at some previously occupied sites. Two large areas of Mulga adjacent to the pipeline were burnt during January 2017, and while regeneration has occurred since then, the height and cover of critical vegetation (Acacia and Aluta species) has not recovered to a stage suitable to provide habitat (see Figures 18 and 19). At these sites vegetation has not yet reached maturity and therefore a stage suitable to support the Southern Scrub-robin.

Figure 18. Regenerating Southern Scrub-robin habitat adjacent to the pipeline.

Figure 19. Regenerating Southern Scrub-robin habitat adjacent to the pipeline.

Rufous Treecreeper

The Rufous Treecreeper has declined throughout the woodlands of the Wheatbelt and Goldfields (Saunders and Ingram 1995) and is sparsely distributed throughout the Great Victoria Desert. As the Rufous Treecreeper requires mature hollow bearing trees and fallen logs for nesting and foraging, it is threatened by repeated, high intensity fires. The Rufous Treecreeper has been recorded from five locations along the Eastern Goldfields pipeline (Figure 20), although one site has since been burnt.

Figure 20. Rufous Treecreeper records along the Eastern Goldfields Pipeline.

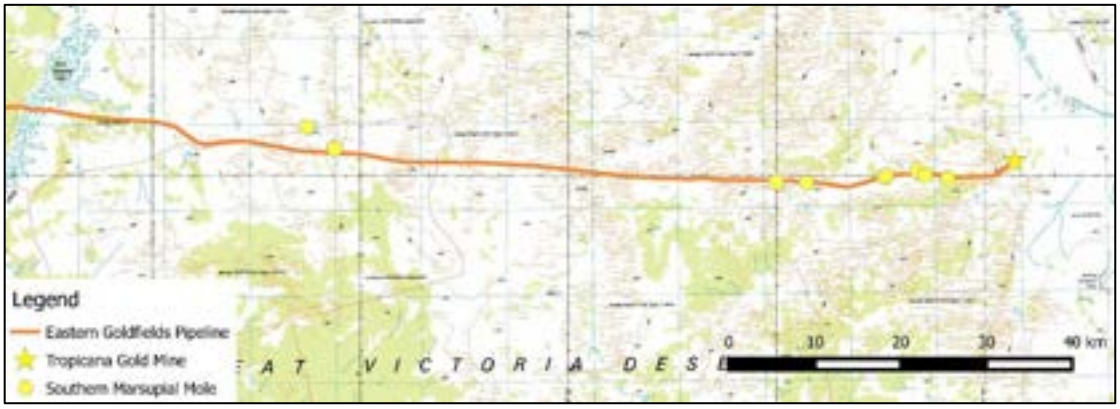
Scarlet-chested Parrot

The Scarlet-chested Parrot (*Neophema splendida*) has declined due to extensive habitat clearance and degradation (Garnett and Crowley 2000). It is sparsely distributed throughout the Great Victoria Desert and occurs at several sites along the Eastern Goldfields Pipeline (Appendix B).

Southern Marsupial Mole

The Southern Marsupial Mole is listed as Priority 4 by DBCA. The species inhabits the desert sand dune fields of inland Australia, extending from the Great Victoria Desert to the southern Northern Territory and Simpson Desert. Southern Marsupial Moles spend almost their entire like underground, and as they rarely comes to the surface, can be difficult to locate. Individuals have been recorded at several locations along the Eastern Goldfields Pipeline, from the remains of predator scats (see Section 5.8, Sites 1, 2, 7, 9, 14) and the species distinctive tracks and tunnels have also been recorded (Figure 21, Table 4).

Figure 21. Southern Marsupial Mole records along the Eastern Goldfields Pipeline.

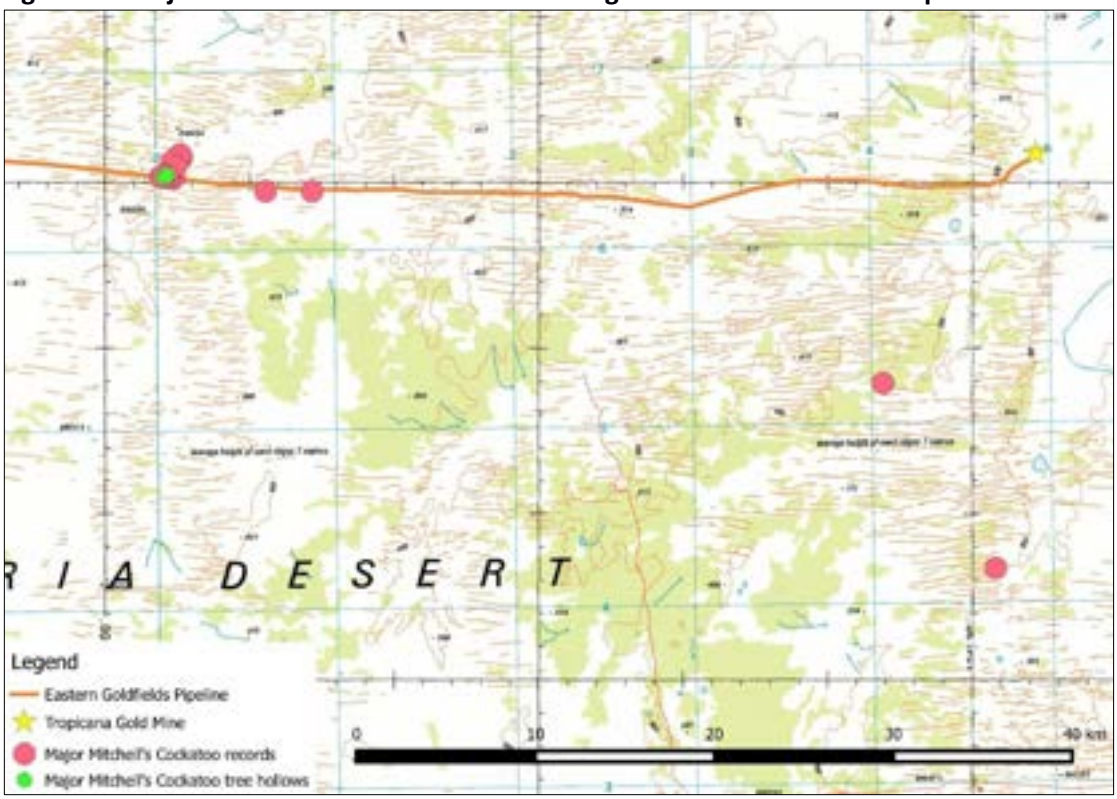


Major Mitchell's Cockatoo

The Major Mitchell's Cockatoo was listed under the Wildlife Conservation Act 1950. Due to the loss of breeding sites (mature Eucalypt trees) it has declined throughout the Murchison and Goldfields and has a highly scattered distribution across the Great Victoria Desert. A large breeding flock of up to 23 birds was recorded feeding, roosting, and foraging along the pipeline corridor, during September 2018. Three roost sites and two breeding sites (tree hollows) were located in mature Marble Gums (*Eucalyptus gongylocarpa*). Forging was observed on Callitris trees and amongst *Leptosema chambersii*. Breeding and roosting was scattered within Marble Gum Woodland and was observed amongst mature stands of Marble Gums and Callitris, where foraging remains were abundant below the many Callitris trees present (Figures 22 and 23). Since 2018 only a handful of birds have been recorded.

Figure 22. Major Mitchell's Cockatoo breeding hollow along the pipeline corridor.

Figure 23. Major Mitchell's Cockatoo records along the Eastern Goldfields Pipeline.



Long-tailed Dunnart (*Sminthopsis longicaudata*)

The Long-tailed Dunnart is listed as Priority 4 by DBCA as it is known from few scattered localities across arid western and central Australia. In Western Australia the species has been recorded from few widely separated populations, extending from the Pilbara south to the Murchison and Great Victoria Desert (DBCA, 2023). The Long-tailed Dunnart is a specialist of rugged, rocky landscapes, inhabiting rocky ridges, hills and breakaways (Pavey 2006) resulting in its highly fragmented range. There are few records for the species in the Great Victoria Desert. Throughout its range, the Long-tailed Dunnart occurs in rugged rocky landscapes that support a low open woodland or shrubland of Acacias (particularly Mulga, Pavey 2006).

The Long-tailed Dunnart was recorded adjacent to the pipeline corridor, from the slopes of the Irwin Hills (Figure 24). Due to its restricted occurrence and the minimal habitat present, it is likely to occur only in this area along the pipeline corridor within the Great Victoria Desert. Other small areas of suitable habitat are intersected by the pipeline corridor near the margins of Lake Carey within the Murchison region.

Figure 24. Long-tailed Dunnart recorded on camera at the Irwin Hills.

6. DISCUSSION

Fauna Assemblage

A similar fauna assemblage has been recorded across all surveys conducted to date. The mammal assemblage recorded has remained consistent, although capture rates have fluctuated (Table 15). Ningauis and Hopping Mice have typically been a high proportion of the mammal captures, however a reduced capture rate has been observed for most dunnarts. The Sandhill Dunnart has been captured at a comparatively low rate (0-5% of all captures), as has the Western Pygmy Possum and Brush-tailed Mulgara (<1%). A comparable capture rate and assemblage was observed within the pipeline trench during construction of the Eastern Goldfields pipeline (Table 15). However during pipeline construction, a reduced number of individuals were trapped, due to the effective management of the pipeline trench.

Table 13. Comparison of mammal captures.

Species	Survey																			EGP Trench
	2014	2015 A	2015 B	2016 A	2016 B	2017 A	2017 B	2018 A	2018 B	2019 A	2019 B	2020 A	2020 B	2021 A	2021 B	2022 A	2022 B	2023 A	2023 B	
Dasycercus blythi	2	1	0	0	0	0	0	1	0	0	1	1	1	1	0	1	0	0	0	1
Ningaui sp.	40	72	73	59	219	95	112	96	108	32	48	20	13	45	99	35	53	56	80	30
Ningaui ridei	-	-	-	-	-	-	-	-	-	27	43	13	11	35	64	23	49	47	73	-
Ningaui yvonnae	-	-	-	-	-	-	-	-	-	5	5	7	2	10	35	12	4	9	7	-
S. crassicaudata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
S. dolichura	5	5	3	5	20	15	29	20	7	2	6	3	1	20	21	17	36	15	25	24
S. hirtipes	9	17	11	9	10	9	10	32	21	5	1	3	4	28	20	27	10	32	26	16
S. ooldea	2	16	3	1	4	18	3	9	6	0	0	1	0	2	1	4	4	1	0	0
S. psammophila	1	2	2	5	8	4	7	10	12	6	1	2	0	4	3	4	1	8	4	2
S. youngsoni	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
C. concinnus	0	0	0	0	1	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0
Notomys alexis	20	52	37	20	45	106	70	234	29	21	9	2	5	15	13	15	17	16	8	7
Pseudomys desertor	4	4	0	1	1	11	10	13	3	1	0	0	0	0	0	0	1	0	0	1
P. hermannsburgensis	4	36	12	12	61	129	68	85	24	3	3	5	3	14	19	23	37	17	11	4
Mus musculus	3	11	14	8	4	38	11	13	2	0	1	0	0	0	1	2	2	1	0	0
Total	87	215	155	122	373	425	320	501	212	70	74	57	27	129	277	163	161	203	154	85

The species totals recorded during monitoring is comparable (see Table 16). Overall, two frog, 77 reptile, 118 bird and 25 native mammal species have been recorded with approximately half to two thirds of the assemblage recorded on any one survey.

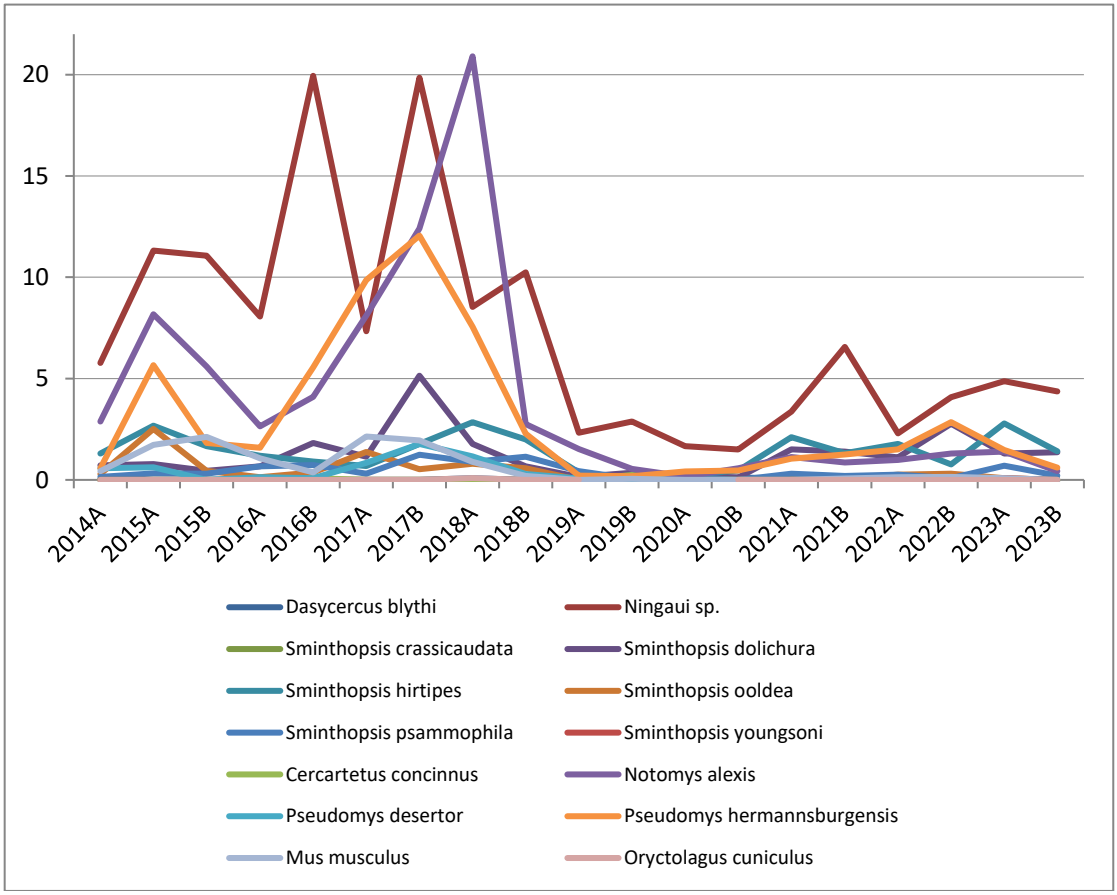
Table 14. Fauna assemblage recorded across all surveys.

Taxa	Survey																			Total EGP
	2014	2015 a	2015 b	2016 a	2016 b	2017 a	2017 b	2018 a	2018 b	2019 a	2019 b	2020 a	2020 b	2021 a	2021 b	2022 a	2022 b	2023 a	2023 B	
Frogs	0	1	0	1	0	1	0	1	0	0	0	0	0	0	0	1	0	2	0	2
Reptiles	34	33	35	50	50	50	46	47	39	18	43	11	37	25	27	28	50	46	50	77
Birds	70	59	66	62	61	67	72	73	70	62	58	52	32	44	46	52	58	60	59	118
Native Mammals	13	14	11	12	13	14	19	13	15	16	12	17	11	16	13	13	12	19	13	25
Exotic Mammals	6	6	6	6	6	6	6	6	6	5	6	6	6	5	6	6	6	6	5	6
Total	123	113	118	131	130	138	143	140	130	101	119	86	86	90	92	100	126	133	127	228

Capture Variation

The capture rate of small mammals has varied within and between sampling periods – attributable to season, temperature, rainfall, and the fire history of the sites sampled. While dunnart capture rates have been relatively consistent between sampling periods, similar to studies elsewhere in the arid zone (e.g. Dickman *et al*., 1999; How and Cooper, 2002), rodent capture rates have exhibited large fluctuations, reflecting variations in rainfall (see Figures 25 and 26). Ningaui capture rates have also fluctuated dramatically and have peaked during spring (Figures 25 and 26). The captures of the Sandhill Dunnart, while low, have exhibited small fluctuations around 1 animal per 100 trap nights.

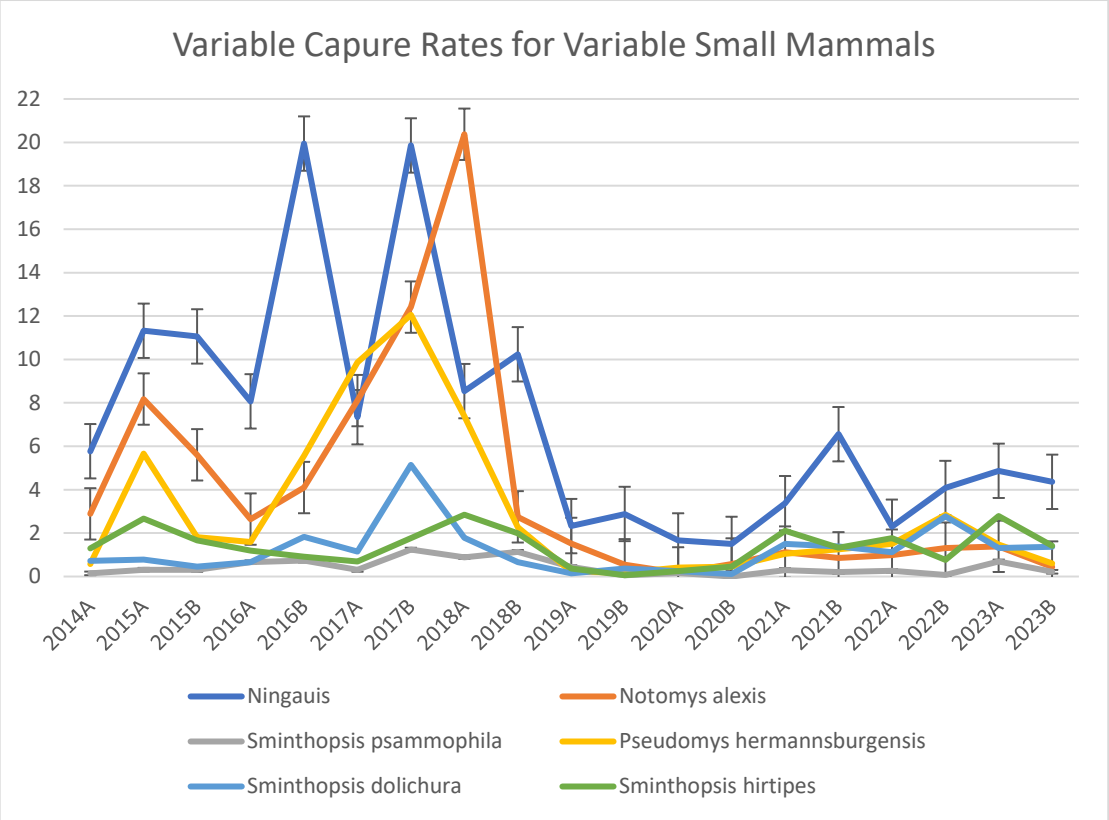
Figure 25. Variation of small mammal capture rates between sampling periods (capture rate expressed as a percentage of captures per 100 trap nights).



Dickman *et al.* (1999) showed rodent numbers to increase after significant rainfall events ("boom" phases) and drop to near indetectable levels during drought ("bust" phases), reflecting the dramatic resource-pulsing in Australian desert environments. Similarly high numbers of rodents have been recorded at Tropicana following rainfall events, with very low numbers recorded during drought. Dasyurid captures have also fluctuated with Ningaui captures varying dramatically between sampling periods (Figure 26). The Sandhill Dunnart has shown a reduced fluctuation in number, however, was trapped at its highest rate during October 2017, and lowest during 2020 (Figure 27), following a similar trend in rainfall (Appendix E). Captures of all mammals were low during 2019 and 2020, reflecting a prolonged period of reduced rainfall and the widespread effects of fire (Figures 25 and 26, Fick and Hijmans 2017,

Appendix E). Since then mammal captures have remained low due to the reduced rainfall experienced, with capture rates during 2023 at some of the lowest rates since monitoring commenced. Despite the preceding adverse conditions, monitoring during 2023 revealed the Sandhill Dunnart persisting in several locations.

Figure 26. Significant variations of rodents and the Ningaui at Tropicana.



The removal of habitat by fire has also influenced Sandhill Dunnart presence and capture rates. Widespread fire during 2019 removed large areas of Sandhill Dunnart habitat along the EGP, rendering significant areas unsuitable for the species for many years. As such, detection rates of the Sandhill Dunnart during 2019 and 2020 were low. However, minimal fire activity since 2019 has enabled the (minor) regeneration of habitat, likely contributing to elevated detection during 2023. Slightly elevated captures since 2021 are likely the result of regenerating vegetation following large wildfires enhancing habitat connectivity and allowing for the movement of individuals. Three monitoring sites appear to have been recently re-colonised by the Sandhill Dunnart as post-fire regeneration in surrounding areas has elevated habitat connectivity, allowing for the movement of individuals. The consistent number of records is indicative of a stable population despite the dry conditions of preceding years resulting in a reduced capture rate.

The Sandhill Dunnarts usage of rehabilitation appears to remain reduced, with capture rates within the rehabilitated corridor lower than those observed overall (Figure 28). This is likely to result from the reduced vegetation cover within the regenerating pipeline corridor. As vegetation cover increases over time, capture rates are likely to resemble those observed elsewhere.

Figure 27. Sandhill Dunnart capture rate (percentage of captures per 100 trap nights) across all sampling periods at Tropicana.

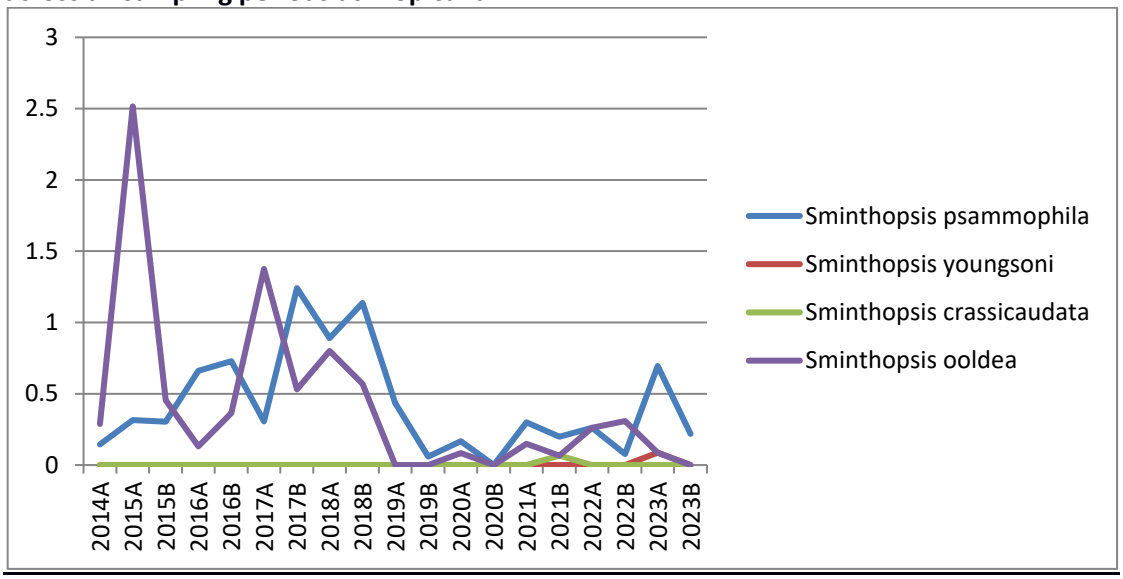
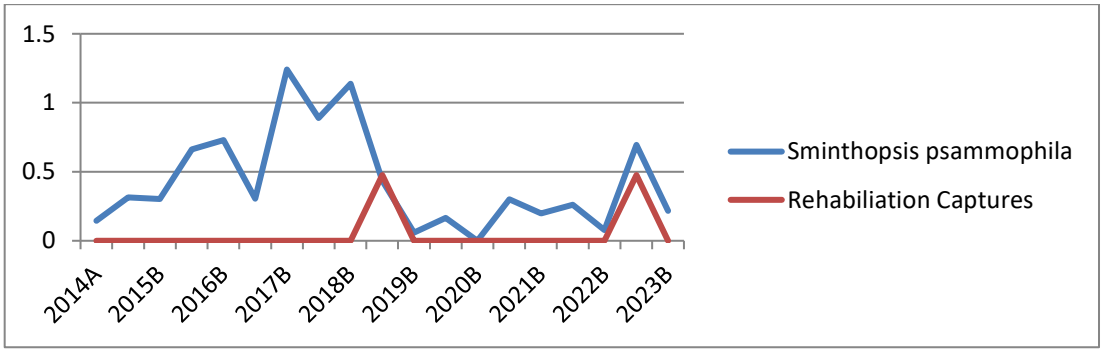


Figure 28. Sandhill Dunnart capture rate (percentage of captures per 100 trap nights) within rehabilitation.



Sandhill Dunnart Survey Techniques

The Sandhill Dunnart has been recorded using a range of techniques. It has been detected at 41 monitoring sites (18 by trapping and all 41 by camera) and also by camera at additional locations elsewhere (away from the EGP). It has most effectively been detected using motion-activated camera, recording Sandhill Dunnarts from a range of habitats. Sandhill Dunnarts have been most effectively trapped using deep-pitfall traps although one record of the species comes from an Elliott trap. Additionally, the Sandhill Dunnart has been recorded from three feral cat scats and one fox scat (from Monitoring Sites 12, 14 and 15). While difficult to detect, a combination of trapping, the use of motion cameras and predator scat analysis readily detects the Sandhill Dunnart. Motion-activated cameras are considered the optimal technique to initially detect the species and to assist in situating trapping sites (see KEC, 2015). The trapping effort employed here is sufficient to record the species. A trapping effort of seven nights per site appears sufficient as individuals have been trapped on survey nights one to seven of the trapping program. Overall, more than half of the species captures (51%) have occurred on survey nights 2 and 3.

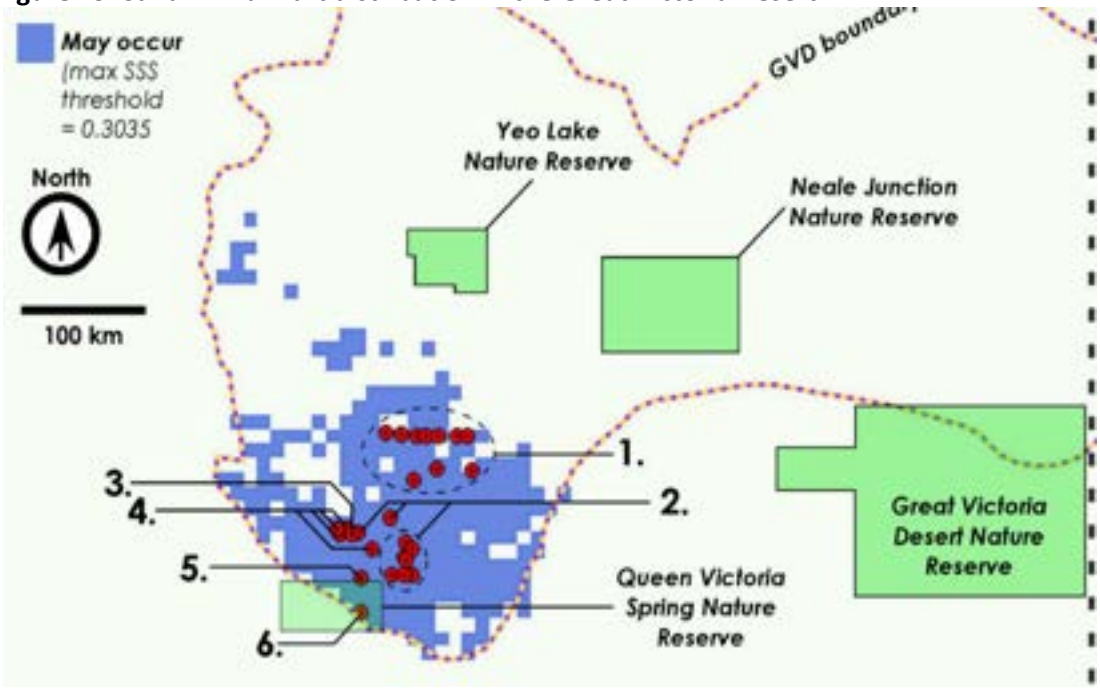
Sandhill Dunnart Range

In Western Australia, the Sandhill Dunnart is known from a small area of the south-western Great Victoria Desert. The species has been considered difficult to study as capture rates are low, its numbers fluctuate widely and populations appear transitory (Pearson *et al.*, 2021). Consequently, the Sandhill Dunnart's distribution is poorly known and confounded by the loss of several populations by fire. Population loss attributable to fire has been recorded along the Eastern Goldfields Pipeline and in the southern GVD (such as Queen Victoria Spring Nature Reserve, Appendix C). In the Tropicana area, the Sandhill Dunnart has been recorded from 38 spatially independent areas (areas at least 2km apart, see Figure 2). This includes from 24 sites along the Eastern Goldfields Pipeline corridor and from additional areas (including along the Plumridge Lakes Access Track, approximately 40km south of the pipeline). These records cover approximately half of the species known range, with previous (pre-fire) records from the vicinity of Queen Victoria Spring and Mulga Rockhole (Figure 29). The Sandhill Dunnart is known to occur across approximately 200 km of the south-western Great Victoria Desert, with the population along the Eastern Goldfields Pipeline occurring at the northern extreme of the species range (Figure 29).

Habitat modelling conducted by J. Riley suggests the species may occur across a wider area, while still restricted to the south-western parts of the Great Victoria Desert (Figure 29). It also indicates the species may also occur in additional areas along the Eastern Goldfields Pipeline, particularly to the west of those areas currently sampled (see Figure 29). While potentially occurring over a wider area, recent surveys targeting the species failed to record the Sandhill Dunnart across much of the Great Victoria Desert. An extensive camera survey across much of the region failed to detect the species north of Tropicana, and as a result, suggests the species has a highly restricted and fragmented range in the southern Great Victoria Desert (J. Turpin, pers. obs.). This highlights the importance of the Eastern Goldfields Pipeline population (which covers a major proportion of the species known range) and the significance of the monitoring programme (occurring at the species arid range extreme). The Sandhill Dunnart Monitoring along the Eastern Goldfields pipeline is the only field study of the species in Western Australia, and the only known location in the state where the species is regularly recorded. As a result, the information collected during monitoring has provided invaluable insights into the Sandhill Dunnart's range and ecology and has been used to update the forthcoming volume of Mammals of Australia (see Van Dyck and Strahan, 2008; Pearson *et al*., 2024).

Monitoring west of the species current known range (along the EGP between Lake Carey and Hope Campell Lake) during 2024 did not detect any additional populations. Suitable habitat in this area has been previously highlighted (Riley et al. 2020) however had not been surveyed since a large wildfire removed significant areas of habitat in 2019. While the Sandhill Dunnart was not recorded the area is proposed to be surveyed further during 2024.

Figure 29. Sandhill Dunnart distribution in the Great Victoria Desert.



Note: Sandhill Dunnart records come from the current KEC monitoring program near Tropicana (1), Gaikhorst and Lambert (2), Vimy (3), Hart and Kitchener (4) Pearson (5) and DPaW (6).

Sandhill Dunnart Habitat

The Sandhill Dunnart favours long-unburnt vegetation, which provides the range and abundance of sites required for shelter and the protection from predation. The species is commonly associated with *Triodia desertorum*, *E. gongylocarpa, Callitris preissii, Hakea francisiana and Grevillea juncifolia.* The presence of long unburnt spinifex (particularly *Triodia desertorum*) appears an important habitat requirement as does an intact shrub layer. Shelter sites are most commonly associated with mature, long-unburnt spinifex (Stage 5, *Triodia desertorum* or Stage 4 *Triodia basedowii and T. rigidissima*) although the species has been recorded to shelter within *Lepidobolus deserti*, *Schoenus hexandrus* and Eucalypt logs.

Post-clearance Habitat Rehabilitation

The Sandhill Dunnarts usage of rehabilitation appears to remain reduced, with capture rates within the rehabilitated corridor lower than those observed overall (Figure 27). This is likely to result from the reduced vegetation cover within the regenerating pipeline corridor. As vegetation cover increases over time capture rates are likely to resemble those observed elsewhere.

The Sandhill Dunnart utilises an extensive number of shelters throughout a home range (often switching on a daily basis), which enables the species to forage over a comparatively large area and reduce predation pressure. As such the species requires extensive areas of critical shelter habitat (mature, large spinifex) throughout a home range. While the Sandhill Dunnart was known from only four locations within 100km of the EGP prior to construction, suitable sheltering habitat was extensive along the pipeline corridor (evidenced by the presence of shelters recorded adjacent to the construction footprint).

Vegetation along the Eastern Goldfields Pipeline is in the process of rehabilitating and is colonising the previously cleared pipeline corridor. The corridor was cleared during April 2015 and now contains a scattered occurrence of vegetation, including species associated with Sandhill Dunnart shelters (*Triodia desertorum*, *Eucalyptus gongylocarpa*, *Eucalyptus trivalva*, *Hakea francisiana*, *Aluta maisonneuvei* and *Baeckia* sp. GVD). However, vegetation cover has not yet reached the stage of maturity or size that provides shelter for the Sandhill Dunnart. As such, the species has not been recorded to shelter within the pipeline corridor. The Sandhill Dunnart has been recorded foraging within and moving through open landscapes to reach shelter in adjacent vegetated areas (Riley 2020). Similarly, the species has been recorded from two rehabilitation sites, where extensive areas of habitat occur adjacent to the pipeline corridor and the rehabilitation of vegetation allows for transit and likely some foraging.

Fire

Fire is a major threat to the Sandhill Dunnart's survival in the Great Victoria Desert. Destructive summer fires remove the mature vegetation required for protection and shelter. Repeat fire events inhibit the development of habitat. The current fire regime, arising from the cessation of traditional burning practises, is ongoing and as such, large areas of the Great Victoria Desert are burnt each summer. Since the commencement of monitoring, fires have rendered large areas unsuitable for the Sandhill Dunnart and have resulted in the loss of several known populations, including at monitoring sites known to formerly support the species (Table 17, Figure 30). While some sites appear to support stable populations (23), sites effected by fire (18) do not support the species (Table 17).

More than one third of the Sandhill Dunnart Monitoring sites have been transformed by fire since their establishment (18/52 sites, Table 17, Figures 30 - 32). Four sites were burned in 2016, 13 sites were burned in January 2019 and one in December 2019 (Table 17). The Sandhill Dunnart is unlikely to remain at these sites as the youngest age of vegetation known to support the species is 14 years. As such, it is likely to take many years before habitat matures to a stage (size and structure) suitable to support the Sandhill Dunnart. Due to the removal of habitat by fire, and subsequent population loss, combined with predation pressure, the Sandhill Dunnart is likely to be declining along the Eastern Goldfields Pipeline. However, habitat recovery (post-fire) is ongoing (Figure 32) and the species can survive in small habitat patches along the pipeline corridor (patches as small as approximately 20 hectares can support the species, Table 17). Minimal fire activity since 2019 has enabled the (minor) regeneration of habitat, which has likely contributed to elevated detection during 2023. Figures 33 and 34 display all Sandhill Dunnart monitoring sites, including those impacted by fire. The influence on the Southern Scrub-robin is displayed in Figure 35.

Figure 30. Formerly occupied Sandhill Dunnart habitat (Site 10B).

Figure 31. Regenerating Sandhill Dunnart habitat (Site 10B).

Figure 32. Regenerating Sandhill Dunnart habitat (Site 10B).

Site	Easting	Northing	Sandhill Dunnarts Recorded																		SHD Record	Patch Size (ha)	Fire	SHD Presence	Pipeline	Age
			2015	2015	2016	2016	2017	2017	2018	2018	2019	2019	2020	2020	2021	2021	2022	2022	2023	2023			Burn Date			
1	64123	6763205	X																		Yes	Burnt	Jan 2019	Unlikely	Yes	5
2	64181	6763078														X					Yes	Burnt	Jan 2019	Transit	Yes	5
3	64080	6763212																				Burnt	Jan 2019	Unlikely	Yes	5
4	60603	6729480			X				X												Yes	Burnt	Dec 2017	Unlikely		6
5	60183	6729764	X																		Yes	Burnt	Dec 2017	Unlikely		6
6	64610	6763194									X							X	X	X	Yes	5000+	Jan 1997	Yes	Yes	27
7	62144	6762911	X		X	X	X	X		X	X	X	X		X	X	X	X	X	X	Yes	3400	Dec 2001	Yes	Yes	22
8	62187	6762857																				3400	Dec 2001	Unknown	Yes	22
9	62500	6762719			X				X	X	X	X				X	X				Yes	3400	Intact	Yes	Yes	40+
10	62681	6762870		X	X	X	X	X	X	X	X				X				X		Yes	3400	Part Burnt	Yes	Yes	40+ / 2.5
10B	62681	6763357			X																Yes	Burnt	Dec 2016	Unlikely	Yes	7
11	60303	6729852		X		X															Yes	Burnt	Dec 2017	Unlikely		6
12	60613	6763323				X	X	X		X							X		X		Yes	2000	Intact	Yes	Yes	40+
13	60882	6763296	X		X		X		X	X	X										Yes	2000	Intact	Yes	Yes	40+
14	63431	6763442		X	X	X		X	X												Yes	Burnt	Jan 2019	Unlikely	Yes	5
15	62342	6762898			X		X	X	X	X	X		X		X	X	X	X	X		Yes	3400	Intact	Yes	Yes	40+
16	63981	6764494			X	X															Yes	Burnt	Jan 2019	Unlikely		5
17	61921	6738684				X															Yes	Burnt	Jan 2019	Unlikely		5
18	62803	6743144					X														Yes	Burnt	Jan 2019	Unlikely		5
19	64313	6763279																				<10	Intact	Unknown	Yes	40+
20	59529	6764675				X	X	X		X											Yes	Burnt	Dec 2019	Unlikely	Yes	4
21	64028	6763563					X	X	X										X	X	Yes	Burnt	Jan 2019	Unlikely	Yes	5
22	63935	6763759					X	X							X				X	X	Yes	145	Intact	Yes	Yes	40+
23	61474	6763088							X	X	X										Yes	5000+	Dec 2001	Yes	Yes	22
24	61183	6763382			X					X					X						Yes	5000+	Dec 2001	Yes	Yes	22
MP	63705	6763604																				Burnt	Jan 2019	Unlikely	Yes	5
26	64694	6763758																				5000+	Intact	Unknown	Yes	40+
27	64520	6763227										X								X	Yes	5000+	Jan 1997	Yes	Yes	27
28	64688	6763245																				5000+	Intact	Unknown	Yes	40+
29	64752	6763513																	X		Yes	5000+	intact	Yes	Yes	40+
30	60202	676398																			Yes	11	intact	Yes	Yes	40+
31	58926	676539																			Yes	75	Intact	Yes	Yes	40+
32	58415	676559																		X	Yes	5000+	Intact	Yes	Yes	40+
C1	56064	6767542																				NA	intact	Unknown	Yes	40+
C1B	55598	6768513																	X		Yes	80	Intact	Yes	Yes	
C2	56199	6767686																				NA	Intact	Unknown	Yes	40+
C3a	57509	6766012									X										Yes	725	Intact	Yes	Yes	40+
C3b	57745	6765759																X		X	Yes	5000+	Intact	Yes	Yes	40+
C4	57825	6765629													X	X	X	X		X	Yes	5000+	2001	Yes	Yes	21
C5	57876	6765525																X		X	Yes	5000+	2001	Yes	Yes	21
C6	57943	6765525																	X	X	Yes	5000+	2001	Yes	Yes	21
C7	58345	6765487	X												X		X		X	X	Yes	5000+	intact	Yes	Yes	40+
C8	58415	6765590													X		X		X		Yes	5000+	intact	Yes	Yes	40+
C9	58632	6765490						X											X		Yes	25	intact	Yes	Yes	40+
C10	58927	6765393									X	X	X	X	X		X	X	X		Yes	135	intact	Yes	Yes	40+
C11	59147	6765041										X		X	X	X	X		X		Yes	18	intact	Yes	Yes	40+
C12	59521	6764697																				<10	Intact	Unlikely	Yes	40+
C13	59669	6764563													X	X		X	X		Yes	47	intact	Yes	Yes	40+
C14	60039	6764246																				NA	Intact	Unknown	Yes	40+
C15	60201	6763983													X		X	X			Yes	16	intact	Yes	Yes	40+
C16	61254	6763421																X			Yes	5000+	Dec 2001	Yes	Yes	22
C17	61754	6763110															X				Yes	5000+	2001	Yes	Yes	21
C18	61945	6763139															X		X	X	Yes		Intact	Yes	Yes	40+
C19	62917	6762311																				5000+	intact	Likely	Yes	40+
C20	64768	6763751														X			X	X	Yes	5000+	intact	Likely	Yes	40+
B1	56176	6767208						X													Yes	NA	Unknown	Unknown	Yes	5
B2	56922	6766788						X													Yes	NA	Jan 2019	Unlikely	Yes	5
B3	58099	6765565						X													Yes	NA	Jan 2019	Unlikely	Yes	5
B4	58620	6765344						X													Yes	NA	Jan 2019	Unlikely	Yes	5
Tota	52		5	3	10	8	9	13	8	9	9	5	3	2	12	8	12	10	18	13	41		27	28	44	

Table 17: Sandhill Dunnart Monitoring Sites, influence of fire and age since burn.

Figure 33. Sandhill Dunnart Sites impacted by fire.

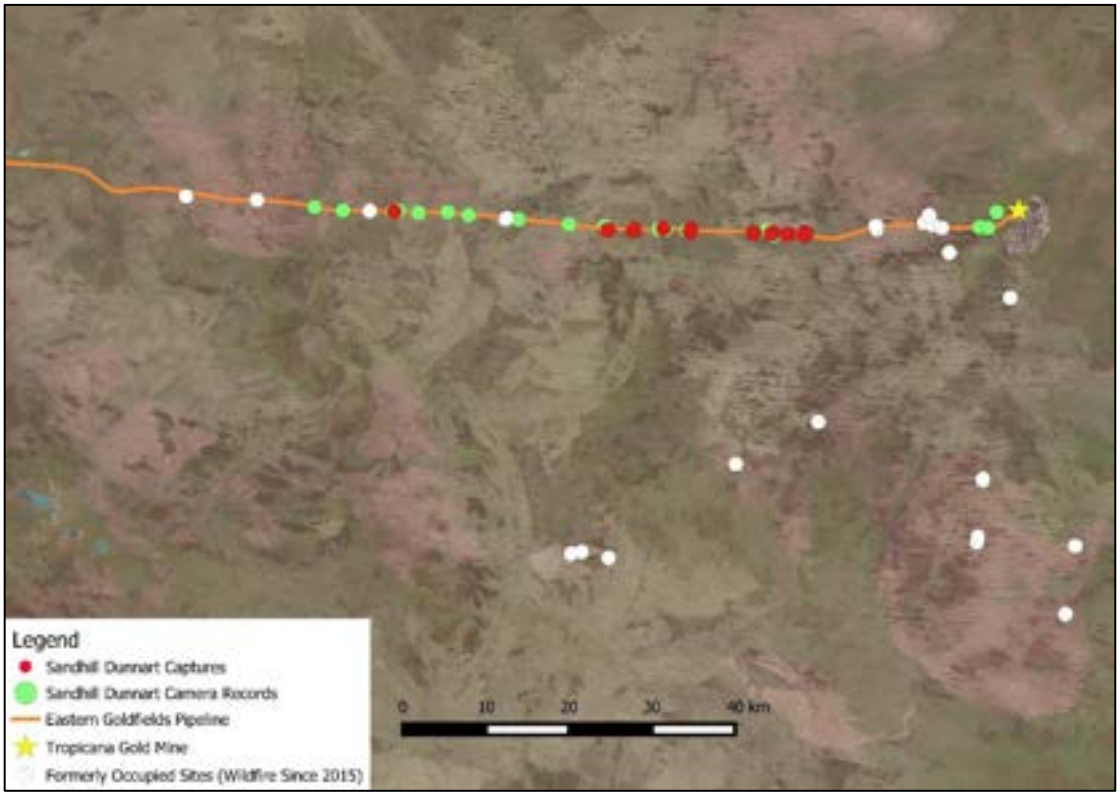


Figure 34. Sandhill Dunnart Sites impacted by fire (with recent fire history displayed).

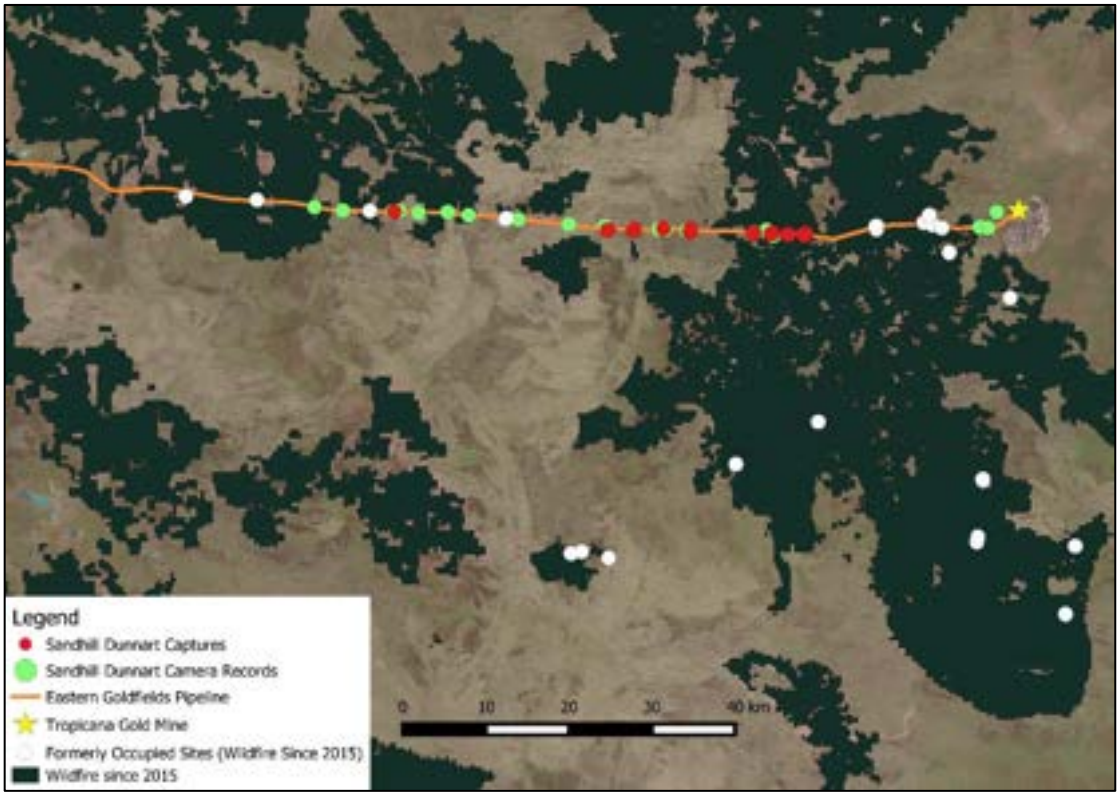
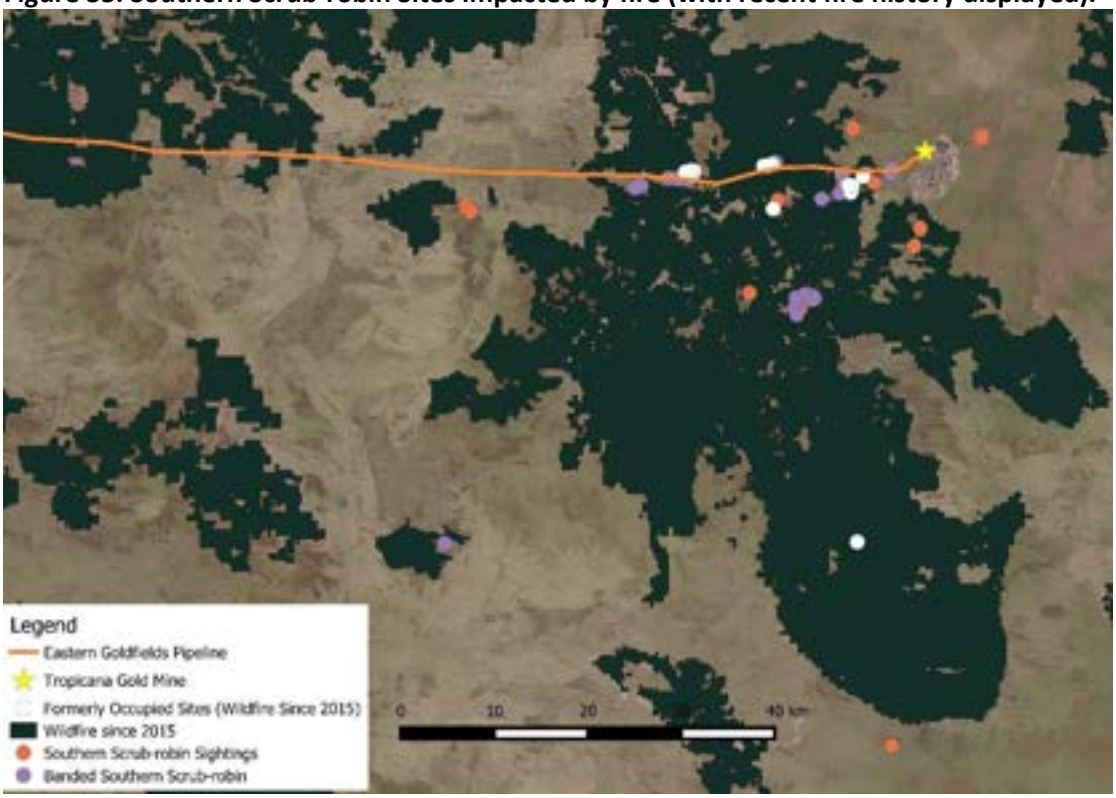


Figure 35. Southern Scrub-robin Sites impacted by fire (with recent fire history displayed).



Eastern Goldfields Pipeline Influences

Sandhill Dunnart Monitoring assesses the significance of any impacts associated with the Eastern Goldfields Pipeline upon the local Sandhill Dunnart population. Significant Impact Guidelines on Matters of National Environmental Significance (e.g. species listed under the EPBC Act such as the Sandhill Dunnart) have been prepared (DOTE, 2013), providing a framework for the assessment of impact.

These include:

- Will the action lead to a long-term decrease in the size of a population?
- Will the action reduce the area of occupancy of the species?
- Will the action fragment an existing population?
- Will the action adversely affect habitat critical to the survival of a species?
- Will the action disrupt the breeding cycle of a population?
- Will the action modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the species is likely to decline?
- Will the action result in introducing invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat?
- Will the action introduce disease that may cause the species to decline? and
- Will the action interfere with the recovery of the species?

The EPA's Environmental Factor Guidelines (EPA 2016) also list the major impacts to terrestrial fauna and these are considered with regard to the Sandhill Dunnart. Impacts are associated with the loss, fragmentation and modification of habitat, the interruption to movement and foraging, increased predation pressure, degradation

of habitat (due to weed invasion or grazing by introduced herbivores) and altered fire regimes. Sandhill Dunnart monitoring aims to address both the Significant Impact Guidelines on Matters of National Significance and the EPA' s Environmental Factor Guidelines. These are summarised and discussed in Table 19.

To assess long-term habitat change, the rehabilitation of habitat along the pipeline corridor was also assessed. Critical habitat for the Sandhill Dunnart is mature spinifex dominated shrublands, as these provide the range and abundance of sites required for shelter and protection from predators. Shelters are associated with or under large, mature hummocks of vegetation (typically spinifex but also *Lepidobolus* or *Schoenus*) and a diverse, structurally complex shrubland provides protection from predators. Clearing for the pipeline corridor resulted in the loss of such habitat, however, since the pipeline's construction in 2015, the pipeline corridor has undergone rehabilitation (both assisted and natural). To assess the development of rehabilitation and its potential to provide habitat for the Sandhill Dunnart, measures of vegetation (see Section 4.3.7) were conducted via standardised vegetation quadrats and compared to intact, mature vegetation, supporting the Sandhill Dunnart at shelter sites (N = 213). Thirty nine quadrats (5 x 5m) located within the rehabilitating pipeline corridor were assessed for habitat suitability. These were also compared to equivalent parameters recorded at Brush-tailed Mulgara burrows (N = 11).

Vegetation within the rehabilitating pipeline corridor is maturing and several species associated with Sandhill Dunnart habitat are now present. *Triodia* (*desertorum* or *basedowii*) spinifex hummocks (an important component of shelter habitat) are also present and over successive years are increasing in size and cover (Figure 36). The measures of vegetation (Figures 36 and 37, Table 18) reveal a positive trend (as vegetation grows) as habitat rehabilitates towards that suitable to support the Sandhill Dunnart (Figure 36). However, vegetation has not (yet) matured to a stage that is suitable to support the species. All major indices of habitat (vegetation cover and measures of spinifex such as life stage and size) remain reduced and reveal significant differences between intact habitat and the vegetation observed within the pipeline corridor (Table 18, Figure 36). Indicative of some localised change, measures of Triodia and shrub cover at some sites are close to replicating Sandhill Dunnart habitat, however, vegetation parameters overall are still reduced. While the pipeline corridor supports some vegetation, and regrowth has been observed (Figure 36), pioneer taxa are still present (e.g. those favouring disturbance, such as *Dubosia, Dicrastylis*). Spinifex hummocks have not (yet) reached a size suitable for shelter, and remain sparsely distributed overall. Other taxa providing habitat (such as *Lepidobolus*) remain immature or absent. While vegetation cover has increased (since clearing for construction), the Sandhill Dunnart has not been recorded sheltering within the rehabilitated pipeline corridor. As vegetation cover is expected to increase over time, it is hoped that further monitoring will confirm the species use of rehabilitation.

Table 15. T-test comparisons of vegetation at intact habitat and the pipeline corridor.

Vegetation Index	Spinifex Stage	Spinifex Cover	Shrub Cover	Ground Cover	Spinifex Height	Spinifex maximum width
T Test: P Value SHD	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
T Test: P Value Mulgara	< 0.05	< 0.05	< 0.05	< 0.05		
Comment	Significant Difference	Significant Difference	Significant Difference	Significant Difference	Significant Difference	Significant Difference

Figure 36. Pipeline rehabilitation (rehab) compared to Sandhill Dunnart habitat (SHD).

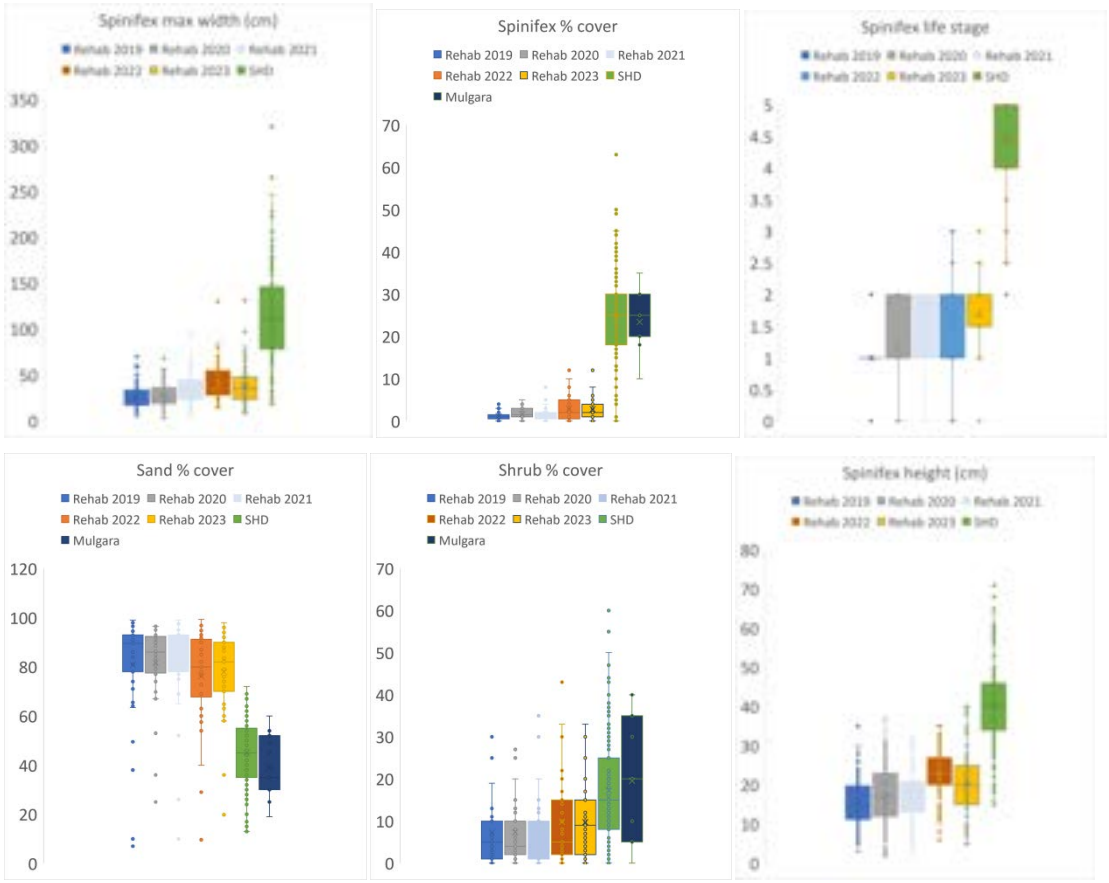
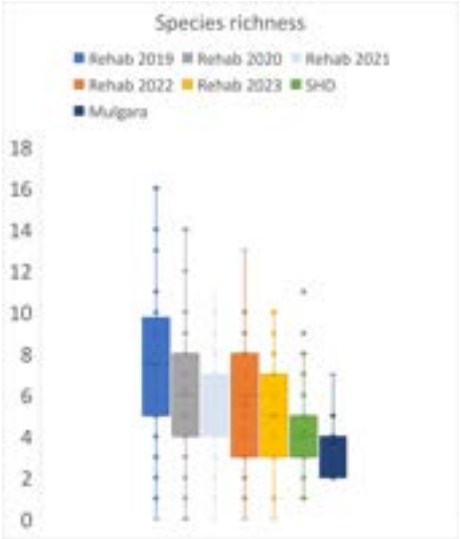


Figure 37. Species richness (rehab) compared to Sandhill Dunnart (SHD) habitat.



While slowly recovering, vegetation within the rehabilitating pipeline corridor has undergone some change (Figures 36 and 37). Species richness has slightly declined along the corridor as disturbance specialists, which originally colonised the corridor (post disturbance), are gradually making way for the established vegetation dominant across Sandhill Dunnart habitat. Figures 36 and 37 show the gradual succession of vegetation towards replicating that utilised by the Sandhill Dunnart and Brush-tailed Mulgara (species richness, spinifex size, stage, and cover). The Brush-tailed Mulgara favours open areas with reduced shrub cover (and therefore reduced species richness, Figure 37), however rehabilitation currently also remains unsuitable for the species.

The Feral Cat is known to predate a wide range of native species across Australia (Woolley *et al.,* 2019), which in the GVD includes the Sandhill Dunnart and Brush-tailed Mulgara. Predation by Feral Cats has been implicated in the extinction of many mammal species, and in the ongoing decline of many extant species (Woolley *et al.,* 2019). A recent analysis of cat predation across Australia (Woolley *et al*., 2019) has shown that native species occurring in lower rainfall areas (arid areas such as the GVD), that do not use rocky habitat refuges, and have a body mass in the critical weight range of 35 – 5500 g are the most likely to be killed by cats. The Sandhill Dunnart falls into these three categories and is ranked by Woolley (*et al.* 2019) within the top five Australian species at most risk of predation by Feral Cats. The coexistence of the Feral Cat, European Red Fox, and the Sandhill Dunnart at sites in the GVD is cause for concern.

Feral predators are known to favour open and disturbed areas, and small, ground foraging mammals are particularly vulnerable to predation in open habitats (Dickman, 1996). The Eastern Goldfields Pipeline provides an open corridor, enabling the movement and predation of feral animals, particularly the European Red Fox and Feral Cat. Both species have been recorded to move extensively along the pipeline corridor and were widely recorded during the survey period. Numerous tracks and scats were recorded, and both species were detected on several cameras. While the associated effects of predation along the pipeline corridor are uncertain, Sandhill Dunnart (and Brush-tailed Mulgara) remains have been recorded in Feral Cat scats and during radiotracking. However, capture rates at intact Sandhill Dunnart sites have been consistent. The Sandhill Dunnart persists at most known sites surveyed along the pipeline corridor, where mature vegetation remains intact and can provide shelter and protection from predation.

The Sandhill Dunnart's occurrence along the Eastern Goldfields Pipeline is likely to be influenced by the complex interactions of predation and fire. While the species can persist in fragmented landscapes, there is the potential for elevated predation pressure, as mesopredators have been shown to preferentially hunt in open and recently burnt areas (McGregor *et al.*, 2015). However, the corridor is regenerating and as predation is linked to vegetation cover and maturity, predation pressure is likely to reduce over time as vegetation matures along the pipeline corridor.

Table 16. EPBC Impact Assessment Criteria.

Aspect	Comment	Outcome	Recommendation
Lead to a long-term decrease in the size of a population.	Key indicators of population status include presence, abundance, movement, home range size and shape (Section 3.1). Survey results suggest some stability within intact vegetation; however, population loss has been recorded, and attributable to habitat loss and the complex interactions of predation and fire. Population loss is likely to have arisen during the initial clearing of the pipeline (from direct mortality and the loss of habitat). Since the commencement of monitoring, habitat loss has occurred in association with the widespread effects of wildfire. In intact habitat, local populations persist in most areas subsequent to the construction (and operation) of the pipeline corridor. However, as a result of fire removing the habitat required for shelter and protection, the species appears to have been removed from nine monitoring sites. Mature vegetation including hummocks of spinifex (and other similar sized plants such as *Lepidobolus*), provide critical habitat as these contain the range and abundance of sites the Sandhill Dunnart requires for shelter. The cleared pipeline corridor is undergoing rehabilitation, with the corridor dominated by pioneer species (e.g. *Goodenia*, *Dubosia*, *Dicrastylis*) but includes the regeneration of spinifex (Life Stages 1 and 2, Figures 36 and 37). The vegetation present within the pipeline corridor has not yet reached a stage of maturity suitable to support the Sandhill Dunnart (the species has not been recorded sheltering or foraging within the corridor). However, as the vegetation along the cleared pipeline matures, it is likely to provide habitat for the Sandhill Dunnart and offset that lost during the initial pipeline construction (see Figures 36 and 37).	Population decrease attributable to habitat loss associated with fire and the initial pipeline clearance. Species persists at most intact sites, suggesting population stability. This suggests the construction of the pipeline has not lead to a long-term decrease in the size of the population. Maturing vegetation is likely to reach a stage suitable for the Sandhill Dunnart.	Significant impact unlikely (although see predation associated with feral predators below).
Reduce the area of occupancy of the species.	The area of occupancy is defined as the area within a species extent of occurrence (distribution, IUCN, 2001). The Sandhill Dunnart is known to occur across approximately 200 km of the south-western Great Victoria Desert, with the population along the Eastern Goldfields Pipeline occurring at its northern extreme. Along the Eastern Goldfields Pipeline the species has been recorded from 23 spatially independent sites, resulting in the expansion of the species known distribution. However, monitoring has identified significant habitat loss from fire (Figures 30 - 33). The Sandhill Dunnart is currently known to persist at 12 sites along the pipeline. It is absent from 11 formerly occupied sites burned by wildfire since monitoring commenced. Consequently, a reduction in the area of occupancy of the species has been recorded, however, this is attributable to fire rather than the effects of the pipeline. Of the small number of sites known to be occupied prior to the pipeline's construction, two sites remain intact and currently support the species. While it is difficult to draw conclusions from a small dataset, the species is persisting at 12 sites along the pipeline, however, remains absent from some formerly occupied sites. A reduction in area of occupancy is attributable to fire rather than the	Additions to known range. Reduction in area of occupancy attributable to fire (absent from 11 formerly occupied sites). Given the known area of occupancy has increased since monitoring commenced, the construction of the pipeline has not reduced the area of occupancy of the species.	Significant impact unlikely.

Aspect	Comment	Outcome	Recommendation
	effects of the pipeline.		
Fragment an existing population into two or more populations.	The Sandhill Dunnart can persist in fragmented landscapes and the species has been recorded foraging and sheltering on both sides of the cleared pipeline corridor. Although, movements and home ranges associated with the pipeline have varied, six tracked dunnarts have had home ranges overlapping the pipeline, traversing the cleared pipeline corridor during nightly foraging and to locate shelter sites. Some movement across the pipeline corridor suggests that foraging and home range are not interrupted. Population fragmentation is unlikely, however, there is potential for increased predation in small, isolated areas of habitat.	Considered Unlikely. Data to date shows some movement across pipeline.	Significant impact unlikely.
Adversely affect habitat critical to the survival of a species.	Critical habitat for the Sandhill Dunnart is mature spinifex dominated shrublands, as these provide the range and abundance of sites required for shelter and protection from predators. The Sandhill Dunnart shelters within or under large, mature hummocks of vegetation (Spinifex typically Life Stages 3-5, *T. desertorum* or *T. basedowii, Lepidobolus* or *Schoenus,* see Tables 9 and 10). A diverse shrub layer is also typically present, as a mature, structurally complex habitat provides protection from predators (see Section 5.4). Clearing for the pipeline corridor resulted in the loss of such habitat, however, since the pipeline's construction in 2015, the pipeline corridor has undergone rehabilitation (both assisted and natural). While the pipeline corridor supports some vegetation, the species present include pioneer taxa (e.g. *Goodenia*, *Dubosia*, *Dicrastylis*), and where present, spinifex hummocks are yet to reach their full size (Life Stage 1 or 2 – unsuitable for Sandhill Dunnart shelter, Figure 36). Vegetation cover is also reduced (Figure 36). Consequently, the pipeline corridor does not yet provide habitat to support the Sandhill Dunnart and the species has not yet been recorded foraging or sheltering within the rehabilitated pipeline corridor. While vegetation cover has increased (since clearing, Figures 36 and 37), it lacks the size and structure to provide habitat for the Sandhill Dunnart. Spinifex (*Triodia desertorum* and *Triodia basedowii*) is in the early stages of regeneration, cover is sparse and other species providing habitat (such as *Lepidobolus*) are largely absent. While the rehabilitated pipeline corridor does not yet provide habitat for the Sandhill Dunnart, another Dunnart species, *S. dolichura*, was observed sheltering within a log pile associated with the corridor's rehabilitation. As vegetation cover is expected to increase over time, it is hoped that further monitoring will confirm the Sandhill Dunnart's use of rehabilitation. Habitat loss arising from wildfire is ongoing. Fire frequency throughout the region occurs at a higher rate than the age of vegetation at most occupied monitoring sites. Most Sandhill Dunnart sites support very old vegetation (typically over 50 years since disturbance), however large areas along the Eastern Goldfields Pipeline have burned multiple times within the last 20 years. For example, Survey	Habitat loss recorded. Rehabilitation has not yet reached a stage suitable to support the species.	Continue Monitoring.

Aspect	Comment	Outcome	Recommendation
	Site 14 has burned twice since 2002 (January 2002 and January 2019) and due to the lack of vegetation cover, the Sandhill Dunnart is unlikely to persist (last recorded in 2018). As the minimum age of vegetation supporting the Sandhill Dunnart at monitoring sites is 14 years and most sites contain mature vegetation older than 50 years (Table 3), it is likely to take many years (likely to be more than 10) after disturbance before vegetation develops to a suitable stage to provide habitat (e.g. suitable size and number of spinifex hummocks). However, habitat regeneration has been recorded (see Appendix C). As vegetation cover is expected to increase over time, it is hoped that further monitoring will confirm the Sandhill Dunnart's use of rehabilitation.		
Disrupt the breeding cycle of a population.	Breeding cycle has not been disrupted; breeding recorded adjacent to corridor.	Breeding documented.	Significant impact unlikely.
Modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the species is likely to decline.	Clearing for the pipeline resulted in habitat loss across the known extent of the Sandhill Dunnart – an approximately 100km stretch of sand dunes and sandplains from Hope Campbell Lakes to Tropicana Gold Mine. Within this range, the Sandhill Dunnart has a highly fragmented (fire-induced) and declining occurrence, and due to its restriction to mature habitats, is vulnerable to habitat loss and isolation. While the removal of habitat is unlikely to have isolated populations (see population fragmentation above), areas of long unburnt spinifex hummock grasslands, critical to the species survival were cleared. Monitoring since the pipeline's construction has since aimed to detect any changes in occurrence, including within areas of rehabilitation, which will eventually mature to a stage suitable for the Sandhill Dunnart, and potentially offset the initial habitat clearance (Figures 36 and 37). Since the pipeline's construction in 2015, the pipeline corridor has undergone rehabilitation (both assisted and natural). While the pipeline corridor supports some vegetation, the species present include pioneer species (e.g. *Goodenia*, *Dubosia*, *Dicrastylis*), and where present, spinifex hummocks are yet to reach their full size (Life Stage 1 or 2 – unsuitable for Sandhill Dunnart shelter). The Sandhill Dunnart requires extensive cover and mature hummocks of vegetation for shelter (Life Stages 3-5, see Tables 9 and 10). Consequently, the pipeline corridor does not yet provide habitat to support the Sandhill Dunnart and the species has not yet been recorded foraging or sheltering within the rehabilitated pipeline corridor. While vegetation cover has increased (since clearing) along the pipeline (Figures 36 and 37), as the corridor is dominated by pioneer species it lacks the structure to provide habitat for the Sandhill Dunnart. Spinifex (*Triodia desertorum* and *Triodia basedowii*) is in the	Habitat loss recorded. Rehabilitation has not yet reached a stage suitable to support the species.	Continue Monitoring.

Aspect	Comment	Outcome	Recommendation
	early stages of regeneration, cover is sparse and other species providing habitat (such as *Lepidobolus*) are largely absent. As vegetation cover is expected to increase over time, it is hoped that further monitoring will confirm the Sandhill Dunnart's use of rehabilitation.		
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat.	Feral fauna are recorded regularly along the pipeline corridor and Feral Cat and Fox predation has been recorded (Sandhill Dunnart remains found in Feral Cat and Fox scats and predation recorded during radiotracking). A recent analysis of cat predation across Australia (Woolley et al., 2019) has shown that native species occurring in lower rainfall areas (arid areas such as the GVD), that do not use rocky habitat refuges, and have a body mass in the critical weight range of 35 – 5500 g are the most likely to be killed by cats. The Sandhill Dunnart falls into these three risk categories and is ranked by Woolley (*et al.* 2019) within the top five Australian species at most risk of predation by Feral Cats. The coexistence of the Feral Cat, European Red Fox and the Sandhill Dunnart at sites is cause for concern. Within intact vegetation, Sandhill Dunnart numbers appear stable, however the species appears absent from sparsely vegetated, immature, and recently burned areas. This is attributable to a lack of suitable habitat required for forging and shelter and the complex interactions of fire and predation. Feral predators are known to favour open and disturbed areas, and small, ground foraging mammals are particularly vulnerable to predation in open habitats (Dickman, 1996). As vegetation is sparse along the cleared corridor (Figure 36), the pipeline has the potential to elevate predation pressure on local Sandhill Dunnart populations. The Sandhill Dunnart currently persists at sites supporting feral predators however its presence may be considered tenuous, particularly as regular fire removes the necessary habitat required for protection. Dense vegetation ameliorates the threat of predation and so where vegetation is sparse the species does not appear to be able to persist. This includes within the former range of the northern GVD, which has reduced vegetation cover (associated with reduced rainfall) when compared to the desert's vegetated southern fringe. Predation pressure is linked to vegetation cover, and as the pipeline corridor is undergoing rehabilitation, the effects of predation are likely to reduce as vegetation matures.	Feral predators widespread prior to disturbance. As predation is linked to vegetation cover and maturity, predation pressure is likely to reduce over time as vegetation matures along the pipeline corridor.	Continue Monitoring.
Introduce disease that may cause the species to decline.	Considered unlikely. Initial results suggest a stable population within intact vegetation from a limited dataset.	Not Applicable.	Significant impact unlikely.
Interfere with the recovery of	Overall, the Sandhill Dunnart has been recorded from 24 monitoring sites along the EGP, however, currently appears present at 13 sites, with its presence considered to be influenced by the combined	Rehabilitation usage has not yet been recorded.	Continue Monitoring.

Aspect	Comment	Outcome	Recommendation
the species.	effects of fire and predation. The species has not been detected at 10 monitoring sites, despite the presence of apparently suitable habitat. The Sandhill Dunnarts perceived absence at intact sites may be attributable to predation. The pipeline corridor may elevate predation pressure as feral predators are known to preferentially hunt in open or sparsely vegetated areas. However, the corridor is regenerating (see habitat loss). Vegetation cover is increasing over time and will eventually mature to a stage suitable to support the Sandhill Dunnart and offset the habitat lost during the initial clearing.	Due to the effects of fire and predation, the local dunnart population may be in decline. However, vegetation cover is increasing along the pipeline corridor.	

7. CONCLUSIONS AND FUTURE PLANNING

The Sandhill Dunnart is a large desert dunnart, favouring old, mature vegetation which provides shelter from predation. Monitoring during 2023, revealed the persistence of the Sandhill Dunnart, including from new areas, via the use of motion-activated cameras (but did not detect the species west of Hope Campbell Lake where suitable occurs). Previous research along the Eastern Goldfields Pipeline (https://doi.org/10.1093/jmammal/gyab024) has revealed the Sandhill Dunnart is unique among many native mammals in that it has a specialised diet (eating mostly ants and termites), is able to dig deep burrows in sandy soils, and is able to regulate its body temperature and metabolism (saving energy and water). The Sandhill Dunnart can also travel long distances (up to three kilometres in an hour) and cross open or burned habitats. These unique traits enable the species to survive adverse desert conditions such as droughts, and persist in desert landscapes fragmented by bushfire.

The Sandhill Dunnart Monitoring Programme along the Eastern Goldfields Pipeline is the only program monitoring the species in Western Australia (a high priority under the Action Plan of Australian Mammals, Woinarski *et al*., 2014). The programme has identified several significant populations, details the habitat critical to the species' survival and provides data on movement, diet, and predation - valuable for the species' conservation. The monitoring programme extends over approximately half of the Sandhill Dunnart's known range, which appears highly restricted and fragmented in the southern Great Victoria Desert.

The programme is also one of very few studies documenting the region's fauna in detail and has highlighted other important components of the assemblage. Thirty (30) mammal species have been recorded during the field surveys, including two species previously unknown from the region. The surveys have also extended the known distributions of several frogs, birds, and reptiles. While new and important populations have been discovered, evidence of ongoing decline has also been noted. The remains of several threatened mammals (such bones and scats of the Western Quoll, Red-tailed Phascogale, Common Brushtail Possum, Burrowing Bettong and Black-flanked Rock-wallaby) formerly occurring in the region highlight the vulnerability of the region's fauna and the significance of those rare species persisting.

Population monitoring is a critical component of threatened species management (Woinarski *et al*. 2014, Legge *et al*., 2018). Monitoring provides the evidence required to assess and review the status of a species in an area, indicate the relative impacts of threats and hence help direct any management response, measure the effectiveness of and help refine management actions and indicate the level of urgency required for management intervention (Legge *et al*., 2018). Monitoring is particularly important for Australia's mammal species which have experienced significant decline in the arid zone (Woinarski *et al*. 2014). The Sandhill Dunnart has been identified as highly vulnerable to a number of threatening processes and highlighted for monitoring (Woinarski *et al*., 2014; Woolley *et al*., 2019).

Within the arid zone of Australia, resource variations influence the distribution patterns of plants and animals as environments are shaped by flood, fire, and drought (Whitford 2002; Bradstock *et al*. 2012; Nano *et al*. 2012; Woinarski *et al*. 2014). Many species undergo marked fluctuations in abundance and distribution at decadal scales in response to drought and high rainfall years, or in response to fire history (Dickman *et al*. 2014; Greenville at al. 2016a, 2016b). Monitoring programs for desert mammals need to account for these complex and dynamic changes (Lindenmayer *et al*., 2012). The Action Plan for Australian Mammals (Woinarski *et al*. 2014) recommends that monitoring should:

- occur at appropriate intervals;
- be undertaken frequently enough to be capable of detecting rapid change and of providing timely warning of any need for conservation response; and
- relate to the life history of the target species (designed to optimise sampling).

Monitoring is essential to understand population trends where complex processes such as climate, rainfall variability, disturbance and predation can influence survey results. Monitoring is especially important to:

- quantify ecological responses to environmental change and disturbance;
- understand complex phenomena that occur over prolonged periods;
- provide core ecological data; and
- provide platforms for collaborative studies, thus promoting multidisciplinary research.

Monitoring programs should span sufficient duration to help differentiate short-term responses to climatic and other variability from longer term trends, and extend over a long enough period to be able to detect changes that are gradual and incremental but of conservation significance (Woinarski *et al*. 2014, Legge *et al*., 2018). As such, to understand the complex ecological patterns in arid, dynamic environments, monitoring is required over prolonged periods.

The Sandhill Dunnart Monitoring Programme is recommended to be conducted over a suitable time period to account for population fluctuations and the species low detectability, and to determine long term population trends. The Sandhill Dunnart Monitoring along the Eastern Goldfields Pipeline is recommended to follow the Department of Biodiversity, Conservation and Attractions "Sandhill Dunnart Monitoring Guidelines" (DBCA 2020). This is to account for the high environmental and population variability of fauna in the arid zone, and to determine any population trends with sufficient certainty (Kutt *et al.* 2009):

> "Due to the broadscale influence of fire, the sandhill dunnart's sensitivity to threatening processes and time lag of presence post-fire (thought to be greater than 10 years), long term monitoring is essential for the identification of key populations, and to dictate and guide any adaptive management. To account for marked fluctuations in abundance and distribution at decadal

> scales monitoring should be conducted over a minimum of 12 years (DBCA 2020). This is especially the case for highly mobile fauna occurring in low densities such as the Sandhill Dunnart that are sensitive to fire and predation (DPaW, 2016)."

Long-term ecological studies are critical for providing key insights in ecology, environmental change, natural resource management and biodiversity conservation (Lindenmayer *et al*., 2012). The Sandhill Dunnart Monitoring Program has identified several areas where the species persists, but also has identified areas where the species no longer appears to occur. Along the pipeline, its absence can be partly attributable to fire, where formerly occupied sites have been burnt and large areas of habitat removed. However, the Sandhill Dunnart's absence from other areas along the pipeline corridor, after pipeline construction, remains unclear.

Monitoring along the pipeline corridor appears to indicate some fire-induced population decline. Where habitat remains intact, and vegetation can provide shelter and protection from predation, the species appears to occur in consistent numbers. However, formerly occupied sites effected by fire do not support the species, due to the removal of the mature vegetation on which the species depends. Due to the high frequency of fires and associated habitat loss, combined with predation pressure, the Sandhill Dunnart is likely to be declining along the Eastern Goldfields Pipeline.

The Sandhill Dunnart Monitoring Programme has been conducted since 2015 and the benefits of conducting monitoring over an extended period are already being realised (Table 20). The programme is the only field study of the species in Western Australia, and the only known location in the state where the species is regularly recorded. As a result, the information collected during monitoring has provided invaluable insights into the species' ecology and has been used to update the forthcoming volume of Mammals of Australia (Pearson *et al*., 2024 - in press). The project has also seen new plants and animals identified for the Great Victoria Desert (e.g. Southern Scrub-robin, Bush Stone-curlew, *Stythelia deserticola* and *Leucopogon* sp. Coolgardie), increased the known range of several threatened species (e.g. Sandhill Dunnart, Great Desert Skink) and documented critical habitat parameters, which in the case of the Sandhill Dunnart, were previously unknown. The Sandhill Dunnart Monitoring Program is a collaborative project involving researchers from the University of Bristol, University of Western Australia, Western Australian Museum, Australian Museum, Western Australian Herbarium, Department of Biodiversity, Conservation and Attractions, APA Group, AngloGold Ashanti Australia, Great Victoria Desert Biodiversity Trust, the Sandhill Dunnart Recovery Team, CSIRO and students from the University of Western Australia, Murdoch University and Curtin University. While the focus is on the Sandhill Dunnart, a collaborative approach has allowed for a broad investigation which includes other species of significance (including the Malleefowl, Brush-tailed Mulgara, Southern Scrub-robin, Great Desert Skink and Striated Grasswren). The programme has provided invaluable insights into the Sandhill Dunnart's distribution and garnered a far greater understanding of its critical habitat requirements. The Sandhill Dunnart Monitoring Programme has collected baseline information on the Sandhill Dunnart occurrence

and relative abundance along the Eastern Goldfields Pipeline. Population changes over time and in association with disturbance are proposed to be further monitored.

Table 17. Significant records obtained during monitoring.

Species	Status	Comments
Sandhill Dunnart	Endangered	Significant population along EGP
Great Desert Skink	Vulnerable	New populations discovered
Malleefowl	Vulnerable	Significant population along EGP
Striated Grasswren	Priority 4	Significant population along EGP
Brush-tailed Mulgara	Priority 4	Significant population along EGP
Regent Parrot	Restricted Range	Few records for the GVD
Southern Scrub-robin	Isolated Population	First records for the GVD
Leucopogon sp. Coolgardie	Isolated Population	First records for the GVD
Stythelia deserticola	Isolated Population	First records for the GVD
Bush Stone Curlew	Isolated Population	First records for the GVD
Slender-billed Thornbill	Isolated Population	Few records for the GVD
Brown-headed Honeyeater	Isolated Population	Range Extension, first records for the GVD
Carpet Python	Isolated Population	Few records for the GVD
Western Pygmy Possum	Isolated Population	Few records for the GVD
Common Brushtail Possum	Extinct	Previously unknown from the GVD
Black-flanked Rock-wallaby	Extinct	Previously unknown from the GVD

Monitoring is proposed to continue during 2024 to provide a robust indication of population trends and to document the Sandhill Dunnart's utilisation of the pipeline corridor. The monitoring aims to differentiate short-term responses to climate (and other processes) from longer term trends and is proposed to cover a sufficient time to be able to detect changes that are gradual and incremental but of conservation significance. Additional motion cameras sites are proposed for the following survey, aiming to detect the species across a wider area. To assess the development of rehabilitation and its potential to provide habitat for the Sandhill Dunnart, further measures of vegetation (e.g. species type, richness, density, cover) are also proposed. These will replicate previous measures, located along the rehabilitating pipeline corridor, and compared to intact, mature vegetation, supporting the Sandhill Dunnart at shelter sites. Results will be used to address the impact guidelines on Matters of National Environmental Significance (MNES).

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Appendix A: Sandhill Dunnart Survey Site Locations

Pitfall Locations

Site	Pit	Easting	Northing	Site	Pit	Easting	Northing
1	Pit 1	641234	6763205	2	Pit 1	641811	6763078
1	Pit 2	641235	6763197	2	Pit 2	641813	6763066
1	Pit 3	641235	6763188	2	Pit 3	641813	6763061
1	Pit 4	641233	6763181	2	Pit 4	641813	6763055
1	Pit 5	641236	6763172	2	Pit 5	641811	6763048
1	Pit 6	641236	6763165	2	Pit 6	641808	6763042
1	Pit 7	641160	6763213	2	Pit 7	641773	6763143
1	Pit 8	641158	6763207	2	Pit 8	641773	6763134
1	Pit 9	641154	6763198	2	Pit 9	641776	6763125
1	Pit 10	641150	6763191	2	Pit 10	641777	6763117
1	Pit 11	641148	6763180	2	Pit 11	641780	6763109
1	Pit 12	641147	6763172	2	Pit 12	641781	6763100
3	Pit 1	640804	6763212	4	Pit 1	606034	6729480
3	Pit 2	640802	6763204	4	Pit 2	605957	6729169
3	Pit 3	640797	6763192	4	Pit 3	605951	6729164
3	Pit 4	640791	6763183	4	Pit 4	605944	6729156
3	Pit 5	640789	6763176	4	Pit 5	605941	6729149
3	Pit 6	640784	6763169	4	Pit 6	605937	6729145
3	Pit 7	640759	6763221	4	Pit 7	605861	6729163
3	Pit 8	640759	6763212	4	Pit 8	605855	6729161
3	Pit 9	640758	6763207	4	Pit 9	605848	6729158
3	Pit 10	640755	6763197	4	Pit 10	605841	6729154
3	Pit 11	640755	6763188	4	Pit 11	605833	6729151
3	Pit 12	640754	6763178	4	Pit 12	605824	6729148
5	Pit 1	601839	6729764	6	Pit 1	646194	6763173
5	Pit 2	601842	6729753	6	Pit 2	646193	6763168
5	Pit 3	601843	6729746	6	Pit 3	646191	6763161
5	Pit 4	601845	6729737	6	Pit 4	646187	6763154
5	Pit 5	601846	6729726	6	Pit 5	646181	6763148
5	Pit 6	601845	6729718	6	Pit 6	646180	6763139
5	Pit 7	601807	6729775	6	Pit 7	646101	6763194
5	Pit 8	601804	6729767	6	Pit 8	646103	6763187
5	Pit 9	601803	6729758	6	Pit 9	646102	6763183
5	Pit 10	601798	6729752	6	Pit 10	646105	6763173
5	Pit 11	601792	6729743	6	Pit 11	646104	6763165
5	Pit 12	601790	6729734	6	Pit 12	646107	6763156
7	Pit 1	621440	6762911	8	Pit 1	621873	6762857
7	Pit 2	621443	6762903	8	Pit 2	621870	6762850
7	Pit 3	621445	6762895	8	Pit 3	621865	6762845
7	Pit 4	621450	6762888	8	Pit 4	621858	6762844
7	Pit 5	621455	6762883	8	Pit 5	621852	6762834
7	Pit 6	621461	6762880	8	Pit 6	621846	6762827
7	Pit 7	621349	6762937	8	Pit 7	621808	6762869
7	Pit 8	621350	6762931	8	Pit 8	621810	6762859
7	Pit 9	621347	6762925	8	Pit 9	621810	6762852

Site	Pit	Easting	Northing	Site	Pit	Easting	Northing
7	Pit 10	621345	6762918	8	Pit 10	621808	6762846
7	Pit 11	621348	6762909	8	Pit 11	621805	6762838
7	Pit 12	621347	6762902	8	Pit 12	621798	6762833
9	Pit 1	625007	6762718	10	Pit 1	626833	6762759
9	Pit 2	625007	6762707	10	Pit 2	626833	6762739
9	Pit 3	625014	6762713	10	Pit 3	626819	6762852
9	Pit 4	624997	6762689	10	Pit 4	626823	6762819
9	Pit 5	625017	6762701	10	Pit 5	626822	6762791
9	Pit 6	625026	6762696	10	Pit 6	626826	6762778
9	Pit 7	625089	6762715	10	Pit 7	626909	6762720
9	Pit 8	625086	6762723	10	Pit 8	626915	6762742
9	Pit 9	625112	6762690	10	Pit 9	626912	6762768
9	Pit 10	625108	6762698	10	Pit 10	626911	6762794
9	Pit 11	625102	6762704	10	Pit 11	626912	6762816
9	Pit 12	625095	6762710	10	Pit 12	626913	6762839
11	Pit 1	603037	6729852	12	Pit 1	606136	6763323
11	Pit 2	603037	6729852	12	Pit 2	606139	6763331
11	Pit 3	603037	6729852	12	Pit 3	606140	6763337
11	Pit 4	603037	6729852	12	Pit 4	606144	6763345
11	Pit 5	603037	6729852	12	Pit 5	606145	6763355
11	Pit 6	603037	6729852	12	Pit 6	606151	6763363
11	Pit 7	603037	6729852	12	Pit 7	606024	6763350
11	Pit 8	603037	6729852	12	Pit 8	606036	6763347
11	Pit 9	603037	6729852	12	Pit 9	606042	6763342
11	Pit 10	603037	6729852	12	Pit 10	606048	6763337
11	Pit 11	603037	6729852	12	Pit 11	606055	6763333
11	Pit 12	603037	6729852	12	Pit 12	606064	6763334
13	Pit 1	608820	6763278	14	Pit 1	634315	6763390
13	Pit 2	608820	6763287	14	Pit 2	634316	6763400
13	Pit 3	608822	6763296	14	Pit 3	634314	6763409
13	Pit 4	608820	6763259	14	Pit 4	634312	6763419
13	Pit 5	608816	6763264	14	Pit 5	634314	6763431
13	Pit 6	608817	6763270	14	Pit 6	634312	6763442
13	Pit 7	608740	6763308	14	Pit 7	634397	6763418
13	Pit 8	608739	6763298	14	Pit 8	634400	6763427
13	Pit 9	608737	6763288	14	Pit 9	634398	6763438
13	Pit 10	608730	6763278	14	Pit 10	634398	6763448
13	Pit 11	608721	6763265	14	Pit 11	634398	6763458
13	Pit 12	608717	6763247	14	Pit 12	634399	6763468
15	Pit 1	623405	6762913	15	Pit 6	623258	6762816
15	Pit 2	623411	6762905	15	Pit 7	623258	6762816
15	Pit 3	623423	6762898	15	Pit 8	623258	6762816
15	Pit 4	623430	6762889	15	Pit 9	623258	6762816
15	Pit 5	623440	6762885	15	Pit 10	623258	6762816
16	Pit 1	639811	6764494	17	Pit 1	619212	6738684
16	Pit 2	639810	6764504	17	Pit 2	619208	6738692
16	Pit 3	639809	6764514	17	Pit 3	619203	6738697
16	Pit 4	639805	6764522	17	Pit 4	619201	6738707

Site	Pit	Easting	Northing	Site	Pit	Easting	Northing
16	Pit 5	639802	6764532	17	Pit 5	619202	6738715
16	Pit 6	639800	6764541	17	Pit 6	619201	6738723
16	Pit 7	639915	6764523	17	Pit 7	619300	6738703
16	Pit 8	639916	6764532	17	Pit 8	619296	6738711
16	Pit 9	639914	6764541	17	Pit 9	619293	6738719
16	Pit 10	639913	6764548	17	Pit 10	619288	6738727
16	Pit 11	639911	6764555	17	Pit 11	619284	6738734
16	Pit 12	639909	6764563	17	Pit 12	619283	6738743
18	Pit 1	628037	6743144	19	Pit 1	643139	6763203
18	Pit 2	628040	6743136	19	Pit 2	643152	6763210
18	Pit 3	628046	6743127	19	Pit 3	643166	6763210
18	Pit 4	628048	6743120	19	Pit 4	643189	6763209
18	Pit 5	628052	6743114	19	Pit 5	643203	6763210
18	Pit 6	628059	6743105	19	Pit 6	643227	6763209
20	Pit 1	595435	6764689	21	Pit 1	640198	6763587
20	Pit 2	595434	6764683	21	Pit 2	640199	6763597
20	Pit 3	595428	6764676	21	Pit 3	640200	6763605
20	Pit 4	595424	6764670	21	Pit 4	640202	6763615
20	Pit 5	595420	6764660	21	Pit 5	640207	6763630
20	Pit 6	595417	6764653	21	Pit 6	640206	6763620
20	Pit 7	595275	6764614	21	Pit 7	640278	6763608
20	Pit 8	595282	6764623	21	Pit 8	640279	6763600
20	Pit 9	595287	6764630	21	Pit 9	640280	6763593
20	Pit 10	595293	6764635	21	Pit 10	640281	6763585
20	Pit 11	595297	6764644	21	Pit 11	640281	6763577
20	Pit 12	595302	6764652	21	Pit 12	640283	6763569
22	Pit 1	639372	6763783	10B	Pit 1	626803	6763395
22	Pit 2	639375	6763791	10B	Pit 2	626805	6763387
22	Pit 3	639368	6763779	10B	Pit 3	626804	6763381
22	Pit 4	639362	6763773	10B	Pit 4	626807	6763372
22	Pit 5	639357	6763766	10B	Pit 5	626807	6763364
22	Pit 6	639353	6763758	10B	Pit 6	626809	6763356
22	Pit 7	639250	6763780	10B	Pit 7	626904	6763361
22	Pit 8	639255	6763787	10B	Pit 8	626899	6763367
22	Pit 9	639259	6763793	10B	Pit 9	626896	6763373
22	Pit 10	639261	6763802	10B	Pit 10	626894	6763379
22	Pit 11	639264	6763809	10B	Pit 11	626891	6763387
22	Pit 12	639266	6763815	10B	Pit 12	626888	6763394
23	Pit 1	614807	6763259	24	Pit 1	611942	6763390
23	Pit 6	614825	6763363	24	Pit 6	611939	6763474
23	Pit 7	614745	6763087	24	Pit 7	611831	6763382
23	Pit 12	614736	6763054	24	Pit 12	611810	6763464
26	Pit 1	646935	6763687	27	Pit 1	645207	6763257
26	Pit 2	646943	6763703	27	Pit 2	645210	6763240
26	Pit 3	646932	6763720	27	Pit 3	645203	6763227
26	Pit 4	646938	6763746	27	Pit 4	645204	6763178
26	Pit 5	646936	6763766	27	Pit 5	645204	6763167
26	Pit 6	646941	6763797	27	Pit 6	645207	6763150

Sandhill Dunnart Monitoring Sites.

1

2

4

5

7

9

10

10B

11

12

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14

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19

20

21

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23

24

26

27

Site 10 Rehabilitation	Site 13 Rehabilitation
	
Site 23 Rehabilitation	Site 7 Rehabiliatation
	
Site 6	Site 28
	

Site Photos showing vegetation change 2015 – 2023.

Site	2015	2019	2022	2023
1				
2				
7				

Site	2015	2019	2022	2023
9				
10				
10B				

Site	2015	2019	2022	2023
12				
13				
14				

Site	2015	2019	2022	2023
15				
20				Samped by camera only
21				Sampled by camera only

Site	2015	2019	2022	2023
21B				
22				
23				

Site	2015	2019	2022	2023
24				
7 R	Not Sampled			
19	Not Sampled			

Site	2015	2019	2022	2023
26	Not Sampled			Sampled by camera only
27	Not Sampled			
28	Not Sampled			

Site	2015	2019	2022	2023
29	Not Sampled			
30	Not Sampled	Not Sampled	Not Sampled	
31				
32				

Motion-activated Camera Locations

Site	Easting	Northing	Habitat	Camera Field Code
26	646946	6763771	Dune	Browning
28	646888	6763245	Dune	8837
6	646058	6763171	Dune	3991
27	645203	6763228	Sandplain	FA10
19	643189	6763209	Dune	FA1
2	641888	6763230	Sandplain	FB9
1	641197	6763208	Swale	FD5
21	640175	6763570	Dune slope	FA7
22	639172	6763813	Dune slope	3991
14	634300	6763353	Sandplain	FA6
East of 10	629175	6762317	Sandplain	TGM
10	626833	6762739	Dune	FC6
10B	626853	6763406	Dune	FC3
9	625069	6762672	Dune	FB3
15	623417	6762820	Dune	FB9
7	621450	6762995	Sandplain	FA7
23	614873	6763238	Sandplain	FB10
24	611922	6763397	Sandplain	FD1
13	608818	6763318	Sandplain	FC2
12	606106	6763331	Sandplain	FD2
C1	575090	6766012	Swale	FB4
C2	577459	6765759	Swale	BClay
C3	578251	6765629	Dune	A11
C4	578767	6765525	Swale	18834
C5	583452	6765487	Swale	FB5
C6	584154	6765590	Dune	18843
C7	586320	6765490	Dune	FB6
C8	589270	6765393	Dune	1637
C9	591472	6765041	Dune	18966
C10	595213	6764697	Plain	Newer
C11	596698	6764563	Swale	Camo
C12	602015	6763983	Swale	FA8
C13	612542	6763421	Swale	FB2
C14	617545	6763110	Swale	FB1
C15	629172	6762311	Swale	TGM
C16	647682	6763751	Dune	M01
C17	647544	6763462	Dune	M03
C18	646888	6763245	Dune	8837

Appendix B: Fauna Recorded / Expected in the Survey Area.

Fauna Recorded from the Survey Area(Tables 1 to 5).

These lists are derived from the results of database and literature searches and from previous field surveys conducted in the local area. These are:

- NatureMap Database (NM);
- Birdlife Australia Database (BA);
- Species recorded from Plumridge Lakes Nature Reserve (PL);
- Species previously recorded from the Tropicana area (TPA, ecologia 2009);
- Species recorded by Jeff Turpin along the Pinjin Infrastructure Corridor (Turpin 2008) and the wide GVD (GVD);
- Species recorded by Kingfisher Environmental Consulting along the Sunrise Dam – Tropicana pipeline route (KEC 2014).
- Species recorded by Kingfisher during TGM Borefields Fauna Assessment (Borefields); and
- Species recorded during Sandhill Dunnart Monitoring (including this survey).

Key:

Note the conservation status of significant taxa is also listed under "Status". This includes species listed under the EPBC and Biodiversity Conservation Acts, DBCA Priority Fauna and Locally Significant Fauna:

- EPBC Act listed species: Endangered (E), Vulnerable (V), Migratory (M), Critically Endangered (C);
- BC Act listed species: Endangered (E), Vulnerable (V), Specially Protected (OS);
- DBCA Priority Species: P1 = Priority 1, P2 = Priority 2, P4 = Priority 4;
- Locally Significant species: L = Locally Significant; and
- R refers to regional records: species recorded within 100km of the EGP.

Table 1. Frogs expected to occur and recorded in the Survey Area.

Common Name	Species Name	Status	NM	Sunrise Dam	TPA	KEC 2014	Borefields	2015 A	2015 B	2016 A	2016 B	2017 A	2017 B	2018 A	2020 A	2020 B	2021 A	2022 A	2023 A	2023 B
HYLIDAE																				
Sheep Frog	*Cyclorana maini*		X	X										R		R				
Water-holding Frog	*Cyclorana occidentalis*		X	X																
Little Red Tree Frog	*Litoria rubella*		X	X																
MYOBATRACHIDAE																				
Kunapalari Frog	*Neobatrachus kunapalari*		X	X										R						
Desert Trilling Frog	*Neobatrachus sudellae*		X																	
Shoemaker Frog	*Neobatrachus sutor*		X	X		X		X		X	X	X		X					X	
Wilsmore's Frog	*Neobatrachus wilsmorei*		X	X																
Centralian Burrowing Frog	*Platyplectrum spenceri*			X																
Western Toadlet	*Pseudophryne occidentalis*		X																X	
TOTAL	9		8	7	0	1	0	1	0	1	1	1	0	1 (3)	0	0 (1)	0	0	2	0

Note: Regional records recorded away from the pipeline survey area are denoted by "R".

Table 2. Reptiles expected to occur and recorded in the Survey Area.

Common Name	Species Name	Status	NM	PL	2008	TPA	2014	Borefield	2015 A	2015 B	2016 A	2016 B	2017 A	2017 B	2018 A	2018 B	2019 A	2019 B	2020 A	2020 B	2021 A	2021 B	2022 A	2022 B	2023 A	2023 B
AGAMIDAE																										
Long-nosed Dragon	*Amphibolurus longirostris*					X					X	X	X													
Black-collared Dragon	*Ctenophorus clayi*					X			X		X	X	X	X	X	X		X		X	X	X	X	X	X	X
Crested Dragon	*Ctenophorus cristatus*		X	X	X	X	X	X	X	X	X	X	X	X	X	X		X		X				X	X	X
Mallee Military Dragon	*Ctenophorus fordi*		X		X	X	X	X	X	X	X	X	X	X	X	X		X		X	X		X	X	X	X
Military Dragon	*Ctenophorus isolepis*		X	X		X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X		X
Central Netted Dragon	*Ctenophorus nuchalis*		X			X		X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Western Netted Dragon	*Ctenophorus reticulatus*		X	X	X	X										R		X						X	X	
Claypan Dragon	*Ctenophorus salinarum*		X		X								R			R										
Lozenge-marked Dragon	*Ctenophorus scutulatus*		X		X		X	X																		
Mulga Dragon	*Diporiphora amphiboluroides*					X						X	X													
Plain-backed Two-line Dragon	*Diporiphora reginae*		X			X	X		X	X	X	X		X	X		X	X	X			X	X	X	X	X
Thorny Devil	*Moloch horridus*					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Bearded Dragon	*Pogona minor*		X	X		X	X	X	X	X	X	X	X	X	X	X		X		X	X	X	X	X		X
DIPLODACTYLIDAE																										
Fat-tailed Gecko	*Diplodactylus laevis*						X	X	X		X		X		X			X		X				X	X	X
Beautiful Gecko	*Diplodactylus pulcher*		X	X																				R		
Desert Wood Gecko	*Diplodactylus wiru*								X		X	X	X	X	X			X				X		X	X	X
Beaded Gecko	*Lucasium damaeum*		X	X		X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X
Beaked Gecko	*Rhynchoedura ornata*		X	X		X	X	X		X	X	X	X	X	X			X		X		X	X	X	X	X
Thorn -tailed Gecko	*Strophurus assimilis*		X				X		X	X		X		X						X						
Jewelled Gecko	*Strophurus elderi*		X			X	X	X			X	X	X		X	X		X		X			X	X		
Ring-tailed Gecko	*Strophurus strophurus*		X			X			X		X		X	C												
CARPHODACTYLIDAE																										
Pale Knob-tailed Gecko	*Nephrurus laevissimus*			X		X	X	X		X	X	X	X	X	X	X		X		X	X	X	X	X	X	X
Smooth Knob-tailed Gecko	*Nephrurus levis*			X		X	X				X							X						X	X	X
Barking Gecko	*Nephrurus milii*		X												R									R		
Midline Knob-tail	*Nephrurus vertebralis*		X	X																			R			
GEKKONIDAE																										
Purplish Dtella	*Gehyra purpurascens*		X	X		X	X	X	X	X	X	X	X	X	X	X		X		X			X	X	X	X
Tree Dtella	*Gehyra variegata*		X	X	X	X	X	X	X			X	X		X											
Bynoe's Gecko	*Heteronotia binoei*		X	X	X	X	X						X													
PYGOPODIDAE																										
Unbanded Dema	*Delma butleri*		X			X				X	X	X	X	X	X	X	X	X			X	X	X		X	X
Sharp-snouted delma	*Delma nasuta*		X			X	X	X	X			X		X				X	X							
Peterson's Delma	*Delma petersoni*		X			X	X		X	X	X	X	X	X	X	X		X		X	X	X		X	X	X
Burton's Legless-Lizard	*Lialis burtonis*		X			X		X	X	X	X	X	X	X	X	X	X	X						X	X	X
Western Hooded Scaly-foot	*Pygopus nigriceps*		X	X		X	X	X			X	X		X	X			X		X	X	X		X	X	X
SCINCIDAE																										
A skink	*Cryptoblepharus australis*		X	X								X		X		X	X					X	X	X		X
A skink	*Cryptoblepharus buchananii*		X	X																						
Southern Mallee Skink	*Ctenotus atlas*			X					X	X	X	X													X	
A skink	*Ctenotus ariadnae*					X																				
A skink	*Ctenotus brooksi*		X			X	X	X		X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X
A skink	*Ctenotus calurus*					X	X				X	X	X		X			X			X			X	X	X

Common Name	Species Name	Status	NM	PL	2008	TPA	2014	Borefield	2015 A	2015 B	2016 A	2016 B	2017 A	2017 B	2018 A	2018 B	2019 A	2019 B	2020 A	2020 B	2021 A	2021 B	2022 A	2022 B	2023 A	2023 B
A skink	*Ctenotus dux*		X			X	X	X	X	X	X	X		X	X	X					X	X	X	X	X	X
A skink	*Ctenotus grandis*					X																				
A skink	*Ctenotus greeri*		X			X	X																			
A skink	*Ctenotus helenae*		X	X	X	X	X	X	X		X		X		X						X				X	
A skink	*Ctenotus kutjupa*																							X	X	X
A skink	*Ctenotus leae*										X										X			X		
Leonhardi's Ctenotus	*Ctenotus leonhardii*		X	X	X	X	X																			
A skink	*Ctenotus pantherinus*		X			X	X			X	X	X	X	X		X	X	X			X	X	X	X	X	X
A skink	*Ctenotus piankai*																									
A skink	*Ctenotus quattuordecimlineatus*		X	X		X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Barred Wedge-snouted Ctenotus	*Ctenotus schomburgkii*		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Spotted Ctenotus	*Ctenotus uber*		X													R										
Spinifex Slender Blue-tongue	*Cyclodomorphus melanops*		X	X		X	X		X	X	X	X	X		X	X		X				X	X		X	X
Pygmy Spiny-tailed Skink	*Egernia depressa*		X		X		X									R										X
Goldfields Crevice Skink	*Egernia formosa*																									
Western Sandswimmer	*Eremiascincus pallidus*																									
Broad-banded Sandswimmer	*Eremiascincus richardsonii*		X			X	X				X	X			X									X	X	X
North-western Sandslider	*Lerista bipes*		X	X		X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X
Central Deserts Robust Slider	*Lerista desertorum*		X	X		X	X				X		X		X			X		X					X	X
Common Mulch Lerista	*Lerista kingi*				X																					
Dotty-tailed Robust Slider	*Lerista puncticauda*	P2													R											
Ribbon Slider	*Lerista taeniata*		X			X		X		X	X	X		X	X			X		X				X		X
Common Mulch Lerista	*Lerista timda*		X	X		X	X						X		X					X						X
Great Desert Skink	*Liopholis kintorei*	V																X	X				X			
Desert Skink	*Liopholis inornata*		X	X		X	X	X		X	X	X	X	X	X	X	X	X		X	X	X		X	X	X
Night Skink	*Liopholis striata*					X												X	X	X			X	X	X	X
Common Dwarf Skink	*Menetia greyii*		X	X		X	X			X	X	X	X	X	X	X		X				X			X	X
Woodland Dark Fleck Skink	*Morethia butleri*		X	X		X	X			X		X	X	X	X	X		X		X				X		X
Western Soil-crevice Skink	*Proablepharus reginae*		X			X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Centralian Blue-tongue	*Tiliqua multifasciata*					X		X	X			X			X	X										
Western Blue-tongue	*Tiliqua occipitalis*		X		X	X	X	X	X	X		X	X	R						X				X	X	X
Bobtail	*Tiliqua rugosa*				X									R	R	R										
VARANIDAE																										
Short-tailed Pygmy Monitor	*Varanus brevicauda*					X														X						
Pygmy Mulga Monitor	*Varanus caudolineatus*		X																							
Pygmy Desert Monitor	*Varanus eremius*					X					X	X	X	X	X	X				X	X			X	X	X
Perentie	*Varanus giganteus*					X	X				X		X	X	X			X	X					X	X	R
Mulga Monitor	*Varanus gilleni*		X	X		X																				
Sand Monitor	*Varanus gouldii*		X	X	X	X	X	X			X	X	X	X	X	X	X		X	X	X		X	X	X	X
Yellow-spotted Monitor	*Varanus panoptes*		X				X																			
Racehorse Monitor	*Varanus tristis*					X	X	X	X	X	X	X	X	X	X	X				X		X		X	X	X
TYPHLOPIDAE																										
Dark-spinned Blind Snake	*Anilios bicolor*								X		X		X	X						X				X		X
Prong-snouted Blind Snake	*Anilios bituberculatus*		X	X								X	X	X												
Interior Blind Snake	*Anilios endoterus*		X			X								R										X	X	
Hook-Snouted Blind Snake	*Anilios hamatus*		X															X								

Common Name	Species Name	Status	NIM	PL	2008	TPA	2014	Borefield	2015 A	2015 B	2016 A	2016 B	2017 A	2017 B	2018 A	2018 B	2019 A	2019 B	2020 A	2020 B	2021 A	2021 B	2022 A	2022 B	2023 A	2023 B
Buff-snouted Blind Snake	*Anilios margaretae*	P2																								
Common Beaked Blind Snake	*Anilios waitii*		X			X			X	X	X		X			X									X	X
BOIDAE																										
Stimson's Python	*Antaresia stimsoni*		X											R												
Woma	*Aspidites ramsayi*														R										R	
Carpet Python	*Morelia spilota*											X						R								
ELAPIDAE																										
Desert Death Adder	*Acanthophis pyrrhus*					X																				
Narrow-banded Shovel-nosed Snake	*Brachyurophis fasciolata*					X	X	X	X		X	X	X	X	X			X		X				X	X	X
Southern Shovel-nosed Snake	*Brachyurophis semifasciata*			X		X	X	X			X	X		X						X				X		
Yellow-faced Whipsnake	*Demansia psammophis*					X	X			X		X	X	X	X	X				X			X			
Moon Snake	*Furina ornata*		X																							
Black-naped Snake	*Neelaps bimaculatus*		X			X																		X		
Monk Snake	*Parasuta monachus*		X			X	X			X	X		X	X	X	X				X				X		X
Mulga Snake	*Pseudechis australis*		X		X	X		X	X	X	X		X	X	X	X	X				X			X	X	X
Spotted Mulga Snake	*Pseudechis butleri*		X																							
Ringed Brown Snake	*Pseudonaja modesta*			X		X							X	X	X	X		X								
Western Brown Snake	*Pseudonaja mengdeni*				X	X		X														R				
Desert Banded Snake	*Simoselaps anomalus*																									
Jan's Banded Snake	*Simoselaps bertholdi*		X	X		X	X	X		X	X	X	X	X	X		X	X		X				X	X	X
Rosen's Snake	*Suta fasciata*		X																							
Total Number of Species Expected: 100 **Total Recorded during SHD Monitoring: 87** **Total Recorded along APA pipeline: 77** **Total Recorded by KEC: 87** **Total Recorded at Tropicana: 89**																										
Total Recorded:		**3**	**70**	**38**	**18**	**70**	**50**	**34**	**33**	**35**	**50**	**50**	**50**	**48**	**47**	**39**	**18**	**43**	**11**	**37**	**25**	**27**	**28**	**50**	**46**	**50**

Table 3. Birds expected to occur and recorded in the Survey Area.

Common Name	Species Name	Status	NM / BA	PL	GVD	TPA	KE2014	Borefield	2015 A	2015 B	2016 A	2016 B	2017 A	Aug 17	2017 B	2018 A	Aug 18	2018 B	2019 A	2019 B	2020 A	2020 B	2021 A	2021 B	2022 B	2022 B	2023 A	2023 B
CASUARIIDAE																												
Emu	*Dromaius novaehollandiae*		X	X	X	X	X	X	X	X		X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X
PHASIANIDAE																												
Stubble Quail	*Coturnix pectoralis*		X		X											R	X									X	
MEGAPODIIDAE																												
Malleefowl	*Leipoa ocellata*	V		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
ANATIDAE																												
Musk Duck	*Biziura lobate*		X		P													P										
Black Swan	*Cygnus atratus*		X		P																							
Australian Shelduck	*Tadorna tadornoides*		X		X									X													X	
Australian Wood Duck	*Chenonetta jubata*		X		X											X											X	
Pacific Black Duck	*Anas superciliosa*		X		X										X										R			
Pink-eared Duck	*Malacorhynchus membranaceus*		X		X								P	X														
Grey Teal	*Anas gracilis*		X		X								X	X	X	X												
Australasian Shoveler	*Anas rhynchotis*		X																									
Hardhead	*Aythya australis*		X		P													P										
Freckled Duck	*Stictonetta naevosa*																	P										
PODICIPEDIDAE																												
Australasian Grebe	*Tachybaptus novaehollandiae*		X		P													P										
Hoary-headed Grebe	*Poliocephalus poliocephalus*		X		X	X												P										
PHALACROCORACIDAE																												
Little Pied Cormorant	*Microcarbo melanoleucos*				X											X												
Little Black Cormorant	*Phalacrocorax sulcirostris*				X																							
COLUMBIDAE																												
Common Bronzewing	*Phaps chalcoptera*		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Crested Pigeon	*Ocyphaps lophotes*		X		X	X	X	X						X	R		X	X										
Diamond Dove	*Geopelia cuneate*				X	X									R		X											
PODARGIDAE																												
Tawny Frogmouth	*Podargus strigoides*		X	X	X	X	X		X	X	X	X	X		X	X	X	X	X									X
EUROSTOPODIDAE																												
Spotted Nightjar	*Eurostopodus argus*		X		X		X	X	X	X	X	X	X	X	X	X	X		X	X	X		X	X		X	X	X
AEGOTHELIDAE																												
Australian Owlet-nightjar	*Aegotheles cristatus*		X	X	X	X	X		X	X	X	X	X		X	X	X	X									X	X
APODIDAE																												
Fork-tailed Swift	*Apus pacificus*	M																										
ARDEIDAE																												
White-faced Heron	*Egretta novaehollandiae*		X		X									X		X												
White-necked Heron	*Ardea pacifica*		X		X								X															
Eastern Great Egret	*Ardea modesta*	M																										
Straw-necked Ibis	*Threskiornis spinicollis*				X						X															X		
Glossy Ibis	*Plegadis falcinellus*																	X										
ACCIPITRIDAE																												
Black-shouldered Kite	*Elanus axillaris*		X		X										R													
Square-tailed Kite	*Lophoictinia isura*																											
Black-breasted Buzzard	*Hamirostra melanosternon*																											

Common Name	Species Name	Status	NM / BA	PL	GVD	TPA	KE2014	Borefield	2015 A	2015 B	2016 A	2016 B	2017 A	Aug 17	2017 B	2018 A	Aug 18	2018 B	2019 A	2019 B	2020 A	2020 B	2021 A	2021 B	2022 B	2022 B	2023 A	2023 B
Whistling Kite	*Haliastur sphenurus*		X																							X		
Black Kite	*Milvus migrans*																											
Brown Goshawk	*Accipiter fasciatus*		X	X	X			X	X	X		X	X		X					X								
Collared Sparrowhawk	*Accipiter cirrocephalus*		X		X	X			X				X															
Spotted Harrier	*Circus assimilis*				X										R		X											
Wedge-tailed Eagle	*Aquila audax*		X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X		X	X	X		X	X
Little Eagle	*Hieraaetus morphnoides*		X		X	X	X	X		X	X		X		X	X				X						X	X	X
FALCONIDAE																												
Nankeen Kestrel	*Falco cenchroides*		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X		X		X	X	X	X	X
Brown Falcon	*Falco berigora*		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Australian Hobby	*Falco longipennis*		X	X	X	X	X	X		X			X		X		X		X	X	X				X	X		
Peregrine Falcon	*Falco peregrinus*	OS	X	X	X	X			X				X			X												
Grey Falcon	*Falco hypoleucos*	V		X																								
RALLIDAE																												
Eurasian Coot	*Fulica atra*		X		X	X									P													
Black-tailed Native-hen	*Tribonyx ventralis*		X		P										P													
OTIDIDAE																												
Australian Bustard	*Ardeotis australis*	L	X	X	X	X	X	X		X	X		X	X	X	X		X	X	X	X		X	X	X	X	X	X
BURHINIDAE																												
Bush Stone-curlew	*Burhinus grallarius*	L			X										X													
RECURVIROSTRIDAE																												
Red-necked Avocet	*Recurvirostra novaehollandiae*				X								H								X							
Black-winged Stilt	*Himantopus himantopus*		X		P																						X	
Banded Stilt	*Cladorhynchus*																											
CHARADRIIDAE																												
Red-capped Plover	*Charadrius ruficapillus*		X	X	X		X							X														
Black-fronted Dotterel	*Elseyornis melanops*		X		P																							
Red-kneed Dotterel	*Erythrogonys cinctus*		X																									
Inland Dotterel	*Charadrius australis*		X		X													R										
Oriental Plover	*Charadrius veredus*	M																										
Grey Plover	*Pluvialis squatarola*				X									X														
Banded Lapwing	*Vanellus tricolor*		X		X	X							X	X		X												
SCOLOPACIDAE																												
Commo Greenshank	*Tringa nebularia*	M	X		P																							
Wood Sandpiper	*Tringa glareola*	M	X		P																							
Red-necked Stint	*Calidris ruficollis*	M	X																									
Sharp-tailed Sandpiper	*Calidris acuminata*	M																										
Curlew Sandpiper	*Calidris ferruginea*	M																										
Common Sandpiper	*Actitis hypoleucos*	M																										
TURNICIDAE																												
Little Button-quail	*Turnix velox*		X	X	X						X				X		X											
LARIDAE																												
Silver Gull	*Larus novaehollandiae*																											
CACATUIDAE																												
Galah	*Eolophus roseicapillus*		X		X	X	X	X		X	X	X	X	X	X	X	X		X	X	X	X			X	X	X	X
Little Corella	*Cacatua sanguinea*																											

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Cockatiel	*Nymphicus hollandicus*		X		X	X	X				X				X	X	X											
Major Mitchell's Cockatoo	*Lophochroa leadbeateri*	L			X		X			X	X	X	X		R			X						X		X		X
PSITTACIDAE																												
Purple-crowned Lorikeet	*Glossopsitta porphyrocephala*	L	X		X	X							X			X			X									
Princess Parrot	*Polytelis alexandrae*	V																										
Regent Parrot	*Polytelis anthopeplus*	L			X	X									R	R		R			X		X		R			
Australian Ringneck	*Barnardius zonarius*		X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Mulga Parrot	*Psephotus varius*		X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				X	X	X	X
Budgerigar	*Melopsittacus undulatus*		X	X	X	X	X	X			X	X	X		X	X	X	X								X		X
Bourke's Parrot	*Neopsephotus bourkii*		X		X												X											
Scarlet-chested Parrot	*Neophema splendida*	L		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				X		
Night Parrot	*Pezoporus occidentalis*	C																										
CUCULIDAE																												
Horsfield's Bronze-Cuckoo	*Chalcites basalis*		X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X		X	X	X
Black-eared Cuckoo	*Chalcites osculans*		X		X	X	X	X	X	X	X	X	X	X	X	X	X	X			X					X		
Pallid Cuckoo	*Cacomantis pallidus*		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X											
Fan-tailed Cuckoo	*Cacomantis flabelliformis*								X																			
STRIGIDAE																												
Southern Boobook	*Ninox novaeseelandiae*		X	X	X		X	X			X	x	X	X	X	X	X										X	X
TYTONIDAE																												
Eastern Barn Owl	*Tyto alba*				X						X	X	X		R	X	X											
HALCYONIDAE																												
Red-backed Kingfisher	*Todiramphus pyrrhopygius*		X	X	X	X	X	X		X	X	X			X	X		X		X				X			X	X
Sacred Kingfisher	*Todiramphus sanctus*		X	X																								
MEROPIDAE																												
Rainbow Bee-eater	*Merops ornatus*	M	X	X	X	X	X	X		X		X	X		X	X				X						X		X
CLIMACTERIDAE																												
White-browed Treecreeper	*Climacteris affinis*		X	X	X	X		X		X				X					X									
Rufous Treecreeper	*Climacteris rufa*	L			X		X		X	X	X	X	X	X	X			X	X	X	X					R		
PTILONORHYNCHIDAE																												
Western Bowerbird	*Ptilonorhynchus guttatus*		X		X		X	X							R		X											
MALURIDAE																												
Splendid Fairy-wren	*Malurus splendens*		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
White-winged Fairy-wren	*Malurus leucopterus*		X	X	X		X	X		X			X	X		X	X		X							X	X	X
Variegated Fairy-wren	*Malurus lamberti*		X		X								X		X		X										X	
Striated Grasswren	*Amytornis striatus striatus*	L	X		X		X		X		X			X	X	X		X	X				X				X	X
Rufous-crowned Emu-wren	*Stipiturus ruficeps*	L			X									X					X									
ACANTHIZIDAE																												
Rufous Fieldwren	*Calamanthus campestri*				X									?	R		X											
Redthroat	*Pyrrholaemus brunneus*		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Weebill	*Smicrornis brevirostris*		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Western Gerygone	*Gerygone fusca*		X	X	X												X											
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*		X	X	X	X	X		X	X	X			X	R		X	X	X		X				X		X	
Chestnut-rumped Thornbill	*Acanthiza uropygialis*		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X
Slaty-backed Thornbill	*Acanthiza robustirostris*		X		X	X	X	X	X	X	X				X					X					X			
Inland Thornbill	*Acanthiza apicalis*		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Common Name	Species Name	Status	NM / BA	PL	GVD	TPA	KE2014	Borefield	2015 A	2015 B	2016 A	2016 B	2017 A	Aug 17	2017 B	2018 A	Aug 18	2018 B	2019 A	2019 B	2020 A	2020 B	2021 A	2021 B	2022 B	2022 B	2023 A	2023 B
Slender billed Thornbill	*Acanthiza iredalei*	L	X	X	X									X					X									
Southern Whiteface	*Aphelocephala leucopsis*		X	X	X	X	X	X		X				X	R													
PARDALOTIDAE																												
Spotted Pardalote	*Pardalotus punctatus*																								R			
Striated Pardalote	*Pardalotus striatus*		X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X		X	X	X	X	X	
MELIPHAGIDAE																												
Pied Honeyeater	*Certhionyx variegatus*		X		X							X																
Singing Honeyeater	*Lichenostomus virescens*		X		X	X	X	X	X	X	X	X	X	X	X		X		X	X	X	X	X			X	X	X
White-eared Honeyeater	*Lichenostomus leucotis*				X										X	R		X	X						R	R		
White-plumed Honeyeater	*Lichenostomus penicillatus*		X																									
Yellow-plumed Honeyeater	*Lichenostomus ornatus*														R											R		X
Grey-fronted Honeyeater	*Lichenostomus plumulus*		X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
White-fronted Honeyeater	*Purnella albifrons*		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X		X	X	X	X
Yellow-throated Miner	*Manorina flavigula*		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X
Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X
Red Wattlebird	*Anthochaera carunculata*		X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X		X	X	R			
Crimson Chat	*Epthianura tricolor*		X	X	X	X	X	X		X		X			X	X											X	X
White-fronted Chat	*Epthianura albifrons*		X		X									X				P										
Orange Chat	*Epthianura aurifrons*			X																					X	X		
Black Honeyeater	*Sugomel niger*		X	X	X																							
Brown Honeyeater	*Lichmera indistincta*		X		X	X	X						P	X				X							X		X	
Brown-headed Honeyeater	*Melithreptus brevirostris*				X									X	X	R		X	X						R			
POMATOSTOMIDAE																												
White-browed Babbler	*Pomatostomus superciliosus*		X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
PSOPHODIDAE																												
Chestnut Quail-thrush	*Cinclosoma castanotus*				X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X		X	X	X
Chestnut-breasted Quail-thrush	*Cinclosoma castaneothorax*		X	X	X										X		X	X			X				X		X	X
Chiming Wedgebill	*Psophodes occidentalis*		X		X																							
NEOSITTIDAE																												
Varied Sittella	*Daphoenositta chrysoptera*				X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X		X	X	X	X	X	X
CAMPEPHAGIDAE																												
Ground Cuckoo-shrike	*Coracina maxima*		X		X	X		X					X		X	X	X	X	X	X				X	X		X	X
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
White-winged Triller	*Lalage sueurii*		X		X		X	X		X																		
PACHYCEPHALIDAE																												
Rufous Whistler	*Pachycephala rufiventris*		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Gilbert's Whistler	*Pachycephala inornata*				X		X							X														X
Grey Shrike-thrush	*Colluricincla harmonica*		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Crested Bellbird	*Oreoica gutturalis*		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
ARTAMIDAE																												
Masked Woodswallow	*Artamus personatus*		X		X	X	X	X		X			X		X	X		X		X				X		X		X
Black-faced Woodswallow	*Artamus cinereus*		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X
Dusky Woodswallow	*Artamus cyanopterus*																		X									
Little Woodswallow	*Artamus minor*		X		X		X				X	X	X		X		X		X	X						X		
Grey Butcherbird	*Cracticus torquatus*		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Pied Butcherbird	*Cracticus nigrogularis*		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

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Australian Magpie	*Cracticus tibicen*		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X
Grey Currawong	*Strepera versicolor*		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X
RHIPIDURIDAE																												
Grey Fantail	*Rhipidura albiscapa*		X		X										X	R												
Willie Wagtail	*Rhipidura leucophrys*		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X
CORVIDAE																												
Little Crow	*Corvus bennetti*		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	
Torresian Crow	*Corvus orru*		X	X	X		X	X	X				X	X	X		X		X	X	X	X	X	X	X	X	X	X
Australian Raven	*Corvus coronoides*				X																						R	
MONARCHIDAE																												
Magpie-lark	*Grallina cyanoleuca*		X		X	X	X				X	X	X		X	X	X		X	X		X	X	X	X		X	
PETROICIDAE																												
Red-capped Robin	*Petroica goodenovii*		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X
Hooded Robin	*Melanodryas cucullata*		X		X	X	X	X		X		X	X	X	X	X	X	X	X	X	X	X		X		X	X	X
Jacky Winter	*Microeca fascinans*		X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X		X	X
Southern Scrub-robin	*Drymodes brunneopygia*	L			X		X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
MEGALURIDAE																												
Rufous Songlark	*Cincloramphus mathewsi*		X		X										R			X										
Brown Songlark	*Cincloramphus cruralis*		X		X		X		X					X	X													
Spinifexbird	*Megalurus carteri*				X										R													
HIRUNDINIDAE																												
White-backed Swallow	*Cheramoeca leucosterna*		X		X	X	X	X	X	X	X	X		X	X				X	X	X		X			X	X	X
Welcome Swallow	*Hirundo neoxena*		X		X		X																					
Fairy Martin	*Petrochelidon ariel*		X		X		X		X					X	X		X			X	X			X	X		X	
Tree Martin	*Petrochelidon nigricans*		X		X	X	X	X			X	X	X		X	X		X										X
NECTARINIIDAE																												
Mistletoebird	*Dicaeum hirundinaceum*		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
ESTRILDIDAE																												
Zebra Finch	*Taeniopygia guttata*		X	X	X	X	X	X			X	X		X	X	X	X	X										
MOTACILLIDAE																												
Australasian Pipit	*Anthus novaeseelandiae*		X		X	X	X	X	X	X				X	R		X	X	X		X		X	X	X		X	X
Total Number of Species Expected: 161 **Total Recorded during SHD Monitoring: 109** **Total Recorded along APA pipeline: 109** **Total Recorded by KEC: 121** **Total Recorded at Tropicana: 116**																												
Total Recorded:		**23**	**118**	**48**	**123**	**73**	**78**	**70**	**59**	**66**	**62**	**61**	**67**	**73**	**73**	**73**	**71**	**70**	**62**	**58**	**52**	**32**	**44**	**46**	**52**	**58**	**60**	**59**

Note: Species recorded along the Eastern Goldfields Pipeline marked “x”, species recorded on Pinjin station marked “P”, species recorded on Hampton Hill Station marked “H”. Species recorded across the wider bioregion are marked “R” (recorded within 100km of the Eastern Goldfields Pipeline).

Table 4. Mammals expected to occur and recorded in the Survey Area.

Common Name	Species Name	Status	NM	PL	2008	TPA	2014	Borefields	2015 A	2015 B	2016 A	2016 B	2017 A	2017 B	2018 A	2018 B	2019 A	2019 B	2020 A	2020 B	2021 A	2021 B	2022 A	2022 B	2023 A	2023 B
TACHYGLOSSIDAE																										
Echidna	*Tachyglossus aculeatus*		X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
DASYURIDAE																										
Brush-tailed Mulgara	*Dasycercus blythi*	P4					X	X	X	S	S	S	X	X	X	X	X	X	X	X	X	X	X		X	X
Ride's Ningaui	*Ningaui ridei*		X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Mallee Ningaui	*Ningaui yvonneae*		X													R	X	X	X	X	X	X	X	X	X	X
Kultarr	*Antechinomys laniger*	L	X																							
Woolley's Pseudantechinus	*Pseudantechinus woolleyae*	L					X	X						X			X								X	X
Fat-tailed Dunnart	*Sminthopsis crassicaudata*		X	X		X																X				
Little Long-tailed Dunnart	*Sminthopsis dolichura*		X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Hairy-footed Dunnart	*Sminthopsis hirtipes*		X			X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Long-tailed Dunnart	*Sminthopsis longicaudata*		X											R												X
Stripe-faced Dunnart	*Sminthopsis macruora*		X											R												
Ooldea Dunnart	*Sminthopsis ooldea*		X	X		X	X	X	X	X	X	X	X	X	X	X			X		X	X	X	X	X	
Sandhill Dunnart	*Sminthopsis psammophila*	E					X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Lesser Hairy-foot Dunnart	*Sminthopsis youngsoni*																								X	
NOTORYCTIDAE																										
Southern Marsupial Mole	*Notoryctes typhlops*					X	X	X	X		X		X			X	X						X		X	
BURRAMYIDAE																										
Western Pygmy Possum	*Cercartetus concinnus*											X						X								
MACROPODIDAE																										
Western Grey Kangaroo	*Macropus fuliginosus*				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Euro	*Macropus robustus*		X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Red Kangaroo	*Macropus rufus*		X			X	X	X		X				X	X	X	X								X	
EMBALLONURIDAE																										
Hill's Sheathtail Bat	*Taphozous hilli*					X													X							
MOLOSSIDAE																										
Inland Freetail Bat	*Ozimops petersi*					X	X														X					
Western Freetail Bat	*Ozimops kitcheneri*																									
White-striped Freetail Bat	*Austronomus australis*			X	X	X	X		X					X		X	X		X		X				X	
VESPERTILIONIDAE																										
Gould's Wattled Bat	*Chalinolobus gouldii*			X		X	X						X	X					X		X					
Chocolate Wattled Bat	*Chalinolobus morio*		X																							
Lesser Long-eared Bat	*Nyctophilus geoffroyi*		X			X	X												X		X					
Greater Long-eared Bat	*Nyctophilus timoriensis*	P4				X																				
Inland Broad-nosed Bat	*Scotorepens balstoni*			X		X								X												
Southern Forest Bat	*Vespadelus regulus*																									
Inland forest bat	*Vespadelus baverstocki*		X																							
Inland Cave Bat	*Vespadelus finlaysoni*		X			X								X					X						X	
MURIDAE																										
Spinifex Hopping Mouse	*Notomys alexis*		X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Mitchell's Hopping Mouse	*Notomys mitchellii*																									
Bolam's Mouse	*Pseudomys bolami*			X																						
Desert Mouse	*Pseudomys desertor*					X	X		X		X	X	X	X	X	X	X							X	X	
Sandy Inland Mouse	*Pseudomys hermannsburgensis*		X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Common Name	Species Name	Status	NM	PL	2008	TPA	2014	Borefields	2015 A	2015 B	2016 A	2016 B	2017 A	2017 B	2018 A	2018 B	2019 A	2019 B	2020 A	2020 B	2021 A	2021 B	2022 A	2022 B	2023 A	2023 B
INTRODUCED MAMMALS																										
Dingo / Dog	*Canis lupus*					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
European Red Fox	*Vulpes vulpes*				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Feral Cat	*Felis catus*		X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Rabbit	*Oryctolagus cuniculus*		X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
House Mouse	*Mus musculus*		X	X		X	X	X	X	X	X	X	X	X	X	X		X	X	X		X	X	X	X	
Dromedary Camel	*Camelus dromedarius*				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Total Number of Native Species: 35 **Total Recorded during SHD Monitoring: 19** **Total Recorded along APA pipeline: 15** **Total Recorded by KEC: 25** **Total Recorded at Tropicana: 26**		**5**	**17**	**9**	**4**	**21**	**19**	**13**	**14**	**11**	**12**	**12**	**14**	**19**	**13**	**15**	**16**	**12**	**17**	**11**	**16**	**13**	**13**	**12**	**19**	**13**
Total Number of Introduced Species: 10			**3**	**1**	**5**	**6**	**6**	**6**	**6**	**6**	**6**	6	6	6	6	6	5	6	6	6	5	6	6	6	6	5

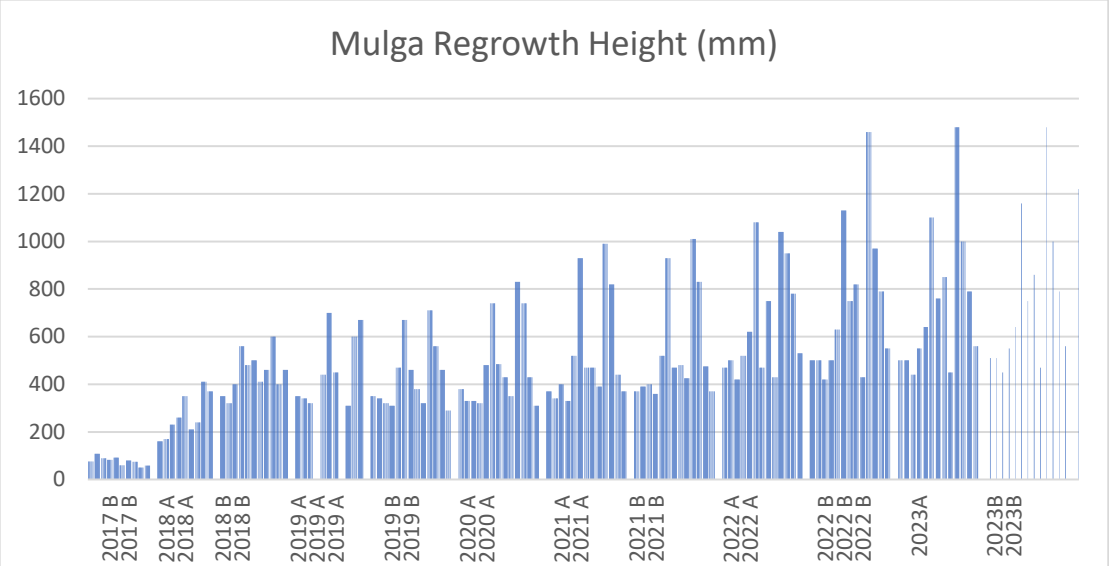
Appendix C: Fire Regeneration: Mulga and Spinifex Assessment.

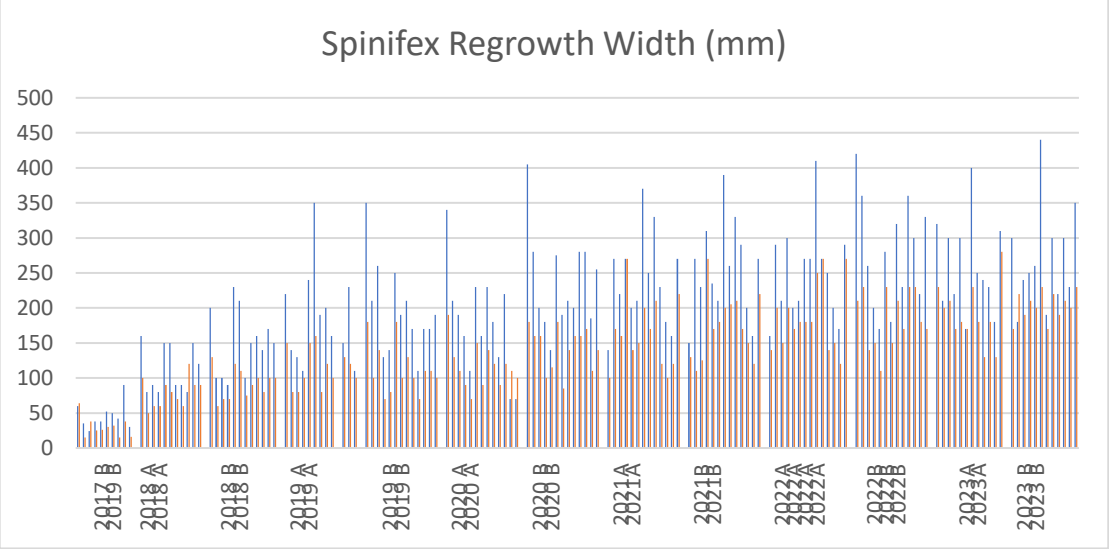
Code	Species	H	W	E	N	Distance from Pit	2018 Autumn		2018 Spring		May 2019		Spring 2019		2020 A		2020 B		2021 A		2021 B		2022 A			2022 B		2023 A		2023 B	
							H	W	H	W	H	W	H	W	H	W	H	W	H	W	H	W	H	W	L	H	W	H	W	H	W
M01	*Acacia incurvaneura*	75	90	627209	6763193	NA	160	230	290	350	350	420	350	400	380	440	370	470	370	430	370	585	470	480	520	500	700	500	580	510	580
M02	*Acacia incurvaneura*	108	130	627202	6763202	NA	170	280	230	320	340	450	340	490	330	500	330	620	340	560	390	440	500	620	500	500	540	500	690	510	700
M03	*Acacia incurvaneura*	89	135	627178	6763185	NA	230	340	290	400	320	420	320	460	330	460			400	490	400	500	420	420	500	420	580	440	540	450	550
M04	*Acacia incurvaneura*	82	140	627167	6763171	NA	NA	NA	370	560			310	510	320	610			330	590	360	615	520	540	640	500	670	550	700	550	700
M05	*Acacia incurvaneura*	92	144	627169	6763155	NA	260	450	300	480	440	590	470	550	480	590	480		520	690	520	720	620	740	720	630	770	640	750	640	750
M06	*Acacia incurvaneura*	60	146	626950	6763027	NA	350	460	520	500	700	640	670	630	740	670			930	960	930	890	1080	1160	1090	1130	1250	1100	1290	1160	1340
M07	*Acacia caesaneura*	80	60	626932	6763011	NA	NA	NA	NA	NA	450	370	460	400	485	410			470	460	470	460	750	530	330	750	580	760	880	750	870
M08	*Acacia caesaneura*	74	108	626782	6763110	NA	210	320	270	410			380	180	430	220			470	340	480	420	750	460	450	820	570	850	540	860	550
M09	*Acacia caesaneura*	50	94	626775	6763118	NA	NA	NA	NA	NA	310	400	320	400	350	420			390	520	425	550	430	470	470	430	480	450	500	470	530
M10	*Acacia caesaneura*	58	50	626771	6763196	NA	240	280	340	460	600	550	710	510	830	560			990	740	1010	710	1040	980	850	1460	1020	1480	1070	1480	1020
M11	*Acacia caesaneura*	NA	NA	627160	6763173	NA	410	580	490	600	670	740	560	650	740	800			820	850	830	910	950	1010	940	970	1040	1000	1060	1000	1140
M12	*Acacia caesaneura*	NA	NA	626933	6763012	NA	370	330	400	400			460	400	430	500	430		440	570	475	610	780	790	590	790	830	790	820	790	860
M13	*Acacia caesaneura*	NA	NA	626877	6763269	NA	200	300	230	460			290	510	310	510	330	510	370	560	370	575	530	740	600	550	580	560	790	560	790
M14	*Acacia incurvaneura*			Next to	13																		630	810	760						
M15	*Acacia incurvaneura*	NA	NA																											1220	1320
A01	*Aluta maisonneuvei*	60	60	627209	6763193	NA	180	200	250	200	280	220	290	280	290	290	300	300	320	330	305	290	480	380	330	360	410	380	430	390	440
A02	*Aluta maisonneuvei*	36	60	627202	6763202	NA	160	120	240	220	280	250	280	330	300	280	310	350	300	300	320	290	360	360	400	380	400	390	400	390	390
A03	*Aluta maisonneuvei*	59	82	627178	6763185	NA	210	230	250	280	300	350	300	300	300	350	315	340	320	340	320	380	350	400	400	310	410	360	330	360	360
A04	*Aluta maisonneuvei*	48	55	627167	6763171	NA	NA	NA	210	290			350	370	360	320	340	350	300	370	320	360	310	400	350	290	360	310	410	330	390
A05	*Aluta maisonneuvei*	72	115	627169	6763155	NA	160	290	200	290	300	360	310	280	370	370			350	400	320	380	370	410	360	360	410	380	430	380	440
A06	*Aluta maisonneuvei*	54	58	626950	6763027	NA	250	300	280	320	320	340	340	340	360	380			360	570	430	605	510	720	760	520	820	620	800	540	770
A07	*Aluta maisonneuvei*	34	36	626932	6763011	NA	NA	NA	NA	NA	300	130	300	150	300	140	340	245	330	160	330	160	510	500	390	550	600	560	600	560	600
A08	*Aluta maisonneuvei*	26	20	626776	6763110	NA	100	100	190	130			320	250	360	220			380	350	390	410	430	340	320	430	380	480	440	480	470
A09	*Aluta maisonneuvei*	54	48	626775	6763118	NA	NA	NA	NA	NA	300	200	310	190	310	230	300		390	350	390	350	450	440	430	440	450	490	420	460	440

A10	*Aluta maisonneuvei*	68	40	626771	6763196	NA	190	190	270	290	300	320	440	560	450	510	465		510	620	490	630	640	740	660	620	870	660	760	680	750
A11	*Aluta maisonneuvei*	NA	NA	627160	6763173	NA	150	230	200	250	300	310	260	370	270	370			290	450	300	440	350	380	450	350	470	370	480	370	490
A12	*Aluta maisonneuvei*	NA	NA	626933	6763012	NA	200	120	240	120					500	330			490	500	310	160	530	580	520	400	770	400	260	400	280
A13	*Aluta maisonneuvei*	NA	NA	626877	6763269	Na	NA	NA	180	190			200	210	220	180			250	280	240	245	240	260	210	250	270	240	270	250	280
A15	*Aluta maisonneuvei*	NA	NA																											470	480
T01	*Triodia desertorum*	64	60	626803	6763395	West 100W	100	160	130	200	150	220	180	350	190	340	180	405	100	140	130	150	140	160	160	210	420	280	310	170	300
T02	*Triodia desertorum*	15	35	626805	6763387	100E	50	80	60	100	80	140	100	210	130	210	160	280	170	270	110	270	200	290	260	230	360	130	180	220	180
T03	*Triodia desertorum*	38	24	626804	6763381	180E	60	90	70	100	80	130	140	260	110	190	160	200	160	220	125	230	150	210	200	140	260	180	230	190	240
T04	*Triodia desertorum*	25	38	626807	6763372	Dead. New=	60	80	70	90	100	110	70	130	90	160	100	180	270	270	270	310	200	300	300	150	200	130	240	210	250
T05	*Triodia desertorum*	26	38	626807	6763364	½ way- 4 & 5	90	150	120	230	150	240	80	140	70	110	115	140	140	200	170	235	170	200	190	110	170	180	250	200	260
T06	*Triodia desertorum*	30	52	626809	6763356	200NE	80	150	110	210	160	350	180	250	150	230	180	275	150	210	180	210	180	210	240	230	280	230	400	230	440
T07	*Triodia desertorum*	32	50	626884	6763395	East P12:120S	70	90	75	100	80	190	100	190	90	160	85	190	200	370	200	390	180	270	320	150	180	170	320	170	190
T08	*Triodia desertorum*	15	42	626891	6763387	P11:100E	60	90	90	150	120	200	130	210	140	230	140	210	170	250	205	260	180	270	240	210	320	180	210	220	300
T09	*Triodia desertorum*	38	90	626894	6763379	P10:200NW	120	80	100	160	100	160	100	170	120	180	160	200	210	330	210	330	250	410	410	170	230	170	300	190	220
Triodia desertorum between pits 3 and 4 on eastern line									80	140			70	110	90	130	160	280			170	290	270	270	240	230	360				
T11	*Triodia desertorum*	NA	NA	626896	6763373	P09: west	90	150	100	170	130	150	110	170	120	220	170	280	100	180	150	200	140	250	250	230	300	210	220	210	300
T10	*Triodia desertorum*	16	30	626899	6763377	P07:300E	90	120	100	150	120	230	110	170	110	70	110	185	120	160	120	160	150	200	190	180	220	200	300	200	230
T12	*Triodia desertorum*										100	110	100	190	100	70	140	255	220	270	220	270	120	170	160	170	330	230	170	230	350
Triodia desertorum – additional measurement																							270	290	250						
B01	*Bertya dimerostigma*					West	240	410	290	680	280	380	400	900	370	540	430	550	450	730	530	780	520	650	690	500	810	520	640	530	640
B02	*Bertya dimerostigma*					West	160	260	200	390	320	270	380	440	440	540	340	430	350	510	330	520	440	590	530	430	600	370	410	380	410
B03	*Bertya dimerostigma*					West	160	170	220	270	320	360	480	550	330	700	410	700	500	590	535	600	560	790	550	600	790	300	420	370	440
B04	*Bertya dimerostigma*					West	140	590	210	670	350	600	400	60	260	430	330	400	440	790	540	800	490	950	870	550	102	380	530	480	620
B05	*Bertya dimerostigma*					West	130	170	180	220	310	400	200	300	340	300	480	530	250	370	280	360	350	490	560	360	550	540	690	620	680
B06	*Bertya dimerostigma*					West	140	120	200	200	350	370	360	610	490	450	440	530	400	500	370	275	450	760	540	430	490	450	520	430	490
B07	*Bertya dimerostigma*					East	140	140	160	180	420	850	400	510	540	750	510	770	490	590	320	405	330	400	280	450	540	550	800	550	800
B08	*Bertya dimerostigma*					East	140	430	200	570	360	450	330	440	350	470	330	440	400	680	420	665	230	440	400	450	690	450	590	460	620
B09	*Bertya dimerostigma*					East	200	280	310	300	580	510	270	560	500	530	490	570	300	390	380	420	450	670	540	330	420	570	800	570	800

B10	*Bertya dimerostigma*					East	160	210	240	330	480	830	320	320	420	810	530	790	320	320	510	570	560	680	660	370	410	540	1000	500	930
B11	*Bertya dimerostigma*					East	150	230	190	340			320	400	220	320	240	320	430	460	410	480	410	500	490	490	870	320	530	360	560

Regeneration of Habitat Post Fire





Vegetation Change Associated with Fire

Site 10B: 2017	Site 10B: 2019	Site 10B: 2022
		
Site 1: 2016	Site 1: 2019	Site 1: 2022
		

Appendix D: Sandhill Dunnart Predator Scat Analysis.

Date	Site	Scat	*Sminthopsis dolichura*	*Sminthopsis hirtipes*	*Sminthopsis sp.*	*Dasycercus blythi*	*Notomys alexis*	*Rodent*	*Pseudomys desertor*	*P. hermannsburgensis*	*Mus musculus*	*Macropus rufus*	*Macropus robustus*	*Macropod sp.*	*Notoryctes typhlops*	Cow	Goat	Rabbit	Cat	Fox	Dog	Skink	Bearded dragon	Dragon	Goanna	Snake	Bird	Beetle /bug	Grasshopper/ cricket	Scorpion	Spider	Centipede	Unidentified invertebrate
20/09/18	1	Cat					60											40															
20/09/18	15	Cat					80				20																						
20/09/18	22	Cat	20					20		50												10											
20/09/18	7	d/c										100																					
20/09/18	15	Dog											100																				
15/09/18	9	Dog											100																				
20/09/18	MM	Dog											100																				
20/09/18	9	Dog				20	20						10		50																		
9/06/18	9	Cat					90																						10				
16/03/18	5	Dog						5					60					30										5					
3/07/2018	7	Dog											100																				
20/9/18	15	Dog											10									30		40				10	10				
16/3/18	5	Dog											100																				
18/3/18	4	Dog											100																				
20/03/2017	7	Dog											100																				
17/10/2017	7	Cat									10											20			40			30					
27/10/2017	14	Cat			5		30				60																		5				
25/10/2017	21	Dog											100																				
16/10/2017	15	Cat		70							10																	5	15				
17/10/2017	19	Dog																100															
9/10/2017	7	Dog												100																			
17/10/2017	C50	Dog					50															10		30				10					
17/10/2017	C9	Cat					80				20																						
17/10/2017	22	Cat									10											10			50			5	20			5	
9/10/2017	7	Dog											100																				
17/10/2017	7	Dog											100																				
17/10/2017	7	Cat				29			30																		40			1			
17/10/2017	7	Dog												100																			
12/04/2017	14	Fox													100																		

Date	Site	Scat	*Sminthopsis dolichura*	*Sminthopsis hirtipes*	*Sminthopsis sp.*	*Dasycercus blythi*	*Notomys alexis*	*Rodent*	*Pseudomys desertor*	*P. hermannsburgensis*	*Mus musculus*	*Macropus rufus*	*Macropus robustus*	*Macropod sp.*	*Notoryctes typhlops*	Cow	Goat	Rabbit	Cat	Fox	Dog	Skink	Bearded dragon	Dragon	Goanna	Snake	Bird	Beetle /bug	Grasshopper/ cricket	Scorpion	Spider	Centipede	Unidentified invertebrate
8/02/2016	5	Dog																														
27/03/2017	13	Cat									30														60			10				
27/03/2017	1	Fox					50															5						20		5			
27/03/2017	14	Dog											100																				
19/03/2016	13	Cat			5		75															10						10					
19/03/2016	7	Dog										100																					
18/03/2016	5	Dog										95																5					
17/03/2016	1	Dog														100																	
20/03/2016	11	Dog										100									0.01												
17/03/2016	1	Dog			1																90		9										
18/03/2016	4	Dog											100																				
18/03/2016	5	Fox				5																5						30	10			50	
18/03/2016	5	Fox						1												0.01		10			70			15					
18/03/2016	5	Fox																															
18/03/2016	5	Fox																80				2		3				10				5	
17/03/2016	9	Dog														100																	
17/03/2016	1	Dog																										5					
18/03/2016	9	Fox					50																					20	10			20	
18/03/2016	4	Goanna																										50			10		40

2015 Results

Sample	Site	Date	Scat Sample	Identification and Content of scat sample																										
			Species	*Sminthopsis psammophila*	*Sminthopsis hirtipes*	*Sminthopsis dolichura*	*Dasycercus blythi*	*Notomys alexis*	*Mus musculus*	*Macropus rufus*	*Macropus robustus*	*Macropod sp.*	*Notoryctes typhlops*	Camel	Goat	Cat	Dog	Skink	Bearded dragon	Goanna	Snake	Bird	Beetle /bug	Grasshopper/ cricket	Scorpion	Grub	Ant/ termite	Grass	Rubbish	Comments
1	Site 7/8	17/04/15	Fox						40														60							
2	Site 7/8	17/04/15	Cat(probable)				10	10	5				10		60						4			1						
3	Site 5	17/04/15	Owl																				1	1	1					
4	Site 5	17/04/15	Dog							100																				
5	Site 1	17/04/15	Cat																			100								
6	Site 1	17/04/15	Dog									100																		M robustus/fuliginosus
7	Site 1	17/04/15	Dog													90						10								
8	Site 5	17/04/15	Dog		40*				10																5	45				
9	Site 5	17/04/15	Cat																			99	1							Black feathers
10	Site 5	21/4/15	Raptor															1					2							
11	Site 5	17/4/15	Dog									99											1							
12	Site 1	17/3/15	Sminthopsis psammophila																								100			
13	Site 1	17/4/15	Sminthopsis psammophila	40																			10				50			Dunnart grooming hair
14	Site 1	17/4/15	Sminthopsis psammophila	10																						50	40			Dunnart grooming hair
15	Site 5	21/4/15	Sminthopsis psammophila																								100			
16	635135 6763376	14/7/15	Dog								100*																			
17	635075 6763369	14/7/15	Fox									100																		
18	Site 5	14/9/15	Cat							99													1							
19	29.25111 124.38757	14/07/15	Cat			60					40*																			Macropod bone . 2 human hairs
20	634718 6763308	13/07/15	Dog								100*						0.01													
21	Site 11	15/9/15	Dog														100													
22	Site 11	16/9/15	Dog														100													Prey
23	Site 11	18/9/15	Cat							10								5					5					80		Grass from herbivore
24	633924 6763197	13/7/15	Dog							100																				

Sample	Site	Date	Scat Sample	Identification and Content of scat sample																											
			Species	*Sminthopsis psammophila*	*Sminthopsis hirtipes*	*Sminthopsis dolichura*	*Dasycercus blythi*	*Notomys alexis*	*Mus musculus*	*Macropus rufus*	*Macropus robustus*	*Macropod sp.*	*Notoryctes typhlops*	Camel	Goat	Cat	Dog	Skink	Bearded dragon	Goanna	Snake	Bird	Beetle /bug	Grasshopper/ cricket	Scorpion	Grub	Ant/ termite	Grass	Rubbish	Comments
25	Site 4	15/9/15	Fox											40					50						5		5			
26	635040 6763362	14/7/15	Dog							100																				
27	621326 6762868	14/7/15	Dog							100																				
28	634269 6763201	14/7/15	Cat	15																		70				15				
29	Site 10	15/9/15	Cat															60		30			5		5					
30	KP265	14/7/15	Cat							100*																				
31	618588 6762974	12/7/15	Fox					100																						
32	Site 4	12/7/15	Dog							100																				
33	635451 6763472	14/7/15	Dog									100																		
34	634937 6763343	13/7/15	Fox																									100		
35	635162 6763390	14/7/15	Dog																										100	Elastic, cloth wipe, pumpkin seeds

Appendix E: Rainfall Recorded at Tropicana Gold Mine.