



Transport
**Roads & Maritime
Services**

Nambucca Heads to Urunga Pacific Highway Upgrade: Operational Phase, Year Three.

Operational Phase Biodiversity Monitoring –
Year Three 2019.

Transport for NSW | May 2020 | Final Report version 3



Document Review

Date	Version	Status	Sent to	Represent	Delivered Format	Dispatched By
18/2/2020	A	Internal Draft	D. Rohweder	SES	MSW	L Andrews
24/2/2020	B	Internal Draft	D. Rohweder	SES	MSW	L. Andrews
4/3/2020	C	Internal Draft	B Taylor	SES	MSW	L. Andrews
11/3/2020	D	Internal Draft	D. Rohweder	SES	MSW	L Andrews
16/3/2020	1	Draft	S. Walker	TfNSW	MSW	D. Rohweder
16/5/2020	2	Draft	S. Walker	TfNSW	MSW	D. Rohweder

Document Distribution

Date	Version	Status	Sent to	Represent	Delivered Format	Dispatched By
26/5/2020	3	Final	S. Walker	TfNSW	MSW	D. Rohweder

Project team:

Dr D. Rohweder (project management,
field survey, reporting)
Mr. L. Andrews (field survey, reporting)
Mr. N. Priest (field survey)
Ms. N. Makings (field survey)
Dr B. Taylor (review)
Mr Damian White (field survey)
Mr. S. Rohweder (field assistant)
Mr. O. Taylor (field assistant).

Report prepared for:

Transport for New South Wales

© Sandpiper Ecological Surveys 2020
ABN: 82 084 096 828

PO Box 401
ALSTONVILLE NSW 2477
P 02 6628 3559 | E david@sandpipereco.com.au

Disclaimer:

This report has been prepared in accordance with the scope of services described in the contract or agreement between Sandpiper Ecological Surveys (ABN 82 084 096 828) and Transport for New South Wales. The report relies upon data, surveys and measurement obtained at the times and locations specified herein. The report has been prepared solely for Transport for New South Wales and Sandpiper Ecological Surveys accepts no responsibility for its use by other parties. Sandpiper Ecological Surveys accepts no responsibility or liability for changes in context, meaning, conclusions or omissions caused by cutting, pasting or editing the report.

Table of contents

1. Introduction	1
1.2 Background	1
1.3 Scope	1
1.3.1 Fauna underpasses and exclusion fence monitoring	2
1.3.2 Vegetated medians.....	3
1.4 Study area.....	3
2. Methods	5
2.1 Survey timing, effort and constraints	5
2.2 Adjacent Habitat Surveys	7
2.2.1 Camera monitoring	7
2.2.2 Active search	7
2.2.3 Spotlighting	7
2.3 Underpass Monitoring	8
2.3.1 Camera monitoring	8
2.3.2 Sand pad monitoring	8
2.3.3 Scat and track searches	8
2.3.4 Frog survey.....	8
2.3.5 Hair funnels	9
2.4 Exclusion Fence Monitoring	9
2.4.1 Camera monitoring	9
2.4.2 Opportunistic observations	10
2.5 Road-kill Monitoring	10
2.6 Vegetated Median Monitoring	10
2.6.1 Spotlighting	10
2.6.2 Hair funnel monitoring	11
2.7 Photo Analysis	11
2.7.1 Adjacent habitat	11
2.7.2 Underpasses	11
2.7.3 Exclusion fence	12
2.8 Data Summary	12
2.9 Habitat Assessment.....	12
3. Results	12
3.1 Species Richness	12
3.1.2 Target species records.....	12
3.2 Adjacent Habitat Surveys	15
3.2.1 Camera monitoring.....	15
3.2.2 Active searches	16
3.2.3 Spotlighting	16
3.3 Underpass Monitoring	16
3.3.1 Camera monitoring	16
3.3.2 Sand pad monitoring	23

3.3.3 Scat and track search.....	23
3.3.4 Frog survey.....	23
3.3.5 Underpass hair funnels.....	23
3.4 Underpass and Adjacent Habitat Comparison.....	24
3.5 Exclusion Fence Monitoring	26
3.6 Road-kill Monitoring	27
3.7 Vegetated Median Monitoring	29
3.7.1 Spotlighting.....	29
3.7.2 Hair funnels	29
3.8 Targeted Threatened Fauna	30
3.8.1 Adjacent habitat.....	30
3.8.2 Underpasses and fauna fence.....	30
3.8.3 Vegetated medians.....	30
3.9 Habitat Assessment.....	30
4. Discussion.....	31
4.1 Underpass and exclusion fencing monitoring	31
4.1.1 Rates of use of fauna underpasses and adjacent habitats by feral predators	31
4.1.2 High levels of fauna underpass use by a wide variety of native fauna species	32
4.1.3 Evidence of use by dispersing individuals and different age cohorts	32
4.1.4 Use by cover-dependent species and species with low mobility	32
4.1.5 Low incidence of fauna road strike	32
4.2 Widened Vegetated Medians.....	33
4.2.1 Evidence of use of median vegetation by the target glider species.....	33
4.2.2 Evidence of use by dispersing individuals and different age cohorts	33
4.2.3 Use by glider species other than threatened species	33
4.3 Targeted Threatened Species	33
4.3.1 Scansorial threatened species	33
4.3.2 Arboreal threatened species.....	34
4.3.3 Other threatened species.....	34
4.4 Species Richness	34
4.5 EPBC Act Condition 13	35
5. Recommendations.....	36
6. References	37
Appendix A – Scientific names.....	39
Appendix B Survey data.....	41

List of tables

Table 1: Location and size of monitored underpasses on the NH2U alignment. MOF = Moist open forest, DOF = Dry open forest, CI = Cleared land, SF = Swamp forest, R = Riparian forest.....	2
Table 2: Location and length of monitored vegetated medians on the NH2U alignment. MOF = Moist open forest, DOF = Dry open forest	3
Table 3: Duration of monitoring in each year of the operational phase monitoring program	5
Table 4: Survey effort for each component of year three (2019) operational phase monitoring. VM = Vegetated Median, HF = Hair Funnels, UP = Underpass, Ad Hab = Adjacent Habitat, FF = Fauna Fence, av = average.	6
Table 5: Species recorded and method of detection during year three (2019) operational phase monitoring. SPT VM = Spotlighting Vegetated Median, SPT = Spotlighting Adjacent Underpass Habitat, AHC = Adjacent Habitat Camera, UPC = Underpass Camera, SP = Sand Pads, AS = Active Searches, STS = Scat/Track Searches, FT = Frog Traverses, RK = Road-kill Surveys, VMHF = Vegetated Median Hair Funnels, UPHF = Underpass Hair Funnels, FFC = Fauna Fence Camera. Fauna in bold listed as vulnerable. ¹ = Introduced species	12
Table 6: Species detected and the cumulative total of complete and incomplete crossings per week recorded on underpass cameras during autumn and spring of year one and two operational phase monitoring.....	16
Table 7: Comparison between species and fauna groups recorded in underpasses via camera, sand pad and active searches versus species detected in adjacent habitat via camera and active searches. Shading denotes a species or group not confirmed in both areas that is likely to be represented in another species/group that was recorded in both areas, for example northern brown bandicoot is likely represented by bandicoot spp. X Includes species recorded using underpasses during operational phase monitoring of the Coopernook to Herons Creek (Sandpiper Ecological 2015), Sapphire to Woolgoolga (Sandpiper Ecological 2018), Glenugie (Sandpiper Ecological 2017), Woolgoolga to Ballina (Sandpiper Ecological unpublished data) upgrades, Nambucca Heads to Urunga (Sandpiper Ecological 2019) and Warrel Creek to Urunga (Sandpiper Ecological 2019). ¹ = Introduced species.....	24
Table 8: Species and species groups recorded at the exclusion fence and within underpasses.....	27
Table 9: Detections of fauna groups found from vegetated median monitoring of 2019.	29
Table 10. Recommendations following Year 3 operational biodiversity monitoring and Transport for NSW response.....	36

List of figures

Figure 1: Map showing the study area with underpasses and widened vegetated medians....	4
---	---

Figure 2: Average complete crossings per week by native species at each site (north to south) during 2018 and 2019.	18
Figure 3: Average complete crossings per week by introduced predators (cat, fox, dog) and black rat at each site (north to south) during 2018 and 2019.....	19
Figure 4: Average complete and incomplete crossings per week ($\pm$ standard deviation, n=7, excludes Mcgrath's site) during 2018 and 2019 for smaller taxa groups.....	20
Figure 5: Crossing completions (% complete and incomplete) in relation to introduced and native species using the fauna furniture vs culvert floor (2018 & 2019 combined).....	21
Figure 6: Average number of complete crossings by taxa per week ($\pm$ standard deviation, n=7, excludes Mcgrath's site) using the fauna furniture vs culvert floor (2018 & 2019 combined).....	21
Figure 7: Average number of road-kill per kilometre ($\pm$ standard deviation, n=4) recorded at each site (north to south) during 2018 and 2019 monitoring.	28
Figure 8: Average number of road-kill/km ($\pm$ standard deviation) recorded at impact sites (n=7) for taxa groups excluded and not excluded (unlikely to be excluded) by fauna fence during 2018 and 2019 monitoring.	28
Figure 9. Total cumulative number of records (detections per week) of sugar/squirrel glider recorded during hair funnel sampling within the Dalhousie and Tyson's medians in autumn and spring 2018 and 2019.	30

List of Plates

Plate 1: Adjacent habitat camera trap set up showing camera mounted on a tree directed at a bait station.	7
Plate 2: Underpass sand pad at Railway (L). Sand pad installation at Tyson's underpass (R).9	
Plate 3: Typical exclusion fence camera set up. It shows a Scoutgaord KG680V camera attached to a steel bracket which is fixed to a fence post.	10
Plate 4: Long-nosed potoroo detected in adjacent habitat at Tyson's west (L) and a koala detected in adjacent habitat at Burke's Lane west (R).....	15
Plate 5: Koala using fauna furniture to cross under the highway at Burkes Lane.....	22
Plate 6: Eastern crevice skink making a complete crossing along the fauna furniture in Martell's North underpass (L). A short-eared brushtail possum performs a complete crossing in a westerly direction in Burke's underpass (R).....	22
Plate 7: Short-beaked echidna tracks at South Martell's underpass (L). Swamp wallaby tracks and tail scrape at Tyson's underpass (R).	23

1. Introduction

Roads and Maritime Services New South Wales (RMS), in conjunction with Lendlease Engineering (LLE) commenced the upgrade of the Pacific Highway between Nambucca Heads and Urunga in 2013. The Nambucca Heads to Urunga (NH2U) upgrade is located on the mid-north coast of New South Wales and covers a 22-kilometre section of highway stretching from Link Road at Nambucca Heads to Waterfall Way, north of Urunga (Figure 1). The project was opened to traffic in July 2016 and construction completed in February 2018.

RMS engaged Sandpiper Ecological Surveys (SES) in May 2017 to conduct biodiversity monitoring as part of the operational phase of the NH2U upgrade. The following report discusses the methods and results of year three operational phase monitoring of fauna underpasses, exclusion fencing, and widened vegetated medians.

1.2 Background

The Minister for Planning approved the NH2U upgrade under Part 3A (now repealed), Section 75J of the *Environmental Planning and Assessment Act 1979* (EP&A Act) on 19 July 2011 subject to the Minister's Conditions of Approval (CoA) being met.

The project was granted approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) on 21 November 2013. Condition 13 of the DoE approval is most relevant to this report. It requires the person taking the action to provide a report to the Minister "detailing the success and/or failings of fauna crossings, fencing and road medians in achieving their intended purpose". The specific requirements of condition 13 are covered throughout the report and a section has been included in the discussion on the success and/or failings of fauna crossings, exclusion fencing and widened vegetated medians.

As part of the obligations under the Minister's CoA B10, an Ecological Monitoring Program (EMP) was to be produced and implemented. RMS engaged Benchmark Environmental Management to prepare the EMP and in June 2013 the plan was finalised. The EMP and threatened species management strategies outline the detailed monitoring requirements to satisfy the Minister's CoA.

The EMP charted the following mitigation measures to be monitored;

- Pre-clearing and clearing procedure;
- Fauna underpass structures and exclusion fencing;
- Widened vegetated medians;
- Nest box installation;
- Landscape rehabilitation;
- Protection of in-situ flora populations; and
- Establishment of translocation areas.

Outlined within the EMP was a requirement to conduct construction phase (Year 3) monitoring. This was conducted in spring 2014 and autumn 2015 (Sandpiper Ecological 2015). The construction phase monitoring established a baseline dataset of fauna recorded adjacent to the alignment and refined methods for underpass monitoring that have been adopted during the operational phase. Year two operational phase monitoring occurred in autumn and spring 2018 (Sandpiper Ecological 2019).

1.3 Scope

The intent of operational phase biodiversity monitoring, as outlined in the project brief, is to investigate the effectiveness of habitat connectivity mitigation measures (i.e. fauna underpasses, vegetated medians and

exclusion fencing). The following report details the results of year three operational phase fauna underpass, fauna exclusion fence and road-kill monitoring as well as vegetated median monitoring. The report focuses on targeted threatened fauna outlined in the EMP (Benchmark 2013) - koala (*Phascolarctus cinereus*), spotted-tailed quoll (*Dasyurus maculatus*), brush-tailed phascogale (*Dasyurus tapoatafa*) yellow-bellied glider (*Petaurus australis*) and squirrel glider (*Petaurus norfolcensis*) but also analyses use or otherwise by other native fauna species.

1.3.1 Fauna underpasses and exclusion fence monitoring

The EMP outlines, in section 3.5.4, potential indicators of success or performance criteria, these include:

- Low rates of use of fauna underpasses and adjacent habitats by feral predators;
- High levels of fauna underpass use by a wide variety of native fauna species;
- Evidence of use by dispersing individuals and different age cohorts;
- Use by cover-dependent species and species with low mobility; and
- Low incidence of fauna road strike mortality.

Section four of this report assesses year two and three results against the aforementioned performance criteria.

The monitoring program included seven fauna underpasses and one reference underpass (Table 1). Six of the eight underpasses were newly constructed box culverts and one was a bridge over the railway at the southern extent of the project. The eighth underpass was a reference culvert on the old Pacific Highway at McGrath's Creek. Monitored underpasses were named Tyson's, Access G, North Martell's, South Martell's, Dalhousie, Burke's, Railway, and McGrath's (Figure 1, Table 1).

Five of the underpasses monitored were combined structures constructed for the dual purpose of fauna passage and drainage, or in the case of Railway, a utility corridor. Two structures, Access G and Martell's south were dedicated underpasses. The McGraths reference site was a drainage culvert that is used incidentally by fauna.

Table 1: Location and size of monitored underpasses on the NH2U alignment. MOF = Moist open forest, DOF = Dry open forest, CI = Cleared land, SF = Swamp forest, R = Riparian forest.

Chainage & Habitat	Location	Type	Purpose	Length	No. & Size (# x W x H)
61800 (MOF)	Railway	Rail Bridge	Incidental	90	2 x 25.7 x 7.2
68470 (SF/MOF/DOF)	Burke's	RCBC	Dedicated	72.4	1 x 3.6 x 2.4 4 x 3.6 x 1.2
73800 (R/DOF)	Dalhousie	RCBC	Dedicated	36.5 (SB) 42 (NB)	1 x 2.4 x 2.4
75250 (MOF)	South Martell's	RCBC	Dedicated	67.4	1 x 3 x 3
75800 (MOF)	North Martell's	RCBC	Dedicated	75.7	1 x 3 x 3
78800 (MOF/CI)	Access G	RCBC	Dedicated	58.9	2 x 2.4 x 3.0
80220 (MOF)	Tyson's	RCBC	Dedicated	27 (SB) 25 (NB)	2 x 3 x 2.1
Reference Site					
Off site (MOF/R)	McGrath's	RCBC	Incidental	18	3 x 2.4 x 1.5

Floppy top fauna exclusion fence is connected to all monitored structures, except McGraths, and extends for the majority of the alignment. The purpose of monitoring exclusion fence was to determine which species move through the fence and to compare species encountering the fence with those recorded in nearby underpasses.

1.3.2 Vegetated medians

The NH2U upgrade includes two widened vegetated medians to provide connectivity for gliders, with a particular focus on yellow-bellied glider (*Petaurus australis*) and squirrel glider (*Petaurus norfolcensis*) which are both listed as vulnerable by the *Biodiversity Conservation Act 2016* (BCA 2016). The location of the Dalhousie and Tyson's vegetated medians are illustrated on Figure 1 and described in Table 2.

Table 2: Location and length of monitored vegetated medians on the NH2U alignment. MOF = Moist open forest, DOF = Dry open forest

Chainage & Habitat	Location	Type	Length
MOF/DOF CH 73800	Dalhousie	Vegetated Median	1035m
MOF CH 80220	Tyson's	Vegetated Median	570m

As with the underpass mitigation structures, the EMP outlines several potential indicators of success for vegetated medians:

- Evidence of regular use of median vegetation by the target glider species;
- Evidence of use by dispersing individuals and different age cohorts; and
- Use by glider species other than threatened species e.g. sugar glider.

The vegetated median monitoring data for year three is compared with year 2 and assessed against the performance criteria in section four of this report.

1.4 Study area

The NH2U project extends for 22km from Link Road, Nambucca Heads in the south to Waterfall Way, Urunga in the north. The single reference and seven impact sites were spaced along the NH2U Pacific Highway upgrade alignment between chainage 61800 (Railway) and 80220 (Tyson's Flat) (Figure 1). The context of each impact site differed and included: a railway corridor; vegetated median (Dalhousie & Tyson's); underpass with adjoining service roads (Burke's); two dedicated underpasses in potential koala habitat (Access G & Martell's South); combined structures situated within vegetated medians (Dalhousie and Tyson's). The reference site at McGrath's Creek was located under the old Pacific Highway, 280m east of the alignment (Figure 1).



Figure 1: Map showing the study area with underpasses and widened vegetated medians.

2. Methods

2.1 Survey timing, effort and constraints

Year three monitoring was conducted in autumn and spring 2019. The autumn monitoring period extended from 25 February to 16 May and the spring period from 19 September to 27 November (Table 3). Survey effort for each monitoring component during each sample period is presented in Table 4. All surveys were undertaken in accordance with the brief, unless otherwise agreed with EPA.

Due to safety issues with road mortality surveys, some carcasses had to be identified through binoculars. Further, traffic noise during nocturnal surveys can mask animal calls and reduces detectability of target species such as yellow-bellied glider, which is typically detected by call.

Table 3: Duration of monitoring in each year of the operational phase monitoring program

Year	Autumn	Spring
Two (2018)	12 March to 29 May	24 September to 29 November
Three (2019)	25 February to 16 May	19 September to 27 November

Table 4: Survey effort for each component of year three (2019) operational phase monitoring. VM = Vegetated Median, HF = Hair Funnels, UP = Underpass, Ad Hab = Adjacent Habitat, FF = Fauna Fence, av = average.

Sample period	Survey Effort											
	VM Spot	VM HF	UP Cams	UP HF	Sand Pads	Frog Traverse	Tracks/Scat Searches	Road-kill	Ad. Hab. Search	Ad. Hab. Cams	Ad. Hab. Spot	FF Cams
Autumn	2 samples/site/6hrs	65 nights	73 days (av)	15 days	6 visits/6 weeks	32 samples/5.4 hrs	3 traverses per underpass/8 hrs	2 samples/site/9 hrs	2 samples/site/32hrs	14 days (av)	2 samples/site/32hrs	25 days (av)
Spring	3 samples/site/9 hrs	64 nights	74 days (av)	64 days	6 visits/5.5 weeks	40 samples/6.7 hrs	3 traverses per underpass/8 hrs	2 samples/site/9 hrs	2 samples/site/32hrs	40 days (av)	2 samples/site/32hrs	23 days (av)
Total	5 samples/15 hrs	129 nights	147 days	79 days	12 visits/11.5 weeks	72 samples/12.1 hrs	6 traverses/16 hrs	72 samples/18 hrs	4 samples/64hrs	54 days (av)	4 samples/64hrs	48 days

2.2 Adjacent Habitat Surveys

2.2.1 Camera monitoring

Cameras were deployed in the adjacent habitat using a combination of Scoutgaurd KG680V, Moultrie S-50i and Reconyx HC500 cameras. One camera was installed on a tree on the east and west side of each underpass within 50m of the underpass entrance and orientated towards a bait station containing chicken and tuna oil (Plate 1). Four cameras (2/side) were installed at McGrath's Creek control site to detect fauna on both sides of the creek. Cameras were set to take a burst of three photos with a ten second delay between activation. Cameras were installed at approximately 0.5m above ground and positioned 2.5m from a bait station.



Plate 1: Adjacent habitat camera trap set up showing camera mounted on a tree directed at a bait station.

2.2.2 Active search

Active diurnal searches were conducted within a one-hectare area of habitat adjoining each side of each underpass by one or two ecologists for one-person hour. Searches targeted diurnal fauna and nocturnal fauna seeking refuge in logs and ground vegetation. Ecologists searched for fauna under logs, among ground vegetation, leafy debris, and in hollow logs. All fauna and signs of fauna, along with standard weather variables (i.e. wind, rain, relative humidity, cloud cover and air temperature) were recorded in a survey proforma on an iPad. Active searches were conducted twice per monitoring event (Table 4).

2.2.3 Spotlighting

A one-hectare area of habitat adjoining each side of each underpass was spotlighted for a period of 30 person minutes twice per monitoring event (Table 4). Spotlighting was concentrated on fence lines, the forest edge and tracks but also included a meandering traverse of intact forest where applicable. Hand-held Led-Lenser 320 lumen torches were used to search for fauna. All fauna and fauna signs, along with standard weather variables were recorded in a survey proforma on an iPad.

2.3 Underpass Monitoring

2.3.1 Camera monitoring

Reconyx HC500 cameras were used to monitor underpasses in autumn and a combination of Reconyx HC 500 and Swift Enduro cameras were used in spring. Reconyx cameras were set to take a series of three photos with no delay between activation and Swift Enduros recorded 10 seconds of video with no delay between activations. In spring, Reconyx HC 500 cameras were installed on fauna furniture (when present) and Swift Enduros near floor level. Cameras were armed continuously for the two monitoring periods and batteries and SD cards checked and/or swapped after approximately four weeks.

Each cell that supported fauna furniture had a camera installed centrally on the horizontal rail facing east. All floor cameras were installed on a cell wall in the centre of the culvert at approximately 300mm above floor level, facing east. Two cameras were installed in cells with fauna furniture, and one in cells without fauna furniture. At the McGraths Creek control site, due to the higher likelihood of inundation, two Scoutgaud KG680V cameras were installed on star pickets at the eastern entrance to the culvert facing the entrance (i.e. facing west). A total of 21 cameras were deployed during each monitoring event.

Cameras were housed within security cases and attached to an underpass wall using dynabolts to minimise the likelihood of theft. Installation included use of plastic wedges to enable correct camera orientation. In underpasses where fauna furniture was installed, cameras were installed above the rail and orientated along the rail to detect fauna using the furniture.

2.3.2 Sand pad monitoring

To complement camera monitoring, sand pads were installed in the centre of each cell at each site. Sand pads were installed using a 1:1 mix of brickie's sand and a local beach sand and smoothed out with a cement trowel at the start of monitoring and after each inspection (Plate 2). Pads were approximately 1m wide and 50mm deep. A small channel (200mm wide) was left in the centre of pads in combined structures to allow for drainage. Sand pads were monitored on a weekly basis for four weeks during the autumn sample period, and for a minimum of four consecutive days during the spring monitoring period. The change in method between autumn and spring was to align sampling with the method used on the Warrell creek to Nambucca Heads (WC2NH) project, and to reduce the loss of data from washouts.

During each inspection pads were systematically scanned for prints with the aid of a hand-held torch, if required. An ecologist, with experience identifying fauna tracks, inspected each pad. Tracks were identified to species, genus, or group and the number and direction of crossings recorded. In some cases, tracks were photographed and sent to colleagues for assistance with identification. Despite the prevailing dry conditions, washouts occurred at several sites in autumn resulting in the loss of some data.

2.3.3 Scat and track searches

All underpasses were searched for scats and tracks on three occasions during each monitoring period. This involved a 20-minute traverse of the structure and apron by one ecologist with a spotlight recording any scats, tracks or other signs left by fauna. Surveys focussed on the fauna furniture and areas of accumulated sand/mud.

2.3.4 Frog survey

Frog surveys of underpasses were carried out when conditions were conducive to frog dispersal (i.e. after rainfall and when relative humidity exceeded 80%). Each survey involved a foot-based traverse of the underpass entrance and structure by two ecologists with spotlights for a period of 20-minutes. Weather variables and detected frogs were recorded on a standard proforma.



Plate 2: Underpass sand pad at Railway (L). Sand pad installation at Tyson's underpass (R).

2.3.5 Hair funnels

Two hair funnels were installed on fauna furniture at sites containing fauna furniture (i.e. all sites except Railway and McGrath's). Funnels were baited with peanut butter, oats and honey and left in situ for a minimum of two weeks per monitoring event. Wafers were collected and sent to Robyn Carter Hair Identification for analysis.

2.4 Exclusion Fence Monitoring

2.4.1 Camera monitoring

Fence cameras were installed at all sites except McGraths. The set up involved installation of a camera on each side of each culvert entrance (total of 28 cameras). Cameras were attached to a bracket which was fixed to a fence post at approximately 400mm and orientated along the fence towards the underpass entrance (Plate 3). Distance from the culvert entrance ranged from 10m to 60m and was dependent on obtaining a reasonable line of sight. Ground vegetation was trimmed at some sites to improve visibility and reduce the incidence of false triggers. Scoutguard KG680V cameras were used at all sites except Reconyx HC500 cameras were used at Burke's west. Reconyx cameras were used at this site to enable python locks to secure the camera to the post to reduce the likelihood of theft. Scoutguard cameras were scheduled to arm at 4pm and disarm at 9am. Cameras were set to take a series of three photos with a ten second delay between activation. Exclusion fence camera monitoring effort is described in Table 4 (see full details in Appendix B, Table B15).



Plate 3: Typical exclusion fence camera set up. It shows a Scoutguard KG680V camera attached to a steel bracket which is fixed to a fence post.

2.4.2 Opportunistic observations

Fauna interactions with the exclusion fence were noted on an opportunistic basis whilst conducting other activities.

2.5 Road-kill Monitoring

Road-kill surveys of the north and southbound carriageways of each site were conducted twice per sample period. Surveys were scheduled to occur near the beginning and end of each monitoring period with 10 weeks between the autumn surveys and nine weeks between the spring surveys. Surveys involved a slow walk traverse by one or two ecologists 250m north and south of each culvert entrance. Walking speed varied but each 500m traverse took between 15 minutes and one hour to complete. During the traverse, ecologists scanned the road surface, shoulder and edge of batter for road-killed fauna. Carcasses situated near the centre of the carriageway were inspected with the aid of binoculars. Each road-kill specimen was identified to species level where possible, and highly degraded carcasses were often identified to genus or group (i.e. small, medium or large mammal, bird, reptile, amphibian). Due to decomposition, carcasses were often difficult to identify to species level. Data collected on each road-killed specimen included species, genus, group, location (GDA 94) and notes on nearby fence condition, any live fauna observed inside the roadway and basic weather variables (e.g. sunny, cloudy, raining). Specimens situated on the road shoulder or batter edge were moved off the road. Data were recorded in a proforma on an iPad during each survey.

2.6 Vegetated Median Monitoring

2.6.1 Spotlighting

At each vegetated median, a 500m transect was established on the east and west side of the alignment and within the median. All transects were parallel to the highway. Each transect was traversed by an experienced ecologist using a hand-held 320 lumen Led-Lenser torch at a speed of one kilometre per hour. Surveys occurred between 1930hrs and 1000hrs. When gliders were detected, species was recorded, and

individuals were observed until direction of movement could be determined. Other data recorded included behaviour (i.e. feeding, transit, grooming) and weather variables including wind, rain, relative humidity, ambient temperature, and moon phase.

2.6.2 Hair funnel monitoring

Hair funnel sampling was conducted at both medians. A transect containing 20 hair funnels at 25m spacing was installed on the east, and west sides of the highway and within the median at each site. Funnels were baited with peanut butter, honey and oats and installed at approximately 6m high on a suitable tree. Rough-barked trees with a DBH greater than 400mm were typically selected. Each tree was sprayed with honey water to help attract gliders to the funnel. Hair funnels were installed for two periods of six weeks during the autumn and spring monitoring events with baits and wafers swapped after three weeks. A total of 120 hair funnels were installed across the two medians. Hair funnels were installed for 57 nights in autumn and 64 nights in spring.

2.7 Photo Analysis

All underpasses, adjacent habitat and exclusion fence camera images were uploaded to a computer and viewed using Windows Photo Viewer®. A senior ecologist or ecologist reviewed all images, with reference to standard field guides (i.e. Menkhorst & Knight 2003; Pizzey & Knight 2007). Input from multiple ecologists was sought to identify some images.

2.7.1 Adjacent habitat

Fauna detected in adjacent habitat was scored on a presence-absence basis. All detections are presented in Appendix B, Table B1 and B2.

2.7.2 Underpasses

For autumn monitoring when cameras were installed at both ends of a culvert, a complete crossing was recorded when an animal showed directional movement in the same direction on both cameras. Animals that were recorded on one camera showing directional movement but not recorded on the other camera were recorded as incomplete crossings. If an animal passed one camera and returned within 10 minutes this was deemed an incomplete crossing. For spring monitoring when cameras were positioned in the center of the underpass, an individual was scored making a complete crossing when they showed directional movement. An incomplete crossing was scored when an individual showed no directional movement (i.e. remained stationary in front of camera) or when an animal passed the camera but returned within 10 minutes. These crossing definitions are consistent with those used at other Pacific Highway monitoring sites (e.g. Sandpiper Ecological 2017) and represent a conservative approach to identification of complete crossings. It is noteworthy that other investigators (e.g. Soanes *et al.* 2015) have used directional movement as evidence of complete crossings.

Data recorded for each active image included: site, date, time, species, accuracy (definite 90%+ certainty, probable 75-90% certainty, and possible 60-75% certainty), movement direction (east, west, no directional movement (animal stationary), returned), number of images and image numbers. A hierarchical approach was adopted to species identification that included: species, genus or group. If a species could not be identified or assigned to a group, it was labelled as “unidentified species”.

2.7.3 Exclusion fence

Data recorded for fence cam detections included species, accuracy, direction of movement (e.g. toward underpass, away from underpass), interaction with fence (e.g. climbs through fence, climbs up fence). These data are presented in Appendix B, Table B15.

2.8 Data Summary

Data have been summarised and presented as present/absent, cumulative totals, passes/week (camera monitoring) and road-kill/km (road-kill). *Petaurid* spp. detections within medians were recorded as number per week to account for variations in sampling effort between years (Table 4).

2.9 Habitat Assessment

A habitat assessment was conducted on both sides of each underpass site. This involved one ecologist recording habitat type, and dominant canopy, mid-story and groundcover species.

3. Results

3.1 Species Richness

A total of 88 vertebrate fauna species and an additional 28 animal groups/genera were recorded during year three operational phase monitoring for the NH2U Pacific Highway upgrade (Table 5). This is comparable to the 87 species recorded during year two operational phase monitoring (Sandpiper 2019). Of the 88 confirmed species, 33 (38%) were birds, 26 (29%) were mammals, 13 (15%) were reptiles, nine (10%) were amphibians (frog) and seven (8%) were introduced (Table 5). Scientific names of all species are provided in Appendix A, Table A1.

3.1.2 Target species records

Five (5.6%) species listed as vulnerable by the *NSW Biodiversity Conservation (BC) Act 2016* and/or *Commonwealth Environment Protection and Biodiversity Conservation (EPBC) Act 1999* were recorded. These include the grey-headed flying fox, powerful owl, long-nosed potoroo and koala. Koala (a target species) was detected on one occasion during underpass monitoring and one occasion during exclusion fence monitoring. Koala scats were also recorded during underpass scat/track searches and adjacent habitat searches (Table 5).

Table 5: Species recorded and method of detection during year three (2019) operational phase monitoring. SPT VM = Spotlighting Vegetated Median, SPT = Spotlighting Adjacent Underpass Habitat, AHC = Adjacent Habitat Camera, UPC = Underpass Camera, SP = Sand Pads, AS = Active Searches, STS = Scat/Track Searches, FT = Frog Traverses, RK = Road-kill Surveys, VMHF = Vegetated Median Hair Funnels, UPHF = Underpass Hair Funnels, FFC = Fauna Fence Camera. Fauna in bold listed as vulnerable. † = Introduced species

Species	Sp VM	Sp AH	AHC	UPC	SP	AS	STS	FT	RK	VMHF	UPHF	FFC
Mammals												
Short-beaked echidna		*	*	*	*	*	*					*
Brown antechinus				*						*		
Yellow-footed antechinus										*		
<i>Antechinus</i> spp.		*	*	*	*		*			*	*	
Long-nosed bandicoot		*	*	*		*						*

Species	Sp VM	Sp AH	AHC	UPC	SP	AS	STS	FT	RK	VMHF	UPHF	FFC
Northern brown bandicoot			*	*					*			*
Bandicoot sp.				*	*	*	*		*			*
Koala			*	*		*	*					*
Sugar glider	*	*										
<i>Acrobates</i> spp.		*	*							*		
Common ringtail possum						*						
Short-eared brushtail possum		*	*	*								*
Common brushtail possum		*	*	*								*
<i>Trichosurus</i> spp.				*	*	*	*			*		*
Long-nosed potoroo			*									
Eastern grey kangaroo				*	*	*						
Swamp wallaby		*	*	*	*	*			*			*
Red-necked wallaby				*					*			*
Wallaby spp.			*		*	*	*					
Macropod spp.		*		*			*		*			
Grey-headed flying-fox		*										
Black flying-fox		*										
Pteropus spp.		*										
Eastern bent-wing bat									*			
Microbat spp.		*		*			*		*			
Fawn-footed melomys		*		*						*		
<i>Melomys</i> spp.			*									
Water rat			*	*	*		*					
Bush rat			*							*	*	
Swamp rat			*	*								
Rodent sp.		*	*	*	*		*			*		*
<i>Rattus</i> spp.							*			*	*	
House mouse ¹		*	*	*	*							*
Black rat ¹			*	*						*		*
Fox ¹			*	*	*	*	*		*			*
Dog ¹			*	*	*	*	*					*
Cat ¹			*	*	*		*		*			*
Cow ¹				*								
Hare ¹												*
Small mammal		*		*					*			*
Medium mammal				*					*			*
Large mammal									*			
Reptiles												
Burtons legless lizard						*						
Lace monitor			*	*	*	*	*		*			*
Eastern water dragon			*	*	*	*	*					*
Land mullet			*			*						
Eastern crevice skink				*								
Common garden skink						*	*					
Red-tailed skink						*						
<i>Lampropholis</i> spp.						*						
<i>Egernia</i> spp.				*								
<i>Eulamprus</i> spp.						*						
Lizard spp.				*	*	*	*					
Green tree snake			*	*		*						
Red-bellied black-snake									*			
Marsh snake						*			*			

Species	Sp VM	Sp AH	AHC	UPC	SP	AS	STS	FT	RK	VMHF	UPHF	FFC
Coastal carpet python		*							*			
Yellow-faced whip snake			*									
Snake spp.		*		*					*			
Small snake spp.									*			
Reptile spp.					*		*		*			
Frogs												
<i>Litoria fallax</i>		*				*		*				
<i>Litoria revelata</i>								*				
<i>Litoria peronii</i>		*				*		*	*			
<i>Litoria taylori</i>		*				*		*				
<i>Adelotus brevis</i>		*						*				
<i>Limnodynastes peronii</i>		*						*	*			
<i>Crinia signifera</i>		*				*		*				
<i>Pseudophryne coriacea</i>		*				*		*				
<i>Uperolia</i> spp.		*						*				
<i>Uperolia laevigata</i>						*		*				
Medium frog									*			
Large frog							*					
Frog sp.					*				*			
Birds												
Powerful owl	*	*										
Tawny frogmouth		*							*			
Southern boobook									*			
Australian owl nightjar		*										
Painted button-quail			*									*
Crested goshawk						*						
Bar-shouldered dove			*									
Eastern whipbird			*									
Eastern yellow robin			*	*								
Australian brush turkey			*									*
Variegated fairywren									*			
Fairywren sp.									*			
Welcome swallow				*			*					
Australian logrunner			*									
Red-browed finch			*	*					*			
Australasian darter				*								
Azure kingfisher				*								
Grey shrike-thrush			*	*								
Grey Fantail									*			
Yellow-faced honeyeater									*			
Yellow-throated scrubwren			*									
Lewin's honeyeater				*					*			
White-cheeked honeyeater									*			
Yellow thornbill									*			
Eastern thornbill									*			
White-necked heron				*								
Silvereye									*			
Purple swamphen												*
White-browed scrubwren			*						*			
Australian magpie									*			
Laughing kookaburra			*	*					*			
Buff-banded rail												

Species	Sp VM	Sp AH	AHC	UPC	SP	AS	STS	FT	RK	VMHF	UPHF	FFC
Dollarbird									*			
Pacific black duck				*					*			
Waterbird sp.												
Medium bird sp.							*		*			
Small bird sp.					*		*		*			
Bird sp.				*								
Total number of species	2	30	37	45	19	29	23	10	42	10	3	24

3.2 Adjacent Habitat Surveys

Adjacent habitat surveys recorded a total of 68 species/groups via camera trap monitoring, active searches and spotlighting. This is comparable to the 66 species recorded during construction phase monitoring in 2014 and 2015 (Sandpiper 2015) and the 69 species recorded in year two of operational phase monitoring (Sandpiper 2019a).

3.2.1 Camera monitoring

A total of 33 species and four fauna groups were detected by cameras installed in adjacent habitat (Table 5). Twelve species (36%) were mammals, 11 (33%) were birds, five (15%) reptiles, and five introduced (15%) with no record of amphibians. Native species represented 28 (85%) of the total 33 species with introduced species constituting the remaining five (15%).

Noteworthy detections included a koala on the western side of the Burkes Lane underpass during autumn and a long-nosed potoroo on the western side of the Tyson's underpass (Plate 4; Appendix B, Table B8). Both species are listed as vulnerable by the NSW *BC Act 2016* and *EPBC Act 1999*.

The range of taxa was similar to year two operational phase monitoring which recorded 86% native and 14% feral species (Sandpiper 2019). Some species, such as red-necked wallaby, were observed during year two but not in year three (Sandpiper 2019). New species recorded in year three were fawn-footed melomys and feathertail glider.



Plate 4: Long-nosed potoroo detected in adjacent habitat at Tyson's west (L) and a koala detected in adjacent habitat at Burke's Lane west (R).

3.2.2 Active searches

Active searches recorded 21 species and evidence of another eight fauna groups (Table 5). Species detections included, eight (32%) reptile species, eight (32%) mammals, six amphibians (24%), one bird (4%) and two introduced species (8%). Koala scat was recorded at Tyson's west under a tallowwood (*Eucalyptus microcorys*) (Appendix B, Table B1). Also, long-nosed potoroo diggings were recorded on both the east and west sides of the Tyson's underpass.

3.2.3 Spotlighting

A total of 20 species were recorded during spotlight surveys in adjacent habitat (Table 5). Of these, 10 (50%) were mammals, seven (35%) were mammals, two (10%) were birds, and one (5%) was an introduced species. An incidental record of a (calling) powerful owl was heard at Burkes east in Autumn 2019 (Appendix B, Table B2). Powerful owl is listed as vulnerable by the BC Act 2016.

3.3 Underpass Monitoring

3.3.1 Camera monitoring

A total of 46 species and fauna groups were confirmed using underpasses during camera monitoring (Table 6). Fauna groups included 11 taxa that could only be identified to genus or group - *Antechinus* spp., rodent spp., bandicoot spp., lizard spp., bird spp., *Trichosurus* spp., small and medium mammal species., macropod spp. *Egernia* spp. and microbat spp. Many of these genera/groups most likely belong to confirmed species.

Of the 34 confirmed species, 28 (83%) were native and six (17%) were introduced. The short-eared brushtail possum (*Trichosurus caninus*), lace monitor, eastern water dragon, and short-beaked echidna all recorded greater than 2.5 complete crossings (cc) per week and constituted the majority of crossings by native species (Table 6). The black rat recorded the highest number of complete and incomplete crossings (ic) with 77.7 and 23.4 per week respectively (Table 6). This equates to 90% of all crossings recorded for introduced species.

Of the other introduced species, dog and fox exhibited a decrease in the number of complete crossings when compared to 2018 going from 2.1 to 0.7 and 2.4 to 1.8 receptively (Table 6). Whereas cat crossings increased from 1.4 (2018) to 4.2 (2019) with the majority recorded in the Dalhousie underpass (3.5cc/week) (Appendix B, Table B12).

Table 6: Species detected and the cumulative total of complete and incomplete crossings per week recorded on underpass cameras during autumn and spring of year one and two operational phase monitoring.

Species	Complete crossings				Total complete crossings		Incomplete crossings				Total Incomplete crossings	
	Autumn		Spring				Autumn		Spring			
	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019
Mammals												
Short-beaked echidna	0.2	0.1	0.4	2.5	0.6	2.6			0.1	0.7	0.1	0.7
Brown Antechinus			0.2		0.2							
<i>Antechinus</i> spp.		0.1	1.4	2.6	1.4	2.7		0.2	0.3	1.2	0.3	1.4
Long-nosed bandicoot		0.2		0.6		0.8		0.1				0.1
Northern brown bandicoot		0.3	0.2	0.3	0.2	0.6		0.1				0.1
Bandicoot spp.		0.2	0.3	1.3	0.3	1.5						
Koala				0.1		0.1						
Common			0.1	0.4	0.1	0.4				0.1		0.1

Brushtail Possum												
Short-eared Brushtail Possum	0.1	8.1	3	8	3	16.1		0.5	0.1	1.8	0.1	2.3
<i>Trichosurus</i> spp.		0.1	0.9		0.9	0.1		0.1	0.1		0.1	0.1
Eastern grey kangaroo			0.1		0.1							
Swamp wallaby	0.5	0.9	1.3	0.8	1.8	1.6	0.3	0.1	0.8	0.6	1	0.7
Red-necked wallaby				0.2		0.2						
Macropod spp.		0.1				0.1						
Microbat spp.				0.2		0.2						
Fawn-footed melomys			0.1		0.1							
Swamp rat										0.1		0.1
Water rat		0.5	0.4	0.9	0.4	1.3		0.1	0.1	0.3	0.1	0.4
Bush rat		0.1		0.9		0.9		0.1		0.5		0.6
Rodent spp.		0.9	0.5	5.7	0.5	6.5		0.3		1.3		1.6
Small mammal spp.		0.1	0.1	0.8	0.1	0.9		0.1				0.1
Medium mammal spp.	0.1				0.1				0.1		0.1	
Reptiles												
Lace monitor	0.2	1.2	2.7	9.3	2.9	10.4				0.3		0.3
Eastern water dragon		0.4	4.1	6.1	4.1	6.5		0.1	1	3.6	1	3.7
Eastern crevice skink		0.3	0.1	0.3	0.1	0.6				0.1		0.1
<i>Egernia</i> spp		0.2		1.3		1.5				0.1		0.1
Lizard spp.			0.1		0.1				0.1		0.1	
Green tree snake										0.1		0.1
Snake spp.									0.1		0.1	
Birds												
Kookaburra									0.3		0.3	
Eastern yellow robin								0.2				0.2
Grey shrike thrush										0.1		0.1
Lewin's honeyeater									0.1		0.1	
Pacific black duck	0.8			0.2	0.8	0.2				0.2		0.2
Red-browed finch								0.4		0.1		0.5
Welcome swallow				0.1		0.1				1		1
Australasian darter		0.1	0			0.1						
Azure kingfisher			0.2		0.2			0.1				0.1
White-necked Heron				0.1		0.1				0.1		0.1
Bird sp.				0.1		0.1				0.2		0.2
Native sub-total (spp)	1.8; (6)	13.6; (18)	16.4; (21)	42.6; (23)	18.2; (22)	56.2; (26)	0.3; (1)	2.4; (14)	3.3; (13)	12.4; (20)	3.6; (13)	14.8; (26)
Introduced												
Black rat	0.3	26.5	31.3	51.3	31.6	77.7	0.4	7.1	10	16.3	10.3	23.4
Cat	0.3	1.2	1.1	3.5	1.4	4.7	0.2		0.2	0.4	0.4	0.4
Cow				0.2		0.2						
Dog	2		0.1	0.7	2.1	0.7	0.1			0.1	0.1	0.1
Fox	1.5	0.8	0.9	1	2.4	1.8	0.3	0.1	0.2	0.1	0.5	0.2
House mouse				0.6		0.6				0.2		0.2
Introduced sub- total (spp)	4.1; (4)	28.5; (3)	33.4; (4)	57.2; (6)	37.5; (4)	85.7; (6)	0.9; (4)	7.2; (2)	10.4; (3)	17; (5)	11.3; (4)	24.2; (5)
Total (spp)	5.9; (10)	42.1; (21)	49.8; (25)	99.8; (29)	55.7; (26)	141.9; (32)	1.2; (50)	9.6; (16)	13.7; (16)	29.4; (25)	14.9; (17)	39; (31)

Native species were recorded making complete crossings (cc) across all sites during 2019 (Figure 2). In 2019, the number of complete crossings recorded at all sites was higher than in 2018 (Figure 2). Increases were most pronounced at Tysons 1.2 to 9.3cc/week, and Dalhousie 1 to 6.8cc/week (Figure 2). The highest number of complete crossings per week by native species was recorded at Tyson's and Dalhousie with an average of 9.3cc/week and 6.8cc/week respectively (Figure 2). The number of cc/week at Access G, Martell's North, Burkes and Railway were lower than the reference site (McGraths Creek). Excluding black rat, cc/week by native species exceeded introduced species at all sites (Figure 2 & 3).

In 2019, complete crossings by introduced species occurred at all underpasses, with the highest number recorded at Tyson's, Dalhousie and Martell's North (Figure 3). Black rat accounted for >90% of complete crossings per week at these sites (Figure 3). Introduced predators (cat, dog, fox) were recorded in all underpasses apart from McGrath's (Figure 3). The average number of complete crossings by feral predators were highest at Dalhousie (1.99cc/week) and Martell's North (0.85cc/week) (Table 6). Across all sites cat recorded the most complete crossings with 4.7cc/week in comparison to 1.8 cc/week by fox and 0.7 cc/week by dog (Table 6).

Records of complete crossings per week increased across all sites in year 3 for both introduced and native species (Figure 2 & 3). During 2018 the black rat similarly accounted for a majority of complete crossings per week by introduced species (Table 6, Figure 3).

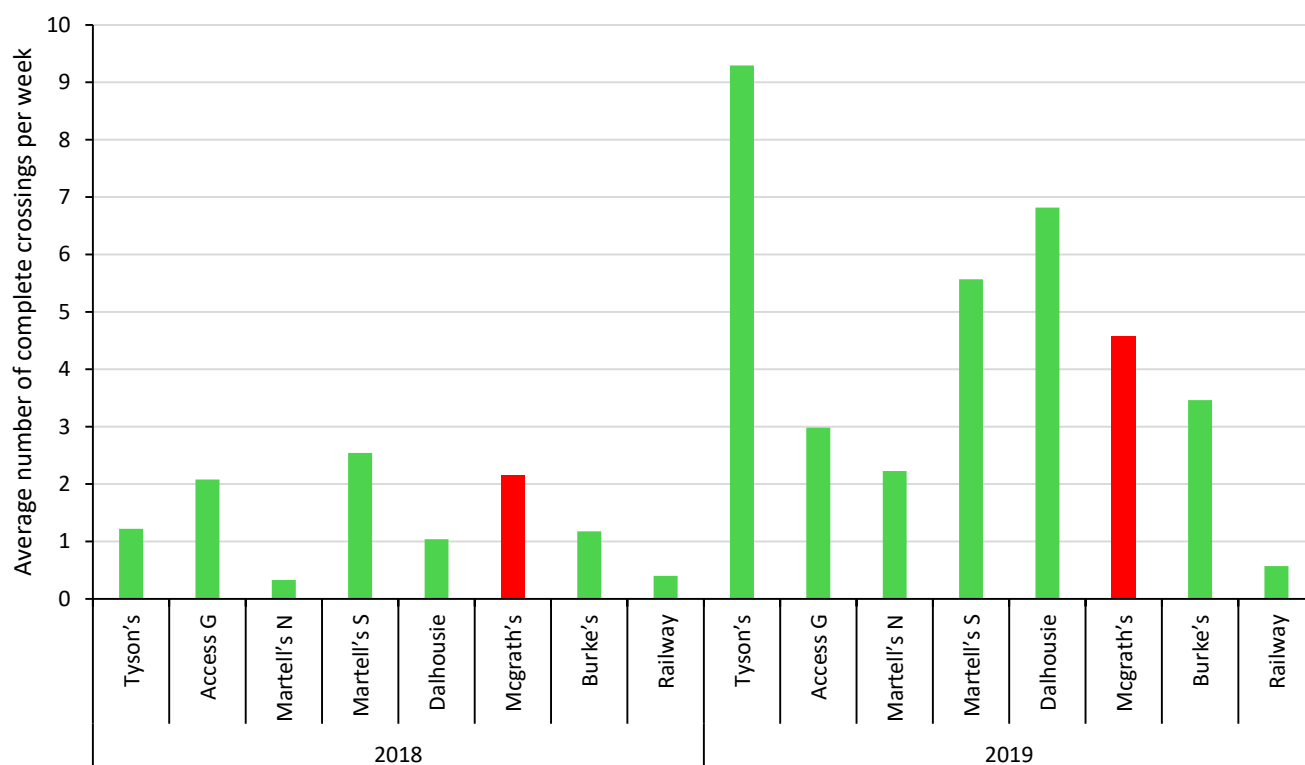


Figure 2: Average complete crossings per week by native species at each site (north to south) during 2018 and 2019. Reference site (McGraths Creek) depicted in red.

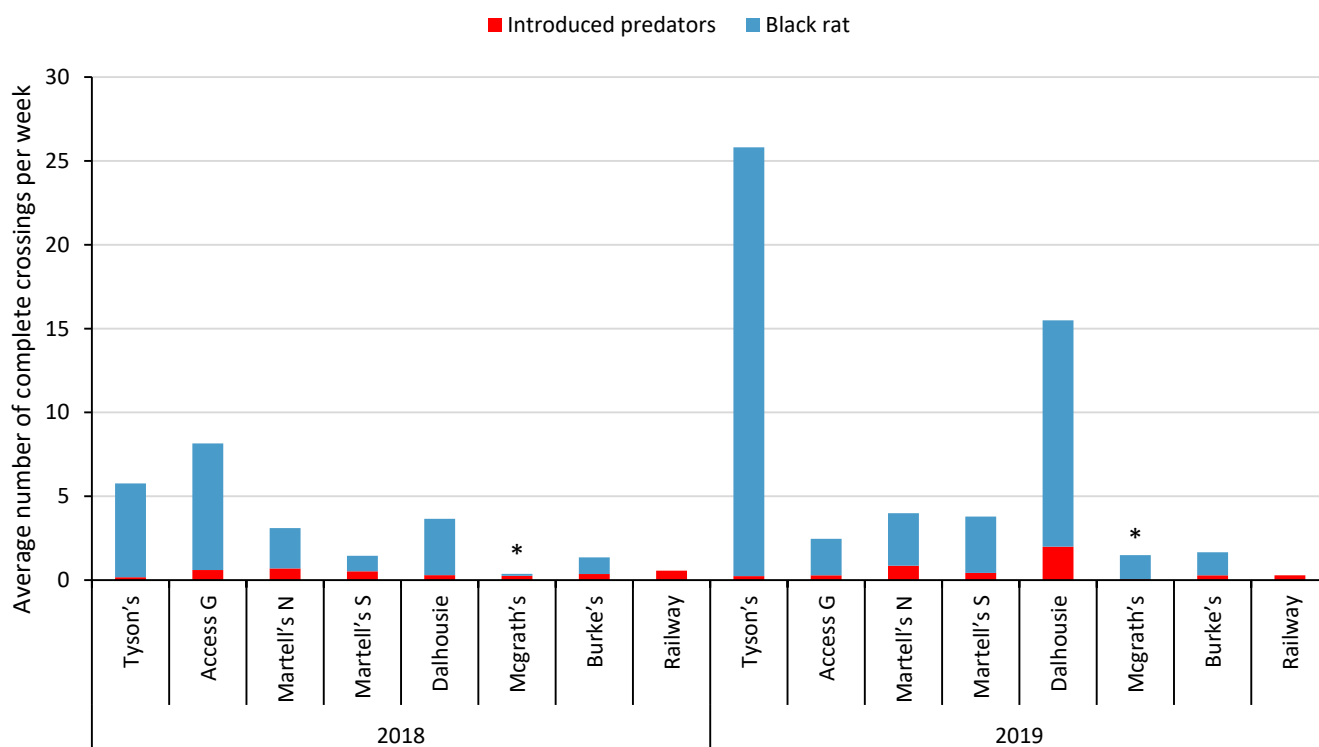


Figure 3: Average complete crossings per week by introduced predators (cat, fox, dog) and black rat at each site (north to south) during 2018 and 2019. * Denotes reference site (Mcgraths Creek).

Small fauna species/groups which are unlikely to be excluded by the fauna fence (e.g. introduced rodent, reptiles excluding lace monitor, *Antechinus* spp. and rodent spp) were reported using underpasses in both 2018 and 2019 (Figure 4). During 2019, introduced rodents (black rat and house mouse) recorded the highest usage of fauna underpasses with an average of 6.4cc/week and 1.67 incomplete crossings (ic) /week (Figure 4). Of the native fauna groups, reptiles were the most frequently recorded group in underpasses with an average of 0.61cc/week and 0.26 ic/week (Figure 4). Rodent spp. was the next highest recorded with 0.56 cc/week and 0.24ic/week (Figure 4). *Antechinus* spp. were also recorded using underpasses with an average of 0.29 cc/week and 0.14 ic/week (Figure 4).

Use of underpasses by small fauna species/groups was higher during 2019 than 2018 (Figure 4). There were no camera detections of amphibians during the 2018 or 2019 monitoring periods.

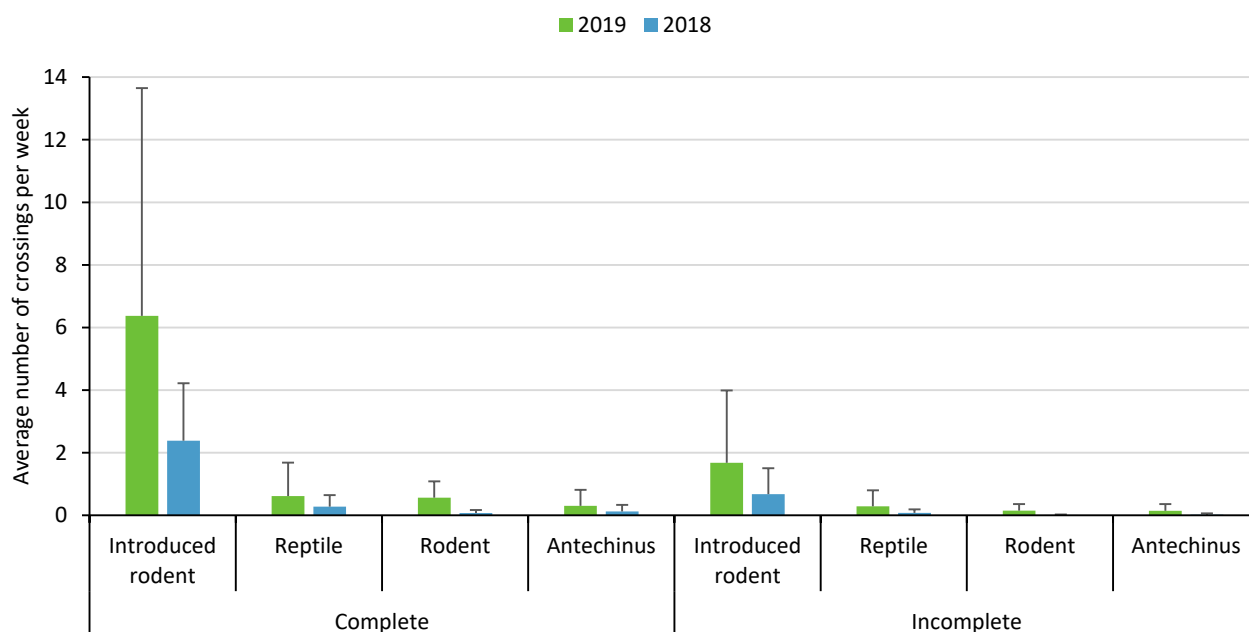


Figure 4: Average complete and incomplete crossings per week ($\pm$ standard deviation, $n=7$, excludes McGrath's site) during 2018 and 2019 for smaller taxa groups.

For the mode of crossing (furniture vs floor), native species recorded an 87% complete crossing rate when using furniture and a 79% complete crossing rate when utilising the floor (Figure 5). These rates were marginally higher than those recorded for introduced species which displayed complete crossings rates of 79% on the furniture and 73% on the culvert floor (Figure 5). Four native taxonomic groups, including the koala, were recorded using the fauna furniture (Figure 6, Plate 5). The highest number of complete crossings per week (across all sites) by native species was recorded for *Trichosurus* spp (0.63cc/week, Plate 6), followed by reptiles (0.28cc/week, including the eastern crevice skink (Plate 6), *Antechinus* spp. (0.11cc/week), and rodent spp. (<0.01cc/week) (Figure 6). Introduced rodents (black rat and house mouse) had the highest number of crossings on both the furniture and floor with 2.17 and 1.62cc/week respectively. *Trichosurus* spp., *Antechinus* spp. and introduced rodents showed a preference for fauna furniture accounting for 94%, 64% and 58% of their respective complete crossings (Figure 6). In contrast, reptile species, introduced predators, and other rodents showed a preference for the culvert floor (Figure 6). Bandicoots, echidnas and macropods used the floor only (Figure 6).

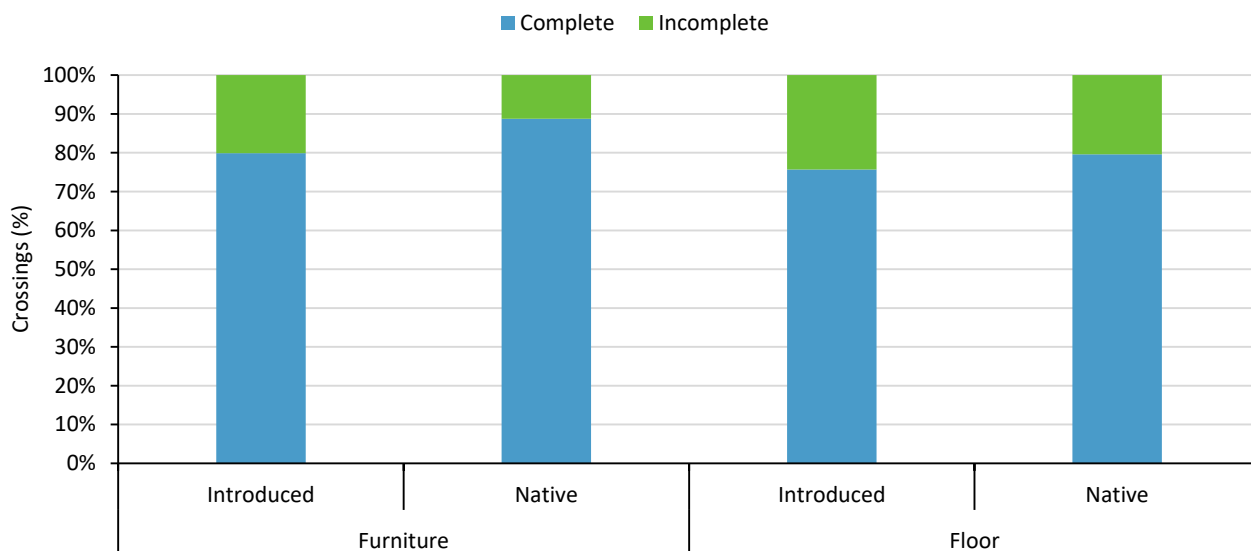


Figure 5: Crossing completions (% complete and incomplete) in relation to introduced and native species using the fauna furniture vs culvert floor (2018 & 2019 combined).

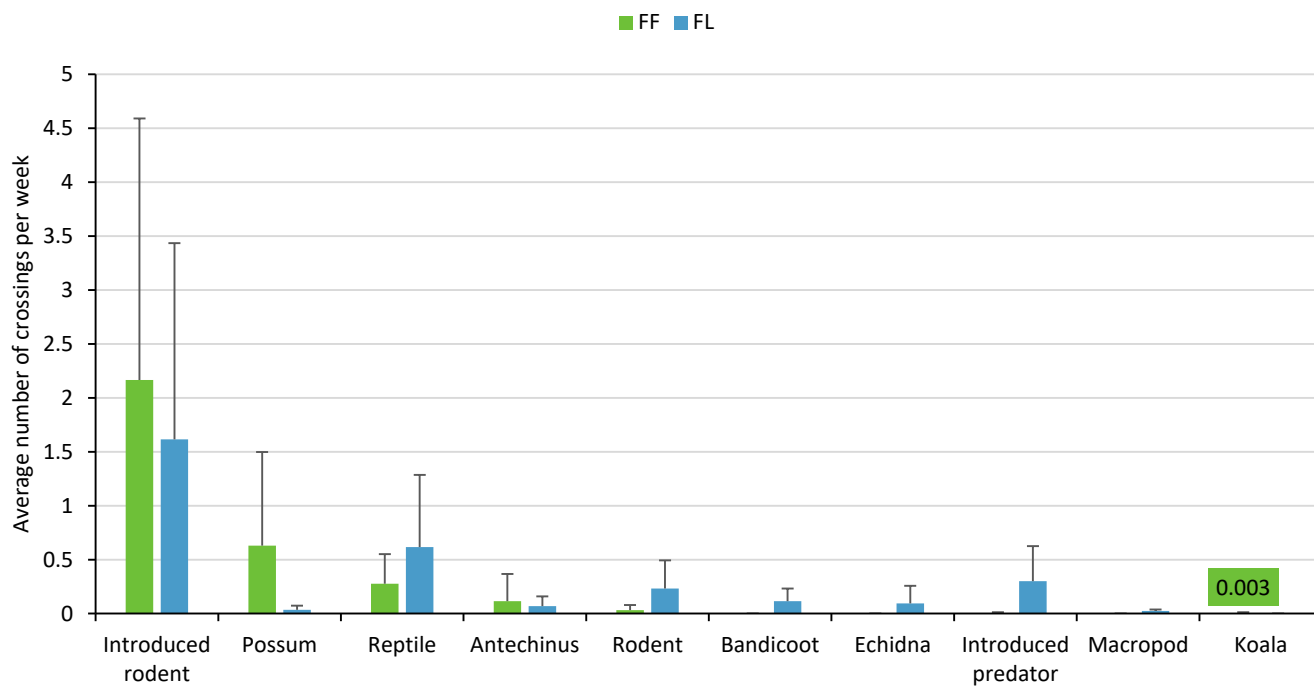


Figure 6: Average number of complete crossings by taxa per week ($\pm$ standard deviation, $n=7$, excludes McGrath's site) using the fauna furniture (FF) vs culvert floor (FL) (2018 & 2019 combined).



Plate 5: Koala using fauna furniture to cross under the highway at Burkes Lane.



Plate 6: Eastern crevice skink making a complete crossing along the fauna furniture in Martell's North underpass (L). A short-eared brushtail possum performs a complete crossing in a westerly direction in Burke's underpass (R).

3.3.2 Sand pad monitoring

Ten species were recorded during sand pad monitoring of underpasses (Table 5). They included short-beaked echidna (Plate 7), eastern water dragon, lace monitor, water rat, dog, fox, cat, swamp wallaby (Plate 7), eastern grey kangaroo, and house mouse. A further nine animal groups including frog spp., wallaby spp., rodent spp., lizard spp. (skink), bandicoot spp., reptile spp., *Antechinus* spp., *Trichosurus* spp. and small bird spp were also recorded. The most commonly recorded taxa group across sites was rodent spp. and the most common confirmed species was the eastern water dragon (Appendix B, Table B9). The McGrath's control site recorded six fauna groups/species during the 2019 sand pad monitoring period while Tyson's recorded the highest species richness of the impact sites with seven (Appendix B, Table B9).



Plate 7: Short-beaked echidna tracks at South Martell's underpass (L). Swamp wallaby tracks and tail scrape at Tyson's underpass (R).

3.3.3 Scat and track search

Evidence of koala, rodent, microbat, eastern water dragon, frog, and *Antechinus* spp. was recorded in underpasses (Table 5). Two koala scats were also recorded in the single cell underpass at Martell's South during the autumn monitoring period (Appendix B, Table B10). The most commonly detected tracks were rodent, eastern water dragon, lace monitor and fox (Appendix B, Table B10). Sites with the highest level of activity were Access G (9 species), and Burkes and McGrath's (8 fauna species/groups each).

3.3.4 Frog survey

In year three 10 frog species were recorded in adjacent habitat (see Table 5). A striped marsh frog (*Limnodynastes peronii*) was recorded moving east on the culvert apron at Martell's north during the autumn monitoring period. Full details of frog surveys are provided in Appendix B, Table B3.

3.3.5 Underpass hair funnels

Analysis of hair funnel samples from underpass fauna furniture recorded one species and two genera (Table 5). Records included two *Antechinus* spp. at Dalhousie, two *Rattus* spp. at Tyson's and one bush rat in both the south Martell's and Tyson's underpasses (Appendix B, Table B16). No fauna were detected by hair funnels in autumn 2019.

3.4 Underpass and Adjacent Habitat Comparison

A total of 56 identified species/groups were detected in the underpasses by all survey methods and 68 were detected within the adjacent habitat (Table 7). Excluding fauna that do not require underpasses for movement (birds and bats), 25 (53%) of the 47 species and fauna groups found in the adjacent habitat were recorded using underpasses (Table 7). An additional 12 species/groups were exclusively recorded within the underpasses and 25 were exclusively reported in the adjacent habitat (Table 7). Common ringtail possum, long-nosed potoroo and sugar glider were the only three mammal species recorded in adjacent habitat but not in underpasses (Table 7). While six out of a total 14 reptile species were found using the underpasses (Table 7). Only one frog species (*Limnodynastes peronii*) out of 10 found in the adjacent habitat was reported within the underpass (Table 7). Seven species recorded in adjacent habitat and known to utilise underpasses elsewhere on the north coast have not been recorded in underpasses on the NH2U upgrade. This includes long-nosed potoroo, which has been recorded on both sides of the Tyson underpass.

Table 7: Comparison between species and fauna groups recorded in underpasses via camera, sand pad and active searches versus species detected in adjacent habitat via camera and active searches. Shading denotes a species or group not confirmed in both areas that is likely to be represented in another species/group that was recorded in both areas, for example northern brown bandicoot is likely represented by bandicoot spp. X Includes species recorded using underpasses during operational phase monitoring of the Coopernook to Herons Creek (Sandpiper Ecological 2015), Sapphire to Woolgoolga (Sandpiper Ecological 2018), Glenugie (Sandpiper Ecological 2017), Woolgoolga to Ballina (Sandpiper Ecological unpublished data) upgrades, Nambucca Heads to Urunga (Sandpiper Ecological 2019) and Warrel Creek to Urunga (Sandpiper Ecological 2019). ¹ = Introduced species.

Species	Species recorded using underpasses in Northern NSW*	Recorded using underpass at NH2U	Recorded in adjacent habitat at NH2U
Mammals			
Short-beaked echidna	X	*	*
Brown antechinus	X	*	
<i>Antechinus</i> spp.		*	*
Long-nosed bandicoot	X	*	*
Northern brown bandicoot	X	*	*
Bandicoot sp.		*	*
Koala	X	*	*
Sugar glider			*
<i>Acrobates</i> spp.			*
Common brushtail possum	X	*	*
Short-eared brushtail possum	X	*	*
Common ringtail possum	X		*
<i>Trichosurus</i> spp.	X	*	*
Long-nosed potoroo	X		*
Eastern grey kangaroo	X	*	*
Swamp wallaby	X	*	*
Red-necked wallaby	X	*	
Wallaby spp.		*	*
Macropod spp.		*	*
Grey-headed flying-fox			*
Black flying-fox			*
Flying-fox spp.			*
Microbat spp.		*	*
Fawn-footed melomys	X	*	
<i>Melomys</i> spp.			*
Water rat	X	*	*

Species	Species recorded using underpasses in Northern NSW*	Recorded using underpass at NH2U	Recorded in adjacent habitat at NH2U
Bush rat	X		*
Swamp rat	X	*	*
Rattus sp.		*	
Rodent spp.		*	*
Medium mammal		*	
Small mammal		*	*
House mouse ¹	X	*	*
Black rat ¹	X	*	*
Fox ¹	X	*	*
Dog ¹	X	*	*
Cat ¹	X	*	*
Cow ¹		*	
Reptiles			
Burtons legless lizard			*
Lace monitor	X	*	*
Eastern water dragon	X	*	*
Land mullet	X		*
Red-tailed skink			*
Eastern crevice skink	X	*	
Common garden skink	X	*	*
<i>Lampropholis</i> spp.			*
<i>Egernia</i> spp.		*	
<i>Eulamprus</i> spp.			*
Lizard spp.		*	*
Carpet python			*
Green tree snake		*	*
Marsh snake	X		*
Yellow-faced whip snake			*
Snake spp.		*	*
Reptile spp.		*	
Frogs			
<i>Litoria fallax</i>			*
<i>Litoria revelata</i>	X		*
<i>Litoria peronii</i>			*
<i>Adelotus brevis</i>			*
<i>Limnodynastes peronii</i>	X	*	*
<i>Crinia signifera</i>			*
<i>Uperolia</i> spp.			*
<i>Uperolia laevigata</i>			*
<i>Pseudophryne coriacea</i>			*
<i>Litoria tylei</i>			*
Large frog		*	
Frog sp.		*	
Birds			
Powerful owl			*
Tawny frogmouth			*
Australian owl nightjar			*
Painted button-quail			*
Crested goshawk			*
Bar-shouldered dove			*
Eastern whipbird			*
Eastern yellow robin		*	*
Australian brush turkey			*

Species	Species recorded using underpasses in Northern NSW*	Recorded using underpass at NH2U	Recorded in adjacent habitat at NH2U
<i>Malurus</i> spp.			
Welcome swallow	X	*	
Australian logrunner			*
Red-browed finch		*	*
Australasian darter		*	
Azure kingfisher		*	
Grey shrike-thrush		*	*
Yellow-throated scrubwren			*
Lewin's honeyeater		*	
White-necked heron		*	
White-browed scrubwren			*
Australian magpie			
Laughing kookaburra		*	*
Pacific black duck	X	*	
Medium bird spp		*	
Small bird spp		*	
Bird spp		*	

3.5 Exclusion Fence Monitoring

Nineteen species, one genera, and five groups were recorded during fauna fence monitoring, including six introduced species (Table 8). A total of 427 fauna detections were recorded during exclusion fence monitoring (Appendix B, Table B15). The most commonly recorded species was black rat with 238 detections, followed by swamp wallaby (46 detections) and house mouse (44 detections; Appendix B, Table B15). Railway had the most detections with 122, 87 of which were either house mouse or black rat and 26 wallaby spp., followed by Bourke's Lane (77 detections) and Access G (65 detections; Appendix B, Table B15).

All species/groups except for purple swamphen, Australian brush turkey and painted button-quail were also recorded using underpasses (Table 8). Excluding birds, all mammal and reptile species recorded at the exclusion fence were also recorded in underpasses (Table 8). Of all species/groups a majority exhibited no directional movement while on 56 (13%) occasions fauna were moving towards the underpass and on 14 (3%) occasions fauna were recorded moving through the fence towards the road (Appendix B, Table B15). Of these, 11 were black rat, and one each of eastern water dragon, painted button-quail, and rodent spp. (Appendix B, Table B15).

Table 8: Species and species groups recorded at the exclusion fence and within underpasses.

Species recorded at fence	Recorded in Underpass
Mammals	
Short-beaked echidna	*
Long-nosed bandicoot	*
Northern brown bandicoot	*
Bandicoot spp.	*
Koala	*
Common brushtail possum	*
Short-eared brushtail possum	*
<i>Trichosurus</i> spp.	*
Swamp wallaby	*
Red-necked wallaby	*
Rodent spp.	*
Small mammal	*
Medium mammal	*
Reptiles	
Lace monitor	*
Eastern water dragon	*
Birds	
Painted button-quail	
Australian brush turkey	
Purple swamphen	
Introduced	
House mouse	*
Black rat	*
Fox	*
Dog	*
Cat	*
Hare	

3.6 Road-kill Monitoring

A total of 52 individuals were recorded during the four (2 in autumn and 2 in spring) year three road-kill surveys (Appendix B, Table B5). This included 33 species and eight fauna groups. Fauna whose movement is not impeded by the exclusion fence (birds and bats) accounted for 42% (23 individuals) of recorded road-kill. Small fauna (i.e. reptiles, amphibians and small mammals) that can move through the exclusion fence accounted for 17% (9 individuals), while fauna which should have been excluded (macropods, large and medium species) accounted for 41% (21 individuals) of all recorded road-kills (Appendix B, Table B5).

During 2019, the highest average number of road-kills was recorded at Dalhousie (7.5/km) followed by Access G, Burkes and Martell's North each with 3.5/km (Figure 7). The least number of road-kills occurred at Railway (1.5/km) followed by McGrath's (0.5/km) (Figure 7). The low number at McGraths is not unexpected as the site is situated on a local road.

Between 2018 and 2019 road-kill decreased at all sites except Martells North and Dalhousie (Figure 7). At Martell's North road-kill increased from 1.5/km in 2018 to 3.5/km in 2019. Whilst the rate at Dalhousie (7.5/km) did not change from 2018 to 2019 (Figure 7). Four macropods (out of a total six records) were recorded at Martell's North in spring 2019, suggesting the possibility of a breach in the fence at that site (Appendix B, Table B5).

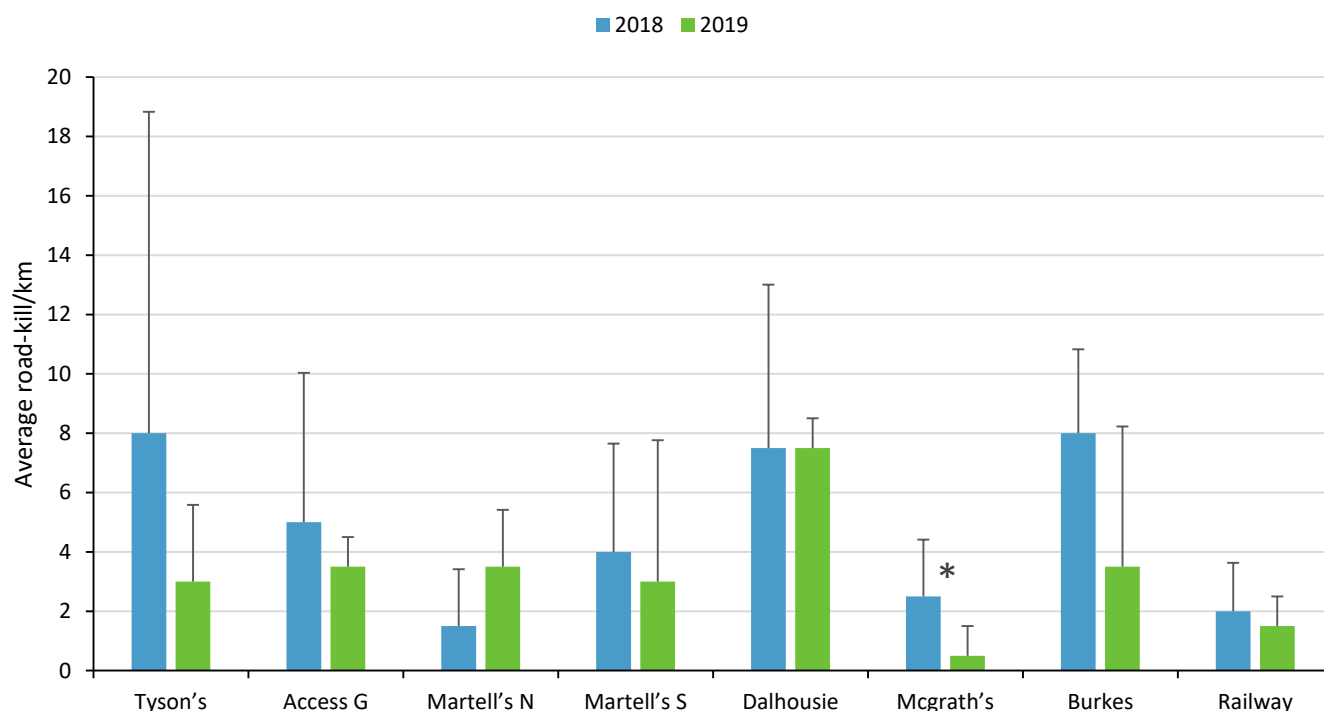


Figure 7: Average number of road-kill per kilometre ($\pm$ standard deviation, $n=4$) recorded at each site (north to south) during 2018 and 2019 monitoring. *Denotes reference site (McGraths).

Amongst the fauna that should be excluded, mammals (bandicoots, possums, unidentified medium and large mammals) recorded the highest number of road-kill/km in 2019 with 1.28/km (Figure 8). Aside from birds, reptiles reported the highest average number of road-kills/km of fauna groups unlikely to be excluded with 0.43/km (Figure 8). The number of road-killed macropods increased from nil in 2018 to 0.14/km in 2019 (Figure 8). In contrast, fauna groups not excluded by the fence exhibited a general decline from 2018 to 2019 (Figure 8).

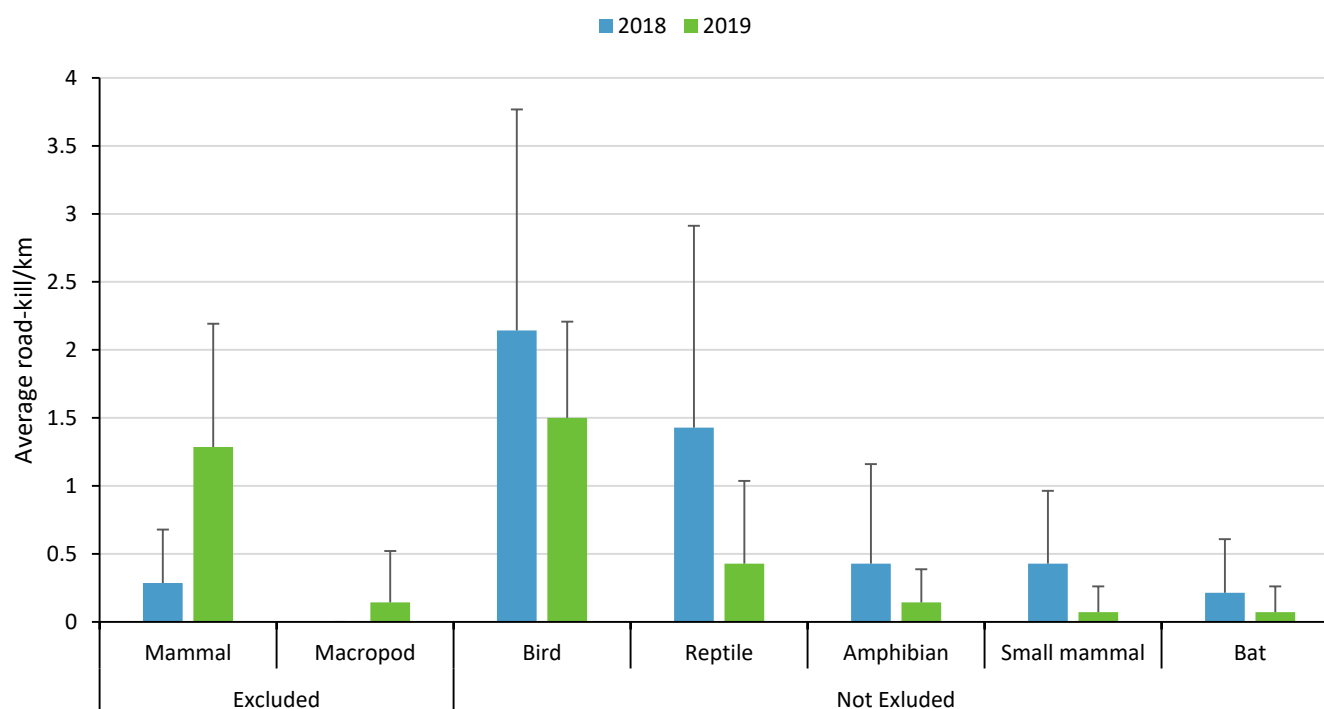


Figure 8: Average number of road-kill/km ($\pm$ standard deviation) recorded at impact sites ($n=7$) for taxa groups excluded and not excluded (unlikely to be excluded) by fauna fence during 2018 and 2019 monitoring.

3.7 Vegetated Median Monitoring

3.7.1 Spotlighting

Spotlight surveys of vegetated medians at Dalhousie and Tyson's detected five sugar gliders, one grey-headed flying fox, and one powerful owl (Appendix B, Table B2). Three sugar gliders were recorded within medians, one at Dalhousie during autumn and two at Tysons during spring. The remaining two sugar gliders were recorded at Dalhousie west and Tyson's east transects (Appendix B, Table B2).

3.7.2 Hair funnels

Fauna were detected at 60 (50%) of the 120 hair funnel sites during autumn 2019 and 77 (64%) during spring 2019 (Appendix B, Table B4). Because the hair of sugar gliders and squirrel gliders cannot be reliably differentiated, hair samples attributed to either species is reported as sugar/squirrel glider, Sugar/squirrel glider hair was recorded at 39 hair funnel sites in autumn and 35 in spring. Twenty-four of these were recorded in the Tyson's median and three in the Dalhousie median (Table 9). Other species detected in hair funnels were *Antechinus* spp, yellow-footed antechinus, brown antechinus, *Trichosurus* spp., black rat, fawn-footed melomys and house mouse.

At Tysons, weekly detections of sugar/squirrel glider in autumn increased from 0.6/week in 2018 to 1.05/week in 2019 (Figure 8). The same trend was evident in spring when detections increased from 0.2/week in 2018 to 1.25/week in 2019 (Figure 8). Sugar/squirrel glider were not detected in the Dalhousie median in spring 2018 or 2019 and records in autumn decreased from 0.9/week in 2018 to 0.25/week in 2019 (Figure 8).

No yellow-bellied gliders or greater gliders were recorded during year three monitoring.

Table 9: Fauna groups recorded during vegetated median monitoring in 2019.

Fauna groups	Dalhousie						Tyson's					
	Autumn			Spring			Autumn			Spring		
	East	Median	West	East	Median	West	East	Median	West	East	Median	West
<i>Antechinus</i> spp.			6		8	4	4	6		7	13	2
<i>Melomys</i> spp.		1		1								
Sugar/squirrel glider	1	3		1		3	12	11	12	13	13	8
Possum spp.									1			1
Rodent spp.	2	1			3							
Total	3	5	6	2	11	7	16	17	13	20	26	11

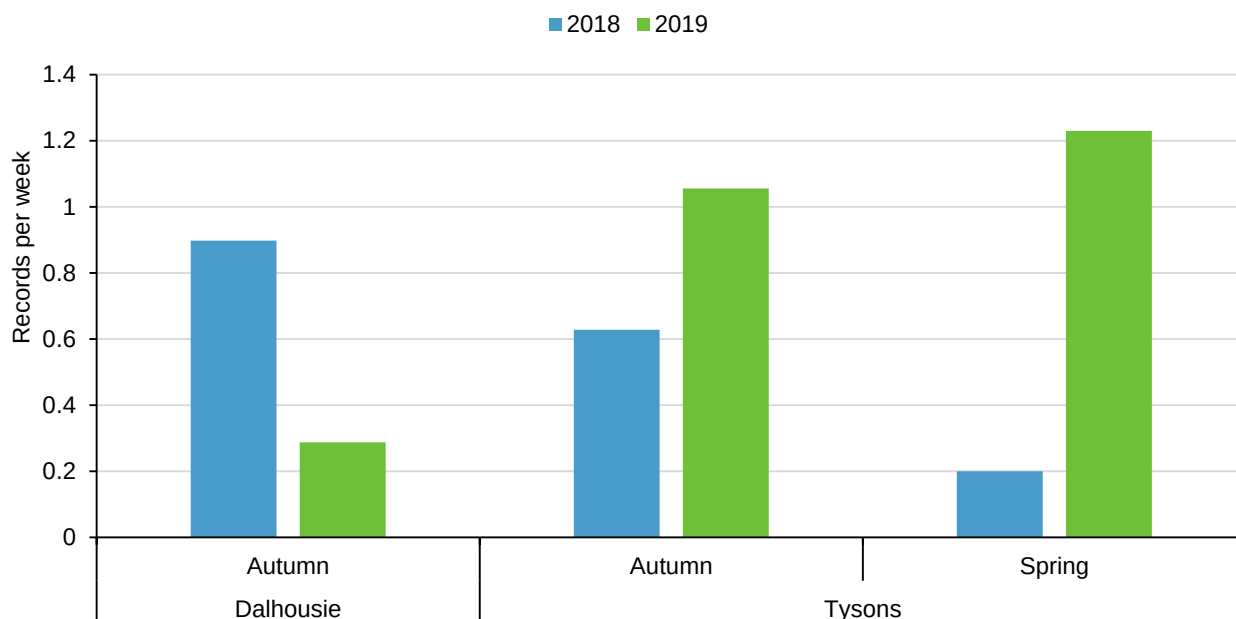


Figure 9. Average record (detections per week) of sugar/squirrel glider recorded during hair funnel sampling within the Dalhousie and Tysons's medians in autumn and spring 2018 and 2019.

3.8 Targeted Threatened Fauna

3.8.1 Adjacent habitat

No individuals or evidence of brush-tailed phascogale or spotted-tail quoll was recorded during adjacent habitat surveys. A koala scat was recorded beneath a tallowwood at Tyson's west and an adjacent habitat camera recorded a koala on the west side of Burkes Lane (Appendix B, Table B6). Although not a target species, long-nosed potoroo was recorded by an adjacent habitat camera on the west side of the Tysons underpasses and probable potoroo diggings were recorded on the east and west sides of the Tysons underpass.

3.8.2 Underpasses and fauna fence

A koala was recorded using fauna furniture to move through the Tyson's underpass (Appendix B, Table B12). Further, a koala was recorded travelling towards the Tyson's underpass during exclusion fence monitoring in spring (Appendix B, B15).

3.8.3 Vegetated medians

Squirrel/sugar glider hair was detected at 27 sites, 10 at Dalhousie and 17 at Tyson's, including nine records inside the median (five at Tyson's and four at Dalhousie). No evidence of yellow-bellied glider was recorded in year 3 monitoring.

3.9 Habitat Assessment

Results of habitat assessment can be found in Appendix B, Table B13.

4. Discussion

Results of year three operational phase monitoring are discussed with reference to the performance criteria described in the Ecological Monitoring Program (Benchmark 2013) and outlined in section 1.2 of this report.

4.1 Underpass and exclusion fencing monitoring

Monitoring results in 2019 suggest a substantial increase in fauna use of underpasses although this is likely due to changes in the type of cameras used rather than an actual increase in underpass use. The combination of Swift cameras (floor) and Reconyx cameras (furniture) was found to be superior in detecting small fauna than the universal use of Reconyx cameras. Reconyx cameras still proved effective in detecting fauna using furniture. Our concerns about the detection rate of Reconyx cameras are supported by Jameau *et al.* (2017) who found that Reconyx HC600 cameras failed to record 43.6% of small mammal and 17% of medium-sized mammal visits to underpasses. In addition, Apps and McNutt (2018) identified performance limitations, including detection dead zones, when Reconyx cameras were angled towards the ground.

The difference in effectiveness between Reconyx and Swift cameras is likely due to the mode of detection. Reconyx use a combination of temperature and movement to detect fauna. To trigger a Reconyx camera an animal (with a temperature different to the background) must be present within one of the horizontal detection bands and move into or out of at least one of the vertical detection zones (Reconyx 2010). In contrast, Swift cameras have a cone-shaped detection zone and are triggered by movement within this zone.

4.1.1 Rates of use of fauna underpasses and adjacent habitats by feral predators

Seven introduced species were detected in fauna underpasses, including three feral predators, fox, cat and dog. In year three (2019) feral predators accounted for 5% of total complete crossings, which was substantially less than 2018 when they accounted for 11% of complete crossings. Complete crossings by dogs declined from 2.1/week in 2018 to 0.7/week in 2019, with a similar result recorded for foxes i.e. 2.4 (2018) to 1.8 (2019). In contrast, complete crossings by cats increased threefold from 1.4/week in 2018 to 4.7 in 2019. Whilst the results for dogs and foxes are encouraging they may be due to drought conditions, which affected the study area throughout 2019.

Black rat activity at underpasses doubled in 2019, which suggests that more prey were available to feral predators. Indeed, increased abundance of rodents may have attracted cats to underpasses as introduced species often comprise the majority of feral cat diets in eastern Australia (Jones & Coman 1981; Molsher *et al.* 1999; Reed *et al.* 2001). In contrast, black rats may not be an important prey species of either dogs or foxes (see Davis *et al.* 2015). The majority (83%) of cat visits occurred at one site (Dalhousie Creek) and these could have been due to frequent use by a small number of individuals.

The total number of fox crossings recorded at NH2U in 2019 (i.e. 19) compares favourably with Sapphire to Woolgoolga (230 fox crossings) and Glenugie (70 fox crossings) (Sandpiper Ecological 2017a & b). In contrast, the number of cat crossings recorded at NH2U in 2019 (i.e. 50) was higher than recorded at Glenugie (n = 34). The dominance of cats in 2019 is consistent with baseline sampling (Sandpiper Ecological 2015). Whilst it is too early to make definitive statements, the level of feral predator use of underpasses at NH2U compares favorably with other similar sites in northern NSW.

A recommendation of the year two underpass monitoring program was to “Undertake additional analysis of feral predator use of underpasses following year three monitoring to determine if a targeted control program is required.” Trends recorded in year three indicate that further monitoring is warranted before a control program is considered.

4.1.2 High levels of fauna underpass use by a wide variety of native fauna species

Thirty native species have been recorded using underpasses and 23 of these have been recorded making complete crossings. Fifty-two native species were recorded in adjacent habitat and 38 (excluding all flying mammals and birds) of these were native species that could use underpasses. Sixteen species, or 42% of species recorded in adjacent habitat, that are targeted by underpasses, were recorded making complete crossings. This result is comparable to the Sapphire to Woolgoolga upgrade where between 23% and 50% of fauna recorded in adjacent habitat utilised underpasses and is slightly higher than the 38% recorded at NH2U in 2018 (Sandpiper Ecological 2018; 2019).

The results obtained at NH2U are encouraging and the number of species and frequency of use of the underpasses will likely increase over time (Gagnon *et al.* 2011) as vegetation near entrances becomes more established. Improved vegetation cover will be critical in attracting species with small home ranges, such as the common garden skink, eastern crevice skink and red-tailed skink.

4.1.3 Evidence of use by dispersing individuals and different age cohorts

Use by different age cohorts is difficult to confirm using the methods applied at NH2U. Other methods such as mark-release-recapture would likely be required to provide definitive proof of use by dispersing individuals and different age cohorts.

4.1.4 Use by cover-dependent species and species with low mobility

Eight cover dependent and/or low mobility species have been recorded using underpasses at NH2U. Species include brown antechinus, short-eared brushtail possum, fawn-footed melomys, swamp rat, swamp wallaby, green tree snake, eastern crevice skink, and common garden skink. *Antechinus* spp., short-eared possums and eastern crevice skink predominantly used fauna furniture, highlighting the value of this feature in providing connectivity for cover dependent species. The increasing presence of small snakes and lizards in underpasses is also encouraging as these species tend to have small home ranges and largely reside in habitat with dense cover.

4.1.5 Low incidence of fauna road strike

A total of 52 animals were recorded during road-kill surveys over the 4km sample area during year three of the operational phase monitoring program. This is substantially less than the 77 individuals recorded in 2018, with decreases in road-kill abundance recorded at most sites. An average of 3.25 individuals/km was recorded during 2019. Whilst this was less than that recorded in 2018 (4.9 ind/km) road strike density at NH2U was higher than recorded along the Warrell Creek to Nambucca Heads upgrade (WC2NH) where densities of 2.38 ind/km and 2.94 ind/km were recorded in October 2018 and January 2019 respectively (Sandpiper Ecological 2018 & 2019). The difference in mortality rate between sites is likely due to survey method (walk verses vehicle transects).

When species that either move over (birds) or through (small mammals, reptiles and frogs) the fence are excluded road-strike density is reduced to 1.4 ind/km, which is slightly higher than the 1 ind/km recorded in 2018 and similar to the findings at WC2NH of 1.01 ind/km in October 2018 and 0.91 ind/km in January 2019.

Monitoring of the exclusion fence also revealed that 83% of species/groups recorded at the fauna fence were recorded in underpasses, suggesting that the fence is funneling fauna to underpasses. The increase in road-strike of macropods and unidentified mammals in 2019 suggests there may be some gaps in the fence. A cluster of road-killed macropods occurred at Martells North and inspection of the fence at that site is a priority.

4.2 Widened Vegetated Medians

4.2.1 Evidence of use of median vegetation by the target glider species

No targeted glider species were identified from hair samples collected adjacent to and within the vegetated medians in 2019. Difficulty in distinguishing between sugar and squirrel glider hair makes accurate identification of squirrel glider through hair analysis unreliable (*pers. comms.* R. Carter). Consequently, several (77) hair samples were identified as sugar/squirrel glider and are presented in the results as sugar/squirrel glider. Based on spotlighting results these samples are most likely sugar glider. Hair funnel detections of sugar/squirrel glider within the Tysons median increased in both spring and autumn 2019, with the opposite trend recorded at Dalhousie. Sugar gliders are known to utilise vegetated medians to cross major roads (Taylor & Rohweder 2013) and based on the available data it is likely that individuals are using the Tysons and Dalhousie medians to cross the highway. Whilst gliders may be denning in the median individuals would still need to cross the carriageways to forage as there is insufficient habitat within medians to support a family group.

The absence of yellow-bellied glider in 2019 is not unexpected as the species is uncommon in the study area and habitat use could have changed in response to drought. There is evidence from several sites that the abundance of yellow-bellied gliders on the north coast has declined between 2016 and 2019 (Sandpiper Ecological 2019b, c). If the presence of sugar gliders is regarded as evidence that the species is crossing the carriageway then it is likely, given published estimates of glide capability, that yellow-bellied gliders would be capable of crossing the carriageways in both directions. Published figures on glide angles suggest that the sugar glider has the steepest glide angle at 29.7° (Jackson 2002), followed by squirrel glider (28.5°; Goldingay & Taylor 2009) and yellow-bellied glider (27.30; Goldingay 2014).

Despite the strong probability that yellow-bellied gliders could use the medians to cross the highway no definitive evidence has been obtained.

4.2.2 Evidence of use by dispersing individuals and different age cohorts

Confirming the age of individuals is virtually impossible using the survey methods outlined in the EMP. Spotlighting detected no immature glider species but again, circumstances (animals high in canopy, limited light, glare from traffic etc.) restricted the ability to accurately ascertain age. No adult animals with back young or pouch young were observed, and all gliders were determined to be adults.

4.2.3 Use by glider species other than threatened species

Sugar gliders were recorded within medians on three occasions in 2019, bringing the total number of median records to five. Hair samples support the direct observation of sugar gliders with 46 records of sugar/squirrel gliders obtained within median vegetation over two years of sampling. Monitoring shows that vegetated medians at Dalhousie and Tyson's are facilitating movement across the highway by sugar gliders. This finding is consistent with monitoring conducted for the Bonville and Sapphire to Woolgoolga upgrades (Taylor & Rohweder 2013; Sandpiper Ecological 2018).

4.3 Targeted Threatened Species

4.3.1 Scansorial threatened species

Neither target scansorial mammal species have been recorded during the operational phase. The absence of spotted-tailed quoll and brush-tailed phascogale is not unexpected. Quolls are uncommon in coastal northern NSW and habitat in the NH2U study area is largely unsuitable for phascogales (Sandpiper Ecological 2019a). In addition, the monitoring periods do not target peak activity times for either species

(i.e. May to August and December to January). Spotted-tailed quolls have been recorded using underpasses at several sites in north-east New South Wales (i.e. Glenugie 2016 & 2019, Oxley Highway to Kempsey 2018, and Coolongolook 2000), although use tends to be sporadic, which is likely due to the species low density and large home range. The absence of confirmed underpass use by spotted-tailed quoll and brush-tailed phascogale at NH2U is not unexpected.

4.3.2 Arboreal threatened species

Koala was recorded during year two (2018) and three (2019) monitoring. In 2018 a single desiccated koala scat was recorded at Burke's west in autumn, and in 2019 a koala was recorded moving through the Burkes Lane underpass, and following the fauna fence on the west side of that underpass. In addition, two koala scats were recorded in the Martells south underpass in autumn. As noted in the year two report, the Dalhousie, Martell's south, and Burke's underpasses are situated in proximity to known koala habitat. Results in 2019 suggest that koala has utilised two underpasses on the NH2U upgrade, with a confirmed crossing at one site. Low visitation by koalas is attributed to low population density in the study area (Sandpiper Ecological 2019a).

Evidence that yellow-bellied gliders reside in the study area is limited to three probable hair samples adjoining the Tysons median. The absence of yellow-bellied glider records during operational phase (2018 and 2019) and construction phase (2013 and 2014) spotlighting suggests that the species is uncommon in the study area. This is supported by the Bionet database, which includes four records in habitat surrounding the vegetated medians for the period January 2000 to January 2019 (Bionet 2019). The absence of yellow-bellied gliders in 2019 may be due to the effect of drought, with notable population declines recorded elsewhere in northern NSW.

Evidence of yellow-bellied glider obtained to date is insufficient to warrant the trapping and radio-tracking requirement outlined in section 3.6.2 of the EMP. Various options should be considered for the final year of median monitoring (i.e. year 5 - 2021) including: apply the same methods as years one and two; expand hair funnel and spotlighting to include quarterly sampling; or replace hair funnel sampling with baited camera traps.

4.3.3 Other threatened species

In 2019, long-nosed potoroo were detected both east and west of the Tysons median. These records add to the record west of Tysons in 2018 (Sandpiper Ecological 2019a) and west of Dalhousie in 2015 (Sandpiper Ecological 2015a). Potoroos are known to utilise underpasses (see Sandpiper Ecological 2015b, AMBS 2002) and the absence of records at NH2U may be due to the timing of monitoring, short duration of monitoring, and or low local abundance of potoroos. Continuation of underpass monitoring in 2021 will increase the likelihood of detecting potoroos in underpasses.

4.4 Species Richness

With a total of 89 vertebrate fauna species detected during year three operational phase monitoring, species diversity is considered high when compared with other pacific highway project locations (e.g. AMBS 2002; Sandpiper Ecological 2015b; 2018). High species richness is attributed to the relatively high habitat quality surrounding the project corridor and dense ground vegetation and abundant woody debris. Many sample sites are also located on creeks or drainage lines where diversity is generally higher. Fauna often use riparian strips as corridors through landscapes and as a source of shelter, water and prey (Lada *et al*, 2008).

4.5 EPBC Act Condition 13

Condition 13 of the *EPBC Act* approval specifies that one year following completion of construction works the person taking the action must provide a report to the Minister detailing the success and/or failings of fauna crossings, fencing and road medians in achieving their intended purpose. The condition specifies five components that must be addressed.

1. Baseline data collected as a requirement of conditions 9 and 12;

Baseline data on underpass use was collected during the construction phase (see; Sandpiper Ecological 2015) and targeted surveys for koala and spotted-tailed quoll occurred immediately prior to commencement of clearing (see Owner & Rohweder 2015). Key findings from these surveys are referred to in Section 4 of this report and by Sandpiper Ecological (2019a).

2. The number, design and location of fauna crossings, fencing and road medians, accompanied by maps and photographs;

Outlined in sections 1 and 2 of this report and Sandpiper Ecological (2019a).

3. Details of a monitoring program to determine the long-term success of fauna crossings, fencing and road medians (including timing, duration, methodology, and performance objectives);

Methods used to monitor underpasses, exclusion fence and vegetated medians were specified in the EMP and, in the case of underpasses, refined during the construction phase sample (see Sandpiper Ecological 2015). The timing, duration and methods used during years two and three operational phase monitoring are described in this report. These methods will be applied in subsequent years unless results suggest that a change is warranted. Performance objectives are discussed in Section 4.

4. The success of fauna crossings to date;

Outlined in section 3 and 4 of this report.

Results from years two and three operational phase monitoring are encouraging. A total of 16 native species (excluding birds) made complete crossings of underpasses in year three, including the koala. Sugar gliders were recorded in both vegetated medians. Road-kill surveys detected 21 individuals from four species that should have been stopped from entering the highway by exclusion fence and the mortality rate is consistent with other nearby upgrades (Sandpiper Ecological 2019d). Continued monitoring will demonstrate trends in fauna interaction with the highway.

5. A comparison of data/results from other projects involving upgrades to the Pacific Highway regarding the long-term success of fauna crossings and/or fencing;

Reference to findings of other Pacific Highway monitoring projects has been included in the discussion (section 4) where required.

5. Recommendations

Table 10: Recommendations following Year 3 operational biodiversity monitoring and Transport for NSW response.

Number	Recommendation	Transport for NSW Response
1.	Continue operational phase monitoring in year five (2021) as per the EMP.	Agree and Adopted
2.	Consider the need for a feral predator control program targeting underpasses following completion of year five monitoring.	Agree and Adopted
3.	The threatened glider trapping and radio-tracking study recommended in the EMP is not supported as such a program is unlikely to provide useful data.	Agree and Adopted
4.	Consider including baited arboreal camera traps in the vegetated medians to increase the likelihood of confirming the presence of yellow-bellied glider. Camera traps should replace spotlighting and hair funnel sampling and would focus solely on the medians. Between five and seven baited camera traps should be installed in each median for a minimum of two, two-month sample periods, with bait changed after one month of sampling. The continuation of spotlighting and hair funnel sampling is unlikely to provide additional data on that collected in years two and three of the monitoring program.	Agree and adopted, noting EPA has reviewed the recommendation and is supportive of the proposed change to the monitoring methodology
5.	In year five of the operational phase assess the condition of regeneration at underpass entrances and provide advice on whether improvements are required to increase fauna use of the underpasses.	Agree and Adopted
6.	Investigate potential breaches in exclusion fence which may be contributing to increased road strike for macropods. Martells North is a priority site.	Agree and Adopted

6. References

- AMBS. (2002). *Fauna underpass monitoring stage two, episode five: Bulahdelah to Coolongolook*. Report prepared for NSW Roads and Traffic Authority.
- Apps, P. & McNutt, J. W. (2018). Are camera traps fit for purpose? A rigorous, reproducible and realistic test of camera trap performance. *African Journal of Ecology*: **56**, 710-720.
- Benchmark (2013). Warrell creek to Urunga pacific Highway Upgrade Ecological Monitoring Program. Stage 1: Nambucca to Urunga. Report prepared for NSW Roads and Maritime Services.
- Bionet (2019). Search performed 5/2/2019.
- Cox, M. P. G., Dickman, C. R. & Cox, W. G. (2001). Use of habitat by the black rat (*Rattus rattus*) at North Head, New South Wales: an observational and experimental study. *Austral Ecology*: **25**, 375-385.
- David, N. E., Forsyth, D. M., Triggs, B., Pascoe, C., Benshemesh, J., Robley, A., Lawrence, J., Ritchie, E. G., Nimmo, D. G. & Lumsden, L. F. (2015). Intraspecific and geographic variation in the diets of sympatric carnivores: dingoes/wild dogs and red foxes in south-eastern Australia. *PLoS ONE*: **10**, e0120975. doi:10.1371/journal.pone.0120975
- Gagnon, J. W. Dodd, N. L., Ogren, K. S. & Schweinsburg, R. E. (2011). Factors associated with use of wildlife underpasses and the importance of long-term monitoring. *Journal of Wildlife Management*: **75**, 1477-1487.
- Geolink (2017). Spotted-tailed quoll management plan: Warrell Creek to Nambucca Heads Upgrade of the Pacific Highway. Report prepared for Acciona Ferrovial Joint Venture and Roads and Maritime Services NSW.
- Goldingay, R. L. (2014). Gliding performance in the yellow-bellied glider in low canopy forest. *Australian Mammalogy*: **36**, 254-258.
- Goldingay, R. L. & Taylor, B. D. (2009). Gliding performance and its relevance to gap crossing by the squirrel glider (*Petaurus norfolcensis*). *Australian Journal of Zoology*: **57**, 99-104.
- Jackson, S. M. (2002). Glide angle in the genus *Petaurus* and a review of gliding in mammals. *Mammal review*: **30**, 9-30.
- Jones, E. & Coman, B. J. (1981). Ecology of the feral cat, *Felis catus*, in south-eastern Australia 1. Diet. *Wildlife Research*: **8**, 537-547.
- Jumeau, J., Petrod, L. & Handrich, Y. (2017). A comparison of camera trap and permanent recording video camera efficiency in wildlife underpasses. *Ecology and Evolution*: **7**, 7399-7407.
- Lada, H., Thomson, J.R., MacNally, R. & Taylor, A.C. (2008) Impacts of massive landscape change on a carnivorous marsupial in south-eastern Australia: interferences from landscape genetics analysis. *Journal of Applied Ecology* 45 (6).
- Lewis, B. D. (2014). Oxley Highway to Kempsey spotted-tailed quoll baseline survey preliminary report. Report prepared by Lewis Ecological for NSW Roads and Maritime Services.
- Molsher, R., Newsome, A. & Dickman, C. (1999). Feeding ecology and population dynamics of the feral cat (*Felis catus*) in relation to the availability of prey in central-eastern New South Wales. *Wildlife Research*: **26**, 593-607.
- Owner, D. G. S. & Rohweder, D. A. (2015). Nambucca Heads to Urunga Pacific Highway Upgrade: baseline population monitoring for koala and spotted-tailed quoll. Prepared for NSW Roads and Maritime Services.

Read, J. & Bowen, Z. (2001) Population dynamics, diet and aspects of the biology of feral cats and foxes in arid South Australia, *Wildlife Research* 28 (2) 195 – 203.

Reconyx (2010). Hyperfire instruction manual. Reconyx Inc Holmen, Wisconsin

Sandpiper Ecological (2011). Glenugie Pacific Highway Upgrade: spotted-tailed quoll status assessment. Report prepared for NSW Roads and Maritime Services.

Sandpiper Ecological (2015a). Pacific Highway Upgrade – Nambucca Heads to Urunga. Underpass monitoring – year 1 (construction phase – year 3). Report prepared for Lendlease Engineering.

Sandpiper Ecological (2015b). Pacific Highway Upgrade – Cooperook to Herons Creek operational phase fauna crossing structure monitoring program. Report prepared for NSW Roads and Maritime Services.

Sandpiper Ecological (2017). Pacific Highway Upgrade – Glenugie: operational phase fauna crossing monitoring program (years 1-3). Report prepared for NSW Roads and Maritime Services.

Sandpiper Ecological (2018). Sapphire to Woolgoolga Pacific Highway Upgrade: operational phase fauna crossing monitoring program years 1-3. Report prepared for NSW Roads and Maritime Services.

Sandpiper Ecological (2018). Pacific Highway Upgrade Warrell Creek to Nambucca Heads: operational phase road-kill monitoring – annual report 2018. Report prepared for NSW Roads and Maritime Services.

Sandpiper Ecological (2019a). Nambucca Heads to Urunga Pacific Highway Upgrade: Operational Phase, Year two underpass and vegetated median monitoring. Report prepared for NSW Roads and Maritime Services.

Sandpiper Ecological (2019b). Pacific Highway Upgrade – Warrell Creek to Nambucca Heads: yellow-bellied glider (*Petaurus australis*) population monitoring: year one operation phase. Report prepared for NSW Roads and Maritime Services.

Sandpiper Ecological (2019c). Woolgoolga to Ballina Pacific Highway Upgrade: threatened gliders monitoring program, operation phase sections 1 and 2, construction phase sections 3-11. Report prepared for NSW Roads and Maritime Services.

Sandpiper Ecological (2019d). Pacific Highway Upgrade Warrell Creek to Nambucca Heads: operational phase road-kill monitoring – annual report 2019. Report prepared for NSW Roads and Maritime Services.

Sandpiper Ecological (2019). Warrell Creek to Nambucca Heads Pacific Highway Upgrade Underpass Monitoring Report – year one operational phase 2018-2019. Report prepared for NSW Roads and Maritime Services.

Taylor, B. D & Rohweder, D. (2013). Radio-tracking three sugar gliders using forested highway median strips at Bongil Bongil National park, north-east New South Wales. *Ecological management & Restoration*: **14**, 228-230.

Watts, C. H. S. (1995). Black rat (*Rattus rattus*), pages 659-660 in *The mammals of Australia*, R. Strahan ed, Australian Museum/Reed Books, Sydney.

Van Dyck, S., Gynther, I. & Baker, A. (2013). *Field Companion to The Mammals of Australia*. New Holland Publishers, Sydney.

Appendix A – Scientific names

Table A1: Common and scientific names for all species recorded during year two and three of operational phase monitoring on NH2U.

Species	Scientific name
Koala	<i>Phascolarctos cinereus</i>
Short-beaked echidna	<i>Tachyglossus aculeatus</i>
Common brushtail possum	<i>Trichosurus vulpecula</i>
Short-eared brushtail possum	<i>Trichosurus caninus</i>
Brushtail possum sp.	<i>Trichosurus sp.</i>
Common ringtail possum	<i>Pseudocheirus peregrinus</i>
Sugar glider	<i>Petaurus breviceps</i>
Squirrel Glider	<i>Petaurus norfolcensis</i>
Yellow-bellied glider	<i>Petaurus australis</i>
Feathertail glider sp.	<i>Acrobates spp.</i>
Fawn-footed melomys	<i>Melomys cervinipes</i>
Water rat	<i>Hydromys chrysogaster</i>
Bush rat	<i>Rattus fuscipes</i>
Swamp rat	<i>Rattus lutreolus</i>
Rat spp.	<i>Rattus spp.</i>
Rodent spp.	<i>Rodentia spp.</i>
Yellow-footed antechinus	<i>Antechinus flavipes</i>
Brown antechinus	<i>Antechinus stuartii</i>
Dusky antechinus	<i>Antechinus swainsonii</i>
Antechinus spp.	<i>Antechinus spp.</i>
Eastern bent-wing	<i>Miniopterus orianae oceanensis</i>
Microbat spp.	
Swamp wallaby	<i>Wallabia bicolor</i>
Red-necked wallaby	<i>Macropus rufogriseus</i>
Eastern Grey Kangaroo	<i>Macropus giganteus</i>
Wallaby spp.	
Long-nosed potoroo	<i>Potorous tridactylus</i>
Macropod spp.	
Long-nosed bandicoot	<i>Parameles nasuta</i>
Northern brown bandicoot	<i>Isodon macrourus</i>
Bandicoot spp.	
Grey-headed flying-fox	<i>Pteropus poliocephalus</i>
Black flying fox	<i>Pteropus alecto</i>
Flying-fox spp.	<i>Pteropus spp.</i>
Large mammal	
Medium mammal	
Small mammal	
Eastern small-eyed snake	<i>Rhinoplocephalus nigrescens</i>
Red-bellied black-snake	<i>Pseudechis porphyriacus</i>
Marsh snake	<i>Hemiaspis signata</i>
Carpet python	<i>Morelia spilota</i>
Green tree snake	<i>Dendrelaphis punctulatus</i>
Yellow-faced whipsnake	<i>Demansia psammophis</i>
Medium snake	
Small snake	
Eastern water dragon	<i>Physignathus lesueurii</i>
Lace monitor	<i>Varanus varius</i>
Egernia mcpheii	<i>Egernia mcpheei</i>
Land mullet	<i>Bellatorias major</i>
Burtons legless lizard	<i>Lialis burtonis</i>
Blue-tongue lizard	<i>Tiliqua scincoides</i>
Garden sun-skink	<i>Lampropholis delicata</i>
Grass sun-skink	<i>Lampropholis guitchinoti</i>
Lampropholis spp.	<i>Lampropholis spp.</i>
Concinnia spp.	<i>Concinnia spp.</i>
Scincidae spp.	<i>Scincidae spp.</i>
Lizard spp.	
Reptile spp.	
Clicking froglet	<i>Crinia signifera</i>
Toadlet spp.	<i>Uperolia spp.</i>
Red-backed broodfrog	<i>Pseudophryne coriacea</i>
Tusked frog	<i>Adelotus brevis</i>
Great barred frog	<i>Mixophyes fasciolatus</i>
Striped marsh frog	<i>Limnodynastes peronii</i>
Whirring tree frog	<i>Litoria revelata</i>
Eastern sedge frog	<i>Litoria fallax</i>
Emerald-spotted tree frog	<i>Litoria peronii</i>

Species	Scientific name
Laughing tree frog	<i>Litoria taylori</i>
Striped rocket frog	<i>Litoria nasuta</i>
Broad-palmed rocket frog	<i>Litoria latopalmata</i>
Graceful tree frog	<i>Litoria gracilentia</i>
Tree frog spp.	<i>Litoria spp.</i>
Large frog	
Medium frog	
Frog spp.	
Tawny frogmouth	<i>Podargus strigoides</i>
Barn owl	<i>Tyto delicatula</i>
Southern boobook	<i>Ninox boobook</i>
Powerful Owl	<i>Ninox strenua</i>
Australian owl nightjar	<i>Aegotheles cristatus</i>
Grey goshawk	<i>Accipiter novaehollandiae</i>
Noisy pitta	<i>Pitta versicolor</i>
Glossy-black cockatoo	<i>Calyptorhynchus lathami</i>
Wonga pigeon	<i>Leucosarcia melanoleuca</i>
Pacific emerald dove	<i>Chalcophaps longirostris</i>
Eastern whipbird	<i>Psophodes olivaceus</i>
Eastern yellow robin	<i>Eopsaltria australis</i>
Australian brush turkey	<i>Alectura lathami</i>
Rufous fantail	<i>Rhipidura rufifrons</i>
Grey fantail	<i>Rhipidura albiscapa</i>
Superb fairywren	<i>Malurus cyaneus</i>
Variegated fairywren	<i>Malurus lamberti</i>
Fairywren spp.	
Welcome swallow	<i>Hirundo neoxena</i>
Australian logrunner	<i>Orthonyx temminckii</i>
Red-browed finch	<i>Neochmia temporalis</i>
Sacred kingfisher	<i>Todiramphus sanctus</i>
Azure kingfisher	<i>Ceyx azureus</i>
Grey shrike-thrush	<i>Colluricincla harmonica</i>
Yellow-faced honeyeater	<i>Caligavis chrysops</i>
Lewins honeyeater	<i>Meliphaga lewinii</i>
White-cheeked honeyeater	<i>Phylidonyris niger</i>
Yellow thornbill	<i>Acanthiza nana</i>
White-browed scrubwren	<i>Sericornis frontalis</i>
Australian magpie	<i>Cracticus tibicen</i>
Laughing kookaburra	<i>Dacelo novaeguineae</i>
Buff-banded rail	<i>Gallirallus philippensis</i>
Dollarbird	<i>Eurystomus orientalis</i>
Pacific black duck	<i>Anas superciliosa</i>
Waterbird spp.	
Medium bird spp.	
Small bird spp.	
Striped gudgeon	<i>Gobiomorphus australis</i>
Mosquito fish	<i>Gambusia affinis</i>
House mouse	<i>Mus musculus</i>
Black rat	<i>Rattus rattus</i>
Red fox	<i>Vulpes vulpes</i>
Dog	<i>Canis lupus familiaris</i>
Cat	<i>Felis catus</i>
Cow	<i>Bos taurus</i>
Human	<i>Homo sapien</i>

Appendix B Survey data

Table B1: Daytime searches of adjacent habitat data. Msb = moves small branches, Mlb = moves large branches, RL = rustles leaves, Pseud. = Pseudophryne species, Lim = Limnodynastes species, Lit = Litoria species, Poss = possible, Prob = probable, E. water dragon = Eastern water dragon.

Site	Date	Side	Day/Night (survey no.)	Observers	Start Time	Finish Time	Wind	Rain	Visibility	Air Temp	Humidity	Species (no. of individuals / behaviour)	Comments
Tyson's	27/02/2019	East	Day	SR, LA	8:05	8:35	Nil	Nil	Overcast	21	74	Wallaby spp.	Scat
	27/02/2019	West	Day	SR,LA	8:37	9:07	Nil	Nil	Overcast	21	74	Wallaby spp.	Scat
	22/03/2019	East	Day	NP/NM	1120	1150	Nil	Nil	Good	25.7	75	Snake skin, Wallaby scat, Lampropholis spp.	OBS and scat
	22/03/2019	West	Day	NP/NM	1150	1220	Nil	Nil	Good	25.7	75	Lampropholis, Eastern Eastern water dragon scat, Wallaby spp. Scat	Obs and scat
Access G	26/02/2019	East	Day	SR, LA	4:00	4:30	Nil	Nil	Overcast	25.6	56	Lampropholis spp. x 5, wallaby spp.	Scats
	26/02/2019	West	Day	SR, LA	3:30	4:00	Nil	Nil	Overcast	25.6	56	Bandicoot spp., Wallaby spp.	Scats
	16/04/2019	East	Day	NP/NM	1050	1120	Nil	Nil	Cloudy	23.7	65	Bandicoot spp, scats, Wallaby spp. scats, echidna diggings, Lampropholis delicata, Eastern Eastern water dragon scats, Crinia signifera	Scats and obs
	16/04/2019	West	Day	NP/NM	1120	1150	Nil	Nil	Cloudy	23.7	65	Lampropholis delicata, small lizard scat	Scat obs
Martell Nth	26/02/2019	East	Day	SR, LA	10:15	10:45	Nil	Nil	Overcast	20.3	85%	Nil	Mud nest in adjacent pipes/ fairy martins
	26/02/2019	West	Day	SR, LA	9:45	10:15	Nil	Nil	Overcast	20.3	85%	Lampropholis spp. X 1, Lit. fallax x 1, bandicoot spp., Wallaby spp.	Wallaby scat, bandicoot diggings
	16/04/0009	East	Day	NP/NM	1330	1400	Nil	Nil	Cloudy	23.1	64	Bandicoot diggings, Wallaby scat, Lampropholis spp.	
	16/04/0009	West	Day	NP/NM	1400	1430	Nil	Nil	Cloudy	23.1	64	Wallaby scat, bandicoot diggings	
Martell Sth	26/02/2019	East	Day	SR, LA	12:30	1:00	Nil	Nil	Overcast	24.2	65%	Lampropholis spp. x 2, wallaby spp.	Wallaby scat

	26/02/2019	West	Day	SR, LA	1:02	1:32	Nil	Nil	Overcast	24.2	65%	Lampropholis spp. x 3, wallaby spp.	Wallaby scat
	17/02/2019	East	Day	NP/NM	1210	1240	Msb	Nil	Cloudy	23.8	67	Lampropholis spp. OBS, Echidna diggings, Wallaby scat, bandicoot diggings	
	17/02/2019	West	Day	NP/NM	1240	1310	Msb	Nil	Cloudy	23.8	67	Lampropholis spp. OBS, Wallaby Scat, c. signifera, Upe. Laevigata.	
Dalhousie	26/02/2019	East	Day	SR, LA	11:27	11:54	Nil	Nil	Overcast	22.3	75	Lampropholis spp. X 1, Bandicoot spp.	Bandicoot diggings
	26/02/2019	West	Day	SR, LA	10:55	11:25	Nil	Nil	Overcast	22.3	75	Lampropholis spp. x 2, wallaby spp.	Wallaby scat
	16/04/2019	East	Day	NP/NM	1210	1240	Msb	Light shower	Cloudy	23.2	68	Swamp wallaby scat, bandicoot diggings, Lampropholis spp. OBS, Lit fallax.	
	16/04/2019	West	Day	NP/NM	1240	1310	Msb	Light shower	Cloudy	23.2	68	Calyptotis ruficauda obs, Wallaby scat, Lampropholis delicata	
Burkes	26/02/2019	East	Day	SR, LA	8:30	9:00	Nil	Nil	Clear	20.3	85%	Lampropholis spp. x 2, Calyptotis ruficauda x 1, wallaby spp.	Wallaby scat
	26/02/2019	West	Day	SR, LA	9:08	9:38	Nil	Nil	Clear	20.3	85%	Lampropholis pp. x 4, wallaby spp.	Wallaby scat
	16/04/2019	East	Day	NP/NM	1445	1515	Nil	Nil	Clear	23.6	76%	Eastern grey kangaroo scat, Wallaby scat, Lampropholis spp. OBS, Lit. fallax calling	
	16/04/2019	West	Day	NP/NM	1515	1545	Nil	Nil	Clear	23.6	76%	Wallaby Scat, bandicoot diggings	
Railway	26/02/2019	East	Day	SR, LA	2:40	3:10	Nil	Nil	Overcast	25.8	58	Lampropholis spp.	
	26/02/2019	West	Day	SR, LA	2:05	2:35	Nil	Nil	Overcast	25.8	58	Lace monitor x 1, bandicoot diggings	
	17/04/2019	East	Day	NP/NM	11:00	1130	Msb	Nil	Cloudy	23.4	66	Wallaby scat, Lampropholis spp. OBS,	
	17/04/2019	West	Day	NP/NM	1130	1200	Msb	Nil	Cloudy	23.4	66	Wallaby scat, Dragon spp. OBS, scat, Lampropholis delicata obs, bandicoot diggings.	
Mcgrath's	27/02/2019	East	Day	SR, LA	9:15	9:45	Nil	Nil	Overcast	22.1	70	Lampropholis spp. x 1, Calyptotis ruficauda x 1, wallaby spp.	Wallaby scat
	27/02/2019	West	Day	SR,LA	10:15	10:40	Nil	Nil	Overcast	22.1	70	Lampropholis spp. x 1	
	22/03/2019	East	Day	NP/NM	10:00	10:30	Nil	Nil	Good	25.1	71	Lampropholis delicata x 8, swamp Wallaby	OBS, scat and browsing sign

	22/03/2019	West	Day	NP/NM	10:30	11:05	Nil	Nil	Good	25.1	71	Land mullet, Swamp wallaby scat, dog scat	OBS
Spring 2018													
Tyson's	16/09/2019	East	Day	NM/DW	1530	1600	Nil	Nil	Smokey	22.4	67	Lampropholis x 4, Brushtail Possum sp. spp scat, prob potoroos diggings, prob swamp snake, wallaby spp scat,	
	16/09/2019	West	Day	NM/DW	1615	1645	Nil	Nil	Smokey	22.4	62	Wallaby scat, lace monitor tree scratches, prob potoroo diggings, Koala scat, Calyptotis ruficauda	Koala scat under E. microcorys
	19/09/2019	East	Day	NM/DW	950	1020	Nil	Nil	Good	18.5	90	Brushtail Possum sp. scat, bandicoot diggings, Lace monitor scratches, wallaby scat, 2 x lampropholis, Fox scat, L. Peronii, L. Fallax	
	19/09/2019	West	Day	NM/DW	900	930	Nil	Nil	Good	18.5	90	Lampropholis spp, candicoot diggings, Wallaby scat, L. fallax, Ps. Coriacea, L. tyleri, crested goshawk, ringtail possum scat	
Access G	17/09/2019	East	Day	NM/DW	930	1000	RL	Nil	Overcast	20.3	67	Wallaby scat, Bandicoot diggings, Lampropholis spp x 2, small lizard sp x 2, small lizard spp scat, C. Signifera call	
	17/09/2019	West	Day	NM/DW	1010	1040	RL	Nil	Overcast	20.8	67	Lampropholis spp x3, Wallaby scat, green tree snake, lace monitor scratches, Calyptotis ruficauda, Prob potoroo diggings, Brushtail Possum sp. scat.	
	19/09/2019	East	Day	NM/DW	1035	1105	Nil	Sprinkle	Overcast	20.1	73	C. Signifera, Fox scat, L. Fallax, Wallaby scat, Calyptotis ruficauda, Brushtail Possum sp. scat	
	19/09/2019	West	Day	NM/DW	1108	1138	Nil	Nil	Overcast	19.4	81	L. Fallax, C. Signifera, wallaby scat, lace monitor scratches, Lampropholis spp, Fox scat, P. Coriacea	
Martell Nth	16/09/2019	East	Day	NM/DW	1355	1425	MSB	Nil	Smokey	23.4	60	Bandicoot diggings, wallaby spp scat,	
	16/09/2019	West	Day	NM/DW	1430	1500	MSB	Nil	Smokey	22.8	68	Wallaby scat, Lit. Fallax, Lampropholis, bandicoot diggings	
	20/09/2019	East	Day	NM/DW	1045	1115	RL	Nil	Nil	21.1	76	Bandicoot diggings, wallaby scat,	
	20/09/2019	West	Day	NM/DW	1130	1200	RL	Nil	Nil	20.8	73	C.signifera, L.fallax, Ps.coriacea, bandicoot diggings, Wallaby scat, Burtons legless lizard, Lampropholis spp x 5	
Martell Sth	17/09/2019	West	Day	NM/DM	800	830	RL	Nil	Overcast	19.4	72	Wallaby scat, Lace monitor scratches, bandicoot diggings, Lit. Fallax	
	17/09/2019	East	Day	NM/DW	840	910	MSB	Nil	Overcast	19.4	72	Wallaby scat, Brushtail Possum sp. spp scat, bandicoot diggings	
	20/09/2019	East	Day	NM/DW	955	1025	Nil	Nil	Nil	18.6	84	C. Signifera, lampropholis spp x 5, wallaby Scat, calyptotis ruficauda	
	20/09/2019	West	Day	NM/DW	920	950	RL	Nil	Nil	18.6	84	L.fallax, C.signifera, Limno. peronii, bandicoot diggings, wallaby scat, Lampropholis spp x 7	

Dalhousie	17/09/2019	East	Day	NM/DW	1100	1130	MSB	Nil	Overcast	20.2	69	Bandicoot diggings, Wallaby scat, Lace monitor scratches, Koala scat, Lampropholis x 2, Brushtail Possum sp. scat,	Koala scat under E. Propinqua
	17/09/2019	West	Day	NM/DW	1145	1215	MLB	Nil	Overcast	20.2	71	Wallaby scat, rodent scat, Lampropholis X 2, lace monitor	
	19/09/2019	East	Day	NM/DW	1150	1220	MSB	Sprinkle	Overcast	19.7	76	L. allax, P. coriacea, prob calyptotis ruficauda, Lampropholis spp, calyptotis ruficauda, wallaby scat, Brushtail Possum sp. scat	
	21/09/2019	West	Day	NM/NP	900	930	RL	Nil	Overcast	21	82	C. signifera, Lit. fallax, P. coriacea, marsh snake, Lampropholis spp. x 4, bandicoot diggings, Wallaby scat,	
Burkes	4/09/2019	East	D1	NM	1340	1440	RL	Nil	Good	20.8	73%	Wallaby spp., lampropholis spp x 3, lamp. Delicata x 1	
	16/09/2019	West	D1	NM/DW	12:45	13:15	MSB	Nil	Smokey	27.2	37	Wallaby scat, Bandicoot diggings, Dog scat, lampropholis spp x 2, koala scat under	
	21/09/2019	East	D2	NM/NP	1145	1215	Msb	Nil	Good	20	85	Water skink, Fox scat, Wallaby scat, Marsh snake x 2, Lampropholis spp.	
	21/09/2019	West	D2	NM/NP	1115	1145	Msb	Nil	Good	20	85	Land mullet, Lampropholis spp., Wallaby scat, bandicoot diggings, lace Monitor	
Railway	17/09/2019	East	D1	NM/DM	1335	1404	RL	Nil	Overcast	19.1	74	Wallaby scat, Fox scat, Lampropholis spp x 1	
	17/09/2019	West	D1	NM/DW	1255	1325	RL	Nil	Overcast	19.4	73	Bandicoot diggings, wallaby scat, Brushtail Possum sp. scat	
	20/09/2019	East	D2	NP	1200	1300	RL	Nil	Good	19	70	Wallaby scat, Lampropholis spp.	
	20/09/2019	West	D2	NM/DW	820	850	Nil	Light	Moderate	17.6	89	C.signifera, wallaby scat, lampropholis spp, Brushtail Possum sp. spp	
Mcgrath's	4/09/2019	East	D1	NM	1120	1220	RL	Nil	Clear	20.4	68%	Lampropholis spp. x 5, L. Delicata x 2, wallaby spp scat	
	4/09/2019	West	D1	NM	1230	1330	RL	Nil	Clear	20.4	68%	Lit. fallax call, dog scat, wallaby spp scat, lampropholis spp. X 3	
	20/09/2019	East	D2	NM/DW	1220	1250	Nil	Nil	Clear	20.3	75	Wallaby scat, bandicoot diggings, Lampropholis x 3, Brushtail Possum sp. scat	
	21/09/2019	West	D2	NM/NP	9045	1015	Msb	Nil	Good	21.2	8100%	Carpet Python, Wallaby scat, Lampropholis spp	

Table B2: Nocturnal spotlight surveys of adjacent habitat. GHFF = grey-headed flying fox, SuG = sugar glider, Lit. = Litoria, SEBtP = short-eared brushtail possum, FtG = feathertail glider sp., CBtP = common brushtail possum, BtPoss = Brushtail possum species, TF = Tawny Frogmouth, CRtP = common ringtail possum, Pseud. = Pseudophryne species, Lim = Limnodynastes species, Lit = Litoria s pecies, A. brevis = Adelotus brevis, Upe sp. = Uperolia species, ONJ = Owlet-Nightjar.

Location	Side	Date	Obs. No.	Observers	Start Time	Finish Time	Species	Wind	Rain	Visibility	Air Temp	Humidity	Comment
Autumn 2019													
Tyson's	East	21/03/2019	1	NP/NM	2010	2040	Nil	Nil	Nil	Good	25.5	82.7	
	West	21/03/2019	1	NP/NM	1930	2000	GHFF	Nil	Nil	Good	25.5	82.7	
Access G	East	21/03/2019	1	NP/NM	2038	2108	Small macropod spp.	Nil	Nil	Good	26.4	79	
	West	21/03/2019	1	NP/NM	2120	2150	Nil	Nil	Nil	Good	26.4	79	
Nth martells	East	1/04/2019	1	NP/NM	2120	2150	Nil	RL	Nil	Good	22.1	76	
	West	1/04/2019	1	NP/NM	2200	2230	Nil	RL	Nil	Good	22.1	76	
Sth martells	East	3/04/2019	1	NP/NM	1930	2000	P. coriacea	Nil	Nil	Good	22.8	76	
	West	3/04/2019	1	NP/NM	2010	2040	FF spp.	Nil	Nil	Good	22.8	76	
Dalhousie	East	01/03/0419	1	NP/NM	2130	2200	ONj	Nil	Nil	Good	18.9	91.4	
	West	01/03/0419	1	NP/NM	2100	2130	Nil	Nil	Nil	Good	18.9	91.4	
Burkes	East	27/02/2019	1	NP/NM	2105	2135	Carpet Python x 1, common brushtail possum x 1, macropod spp. x 1	Nil	Nil	Good	19.6	80	Incidental: PO calling on east side 2/4/19.
	West	27/02/2019	1	NP/NM	2145	2215	Swamp wallaby x 1, FtG spp. x 1, GHFF	Nil	Nil	Good	19.6	80	
	East	4/04/2019	1	NP/NM	2100	2130	GHFF	Nil	Nil	Good	22.3	65	
	West	4/04/2019	1	NP/NM	2130	2200	Short-eared Brushtail Possumx2, TF, Swamp wallaby	Nil	Nil	Good	22.3	65	
Railway	East	27/02/2019	1	NP/NM	2220	2250	GHFF, macropod spp.	Nil	Nil	Good	19.8	83	
	West	27/02/2019	1	NP/NM	2300	2330	GHFF, P. coriacea	Nil	Nil	Good	19.8	83	
	East	1/04/2019	2	NP/NM	2240	2310	GHFF	RL	Light	Good	18.1	91	
	West	1/04/2019	2	NP/NM	2310	2340	GHFF, P. coriacea	RL	Light	Good	18.1	91	
Mcgrath's	East	27/02/2019	1	NP/NM	1955	2025	TF, Antechinus spp. x 1, Long-nosed bandicoot x 1, macropod spp.	Nil	Nil	Good	22.8	67	
	West	27/02/2019	1	NP/NP	2025	2055	SuG/SqG x 1, Snake spp. x 1	Nil	Nil	Good	22.8	67	
Spring 2019													
Tyson's	East	19/09/2019	1	NM/DW	1835	1905	FF spp.	Nil	Nil	Good	17.9	91	
	West	19/09/2019	1	NM/DW	1915	1945	(L. Tyleri, L. Peronii, L. Fallax, P. Coriacea: in median strip), P. coriacea, L. fallax west, rodent spp, black FF	Nil	Nil	Good	17.9	91	
	East	21/09/2019	2	NP/NM	1855	1925	Lit. Tyleri, peronii, fallax.	Msb	Nil	Good	20.1	82	
	West	21/09/2019	2	NP/NM	1825	1855	P. coriacea, FF spp.	Msb	Nil	Good	20.1	82	
Access G	East	19/09/2019	1	NM/DW	1950	2020	L. fallax, L. peronii, L. tyleri, C. signifera, P. coriacea,	Nil	Nil	Good	18	89	
	West	19/09/2019	1	NM/DW	2030	2100	House mouse, C. signifera, L. fallax, FtG, P. coriacea	Nil	Nil	Good	18	89	
	East	21/09/2019	2	NP/NM	1930	2000	LN Bandicoot, Lit. fallax, tyleri, peronii, C. signifera, A.	Msb	Nil	Good	20.2	80	

Location	Side	Date	Obs. No.	Observers	Start Time	Finish Time	Species	Wind	Rain	Visibility	Air Temp	Humidity	Comment
Nth martells							brevis						
	West	21/09/2019	2	NP/NM	2000	2030	FF Melomys, C. signifera, Lim. peronii, P. coriacea	Msb	Nil	Good	20.2	80	
	East	21/09/2019	1	NP/NM	2040	2110	SuG, Wallaby spp., Small mammal spp., Crinia signifera	RL	Nil	Good	20.2	78	
	West	21/09/2019	1	NP/NM	2110	2140	FtG, Crinia. signifera, Lit. fallax, tyleri.	RL	Nil	Good	20.2	78	
	East	23/09/2019	2	NP/NM	1815	1845	FF spp.	Nil	Nil	Good	18.3	67	
Sth martells	West	23/09/2019	2	NP/NM	1845	1915	C. Signifera, Lit. fallax, Lit. tyleri, P. coriacea	Nil	Nil	Good	18.3	67	
	East	18/09/2019	1	NM/DW	2050	2120	C. signifera, Lit. Fallax, Short-eared Brushtail Possum, Lit. Peronii, rodent spp, A. Brevis, FF spp	Nil	Nil	Good	17.1	82	
	West	18/09/2019	1	NM/DW	2010	2040	Lit. Fallax, C. Signifera, Lit. Tyleri, Lit. Peronii, Limnodynastes peronii, Short-eared Brushtail Possum, A. Brevis	Nil	Nil	Good	17.1	82	
	East	2/10/2019	2	BT	2145	2215	A brevis, C signifera, GHFF.	Nil	Nil	Good	16.3	70	
	West	2/10/2019	2	BT	2215	2245	Lit peronii, Lim peronii, Lit tyleri, Lit fallax, A brevis, Upe fusca, C signifera	Nil	Nil	Good	16.3	70	
Dalhousie	East	18/09/2019	1	NM/DW	1845	1915	P. Coriacea,	MSB	Nil	Good	17.2	80	
	West	18/09/2019	1	NM/DW	1925	1955	P. Coriacea	MSB	Nil	Good	17.2	80	
	East	22/09/2019	2	NP/NM	2100	2130	P. coriacea	RL	Nil	Poor	17.7	92	
	West	22/09/2019	2	NP/NM	2030	2100	C. signifera, Lim. peronii, FtG, GHFF	RL	Nil	Poor	17.7	92	
Burkes	East	17/09/2019	1	NM/DW	1955	2025	GHFF, Lit. f allax, FtG, black FF	RL	Medium	Rainy	16.5	87	
	West	17/09/2019	1	NM/DW	2125	2155	SuG, GHFF, OnJ, FtG	Nil	Light	Rainy	15.7	90	
	East	23/09/2019	2	NP/NM	1930	2000	GHFF, FtGx2, Lit. fallax	Nil	Nil	Good	15.6	81	
	West	23/09/2019	2	NP/NM	2000	2030	CRTp, Echidna, GHFF,	Nil	Nil	Good	15.6	81	
Railway	East	4/09/2019	1	BT	2145	2215	FF spp.	Nil	Nil	Good	12.7	82	
	West	4/09/2019	1	NP	2145	2215	FF spp.	Nil	Nil	Good	12.7	82	
	East	18/09/2019	2	NM/DW	2150	2220	FF spp.,	Nil	Nil	Good	16.7	81	
	West	19/09/2019	2	NM/DW	2110	2140	L. fallax, C. signifera,	Nil	Medium	Poor	17.1	91	
Mcgrath's	East	17/09/2019	1	NM/DW	1830	1900	Black FF, OnJ, Lit. Fallax,	Nil	Sprinkle	Good	17.1	88	
	West	17/09/2019	1	NM/DW	1915	1945	FF spp., Lit. Fallax, Lit. Peronii, FtG, SuG	Nil	Sprinkle	Good	17.1	88	
	East	2/10/2019	2	NP	2145	2215	GHFF, Lit fallax	Nil	Nil	Good	16.3	70	
	West	2/10/2019	2	NP	2215	2245	Lit fallax, Uperolia spp, A brevis	Nil	Nil	Good	16.3	70	

Table B3: Frog survey data. Lit = Litoria spp., C. = Crinia spp., Pseud. = Pseudophryne spp., Lim. = Limnodynastes spp., M. fasciolatus = Mixophyes fasciolatus.

Location	Date	Obs. No.	Observers	Start Time	Finish Time	Species (entrance)	Species (culvert)	Wind	Rain	Visibility	Air Temp	Humidity	Notes
Autumn 2019													
Tyson's	28/02/2019	1	NP/NM	0750	2000	Nil	Nil	Nil	Nil	Good	23.4	83	
	21/03/2019	2	NP/NM	2000	2010	P. coriacea, Lit. peronii.	Nil	Nil	Nil	Good	25.5	82.7	
	2/04/2019	3	NP/NM	1920	1933	C. signifera, P. coriacea	Nil	Nil	Nil	Good	19.6	87	One frog of each species made single call
	3/04/2019	4	NP/NM	2045	2055	P. coriacea	Nil	Nil	Nil	Good	20	87.4	
Access G	28/02/2019	1	NP/NM	2003	2013	Lit. fallax, P. coriacea	Nil	Nil	Nil	Good	23.9	80.1	
	21/03/2019	2	NP/NM	2110	2120	Lit. fallax, C. signifera, P. coriacea	Nil	Nil	Nil	Good	26.4	79	
	2/04/2019	3	NP/NM	1937	1946	C. signifera	Nil	Nil	Nil	Good	19.9	91.2	
	3/04/2019	4	NP/NM	2035	2045	C. signifera, Lit. fallax	Nil	Nil	Nil	Good	21	91.1	
Nth Martells	28/02/2019	1	NP/NM	2018	2028	Lim. peronii	Nil	Nil	Nil	Good	24.2	81.2	
	21/03/2019	2	NP/NM	2155	2205	P. coriacea	Lim. peronii x 1 (Eastern apron moving east)	Nil	Nil	Good	25.3	100	
	1/04/2019	3	NP/NM	2150	2200	Nil	Nil	RL	Nil	Good	22.1	76.2	
	2/04/2019	4	NP/NM	1955	2005	Nil	Nil	Nil	Nil	Good	19.3	91.2	
Sth martells	28/02/2019	1	NP/NM	2030	2040	Lit. peronii, Lit. fallax	Nil	Nil	Nil	Good	25	83.1	
	21/03/2019	2	NP/NM	2210	2220	Lit. peronii, Lim. peronii, C. signifera, Lit. fallax	Nil	Nil	Nil	Good	24	98.3	
	2/04/2019	3	NP/NM	2008	2015	Lit. revelata, C. signifera	Nil	Nil	Light	Good	21.4	81.4	
	3/04/2019	4	NP/NM	2000	2010	Lit. peronii, C. signifera, Lim. peronii, Upe. laevigata, P. coriacea	Nil	Nil	Nil	Good	22.8	78.6	
Dalhousie	28/02/2019	1	NP/NM	2045	2055	Nil	Nil	Nil	Nil	Good	25.6	82.2	
	21/03/2019	2	NP/NM	2225	2235	P. coriacea	Nil	Nil	Nil	Good	24.1	95.4	
	2/04/2019	3	NP/NM	2019	2030	Nil	Nil	Nil	Light	Good	20.1	88.9	
	3/04/2019	4	NP/NM	2120	2130	P. coriacea	Nil	Nil	Nil	Good	18.9	91.4	
Burkes	27/02/2019	1	NP/NM	2135	2145	Nil	Nil	Nil	Nil	Good	24.7	73.3	
	28/02/2019	2	NP/NM	2112	2122	Nil	Nil	Nil	Nil	Good	24.7	100	
	21/03/2019	3	NP/NM	2255	2305	Nil	Nil	Nil	Nil	Good	26.5	99.9	
	2/04/2019	4	NP/NM	2048	2100	Nil	Nil	Nil	Nil	Good	21.7	81.6	
Railway	27/02/2019	1	NP/NM	2250	2300	P. coriacea	Nil	Nil	Nil	Good	21.1	97	
	28/02/2019	2	NP/NM	2115	2135	Nil	Nil	Nil	Nil	Good	22.1	86.9	
	20/03/2019	3	NP/NM	2315	2330	Nil	Nil	Nil	Nil	Good	20.5	92	
	21/03/2019	4	NP/NM	2310	2322	Nil	Nil	Nil	Nil	Good	23.4	92	
Mcgrath's	27/02/2019	1	NP/NM	2020	2030	Nil	Nil	Nil	Nil	Good	24.9	73.1	
	28/02/2019	2	NP/NM	2101	2111	Nil	Nil	Nil	Nil	Good	24.3	91.3	
	21/03/2019	3	NP/NM	2240	2250	Nil	Nil	Nil	Nil	Good	23.3	98.4	
	2/04/2019	4	NP/NM	2032	2042	Nil	Nil	Nil	Mod	Good	19.3	93.4	

Location	Date	Obs. No.	Observers	Start Time	Finish Time	Species (entrance)	Species (culvert)	Wind	Rain	Visibility	Air Temp	Humidity	Notes
Spring 2019													
Tyson's	17/09/2019	1	NP	2035	2050	Lit. peronii, Lit. fallax	Nil	RL	Heavy storm	Good	15.8	90	
	18/09/2019	2	NP	2020	2030	Lit. peronii, Lit. fallax, P. coriacea	Nil	RL	Nil	Good	16.9	82	
	19/09/2019	3	NM/DW	1905	1915	L. Tyleri, L. Peronii, L. Fallax, P. Coriacea	Nil	Nil	Nil	Good	19.8	98.3	
	15/10/2019	4	NP	1930	1940	Lit peronii, Lit fallax	Nil	Nil	Nil	Good	22	77.7	
	21/10/2019	5	NP	1940	1950	Lit peronii, Lit fallax	Nil	RL	Nil	Good	20.1	64.2	
Access G	17/09/2019	1	NP	2050	2105	Lit. fallax, Lit. peronii, Lit. tyleri, C. signifera,	Nil	Nil	Storm	Good	15.6	89	Lit. fallax x 1 on rocks 3m from entrance
	18/09/0009	2	NP	2035	2045	Lit. fallax, Lit. peronii, Lit. tyleri, C. signifera,	Nil	Nil	Nil	Good	16.8	81	
	19/09/2019	3	NM/DW	2020	2030	L. fallax, L. peronii, L. tyleri, C. signifera, P. coriacea	Nil	Nil	Nil	Good	19.3	90.5	
	15/10/2019	4	NP	1945	1955	L. fallax, L. tyleri, Lit. peronii, Lim peronii	Nil	Nil	Nil	Good	22.5	79.8	
	21/10/2019	5	NP	1955	2005	L fallax, L tyleri, L peronii	Nil	RL	Nil	Good	21.2	65.6	
Nth Martells	17/09/2019	1	NP	2110	2120	Nil	Nil	Nil	Storm	Good	15.7	90	Culvert flooded
	18/09/2019	2	NP	2050	2100	C. signifera, Lit. tyleri	Nil	Nil	Nil	Good	16.7	82	
	19/09/2019	3	NP	2010	2020	C. signifera, Lit. tyleri, Lit. fallax	Nil	Nil	Showers	Good	17.6	89	
	15/10/2019	4	NP	2000	2010	L. fallax, P. coriacea	Nil	Nil	Nil	Good	20.6	85.1	
	21/10/2019	5	NP	2010	2020	L. fallax	Nil	Nil	Nil	Good	18.3	75.7	
Sth martells	17/09/2019	1	NP	2125	2135	Lit. fallax, Lit. peronii, C. signifera	Nil	Nil	Passed	Good	15.3	91	
	18/09/2019	2	NM/DW	2040	2050	A. Brevis, Lit. Peronii, Lit. Tyleri, Lit. Fallax, C. signifera, Limno. peronii,	Nil	Nil	Nil	Good	17.3	89.6	
	19/09/2019	3	NP	2025	2035	Upe spp., Lit. fallax, Lit. peronii, Lim. peronii, Lit. tyleri, Lim. peronii, A. brevis	Nil	Nil	Showers	Good	17.4	89	
	2/10/2019	4	BT	2200	2210	Lit peronii, Lim peronii, Lit tyleri, Lit fallax, A brevis, Upe fusca, C signifera	Nil	Nil	Nil	Good	16.3	70	
	15/10/2019	5	NP	2015	2025	Lit fallax, Upe fusca, Lit peronii, A brevis,	Nil	Nil	Nil	Good	21.8	95	
Dalhousie	17/09/2019	1	NP	2140	2155	Nil	Nil	Nil	Light	Good	15	92	
	18/09/2019	2	NM/DW	1915	1925	P. coriacea, Lit. peronii OBS	Nil	Nil	Nil	Good	19	84.2	
	19/09/2019	3	NP	1955	2005	Nil	Nil	Nil	Showers	Good	18	89	
	15/10/2019	4	NP	2030	2040	Nil	Nil	Nil	Nil	Good	22.6	84.8	
	21/10/2019	5	NP	2030	2040	Nil	Nil	Nil	Nil	Good	19.6	64.1	
Burkes	17/09/2019	1	NM/DW	2115	2125	Nil	Nil	Nil	Light	Good	18.7	81	
	18/09/2019	2	NP	2125	2135	Nil	Nil	Nil	Nil	Good	17	80	
	19/09/2019	3	NP	2055	2105	Lit. fallax	Nil	Nil	Showers	Good	17.2	91	

	15/10/2019	4	NP	2100	2110	Lit. fallax	Nil	Nil	Nil	Good	23.7	76	
	21/10/2019	5	NP	2050	2100	Lit fallax	Nil	Nil	Nil	Good	21.6	71.1	
Railway	4/09/2019	1	NP	2215	2225	Nil	Nil	Nil	Nil	Good	12.7	82	
	17/09/2019	2	NM/DW	2210	2220	Lit. Fallax	Nil	Nil	Medium	Rainy	16.8	95.9	
	19/09/2019	3	NM/DW	2115	2125	L. Fallax, C. signifera	Nil	Nil	Medium	Poor	17.1	91	
	16/10/2019	4	NP/NM	2045	2055	Nil	Nil	Msb	Storm	Moderate	20.5	83	
	11/1/19	5	NP	2105	2115	Nil	Nil	Nil	Nil	Good	15.6	88.7	
Mcgrath's	17/09/2019	1	NM/DW	1900	1910	Lit. Fallax, Lit. Peronii	Nil	RL	Light	Good	18	93.1	
	18/09/2019	2	NP	2110	2120	Nil	Nil	Nil	Nil	Good	16.9	80	
	19/09/2019	3	NP	2040	2050	Nil	Nil	Nil	Showers	Good	17.3	90	
	2/10/2019	4	NP	2200	2210	A. brevis, Lit. fallax, Upe. spp.	Nil	Nil	Nil	Good	16.3	70	
	15/10/2019	5	NP	2045	2055	L fallax, Lim peronii, A brevis	Nil	Nil	Nil	Good	22.4	88	

Table B4: Widened vegetated median hair funnel data. *Sug* = Sugar Glider, *SqG*= squirrel glider.

Funnel ID	Easting	Northing	Tree sp	Autumn 2019 (session 1)			Autumn 2019 (session 2)			Spring 2019 (session 1)			Spring 2019 (session 2)		
				Install Date	Collect date	Fauna	Re-bait/wafer Date	Collect date	Fauna	Install Date	Collect date	Fauna	Re-bait/wafer Date	Collect date	Fauna
Dal_East 1	499755	6622025	Tallowwood	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/18		15/10/18	20/11/2019	
Dal_East1APole	500051	6621710	Glide pole	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_East 2	499778	6622000	Red Mahogany	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_East 3	499788	6621991	Blackbutt	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_East 4	499802	6621959	Blackbutt	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_East 5	499845	6621902	Blackbutt	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_East 6	499908	6621887	Blackbutt	11/03/2019	8/4/19		8/4/19	7/5/19	<i>Rattus spp.</i>	17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_East 7	499927	6621849	Flooded Gum	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_East 8	499947	6621808	Tallowwood	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19	<i>SuG/SqG</i>	15/10/19	20/11/2019	
Dal_East 9	499979	6621781	Red Mahogany	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_East 10	499987	6621764	Blackbutt	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_East 11	499980	6621730	Flooded Gum	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_East 12	500051	6621710	Blackbutt	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_East 13	500095	6621644	Red Mahogany	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_East 14	500102	6621607	Blackbutt	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19	<i>Melomys cervinipes</i> (Fawn-footed Melomys)	15/10/19	20/11/2019	
Dal_East 15	500102	6621580	Blackbutt	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_East 16	500123	6621570	Smoothbarked Apple	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_East 17	500119	6621548	Tallowwood	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_East 18	500156	6621473	Red Mahogany	11/03/2019	8/4/19		8/4/19	7/5/19	Black rat	17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_East 19	500276	6621207	Blackbutt	11/03/2019	8/4/19		8/4/19	7/5/19	<i>SuG/SqG</i>	17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_East 20	500284	6621243	Blackbutt	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_Med 1	499708	6621998	Tallowwood	11/03/2019	8/4/19	<i>Rattus fuscipes</i>	8/4/19	7/5/19		17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_Med 2	499723	6621992	White Mahogany	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_Med 3	499722	6621948	Blackbutt	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19	<i>Antechinus sp.</i>	15/10/19	20/11/2019	
Dal_Med 4	499754	6621925	White Mahogany	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_Med 5	499764	6621917	Flooded Gum	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_Med 6	499797	6621910	Red	11/03/2019	8/4/19		8/4/19	7/5/19	FF	17/9/19	15/10/19		15/10/19	20/11/2019	

			Mahogany						Melomys						
Dal_Med 7	499812	6621844	Blackbutt	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_Med 8	499851	6621846	Blackbutt	11/03/2019	8/4/19		8/4/19	7/5/19	SuG/SqG	17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_Med 9	499855	6621807	Blackbutt	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_Med 10	499881	6621791	Blackbutt	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_Med 11	499954	6621739	Blackbutt	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_Med 12	499919	6621703	Tallowwood	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_Med 13	500078	6621531	Ironbark	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_Med 14	500012	6621531	Blackbutt	11/03/2019	8/4/19	SuG/SqG	8/4/19	7/5/19		17/9/19	15/10/19		15/10/19	20/11/2019	Rodent spp., Rattus fuscipes (Southern Bush-rat)
Dal_Med 15	500020	6621515	Blackbutt	11/03/2019	8/4/19	SuG/SqG	8/4/19	7/5/19		17/9/19	15/10/19		15/10/19	20/11/2019	Rodent spp., Antechinus spp.
Dal_Med 16	500097	6621472	Mahogany spp.	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19	Antechinus spp.	15/10/19	20/11/2019	Antechinus spp.
Dal_Med 17	500097	6621477	Blackbutt	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19	Antechinus spp.	15/10/19	20/11/2019	Antechinus spp.
Dal_Med 18	500125	6621442	Mahogany	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19	Antechinus spp.	15/10/19	20/11/2019	Antechinus spp.
Dal_Med 19	500197	6621254	Blackbutt	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_Med 20	500261	6621248	White Mahogany	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_West 1	499622	6622008	Glide Pole	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_WEst 2	499636	6621973	Pink Bloodwood	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_West 3	499705	6621943	Blackbutt	11/03/2019	8/4/19	Antechinus spp.	8/4/19	7/5/19	Antechinus spp.	17/9/19	15/10/19	Antechinus spp. (prob Dusky Antechinus)	15/10/19	20/11/2019	
Dal_West 4	499738	6621880	Red Mahogany	11/03/2019	8/4/19		8/4/19	7/5/19	Brown antechinus	17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_West 5	499732	6621850	Blackbutt	11/03/2019	8/4/19	Brown Antechinus	8/4/19	7/5/19	Antechinus spp.	17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_West 6	499763	6621813	Ironbark	11/03/2019	8/4/19		8/4/19	7/5/19	Antechinus spp.	17/9/19	15/10/19	Antechinus spp.	15/10/19	20/11/2019	Brown Antechinus
Dal_West 7	499760	6621752	Red Mahogany	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_West 8	499826	6621704	Blackbutt	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_West 9	499856	6621677	Glide Pole	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19	SuG/SqG	15/10/19	20/11/2019	
Dal_West 10	499817	6621671	Smoothbark Apple	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19	SuG/SqG	15/10/19	20/11/2019	
Dal_West 11	499872	6621646	Ironbark	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19		15/10/19	20/11/2019	

Dal_West 12	499885	6621623	Ironbark	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_West 13	499903	6621579	Tallowwood	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_West 14	499927	6621542	Blackbutt	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_West 15	499972	6621521	Blackbutt	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19	Antechinus spp.	15/10/19	20/11/2019	
Dal_West 16	499983	6621519	Glide Pole	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_West 17	500012	6621457	Mahogany spp.	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_West 18	500014	6621441	Blackbutt	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_West 19	500165	6621248	Blackbutt	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19		15/10/19	20/11/2019	
Dal_West 20	500177	6621243	Blackbutt	11/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	15/10/19		15/10/19	20/11/2019	
Tys_East 1	498665	6627349	Glide Pole	10/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	16/10/19	SuG/SqG	16/10/19	20/11/2019	
Tys_East 2	498648	6627340	Swamp Mahogany	10/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	16/10/19		16/10/19	20/11/2019	
Tys_East 3	498615	6627268	Tallowwood	10/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	16/10/19	SuG/SqG	16/10/19	20/11/2019	SuG/SqG
Tys_East 4	498610	6627278	Tallowwood	10/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	16/10/19		16/10/19	20/11/2019	
Tys_East 5	498456	6627053	Red Mahogany	10/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	16/10/19	SuG/SqG	16/10/19	20/11/2019	
Tys_East 6	498464	6627047	Tallowwood	10/03/2019	8/4/19		8/4/19	7/5/19	SuG/SqG	17/9/19	16/10/19	SuG/SqG	16/10/19	20/11/2019	SuG/SqG
Tys_East 7	498443	6627022	Ironbark	10/03/2019	8/4/19	SuG/SqG	8/4/19	7/5/19	SuG/SqG, Brown antechinus	17/9/19	16/10/19	SuG/SqG	16/10/19	20/11/2019	
Tys_East 8	498412	6626948	White Mahogany	10/03/2019	8/4/19		8/4/19	7/5/19	SuG/SqG	17/9/19	16/10/19	SuG/SqG	16/10/19	20/11/2019	
Tys_East 9	498411	6626965	Tallowwood	10/03/2019	8/4/19	SuG/SqG	8/4/19	7/5/19	Antechinus spp.	17/9/19	16/10/19	SuG/SqG	16/10/19	20/11/2019	
Tys_East 10	498409	6626948	Pink Bloodwood	10/03/2019	8/4/19		8/4/19	7/5/19	SuG/SqG	17/9/19	16/10/19		16/10/19	20/11/2019	
Tys_East 11	498373	6626931	White Mahogany	10/03/2019	8/4/19		8/4/19	7/5/19	SuG/SqG	17/9/19	16/10/19	SuG/SqG	16/10/19	20/11/2019	
Tys_East 12	498362	6626908	Mahogany spp.	10/03/2019	8/4/19		8/4/19	7/5/19	SuG/SqG	17/9/19	16/10/19	SuG/SqG	16/10/19	20/11/2019	
Tys_East 13	498347	6626902	Glide Pole	10/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	16/10/19		16/10/19	20/11/2019	
Tys_East 14	498252	6626683	Tallowwood	10/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	16/10/19	Antechinus spp. (probable Dusky Atechinus)	16/10/19	20/11/2019	Antechinus spp.
Tys_East 15	498221	6626654	Turpentine	10/03/2019	8/4/19	SuG/SqG	8/4/19	7/5/19		17/9/19	16/10/19	Antechinus sp. (probable Brown antechinus)	16/10/19	20/11/2019	
Tys_East 16	498208	6626657	Glide Pole	10/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	16/10/19		16/10/19	20/11/2019	
Tys_East 17	498198	6626630	SF Grey Gum	10/03/2019	8/4/19	SuG/SqG	8/4/19	7/5/19		17/9/19	16/10/19	SuG/SqG	16/10/19	20/11/2019	
Tys_East 18	498184	6626589	SF Grey Gum	10/03/2019	8/4/19	SuG/SqG	8/4/19	7/5/19	SuG/SqG	17/9/19	16/10/19		16/10/19	20/11/2019	
Tys_East 19	498181	6626564	Red	10/03/2019	8/4/19		8/4/19	7/5/19	SuG/SqG	17/9/19	16/10/19	Antechinus	16/10/19	20/11/2019	Antechinus

			Mahogany									sp.			sp. (prob Brown Antechinus)
Tys_East 20	498151	6626559	Mahogany spp.	10/03/2019	8/4/19		8/4/19	7/5/19	Antechinus spp.	17/9/19	16/10/19	Antechinus sp.	16/10/19	20/11/2019	Antechinus sp. (prob Dusky Antechinus)
Tys_Med 1	468643	6627360	Tallowwood	10/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	16/10/19		16/10/19	20/11/2019	
Tys_Med 2	498628	6627334	Tallowwood	10/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	16/10/19		16/10/19	20/11/2019	
Tys_Med 3	468611	6627271	Tallowwood	10/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	16/10/19		16/10/19	20/11/2019	
Tys_Med 4	498577	6627288	Ironbark	10/03/2019	8/4/19		8/4/19	7/5/19	SuG/SqG	17/9/19	16/10/19	SuG/SqG	16/10/19	20/11/2019	
Tys_Med 5	498424	6627047	SF Grey Gum	10/03/2019	8/4/19		8/4/19	7/5/19	SuG/SqG	17/9/19	16/10/19	SuG/SqG	16/10/19	20/11/2019	
Tys_Med 6	498400	6627043	Pink Bloodwood	10/03/2019	8/4/19		8/4/19	7/5/19	SuG/SqG	17/9/19	16/10/19		16/10/19	20/11/2019	
Tys_Med 7	498367	6627010	Mahogany spp.	10/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	16/10/19		16/10/19	20/11/2019	
Tys_Med 8	498344	6626986	Tallowwood	10/03/2019	8/4/19		8/4/19	7/5/19	SuG/SqG	17/9/19	16/10/19	SuG/SqG	16/10/19	20/11/2019	
Tys_Med 9	498346	6626977	SF Grey Gum	10/03/2019	8/4/19		8/4/19	7/5/19	SuG/SqG	17/9/19	16/10/19	SuG/SqG, Antechinus sp.	16/10/19	20/11/2019	
Tys_Med 10	498337	6626958	Red Mahogany	10/03/2019	8/4/19		8/4/19	7/5/19	SuG/SqG	17/9/19	16/10/19	SuG/SqG, Antechinus spp.	16/10/19	20/11/2019	Antechinus spp.
Tys_Med 11	498318	6626920	Mahogany spp.	10/03/2019	8/4/19		8/4/19	7/5/19	SuG/SqG	17/9/19	16/10/19	SuG/SqG	16/10/19	20/11/2019	
Tys_Med 12	498313	6626898	Tallowwood	10/03/2019	8/4/19		8/4/19	7/5/19	SuG/SqG	17/9/19	16/10/19	SuG/SqG	16/10/19	20/11/2019	Antechinus spp. (prob Yellow-footed Antechinus)
Tys_Med 13	498303	6626859	Mahogany spp.	10/03/2019	8/4/19		8/4/19	7/5/19	SuG/SqG	17/9/19	16/10/19	Antechinus spp. (prob Yellow-footed Antechinus)	16/10/19	20/11/2019	Antechinus sp. (prob Dusky Antechinus)
Tys_Med 14	498200	6626624	Tallowwood	10/03/2019	8/4/19		8/4/19	7/5/19	Antechinus spp.	17/9/19	16/10/19	SuG/SqG, Antechinus spp.	16/10/19	20/11/2019	Antechinus spp.
Tys_Med 15	498157	6626639	SF Grey Gum	10/03/2019	8/4/19		8/4/19	7/5/19	SuG/SqG	17/9/19	16/10/19		16/10/19	20/11/2019	Antechinus spp.
Tys_Med 16	498148	6626639	Red Mahogany	10/03/2019	8/4/19		8/4/19	7/5/19	Dusky antechinus (prob)	17/9/19	16/10/19	SuG/SqG	16/10/19	20/11/2019	Antechinus spp.
Tys_Med 17	498154	6626614	Ironbark	10/03/2019	8/4/19	Antechinus spp.	8/4/19	7/5/19		17/9/19	16/10/19	SuG/SqG	16/10/19	20/11/2019	Antechinus spp.
Tys_Med 18	498124	6626607	White Stringybark	10/03/2019	8/4/19	Dusky Antechinus	8/4/19	7/5/19	Dusky antechinus (prob)	17/9/19	16/10/19	SuG/SqG	16/10/19	20/11/2019	Antechinus spp.

Tys_Med 19	498144	6626577	SF Grey Gum	10/03/2019	8/4/19		8/4/19	7/5/19	SuG/SqG	17/9/19	16/10/19	SuG/SqG	16/10/19	20/11/2019	<i>Antechinus sp. (prob Dusky Antechinus)</i>
Tys_Med 20	498148	6626582	Pink Bloodwood	10/03/2019	8/4/19		8/4/19	7/5/19	Dusky antechinus (prob)	17/9/19	16/10/19	SuG/SqG	16/10/19	20/11/2019	<i>Antechinus spp.</i>
Tys_West 1	498616	6627402	Red Mahogany	10/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	16/10/19		16/10/19	20/11/2019	
Tys_West 2	498590	6627388	Red Mahogany	10/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	16/10/19		16/10/19	20/11/2019	
Tys_West 3	498560	6627361	Tallowwood	10/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	16/10/19		16/10/19	20/11/2019	
Tys_West 4	498539	6627333	Glide Pole	10/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	16/10/19		16/10/19	20/11/2019	
Tys_West 5	498336	6627014	Mahogany spp.	10/03/2019	8/4/19		8/4/19	7/5/19	SuG/SqG	17/9/19	16/10/19	SuG/SqG	16/10/19	20/11/2019	
Tys_West 6	498329	6627029	Turpentine	10/03/2019	8/4/19		8/4/19	7/5/19	SuG/SqG	17/9/19	16/10/19		16/10/19	20/11/2019	
Tys_West 7	498317	6626967	White Mahogany	10/03/2019	8/4/19		8/4/19	7/5/19	SuG/SqG	17/9/19	16/10/19	SuG/SqG	16/10/19	20/11/2019	
Tys_West 8	498310	6626980	Turpentine	10/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	16/10/19	SuG/SqG	16/10/19	20/11/2019	
Tys_West 9	498280	6626978	Ironbark	10/03/2019	8/4/19		8/4/19	7/5/19	SuG/SqG	17/9/19	16/10/19		16/10/19	20/11/2019	
Tys_West 10	498268	6626963	Turpentine	10/03/2019	8/4/19		8/4/19	7/5/19	SuG/SqG	17/9/19	16/10/19		16/10/19	20/11/2019	
Tys_West 11	498252	6626884	Pink Bloodwood	10/03/2019	8/4/19		8/4/19	7/5/19	SuG/SqG	17/9/19	16/10/19	<i>Antechinus spp.</i>	16/10/19	20/11/2019	
Tys_West 12	498222	6626870	Pink Bloodwood	10/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	16/10/19	<i>Antechinus spp.</i>	16/10/19	20/11/2019	
Tys_West 13	498202	6626879	Tallowwood	10/03/2019	8/4/19		8/4/19	7/5/19	SuG/SqG	17/9/19	16/10/19		16/10/19	20/11/2019	
Tys_West 14	498115	6626655	SF Grey Gum	10/03/2019	8/4/19	SuG/SqG	8/4/19	7/5/19		17/9/19	16/10/19	SuG/SqG	16/10/19	20/11/2019	
Tys_West 15	498106	6626638	Turpentine	10/03/2019	8/4/19	<i>Trichosurus spp.</i>	8/4/19	7/5/19	SuG/SqG	17/9/19	16/10/19	SuG/SqG	16/10/19	20/11/2019	
Tys_West 16	498109	6626614	Pink Bloodwood	10/03/2019	8/4/19		8/4/19	7/5/19	SuG/SqG	17/9/19	16/10/19		16/10/19	20/11/2019	
Tys_West 17	498081	6626616	Brushbox	10/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	16/10/19		16/10/19	20/11/2019	
Tys_West 18	498069	6626599	Pink Bloodwood	10/03/2019	8/4/19		8/4/19	7/5/19		17/9/19	16/10/19		16/10/19	20/11/2019	
Tys_West 19	498072	6626598	Ironbark	10/03/2019	8/4/19		8/4/19	7/5/19	SuG/SqG	17/9/19	16/10/19	SuG/SqG	16/10/19	20/11/2019	<i>Trichosurus sp. (Brush-tail Possum)</i>
Tys_West 20	498082	6626579	Pink Bloodwood	10/03/2019	8/4/19		8/4/19	7/5/19	SuG/SqG	17/9/19	16/10/19	SuG/SqG	16/10/19	20/11/2019	

Table B5: Road-kill survey data. RB Finch = red browed finch, TF = tawny frogmouth, SB = Southern boobook, Med = medium, UnID = Unidentified.

Site/Side	Date	Survey no.	Observers	Start	End	Road kill	Easting	Northing	Cleared off Rd	Live fauna on Rd edge	Notes	Fence conditions	Weather
Autumn 2019													
Railway													
East	25/02/2019	1	NP/SR	810	825	UnID mammal spp.	497463	6611255	Y		Very old, possible leg	Good	Fine
	17/05/2019	2	DR	1600	1615								
West	25/02/2019	1	NP/SR	826	840	Nil						Good	Fine
	17/05/2019	2	DR	1200	1215	Silvereye	497446	6611186	Y				
Burkes													
East	25/02/2019	1	NP/SR	859		UnID small bird	500415	6616984	Y				
						Aus. Magpie	500389	6616911	Y				
						Bandicoot spp.	500368	6616881	Partially				
						UnID Medium mammal spp	500235	6616629	N		Small part of vertebrae		
West	25/02/2019	1	NP/SR	845	858	RB Finch	500333	6616873	Y		Fresh kill		
	16/05/2019	2	NP	1545	1600	RB Finch	500350	6616917	Y				
						Northern brown bandicoot	500319	6616848	Y		Juvenile		
Mcgrath's													
East	25/02/2019	1	NP/SR	1140	1150	Nil							
	16/05/2019	2	NP	1520	1535	Nil							
West	25/02/2019	1	NP/SR	1130	1140	Nil							
	16/05/2019	2	NP	1505	1520	Nil							
Dalhousie													
East	25/02/2019	1	NP/SR	920	935	Fairy wren spp.	499811	6621928	Y				
	16/05/2019	2	NP	1420	1435	Medium mammal spp	499769	6621976	N				
West	25/02/2019	1	NP/SR	935	945	Red-bellied black snake	499873	6621710	N		YtB Cockatoos investigating big flooded Gum in median		
						Medium mammal spp	499847	6621742	Y		One leg/claws only		
						Microbat spp.	499847	6621740	Y				
	16/05/2019	2	NP	1435	1455	Northern brown bandicoot	499634	6622031	N				
						Eastern spinebill	499758	6621830	Y				
Martell's South													
East	25/02/2019	1	NP/SR	950	958	Lewin's Honeyeater	498735	6622699	Y				
						Rattus spp.	498701	6622742	Y				

Site/Side	Date	Survey no.	Observers	Start	End	Road kill	Easting	Northing	Cleared off Rd	Live fauna on Rd edge	Notes	Fence conditions	Weather
						Common blue-tongue skink	498547	6622948	Y				
	16/05/2019	2	NP	1400	1415	nil							
West	25/02/2019	1	NP/SR	958	1010	Snake spp.	498508	6622933	Y				
						Lace Monitor	498534	6622904	Y				
	16/05/2019	2	NP	1345	1400	Tawny Frogmouth	498482	6622995	Y				
Martell's North													
East	25/02/2019	1	NP/SR	1023	1036	Small macropod spp.	498383	6623332	N				
	16/05/2019	2	NP	1315	1330	Nil							
West	25/02/2019	1	NP/SR	1012	1022	White-cheeked Honeyeater	498311	6623427	Y		Bandicoot diggings in batter, roadside of fence		
						Coastal carpet Python	498340	6623326	Y				
	16/05/2019	2	NP	1330	1345	Lewin's Honeyeater (prob)	498351	6623314	Y				
Access G													
East	25/02/2019	1	NP/NM	12:30	1240	Bandicoot spp.	497998	6626296	Y				
	16/519	2	NP	1240	1255	Nil							
West	25/02/2019	1	NP/NM	1240	1250	Swamp snake	497871	6626078	Y				
	16/05/2019	2	NP	1255	1310	Med bird	497948	6626270	N				
						Yellow thornbill	497915	6626213	Y				
Tyson's													
East	25/02/2019	1	NP/NM	1255	1305	Cat	498724	6627422	N				
	16/05/2019	2	NP	1200	1215	Lewin's Honeyeater	498784	6627498	Y	Lampropholis spp.			
						Red-browed Finch	498789	6627501	Y				
						Fairywren spp.	498815	6627525	Y				
West	25/02/2019	1	NP/NM	1305	1315	TF	498585	6627341	Y				
	16/05/2019	2	NP	1215	1230	Nil				Lampropholis spp.			
Spring 2019													
Railway													
East	27/11/2019	2	DR/LA	1715	1734	nil						good	Fine, 23 deg, 50%RH, 23kph ESE.
	19/09/2019	1	NP	1130	1140	Medium mammal spp	497470	6611342	N			Good	Showers
West	27/11/2019	2	DR/LA	1715	1734	nil						good	

Site/Side	Date	Survey no.	Observers	Start	End	Road kill	Easting	Northing	Cleared off Rd	Live fauna on Rd edge	Notes	Fence conditions	Weather
	19/09/2019	1	NP	1140	1150	Nil						Good	Showers
Burkes													
East	27/11/2019	2	DR/LA	1640	1655	nil						good	
	19/09/2019	1	NP	920	930	Nil						Good	Showers
West	27/11/2019	2	DR/LA	1640	1655	nil						good	
	19/09/2019	1	NP	910	920	Nil						Good	Showers
Mcgrath's													
East	27/11/2019	2	DR/LA	1620	1630	Nil						good	
	19/09/2019	1	NP	940	950	Nil							
West	27/11/2019	2	DR/LA	1620	1630	Nil						good	
	19/09/2049	1	NP	950	1000	RN Wallaby	500819	6620191	No			NA	Showers
Dalhousie													
East	27/11/2019	2	DR/LA	1355	1405	Yellow-faced Honeyeater	499775	661969	yes			good	
	20/09/2019	1	NP	1000	1010							Good	Showers
	19/10/2019		NP			Northern brown bandicoot	499664	6622046			Incidental		
West	27/11/2019	2	DR/LA	1355	1405	Lace monitor	499636	6622014	no			good	
						Yellow-faced Honeyeater	499576	6622084	no				
						Medium mammal spp	499785	6621818	yes				
	20/09/2019	1	NP	1010	1020	Litoria peronii	499585	6622097	Yes			Good	Showers
						Medium mammal spp	499807	6621830	N				
	21/10/2019		NP			Silvereye	499689	6621939			Incidental		
Martell's South													
East	27/11/2019	2	DR/LA	1425	1435	nil						good	
	20/09/2019	1	NP	940	950	Nil						Good	Showers
West	27/11/2019	2	DR/LA	1425	1435	nil						good	
	20/09/2019	1	NP	930	940	Nil							
Martell's North													
East	27/11/2019	2	DR/LA	1448	1459	Northern brown bandicoot	498371	5523354	no			good	
	20/09/2019	1	NP	910	920	Bandicoot spp.	498383	6623327	N			Good	Showers

Site/Side	Date	Survey no.	Observers	Start	End	Road kill	Easting	Northing	Cleared off Rd	Live fauna on Rd edge	Notes	Fence conditions	Weather
West	27/11/2019	2	DR/LA	1450	1500	Swamp wallaby	498317	6623412	yes			good	
	20/09/2019	1	NP	920	930	Nil							
Access G													
East	27/11/2019	2	DR/LA	1549	1559	nil						good	
	19/09/2019	1	NP	1050	1100	Fairy-wren spp.	497900	6626104	N			Good	Showers
						Mammal spp.	497879	6626083	N		Small piece of hide		
West	27/11/2019	2	DR/LA	1550	1600	Northern brown bandicoot	498076	6626426	yes			good	
	19/09/2019	1	NP	1100	1110	Nil							
Tyson's													
East	27/11/2019	2	DR/LA	1517	1530	nil						good	
	19/09/2019	1	NP	1010	1020	Medium mammal spp	498732	6627427	No			Good	Showers
West	27/11/2019	2	DR/LA	1517	1530	nil						good	
	19/09/2019	1	NP	1020	1030	Nil							

Table B6: Widened vegetated median spotlighting data. SuG = sugar glider, GHFF = grey-headed flying fox, SqG = squirrel glider, FtG = feathertail glider, FF sp. = flying fox species, msb = moves small branches, rl = rustles leaves.

Site	Date	Observers	Start Time	Finish Time	Species	Comments	Flowering	Moon	Wind	Rain	Visibility	Air Temp	Humidity
Autumn 2019													
Dalhousie EAST	1/04/2019	NM	2030	2100	Nil		Nil	New	RL	Nil	Good	19.2	88%
	4/04/2019	NM	2030	2100	Nil			New	Nil	Nil	Good	22.4	59%
Dalhousie MEDIAN	1/04/2019	NM	2000	2030	SuGx1	Feeding in flowering P. Bloodwood	P. Bloodwood	New	RL	Light shower	Good	19.2	88%
	4/04/2019	NM	2000	2030	Nil			New	Nil	Nil	Good	22.4	59%
Dalhousie WEST	1/04/2019	NM	1930	2000	Nil		Nil	New	RL	Nil	Good	19.2	88%
	4/04/2019	NM	1930	2000	Nil			New	Nil	Nil	Good	22.4	59%
Tyson's EAST	1/04/2019	NP	2030	2100	Nil		Nil	New	Msb	Nil	Good	19.2	88%

	4/04/2019	NP	2030	2100	Nil			New	Nil	Nil	Good	22.4	59%
Tyson's MEDIAN	1/04/2019	NP	2000	2030	Nil		Nil	New	RL	Light shower	Good	19.2	88%
	4/04/2019	NP	2000	2030	SuGx1 E:498158 N:6626642	In transit heading west.		New	Nil	Nil	Good	22.4	59%
Tyson's WEST	1/04/2019	NP	1930	2000	Nil		Nil	New	RL	Nil	Good	19.2	88%
	4/04/2019	NP	1930	2000	Powerful Owl E:498268 N:6627048	Calling out west, prob female.		New	Nil	Nil	Good	22.4	59%
Spring 2019													
Dalhousie EAST	17/09/2019	NP	1930	2000	Nil		Tallow	New	MSB	Shower	Poor	16.6	88
	19/09/2019	NP	1925	1955	Nil		Tallow	New	RL	Showers	Moderate	18	89
	22/09/2019	NM	1945	2015	Nil		Tallow	New	RL	Storm	Poor	20.2	85
Dalhousie MEDIAN	17/09/2019	NP	1857	1927	GHFF		Tallow	New	RL	Nil	Poor	16.2	89
	19/09/2019	NP	1855	1925	Nil		Tallow	New	RL	Showers	Moderate	18	89
	22/09/2019	NM	1915	1945	Nil		Tallow	New	RL	Storm	Poor	20.2	85
Dalhousie WEST	17/09/2019	NP	1825	1855	SuGx1.E:499632, N:6621988	Prob SuG, high in canopy	Tallow	New	RL	Light shower	Moderate	17.2	87
	19/09/2019	NP	1825	1855	Nil		Tallow	New	RL	Showers	Moderate	18.1	92
	22/09/2019	NM	1845	1915	Nil		Tallow	New	RL	Storm	Poor	20.2	85
Tyson's EAST	18/09/2019	NP	1945	2015	Nil		Nil	New	RL	Nil	Good	16.9	82
	22/09/2019	NP	1945	2015	SuG.SE@498421, 6627004	Feeding in Ironbark	Ironbark	New	RL	Storm	Moderate	20.2	85
	3/10/2019	NP	2125	2155	Nil			1-Apr	RL	Nil	Good	15.3	83
Tyson's MEDIAN	18/09/2019	NP	1910	1940	Nil		Nil	New	RL	Nil	Good	17.3	80
	22/09/2019	NP	1915	1945	SuG.SM@498250, 6626754	Down low in acacia	Nil	New	RL	Storm	Moderate	20.2	85
	3/10/2019	NP	2055	2125	Nil			1-Apr	RL	Nil	Good	18.4	78
Tyson's WEST	18/09/2019	NP	1835	1905	Nil		Nil	New	RL	Nil	Good	17.6	78
	22/09/2019	NP	1845	1915	Nil		Nil	New	RL	Storm	Moderate	20.2	85
	3/10/2019	NP	2025	2055	Nil			1-Apr	RL	Nil	Good	18.4	78

Table B7: Effort of adjacent habitat cameras. HWY = highway. Need to fix bait and days active rows.

Site	Side	Easting	Northing	Date in	Date retrieved	Pics	Battery alive?	Days active	Notes	Bait
Autumn 2019										
Tyson	W	498637	6627475	24/02/2019	2/04/2019	36	Yes	38		Chicken/tuna
	E	498749	6627401	24/02/2019	2/04/2019	5284	No	2		Chicken/tuna
Access G	W	498031	6626232	24/02/2019	2/04/2019	54	No	26		Chicken/tuna
	E	497911	6626258	24/02/2019	2/04/2019	222	No	34		Chicken/tuna
Martell's N	W	498264	6623352	24/02/2019	2/04/2019	168	No	17		Chicken/tuna

	E	498397	6623445	24/02/2019	2/04/2019	600	No	11		Chicken/tuna
Martell's S	W	498512	6622842	24/02/2019	2/04/2019	150	Yes	38		Chicken/tuna
	E	498620	6622918	24/02/2019	2/04/2019	213	No	18		Chicken/tuna
Dalhousie	W	499614	6621977	24/02/2019	2/04/2019	126	Yes	38		Chicken/tuna
	E	499802	6622011	24/02/2019	2/04/2019	285	Yes	38		Chicken/tuna
Burkes	W	500232	6616847	24/02/2019	2/04/2019	384	Yes	38		Chicken/tuna
	E	500386	6616759	24/02/2019	2/04/2019	288	No	7	Lots of Small mammal spps to ID	Chicken/tuna
Railway	W	497389	6611171	24/02/2019	2/04/2019	0	No	0	Malfunction	Chicken/tuna
	E	497538	6611218	24/02/2019	2/04/2019	74	No	11		Chicken/tuna
Mcgrath's	WS	500707	6619974	24/02/2019	2/04/2019	117	No	11		Chicken/tuna
	WN	500730	6620026	24/02/2019	2/04/2019	63	No	4		Chicken/tuna
	ES	500759	6619916	24/02/2019	2/04/2019	203	No	8		Chicken/tuna
	EN	500773	6619994	24/02/2019	2/04/2019	159	No	4		Chicken/tuna
Site	Side	Easting	Northing	Date in	Date retrieved	Pics	Battery alive?	Days active	Notes	Bait
Spring 2019										
Tyson	W	498637	6627475		21/10/2019	183	yes	43		Chicken/tuna
	E	498749	6627401	16/09/2019		22580	no	29		Chicken/tuna
Access G	W	498031	6626232	18/09/2019	12/10/2019	18381	no	24		Chicken/tuna
	E	497911	6626258		21/10/2019	201	yes	43		Chicken/tuna
Martell's N	W	498264	6623352		19/09/2019	9639	no	31		Chicken/tuna
	E	498397	6623445		21/10/2019	148	yes	43		Chicken/tuna
Martell's S	W	498512	6622842	17/09/2019	21/10/2019	675	yes	43		Chicken/tuna
	E	498620	6622918		21/10/2019	1038	yes	43		Chicken/tuna
Dalhousie	W	499614	6621977		21/10/2019	1161	yes	43		Chicken/tuna
	E	499802	6622011		22/10/2019	375	yes	44		Chicken/tuna
Burkes	W	500232	6616847		21/10/2019	255	yes	43		Chicken/tuna
	E	500386	6616759		21/10/2019	435	yes	43		Chicken/tuna
Railway	W	497389	6611171		21/10/2019	423	yes	43		Chicken/tuna
	E	497538	6611218		21/10/2019	225	yes	43		Chicken/tuna
Mcgrath's	SW	500707	6619974		21/10/2019	102	yes	43		Chicken/tuna
	NW	500730	6620026		21/10/2019	30	yes	43		Chicken/tuna
	SE	500759	6619916		21/10/2019	51	yes	43		Chicken/tuna
	NE	500773	6619994		21/10/2019	77	yes	43		Chicken/tuna

Table B8: Adjacent habitat image review species detected.

Species	Tyson's Flat (8022)		Acces Rd G (78800)		Martells Rd North (75800)		Martells Rd South (75250)		Dalhousie Ck (73800)		Burkes Ln (68470)		Railway (61800)		Mcgrath's Ck (Control)	
	E	W	E	W	E	W	E	W	E	W	E	W	E	W	E	W
Spring 2019																
Short-beaked echidna		*		*			*	*			*	*		*		
Antechinus spp											*	*				*
Koala												*				
Long-nosed bandicoot										*						
Northern brown b'icoot		*	*	*		*	*									
Short-eared b'tail Possum		*		*				*				*				
Common b tail Possum			*							*	*	*				
Long-nosed potoroo		*														
Swamp wallaby		*	*			*			*	*		*		*		*
Water rat			*													
Bush rat							*	*	*	*		*			*	*
Black rat		*	*		*	*	*	*	*		*	*			*	*
Melomys spp.						*										
Mouse sp.					*					*	*					
Dog							*									
Red fox									*							
Australian brush-turkey		*					*	*								
Bar-shouldered dove					*							*				
Eastern whipbird		*														
Eastern yellow robin									*						*	
Yellow-thr scrub wren												*				
Laughing kookaburra				*												
Australian logrunner															*	
Grey shrikethrush				*												
Lace monitor			*	*					*			*		*		
Land Mullet						*	*					*				
Green tree snake								*								

Species	Tyson's Flat (8022)		Acces Rd G (78800)		Martells Rd North (75800)		Martells Rd South (75250)		Dalhousie Ck (73800)		Burkes Ln (68470)		Railway (61800)		Mcgrath's Ck (Control)			
	E	W	E	W	E	W	E	W	E	W	E	W	E	W	SE	NE	SW	NW
Spring 2019																		
Echidna		*		*			*	*								*		
Antechinus spp																		*
Long-nosed bandicoot	*			*				*	*			*	*					
Northern brown b'icoot		*			*		*	*	*	*		*		*				
Short-eared b'tail Possum		*					*	*	*				*					*
Common b tail Possum														*				
Long-nosed potoroo		*																
Feathertail glider																*		
Swamp wallaby	*	*	*	*	*			*		*		*	*	*				
Wallaby sp.																		
Water rat																		
Bush rat	*	*		*		*	*	*	*	*	*	*	*	*				
Swamp Rat																		
Black rat	*		*		*	*	*	*	*		*			*			*	
Rodent spp																		
House mouse		*						*		*								
Mouse sp.																		
Dog									*									
Cat												*						
Cow																	*	
Australian brush-turkey									*	*		*				*		
Eastern whipbird								*			*							
Eastern yellow robin															*			
Superb fairy wren						*												
Yellow-thr scrub wren														*				
White-browed scrub-wren				*							*							
Painted button-quail											*							
Red-browed Finch												*						
Lace monitor			*				*	*		*	*	*	*	*	*	*	*	
Eastern Eastern water dragon											*							
Land Mullet							*											
Green tree snake											*							
Yellow-faced whip snake				*														

Table B9: Underpass sand track data. Prob = probably, poss = possible, Lit = Litoria, Btposs = brushtail possum, unid = unidentified.

Site	Cell	Date	Check no.	Tracks (no. of/direction of travel)	Pad condition	Comments
Autumn 2019						
Tyson's	NE	25/02/2019	Install			2 bags each (8 bags)
		1/03/2019	1	Brushtail Possum sp. (1/e)	Moderate, 1/4 washed away	
		7/03/2019	2	Water rat (prob; 2, E&W); Eastern water dragon (3, E&W); Skink (2, E&W)		
		21/03/2019	3	Eastern water dragon(2/e, 2/w), poss water skink track (1/e, 1/w), water rat (1/e)		
		1/04/2019	4	Water rat (2/e, 2/w), rodent (multiple), small lizard x 3		
		5/04/2019	5	Nil		Check
	SE	25/02/2019	Install			
		1/03/2019	1	Nil	Moderate	
		7/03/2019	2	Water rat (1, W - didn't cross pad); Eastern water dragon (1, E)		
		21/03/2019	3	Water rat meander, Eastern water dragon(1/e, 1/w) Brushtail Possum sp meander, rodent spp. meander		
		1/04/2019	4	Small lizard x 2, rodent x multiple.		
		5/04/2019	5	House mouse (1/w) water rat (meander)		
	NW	25/02/2019	Install			
		1/03/2019	1	Nil		
		7/03/2019	2	Eastern water dragon (2, W); lace monitor poss (1, W)		
		21/03/2019	3	Water rat (1 meander), Eastern water dragon(1/e), Rattus spp meander		
		1/04/2019	4	Possum spp. (1/e, 1/w), rodent spp.		
		5/04/2019	5	Water rat (2/w), Rat (meander), Unknown (1/w)		
	SW	25/02/2019	Install			
		1/03/2019	1	Rattus spp. (2w2e)	Good, minor washout	
		7/03/2019	2	Brushtail possum (1, W); Eastern water dragon (poss, 3, E&W); skink (1, W); Rattus spp (1,E)		
		21/03/2019	3	Rodent spp, Brushtail Possum sp. (1/e, 1/w), Eastern water dragon(1/e), water rat (1/e)		
		1/04/2019	4	Rodent spp. X 3		
		5/04/2019	5	Water rat (2/e, 1/w), Rodent spp. (Numerous)		
Access G	N	25/02/2019	Install			2 bags each (4 bags)
		1/03/2019	1	Lace Monitor (2/e)	Good	
		7/03/2019	2	Eastern water dragon (2; E); Rattus spp. (Several; E,W,N/S)		
		21/03/2019	3	Eastern water dragonwest		
		1/04/2019	4	Wallaby spp. (1/e), rodent spp x 3 Eastern water dragon x 2		
		5/04/2019	5	Eastern water dragon (1/w)		
	S	25/02/2019	Install			

		1/03/2019	1	Nil		
		7/03/2019	2	Lace monitor (1; W); House mouse (prob; 2; E,W,N/S)		
		21/03/2019	3	Eastern water dragon(1/e), cat (1/w), rodent spp meander		
		1/04/2019	4	Eastern water dragon(1/w)		
		5/04/2019	5	Nil		
Nth Martells	Single	25/02/2019	Install			2 bags
		1/03/2019	1	Fox (1/e), rodent spp. (1/w)	3/4 washed away	
		7/03/2019	2	Nil		
		21/03/2019	3	Complete washout		
		16/04/2019	4	Complete washout		
Sth Martells	Single	25/02/2019	Install			2 bags
		1/03/2019	1	Dog (1/e, 1/w)	Pad washed away	
		7/03/2019	2	Nil		
		21/03/2019	3	Complete washout		
		17/04/2019	4	Complete washout		
Dalhousie	E	25/02/2019	Install			2 bags each (4 bags)
		1/03/2019	1	Cat (1/e, 1/w), fox (1/w)	Moderate; 1/4 of pad washed away.	
		7/03/2019	2	Nil		
		21/03/2019	3	Complete washout		
		16/04/2019	4	Bandicoot spp. (3w & 3e), cat (1/w)		
	W	25/02/2019	Install			
		1/03/2019	1	Fox west	Good, minor wash out	
		7/03/2019	2	Lace monitor (1;W); Rattus spp (2 (adult & juv); E&W)		
		21/03/2019	3	Complete washout		
Burkes	Single	16/04/2019	4	Rattus spp. (1/w)	Good	
		25/02/2019	Install			3 bags
		1/03/2019	1	Swamp wallaby(1/e, 1/w)	Good	
		7/03/2019	2	Rattus spp (4, E&W); Fox (1, W); Bandicoot poss (2, E&W)		
		21/03/2019	3	Washout		
Railway	N	16/04/2019	4	Wallaby spp. (2/e, 1/w), Fox (1each), Rodent spp. (1/e)		
		25/02/2019	Install			6 bags
		20/03/2019	1	Wallaby spp. (1/e), Human (1/w)		
		1/04/2019	2	Fox (1/E)		
		5/04/2019	3	Nil		
		17/04/2019	4	Poss frog (1/w), rodent (1/w)		
	S	25/02/2019	Install			
		20/03/2019	1	Eastern water dragon(1/w), Wallaby spp. (3/e, 1/w), Eastern grey kangaroo (2/w, 1/e), Fox (1/e, 1/w), human (2/e, 2/w)		

		1/04/2019	2	Wallaby spp. (3/w, 1/e), Fox (2/e, 2/w), dog (1/e), Rodent, (1/e)		
		5/04/2019	3	Wallaby spp. (2/w, 1/e), Fox (1/w), possible dasyurid (1/e)	Good	
		17/04/2019	4	Fox (2/e), rodent (1/meander)		
Mcgrath	S	25/02/2019	Install			2 bags each (6)
		1/03/2019	1	Rodent (2/e)	Moderate; 1/3 washed away	
		7/03/2019	2	Bandicoot spp (1, W); Rattus spp (2,E&W); water rat poss (1, E&W)		
		21/03/2019	3	Rodent tracks (numerous)		
		1/04/2019	4	Water rat (3/e, 4/w)		
		5/04/2019	5	Water rat (1/w)		
		25/02/2019	Install			
	M	1/03/2019	1	Rodent spp. (2/e, 2/w), med reptile (1/e)	Moderate	
		7/03/2019	2	Water rat (2, W&E); Rattus spp (1, E)		
		21/03/2019	3	Rodent tracks		
		1/04/2019	4	Water rat (2/w, 2/e)		
		5/04/2019	5	Water rat (1/e)		
	N	25/02/2019	Install			
		1/03/2019	1	Med reptile (2e/2w), rodent spp. (Numerous meandering)		
		7/03/2019	2	Swamp wallaby poss (2, E&W); water rat (1, E); Rattus spp (2, E); Eastern water dragon poss (1, W)		
		21/03/2019	3	Brushtail Possum sp. spp (1/e), rodent tracks, water rat (1/w), Lace Monitor (1/w), Eastern water dragon(1/w)		
		1/04/2019	4	Brushtail Possum sp. (3/e, 2/w), Wallaby spp. (1/w), water rat (1/e, rodent spp. Multiple)		
		5/04/2019	5	Water rat (3/e, 5w), Brushtail Possum sp. spp. (1/e), Wallaby spp. (1/w), Rodent spp. (1/w, 2/e)		
Spring 2019						
Tyson's	NE	18/09/2019	Install			
		19/09/2019	1	Rodent spp (1/e)		
		20/09/2019	2	Rodent spp.		
		21/09/2019	3	Rodent spp.		
		22/09/2019	4	Rodent spp.		
	SE	18/09/2019	Install			
		19/09/2019	1	Nil		
		20/09/2019	2	Rodent spp.		
		21/09/2019	3	Small bird spp.		
		22/09/2019	4	Rodent spp. Eastern water dragon		
	NW	18/09/2019	Install			
		19/09/2019	1	Nil		
		20/09/2019	2	Nil		
		21/09/2019	3	Nil		
		22/09/2019	4	Rodent spp.		
	SW	18/09/2019	Install			

		19/09/2019	1	Eastern water dragon(1/w)		
		20/09/2019	2	Nil		
		21/09/2019	3	Nil		
		22/09/2019	4	Rodent spp.		
Access G	N	18/09/2019	Install			
		19/09/2019	1	Nil		
		20/09/2009	2	Nil	Saturated	
		21/09/2019	3	Nil		
		22/09/2019	4	Nil		
	S	18/09/2019	Install			
		19/09/2019	1	Nil		
		20/09/2019	2	Nil	Saturated	
		21/09/2019	3	Nil		
		22/09/2019	4	Nil		
Nth Martells	Single	18/09/2019	Install			
		19/09/2009	1	Rodent	Saturated	
		20/09/2019	2	Nil		
		21/09/2019	3	Nil	Partial washout	
		22/09/2019	4	Echidna (1/w), Fox (1e/1w), Rodent spp.		
Sth Martells	Single	19/09/2019	Install			
		20/09/2019	1	Nil		
		21/09/2019	2	Washout		
		22/09/2019	3	Rodent spp.		
Dalhousie	E	18/09/2019	Install			
		19/09/2019	1	Rodent (1e/1w)		
		20/09/2019	2	Nil	Saturated	
		21/09/2009	3	Nil	Partial washout	
	W	22/09/2019	4	Complete washout		
		19/09/2019	1	Nil		
		20/09/2019	2	Nil	Saturated	
		21/09/2019	3	Nil	Partial washout	
Burkes	Single	22/09/2019	4	Complete washout		
		18/09/2019	Install			
		19/09/2019	1	Nil	Good	
		20/09/2019	2	Nil	Good	
		21/09/2019	3	Lace Monitor, Eastern water dragon, rodent	Good	
Railway	N	23/09/2019	4	Fox, rodent		
		18/09/2019	Install			

		19/09/2009	1	Nil	Good	
		20/09/2019	2	Nil		
		21/09/2019	3	Nil		
		22/09/2019	4	Small bird		
	S	18/09/2019	Install			
		19/09/2019	1	Fox	Good	
		20/09/2019	2	Bandicoot (1e/1w)		
		21/09/2019	3	Bandicoot (1e/1w)		
		22/09/2019	4	Fox		
Mcgrath	S	19/09/2019	Install			
		20/09/2019	1	Nil		
		21/09/2019	2	Nil	Saturated	
		23/09/2019	3	Eastern water dragon(1w)		
		24/09/2019	4	Nil		
	M	19/09/2019	Install			
		20/09/2019	1	Nil		
		21/09/2019	2	Nil	Saturated, partial washout	
		23/09/2019	3	Rodent (1e)		
		24/09/2019	4	Nil		
	N	19/09/2019	Install			
		20/09/2019	1	Nil		
		21/09/2019	2	Brushtail Possum sp. (1/E&W), rodent multiple	Saturated	
		23/09/2019	3	Rodent (1w), water rat (1e/1w), Swamp wallaby(1w)		
		24/09/2019	4	Nil		

Table B10: Underpass tracks/scats data.

Site	Cell	Date	Check no.	Scats/tracks	Comments
Autumn 2019					
Tyson	NE	24/02/2019	1	Eastern water dragon scats, tracks. Rodent scats/tracks	
		21/03/2019	2	Antechinus spp.	Retained for confirmation
		2/04/2019	3	Small reptile scat, Antechinus spp scat	
	SE	24/02/2019	1	Rodent scats/tracks, Eastern water dragon scats, large frog scat (prob)	
		21/03/2019	2	Possible Dusky Antechinus scat	
		2/04/2019	3	Rodent spp scat	Incidental: Lampropholis delicata in UP moving west.
	NW	24/02/2019	1	Eastern water dragon scat	
		21/03/2019	2	Med reptile scat	

	SW	2/04/2019	3	Antechinus spp scat	
		24/02/2019	1	Eastern water dragon scat	
		21/03/2019	2	Nil	
		2/04/2019	3	Eastern water dragon scat	
Access G	N	24/02/2019	1	Eastern water dragon scat, bandicoot spp. scat, dog scat (prob), W. swallow nest/scat	
		21/03/2019	2	Microbat scat	
		2/04/2019	3	Prob Eastern water dragon scat, microbat scat	
	S	24/02/2019	1	Nil	
		21/03/2019	2	Microbat scat	
		2/04/2019	3	Bird scat, Wallaby scat, probably bandicoot scat	
Nth Martells	Single cell	24/02/2019	1	Eastern water dragon scat, Rodent spp. scat, Welcome swallow scat/nest	
		21/03/2019	2	Microbat scat, bird scat	
		1/04/2019	3	Antechinus scat, bird scat, Eastern water dragon scat	
Sth Martells	Single cell	24/02/2019	1	Koala? scat (2 pellets), small bird scat	Scats retained. Double check.
		21/03/2019	2	Microbat spp. scats	
		2/04/2019	3	Microbat spp. scats	
Dalhousie	E	24/02/2019	1	Nil	
		21/03/2019	2	Rattus spp. scats	
		2/04/2019	3	Antechinus spp scat, small reptile scat, rodent spp scat	
	W	24/02/2019	1	Nil	
		21/03/2019	2	Microbat spp. scats, Rattus spp. scats	
		2/04/2019	3	Antechinus spp scat	
Burkes	Single cell	24/02/2019	1	Fox tracks, Eastern water dragon scat and tracks, L. Monitor tracks	
		21/03/2019	2	Wallaby spp. (1e, 1w), Rodent spp. tracks, Antechinus scat, microbat scat, bird scat, Brushtail Possum sp. spp. scat	
		2/04/2019	3	Nil	
Railway	Single cell	28/02/2019	1	5 x wallaby spp east, 7 x wallaby spp west, large reptile spp scat, Bandicoot spp, Eastern water dragon	In old sand pads
		20/03/2019	2	Wallaby spp. scats	
		2/04/2019	3	Nil	
Mcgrath's	S	24/02/2019	1	Nil	
		21/03/2019	2	Nil	
		5/04/2019	3	Ni	
	M	24/02/2019	1	Nil	
		21/03/2019	2	Nil	
		01/05/0419	3	Nil	
	N	24/02/2019	1	Wallaby tracks, Eastern water dragon tracks, Brushtail Possum sp. spp. tracks.	
		21/03/2019	2	Nil	
		5/04/2019	3	Wallaby spp. tracks	
Spring 2019					
Tyson	NE	16/9/19	1	Microbat scat, rodent scat, rodent tracks,	
		23/9/19	2	Rodent tracks & scats, eastern water skink	EW skink in log

	SE	15/10/19	3	Rodent scat	
		16/9/19	1	Rodent tracks, prob fox tracks,	
		23/9/19	2	Rodent tracks	
	NW	15/10/19	3	Nil	
		16/9/19	1	Eastern water dragon scat, rodent scat, rodent tracks, lace monitor tracks west,	
		23/9/19	2	Rodent tracks & scat, microbat scat	
	SW	15/10/19	3	Nil	
		16/9/19	1	Fox tracks, rodent scat	
		23/9/19	2	Rodent tracks, Eastern water dragon tracks	
Access G	N	15/10/19	3	Nil	
		16/9/19	1	Fox tracks, rodent scat	
		23/9/19	2	Rodent tracks, Eastern water dragon tracks	
	S	15/10/19	3	Microbat, bandicoot, w. swallow, Brushtail Possum sp., Lace Monitor, Eastern water dragon, rodent tracks	
		17/9/19	1	Lace monitor tracks, macropod spp tracks,	
		23/9/19	2	Lace Monitor tracks, small lizard tracks	
Nth Martells	Single cell	15/10/19	3	Microbat, bandicoot, w. swallow, Brushtail Possum sp., Lace Monitor, Eastern water dragon, rodent tracks	
		16/9/19	1	Microbat scat, rodent scat, Echidna scat,	
		23/9/19	2	Welcome swallow scat	
Sth Martells	Single cell	15/10/19	3	Welcome swallow, echidna, Eastern water dragon, rodent scat	
		17/9/19	1	Brushtail Possum sp. spp scat, microbat scat,	
		23/9/19	2	Nil	Recent rain
Dalhousie	E	15/10/19	3	Rodent, microbat scat	
		17/9/19	1	Microbat scat,	
		23/9/19	2	Rodent scat, microbat scat	
	W	15/10/19	3	Eastern water dragon scat/track	
		17/9/19	1	Eastern water dragon scat, microbat scat,	
		23/9/19	2	Nil	
Burkes	Single cell	15/10/19	3	Nil	
		4/9/19	1	Rodent spp. tracks, Brushtail Possum sp. tracks, lace monitor tracks, Eastern water dragon tracks, bandicoot tracks, wallaby spp. tracks, small bird scat.	
		17/9/19	2	Rodent scat, Macropod scat, small bird scat, Rodent tracks, wallaby spp, Brushtail Possum sp. tracks. Bandicoot spp tracks,	
Railway	Single cell	15/10/19	3	Fox, Eastern water dragon, dog, small lizard, echidna tracks	
		4/9/19	1	Wallaby spp. scat, Bandicoot spp tracks, fox tracks, dog tracks, canid scat, wallaby spp. tracks	
		22/9/19	2	Fox tracks, wallaby scat, rodent tracks, bandicoot tracks	
Mcgrath's	S	16/10/19	3	Fox, bandicoot, lace Monitor, rodent tracks	
		4/9/19	1	Bandicoot spp. tracks, water rat tracks, rodent spp tracks. welcome swallow scat	
		24/9/19	2	Nil	
	M	15/10/19	3	medium bird,	
		4/9/19	1	Rodent spp. tracks, water rat tracks, welcome swallow scat	
		24/9/19	2	Nil	

	N	15/10/19	3	Eel? Rodent, Eastern water dragon, water bird	
		4/9/19	1	Wallaby spp. tracks, rodent spp. tracks, water rat tracks, Brushtail Possum sp. tracks	
		24/9/19	2	Nil	
		15/10/19	3	Brushtail Possum sp. spp. Rodent, Eastern water dragon tracks	

Table B11: Underpass camera effort.

Location	Cam Location	Date in	Date check	Pics	Active at check?	Days Active	Date Retrieve	Date in	Pics	Batt	Last pic	Days Active	Total Days Active	Comment
Autumn 2019														
Tyson's	NE	27/02/2019	2/04/2019	55	Yes	35	8/5/19		29	80	8/05/2019	37	72	
	NE FF	27/02/2019	2/04/2019	306	Yes	35	8/5/19		339	76		37	72	
	SE	27/02/2019	2/04/2019	60	Yes	35	8/5/19		206	88	8/05/2019	37	72	
	NW	27/02/2019	2/04/2019	483	Yes	35	8/5/19		110	86		37	72	
	NW FF	27/02/2019	2/04/2019	178	Yes	35	8/5/19		60	82		37	72	
	SW	27/02/2019	2/04/2019	810	Yes	35	8/5/19		183	86		37	72	
Access G	N	27/02/2019	2/04/2019	356	Yes	35	8/05/2019		126	76		37	72	
	S FF	27/02/2019	2/04/2019	122	Yes	35	8/05/2019		131	89		37	72	
	S	27/02/2019	2/04/2019	381	Yes	35	8/05/2019		83	0	8/05/2019	37	72	
Martell's N	Floor	27/02/2019	2/04/2019	213	Yes	35	8/5/19		162	69		37	72	
	FF	27/02/2019	2/04/2019	24	Yes	35	8/5/19		333	error	8/05/2019	37	72	
Martell's S	Floor	27/02/2019	2/04/2019	628	Yes	35	8/05/2019		288	71		37	72	
	FF	27/02/2019	2/04/2019	3	Yes	35	8/05/2019		384	84		37	72	Cam malfunction
Dalhousie	W	28/02/2019	2/04/2019	550	Yes	35	8/5/19		505	69		37	72	
	W FF	28/02/2019	2/04/2019	330	Yes	35	8/5/19		483	82		37	72	
	E	28/02/2019	2/04/2019	191	Yes	35	8/5/19		211	61		37	72	
	E FF	28/02/2019	2/04/2019	641	Yes	35	8/5/19		907	54		37	72	
Burkes	Floor	7/03/2019	2/04/2019	38	Yes	28	8/05/2019		162	86		37	65	
	FF	28/02/2019	2/04/2019	378	Yes	35	8/05/2019		489	57		37	72	
Railway	N	28/02/2019	2/04/2019	300	Yes	35	16/5/19		288	active	16/05/2019	45	80	
	S	28/02/2019	2/04/2019	351	Yes	35	16/5/19		914	active	16/05/2019	45	80	
Mcgrath's	N	27/02/2019	2/04/2019	252	Yes	35	8/05/2019		210	active		37	72	
	S	27/02/2019	2/04/2019	3	Yes	35	8/05/2019		51	flat	15/04/2019	14	49	
Spring 2019														
Tyson's	NE	23/09/2019	22/10/2019	132	Yes	30		22/10/2019	207	Active	18/12/2019	51	81	SES168
	NE FF	22/09/2019	22/10/2019	546	Yes	31		22/10/2019	360	Active	18/12/2019	51	82	SES7
	SE	23/09/2019	22/10/2019	169	Yes	30		22/10/2019	300	Active	18/12/2019	51	81	SES164
	NW	23/09/2019	22/10/2019	102	Yes	30		22/10/2019	159	Active	18/12/2019	51	81	SES163
	NW FF	22/09/2019	22/10/2019	768	Yes	31		22/10/2019	413	Active	18/12/2019	51	82	SES16
	SW	22/09/2019	22/10/2019	nil	Yes	31		22/10/2019	308	Active	18/12/2019	51	82	

Access G	N	23/09/2019	22/10/2019	236	Yes	30		22/10/2019	239	Active	18/12/2019	51	81	SES153
	S FF	24/09/2019	22/10/2019	45	Yes	29		22/10/2019	234	Active	18/12/2019	51	80	SES3
	S	23/09/2019	22/10/2019	52	Yes	30		22/10/2019	85	Active	18/12/2019	51	81	SES170
Martell's N	Floor	23/09/2019	21/10/2019	193	Yes	29		21/10/2019	165	Active	18/12/2019	52	81	SES171
	FF	24/09/2019	21/10/2019	117	Yes	28		21/10/2019	165	Active	18/12/2019	52	80	? White flash
Martell's S	Floor	24/09/2019	22/10/2019	194	Yes	29		22/10/2019	186	Active	18/12/2019	51	80	SES178
	FF	23/09/2019	22/10/2019	19	No- malfunctioned	1		22/10/2019	181	Active	18/12/2019	51	52	SES88
Dalhousie	W	23/09/2019	21/10/2019	194	Yes	29		21/10/2019	271	Active	18/12/2019	52	81	S123
	W FF	23/09/2019	21/10/2019	276	Yes	29		21/10/2019	429	Active	18/12/2019	52	81	SES30
	E	23/09/2019	21/10/2019	217	Yes	29		21/10/2019	237	Active	18/12/2019	52	81	SES177
	E FF	23/09/2019	21/10/2019	330	Yes	29		21/10/2019	6	malfunctioned	21/10/2019	1	30	
Burkes	Floor	23/09/2019	20/10/2019	117	Yes	28		21/10/2018	89	Active	18/12/2019	52	80	
	FF	23/09/2019	21/10/2019	22	No	1		21/10/2019	465	Active	18/12/2019	52	53	
Railway	N	22/09/2019	21/10/2019	68	Yes	30		21/10/2019	51	Active	18/12/2019	52	82	SES87
	S	23/09/2019	21/10/2019	81	Yes	29		21/10/2019	79	Active	18/12/2019	52	81	SES86
Mcgrath's	N	24/09/2019	21/10/2019	207	Yes	28		21/10/2019	201	Active	18/12/2019	52	80	S145
	S	24/09/2019	21/10/2019	2817	Yes	28		21/10/2019	9,306	Active	18/12/2019	52	80	S134

Table B12: Summary of underpass image review data with number of species/fauna groups recorded per site during spring and Autumn 2019.

Species	Complete							Incomplete						
	Access G	Burke's	Dalhousie	Martell's N	Martell's S	Railway	Tyson's	Access G	Burke's	Dalhousie	Martell's N	Martell's S	Tyson's	
Autumn														
Antechinus spp			1						1					
Australasian darter							1							
Bandicoot spp		1		1										
Black rat	1	4	156	14			87	1	2	19	6			32
Brushtail Possum sp.							1							
Bush rat			1											
Cat	1		6			5	1							
Eastern crevice skink		1			2									
Eastern Eastern water dragon				1			3							1
Echidna				1										
Egernia spp							2							
Fox		1	1	5	1									1
Lace monitor	5		4			1	2							
Long-nosed bandicoot			1		1									
Macropod spp	1													
Northern brown bandicoot			2	1										1

Species	Complete							Incomplete					
	Access G	Burke's	Dalhousie	Martell's N	Martell's S	Railway	Tyson's	Access G	Burke's	Dalhousie	Martell's N	Martell's S	Tyson's
Rodent spp			1				2			1			
Short-eared Brushtail Possum		10			47		22		1			2	2
Small mammal spp									1				
Swamp wallaby						4							
Spring													
Antechinus spp			24	1			3			13			
Bandicoot spp			2	5	6		1						
Bird				1									
Black rat	25	22	91	39	54		309	19	1	17	7	17	111
Bush rat	1	1	2		1		3	1				1	3
Cat	3		32		1	1		1		2		1	
Common Brushtail Possum		1					3						1
Cows				2									
Dog				3	4						1		
Eastern crevice skink			2	1				1					
Eastern Eastern water dragon	14		4	3			44	6		1	1	1	28
Echidna				14	8			1					
Egernia spp							14						1
Fox		5		6									
Green tree snake												1	
Grey shrike thrush													1
House mouse	1		1		2		2				1		1
Koala							1						
Lace monitor	24		64		5	4	1	1		2			
Long-nosed bandicoot			1	1	2		2						
Microbat							2						
Northern brown bandicoot					2	1							
Red-necked wallaby						2							
Rodent spp	3	5	10	2	15		23	1		1			7
Short-eared Brushtail Possum	4	46	1		19		5		3			2	2
Small mammal spp			6	1	1								
Swamp wallaby		1		2	1								
Water rat							9						3
Welcome swallow				1					1		10		
White-necked Heron							1						1
Total	83	98	413	105	172	18	544	32	10	56	26	25	196

Table B13: Site habitat assessment. Eucs = eucalypts, MoF = moist open forest, DoF = dry open forest, McF = moist closed forest.

Site	Side	Hab class	Dominant canopy spp.	Dominant sub canopy spp.	Dominant Ground cover	Comments
McGrath's	East	MOF	Flooded Gum, blackbutt, Pink Bloodwood, brushbox, Tallowwood	Vine spp, Rainforest spp, Bangalow palms, cheese tree	Gahnia spp, Cordyline spp, blady grass, Lantana, leaf litter	
	West		Pints radiata, blackbutt, Rainforest spp,	Vine spp, Rainforest spp, camphor laurel	Agricultural grasses, Lantana, bracken, pine needles	
Burkes	East	MOF/DOF	Blackbutt, Tallowwood, swamp Mahogany	Bamboo, emergent eucs, acacia spp, casuarina spp, cheese tree	Blady grass, lantana, scetaria, cordyline spp	
	West	DOF	Tallowwood, blackbutt, Flooded Gum, Grey Ironbark	Emergent eucs, acacia spp, casuarina spp, vine spp	Cordyline, blady grass	
South Martells	East	MOF	Blackbutt, Flooded Gum, grey ironbark	Vine spp, emergent eucs, acacia spp, some Rainforest spp, casuarina spp	Cordyline, vine spp	
	West	MOF	Flooded Gum, Grey Ironbark, small fruited grey gum	Vine spp, emergent eucs, acacia spp, some Rainforest spp, casuarina spp	Cordyline, vine spp	
Tyson's	West	MOF	Swamp Mahogany, melaleuca quin,	Melaleuca spp, emergent eucs, acacia spp, cheese story	Cordyline, blady grass, gahnia	
	East	MCF/MOF	Flooded Gum, Grey Ironbark, turpentine,	Casuarina spp, emergent eucs, vine spp	Cordyline, gahnia, leaf litter	
Access G	West	MCF	Grey Ironbark, brushbox, small fruited grey gum,	Bangalow palms, Rainforest spp, vine spp	Cordyline spp, emergent Rainforest spp,	
	East	MCF	Grey Ironbark, flooded Gum,	Melaleuca spp, emergent eucs, casuarina spp	Cordyline spp, gahnia, leaf palms	
Dalhousie	West	DOF	Blackbutt, pink Bloodwood, Flooded Gum, turpentine	Casuarina spp, emergent eucs, vine spp, Rainforest spp	Various grasses, blady grass, leaf litter	
	East	MOF	Blackbutt, pink Bloodwood, Flooded Gum, turpentine	Casuarina spp, emergent eucs, vine spp, Rainforest spp	Various grasses, blady grass, gahnia spp, Cordyline spp, leaf litter, Acacia spp.	
North Martells	West	MOF/DOF	Blackbutt, Red Mahogany	Melaleuca spp, emergent eucs, acacia spp	Cordyline, gahnia, small shrubs	Heavily logged, heavy regen
	East	MOF/DOF	Blackbutt, Red Mahogany	Melaleuca spp, emergent eucs, acacia spp	Cordyline, gahnia, small shrubs	Heavily logged, heavy regen
Railway	East	MOF	Flooded Gum, blackbutt, Pink bloodwood	Vine spp 60%	Lantana, blady grass	
	West	MOF	Blackbutt, Flooded Gum, turpentine, brushbox	Emergent eucs, acacia spp,	50% grass cover scetaria, blady grass, 50% leAf litter	

Table B14: Exclusion fence camera effort.

Location	Cam Location	Date in	Date check	Pics	Active at check?	Days Active	Date Retrieve	Date in	Pics	Batt	Last pic	Days Active	Total Days Active	Comment
Autumn 2019														
Tyson's	NE	27/02/2019	2/04/2019	55	Yes	35	8/5/19		29	80	8/05/2019	37	72	
	NE FF	27/02/2019	2/04/2019	306	Yes	35	8/5/19		339	76		37	72	
	SE	27/02/2019	2/04/2019	60	Yes	35	8/5/19		206	88	8/05/2019	37	72	
	NW	27/02/2019	2/04/2019	483	Yes	35	8/5/19		110	86		37	72	
	NW FF	27/02/2019	2/04/2019	178	Yes	35	8/5/19		60	82		37	72	
	SW	27/02/2019	2/04/2019	810	Yes	35	8/5/19		183	86		37	72	

Access G	N	27/02/2019	2/04/2019	356	Yes	35	8/05/2019		126	76		37	72	
	S FF	27/02/2019	2/04/2019	122	Yes	35	8/05/2019		131	89		37	72	
	S	27/02/2019	2/04/2019	381	Yes	35	8/05/2019		83	0	8/05/2019	37	72	
Martell's N	Floor	27/02/2019	2/04/2019	213	Yes	35	8/5/19		162	69		37	72	
	FF	27/02/2019	2/04/2019	24	Yes	35	8/5/19		333	error	8/05/2019	37	72	
Martell's S	Floor	27/02/2019	2/04/2019	628	Yes	35	8/05/2019		288	71		37	72	
	FF	27/02/2019	2/04/2019	3	Yes	35	8/05/2019		384	84		37	72	Cam malfunction
Dalhousie	W	28/02/2019	2/04/2019	550	Yes	35	8/5/19		505	69		37	72	
	W FF	28/02/2019	2/04/2019	330	Yes	35	8/5/19		483	82		37	72	
	E	28/02/2019	2/04/2019	191	Yes	35	8/5/19		211	61		37	72	
	E FF	28/02/2019	2/04/2019	641	Yes	35	8/5/19		907	54		37	72	
Burkes	Floor	7/03/2019	2/04/2019	38	Yes	28	8/05/2019		162	86		37	65	
	FF	28/02/2019	2/04/2019	378	Yes	35	8/05/2019		489	57		37	72	
Railway	N	28/02/2019	2/04/2019	300	Yes	35	16/5/19		288	active	16/05/2019	45	80	
	S	28/02/2019	2/04/2019	351	Yes	35	16/5/19		914	active	16/05/2019	45	80	
Mcgrath's	N	27/02/2019	2/04/2019	252	Yes	35	8/05/2019		210	active		37	72	
	S	27/02/2019	2/04/2019	3	Yes	35	8/05/2019		51	flat	15/04/2019	14	49	
Spring 2019														
Tyson's	NE	23/09/2019	22/10/2019	132	Yes	30		22/10/2019	207	Active	18/12/2019	51	81	SES168
	NE FF	22/09/2019	22/10/2019	546	Yes	31		22/10/2019	360	Active	18/12/2019	51	82	SES7
	SE	23/09/2019	22/10/2019	169	Yes	30		22/10/2019	300	Active	18/12/2019	51	81	SES164
	NW	23/09/2019	22/10/2019	102	Yes	30		22/10/2019	159	Active	18/12/2019	51	81	SES163
	NW FF	22/09/2019	22/10/2019	768	Yes	31		22/10/2019	413	Active	18/12/2019	51	82	SES16
	SW	22/09/2019	22/10/2019	nil	Yes	31		22/10/2019	308	Active	18/12/2019	51	82	
Access G	N	23/09/2019	22/10/2019	236	Yes	30		22/10/2019	239	Active	18/12/2019	51	81	SES153
	S FF	24/09/2019	22/10/2019	45	Yes	29		22/10/2019	234	Active	18/12/2019	51	80	SES3
	S	23/09/2019	22/10/2019	52	Yes	30		22/10/2019	85	Active	18/12/2019	51	81	SES170
Martell's N	Floor	23/09/2019	21/10/2019	193	Yes	29		21/10/2019	165	Active	18/12/2019	52	81	SES171
	FF	24/09/2019	21/10/2019	117	Yes	28		21/10/2019	165	Active	18/12/2019	52	80	? White flash
Martell's S	Floor	24/09/2019	22/10/2019	194	Yes	29		22/10/2019	186	Active	18/12/2019	51	80	SES178
	FF	23/09/2019	22/10/2019	19	No-malfunctioned	1		22/10/2019	181	Active	18/12/2019	51	52	SES88
Dalhousie	W	23/09/2019	21/10/2019	194	Yes	29		21/10/2019	271	Active	18/12/2019	52	81	S123
	W FF	23/09/2019	21/10/2019	276	Yes	29		21/10/2019	429	Active	18/12/2019	52	81	SES30
	E	23/09/2019	21/10/2019	217	Yes	29		21/10/2019	237	Active	18/12/2019	52	81	SES177
	E FF	23/09/2019	21/10/2019	330	Yes	29		21/10/2019	6	malfunctioned	21/10/2019	1	30	
Burkes	Floor	23/09/2019	20/10/2019	117	Yes	28		21/10/2018	89	Active	18/12/2019	52	80	
	FF	23/09/2019	21/10/2019	22	No	1		21/10/2019	465	Active	18/12/2019	52	53	
Railway	N	22/09/2019	21/10/2019	68	Yes	30		21/10/2019	51	Active	18/12/2019	52	82	SES87

	S	23/09/2019	21/10/2019	81	Yes	29		21/10/2019	79	Active	18/12/2019	52	81	SES86
Mcgrath's	N	24/09/2019	21/10/2019	207	Yes	28		21/10/2019	201	Active	18/12/2019	52	80	S145
	S	24/09/2019	21/10/2019	2817	Yes	28		21/10/2019	9,306	Active	18/12/2019	52	80	S134

Table B15: Underpass fence entrance image review data. TB = Towards Bush, TR = Towards Road, TU- Towards Underpass, AFU = Away from Underpass, NDM = No Directional Movement.

Site	Side	Date	Time	Species	Accuracy	Movement	Pic No.	Confirmed Crossing	Concurrent sand detection	Comments	
Dalhousie	NW	17/04/2019	0240	Black rat	D	EXM	298-309			On fence	Key
		22/09/2019	0443	Black rat	Pr	NDM	1			In fence	TB = Towards Bush
		22/09/2019	2231	Northern brown bandicoot	Pr	TB	2				TR = Towards Road
		30/09/2019	0428	Lace monitor	D	TU	92-93				TU- Towards Underpass
		1/10/2019	1910	Rabbit	D	EXM	130-138				AFU = Away from Underpass
	SW	7/04/2019	2141	House mouse	Pr	EXM	34-36			In fence	
		14/04/2019	0440	House mouse	Pr	NDM	67-69			In fence	
		24/04/2019	1916	House mouse	Pr	EXM	94-96			In fence	
		24/04/2019	2210	House mouse	Pr	EXM	97-99			In fence	
		26/04/2019	2136	House mouse	Pr	EXM	107-108			In fence	
		27/04/2019	2144	House mouse	Pr	NDM	121-122			on fence	
		29/04/2019	0033	House mouse	Pr	NDM	133-134			in fence	
		22/09/2019	0005	Long-nosed bandicoot	Pr	AFU	20				
	NE	22/04/2019	1617	Black rat	Pr	TB	43-45				
		27/04/2019	1920	Black rat	Pr	NDM	46-48				
		2/05/2019	2210	Black rat	Pr	TB	49-51				
		3/05/2019	1950	Northern brown bandicoot	D	AFU	52-55				
		21/09/2019	1932	Northern brown bandicoot	Pr	TB	23				
	SE	5/04/2019	0134	House mouse	Pr	EXM	1-3				
		5/04/2019	2027	House mouse	Pr	NDM	4-6				
		6/04/2019	0257	House mouse	Pr	EXM	10-12				
		8/04/2019	2042	Black rat	D	EXM	25-30				
		13/04/2019	0341	Black rat	D	EXM	37-39				

Site	Side	Date	Time	Species	Accuracy	Movement	Pic No.	Confirmed Crossing	Concurrent sand detection	Comments	
		13/04/2019	2348	Bandicoot spp	D	TU	40-42				
		14/04/2019	0026	Black rat	D	NDM	43-45				
		14/04/2019	0503	Black rat	D	TU	46-51				
		21/04/2019	2102	Black rat	D	NDM	61-63				
		22/04/2019	0407	Black rat	D	NDM	64-66				
		25/04/2019	2102	Black rat	D	EXM	91-92				
		26/04/2019	1833	Black rat	D	EXM	94-96				
		26/04/2019	2003	Black rat	D	EXM	109-111,115-120				
		1/05/2019	0004	House mouse	Pr	EXM	121-125				
		4/05/2019	0025	Black rat	D	EXM	133-135				
		4/05/2019	0446	Black rat	D	EXM	136-141				
		4/05/2019	1942	Black rat	D	EXM	142-147				
		18/09/2019	0145	Black rat	D	EXM	2				
		24/09/2019	2130	Black rat	D	EXM	3				
		24/09/2019	2331	Black rat	Pr	NDM	4-5				
		27/09/2019	1856	Black rat	Pr	EXM	14				
South Martells	NW	8/04/2019	2109	Echidna	D	NDM	19				
		17/09/2019	1911	Northern brown bandicoot	Pr	EXM	4-6				
		24/09/2019	1938	Rodent spp	D	TU	37				
		25/09/2019	0030	Northern brown bandicoot	D	TU	39				
		26/09/2019	2354	Northern brown bandicoot	Pr	TU	41				
		27/09/2019	0052	Small mammal spp	D	EXM	42	can only see end of tail			
		29/09/2019	2006	Northern brown bandicoot	Pr	EXM	47-48				
		1/10/2019	0203	Rodent spp	D	TR	50				
		2/10/2019	0610	Brush turkey	D	EXM	51-53				
	SW	7/04/2019	1734	Swamp wallaby	D	EXM	7-12				
		8/04/2019	0209	Black rat	Pr	NDM	13-15				
		8/04/2019	0229	Swamp wallaby	D	AFU	16-25				

Site	Side	Date	Time	Species	Accuracy	Movement	Pic No.	Confirmed Crossing	Concurrent sand detection	Comments	
		22/09/2019	2237	Echidna	D	TU	17				
		24/09/2019	2103	Bandicoot spp	Pr	TU	22-24	Juvenile			
		27/09/2019	0204	Black rat	D	EXM	31-32				
		28/09/2019	0925	Eastern Eastern water dragon	D	TR	34-35				
		28/09/2019	1749	Swamp wallaby	Pr	TU	36				
	NE	6/04/2019	2245	Black rat	Pr	NDM	10-12				
		6/04/2019	2327	Black rat	D	EXM	13-27			2 x individuals in one frame	
		7/04/2019	2007	Black rat	D	EXM	34-38				
		8/04/2019	0120	Northern brown bandicoot	D	EXM	40-57				
		10/04/2019	1803	Rodent spp	D	EXM	58-60				
		11/04/2019	0044	Black rat	D	EXM	61-63				
		12/04/2019	1804	Black rat	D	EXM	64-72				
		15/04/2019	0459	Cat	Po	TU	79-81				
		23/04/2019	1828	Black rat	D	NDM	82-84				
		28/04/2019	1838	Northern brown bandicoot	D	EXM	97-99				
		28/04/2019	2037	Cat	Po	TU	100-102				
		1/05/2019	0053	Black rat	D	EXM	103-105				
		5/05/2019	1852	House mouse	Pr	EXM	118-120				
		5/05/2019	2009	Rodent spp	D	EXM	121-123				
		18/09/2019	2042	Rodent spp	D	NDM	3				
		18/09/2019	2104	Black rat	D	TR	5				
		21/09/2019	1721	Brush turkey	D	TU	11-14				
		21/09/2019	2055	Black rat	D	TR	15-16				
		21/09/2019	2208	Long-nosed bandicoot	D	AFU	17-18				
		28/09/2019	0941	Swamp wallaby	D	TU	21				
		2/10/2019	1919	Dog	D	TU	25				
		2/10/2019	2028	Black rat	D	EXM	27				
		5/10/2019	1803	Swamp wallaby	D	NDM	32-37				
		8/10/2019	1836	Black rat	Pr	TU	41				

Site	Side	Date	Time	Species	Accuracy	Movement	Pic No.	Confirmed Crossing	Concurrent sand detection	Comments	
		17/10/2019	2133	Black rat	D	EXM	54				
		20/10/2019	1002	Red-necked wallaby	D	TU	60-66				
		20/10/2019	1701	Swamp wallaby	D	TU	69-75				
	SE	6/04/2019	0452	Black rat	D	EXM	16-18				
		9/04/2019	2211	Swamp wallaby	D	NDM	22-24				
		10/04/2019	1822	Swamp wallaby	D	NDM	28-33				
		17/09/2019	1904	Black rat	Pr	TR	8				
		18/09/2019	2105	Black rat	Pr	TR	16				
		19/09/2019	1918	Black rat	D	TU	22				
		19/09/2019	1954	Rodent spp	Pr	TU	24				
		19/09/2019	2032	Black rat	D	EXM	26			climbs up fence	
		20/09/2019	2004	Black rat	D	NDM	34				
		21/09/2019	2151	Long-nosed bandicoot	D	TB	40-41				
		22/09/2019	2325	Rodent spp	D	TU	42				
		23/09/2019	1931	Black rat	D	TU	45				
		23/09/2019	2244	Fox	D	TU	46				
		27/09/2019	0042	Black rat	D	TU	56				
		28/09/2019	0035	Black rat	Pr	EXM	59				
		28/09/2019	1955	Bandicoot spp	D	TB	63				
		28/09/2019	2157	Black rat	D	TU	64				
Burkes	NW	29/04/2019	1809	Medium mammal spp	D	TU	61-63			In long grass	
		4/05/2019	0033	Cat	D	TU	64-69			towards then on escape structure	
		4/05/2019	0435	Cat	Po	NDM	70-72			Can only see eyeshine	
	SW	4/4/19	2102	Black rat	D	TB	4-6				
		5/4/19	0002	Black rat	Pr	NDM	10-12				
		6/4/19	2312	Rodent spp	D	NDM	19-21			In fence	
		7/4/19	2351	Black rat	Pr	TB	22-30				
		8/4/19	0400	Rodent spp	D	NDM	34-39				

Site	Side	Date	Time	Species	Accuracy	Movement	Pic No.	Confirmed Crossing	Concurrent sand detection	Comments	
		9/4/19	1924	Black rat	Pr	EXM	40-45			From bush side into fence	
		9/4/19	2252	Black rat	D	NDM	52-54				
		11/10/19	0320	Black rat	D	NDM	4-6				
		19/10/19	2142	Black rat	D	NDM	10-15				
	NE	4/04/2019	1839	Black rat	D	TR	4-6,10-12				
		4/04/2019	1921	Black rat	D	EXM	13-18				
		4/04/2019	2041	Black rat	D	NDM	22-24				
		4/04/2019	2252	Black rat	D	NDM	25-27			on fence	
		4/04/2019	2256	Swamp wallaby	D	TU	34-42				
		6/04/2019	0115	Black rat	D	TB	43-45				
		6/04/2019	0234	Black rat	D	NDM	46-48				
		6/04/2019	1926	Black rat	D	NDM	49-51				
		6/04/2019	2126	Black rat	D	NDM	52-54				
		7/04/2019	0001	Black rat	D	EXM	55-60				
		7/04/2019	0453	Black rat	Pr	NDM	62-63				
		8/04/2019	0108	Black rat	D	NDM	70-72				
		8/04/2019	2157	Black rat	D	EXM	73-75			climbing along fence	
		9/04/2019	2326	Black rat	D	EXM	76-78			climbing along fence	
		10/04/2019	1804	Black rat	D	NDM	94-96				
		10/04/2019	1813	House mouse	Pr	TB	109-132				
		11/04/2019	1735	Black rat	D	NDM	136-137				
		11/04/2019	1831	Black rat	D	EXM	142-152				
		11/04/2019	1941	Black rat	D	EXM	157-162				
		11/04/2019	2211	Black rat	D	NDM	166-168			on fence	
		11/04/2019	2303	Black rat	D	EXM	169-174			in fence	
		12/04/2019	0101	house mouse	Pr	EXM	181-195			on fence	
		12/04/2019	0518	black rat	Pr	NDM	197-198				
		13/04/2019	0107	house mouse	Pr	EXM	202-210				

Site	Side	Date	Time	Species	Accuracy	Movement	Pic No.	Confirmed Crossing	Concurrent sand detection	Comments	
		14/04/2019	0128	Black rat	D	NDM	220-222				
		14/04/2019	2000	Black rat	D	NDM	232-234				
		15/04/2019	0147	Black rat	D	EXM	235-273				
		16/04/2019	2333	House mouse	Pr	NDM	343				
		17/04/2019	2339	Black rat	D	EXM	355-357				
		18/04/2019	0307	Black rat	D	TB	360-363				
		20/04/2019	1649	Black rat	D	NDM	376-378				
		22/04/2019	0321	Black rat	D	NDM	397-399				
		22/04/2019	1610	Black rat	D	NDM	400-405				
		24/04/2019	1827	Black rat	Pr	NDM	424-426				
		24/04/2019	2356	House mouse	Pr	EXM	451-453				
		25/04/2019	1700	Black rat	D	EXM	469-471				
		27/04/2019	0015	Black rat	D	NDM	475-483				
		27/04/2019	2054	Black rat	D	NDM	622-624				
		28/04/2019	2137	Swamp wallaby	Pr	NDM	637-639				
		30/04/2019	1614	Black rat	D	NDM	724-726				
		30/04/2019	2322	Swamp wallaby	D	AFU	727-732				
		1/05/2019	2145	Black rat	D	EXM	736-746				
		6/05/2019	1628	Black rat	D	TB	964-966				
		7/05/2019	1600	Black rat	D	NDM	992-996				
		19/09/2019	2244	Rodent spp	D	TB	1				
		20/09/2019	0316	Swamp wallaby	D	TU	2-11				
		20/09/2019	2313	Black rat	Pr	EXM	33				
		26/09/2019	1704	Swamp wallaby	D	TU	707-727				
	SE	5/04/2019	0302	Black rat	Pr	EXM	1-3				
		5/04/2019	2249	Black rat	D	EXM	4-6			Climbing up fence	
		21/04/2019	2220	Rodent spp	D	NDM	1042-1043				
		22/04/2019	0542	Black rat	D	NDM	1045-1050				
		23/04/2019	0358	Black rat	D	EXM	1054-1077				
		23/04/2019	2013	Black rat	D	NDM	1081-1083				

Site	Side	Date	Time	Species	Accuracy	Movement	Pic No.	Confirmed Crossing	Concurrent sand detection	Comments	
		24/04/2019	2154	Black rat	D	EXM	1090-1095				
		26/04/2019	0506	Black rat	D	EXM	1105-1113				
		28/04/2019	0322	Black rat	D	EXM	1279-1287				
		1/05/2019	2310	Black rat	D	EXM	1423-1425				
		3/05/2019	2205	Black rat	Pr	NDM	1429-1431				
		4/05/2019	0441	Rodent spp	D	NDM	1435-1437				
		4/05/2019	2335	Black rat	D	EXM	1438-1449				
		7/05/2019	0209	Swamp wallaby	Pr	TC	1450-1455				
		7/05/2019	1940	Rodent spp	D	TB	1468-1470				
		8/05/2019	0043	Rodent spp	D	EXM	1474-1478				
		22/09/2019	0010	Echidna	D	EXM	102-107				
North Martells	NW	15/04/2019	1805	Swamp wallaby	D	TC	70-78				
		17/04/2019	1841	Black rat	Pr	NDM	253-255				
		22/04/2019	0531	Bandicoot spp	D	TC	907-909			fence	
		22/04/2019	0746	Black rat	D	EXM	910-915				
		22/04/2019	0901	Bandicoot spp	Pr	NDM	916-918				
		22/04/2019	0349	Black rat	Pr	EXM	1027-1032				
		27/04/2019	0508	Black rat	Pr	EXM	1033-1035				
		28/04/2019	0835	House mouse	Pr	EXM	1039-1041				
		29/04/2019	2203	Northern brown bandicoot	Pr	NDM	1048-1050				
		2/05/2019	2224	Bandicoot spp	Pr	TC	1057-1059				
		3/05/2019	2313	Black rat	Pr	EXM	1060-1062				
		4/05/2019	2247	Black rat	Pr	EXM	1084-1095				
		5/05/2019	2208	Black rat	Pr	EXM	1099-1104				
	SW	4/04/2019	1816	Rodent spp	D	EXM	82-83				
		6/04/2019	2114	Rodent spp	D	NDM	3829-3831				
		26/09/2019	0017	Bandicoot spp	D	TU	14				
		30/09/2019	0236	Black rat	Pr	TB	26				
		13/10/2019	0842	Painted button quail	D	TR	176			goes through fence towards road	

Site	Side	Date	Time	Species	Accuracy	Movement	Pic No.	Confirmed Crossing	Concurrent sand detection	Comments	
	NE	9/04/2019	0231	Bandicoot spp	Pr	TU	7-9				
		10/04/2019	1847	Echidna	D	AFU	16-18				
		11/04/2019	1909	Echidna	D	NDM	34-36				
		11/04/2019	2300	Black rat	Pr	NDM	37-38				
		22/04/2019	1839	Bandicoot spp	Pr	TU	52-54				
		22/04/2019	1907	House mouse	Pr	EXM	58-60				
		24/04/2019	1906	Bandicoot spp	Pr	TU	61-63				
		25/04/2019	1906	House mouse	D	EXM	67-72				
		27/04/2019	2216	House mouse	D	NDM	79-81				
		27/04/2019	2242	House mouse	D	EXM	82-85				
		29/04/2019	2348	House mouse	D	EXM	88-94				
		1/05/2019	1943	House mouse	D	EXM	97-99				
		1/05/2019	2028	House mouse	D	EXM	101-105				
		1/05/2019	2059	Echidna	D	TU	106-111				
		1/05/2019	2233	House mouse	D	EXM	112-117				
		2/05/2019	0232	House mouse	Pr	NDM	121-123				
		3/05/2019	2309	House mouse	Pr	NDM	124-125				
		5/05/2019	1833	House mouse	D	NDM	130-132				
		23/09/2019	0249	Black rat	D	TU	14-15				
		23/09/2019	1859	Northern brown bandicoot	Pr	EXM	18-24				
	SE	8/04/2019	0031	Rodent spp	D	NDM	1-2				
		19/04/2019	0314	Swamp wallaby	Pr	NDM	7-9				
		20/04/2019	2007	House mouse	Pr	NDM	10-12				
		25/04/2019	0258	Black rat	D	NDM	22-24				
Tyson's	NW	6/04/2019	2358	Rodent spp	D	EXM	4-6				
		11/04/2019	0215	Black rat	D	N DM	10-12				
		11/04/2019	2004	Black rat	D	NDM	22-24				
		23/09/2019	2042	Northern brown bandicoot	Pr	NDM	40				
	SW	6/04/2019	0205	House mouse	Pr	NDM	1-3				

Site	Side	Date	Time	Species	Accuracy	Movement	Pic No.	Confirmed Crossing	Concurrent sand detection	Comments	
		6/04/2019	2305	Echidna	D	TU	4-9				
		8/04/2019	1912	Rodent spp	D	NDM	19-21				
		9/04/2019	2305	House mouse	Pr	NDM	34-39				
		9/04/2019	2351	Bandicoot spp	Pr	NDM	40-43				
		10/04/2019	2306	Rodent spp	D	EXM	112-117				
		11/04/2019	0015	Rodent spp	D	EXM	121-126				
		22/09/2019	0400	Koala	D	TU	3				
	NE	7/04/2019	0236	House mouse	Pr	NDM	13-15				
		8/04/2019	0452	House mouse	Pr	EXM	19-21				
		10/04/2019	0254	House mouse	Pr	NDM	34-36				
		13/04/2019	0053	House mouse	Pr	NDM	37-39				
		17/04/2019	0303	House mouse	Pr	EXM	43-48				
		18/04/2019	0244	House mouse	Pr	EXM	52-57				
		21/09/2019	1922	Rodent spp	D	NDM	21				
		7/10/2019	2038	Swamp wallaby	D	NDM	66				
	SE	5/04/2019	1910	Fox	D	TU	502-504				
		26/09/2019	1931	Black rat	D	TB	389				
		30/09/2019	2351	Fox	D	AFU	630				
		3/10/2019	2144	Long-nosed bandicoot	Pr	TB	832-833				
Access G	NW	5/04/2019	2142	house mouse	Pr	NDM	31-33				
		6/04/2019	1908	house mouse	Pr	TR	91-93				
		9/04/2019	2007	Northern brown bandicoot	D	AFU	307-309				
		15/04/2019	0440	Swamp wallaby	D	AFU	685-690				
		30/04/2019	0131	Black rat	Pr	EXM	1687-1689				
		20/09/2019	2058	Echidna	D	AFU	7				
		25/09/2019	0357	Black rat	D	TB	9				
		26/09/2019	0132	Black rat	Pr	EXM	10				
		26/09/2019	2255	Northern brown bandicoot	Pr	EXM	11				
		27/09/2019	0027	Black rat	Pr	EXM	13				
		29/09/2019	0006	Black rat	D	TB	14				

Site	Side	Date	Time	Species	Accuracy	Movement	Pic No.	Confirmed Crossing	Concurrent sand detection	Comments	
		30/09/2019	0417	Black rat	D	TB	15				
		4/10/2019	2341	Black rat	Pr	EXM	17-18				
		13/10/2019	0415	Black rat	Pr	TB	22				
		15/10/2019	2254	Black rat	D	TB	29-30				
	SW	9/04/2019	0051	Northern brown bandicoot	Pr	NDM	19-21				
		21/04/2019	0459	Black rat	D	NDM	67-69				
		21/04/2019	2207	House mouse	Pr	EXM	70-71				
		27/04/2019	1813	Bandicoot spp	Pr	TU	76-78				
		28/04/2019	1716	Swamp wallaby	D	NDM	97-108				
		4/05/2019	2332	House mouse	Pr	NDM	115-117				
		6/05/2019	0022	Rodent spp	D	NDM	121-123				
		22/09/2019	0202	Black rat	D	EXM	20-22				
	NE	8/04/2019	2123	Black rat	D	EXM	28-33				
		9/04/2019	2040	Black rat	D	EXM	34-36				
		18/09/2019	1650	Swamp wallaby	D	TU	28				
		22/09/2019	1946	Black rat	D	EXM	96-97				
		23/09/2019	1818	Brushtail Possum sp. spp	D	TU	118				
		26/09/2019	0058	Black rat	Pr	TB	188				
		27/09/2019	1513	Purple swamp hen	D	TU	225-227				
	SE	5/04/2019	1811	Black rat	D	EXM	7-18				
		6/04/2019	0018	Bandicoot spp	Pr	TU	19-21				
		6/04/2019	1818	Black rat	D	EXM	55-65				
		6/04/2019	1931	Black rat	D	EXM	67-75				
		6/04/2019	2140	Black rat	D	EXM	77-92				
		7/04/2019	1819	Black rat	D	EXM	94-96				
		8/04/2019	1958	Northern brown bandicoot	Pr	NDM	103-105				
		8/04/2019	2220	Echidna	D	NDM	106-108				
		9/04/2019	0314	Black rat	D	NDM	109-111				
		10/04/2019	0447	Black rat	D	NDM	127-129				
		11/04/2019	0506	Black rat	D	NDM	142-144				

Site	Side	Date	Time	Species	Accuracy	Movement	Pic No.	Confirmed Crossing	Concurrent sand detection	Comments	
		11/04/2019	2152	Black rat	D	EXM	151-156				
		14/04/2019	2350	Black rat	D	EXM	184-185				
		16/04/2019	0016	Black rat	Pr	NDM	190-192				
		19/04/2019	1817	Black rat	D	NDM	256-258				
		20/04/2019	1748	Black rat	D	EXM	259-270				
		20/04/2019	1800	Black rat	D	NDM	271-273				
		23/04/2019	0532	Black rat	Pr	NDM	274-276				
		23/04/2019	1855	Black rat	D	EXM	280-288				
		24/04/2019	1851	Black rat	D	EXM	295-300				
		25/04/2019	2327	Black rat	D	EXM	300-306				
		27/04/2019	1842	Black rat	D	EXM	358-360				
		28/04/2019	1806	Black rat	D	NDM	364-366				
		30/04/2019	0500	Black rat	D	NDM	397-399				
		30/04/2019	0533	Black rat	D	NDM	400				
		30/04/2019	1820	Black rat	D	EXM	403-408				
		2/05/2019	0028	Black rat	D	EXM	412-414				
		2/05/2019	0135	Black rat	D	EXM	415-420				
		3/05/2019	0325	Black rat	D	EXM	433-438				
		3/05/2019	1937	Black rat	D	NDM	439-441				
		5/05/2019	1752	Black rat	D	EXM	451-456				
		6/05/2019	1811	Black rat	D	EXM	457-462				
		7/05/2019	2012	Black rat	Pr	NDM	463-465				
		22/09/2019	1024	Purple swamp hen	D	TU	173-174				
		26/09/2019	2048	Northern brown bandicoot	Pr	TU	634-635				
	NW	6/4/19	2158	House mouse	D	EXM	313-315				
		22/4/19	0440	Swamp wallaby	D	NDM	544-546				
		22/4/19	0736	Swamp wallaby	D	NDM	547-549				
		22/4/19	1821	Bandicoot spp	D	NDM	553				
		24/4/19	0000	Swamp wallaby	D	EXM	562-582				
		27/4/19	0537	Swamp wallaby	D	NDM	586-594				

Site	Side	Date	Time	Species	Accuracy	Movement	Pic No.	Confirmed Crossing	Concurrent sand detection	Comments	
		30/4/19	2211	Swamp wallaby	Pr	NDM	596-597				
		20/9/19	0302	Swamp wallaby	Pr	NDM	3				
		24/9/19	1000	Swamp wallaby	D	TU	44-94			foraging	
		30/9/19	0208	Swamp wallaby	D	TU	212-224			foraging	
		30/9/19	1931	Northern brown bandicoot	Pr	TU	281				
		6/10/19	0247	Swamp wallaby	D	TU	465-493			foraging	
		6/10/20	0135	Swamp wallaby	D	TB	547-557				
	SW	4/4/19	2137	Echidna	D	NDM	10-12				
		23/9/19	0037	Black rat	D	NDM	7				
		28/9/19	0028	Swamp wallaby	D	AFU	56-78			foraging	
		1/10/19	2148	Swamp wallaby	D	AFU	85-100				
		1/10/20	2021	Black rat	D	EXM	170-173				
		2/10/19	2324	Northern brown bandicoot	Pr	TB	175				
		3/10/19	0051	Swamp wallaby	D	NDM	177				
		3/10/19	0635	Swamp wallaby	D	EXM	178-187				
		9/10/19	1853	2 x Swamp wallaby	D	EXM	460-506			2 individuals, foraging	
		10/10/19	2251	Swamp wallaby	Pr	NDM	556				
		18/10/19	2111	Northern brown bandicoot	D	TB	758				
		19/10/19	0000	Swamp wallaby	D	EXM	760-810				
		19/10/19	1803	Swamp wallaby	D	TB	829-830				
		19/10/19	2328	Swamp wallaby	D	AFU	831-834				
		20/10/19	2232	Swamp wallaby	D	AFU	971-984				
	NE	4/04/2019	1906	Black rat	D	EXM	1-12				
		4/04/2019	1941	Black rat	D	EXM	13-18				
		7/04/2019	1813	Black rat	D	NDM	22,25-27				
		10/04/2019	1809	Black rat	Pr	NDM	40-42				
		11/04/2019	1849	Black rat	D	EXM	43-44				
		12/04/2019	0441	Black rat	D	NDM	46-48				
		12/04/2019	1850	Black rat	D	NDM	49-51				
		14/04/2019	1802	Black rat	D	EXM	52-57				

Site	Side	Date	Time	Species	Accuracy	Movement	Pic No.	Confirmed Crossing	Concurrent sand detection	Comments	
		15/04/2019	1753	Black rat	D	EXM	61-69				
		18/04/2019	0426	Black rat	D	NDM	70-72				
		18/04/2019	2331	Black rat	D	NDM	73-75				
		20/04/2019	1802	Black rat	D	NDM	76-81				
		22/04/2019	0331	Black rat	D	NDM	88-90				
		26/04/2019	0400	Black rat	D	EXM	91-93				
		28/04/2019	0252	Black rat	Pr	NDM	94-96				
		28/04/2019	0504	Black rat	D	EXM	100-102				
		28/04/2019	2042	Black rat	D	NDM	103-105				
		29/04/2019	0403	Common Brushtail Possum	D	TU	109-111				
		29/04/2019	0409	Black rat	D	EXM	115-117				
		3/05/2019	2253	Black rat	D	EXM	118-122				
		5/05/2019	1823	Black rat	D	EXM	124-132				
		19/09/2019	0236	Black rat	D	EXM	1-4				
		21/09/2019	1912	Black rat	D	EXM	79				
		23/09/2019	0033	Small mammal spp	D	EXM	135			ontop of camera	
		23/09/2019	1916	Black rat	D	EXM	153				
		23/09/2019	2303	Black rat	D	AFU	154-155				
		25/09/2019	0452	Rodent spp x 2	D	EXM	202-203				
		26/09/2019	1928	Black rat	Pr	NDM	231-232				
		28/09/2019	1831	Rodent spp	D	EXM	305			ontop of camera	
		30/09/2019	0015	Black rat	Pr	EXM	318				
		1/10/2019	2147	House mouse	Pr	EXM	349-350				
		2/10/2019	2340	Black rat	Pr	EXM	452				
		3/10/2019	1951	Black rat	Pr	EXM	495-498				
		8/10/2019	2216	Rodent spp	Pr	EXM	707			only see end of tail	
		10/10/2019	0057	Black rat x 2	Pr	EXM	890-892				
		10/10/2019	1829	Black rat	D	EXM	972				
		10/10/2019	2246	Black rat	D	TB	973				

Site	Side	Date	Time	Species	Accuracy	Movement	Pic No.	Confirmed Crossing	Concurrent sand detection	Comments	
		15/10/2019	0002	Black rat	D	EXM	1187-1188				
		15/10/2019	0129	Black rat	D	EXM	1189				
	SE	4/04/2019	2111	Black rat	D	EXM	7-21				
		4/04/2019	2253	Black rat	D	TR	22-24				
		4/04/2019	2337	Black rat	Pr	NDM	25-27				
		6/04/2019	0030	Black rat	D	EXM	34-39				
		7/04/2019	0047	Black rat	D	TR	43-45				
		8/04/2019	0013	Black rat	D	NDM	49-51				
		15/04/2019	0219	Black rat	D	EXM	58-63				
		16/04/2019	0058	Black rat	D	TR	70-72				
		16/04/2019	0245	Black rat	D	EXM	76-78				
		16/04/2019	1858	Black rat	D	EXM	79-84				
		17/04/2019	0007	Black rat	D	NDM	85-87				
		17/04/2019	0132	Black rat	D	NDM	88-90				
		17/04/2019	0309	Black rat	D	NDM	91-93				
		20/04/2019	2053	Black rat	D	NDM	106-111				
		21/04/2019	0419	Black rat	D	NDM	112-114				
		21/04/2019	1810	Black rat	Pr	NDM	115-117				
		21/04/2019	1928	Black rat	D	NDM	118-120				
		23/04/2019	2055	Black rat	D	EXM	124-138				
		24/04/2019	2035	Black rat	D	EXM	142-144				
		24/04/2019	2120	Black rat	D	NDM	145-147				
		25/04/2019	2024	Swamp wallaby	D	NDM	148-150				
		26/04/2019	2350	Black rat	D	NDM	163-165				
		27/04/2019	0157	Black rat	D	NDM	166-168				
		27/04/2019	2035	Black rat	D	NDM	169-171				
		27/04/2019	2127	Black rat	D	NDM	175-177				
		28/04/2019	2042	Black rat	D	EXM	178-186				
		29/04/2019	0350	Black rat	D	NDM	187-189				
		29/04/2019	1902	Black rat	D	NDM	190-192				

Site	Side	Date	Time	Species	Accuracy	Movement	Pic No.	Confirmed Crossing	Concurrent sand detection	Comments	
		30/04/2019	0045	Black rat	D	TR	196-198				
		30/04/2019	1909	Black rat	D	NDM	202-204				
		1/05/2019	0156	Black rat	D	EXM	208-210				
		1/05/2019	2046	Black rat	D	EXM	211-213				
		2/05/2019	2104	Black rat	D	EXM	217-220				
		2/05/2019	2155	Black rat	D	EXM	223-225				
		3/05/2019	1846	Black rat	D	EXM	229-234				
		4/05/2019	0322	Black rat	D	EXM	241-249				
		5/05/2019	0432	Black rat	D	TR	250-252				
		5/05/2019	1824	Black rat	Pr	EXM	256-258				
		7/05/2019	2147	Black rat	Pr	EXM	262-264				
		8/05/2019	0525	Black rat	D	EXM	265-267				
		19/09/2019	2234	Black rat	D	NDM	1-3				
		22/09/2019	2354	Black rat	Pr	NDM	10-12				
		29/09/2019	0052	Black rat	D	NDM	19-21				
		30/09/2019	0205	Swamp wallaby	D	EXM	25-45				
		1/10/2019	0402	Black rat	D	AFU	49-51				
		1/10/2019	1927	Black rat	Pr	NDM	52-54				
		1/10/2019	2014	Swamp wallaby	D	EXM	55-63				
		8/10/2019	0216	Northern brown bandicoot	D	NDM	67-72				
		8/10/2019	0655	Swamp wallaby	D	TU	73-75				
		16/10/2019	0111	Swamp wallaby	D	NDM	91-96				
		16/10/2019	2044	Short-eared Brushtail Possum	D	TB	103-105				
		20/10/2019	2100	Black rat	D	TR	118-120				

Table B16: Underpass hair funnel data for 2019.

Funnel ID	Autumn 2019		
	Install Date	Collect date	Fauna
Dalhousie EE	21/03/2019	4/04/2019	Nil
Dalhousie EW	21/03/2019	4/04/2019	Nil
Dalhousie WW	21/03/2019	4/04/2019	Nil
Dalhousie WE	21/03/2019	4/04/2019	Nil
South Martells E	21/03/2019	5/04/2019	Nil
South Martells W	21/03/2019	5/04/2019	Nil
Burke's E	21/03/2019	4/04/2019	Nil
Burke's W	21/03/2019	4/04/2019	Nil
North Martells E	21/03/2019	4/04/2019	Nil
North Martells W	21/03/2019	4/04/2019	Nil
Tyson's WW	21/03/2019	5/04/2019	Nil
Tyson's WE	21/03/2019	5/04/2019	Nil
Tyson's EW	21/03/2019	5/04/2019	Nil
Tyson's EE	21/03/2019	5/04/2019	Nil
Access G W	21/03/2019	5/04/2019	Nil
Access G E	21/03/2019	5/04/2019	Nil
Dalhousie EE	19/10/2019		Nil
Dalhousie EW	19/10/2019		Antechinus sp.
Dalhousie WW	19/10/2019		Antechinus sp.
Dalhousie WE	19/10/2019		Nil
South Martells E	19/10/2019		Rattus fuscipes (Southern Bush-rat)
South Martells W	19/10/2019		Nil
Burke's E	19/10/2019		Nil
Burke's W	19/10/2019		Nil
North Martells E	19/10/2019		Nil

North Martells W	19/10/2019		Nil
Tyson's WW	19/10/2019		Rattus sp.
Tyson's WE	19/10/2019		<i>Rattus</i> sp.
Tyson's EW	19/10/2019		Nil
Tyson's EE	19/10/2019		<i>Rattus fuscipes</i> (Southern Bush-rat)
Access G W	19/10/2019		Nil
Access G E	19/10/2019		Nil