Second Annual Report for Post Construction Year 3, 4 and 6 Ecological Monitoring

Devils Pulpit Pacific Highway Upgrade

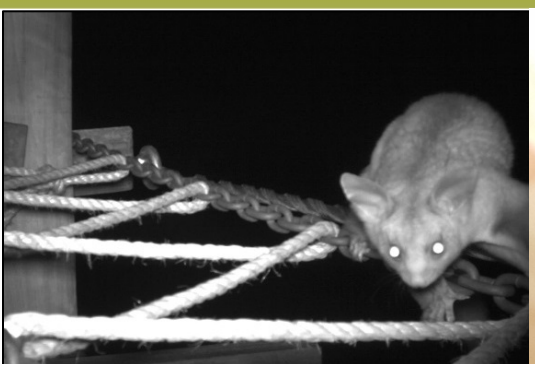
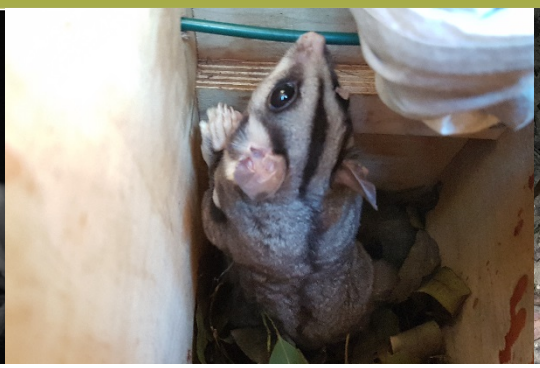


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Table of Contents

Illustrations

Tables

Plates

Figures

Appendices

Executive Summary

NSW Roads and Maritime Services (RMS) upgraded a 7.3 kilometre section of the Pacific Highway at Devils Pulpit, between Grafton and Ballina on the NSW north coast. Conditions of Approval for the Project included the development and implementation of an Ecological Monitoring Program (EMP). GeoLINK has been engaged by RMS to implement the post construction terrestrial species monitoring program for the Project. The broad objective is to monitor the effectiveness of the following mitigation measures: fauna crossings and structures, vegetated medians and vegetated connectivity corridor.

This report presents the results of Year 4 (2018/ 2019) post construction monitoring completed from June 2018 to February 2019 (referred to as Year 4). Permanent underpass camera and rope bridge camera results from December 2017 until February 2019 that were not reported in the Year 3 monitoring report (GeoLINK 2018) are also discussed.

The monitoring completed for the reporting period included:

- Targeted threatened species monitoring for the Rufous Bettong, Wallum Froglet, Green-thighed Frog, Yellow-bellied Glider, Squirrel Glider, Brush-tailed Phascogale, Koala and Spotted-tailed Quoll. The Greater Glider and Long-nosed Potoroo are also considered target threatened species.
- Fauna underpass monitoring (motion detection cameras and scat/ track searches at ten structures).
- Rope bridge monitoring with motion detection cameras (one rope bridge).
- Vegetated median monitoring (spotlighting, nest box monitoring and arboreal hair tubes; two medians)
- Restoration of vegetated connectivity corridor (vegetation) monitoring.
- Road kill monitoring.

All target species were recorded during the reporting period except for the Rufous Bettong, Wallum Froglet and Spotted-tailed Quoll.

Assessment of the monitoring results against the performance measures of mitigation measures being monitored found:

- Fauna Underpass: No complete crossings of target threatened species have been recorded to date, though crossings by a number of native non-threatened species have been recorded. Varying levels of fauna activity between structures and limited results at a number of structures (including no complete crossings at one structure) indicate varying suitability or quality of each in providing fauna connectivity. Significant rainfall events in early 2017 resulted in damage at some structures, including:

  - Scouring at the inlet and/ or outlet of five culvert structures, causing pooling of water within or at the entrance to the subject culverts.
  - Damage to the fauna furniture.

  RMS are currently investigating repair works for these structures. Construction works are currently being undertaken at C6 as part of W2B. Variations with EMP underpass design requirements and/ or construction/ condition issues are likely to be affecting the functionality of the structures in providing fauna passage across the highway.

- Rope Bridge: Three target threatened species (Squirrel Glider, Brush-tailed Phascogale and Yellow-bellied Glider) and four other native species have been recorded on the rope bridge. Direction movements have been recorded by six of these species, though complete crossings have only been recorded for the Feathertail Glider.
- Vegetated medians: Clearing phase surveys and post construction monitoring have indicated Yellow-bellied Glider and Greater Glider movements at the southern median. No glider movements at the northern median have been recorded. Squirrel Glider radio tracking is scheduled for July-September 2019.
- Vegetation Connectivity Corridor: Recruitment and growth of native species has been recorded across the corridor, however exotic groundcovers (including weeds) are present and reducing native species recruitment in some areas in the southern monitoring quadrats.
- Road Kill Monitoring: Road kill rates have been low and no target threatened species have been recorded to date.

Two recommendations were provided based on the monitoring findings in relation to fauna underpass structures and the vegetation connectivity corridor. Future monitoring will establish a larger more robust dataset to determine performance indicators for the Project. This includes completion of Year 4 rope bridge and underpass monitoring; and Year 6 monitoring.

1. Introduction

1.1 Background

1.1.1 Introduction

NSW Roads and Maritime Services (RMS) upgraded a 7.3 kilometre section of the Pacific Highway at Devils Pulpit, between Grafton and Ballina on the NSW north coast (the Project – refer to **Illustration 1.1**). The Project involved widening the Pacific Highway from the existing single carriageway to a four-lane dual carriageway, with a wide median to allow for future upgrade to six lanes (Hyder 2012). Construction was completed in March 2014.

The project was approved by the NSW Minister of Planning on 1 February 2011, subject to a number of conditions. Condition B6 stated:

'*Prior to the commencement of construction, the Proponent shall develop and implement an Ecological Monitoring Program to monitor the effectiveness of the mitigation measure identified in condition B4 for threatened species directly impacted by the project…*'.

The *Devils Pulpit Upgrade Ecological Monitoring Program* (EMP) was developed by Hyder Consulting Pty Ltd (Hyder 2012) on behalf of RMS to address this condition. The broad objective of the EMP is to monitor the effectiveness of the mitigation measures identified in the Biodiversity Offset Strategy for threatened species directly impacted by the Project.

Project approval from the Commonwealth Minister for the Department of Sustainability, Environment, Water, Populations and Communities (now Department of Energy and Environment - DEE) was received on 14 February 2011, also subject to a number of conditions. The *Spotted-tailed Quoll Management Plan* (SKM 2012) was prepared to address conditions 5(a)-(h) of Commonwealth Conditions of Approval. This included the implementation of a program to monitor the effectiveness of the fauna crossings constructed for the Project for Spotted-tailed Quoll using surveillance cameras (which correlated to the EMP fauna underpass monitoring) and population monitoring. Post construction Spotted-tailed Quoll population monitoring was completed in 2015 as part of a separate monitoring program (Sandpiper 2016a).

GeoLINK has been engaged by RMS to implement the post construction terrestrial species monitoring program for the Project in accordance with the EMP (Hyder 2012), *Spotted-tailed Quoll Management Plan* (SKM 2012) and the *Pre-construction Threatened Fauna Monitoring Results* (GeoLINK 2012a). Specifically, the monitoring covers the following sections of the EMP:

- Section 6: Monitoring Target Terrestrial Species.
- Section 7: Monitoring Crossing Structures (excluding *Section 7.4 Fauna Fencing*).
- Section 8: Monitoring Changes to Habitat Use.
- Section 9: Other Monitoring Activities (excluding *Section 9.1 Weed Monitoring*).

The mitigation measures monitored for effectiveness under this program and their objective as stated in the EMP are provided in **Table 1.1** and shown in **Illustration 1.2**, and include:

- Fauna crossing and structures;
- Vegetated medians; and
- Vegetated connectivity corridor (Hyder 2012).

The effectiveness of these mitigation measures would be assessed by:

- Monitoring threatened species adjacent to the Project footprint; and
- Identifying changes to habitat usage and assess whether changes can be attributed to the Project (Hyder 2012).

Eight target terrestrial species were identified in the EMP including:

- Rufous Bettong (*Aepyprymnus rufescens*);
- Wallum Froglet (*Crinnia tinnula*);
- Spotted-tailed Quoll (*Dasyurus maculatus*);
- Green-thighed Frog (*Litoria brevipalmata*);
- Yellow-bellied Glider (*Petaurus australis*);
- Squirrel Glider (*Petaurus norfolcensis*);
- Brush-tailed Phascogale (*Phascogale tapoatafa*); and
- Koala (*Phascolarctos cinereus*) (Hyder 2012).

All of these species are listed under the NSW *Biodiversity Conservation Act 2016* (BC Act). The Spotted-tailed Quoll and Koala are dually listed as threatened species under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Post construction monitoring in Year 3 (2017/ 2018 – GeoLINK 2018) identified the Long-nosed Potoroo (*Potorous tridactylus*) and Greater Glider (*Petauroides volans*) as additional threatened species at the site to monitor as part of the project. Both species are listed under the EPBC Act, while the Long-nosed Potoroo is dually listed under the BC Act.

The Oxleyan Pygmy Perch (*Nannoperca oxleyana*) comprises the target aquatic species of the EMP. Post construction monitoring requirements of the EMP for this species have been completed and are documented in the *Devils Pulpit Pacific Highway Upgrade Post-Construction Monitoring of Oxleyan Pygmy Perch and Surface Water* (GeoLINK 2015).

Post construction monitoring is required in Year 3 (2017/ 2018), Year 4 (2018/ 2019) and Year 6 (2020/ 2021) following completion of construction. This report presents the results of Year 4 (2018/ 2019) post construction monitoring completed from June 2018 to February 2019 (referred to as Year 4). Permanent underpass camera and rope bridge camera results from December 2017 until February 2019 that were not reported in the Year 3 monitoring report (GeoLINK 2018) are also discussed. Refer to GeoLINK (2018) for the study area description and a summary of the baseline (pre-construction) monitoring results.

Table 1.1 Relevant Mitigation Measures Being Monitored

Mitigation Measure	*Objective*	*Target Species*	*Features Being Monitoring*
Fauna underpasses	■ Maintain fauna movements and habitat connectivity for terrestrial and aquatic species. ■ Reduce road kill.	■ Frogs ■ Reptiles ■ Terrestrial mammals	Six Culverts: ■ C3, C6, C7, C8, C9, C10. Four Bridges: ■ Southbound bridge over Tabbimoble Floodway No. 2 (SBT2). ■ Northbound bridge over Tabbimoble Floodway No. 2 (NBT2). ■ Southbound bridge over Tabbimoble Floodway No. 3 (SBT3). ■ Northbound bridge over Tabbimoble Floodway No. 3 (NBT3).
Rope bridges	■ Maintain fauna movements and habitat connectivity for arboreal mammals. ■ Reduce road kill.	■ Sugar Glider (*Petaurus breviceps*) ■ Greater Glider ■ Common Brushtail Possum (*Trichosurus vulpecular*) ■ Common Ringtail Possum (*Pseudocheirus peregrines*) ■ Squirrel Glider ■ Yellow-bellied Glider	■ 1 x rope bridge extending over both carriageways linking Devils Pulpit State Forest and Bundjalung National Park (chainage 68.500).
Vegetated medians	■ Maintain fauna movements and habitat connectivity for arboreal mammals. ■ Reduce gap crossing distance for gliding mammals. ■ Reduce road kill.	■ Sugar Glider ■ Greater Glider ■ Squirrel Glider ■ Yellow-bellied Glider	■ 2 x vegetated medians at chainage 66.300-67.800 and 69.300-70.700. ■ Gliders will be able to use vegetated median to move between Devils Pulpit State Forest and Bundjalung National Park due to short glide distances. ■ Supports Dry Sclerophyll Forest and Floodplain Forest vegetation communities.

Mitigation Measure	*Objective*	*Target Species*	*Features Being Monitoring*
Vegetated connectivity corridor	■ The vegetated connectivity corridor will improve connectivity in the vicinity of Tabbimoble Floodways 2 and 3, facilitating the movement of cover-dependent and less mobile fauna species.	■ Frogs ■ Reptiles ■ Terrestrial mammals ■ Arboreal mammals ■ Cover-dependent birds	■ 1 x corridor at chainage 70.200 - 71.900 (east of the highway alignment). ■ Vegetated connectivity corridor will be at least 60m wide will involve rehabilitation of Subtropical Coastal Floodplain Forest.

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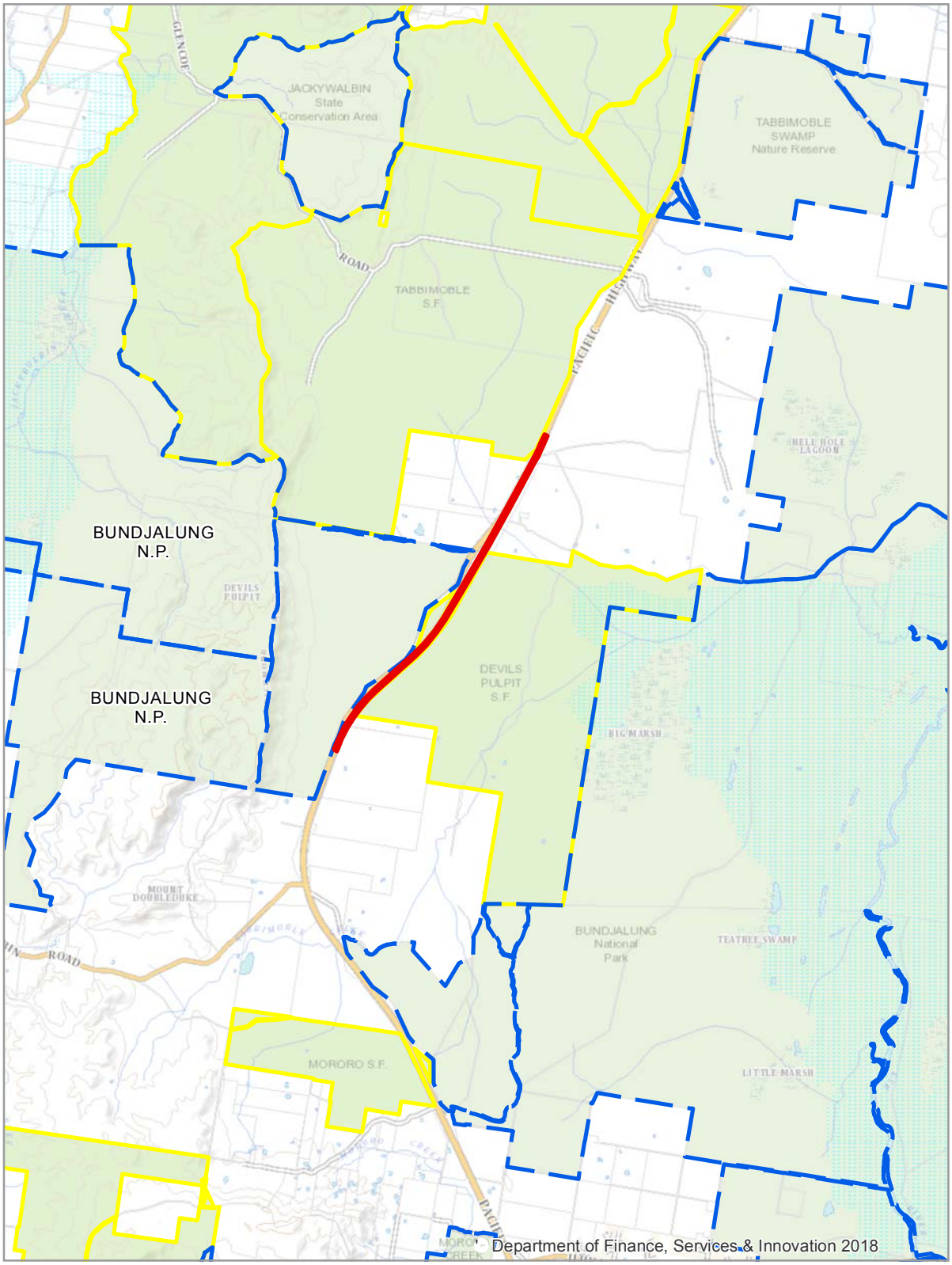

LEGEND

- The project
- National park reserve
- State forest

0 2 Km

Site Locality

GeoLINK environmental management and design

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2885-1031

Illustration 1.1

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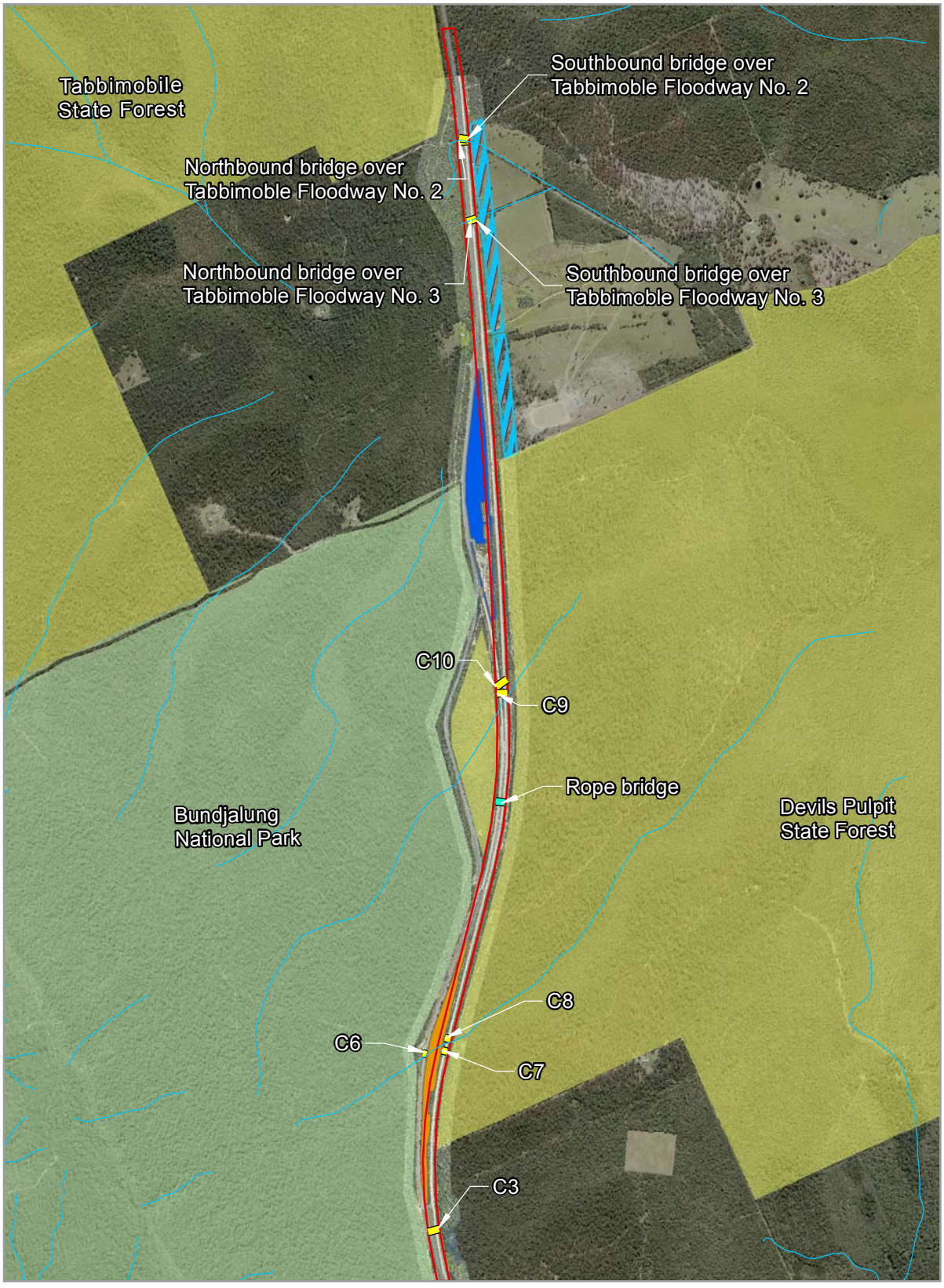

LEGEND

- Devil's Pulpit concept clearing limit
- Vegetated connectivity corridor
- Northern median
- Southern median
- State forest
- National park reserve
- Rope bridge
- Combined fauna underpass
- Watercourse

0 600

Mitigation Measures Being Monitored

2. Methodology

2.1 Monitoring Target Terrestrial Species

2.1.1 Monitoring Sites

Six monitoring 'Impact' sites and six monitoring 'Control' sites are monitored as part of the target terrestrial species monitoring component of the project. The impact sites (numbered 1-6) were originally paired (east and west of the new upgraded highway alignment), with Impact Sites 2 and 4 encompassing the vegetated medians. The following modifications were made as part of post construction monitoring due to access constraints or insufficient habitat remaining in the road reserve:

- Impact Site 1 (east) was relocated to the western side of the highway due to insufficient habitat remaining within road reserve and access limitations on adjacent land to the east.
- Impact Site 6 (east) was removed. The survey effort at other impact sites was increased to offset the reduced effort at Impact Site 6.

Localised clearing (fence line and road formation widening) and road construction works have occurred at all impact sites to varying extents between spring 2017 and February 2019 due to Woolgoolga to Ballina Pacific Highway Upgrade (W2B) construction works.

Six monitoring 'Control' sites were established as part of the post construction monitoring (GeoLINK 2018) and located a minimum of 0.5 km from the Pacific Highway (refer to **Illustration 2.2**); with:

- Three control sites (Control Site 1-3) located in Devils Pulpit State Forest to the east of the Project.
- Three control sites (Control Site 4-6) located in Bundjalung National Park to the west of the Project.

Table 2.1 details the habitat and target species for each site.

Table 2.1 Target Terrestrial Species Monitoring Sites and Target Species

Site	*Location (central chainage for impact sites)*	*Target Species*	*Design Mitigation Measure (impact sites only)*	*Vegetation Form and Class (Hyder 2011)*
Impact Site 1	CH 66.270	■ Brush-tailed Phascogale ■ Koala ■ Rufous Bettong ■ Long-nosed Potoroo	■ Combined fauna underpass. ■ Fauna fencing.	■ Dry Open Sclerophyll Forest (shrubby sub formation): - Spotted Gum Dry Sclerophyll Forest. ■ Grassy Woodlands: - Eastern Red Gum Floodplain Forest. - Forest Red Gum Floodplain Forest.
Impact Site 2	CH 67.170	■ Brush-tailed Phascogale ■ Green-thighed Frog ■ Koala ■ Rufous Bettong ■ Squirrel Glider ■ Yellow-bellied Glider ■ Long-nosed Potoroo ■ Greater Glider	■ Combined fauna underpass. ■ Vegetated median. ■ Fauna fencing.	■ Dry Open Sclerophyll Forest (shrubby sub formation): - Blackbutt Dry Sclerophyll Forest. - Spotted Gum Dry Sclerophyll Forest. ■ Grassy Woodlands: - Forest Red Gum Floodplain Forest.
Impact Site 3	CH 69.000	■ Brush-tailed Phascogale ■ Green-thighed Frog ■ Koala ■ Squirrel Glider ■ Yellow-bellied Glider ■ Long-nosed Potoroo	■ Combined fauna underpass. ■ Fauna fencing. ■ Rope bridge.	■ Dry Open Sclerophyll Forest (shrubby sub formation): - Scribbly Gum Dry Sclerophyll Forest. - Blackbutt Dry Sclerophyll Forest. ■ Grassy Woodlands: - Eastern Red Gum Floodplain Forest.
Impact Site 4	CH 70.100	■ Brush-tailed Phascogale ■ Rufous Bettong ■ Squirrel Glider ■ Yellow-bellied Glider ■ Long-nosed Potoroo ■ Greater Glider	■ Vegetated median	■ Dry Open Sclerophyll Forest (shrubby sub formation): - Scribbly Gum Dry Sclerophyll Forest. - Blackbutt Dry Sclerophyll Forest. ■ Grassy Woodlands: - Forest Red Gum Floodplain Forest.

Site	Location (central chainage for impact sites)	Target Species	Design Mitigation Measure (impact sites only)	Vegetation Form and Class (Hyder 2011)
Impact Site 5	CH 71.845 (Tabbimoble 2)	■ Brush-tailed Phascogale ■ Green-thighed Frog ■ Koala ■ Rufous Bettong ■ Wallum Froglet ■ Long-nosed Potoroo	■ Restoration of vegetation connectivity corridor. ■ Combined fauna underpass. ■ Fauna fencing.	■ Dry Open Sclerophyll Forest (shrubby sub formation): - Scribbly Gum Dry Sclerophyll Forest. - Blackbutt Dry Sclerophyll Forest. ■ Grassy Woodlands: - Eastern Red Gum Floodplain Forest. ■ Forested Wetland: - Paperbark Swamp Forest on coastal lowlands of the North Coast (note: this community is outside the Hyder 2011 study area footprint).
Impact Site 6	CH 72.300	■ Squirrel Glider ■ Yellow-bellied Glider ■ Greater Glider	■ No mitigation measures.	■ Dry Open Sclerophyll Forest (shrubby sub formation): - Scribbly Gum Dry Sclerophyll Forest. - Blackbutt Dry Sclerophyll Forest. ■ Grassy Woodlands: - Eastern Red Gum Floodplain Forest.
Control Site 1	Devils Pulpit State Forest	■ Brush-tailed Phascogale ■ Rufous Bettong ■ Squirrel Glider ■ Yellow-bellied Glider	-	■ Dry Open Sclerophyll Forest (shrubby sub formation): - Spotted Gum Dry Sclerophyll Forest. ■ Blackbutt Dry Sclerophyll Forest.
Control Site 2	Devils Pulpit State Forest	■ Brush-tailed Phascogale ■ Koala ■ Rufous Bettong ■ Squirrel Glider ■ Yellow-bellied Glider	-	■ Dry Open Sclerophyll Forest (shrubby sub formation): - Blackbutt Dry Sclerophyll Forest. ■ Scribbly Gum Dry Sclerophyll Forest.

Site	Location (central chainage for impact sites)	Target Species	Design Mitigation Measure (impact sites only)	Vegetation Form and Class (Hyder 2011)
Control Site 3	Devils Pulpit State Forest	▪ Brush-tailed Phascogale ▪ Green-thighed Frog ▪ Koala ▪ Rufous Bettong ▪ Wallum Froglet	-	▪ Dry Open Sclerophyll Forest (shrubby sub formation): - Blackbutt Dry Sclerophyll Forest. ▪ Grassy Woodlands: ▪ Eastern Red Gum Floodplain Forest.
Control Site 4	Bundjalung National Park	▪ Brush-tailed Phascogale ▪ Green-thighed Frog ▪ Koala ▪ Rufous Bettong ▪ Squirrel Glider ▪ Yellow-bellied Glider	-	▪ Dry Open Sclerophyll Forest (shrubby sub formation): - Spotted Gum Dry Sclerophyll Forest ▪ Grassy Woodlands: ▪ Forest Red Gum Floodplain Forest.
Control Site 5	Bundjalung National Park	▪ Brush-tailed Phascogale ▪ Green-thighed Frog ▪ Rufous Bettong ▪ Squirrel Glider ▪ Yellow-bellied Glider	-	▪ Dry Open Sclerophyll Forest (shrubby sub formation): - Spotted Gum Dry Sclerophyll Forest ▪ Grassy Woodlands: ▪ Forest Red Gum Floodplain Forest.
Control Site 6	Bundjalung National Park	▪ Koala	-	▪ Grassy Woodlands: - Eastern Red Gum Floodplain Forest. ▪ Forested Wetland: ▪ Paperbark Swamp Forest on coastal lowlands of the North Coast (note: this community is outside the Hyder 2011 study area footprint).

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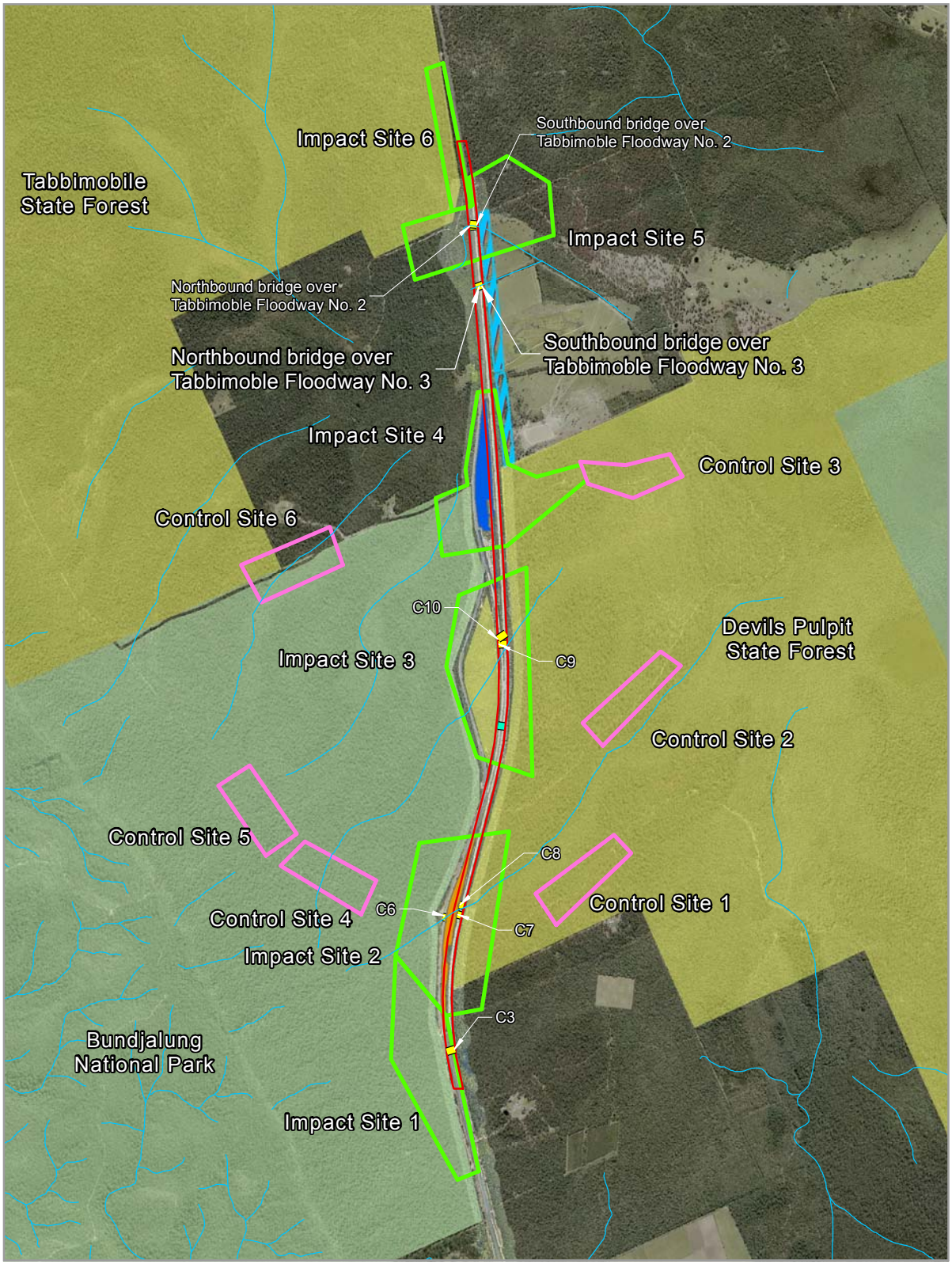

LEGEND

- Devil's Pulpit concept clearing limit
- Vegetated connectivity corridor
- Control site
- Impact site
- State forest
- National park reserve
- Northern median
- Southern median
- Rope bridge
- Combined fauna underpass
- Watercourse

0 800

Monitoring Site Locations

2.1.2 Methodology

This section provides the '*Target Terrestrial Species*' monitoring methodology used during post construction monitoring. Survey techniques are generally in accordance with the EMP (Hyder 2012) and GeoLINK (2012a), with the following modifications:

- Camera traps targeting the Rufous Bettong and Brush-tailed Phascogale were used in substitution of hair tubes. The survey methodology was revised so that data collected was comparable to the data collected as part of the *Woolgoolga to Ballina Pacific Highway Upgrade Rufous Bettong & Brush-tailed Phascogale Preconstruction Baseline Monitoring Survey* (Lewis 2014).
- Nest box monitoring was undertaken in substitution of arboreal Elliott B trapping.
- Mammal spotlighting transects use one person per spotlighting transect rather than two people.

These modifications were developed in consultation with RMS and NSW Environment Protection Authority (EPA) and approved by the NSW Department of Planning and Environment (DoPE) on 22 June 2017.

Additionally, Koala Spot Assessment Technique (SAT) monitoring was terminated from the monitoring program and was not undertaken as part of the Year 4 monitoring. Year 3 post construction monitoring found that '*Due to the recorded low density and activity levels of Koalas in the study area and EMP design, the EMP will not be able to identify changes in Koala relative abundance nor determine if any changes are attributed to the Devils Pulpit Pacific Highway upgrade*' (GeoLINK 2018). Cessation of Koala SAT monitoring was endorsed by the NSW Environmental Protection Agency (EPA – Peter Higgs – Senior Threatened Species Officer; email correspondence dated 12 July 2018).

All other survey techniques adopted during Year 4 monitoring were consistent with the methods used during the Year 3 monitoring (GeoLINK 2018).

2.1.3 Rufous Bettong

Rufous Bettong monitoring included camera traps at five impact and five control sites and spotlighting at six impact and six control sites in winter, spring and summer of 2018/ 19.

2.1.3.1 Camera Traps

Camera traps were established at each site in two lines of three (six cameras in a grid) spaced 100 m apart, with a trap density of one camera per hectare. The cameras were primarily Titley Scientific Trail Camera 0.35 sec Fast Trigger 12MP No-Glow Infra-red LED (Trail Cameras). Up to three Bushnell NatureView Cam HD Max cameras and one Reconyx HC500 HyperFire camera used when the Trail Cameras were being maintained. The cameras were set in a horizontal orientation following the methodology in *Taylor et al.* (2014). This included:

- Removing vegetation and leaf litter at the site. Existing clearings were selected to minimise vegetation disturbance.
- Use of a bait station (110 mm x 35 mm PVC pipe pegged to the ground). Bait stations were positioned 1.5 m* from the camera for Trail Cameras and 2 m for the other cameras.
- Positioning the camera approximately 0.4 m above the ground on a tree, with the camera angled down at the bait station.

**Bait stations were moved closer to the cameras (from 2 m in Year 3 monitoring) for the Trail Cameras as this was found to produce better quality images for identification with the wide-angle camera lens.*

Cameras were set for 14 continuous trap nights each season (winter, spring and summer), with the following recording parameters for the Trail Cameras:

- Camera mode: Photo.
- Resolution: 12MP.
- Night mode: Balanced.
- Multi-shot: three (reduced from five after the first survey event) with 20 second delay.
- Sensitivity: High.
- Timer mode set from 5.00 pm to 7.00 am (14 hours) each day, with the time adjusting for changes in daylight saving.

Equivalent settings were used with the other camera types.

Bait stations were baited with a peanut butter, honey, oats, vanilla essence and sesame oil mix. Camera trap locations are provided in **Appendix A** and shown in **Illustration 2.2**. All camera trap locations were the same as those used during Year 3 monitoring, except at Impact Site 5 (east) during the Year 4 spring and summer surveys. At this site the camera traps were relocated onto RMS land to avoid conflicts with activities on the private land. A summary of the installation and retrieval dates, and survey effort is provided in **Appendix A**.

All images were downloaded onto a computer and reviewed by a senior ecologist. Data recorded included species, identification accuracy and number of individuals (>1 only if >1 in the photo/ s or defined features were observed). Where traps were collected after 14 nights, recordings from night 15 onwards were not included in the capture rate dataset, however were recorded as additional species.

'Activity levels' of target species at each site were calculated as a function of the number of cameras that detected the relevant target species for each season. It is used as a surrogate for relative density. The mean and standard errors were derived from the percentage activity values for the three survey periods (seasons) to provide an overall activity level for each site for Year 4 monitoring. This methodology allows for comparison with data collected in Lewis (2014).

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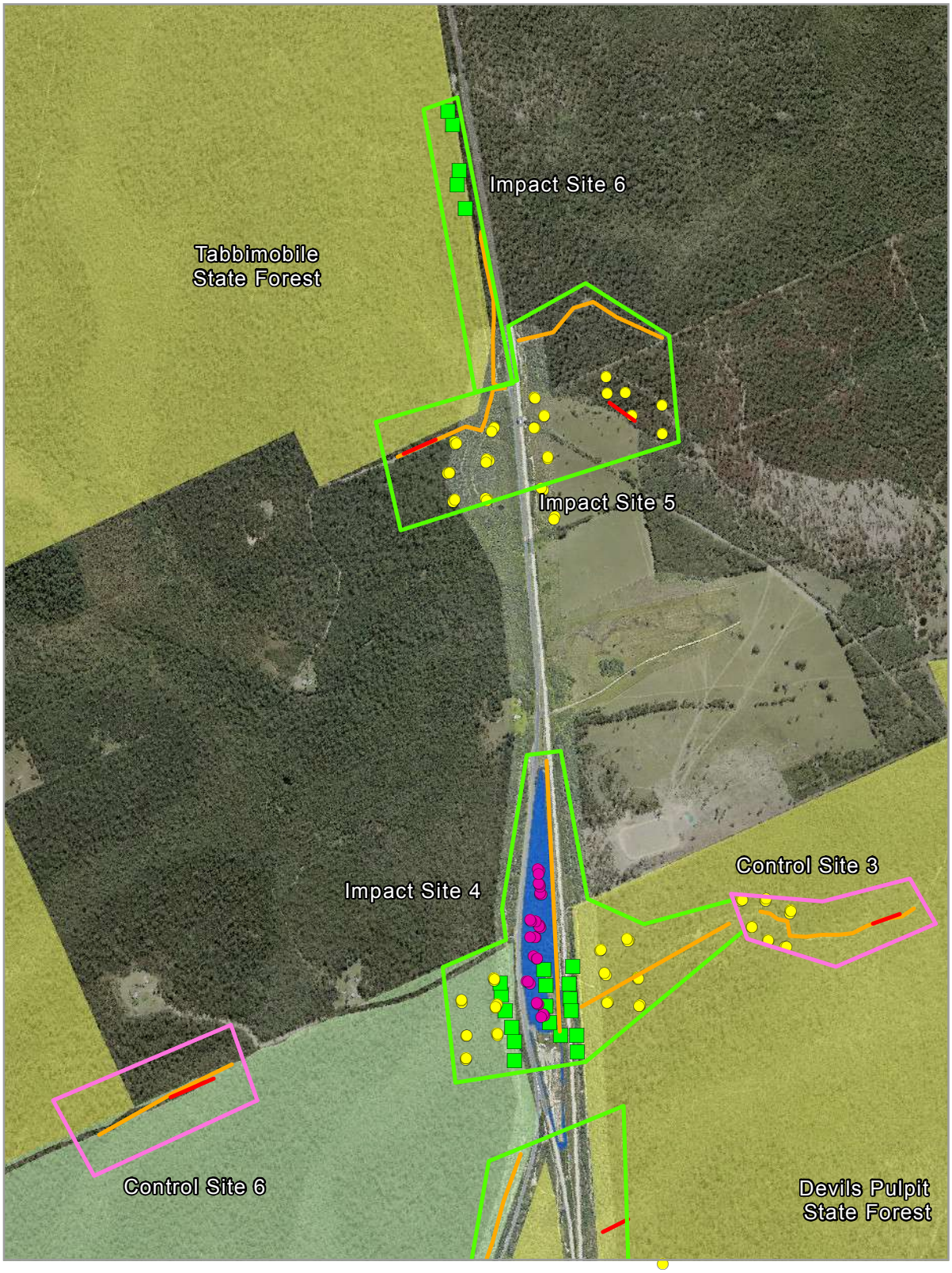

LEGEND

- Control site
- Impact site
- Northern median
- State forest
- Frog survey
- Mammal spotlighting survey
- RB-BTP camera
- Nest box
- Hairtube

0 400

Target Terrestrial Species Monitoring Locations

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Year 3, 4 and 6 Ecological Monitoring
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Illustration 2.2
Sheet 1 of 2

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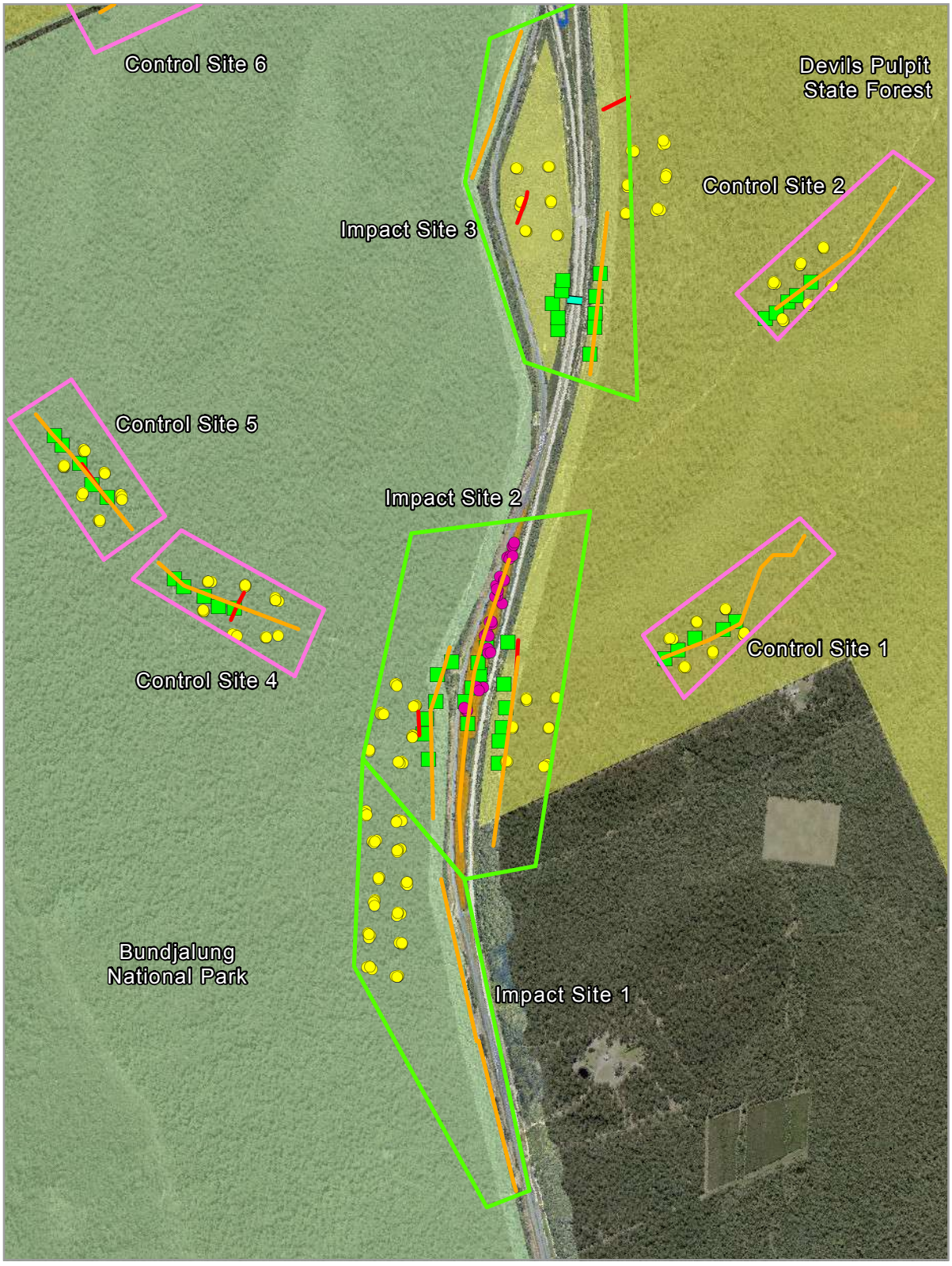

LEGEND

- Control site
- Impact site
- Northern median
- Southern median
- State forest
- Frog survey
- Mammal spotlighting survey
- RB-BTP camera
- Nest box
- Rope bridge
- Hairtube

0 400

Target Terrestrial Species Monitoring Locations

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Second Annual Report for Post Construction
Year 3, 4 and 6 Ecological Monitoring
2885-1034

Illustration 2.2
Sheet 2 of 2

2.1.3.2 Spotlighting

While five impact sites (1, 2, 3, 4 and 5) and five control sites (1, 2, 3, 4 and 5), where nominated as target sites for the Rufous Bettong, spotlighting was undertaken at all six impact and six control sites, targeting all target mammal species. Spotlighting was undertaken along 500 m transects with one observer spotlighting at a rate of 1 km/ hour. This included ten impact site transects and six control site transects. Two additional 1 km transects were undertaken at the vegetated medians at Impact Sites 2 and 4 and were spotlighted at the same rate. Refer to **Illustration 2.2** for spotlighting survey locations.

Spotlighting surveys were undertaken over three non-consecutive nights per season (winter, spring and summer). Threatened nocturnal avifauna and reptiles detected were also recorded.

Table 2.2 summarises spotlighting survey sites and effort. Survey dates and weather conditions are provided in **Appendix A**.

All mammals (excluding flying-foxes) detected (observed and/ or heard) were recorded, with the following data collected:

- Species
- Number of individuals
- Sex
- Age
- Number of dependant young
- Behaviour

Table 2.2 Spotlighting Survey Effort During Year 4 Monitoring

Site	*No. Spotlighting Surveys*			
	Winter	*Spring*	*Summer*	*Total*
Impact Site 1 (east)	3	3	3	**9**
Impact Site 1 (west)	3	3	3	**9**
Impact Site 2 (east)	3	3	3	**9**
Impact Site 2 (median)	3	3	3	**9**
Impact Site 2 (west)	3	3	3	**9**
Impact Site 3 (east)	3	3	3	**9**
Impact Site 3 (west)	3	3	3	**9**
Impact Site 4 (east)	3	3	3	**9**
Impact Site 4 (median)	3	3	3	**9**
Impact Site 5 (east)	3	3	3	**9**
Impact Site 5 (west)	3	3	3	**9**
Impact Site 6 (west)	3	3	3	**9**
Control site 1	3	3	3	**9**
Control site 2	3	3	3	**9**
Control site 3	3	3	3	**9**
Control site 4	3	3	3	**9**
Control site 5	3	3	3	**9**

Site	No. Spotlighting Surveys			
	Winter	Spring	Summer	Total
Control site 6	3	3	3	**9**
Total Impact Sites	36	36	36	**108**
Total Control Sites	18	18	18	**54**
Total All Sites	**54**	**54**	**54**	**162**

2.1.4 Spotted-tailed Quoll

The Spotted-tailed Quoll monitoring component covered under this monitoring program is detailed in the *Spotted-tailed Quoll Management Plan* (SKM 2012) and relates to monitoring fauna underpass structures. The survey methodology is discussed in **Section 2.2.1**, noting that the monitoring is being undertaken in post construction years 3, 4 and 6 as per the EMP, rather than years 1, 3 and 5 as stated in some sections of SKM (2012).

2.1.5 Green-thighed Frog and Wallum Froglet

Threatened frog monitoring was undertaken targeting the Green-thighed Frog and Wallum Froglet. Target sites are shown in **Illustration 2.2**. Three impact sites (2, 3 and 5) and three control sites (3, 4 and 5) were surveyed targeting the Green-thighed Frog. One impact site (5) and one control site (3) was also surveyed targeting the Wallum Froglet. Survey dates during Year 4 monitoring are provided in **Table 2.3**.

The surveys included:

- **Spotlighting**: 100 m spotlighting transects with two observers 20 m apart, on two non-consecutive nights per season (spring and summer). Spotlighting was undertaken at a rate of 200 m/ hour.
- **Call Playback**: Green-thighed Frog and/ or Wallum Froglet call playback was undertaken near the centre of each spotlighting transect or within appropriate habitat. The methodology included five minutes listening, two minutes call playback, five minutes listening, two minutes call playback, then five minutes listening.

Frog surveys were undertaken when the rainfall event criteria outlined in Hyder (2012) were met (i.e. when between 30-50 mm of rain was recorded within a 24 hour period, or when soil saturation levels are high and 20-30 mm of rain was recorded within a 24 hour period) on two non-consecutive nights in spring and one night in summer. Weather conditions during the surveys are provided in **Appendix A**. Attempts to bring the frog survey triggers in line with those recommended in GeoLINK (2018) (i.e. '*a rainfall event which exceeded 50 mm within a 24 hour period with a preference given to rainfall events which exceeded 75 mm in 24 hours or an accumulated total of 150 mm over a 72 hour period*') failed due to limited rainfall. A third summer survey event was undertaken to supplement the second Year 3 summer survey event which was delayed due to unsuitable weather conditions.

Table 2.3 Threatened Frog Monitoring Survey Dates During Year 4 Monitoring

Survey Event	*Date*
Year 4 Spring Survey 1	5/ 09/ 2018
Year 4 Spring Survey 2	15/ 10/ 2018
Year 4 Summer Survey 1	21/ 12/ 2018
Year 4 Summer Survey 2	8/ 03/ 2019
Year 4 Summer Survey 3 (Supplementary Year 3 Summer Survey 2)	17/ 03/ 2019

2.1.6 Yellow-bellied Glider

Targeted Yellow-bellied Glider surveys were undertaken at four impact sites (2, 3, 4 and 6) and four control sites (1, 2, 4 and 5) in winter, spring and summer for three non-consecutive nights per season. Spotlighting was also undertaken at Impact Sites 1 and 5, and Control Sites 3 and 6. The surveys included:

- **Spotlighting**: As for **Section 2.1.3.2**. Spotlighting was undertaken along ten 500 m impact site transects; two 1 km impact site transects and six 500 m control site transects with one observer spotlighting at a rate of 1km/ hour.
- **Call-playback**: Yellow-bellied Glider call-playback was undertaken at one point along the seven impact sites (2 east, 2 median, 2 west, 3 east, 3 west, 4 east, 4 median and 6 west) and four control site (1, 2, 4 and 5) spotlighting transects that targeted the Yellow-bellied Glider. The methodology comprised five minutes listening, five minutes Yellow-bellied Glider call playback, two minutes listening, five minutes playback, two minutes listening. A Faunatech modified Toa megaphone (or equivalent) was used to broadcast recorded Yellow-bellied Glider call.

Yellow-bellied Glider survey dates are provided in **Appendix A**.

2.1.7 Squirrel Glider

Target Squirrel Glider surveys were undertaken at four impact sites (2, 3, 4 and 6) and four control sites (1, 2, 4 and 5). Spotlighting was also undertaken at Impact Sites 1 and 5, and Control Sites 3 and 6. The surveys included:

- **Spotlighting**: As for **Section 2.1.3.2**. Spotlighting was undertaken along ten 500 m impact site transects; two 1 km impact site transects and six 500 m control site transects with one observer spotlighting at a rate of 1 km/ hr. Spotlighting surveys were conducted for three non-consecutive nights each season (winter, spring and summer).
- **Nest Box Monitoring**: The seventy Squirrel Glider nest boxes (Hollow-Log Home – rear entry timber design) installed in winter 2017 were inspected in winter, spring and summer. Nest box locations are shown in **Illustration 2.2** and detailed in **Appendix B**.
- **Table 2.4** details the nest box configuration at relevant sites. The nest boxes were checked by a tree climber under ecologist supervision. When fauna were present, the nest box entrance was blocked and the nest box was lowered for direct ecologist inspection and species identification. The nest boxes were subsequently re-instated.

Table 2.4 Nest Box Configuration

Site	*No. of Nest Boxes*
Impact Site 2 (east)	6
Impact Site 2 (median)	6
Impact Site 2 (west)	6
Impact Site 3 (east)	5
Impact Site 3 (west)	5
Impact Site 4 (east)	6
Impact Site 4 (median)	5
Impact Site 4 (west)	6
Impact Site 6 (west)	5
Control site 1	5
Control site 2	5
Control site 4	5
Control site 5	5
Total Impact Sites	**50**
Total Control Sites	**20**
Total All Sites	**70**

Squirrel Glider radio tracking was scheduled for Year 4 spring-summer, however delayed until July-September 2019 (post construction Year 5), due to the following considerations:

- Delaying the radio tracking until after the W2B clearing is complete (February 2019) to enable the monitoring to determine if Squirrel Gliders can move across the final/ long-term highway clearing width at the medians. Radio tracking prior to completion of clearing may render the results invalid in the long-term.
- Provide time for resident gliders to adjust following clearing disturbances (e.g. home range adjustments). The delay will allow for an approximate 5 month 'adjustment' period.
- Avoid the locally recorded breeding peaks in May (ie. when dependant young are present in highest numbers – Dr David Sharpe, pers. comm.).
- Squirrel Gliders dispersal occurs at 12-18 months of age. The proposed timing should be within the local peak period of dispersing young.
- The nest box monitoring to date has recorded the highest occupancy rates of Squirrel Gliders in Winter (2018). This suggests the project is more likely to capture animals to radio track in winter.
- Most of the gliders recorded during nest box monitoring to date have been animals in social groups (i.e. resident gliders). Therefore, the project is more likely to capture and radio track resident gliders moving through their home range rather than dispersing sub-adults moving across the landscape. To maximise the chance of the radio tracking recording Squirrel Glider movement across the medians, the Project needs to radio track as many animals as possible.

This was endorsed by NSW EPA (Peter Higgs – Senior Threatened Species Officer; email correspondence dated 20 December 2018).

2.1.8 Brush-tailed Phascogale

Brush-tailed Phascogale monitoring was undertaken in winter, spring and summer, and included:

- Camera Traps: Refer to **Section 2.1.3.1**.
- Spotlighting: Refer to **Section 2.1.3.2**.
- Nest Box Monitoring: Refer to **Section 2.1.7**.

2.1.9 Koala

Koala monitoring surveys included:

- **Spotlighting**: Refer to **Section 2.1.3.2**.
- **Call-playback**: Koala call-playback was undertaken at one point along the eight impact sites (1 east, 1 west, 2 east, 2 west, 3 east, 3 west, 5 east, 5 west) and four control sites (2, 3, 4, 6) spotlighting transects that targeted the Koala for three non-consecutive nights in winter, spring and summer. The methodology comprised five minutes listening, five minutes Koala call playback, two minutes listening, five minutes playback, two minutes listening. A Faunatech modified Toa megaphone (or equivalent) was used to broadcast the Koala call recording. Survey dates are provided in **Appendix A**.

2.2 Monitoring Crossing Structures

2.2.1 Fauna Underpasses

2.2.1.1 Monitoring Sites

The EMP (Hyder 2012) and *Spotted-tailed Quoll Management Plan* (SKM 2012) identified 10 combined fauna underpass structures that require monitoring. These structures are shown in **Illustration 1.2** and are described in GeoLINK (2018).

2.2.1.2 Methodology

Underpass monitoring undertaken as part of Year 4 monitoring included:

- **Underpass camera traps**: Motion-detecting cameras were installed at each of the ten combined fauna underpass structures. The camera configurations and installation/ retrieval dates are provided in **Table 2.5**. The cameras are operating for the full year and checked each season (roughly two to three monthly). Batteries are replaced when battery capacity is at or below 60 per cent. This reporting period covers monitoring undertaken between 19/ 12/ 2017 and 18/ 02/ 2019**.**
- **Substitution camera traps**: Two camera traps (substituting sand-plots) were established 0.4 m above the ground at the ends of each fauna underpass culvert or in locations complementing underpass cameras at the bridges for a minimum of four weeks each season (winter, spring and summer; excluding at C3 and C6 which were disrupted by W2B construction works). Installation and retrieval dates are provided in **Table 2.6**.
- **Fauna furniture camera traps**: Two camera traps (substituting hair-tubes) were installed at the six underpass structures with timber rail fauna furniture (12 cameras in total). The cameras were installed at each end of the fauna furniture within the underpass (facing towards the centre of the structure) and set for a minimum of four weeks per season. Installation and retrieval dates are provided in **Table 2.6**.

- **Scat and track searches:** Scat and track searches were undertaken at each of the ten fauna underpass structures twice per season (0.5 hours per structure per event) in winter, spring and summer, typically overlapping with substitution camera installation/ retrieval dates. Triggs (2004) was used for fauna identification. Survey dates are provided in **Appendix C**.

The underpass camera traps comprised Reconyx HC500 HyperFire cameras, housed in security casings. At culverts, they were installed on the wall between 0.4 to 1 m high (depending on inundation risk), while locations at bridges varied to maximise field of view. The cameras were set with the following recording parameters, consistent with those used for the Glenugie Pacific Highway Upgrade monitoring (Sandpiper 2017):

- Motion Sensor: On.
- Sensitivity: High.
- Time Lapse: Off.
- Pictures/ Trigger: 5
- Picture interval: Rapidfire.
- Image resolution: 1080p.
- Quiet Period: No delay.

The substitution camera traps and fauna furniture camera traps primarily comprised Titley Scientific Trail Camera 0.35 sec Fast Trigger 12MP No-Glow Infra-red LED. Two Bushnell NatureView Cam HD Max were used randomly as spare cameras when maintenance of the Titley Scientific Trail Cameras was required. The cameras were set with the following recording parameters:

- Camera mode: Photo.
- Resolution: 12MP.
- Night mode: Balanced.
- Multi-shot: 5 with 0 second delay.
- Sensitivity: High.
- Timer: off.

All images were downloaded onto a computer and reviewed by a senior ecologist. Data recorded included species, date, time, location, direction of movement (east, west, N/ A, returned), and outcome. 'Complete crossings' were defined as follows:

- Bridges:
    - Image sequence shows a complete crossing.
    - Directional movement indicative of a complete crossing.
    - Image sequence shows a complete crossing when comparing cameras fauna species and recording times at other cameras on the subject bridge or the adjacent opposite carriageway bridge.
- Underpasses:
    - Image sequence shows a complete crossing when comparing cameras at each end of the structure; or
    - Image sequence from camera in the centre (middle) of a culvert shows movement in one direction and the fauna does not return.

Unique complete crossings were identified by comparing the species, times and dates of recordings on the different cameras at each structure.

Table 2.5 Underpass Camera Trap Configuration and Effort During Year 4 Reporting Period

Under-pass	*Underpass Camera Trap*	*Start of Reporting Period Recordings*	*1st Check*		*2nd Check*		*3rd Check*		*4th Check*		*5th Check*		*6th Check*		*Total Days Active*
			Date	*Days Active*	*Date*	*Days Active*	*Date*	*Days Active*	*Date*	*Days Active*	*Date*	*Days Active*	*Date*	*Days Active*	
C3 (3 cell RBC	2 x cameras (attached to northern wingwall at inlet and outlet).	19/12/2017	18/04/2018	120	26/06/2018	69	8/08/2018	43	18/10/2018	71	10/12/2018	53	18/02/19*	70	426
C6 (1 cell RCBC)	1 x camera (in centre of culvert)	19/12/2017	18/04/2018	120	26/06/2018	69	8/08/2018	43	18/10/2018	71	10/12/2018	53	18/02/19*	70	426
C7 (2 cell RCBC):	2 x camera (in centre of each culvert cell)	19/12/2017	18/04/2018	120	26/06/2018	69	8/08/2018	43	18/10/2018	71	10/12/2018	53	18/02/2019	70	426
C8 (2 cell RCBC):	2 x camera (in centre of each culvert cell)	19/12/2017	18/04/2018	120	26/06/2018	69	8/08/2018	49	18/10/2018	65	10/12/2018	53	18/02/2019	70	426
C9 (2 cell RCBC):	2 x camera (in centre of each culvert cell)	19/12/2017	18/04/2018	120	26/06/2018	69	8/08/2018	49	18/10/2018	65	10/12/2018	53	18/02/2019	70	426
C10 (2 cell RCBC):	2 x camera (in centre of each culvert cell)	19/12/2017	18/04/2018	120	26/06/2018	69	8/08/2018	49	18/10/2018	65	10/12/2018	53	18/02/2019	70	426
NBT3	2 x camera (1 at northern bank; 1 at southern bank)	19/12/2017	18/04/2018	120	26/06/2018	69	8/08/2018	49	18/10/2018	65	10/12/2018	53	18/02/2019	70	426
NBT2	2 x camera (1 at northern bank; 1 at southern bank)49	19/12/2017	18/04/2018	120	26/06/2018	69	8/08/2018	49	18/10/2018	65	10/12/2018	53	18/02/2019	70	426
SBT3	3 x camer49a (1 at northern bank; 1 at southern bank central span; 1 at southern abutment span)	19/12/2017	18/04/2018	120	26/06/2018	69	8/08/2018	49	18/10/2018	65	10/12/2018	53	18/02/2019	70	426
SBT2	2 x camera (1 at northern bank; 1 at southern bank)	19/12/2017	18/04/2018	120	26/06/2018	69	8/08/2018	49	18/10/2018	65	10/12/2018	53	18/02/2019	70	426

*C3 west and C6 underpass camera traps were removed temporarily on 18/ 02/ 2019 due to W2B construction works.

Table 2.6 Underpass Substitution and Fauna Furniture Camera Trap Installation and Retrieval Dates, and Effort during Year 4 Monitoring

Id.	No. Substitution Cameras	No. Fauna Furniture Cameras	Winter			Spring			Summer			Total Active Days	
			Date Installed	Date Retrieved	Active Days	Date Installed	Date Retrieved	Active Days	Date Installed	Date Retrieved	Active Days	Substitution Camera	Fauna Furniture Camera
C3 (3 cell RCBC)	2	0	26/06/2018 (eastern camera only) ^*	24/07/2018 (eastern camera only) ^*	13* (13)	13/09/2018 (eastern camera only)*	11/10/2018 (eastern camera only)*	28 (28)	N/A^	N/A^	0	41^ (41)	N/A
C6 (1 cell RCBC)	2	2	26/06/2018	24/07/2018	28 (56)	13/09/2018	11/10/2018	28 (56)	15/01/2019^ (fauna furniture cameras only)	18/02/2019^ (fauna furniture cameras only)	34 (68)	56^ (106)	90 (180)
C7 (2 cell RCBC):	2	0	26/06/2018	24/07/2018	28 (56)	13/09/2018	11/10/2018	28 (56)	15/01/2019	18/02/2019	34 (68)	90 (180)	N/A
C8 (2 cell RCBC):	2	2	26/06/2018	24/07/2018	28 (56)	13/09/2018	11/10/2018	28 (56)	15/01/2019	18/02/2019	34 (68)	90 (180)	90 (180)
C9 (2 cell RCBC):	2	0	26/06/2018	24/07/2018	28 (56)	13/09/2018	11/10/2018	28 (56)	10/01/2019	18/02/2019	39[2] (46)	95 (180)	N/A
C10 (2 cell RCBC):	2	0	26/06/2018	24/07/2018	28[1] (28)	13/09/2018	11/10/2018	28 (56)	10/01/2019	18/02/2019	39 (78)	67[1] (162)	N/A
NBT3	2	2	26/06/2018	24/07/2018	28 (56)	13/09/2018	11/10/2018	28[1] (28)	10/01/2019	18/02/2019	39[2] (46)	67[1] (130)	95 (190)
NBT2	2	2	26/06/2018	24/07/2018	28 (56)	13/09/2018	11/10/2018	28 (56)	10/01/2019	18/02/2019	39[1] (39)	56[1] (151)	95 (190)
SBT3	2	2	26/06/2018	24/07/2018	28 (56)	13/09/2018	11/10/2018	28 (56)	10/01/2019	18/02/2019	39 (78)	95 (190)	95 (190)
SBT2	2	2	26/06/2018	24/07/2018	28 (56)	13/09/2018	11/10/2018	28 (56)	10/01/2019	18/02/2019	39[2] (40)	95 (152)	95 (190)

* denotes cameras affected via vandalism on 9/ 07/ 2018.

^ denotes occasions when substitution cameras were not installed due to W2B construction works.

[1] denotes camera or SD card errors at substitution cameras that affected effective trap nights.

[2] denotes when cameras were not effective for the full survey period due to false triggers filling up SD card memory capacity.

Effective trap nights are provided in brackets behind '*Active Days*'.

2.2.2 Rope Bridge

2.2.2.1 Description

The Devils Pulpit rope bridge is located at approximate chainage 68.500 over both the north and southbound carriageways at a cutting (refer to **Illustration 1.2**). Design features of the rope bridge are described in GeoLINK (2018). Modifications to the rope bridge were undertaken on 19 December 2018 and included:

- Installation of a release (weak) point on the western rope bridge ladder connecting the western pole and a large Pink Bloodwood (*Corymbia intermedia*). The tree has a fire scar and cracking at the base. The tree was identified as a risk of falling away from the highway and damaging the rope bridge structure. Decisions were made to install a release point rather than relocate the rope ladder to a different tree or remove the tree. The release point included a 100 kg strength cable tie and hose clamp attached at the pole end of the ladder. The hose clamp is designed to allow the 30 mm silver rope to slide out upon excess force.
- Installation of 30 mm diameter silver rope over the chained section of the rope bridge to provide linear opportunities for fauna movement on non-metal elements (thus reducing the chance of fauna slipping on the metal components when moving along the rope bridge (refer to **Plate 2.1**). This was undertaken at both the east and western poles following observations of fauna slipping on the metal components (refer to **Plate 2.1**).

Plate 2.1 Silver rope addition at rope bridge chain on the eastern pole (left) and western pole (right)

Plate 2.2 Image sequence of a Sugar Glider slipping then recovering on the metal wire component near the western rope bridge pole.

2.2.2.2 Methodology

Monitoring of the rope bridge is required continuously in post construction monitoring years 3, 4 and 6. Two Reconyx SC950 cameras were installed on the 6 August 2017 at each rope bridge pole (one camera at each end). The cameras were positioned on the main rope bridge approximately 2 m from the poles, facing towards the respective pole. Recording parameters set include:

- Motion Sensor: On.
- Sensitivity: High.
- Time Lapse: Off.
- Pictures/ Trigger: 10
- Picture interval: Rapidfire (up to two per second).
- Image resolution: 3.1MP.
- Quiet Period: 6.00 am to 6.00 pm.
- Night mode: Balanced.

This reporting period covers monitoring undertaken between 24/ 01/ 2018 and 15/ 01/ 2019. Four inspections have occurred over the reporting periods (**Table 2.7**).

All images were downloaded onto a computer and reviewed by a senior ecologist. Data recorded included species, date, time, location (eastern rope bridge pole or western rope bridge pole) and direction of movement (east, west, N/ A, returned). Complete crossings were noted where an individual was recorded at both ends of the structure, moving in one direction and the time and sequence of images corresponding to indicate the individual crossed the entire structure.

Table 2.7 Rope Bridge Camera Inspection Dates and Effort for Year 4 Reporting Period

Camera/ Pole	Reporting Period Commencement Date	1st Check				2nd Check				3rd Check				4th Check				Total Days Active
		Date	Days Active	Battery Level	No. Images	Date	Days Active	Battery Level	No. Images	Date	Days Active	Battery Level	No. Images	Date	Days Active	Battery Level	No. Images	
Rope Bridge Pole East	24/01/18	18/04/18	84	99%	140	19/07/18	92	99%	90	9/11/18	113	5%	220	15/01/19	67	99	400	356
Rope Bridge Pole West	24/01/18	18/04/18	84	99%	260	19/07/18	92	99%	190	9/11/18	113	9%	510	15/01/19	67	99	810	356

2.2.3 Vegetated Median

2.2.3.1 Description

The project encompasses two vegetated medians that are surveyed as part of the EMP. Locations of the medians are shown in **Illustration 1.2**. The southern median corresponds with Impact Site 2, while the northern median corresponds with Impact Site 4. A description of each median is provided in GeoLINK (2018).

2.2.3.2 Methodology

Vegetated median monitoring activities undertaken during the Year 4 monitoring included:

- **Spotlighting**: As for **Section 2.1.3.2**. Spotlighting was undertaken along a one one-kilometre transect at each median with one observer spotlighting at a rate of one kilometre/ hour. Spotlighting surveys were conducted for three non-consecutive nights each season (winter, spring and summer). **Table 2.2** lists spotlighting survey sites and effort. Survey dates and weather conditions are provided in **Appendix A**.
- **Nest Box Monitoring**: As for **Section 2.1.7**. Squirrel Glider nest boxes were monitored once per season in winter, spring and summer. Six nest boxes are located at Impact Site 2 (median) and five nest boxes are located at Impact Site 4 (median). Nest box locations are shown in **Illustration 2.2** and detailed in **Appendix B**.
- **Hair Tubes**: 30 arboreal hair-tubes were installed in each of the vegetated medians for a minimum of 6 weeks in spring and summer. The hair tubes were set in groups of three at ten habitat trees 30-50 m intervals at each median (i.e. one hair tube per tree; each tree a habitat tree or tree adjacent to a habitat tree). The hair tubes were set at around 6-7 m high and baited with a mixture of peanut butter, honey and oats. A honey solution will be sprayed up the tree trunk as an attractant. The hair tubes were set for a minimum of six weeks per season, with wafers and baits replaced at three weeks. Hair tube locations are shown in **Illustration 2.2** and detailed in **Appendix A**.

Table 2.8 Vegetated Median Hairtube Survey Dates for Year 4 Monitoring

Median	*Spring*				*Survey Effort*				*Total Survey Nights*	*Total Trap Nights*
	Date Installed	*Dated Checked*	*Date Removed*	*Survey nights*	*Date Installed*	*Dated Checked*	*Date Removed*	*Survey nights*		
Impact Site 2 (median)	26/09/2018	18/10/2018	12/11/2018	47	19/12/2018	9/01/2019	31/01/2019	43	90	2700
Impact Site 4 (median)	26/09/2018	18/10/2018	12/11/2018	47	19/12/2018	9/01/2019	31/01/2019	43	90	2700

2.2.4 Restoration of Vegetated Connectivity Corridor

The 'vegetation connectivity corridor' is located between chainage 70.200-71.900 on the eastern side of the highway. It has a width of approximately 60 m (refer to **Illustration 1.2**).

Vegetation monitoring at the connectivity corridor during the reporting period included:

- Year 3 autumn post construction monitoring; undertaken on 29/05/2018.
- Year 4 spring post construction monitoring: undertaken on 24/10/2018.

The monitoring included:

- **Vegetation quadrats**: The eight 20x20 m quadrats established in winter Year 3 within the corridor were monitored (refer to **Illustration 2.1** and **Appendix D**). Within each quadrat, the following attributes were recorded:
  - Diversity of species (i.e. species inventory of all native and exotic species, including noxious weeds)
  - Per cent cover of native and exotic species (modified Braun-Blanquet scale; refer to **Table 2.9**).
  - Height of plants in each stratum.
  - General condition of the quadrat.
  - Whether any second generation or subsequent generations have been naturally recruited.
  - Any evidence of disturbance (e.g. fire, litter, disease, herbivory).

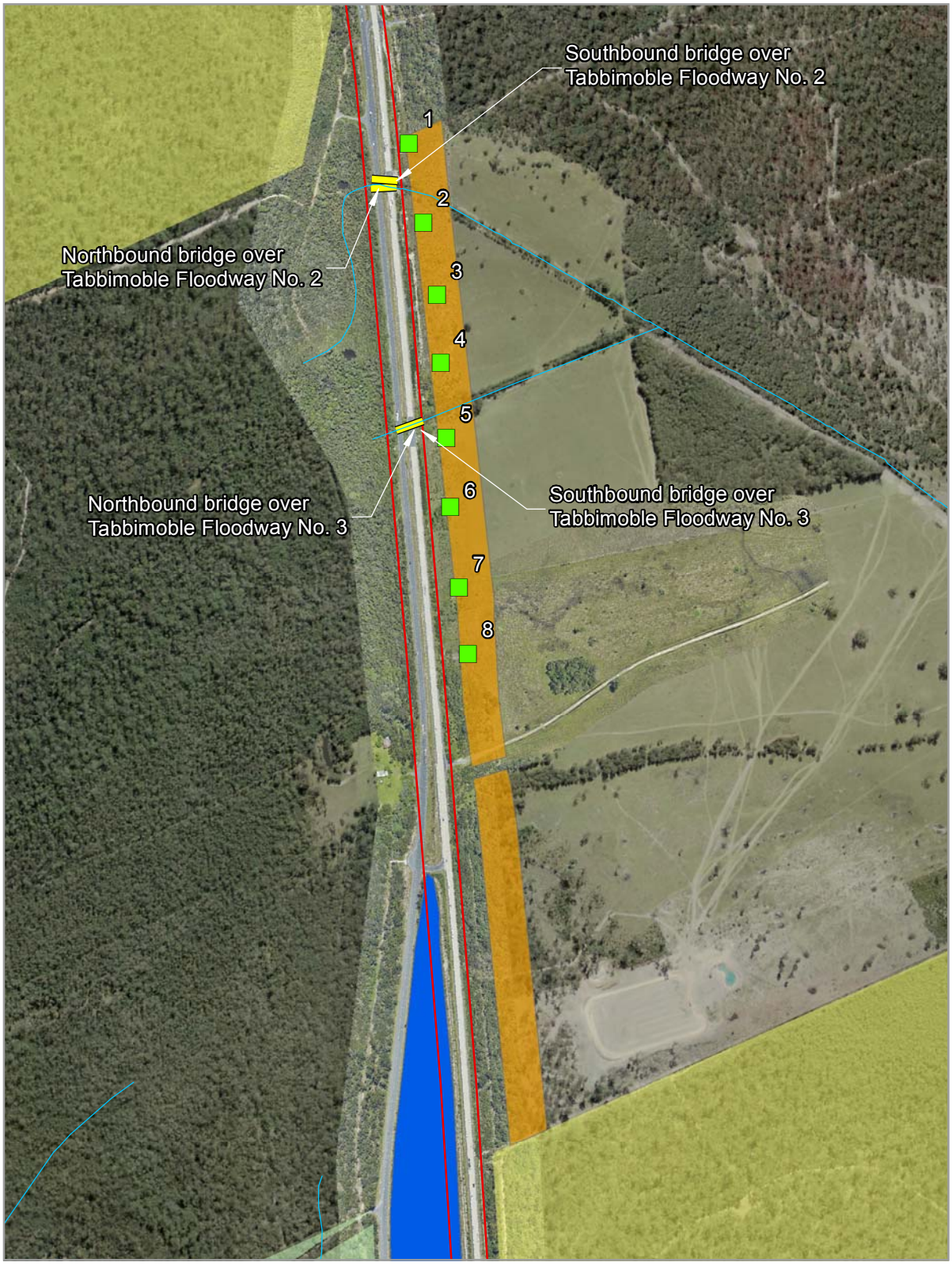
- **Photo point monitoring**: A photo was undertaken of the quadrat during each monitoring event, from the north-east corner facing the south-east corner.

Table 2.9 Modified Braun-Blanquet Cover Classes

Class	*Percentage Cover*
1	<5% sparse
2	<5% common
3	5-25%
4	26-50%
5	51-75%
6	76-100%

Information shown is for illustrative purposes only

Drawn by: AB Checked by: RE Reviewed by: DSA Date: 04/04/2019
Source of base data: RMS



LEGEND

- Devil's Pulpit concept clearing limit
- Northern median
- State forest
- NPWSReserve
- Combined fauna underpass
- Watercourse
- Vegetation monitoring location

0 200

Vegetation Connectivity Corridor Monitoring Sites

2.3 Other Monitoring Activities

2.3.1 Road Kill Monitoring

Road kill monitoring was undertaken once per week for a minimum of four weeks per season (winter, spring and summer), totalling 12 events. It involved a vehicle being driven for the length of the upgrade (approximately 15.5 km of road encompassing both highway carriageways and the Bundjalung rest area) mapping and identifying road kill. The following data was recorded at each road kill: species, GPS location, carriageway and presence/ absence of fauna fence. Road kill monitoring dates are provided in **Appendix E**. Opportunistic road kill detected when undertaking other activities were also recorded.

2.4 Survey Limitations

The EMP provides a list of typical survey limitations. The following specific limitations were also noted during Year 4 monitoring:

- Call playback and call identification: Highway traffic noise was considered a key limitation for call playback broadcast, and response detection and identification at impact sites. The range to which call playback was effective and the ability to hear and identify fauna calls was reduced.

- Spotlighting:
  - The effectiveness of spotlighting was affected (reduced) by highway vehicle lighting in some sections of Impact Site 1 (east), Impact Site 1 (west), Impact Site 2 (median) and Impact Site 6 (west).
  - Spotlighting transects have been established along cleared tracks/ easements at all sites except Impact Site 2 (median), Impact Site 4 (median) and Impact Site 6 (west). The ability to observe in the canopy is reduced along some sections of these transects.

- Fauna underpass monitoring: W2B construction works were undertaken in the vicinity of underpass C3 and C6. At C6:
  - Plastic sheets for microbat exclusion were present throughout the entire reporting period.
  - The C6 fauna underpass and associated pipe culverts to the south were cleaned out in January 2019.
  - The pipe culvert south of the C6 fauna underpass was removed and replaced with new pipe culverts in January-March 2019.
  - The eastern end of C6 was being extended in January-March 2019.

- Clearing was undertaken at Devils Pulpit as part of W2B works between October 2018 and February 2019. This included:
  - Northbound Lane: Clearing of mature vegetation and regrowth along both sides of the northbound lane in the vicinity of the medians.
  - Southbound Lane:
    - Clearing of regrowth vegetation for fauna and property fences (mostly along the eastern side of the highway).
    - Clearing of hazardous trees (including mature trees).
    - Clearing for W2B construction access gates and to accommodate traffic switch provisions.

- At impact monitoring sites affected by the clearing, all seasonal spotlighting/ call playback surveys were completed prior to any significant mature vegetation clearing.

3. Results

3.1 Results

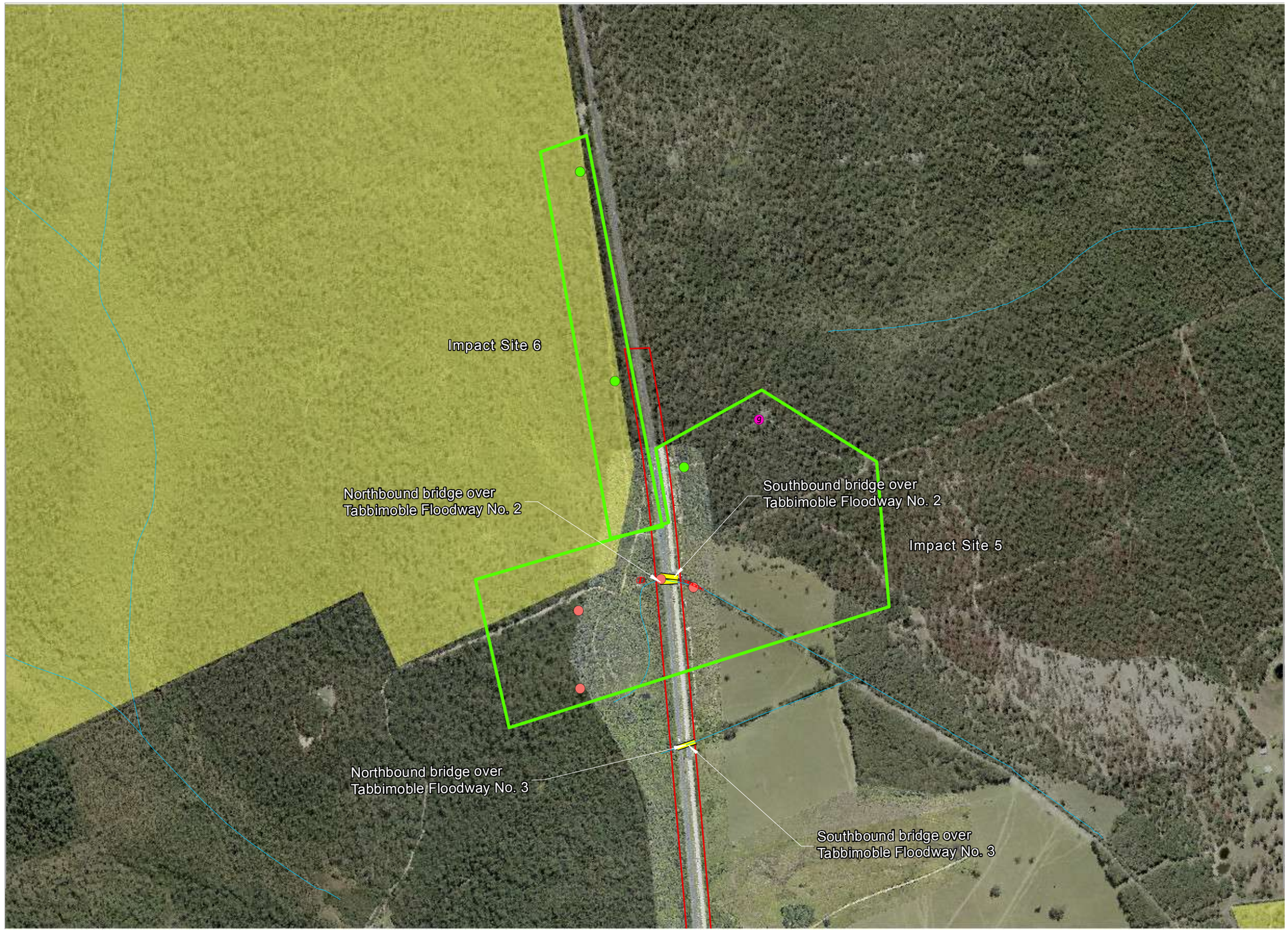
Monitoring results are provided below per survey method and target mitigation measure. Raw monitoring results are provided in **Appendix B** to **Appendix I** as follows:

- Appendix B: Nest Box Monitoring Locations and Results
- Appendix C: Fauna Underpass Monitoring Results
- Appendix D: Restoration of Vegetation Connectivity Corridor Results
- Appendix E: Road Kill Monitoring Results
- Appendix F: Rufous Bettong/ Brush-tailed Phascogale Camera Trap Results
- Appendix G: Spotlighting and Call Playback Results
- Appendix H: Threatened Frog Survey Results
- Appendix I: Fauna Underpass Scat and Track Search Results

Locations of recorded threatened species are shown in **Illustration 3.1**.

Information shown is for illustrative purposes only

Drawn by: AB Checked by: RE Reviewed by: DSA Date: 04/04/2019
Source of base data: RMS



LEGEND

- Devil's Pulpit concept clearing limit
- Combined fauna underpass
- Watercourse

Threatened Fauna

- Brush-tailed Phascogale
- Greater Glider
- Squirrel Glider

Threatened Flora

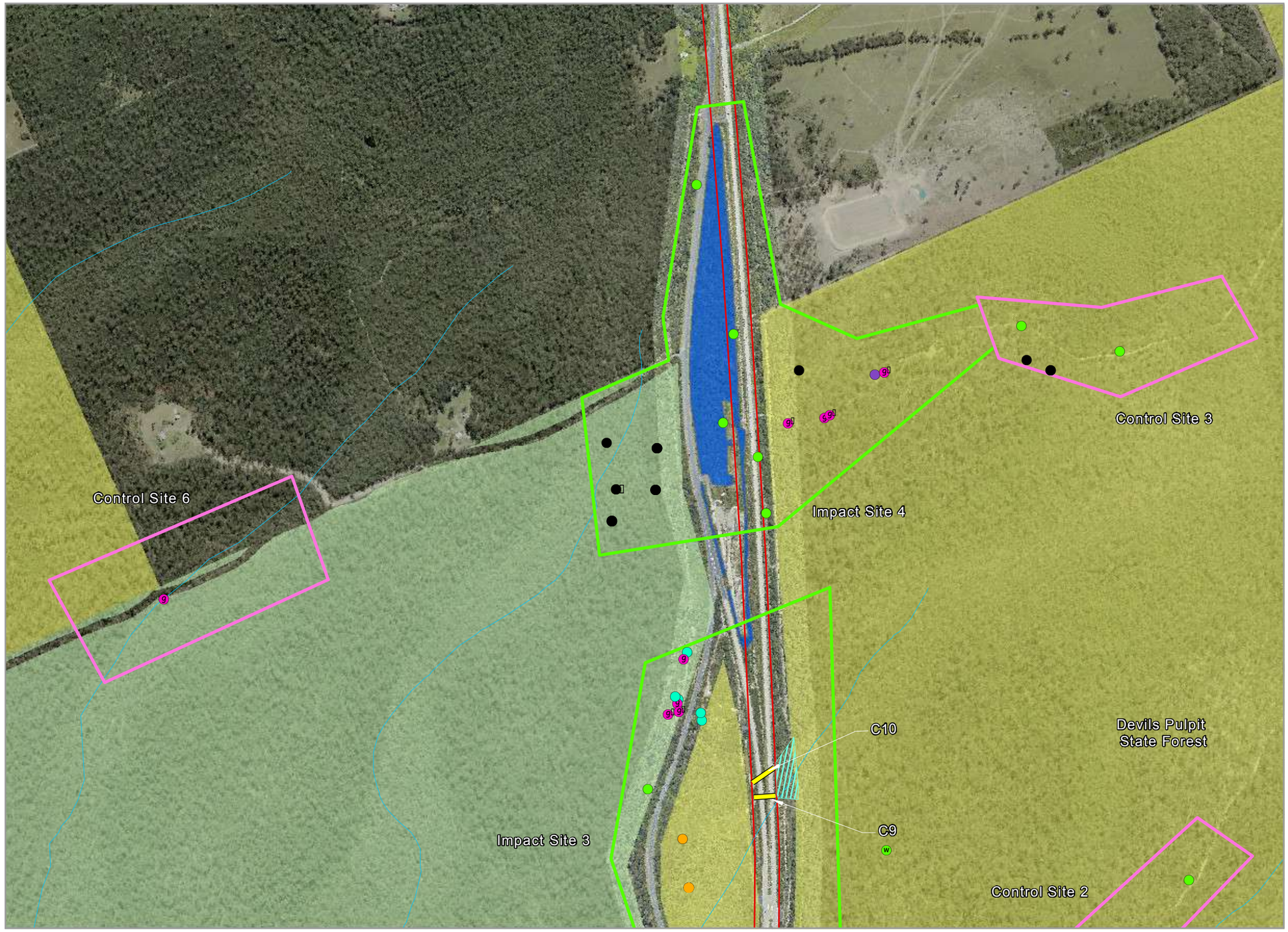
- Maundia

0 200

Recorded Threatened Species

Information shown is for illustrative purposes only

Drawn by: AB Checked by: RE Reviewed by: DSA Date: 04/04/2019
Source of base data: RMS



LEGEND

- Devil's Pulpit concept clearing limit
- Northern median
- Combined fauna underpass
- Watercourse

Threatened Fauna

- Brown Treecreeper
- Dusky Woodswallow
- Greater Glider
- Koala
- Long-nosed Potoroo
- Possible Native Mouse
- Squirrel Glider
- Yellow-bellied Glider

Threatened Flora

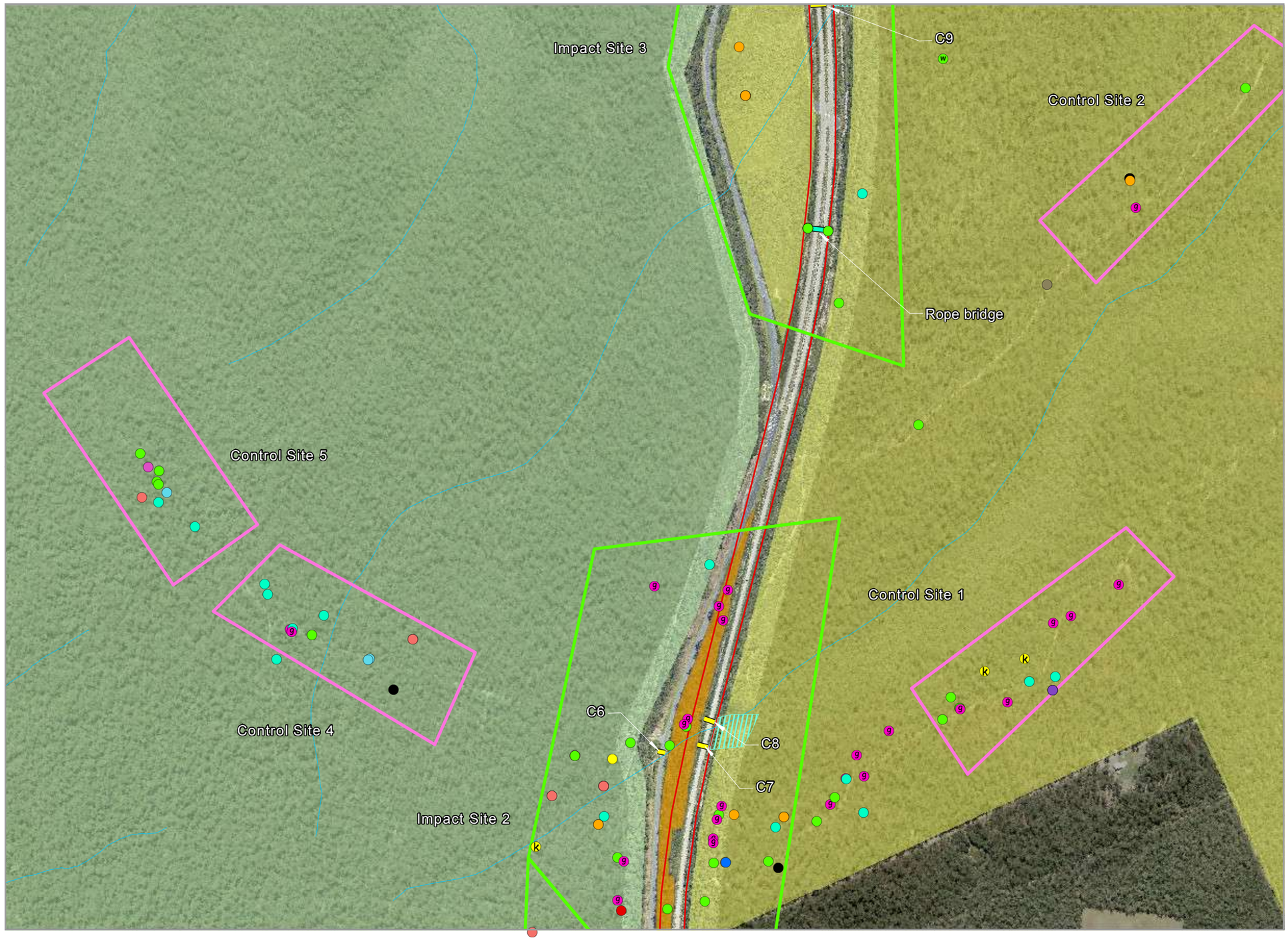
- Square-stemmed Spike-rush

0 200

Recorded Threatened Species

Information shown is for illustrative purposes only

Drawn by: AB Checked by: RE Reviewed by: DSA Date: 04/04/2019
Source of base data: RMS



LEGEND

- Devil's Pulpit concept clearing limit
- Southern median
- Combined fauna underpass
- Rope bridge
- Watercourse

Threatened Fauna

- Barking Owl
- Brown Treecreeper
- Brush-tailed Phascogale
- Dusky Woodswallow
- Glossy Black Cockatoo
- Greater Glider
- Green Thighed Frog
- Koala
- Koala (scat)
- Long-nosed Potoroo
- Masked Owl
- Possible Native Mouse
- Squirrel Glider
- Stephens' Banded Snake
- Yellow-bellied Glider

Threatened Flora

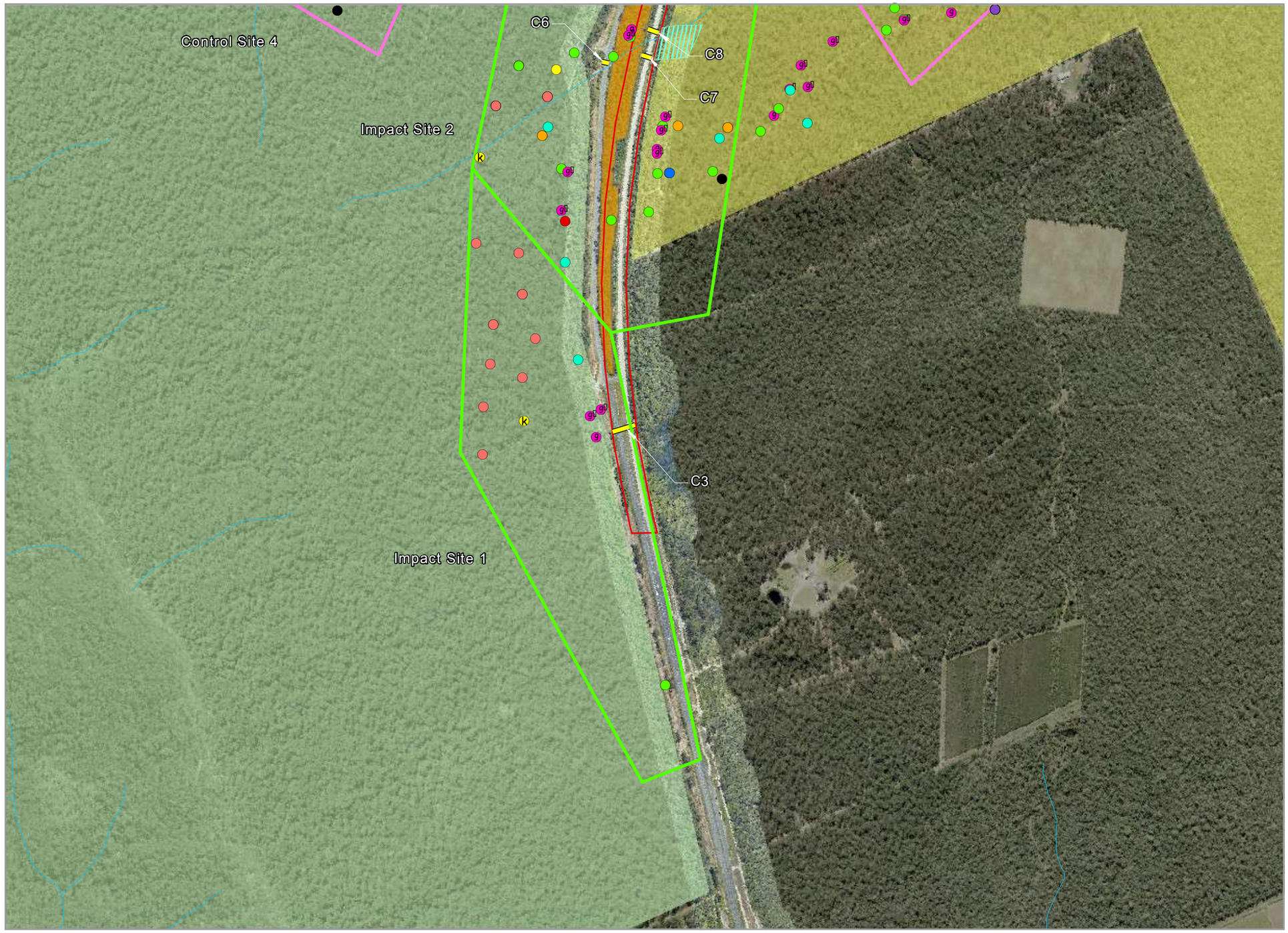
- Square-stemmed Spike-rush

0 200

Recorded Threatened Species

Information shown is for illustrative purposes only

Drawn by: AB Checked by: RE Reviewed by: DSA Date: 04/04/2019
Source of base data: RMS



LEGEND

- Devil's Pulpit concept clearing limit
- Southern median
- Combined fauna underpass
- Watercourse

Threatened Fauna

- Barking Owl
- Brown Treecreeper
- Brush-tailed Phascogale
- Greater Glider
- Koala
- Koala (scat)
- Long-nosed Potoroo
- Masked Owl
- Possible Native Mouse
- Squirrel Glider
- Yellow-bellied Glider

Threatened Flora

- Square-stemmed Spike-rush

0 200

Recorded Threatened Species

3.2 Rufous Bettong/ Brush-tailed Phascogale Camera Traps

Rufous Bettong/ Brush-tailed Phascogale (RB/ BTP) camera trap results are provided in **Appendix F**. A total of 1915 records* of 67 species/ species groups were obtained, an average 29.6 records (SD: 63.47) per species. The Bush Rat (*Rattus fuscipes* – 348 individuals; 15 sites), Yellow-footed Antechinus (*Antechinus flavipes* – 228 individuals; 14 sites), Swamp Wallaby (*Wallabia bicolor* – 222 individuals;15 sites), Northern Brown Bandicoot (*Isoodon macrourus* – 179 individuals; 15 sites) and Long-nosed Bandicoot (*Perameles nasuta* – 148 individuals; 15 sites) were the most commonly recorded species/ species group and were recorded at the highest number of sites (mean number of sites per species: 5.0).

The average number of species/ species groups recorded at each site was 22.5 (SD: 3.85; refer to **Table 3.1**). Average diversity at impact and control sites was similar (22.6 and 22.2 respectively). Most records were obtained in spring (47%) while the least number of records were obtained in summer (22%). Sites that recorded highest diversity of species/ species groups were Impact Site 1 (east) (32), Impact Site 1 (west) (27) and Control Site 1 (26). The site with the lowest recorded species diversity was Impact Site 5 (west) (17).

Table 3.1 Summary of Seasonal RB/ BTP Camera Traps Results

	Winter	*Spring*	*Summer*	*Total*
No. of Records*	601	895	419	1915
No. Individuals^	614	942	430	1986
% of Individuals^	31%	47%	22%	100%
Average no. of Species per Site	11.13	17.93	10.20	22.47 (all seasons)

** No. of Records is an indicative value of the number of visits of an individual recorded at each camera and is influenced by factors such as fauna behaviour and the frequency of return visits to each camera.*
^ The No. of individuals accounts for additional individuals captured in any image, where relevant.

Four target threatened species were recorded via the RB/ BTP camera traps:

- Brush-tailed Phascogale: 25 records at seven grid sites (five impact sites and two control sites).
- Koala: five records at four grid sites (three impact sites and one control site).
- Long-nosed Potoroo: 28 records at six grid sites (three impact sites and three control sites).
- Squirrel Glider: one record at one grid site (Impact Site 2 (west)).

No Rufous Bettongs were recorded. Other non-target threatened species recorded include:

- Dusky Woodswallow (*Artamus cyanopterus cyanopterus*) at Impact Site 3 (east).
- Brown Treecreeper (*Climacteris picumnus victoriae*) at Control Site 1.

Both of this species is listed as Vulnerable under the BC Act. Images of all recorded threatened species are shown from **Plate 3.1** to **Plate 3.6**.

Images of a possible native mouse (*Pseudomys sp.*) were recorded at Impact Site 2 (west), Impact Site 2 (east), Impact Site 3 (west) and Control Site 2 (refer to **Plate 3.7**). The animal was unable to be identified to species level from the images and the records are considered a tentative 'possible' identification. The *Pseudomys* genus includes a number of threatened species.

Activity levels of the Brush-tailed Phascogale and Long-nosed Potoroo for each site are provided in **Table 3.2**. Average activity levels were higher at impact sites than at control sites for the Brush-tailed Phascogale and equal at impact and control sites for the Long-nosed Potoroo.

Table 3.2 No. of Individual Records and Activity Levels for the Brush-tailed Phascogale and Long-nosed Potoroo for Year 4 Monitoring

Brush-tailed Phascogale				*Long-nosed Potoroo*		
No. Recorded		*Activity Level*	*Activity Level Standard Error*	*No. Recorded*	*Activity Level*	*Activity Level Standard Error*
Impact Site 1 (west)	7	28%	11	0	0%	0
Impact Site 1 (east)	4	22%	10	0	0%	0
Impact Site 2 (west)	8	22%	10	0	0%	0
Impact Site 2 (east)	0	0%	0	1	6%	6
Impact Site 3 (west)	0	0%	0	0	0%	0
Impact Site 3 (east)	0	0%	0	0	0%	0
Impact Site 4 (west)	0	0%	0	19	50%	12
Impact Site 4 (east)	0	0%	0	1	6%	6
Impact Site 5 (west)	2	12%	8	0	0%	0
Impact Site 5 (east)	1	6%	6	0	0%	0
Average Impact Sites	**2.2**	**9%**	**2**	**2.1**	**6%**	**2**
Control Site 1	0	0%	0	0	0%	0

	Brush-tailed Phascogale			Long-nosed Potoroo		
	No. Recorded	Activity Level	Activity Level Standard Error	No. Recorded	Activity Level	Activity Level Standard Error
Control Site 2	0	0%	0	3	6%	6
Control Site 3	0	0%	0	3	18%	10
Control Site 4	2	6%	6	1	6%	6
Control Site 5	1	6%	6	0	0%	0
Average Control Sites	**0.6**	**2%**	**2**	**1.4**	**6%**	**3**
All Sites	**1.7**	**7%**	**2**	**1.9**	**6%**	**1**

Plate 3.1 Brush-tailed Phascogale image from Impact Site 5 (west) during Year 4 spring monitoring.

Plate 3.2 Koala image from Impact Site 4 (west) during Year 4 spring monitoring.

Plate 3.3 Long-nosed Potoroo image from Impact Site 4 (west) during Year 4 winter monitoring.

Plate 3.4 Squirrel Glider image from Impact Site 2 (west) during Year 4 summer monitoring.

Plate 3.5 Dusky Woodswallow image from Impact Site 3 (east) during Year 4 spring monitoring.

Plate 3.6 Brown Treecreeper image from Control Site 4 during Year 4 spring monitoring.

Plate 3.7 Possible native mouse (*Pseudomys sp.*) image from Control Site 2 during Year 4 winter monitoring.

3.3 Spotlighting and Call Playback Results

Spotlighting and call playback results are provided in **Appendix G** and summarised in **Table 3.3**. A total of 141 on-site records of 16 species were obtained. The average number of records (abundance) per species was 9.2 (SD: 11.46). The Greater Glider (35 records; 11 sites), Feathertail Glider (24 records; 13 sites), Sugar Glider (24 records; 10 sites), Yellow-bellied Glider (24 records; 8 sites) and Squirrel Glider (17 records; 11 sites) were the most commonly recorded species and were recorded at the highest number of sites (mean number of sites per species: 4.6, SD 4.43). The highest percentage of records were obtained in summer (41%), while the percentage of results obtained in winter (27%) and spring (32%) were similar.

The average number of species recorded at each site (species diversity) was 4.1 (SD: 1.76), which was similar at impact sites (mean: 4.1, SD: 1.88) and control sites (mean: 4.0, SD: 1.67). The highest species diversity was recorded at Impact Site 3 (west) (seven species). The lowest species diversity was recorded at Impact Site 1 (east), Impact Site 3 (east), Impact Site 5 (west), Impact Site 6 (west) and Control Site 3, which each had two species recorded.

Three target threatened species were recorded during spotlighting/ call playback surveys:

- Squirrel Glider: 17 individuals recorded from 11 transect sites (seven impact sites and four control sites). This species was recorded on both sides of the highway and within both vegetated medians.
- Yellow-bellied Glider: 24 individuals recorded from eight transect sites (five impact sites and three control sites). This species was recorded on both sides of the highway, but not within the medians.

- Greater Glider: 35 individuals recorded from 11 transect sites (seven impact sites and four control sites). This species was recorded on both sides of the highway and within the southern median, but not within the northern median.

Target threatened species not recorded included the Koala, Rufous Bettong, Long-nosed Potoroo and Brush-tailed Phascogale.

Other threatened species recorded were the Masked Owl (*Tyto novaehollandiae*), Stephens' Banded Snake (*Hoplocephalus stephensii*), Glossy Black Cockatoo (*Calyptorhynchus lathami*) and Barking Owl (*Ninox connivens*). All of these species are listed under the BC Act.

The number of individuals of each recorded target threatened species at each site is displayed in **Figure 3.1**. A comparison of activity levels of threatened species during Year 3 and Year 4 monitoring is provided in **Figure 3.2**. Average activity levels of the Squirrel Glider and Yellow-bellied Glider were lower at impact sites compared to control sites. In contrast, the average activity levels for the Greater Glider were higher at impact sites compared to control sites. These trends were similar in both Year 3 and Year 4 monitoring.

Table 3.3 Summary of Recorded Target Species Spotlighting/ Call Playback Results for Year 4 Monitoring

Site	*Greater Glider*	*Squirrel Glider*	*Yellow-bellied Glider*	*Other Arboreal Mammals*	*Other Terrestrial Mammals*	*Total*
Impact Site 1 (west)	2	0	1	1	1	5
Impact Site 1 (east)	0	1	0	2	0	3
Impact Site 2 (west)	3	0	3	3	1	10
Impact Site 2 (median)	7	2	0	6	0	15
Impact Site 2 (east)	4	2	1	5	1	13
Impact Site 3 (west)	4	1	6	4	0	15
Impact Site 3 (east)	0	0	1	1	0	2
Impact Site 4 (median)	0	1	0	4	0	5
Impact Site 4 (east)	5	0	0	4	0	9
Impact Site 5 (west)	0	0	0	3	0	3
Impact Site 5 (east)	1	1	0	7	2	11
Impact Site 6 (west)	0	2	0	1	0	3
Impact Total	**26**	**10**	**12**	**41**	**5**	**94**
Activity Level*	**1.73**	**0.67**	**0.80**	**2.73**	**0.33**	**-**
ST Dev	**2.41**	**0.83**	**1.81**	**1.98**	**0.67**	**-**
ST Error	**0.62**	**0.22**	**0.47**	**0.51**	**0.17**	**-**
Control Site 1	5	1	2	6	0	14
Control Site 2	1	1	0	2	1	5
Control Site 3	0	2	0	0	1	3

Site	*Greater Glider*	*Squirrel Glider*	*Yellow-bellied Glider*	*Other Arboreal Mammals*	*Other Terrestrial Mammals*	*Total*
Control Site 4	2	0	7	0	0	9
Control Site 5	0	3	3	6	1	13
Control Site 6	1	0	0	1	1	3
Control Total	**9**	**7**	**12**	**15**	**4**	**47**
Activity Level*	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**	**-**
ST Dev	1.87	1.17	2.76	2.81	0.52	**-**
ST Error	0.76	0.48	1.13	1.15	0.21	**-**
Total All Sites	**35**	**17**	**24**	**56**	**9**	**141**

* Activity levels (no. of individuals/ 500 m spotlight transect^)

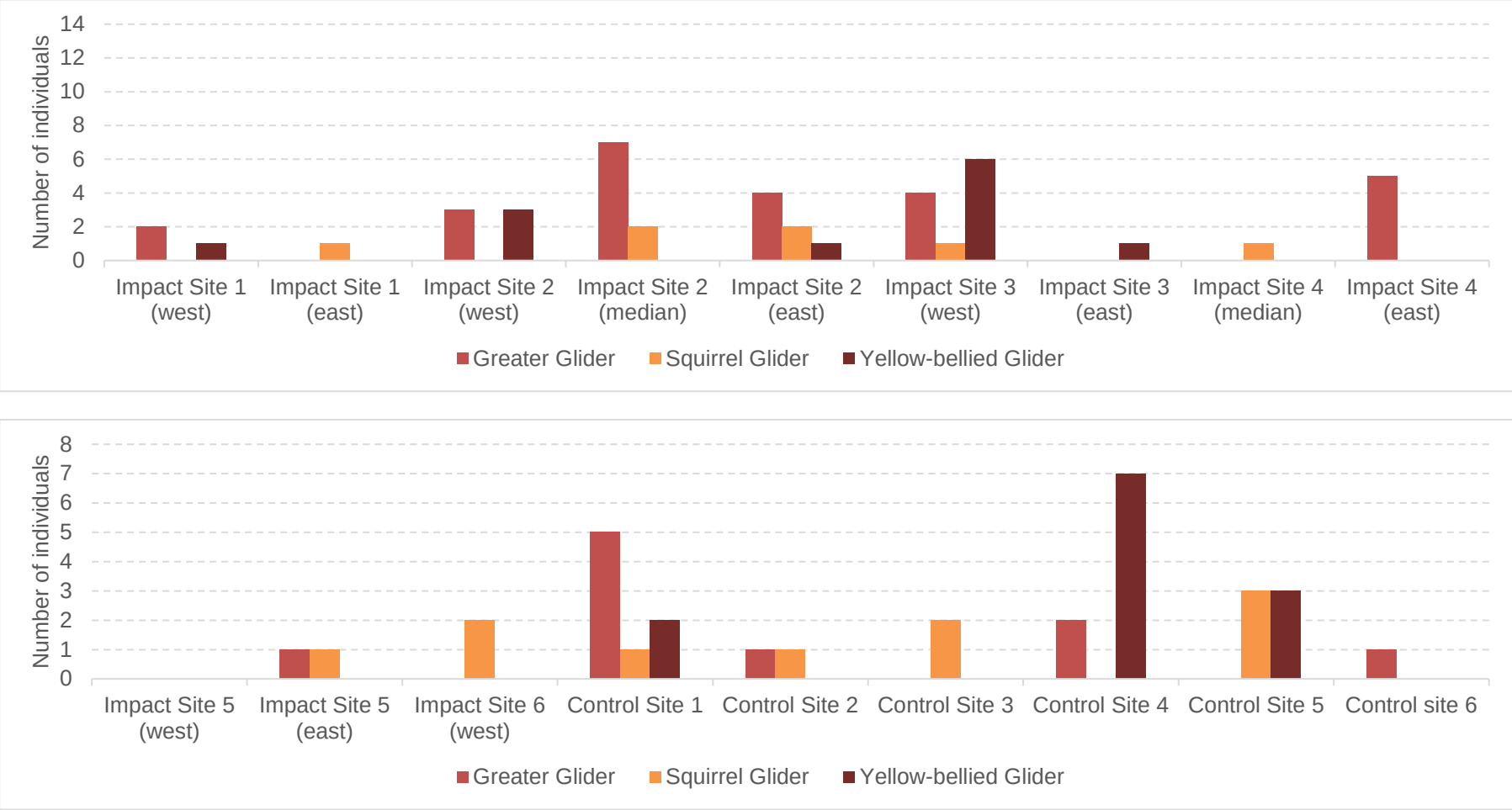


Figure 3.1 Number of Individuals of Recorded Target Species via Spotlighting/ Call Playback during Year 4 Monitoring
Note: Spotlighting transects are one kilometre long at Impact Site 2 (median) and Impact Site 4 (median); and 500 m long at all other sites.

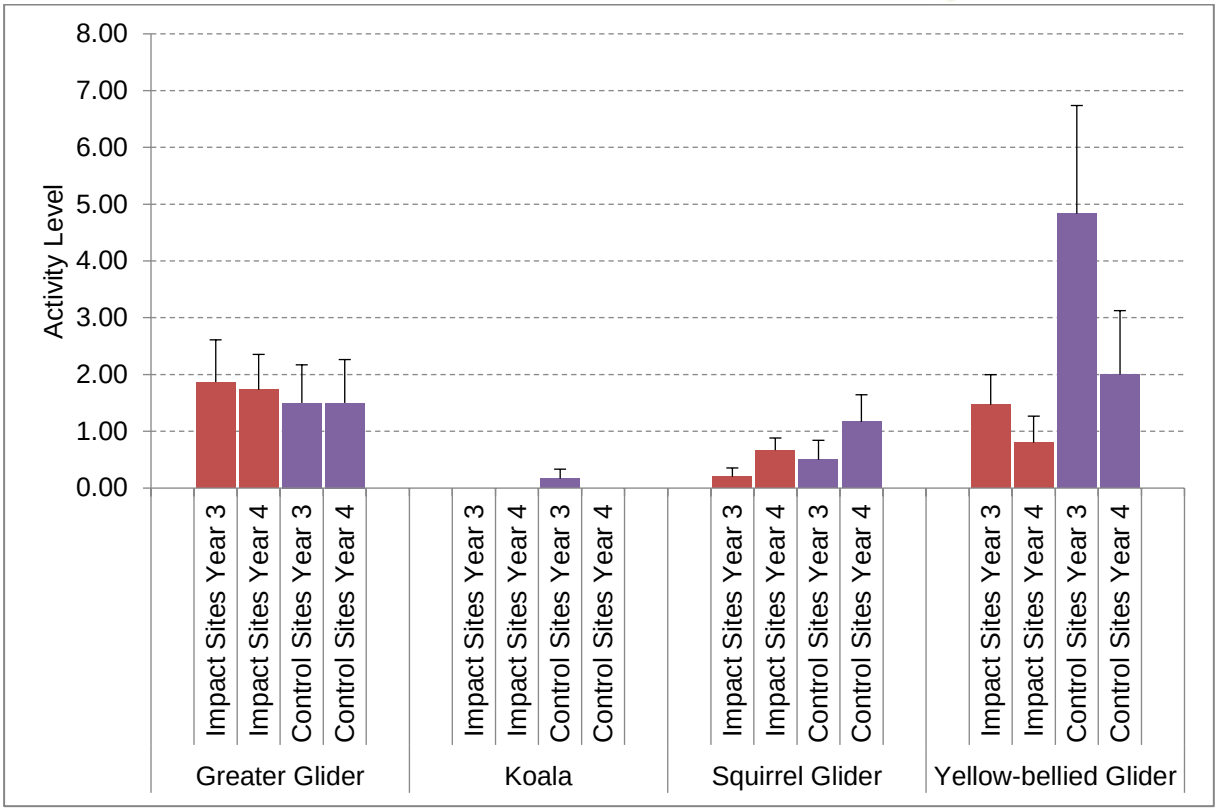


Figure 3.2 Mean Activity Levels of Target Species Recorded via Spotlighting/ Call Playback Survey during Year 3 and Year 4 Monitoring

3.4 Threatened Frog Survey Results

Frog survey results are shown in **Appendix H**. Seventeen frog species were recorded in total, averaging 10.1 species per site (range: 5-14; SD: 2.62). The highest diversity (number) of species was recorded at Control Site 3 (14), Impact Site 3 (west) (12) and Impact Site 3 (east) (12).

The average number of species per transect site was 4.3 (SD: 2.32). The most commonly recorded species (i.e. species recorded at the most number of transect sites) were the Peron's Tree Frog (*Litoria peronii* – nine sites), Red-backed Brood Frog (*Pseudophryne coriacea* – nine sites), Beeping Froglet (*Crinia parinsignifera* – eight sites) and Common Eastern Froglet (*Crinia signifera* – eight sites).

The Green-thighed Frog was only recorded at two control sites (Control Site 4 and 5) located on the western side of the highway. It was only recorded during two survey events (Spring Survey 2 and Summer Survey 1). The Wallum Froglet was not recorded during the reporting period.

The number of individuals and location of threatened frog species recorded during each survey event is provided in **Figure 3.3**. Green-thighed Frog numbers during survey events with positive results ranged from 1-5 (mean: 3.7; SD: 2.31).

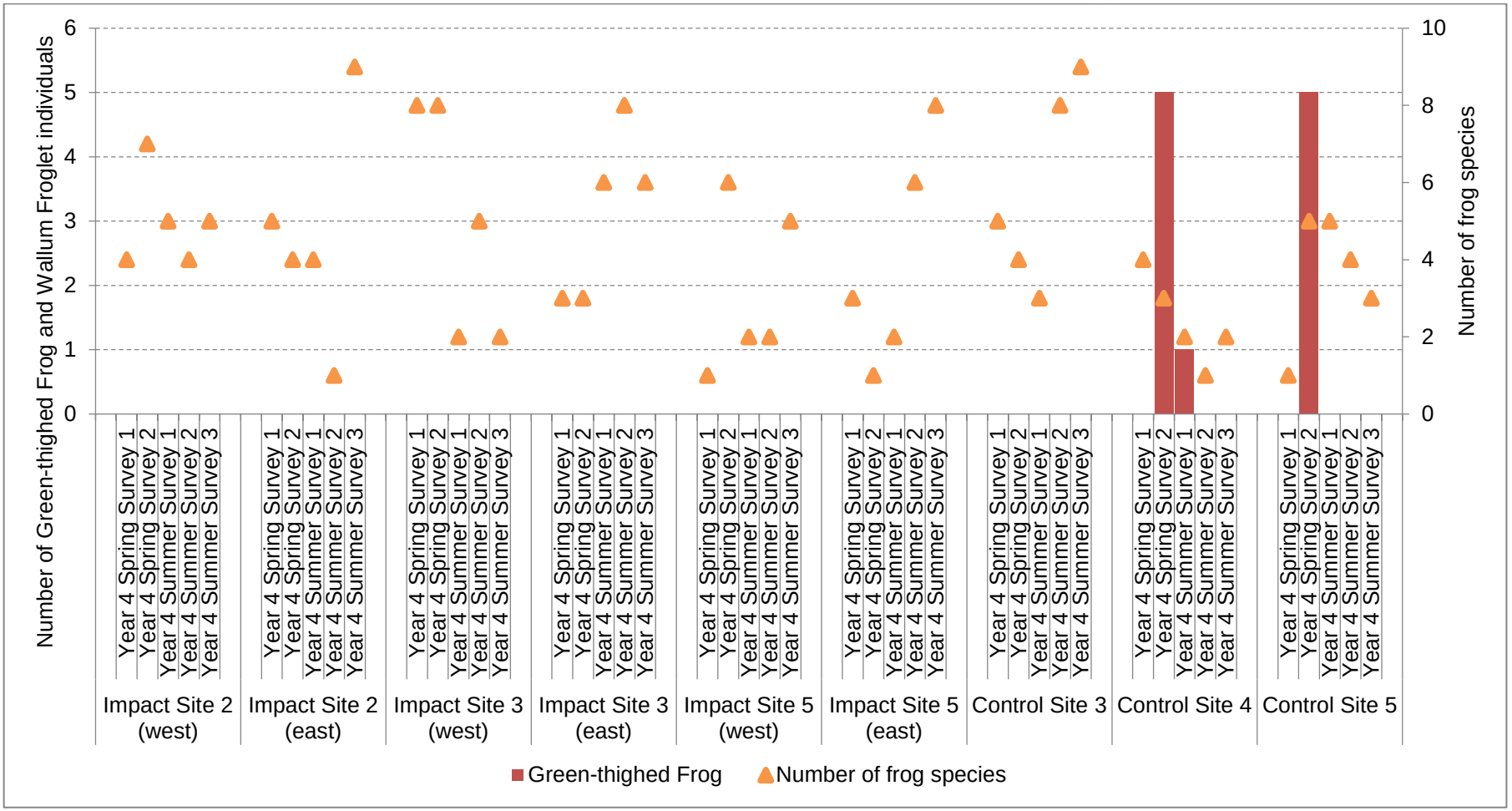


Figure 3.3 Threatened Frog Survey Results During Year 4 Monitoring

Figure 3.4 shows a comparison between the number of target threatened frog species individuals and the number of frog species recorded at impact and control sites in Year 3 and Year 4 monitoring. A higher number of threatened frog individuals were recorded at both impact and control sites in Year 3 compared to Year 4. In contrast, a higher number of frog species was recorded during Year 4 at both impact and control sites compared to Year 3.

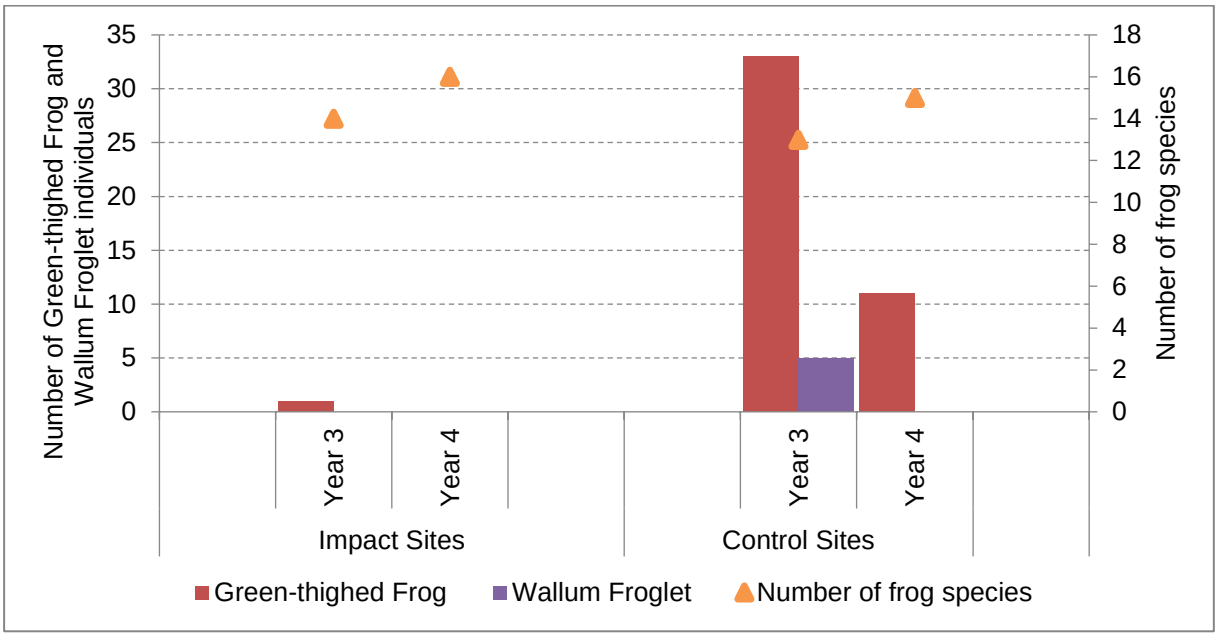


Figure 3.4 Threatened Frog Survey Results During Year 3 and Year 4 Monitoring

3.5 Nest Box Monitoring Results

The nest box monitoring results are provided in **Appendix B**. The Squirrel Glider was the only target species recorded occupying nest boxes, with a total of 37 individuals (including subadults; excluding dependant pouched young) recorded occupying 15 nest boxes (21%). A summary of sites with nest boxes occupied by Squirrel Glider is provided in **Table 3.4**.

Other vertebrate fauna recorded occupying the nest boxes include:

- Sugar Glider: one individual.
- Common Ringtail Possum: one subadult female.
- Brushtail Possum: one dead carcass.

A further 30 nest boxes (43%) were not occupied, however showed evidence of glider (*Petaurus sp.*) activity through leaf nesting material deposits. No Brush-tailed Phascogales or evidence of nest box usage by this species was recorded. No active European Bee (*Apis mellifera*) hives were present.

Table 3.4 Summary of Squirrel Glider Nest Box Site Occupancy for Year 3 and Year 4 Monitoring

Site	*Nest Boxes Occupied During Year 3*	*Nest Boxes Occupied During Year 4*
Impact Site 2 (west)	-	Y
Impact Site 2 (median)	-	Y
Impact Site 2 (east)	Y	Y
Impact Site 3 (west)	Y	-
Impact Site 3 (east)	Y	Y
Impact Site 4 (median)	Y	Y
Impact Site 4 (east)	-	Y
Impact Site 6 (west)	-	Y
Control Site 1	-	Y
Control Site 4	-	Y
Control Site 5	-	Y

Figure 3.5 shows the number of Squirrel Glider individuals recorded over time at the site while **Figure 3.6** shows nest box occupancy rates. To date, Squirrel Glider numbers peaked in Year 4 winter (22). Similar numbers were recorded in Year 4 spring and summer (7 and 8 individuals respectively). The number of nest boxes showing evidence of glider occupancy initially increased then plateaued at both impact and control sites at 55% to 60%.

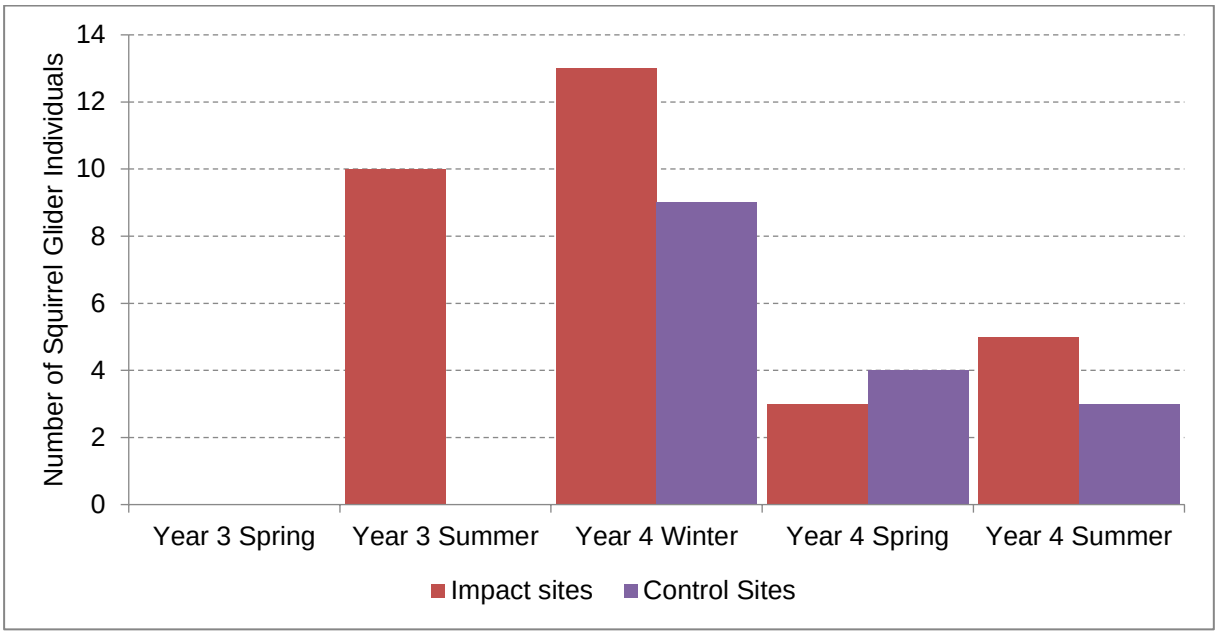


Figure 3.5 Squirrel Glider Results During Year 3 and Year 4 Monitoring

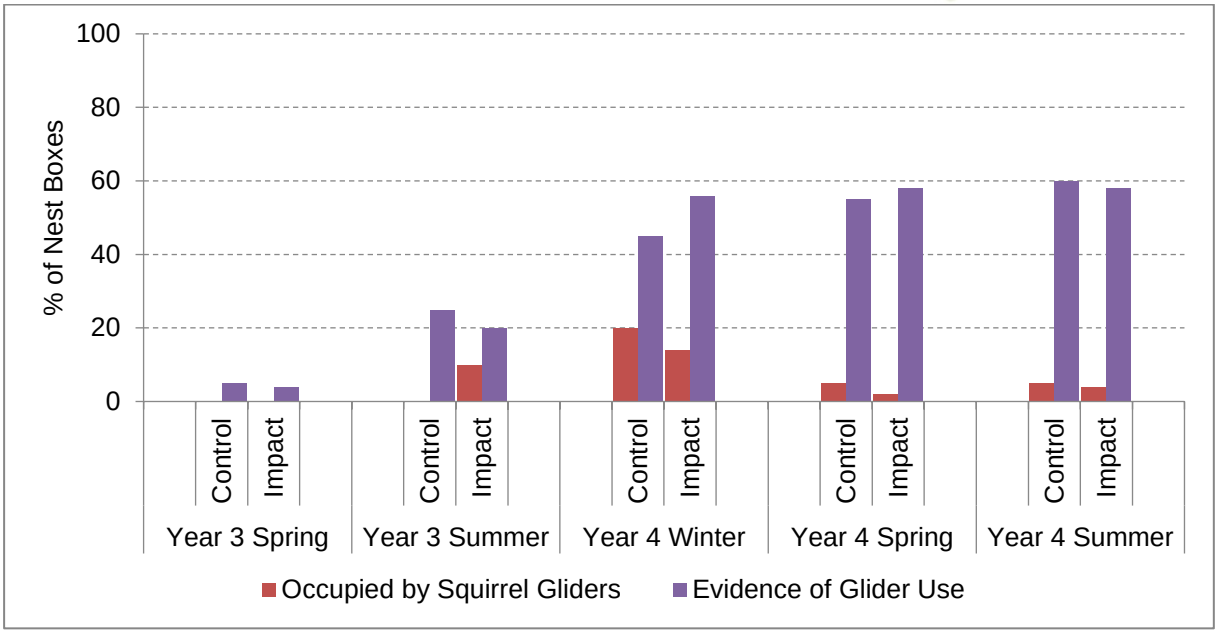


Figure 3.6 Nest Box Occupancy Rates During Year 3 and Year 4 Monitoring

Evidence of glider use = no. of nest boxes occupied by gliders or containing leaf litter.

3.6 Fauna Underpass Monitoring Results

Fauna underpass camera monitoring results are summarised in **Table 3.5**. Camera monitoring (including underpass cameras, substitution cameras and fauna furniture cameras) recorded a total of 1505 records of 33 fauna species/ species groups (excluding birds and domestic cattle). The most commonly recorded species were Lace Monitors (*Varanus varius* – 308), Black Rat (*Rattus rattus* - 266), Eastern Water Dragon (*Intellagama lesueurii* - 252) and Swamp Wallaby (*Wallabia bicolor*). Several species (e.g. Eastern Water Dragon, Black Rat, Swamp Wallaby, Lace Monitor, Cat (*Felis catus)*, Yellow-footed Antechinus (*Antechinus flavipes*) regularly displayed habitation behaviour within or adjacent to the structures (such as foraging, basking, etc) rather than dispersing through the underpasses.

The majority of records were obtained from C8 (380), C7 (337) and SBT3 (217). Fauna underpasses with the least number of records included C3 (14), C9 (64), C10 (64), NBT2 (75) and SBT2 (80).

A total of 534 unique complete crossings of 27 species/ species groups were recorded. Most unique complete crossings recorded were of Lace Monitors (181), Black Rats (127) and Swamp Wallaby. C7, C8 and SBT3 recorded the most unique complete crossings, numbering 155, 152 and 78 respectively. No unique complete crossings were recorded at C3, while low numbers of unique complete crossings were recorded at C9 (5), C10 (22) NBT2 (22), C6 (24) and SBT2 (27). The overall weekly rate of unique complete crossings for all species was 8.77.

A single Brush-tailed Phascogale record was made on the western side (southern bank) of NBT2 in spring with a substitution camera, however a complete crossing was not recorded. No other records of this species or any other threatened species were obtained during underpass monitoring.

Plate 3.8 Brush-tailed Phascogale at the western side (southern bank) of NBT2.

Plate 3.9 Short-eared Possum using fauna furniture at fauna underpass C6.
A complete crossing was recorded.

Plate 3.10 Brown Goshawk in the middle of fauna underpass C7.
A complete crossing was recorded. Brown Goshawks were regularly recorded at the underpasses (in particular moving along fauna furniture).

Plate 3.11 Domestic cattle at NBT3.
The cattle were from private land to the east that escaped onto RMS land.

Plate 3.12 A Swamp Wallaby in the middle of fauna underpass C8.
A return was recorded.

Plate 3.13 A Yellow-footed Antechinus using the fauna furniture at SBT2.
A complete crossing was not recorded.

Table 3.5 Summary of Fauna Underpass Monitoring Results During the Year 4 Reporting Period

Species	C3			C6			C7			C8			C9			C10			NBT3			SBT3			NBT2			SBT2			Total NR	Total RCC	Total UCC	UCC/ week
	NR	RCC	UCC	NR	RCC	UCC	NR	RCC	UCC	NR	RCC	UCC	NR	RCC	UCC	NR	RCC	UCC	NR	RCC	UCC	NR	RCC	UCC	NR	RCC	UCC	NR	RCC	UCC				
Antechinus sp.				2															3	2	1	4	1	1	9	6	4	2	2	2	20	11	8	0.13
Antechinus sp./ Rodent				1			22			10			3			1	1	1							5						42	1	1	0.02
Bandicoot																						4	2	2							4	2	2	0.03
Black Rat				34	14	8	76	50	50	127	87	61	1			3	2	2	3	1	1	16	8	5	4			2			266	162	127	2.09
Brush-tailed Phascogale																									1						1			0
Bush Rat										2																					2			0
Cane Toad										21	6	3				12	2	1													33	8	4	0.07
Cat	1						6	5	2				4			1			2	1	1	3	2	2	17	8	8	16	9	8	50	25	21	0.35
Common Brushtail Possum							1			2	2	2										1			2						6	2	2	0.03
Dingo/ Wild Dog							2	1	1																						2	1	1	0.02
Eastern Blue Tongue Lizard																						1									1			0
Eastern Grey Kangaroo																			4	3	2	8	5	5	1			2	1	1	15	9	8	0.13
Eastern Water Dragon	6			68	22	13	7	2	2	29	12	6	10			5	3	2	27	1	1	65	4	4	10	2	2	25	4	2	252	50	32	0.53
Eastern Water Skink				7																					5	2	2				12	2	2	0.03
Fox																1			1	1	1	1	1	1							3	2	2	0.03
House Mouse																						1	1	1							1	1	1	0.02
Lace Monitor	1			1	1	1	108	94	86	118	90	64	10	2	1	34	25	15	6	2	2	23	9	9	5	1	1	2	2	2	308	226	181	2.97
Land Mullet							1	1	1													2									3	1	1	0.02
Lizard																			1						2			2			5			0
Long-nosed Bandicoot	2						4	1	1	6	1	1							2												14	2	2	0.03
Macropod sp.							7	2	1										15	7	6	12	5	5	2	2	2	1			37	16	14	0.23
Northern Brown Bandicoot							10	1	1	3			1						1			11	6	6	3			1			30	7	7	0.12
Red-necked Wallaby																						7	6	6				7	4	4	14	10	10	0.16
Ringtail Possum																1															1			0
Rodent				6			4			4	3	1	11						7			8			2			3			45	3	1	0.02
Short-beaked Echidna							1	1	1							1															2	1	1	0.02
Short-eared Possum				7	3	1	4	2	1	22	17	6				1															34	22	8	0.13
Snake	1																					1						1			3			0
Swamp Wallaby	2						81	32	21	21	11	6	6	5	4	1			61	30	20	45	35	30				13	7	7	230	120	88	1.45
Unidentifiable							3			7			1			1			1			1	1	1							14	1	1	0.02
Wall Skink																			2	1	1				7	3	3				9	4	4	0.07
Water Rat	1			9						2	1	1	17			2	1	1				1									32	2	2	0.03
Yellow-footed Antechinus				3	2	1				6	2	1										2						3	2	1	14	6	3	0.05
Total	**14**			**138**	**42**	**24**	**337**	**192**	**168**	**380**	**232**	**152**	**64**	**7**	**5**	**64**	**34**	**22**	**136**	**49**	**36**	**217**	**86**	**78**	**75**	**24**	**22**	**80**	**31**	**27**	**1505**	**697**	**534**	**8.77**

NR = No. of records; RCC = No. of records of complete crossing; UCC = No. of unique complete crossings; NBT2 = Northbound bridge over Tabbimoble Floodway No.2; NBT3 = Northbound bridge over Tabbimoble Floodway No.3; SBT2 = Southbound bridge over Tabbimoble Floodway No.2; SBT3 = Southbound bridge over Tabbimoble Floodway No.3.

Underpass scat and track search results are provided in **Appendix I**. Scats and/ or tracks detected evidence of 15 species/ species groups (excluding avifauna) including:

- Nine mammals: Common Brushtail Possum, Rattus sp., Antechinus sp., domestic cattle, Eastern Grey Kangaroo (*Macropus giganteus*), Water Rat (*Hydromys chrysogaster*), microbats (bent-winged bats (mostly Little Bent-winged Bats)) Swamp Wallaby and Wild Dog/ Dingo.
- One amphibian: Common Eastern Froglet (*Crinia signifera*).
- Five reptiles: Lace Monitor, Eastern Water Dragon, skink sp. (scats), Sun-skink (*Lampropholis delicata*) and Carpet Snake (*Morelia spilota*).

Results indicative of complete crossing fauna crossings were of:

- Cattle at SBT3, NBT2 and NBT3.
- Common Eastern Froglet at C9 (individual recorded in centre of culvert).
- Lace Monitor at C7, C9 and C10.
- Sun-skink at C8 (individual recorded in centre of culvert).
- Swamp Wallaby at C6 (pipe culverts south of fauna underpass), C7 and C9.

No scats or tracks of target threatened species were detected at the underpass structures.

Fauna underpass structures C3, C7, C8, C9 and C10 were recorded to support roosting colonies of the BC Act listed threatened species: Little Bent-winged Bat (*Miniopterus australis*) and Eastern Bent-winged Bat (*M. orianae oceanensis*). Colonies numbered > 50 individuals and were occupied in winter and spring. While old guano was present at the pipe culvert south of C6, no microbats were recorded at this site (microbat exclusion was in place).

3.7 Rope Bridge

Rope bridge cameras recorded a total of 102 records of seven species (refer to **Table 3.6**). The Feathertail Glider (*Acrobates pygmaeus* – 79 records) was the most commonly recorded species followed by the Squirrel Glider (9 records) and Sugar Glider (7 records) (plus three *Petaurus sp*. records of either of these species that could not be identified to species levels). The Brush-tailed Phascogale, Common Ringtail Possum, Yellow-bellied Glider and Yellow-footed Antechinus were only recorded once each.

The Feathertail Glider, Squirrel Glider and Sugar Glider were recorded on both the eastern and western sides of the rope bridge. The Yellow-bellied Glider was recorded on the eastern side of the rope bridge only, while the Common Ringtail Possum, Brush-tailed Phascogale and Yellow-footed Antechinus were recorded at the western end of the rope bridge only. Overall, the total number of records was higher at the western side (67) than the eastern site (35).

No Greater Glider activity on the rope bridge was recorded.

Table 3.6 Species Recorded by Rope Bridge Camera Traps During the Year 4 Reporting Period

Species	Eastern Pole		Western Pole		TOTAL Visits
	No. of Visits	Visits/ Week	No. of Visits	Visits/ Week	
Brush-tailed Phascogale	0	0.00	1	0.02	1
Common Ringtail Possum	0	0.00	1	0.02	1
Feathertail Glider	28	0.55	51	1.00	79
Glider sp.	2	0.04	1	0.02	3
Squirrel Glider	2	0.04	7	0.14	9
Sugar Glider	2	0.04	5	0.10	7
Yellow-bellied Glider	1	0.02	0	0.00	1
Yellow-footed Antechinus	0	0.00	1	0.02	1
TOTAL	**35**	**0.69**	**67**	**1.32**	**102**

Directional movement of the Feathertail Glider, Squirrel Glider and Sugar Glider occurred on both the eastern and western sides of the rope bridge (refer to **Table 3.7**). There were ten occasions when Feathertail Gliders were recorded on both side of the rope bridge on the same night. These are potentially indicative of rope bridge crossings, with:

- four occasions indicative of east-west movement;
- five occasions indicative of west-east movement; and
- one occasion indicative of west-east-west.

However directional movements were not consistent at each end of the rope bridge. It is also plausible that gliders were present at each end of the rope bridge on the same night and did not cross. On one occasion, two gliders had a territorial dispute at the eastern rope bridge pole, after one glider approached from the west (this was recorded as a potential complete crossing; refer to **Plate 3.14**).

Squirrel Gliders were recorded moving east on both sides of the rope bridge and west on the western side of the rope bridge. Directional movement of Squirrel Gliders was recorded most often in an eastern direction (four records). One return movement of a Squirrel Glider was recorded on the eastern side of the rope.

The Yellow-bellied Glider record was obtained on the eastern side of the rope bridge moving to the west along the rope bridge (refer to **Plate 3.15** and **Plate 3.16**). The image sequence does not show the animal going completely past the camera, with the last image showing the animal moving backwards slightly. No Yellow-bellied Glider images were recorded at the western side of the rope bridge; therefore a complete crossing was not confirmed.

A Brush-tailed Phascogale was recorded on the western side of the rope bridge (refer to **Plate 3.16**). The sequence shows the animal returning to the pole.

A relatively high number of records (58 or 57%) did not involve directional movement. This was largely attributed to Feathertail Glider habitation (i.e. foraging) activity at the rope bridge poles.

Table 3.7 Direction of Movement of Species on Rope Bridge During the Year 4 Reporting Period

Species	*Eastern Pole*				*Western Pole*				*TOTAL*
	East	*West*	*Return*	*N/ A*	*East*	*West*	*Return*	*N/ A*	
Brush-tailed Phascogale							1		1
Common Ringtail Possum					1				1
Feathertail Glider	9	3		16	12	4		35	79
Glider sp.	1			1	1				3
Squirrel Glider	1		1		3	1		3	9
Sugar Glider	1			1	2		1	2	7
Yellow-bellied Glider		1							1
Yellow-footed Antechinus					1				1
TOTAL	**12**	**4**	**1**	**18**	**20**	**5**	**2**	**40**	**102**

Plate 3.14 Two feathertail Gliders having a territorial dispute at the eastern rope bridge pole.
A likely complete crossing was recorded in this instance.

Plate 3.15 Yellow-bellied Glider at the eastern rope bridge pole.
A complete crossing was not recorded in this instance.

Plate 3.16 Brush-tailed Phascogale on the western rope bridge pole.
The image sequence shows the animal return to the pole.

3.8 Vegetated Median

The results of spotlighting and nest box monitoring provided in **Sections 3.3** and **3.5** (respectively) include results for the vegetated medians. Arboreal hair tube results are provided in **Table 3.8**. At the northern median (Impact Site 4), the Year 4 post construction surveys have recorded:

- No Yellow-bellied Gliders within or adjacent to the median.
- Squirrel Gliders within the median (nest box monitoring and spotlighting) and on both the eastern (spotlighting) side of the highway. An opportunistic record on the western side of the highway was also made during W2B works that coincided with the Year 4 monitoring.
- Feathertail Glider was recorded within the median (spotlighting), while an opportunistic record on the western side of the highway was also made during W2B works that coincided with Year 4 monitoring.
- No Greater Gliders were recorded within the median, however the species was recorded on the eastern side of the highway at this median (spotlighting).
- Sugar Glider was recorded within the median as well as on the eastern side of the highway (spotlighting).

At the southern median (Impact Site 2), the Year 4 post construction surveys recorded:

- No Yellow-bellied Gliders within the median, however the species was recorded on both sides of the highway at this median.
- Squirrel Gliders within the median (nest box monitoring and spotlighting) and on the eastern (nest box monitoring and spotlighting) and western (nest box monitoring and RB/ BTP camera trap) sides of the highway.
- Feathertail Gliders within and on both sides of the median (spotlighting).
- Greater Gliders within and on both sides of the median.
- Sugar Gliders within and on both sides of the median (spotlighting).

In relation to gliders, the arboreal hair tubes were only able to record 'Glider *Petaurus breviceps/ norfolcensis*)'. It was not possible to differential the Sugar Glider and Squirrel Glider from hair samples.

Table 3.8 Vegetated Median Hair Tube Monitoring Results

Median	*Site*	*Date*	*Survey*	*Common Name*	*Scientific Name*	*Confidence*	*Comment*
North	9b	31/01/2019	Summer	Common Dunnart	*Sminthopsis murina*	Probable	-
North	7b	31/01/2019	Summer	Antechinus	*Antechinus sp.*	-	-
North	6a	31/01/2019	Summer	Antechinus	*Antechinus sp.*	-	-
North	10a	10/01/2019	Summer	Yellow-footed Antechinus	*Antechinus flavipes*	-	-
North	8a	10/01/2019	Summer	Yellow-footed Antechinus	*Antechinus flavipes*	-	-
North	7a	10/01/2019	Summer	Common Dunnart	*Sminthopsis murina*	-	-
North	1b	13/11/2018	Spring	Glider	*Petaurus breviceps/ norfolcensis*	-	-
North	3c	13/11/2018	Spring	Glider	*Petaurus breviceps/ norfolcensis*	-	-
South	3c	13/11/2018	Spring	Yellow-footed Antechinus	*Antechinus flavipes*	-	-
South	4a	13/11/2018	Spring	Antechinus	*Antechinus sp.*	-	-
South	5c	13/11/2018	Spring	Cat	*Felis catus*	Probable	-
North	5c	13/11/2018	Spring	Glider	*Petaurus breviceps/ norfolcensis*	-	-
North	5c	18/10/2018	Spring	Yellow-footed Antechinus	*Antechinus flavipes*	-	-
North	1c	18/10/2018	Spring	Glider	*Petaurus breviceps/ norfolcensis*	-	-
South	9a	18/10/2018	Spring	Possum	*Trichosurus sp.*	Possible	-
South	5c	18/10/2018	Spring	Possum	*Trichosurus sp.*	Possible	-
North	10c	18/10/2018	Spring	Dusky Antechinus	*Antechinus swainsonii*	Probable	Otherwise *A. flavipes*

3.9 Restoration of Vegetated Connectivity Corridor

Vegetation quadrats and photo point results are provided in **Appendix D** and summarised in **Table 3.9** and **Table 3.10**. Vegetation structure at each site was divided into three categories:

- Trees (T1) = 3m tall
- Shrubs (T2) = woody species <3m tall
- Groundcovers (G) = non-woody species (e.g. herbs, grasses, sedges and rushes)

3.9.1 Year 3 Autumn

A total of seven tree species (all native) were recorded in the tree layer, with Broad-leaved Paperbark (*Melaleuca quinquenervia*) and Swamp Box (*Lophostemon suaveolens*) being the dominant species at most sites. Upper tree height ranged between five and six metres at each quadrat. Total cover scores at each site varied from 2 to 5 for native trees.

Seventeen 'shrub' species were recorded, including both native and weed species. Commonly recorded species included Paperbark (*Melaleuca linariifolia*, *M. nodosa*, *M. quinquenervia* and *M. sieberi*), Swamp Box saplings and Banksias (*Banksia ericifolia subsp. ericifolia* and *B. oblongfolia*). Weed were uncommon and included one species, Groundsel Bush (*Baccharis halimifolia**). Total shrub cover scores at each site ranged from 2 to 4 for native species and 0 to 1 for weed species.

Sixty-two species were recorded in the groundcover layer, including 40 native and 22 exotic species. Dominant species included Pigeon Grass (*Setaria sphacelata**), Blady Grass (*Imperata cylindrica*), Bluegrass (*Ischaemum australe*), Milkwort (*Polygala paniculata**) and Matgrass (*Hemarthria uncinate*). Total cover scores of groundcovers at each site ranged from 1 to 6 for native species and 3 to 6 for exotic species.

Condition varied from good to excellent at three quadrats (Q1, Q2, Q3), moderate at three (Q4, Q6 and Q8) and poor at two sites (Q5 and Q6). All sites showed signs of native species recruitment.

Table 3.9 Summary of Year 3 Autumn Vegetation Quadrat Data

	Q1	*Q2*	*Q3*	*Q4*	*Q5*	*Q6*	*Q7*	*Q8*
TREES (T1) > 3m								
Number of native species	4	4	5	4	2	4	5	2
Number of exotic species	0	0	0	0	0	0	0	0
Mean height (m)	6	5	6	6	5	6	6	6
Cover of native species*	5	3	4	3	2	4	2	3
Cover of exotic species*	0	0	0	0	0	0	0	0
SHRUBS (T2) < 3m								
Number of native species	7	10	11	9	5	11	10	4
Number of exotic species	1	1	1	1	0	0	0	1
Mean height (m)	2	3	4	2	3	3	3	3
Cover of native species*	3	3	4	3	2	3	3	3
Cover of exotic species*	1	1	1	1	0	0	0	1
GROUNDCOVERS (G)								
Number of native species	18	21	18	15	1	11	12	16
Number of exotic species	11	8	7	11	5	10	11	12
Mean height (m)	0.5	0.4	0.5	0.5	1.8	1.5	0.5	0.8
Cover of native species*	6	5	5	5	1	2	5	5
Cover of exotic species*	3	3	3	4	6	6	4	5
Condition	Very Good	Good	Very Good	Good	Very Poor	Moderate	Moderate	Moderate

	Q1	*Q2*	*Q3*	*Q4*	*Q5*	*Q6*	*Q7*	*Q8*
Evidence of recruitment	**Yes -** *M. quinquenervia, L. suaveolens, M.sieberi, L. brachyandrum, M. nodosa, B. ericifolia, B oblongfolia*	**Yes -** *M. quinquenervia* & other T2 species (refer to **Appendix D)**	**Yes -** *M. quinquenervia, L. suaveolens, M. sieberi, A. concurrens, B. ericifolia, B. oblongfolia*	**Yes -** T2 shrubs (refer to **Appendix D**)	**Yes -** minor shrub recruitment. No groundcover recruitment - groundcover dominated by *S. sphacelata* infestation.	**Yes -** *M. quinquenervia, M. sieberi, E. tereticornis*	**Yes -** *M. quinquenervia, L. suaveolens, Banksias*	**Yes -** *L. suaveolens*
Evidence of disturbance (e.g. fire, litter, disease, herbivory)	Nil – very low	Nil	Nil	Low	High – flooding	Nil	Nil	Nil

*Braun-Blanquet score

3.9.2 Year 4 Spring

A total of eight tree species (all native) were recorded in the tree layer, with Swamp Box and Broad-leaved Paperbark being the dominant species at most sites. Upper tree height ranged between five and six metres at each quadrat. Total cover scores at each site varied from 2 to 7 for native trees.

Seventeen 'shrub' species were recorded, including both native and weed species. Commonly recorded species included Paperbark (*Melaleuca linariifolia*, *M. nodosa*, *M. quinquenervia* and *M. sieberi*), Swamp Box saplings and Banksias (*Banksia ericifolia subsp. ericifolia* and *B. oblongfolia*). Weed were uncommon and included two species, Groundsel Bush and Camphor Laurel saplings (*Cinnamomum camphora**). Total shrub cover scores at each site ranged from 1 to 4 for native species and 0 to 1 for weed species.

Fifty-five species were recorded in the groundcover layer, including 36 native and 18 exotic species (one species was not identified past the genus level, therefore it has not been categorised as either a native or weed). Dominant species included Blady Grass, Bluegrass, Kikuyu (*Cenchrus clandestinus**), Vasey Grass (*Paspalum urvillei**), Milkwort and Pigeon Grass. Total cover scores of groundcovers at each site ranged from 2 to 6 for native species and 2 to 6 for exotic species.

Condition varied from good to excellent at three quadrats (Q1, Q2, Q3), moderate at three (Q4, Q6 and Q8) and poor at two sites (Q5 and Q6). Disturbance from cattle and vehicles (e.g. quad bikes) was recorded at four sites (Q4, Q5, Q7 and Q8); attributed to cattle escaping onto RMS land from adjacent private land to the east, then being re-captured. The cattle disturbance corresponds with the cattle records at SBT2, SBT3, NBT2 and NBT3 during underpass monitoring.

3.9.3 Year 3 and 4 Comparison

A comparison of cover, number of native species and mean height cover for the tree, shrub and ground layer at each quadrat recorded in spring Year 3 and spring Year 4 is provided in **Figure 3.7**, **Figure 3.8** and **Figure 3.9** respectively. The results were generally the same, with the exception of the following minor trends:

- Increased number of native tree species in the tree layer at most sites.
- A reduction in the number of native species in the shrub and groundcover layers at most sites.

Variations in native species cover and weed cover scores were minor.

Table 3.10 Summary of Year 4 Spring Vegetation Quadrat Data

	Q1	*Q2*	*Q3*	*Q4*	*Q5*	*Q6*	*Q7*	*Q8*
TREES (T1) > 3m								
Number of native species	2	4	5	4	2	5	7	3
Number of exotic species	0	0	0	0	0	0	0	0
Mean height (m)	6	5	6	6	5	6	6	6
Cover of native species*	6	3	4	3	2	4	2	2
Cover of exotic species*	0	0	0	0	0	0	0	0
SHRUBS (T2) < 3m								
Number of native species	7	11	11	8	5	10	10	3
Number of exotic species	0	1	0	1	0	0	0	1
Mean height (m)	2	3	4	2	3	3	3	3
Cover of native species*	3	3	4	3	2	3	2	2
Cover of exotic species*	0	0	0	0	0	0	0	1
GROUNDCOVERS (G)								
Number of native species	17	18	17	14	2	9	8	14
Number of exotic species	7	8	6	9	7	7	6	8
Mean height (m)	0.5	0.4	0.5	0.5	1.2	1	1.2	0.8
Cover of native species*	6	5	5	5	2	3	4	3
Cover of exotic species*	2	3	3	3	6	6	5	5
Condition	Very Good - Excellent	Good	Good	Moderate	Poor	Poor	Moderate	Moderate

	Q1	*Q2*	*Q3*	*Q4*	*Q5*	*Q6*	*Q7*	*Q8*
Evidence of recruitment	**Yes -** *M. quinquenervia, L. suaveolens, M.sieberi, L. brachyandrum, M. nodosa, B. ericifolia, B oblongfolia* No change from Year 3	**Yes -** *M. quinquenervia* & other T2 species (refer to **Appendix D)** No change from Year 3	**Yes -** *M. quinquenervia, L. suaveolens, M. sieberi, A. concurrens, B. ericifolia, B. oblongfolia* No change from Year 3	**Yes -** T2 shrubs (refer to **Appendix D**) No change from Year 3	**Yes -** minor shrub recruitment. No groundcover recruitment - groundcover dominated by *S. sphacelata* infestation. No change from Year 3	**Yes -** *M. quinquenervia, M. sieberi, E. tereticornis* No change from Year 3	**Yes -** *M. quinquenervia, L. suaveolens, Banksias* No change from Year 3	**Yes -** *L. suaveolens* No change from Year 3
Evidence of disturbance (e.g. fire, litter, disease, herbivory)	Nil	Nil - low	Nil	Y – cattle	Y – flooding, cattle	Y – some large fallen trees	Y – vehicle tracks, cattle	Y – vehicle tracks, cattle, weedy groundcover

*Braun-Blanquet score

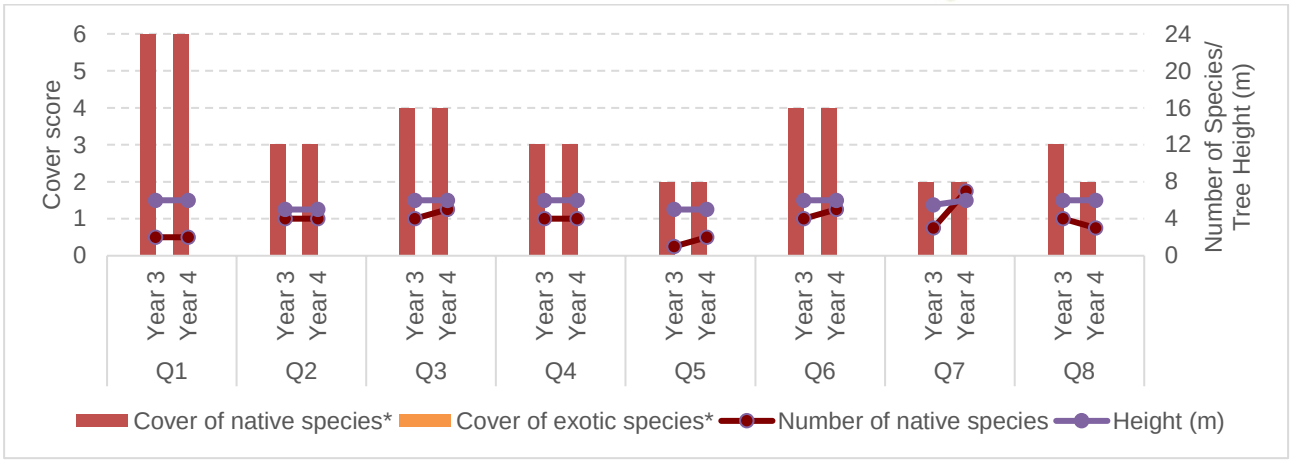


Figure 3.7 Cover of native and exotic species, number of native species and mean height of tree (T1) layer – Year 3 and Year 4 monitoring

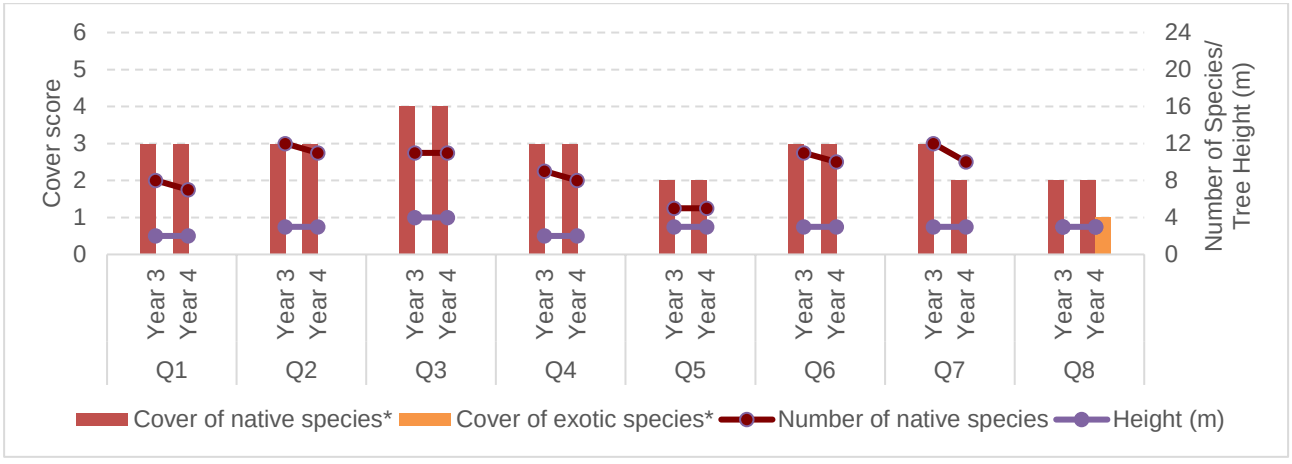


Figure 3.8 Cover of native and exotic species, number of native species and mean height of shrub (T2) layer – Year 3 and Year 4 monitoring

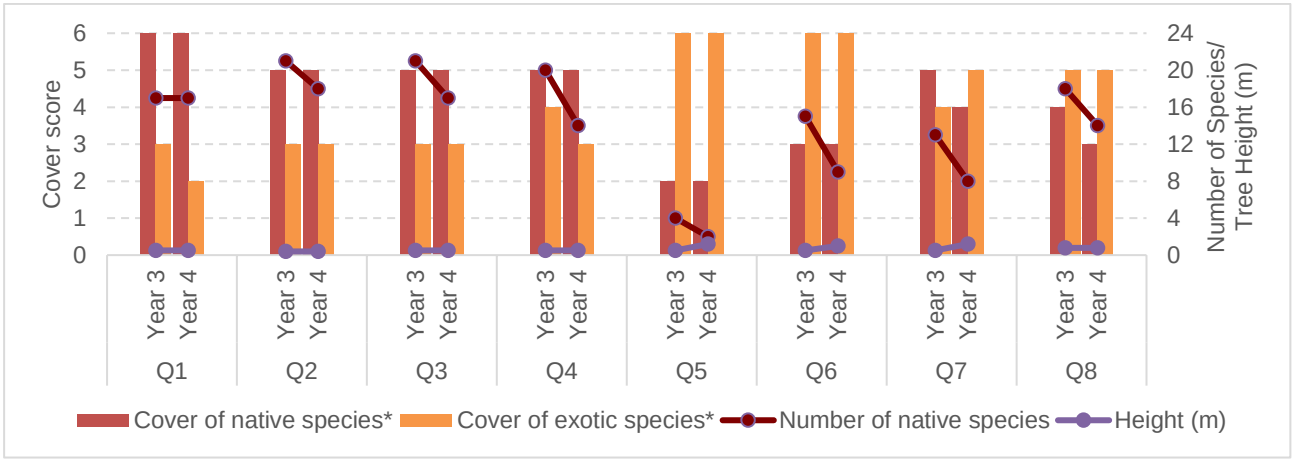


Figure 3.9 Cover of native and exotic species, number of native species and mean height of groundcover (G) layer – Year 3 and Year 4 monitoring

3.10 Road Kill Monitoring Results

Road kill monitoring results are provided in **Appendix E** and summarised in **Table 3.10**. A total of 19 road kills were recorded, comprising fifteen species/ species groups. Macropods (three Swamp Wallabies and one unidentifiable) road kills were recorded the most, followed by the Short-beaked Echidna (*Tachyglossus aculeatus*) and Barn Owl (*Tyto javanica*) (two road kill records each). No threatened species road kills were confirmed. Road kills numbers were highest in summer and spring compared to winter.

All records of terrestrial mammals were in locations without fauna fencing. Terrestrial mammals are the main fauna group that current fauna fencing at Devils Pulpit provides a barrier for. Only two road kills were recorded within the fauna fencing, however this comprised birds whose movements would not be inhibited by the fencing.

Table 3.10 Summary of Road Kill Monitoring Results

Species	*Winter*	*Spring*	*Summer*	*Total*	*No. Road Kill in Area with Fauna Fencing*	*No. Road Kill in Area without Fauna Fencing*
Arboreal mammals	1	0	0	1	0	1
Birds	3	2		5	2	3
Reptiles	0	1	2	3	0	3
Terrestrial mammals	3	5	2	10	0	10
All species	**7**	**8**	**4**	**19**	**2**	**17**

3.11 Opportunistic Threatened Flora Records

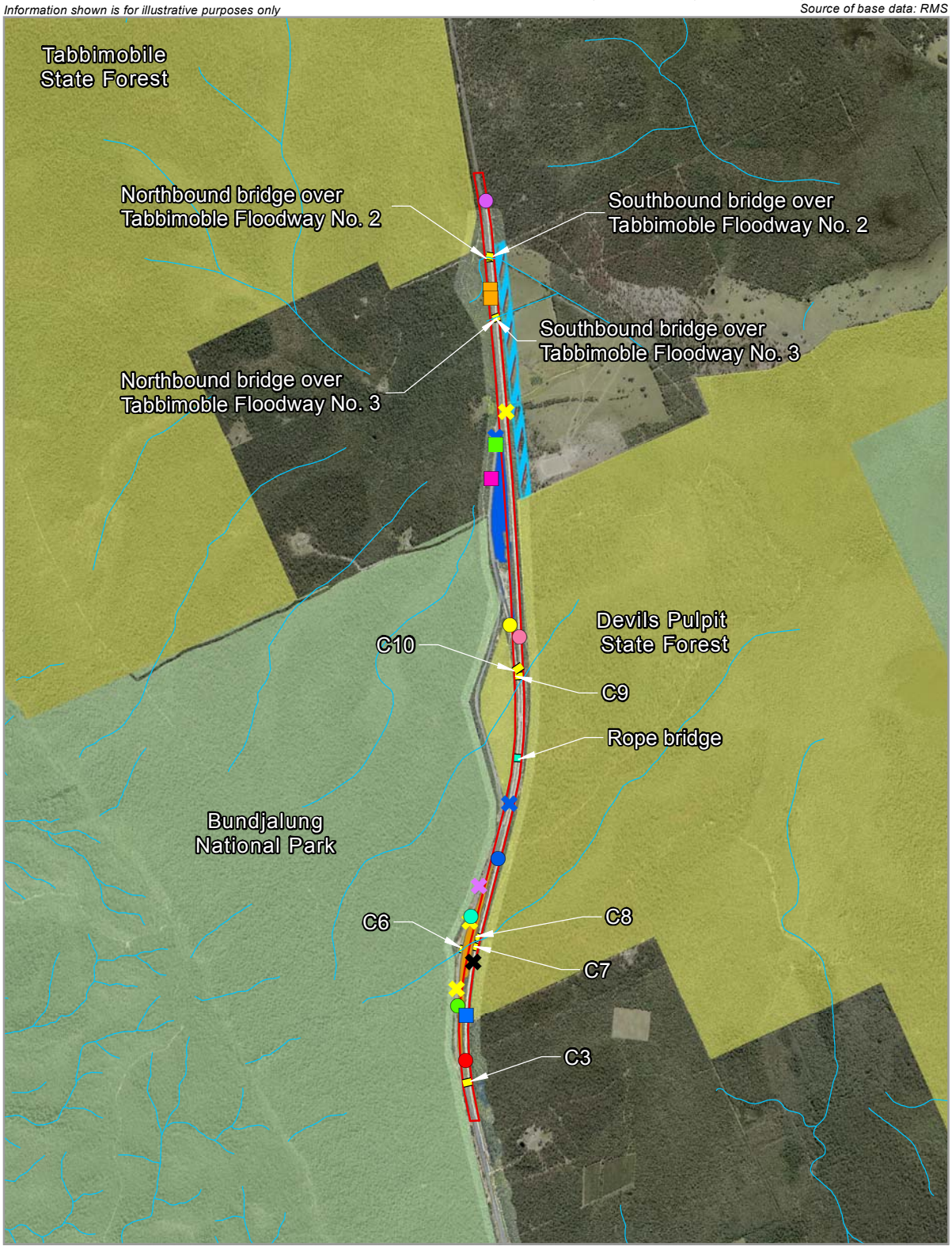
Square-stemmed Spike-rush (*Eleocharis tetraquetra*) was recorded at the Devils Pulpit site on the eastern side of the highway at two locations at approximately chainage 67200 and 69050 (refer to **Illustration 3.1**). Square-stemmed Spike-rush is listed as Endangered under the BC Act and this record is a new record for Project.

Maundia triglochinoides (BC Act listed) is known to occur along the waterway associated with Tabbimoble Floodway 2 and was assessed as a potential occurrence in the Project EA. The current distribution of this species (as of summer 2018/ 19) is located on both sides of the highway (refer to **Illustration 3.1**).

Drawn by: AB Checked by: RE Reviewed by: DSA Date: 04/04/2019

Information shown is for illustrative purposes only

Source of base data: RMS



LEGEND

- Devil's Pulpit concept clearing limit
- Vegetated connectivity corridor
- Northern median
- Southern median
- State forest
- National park reserve
- Rope bridge
- Combined fauna underpass
- Watercourse

- Bandicoot
- Barn Owl
- Butcherbird
- Carpet Python
- European Fox
- Feral Cat
- Kookaburra
- Lace Monitor
- Macropod
- Northern Brown Bandicoot
- Pied Currawong
- Red-bellied Black Snake
- Short-beaked Echidna
- Swamp Wallaby
- Unidentifiable (possible glider)

0 800

Road Kill Monitoring Results

4. Discussion

4.1 Target Threatened Species

The following target threatened species were recorded during the Year 4 monitoring reporting period:

- Green-thighed Frog.
- Yellow-bellied Glider.
- Squirrel Glider.
- Brush-tailed Phascogale.
- Koala.
- Long-nosed Potoroo.
- Greater Glider.

The Rufous Bettong, Wallum Froglet and Spotted-tailed Quoll were target species not recorded. This was not unexpected given:

- Very low rate of the Rufous Bettong was recorded during Year 3 monitoring (two records only).
- Very low rate and restricted distribution of Wallum Froglet records during Year 3 monitoring (recorded during one survey one control site only).
- A failure to record the Spotted-tailed Quoll during target surveys in 2014 and 2015 (Sandpiper 2016a) and during Year 3 monitoring. Sandpiper (2016a) found '*that the area does not support a resident population of quolls. Therefore, the probability of detecting quolls within the Devils Pulpit study area is low*'.

No corrective actions of the Spotted-tailed Quoll Management Plan have been triggered to date.

Other non-target threatened species recorded during Year 4 monitoring include:

- Barking Owl (BC Act listed). Assessed in the Project EA (Hyder 2011).
- Masked Owl (BC Act listed). Assessed in the Project EA (Hyder 2011).
- Brown Treecreeper (BC Act listed). Assessed in the Project EA (Hyder 2011).
- Glossy Black Cockatoo (BC Act listed). Assessed in the Project EA (Hyder 2011).
- Grey-headed Flying-fox (EPBC Act and BC Act listed). Assessed in the Project EA (Hyder 2011).
- Little Bent-winged Bat and Eastern Bent-winged Bat (EPBC Act and BC Act listed). Assessed in the Project EA (Hyder 2011).
- Dusky Woodswallow (BC Act listed). The Project EA recorded this species however it was only listed as threatened in 2016 (therefore there is no statutory assessment of this species).
- Stephens' Banded Snake (BC Act listed). The Project EA recorded the study area as being of moderate suitability for this species (Hyder 2011), however it was not assessed further.

Tentative possible native mouse (*Pseudomys sp.*) records were made again this year during RB/ BTP camera trap images analysis. The *Pseudomys* genus includes a number of threatened species. Differences in possible native mouse records at locations between Year 3 and 4 suggest the species is more likely to be from the Rattus or Melomys genus (although target Elliott A trapping at these sites would be required for the species identification to be confirmed).

4.1.1 Rufous Bettong

The Rufous Bettong was not recorded during Year 4 monitoring. This supports the suggestion of GeoLINK (2018); that the habitats within the study area are suboptimal for this species. Fauna underpass monitoring to date has not recorded Rufous Bettongs using any of the monitored structures. This is not unexpected given the low density in which the species has been recorded during the EMP (GeoLINK 2012a; 2018) and Project EA surveys (Hyder 2011). It is unlikely that the EMP will be effective in determining any relative abundance changes over time (and attribute these to the highway upgrade) or determine the effectiveness of the relevant mitigation measures for the Rufous Bettong.

4.1.2 Wallum Froglet

The Wallum Froglet was not recorded during Year 4 monitoring. The results of the EMP to date indicate that a Wallum Froglet population does not occur in the immediate vicinity of the highway at Devils Pulpit. Therefore, ongoing target surveys of the Wallum Froglet as part of the EMP is not warranted as conclusions relative to the EMP objectives cannot be determined for this species.

4.1.3 Green-thighed Frog

Green-thighed Frog detection rates and numbers were lower in Year 4 in comparison to Year 3. This is attributed to:

- Below average rainfall and limited significant rainfall events.
- The species' cryptic nature (*Lemckert, et al., 2006*).

Year 6 post construction threatened frog monitoring events would continue to comply with the W2B Green-thighed Frog survey triggers where possible to allow for a cumulative broader and comparable dataset for RMS in the region. That is, *'a rainfall event which exceeded 50 mm within a 24 hour period with a preference given to rainfall events which exceeded 75 mm in 24 hours or an accumulated total of 150 mm over a 72 hour period*'. This is higher than the EMP threatened frog survey triggers of between 30-50 mm of rain within a 24 hour period, or when soil saturation levels are high and 20-30 mm of rain is recorded within a 24 hour period; and supported by the findings of Lewis (unpublished, cited in Lewis 2013).

4.1.4 Yellow-bellied Glider

The Yellow-bellied Glider was recorded at eight (44%) of the 18 spotlighting transect sites during Year 4 monitoring; comprising five (42%) of the 12 impact transects and three (50%) of the six control transects. This is a reduction compared to Year 3 monitoring where the Yellow-bellied Glider was recorded at 61% (reduction of 17%) of the 18 spotlighting transects; although applies to both impact sites (reduction of 14%) and control sites (reduction of 15%). At specific sites where the Yellow-bellied Glider was targeted (which included call playback surveys), 50% (four of eight) of impact sites recorded positive results compared to 75% (three of four) of control sites during Year 4 monitoring. This is similar to the Year 3 results (57% impact sites and 100% control sites).

The total number of Yellow-bellied Glider individuals recorded were the same at impact and control sites (12 each) during Year 4 monitoring, however the activity levels overall were lower at impact sites in comparison to control sites (refer to **Figure 3.2**). This pattern was observed during Year 3 monitoring, although activity levels were higher. The reasons speculated in GeoLINK (2018) for the difference in activity levels between impact and control sites remain valid, that is:

- The area of habitat being effectively surveyed at impact sites is generally less than at control sites.
- Variations in habitat quality.

Pre/ during construction surveys (Hyder 2011; GeoLINK 2012a; GeoLINK 2012b) recorded the Yellow-bellied Glider at three impact site locations: Impact Sites 2, 3 and 6. Based on the distance between trees along the Pacific Highway pre-construction (approximately 30 m), tree height along the highway (20-30 m) and the recorded gliding ability of the Yellow-bellied Glider (Goldingay 2014); it is assumed that this species occurred (or at least had the potential to occur) on both sides of the highway at these sites pre-construction. Post construction monitoring to date has recorded the Yellow-bellied Glider on both sides of the highway at two of these sites (Impact Site 2 (east and west) and Impact Site 3 (east and west), as well as on one side of the highway at three additional impact sites: Impact Site 1 (west), Impact Site 4 (east) and Impact Site 5 (east). These results indicate resident Yellow-bellied Glider family groups on both sides of the highway.

The rope bridge cameras recorded a single Yellow-bellied Glider on the eastern side of the rope bridge. While a complete crossing was not confirmed, this record is significant as it is the first known record of the species on a rope bridge; although the Yellow-bellied Glider has previously been recorded on glider poles (Goldingay *et al*. 2018). For the glider to be have been recorded at the eastern rope bridge pole, it would have either:

- Glided approximately 20 m to the pole from adjacent vegetation.
- Travelled approximately 20 m to the pole using the ladder or rope that connects the pole to adjacent vegetation.
- Moved between the understorey vegetation (approximately 6-7 m tall acacia regrowth).

The first two options are considered more likely.

The Yellow-bellied Glider has not been recorded within either vegetated medians to date, however has been recorded on both sides of southern median in both Years 3 and 4; and on the eastern side of the northern median in Year 3. Results from a recent (post W2B clearing) glide crossing assessment (based on tree height, distance between trees/ clearing width and glider glide performance from available literature) suggest the Yellow-bellied Glider should be able to cross the highway at both medians in both directions, although an above average glide performance would be required to cross east-west over the southbound lane at the northern median (GeoLINK 2019).

4.1.5 Squirrel Glider

The Squirrel Glider was recorded by spotlighting, rope bridge monitoring and nest box monitoring during Year 4 monitoring, at:

- Eleven (61%) of the spotlighting transect sites, comprising seven (58%) of the 12 impact transects and four (67%) of the six control transects. This is an increase compared to the Year 3 monitoring results and applies to both impact sites (increase of 41%) and control sites (increase of 34%). The number of recorded individuals and activity levels were higher at both impact and control sites when compared to Year 3; with control sites recording higher activity levels than impact sites during both years.
- Ten (77%) of the nest box transects, comprising seven (78%) of the nine impact transects and three (75%) of the four control transects. The number of sites with Squirrel Gliders nest box records has increased since Year 3.

- Both sides of the rope bridge. No complete crossings were confirmed, through directional movements to the east and west were detected.

A single Squirrel Glider record was also made on the RB/ BTP camera traps (Impact Site 2 (west)).

Collectively, the Squirrel Glider was recorded at all target impact sites (four sites) and control sites (four sites) during the post construction monitoring to date. The subject impact sites (2, 3, 4 and 6) are the same locations the Squirrel Glider was recorded during preconstruction surveys (Hyder 2011 and GeoLINK 2012a). The results indicate that resident Squirrel Glider groups continue to occupy both sides of the highway at these sites.

Visitation rates by Squirrel Gliders to the rope bridge during Year 4 monitoring (eastern pole: 0.4 visits per week, western pole: 0.14 visits per week) were lower than during Year 3 monitoring; although higher than the rates recorded during the initial trial monitoring (eastern pole: 0.02 visits/week, western pole: 0 visits/week; Sandpiper 2016b). The recorded Year 4 visitation rate is within the range recorded during rope bridge monitoring at the Glenugie Pacific Highway upgrade site (0.01 to 0.14 visits per week; Sandpiper 2017).

The Squirrel Glider has been recorded within and on both sides of the highway at the northern and southern median. As for the Yellow-bellied Glider, results from a recent (post W2B clearing) glide crossing assessment (based on tree height, distance between trees/ clearing width and glider glide performance from available literature) suggest the Squirrel Glider should be able to cross the highway at both medians in both directions, although an above average glide performance would be required to cross east-west over the southbound lane at the northern median (GeoLINK 2019). Upcoming radio tracking (scheduled for July-September 2019) should confirm if Squirrel Gliders are using the vegetated medians to cross the highway.

4.1.6 Brush-tailed Phascogale

The Brush-tailed Phascogale was recorded by camera traps at seven (47%) of the RB/ BTP camera trap grid sites; comprising 5 (50%) of the 10 impact grid sites and two (40%) of the five control grid sites. It was also recorded on the western side of the highway at fauna underpass SBT3, which corresponds with Impact Site 5 (west) (the Brush-tailed Phascogale was recorded on both sides of the highway at this site). It was also recorded on the western rope bridge camera, which corresponds with Impact Site 3 (west).

The overall distribution of the Brush-tailed Phascogale was the same in Year 3 and Year 4 post construction monitoring. Pre/ during construction surveys (Hyder 2011; GeoLINK 2012a; GeoLINK 2012b) did not record any Brush-tailed Phascogales, therefore distribution comparisons cannot be made pre-post construction.

The number of individuals recorded and average activity levels were higher at impact sites compared to control sites (9% to 7%), which is similar to the Year 3 results. In contrast, average activity levels were slightly lower in Year 4 compared to Year 3; although within the range recorded in Lewis (2014).

In relation to the fauna underpass structures, the Year 4 Brush-tailed Phascogale records were located:

- Within 500 m on both sides of the highway at SBT2, NBT2, SBT3, NBT3.
- Not within 500 m of C9 and C10.
- On the western side of the highway only within 500 m of C6, C7 and C8.
- On the western side of the highway only within 500 m of C3; though camera trap surveys were not undertaken on the eastern side of the highway at this site.

No underpass or rope bridge crossings were recorded.

4.1.7 Koala

The Year 3 and 4 monitoring results are indicative of a low-density resident Koala population within the study area. During Year 4 monitoring, the Koala was recorded at low densities on both sides of the highway via RB/ BTP camera traps (five records at four grid sites) and opportunistic detection of Koala scats (one record at one site). No spotlighting/ call playback records were made and nor any underpass or rope bridge crossing. This was not unexpected given the low density of records and limited fauna fencing along the project site to direct Koalas moving east or west across the study area to underpass structures.

4.1.8 Long-nosed Potoroo

The Long-nosed Potoroo was recorded by camera traps at six (40%) of the RB/ BTP camera trap grid sites; comprising three (30%) of the 10 impact grid sites and three (60%) of the five control grid sites. This location of records was similar to that recorded during Year 3, with the main concentration around Impact Site 4/ Control Site 1. Average activity levels were the same at impact and control sites (6%), although the range was greater at impact sites (0-50%) compared to control sites (0-18%).

No Long-nosed Potoroo activity was recorded at any of the underpass crossing structures. This was not unexpected given:

- As with Year 3, Impact Site 4 was the only impact site where the Long-nosed Potoroo was recorded on both sides of the highway during Year 4. No fauna underpass structures occur at this site. Fauna underpass C10 is the closest structure which is located >600m south of the closest record.
- Long-nosed Potoroo activity else was either low (as the case of Impact Site 2 (east)) and/ or located greater than 500 m away from any of the fauna underpass structures.
- There is limited fauna fencing along the project site to direct Long-nosed Potoroos moving east or west across the study area to underpass structures.

4.1.9 Greater Glider

The Greater Glider was recorded at 11 (61%) of the 18 spotlighting transect sites; comprising seven (39%) of the 13 impact transects and four (67%) of the six control transects. The location of records was generally similar to Year 3. Similar mean activity levels were recorded between impact and control sites during Year 3 and Year 4 monitoring.

The rope bridge cameras have not recorded any Greater Glider activity to date. The species has been recorded on both sides of the highway in the general vicinity of the rope bridge at Impact Site 3 (east and west), though only in low numbers to the east.

At the southern vegetated median, the Greater Glider was again recorded within and on both sides of the highway at this site (Impact Site 2 (east, median and west)). Variability with the timing and location of records in or adjacent to the median further supports the notion discussed in GeoLINK (2018) of Greater Glider movement across the highway at the southern median. No Greater Glider records within the northern median were recorded, though the species has been recorded within habitat east of the median.

4.2 Monitoring Crossing Structures and Road Kill Monitoring

Monitoring of crossing structures and road kill monitoring to date (Year 3 and 4 reporting periods) is discussed in **Table 4.1** in terms of the performance measures specified in the EMP. Key findings are summarised below:

- Fauna Underpass: No complete crossings of target threatened species have been recorded to date, though crossings by a number of native non-threatened species have been recorded. Varying levels of fauna activity between structures and limited results at a number of structures (including no complete crossings C3) indicate varying suitability or quality of each in providing fauna connectivity. As discussed in GeoLINK (2018), significant rainfall events in early 2017 resulted in damage at some structures, including:
  - Scouring at the inlet and/ or outlet of five culvert structures, causing pooling of water within or at the entrance to the subject culverts.
  - Damage to the fauna furniture.

  RMS are currently investigating repair works for these structures. Construction works are currently being undertaken at C6 as part of W2B. Variations with EMP underpass design requirements and/ or construction/ condition issues (GeoLINK, unpublished) are likely to be affecting the functionality of the structures in providing fauna passage across the highway.
- Rope Bridge: Three target threatened species (Squirrel Glider, Brush-tailed Phascogale and Yellow-bellied Glider) and four other native species have been recorded on the rope bridge. Direction movements have been recorded by six of these species, through complete crossings have only been recorded for the Feathertail Glider.
- Vegetated medians: Clearing phase surveys and post construction monitoring have indicated Yellow-bellied Glider and Greater Glider movements at the southern median. No glider movements at the northern median have been recorded. Squirrel Glider radio tracking is scheduled for July-September 2019.
- Vegetation Connectivity Corridor: Recruitment and growth of native species has been recorded across the corridor, however exotic groundcovers (including weeds) are present and reducing native species recruitment in some areas in the southern half of the corridor.
- Road Kill Monitoring: Road kill rates have been low and no target threatened species have been recorded to date.

Future monitoring will continue to establish a larger more robust dataset to determine performance indicators for the Project.

Table 4.1 EMP Performance Measures and Year 4 Post Construction Monitoring Findings

Mitigation	*Performance Measure*	*Findings to Date*
7.2 Fauna Underpasses	A completed passage from one side of the Project to the other by native fauna species previously recorded from the Project area. Completed passage/ s to be made by species from each native fauna group; reptile, frog, terrestrial mammal.	The design of the monitoring program targets listed threatened species, none of which have been recorded crossing any of the fauna underpass structures. Notwithstanding, the Year 4 reporting period recorded unique complete crossings by non-threatened native species, including: ■ Antechinus at NBT3, SBT3, NBT2 and SBT2 (eight crossings). ■ Bandicoot sp. at SBT3 (two crossings). ■ Common Eastern Froglet at C9 (one event). ■ Common Brushtail Possum at C8 (two crossings). ■ Eastern Grey Kangaroo at NBT3, SBT3 and SBT2 (eight crossings). ■ Eastern Water Dragon at C6, C7, C8, C10, NBT3, SBT3, NBT2 and SBT2 (32 crossings). ■ Easter Water Skink at NBT2 (two crossings). ■ Lace Monitors at C6, C7, C8, C9, C10, NBT3, SBT3, NBT2 and SBT2 (181 crossings). ■ Land Mullet at C7 (one crossing). ■ Long-nosed Bandicoot at C7 and C8 (two crossings). ■ Macropod sp. at C7, NBT3, SBT3 and NBT2 (14 crossings). ■ Northern Brown Bandicoot at C7 and SBT3 (seven crossings). ■ Red-necked Wallaby at SBT3 and NBT2 (ten crossings). ■ Short-beaked Echidna at C8 (one crossing). ■ Short-eared Possum at C6, C7 and C8 (eight crossings). ■ Sun-skink at C8 (one event). ■ Swamp Wallaby at C7, C8, C9, NBT3, SBT3 and SBT2 (eight crossings). ■ Wall Skink at NBT3 and NBT2 (4 crossings). ■ Water Rat at C8 and C10 (2 crossings). ■ Yellow-footed Antechinus at C6, C8 and SBT2 (3 crossings). Results varied between structures and limited results at a number of structures (including no unique complete crossings at C3; limited crossings at C6, C9, C10, NBT2, and SBT2; C6 recordings primarily being on the fauna furniture due to the culvert being inundated) indicate varying suitability or quality of each in providing fauna connectivity. Variations with EMP underpass design requirements and/ or construction/ condition issues (GeoLINK, unpublished) are likely to be affecting the functionality of the structures in providing fauna passage across the highway.

Mitigation	Performance Measure	Findings to Date
	If Spotted-tailed Quolls are detected via camera surveys, underpass monitoring or road kill monitoring a completed passage/ s by spotted-tailed quoll.	No Spotted-tailed Quolls have been recorded to date.
	No threatened species road kill.	No threatened species road kills have been recorded to date. It is not possible to quantify how the fauna underpasses have contributed to this outcome as no underpass crossings by threatened fauna have been recorded to date. The corresponding fauna fencing is likely to inhibit some target threatened fauna species accessing the road carriageways where the fencing is present. The fencing at Devils Pulpit is currently being updated as part of W2B works.
7.3 Rope Bridge	Complete crossing of the rope bridge by a diversity of native arboreal fauna species known to occur in the Project area, such as Brushtail Possum or Sugar Glider.	Rope bridge monitoring has recorded four non-threatened target species visiting the rope bridge (Feathertail Glider, Yellow-footed Antechinus, Ringtail Possum and Sugar Glider). Of these, complete crossings have only been recorded for the Feathertail Glider, although directional movements have been recorded for the other species.
	Complete crossing of the rope bridge by arboreal target species (Brush-tailed Phascogale, Squirrel Glider, Yellow-bellied Glider).	The Brush-tailed Phascogale, Squirrel Glider and Yellow-bellied Glider have all been recorded at the rope bridge. While no complete crossings have been confirmed, directional movements have been recorded at both ends of the rope bridge for the Squirrel Glider. Directional movement at the eastern end of the rope bridge was also recorded for the Yellow-bellied Glider. The Greater Glider has not been recorded on the rope bridge.
	Lower rates of roadkill in proximity to rope bridge than in sections of the upgrade away from crossing structures.	Only one possible road kill of an arboreal mammal (possible glider) has been recorded to date during post construction monitoring. It was located >1 km north of the rope bridge along the southbound lane at the northern widened median.
7.5 Vegetated Median	Identification of arboreal fauna species within vegetated medians.	Arboreal fauna recorded at the vegetated medians during post construction monitoring to date include: ■ Northern median: three species including the Squirrel Glider, Feathertail Glider and Sugar Glider. ■ Southern median: six species including Squirrel Glider, Feathertail Glider, Greater Glider, Ringtail Possum, Small-eared Possum and Sugar Glider. The Yellow-bellied Glider has been recorded on both sides of the highway in the vicinity of the rope bridge, however not within the actual median during post construction monitoring to date. Of these species, the medians are designed to facilitate connectivity for gliders across both carriageways. Two results indicative of glider movements have been recorded at the southern

Mitigation	Performance Measure	Findings to Date
		median: ■ Pre-clearing surveys recorded three Yellow-bellied Gliders crossing the southbound carriageway at the southern median where clearing had been completed (GeoLINK 2012b). While the highway was not open to traffic at this stage, this recording demonstrates the ability of the Yellow-bellied Glider to cross the southbound carriageway, as well as the northbound carriageways which has a similar clearing width and adjacent trees of similar height. ■ Greater Gliders recordings, discussed in **Section 4.1.9**. No direct observations or indications of glider movement at the northern median have been recorded to date. Due to the size of the vegetated medians, they provide habitat for both gliding and non-gliding fauna in their own right, as well as provide refuge for fauna crossing the highway. Squirrel Glider radio tracking is scheduled for July/ September 2019.
	Identification of other fauna species within vegetated medians.	See comments above.
7.6 Restoration of Vegetated Connectivity Corridor	Increase in height of native plants over time.	This performance measure is being realised. During the Project construction phase the corridor primarily comprised former managed pastoral land, with saplings around 2-3m tall (David Andrighetto, pers. obs. 2012). All quadrats recorded recruitment and growth of native species to varying extents with upper limit tree heights currently ranging between 5-6m. Future monitoring will confirm this performance measure.
	Increase of per cent cover in native plant species and a reduction of per cent cover of exotic species over time.	This performance measure is likely to be occurring in most areas of the corridor, however no comprehensive baseline data was collected for comparison. Future monitoring will be required to confirm this performance measure. Dense Pigeon Grass in the central southern quadrats (particularly at quadrats 5 and 6) is likely to reduce recruitment rates of native species in this area.
	Weed cover (including noxious and invasive weed species) not to exceed 20%. In the event that weed cover exceeds 20%, a regular weeding program will be implemented.	Exotic species (including weeds and invasive grasses) exceed 20% cover in the southern quadrats (particularly around quadrats 5 and 6), triggering the provision for '*a regular weeding program*'. This is primarily triggered by dense occurrences of Pigeon Grass. In the long-term, recruitment and growth of native trees and shrubs is likely to 'shade out' and reduce exotic species cover in most relevant areas. Bush regeneration and tree plantings works in localised areas with dense exotic groundcovers would however assist the regeneration process where the density of understorey/ canopy tree recruits are low. In the short-term, the occurrence of exotic species at the site is not likely to result in a reduction in native species cover or growth. Weed species diversity and cover will continue to the monitored as part of the EMP.

Mitigation	Performance Measure	Findings to Date
	Prompt management of noxious weeds identified within the corridor. Any noxious weeds identified during monitoring of the corridor should be managed in accordance with *Noxious and Environmental Weed Control Handbook (DPI 2007).*	*Noxious Weed Act 1993* (repealed) listed species for the Clarence Valley Council LGA species at the site including: Annual Ragweed (*Ambrosia artemisiifolia*), Groundsel Bush (*Baccharis halimifolia*) and Fireweed (*Senecio madagascariensis*). Cover of these species is <5%. The latter two species are listed under the *Biosecurity Act 2015* which replaces the *Noxious Weed Act 1993*.
	A minimum seedling density of 0.5 tree, 1 shrub and 2 groundcover seedlings per square metre within each quadrat.	This performance measure relates to planting densities. The RMS brief for the establishment of fauna connectivity corridor stipulates planting density of 1.75 x 1.75 m spacing, except at in specific locations around Tabbimoble overflow 2 and 3 bridges which required 0.75 m centres. The current corridor comprises a mix of plantings and natural recruitment. Year 6 monitoring will determine whether tree densities satisfy the overall objective of this mitigation measure.
	Seedling survival of 60%. If seedling survival falls below this percentage, a qualified and experienced expert in bush regeneration will assess the requirement for additional seedling planting.	It is not possible to determine if this performance measure has been met due to the time between the plantings and the monitoring.
	A qualified and experienced expert in bush regeneration to assess whether the regenerating vegetation within the corridor is self-sustaining by spring of Year 6.	To be determined during the final monitoring event in spring of Year 6.
9.2 Road Kill Monitoring	Lower rates of road kill in proximity to fauna fencing, rope bridges and fauna underpasses than in sections of the upgrade not near fauna crossing structures.	The road kill monitoring to date has recorded lower rates of road kill in areas with fauna fencing compared to unfenced areas, however the data pool is too small for comprehensive analysis. All terrestrial mammal road kill records in Year 4 (the main species group that the constructed fence design provides a barrier for), were located in areas without fauna fencing. The fauna fencing corresponds with underpass structures. Fauna fencing does not occur at the rope bridge. Only one possible road kill of an arboreal mammal (possible glider) has been recorded to date during post construction monitoring. It was located >1 km north of the rope bridge along the southbound lane at the northern widened median.

Mitigation	Performance Measure	Findings to Date
	No threatened species recorded as road kill throughout the length of the Project.	No threatened species road kills have been recorded to date.
	If these performance measures are not met, the following contingency measures would be implemented: ■ Review/ modify fauna furniture associated with underpass. ■ Review/ modify habitat (i.e. vegetation composition and structure; type and abundance of ■ natural habitat features) adjoining the underpass.	The road kill monitoring findings to date have not triggered these contingency measures. Fauna fencing at Devils Pulpit is currently being revised as part of the W2B project.

5. Recommendations

5.1 Recommendations

The following recommendations are provided based on EMP triggers based on the monitoring findings to date:

- Fauna underpass monitoring results varied between structures and limited results at a number of structures. Variations with EMP underpass design requirements and/ or construction/ condition issues (GeoLINK, unpublished) are likely to be affecting the functionality of the structures in providing fauna passage across the highway. Maintenance/ rectification of the underpasses so they are consistent with EMP design intent is recommended (noting that works are currently being undertaken at C6 as part of W2B). RMS are currently investigating repair works for these structures.
- Weed management requirements in the vegetated connectivity corridor are triggered by recorded weed cover classes and species occurrences, primarily in the southern half of the corridor around quadrats 5 and 6. This is primarily triggered by dense occurrences of Pigeon Grass. In the long-term, recruitment and growth of native trees and shrubs is likely to 'shade out' and reduce exotic species cover in most relevant areas. Bush regeneration and tree plantings works in localised areas with dense exotic groundcovers would however assist the regeneration process where the density of understorey/ canopy tree recruits are low. In the short-term, the occurrence of exotic species at the site is not likely to result in a reduction in native species cover or growth. Weed species diversity and cover will continue to the monitored as part of the EMP in Year 6.

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Appendix A

Target Terrestrial Species Monitoring Survey Methodology and Weather Data

Table A1 Rufous Bettong/ Brush-tailed Phascogale Camera Trap Locations During Year 4 Post Construction Monitoring

Site	*Trap No.*
Control site 1	1
Control site 1	2
Control site 1	3
Control site 1	4
Control site 1	5
Control site 1	6
Control site 2	1
Control site 2	2
Control site 2	3
Control site 2	4
Control site 2	5
Control site 2	6
Control site 3	1
Control site 3	2
Control site 3	3
Control site 3	4
Control site 3	5
Control site 3	6
Control site 4	1
Control site 4	2
Control site 4	3
Control site 4	4
Control site 4	5
Control site 4	6
Control site 5	1
Control site 5	2
Control site 5	3
Control site 5	4
Control site 5	5
Control site 5	6
Impact Site 1 (east)	1
Impact Site 1 (east)	2
Impact Site 1 (east)	3
Impact Site 1 (east)	4
Impact Site 1 (east)	5
Impact Site 1 (east)	6
Impact Site 1 (west)	1
Impact Site 1 (west)	2
Impact Site 1 (west)	3
Impact Site 1 (west)	4
Impact Site 1 (west)	5

Site	Trap No.
Impact Site 1 (west)	6
Impact Site 2 (east)	1
Impact Site 2 (east)	2
Impact Site 2 (east)	3
Impact Site 2 (east)	4
Impact Site 2 (east)	5
Impact Site 2 (east)	6
Impact Site 2 (west)	1
Impact Site 2 (west)	2
Impact Site 2 (west)	3
Impact Site 2 (west)	4
Impact Site 2 (west)	5
Impact Site 2 (west)	6
Impact Site 3 (east)	1
Impact Site 3 (east)	2
Impact Site 3 (east)	3
Impact Site 3 (east)	4
Impact Site 3 (east)	5
Impact Site 3 (east)	6
Impact Site 3 (west)	1
Impact Site 3 (west)	2
Impact Site 3 (west)	3
Impact Site 3 (west)	4
Impact Site 3 (west)	5
Impact Site 3 (west)	6
Impact Site 4 (east)	1
Impact Site 4 (east)	2
Impact Site 4 (east)	3
Impact Site 4 (east)	4
Impact Site 4 (east)	5
Impact Site 4 (east)	6
Impact Site 4 (west)	1
Impact Site 4 (west)	2
Impact Site 4 (west)	3
Impact Site 4 (west)	4
Impact Site 4 (west)	5
Impact Site 4 (west)	6
Impact Site 5 (east) (winter survey)	1
Impact Site 5 (east) (winter survey)	2
Impact Site 5 (east) (winter survey)	3
Impact Site 5 (east) (winter survey)	4
Impact Site 5 (east) (winter survey)	5
Impact Site 5 (east) (winter survey)	6
Impact Site 5 (east) (spring and summer surveys)	1

Site	Trap No.
Impact Site 5 (east) (spring and summer surveys)	2
Impact Site 5 (east) (spring and summer surveys)	3
Impact Site 5 (east) (spring and summer surveys)	4
Impact Site 5 (east) (spring and summer surveys)	5
Impact Site 5 (east) (spring and summer surveys)	6
Impact Site 5 (west)	1
Impact Site 5 (west)	2
Impact Site 5 (west)	3
Impact Site 5 (west)	4
Impact Site 5 (west)	5
Impact Site 5 (west)	6

Table A2 Rufous Bettong/ Brush-tailed Phascogale Camera Trap Survey Dates and Effort During Year 4 Post Construction Monitoring

Site	*Survey Season*	*Installation Date*	*Survey Completion Date*	*No. Trap Nights*	*No. Camera Traps*	*Effort (effective trap nights)*
Impact Site 1 (east)	Winter	12/06/2018	26/06/2018	14	6	84
Impact Site 1 (east)	Spring	27/09/2018	11/10/2018	14	6	84
Impact Site 1 (east)	Summer	4/12/2018	18/12/2018	14	6	84
Impact Site 1 (west)	Winter	12/06/2018	26/06/2018	14	6	84
Impact Site 1 (west)	Spring	27/09/2018	11/10/2018	14	6	84
Impact Site 1 (west)	Summer	4/12/2018	18/12/2018	14	6	84
Impact Site 2 (east)	Winter	12/06/2018	26/06/2018	14	6	84
Impact Site 2 (east)	Spring	18/10/2018	1/11/2018	14	6	84
Impact Site 2 (east)	Summer	24/01/2019	7/02/2019	14	6	84
Impact Site 2 (west)	Winter	12/06/2018	26/06/2018	14	6	84
Impact Site 2 (west)	Spring	27/09/2018	11/10/2018	14	6	84
Impact Site 2 (west)	Summer	4/12/2018	18/12/2018	14	6	84
Impact Site 3 (east)	Winter	12/06/2018	26/06/2018	14	6	84
Impact Site 3 (east)	Spring	18/10/2018	1/11/2018	14	6	84
Impact Site 3 (east)	Summer	24/01/2019	7/02/2019	14	6	84
Impact Site 3 (west)	Winter	12/06/2018	26/06/2018	14	6	84
Impact Site 3 (west)	Spring	27/09/2018	11/10/2018	14	6	84
Impact Site 3 (west)	Summer	4/12/2018	18/12/2018	14	6	84
Impact Site 4 (east)	Winter	29/06/2018	13/07/2018	14	6	84
Impact Site 4 (east)	Spring	18/10/2018	1/11/2018	14	6*	70
Impact Site 4 (east)	Summer	4/12/2018	18/12/2018	14	6*	70
Impact Site 4 (west)	Winter	26/06/2018	13/07/2018	14	6	84
Impact Site 4 (west)	Spring	27/09/2018	11/10/2018	14	6	84
Impact Site 4 (west)	Summer	4/12/2018	18/12/2018	14	6	84
Impact Site 5 (east)	Winter	26/06/2018	13/07/2018	14	6^	70
Impact Site 5 (east)	Spring	18/10/2018	1/11/2018	14	6	84
Impact Site 5 (east)	Summer	4/12/2018	18/12/2018	14	6	84

Site	Survey Season	Installation Date	Survey Completion Date	No. Trap Nights	No. Camera Traps	Effort (effective trap nights)
Impact Site 5 (west)	Winter	26/06/2018	13/07/2018	14	6	84
Impact Site 5 (west)	Spring	18/10/2018	1/11/2018	14	6*	70*
Impact Site 5 (west)	Summer	4/12/2018	18/12/2018	14	6	84
Control site 1	Winter	12/06/2018	26/06/2018	14	6	84
Control site 1	Spring	18/10/2018	1/11/2018	14	6	84
Control site 1	Summer	24/01/2019	7/02/2019	14	6	84
Control site 2	Winter	12/06/2018	26/06/2018	14	6	84
Control site 2	Spring	18/10/2018	1/11/2018	14	6	84
Control site 2	Summer	24/01/2019	7/02/2019	14	6*	70
Control site 3	Winter	29/06/2018	13/07/2018	14	6	84
Control site 3	Spring	18/10/2018	1/11/2018	14	6	84
Control site 3	Summer	24/01/2019	7/02/2019	14	6*	70
Control site 4	Winter	12/06/2018	26/06/2018	14	6	84
Control site 4	Spring	18/10/2018	1/11/2018	14	6*	56
Control site 4	Summer	4/12/2018	18/12/2018	14	6	84
Control site 5	Winter	12/06/2018	26/06/2018	14	6	84
Control site 5	Spring	18/10/2018	1/11/2018	14	6	84
Control site 5	Summer	4/12/2018	18/12/2018	14	6	84
All Sites	Winter	-	-	-	-	1246
All Sites	Spring	-	-	-	-	1134
All Sites	Summer	-	-	-	-	1218
All Impact Sites	All seasons	-	-	-	-	2394
All Control Sites	All seasons	-	-	-	-	1204
Total All Seasons	All seasons	-	-	-	-	3598

* denotes sites where camera or sd card errors reduced the number of effective traps or trap nights.

^ denotes sites where camera theft reduced the number of trap nights.

Table A3 Spotlighting Survey Dates During Year 4 Post Construction Monitoring

Site	*Survey*	*Date*	*Transect Length (m)*	*Call Playback Species*
Control site 1	Year 4 Winter Survey 1	13/06/2018	500	Yellow-bellied Glider
Control site 1	Year 4 Winter Survey 2	21/06/2018	500	Yellow-bellied Glider
Control site 1	Year 4 Winter Survey 3	11/07/2018	500	Yellow-bellied Glider
Control site 1	Year 4 Spring Survey 1	27/09/2018	500	Yellow-bellied Glider
Control site 1	Year 4 Spring Survey 2	9/10/2018	500	Yellow-bellied Glider
Control site 1	Year 4 Spring Survey 3	30/10/2018	500	Yellow-bellied Glider
Control site 1	Year 4 Summer Survey 1	4/12/2018	500	Yellow-bellied Glider
Control site 1	Year 4 Summer Survey 2	24/01/2019	500	Yellow-bellied Glider
Control site 1	Year 4 Summer Survey 3	4/02/2019	500	Yellow-bellied Glider
Control site 2	Year 4 Winter Survey 1	14/06/2018	500	Koala and Yellow-bellied Glider
Control site 2	Year 4 Winter Survey 2	19/06/2018	500	Koala and Yellow-bellied Glider
Control site 2	Year 4 Winter Survey 3	11/07/2018	500	Koala and Yellow-bellied Glider
Control site 2	Year 4 Spring Survey 1	27/09/2018	500	Koala and Yellow-bellied Glider
Control site 2	Year 3 Spring Survey 2	30/10/2018	500	Koala and Yellow-bellied Glider
Control site 2	Year 4 Spring Survey 3	26/11/2018	500	Koala and Yellow-bellied Glider
Control site 2	Year 4 Summer Survey 1	4/12/2018	500	Koala and Yellow-bellied Glider
Control site 2	Year 4 Summer Survey 2	24/01/2019	500	Koala and Yellow-bellied Glider
Control site 2	Year 4 Summer Survey 3	4/02/2019	500	Koala and Yellow-bellied Glider
Control site 3	Year 4 Winter Survey 1	14/06/2018	500	Koala
Control site 3	Year 4 Winter Survey 2	21/06/2018	500	Koala
Control site 3	Year 4 Winter Survey 3	9/07/2018	500	Koala
Control site 3	Year 4 Spring Survey 1	4/10/2018	500	Koala
Control site 3	Year 4 Spring Survey 2	30/10/2018	500	Koala
Control site 3	Year 4 Spring Survey 3	1/11/2018	500	Koala
Control site 3	Year 4 Summer Survey 1	6/12/2018	500	Koala
Control site 3	Year 4 Summer Survey 2	11/12/2018	500	Koala
Control site 3	Year 4 Summer Survey 3	13/12/2018	500	Koala
Control site 4	Year 4 Winter Survey 1	13/06/2018	500	Koala and Yellow-bellied Glider
Control site 4	Year 4 Winter Survey 2	19/06/2018	500	Koala and Yellow-bellied Glider
Control site 4	Year 4 Winter Survey 3	9/07/2018	500	Koala and Yellow-bellied Glider
Control site 4	Year 4 Spring Survey 1	4/10/2018	500	Koala and Yellow-bellied Glider
Control site 4	Year 4 Spring Survey 2	18/10/2018	500	Koala and Yellow-bellied Glider
Control site 4	Year 4 Spring Survey 3	26/11/2018	500	Koala and Yellow-bellied Glider
Control site 4	Year 4 Summer Survey 1	6/12/2018	500	Koala and Yellow-bellied Glider
Control site 4	Year 4 Summer Survey 2	10/01/2019	500	Koala and Yellow-bellied Glider
Control site 4	Year 4 Summer Survey 3	15/01/2019	500	Koala and Yellow-bellied Glider
Control site 5	Year 4 Winter Survey 1	13/06/2018	500	Yellow-bellied Glider
Control site 5	Year 4 Winter Survey 2	19/06/2018	500	Yellow-bellied Glider
Control site 5	Year 4 Winter Survey 3	9/07/2018	500	Yellow-bellied Glider
Control site 5	Year 4 Spring Survey 1	4/10/2018	500	Yellow-bellied Glider
Control site 5	Year 4 Spring Survey 2	18/10/2018	500	Yellow-bellied Glider

Site	Survey	Date	Transect Length (m)	Call Playback Species
Control site 5	Year 4 Spring Survey 3	26/11/2018	500	Yellow-bellied Glider
Control site 5	Year 4 Summer Survey 1	6/12/2018	500	Yellow-bellied Glider
Control site 5	Year 4 Summer Survey 2	10/01/2019	500	Yellow-bellied Glider
Control site 5	Year 4 Summer Survey 3	15/01/2019	500	Yellow-bellied Glider
Control site 6	Year 4 Winter Survey 1	14/06/2018	500	Koala
Control site 6	Year 4 Winter Survey 2	19/06/2018	500	Koala
Control site 6	Year 4 Winter Survey 3	9/07/2018	500	Koala
Control site 6	Year 4 Spring Survey 1	27/09/2018	500	Koala
Control site 6	Year 4 Spring Survey 2	30/10/2018	500	Koala
Control site 6	Year 4 Spring Survey 3	1/11/2018	500	Koala
Control site 6	Year 4 Summer Survey 1	11/12/2018	500	Koala
Control site 6	Year 4 Summer Survey 2	10/01/2019	500	Koala
Control site 6	Year 4 Summer Survey 3	24/01/2019	500	Koala
Impact Site 1 (east)	Year 4 Winter Survey 1	13/06/2018	500	Koala
Impact Site 1 (east)	Year 4 Winter Survey 2	19/06/2018	500	Koala
Impact Site 1 (east)	Year 4 Winter Survey 3	9/07/2018	500	Koala
Impact Site 1 (east)	Year 4 Spring Survey 1	9/10/2018	500	Koala
Impact Site 1 (east)	Year 4 Spring Survey 2	1/11/2018	500	Koala
Impact Site 1 (east)	Year 4 Spring Survey 3	22/11/2018	500	Koala
Impact Site 1 (east)	Year 4 Summer Survey 1	6/12/2018	500	Koala
Impact Site 1 (east)	Year 4 Summer Survey 2	10/01/2019	500	Koala
Impact Site 1 (east)	Year 4 Summer Survey 3	4/02/2019	500	Koala
Impact Site 1 (west)	Year 4 Winter Survey 1	12/06/2018	500	Koala
Impact Site 1 (west)	Year 4 Winter Survey 2	19/06/2018	500	Koala
Impact Site 1 (west)	Year 4 Winter Survey 3	9/07/2018	500	Koala
Impact Site 1 (west)	Year 4 Spring Survey 1	9/10/2018	500	Koala
Impact Site 1 (west)	Year 4 Spring Survey 2	1/11/2018	500	Koala
Impact Site 1 (west)	Year 4 Spring Survey 3	22/11/2018	500	Koala
Impact Site 1 (west)	Year 4 Summer Survey 1	6/12/2018	500	Koala
Impact Site 1 (west)	Year 4 Summer Survey 2	13/12/2018	500	Koala
Impact Site 1 (west)	Year 4 Summer Survey 3	10/01/2019	500	Koala
Impact Site 1 (west)	Year 4 Winter Survey 1	12/06/2018	500	Koala
Impact Site 2 (east)	Year 4 Winter Survey 1	13/06/2018	500	Koala and Yellow-bellied Glider
Impact Site 2 (east)	Year 4 Winter Survey 2	21/06/2018	500	Koala and Yellow-bellied Glider
Impact Site 2 (east)	Year 4 Winter Survey 3	11/07/2018	500	Koala and Yellow-bellied Glider
Impact Site 2 (east)	Year 4 Spring Survey 1	27/09/2018	500	Koala and Yellow-bellied Glider
Impact Site 2 (east)	Year 4 Spring Survey 2	9/10/2018	500	Koala and Yellow-bellied Glider
Impact Site 2 (east)	Year 4 Spring Survey 3	30/10/2018	500	Koala and Yellow-bellied Glider
Impact Site 2 (east)	Year 4 Summer Survey 1	4/12/2018	500	Koala and Yellow-bellied Glider
Impact Site 2 (east)	Year 4 Summer Survey 2	24/01/2019	500	Koala and Yellow-bellied Glider
Impact Site 2 (east)	Year 4 Summer Survey 3	4/02/2019	500	Koala and Yellow-bellied Glider
Impact Site 2 (median)	Year 4 Winter Survey 1	13/06/2018	1000	Yellow-bellied Glider

Site	Survey	Date	Transect Length (m)	Call Playback Species
Impact Site 2 (median)	Year 4 Winter Survey 2	21/06/2018	1000	Yellow-bellied Glider
Impact Site 2 (median)	Year 4 Winter Survey 3	11/07/2018	1000	Yellow-bellied Glider
Impact Site 2 (median)	Year 4 Spring Survey 1	9/10/2018	1000	Yellow-bellied Glider
Impact Site 2 (median)	Year 4 Spring Survey 2	30/10/2018	1000	Yellow-bellied Glider
Impact Site 2 (median)	Year 4 Spring Survey 3	26/11/2018	1000	Yellow-bellied Glider
Impact Site 2 (median)	Year 4 Summer Survey 1	4/12/2018	1000	Yellow-bellied Glider
Impact Site 2 (median)	Year 4 Summer Survey 2	6/12/2018	1000	Yellow-bellied Glider
Impact Site 2 (median)	Year 4 Summer Survey 3	10/12/2018	1000	Yellow-bellied Glider
Impact Site 2 (west)	Year 4 Winter Survey 1	12/06/2018	500	Koala and Yellow-bellied Glider
Impact Site 2 (west)	Year 4 Winter Survey 2	19/06/2018	500	Koala and Yellow-bellied Glider
Impact Site 2 (west)	Year 4 Winter Survey 3	9/07/2018	500	Koala and Yellow-bellied Glider
Impact Site 2 (west)	Year 4 Spring Survey 1	9/10/2018	500	Koala and Yellow-bellied Glider
Impact Site 2 (west)	Year 4 Spring Survey 2	1/11/2018	500	Koala and Yellow-bellied Glider
Impact Site 2 (west)	Year 4 Spring Survey 3	22/11/2018	500	Koala and Yellow-bellied Glider
Impact Site 2 (west)	Year 4 Summer Survey 1	6/12/2018	500	Koala and Yellow-bellied Glider
Impact Site 2 (west)	Year 4 Summer Survey 2	13/12/2018	500	Koala and Yellow-bellied Glider
Impact Site 2 (west)	Year 4 Summer Survey 3	10/01/2019	500	Koala and Yellow-bellied Glider
Impact Site 3 (east)	Year 4 Winter Survey 1	14/06/2018	500	Koala and Yellow-bellied Glider
Impact Site 3 (east)	Year 4 Winter Survey 2	19/06/2018	500	Koala and Yellow-bellied Glider
Impact Site 3 (east)	Year 4 Winter Survey 3	11/07/2018	500	Koala and Yellow-bellied Glider
Impact Site 3 (east)	Year 4 Spring Survey 1	27/09/2018	500	Koala and Yellow-bellied Glider
Impact Site 3 (east)	Year 4 Spring Survey 2	30/10/2018	500	Koala and Yellow-bellied Glider
Impact Site 3 (east)	Year 3 Spring Survey 3	26/11/2018	500	Koala and Yellow-bellied Glider
Impact Site 3 (east)	Year 4 Summer Survey 1	4/12/2018	500	Koala and Yellow-bellied Glider
Impact Site 3 (east)	Year 4 Summer Survey 3	24/01/2019	500	Koala and Yellow-bellied Glider
Impact Site 3 (east)	Year 4 Summer Survey 3	4/02/2019	500	Koala and Yellow-bellied Glider
Impact Site 3 (west)	Year 4 Winter Survey 1	12/06/2018	500	Koala and Yellow-bellied Glider
Impact Site 3 (west)	Year 4 Winter Survey 2	21/06/2018	500	Koala and Yellow-bellied Glider
Impact Site 3 (west)	Year 4 Winter Survey 3	9/07/2018	500	Koala and Yellow-bellied Glider
Impact Site 3 (west)	Year 4 Spring Survey 1	27/09/2018	500	Koala and Yellow-bellied Glider
Impact Site 3 (west)	Year 4 Spring Survey 2	1/11/2018	500	Koala and Yellow-bellied Glider
Impact Site 3 (west)	Year 4 Spring Survey 3	26/11/2018	500	Koala and Yellow-bellied Glider
Impact Site 3 (west)	Year 4 Summer Survey 1	4/12/2018	500	Koala and Yellow-bellied Glider
Impact Site 3 (west)	Year 4 Summer Survey 2	11/12/2018	500	Koala and Yellow-bellied Glider
Impact Site 3 (west)	Year 4 Summer Survey 3	15/01/2019	500	Koala and Yellow-bellied Glider
Impact Site 4 (east)	Year 4 Winter Survey 1	14/06/2018	500	Yellow-bellied Glider
Impact Site 4 (east)	Year 4 Winter Survey 2	21/06/2018	500	Yellow-bellied Glider
Impact Site 4 (east)	Year 4 Winter Survey 3	9/07/2018	500	Yellow-bellied Glider
Impact Site 4 (east)	Year 4 Spring Survey 1	4/10/2018	500	Yellow-bellied Glider
Impact Site 4 (east)	Year 4 Spring Survey 2	30/10/2018	500	Yellow-bellied Glider
Impact Site 4 (east)	Year 4 Spring Survey 3	1/11/2018	500	Yellow-bellied Glider
Impact Site 4 (east)	Year 4 Summer Survey 1	6/12/2018	500	Yellow-bellied Glider

Site	Survey	Date	Transect Length (m)	Call Playback Species
Impact Site 4 (east)	Year 4 Summer Survey 2	11/12/2018	500	Yellow-bellied Glider
Impact Site 4 (east)	Year 4 Summer Survey 3	13/12/2018	500	Yellow-bellied Glider
Impact Site 4 (median)	Year 4 Winter Survey 1	14/06/2018	1000	Yellow-bellied Glider
Impact Site 4 (median)	Year 4 Winter Survey 2	19/06/2018	1000	Yellow-bellied Glider
Impact Site 4 (median)	Year 4 Winter Survey 3	9/07/2018	1000	Yellow-bellied Glider
Impact Site 4 (median)	Year 4 Spring Survey 1	4/10/2018	1000	Yellow-bellied Glider
Impact Site 4 (median)	Year 4 Spring Survey 2	30/10/2018	1000	Yellow-bellied Glider
Impact Site 4 (median)	Year 4 Spring Survey 3	1/11/2018	1000	Yellow-bellied Glider
Impact Site 4 (median)	Year 4 Summer Survey 1	6/12/2018	1000	Yellow-bellied Glider
Impact Site 4 (median)	Year 4 Summer Survey 2	11/12/2018	1000	Yellow-bellied Glider
Impact Site 4 (median)	Year 4 Summer Survey 3	15/01/2019	1000	Yellow-bellied Glider
Impact Site 5 (east)	Year 4 Winter Survey 1	14/06/2018	500	Koala
Impact Site 5 (east)	Year 4 Winter Survey 2	21/06/2018	500	Koala
Impact Site 5 (east)	Year 4 Winter Survey 3	9/07/2018	500	Koala
Impact Site 5 (east)	Year 4 Spring Survey 1	9/10/2018	500	Koala
Impact Site 5 (east)	Year 4 Spring Survey 2	1/11/2018	500	Koala
Impact Site 5 (east)	Year 4 Spring Survey 3	22/11/2018	500	Koala
Impact Site 5 (east)	Year 4 Summer Survey 1	11/12/2018	500	Koala
Impact Site 5 (east)	Year 4 Summer Survey 3	24/01/2019	500	Koala
Impact Site 5 (east)	Year 4 Summer Survey 3	4/02/2019	500	Koala
Impact Site 5 (west)	Year 4 Winter Survey 1	12/06/2018	500	Koala
Impact Site 5 (west)	Year 4 Winter Survey 2	21/06/2018	500	Koala
Impact Site 5 (west)	Year 4 Winter Survey 3	9/07/2018	500	Koala
Impact Site 5 (west)	Year 4 Spring Survey 1	4/10/2018	500	Koala
Impact Site 5 (west)	Year 4 Spring Survey 2	18/10/2018	500	Koala
Impact Site 5 (west)	Year 4 Spring Survey 3	22/11/2018	500	Koala
Impact Site 5 (west)	Year 4 Summer Survey 1	11/12/2018	500	Koala
Impact Site 5 (west)	Year 4 Summer Survey 2	15/01/2019	500	Koala
Impact Site 5 (west)	Year 4 Summer Survey 3	4/02/2019	500	Koala
Impact Site 6 (west)	Year 4 Winter Survey 1	14/06/2018	500	Yellow-bellied Glider
Impact Site 6 (west)	Year 4 Winter Survey 2	21/06/2018	500	Yellow-bellied Glider
Impact Site 6 (west)	Year 4 Winter Survey 3	9/07/2018	500	Yellow-bellied Glider
Impact Site 6 (west)	Year 4 Spring Survey 1	4/10/2018	500	Yellow-bellied Glider
Impact Site 6 (west)	Year 4 Spring Survey 2	18/10/2018	500	Yellow-bellied Glider
Impact Site 6 (west)	Year 4 Spring Survey 3	22/11/2018	500	Yellow-bellied Glider
Impact Site 6 (west)	Year 4 Summer Survey 1	11/12/2018	500	Yellow-bellied Glider
Impact Site 6 (west)	Year 4 Summer Survey 2	15/01/2019	500	Yellow-bellied Glider
Impact Site 6 (west)	Year 4 Summer Survey 3	4/02/2019	500	Yellow-bellied Glider

Table A4 Arboreal Hair Tube Survey Dates and Locations During Year 4 Post Construction Monitoring

Site	Hair Tube Group	Hair Tube Ref.	Spring Date Installed	Spring Dated Checked	Spring Date Removed	Summer Date Installed	Summer Dated Checked	Summer Date Removed	Tree Species	Tree Height (m)	On or adjacent to Hollow-bearing Tree	Easting	Northing
Impact Site 2 (median)	1	a	26/09/2018	18/10/2018	12/11/2018	19/12/2018	09/01/2019	31/01/2019	Stag	24	On	521827	6762360
Impact Site 2 (median)	1	b	26/09/2018	18/10/2018	12/11/2018	19/12/2018	09/01/2019	31/01/2019	Swamp box	30	Adjacent	521818	6762350
Impact Site 2 (median)	1	c	26/09/2018	18/10/2018	12/11/2018	19/12/2018	09/01/2019	31/01/2019	Swamp box	25	Adjacent	521826	6762350
Impact Site 2 (median)	2	a	26/09/2018	18/10/2018	12/11/2018	19/12/2018	09/01/2019	31/01/2019	Stag	25	On	521840	6762400
Impact Site 2 (median)	2	b	26/09/2018	18/10/2018	12/11/2018	19/12/2018	09/01/2019	31/01/2019	Spotted Gum	25	Adjacent	521853	6762400
Impact Site 2 (median)	2	c	27/09/2018	18/10/2018	13/11/2018	27/09/2018	09/01/2019	31/01/2019	Spotted Gum	25	Adjacent	521852	6762390
Impact Site 2 (median)	3	a	26/09/2018	18/10/2018	12/11/2018	19/12/2018	09/01/2019	31/01/2019	Spotted Gum	30	Adjacent	521882	6762420
Impact Site 2 (median)	3	b	27/09/2018	18/10/2018	12/11/2018	19/12/2018	09/01/2019	31/01/2019	Spotted Gum	30	Adjacent	521880	6762430
Impact Site 2 (median)	3	c	27/09/2018	18/10/2018	12/11/2018	19/12/2018	09/01/2019	31/01/2019	Mahogany	25	On	521886	6762430
Impact Site 2 (median)	4	a	27/09/2018	18/10/2018	12/11/2018	19/12/2018	09/01/2019	31/01/2019	Iron bark	30	Adjacent	521949	6762460
Impact Site 2 (median)	4	b	27/09/2018	18/10/2018	12/11/2018	19/12/2018	09/01/2019	31/01/2019	Spotted Gum	30	On	521951	6762490
Impact Site 2 (median)	4	c	27/09/2018	18/10/2018	12/11/2018	19/12/2018	10/01/2019	31/01/2019	Spotted	25	Adjacent	521942	6762490
Impact Site 2 (median)	5	a	27/09/2018	18/10/2018	12/11/2018	19/12/2018	10/01/2019	31/01/2019	Spotted Gum	30	On	521965	6762520
Impact Site 2 (median)	5	b	27/09/2018	18/10/2018	12/11/2018	19/12/2018	10/01/2019	31/01/2019	Spotted Gum	30	Adjacent	521962	6762510
Impact Site 2 (median)	5	c	27/09/2018	18/10/2018	12/11/2018	19/12/2018	10/01/2019	31/01/2019	Tallowwood	20	Adjacent	521961	6762510
Impact Site 2 (median)	6	a	27/09/2018	18/10/2018	12/11/2018	19/12/2018	10/01/2019	31/01/2019	Blackbutt	35	On	521991	6762540
Impact Site 2 (median)	6	b	27/09/2018	18/10/2018	12/11/2018	19/12/2018	10/01/2019	31/01/2019	Small fruited grey gum	25	Adjacent	521994	6762520
Impact Site 2 (median)	6	c	27/09/2018	18/10/2018	12/11/2018	19/12/2018	10/01/2019	31/01/2019	Spotted Gum	25	Adjacent	521999	6762520
Impact Site 2 (median)	7	a	27/09/2018	18/10/2018	12/11/2018	19/12/2018	10/01/2019	31/01/2019	Spotted Gum	25	Adjacent	522050	6762570
Impact Site 2 (median)	7	b	27/09/2018	18/10/2018	12/11/2018	-	-	-	Spotted Gum	25	Adjacent	522048	6762580
Impact Site 2 (median)	7	b	-	-	-	19/12/2018	10/01/2019	31/01/2019	Stringybark	25	On	522066	6762570
Impact Site 2 (median)	7	c	27/09/2018	18/10/2018	12/11/2018	20/12/2018	10/01/2019	31/01/2019	Stag	25	On	522060	6762580
Impact Site 2 (median)	8	a	27/09/2018	18/10/2018	12/11/2018	19/12/2018	10/01/2019	31/01/2019	Spotted Gum	26	Adjacent	522082	6762600
Impact Site 2 (median)	8	b	27/09/2018	18/10/2018	12/11/2018	19/12/2018	10/01/2019	31/01/2019	Spotted Gum	28	Adjacent	522089	6762600
Impact Site 2 (median)	8	c	27/09/2018	18/10/2018	12/11/2018	19/12/2018	10/01/2019	31/01/2019	Spotted Gum	29	Adjacent	522094	6762610
Impact Site 2 (median)	9	a	27/09/2018	18/10/2018	13/11/2018	19/12/2018	09/01/2019	31/01/2019	Stag	25	On	521742	6762260
Impact Site 2 (median)	9	b	27/09/2018	17/10/2018	13/11/2018	19/12/2018	09/01/2019	31/01/2019	Ironbark changes to adjacent swamp box	30	On	521724	6762280
Impact Site 2 (median)	9	c	27/09/2018	17/10/2018	13/11/2018	19/12/2018	09/01/2019	31/01/2019	Forest red gum	30	On	521723	6762260
Impact Site 2 (median)	10	a	27/09/2018	17/10/2018	13/11/2018	19/12/2018	09/01/2019	31/01/2019	Forest Red Gum	30	On	521651	6762230
Impact Site 2 (median)	10	b	27/09/2018	17/10/2018	13/11/2018	19/12/2018	09/01/2019	31/01/2019	Ironbark	25	Adjacent	521653	6762230
Impact Site 2 (median)	10	c	27/09/2018	17/10/2018	13/11/2018	19/12/2018	09/01/2019	31/01/2019	Ironbark	20	Adjacent	521650	6762240
Impact Site 4 (median)	1	a	27/09/2018	18/10/2018	13/11/2018	19/12/2018	10/01/2019	30/01/2019	Scribbly gum	25	On	523384	6764360
Impact Site 4 (median)	1	b	27/09/2018	18/10/2018	13/11/2018	19/12/2018	10/01/2019	30/01/2019	Angophora woodsiana	25	Adjacent	523383	6764370
Impact Site 4 (median)	1	c	27/09/2018	18/10/2018	13/11/2018	19/12/2018	10/01/2019	30/01/2019	Scribbly gum	25	Adjacent	523371	6764360

Site	Hair Tube Group	Hair Tube Ref.	Spring Date Installed	Spring Dated Checked	Spring Date Removed	Summer Date Installed	Summer Dated Checked	Summer Date Removed	Tree Species	Tree Height (m)	On or adjacent to Hollow-bearing Tree	Easting	Northing
Impact Site 4 (median)	2	a	27/09/2018	18/10/2018	13/11/2018	20/12/2018	10/01/2019	30/01/2019	Angophora woodsiana	20	Adjacent	523388	6764400
Impact Site 4 (median)	2	b	27/09/2018	18/10/2018	13/11/2018	19/12/2018	10/01/2019	30/01/2019	Stag	25	On	523385	6764410
Impact Site 4 (median)	2	c	27/09/2018	18/10/2018	13/11/2018	19/12/2018	10/01/2019	30/01/2019	Stringy bark	25	Adjacent	523386	6764410
Impact Site 4 (median)	3	a	27/09/2018	18/10/2018	13/11/2018	20/12/2018	10/01/2019	30/01/2019	Bloodwood	30	On	523403	6764480
Impact Site 4 (median)	3	b	27/09/2018	18/10/2018	13/11/2018	20/12/2018	10/01/2019	30/01/2019	Stringy bark	20	Adjacent	523398	6764490
Impact Site 4 (median)	3	c	27/09/2018	18/10/2018	13/11/2018	20/12/2018	10/01/2019	30/01/2019	Red mahogany	20	Adjacent	523401	6764490
Impact Site 4 (median)	4	a	27/09/2018	18/10/2018	13/11/2018	20/12/2018	10/01/2019	30/01/2019	Angophora woodsiana	20	Adjacent	523464	6764550
Impact Site 4 (median)	4	b	27/09/2018	18/10/2018	13/11/2018	20/12/2018	10/01/2019	30/01/2019	Angophora woodsiana	20	Adjacent	523466	6764540
Impact Site 4 (median)	4	c	27/09/2018	18/10/2018	13/11/2018	20/12/2018	10/01/2019	30/01/2019	Angophora woodsiana	20	On	523469	6764540
Impact Site 4 (median)	5	a	18/10/2018	18/10/2018	13/11/2018	20/12/2018	10/01/2019	30/01/2019	Blackbutt	25	Adjacent	523504	6764600
Impact Site 4 (median)	5	b	27/09/2018	18/10/2018	13/11/2018	20/12/2018	10/01/2019	30/01/2019	Stag	20	On	523502	6764600
Impact Site 4 (median)	5	c	27/09/2018	18/10/2018	13/11/2018	20/12/2018	10/01/2019	30/01/2019	Bloodwood	25	Adjacent	523488	6764610
Impact Site 4 (median)	6	a	27/09/2018	18/10/2018	13/11/2018	20/12/2018	10/01/2019	30/01/2019	Stag	20	On	523536	6764620
Impact Site 4 (median)	6	b	27/09/2018	18/10/2018	13/11/2018	20/12/2018	10/01/2019	30/01/2019	Blackbutt	26	Adjacent	523536	6764620
Impact Site 4 (median)	6	c	27/09/2018	18/10/2018	13/11/2018	20/12/2018	10/01/2019	30/01/2019	Tallowwood	30	Adjacent	523533	6764620
Impact Site 4 (median)	7	a	27/09/2018	18/10/2018	13/11/2018	20/12/2018	10/01/2019	30/01/2019	Stag	20	On	523533	6764640
Impact Site 4 (median)	7	b	27/09/2018	18/10/2018	13/11/2018	20/12/2018	10/01/2019	30/01/2019	Tallowwood	30	Adjacent	523520	6764650
Impact Site 4 (median)	7	c	27/09/2018	18/10/2018	13/11/2018	10/01/2019	09/12/2018	30/01/2019	Narrow leaf red gum	20	Adjacent	523521	6764660
Impact Site 4 (median)	8	a	27/09/2018	18/10/2018	13/11/2018	20/12/2018	10/01/2019	30/01/2019	Stag	20	On	523595	6764710
Impact Site 4 (median)	8	b	27/09/2018	18/10/2018	13/11/2018	20/12/2018	10/01/2019	30/01/2019	Blackbutt	20	Adjacent	523599	6764700
Impact Site 4 (median)	8	c	27/09/2018	18/10/2018	13/11/2018	20/12/2018	10/01/2019	30/01/2019	Tallowwood	25	Adjacent	523598	6764710
Impact Site 4 (median)	9	a	27/09/2018	18/10/2018	13/11/2018	20/12/2018	10/01/2019	30/01/2019	Stag	15	On	523610	6764730
Impact Site 4 (median)	9	b	27/09/2018	18/10/2018	13/11/2018	20/12/2018	10/01/2019	30/01/2019	Blackbutt	30	Adjacent	523612	6764740
Impact Site 4 (median)	9	c	27/09/2018	18/10/2018	13/11/2018	20/12/2018	10/01/2019	30/01/2019	Red Mahogany	27	Adjacent	523612	6764740
Impact Site 4 (median)	10	a	27/09/2018	18/10/2018	13/11/2018	20/12/2018	10/01/2019	30/01/2019	Stag	20	On	523638	6764780
Impact Site 4 (median)	10	b	27/09/2018	18/10/2018	13/11/2018	20/12/2018	10/01/2019	30/01/2019	Bloodwood	25	Adjacent	523635	6764780
Impact Site 4 (median)	10	c	27/09/2018	18/10/2018	13/11/2018	20/12/2018	10/01/2019	30/01/2019	Tallowwood	20	Adjacent	523630	6764770

Table A5 Weather Conditions During Nocturnal Surveys During Year 4 Post Construction Monitoring

Date	*Survey Type*	*Temperature*	*Wind*	*Cloud cover*	*Moon phase*	*Humidity*	*Evidence of Rain within 24hrs*	*Evidence of Rain within 48hrs*	*Rainfall (mm)**	*Comments*	*Flowering Resources Observed*
12/06/2018	Threatened mammals (spotlighting/ call playback)	Mild (15-20°c)	No wind	0-25%	No moon	Low	No	No	0	-	Various Acacias flowering
13/06/2018	Threatened mammals (spotlighting/ call playback)	Mild (15-20°c)	No wind	0-25%	No moon	Low	Yes	Yes	0.2mm in 24hrs; 0.2mm in last 48 hr.	-	Various Acacias flowering
14/06/2018	Threatened mammals (spotlighting/ call playback)	Mild (15-20°c)	No wind	0-25%	No moon	Low	No	Yes	0mm in 24hrs; 0.2mm in last 48 hr.	-	Various Acacias, Forest Red Gum
19/06/2018	Threatened mammals (spotlighting/ call playback)	Mild (15-20°c)	No wind	26-50%	26-50%	Low	No	No	0	-	Various Acacias, Forest Red Gums, one Large-leaved Spotted Gum observed flowering
19/06/2018	Threatened mammals (spotlighting/ call playback)	Cool (10-15°c)	No wind	0-25%	26-50%	Low	No	No	0	-	Various Acacias, Forest Red Gums, one Large-leaved Spotted Gum observed flowering. Broad-leaved Paperbark in full flower
21/06/2018	Threatened mammals (spotlighting/ call playback)	Mild (15-20°c)	No wind	0-25%	26-50%	Low	No	No	0	-	Various Acacias, Forest Red Gum, Broad-leaved Paperbark
9/07/2018	Threatened mammals (spotlighting/ call playback)	Cool (10-15°c)	No wind	0-25%	<Null>	Low	No	Yes	0.2	-	Forest Red Gum, Large-leaved Spotted Gum, various Acacias
11/07/2018	Threatened mammals (spotlighting/ call playback)	Mild (15-20°c)	No wind	26-50%	No moon	Low	No	No	0	-	Grey Ironbark, Forest Red Gum, Large-leaved Spotted Gum, various Acacias
5/09/2018	Threatened Frogs	Mild (15-20°c)	No wind	51-75%	0-25%	High	Yes	Yes	23.4mm in 24hrs; 56.8mm in last 48 hr.	Dry on ground with minimal pooled water.	-
27/09/2018	Threatened mammals (spotlighting/ call playback)	Mild (15-20°c)	No wind	0-25%	76-100%	Moderate	Yes	Yes	2.8mm in 24hrs; 3.0mm in 48 hr.	-	Tallowwood, Grey Ironbark, Narrow-leaved Red Gum
4/10/2018	Threatened mammals (spotlighting/ call playback)	Warm (>20-28°c)	No wind	76-100%	51-75%	High	No	No	0	Third quarter of moon phase rising late. Isolated storm with light showers	Grey Ironbark, Narrow-leaved Red Gum, Tallowwood and *Melaleuca linariifolia*
9/10/2018	Threatened mammals (spotlighting/ call playback)	Warm (>20-28°c)	No wind	0-25%	0-25%	Moderate	Yes	Yes	0.2mm in 24hrs; 0.6mm in 48 hr.	-	Minor Blackbutt in flower; moderate Grey Ironbark, Forest Red Gum; Narrow-leaved Red Gum
15/10/2018	Threatened Frogs	Mild (15-20°c)	Light (leaves moving)	76-100%	26-50%	High	Yes	Yes	27.2mm in 24hrs; 63.8mm in 48 hr.	-	-
18/10/2018	Threatened mammals (spotlighting/ call playback)	Mild (15-20°c)	No wind	76-100%	76-100%	Moderate	Yes	Yes	0.8mm in 24hrs; 11.4\mm in 48 hr.	Short thunderstorm during survey	Narrow-leaved Red Gum, Grey Ironbark
30/10/2018	Threatened mammals (spotlighting/ call playback)	Warm (>20-28°c)	No wind	0-25%	51-75%	High	Yes	Yes	0.8mm in 24hrs; 1.8mm in 48 hr.	Light sprinkle likely in preceding day. Three quarter moon phase late rise. Cool later during survey	*Callistemon salignus* and Tallowwood in moderate flower. Light Blackbutt and Grey Ironbark flowering

Date	Survey Type	Temperature	Wind	Cloud cover	Moon phase	Humidity	Evidence of Rain within 24hrs	Evidence of Rain within 48hrs	Rainfall (mm)*	Comments	Flowering Resources Observed
1/11/2018	Threatened mammals (spotlighting/ call playback)	Warm (>20-28°c)	No wind	0-25%	26-50%	Moderate	No	No	0	Last quarter moon phase	Minor Blackbutt, Grey Ironbark and *Melaleuca linariifolia*
22/11/2018	Threatened mammals (spotlighting/ call playback)	Warm (>20-28°c)	No wind	0-25%	76-100%	Moderate	Yes	Yes	17.2mm in 24hrs; 17.2mm in 48 hr.	Full moon	*Melaleuca linariifolia*, *Eucalyptus tindaliae* and Tallowwood in light to moderate flower; Narrow-leaved Red Gum in moderate to heavy flower.
26/11/2018	Threatened mammals (spotlighting/ call playback)	Warm (>20-28°c)	No wind	0-25%	76-100%	Moderate	No	No	0	Past full moon. Late moon rise.	*Eucalyptus tindaliae* and Narrow-leaved Red Gum
4/12/2018	Threatened mammals (spotlighting/ call playback)	Warm (>20-28°c)	Light (leaves moving)	26-50%	0-25%	Moderate	No	No	0	Sprinkle of rain and lightning at end of survey	*Eucalyptus tindaliae*
6/12/2018	Threatened mammals (spotlighting/ call playback)	Mild (15-20°c)	No wind	0-25%	0-25%	Low	No	No	0	-	Narrow-leaved Red Gum in light flower. *Eucalyptus tindaliae* in moderate flower
10/12/2018	Threatened mammals (spotlighting/ call playback)	Mild (15-20°c)	No wind	0-25%	0-25%	Moderate	Yes	Yes	0.2mm in 24hrs; 1.0mm in 48 hr.	-	Light *Eucalyptus tindaliae*
11/12/2018	Threatened mammals (spotlighting/ call playback)	Warm (>20-28°c)	No wind	0-25%	0-25%	Moderate	No	Yes	0mm in 24hrs; 0.2mm in 48 hr.	-	Light *Eucalyptus tindaliae* in flower. Very light Narrow-leaved Red Gum in flower
13/12/2018	Threatened mammals (spotlighting/ call playback)	Warm (>20-28°c)	Light (leaves moving)	51-75%	0-25%	High	Yes	Yes	3.2mm in 24hrs; 3.2mm in 48 hr.	Rained intermittently during survey	Narrow-leaved Red Gum flowering
21/12/2018	Threatened Frogs	Warm (>20-28°c)	Light (leaves moving)	26-50%	51-75%	High	Yes	Yes	40.4mm in 24hrs; 45.2mm in 48 hr.	-	Moderate *Anophora woodsiana* in flower; light Large-leaved Spotted Gum.
10/01/2019	Threatened mammals (spotlighting/ call playback)	Warm (>20-28°c)	No wind	0-25%	0-25%	Moderate	No	No	0	-	Light *Angophora woodsiana* and Red Mahogany in flower
15/01/2019	Threatened mammals (spotlighting/ call playback)	Warm (>20-28°c)	No wind	0-25%	51-75%	Moderate	No	No	0	-	Red Mahogany and Blackbutt in moderate flower; Scribbly Gum in light flower
24/01/2019	Threatened mammals (spotlighting/ call playback)	Hot (>28°c)	No wind	0-25%	0-25%	High	Yes	Yes	1.2mm in 24hrs; 1.2mm in 48 hr.	-	Blackbutt, Small-fruited Grey Gum, Red Mahogany and *Angophora woodsiana*
4/02/2019	Threatened mammals (spotlighting/ call playback)	Warm (>20-28°c)	No wind	0-25%	No moon	Moderate	No	No	0	-	Blackbutt, Small-fruited Grey Gum, Large-leaved Spotted Gum, Scribbly Gum
8/03/2019	Threatened Frogs	Warm (>20-28°c)	No wind	0-25%	No moon	Moderate	Yes	Yes	5.6mm in 24hrs; 10.2mm in 48 hr.	-	-
17/03/2019	Threatened Frogs	Warm (>20-28°c)	No wind	76-100%	No moon	High	Yes	Yes	3.4mm in 24hrs; 75mm in 48 hr.	Cloud cover inhibited inspection of the moon. Light showers and an isolated storm occurred during the surveys.	-

*****Rainfall data for Threatened Frog Survey events is from the Woolgoolga to Ballina Pacific Highway Upgrade Devils Pulpit weather station. Rainfall is recorded at 9am each day for the previous 24hours.

Appendix B

Nest Box Monitoring Locations and Results

Table B1 Year 4 Post Construction Nest Box Monitoring Installation Data and Results

Site	Nest Box No.	Date Installed	Easting	Northing	Nest Box Height (m)	Tree Species	DBH (cm)	Nest Box Orient-ation	Tree Height (m)	Year 4 Winter Monitoring		Year 4 Spring Monitoring		Year 4 Summer Monitoring	
										Date	Results	Date	Results	Date	Results
Impact Site 2 (west)	1	26/07/2017	521701	6762394	9	Small-fruited grey gum	40	SW	26	20/07/2018	Nil spp. Nil evidence of use.	8/11/2018	Nil spp. Nil evidence of use. Ants present.	14/01/2019	Nil spp. Leaf nesting material.
Impact Site 2 (west)	2	26/07/2017	521638	6762383	9	Red Mahogany	35	SW	25	20/07/2018	Nil spp. Leaf nesting material.	8/11/2018	Nil spp. Old leaf nesting material.	14/01/2019	2 x Adult Squirrel Glider. Male w:212g, hb:160mm, t:260mm. Female w:159g, hb:160mm, t:260mm
Impact Site 2 (west)	3	26/07/2017	521584	6762311	8	Bloodwood	35	E	24	20/07/2018	Nil spp. Nil evidence of use. Ants present.	8/11/2018	Nil spp. Nil evidence of use. Ants present.	14/01/2019	Nil spp. Nil evidence of use. Ants present.
Impact Site 2 (west)	4	26/07/2017	521525	6762282	12	Spotted Gum	40	SW	26	20/07/2018	Nil spp. Nil evidence of use. Ants present.	8/11/2018	Nil spp. Nil evidence of use. Ants present.	14/01/2019	Nil spp. Nil evidence of use. Ants present.
Impact Site 2 (west)	5	26/07/2017	521488	6762244	14	Grey Ironbark	50	SW	31	20/07/2018	Nil spp. Nil evidence of use. Ants present.	8/11/2018	Nil spp. Nil evidence of use. Ants present.	14/01/2019	Nil spp. Nil evidence of use.
Impact Site 2 (west)	6	26/07/2017	521456	6762166	12	Spotted Gum	45	SW	33	20/07/2018	1 x adult male Squirrel Glider. 190 g; hb:192mm; t:220mm.	8/11/2018	Nil spp. Old leaf nesting material.	14/01/2019	Nil spp. Nil evidence of use. Ants present.
Impact Site 2 (median)	1	26/07/2017	521825	6762370	10	Red Mahogany	50	S	27	20/07/2018	Nil spp. Nil evidence of use. Termites present.	8/11/2018	Nil spp. Nil evidence of use. Termites present.	14/01/2019	Nil spp. Nil evidence of use. Termites present.
Impact Site 2 (median)	2	26/07/2017	521772	6762341	13	Red Mahogany	60	E	27	20/07/2018	3 x Squirrel Glider. Dispersed when setting climbing line.	8/11/2018	Nil spp. Old leaf nesting material.	14/01/2019	Nil spp. Old leaf nesting material.
Impact Site 2 (median)	3	26/07/2017	521757	6762307	7	Swamp Box	50	SW	24	20/07/2018	Nil spp. Leaf nesting material.	8/11/2018	Nil spp. Old leaf nesting material.	14/01/2019	Nil spp. Nil evidence of use.
Impact Site 2 (median)	4	26/07/2017	521709	6762282	10	Grey Ironbark	40	S	28	20/07/2018	Nil spp. Nil evidence of use. Ants present.	8/11/2018	Nil spp. Nil evidence of use. Ants present.	14/01/2019	Nil spp. Nil evidence of use. Ants present.
Impact Site 2 (median)	5	26/07/2017	521665	6762261	11	Bloodwood	50	SE	28	20/07/2018	Nil spp. Nil evidence of use. Ants present.	8/11/2018	Nil spp. Nil evidence of use. Ants present.	14/01/2019	Nil spp. Nil evidence of use. Ants present. Relocated out of W2B clearing limit. Swamp Box 18m tall; 40 dbh; 7 m high; shaded west orientation.
Impact Site 2 (median)	6	26/07/2017	521632	6762191	8	Spotted Gum	40	SE	28	20/07/2018	Nil spp. Nil evidence of use. Ants present.	8/11/2018	Nil spp. Nil evidence of use. Ants present.	14/01/2019	Nil spp. Nil evidence of use. Ants present.
Impact Site 2 (east)	1	27/07/2017	521894	6762345	12	Red Mahogany	50	S	25	18/07/2018	Nil spp. Nil evidence of use. Ants present.	8/11/2018	Nil spp. Old leaf nesting material.	16/01/2019	Nil spp. Old leaf nesting material.
Impact Site 2 (east)	2	27/07/2017	521806	6762234	11	Spotted Gum	40	SW	27	18/07/2018	Nil spp. Nil evidence of use. Ants present.	8/11/2018	Nil spp. Nil evidence of use. Ants present.	16/01/2019	Nil spp. Nil evidence of use. Ants present.
Impact Site 2 (east)	3	27/07/2017	521768	6762166	8	Red Mahogany	30	SE	22	18/07/2018	Nil spp. Nil evidence of use. Ants present.	8/11/2018	Nil spp. Nil evidence of use. Ants present.	16/01/2019	Nil spp. Nil evidence of use. Ants present.
Impact Site 2 (east)	4	27/07/2017	521720	6762116	11	Spotted Gum	40	SW	29	18/07/2018	1 x Squirrel Glider	8/11/2018	Nil spp. Old leaf nesting material.	16/01/2019	Nil spp. Old leaf nesting material.
Impact Site 2 (east)	5	27/07/2017	521687	6762085	15	Stringy Bark	40	SW	29	18/07/2018	Nil spp. Leaf nesting material.	8/11/2018	Nil spp. Old leaf nesting material.	16/01/2019	Nil spp. Old leaf nesting material.
Impact Site 2 (east)	6	27/07/2017	521644	6762026	10	Spotted Gum	30	S	25	18/07/2018	Nil spp. Leaf nesting material.	8/11/2018	3 x Squirrel Gliders. 2 fled during arborist climb/ inspection.	16/01/2019	Nil spp. Old leaf nesting material.

Site	Nest Box No.	Date Installed	Easting	Northing	Nest Box Height (m)	Tree Species	DBH (cm)	Nest Box Orient-ation	Tree Height (m)	Year 4 Winter Monitoring		Year 4 Spring Monitoring		Year 4 Summer Monitoring	
										Date	Results	Date	Results	Date	Results
Impact Site 3 (west)	1	11/08/2017	522612	6763123	10	Red Mahogany	45	S	20	19/07/2018	Nil spp. Leaf nesting material.	9/11/2018	Nil spp. Old leaf nesting material.	15/01/2019	Nil spp. Leaf nesting material. Ants present.
Impact Site 3 (west)	2	11/08/2017	522634	6763156	12	White Mahogany	65	S	25	19/07/2018	Nil spp. Leaf nesting material.	9/11/2018	Nil spp. Old leaf nesting material.	15/01/2019	Nil spp. Fresh leaf nesting material.
Impact Site 3 (west)	3	11/08/2017	522645	6763207	8	Spotted Gum	40	S	25	19/07/2018	Nil spp. Nil evidence of use. Ants present.	9/11/2018	Nil spp. Nil evidence of use. Ants present.	15/01/2019	Nil spp. Nil evidence of use. Ants present.
Impact Site 3 (west)	4	11/08/2017	522695	6763226	12	Stringy Bark	40	S	20	19/07/2018	1 x dead decomposing Brushtail Possum.	9/11/2018	Nil spp. Nil evidence of use.	15/01/2019	1 x Juvenile female Ringtail Possum.
Impact Site 3 (west)	5	11/08/2017	522716	6763250	12	Swamp Box	55	S	25	19/07/2018	Nil spp. Nil evidence of use. Ants present.	9/11/2018	Nil spp. Nil evidence of use. Ants present.	15/01/2019	Nil spp. Nil evidence of use. Ants present.
Impact Site 3 (east)	1	27/07/2017	522834	6763203	9	Red Mahogany	40	SE	26	18/07/2018	Nil spp. Nil evidence of use.	9/11/2018	Nil spp. Nil evidence of use.	15/01/2019	Nil spp. Nil evidence of use.
Impact Site 3 (east)	2	27/07/2017	522779	6763146	10	Blackbutt	30	S	28	18/07/2018	1 x Sugar Glider. W:78g, HB:150mm; T:180mm.	9/11/2018	Nil spp. Old leaf nesting material.	15/01/2019	Nil spp. Old leaf nesting material.
Impact Site 3 (east)	3	27/07/2017	523467	6764328	11	Red Mahogany	30	SW	25	18/07/2018	2 x Squirrel Glider: W:225g & 175g.	8/11/2018	Nil spp. Leaf nesting material.	16/01/2019	Nil spp. Old leaf nesting material.
Impact Site 3 (east)	3	27/07/2017	522745	6763100	11	Spotted Gum	40	S	27	18/07/2018	1 x Sugar Glider. w: 125g.	9/11/2018	Nil spp. Leaf nesting material.	15/01/2019	Nil spp. Old leaf nesting material.
Impact Site 3 (east)	4	27/07/2017	522717	6763062	9	Red Mahogany	30	E	24	18/07/2018	Nil spp. Fresh leaf nesting material.	9/11/2018	Nil spp. Leaf nesting material.	15/01/2019	Nil spp. Fresh leaf nesting material.
Impact Site 3 (east)	5	27/07/2017	522655	6762996	12	Spotted Gum	40	SW	26	18/07/2018	1 x Squirrel Glider exited box whilst rope was being established	9/11/2018	Nil spp. Old leaf nesting material.	15/01/2019	Nil spp. Old leaf nesting material.
Impact Site 4 (west)	1	11/08/2017	523320	6764536	8	Stringy Bark	45	S	25	19/07/2018	Nil spp. Leaf nesting material.	8/11/2018	Nil spp. Old leaf nesting material.	14/01/2019	Nil spp. Leaf nesting material.
Impact Site 4 (west)	2	11/08/2017	523302	6764501	8	Stringy Bark	55	S	30	19/07/2018	Nil spp. Leaf nesting material.	19/07/2018	Nil spp. Leaf nesting material.	14/01/2019	Nil spp. Leaf nesting material.
Impact Site 4 (west)	3	11/08/2017	523284	6764450	10	Stringy Bark	50	S	30	19/07/2018	Nil spp. Leaf nesting material.	8/11/2018	Nil spp. Old leaf nesting material.	14/01/2019	Nil spp. Leaf nesting material.
Impact Site 4 (west)	4	11/08/2017	523270	6764391	15	Bloodwood	35	S	30	19/07/2018	Nil spp. Nil evidence of use.	8/11/2018	Nil spp. Old leaf nesting material.	14/01/2019	Nil spp. Leaf nesting material.
Impact Site 4 (west)	5	11/08/2017	523252	6764347	8	Blackbutt	120	S	35	19/07/2018	Nil spp. Nil evidence of use.	8/11/2018	Nil spp. Nil evidence of use.	14/01/2019	Nil spp. Fresh leaf nesting material.
Impact Site 4 (west)	6	11/08/2017	523216	6764293	10	Blackbutt	65	E	30	19/07/2018	Nil spp. Leaf nesting material.	8/11/2018	Nil spp. Old leaf nesting material.	14/01/2019	Nil spp. Nil evidence of use.
Impact Site 4 (median)	1	11/08/2017	523391	6764279	8	Bloodwood	80	S	25	20/07/2018	Nil spp. Fresh leaf nesting material.	8/11/2018	Nil spp. Old leaf nesting material.	16/01/2019	Nil spp. Leaf nesting material.
Impact Site 4 (median)	2	11/08/2017	523385	6764336	8	Smudgy apple	40	S	25	20/07/2018	Nil spp. Fresh leaf nesting material.	8/11/2018	Nil spp. Old leaf nesting material.	16/01/2019	Nil spp. Leaf nesting material.
Impact Site 4 (median)	3	11/08/2017	523405	6764386	10	Smudgy apple	60	S	25	20/07/2018	Nil spp. Fresh leaf nesting material.	8/11/2018	Nil spp. Old leaf nesting material.	16/01/2019	Nil spp. Fresh leaf nesting material.
Impact Site 4 (median)	4	11/08/2017	523442	6764445	10	Smudgy apple	55	S	30	20/07/2018	3 x Squirrel Glider. Two adults (1 x male, 1 x female) and 1 x subadult. Dispersed	8/11/2018	Nil spp. Leaf nesting material.	16/01/2019	Nil spp. Leaf nesting material. Ants present.

Site	Nest Box No.	Date Installed	Easting	Northing	Nest Box Height (m)	Tree Species	DBH (cm)	Nest Box Orient-ation	Tree Height (m)	Year 4 Winter Monitoring		Year 4 Spring Monitoring		Year 4 Summer Monitoring	
										Date	Results	Date	Results	Date	Results
											when establishing rope				
Impact Site 4 (median)	5	11/08/2017	523468	6764494	12	Smudgy apple	50	S	25	20/07/2018	Nil spp. Leaf nesting material.	8/11/2018	Nil spp. Old leaf nesting material.	16/01/2019	Nil spp. Fresh leaf nesting material.
Impact Site 4 (east)	1	27/07/2017	523513	6764408	8	Red Mahogany	40	S	25	18/07/2018	Nil spp. Old leaf nesting material. Termites eating the box.	8/11/2018	Nil spp. Fresh leaf nesting material.	16/01/2019	Nil spp. Leaf nesting material.
Impact Site 4 (east)	2	27/07/2017	523486	6764362	9	Bloodwood	45	SW	26	18/07/2018	Nil spp. Small amount of fresh leaf nesting material. Termites eating box.	8/11/2018	Nil spp. Nil evidence of use. Ants present.	16/01/2019	Nil spp. Nil evidence of use. Ants present.
Impact Site 4 (east)	4	27/07/2017	523438	6764249	8	Bloodwood	65	SE	25	18/07/2018	Nil spp. Nil evidence of use.	8/11/2018	Nil spp. Nil evidence of use. Ants present.	16/01/2019	Nil spp. No evidence of use.
Impact Site 4 (east)	5	27/07/2017	523408	6764202	8	Others	40	S	25	18/07/2018	2 x Squirrel Gliders, escaped when rope being established.	8/11/2018	Nil spp. Leaf nesting material.	16/01/2019	Nil spp. Leaf nesting material.
Impact Site 4 (east)	6	27/07/2017	523553	6764450	8	Red Mahogany	45	E	24	18/07/2018	Nil spp. Nil evidence of use.	8/11/2018	Nil spp. Nil evidence of use. Ants present.	16/01/2019	Nil spp. Nil evidence of use. Ants present.
Impact Site 6 (west)	1	26/07/2017	524788	6767065	10	Scribbly Gum	50	S	20	19/07/2018	Nil spp. Leaf nesting material.	9/11/2018	Nil spp. Old leaf nesting material.	14/01/2019	Nil spp. Leaf nesting material.
Impact Site 6 (west)	2	26/07/2017	524777	6767019	12	Stringy Bark	35	S	25	19/07/2018	Nil spp. Leaf nesting material.	9/11/2018	Nil spp. Leaf nesting material.	14/01/2019	3 x Squirrel Gliders, plus two dependant young. One adult male (w:257g; hb:170mm; t:270mm), One female (w:212g, hb:160mm, t;240) supporting two dependant young. One female adult not processed.
Impact Site 6 (west)	3	26/07/2017	524709	6766878	15	Blackbutt	40	SE	30	19/07/2018	Nil spp. Nil evidence of use.	9/11/2018	Nil spp. Nil evidence of use.	14/01/2019	Nil spp. Leaf nesting material.
Impact Site 6 (west)	4	26/07/2017	524678	6766843	12	Bloodwood	40	S	20	19/07/2018	Nil spp. Nil evidence of use. Ants present.	9/11/2018	Nil spp. Nil evidence of use.	14/01/2019	Nil spp. Nil evidence of use. Ants present.
Impact Site 6 (west)	5	26/07/2017	524657	6766761	8	Stringy Bark	40	S	27	19/07/2018	Nil spp. Nil evidence of use. Ants present.	9/11/2018	Nil spp. Nil evidence of use.	14/01/2019	Nil spp. Nil evidence of use. Ants present.
Control site 1	1	27/07/2017	522303	6762009	11	Spotted Gum	45	E	30	18/07/2018	2 x Squirrel Gliders, exited whilst rope was being established.	12/11/2018	Nil spp. Fresh leaf nesting material.	16/01/2019	Nil spp. Old leaf nesting material.
Control site 1	2	27/07/2017	522354	6762008	9	Spotted Gum	30	S	27	18/07/2018	Nil spp. Fresh leaf nesting material.	12/11/2018	3 x adult Squirrel Glider. 1 x subadult Squirrel Glider.	16/01/2019	3 x Squirrel Glider. 1 x adult female (dispersed during climb/ inspection). 2 x subadults w:104g, hb: 150mm; t:220mm; and w110g; hb:150mm; t:220mm.
Control site 1	3	27/07/2017	522423	6762010	8	Red Mahogany	45	E	27	18/07/2018	Nil spp. Nil evidence of use. Ants present.	12/11/2018	Nil spp. Nil evidence of use.	16/01/2019	Nil spp. Nil evidence of use.
Control site 1	4	27/07/2017	522517	6761981	8	White Mahogany	45	SW	24	18/07/2018	Nil spp. Nil evidence of use. Ants present.	12/11/2018	Nil spp. Nil evidence of use.	16/01/2019	Nil spp. Nil evidence of use.
Control site 1	5	27/07/2017	522568	6761980	14	Grey Ironbark	45	S	30	18/07/2018	Nil spp. Leaf nesting material.	12/11/2018	Nil spp. Old leaf nesting material.	16/01/2019	Nil spp. Fresh leaf nesting material.

Site	Nest Box No.	Date Installed	Easting	Northing	Nest Box Height (m)	Tree Species	DBH (cm)	Nest Box Orient-ation	Tree Height (m)	Year 4 Winter Monitoring		Year 4 Spring Monitoring		Year 4 Summer Monitoring	
										Date	Results	Date	Results	Date	Results
Control site 2	1	11/08/2017	523210	6762772	10	Bloodwood	40	S	20	18/07/2018	Nil spp. Nil evidence of use.	12/11/2018	Nil spp. Nil evidence of use.	15/01/2019	Nil spp. Nil evidence of use.
Control site 2	2	11/08/2017	523251	6762765	12	Scribbly Gum	45	S	25	18/07/2018	Nil spp. Nil evidence of use.	12/11/2018	Nil spp. Nil evidence of use.	15/01/2019	Nil spp. Nil evidence of use.
Control site 2	3	11/08/2017	523305	6762777	15	Blackbutt	60	SE	30	18/07/2018	Nil spp. Nil evidence of use.	12/11/2018	Nil spp. Nil evidence of use.	15/01/2019	Nil spp. Nil evidence of use.
Control site 2	4	11/08/2017	523340	6762777	10	Bloodwood	50	S	25	18/07/2018	Nil spp. Nil evidence of use.	12/11/2018	Nil spp. Nil evidence of use.	15/01/2019	Nil spp. Nil evidence of use.
Control site 2	5	11/08/2017	523405	6762789	8	Turpentine	45	S	25	18/07/2018	Nil spp. Nil evidence of use.	12/11/2018	Nil spp. Nil evidence of use.	15/01/2019	Nil spp. Old leaf nesting material. Ants present.
Control site 4	1	26/07/2017	521084	6763138	8	Spotted Gum	40	S	28	20/07/2018	Nil spp. Nil evidence of use. Ants present.	9/11/2018	Nil spp. Nil evidence of use. Ants present.	14/01/2019	Nil spp. Nil evidence of use. Ants present.
Control site 4	2	26/07/2017	521093	6763099	9	Spotted Gum	45	SE	28	20/07/2018	Nil spp. Old leaf nesting material.	9/11/2018	Nil spp. Old leaf nesting material.	14/01/2019	Nil spp. Leaf nesting material.
Control site 4	3	26/07/2017	521134	6763032	10	Small-fruited grey gum	45	E	27	20/07/2018	3 x Squirrel Gliders. Dispersed when establishing climbing line.	9/11/2018	Nil spp. Old leaf nesting material.	14/01/2019	Nil spp. Leaf nesting material.
Control site 4	4	26/07/2017	521155	6762979	12	Grey Ironbark	40	S	30	20/07/2018	Nil spp. Old leaf nesting material.	9/11/2018	Nil spp. Old and fresh leaf nesting material.	14/01/2019	Nil spp. Old leaf nesting material.
Control site 4	5	26/07/2017	521195	6762945	12	Grey Ironbark	30	SE	20	20/07/2018	Nil spp. Nil evidence of use.	9/11/2018	Nil spp. Old leaf nesting material.	14/01/2019	Nil spp. Old leaf nesting material.
Control site 5	1	26/07/2017	521045	6763490	12	Grey Ironbark	75	S	32	20/07/2018	Nil spp. Nil evidence of use. Ants present.	9/11/2018	Nil spp. Nil evidence of use. Ants present.	14/01/2019	Nil spp. Nil evidence of use. Ants present.
Control site 5	2	26/07/2017	521026	6763553	15	Blackbutt	55	SW	32	20/07/2018	2 x Squirrel glider. One dispersed when fixing rope. Other female with 2 dependant furred young out of pouch. Total weight 232g; head body: 190mm; tail: 220mm	9/11/2018	Nil spp. Old leaf nesting material.	14/01/2019	Nil spp. Old leaf nesting material.
Control site 5	3	26/07/2017	521030	6763633	9	Bloodwood	55	SW	28	20/07/2018	2 x Squirrel Glider. One dispersed when fixing rope. Other 1 x adult female 183g, hb 180mm, t230mm.	9/11/2018	Nil spp. Old leaf nesting material.	14/01/2019	Nil spp. Leaf nesting material.
Control site 5	4	26/07/2017	521016	6763719	9	Swamp Box	45	S	23	20/07/2018	Nil spp. Nil evidence of use. Ants present.	9/11/2018	Nil spp. Old and fresh leaf nesting material.	14/01/2019	Nil spp. Leaf nesting material.
Control site 5	5	26/07/2017	521012	6763758	7	Narrow-leaved red gum	40	E	24	20/07/2018	Nil spp. Leaf nesting material.	9/11/2018	Nil spp. Old and fresh leaf nesting material.	14/01/2019	Nil spp. Leaf nesting material.

Appendix C

Fauna Underpass Monitoring Results

Table C1 Underpass Scat/ Track Search Results for Year 4 Post Construction Monitoring

Date	*Site*	*Season*	*Survey Number*	*Result*	*Species*	*Identification Confidence*	*Recording Type*	*Direction of Movement*	*Complete Crossing*	*Comments*
28/06/2018	Northbound bridge over Tabbimoble Floodway No.3	Winter	1	Yes	Antechinus sp.	Possible	Scats	-	-	-
28/06/2018	Northbound bridge over Tabbimoble Floodway No.3	Winter	1	Yes	Eastern Grey Kangaroo (*Macropus giganteus*)	Possible	Scats	-	-	-
29/06/2018	Northbound bridge over Tabbimoble Floodway No.2	Winter	1	Yes	Antechinus sp.	Probable	Scats	-	-	Habitation activity
29/06/2018	Northbound bridge over Tabbimoble Floodway No.2	Winter	1	Yes	Rattus sp.	Probable	Scats	-	-	-
29/06/2018	Northbound bridge over Tabbimoble Floodway No.3	Winter	1	Yes	Rattus sp.	Possible	Scats	-	-	-
29/06/2018	Southbound bridge over Tabbimoble Floodway No.2	Winter	1	Yes	Antechinus sp.	Probable	Scats	-	-	-
29/06/2018	Southbound bridge over Tabbimoble Floodway No.2	Winter	1	Yes	Rattus sp.	Probable	Scats	-	-	-
29/06/2018	Southbound bridge over Tabbimoble Floodway No.3	Winter	1	Yes	Water Dragon (*Intellagama lesueurii*)	Probable	Scats	-	-	-
29/06/2018	Underpass C10	Winter	1	Yes	Water Rat (*Hydromys chrysogaster*)	Probable	Scats	-	-	-
29/06/2018	Underpass C3	Winter	1	Yes	Rattus sp.	Probable	Scats	-	-	-
29/06/2018	Underpass C3	Winter	1	Yes	Water Dragon (*Intellagama lesueurii*)	Probable	Scats and tracks	Not directional	-	Habitation activity
29/06/2018	Underpass C3	Winter	1	Yes	Water Rat (*Hydromys chrysogaster*)	Probable	Scats	-	-	-
29/06/2018	Underpass C6	Winter	1	No	-	-	-	-	-	No scats or tracks in fauna underpass. Inundated culvert floor.
29/06/2018	Underpass C7	Winter	1	Yes	Microbat	Definite	Scats	-	-	Guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins.
29/06/2018	Underpass C7	Winter	1	Yes	Rattus sp.	Probable	Scats	-	-	-
29/06/2018	Underpass C8	Winter	1	Yes	Microbat	Definite	Scats	-	-	Guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins.
29/06/2018	Underpass C8	Winter	1	Yes	Rattus sp.	Probable	Scats	-	-	-
29/06/2018	Underpass C8	Winter	1	Yes	Water Dragon (*Intellagama lesueurii*)	Probable	Scats	-	-	-
29/06/2018	Underpass C9	Winter	1	Yes	Rattus sp.	Probable	Tracks	West	Unknown	Likely habitation activity
29/06/2018	Underpass C9	Winter	1	Yes	Water Rat (*Hydromys chrysogaster*)	Possible	Scats	-	-	
29/06/2018	Underpass C9	Winter	1	Yes	Water Rat (*Hydromys chrysogaster*)	Possible	Scats	-	-	-
24/07/2018	Northbound bridge over Tabbimoble Floodway No.2	Winter	2	Yes	Antechinus sp.	Probable	Scats	-	-	Habitation activity
24/07/2018	Northbound bridge over Tabbimoble Floodway No.2	Winter	2	Yes	Cattle	Definite	Scats and tracks	East and west	Yes	-
24/07/2018	Northbound bridge over Tabbimoble Floodway No.2	Winter	2	Yes	Rattus sp.	Definite	Scats	-	-	Habitation activity
24/07/2018	Northbound bridge over Tabbimoble Floodway No.3	Winter	2	Yes	Cattle	Definite	Scats and tracks	East and west	Yes	-

Date	Site	Season	Survey Number	Result	Species	Identification Confidence	Recording Type	Direction of Movement	Complete Crossing	Comments
24/07/2018	Northbound bridge over Tabbimoble Floodway No.3	Winter	2	Yes	Wild Dog/ Dingo	Definite	Scats	-	-	-
24/07/2018	Southbound bridge over Tabbimoble Floodway No.2	Winter	2	Yes	Antechinus sp.	Probable	Scats	-	-	Habitation activity
24/07/2018	Southbound bridge over Tabbimoble Floodway No.2	Winter	2	Yes	Cattle	Definite	Scats and tracks	Not directional	-	Habitation activity
24/07/2018	Southbound bridge over Tabbimoble Floodway No.3	Winter	2	Yes	Cattle	Definite	Tracks	East and west	Yes	-
24/07/2018	Underpass C10	Winter	2	Yes	Microbat	Definite	Scats	-	-	Guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins
24/07/2018	Underpass C10	Winter	2	Yes	Rattus sp.	Probable	Scats	-	-	-
24/07/2018	Underpass C3	Winter	2	Yes	Antechinus sp.	Probable	Scats	-	-	-
24/07/2018	Underpass C3	Winter	2	Yes	Microbat	Definite	Scats	-	-	Guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins
24/07/2018	Underpass C3	Winter	2	Yes	Rattus sp.	Definite	Scats	-	-	-
24/07/2018	Underpass C3	Winter	2	Yes	Water Rat (*Hydromys chrysogaster*)	Possible	Scats	-	-	-
24/07/2018	Underpass C6	Winter	2	Yes	Microbat	Definite	Scats	-	-	Old guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert lift joint. Microbat exclusion in place.
24/07/2018	Underpass C6	Winter	2	Yes	Rattus sp.	Definite	Scats	-	-	Rattus sp. scats on fauna furniture in fauna underpass.
24/07/2018	Underpass C6	Winter	2	Yes	Swamp Wallaby (Wallabia bicolor)	Probable	Tracks	East and west	Yes	Old tracks in pipe culverts to south of fauna structure.
24/07/2018	Underpass C7	Winter	2	Yes	Microbat	Definite	Scats	-	-	Guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins.
24/07/2018	Underpass C7	Winter	2	Yes	Rattus sp.	Probable	Scats	-	-	-
24/07/2018	Underpass C7	Winter	2	Yes	Swamp Wallaby (Wallabia bicolor)	Possible	Tracks	East	Unknown	-
24/07/2018	Underpass C7	Winter	2	Yes	Water Rat (*Hydromys chrysogaster*)	Probable	Scats	-	-	-
24/07/2018	Underpass C8	Winter	2	Yes	Antechinus sp.	Probable	Scats	-	-	-
24/07/2018	Underpass C8	Winter	2	Yes	Wild Dog/ Dingo	Probable	Tracks	West	Unknown	-
24/07/2018	Underpass C8	Winter	2	Yes	Microbat	Definite	Scats	-	-	Guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins.
24/07/2018	Underpass C8	Winter	2	Yes	Rattus sp.	Probable	Scats	-	-	-
24/07/2018	Underpass C9	Winter	2	Yes	Microbat	Definite	Scats	-	-	Guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins.
24/07/2018	Underpass C9	Winter	2	Yes	Rattus sp.	Possible	Tracks	Not directional	Unknown	Likely habitation activity
24/07/2018	Underpass C9	Winter	2	Yes	Water Rat (*Hydromys chrysogaster*)	Possible	Tracks	Not directional	Unknown	Likely habitation activity
27/09/2018	Northbound bridge over Tabbimoble Floodway No.3	Spring	1	Yes	Cattle	Definite	Scats	Unknown	-	-
27/09/2018	Northbound bridge over Tabbimoble Floodway No.3	Spring	1	Yes	Swamp Wallaby (Wallabia bicolor)	Definite	Scats	-	-	-
27/09/2018	Southbound bridge over Tabbimoble Floodway No.2	Spring	1	No	-	-	-	-	-	Nil scats or new tracks detected.

Date	Site	Season	Survey Number	Result	Species	Identification Confidence	Recording Type	Direction of Movement	Complete Crossing	Comments
27/09/2018	Southbound bridge over Tabbimoble Floodway No.3	Spring	1	Yes	Cattle	Definite	Scats and tracks	East and west	Yes	-
27/09/2018	Southbound bridge over Tabbimoble Floodway No.3	Spring	1	Yes	Swamp Wallaby (Wallabia bicolor)	Definite	Scats	-	-	-
27/09/2018	Underpass C10	Spring	1	Yes	Microbat	Definite	Scats	-	-	Guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins
27/09/2018	Underpass C10	Spring	1	Yes	Water Rat (*Hydromys chrysogaster*)	Probable	Scats	-	-	-
27/09/2018	Underpass C3	Spring	1	Yes	Microbat	Definite	Scats	-	-	Guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins
27/09/2018	Underpass C3	Spring	1	Yes	Rattus sp.	Probable	Scats and tracks	Not directional	Unknown	Likely habitation activity
27/09/2018	Underpass C3	Spring	1	Yes	Water Rat (*Hydromys chrysogaster*)	Probable	Scats and tracks	East	Unknown	Likely habitation activity
27/09/2018	Underpass C6	Spring	1	No	-	-	-	-	-	No new results. Same Swamp Wallaby and microbat scats and tracks in pipe culverts as per Winter Survey 2. No scats or tracks in fauna underpass.
27/09/2018	Underpass C7	Spring	1	Yes	Microbat	Definite	Scats	-	-	Old guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins.
27/09/2018	Underpass C7	Spring	1	Yes	Rattus sp.	Definite	Scats and tracks	West	Unknown	-
27/09/2018	Underpass C7	Spring	1	Yes	Swamp Wallaby (Wallabia bicolor)	Probable	Tracks	East and west	Yes	Complete crossing both directions
27/09/2018	Underpass C8	Spring	1	Yes	Wild Dog/ Dingo	Definite	Tracks	West	Yes	-
27/09/2018	Underpass C8	Spring	1	Yes	Microbat	Definite	Scats	-	-	Guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins.
27/09/2018	Underpass C8	Spring	1	Yes	Rattus sp.	Probable	Scats	-	-	-
27/09/2018	Underpass C9	Spring	1	Yes	Microbat	Definite	Scats	-	-	Guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins.
27/09/2018	Underpass C9	Spring	1	Yes	Swamp Wallaby (Wallabia bicolor)	Definite	Tracks	East and west	Unknown	-
27/09/2018	Underpass C9	Spring	1	Yes	Water Rat (*Hydromys chrysogaster*)	Probable	Scats	-	-	-
30/10/2018	Northbound bridge over Tabbimoble Floodway No.3	Spring	2	Yes	Cattle	Definite	Scats	-	-	-
30/10/2018	Southbound bridge over Tabbimoble Floodway No.2	Spring	2	Yes	Antechinus sp.	Probable	Scats	-	-	-
30/10/2018	Southbound bridge over Tabbimoble Floodway No.2	Spring	2	Yes	Rattus sp.	Probable	Scats	-	-	-
30/10/2018	Southbound bridge over Tabbimoble Floodway No.3	Spring	2	Yes	Cattle	Definite	Tracks	East and west	Complete	-
30/10/2018	Underpass C10	Spring	2	Yes	Lace Monitor (*Varanus varius*)	Probable	Tracks	East and west	Likely	-
30/10/2018	Underpass C3	Spring	2	Yes	Microbat	Definite	Scats	-	-	Guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins
30/10/2018	Underpass C3	Spring	2	Yes	Rattus sp.	Probable	Scats	-	-	Water pooled at outlet.
30/10/2018	Underpass C6	Spring	2	Yes	Rattus sp.	Definite	Scats and tracks	East and west	Unknown	Same Swamp Wallaby and microbat scats and tracks in pipe culverts as per Winter Survey 2. No scats or tracks in fauna underpass.

Date	Site	Season	Survey Number	Result	Species	Identification Confidence	Recording Type	Direction of Movement	Complete Crossing	Comments
30/10/2018	Underpass C7	Spring	2	Yes	Water Dragon (*Intellagama lesueurii*)	Probable	Scats	-	-	-
30/10/2018	Underpass C8	Spring	2	Yes	Antechinus sp.	Probable	Scats	-	-	-
30/10/2018	Underpass C8	Spring	2	Yes	Water Dragon (*Intellagama lesueurii*)	Probable	Scats	-	-	-
30/10/2018	Underpass C9	Spring	2	Yes	Wild Dog/ Dingo	Probable	Tracks	East	Unknown	Water in eastern half of culvert
30/10/2018	Underpass C9	Spring	2	Yes	Lace Monitor (*Varanus varius*)	Probable	Tracks	Unknown	Unknown	Water in eastern half of culvert
30/10/2018	Underpass C9	Spring	2	Yes	Swamp Wallaby (Wallabia bicolor)	Probable	Tracks	West	Yes	-
10/12/2018	Northbound bridge over Tabbimoble Floodway No.2	Summer	1	Yes	Lace Monitor (*Varanus varius*)	Probable	Tracks	East	Unknown	-
10/12/2018	Northbound bridge over Tabbimoble Floodway No.2	Summer	1	Yes	Rattus sp.	Probable	Scats	-	-	-
10/12/2018	Northbound bridge over Tabbimoble Floodway No.2	Summer	1	Yes	Swamp Wallaby (Wallabia bicolor)	Probable	Scats	-	-	Degraded scat.
10/12/2018	Northbound bridge over Tabbimoble Floodway No.2	Summer	1	Yes	Water Dragon (*Intellagama lesueurii*)	Definite	Scats	-	-	-
10/12/2018	Northbound bridge over Tabbimoble Floodway No.3	Summer	1	Yes	Antechinus sp.	Probable	Scats	-	-	-
10/12/2018	Northbound bridge over Tabbimoble Floodway No.3	Summer	1	Yes	Cattle	Definite	Scats and tracks	East and west	Yes	-
10/12/2018	Northbound bridge over Tabbimoble Floodway No.3	Summer	1	Yes	Water Dragon (*Intellagama lesueurii*)	Probable	Scats	-	-	-
10/12/2018	Southbound bridge over Tabbimoble Floodway No.2	Summer	1	Yes	Antechinus sp.	Probable	Scats	-	-	-
10/12/2018	Southbound bridge over Tabbimoble Floodway No.2	Summer	1	Yes	Rattus sp.	Probable	Scats	-	-	-
10/12/2018	Southbound bridge over Tabbimoble Floodway No.3	Summer	1	Yes	Cattle	Definite	Tracks	East and west	Yes	-
10/12/2018	Southbound bridge over Tabbimoble Floodway No.3	Summer	1	Yes	Cattle	Definite	Tracks	East and west	Yes	-
10/12/2018	Underpass C10	Summer	1	Yes	Lace Monitor (*Varanus varius*)	Probable	Tracks	East and west	Likely	-
10/12/2018	Underpass C10	Summer	1	Yes	Microbat	Definite	Scats	-	-	Old guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins.
10/12/2018	Underpass C10	Summer	1	Yes	Swamp Wallaby (Wallabia bicolor)	Definite	Tracks	East	Unknown	-
10/12/2018	Underpass C10	Summer	1	Yes	Water Rat (*Hydromys chrysogaster*)	Probable	Scats	-	-	-
10/12/2018	Underpass C3	Summer	1	Yes	Microbat	Definite	Scats	-	-	Old guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins.
10/12/2018	Underpass C3	Summer	1	Yes	Rattus sp.	Probable	Scats	-	-	-
10/12/2018	Underpass C3	Summer	1	Yes	Water Dragon (*Intellagama lesueurii*)	Probable	Scats	-	-	-
10/12/2018	Underpass C7	Summer	1	Yes	Lace Monitor (*Varanus varius*)	Probable	Tracks	East and west	Complete	-

Date	Site	Season	Survey Number	Result	Species	Identification Confidence	Recording Type	Direction of Movement	Complete Crossing	Comments
10/12/2018	Underpass C7	Summer	1	Yes	Microbat	Definite	Scats	-	-	Old guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins.
10/12/2018	Underpass C7	Summer	1	Yes	Microbat	Definite	Scats	-	-	Old guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins.
10/12/2018	Underpass C7	Summer	1	Yes	Rattus sp.	Probable	Scats	-	-	-
10/12/2018	Underpass C7	Summer	1	Yes	Swamp Wallaby (Wallabia bicolor)	Possible	Tracks	East and west	Complete	-
10/12/2018	Underpass C7	Summer	1	Yes	Water Dragon (*Intellagama lesueurii*)	Probable	Scats	-	-	-
10/12/2018	Underpass C7	Summer	1	Yes	Water Dragon (*Intellagama lesueurii*)	Probable	Scats	-	-	-
10/12/2018	Underpass C8	Summer	1	Yes	Lace Monitor (*Varanus varius*)	Possible	Tracks	Unknown	Unknown	-
10/12/2018	Underpass C8	Summer	1	Yes	Microbat	Definite	Scats	-	-	Old guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins.
10/12/2018	Underpass C8	Summer	1	Yes	Possum	Possible	Tracks	East	-	-
10/12/2018	Underpass C8	Summer	1	Yes	Rattus sp.	Probable	Scats and tracks	East and west	Unknown	-
10/12/2018	Underpass C8	Summer	1	Yes	Water Dragon (*Intellagama lesueurii*)	Probable	Scats	-	-	-
10/12/2018	Underpass C9	Summer	1	Yes	Lace Monitor (*Varanus varius*)	Probable	Tracks	Unknown	Unknown	-
10/12/2018	Underpass C9	Summer	1	Yes	Lace Monitor (*Varanus varius*)	Probable	Tracks	Unknown	Unknown	-
10/12/2018	Underpass C9	Summer	1	Yes	Microbat	Definite	Scats	-	-	Guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins.
10/01/2019	Northbound bridge over Tabbimoble Floodway No.2	Summer	2	Yes	Water Dragon (*Intellagama lesueurii*)	Probable	Scats	-	-	Habitation activity
10/01/2019	Northbound bridge over Tabbimoble Floodway No.3	Summer	2	Yes	Cattle	Definite	Scats and tracks	East and west	Yes	
10/01/2019	Northbound bridge over Tabbimoble Floodway No.3	Summer	2	Yes	Water Dragon (*Intellagama lesueurii*)	Probable	Scats	-	-	-
10/01/2019	Southbound bridge over Tabbimoble Floodway No.2	Summer	2	Yes	Antechinus sp.	Probable	Scats	-	-	-
10/01/2019	Southbound bridge over Tabbimoble Floodway No.2	Summer	2	Yes	Water Dragon (*Intellagama lesueurii*)	Probable	Scats	-	-	-
10/01/2019	Southbound bridge over Tabbimoble Floodway No.3	Summer	2	Yes	Water Dragon (*Intellagama lesueurii*)	Probable	Scats	-	-	-
10/01/2019	Underpass C10	Summer	2	Yes	Lace Monitor (*Varanus varius*)	Probable	Tracks	East and west	Likely	
10/01/2019	Underpass C10	Summer	2	Yes	Microbat	Definite	Scats	-	-	Old guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins.
10/01/2019	Underpass C10	Summer	2	Yes	Water Rat (*Hydromys chrysogaster*)	Probable	Scats	-	-	-
10/01/2019	Underpass C9	Summer	2	Yes	Common Eastern Froglet (*Crinia signifera*)	Definite	Animal	-	-	Common Eastern Froglet in centre of culvert.
10/01/2019	Underpass C9	Summer	2	Yes	Lace Monitor (*Varanus varius*)	Probable	Tracks	West	Complete	-
10/01/2019	Underpass C9	Summer	2	Yes	Microbat	Definite	Scats	-	-	Old guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins.
10/01/2019	Underpass C9	Summer	2	Yes	Rattus sp.	Probable	Tracks	West	Unknown	Likely habitation activity

Date	Site	Season	Survey Number	Result	Species	Identification Confidence	Recording Type	Direction of Movement	Complete Crossing	Comments
10/01/2019	Underpass C9	Summer	2	Yes	Water Dragon (*Intellagama lesueurii*)	Probable	Scats	-	-	-
10/01/2019	Underpass C9	Summer	2	Yes	Water Rat (*Hydromys chrysogaster*)	Possible	Scats	-	-	-
15/01/2019	Underpass C3	Summer	2	Yes	Lace Monitor (*Varanus varius*)	Possible	Tracks	Unknown	Unknown	-
15/01/2019	Underpass C3	Summer	2	Yes	Microbat	Definite	Scats	-	-	Old guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins.
15/01/2019	Underpass C3	Summer	2	Yes	Rattus sp.	Probable	Scats	-	-	-
15/01/2019	Underpass C3	Summer	2	Yes	Water Dragon (*Intellagama lesueurii*)	Probable	Scats and tracks	Not directional	-	Habitation activity
15/01/2019	Underpass C3	Summer	2	Yes	Water Rat (*Hydromys chrysogaster*)	Probable	Scats	-	-	-
15/01/2019	Underpass C6	Summer	2	Yes	Rattus sp.	Definite	Scats	-	-	Scats on fauna furniture in fauna underpass. Pipe culvert and fauna underpass cleaned in December 2018.
15/01/2019	Underpass C6	Summer	2	Yes	Water Dragon (*Intellagama lesueurii*)	Probable	Scats	-	-	Scats on fauna furniture in fauna underpass and in pipe culverts to south. Pipe culvert and fauna underpass cleaned in December 2018.
15/01/2019	Underpass C7	Summer	2	Yes	Lace Monitor (*Varanus varius*)	Probable	Tracks	East and west	Complete	-
15/01/2019	Underpass C7	Summer	2	Yes	Microbat	Definite	Scats	-	-	Old guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins.
15/01/2019	Underpass C7	Summer	2	Yes	Rattus sp.	Probable	Scats	-	-	-
15/01/2019	Underpass C8	Summer	2	Yes	Lace Monitor (*Varanus varius*)	Possible	Tracks	Unknown	Unknown	Grass skink mid way along culvert northern cell (habitat usage). Old guano
15/01/2019	Underpass C8	Summer	2	Yes	Microbat	Definite	Scats	-	-	Old guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins.
15/01/2019	Underpass C8	Summer	2	Yes	Rattus sp.	Probable	Scats	-	-	-
15/01/2019	Underpass C8	Summer	2	Yes	Skink	Probable	Scats	-	-	-
15/01/2019	Underpass C8	Summer	2	Yes	Sun-skink (Lampropholis delicata)	Definite	Animal	-	-	Found midway along culvert; habitation activity
15/01/2019	Underpass C8	Summer	2	Yes	Swamp Wallaby (Wallabia bicolor)	Possible	Tracks	East	Unknown	-
18/02/2019	Southbound bridge over Tabbimoble Floodway No.2	Summer	Opportunistic	Yes	Carpet Snake (*Morelia spilota*)	Definite	Skin	-	-	-
18/10/2018	-	Spring	Opportunistic	-	Koala	Definite	Scat	-	-	Koala scat detected opportunistically at easting: 521669; northing 6762010

Appendix D

Restoration of Vegetation Connectivity Corridor Results

Table D1 Vegetation Quadrat Results for Year 3 Autumn and Year 4 Spring Post Construction Monitoring

TREES (T1) > 3m			Q1		Q2		Q3		Q4		Q5		Q6		Q7		Q8	
Scientific name	**Commmon name**	**Native/ Weed**	**Yr 3 A**	**Yr 4 Sp**	**Yr 3 A**	**Yr 4 Sp**	**Yr 3 A**	**Yr 4 Sp**	**Yr 3 A**	**Yr 4 Sp**	**Yr 3 A**	**Yr 4 Sp**	**Yr 3 A**	**Yr 4 Sp**	**Yr 3 A**	**Yr 4 Sp**	**Yr 3 A**	**Yr 4 Sp**
Acacia concurrens	Curracabah	Native					3	2							1	1		1
Allocasuarina littoralis	Black Sheoak	Native			1	1	1	1	1	1				1	1	1		
Banksia ericifolia subsp. ericifolia	Heath-leaved Banksia	Native														1		
Callistemon salignus	Willow Bottlebrush	Native											1	1		1		
Eucalyptus tereticornis	Forest Red Gum	Native	1		1	1	1	1	1	1	1	1	2	2	1	2		
Lophostemon suaveolens	Swamp Box	Native	1	1	1	2	3	4	2	2	2	2	1	1	2	2	2	2
Melaleuca quinquenervia	Broad-leaved Paperbark	Native	5	5	3	3	1	1	2	1			2	2			2	2
Melaleuca sieberi	Sieber's Paperbark	Native	1												1	1		
Number of native species			**4**	**2**	**4**	**4**	**5**	**5**	**4**	**4**	**2**	**2**	**4**	**5**	**5**	**7**	**2**	**3**
Number of exotic species			**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Height (m)			**6**	**6**	**5**	**5**	**6**	**6**	**6**	**6**	**5**	**5**	**6**	**6**	**6**	**6**	**6**	**6**
Cover of native species*			**5**	**6**	**3**	**3**	**4**	**4**	**3**	**3**	**2**	**2**	**4**	**4**	**2**	**2**	**3**	**2**
Cover of exotic species*			**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

***Cover score**

Class	***Percentage Cover***
1	<5% sparse
2	<5% common
3	5-25%
4	26-50%
5	51-75%
6	76-100%

Table D1 Vegetation Quadrat Results for Year 3 Autumn and Year 4 Spring Post Construction Monitoring

SHRUBS (T2) < 3m			Q1		Q2		Q3		Q4		Q5		Q6		Q7		Q8	
Scientific name	**Commmon name**	**Native/ Weed**	**Yr 3 A**	**Yr 4 Sp**	**Yr 3 A**	**Yr 4 Sp**	**Yr 3 A**	**Yr 4 Sp**	**Yr 3 A**	**Yr 4 Sp**	**Yr 3 A**	**Yr 4 Sp**	**Yr 3 A**	**Yr 4 Sp**	**Yr 3 A**	**Yr 4 Sp**	**Yr 3 A**	**Yr 4 Sp**
Acacia concurrens	Curracabah	Native				1	3	2					1	1	1	1		
Acacia melanoxylon	Blackwood	Native													1	1		
Allocasuarina littoralis	Black Sheoak	Native	1		1	1	1	1	1	1			1	1				
Amyema congener	Mistletoe	Native		1													1	1
*Baccharis halimifolia**	Groundsel Bush	Weed	1		1	1	1	1	1	1							1	1
Banksia ericifolia subsp. ericifolia	Heath-leaved Banksia	Native	1	1	1	1	1	1	1	1			1	1				
Banksia oblongifolia	Swamp Banksia	Native			1	1	1	1	1	1			1	1	1	1		
Callistemon pachyphyllus	Wallum Bottlebrush	Native			1	1	1	1	1				1	1	1	1		
Callistemon salignus	Willow Bottlebrush	Native									1	1	1	1	1	1		
*Cinnamomum camphora**	Camphor Laurel	Weed																1
Eucalyptus tereticornis	Forest Red Gum	Native			1	1	1	1	1	1	1	1	1	1	1	2	1	
Glochidion ferdinandi var. ferdinandi	Cheese Tree	Native					1											
Leptospermum brachyandrum	Teatree	Native	1	1														
Lophostemon suaveolens	Swamp Box	Native	1	1	1	2	3	4	1	2	2	2	2	2	2	2	2	2
Melaleuca linariifolia	Flax-leaved Paperbark	Native			1	1												
Melaleuca nodosa	Prickly-leaved Paperbark	Native	1	1	1	1	1	1	1	1			1		2	2		
Melaleuca quinquenervia	Broad-leaved Paperbark	Native	2	2	2	2	1	2	1	1	1	1	1	1	1	1	2	
Melaleuca sieberi	Sieber's Paperbark	Native	2	2	1	1	1	1	1	1	1	1	1	1	1	1		
Number of native species			**7**	**7**	**10**	**11**	**11**	**11**	**9**	**8**	**5**	**5**	**11**	**10**	**10**	**10**	**4**	**3**
Number of exotic species			**1**	**0**	**1**	**1**	**1**	**0**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**
Height (m)			**2**	**2**	**3**	**3**	**4**	**4**	**2**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
Cover of native species*			**3**	**3**	**3**	**3**	**4**	**4**	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**2**	**3**	**2**
Cover of exotic species*			**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**

***Cover score**

Class	*Percentage Cover*
1	<5% sparse
2	<5% common
3	5-25%
4	26-50%
5	51-75%
6	76-100%

Table D1 Vegetation Quadrat Results for Year 3 Autumn and Year 4 Spring Post Construction Monitoring

GROUNDCOVERS (G)			Q1		Q2		Q3		Q4		Q5		Q6		Q7		Q8	
Scientific name	Commmon name	Native/ Weed	Yr 3 A	Yr 4 Sp	Yr 3 A	Yr 4 Sp	Yr 3 A	Yr 4 Sp	Yr 3 A	Yr 4 Sp	Yr 3 A	Yr 4 Sp	Yr 3 A	Yr 4 Sp	Yr 3 A	Yr 4 Sp	Yr 3 A	Yr 4 Sp
*Ageratina adenophora**	Crofton Weed	Weed	1	1					2	1			1	1			1	1
*Ageratum houstonianum**	Blue Billygoat Weed	Weed	1	1	1	1				2	1	1	1	1	1		1	
Alternanthera denticulata	Lesser Joyweed	Native						1										
Alternanthera sp.	Joyweed	?		1		1												
*Ambrosia artemisiifolia**	Annual Ragweed	Weed									1	1						
*Andropogon virginicus**	Whiskey Grass	Weed	1															
*Aster subulatus**	Wild Aster	Weed				1	1	1	1	1		1	1				1	
*Axonopus fissifolius**	Carpet Grass	Weed	1				1		1						2		2	
*Bidens pilosa**	Cobbler's Pegs	Weed											1	1			1	
Capillipedium spicigerum	Scented-top Grass	Native	2		2		2		2						1			
*Cenchrus clandestinus**	Kikuyu	Weed	3	3	2	2	1	2	1	3					2	3	2	3
Centella asiatica	Pennywort	Native		2	1	2			1	2		1		1	2	2	2	2
Cheilanthes sieberi subsp. sieberi	Mulga Fern	Native			1													
Chorizandra cymbaria	Bristle-sedge	Native		1														
*Conyza bonariensis**	Fleabane	Weed				1												1
*Crassocephalum crepidioides**	Thickhead	Weed			1				1						1		1	1
*Cuphea carthagenensis**	Cuphea	Weed	1	2														
Cynodon dactylon	Common Couch	Native							1	1				1	2	3		2
Cyperus polystachyos	Bunchy Sedge	Native	1		2	1	1	1	1				1		1		2	
Dianella caerulea	Blue Flax lily	Native		1		1		1								1		
Dichondra repens	Kidney Weed	Native			1	2	2	2	2	2			1	1				1
*Digitaria sanguinalis**	Summer Grass	Weed							1									
Eclipta platyglossa	Eclipta	Native											1					
Eleocharis philippinensis		Native	1															
Eragrostis brownii	Brown's Lovegrass	Native	1		2		3						1		1			
*Emilia sonchifolia**	Purple Sow Thistle	Weed						1										
Entolasia stricta	Wiry Panic	Native						2										
Eragrostis leptostachya	Paddock Lovegrass	Native	2	2	3	2		2							1		2	
Euchiton involucratus	Star Cudweed	Native			1									1				
Fimbristylis dichotoma	Common Fringe-sedge	Native											1				1	
Glycine clandestina	Climbing Glycine	Native			1					1			1					
*Gomphocarpus physocarpus**	Balloon Cotton Bush	Weed															1	1
Gonocarpus humilis	Raspwort	Native			1	2												
Gonocarpus micranthus	Creeping Raspwort	Native	1	1														
Goodenia paniculata	Branched Goodenia	Native	1	2		2	2		1	2				1			1	1
Hemarthria uncinata	Matgrass	Native	4	4	4	4	1	2	3								2	
Hydrocotyle sibthorpioides	Pennywort	Native														1		
Hypericum gramineum	Small St. John's Wort	Native	1	1		1	1			1	1	1	1	1				
*Hypochaeris radicata**	Catsear	Weed											1					
Hypolepis muelleri	Harsh Ground Fern	Native															2	2
Imperata cylindrica	Blady Grass	Native	1		2	3	3	5	4	3					3	3	3	3
Ischaemum australe	Bluegrass	Native	4	4	4	4	3	2		1					2		2	2
Juncus usitatus	Pin Rush	Native			1	1												1
Leersia hexandra	Swamp Ricegrass	Native			1		1		2									
Lobelia sp.	Lobelia	Native		1		1								1				
Lomandra longifolia	Spiny-headed Mat-rush	Native						1	1	1								
*Macroptilium lathyroides**	Phasey Bean	Weed				1												
Oxalis perennans	Oxalis	Native			1	2							1			1	1	1
Parsonsia straminea	Common Silkpod	Native	1	1	1	1	1	2	1	1					1		1	1

Paspalidium distans	Shotgrass	Native					3	2										
*Paspalum ciliatifolium**	Paspalum	Weed													1			
*Paspalum mandiocanum**	Broad-leaved Paspalum	Weed	1										1	2	2	2		
*Paspalum scrobiculatum**	Scrobic	Weed	1				1		1								1	
*Paspalum urvillei**	Vasey Grass	Weed	2	2	3	3	2	2	2	3			1		2	2		
Philydrum lanuginosum	Frogsmouth	Native	2	2														
*Polygala paniculata**	Milkwort	Weed	2	2	2	2	2	2	2	2	1	2	1		2	2	3	2
Polymeria calycina	Bindweed	Native					1	2		2				1	2	2	2	2
Pratia purpurascens	Whiteroot	Native											1					
Pteridium esculentum	Bracken	Native					1	1										
Ranunculus lappaceus	Common Buttercup	Native												1				
Ranunculus tripartita		Native		1	1	2	1	1		2								2
Sacciolepis indica	Indian Cupscale Grass	Native	1		3		2	2	2						2		1	
Schoenus brevifolius	Zig-zag Bog Rush	Native	1	1														
Scleria tricuspidata	Fine Sedge	Native	2	3	1	2	1		2	1			1				1	
*Senecio madagascariensis**	Fireweed	Weed			1	2			1	2		1	1	1	2	2	2	2
*Setaria sphacelata**	Pigeon Grass	Weed	1	1	2		1	2	3	2	6	6	6	6	4	5	4	5
*Sporobolus africanus**	Parramatta Grass	Weed			1										1			
Stylidium debile	Frail Triggerplant	Native		1													1	1
Themeda australis	Kangaroo Grass	Native	1	1		1	1	1	1	1					1	3	2	2
*Verbena bonariensis**	Purpletop	Weed								1	1	1		1				
Viola banksii	Wild Violet	Native											1					
Viola betonicifolia	Native Violet	Native							1									
Xyris complanata	Hatpins	Native	1		1													
Number of native species			**18**	**17**	**21**	**18**	**18**	**17**	**15**	**14**	**1**	**2**	**11**	**9**	**12**	**8**	**16**	**14**
Number of exotic species			**11**	**7**	**8**	**8**	**7**	**6**	**11**	**9**	**5**	**7**	**10**	**7**	**11**	**6**	**12**	**8**
Height (m)			**0.5**	**0.5**	**0.4**	**0.4**	**0.5**	**0.5**	**0.5**	**0.5**	**1.8**	**1.2**	**1.5**	**1**	**0.5**	**1.2**	**0.8**	**0.8**
Cover of native species*			**6**	**6**	**5**	**5**	**5**	**5**	**5**	**5**	**1**	**2**	**2**	**3**	**5**	**4**	**5**	**3**
Cover of exotic species*			**3**	**2**	**3**	**3**	**3**	**3**	**4**	**3**	**6**	**6**	**6**	**6**	**4**	**5**	**5**	**5**

***Cover score**

Class	***Percentage Cover***
1	<5% sparse
2	<5% common
3	5-25%
4	26-50%
5	51-75%
6	76-100%

Table D2 Photo Point Results for Year 3 Autumn and Year 4 Spring Monitoring

Site	*Year 3 Autumn*	*Year 4 Spring*
Q1		
Q2		
Q3		

Site	Year 3 Autumn	Year 4 Spring
Q4		
Q5		
Q6		

Site	Year 3 Autumn	Year 4 Spring
Q7		
Q8		

Appendix E

Road Kill Monitoring Results

Table E1 Road Kill Monitoring Survey Dates and Results for Year 4 Post Construction Monitoring

Season	*Date*	*Survey No.*	*Species*	*Carriageway*	*Fauna Fencing Present*	*Comment*	*Approx. Age of Carcass*	*Easting*	*Northing*
Winter	14/06/2018	1	Feral Cat	Southbound	No	Black cat	>4 weeks	523171	6763841
Winter	14/06/2018	1	Kookaburra	Southbound	No	-	1 week	522233	6762685
Winter	14/06/2018	1	Unidentifiable (possible glider)	Southbound	No	Unidentifiable, fur only. Potentially a small glider.	>4 weeks	521710	6762206
Winter	14/06/2018	1	Bandicoot	Southbound	No	Bandicoot. Only identifiable from rear foot.	>4 weeks	521477	6761931
Winter	14/06/2018	1	European Fox	Southbound	No	-	1 week	521305	6761679
Winter	19/06/2018	2	Nil	-	-	Nil roadkill detected	-	0	0
Winter	29/06/2018	3	Butcherbird	Northbound	No	Butcherbird	1 week	523747	6765000
Winter	5/07/2018	4	Nil	-	-	Nil roadkill detected	-	0	0
Winter	13/07/2018	Opportunistic	Barn Owl	Northbound	Yes	Barn Owl	2 weeks	524293	6765890
Spring	27/09/2018	1	Swamp Wallaby	Northbound	No	-	5-10 days	521515	6762115
Spring	4/10/2018	2	Nil	-	-	Nil roadkill detected	-	0	0
Spring	9/10/2018	3	Swamp Wallaby	Northbound	No	Male	5-7 days	521842	6762444
Spring	9/10/2018	3	Short-beaked Echidna	Northbound	No	-	5-7 days	522497	6762954
Spring	9/10/2018	3	Carpet Python	Northbound	No	-	5-10 days	523597	6764828
Spring	9/10/2018	3	Barn Owl	Northbound	Yes	-	5-10 days	524262	6765836
Spring	18/10/2018	4	Nil	-	-	Nil roadkill detected	-	0	0
Spring	21/10/2018	Opportunistic	Swamp Wallaby	Southbound	No	-	1 week	523927	6765150

Season	Date	Survey No.	Species	Carriageway	Fauna Fencing Present	Comment	Approx. Age of Carcass	Easting	Northing
Spring	11/11/2018	Opportunistic	Macropod	Southbound	No	Unidentifiable macropod. Temporary construction concrete barriers along road edge.	1 week	524596	6766398
Spring	11/11/2018	Opportunistic	Pied Currawong	Northbound	No	Pied Currawong	5 days	521461	6762015
Summer	10/12/2018	1	Short-beaked Echidna	Northbound	No	-	1 week	523774	6765047
Summer	18/12/2018	2	Nil	-	-	Nil roadkill detected	-	0	0
Summer	27/12/2018	3	Northern Brown Bandicoot	Northbound	No	-	4 days	523159	6763943
Summer	10/01/2019	4	Nil	-	-	Nil roadkill detected	-	0	0
Summer	16/01/2019	Opportunistic	Red-bellied Black Snake	Northbound	No	-	1 week	522022	6762610
Summer	16/01/2019	Opportunistic	Lace Monitor	Northbound	No	-	1 week	521865	6762466

Appendix F

Rufous Bettong/ Brush-tailed Phascogale Camera Trap Results

Table F1 **Rufous Bettong and Brush-tailed Phascogale Camera Trap Results**

	Impact Site 1 (west)				Impact Site 1 (east)				Impact Site 2 (west)				Impact Site 2 (east)				Impact Site 3 (west)			
Species	**W**	**Sp**	**Su**	**T**	**W**	**Sp**	**Su**	**T**	**W**	**Sp**	**Su**	**T**	**W**	**Sp**	**Su**	**T**	**W**	**Sp**	**Su**	**T**
Antechinus sp.	3	1	3	7	4	1	3	8	6	3	2	11	3		4	7	2	1	4	7
Australian Owlet-nightjar														1		1		1		1
Bandicoot sp.						1		1												
Bird sp.						1		1						1		1				
Black Rat					1			1						1		1				
Brown Hare																				
Brown Quail		1		1		1		1						3		3				
Brown Treecreeper																				
Brush Turkey		1		1		1	1	2						2		2		1		1
Brush-tailed Phascogale	3	1	3	7	2	1	1	4	4	1	3	8								
Bush Rat	8	18	6	32	7	11	6	24	8	11	4	23	11	10	8	29	12	14	7	33
Common Bronzewing																				
Common Brushtail Possum	3	7	4	14	5	4	1	10	12	11	3	26								
Common Dunnart	2			2					2		2	4								
Common Ringtail Possum	1	1		2																
Cow																				
Dingo / Wild Dog / Cat						1		1												
Dusky Antechinus														2		2				
Dusky Woodswallow																				
Eastern Grey Kangaroo														1		1	1		1	2
Eastern Water Dragon																				
Eastern Whipbird																				
Eastern Yellow Robin		2		2		9		9		3		3		2		2	1	2		3
Fawn-footed Melomys		1		1		1		1						1		1				
Feathertail Glider																				
Feral Cat														2		2				
Forest Kingfisher																				
Grey Fantail																				
Grey Shrike-thrush		2		2		1		1		2		2		2		2		1		1
House Mouse	1		1	2	1			1	2			2					1		1	2
King Quail		2		2		5		5												
Koala					1			1			1	1								
Lace Monitor			1	1			1	1												
Land Mullet																				
Laughing Kookaburra																				
Lewins Honeyeater										2		2								
Long-nosed Bandicoot	6	5	6	17	5	2	2	9	1	3	3	7	8	3	1	12	5		3	8
Long-nosed Potoroo															1	1				
Macropod sp.					1	1		2		2		2		2		2		1		1
Noisy Pitta					1			1												
Northern Brown Bandicoot	3	10	4	17	6	8	2	16	10	9	2	21	2		1	3	10	7	3	20
Painted Button Quail																		1		1
Petaurus sp.																				
Red-browed Finch		1		1																
Red-necked Pademelon		1	2	3		2	1	3		2	2	4								
Red-necked Wallaby					1			1					1			1	1			1
Robin sp.						1		1												
Rodent sp.						2		2		6		6		1		1	2	1		3
Rufous Fantail																				
Short-beaked Echidna		4		4		5		5	2	5	3	10		1	6	7	1			1
Short-eared Brushtail Possum	1	2		3	2		2	4									2	1	3	6
Squirrel Glider											1	1								
Stubble Quail	1			1																
Superb Blue Wren						2		2												
Swamp Rat																		6	1	7
Swamp Wallaby	6	4	4	14	3	8	4	15	6	10	6	22	5	12	10	27	4	5	1	10
Thornbill/Gerygone																		1		1
Variegated Fairy-wren																				
Water Rat																				
White-browed Scrubwren		2		2		7		7		1		1		4		4		2		2
White-cheeked Honeyeater										1		1						2		2
White-throated Nightjar	1		1	2													1			1
Willie Wagtail																				
Wonga Pigeon			1	1			2	2												
Yellow-faced Honeyeater		1		1																
Yellow-footed Antechinus	6	17	2	25	1	10	3	14	1	10		11	8	13	2	23	8	8	2	18
Possible Native Mouse										2		2	5			5	4	3		7
Grand Total	**45**	**84**	**38**	**167**	**41**	**86**	**29**	**156**	**54**	**84**	**32**	**170**	**43**	**64**	**33**	**140**	**55**	**58**	**26**	**139**
No. Species/Site	**14**	**21**	**13**	**27**	**15**	**24**	**13**	**32**	**11**	**18**	**12**	**22**	**8**	**19**	**8**	**24**	**15**	**18**	**10**	**24**

	Impact Site 3 (east)				Impact Site 4 (west)				Impact Site 4 (east)				Impact Site 5 (west)				Impact Site 5 (east)			
Species	**W**	**Sp**	**Su**	**T**	**W**	**Sp**	**Su**	**T**	**W**	**Sp**	**Su**	**T**	**W**	**Sp**	**Su**	**T**	**W**	**Sp**	**Su**	**T**
Antechinus sp.	4	3	6	13	5	3	1	9	2	3	1	6	5		3	8	2			2
Australian Owlet-nightjar		3		3																
Bandicoot sp.																		2		2
Bird sp.																		1		1
Black Rat		4		4							2	2								
Brown Hare																				
Brown Quail		1		1																
Brown Treecreeper																				
Brush Turkey		2		2		1		1		1		1								
Brush-tailed Phascogale														2		2			1	1
Bush Rat	10	12	9	31		2	2	4	4	10		14	4	8	5	17	14	1	2	17
Common Bronzewing																				
Common Brushtail Possum					6	9	4	19					2	3	1	6	3			3
Common Dunnart						3	3	6					1			1				
Common Ringtail Possum																	1			1
Cow															1	1				
Dingo / Wild Dog / Cat							2	2			2	2					6		2	8
Dusky Antechinus																				
Dusky Woodswallow		1		1																
Eastern Grey Kangaroo	1	1	3	5	3	4	3	10		4		4		1		1		12	5	17
Eastern Water Dragon																		8		8
Eastern Whipbird																				
Eastern Yellow Robin						1		1		1		1		5		5		1		1
Fawn-footed Melomys																				
Feathertail Glider	1			1																
Feral Cat	1	1		2																
Forest Kingfisher																				
Grey Fantail		1		1																
Grey Shrike-thrush		1		1		1		1												
House Mouse			1	1														4	1	5
King Quail										1		1								
Koala						1		1												
Lace Monitor														1		1		1		1
Land Mullet																				
Laughing Kookaburra																				
Lewins Honeyeater																				
Long-nosed Bandicoot	5		3	8	5	6	3	14	1	3	1	5	1	6	2	9	11	1	1	13
Long-nosed Potoroo					12	6	1	19		1		1								
Macropod sp.						3		3	1	1		2		1		1				
Noisy Pitta																				
Northern Brown Bandicoot	8	2	3	13	2	6	1	9	3	2	1	6	9	4	2	15		2	2	4
Painted Button Quail																				
Petaurus sp.																				
Red-browed Finch										1		1								
Red-necked Pademelon										1		1								
Red-necked Wallaby																	1	6	3	10
Robin sp.																				
Rodent sp.						2		2		1		1						1		1
Rufous Fantail																				
Short-beaked Echidna	2	2	3	7	1		1	2	2	3	2	7	1		2	3	3	2	2	7
Short-eared Brushtail Possum			1	1	1			1												
Squirrel Glider																				
Stubble Quail																				
Superb Blue Wren																				
Swamp Rat										4	1	5		1		1		1	2	3
Swamp Wallaby	4	3	4	11	9	14	6	29	4	8	5	17	6	11	7	24	2	1	1	4
Thornbill/Gerygone						1		1												
Variegated Fairy-wren																				
Water Rat																		1		1
White-browed Scrubwren														5		5				
White-cheeked Honeyeater						1		1												
White-throated Nightjar																				
Willie Wagtail																				
Wonga Pigeon																				
Yellow-faced Honeyeater																				
Yellow-footed Antechinus	1	13	5	19	3	3		6	1	11	2	14	3	10		13				
Possible Native Mouse																				
Grand Total	**37**	**50**	**38**	**125**	**47**	**67**	**27**	**141**	**18**	**56**	**17**	**91**	**32**	**58**	**23**	**113**	**43**	**45**	**22**	**110**
No. Species/Site	**10**	**15**	**10**	**19**	**10**	**18**	**11**	**21**	**8**	**17**	**9**	**19**	**9**	**13**	**8**	**17**	**9**	**16**	**11**	**21**

	Control Site 1				Control Site 2				Control Site 3				Control Site 4				Control Site 5				Grand Total	Total No. Sites
Species	**W**	**Sp**	**Su**	**T**	**W**	**Sp**	**Su**	**T**	**W**	**Sp**	**Su**	**T**	**W**	**Sp**	**Su**	**T**	**W**	**Sp**	**Su**	**T**		
Antechinus sp.	6	1	5	12	9	1	3	13	6	2	1	9	4	7	3	14	8	6	4	18	**144**	**15**
Australian Owlet-nightjar																					**5**	**3**
Bandicoot sp.		1		1	1			1						1		1		2		2	**8**	**6**
Bird sp.						1		1		1		1									**5**	**5**
Black Rat	1		1	2		1		1					1			1			1	1	**13**	**8**
Brown Hare					1			1													**1**	**1**
Brown Quail																					**6**	**4**
Brown Treecreeper		3		3																	**3**	**1**
Brush Turkey						2		2						1		1	2	1		3	**16**	**10**
Brush-tailed Phascogale													2			2		1		1	**25**	**7**
Bush Rat	8	4	7	19	9	12	8	29		8	1	9	10	13	10	33	13	14	7	34	**348**	**15**
Common Bronzewing										1		1									**1**	**1**
Common Brushtail Possum	2	5	2	9											3	3		1	1	2	**92**	**9**
Common Dunnart																					**13**	**4**
Common Ringtail Possum										1		1									**4**	**3**
Cow																					**1**	**1**
Dingo / Wild Dog / Cat					1	1		2	1			1					1			1	**17**	**7**
Dusky Antechinus																					**2**	**1**
Dusky Woodswallow																					**1**	**1**
Eastern Grey Kangaroo	1	1		2					1	4	2	7									**49**	**9**
Eastern Water Dragon																					**8**	**1**
Eastern Whipbird														1		1					**1**	**1**
Eastern Yellow Robin					1	3		4		1		1									**32**	**11**
Fawn-footed Melomys										1		1		1		1					**5**	**5**
Feathertail Glider																					**1**	**1**
Feral Cat		3		3																	**7**	**3**
Forest Kingfisher		1		1																	**1**	**1**
Grey Fantail																					**1**	**1**
Grey Shrike-thrush		2	1	3		2		2		1		1									**16**	**10**
House Mouse	1		1	2									2		1	3					**18**	**8**
King Quail																		1		1	**9**	**4**
Koala		1	1	2																	**5**	**4**
Lace Monitor											2	2							1	1	**7**	**6**
Land Mullet										1		1									**1**	**1**
Laughing Kookaburra																		1		1	**1**	**1**
Lewins Honeyeater																					**2**	**1**
Long-nosed Bandicoot	5	2	4	11	4	4	1	9	1	2		3	1	1	1	3	6	6	8	20	**148**	**15**
Long-nosed Potoroo					3			3	1	1	1	3	1			1					**28**	**6**
Macropod sp.	1			1		1		1													**15**	**9**
Noisy Pitta																					**1**	**1**
Northern Brown Bandicoot	3	2		5	5	9	7	21	4	4	2	10	4	2	6	12	5	2		7	**179**	**15**
Painted Button Quail		2		2																	**3**	**2**
Petaurus sp.						1		1													**1**	**1**
Red-browed Finch		1		1																	**3**	**3**
Red-necked Pademelon	1	1	1	3	2	4	1	7					4	5	5	14	5	3	3	11	**46**	**8**
Red-necked Wallaby		1		1														1		1	**15**	**6**
Robin sp.																					**1**	**1**
Rodent sp.		1		1		3		3		1		1						4		4	**25**	**11**
Rufous Fantail						1		1													**1**	**1**
Short-beaked Echidna	4	2	2	8		3	2	5		8	4	12	1	2	1	4		3	1	4	**86**	**15**
Short-eared Brushtail Possum																	5		5	10	**25**	**6**
Squirrel Glider																					**1**	**1**
Stubble Quail																					**1**	**1**
Superb Blue Wren										3		3									**5**	**2**
Swamp Rat		1		1																	**17**	**5**
Swamp Wallaby	4	6	2	12	8	7	2	17	5	1	4	10	3	1	4	8	1	1		2	**222**	**15**
Thornbill/Gerygone																					**2**	**2**
Variegated Fairy-wren						1		1													**1**	**1**
Water Rat																					**1**	**1**
White-browed Scrubwren														1		1					**22**	**7**
White-cheeked Honeyeater																					**4**	**3**
White-throated Nightjar	2			2	1		1	2	1			1									**8**	**5**
Willie Wagtail		5		5						2		2									**7**	**2**
Wonga Pigeon														1	1	2					**5**	**3**
Yellow-faced Honeyeater																					**1**	**1**
Yellow-footed Antechinus	5	5		10	1	20	7	28		17		17	4	4		8	5	14	3	22	**228**	**14**
Possible Native Mouse					1			1													**15**	**4**
Grand Total	**44**	**51**	**27**	**122**	**47**	**77**	**32**	**156**	**20**	**60**	**17**	**97**	**37**	**41**	**35**	**113**	**51**	**61**	**34**	**146**	**1986**	-
No. Species/Site	**14**	**22**	**11**	**26**	**14**	**19**	**9**	**24**	**8**	**19**	**8**	**22**	**12**	**14**	**10**	**19**	**10**	**16**	**10**	**20**	**67**	-
																				Mean	**29.6**	**5.0**
																				SD	**63.47**	**4.49**

W = Winter
Sp = Spring
Su = Summer
T = Total

Appendix G

Spotlighting and Call Playback Results

Table G2 Spotlighting and Call Playback Results

Site	Date	Season	No. Animals	Sex	Age Class	No. of Dependant young	Species	Behaviour	Comments	Easting	Northing
Onsite Survey Records											
Impact Site 1 (west)	12/06/2018	Winter	1	Unknown	Adult	0	Greater Glider	-	-	521180	6761624
Impact Site 1 (west)	19/06/2018	Winter	1	Unknown	Unknown	0	Southern Boobook Owl	-	-	521186	6761616
Impact Site 1 (west)	1/11/2018	Spring	1	Unknown	Unknown	0	Feathertail Glider	Sitting in Narrow-leaved Red Gum	-	521131	6761482
Impact Site 1 (west)	1/11/2018	Spring	1	Unknown	Unknown	0	Bandicoot sp.	Calling	-	521137	6761541
Impact Site 1 (west)	1/11/2018	Spring	1	Unknown	Adult	0	Greater Glider	Sitting in Grey Ironbark 10cm dbh, 12m high in tree	-	521210	6761622
Impact Site 1 (west)	10/01/2019	Summer	1	Unknown	Adult	0	Yellow-bellied Glider	Calling without call playback stimulus	-	521231	6761754
Impact Site 1 (east)	6/12/2018	Summer	1	Unknown	Adult	0	Squirrel Glider	In canopy of Grey Ironbark; on limb.	-	520969	6760973
Impact Site 1 (east)	10/01/2019	Summer	1	Unknown	Adult	0	Brushtail Possum	Sitting in canopy of A. woodsiana	-	520876	6760812
Impact Site 1 (east)	10/01/2019	Summer	1	Unknown	Adult	0	Brushtail Possum	Sitting in canopy of Swamp Box	-	521058	6761257
Impact Site 2 (west)	12/06/2018	Winter	2	Unknown	Adult	0	Yellow-bellied Glider	Feeding on sap of Spotted Gum	-	521336	6761970
Impact Site 2 (west)	12/06/2018	Winter	1	Unknown	Adult	0	Masked Owl	-	Pale morph	521392	6762054
Impact Site 2 (west)	12/06/2018	Winter	2	Unknown	Adult	0	Sugar Glider	Calling	-	521392	6762054
Impact Site 2 (west)	9/07/2018	Winter	1	Unknown	Unknown	0	Yellow-bellied Glider	Calling in response to call playback.	-	521484	6762269
Impact Site 2 (west)	1/11/2018	Spring	1	Unknown	Adult	0	Greater Glider	Sitting in Pink Bloodwood	-	521399	6762080
Impact Site 2 (west)	1/11/2018	Spring	1	Unknown	Adult	0	Feathertail Glider	Foraging	-	521462	6762166
Impact Site 2 (west)	6/12/2018	Summer	1	Unknown	Adult	0	Short-beaked Echidna	Foraging in sandy mound on ground	Unable to discern if any young were present.	521568	6762319
Impact Site 2 (west)	10/01/2019	Summer	2	Female	Adult	0	Greater Glider	One glider sitting in Broad-leaved Spotted Gum. The other moving to the first glider, gliding 3 m from canopy of the adjacent tree then moving through canopy. Likely female and dependant subadult	-	521163	6761572
Impact Site 2 (median)	13/06/2018	Winter	1	Unknown	Unknown	0	Feathertail Glider	Exited nestbox	-	521748	6762301
Impact Site 2 (median)	13/06/2018	Winter	1	Unknown	Unknown	0	Greater Glider	Perched 20 m high in Broad-leaved Paperbark	-	521786	6762354
Impact Site 2 (median)	21/06/2018	Winter	1	Unknown	Unknown	0	Greater Glider	Perched approximately 20 m up in the foliage of a Blackbutt	Black morph	522001	6762541
Impact Site 2 (median)	9/10/2018	Spring	1	Unknown	Adult	0	Squirrel Glider	Foraging	-	521488	6761994
Impact Site 2 (median)	9/10/2018	Spring	1	Unknown	Adult	0	Greater Glider	In Broad-leaved Paperbark	-	521771	6762347
Impact Site 2 (median)	9/10/2018	Spring	1	Unknown	Adult	0	Feathertail Glider	Actively foraging	-	521870	6762412
Impact Site 2 (median)	30/10/2018	Spring	1	Unknown	Unknown	0	Greater Glider	Sitting high in Bloodwood	-	521991	6762507
Impact Site 2 (median)	30/10/2018	Spring	1	Unknown	Unknown	0	Greater Glider	Sitting high in Blackbutt	-	522041	6762562
Impact Site 2 (median)	30/10/2018	Spring	2	Unknown	Unknown	0	Sugar Glider	-	-	521923	6762494
Impact Site 2 (median)	6/12/2018	Summer	1	Female	Adult	0	Squirrel Glider	Gum foraging in acacia; open cutting observed	-	521713	6762323
Impact Site 2 (median)	10/12/2018	Summer	2	Unknown	Adult	0	Greater Glider	In Blackbutt canopy	Likely adult pair.	521897	6762669
Impact Site 2 (median)	10/12/2018	Summer	1	Unknown	Adult	1	Sugar Glider	Actively foraging for invertebrates	-	521969	6762504
Impact Site 2 (median)	10/12/2018	Summer	1	Male	Adult	0	Sugar Glider	Foraging	-	522173	6762657
Impact Site 2 (east)	13/06/2018	Winter	1	Unknown	Unknown	0	Greater Glider	Perched approx 15 m high in Spotted Gum	Grey morph	521710	6762109
Impact Site 2 (east)	27/09/2018	Spring	1	Unknown	Unknown	0	Greater Glider	Sitting in White Mahogany approx. 18m off the ground.	-	521676	6762076

Site	Date	Season	No. Animals	Sex	Age Class	No. of Dependant young	Species	Behaviour	Comments	Easting	Northing
Impact Site 2 (east)	9/10/2018	Spring	1	Unknown	Unknown	0	Squirrel Glider	Foraging in flowering Blackbutt	Probable identification. In top of canopy.	521758	6761955
Impact Site 2 (east)	9/10/2018	Spring	2	Unknown	Adult	0	Feathertail Glider	Foraging in flowering Grey Ironbark	-	521495	6761922
Impact Site 2 (east)	30/10/2018	Spring	1	Unknown	Unknown	0	Yellow-bellied Glider	Calling unprompted	-	521819	6762014
Impact Site 2 (east)	4/12/2018	Summer	1	Unknown	Unknown	0	Greater Glider	Sitting high in a Blackbutt	-	521738	6762131
Impact Site 2 (east)	24/01/2019	Summer	1	Unknown	Adult	0	Greater Glider	In stag	-	521671	6762068
Impact Site 2 (east)	4/02/2019	Summer	1	Unknown	Unknown	0	Squirrel Glider	Foraging in flowering Blackbutt	-	521574	6761959
Impact Site 2 (east)	4/02/2019	Summer	2	Unknown	Unknown	0	Feathertail Glider	Foraging in flowering Blackbutt	-	521579	6761948
Impact Site 2 (east)	4/02/2019	Summer	1	Unknown	Unknown	0	Macropod sp.	Macropod moving	Heard macropod moving through vegetation. Not observed	521569	6761993
Impact Site 2 (east)	4/02/2019	Summer	1	Male	Unknown	0	Sugar Glider	Perched in Acacia grooming	-	521743	6762145
Impact Site 3 (west)	12/06/2018	Winter	1	Unknown	Unknown	0	Greater Glider	Perched approx 15 m high in Spotted Gum	Grey morph	522936	6763926
Impact Site 3 (west)	1/11/2018	Spring	1	Unknown	Unknown	0	Squirrel Glider	In foliage of Acacia	-	522795	6763800
Impact Site 3 (west)	1/11/2018	Spring	1	Unknown	Unknown	0	Yellow-bellied Glider	Responded to call playback	-	522997	6763866
Impact Site 3 (west)	1/11/2018	Spring	1	Unknown	Unknown	0	Sugar Glider	In Acacia	-	522685	6763709
Impact Site 3 (west)	26/11/2018	Spring	1	Unknown	Unknown	0	Yellow-bellied Glider	Call playback response	-	523005	6763885
Impact Site 3 (west)	26/11/2018	Spring	1	Unknown	Unknown	0	Yellow-bellied Glider	Call playback response	-	522978	6763942
Impact Site 3 (west)	26/11/2018	Spring	1	Unknown	Adult	0	Feathertail Glider	Gliding/ foraging	-	522846	6763823
Impact Site 3 (west)	26/11/2018	Spring	1	Unknown	Adult	0	Southern Boobook Owl	Calling	-	523150	6764063
Impact Site 3 (west)	4/12/2018	Summer	1	Unknown	Adult	0	Greater Glider	Sitting	-	522971	6763935
Impact Site 3 (west)	4/12/2018	Summer	2	Unknown	Adult	0	Yellow-bellied Glider	Call playback response	-	522975	6763952
Impact Site 3 (west)	11/12/2018	Summer	1	Male	Unknown	0	Yellow-bellied Glider	Responding to call playback	-	523058	6764025
Impact Site 3 (west)	11/12/2018	Summer	1	Unknown	Adult	0	Greater Glider	Very high up on limb	-	523042	6764017
Impact Site 3 (west)	11/12/2018	Summer	1	Unknown	Adult	0	Sugar Glider	On limb	-	522962	6763921
Impact Site 3 (west)	15/01/2019	Summer	1	Unknown	Adult	0	Greater Glider	Resting in branch of Spotted Gum.	-	522963	6763916
Impact Site 3 (west)	4/02/2019	Summer	1	Unknown	Adult	0	Brushtail Possum	Sitting on tree branch	-	524044	6766202
Impact Site 3 (east)	27/09/2018	Spring	1	Unknown	Unknown	0	Yellow-bellied Glider	Call playback response	-	522851	6763188
Impact Site 3 (east)	24/01/2019	Summer	1	Unknown	Unknown	0	Feathertail Glider	Foraging in flowering Blackbutt	-	522690	6763040
Impact Site 4 (median)	30/10/2018	Spring	1	Unknown	Unknown	0	Sugar Glider	Chewing	-	523414	6764353
Impact Site 4 (median)	1/11/2018	Spring	1	Male	Adult	0	Squirrel Glider	-	-	523584	6764611
Impact Site 4 (median)	6/12/2018	Summer	1	Unknown	Unknown	0	Feathertail Glider	Foraging in flowering stringybark	-	523801	6764993
Impact Site 4 (median)	11/12/2018	Summer	1	Unknown	Unknown	0	Feathertail Glider	Foraging in a Bloodwood	-	523695	6764809
Impact Site 4 (median)	11/12/2018	Summer	1	Unknown	Unknown	0	Feathertail Glider	Foraging in flowering Tallowwood	-	523806	6764982
Impact Site 4 (median)	15/01/2019	Summer	1	Unknown	Unknown	0	Tawny Frogmouth	Roosting	-	523384	6764326
Impact Site 4 (east)	14/06/2018	Winter	1	Unknown	Unknown	0	Tawny Frogmouth	-	-	523873	6764320
Impact Site 4 (east)	21/06/2018	Winter	1	Unknown	Unknown	0	Greater Glider	Foraging on leaves	-	523655	6764318
Impact Site 4 (east)	9/07/2018	Winter	2	Unknown	Unknown	0	Greater Glider	Foraging	-	523574	6764357
Impact Site 4 (east)	9/07/2018	Winter	1	Unknown	Unknown	0	Greater Glider	Foraging	-	523670	6764316
Impact Site 4 (east)	30/10/2018	Spring	1	Unknown	Adult	0	Greater Glider	Foraging	-	523839	6764330
Impact Site 4 (east)	30/10/2018	Spring	1	Unknown	Adult	0	Sugar Glider	-	-	523640	6764337
Impact Site 4 (east)	1/11/2018	Spring	2	Unknown	Adult	0	Sugar Glider	Calling	-	523784	6764352
Impact Site 4 (east)	11/12/2018	Summer	1	Unknown	Unknown	0	Sugar Glider	Foraging in a White Mahogany	-	524038	6764325
Impact Site 5 (west)	21/06/2018	Winter	1	Unknown	Unknown	0	Brushtail Possum	Perched 15 m high in Red Gum	-	524162	6766170
Impact Site 5 (west)	9/07/2018	Winter	1	Unknown	Unknown	0	Brushtail Possum	Perched in Broad-leaved Paperbark	-	524354	6766171

Site	Date	Season	No. Animals	Sex	Age Class	No. of Dependant young	Species	Behaviour	Comments	Easting	Northing
Impact Site 5 (west)	22/11/2018	Spring	1	Unknown	Adult	0	Feathertail Glider	Feeding in flowering Narrow-leaved Red Gum	-	524150	6766165
Impact Site 5 (east)	14/06/2018	Winter	1	Unknown	Unknown	0	Sugar Glider	Foraging	-	524642	6766259
Impact Site 5 (east)	21/06/2018	Winter	1	Male	Adult	0	Sugar Glider	-	-	524610	6766281
Impact Site 5 (east)	9/07/2018	Winter	1	Unknown	Unknown	0	Sugar Glider	Calling	-	524860	6766163
Impact Site 5 (east)	9/07/2018	Winter	2	Unknown	Unknown	0	Sugar Glider	Foraging	-	524884	6766119
Impact Site 5 (east)	1/11/2018	Spring	1	Unknown	Unknown	0	Short-eared Brushtail Possum	Sitting in tree	-	524631	6766279
Impact Site 5 (east)	22/11/2018	Spring	2	Unknown	Adult	0	Feral Cat	In dumped car (nissan) off the track	-	524814	6766293
Impact Site 5 (east)	11/12/2018	Summer	1	Unknown	Adult	0	Squirrel Glider	On trunk of tree	-	524589	6766277
Impact Site 5 (east)	24/01/2019	Summer	1	Unknown	Adult	0	Feathertail Glider	Gliding	-	524915	6766093
Impact Site 5 (east)	4/02/2019	Summer	1	Unknown	Unknown	0	Greater Glider	Sitting 8m up in small Red Gum	-	524806	6766272
Impact Site 6 (west)	4/10/2018	Spring	1	Unknown	Unknown	0	Sugar Glider	Perched high in tree	-	524524	6766460
Impact Site 6 (west)	11/12/2018	Summer	2	Unknown	Adult	0	Squirrel Glider	Foraging in flowering e. Tindaliae	-	524564	6766545
Control site 1	13/06/2018	Winter	1	Unknown	Unknown	0	Greater Glider	Perched approx 18 m high in Spotted Gum	-	522704	6762046
Control site 1	11/07/2018	Winter	1	Unknown	Unknown	0	Yellow-bellied Glider	Calling without call playback stimulus	-	522591	6761944
Control site 1	11/07/2018	Winter	1	Unknown	Unknown	0	Greater Glider	Perched approximately 10 m up in tree	-	522844	6762045
Control site 1	9/10/2018	Spring	2	Unknown	Adult	0	Feathertail Glider	Foraging in flowering Grey Ironbark	-	522548	6762003
Control site 1	9/10/2018	Spring	1	Unknown	Adult	0	Sugar Glider	Gliding to north	-	522361	6762010
Control site 1	4/12/2018	Summer	1	Unknown	Unknown	0	Greater Glider	Sitting high in Spotted Gum	-	522660	6762056
Control site 1	4/12/2018	Summer	1	Unknown	Unknown	0	Greater Glider	Sitting high in Spotted Gum	-	522353	6762005
Control site 1	24/01/2019	Summer	1	Unknown	Adult	0	Brushtail Possum	-	-	522778	6762091
Control site 1	24/01/2019	Summer	1	Unknown	Adult	0	Sugar Glider	-	-	522727	6762070
Control site 1	24/01/2019	Summer	1	Unknown	Unknown	0	Yellow-bellied Glider	Heard calling east 100 m	-	522531	6761968
Control site 1	4/02/2019	Summer	1	Unknown	Adult	0	Greater Glider	In Spotted Gum canopy	-	522460	6761957
Control site 1	4/02/2019	Summer	1	Unknown	Adult	0	Squirrel Glider	Foraging in flowering Blackbutt	-	522350	6762043
Control site 1	4/02/2019	Summer	1	Unknown	Adult	0	Feathertail Glider	Foraging in flowering Blackbutt	-	522347	6761993
Control site 2	27/09/2018	Spring	1	Unknown	Adult	0	Antechinus or Melonys	Foraging in Blackbutt	-	523583	6762841
Control site 2	4/12/2018	Summer	1	Unknown	Unknown	0	Feathertail Glider	Foraging in flowering e. tindaliae	-	523545	6762842
Control site 2	24/01/2019	Summer	1	Unknown	Unknown	0	Squirrel Glider	Foraging in flowering Blackbutt	-	523773	6762885
Control site 2	24/01/2019	Summer	1	Unknown	Unknown	0	Feathertail Glider	Foraging in flowering Blackbutt	-	523373	6762795
Control site 2	4/02/2019	Summer	1	Unknown	Unknown	0	Greater Glider	Looking out from inside a trunk hollow	-	523388	6762790
Control site 3	9/07/2018	Winter	1	Unknown	Unknown	0	Short-beaked Echidna	-	-	524366	6764040
Control site 3	4/10/2018	Spring	1	Unknown	Adult	0	Squirrel Glider	Foraging in Blackbutt	-	524181	6764238
Control site 3	1/11/2018	Spring	1	Unknown	Sub-adult	0	Squirrel Glider	Foraging	-	524346	6764055
Control site 4	19/06/2018	Winter	2	Unknown	Unknown	0	Yellow-bellied Glider	Territorial calling response to call playback	-	521099	6763175
Control site 4	9/07/2018	Winter	1	Unknown	Unknown	0	Yellow-bellied Glider	Calling in response to call playback.	-	521184	6763056
Control site 4	4/10/2018	Spring	1	Unknown	Unknown	0	Greater Glider	Sitting high in a tree distant from the track.	-	521097	6763072
Control site 4	26/11/2018	Spring	1	Unknown	Adult	0	Yellow-bellied Glider	Occasional territorial call without call playback stimulioucalling	-	521104	6763071
Control site 4	6/12/2018	Summer	1	Unknown	Unknown	0	White throated nightjar	Calling	White throated nightjar	521047	6763149
Control site 4	6/12/2018	Summer	2	Unknown	Adult	0	Yellow-bellied Glider	Calling	Call and visual identification. Moving through forest. Likely call playback response/ investigation	521107	6763200
Control site 4	10/01/2019	Summer	1	Unknown	Unknown	0	Yellow-bellied Glider	Calling unprompted to the west	-	521029	6763030
Control site 4	15/01/2019	Summer	1	Unknown	Adult	0	Greater Glider	Resting in fork of Spotted Gum	-	521098	6763066
Control site 5	13/06/2018	Winter	2	Unknown	Unknown	0	Yellow-bellied Glider	Territorial call	-	521042	6763411
Control site 5	9/07/2018	Winter	1	Unknown	Unknown	0	Yellow-bellied Glider	Calling	Heard call without call playback	521001	6763510
Control site 5	9/07/2018	Winter	1	Male	Adult	0	Sugar Glider	Actively crawling up young Grey Ironbark; foraging	Detected on movement	521027	6763746

Site	Date	Season	No. Animals	Sex	Age Class	No. of Dependant young	Species	Behaviour	Comments	Easting	Northing
Control site 5	9/07/2018	Winter	2	Male	Adult	0	Squirrel Glider	Foraging	In flowering Grey Ironbark. One glider entered nest box c5-2. Sex only confirmed of one glider.	521024	6763545
Control site 5	9/07/2018	Winter	1	Unknown	Unknown	0	Squirrel Glider	Foraging	-	521044	6763571
Control site 5	6/12/2018	Summer	1	Unknown	Unknown	0	Feathertail Glider	Foraging in flowering Narrow-leaved Red Gum	-	521010	6763695
Control site 5	6/12/2018	Summer	1	Unknown	Adult	0	Brushtail Possum	Perched in flowering Narrow-leaved Red Gum	-	521005	6763835
Control site 5	10/01/2019	Summer	1	Unknown	Unknown	0	Sugar Glider	Moving in canopy of red gum	-	521037	6763506
Control site 5	10/01/2019	Summer	1	Unknown	Unknown	0	Bandicoot sp.	Calling	-	521053	6763594
Control site 5	15/01/2019	Summer	2	Unknown	Unknown	0	Feathertail Glider	Gliding in canopy - running up trunk	-	521043	6763511
Control site 6	27/09/2018	Spring	1	Unknown	Adult	0	Feathertail Glider	Foraging	In flowering Grey Ironbark	521993	6764859
Control site 6	30/10/2018	Spring	1	Unknown	Unknown	0	Bandicoot sp.	Call identification	-	522200	6764845
Control site 6	1/11/2018	Spring	1	Unknown	Unknown	0	Greater Glider	Sitting high in Grey Ironbark	-	522065	6764840
Control site 1	27/ 09/ 2018	Spring	2	Unknown	Unknown	0	Squirrel Glider	Foraging in flowering Grey Ironbark	-	521910	6761973
Control site 1	27/ 09/ 2018	Spring	1	Unknown	Unknown	0	Yellow-bellied Glider	Heard calling to the south of the track.	-	522017	6761926
Control site 1	9/ 10/ 2018	Spring	1	Unknown	Adult	0	Greater Glider	Roosting in stringybark	-	522066	6761999
Control site 1	9/ 10/ 2018	Spring	1	Unknown	Adult	0	Greater Glider	Resting in Spotted Gum	-	521960	6761987
Control site 1	9/ 10/ 2018	Spring	1	Male	Adult	0	Squirrel Glider	Moving through trees. Initially 1 m from Greater Glider	-	521978	6761995
Control site 1	30/ 10/ 2018	Spring	1	Unknown	Unknown	0	Bandicoot sp.	Heard calling	-	522102	6762021
Control site 1	4/ 12/ 2018	Summer	1	Unknown	Unknown	0	Greater Glider	-	Sitting high in tree	522027	6762020
Control site 1	4/ 12/ 2018	Summer	2	Unknown	Unknown	0	Yellow-bellied Glider	Calling unprompted	-	522027	6762018
Control site 1	4/ 02/ 2019	Summer	1	Unknown	Adult	0	Greater Glider	Sitting in canopy of Spotted Gum	-	522179	6762058
Control site 1	4/ 02/ 2019	Summer	1	Unknown	Adult	0	Greater Glider	Perched	-	522082	6762052
Control site 2	25/ 06/ 2018	Winter	3	Unknown	Unknown	0	Glossy Black Cockatoo	-	Glossy Black Cockatoos feeding when collecting cameras	523104	6762753
Control site 5	21/ 12/ 2018	Summer	1	Unknown	Unknown	0	Stephens' Banded Snake	-	50cm long. traversing fire trail. Opportunistic recording during frog surveys.	521028	6763595
Impact Site 2 (median)	10/ 12/ 2018	Summer	1	Unknown	Unknown	0	Sugar Glider	Leaving den tree (Blackbutt)	Western side of highway not in median.	521900	6762519
Impact Site 2 (median)	10/ 12/ 2018	Summer	2	Unknown	Adult	0	Yellow-bellied Glider	Leaving den tree at 8.26pm. Calling between family	West of highway. Not in median. Possibly more. Moved to south-west.	522038	6762638
Impact Site 2 (west)	9/ 07/ 2018	Winter	1	Unknown	Adult	0	Greater Glider	Sitting in Grey Ironbark	-	521464	6762150
Impact Site 2 (west)	10/ 12/ 2018	Summer	2	Unknown	Unknown	0	Barking Owl	-	Calling. Likely pair.	521578	6762374
Impact Site 3 (east)	11/ 07/ 2018	Winter	1	Unknown	Unknown	0	Squirrel Glider	-	-	522652	6762641
Impact Site 4 (east)	12/ 07/ 2018	Winter	3	Unknown	Unknown	0	Brown Treecreeper	Foraging	Family group of 3 x Brown Treecreepers foraging in blackbutt. Diurnal observation at 9am	523817	6764338
Impact Site 4 (median)	28/ 01/ 2019	Summer	1	Female	Adult	0	Squirrel Glider	-	On western side of highway	523710	6764965
Impact Site 4 (median)	28/ 01/ 2019	Summer	1	Unknown	Unknown	0	Feathertail Glider	Foraging then denning in hollow-bearing tree	On western side of highway.	523696	6764972

Table F1 **Spotlighting and Call Playback Results for Year 3 Post Construction Monitoring - Impact Sites**

	Impact Site 1 (west)				Impact Site 1 (east)				Impact Site 2 (west)				Impact Site 2 (median)				Impact Site 2 (east)				Impact Site 3 (west)				Impact Site 3 (east)				Impact Site 4 (median)				Impact Site 4 (east)				Impact Site 5 (west)				Impact Site 5 (east)				Impact Site 6 (west)			
Species	**W**	**Sp**	**Su**	**T**	**W**	**Sp**	**Su**	**T**	**W**	**Sp**	**Su**	**T**	**W**	**Sp**	**Su**	**T**	**W**	**Sp**	**Su**	**T**	**W**	**Sp**	**Su**	**T**	**W**	**Sp**	**Su**	**T**	**W**	**Sp**	**Su**	**T**	**W**	**Sp**	**Su**	**T**	**W**	**Sp**	**Su**	**T**	**W**	**Sp**	**Su**	**T**	**W**	**Sp**	**Su**	**T**
Antechinus or Melonys																																															
Bandicoot sp.		1		1																																											
Brushtail Possum							2	2															1	1											2			2										
Feathertail Glider		1		1						1		1	1	1		2		2	2	4		1		1			1	1			3	3						1		1				1	1				
Feral Cat																																									2		2						
Greater Glider	1	1		2						1	2	3	2	3	2	7	1	1	2	4	1		3	4								4	1		5							1	1				
Macropod sp.																			1	1																												
Masked Owl									1			1																																				
Short-beaked Echidna											1	1																																			
Short-eared Brushtail Possum																																									1		1						
Southern Boobook Owl	1			1																		1		1																								
Squirrel Glider							1	1						1	1	2		1	1	2		1		1						1		1										1	1			2	2
Sugar Glider									2			2		2	2	4			1	1		1	1	2						1		1		3	1	4					5			5		1		1
Tawny Frogmouth																															1	1	1			1											
White throated nightjar																																															
Yellow-bellied Glider			1	1					3			3						1		1		3	3	6		1		1																		
Grand Total	**2**	**3**	**1**	**6**			**3**	**3**	**6**	**2**	**3**	**11**	**3**	**7**	**5**	**15**	**1**	**5**	**7**	**13**	**1**	**7**	**8**	**16**		**1**	**1**	**2**		**2**	**4**	**6**	**5**	**4**	**1**	**10**	**2**	**1**		**3**	**5**	**3**	**3**	**11**		**1**	**2**	**3**
No. species/site	**2**	**3**	**1**	**5**	**0**	**0**	**2**	**2**	**3**	**2**	**2**	**6**	**2**	**4**	**3**	**4**	**1**	**4**	**5**	**6**	**1**	**5**	**4**	**7**	**0**	**1**	**1**	**2**	**0**	**2**	**2**	**4**	**2**	**2**	**1**	**3**	**1**	**1**	**0**	**2**	**1**	**2**	**3**	**6**	**0**	**1**	**1**	**2**

W = Winter
Sp = Spring
Su = Summer
T = Total

Table F1 **Spotlighting and Call Playback Results for Year 3 Post Construction Monitoring - Control Sites and Combined Impact and Control Sites Total**

Control site 1				Control site 2				Control site 3				Control site 4				Control site 5				Control site 6				Grand Total	No. of sites/ species
W	Sp	Su	T	W	Sp	Su	T	W	Sp	Su	T	W	Sp	Su	T	W	Sp	Su	T	W	Sp	Su	T		
					1		1																	**1**	1
																		1	1		1		1	**3**	3
		1	1															1	1					**7**	5
	2	1	3			2	2											3	3		1		1	**24**	13
																								2	1
2		3	5			1	1						1	1	2						1		1	**35**	11
																								1	1
																								1	1
								1			1													**2**	2
																								1	1
																								2	2
		1	1			1	1		2		2					3			3					**17**	11
	1	1	2													1		1	2					**24**	10
																								2	2
														1	1									**1**	1
1		1	2									3	1	3	7	3			3					**24**	8
3	**3**	**8**	**14**		**1**	**4**	**5**	**1**	**2**		**3**	**3**	**2**	**5**	**10**	**7**		**6**	**13**		**3**		**3**	**147**	
2	**2**	**6**	**6**	**0**	**1**	**3**	**4**	**1**	**1**	**0**	**2**	**1**	**2**	**3**	**3**	**3**	**0**	**4**	**6**	**0**	**3**	**0**	**3**		
																							Mean	**9.2**	**4.6**
																							SD	**11.46**	**4.43**

Appendix H

Threatened Frog Survey Results

Table H1 **Threatened Frog Survey Results**

											Other species (present = 1)																					
Site	*Survey*	*No. of Green-thighed Frog*	*No. of Wallum Froglet*	*Sex*	*Age Class*	*Breeding Condition*	*Length (cm)*	*Behaviour*	*Recording Type*	*Adelotus brevis*	*Crinia parinsignifera*	*Crinia signifera*	*Limnodynastes peronii*	*Litoria caerulea*	*Litoria chloris*	*Litoria dentata*	*Litoria fallax*	*Litoria gracilenta*	*Litoria nasuta*	*Litoria peronii*	*Litoria revelata*	*Litoria tyleri*	*Mixophyes fasciolatus*	*Pseudophryne coriacea*	*Rhinella marina*	*Uperoleia fusca*	*Total no. of species per survey event*	*Easting*	*Northing*
Impact Site 2 (west)	Year 4 Spring Survey 1	-	-	-	-	-		-	-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	1	**4**	521601	6762338
Impact Site 2 (west)	Year 4 Spring Survey 2	-	-	-	-	-		-	-	-	1	1	1	-	-	-	1	-	1	1	-	-	-	1	-	-	**7**	521657	6762318
Impact Site 2 (west)	Year 4 Summer Survey 1	-	-	-	-	-		-	-	-	1	1	1	-	-	-	-	-	-	1	-	-	-	1	-	-	**5**	521654	6762317
Impact Site 2 (west)	Year 4 Summer Survey 2	-	-	-	-	-		-	-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	1	**4**	521662	6762330
Impact Site 2 (west)	Year 4 Summer Survey 3	-	-	-	-	-		-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	1	1	-	1	**5**	521541	6762279
Impact Site 2 (west) Total		**-**	**-**							**-**	**1**	**1**	**1**	**-**	**1**	**-**	**1**	**-**	**1**	**1**	**-**	**-**	**1**	**1**	**-**	**1**	**10**		
Impact Site 2 (east)	Year 4 Spring Survey 1	-	-	-	-	-		-	-	-	1	1	-	-	-	-	-	1	-	-	-	-	-	1	-	1	**5**	521845	6762310
Impact Site 2 (east)	Year 4 Spring Survey 2	-	-	-	-	-		-	-	-	1	1	-	-	-	-	-	1	-	-	-	-	-	-	-	1	**4**	521871	6762318
Impact Site 2 (east)	Year 4 Summer Survey 1	-	-	-	-	-		-	-	-	-	-	1	-	-	-	-	-	1	-	-	-	-	1	1	-	**4**	521863	6762291
Impact Site 2 (east)	Year 4 Summer Survey 2	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	**1**	521853	6762316
Impact Site 2 (east)	Year 4 Summer Survey 3	-	-	-	-	-		-	-	-	1	1	1	-	1	-	-	1	-	1	-	1	-	1	-	1	**9**	521872	6762301
Impact Site 2 (east) Total		**-**	**-**							**-**	**1**	**1**	**1**	**-**	**1**	**-**	**-**	**1**	**1**	**1**	**-**	**1**	**-**	**1**	**1**	**1**	**11**		
Impact Site 3 (west)	Year 4 Spring Survey 1	-	-	-	-	-		-	-	-	1	1	1	1	1	-	-	1	-	-	-	1	-	-	-	1	**8**	522694	6763495
Impact Site 3 (west)	Year 4 Spring Survey 2	-	-	-	-	-		-	-	-	1	1	1	-	-	1	1	1	1	-	-	-	-	1	-	-	**8**	522798	6763577
Impact Site 3 (west)	Year 4 Summer Survey 1	-	-	-	-	-		-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-	**2**	522647	6763539
Impact Site 3 (west)	Year 4 Summer Survey 2	-	-	-	-	-		-	-	-	1	1	-	1	-	-	-	-	1	-	-	-	-	1	-	-	**5**	522714	6763574
Impact Site 3 (west)	Year 4 Summer Survey 3	-	-	-	-	-		-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**2**	522674	6763542
Impact Site 3 (west) Total		**-**	**-**							**-**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**-**	**-**	**1**	**-**	**1**	**-**	**1**	**12**		
Impact Site 3 (east)	Year 4 Spring Survey 1	-	-	-	-	-		-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	1	-	-	**3**	523065	6763617
Impact Site 3 (east)	Year 4 Spring Survey 2	-	-	-	-	-		-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	1	-	-	**3**	521635	6762320
Impact Site 3 (east)	Year 4 Summer Survey 1	-	-	-	-	-		-	-	-	1	1	1	-	-	-	-	1	-	-	-	1	-	-	-	1	**6**	523090	6763637
Impact Site 3 (east)	Year 4 Summer Survey 2	-	-	-	-	-		-	-	-	1	1	1	-	-	-	1	-	1	1	-	1	-	1	-	-	**8**	523091	6763627
Impact Site 3 (east)	Year 4 Summer Survey 3	-	-	-	-	-		-	-	-	1	1	1	-	-	-	1	-	-	-	-	-	-	1	1	-	**6**	523074	6763545
Impact Site 3 (east) Total		**-**	**-**							**-**	**1**	**1**	**1**	**-**	**-**	**-**	**1**	**1**	**1**	**1**	**-**	**1**	**1**	**1**	**1**	**1**	**12**		
Impact Site 5 (west)	Year 4 Spring Survey 1	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	**1**	524118	6766176
Impact Site 5 (west)	Year 4 Spring Survey 2	-	-	-	-	-		-	-	-	-	1	1	-	-	-	1	-	1	-	-	-	-	1	1	-	**6**	524272	6766120
Impact Site 5 (west)	Year 4 Summer Survey 1	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	**2**	524317	6766144
Impact Site 5 (west)	Year 4 Summer Survey 2	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	**2**	524323	6766130
Impact Site 5 (west)	Year 4 Summer Survey 3	-	-	-	-	-		-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	1	1	-	-	**5**	524321	6766122
Impact Site 5 (west) Total		**-**	**-**							**1**	**1**	**1**	**1**	**-**	**-**	**-**	**1**	**-**	**1**	**-**	**-**	**-**	**1**	**1**	**1**	**-**	**9**		
Impact Site 5 (east)	Year 4 Spring Survey 1	-	-	-	-	-		-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	1	-	-	**3**	524719	6765851
Impact Site 5 (east)	Year 4 Spring Survey 2	-	-	-	-	-		-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1**	524513	6766075
Impact Site 5 (east)	Year 4 Summer Survey 1	-	-	-	-	-		-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	**2**	524485	6766108
Impact Site 5 (east)	Year 4 Summer Survey 2	-	-	-	-	-		-	-	-	-	1	1	-	-	-	-	1	-	-	-	-	1	1	-	1	**6**	524502	6766105
Impact Site 5 (east)	Year 4 Summer Survey 3	-	-	-	-	-		-	-	-	1	1	1	-	-	1	1	1	1	-	-	-	-	1	-	-	**8**	524495	6766137
Impact Site 5 (east) Total		**-**	**-**							**-**	**1**	**1**	**1**	**-**	**-**	**1**	**1**	**1**	**1**	**-**	**-**	**-**	**1**	**1**	**-**	**1**	**10**		
Control Site 3	Year 4 Spring Survey 1	-	-	-	-	-	40	Calling without call-playback stimulus	Call identification and spotlighting	-	-	-	-	-	-	-	-	-	1	-	1	-	1	1	1	-	-	**5**	524581	6763999
Control Site 3	Year 4 Spring Survey 2	-	-	-	-	-		-	-	-	-	1	1	-	-	-	-	-	1	-	-	-	-	1	-	-	**4**	524581	6763999
Control Site 3	Year 4 Summer Survey 1	-	-	-	-	-		-	-	-	-	-	-	1	-	-	-	-	1	-	-	-	-	1	-	-	**3**	524481	6764024
Control Site 3	Year 4 Summer Survey 2	-	-	-	-	-		Actively calling	Call identification	-	-	1	1	-	-	-	-	1	-	-	1	1	1	1	-	1	**8**	524575	6764004
Control Site 3	Year 4 Summer Survey 3	-	-	-	-	-		-	-	-	1	1	1	1	1	1	-	1	-	-	-	-	-	1	-	1	**9**	524443	6764025
Control Site 3 Total		**-**	**-**							**-**	**1**	**1**	**1**	**1**	**1**	**1**	**-**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**-**	**1**	**14**		
Control Site 4	Year 4 Spring Survey 1	-	-	-	-	-		-	Call identification	-	-	-	1	-	-	-	-	1	-	-	-	-	1	1	-	-	**4**	521226	6762910
Control Site 4	Year 4 Spring Survey 2	5	-	Male	Adult	-		-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	-	-	**3**	521220	6762906
Control Site 4	Year 4 Summer Survey 1	1	-	Male	Adult	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	**2**	521215	6762906
Control Site 4	Year 4 Summer Survey 2	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	**1**	521223	6762908
Control Site 4	Year 4 Summer Survey 3	-	-	-	-	-		-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1	-	-	**2**	521231	6762914
Control Site 4 Total		**6**	**-**							**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**-**	**-**	**5**		
Control Site 5	Year 4 Spring Survey 1	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	**1**	521035	6763516
Control Site 5	Year 4 Spring Survey 2	5	-	Male	Adult	-		-	-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	1	-	-	**5**	521031	6763518
Control Site 5	Year 4 Summer Survey 1	-	-	-	-	-		-	-	-	1	1	1	-	-	-	-	1	-	-	-	-	1	-	-	-	**5**	521034	6763515
Control Site 5	Year 4 Summer Survey 2	-	-	-	-	-		-	-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	1	-	-	**4**	521042	6763518
Control Site 5	Year 4 Summer Survey 3	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	1	-	**3**	521043	6763525
Control Site 5 Total		**-**	**-**							**-**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**1**	**-**	**8**		
	Total no. of individuals	**11**	**0**				**Total no. of sites species was recorded**			**1**	**8**	**8**	**9**	**2**	**4**	**3**	**5**	**7**	**7**	**4**	**1**	**4**	**7**	**9**	**4**	**6**	**10.1**	**Mean no. of species per survey event**	
	Mean no. of individuals	**3.7**																									**2.62**	**SD**	
	SD	**2.31**																											

Appendix I

Fauna Underpass Scat and Track Search Results

Table I1 Underpass Scat/ Track Search Results for Year 4 Post Construction Monitoring

Date	*Site*	*Season*	*Survey Number*	*Result*	*Species*	*Identification Confidence*	*Recording Type*	*Direction of Movement*	*Complete Crossing*	*Comments*
28/06/2018	Northbound bridge over Tabbimoble Floodway No.3	Winter	1	Yes	Antechinus sp.	Possible	Scats	-	-	-
28/06/2018	Northbound bridge over Tabbimoble Floodway No.3	Winter	1	Yes	Eastern Grey Kangaroo (*Macropus giganteus*)	Possible	Scats	-	-	-
29/06/2018	Northbound bridge over Tabbimoble Floodway No.2	Winter	1	Yes	Antechinus sp.	Probable	Scats	-	-	Habitation activity
29/06/2018	Northbound bridge over Tabbimoble Floodway No.2	Winter	1	Yes	Rattus sp.	Probable	Scats	-	-	-
29/06/2018	Northbound bridge over Tabbimoble Floodway No.3	Winter	1	Yes	Rattus sp.	Possible	Scats	-	-	-
29/06/2018	Southbound bridge over Tabbimoble Floodway No.2	Winter	1	Yes	Antechinus sp.	Probable	Scats	-	-	-
29/06/2018	Southbound bridge over Tabbimoble Floodway No.2	Winter	1	Yes	Rattus sp.	Probable	Scats	-	-	-
29/06/2018	Southbound bridge over Tabbimoble Floodway No.3	Winter	1	Yes	Water Dragon (*Intellagama lesueurii*)	Probable	Scats	-	-	-
29/06/2018	Underpass C10	Winter	1	Yes	Water Rat (*Hydromys chrysogaster*)	Probable	Scats	-	-	-
29/06/2018	Underpass C3	Winter	1	Yes	Rattus sp.	Probable	Scats	-	-	-
29/06/2018	Underpass C3	Winter	1	Yes	Water Dragon (*Intellagama lesueurii*)	Probable	Scats and tracks	Not directional	-	Habitation activity
29/06/2018	Underpass C3	Winter	1	Yes	Water Rat (*Hydromys chrysogaster*)	Probable	Scats	-	-	-
29/06/2018	Underpass C6	Winter	1	No	-	-	-	-	-	No scats or tracks in fauna underpass. Inundated culvert floor.
29/06/2018	Underpass C7	Winter	1	Yes	Microbat	Definite	Scats	-	-	Guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins.
29/06/2018	Underpass C7	Winter	1	Yes	Rattus sp.	Probable	Scats	-	-	-
29/06/2018	Underpass C8	Winter	1	Yes	Microbat	Definite	Scats	-	-	Guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins.
29/06/2018	Underpass C8	Winter	1	Yes	Rattus sp.	Probable	Scats	-	-	-
29/06/2018	Underpass C8	Winter	1	Yes	Water Dragon (*Intellagama lesueurii*)	Probable	Scats	-	-	-
29/06/2018	Underpass C9	Winter	1	Yes	Rattus sp.	Probable	Tracks	West	Unknown	Likely habitation activity
29/06/2018	Underpass C9	Winter	1	Yes	Water Rat (*Hydromys chrysogaster*)	Possible	Scats	-	-	
29/06/2018	Underpass C9	Winter	1	Yes	Water Rat (*Hydromys chrysogaster*)	Possible	Scats	-	-	-
24/07/2018	Northbound bridge over Tabbimoble Floodway No.2	Winter	2	Yes	Antechinus sp.	Probable	Scats	-	-	Habitation activity
24/07/2018	Northbound bridge over Tabbimoble Floodway No.2	Winter	2	Yes	Cattle	Definite	Scats and tracks	East and west	Yes	-
24/07/2018	Northbound bridge over Tabbimoble Floodway No.2	Winter	2	Yes	Rattus sp.	Definite	Scats	-	-	Habitation activity
24/07/2018	Northbound bridge over Tabbimoble Floodway No.3	Winter	2	Yes	Cattle	Definite	Scats and tracks	East and west	Yes	-

Date	Site	Season	Survey Number	Result	Species	Identification Confidence	Recording Type	Direction of Movement	Complete Crossing	Comments
24/07/2018	Northbound bridge over Tabbimoble Floodway No.3	Winter	2	Yes	Wild Dog/ Dingo	Definite	Scats	-	-	-
24/07/2018	Southbound bridge over Tabbimoble Floodway No.2	Winter	2	Yes	Antechinus sp.	Probable	Scats	-	-	Habitation activity
24/07/2018	Southbound bridge over Tabbimoble Floodway No.2	Winter	2	Yes	Cattle	Definite	Scats and tracks	Not directional	-	Habitation activity
24/07/2018	Southbound bridge over Tabbimoble Floodway No.3	Winter	2	Yes	Cattle	Definite	Tracks	East and west	Yes	-
24/07/2018	Underpass C10	Winter	2	Yes	Microbat	Definite	Scats	-	-	Guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins
24/07/2018	Underpass C10	Winter	2	Yes	Rattus sp.	Probable	Scats	-	-	-
24/07/2018	Underpass C3	Winter	2	Yes	Antechinus sp.	Probable	Scats	-	-	-
24/07/2018	Underpass C3	Winter	2	Yes	Microbat	Definite	Scats	-	-	Guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins
24/07/2018	Underpass C3	Winter	2	Yes	Rattus sp.	Definite	Scats	-	-	-
24/07/2018	Underpass C3	Winter	2	Yes	Water Rat (*Hydromys chrysogaster*)	Possible	Scats	-	-	-
24/07/2018	Underpass C6	Winter	2	Yes	Microbat	Definite	Scats	-	-	Old guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert lift joint. Microbat exclusion in place.
24/07/2018	Underpass C6	Winter	2	Yes	Rattus sp.	Definite	Scats	-	-	Rattus sp. scats on fauna furniture in fauna underpass.
24/07/2018	Underpass C6	Winter	2	Yes	Swamp Wallaby (*Wallabia bicolor*)	Probable	Tracks	East and west	Yes	Old tracks in pipe culverts to south of fauna structure.
24/07/2018	Underpass C7	Winter	2	Yes	Microbat	Definite	Scats	-	-	Guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins.
24/07/2018	Underpass C7	Winter	2	Yes	Rattus sp.	Probable	Scats	-	-	-
24/07/2018	Underpass C7	Winter	2	Yes	Swamp Wallaby (*Wallabia bicolor*)	Possible	Tracks	East	Unknown	-
24/07/2018	Underpass C7	Winter	2	Yes	Water Rat (*Hydromys chrysogaster*)	Probable	Scats	-	-	-
24/07/2018	Underpass C8	Winter	2	Yes	Antechinus sp.	Probable	Scats	-	-	-
24/07/2018	Underpass C8	Winter	2	Yes	Wild Dog/ Dingo	Probable	Tracks	West	Unknown	-
24/07/2018	Underpass C8	Winter	2	Yes	Microbat	Definite	Scats	-	-	Guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins.
24/07/2018	Underpass C8	Winter	2	Yes	Rattus sp.	Probable	Scats	-	-	-
24/07/2018	Underpass C9	Winter	2	Yes	Microbat	Definite	Scats	-	-	Guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins.
24/07/2018	Underpass C9	Winter	2	Yes	Rattus sp.	Possible	Tracks	Not directional	Unknown	Likely habitation activity
24/07/2018	Underpass C9	Winter	2	Yes	Water Rat (*Hydromys chrysogaster*)	Possible	Tracks	Not directional	Unknown	Likely habitation activity
27/09/2018	Northbound bridge over Tabbimoble Floodway No.3	Spring	1	Yes	Cattle	Definite	Scats	Unknown	-	-
27/09/2018	Northbound bridge over Tabbimoble Floodway No.3	Spring	1	Yes	Swamp Wallaby (*Wallabia bicolor*)	Definite	Scats	-	-	-
27/09/2018	Southbound bridge over Tabbimoble Floodway No.2	Spring	1	No	-	-	-	-	-	Nil scats or new tracks detected.

Date	Site	Season	Survey Number	Result	Species	Identification Confidence	Recording Type	Direction of Movement	Complete Crossing	Comments
27/09/2018	Southbound bridge over Tabbimoble Floodway No.3	Spring	1	Yes	Cattle	Definite	Scats and tracks	East and west	Yes	-
27/09/2018	Southbound bridge over Tabbimoble Floodway No.3	Spring	1	Yes	Swamp Wallaby (*Wallabia bicolor*)	Definite	Scats	-	-	-
27/09/2018	Underpass C10	Spring	1	Yes	Microbat	Definite	Scats	-	-	Guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins
27/09/2018	Underpass C10	Spring	1	Yes	Water Rat (*Hydromys chrysogaster*)	Probable	Scats	-	-	-
27/09/2018	Underpass C3	Spring	1	Yes	Microbat	Definite	Scats	-	-	Guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins
27/09/2018	Underpass C3	Spring	1	Yes	Rattus sp.	Probable	Scats and tracks	Not directional	Unknown	Likely habitation activity
27/09/2018	Underpass C3	Spring	1	Yes	Water Rat (*Hydromys chrysogaster*)	Probable	Scats and tracks	East	Unknown	Likely habitation activity
27/09/2018	Underpass C6	Spring	1	No	-	-	-	-	-	No new results. Same Swamp Wallaby and microbat scats and tracks in pipe culverts as per Winter Survey 2. No scats or tracks in fauna underpass.
27/09/2018	Underpass C7	Spring	1	Yes	Microbat	Definite	Scats	-	-	Old guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins.
27/09/2018	Underpass C7	Spring	1	Yes	Rattus sp.	Definite	Scats and tracks	West	Unknown	-
27/09/2018	Underpass C7	Spring	1	Yes	Swamp Wallaby (*Wallabia bicolor*)	Probable	Tracks	East and west	Yes	Complete crossing both directions
27/09/2018	Underpass C8	Spring	1	Yes	Wild Dog/ Dingo	Definite	Tracks	West	Yes	-
27/09/2018	Underpass C8	Spring	1	Yes	Microbat	Definite	Scats	-	-	Guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins.
27/09/2018	Underpass C8	Spring	1	Yes	Rattus sp.	Probable	Scats	-	-	-
27/09/2018	Underpass C9	Spring	1	Yes	Microbat	Definite	Scats	-	-	Guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins.
27/09/2018	Underpass C9	Spring	1	Yes	Swamp Wallaby (*Wallabia bicolor*)	Definite	Tracks	East and west	Unknown	-
27/09/2018	Underpass C9	Spring	1	Yes	Water Rat (*Hydromys chrysogaster*)	Probable	Scats	-	-	-
30/10/2018	Northbound bridge over Tabbimoble Floodway No.3	Spring	2	Yes	Cattle	Definite	Scats	-	-	-
30/10/2018	Southbound bridge over Tabbimoble Floodway No.2	Spring	2	Yes	Antechinus sp.	Probable	Scats	-	-	-
30/10/2018	Southbound bridge over Tabbimoble Floodway No.2	Spring	2	Yes	Rattus sp.	Probable	Scats	-	-	-
30/10/2018	Southbound bridge over Tabbimoble Floodway No.3	Spring	2	Yes	Cattle	Definite	Tracks	East and west	Yes	-
30/10/2018	Underpass C10	Spring	2	Yes	Lace Monitor (*Varanus varius*)	Probable	Tracks	East and west	Likely	-
30/10/2018	Underpass C3	Spring	2	Yes	Microbat	Definite	Scats	-	-	Guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins
30/10/2018	Underpass C3	Spring	2	Yes	Rattus sp.	Probable	Scats	-	-	Water pooled at outlet.
30/10/2018	Underpass C6	Spring	2	Yes	Rattus sp.	Definite	Scats and tracks	East and west	Unknown	Same Swamp Wallaby and microbat scats and tracks in pipe culverts as per Winter Survey 2. No scats or tracks in fauna underpass.

Date	Site	Season	Survey Number	Result	Species	Identification Confidence	Recording Type	Direction of Movement	Complete Crossing	Comments
30/10/2018	Underpass C7	Spring	2	Yes	Water Dragon (*Intellagama lesueurii*)	Probable	Scats	-	-	-
30/10/2018	Underpass C8	Spring	2	Yes	Antechinus sp.	Probable	Scats	-	-	-
30/10/2018	Underpass C8	Spring	2	Yes	Water Dragon (*Intellagama lesueurii*)	Probable	Scats	-	-	-
30/10/2018	Underpass C9	Spring	2	Yes	Wild Dog/ Dingo	Probable	Tracks	East	Unknown	Water in eastern half of culvert
30/10/2018	Underpass C9	Spring	2	Yes	Lace Monitor (*Varanus varius*)	Probable	Tracks	Unknown	Unknown	Water in eastern half of culvert
30/10/2018	Underpass C9	Spring	2	Yes	Swamp Wallaby (*Wallabia bicolor*)	Probable	Tracks	West	Yes	-
10/12/2018	Northbound bridge over Tabbimoble Floodway No.2	Summer	1	Yes	Lace Monitor (*Varanus varius*)	Probable	Tracks	East	Unknown	-
10/12/2018	Northbound bridge over Tabbimoble Floodway No.2	Summer	1	Yes	Rattus sp.	Probable	Scats	-	-	-
10/12/2018	Northbound bridge over Tabbimoble Floodway No.2	Summer	1	Yes	Swamp Wallaby (*Wallabia bicolor*)	Probable	Scats	-	-	Degraded scat.
10/12/2018	Northbound bridge over Tabbimoble Floodway No.2	Summer	1	Yes	Water Dragon (*Intellagama lesueurii*)	Definite	Scats	-	-	-
10/12/2018	Northbound bridge over Tabbimoble Floodway No.3	Summer	1	Yes	Antechinus sp.	Probable	Scats	-	-	-
10/12/2018	Northbound bridge over Tabbimoble Floodway No.3	Summer	1	Yes	Cattle	Definite	Scats and tracks	East and west	Yes	-
10/12/2018	Northbound bridge over Tabbimoble Floodway No.3	Summer	1	Yes	Water Dragon (*Intellagama lesueurii*)	Probable	Scats	-	-	-
10/12/2018	Southbound bridge over Tabbimoble Floodway No.2	Summer	1	Yes	Antechinus sp.	Probable	Scats	-	-	-
10/12/2018	Southbound bridge over Tabbimoble Floodway No.2	Summer	1	Yes	Rattus sp.	Probable	Scats	-	-	-
10/12/2018	Southbound bridge over Tabbimoble Floodway No.3	Summer	1	Yes	Cattle	Definite	Tracks	East and west	Yes	-
10/12/2018	Southbound bridge over Tabbimoble Floodway No.3	Summer	1	Yes	Cattle	Definite	Tracks	East and west	Yes	-
10/12/2018	Underpass C10	Summer	1	Yes	Lace Monitor (*Varanus varius*)	Probable	Tracks	East and west	Likely	-
10/12/2018	Underpass C10	Summer	1	Yes	Microbat	Definite	Scats	-	-	Old guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins.
10/12/2018	Underpass C10	Summer	1	Yes	Swamp Wallaby (*Wallabia bicolor*)	Definite	Tracks	East	Unknown	-
10/12/2018	Underpass C10	Summer	1	Yes	Water Rat (*Hydromys chrysogaster*)	Probable	Scats	-	-	-
10/12/2018	Underpass C3	Summer	1	Yes	Microbat	Definite	Scats	-	-	Old guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins.
10/12/2018	Underpass C3	Summer	1	Yes	Rattus sp.	Probable	Scats	-	-	-
10/12/2018	Underpass C3	Summer	1	Yes	Water Dragon (*Intellagama lesueurii*)	Probable	Scats	-	-	-
10/12/2018	Underpass C7	Summer	1	Yes	Lace Monitor (*Varanus varius*)	Probable	Tracks	East and west	Yes	-
10/12/2018	Underpass C7	Summer	1	Yes	Microbat	Definite	Scats	-	-	Old guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins.

Date	Site	Season	Survey Number	Result	Species	Identification Confidence	Recording Type	Direction of Movement	Complete Crossing	Comments
10/12/2018	Underpass C7	Summer	1	Yes	Microbat	Definite	Scats	-	-	Old guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins.
10/12/2018	Underpass C7	Summer	1	Yes	Rattus sp.	Probable	Scats	-	-	-
10/12/2018	Underpass C7	Summer	1	Yes	Swamp Wallaby (*Wallabia bicolor*)	Possible	Tracks	East and west	Yes	-
10/12/2018	Underpass C7	Summer	1	Yes	Water Dragon (*Intellagama lesueurii*)	Probable	Scats	-	-	-
10/12/2018	Underpass C7	Summer	1	Yes	Water Dragon (*Intellagama lesueurii*)	Probable	Scats	-	-	-
10/12/2018	Underpass C8	Summer	1	Yes	Lace Monitor (*Varanus varius*)	Possible	Tracks	Unknown	Unknown	-
10/12/2018	Underpass C8	Summer	1	Yes	Microbat	Definite	Scats	-	-	Old guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins.
10/12/2018	Underpass C8	Summer	1	Yes	Common Brushtail Possum (*Trichosurus vulpecular*)	Possible	Tracks	East	-	-
10/12/2018	Underpass C8	Summer	1	Yes	Rattus sp.	Probable	Scats and tracks	East and west	Unknown	-
10/12/2018	Underpass C8	Summer	1	Yes	Water Dragon (*Intellagama lesueurii*)	Probable	Scats	-	-	-
10/12/2018	Underpass C9	Summer	1	Yes	Lace Monitor (*Varanus varius*)	Probable	Tracks	Unknown	Unknown	-
10/12/2018	Underpass C9	Summer	1	Yes	Microbat	Definite	Scats	-	-	Guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins.
10/01/2019	Northbound bridge over Tabbimoble Floodway No.2	Summer	2	Yes	Water Dragon (*Intellagama lesueurii*)	Probable	Scats	-	-	Habitation activity
10/01/2019	Northbound bridge over Tabbimoble Floodway No.3	Summer	2	Yes	Cattle	Definite	Scats and tracks	East and west	Yes	
10/01/2019	Northbound bridge over Tabbimoble Floodway No.3	Summer	2	Yes	Water Dragon (*Intellagama lesueurii*)	Probable	Scats	-	-	-
10/01/2019	Southbound bridge over Tabbimoble Floodway No.2	Summer	2	Yes	Antechinus sp.	Probable	Scats	-	-	-
10/01/2019	Southbound bridge over Tabbimoble Floodway No.2	Summer	2	Yes	Water Dragon (*Intellagama lesueurii*)	Probable	Scats	-	-	-
10/01/2019	Southbound bridge over Tabbimoble Floodway No.3	Summer	2	Yes	Water Dragon (*Intellagama lesueurii*)	Probable	Scats	-	-	-
10/01/2019	Underpass C10	Summer	2	Yes	Lace Monitor (*Varanus varius*)	Probable	Tracks	East and west	Likely	
10/01/2019	Underpass C10	Summer	2	Yes	Microbat	Definite	Scats	-	-	Old guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins.
10/01/2019	Underpass C10	Summer	2	Yes	Water Rat (*Hydromys chrysogaster*)	Probable	Scats	-	-	-
10/01/2019	Underpass C9	Summer	2	Yes	Common Eastern Froglet (*Crinia signifera*)	Definite	Animal	-	Indicative	Common Eastern Froglet in centre of culvert.
10/01/2019	Underpass C9	Summer	2	Yes	Lace Monitor (*Varanus varius*)	Probable	Tracks	West	Yes	-
10/01/2019	Underpass C9	Summer	2	Yes	Microbat	Definite	Scats	-	-	Old guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins.
10/01/2019	Underpass C9	Summer	2	Yes	Rattus sp.	Probable	Tracks	West	Unknown	Likely habitation activity
10/01/2019	Underpass C9	Summer	2	Yes	Water Dragon (*Intellagama lesueurii*)	Probable	Scats	-	-	-

Date	Site	Season	Survey Number	Result	Species	Identification Confidence	Recording Type	Direction of Movement	Complete Crossing	Comments
10/01/2019	Underpass C9	Summer	2	Yes	Water Rat (*Hydromys chrysogaster*)	Possible	Scats	-	-	-
15/01/2019	Underpass C3	Summer	2	Yes	Lace Monitor (*Varanus varius*)	Possible	Tracks	Unknown	Unknown	-
15/01/2019	Underpass C3	Summer	2	Yes	Microbat	Definite	Scats	-	-	Old guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins.
15/01/2019	Underpass C3	Summer	2	Yes	Rattus sp.	Probable	Scats	-	-	-
15/01/2019	Underpass C3	Summer	2	Yes	Water Dragon (*Intellagama lesueurii*)	Probable	Scats and tracks	Not directional	-	Habitation activity
15/01/2019	Underpass C3	Summer	2	Yes	Water Rat (*Hydromys chrysogaster*)	Probable	Scats	-	-	-
15/01/2019	Underpass C6	Summer	2	Yes	Rattus sp.	Definite	Scats	-	-	Scats on fauna furniture in fauna underpass. Pipe culvert and fauna underpass cleaned in December 2018.
15/01/2019	Underpass C6	Summer	2	Yes	Water Dragon (*Intellagama lesueurii*)	Probable	Scats	-	-	Scats on fauna furniture in fauna underpass and in pipe culverts to south. Pipe culvert and fauna underpass cleaned in December 2018.
15/01/2019	Underpass C7	Summer	2	Yes	Lace Monitor (*Varanus varius*)	Probable	Tracks	East and west	Yes	-
15/01/2019	Underpass C7	Summer	2	Yes	Microbat	Definite	Scats	-	-	Old guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins.
15/01/2019	Underpass C7	Summer	2	Yes	Rattus sp.	Probable	Scats	-	-	-
15/01/2019	Underpass C8	Summer	2	Yes	Lace Monitor (*Varanus varius*)	Possible	Tracks	Unknown	Unknown	Grass skink mid way along culvert northern cell (habitat usage). Old guano
15/01/2019	Underpass C8	Summer	2	Yes	Microbat	Definite	Scats	-	-	Old guano from bent-winged bats (mostly Little Bent-winged Bats) roosting in culvert cell joins.
15/01/2019	Underpass C8	Summer	2	Yes	Rattus sp.	Probable	Scats	-	-	-
15/01/2019	Underpass C8	Summer	2	Yes	Skink	Probable	Scats	-	-	-
15/01/2019	Underpass C8	Summer	2	Yes	Sun-skink (*Lampropholis delicata*)	Definite	Animal	-	Indicative	Found midway along culvert; habitation activity
15/01/2019	Underpass C8	Summer	2	Yes	Swamp Wallaby (*Wallabia bicolor*)	Possible	Tracks	East	Unknown	-
18/02/2019	Southbound bridge over Tabbimoble Floodway No.2	Summer	Opportunistic	Yes	Carpet Snake (*Morelia spilota*)	Definite	Skin	-	-	-
18/10/2018	-	Spring	Opportunistic	-	Koala	Definite	Scat	-	-	Koala scat detected opportunistically at easting: 521669; northing 6762010; (Impact Site 2 (east))