



Transport for
New South Wales

Pacific Highway Upgrade Woolgoolga to Ballina

Threatened Gliders Monitoring Program, Year
Five (2021)

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1. Introduction

1.1 Background

The Woolgoolga to Ballina (W2B) Pacific Highway Upgrade received State approval under Part 5.1 of the *Environmental Planning and Assessment Act 1979 (EP&A Act)* on 24 June 2014 and Federal approval under the *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)* on 14 August 2014. The Threatened Glider Management Plan (TGMP) (Roads and Maritime Services, version 3.0, February 2018) was developed to meet the requirements of State Ministerial Condition of Approval (MCoA) D8 and components of MCoA D2. None of the glider species addressed in the plan are listed under the *EPBC Act*.

The TGMP identifies potential impacts of the upgrade on two threatened glider species - squirrel glider (*Petaurus norfolcensis*) and yellow-bellied glider (*P. australis*) - collectively referred to as 'threatened gliders'. Both species are listed as vulnerable by the NSW *Biodiversity Conservation Act 2016 (BC Act)* and inhabit open forests and woodlands throughout the ranges and coastal areas of north-east NSW, although the yellow-bellied glider is largely absent from highly fragmented alluvial floodplains and coastal heathlands (RMS 2018). Numerous records of both species occur within 10km of the W2B alignment (RMS 2018).

The TGMP details a comprehensive monitoring program. The components of the monitoring program include:

1. Glider population monitoring.
2. Arboreal crossing structures and widened medians monitoring.
3. Road mortality monitoring.
4. Nest box monitoring.
5. Habitat revegetation monitoring.

The following report addresses components 1 – 3 of the monitoring program. Components 4 and 5 (Nest box monitoring and Habitat revegetation monitoring) are not part of the scope of this report. Earlier phases of components 1 - 3 of the monitoring program have been reported on previously (refer Sandpiper Ecological 2014, 2015, 2016, 2018a, 2019, 2020a, 2021).

1.1.1 Scope

Sandpiper Ecological was engaged by Jacobs in January 2017 to undertake the W2B threatened glider monitoring program. The current annual report addresses year 5 monitoring activities undertaken during Q1-Q4 of the 2021 calendar year in sections 1-2 (Q1&2; year 4 operation phase) and sections 3-11 (Q1-Q3 year 1 operation phase & Q4 yr two operation phase). In 2021, monitoring in sections 1 and 2 was limited to aerial crossings and vegetated medians and occurred in Q1 and 2 only. These activities build upon years 1, 2, 3 and 4 monitoring (refer Sandpiper 2018a, 2019, 2020a, 2021) and earlier baseline and construction phase monitoring (refer Sandpiper 2014, 2015, 2016).

1.2 Glider population monitoring

The TGMP states that the objective of glider population monitoring is:

“To establish if there is a difference in occupational abundance of threatened gliders or activity levels before, during and after the project.”

To achieve this objective, the TGMP directs that population monitoring will occur at:

- Impact sites: mitigated sites such as widened medians and crossing structures within 100m of the road edge.

- Control sites: unmitigated sites within 100m of the road edge.
- Reference sites: sites >300m from the project.

The TGMP details that glider population monitoring will occur before (i.e., pre-disturbance), during (i.e., during disturbance) and after (i.e., post-disturbance/operation phase when mitigation is in place) construction and that the occupation rates (i.e., presence/absence) will be compared between these periods for impact, control and reference sites.

To determine the effectiveness of mitigation measures, Table 8.1 of the TGMP describes performance indicators and corrective actions for threatened glider population monitoring. A single performance indicator is stated for the threatened glider population monitoring:

1. Decline in the after-construction occupancy rates of squirrel glider or yellow-bellied glider at impact sites over three consecutive monitoring sessions (years).

In the event of a decline in post-construction occupational abundance (i.e., rates), the following *Corrective Actions* are described:

- a. Review monitoring methods, considering further monitoring and assessment should there be a decline in population abundance.
- b. Consider potential for natural variation to be responsible for decline in population numbers /density.
- c. Review location of arboreal crossing structures and consider adding new structures.
- d. Investigate habitat adjoining the highway and consider improving habitat condition and connectivity.
- e. Post three years of monitoring and implementation of corrective actions, if connectivity measures cannot be demonstrated to be effective at successfully mitigating the barrier and fragmentation impact to glider species, the residual impact to connectivity shall be offset. This is in accordance with MCoA D2.

1.3 Arboreal crossing structures and widened medians monitoring

The TGMP states that the objective of arboreal crossing structures and widened medians monitoring is:

“To establish the level of use of various crossing structures (i.e., glide poles, widened medians and rope bridges) by squirrel glider and yellow-bellied glider.”

Monitoring locations include connectivity structures targeted for threatened gliders listed in Table 8.4 of the TGMP and include rope crossings, land bridges and widened medians. As different sections of the W2B upgrade are being constructed independently, crossing structure deployment will occur at different times during the construction phase. The intention is to schedule monitoring of all arboreal crossing structures within a project section/portion at the same time, rather than individually (RMS 2018). This will enable meaningful and robust data comparisons and reduce the potentially confounding effects of differing stages of construction.

To determine the effectiveness of crossing structures and widened medians, Table 8.2 of the TGMP outlines performance indicators and corrective actions. A single Performance Indicator is stated for crossing structures and widened medians monitoring:

1. No evidence of use of arboreal crossing structures and widened medians by threatened gliders post-construction.

In the event of no evidence of use, the following *Corrective Actions* are described:

- a. *Review location and type of connectivity structures installed and implement provisional measures in consultation with EPA which may include but not limited to the installation of more glide poles or rope bridges, particularly where known mortality hotspots occur.*
- b. *Consider more strategic planting of habitat or the installation of additional glide poles, informed by the long-term population monitoring data.*
- c. *Post three years of monitoring and implementation of corrective actions, if connectivity measures cannot be demonstrated to be effective at successfully mitigating the barrier and fragmentation impact to glider species, the residual impact to connectivity shall be offset. This is in accordance with MCoA D2.*

1.4 Road mortality monitoring

Monitoring of threatened glider mortalities on the road will occur adjacent to all arboreal crossing structures and the widened medians in relevant project sections and at established control sites (RMS 2018). The monitoring program will measure correlations between connectivity structures and glider road mortalities. A higher mortality at impact sites compared to control sites may indicate that the mitigation measure is ineffective for road mortality prevention or reduction.

The stated objective of road mortality monitoring is:

“Record the incidence of glider-vehicle collisions at mitigated (impact) and unmitigated (control) sites, to establish if there is a positive effect (i.e., decrease in glider mortality) associated with crossing structures. This is to meet MCoA D8(g).”

To determine the effectiveness of connectivity structures in preventing or reducing glider road mortality, Table 8.3 of the TGMP outlines Performance Indicators (1 & 2) and their respective *Corrective Actions* (a, b, ... etc.). They are as follows:

1. Higher mortality rate at impact sites or no significant difference in mortality rates for threatened gliders between impact and control sites.
 - a. *Review reported usage level of crossing structure by threatened gliders.*
 - b. *Corrective actions may include but not limited to the installation of more glide poles or rope bridges to known mortality hotspots.*
 - c. *Crossing structures also serve as ‘insurance’ in the case of stochastic events such as fire or disease, which may occur at long time intervals. Further the cost of decommissioning and relocating a rope bridge or glide pole array is likely to be comparable to the cost of installing a new structure. Therefore, existing glide poles/rope bridges will be retained.*
 - d. *Should road kill data indicate a road-kill hot-spot for gliders where there is limited crossing structures RMS will investigate the feasibility of installing additional crossing structures*
 - e. *Post three years of monitoring and implementation of corrective actions, if connectivity measures cannot be demonstrated to be effective at successfully mitigating the barrier and fragmentation impact to glider species, the residual impact to connectivity shall be offset. This is in accordance with MCoA D2.*
2. High number of incidental records of threatened glider mortality away from crossing structures.
 - a. *Identify a hot spot.*
 - b. *Review options for mitigation, i.e., crossing structure, signage, lowering speed limit.*
 - c. *Consider implementation of crossing structure at identified hot-spot or other methods to reduce mortality (e.g. signage, review design of structure in that locality, additional plantings to encourage gliders away from road and to crossing structure).*

2. Methods

2.1 Study area

The study area includes sections 1-11 of the W2B Pacific Highway upgrade, between Woolgoolga and Wardell and habitat within 1km of the project alignment (impact and control sites) and habitat surrounding reference sites up to 4km from the project alignment (Figures 1-6). Sample sites were largely dry sclerophyll forest with small areas of swamp sclerophyll forest. The study area is located within the north coast bioregion and experiences a largely sub-tropical climate (NSW NPWS 2003).

In sections 3-11, glider population surveys were conducted at 48 sites – 20 impact, 18 control, 10 reference (Table 1). Impact sites were at locations of proposed crossing structures and vegetated medians. Control sites were positioned in forest habitat largely equivalent to impact sites and a minimum 500m but mostly >1000m from impact sites. Reference sites were in equivalent forest habitat >1-4km from either impact or control sites. Aerial crossing monitoring was conducted at 22 sites, and included 12 rope bridges, and 10 glide poles or glide pole arrays. In sections 1 and 2 aerial crossing structures were situated at five sites and included four rope bridges and three glide poles (Figures 1 & 2). Three vegetated medians were monitored, VM1 - McLaughlins Road (Section 1), VM2 - Parker Road (Section 2) and VM3 - Tabbimoble (Section 7).

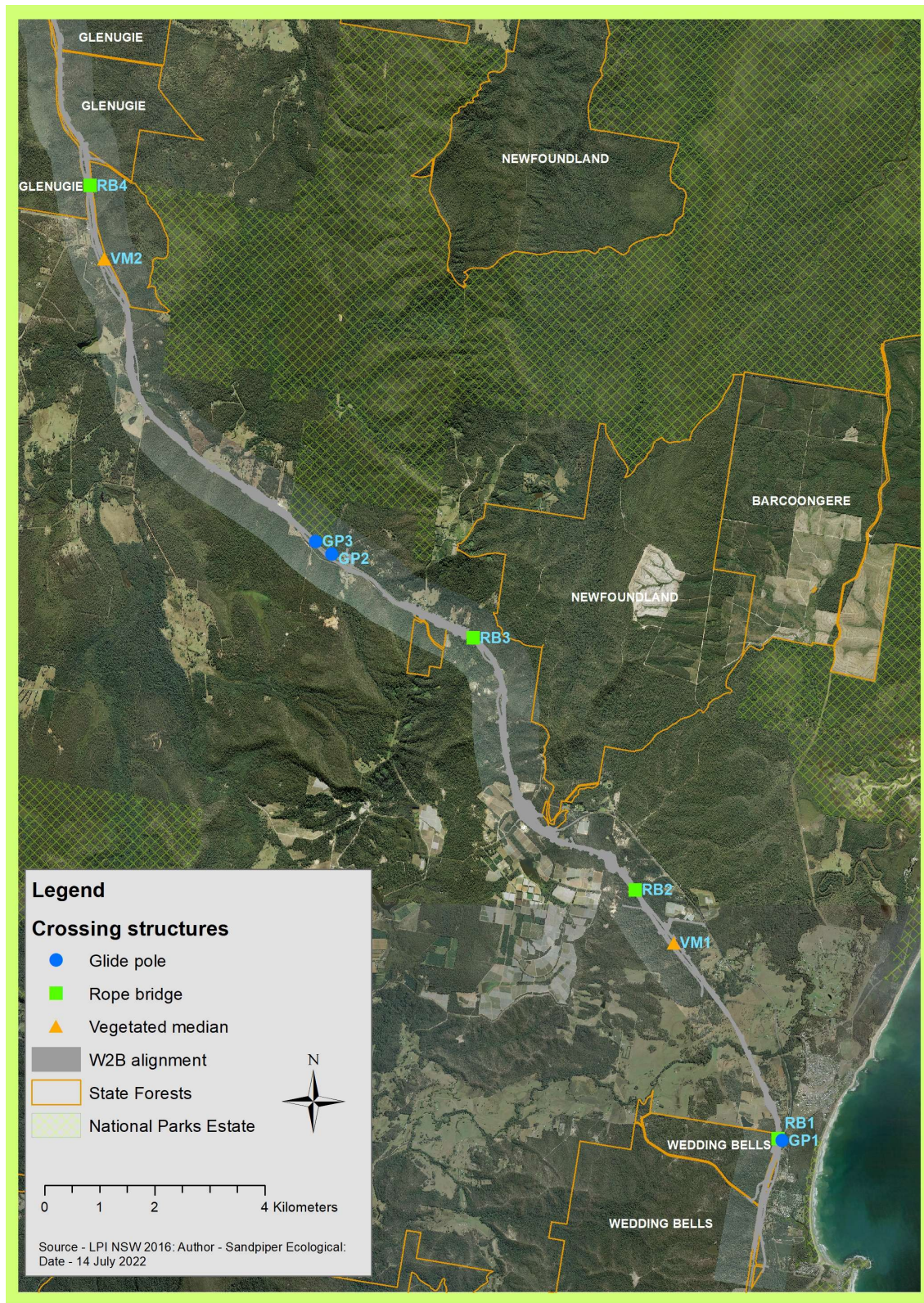


Figure 1: Location of aerial crossing structures and vegetated medians in sections 1 and 2 of the W2B alignment.

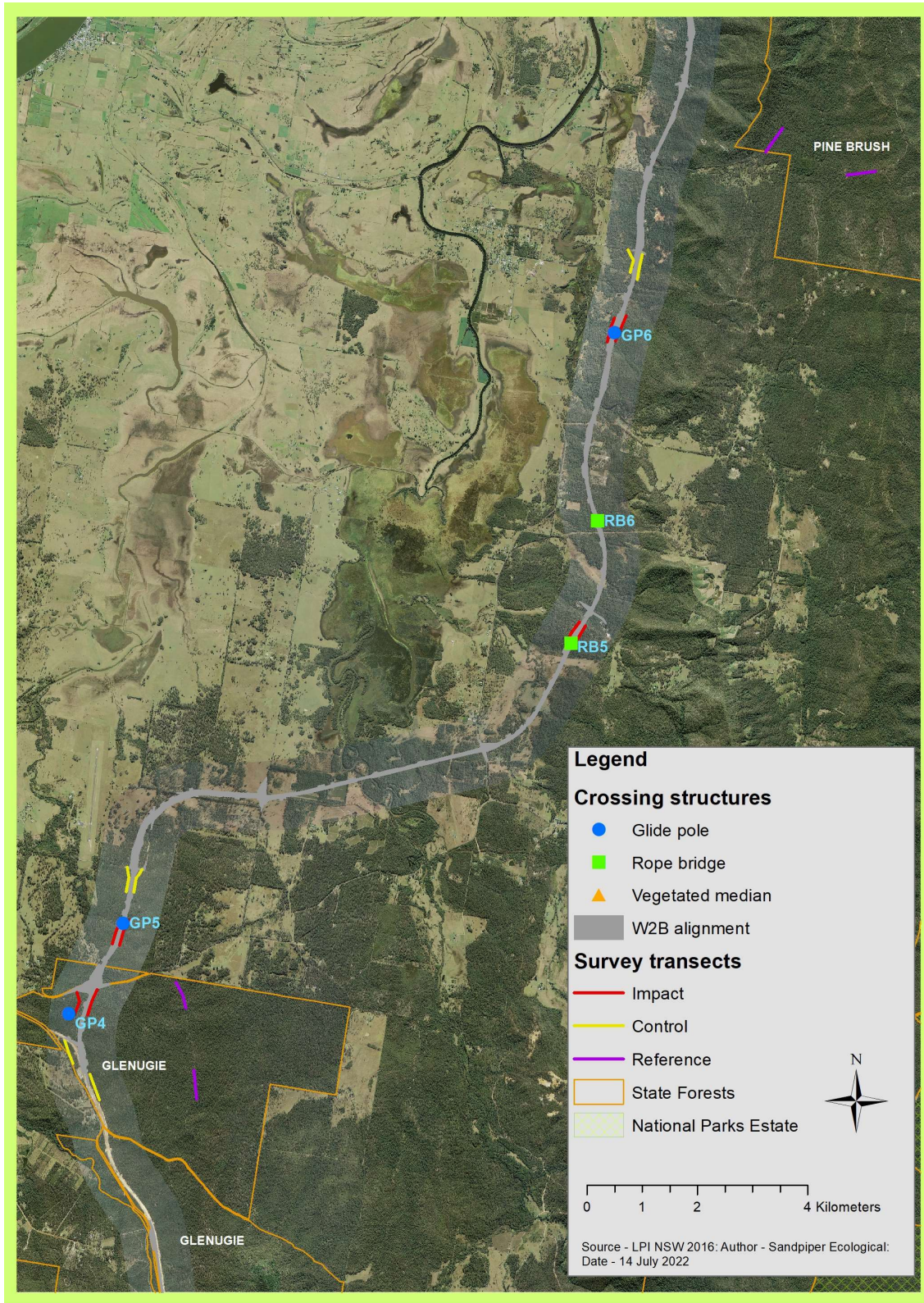


Figure 2: Threatened glider impact, control and reference sites and aerial crossing structures in section 3-11 of the W2B alignment.

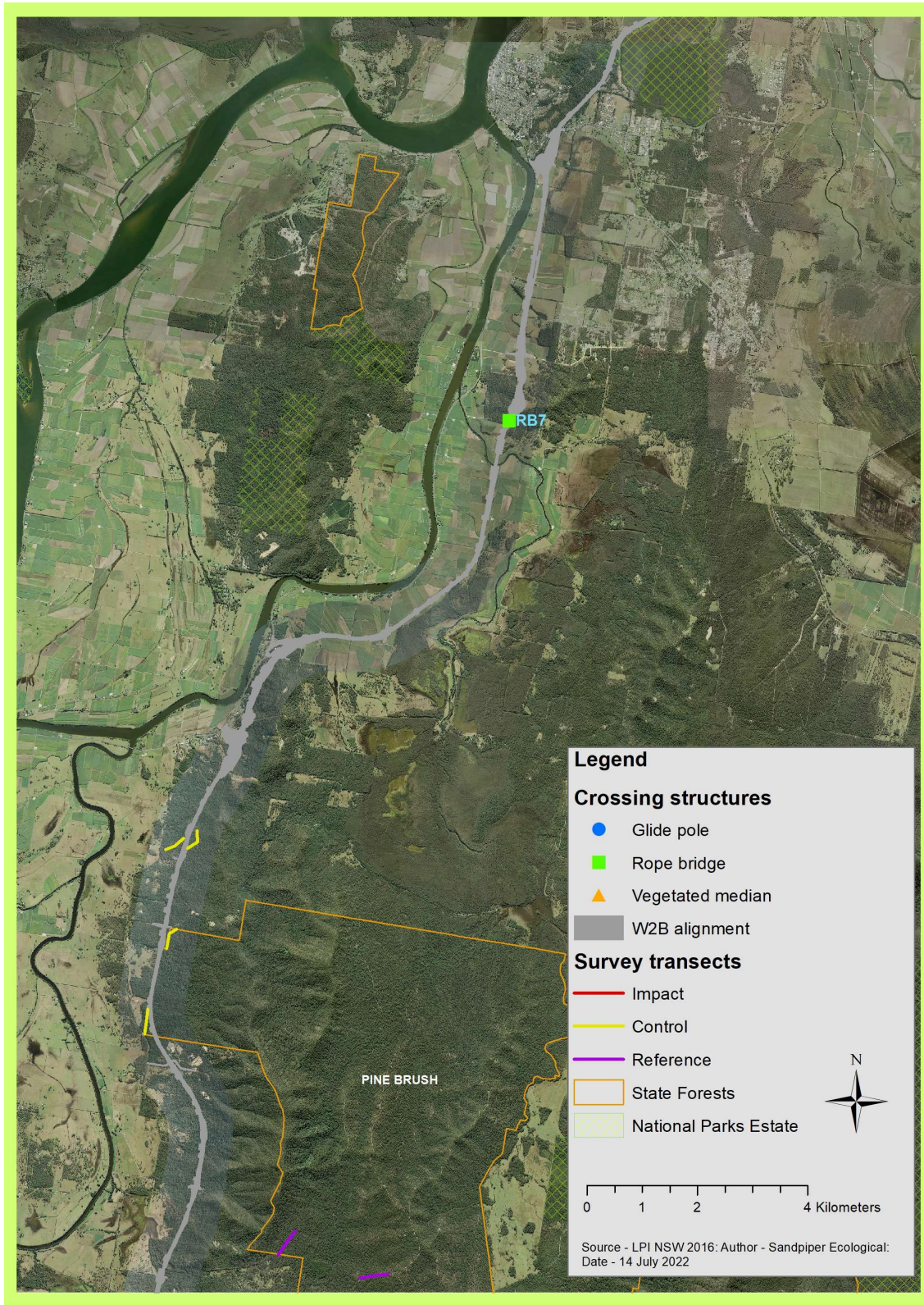


Figure 3: Threatened glider impact, control and reference sites, and aerial crossing structures in sections 3-11 of the W2B alignment.

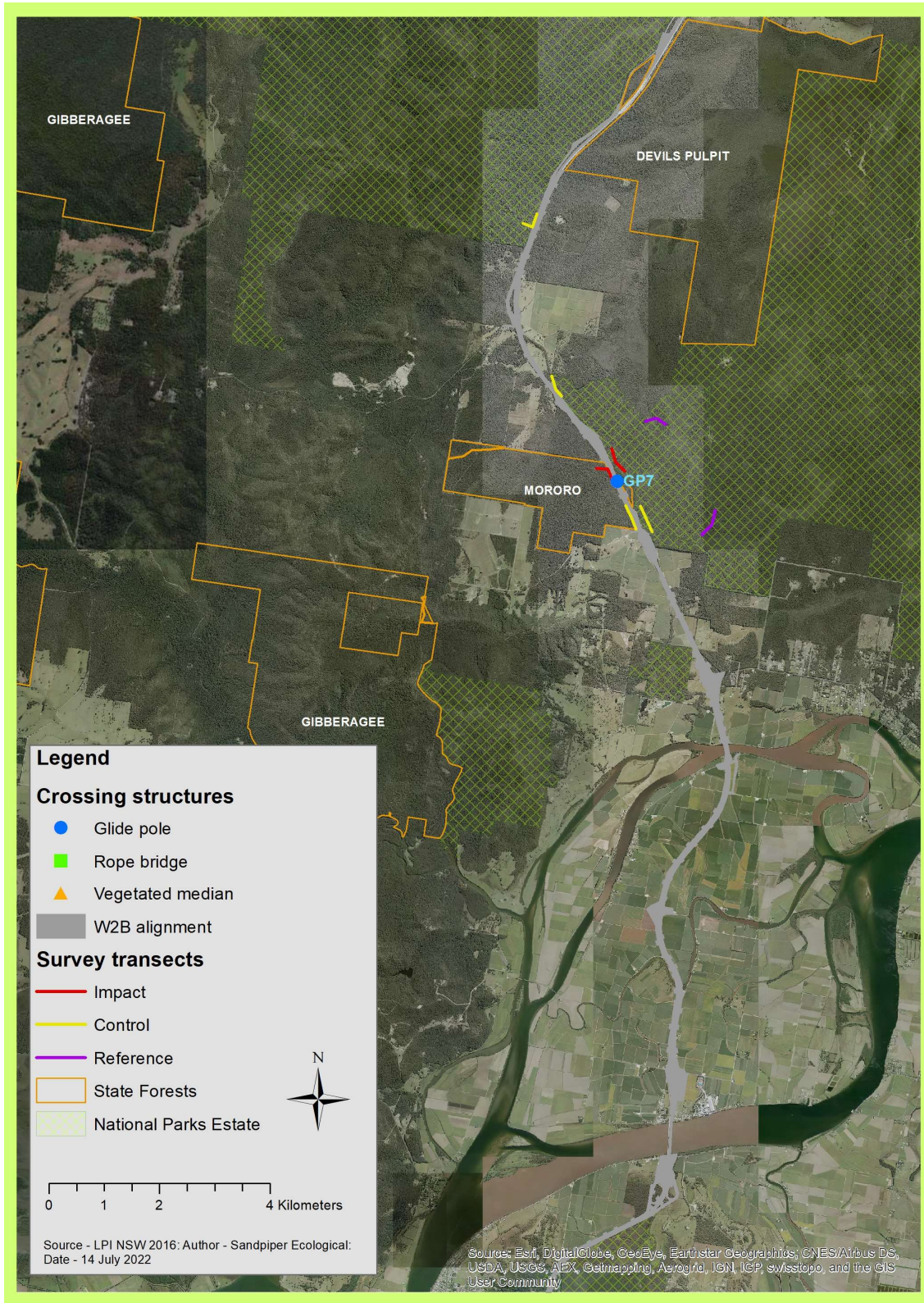


Figure 4: Threatened glider impact, control and reference sites, and aerial crossing structures in sections 3-11 of the W2B alignment.

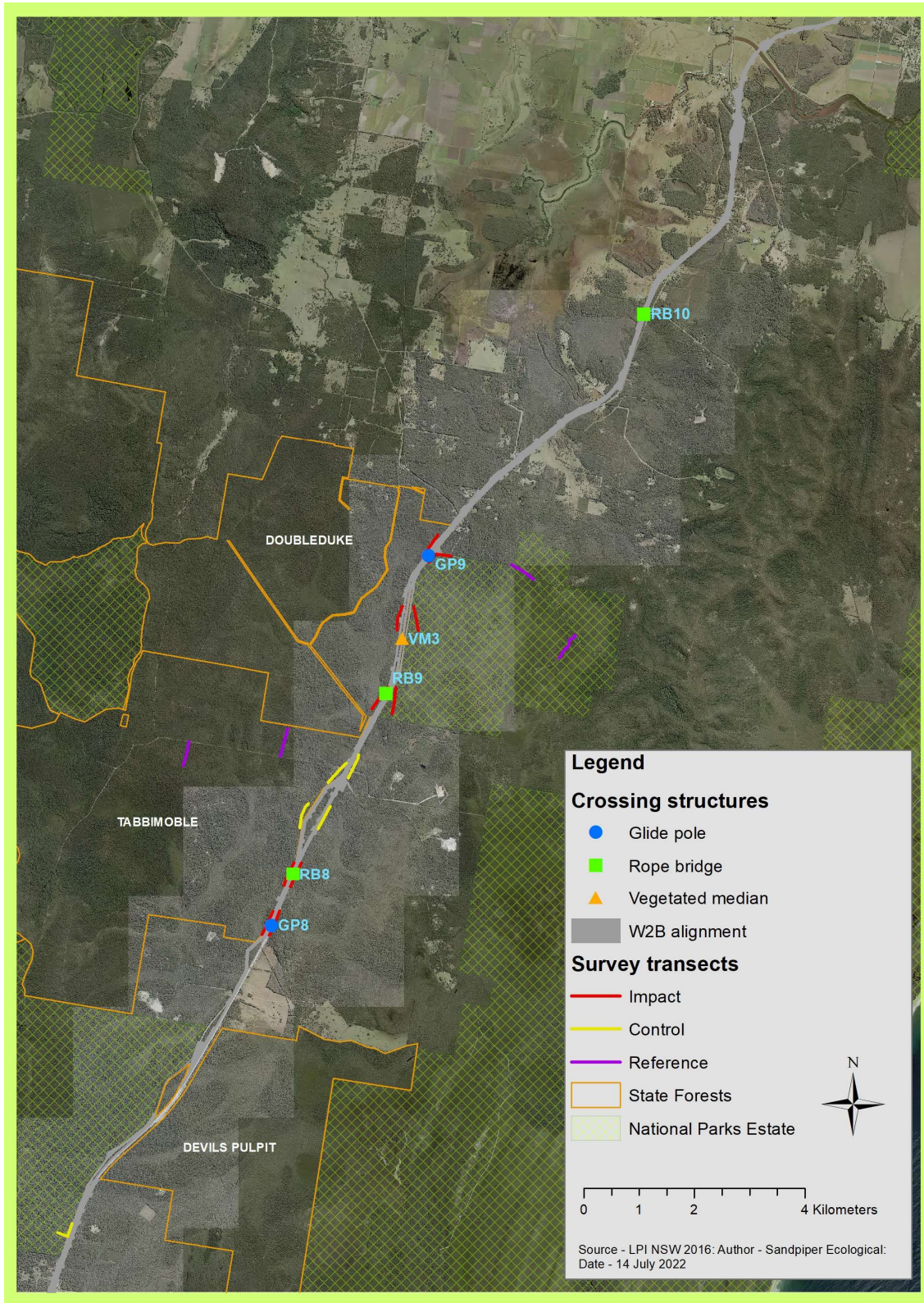


Figure 5: Threatened glider impact, control and reference sites, and aerial crossing structures in sections 3-11 of the W2B alignment.



Figure 6: Location of aerial crossing structures within sections 3-11 of the W2B alignment.

Table 1: Location of impact, control and reference glider population monitoring sites positioned in sections 3-11 of the W2B Upgrade. RB = rope bridge; GP = glide pole; VM = vegetated median.

Section	Site Name	Transect ID	Approximate chainage at centre of transect		
			Impact	Control	Reference
3	Glenugie South (GP4)	GS-east	35700	34050	-
		GS-west	35700	34750	-
3	Glenugie North (GP5)	GN-east	37050	38000	-
		GN-west	37050	38000	-
3	Glenugie Reference	G-r-north	-	-	35800
		G-r-south	-	-	33950
3	Tucabia South (RB5)	TucS-east	48250	55250	-
		TucS-west	48250	55350	-
3	Tucabia Mid	TucM-east	-	63500	-
		TucM-west	-	61850	-
3	Tucabia North (GP6)	TucN-east	54050	65300	-
		TucN-west	54050	65100	-
3	Tucabia Reference	Tuc-r-north	-	-	57900
		Tuc-r-south	-	-	57200
6	Mororo (GP7)	Mor-east/north	99600	98500	100100
		Mor-west/south	99600	98600	98100
6 & 7	Tabbimoble South (GP8)	TabS-east	111350	101400	-
		TabS-west	111350	104550	-
7	Tabbimoble Mid (RB8)	TabM-east	112350	113550	-
		TabM-west	112350	113550	-
7	Tabbimoble North (RB9)	TabN-east	115950	114550	-
		TabN-west	115950	114550	-
7	Tabbimoble Veg Median	TabVM-east	117400	-	-
		TabVM-west	117400	-	-
7	Tabbimoble Land Bridge (GP9)	TabLB-east	118850	-	-
		TabLB-west	118850	-	-
7	Tabbimoble Nature Reserve Reference	TabNR-r-nth	-	-	118700
		TabNR-r-sth	-	-	117300
7	Tabbimoble Double Duke State Forest Reference	TabDD-r-north	-	-	114750
		TabDD-r-south	-	-	114300
Total Transects			20	18	10

2.2 Glider population monitoring

Glider population surveys were conducted at monitoring sites in S3-11 which were established during baseline surveys (Sandpiper 2015, 2016a; Table 1). Each site featured a 500m-long transect mostly positioned on existing tracks or management trails. Impact and control transects' were parallel to and within 100m of the highway alignment whereas reference transects were >1km from the highway alignment. Transects were located within dry open forest habitat or a combination of dry open forest and moist open forest or swamp forest.

Spotlight and call playback surveys were conducted at each site in each quarter of 2021. Survey periods were: 8/3-12/4/2021 (Q1), 15-22/6/2021 (Q2), 30/8-2/9/2021 (Q3) and 2-22/12/2021 (Q4). As sections 3-11 became

operational in Q4 2020 the first three quarters of 2021 are considered year one operation phase and Q4 of 2021 is the first quarter of year two operation phase.

Each transect was surveyed on two non-consecutive nights during each survey period. Two to four experienced ecologists conducted the surveys concurrently on nearby transects (i.e., one observer/transect). The order and allocation of transects was changed each survey to avoid bias and to ensure each transect was surveyed during the early part of the evening at least once during the survey period. Several transects were at times inaccessible due to flooding, poor road conditions and presence of campers. Transects were typically revisited when conditions had improved, with exception of site G-r-s on one night in Q1.

Spotlight surveys were of 30 minutes' duration and preceded by yellow-bellied glider call playback. Playback included a five-minute listening period, five minutes of playback followed by spotlighting with a hand-held 200+ lumen torch. Surveys began at least 30-45 minutes after sunset and were completed within six hours. Where possible, surveys were conducted between third quarter and first quarter moon phases to avoid the period around the full moon. Weather conditions were generally fine during surveys with occasions of moderate winds (i.e. moves large branches) and/or light showers.

On occasions during surveys when an individual could not be confidently distinguished between a squirrel glider and a sugar glider (*P. breviceps*), it was recorded as squirrel/sugar. To determine the likelihood of each of these records being a squirrel glider, all survey data for all periods (including pre-construction) for each of these transects was reviewed. If squirrel gliders only were detected on that transect on other occasions or on more occasions than sugar gliders, the record was scored as 'probable' squirrel glider and included as a 'presence' record. If squirrel gliders were not detected on that transect on other occasion(s) or if sugar gliders were previously detected on more occasions the record was scored as 'probable' sugar glider.

2.3 Arboreal crossing structures and widened medians monitoring

2.3.1 Rope bridges

In section 1 and 2 rope bridges were located at Corindi (RB1), Dirty Creek (RB2), McPhillips Road (RB3) and Wells Crossing (RB4) (Table 2). In sections 3-11 rope bridges were located at Tucabia (RB5 and RB6), Shark Creek (RB7), Tabbimobile (RB8 and RB9), Nortons Lane, New Italy (RB10) Broadwater (RB11) and Laws Point (RB12) (Table 2). Rope bridges were ladder mesh design and featured 10 mm diameter silver rope woven into a 100 mm wide grid pattern for a total width of 400 mm. The exception was RB12 which consisted of a 550 mm x 200 mm rope cage made from 10 mm diameter silver rope. The mesh design included two 20mm-thick ropes running the entire length (Plate 1).

Rope bridges were slung between 3 mm wire rope and supported by 10 mm wire rope. Bridge ends were at the height of mid-upper canopy of adjoining forest and 2-8m from the closest tree canopy. Lengths of 25mm diameter silver rope extended from the bulkhead to adjacent trees (Plate 1). Rope bridge monitoring entailed camera surveillance of the rope bridge surface at each end to determine use by arboreal fauna. Cameras were strapped to the bulkhead at each end of the 12 rope bridges and were oriented along the bridge (Plate 1). A 1 m sheet of corflute was attached to the bottom of each bridge to reduce the incidence of false triggers (Plate 1).

Table 2: Rope bridge locations, sections 1-11, of the W2B upgrade. *maintenance inspection undertaken on 14 December 2021.

Chainage	Cam no. (east/west)	Location of cam/s	Location Name	Label	Easting	Northing
147350 (10)	W6*/W5*	Roadside	Laws Pt Rope	RB12	542498	6793628
140600 (9)	W3/W4*	Roadside	Edge of Broadwater NP	RB11	540545	6788936

Chainage	Cam no. (east/west)	Location of cam/s	Location Name	Label	Easting	Northing
124610 (7)	W7/W8	Roadside	Near Nortons Lane	RB10	531347	6777559
116000 (7)	W9/W13	Roadside	Tabbimoble north	RB9	526672	6770680
112300 (7)	W10/W12	Roadside	Tabbimoble mid	RB8	524991	6767407
75820 (4)	W17/W18*	Roadside	Shark Ck	RB7	519398	6735146
50430 (3)	W24*/W25*	Roadside	Tucabia Mid	RB6	512165	6713339
48050 (3)	W23/W22*	Roadside	Tucabia South (Mitchells Rd)	RB5	511684	6711127
24800 (2)	NA	Roadside	Wells Crossing	RB4	505723	6694235
13040 (1)	NA	Roadside	McPhillips Rd	RB3	512683	6686021
7100 (1)	NA	Roadside	Dirty Creek	RB2	515610	6681424
1800 (1)	NA	Roadside	Corindi	RB1	518212	6676929



Plate 1: Rope bridges were suspended >10m above the road deck (upper) and supported by poles adjacent to the forest edge. A camera was strapped to the bulkhead at each end of the bridge (lower left). Black core-flute was cable tied to the underside of the rope ladder at each end during year 1 to reduce the incidence of false-triggering caused by traffic (lower right).

Sections 1 and 2

Section 1 and 2 cameras were initially installed by an arborist in June 2018 and operated continuously until retrieval on 11 May 2021. To ensure that three years of operational monitoring occurred in S1-2 monitoring was extended into Q1 and Q2 of 2021. The final monitoring period in S1-2 extended from 21/12/20 to 11/5/21 (Table 3). All cameras were operational for the entire 141 days with exception of RB2 west (87 days). Camera types used on rope bridges in S1-2 included Swift 3C, Swift Enduro and Spromise S108. Cameras in S1-2 were active between 1700 and 0600hrs eastern standard time (EST). Cameras were set at low sensitivity to reduce the incidence of false triggering caused by passing traffic and programmed upon triggering to take 10 seconds of video, with no delay between triggers.

Sections 3 to 11

An arborist installed wireless 4G Swift Enduro cameras on rope bridges in sections 3-11 between 26 May and 7 July 2021 (Plate 2). Wireless cameras were installed to minimise the number of aerial climbs required to download and maintain cameras, thereby improving safety. Wireless cameras were equipped with a 16 or 32GB SD card. A small solar panel with inbuilt battery was attached to each camera, and all cameras were fitted with 12 NiMH rechargeable batteries as a back-up during cloudy conditions. Cameras were active from 1700-0500hrs EST from 26 May to 30 November and from 2000-0500hrs EST from 1 November to 31 December 2021. Cameras were set at low sensitivity to reduce the incidence of false triggering caused by passing traffic and upon activation each camera sent a series of three photographs to a central email address, with no delay between triggers. Video was not used on wireless cameras due to concern about signal strength and battery capacity. Images from the previous night were reviewed daily, false triggers discarded immediately and active images saved for further review. Consequently, the number of images taken was not recorded for cameras in S3-11.

As monitoring in S3-11 did not formally commence until the end of Q2 (i.e. 30 June) the period of activity is based on the number of days active from 1 July to 31 December 2021 (Table 5). Cameras at RB5 and RB6 were active for 96% of the sample period (i.e. 1 July to 31 December) and all other cameras, with exception of one at RB11, were active for the entire sample period. The west camera at RB 11 (cam no W4) was missing during the maintenance inspection on 14/12/21 and had presumably fallen from the rope bridge.

Table 3: Rope bridge camera activity periods during the 2021 monitoring year in sections 1-11.

Rope bridge no.	No. of videos	No. of days each camera active (east/west)	% of period either camera active
RB1	144	141/141	100
RB2	1434	141/87	100
RB3	504	141/141	100
RB4	248	141/141	100
RB5	NA	177/177	96
RB6	NA	177	96
RB7	NA	217	100
RB8	NA	218	100
RB9	NA	218	100
RB10	NA	218	100
RB11	NA	219/0	100
RB12	NA	218	100



Plate 2: Location of camera attachment on rope bridges (left) and glide poles (right) in S3-11. Each structure contained a wireless 4G Enduro camera with a small solar panel.

2.3.2 Glide poles

In S1 and 2, glide poles were positioned within the median at Halfway Creek (GP2 & GP3) and along the southbound road shoulder of the Solitary Islands Way/old Pacific Hwy (GP1) (Table 4). In S3-11 glide poles were positioned roadside near Eight Mile Lane, Glenugie (GP4 e&w), at Mororo (GP7 e&w) and at Laws Point (GP10 e&w). Median poles were installed near Old Six Mile Lane, Glenugie (GP5), Bostock Road, Tucabia (GP6), at Tabbimoble (GP8), and near Minyamai Road (GP9) (Table 4). Poles were CCA-treated hardwood timber, approximately 450mm diameter at breast height and tapered to approximately 330mm near the pole top. A 500mm diameter metal predator shield was attached to the top of all glide poles except GP2 (Plate 2).

Each pole in S1 and 2 featured two cross arms for gliders to launch from whilst poles in S3-11 had a single arm only. Each arm was approximately 2400 mm long and 90 x 100 mm thick hardwood and brace-mounted to the pole at its centre (Plate 2). In S1 and 2, arms were oriented perpendicular and parallel to the highway and the upper arm was attached approximately 300 mm below the top of the pole. The upper arm was parallel to the highway and fixed approximately 70 mm above the lower/perpendicular arm for GP2 and GP3. The arm positions were the opposite for GP1. In S3-11, the single arm was perpendicular to the highway at all sites.

Table 4: Glide pole locations.

Chainage (Section)	Cam no.(e/w)	Crossing type	Location of cam/s	Location Name	Site	Easting	Northing
146480 (10)	W02/W01	Poles	Roadside	Laws Pt Poles (roadside poles)	GP10e&w	542607	6792765
118620 (7)	W14	Poles	Median	Tabbimoble Land Br (Minyamai Rd)	GP9	527449	6773170
111300 (7)	W11	Poles	Median	Tabbimoble south	GP8	524605	6766463
99320 (6)	W15/W16	Poles	Roadside	Mororo	GP7e&w	522443	6756232
53920 (3)	W26	Poles	Median	Tucabia North (Bostock Rd)	GP6	512478	6716758
37200 (3)	W21	Poles	Median	Glenugie North (Old 6mile Lane)	GP5	503569	6706040
35420 (3)	W19/W20	Poles	Roadside	Glenugie South (8mile Lane)	GP4e&w	502590	6704406
16430 (1)	NA	Poles	Median	Halfway Creek	GP3	509821	6687763
16060 (1)	NA	Poles	Median	Halfway Creek	GP2	510110	6687539
1800 (1)	NA	Poles	Roadside	Corindi	GP1	518282	6676892

Glide pole monitoring entailed camera surveillance of the pole arm to determine use by gliding mammals. Installation involved attaching a Swift Enduro camera (S1 and 2) and 4G wireless Swift Enduro camera (S3-11) to a flat 600-900 mm long metal bar which was then mounted on the northern end of parallel arms, the west end of perpendicular arms on median poles and the end closest to the forest of perpendicular arms on roadside poles. The camera was positioned 100-200 mm beyond the end of, and offset to, the glide pole arm (Plate 2). Activation periods and camera configuration were the same as for rope bridges, with exception of sensitivity, which was set on high for glide poles. Installation dates and monitoring periods for glide poles were the same as described for rope bridges in Section 2.3.1.

Glide pole cameras were active for the entire installation period, with the exception of GP2 at Halfway Creek which was operational for 69% of the 141 day installation period (i.e. 21/12/20 – 11/5/21). Due to delayed installation, cameras at GP4 east, GP5 and GP6 were active for 96% of the sample period. To compensate for late commencement, monitoring in S3-11 will continue until at least 30 June 2024 thereby ensuring three consecutive years of monitoring. Monitoring of glide poles in S1-2 ceased on 11 May 2021.

Table 5: Glide pole camera activity periods during the 2021 monitoring year in sections 1-11.

Glide pole no.	No. of videos	No. of days camera active (east/west)	% of period camera active
GP1	187	141	100
GP2	62	97	69
GP3	175	141	100
GP4e&w	NA	178/217	96/100
GP5	NA	177	96
GP6	NA	177	96
GP7e&w	NA	217/217	100/100
GP8	NA	218	100
GP9	NA	217	100
GP10e&w	NA	202/219	100/100

Camera maintenance

Maintenance was conducted on nine rope bridge cameras on 14 December 2021 (Table 2). Sites were selected on the basis of: high incidence of false triggers, lack of recent activation, or poor camera orientation. The inspection found that one camera was missing, presumably it had fallen and been taken from the site, and seven of the remaining eight cameras remained active. The orientation of six cameras was adjusted to better capture the structure and reduce the incidence of false triggers, one camera was replaced due to a faulty SD card port. The missing camera will be replaced in the next scheduled maintenance inspection in June 2022.

2.3.3 Vegetated medians

Vegetated medians extend for 1150 m (VM1: chainage 5350-6500), 550m (VM2: chainage 22900-23450) and 1350 m (VM3: 116200-117600) and pass through dry sclerophyll open forest. Carriageway corridor widths range between 30-60m and roadside tree heights are approximately 20-30 m. VM1 and 2 featured a parallel-running service road 15-70 m west of the northbound carriageway (i.e., McLaughlin's Road at VM1 & old Pacific Highway at VM2).

Two camera traps were installed in each vegetated median and each positioned at the most viable glide crossing locations (Figure 7). The location of camera traps in VM2 were changed on 14/5/2021 due to accessibility issues. Camera traps featured a Swift Enduro camera, mounted to a 150 mm x 500 mm x 10 mm timber board, oriented towards a capped 250 mm x 100 mm diameter PVC pipe (Plate 3). The PVC pipe was perforated by numerous holes and filled with creamed honey and a sponge. The camera array was attached to

a metal bracket and mounted to subject trees at approximately 6m above ground level (Plate 3). A dilute mixture of honey and water was sprayed up the trunk of the tree above the camera trap to act as extra attractant.

Cameras were checked on 20/01/2021 (VM1 and VM2), 7/5/21 (VM1) and 14/5/2021 (VM2) and 10/9/2021 (VM1 and VM2) to refresh batteries and change SD cards. At least one camera in VM1 and 2 remained active from 24/9/2020 to 10/9/2021 (351 days). Cameras were removed from VM1 and 2 on 10/9/2021. Two cameras were installed in the Tabbimoble median (VM3) on 21/1/2021, with images downloaded and bait replaced on 14/5, 10/9 and 20/12/2021. At least one camera remained active in VM3 between 21/1 and 20/12/2021 a period of 333 days.



Plate 3: Vegetated median camera trap set up.

2.4 Road mortality monitoring

Car-based road mortality surveys were conducted during each of the four quarters of year 5 monitoring. Car-based surveys entailed a driver and passenger (observer) travelling both the northbound and southbound length of sections 1-11 (Q1 & Q2) or sections 3-11 (Q3 & Q4). The survey vehicle featured a 'Vehicle Frequently Stopping' sign on the tailgate, a flashing light and travelled at 80-90 km/h in the left-hand lane. Surveys involved the passenger scanning the road surface and road shoulder for animal carcasses. When a carcass was observed, the location was recorded using Motion X-GPS application and the species recorded into a handheld voice recorder. If a potential threatened glider was identified, the vehicle would pull over at the nearest safe location and the passenger would walk back to inspect the carcass behind the guard rail/wire rope. The location of each carcass was later recorded into an excel spreadsheet and referred to in subsequent surveys to avoid double-counting. Car-based surveys were substituted for walking-based surveys during year three due to safety concerns with walking along the edge of the highway (refer Sandpiper 2020a). Surveys were completed on 23/02/2021 (Q1), 07/05/2021 (Q2), 26/8/2021 (Q3) and 10/11/2021 (Q4).

2.5 Parker Road glide assessment

The year four monitoring report recommended that a glide feasibility assessment be undertaken at the Parker Road vegetated median (Sandpiper Ecological 2021). This was in response to mortality of a yellow-bellied glider near the median, and the general observation that glide lengths over both carriageways were not viable.

Glide viability was assessed by undertaking a foot-based traverse of the east and west highway edges, and the east and west median edges searching for potential launch points. Information on launch and landing position was obtained from Goldingay (2014), and Goldingay and Taylor (2009). Launch height and horizontal distance from launch point to a suitable landing point (i.e. a 200mm wide bare trunk) were measured using a Nikon ForestryPro range finder.

Glide distance was calculated by multiplying launch height by 1.94, and landing height was calculated by subtracting horizontal distance from glide distance and dividing by 1.94. A glide angle of 1.94 was used to replicate the approximate glide performance of the yellow-bellied glider, which is superior to the smaller Petaurid gliders. This means that the results represent the best case scenario for the target threatened glider species.

2.6 Data analysis

2.6.1 Population survey data

For each survey quarter, data for the two samples were pooled to determine presence/absence of yellow-bellied glider and squirrel glider for each transect. The number of present or 'occupied' transects for each species for each survey period/quarter were then summed and expressed as a proportion of total sites (i.e. occupancy rate) for that treatment (i.e., impact, control, reference).

The occupancy rate of yellow-bellied glider and squirrel glider for each treatment for each survey quarter was then tabulated according to phase of construction. A mean (\pm SD) of all samples (i.e., survey quarters) was calculated for each treatment type for the three construction phases: pre-construction, construction and operation.

In order to determine the association between pre-construction and operation phase occupation rate of yellow-bellied glider and squirrel glider at impact sites, a Fisher's Exact Test was performed. The test examines the relationship between proportions (i.e., presence/absence) of categorical variables (i.e., pre-construction and operation) and is appropriate for small sample sizes (McDonald 2014). Presence/absence data (i.e., 0 or 1) were organised in columns according to phase of construction. The null hypothesis was that the proportion of present/absent records do not differ between treatments. Data analyses were performed on SYSTAT 13.1 (Systat Software Inc.).

2.6.2 Rope bridge and glide pole camera data

Rope bridge and glide pole camera images were uploaded to a desktop computer and viewed using Windows Photo Viewer. Data recorded included: site, sample period, species and the number of complete or incomplete crossings including glide direction for glide poles. An ecologist reviewed all images, with reference to standard field guides (e.g., Menkhorst & Knight 2003; Pizzey & Knight 2007). A hierarchical approach was adopted for species identification, which included: species, genus or group.

For rope bridge pictures/footage, the road crossing likelihood was also scored according to the following criteria:

- *Complete crossing* - animal moves past camera in either direction and does not return within 10 minutes.
- *Incomplete crossing* - animal either moves away from camera but returns within 10 minutes, or exhibits no directional movement along the bridge, or shows only exploratory movement, or glides from end of bridge after moving past camera.

According to these definitions, a ‘complete crossing’ does not require complementary evidence of the same crossing event from both cameras. Instead, it is inferred from display of strong directional movement and no evidence of return movement albeit this can be difficult to interpret for the feathertail glider (*Acrobates spp.*) due to their erratic and rapid movements. The absence of images/footage at the other end of the bridge is presumed to be an instance of detection evasion and is consistent with other investigations of arboreal crossing structure use (see Goldingay *et al.* 2013; Soanes *et al.* 2015).

For glide pole footage, any animal detection on median-positioned glide poles was scored as a highway crossing. On occasions when the glide launch was captured, the direction of highway crossing was also recorded. Determining glides from still images is more difficult than video and glides were inferred based on movement direction and the lack of subsequent images. When detections did not include images/footage of glide launch, a crossing was inferred based on the reasoning that while an individual may glide to the central pole and return to the same side, it likely represents a very small proportion of detections. There is no habitat in the centre of the carriageway where GP2, GP3, GP5, GP6, GP8 and GP9 are located and, therefore, no apparent reason for gliders to repeatedly access the glide pole without completing a crossing. This is consistent with analyses of glide pole monitoring records from the Hume Highway which were supported by radio-tracking data (see Soanes *et al.* 2015) and previous glide pole monitoring for the Sapphire to Woolgoolga Pacific Highway upgrade (Sandpiper Ecological 2018b).

For GP1, GP4, GP7 and GP10, which are positioned on the forest edge, some glider detections likely represent movements along the forest edge and not road crossings (see Goldingay *et al.* 2019). As such, we acknowledge that the sum of glider detections at those sites is likely an overestimate of road crossings. Other information recorded from glide pole detections included (where discernible): species, sex, tail tip tone (for sugar gliders) and movement type (i.e., explore arm, climb pole, launch east, launch west).

Each rope bridge and pole site was treated as a replicate of that structure type. Further, data from both cameras at rope bridge sites were pooled for analysis.

2.7 Survey limitations and constraints

The population monitoring program has been influenced by variable environmental conditions, including a severe drought in 2019 and an extended La-Nina event throughout most of 2020 and 2021. Severe bushfires, occurred during late 2019, impacting much of the section 6 (Mororo) and section 7 (Tabbimobile) study area. Local flooding occurred on several occasions in 2020 and 2021. General observations indicate a high abundance of arthropods in summer and autumn 2020 and 2021.

3. Results

3.1 Population monitoring sections 3-11

With the inclusion of 2021 data, the mean yellow-bellied glider occupation rate in sections 3-11 continued to show a decline from pre-construction levels at impact and reference sites (Figure 8). Occupation rate at control sites has remained stable. The scale of the decline between construction phase and year one operation was substantially greater than recorded between pre-construction and construction phases. The change in occupation rate from pre-construction to construction ranged from 25% at control sites to 36.4% at impact sites, whilst the change from construction to year one operation was 85.7% at impact sites and nil at control sites. A similar downward trend was evident at reference sites where occupancy has declined from 10% in pre-construction to nil in year one operation (Figure 8). No yellow-bellied gliders were recorded in the first quarter of year two (i.e. Q4 2021) operational phase monitoring.

Results of the Fisher’s Exact Test suggest that impact site occupation levels differed significantly for yellow-bellied glider between pre-construction and operation year 1 ($P = 0.018$). The cumulative tally of sites with yellow-bellied gliders in pre-construction was nine compared to one in year one of operation.

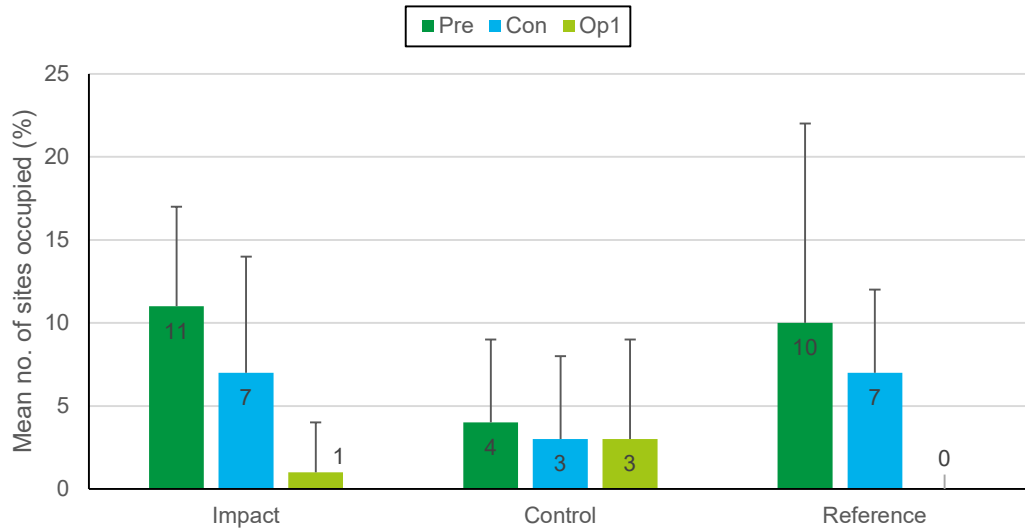


Figure 7: Mean ± SD occupation rates for yellow-bellied glider at impact, control and reference sites in sections 3-11 during pre-construction, construction and year one operation phase. Pre = pre-construction; Con = construction; Op1 = operation year 1.

The trend in occupation rate across treatments was mixed for squirrel glider (Figure 9). With the inclusion of year one operational phase data (i.e. Q4 2020 & Q1-3 2021), mean squirrel glider occupation rates were between 68.7 and 95.7% lower than construction levels across all treatments. Inclusion of data from one sample in year two operational phase (i.e. Q4 2021) shows some evidence of increasing occupancy at impact and control sites, with occupancy remaining stable at reference sites (Figure 9). Results of the Fisher’s Exact Test suggest that impact site occupation rates differed significantly for squirrel glider between pre-construction and operation year 1 ($P = 0.000$). The cumulative tally of sites with squirrel gliders during the baseline was 15 compared to one in year one of operation.

Full details of population survey effort and fauna detections for all surveys are presented in Appendix A.

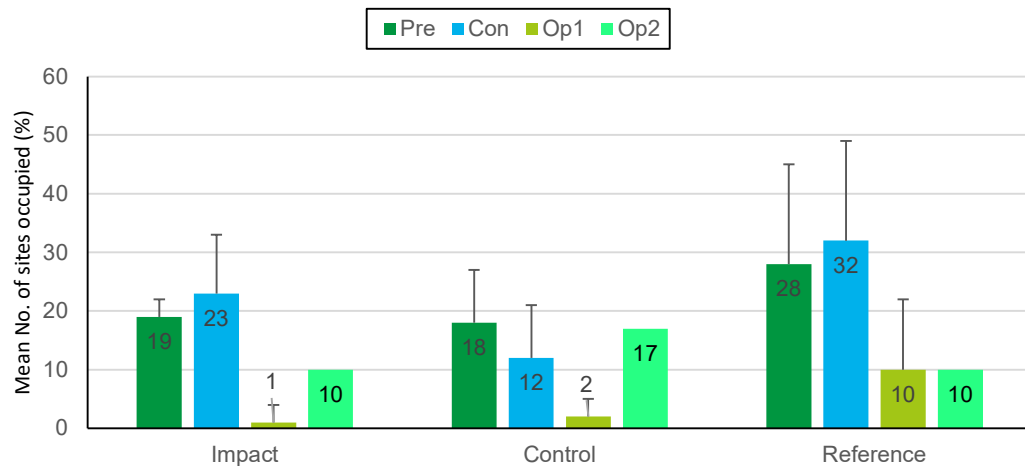


Figure 8: Mean ± SD occupation rates for squirrel glider at impact, control and reference sites in sections 3-11 during pre-construction, construction, year one operation phase and one quarter of year two operation phase (i.e., Q4 of 2021). Pre = pre-construction; Con = construction; Op1 = operation year 1.

3.2 Arboreal crossing structures and widened medians monitoring

3.2.1 Rope bridges

In 2021, arboreal mammals were detected on 60 occasions across the 12 rope bridge sites during 4,180 nights of camera monitoring (Table 7). The most detections were recorded at RB2 (n=23) followed by RB1 (n=14). RB4, RB8, RB10 and RB12 had no detections. The overall mean weekly detection rate was 0.13 ± 0.21 SD.

Squirrel gliders were confirmed making complete crossings at RB1, 2 and 3 and *Petaurus* spp. were recorded at RB5, 7 and 9. The highest number of complete crossings by squirrel glider (12) was recorded at RB2 (Table 7). The mean number of weekly complete crossings was 0.05 ± 0.11 SD and ranged from zero to 0.37 crossings/week.

Other species recorded on rope bridges were feathertail glider (RB2), common brushtail possum (RB1), sugar glider (RB1) and *Antechinus* spp (RB1; either *A. flavipes* or *A. stuartii*). Unidentified mammal was recorded at RB5, RB6, RB7, RB9 and RB11. Records of 'unidentified mammal' typically consisted of individuals that were either on or immediately in front of the camera and the only visible distinguishing feature was fur. Yellow-bellied gliders were not detected by rope bridge cameras. Full details of rope bridge detections are presented in Appendix B.

The overall mean number of complete crossings/week in 2021 (0.13 ± 0.21 SD) was substantially lower than that recorded in 2020 (0.72 ± 1.01 SD), 2019 (0.96 ± 1.01 SD) and 2018 (0.36 ± 0.42 SD) (Figure 10). Complete crossings by squirrel glider decreased substantially in 2021 from a high of 0.22 ± 0.41 SD crossings/week in 2020 to 0.05 ± 0.11 in 2021. Despite this decline squirrel glider was the most frequently detected species. Sugar glider and *Antechinus* spp., which were not detected in 2018, have recorded similar small numbers of complete crossings in 2021, 2020 and 2019. Feathertail glider detections declined substantially in 2021, with a mean of $0.01 (\pm 0.02$ SD) individuals/week compared to 0.47/week (± 0.57 SD) in 2020 (Figure 12). The 2021 result continues the declining trend in feathertail detections since a peak in 2019.

Table 6: Rope bridge detections and number of complete crossings per week. cc = complete crossing; ic = incomplete crossing. Weekly crossing rate is shown in parenthesis.

Rope bridge no. (sum of weeks cams active)	Camera detections*	Common brushtail possum		Feathertail glider		Squirrel glider		Sugar glider		<i>Petaurus</i> spp.		<i>Unid mammal</i>		<i>Antechinus</i> spp.	
		cc	ic	cc	ic	cc	ic	cc	ic	cc	ic	cc	ic	cc	ic
RB1 (40.3)	14 (0.35)	0	1 (0.02)	0	0	4 (0.1)	6 (0.15)	1 (0.02)	0	0	0	0	0	1 (0.02)	0
RB2 (32.6)	23 (0.71)	0	0	2 (0.06)	2 (0.06)	12 (0.37)	7 (0.17)	0	0	0	0	0	0	0	0
RB3 (40.3)	3 (0.07)	0	0	0	0	3 (0.07)	0	0	0	0	0	0	0	0	0
RB4 (40.3)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RB5 (50.6)	3 (0.06)	0	0	0	0	0	0	0	0	2 (0.04)	0	0	1 (0.02)	0	0
RB6 (50.6)	4 (0.08)	0	0	0	0	0	0	0	0	0	0	0	4 (0.08)	0	0
RB7 (62)	8 (0.13)	0	0	0	0	0	0	0	0	1 (0.02)	3 (0.05)	0	4 (0.06)	0	0
RB8 (62.3)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RB9 (62.3)	4 (0.07)	0	0	0	0	0	0	0	0	1 (0.02)	0	0	3 (0.05)	0	0
RB10 (62.3)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RB11 (31.3)	1 (0.03)	0	0	0	0	0	0	0	0	0	0	0	1 (0.03)	0	0
RB12 (62.3)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total (597.2)	60 (0.1)	0	1 (0.002)	2 (0.003)	2 (0.003)	19 (0.03)	13 (0.02)	1 (0.002)	0	4 (0.007)	3 (0.005)	6 (0.01)	7 (0.01)	1 (0.002)	0
Mean weekly rate ± SD	0.13 ± 0.21	0.00 ± 0.00	0.002 ± 0.00	0.005 ± 0.02	0.005 ± 0.02	0.05 ± 0.11	0.03 ± 0.06	0.002 ± 0.01	0.00 ± 0.00	0.007 ± 0.01	0.004 ± 0.01	0.00 ± 0.00	0.02 ± 0.03	0.002 ± 0.00	0.00 ± 0.00

* Sum of cc & ic is not equal to sum of Camera detections because a crossing detected by both cameras is scored as a single complete crossing.

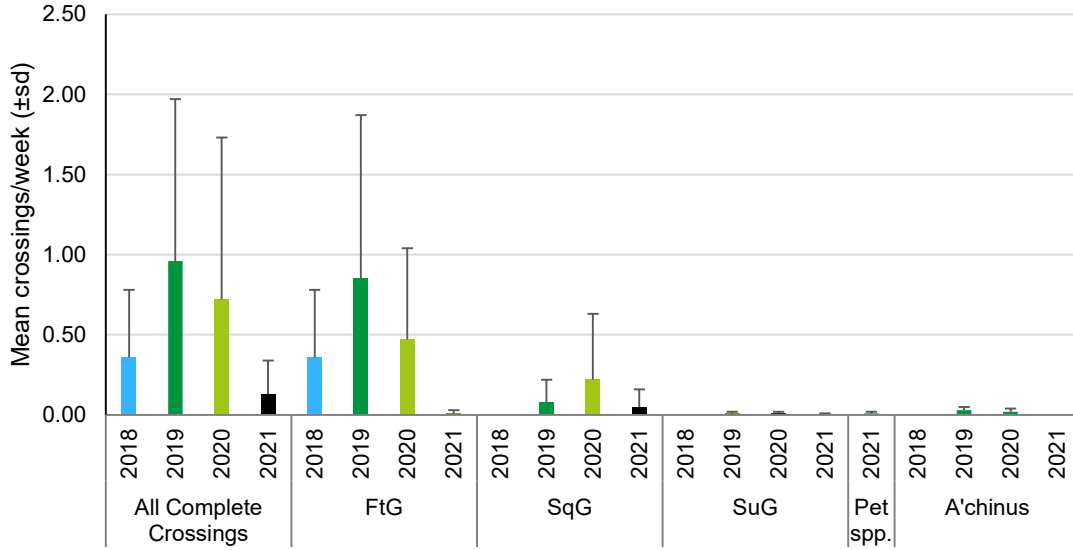


Figure 9: Comparison of mean \pm SD weekly rope bridge complete crossings for 2018, 2019, 2020 and 2021. FtG = feathertail glider; SqG = squirrel glider; SuG = sugar glider; Pet spp. = Petaurus species; A'chinus = *Antechinus* spp.

Comparison of mean weekly rope bridge complete crossings in sections 1 and 2 from 2018 to 2021 highlights the substantial decline in 2021 for complete crossings by feathertail glider and squirrel glider (Figure 11). This suggests that the low numbers recorded in sections 3-11 in 2021 may not be solely due to camera issues.

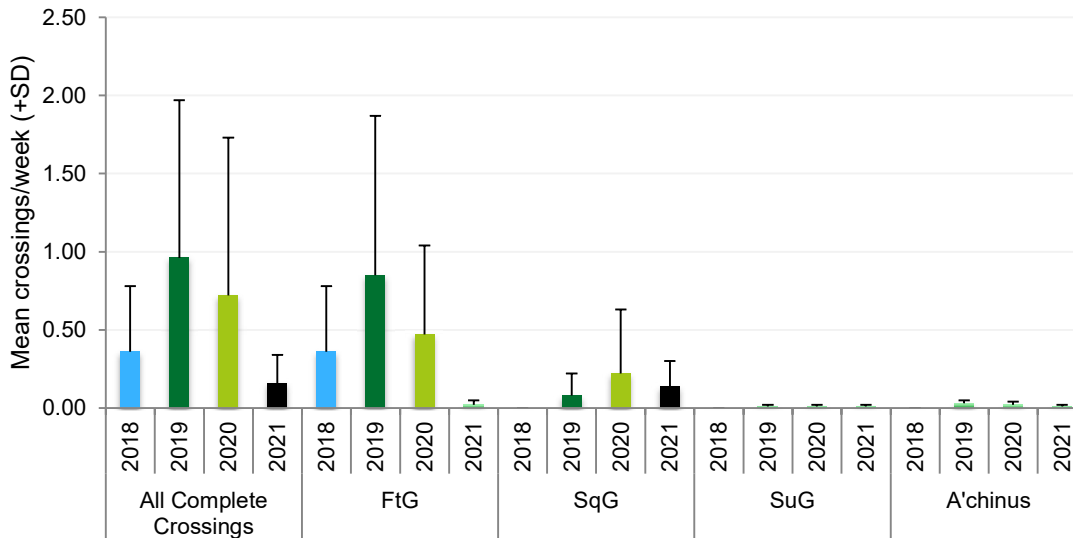


Figure 10: Comparison of mean \pm SD weekly rope bridge complete crossings for 2018, 2019, 2020 and 2021 in sections 1 and 2. FtG = feathertail glider; SqG = squirrel glider; SuG = sugar glider; Pet spp. = Petaurus species; A'chinus = *Antechinus* spp.

3.2.2 Glide poles

Arboreal mammals were detected on 63 occasions across the 13 glide poles during a combined total of 2416 nights of camera monitoring (Table 8). Most detections were recorded at GP4west (n = 22) followed by GP7east (n = 10) and GP7 west (n = 8). The overall mean weekly detection rate was 0.17 ± 0.19 SD.

Squirrel gliders were recorded on nine glide poles, with the highest number of detections at GP8 (5 detections), followed by GP7 east and west (3 detections each; table 8). One confirmed glide in an easterly direction was obtained from GP4 west. The use of still images on wireless cameras makes identification of glides more difficult than when using video footage. Weekly crossing rate ranged between 0.03 and 0.16 crossings/week and averaged 0.06 ± 0.05 SD for the period.

Feathertail gliders were the most frequently detected species and were recorded on 38 occasions across six glide poles (Table 8). All detections were on glide poles situated on the forest edge as opposed to the median. No feathertail gliders were recorded at GP1, 2 and 3 in sections 1 and 2 during the 20 week sample period, or at GP5, 6, 8 and 9. The most detections occurred at GP4 west (n = 18), followed by GP10east (n = 10). Accurate identification of glides was difficult with still images. Suspected glides were recorded at four sites, GP4west, GP7east, GP10east and GP10west (Table 8). All but one of the suspected glides was towards the nearest forest edge. Weekly crossing rate ranged between 0.04 and 0.58 crossings/week and averaged 0.10 ± 0.17 SD for the period.

Sugar glider was recorded on one occasion at GP4west and GP7east (Table 8). Both individuals were observed making slow exploratory movements along the pole arms. *Antechinus* spp. (either *A. flavipes* or *A. stuartii*) was recorded on single occasions at GP4east, GP4west and GP7west (Table 8). On each occasion individuals were observed making rapid exploratory movements across the surface of the pole and pole arm.

Full details of glide pole detections are presented in Appendix C.

Table 7: Glide pole detections and rate of weekly crossings. Weekly crossing rate is shown in parenthesis. Glide direction = number and direction of observed glide launches; e = east; w = west.

Glide pole no. (weeks cam active)	Camera detections*	Feathertail glider		Squirrel glider		Sugar glider		<i>A'chinus</i> spp. Detections
		Crossings	Glide direction	Crossings	Glide direction	Crossings	Glide direction	
GP1 (20.1)	0	0	-	0	-	0	-	0
GP2 (13.9)	1 (0.07)	0	-	1 (0.07)	-	0	-	0
GP3 (20.1)	2 (0.1)	0	-	2 (0.1)	-	0	-	0
GP4e (25.4)	2 (0.08)	1 (0.04)	-	0	-	0	-	1 (0.04)
GP4w (31)	22 (0.71)	18 (0.58)	3e	2 (0.06)	1e	1 (0.03)	-	1 (0.03)
GP5 (25.3)	0	0	-	0	-	0	-	0
GP6 (25.3)	2 (0.08)	0	-	2 (0.08)	-	0	-	0
GP7e (31)	10 (0.32)	6 (0.19)	1e	3 (0.1)	-	1 (0.03)	-	0
GP7w (31)	8 (0.26)	4 (0.13)	-	3 (0.1)	-	0	-	1 (0.03)
GP8 (31)	5 (0.16)	0	-	5 (0.16)	-	0	-	0

Glide pole no. (weeks cam active)	Camera detections*	Feathertail glider		Squirrel glider		Sugar glider		<i>A'chinus</i> spp. Detections
		Crossings	Glide direction	Crossings	Glide direction	Crossings	Glide direction	
GP9 (31)	1 (0.03)	0	-	1 (0.03)	-	0	-	0
GP10e (28.8)	7 (0.24)	7 (0.24)	4e	0	-	0	-	0
GP10w (31.3)	3 (0.1)	2 (0.06)	1e 1w	1 (0.03)	-	0	-	0
Total (345.2)	63 (0.18)	38 (0.11)	9e 1w	20 (0.06)	1e	2 (0.006)	-	3 (0.009)
Mean weekly rate (± sd)	0.17 ± 0.19	0.10 ± 0.17	-	0.06 ± 0.05	-	0.00 ± 0.01	-	0.01 ± 0.01

The overall mean detection rate for 2021 was 89.4% below the 2020 level, and 91.1% below the 2019 level (Figure 12). The relative decline in detections was broadly similar across all taxa, except squirrel glider, which had a smaller proportional decrease. Feathertail glider detections declined by 93.4% and squirrel glider by 25%. Yellow-bellied gliders, which were detected on nine occasions at GP2 and GP3 during 2019, were not detected at glide poles during the 2021 monitoring period.

Comparison of glide pole data for sections 1 and 2 further emphasises the substantial decline in 2021 (Figure 13). Squirrel glider was the only species that maintained a reasonable detection rate, although there is evidence of a declining trend in squirrel glider detections since 2019.

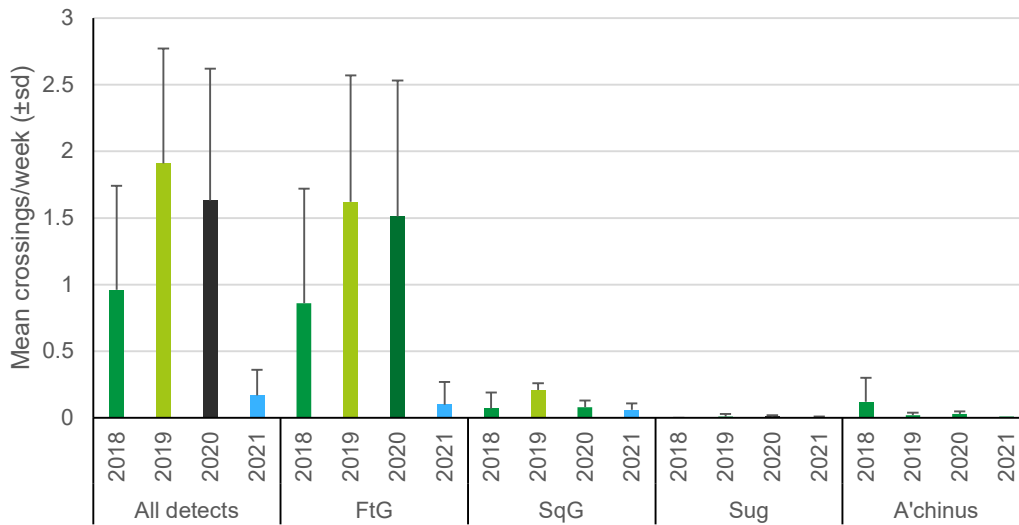


Figure 11: Comparison of mean ± SD weekly glide pole detections for 2018, 2019, 2020 and 2021. FtG = feathertail glider; SqG = squirrel glider; SuG = sugar glider; A'chinus = *Antechinus* spp.

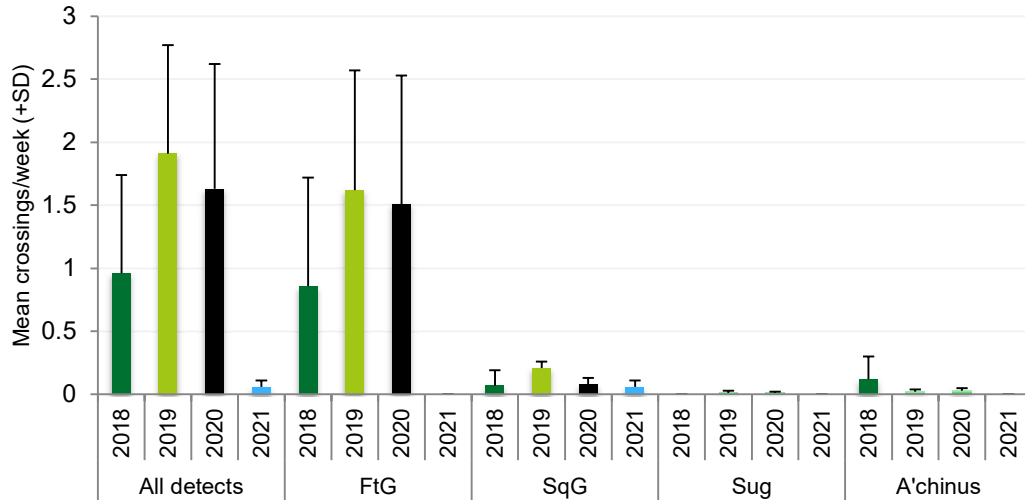


Figure 12: Comparison of mean \pm SD weekly glide pole detections for 2018, 2019, 2020 and 2021 in sections 1 and 2. FtG = feathertail glider; SqG = squirrel glider; SuG = sugar glider; A'chinus = *Antechinus* spp.

3.2.2 Vegetated medians

Camera traps in the vegetated medians detected four species of glider plus *Antechinus* spp. and black rat (Table 9). Yellow-bellied glider was detected in the northern vegetated median by the southern camera on two occasions (Plate 9). Squirrel glider was detected in each vegetated medians with detections ranging from 7 in TABs to 28 at VM1s. Sugar glider and feathertail glider were detected in all vegetated medians by all cameras on numerous occasions (Table 9).

Table 8: Vegetated median camera detections. VM1 = southern median (S1); VM2 = northern median (S2); Tab = Tabbimoble median; n = camera positioned in northern section of median; s = camera positioned in southern section of the median.

Camera location	Yellow-bellied glider	Squirrel glider	Sugar glider	Feathertail glider	Antechinus spp.	Black rat
VM1s	-	28	3	12	6	3
VM1n	-	-	3	6	17	-
VM2s	2	5	17	7	5	-
VM2n	-	8	5	3	11	-
VM3n	-	12	32	20	11	-
VM3s	-	16	2	6	1	-

Parker Road – glide feasibility

Potential launch height and glide distance was measured for 24 trees, six to the west of the northbound lanes, four on the west side of the median, eight on the east side of the median, and six on the east side of the southbound lanes (Table C1, Appendix C). Launch heights ranged from 15 to 27.4m with a mean height of 20.56m (\pm 2.98m). Horizontal glide distance (i.e., launch point to trunk) ranged from 34.5 to 56.4m with a mean horizontal distance of 44.87m (\pm 6.43m).

Multiplying approximate launch height by 1.94 identified five instances where a yellow-bellied glider would land above the base of the closest suitable tree. A suitable landing tree had a bare trunk with a DBH >200mm. This included two west-median glides, two median to east glides, and one east to median glide. No median to west glides had an individual landing above ground height. Landing height ranged from 0.99 to 1.93m. Two of

the five potential glide paths were obstructed by 3-4m shrubs near the landing tree. The remaining three glides consisted of one west-median, one median to east, and east to median. Irrespective of landing height limitations no viable median to west glides were recorded.

3.3 Road mortality

A possible road-killed greater glider (*Petauroides volans*) was recorded during the August (Q3) 2021 road mortality survey. Whilst not a target species for this project greater glider is listed as Vulnerable under the Commonwealth *Environment Protection and Conservation Act 1999*. The subject individual was observed between the carriageways approximately 460m north of GP4. Observers were unable to obtain a positive identification due to the carcass location, between the carriageways. No other arboreal mammals were recorded during road-kill surveys.

4. Discussion

Results of the 2021 monitoring year are discussed with reference to the performance indicators described in the TGMP.

4.1 Population monitoring

4.1.1 Decline in the after-construction occupancy rates of squirrel glider or yellow-bellied glider at impact sites over three consecutive monitoring sessions.

Yellow-bellied glider occupation rate at impact and reference sites within sections 3-11 decreased substantially compared to pre-construction levels in year one of the operation phase. A similar, albeit smaller, decline occurred in sections 1 and 2 in years one and two of operation (Sandpiper Ecological 2021). The results of the Fisher's Exact Test suggest that the difference between pre-construction and operation year one in sections 3-11 was statistically significant, however, the high variance and low number of yellow-bellied gliders somewhat constrain the power of the test.

The lower yellow-bellied glider occupation rate in year one of operation compared to pre-construction was consistent at impact and reference sites, with occupancy at control sites remaining constant, albeit low (Figure 8). This result is similar to that recorded in sections 1 and 2 where occupation rate declined from pre-construction to year one operational at impact and control sites. And occupancy declined at reference sites in year two of the operational phase.

A similar pattern of decline in yellow-bellied glider detections between 2014 and 2020 was reported at reference and impact sites associated with the Warrell Creek to Nambucca Heads (WC2NH) Pacific Highway upgrade (Sandpiper Ecological 2020a). That decline appears to have halted in spring 2021 when yellow-bellied glider detections increased at reference sites yet remained low at impact sites (Sandpiper Ecological 2022). Whilst it is too early to confirm causative factors, data from the WC2NH project indicates that the yellow-bellied glider population around the upgrade declined following construction and has remained at a low level.

Yellow-bellied glider abundance is sensitive to changes in climatic conditions driven by rainfall, which trigger variations in food availability (Goldingay 1992). At W2B above average rainfall was recorded in the years preceding baseline surveys and was generally below average during the construction phase, culminating in a severe drought in 2019. Since 2019, rainfall has returned to average or above average levels with a La Nina weather pattern evident from early 2020 to mid-2022. The result for yellow-bellied gliders could reflect the small numbers and high between sample variability in detection. Given the low sample numbers ongoing

monitoring is essential to determine if there is a declining trend. More robust analysis of survey data may also assist with interpretation of trends.

Squirrel glider occupation rate in year one operation in sections 3-11 was significantly lower at all treatments (Figure 9). This is consistent with the trend recorded in sections 1 and 2 where occupancy trended downwards after peaking well above pre-construction levels at all treatments in year one operation. The year one result in sections 3-11 may reflect a broader spatial decline in squirrel glider abundance. The higher occupancy rate recorded in the first quarter of year two operation phase (i.e., Q4 2021) is encouraging, although no conclusions can be drawn from a single sample.

As for the yellow-bellied glider, it is likely that the low and variable rainfall conditions since 2014 and the severe drought, high temperatures and wildfires of 2019 adversely affected population numbers of squirrel glider. Results may reflect a post fire decline in occupancy, particularly in the Tabbimoble area (section 7) where 20 of the 48 transects are situated. Low rainfall, in particular, can adversely affect flowering events, which are known to impact squirrel glider populations (Sharpe & Goldingay 1998). This further suggests that the primary causative factor of population declines is not the highway upgrade, although the upgrade has likely contributed to cumulative impacts.

4.2 Use of rope bridges, glide poles and vegetated median

4.2.1 No evidence of use of arboreal crossing structures and widened medians by threatened gliders post-construction

Rope bridges

Feathertail glider, squirrel glider, sugar glider and *Antechinus* spp. were recorded using rope bridges in 2021. However, mean crossings per week declined for all species, particularly feathertail glider. The result occurred across the entire upgrade, including sections 1 and 2 where complete crossings/week by squirrel gliders peaked at 0.22 in 2020 and declined to 0.15 in 2021. The 2021 mean weekly rate across all sections (0.05/week) is substantially lower than that reported for squirrel gliders on the Hume Highway (i.e., 5.9 crossings/week, Soanes *et al.* 2015) but comparable to that reported at Glenugie Pacific Highway upgrade (i.e., 0.01 – 0.14 visits/week, Sandpiper Ecological 2017).

Rope bridges #2 and #3 recorded considerably more activity than other sites, which may be indicative of habitat quality, although camera installation in sections 3-11 is a contributing factor. No squirrel gliders were confirmed using rope bridges in sections 3-11, however, *Petaurus* spp. was recorded at RB5, RB7 and RB9, and unidentified mammal was recorded at those sites plus RB6 and RB11. At least some of these records would likely be squirrel glider. Changes in camera placement is required to improve image detection in sections 3-11. While yellow-bellied gliders have not been recorded using the section 1-11 rope bridges, there is only one reported record of rope bridge use by this species – an incomplete crossing of at Devils Pulpit on the Pacific Highway in 2018 (Geolink 2019).

Glide poles

Glide poles showed continued use by squirrel gliders, feathertail gliders and sugar gliders during the 2021 monitoring year. The level of use was substantially lower than for 2020 for all species across all upgrade sections. The largest decline in use was recorded for feathertail glider in sections 1 and 2 where use decreased from 1.51 crossings/week in 2020 to nil in 2021. Very low use by feathertail glider (i.e., 0.1 crossings/week) was recorded in Sections 3-11. The 2021 mean weekly rate of use by squirrel gliders in sections 3-11 (i.e., 0.06 crossings/week) was only slightly lower than recorded in sections 1 and 2 in 2020 (i.e., 0.08) and substantially less than reported for squirrel gliders on the Hume Highway (i.e., 2.6 crossings/week, Soanes *et al.* 2015) and

Sapphire to Woolgoolga (S2W) Pacific Highway upgrade (i.e., 0.23 crossings/week, Sandpiper Ecological 2018b). No yellow-bellied gliders were recorded on glide poles in 2021.

Preliminary evidence gathered in January and February 2022 in sections 3-11 suggests that glide pole use has increased on the levels recorded in 2021. For example, the number of active images recorded in January and February 2021 is almost equivalent to that recorded over a six-month period between July and December 2021. Increased glide pole use in summer 2022 may reflect seasonal changes in glider behaviour or good seasonal conditions.

The reason for the sharp decline in pole detections in S1 and 2 in Q1 and Q2 2021 is unconfirmed, however, it may be due to favourable environmental conditions and abundant insect prey. An abundant source of prey is likely to reduce the need for larger movements that may require use of aerial crossings.

Vegetated medians

Camera traps confirmed the use of all (three) vegetated medians by squirrel glider, sugar glider, feathertail glider and *Antechinus* spp, with squirrel gliders recorded frequently by five of the six cameras. Yellow-bellied gliders were recorded on two occasions in the Parker Road median (i.e., VM2). Results support the findings of previous studies that have recorded squirrel gliders and sugar gliders using vegetated highway medians (Taylor & Rohweder 2013; Sandpiper Ecological 2018b; van der Ree *et al.* 2010) and squirrel gliders using land-bridges with glide poles to cross a dual carriageway (Taylor & Goldingay 2012). Despite several studies confirming complete crossings Geolink (2021) found that radio-tracked squirrel gliders regularly accessed a vegetated median at Devils Pulpit across one carriageway yet no individuals made complete crossings. Whilst there are several likely reasons to explain the result it suggests that the presence of gliders in the median is not proof of complete crossings.

Camera trap results show that target glider species are accessing the median and are therefore capable of crossing at least one carriageway. Due to the small area of habitat within VM1 (1.97ha) and VM2 (1.04ha) it is unlikely that squirrel or yellow-bellied gliders would be residing in those areas permanently. VM3 is substantially larger, with a forested area of 10.38ha, and could support resident squirrel and sugar gliders, which have home ranges in the vicinity of 6 ha on the NSW north coast (Sharpe & Goldingay 2007). None of the medians are large enough to support a resident group of yellow-bellied glider, which have home ranges in excess of 60ha (Goldingay & Kavanagh 1993).

Whilst the data suggest that Petaurid gliders are crossing at least one carriageway to access VM1 and 2 crossing of both carriageways remains unconfirmed. Despite this, the attributes of VM1 (i.e., roadside tree heights and cross-carriageway canopy gaps) appear to provide viable glide crossing opportunities in both directions across both carriageways at numerous locations for the full range of gliding species. Sandpiper Ecological (2021a) expressed concern that the southbound carriageway gap at Parker Road (i.e., VM2) is too large for an effective glide and recommended that a glide feasibility study be undertaken.

The glide feasibility study of the Parker Road median found that glide potential is constrained. The analysis focussed on glide feasibility of yellow-bellied glider, which has a superior glide performance to the smaller squirrel glider (i.e. 1:1.9m vs 1:1.84m). The study identified three glides where an individual would land on a trunk rather than the ground or in shrubs, with no viable glide from the median across the northbound carriageway. Indeed, none of the three glides achieved the mean landing height of 5.8m recorded by Goldingay (2014), with landing heights <2m recorded for 'viable' glides. Confounding this result is the occurrence of squirrel, sugar gliders in VM2 in 2020 and 2021 after the median was fully isolated from adjacent vegetation. The inferior glide performance of these species (see Goldingay & Taylor 2009) means they should be less capable of accessing the median than yellow-bellied gliders.

One likely explanation for the presence of gliders in the median is that published studies have underestimated glide capability and/or the ability of gliders to land in mid-storey shrubs (that are closer to the road edge) or land low on the trunk. Goldingay and Taylor (2009), in a study on squirrel gliders, recorded a horizontal glide distance range of 9-47m and a mean of 21.5m, and Goldingay (2014) recorded a horizontal glide distance range of 19-45m and a mean of 25.2m for yellow-bellied glider. Soanes *et al.* (2015) provide evidence of glides that should be unfeasible based on published estimates of glide angle. In their study, squirrel gliders were recorded crossing carriageway gaps of 39 (160 crossings) and 47m (4 crossings) from launch heights of 15 and 16m respectively. Using a glide angle of 1.84m and a launch height of 15m a squirrel glider should only be capable of a 27.6m horizontal glide.

Reassessing glide feasibility at VM2 using data from Soanes *et al.* (2015), that is an upper horizontal distance limit of 40m and a launch height of 16m or higher, identifies six potential glides, three from west to median and one each for median to west, median to east and east to median (Table C1, Appendix C). If the horizontal glide limit is set at 45m and launch height above 18.5m, which is the upper threshold identified by Goldingay (2014) there are nine potential glides at VM2. This includes four from west to median, two from median to west, two from median to east, and one from east to median.

Whilst longer glides seem feasible this raises the possibility that such glides are viable for larger individuals only, or that individuals will be more susceptible to vehicle strike as they cross the carriageway at a lower height. Glide profile can be described as an inverted “J” with a steep decline immediately after launch followed by a flattening of the glide angle as velocity increases. Vehicle strike risk will be influenced by a combination of horizontal distance and the location of the carriageway in relation to the launch or landing site. A carriageway that is situated close to the landing site of a wide gap poses the greatest risk.

The viability of VM2 to function as a crossing point for gliders is unclear. Whilst it seems likely that gliders are accessing the median it is unclear if movement occurs in both directions across both carriageways. Results of radio-tracking in the Devils Pulpit median shows that occurrence of gliders in the median cannot be interpreted as functional highway crossing. A key point from the Devils Pulpit study is the presence of several viable glides for squirrel glider, assuming a glide angle of 1:1.84, across the northbound carriageway. Further assessment of glide potential at VM2 is warranted to try and determine if complete highway crossings are feasible. Further analysis should consider the location of the carriageway in relation to launch and landing trees, clearance zones above the carriageway, height of the carriageway above surrounding ground level, and potential glide pole locations in case analysis concludes that the median is not functional.

4.3 Road mortality

4.3.1 Higher mortality rate at impact sites or no significant difference in mortality rates for threatened gliders between impact and control sites.

No target species of glider were reported or recorded during road mortality surveys of the dual carriageway during 2021. A possible road-killed greater glider was recorded approximately 460m north of GP4. The subject site was within Glenugie State Forest, which is known to support a population of greater glider.

4.3.2 High number of incidental records of threatened glider mortality away from crossing structures.

No incidental records of glider road mortality were recorded in 2021.

5. Recommendations

Table 9: Recommendations of the year five threatened glider population and crossing structure surveys.

Number	Recommendation	TfNSW response
1	Inspect all rope bridge and glide pole cameras that are not providing regular image uploads or which require re-orientation.	Agreed
2.	Undertake further assessment of glide potential at VM2. Such an assessment should consider carriageway location and height, and carriageway clearzone, the need for a more accurate geodetic survey, and potential glide pole locations.	Agree: conduct further investigation to determine feasibility of additional survey
3.	Consider undertaking a more robust analysis of population survey data to assist with the interpretation of trends in occupancy.	Agreed: the author has considered results from the WC2NH monitoring, noting similar trend in occupancy for impact, reference, and control sites

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Appendix A – Population survey effort, weather and fauna detections

Table A1: Survey effort, weather conditions and fauna detections Q1 2021 threatened glider population monitoring. Msb = wind moves small branches; MLB = wind moves large branches. Ns = not surveyed. SqG = squirrel glider; SuG = sugar glider; YbG = yellow-bellied glider; GG = greater glider; FTG = feathertail glider; BtPhas = brush-tailed phascogale; CbTP = common brushtail possum; SeBtP = short-eared brushtail possum; CRP = common ringtail possum; TF = tawny frogmouth; PO = powerful owl; SO = sooty owl; MO = masked owl; BbO = boobook owl; ON = owlet nightjar; WtN = white-throated nightjar; GhFF = grey-headed flying fox; LRFF = little red flying fox. HM = heard movement, HC = heard call; HL = heard glide-land on tree; SE = saw eyeshine; SG = saw glide; SM = saw movement.

Transect	Date	Order	Obs	Temp	Hum	Cloud %	Wind	Rain	Moon	Start	Finish	Fauna	Flowering
TabLB-ie	8/03/2021	7	LA	19.1	97	100	MSB	Light rain	24%	2301	2331	Nil	
	10/3/21	5	NM	24.0	80	100	Msb	Nil	9%	2212	2242	Nil	
TabLB-iw	8/3/21	5	NM&LA	19.1	97	100	Msb	Sprinkle	24%	2300	2315	Pteropus spp	Spotted gum
	10/3/21	3	LA	24.0	80	100	Nil	Nil	9%	2111	2141	Nil	Spotted gum
TabNR-rn	8/3/21	6	NM	19.1	97	100	Msb	Sprinkle	24%	2324	2354	SuG.hc.160e,40n	
	10/3/21	4	NM	24.0	80	100	Msb	Nil	9%	2140	2210	Nil	
TabNR-rs	8/03/2021	6	LA	19.1	97	100	MSB	Light rain	24%	2324	2354	Nil	M. quinquenervia Angophora
	10/3/21	3	NM	24.0	80	100	Msb	Nil	9%	2105	2135	TF.hc, Pteropus spp	M. quinquenervia Angophora
TabVM-ie	8/3/21	7	NM	19	97	100	Msb	Nil	24%	1200	1230	Nil	Spotted gum
	10/3/21	4	LA	24.0	80	100	Nil	Nil	9%	2150	2220	GG SE 400N10E	Spotted gum
TabVM-iw	8/3/21	4	NM	19.1	97	100	Msb	Sprinkle	24%	2223	2253	Nil	
	10/3/21	2	LA	24.0	80	100	Nil	Nil	9%	2020	2040	Nil	
TabN-ie	8/03/2021	8	LA	19.1	97	100	MSB	Light rain	24%	2301	2331	Nil	
	10/3/2021	6	NM	23.8	81	1/8	Msb	Nil		2255	2325		
TabN-iw	8/03/2021	4	LA	19.5	93	100	MSB	Rain	24%	2217	2247	Nil	
	10/3/21	1	LA	24.0	80	100	Nil	Nil	9%	1945	2015	Nil	
TabN-ce	8/3/21	8	NM	19	97	100	Msb	Nil	24%	1235	1305	Nil	
	10/3/21	7	NM	23.8	81	1/8	Msb	Nil	9%	2230	1200	GhFF	M. quinquenervia
TabN-cw	8/3/21	2	NM	19.5	93	100	MLB	Rain	24%	2110	2140	Nil	Angophora
	10/3/21	2	NM	24.0	80	100	Nil	Nil	9%	2020	2050	Pteropus spp	Angophora
TabDD-rn	8/3/21	3	NM	19.5	93	100	MLB	Rain	24%	2143	2213	Nil	
	10/3/21	1	NM	24.0	80	100	Nil	Nil	9%	1945	2015	Nil	
TabDD-rs	8/3/21	3	LA	19.5	93	100	MLB	Rain	24%	2140	2210	CbtP SE 150S30W	
	10/3/21	5	LA	24.0	80	100	Nil	Nil	9%	2229	2259	CbtP SE 180S30W	
TabM-ce	8/3/21	2	LA	19.5	93	100	MLB	Rain	24%	2105	2135	Nil	
	10/3/21	6	LA	24.0	80	100	Nil	Nil	9%	2303	2333	GhFF, ONJ	
TabM-cw	8/3/21	9	LA	19.5	93	100	MLB	Rain	24%	1255	1325	Nil	
	10/3/21	9	LA	24.0	80	100	Nil	Nil	9%	1247	113	Nil	

Transect	Date	Order	Obs	Temp	Hum	Cloud %	Wind	Rain	Moon	Start	Finish	Fauna	Flowering
TabM-ie	8/3/21	9	NM	19	97	100	Msb	Nil	24%	1307	1337	Nil	
	10/3/21	7	LA	24.0	80	100	Nil	Nil	9%	2336	1206	Nil	Angophora
TabM-iw	8/3/21	1	NM	19.5	93	100	MLB	Rain	24%	1950	2020	Nil	Spotted gum
	10/3/21	9	NM	23.9	81	100	Mlb	Nil	9%	1242	1312	Nil	
TabS-ie	8/3/21	10	NM	18.6	95	100	Mlb	Nil	24%	1340	1410	Nil	Angophora
	10/3/21	8	NM	NM	23.8	81	1/8	Msb	Nil	1204	1234	GHFF	Angophora
TabS-iw	8/03/2021	1	LA	19.5	93	100	MLB	Rain	24%	1950	2020	Nil	
	10/3/21	8	LA	24.0	80	100	Nil	Nil	9%	1210	1240	Nil	
TabS-ce	8/3/21	7	BT	20	98	8/8	ML	NIL	3/4	2422	2453	GHFF	Nil
	10/3/21	8	BT	24.2	80	7/8	MSB	Nil	3/4	2425	2455	Nil	Nil
TabS-cw	8/3/21	6	BT	20	98	8/8	ML	NIL	3/4	2345	2415	BtPhas,hm400w 10s	Nil
	10/3/21	7	BT	24.2	80	7/8	MSB	Nil	3/4	2343	2414	Nil	Nil
MOR-ie	8/3/21	3	BT	20.4	95	8/8	MSB	LSh	3/4	2151	2223	Nil	Nil
	10/3/21	4	BT	24.5	82	7/8	MSB	Nil	3/4	2140	2210	Nil	Nil
MOR-iw	8/3/21	8	BT	20	98	8/8	ML	NIL	3/4	2459	0130	Nil	Nil
	10/3/21	5	BT	24.5	78	7/8	MSB	Nil	3/4	2225	2255	Nil	Nil
MOR-ce	8/3/21	4	BT	20.4	95	8/8	MSB	LSh	3/4	2226	2256	Nil	Nil
	10/3/21	1	BT	24.5	82	6/8	MSB	Nil	3/4	1944	2015	Nil	Nil
MOR-cw	8/3/21	5	BT	20	98	8/8	ML	Driz	3/4	2304	2335	Nil	Nil
	10/3/21	6	BT	24.5	78	7/8	MSB	Nil	3/4	2305	2336	Nil	Nil
MOR-rn	8/3/21	2	BT	20.4	95	8/8	MSB	LSh	3/4	2114	2145	SuG,se450e10n	Nil
	10/3/21	3	BT	24.5	82	6/8	MSB	Nil	3/4	2057	2128	SuG,se350e20n	Nil
MOR-rs	8/3/21	1	BT	22.7	90	8/8	MLB	LSh	3/4	1945	2015	Nil	Nil
	10/3/21	2	BT	24.5	82	6/8	MSB	Nil	3/4	2019	2050	Nil	Nil
TucN-ce	11/3/21	1	NM	20.6	97	100	RI	Rain	4%	1945	2015	FtG.sm.250e.5n, Pteropus spp	
	12/4/21	3	BT	13.9	61	0/8	Still	Nil	0/4	1941	2010	CBP,se100e20s	Nil
TucN-cw	11/3/2021	1	LA	20.6	97	100	RL	Rain	4%	1945	2015	Nil	
	12/4/21	3	NM	15	64	Nil	Nil	Nil	New	1940	2010	Nil	
TucM-ce	11/3/21	1	BT	20.7	97	8/8	MSB	LSh	3/4	1943	2014	Nil	Nil
	12/4/21	2	BT	15.5	60	0/8	Still	Nil	0/4	1859	1930	Nil	
TucM-cw	11/3/21	2	BT	20.7	97	8/8	MSB	LSh	3/4	2022	2051	Nil	BL Pbk
	12/4/21	2	NM	15	64	Nil	Nil	Nil	New	1858	1928	GHFF.hc	
Tuc-r-n	11/3/21	3	BT	20.7	97	8/8	ML	LSh	3/4	2104	2135	Nil	Nil
	12/4/21	1	NM	15	64	Nil	Nil	Nil	New	1805	1835	SqG.hc.30n,40w; SqG.hm.sg.200n, 15e;BTPhas.100 N,20w	P wood
Tuc-r-s	11/3/21	4	BT	20.7	97	8/8	ML	LSh	3/4	2142	2213	Nil	P bwood

Transect	Date	Order	Obs	Temp	Hum	Cloud %	Wind	Rain	Moon	Start	Finish	Fauna	Flowering
	12/4/21	1	BT	15.5	60	0/8	Still	Nil	0/4	1806	1837	SqG,hc,200e40n	
TucS-ce	11/3/2021	2	LA	20.6	97	100	RL	Rain	4%	2033	2103	Sug 80ms5e SM	
	12/4/21	4	BT	13.9	61	0/8	Still	Nil	0/4	2028	2100	Nil	
TucS-cw	11/3/21	2	NM	20.6	97	100	RI	Rain	4%	2030	2100	Nil	Angophora
	12/4/21	4	NM	10.6	82	Nil	Nil	Nil	New	2030	2100	TF.SI	
TucN-ie	11/3/2021	4	LA	20.6	97	100	RL	Rain	4%	2218	2248	Nil	
	12/4/21	6	NM	10.6	82	Nil	Nil	Nil	New	2138	2208	Nil	
TucN-iw	11/3/21	4	NM	19.8	98	100	RI	Nil	4%	2215	2245	Nil	
	12/4/21	5	NM	10.6	82	Nil	Nil	Nil	New	2108	2138	Nil	
TucS-ie	11/3/2021	3	LA	20.6	97	100	RL	Rain	4%	2121	2151	YbG SE 380n20E	
	12/4/21	6	BT	10.4	83	0/8	Still	Nil	0/4	2148	2217	Nil	Nil
TucS-iw	11/3/21	3	NM	20.6	97	100	RI	Rain	4%	2122	2200	Nil	
	12/4/21	5	BT	10.4	83	0/8	Still	Nil	0/4	2113	2145	GG,se400n20w. FtG, sg,350n20w	Nil
GN-ce	11/3/21	5	NM	19.3	98	100	Nil	Nil	4%	2305	2335	FtG.sm.360n.10e	
	12/4/21	7	BT	10.4	83	0/8	Still	Nil	0/4	2230	2301	Nil	
GN-cw	11/3/2021	5	LA	20.6	97	100	RI	Rain	4%	2305	2335	Nil	
	12/4/21	7	NM	10.1	84	Nil	Nil	Nil	New	2230	2300	Nil	
GN-ie	11/3/21	6	NM	19.3	98	100	Nil	Nil	4%	1236	1306	Nil	
	12/4/21	8	BT	10.4	83	0/8	Still	Nil	0/4	2307	2338	Nil	
GN-iw	11/3/2021	6	LA	20.6	97	100	RI	Rain	4%	2337	0003	Nil	
	12/4/21	8	NM	10.1	84	Nil	Nil	Nil	New	2305	2335	Nil	
GS-ie	9/3/21	1	BT	20.6	100	8/8	MSB	LSh	3/4	1944	2015	Nil	Nil
	11/3/21	6	BT	19.7	98	8/8	ML	Nil	3/4	2325	2355	CBP,se50s20e	Nil
GS-iw	9/3/21	2	BT	20.6	100	8/8	MSB	LSh	3/4	2020	2052	Nil	Nil
	11/3/21	7	BT	19.7	98	8/8	ML	Nil	3/4	2359	2430	Nil	Nil
GS-ce	9/3/21	1	NM	21.7	89%	8/8	RI	Rain	16%	2015	2045	Nil	
	11/3/21	8	BT	19.7	98	8/8	ML	Nil	3/4	2450	0121	Nil	Nil
GS-cw	9/3/21	1	NM	21.7	89%	8/8	RI	Rain	16%	1940	2010	Nil	
	11/3/2021	7	LA	20.6	97	100	RI	Rain	4%	0015	0045	Nil	
G-r-n	9/03/2021	1	LA	21.7	89%	8/8	RI	Rain	16%	1940	2010	Nil	
	11/3/21	5	BT	19.7	98	8/8	ML	Nil	3/4	2239	2310	Nil	Nil
G-r-s	9/03/2021	2	LA	21.7	89%	8/8	RI	Rain	16%	2013	2043	Nil	
			X	No access due to hazard									

Table A2: Survey effort, weather conditions and fauna detections Q2 2021 threatened glider population monitoring. Msb = wind moves small branches; MLB = wind moves large branches. Ns = not surveyed. SqG = squirrel glider; SuG = sugar glider; YbG = yellow-bellied glider; GG = greater glider; FtG = feathertail glider; BtPhas = brush-tailed phascogale; CbTP = common brushtail possum; SeBtP = short-eared brushtail possum; CRP = common ringtail possum; TF = tawny frogmouth; PO = powerful owl; SO = sooty owl; MO = masked owl; BbO = boobook owl; ON = owlet nightjar; WtN = white-throated nightjar; GhFF = grey-headed flying fox; LRFF = little red flying fox. HM = heard movement, HC = heard call; HL = heard glide-land on tree; SE = saw eyeshine; SG = saw glide; SM = saw movement.

Transect	Date	Order	Obs	Temp	Hum	Cloud %	Wind	Rain	Moon	Start	Finish	Fauna	Flowering
TabLB-ie	15/6/21	6	NM	14.5	96	0	Nil	Nil	23%	2050	2120	Nil	
	20/06/2021	1	LA	15.3	66	0	RI	Nil	75%	1751	1821	nil	
TabLB-iw	15/6/21	5	NM	14.9	95	0	Nil	Nil	23%	2025	2055	Nil	
TabNR-rn	15/06/2021	6	LA	14.9	95	0	Nil	Nil	23%	2056	2126	nil	
	20/6/21	2	NM	16.1	69	1	Mlb	Nil	75%	1815	1845	Nil	
TabNR-rs	15/06/2021	5	LA	14.9	95	0	Nil	Nil	23%	2025	2055	nil	
	20/6/21	1	NM	16.1	69	1	Mlb	Nil	75%	1740	1810	Nil	Melaleuca
TabVM-ie	15/06/2021	7	LA	14.9	95	0	Nil	Nil	23%	2134	2204	nil	
	20/6/21	3	NM	15.3	66	0	RI	Nil	75%	1858	1928	Nil	
TabVM-iw	15/6/21	4	NM	14.9	95	0	Nil	Nil	23%	1950	2020	Nil	
	20/06/2021	9	LA	14.9	66	0	RI	Nil	75%	2311	2341	nil	
TabN-ie	15/6/21	7	NM	14.7	96	0	Nil	Nil	23%	2126	2156	Nil	
	20/06/2021	2	LA	15.3	66	0	RI	Nil	75%	1841	1911	nil	
TabN-iw	15/06/2021	4	LA	15.9	91	0	Nil	Nil	23%	1945	2015	nil	
	20/6/21	9	NM	14.0	68	0	RI	Nil	75%	2235	2305	Nil	
TabN-ce	15/06/2021	8	LA	14.7	96	0	Nil	Nil	23%	2210	2240	nil	
	20/6/21	4	NM	15.3	66	0	RI	Nil	75%	1930	2000	Nil	
TabN-cw	15/6/21	2	NM	18.5	81	0	Nil	Nil	23%	1831	1901	Nil	
	20/6/21	7	NM	14.2	70	0	Nil	Nil	75%	2120	2150	Nil	
TabDD-rn	15/06/2021	3	LA	18.5	81	0	Nil	Nil	23%	1902	1932	nil	
	20/6/21	8	NM	14.4	67	0	Nil	Nil	75%	2155	2225	Nil	
TabDD-rs	15/6/21	3	NM	15.9	91	0	Nil	Nil	23%	1905	1935	Nil	
	20/06/2021	7	LA	14.9	66	0	RI	Nil	75%	2145	2215	nil	
TabM-ce	15/6/21	9	NM	14	96	0	RI	Nil	23%	2250	2320	Nil	Melaleuca
	20/06/2021	3	LA	15.3	66	0	RI	Nil	75%	1920	1950	nil	
TabM-cw	15/06/2021	2	LA	18.5	81	0	Nil	Nil	23%	1826	1856	CbtP se 120s15w	
	20/06/2021	6	LA	14.9	66	0	RI	Nil	75%	2110	2140	nil	
TabM-ie	15/6/21	8	NM	14	96	0	RI	Nil	23%	2210	2240	Nil	
	20/06/2021	4	LA	15.3	66	0	RI	Nil	75%	1955	2025	nil	
TabM-iw	15/6/21	1	NM	18.5	81	0	Nil	Nil	23%	1755	1825	GG,se.365n,5 w	
	20/06/2021	5	LA	14.9	66	0	RI	Nil	75%	2031	2101	nil	
TabS-ie	15/06/2021	9	LA	14	96	0	RI	Nil	23%	2249	2319	nil	
	20/6/21	5	NM	14.9	66	0	RI	Nil	75%	2007	2037	Nil	
TabS-iw	20/6/21	5	NM	14.9	66	0	RI	Nil	75%	2047	2117	FtG.sm.400n, 5w	

Transect	Date	Order	Obs	Temp	Hum	Cloud %	Wind	Rain	Moon	Start	Finish	Fauna	Flowering
	15/06/2021	1	LA	18.5	81	0	Nil	Nil	23%	1751	1821	nil	
TabS-ce	16/06/2021	5	LA	19	89	8	Mlb	Nil	32%	2125	2155	nil	
	21/6/21	4	NM	14.6	94	8	Mlb	Driz	85%	2020	2040	Nil	
TabS-cw	16/06/2021	4	LA	19	89	8	Mlb	Nil	32%	2034	2104	nil	
	21/6/21	3	NM	14.6	94	8	Mlb	Driz	85%	1940	2010	Nil	
MOR-ie	16/6/21	6	NM	17.7	84	8	Mlb	Lsh	32%	2200	2230	Nil	
	21/06/2021	1	LA	15	91	2	Msb	Nil	85%	1758	1828	nil	
MOR-iw	16/6/21	5	NM	19	89	8	Mlb	Nil	32%	2100	2130	Nil	
	21/06/2021	4	LA	15	91	2	Msb	Nil	85%	2006	2036	nil	
MOR-ce	16/6/21	7	NM	17.9	79	8	Mlb	Lsh	32%	2235	2305	Nil	
	21/6/21	2	NM	15	91	2	Msb	Nil	85%	1840	1910	Nil	
MOR-cw	16/6/21	4	NM	19	89	8	Msb	Nil	32%	2020	2050	Nil	
	21/06/2021	3	LA	15	91	2	Msb	Nil	85%	1934	2004	nil	
MOR-rn	16/06/2021	6	LA	17.9	79	8	Mlb	Lsh	32%	2205	2235	nil	
	21/6/21	1	NM	15	91	2	Msb	Nil	85%	1804	1834	Nil	
MOR-rs	16/06/2021	7	LA	17.9	79	8	Mlb	Lsh	32%	2251	2319	nil	
	21/06/2021	2	LA	15	91	2	Msb	Nil	85%	1834	1904	nil	
TucN-ce	16/6/21	3	NM	14.9	89	6	Msb	Nil	32%	1905	1935	Nil	
	21/06/2021	7	LA	13.6	88	5	RI	Nil		2306	2336	Cbtp se 260e10e	
TucN-cw	16/06/2021	2	LA	19	89	8	Mlb	Nil	32%	1813	1843	nil	
	21/6/21	7	NM	13.6	88	5	RI	Nil	85%	2242	2312	GhFF	Tallowwood
TucM-ce	16/6/21	2	NM	14.9	89	6	Msb	Nil	32%	1830	1900	Nil	
	21/06/2021	6	LA	13.6	88	5	RI	Nil	85%	2206	2236	nil	
TucM-cw	16/06/2021	3	LA	19	89	8	Mlb	Nil	32%	1908	1938	GhFF, TF	Red mahogany
	21/6/21	6	NM	13.9	87	7	Nil	Nil	85%	2206	2236	GhFF	Red mahogany
Tuc-r-n	16/06/2021	1	LA	19	89	8	Mlb	Nil	32%	1723	1753	SqG SM 150N20W	
	21/6/21	5	NM	13.9	87	7	Nil	Nil	85%	2116	2146	Nil	
Tuc-r-s	16/6/21	1	NM	14.9	89	6	Msb	Nil	32%	1745	1815	Nil	
	21/06/2021	5	LA	13.9	87	7	Nil	Nil	85%	2136	2204	TF	
TucS-ce	17/6/21	1	NM	15.2	38	1	RI	Nil	43%	1750	1820	Nil	Swamp mahogany
	22/06/2021	8	LA	13.2	98	8	RI	Nil	93%	2245	2315	nil	
TucS-cw	17/6/2021	1	LA	13.2	98	8	RI	Nil	93%	1749	1819	nil	
	22/6/21	8	NM	13.2	98	8	RI	Nil	93%	2145	2215	Nil	
TucN-ie	17/6/21	3	NM	14.6	43	1	RI	Nil	43%	1935	2005	Fig.sm.103n, 5w	Ironbark
	22/06/2021	7	LA	13.2	98	8	RI	Nil	93%	2155	2225	nil	
TucN-iw	17/6/2021	2	LA	13.2	98	8	RI	Drizzle	93%	1825	1855	Cbtp se 320n10e	

Transect	Date	Order	Obs	Temp	Hum	Cloud %	Wind	Rain	Moon	Start	Finish	Fauna	Flowering
	22/6/21	7	NM	13.2	98	8	RI	Drizzle	93%	2145	2215	Nil	
TucS-ie	17/6/21	2	NM	15.2	38	1	RI	Nil	43%	1837	1907	Nil	
	22/06/2021	6	LA	13.2	98	8	RI	Drizzle	93%	2105	2135	nil	
TucS-iw	17/6/2021	3	LA	13.2	98	8	RI	Drizzle	93%	1930	2000	Cbtp se 400n5e	
	22/6/21	6	NM	13.2	98	8	RI	Drizzle	93%	2105	2135	Nil	Tallowwood
GN-ce	17/6/21	5	NM	13.4	48	1	RI	Nil	43%	2110	2140	Nil	
	22/06/2021	5	LA	13.4	81	8	Msb	Nil	93%	2015	2045	GG SE 100n50e	
GN-cw	17/6/2021	5	LA	13.4	81	8	Msb	Nil	93%	2111	2141	nil	
	22/6/21	5	NM	13.4	81	8	Msb	Nil	93%	2015	2045	Nil	
GN-ie	17/6/21	4	NM	13.4	48	1	RI	Nil	43%	2032	2102	Nil	
	22/06/2021	4	LA	13.4	81	8	Msb	Nil	93%	1938	2005	nil	
GN-iw	17/6/2021	4	LA	13.4	81	8	Msb	Nil	93%	2015	2045	nil	
	22/6/21	4	NM	13.4	81	8	Msb	Nil	93%	1935	2005	2 x SuG.hc.250n, 50w	
GS-ie	17/6/21	7	NM	12.2	51	1	Msb	Nil	43%	2231	2301	Nil	
	22/6/21	3	NM	16.2	69	7	Mlb	Nil	93%	1827	1857	Nil	
GS-iw	17/6/2021	6	LA	16.2	69	7	Mlb	Nil	93%	2152	2222	Cbtp se 50s30w	
	22/05/2021	3	LA	16.2	69	7	Mlb	Nil	93%	1905	1935	nil	
GS-ce	22/06/2021	1	LA	16.2	69	7	Mlb	Nil	93%	1754	1826	nil	
	17/06/2021	8	LA	12.1	51	1	Msb	Nil	43%	2312	2342	cbtp SM 250n0w	
GS-cw	17/6/21	8	NM	12.2	51	1	Msb	Nil	43%	2312	2342	Nil	
	22/6/21	1	NM	16.2	69	7	Mlb	Nil	93%	1745	1815	Nil	
G-r-n	17/6/21	6	NM	12.2	51	1	Msb	Nil	43%	2150	2220	Nil	
	22/6/21	2	NM	16.2	69	7	Mlb	Nil	93%	1825	1855	Nil	
G-r-s	17/06/2021	6	LA	12.2	51	1	Msb	Nil	43%	2150	2220	nil	
	22/6/2021	2	LA	16.2	69	7	Mlb	Nil	93%	1829	1859	nil	

Table A3: Survey effort, weather conditions and fauna detections Q3 2021 threatened glider population monitoring. Msb = wind moves small branches; MLB = wind moves large branches. Ns = not surveyed. SqG = squirrel glider; SuG = sugar glider; YbG = yellow-bellied glider; GG = greater glider; FtG = feathertail glider; BtPhas = brush-tailed phascogale; CBTP = common brushtail possum; SeBtP = short-eared brushtail possum; CRP = common ringtail possum; TF = tawny frogmouth; PO = powerful owl; SO = sooty owl; MO = masked owl; BbO = boobook owl; ON = owlet nightjar; WtN = white-throated nightjar; GhFF = grey-headed flying fox; LRFF = little red flying fox. HM = heard movement, HC = heard call; HL = heard glide-land on tree; SE = saw eyeshine; SG = saw glide; SM = saw movement.

Transect	Date	Order	Obs	Temp	Hum	Cloud %	Wind	Rain	Moon	Start	Finish	Fauna	Flowering
TabLB-ie	30/8/21	4	AE	13	70	0/8	RL	nil	12.7	20:55	21:25		
	1/9/2021	1	AE	19.7	93	6/8	RL	nil	12.7	18:35	19:05		
TabL- iw	30/8/21	5	LA	13	70	0/8	RL	nil	12.7	20:18	20:48	Ftg sm 250s 5e	nil
	1/9/21	8	AE	19	92	0/8	RL	nil	12.7	23:50	0:20		
TabNR- rn	30/8/21	5	AE	13	70	1/8	RL	nil	12.7	21:30	22:00	nil	
	1/9/21	1	LA	19.7	93	1/8	RL	nil	12.7	18:11	18:41	nil	
TabNR- rs	30/8/21	7	LA	13	70	0/8	Nil	nil	12.7	21:40	22:10	onj, Prob SQse 0s 10w	
	1/9/21	2	LA	19.7	93	1/8	RL	nil	12.7	18:44	19:16		
TabVM- ie	30/8/21	6	AE	13	70	0/8	ml	nil	12.7	22:20	22:50	gg, s200m on transect w side	nil
	1/9/2021	8	AE	19	92	0/9	ml	nil	12.7	23:50	0:20		
TabVM- iw	30/8/2021	6	LA	13	70	0/8	Nil	nil	12.7	20:56	21:26		nil
	1/9/21	10	LA	19.7	93	0/8	RL	nil	12.7	23:55	25	sug se20s15w	red bloodwood
TabN-ie	30/8/21	2	AE	17	75	0/8	Nil	nil	12.7	20:15	20:45	GG se 30ms15w	
	1/9/21	3	LA	19.7	93	6/8	RL	nil	12.7	19:27	19:57	onj	
TabN-iw	30/8/21	3	AE	16	70	0/8	Nil	nil	12.7	20:20	20:50		
	1/9/21	9	LA	19.7	93	0/8	RL	nil	12.7	23:17	23:47		
TabN-ce	30/8/21	7	AE	13	70	0/8	ml	nil	12.7	22:55	23:25		
	1/9/2021	3	AE	19.7	93	6/8	RL	nil	12.7	20:05	20:35		
TabN- cw	30/8/21	2	AE	16	70	0/8	ml	nil	12.7	19:10	19:40	Petaurid sp. saw glide 250NOE	
	1/9/2021	6	AE	19	92	0/8	ml	nil	12.7	22:25	22:55	sg, hc 400m s 20m sw	
TabDD- rn	30/08/2021	4	LA/AE	13	70	0/8	Nil	nil	12.7	19:43	20:00	nil	nil
	1/9/21	7	AE	19	92	0/8	ml	nil	12.7	23:00	23:30	nil	nil
TabDD- rs	30/8/21	3	LA			0/8	Nil	nil	12.7				
	1/9/21	8	LA	19.7	93	0/8	RL	nil	12.7	22:43	23:13	GG Se 320s25w	
TabM- ce	30/8/21	9	LA	13	70	0/8	Nil	nil	12.7	22:54	23:26	nil	
	1/9/21	4	LA	19.7	93	6/8	RL	nil	12.7	20:11	20:41	nil	Melaleuca
TabM- cw	30/8/21	2	LA	13	70	0/8	Nil	nil	12.7	18:45	19:15	ftg sm 220s20w	nil
	1/9/21	7	LA	19.7	93	0/8	RL	nil	12.7	21:55	22:25	nil	
TabM-ie	30/8/21	10	LA	13	70	0/8	Nil	nil	12.7	23:28	23:59	nil	
	1/9/21	5	LA	19.7	93	6/8	RL	nil	12.7	20:44	21:14	nil	
TabM- iw	30/8/21	1	LA	13	70	0/8	Nil	nil	12.7	18:05	18:35	nil	
	1/9/21	6	LA	19.7	93	0/8	RL	nil	12.7	21:12	21:42	GG Se 80s10w	spotted gum
TabS-ie	30/8/21	8	AE	13	70	0/8	ml	nil	12.7	11:30	12:00		
	1/9/2021	4	AE	19.7	93	6/8	RL	nil	12.7	20:45	21:15		
TabS-iw	30/8/21	1	AE	16	70	0/8	ml	nil	12.7	18:20	18:50		
	1/9/2021	5	AE	19	92	0/8	ml	nil	12.7	21:45	22:15		
TabS-ce	30/8/21	7	DR	11	84	Nil	Nil	Nil	Nil	11:12	11:42	ONJ	Nil
	1/9/21	4	DR	18	94	90	Nil	Nil	Nil	8:14	8:44	Nil	Nil
TabS-cw	30/8/21	6	DR	12	84	Nil	Nil	Nil	Nil	10:23	10:52	YBG, 50m SW of corner, CBTP	Forest red gum
	1/9/21	3	DR	18	94	90	RL	Nil	Nil	8:29	9:00	GHFF	Forest red gum, iron bark
MOR-ie	30/8/21	4	DR	13	79	Nil	Nil	Nil	Nil	8:30	9:00	ONJ	Nil
	1/9/21	5	DR	18	94	Nil	RL	Nil	Nil	8:57	9:27	Nil	Nil
MOR-iw	30/8/21	8	DR	11	84	Nil	Nil	Nil	Nil	12:01	12:26	MO	Nil
	1/9/21	1	DR	19	91	60	Nil	Nil	Nil	6:10	6:37	Nil	Nil
MOR-ce	30/8/21	1	DR	16	58	50	Nil	Nil	Nil	6:15	6:48	ONJ	Nil

Transect	Date	Order	Obs	Temp	Hum	Cloud %	Wind	Rain	Moon	Start	Finish	Fauna	Flowering
	1/9/21	8	DR	18	92	Nil	RL	Nil	Nil	1105	1134	ONJ	Stringybark
MOR-cw	30/8/21	5	DR	13	80	Nil	Nil	Nil	Nil	925	955	ONJ	Nil
	1/9/21	2	DR	19	91	75	Nil	Nil	Nil	642	711	ONJ	Nil
MOR-rn	30/8/21	3	DR	13	75	Nil	Nil	Nil	Nil	739	810	ONJ	Nil
	1/9/21	6	DR	18	94	Nil	MSB	Nil	Nil	943	1012	Nil	Nil
MOR-rs	30/8/21	2	DR	16	65	50	Nil	Nil	Nil	652	722	ONJ	Nil
	1/9/21	7	DR	18	92	Nil	RL	Nil	Nil	1023	1053	ONJ, TFrog	
TucN-ce	31/8/21	5	DR	16	80	Nil	Nil	Nil	Nil	937	1008	SuG (se, 200m, 10m N), CBTP * 2	Wattle
	2/9/21	1	DR	17	75	Nil	Nil	Nil	Nil	615	652	CBTP, WTNJ	Wattle
TucN-cw	31/8/21	6	DR	16	91	Nil	Nil	Nil	Nil	1017	1046	Nil	Wattle
	2/9/21	2	DR	17	75	Nil	Nil	Nil	Nil	700	730	Nil	Tallowwood
TucM-ce	31/8/21	4	DR	20	74	Nil	Nil	Nil	Nil	852	921	Nil	Wattle
	2/9/21	3	DR	16	77	Nil	Nil	Nil	Nil	740	810	CRTP, FtG x 2 (sm, 325m S, 5m E)	Wattle
TucM-cw	31/8/21	3	DR	20	74	Nil	Nil	Nil	Nil	809	837	Nil	Sw mahog
	2/9/21	4	DR	15	83	Nil	Nil	Nil	Nil	825	856	CBTP x 2	Swamp mahog
Tuc-r-n	31/8/21	2	DR	20	74	Nil	Nil	Nil	Nil	712	745	SuG (se, 300m, 10m W), CBTP, ONJ	Wattle
	2/9/21	6	DR	15	83	Nil	Nil	Nil	Nil	956	1027	BkOI x2 (hc), PO (hc)	Wattle
Tuc-r-s	31/8/21	1	DR	20	74	25	Nil	Nil	Nil	625	700	Pet spp (se, 200m, 30S), WTNJ (HC)	Wattle
	2/9/21	5	DR	15	83	75	Nil	Nil	Nil	915	946	SuG (hc, 100m E, 50m N), SqG (SM, 200m, 10m S), TF(HC)	Wattle
TucS-ce	31/8/21	1	LA	17	74	Nil	Nil	Nil	1/4	1812	1842	cbtp se 100s10w	
	2/9/21	2	AE	15	79	Nil	Nil	Nil	1/4	19:00	19:30		
TucS-cw	31/8/21	1	AE	17	74	Nil	Nil	Nil	1/4	18:20	18:50		
	2/09/2021	2	LA	15	79	Nil	Nil	Nil	1/4	1856	1924		ironbark
TucN-ie	31/8/21	2	LA	17	74	Nil	Nil	Nil	1/4	1903	1933		tallowwood
	2/9/21	1	AE	15	79	Nil	Nil	Nil	1/4	18:10	18:40		
TucN-iw	31/8/21	2	AE	17	74	Nil	Nil	Nil	1/4	19:15	19:45		
	2/09/2021	1	LA	15	79	Nil	Nil	Nil	1/4	1811	1841	ftg sm 250n5w	ironbark
TucS-ie	31/8/21	3	LA	17	74	Nil	Nil	Nil	1/4	1955	2020		tallowwood
	2/9/21	3	AE	15	79	Nil	Nil	Nil	1/4	19:45	20:15	GG, 200m n s transect 5m	
TucS-iw	31/8/21	3	AE	17	74	Nil	Nil	Nil	1/4	20:00	20:30		Tallowwood
	2/09/2021	3	LA	15	79	Nil	Nil	Nil	1/4	1941	2011		Tallowwood, acacia
GN-ce	31/8/21	4	AE	17	74	Nil	Nil	Nil	1/4	21:00	21:30	YbG 300s100e, possible record check	
	2/9/21	4	AE	13.2	79	Nil	Nil	Nil	1/4	20:30	21:00		
GN-cw	2/09/2021	4	LA	13.2	79	Nil	Nil	Nil	1/4	2034	2105		
	31/8/21	4	LA	17	74	Nil	Nil	Nil	1/4	2057	2123		
GN-ie	31/8/21	5	AE	17	74	Nil	Nil	Nil	1/4	21:45	22:15		
	2/09/2021	5	LA	13.2	79	Nil	Nil	Nil	1/4	2122	2152	GG se 480s100e	
GN-iw	31/8/21	5	LA	17	74	Nil	Nil	Nil	1/4	2143	2213		
	2/9/21	5	AE	13.2	79	Nil	Nil	Nil	1/4	21:25	21:55		
GS-ie	31/8/21	5	AE	17	74	Nil	Nil	Nil	1/4	21:45	22:15		
	2/09/2021	7	LA	13.2	79	Nil	Nil	Nil	1/4	2257	2323		
GS-iw	31/8/21	6	LA	17	74	Nil	Nil	Nil	1/4	2215	2245		
	2/9/21	7	AE	13.2	79	Nil	Nil	Nil	1/4	23:00	23:30		
GS-ce	31/8/21	8	LA	17	74	Nil	Nil	Nil	1/4	2352	2322		
	2/09/2021	8	LA	13.2	79	Nil	Nil	Nil	1/4	2351	0021	2 x sug hm 10n10w	
GS-cw	31/8/21	7	AE	17	74	Nil	Nil	Nil	1/4	23:50	00:20		
	2/9/21	8	AE	13.2	79	Nil	Nil	Nil	1/4	23:45	00:15		
G-r-n	31/8/21	6	AE	17	74	Nil	Nil	Nil	1/4	23:00	23:30		
	2/9/21	6	AE	13.2	79	Nil	Nil	Nil	1/4	22:00	22:30		
G-r-s	31/8/21	7	LA	17	74	Nil	Nil	Nil	1/4	2301	2329		
	2/09/2021	6	LA	13.2	79	Nil	Nil	Nil	1/4	2216	2246	onj	

Table A4: Survey effort, weather conditions and fauna detections Q4 2021 threatened glider population monitoring. Msb = wind moves small branches; MLB = wind moves large branches. Ns = not surveyed. SqG = squirrel glider; SuG = sugar glider; YbG = yellow-bellied glider; GG = greater glider; FtG = feathertail glider; BtPhas = brush-tailed phascogale; CBTP = common brushtail possum; SeBtP = short-eared brushtail possum; CRP = common ringtail possum; TF = tawny frogmouth; PO = powerful owl; SO = sooty owl; MO = masked owl; BbO = boobook owl; ON = owlet nightjar; WtN = white-throated nightjar; GhFF = grey-headed flying fox; LRFF = little red flying fox. HM = heard movement, HC = heard call; HL = heard glide-land on tree; SE = saw eyeshine; SG = saw glide; SM = saw movement.

Transect	Date	Order	Obs	Temp	Hum	Cloud %	Wind	Rain	Moon (%)	Start	Finish	Fauna	Flowering
TabLb-ie	29/11/21	7	AE	21	83	8	nil	Light drizzle	30.5	12:15	12:45	Nil	Nil
	3/12/21	2	AE	22	83	100	nil	nil	1	9:00	9:30	Nil	Nil
TabLb-iw	29/11/21	1	LA	21.8	84	20%	nil	Nil	30.5%	2010	2040	Nil	Spotted gum, ironbark
	3/12/21	5	LA	21.8	81	100	nil	Nil	1	2251	2321	FtG SG 310n10w, GG se 400n20e	Corymbia maculata, eucalyptus acmenoides
TabNR-rn	29/11/21	6	AE	21	83	8	nil	Light drizzle	30.5	11:40	0:10		
	3/12/21	9	LA	21.1	95	0	Nil	Nil	1	1222	1252	FtG sm 20s15e	Spotted gum
TabNR-rs	29/11/21	5	AE	21	83	8	nil	nil	30.5%	10:55	11:25		
	3/12/21	1	LA	22.2	92	0	Nil	Nil	1	2020	2050	PO HC, PO SE	Corymbia maculata
TabVM-ie	29/11/21	6	LA	21.8	81	100	nil	Nil	30.5%	2335	1205	FtG SG 20s5w, FtG100s20w	Corymbia maculata, eucalyptus acmenoides
	3/12/21	2	LA	22.2	92	0	Nil	Nil	1%	2101	2131	GHFF SE Hc, GG se60s40e	Corymbia maculata
TabVM-iw	29/11/21	5	LA	21.8	84	100	nil	Nil	30.5%	2240	2310	FtG sm 200n10w, FtG se 230n15e	Corymbia maculata, eucalyptus acmenoides
	3/12/21	10	LA	21.1	95	0	Nil	Nil	1%	1222	1252	Petaurid spp SG 150n20w	Spotted gum
TabN-ie	29/11/21	7	LA	21.5	81	100	nil	Light drizzle	30.5%	1211	1241	Nil	Nil
	3/12/21	3	AE	22	83	100	nil	nil	1	9:45	10:15	Nil	Nil
TabN-iw	29/11/21	4	AE	21	83	50	ml	nil	30.5%	10:10	10:40	Nil	Nil
	3/12/21	1	AE	22	83	100	nil	nil	1	20:15	2045	Nil	Nil
TabN-ce	29/11/2021	8	AE	21	83	80	nil	Light drizzle	30.5%	1:00	1:30	Nil	Nil
	3/12/21	3	LA	22.2	92	0	Nil	Nil	1%	2141	2211	Nil	Nil
TabN-cw	29/11/21	2	AE	21	83	50	ml	nil	30.5%	8:53	9:25	Nil	Nil
	3/12/21	7	AE	22	83	100	nil	nil	1	12:00	12:30	Nil	Nil
TabDD-rn	29/11/21	3	AE	21	83	80	nil	nil	30.5%	9:35	10:05	Nil	Nil
	3/12/21	6	AE	22	83	100	nil	nil	1	12:30	1:00	Nil	Nil
TabDD-rs	29/11/21	4	LA	21.8	84	20%	nil	Nil	30.5%	2154	2224	SUG HC 120s50e	Corymbia maculata
	3/12/21	8	LA	21.1	95	0	Nil	Nil	1%	1222	1252	Nil	Spotted gum
TabM-ce	29/11/21	9	LA	21.5	81	100	nil	Light drizzle	30.5%	125	155	Nil	Spotted gum
	3/12/21	4	AE	22	83	100	nil	nil	1	10:40	11:10	Nil	Nil
TabM-cw	29/11/21	3	LA	21.8	84	100	nil	Nil	30.5%	2124	2154	Nil	Nil
	3/12/21	7	LA									People on track	People on track
TabM-ie	29/11/21	8	LA	21.5	81	100	nil	Light drizzle	30.5%	1251	121	FtG sm 80n10w	Spotted gum, ironbark
	3/12/21	5	AE	22	83	100	nil	nil	1	11:20	11:50	Nil	Nil
TabM-iw	29/11/21	2	LA	21.8	84	20%	nil	Nil	30.5%	2046	2116	Nil	Nil
	3/12/21	6	LA	21.1	95	0	Nil	Nil	1%	2332	1202	GG SE 280s10e, FtG sm 100s20e, GHFF, Sug HC 0s40e	Spotted gum
TabS-ie	29/11/21	9	AE	21	83	100	ml	nil	30.5%	1:30	2:00		
	3/12/21	4	LA	22.2	92	0	Nil	Nil	1%	2216	2246	Nil	Nil
TabS-iw	29/11/21	1	AE	21.8	84	20%	nil	Nil	30.5%	2010	2040	Nil	Nil

Transect	Date	Order	Obs	Temp	Hum	Cloud %	Wind	Rain	Moon (%)	Start	Finish	Fauna	Flowering
	3/12/21	5	LA	22.2	92	0	Nil	Nil	1%	2253	2323	Nil	Nil
TabS-ce	29/11/21	3	DR	21	86	75	Nil	Nil	Nil	2151	2220	Nil	G' ironbark
	3/12/21	8	DR	21	94	Nil	Nil	Nil	Nil	0111	0143	SuG x 1 (SM)	Nil
TabS-cw	29/11/21	2	DR	21	85	75	Nil	Nil	Nil	2105	2135	SqG x 1 (ES); Pet spp x 1 (ES); GHFF	FRG, G i' bark
	3/12/21	7	DR	21	94	Nil	Nil	Nil	Nil	2427	2459	Nil	Nil
MOR-ie	29/11/21	8	DR	21	85	100	Nil	Nil	Nil	0137	0205	Pink tongue	Nil
	3/12/21	1	DR	22	86	0	Nil	Nil	Nil	2019	2049	Nil	Nil
MOR-iw	29/11/21	4	DR	21	87	100	Nil	V light	Nil	2230	2300	Nil	Nil
	3/12/21	6	DR	21	94	Nil	Nil	Nil	Nil	2353	2422	Nil	Nil
MOR-ce	29/11/21	5	DR	21	87	100	Nil	Nil	Nil	2318	2348	SuG x 1 (ES); GGFF	Nil
	3/12/21	4	DR	22	88	Nil	Nil	Nil	Nil	2227	2257	GHFF (hc)	Nil
MOR-cw	29/11/21	1	DR	21	82	10	Nil	Nil	Nil	2018	2048	Nil	Spotted gum
	3/12/21	5	DR	22	90	Nil	Nil	Nil	Nil	1116	1145	Sug x 1 (ES); SqG (pr) x 2 (ES)	Spotted gum
MOR-rn	29/11/21	7	DR	21	87	100	Nil	Light drizzle	Nil	2448	0118	GHFF, T'frog	Nil
	3/12/21	2	DR	22	86	Nil	Nil	Nil	Nil	2103	2132	OnJ (hc)	Nil
MOR-rs	29/11/21	6	DR	21	87	100	Nil	Nil	Nil	2329	2431	GHFF	G i' bark; Sp gum
	3/12/21	3	DR	22	88	Nil	Nil	Nil	Nil	2147	2218	GHFF	Sp gum, G i' bark
TucN-ce	2/12/21	5	DR	21	93	Nil	Nil	Nil	Nil	2336	2406	SqG x 1 (ES), M. FASCIOIATATUS	Mahogany
	7/7/21	6	NM/AE	18.4	98	100	Nil	N	Nil	1215	1230	Nil	Nil
TucN-cw	2/12/21	6	DR	21	93	Nil	Nil	Nil	Nil	2420	2450	Sth boobook	Nil
	6/12/21	7	LA/AE	19	97	100%	Nil	Light showers	7%	0041	0056	Nil	Nil
TucM-ce	2/12/21	4	DR	22	89	80	RL	Nil	Nil	2243	2313	Nil	Mahogany
	6/12/21	6	LA	19	97	100%	Nil	Light showers	7%	2359	0029	Ni	Mahogany
TucM-cw	2/12/21	3	DR	22	89	100	Nil	Nil	Nil	2150	2120	Nil	Nil
	6/12/21	5	LA	19	97	100%	Nil	Light showers	7%	2316	2346	L. Brevipalmata present	Nil
Tuc-r-n	2/12/21	2	DR	22	89	100	RL	Light	Nil	2100	2130	FtG x 1 (ES)	Nil
	7/7/21	5	NM/AE	18.4	98	100	Nil	N	Nil	1215	1230	Nil	Nil
Tuc-r-s	2/12/21	1	DR	22	89	100	MSB	Light	Nil	2017	2047	ONJ (o)	Mahogany
	20/12/21	2	LA/AE	22.4	87	75	Nil	Nil	90	2141	2200	Pet Spp SG 190NSE	White Mahogany
TucS-ce	2/12/21	1	LA	22	87	100%	nil	Nil	11%	2010	2040	3 x CBTP se 175s10w	Pink bloodwood
	6/12/21	4	AE	19.3	95	100	Nil	Light	7%	2150	2220	Nil	Nil
TucS-cw	2/12/21	1	AE	22	87	100%	nil	Nil	11%	2010	2040	Nil	Nil
	7/12/21	4	NM	19.3	95	100	Nil	Light	7%	2150	2220	FtG sm 120s,0m	Tallowwood
TucN-ie	2/12/21	2	LA	22	87	100%	nil	Nil	11%	2059	2129	Nil	Corymbia maculata
	6/12/21	3	LA	19	97	100%	Nil	Nil	7%	2143	2213	SqG SM 150n10w	Spotted gum
TucN-iw	2/12/21	2	AE	21	83	87	100%	nil	Nil	11%	2129	Nil	Nil
	6/12/21	4	LA	19	97	100%	Nil	Light showers	7%	2215	2245	Ni	Spotted gum
TucS-ie	2/12/21	3	AE	21	83	100%	nil	Light showers	11%	2146	2214	Nil	Nil
	7/12/21	3	NM	19.3	95	100	Nil	Light	7%	2150	2220	Nil	Nil
TucS-iw	2/12/21	3	LA	22	87	100%	nil	Light showers	11%	2146	2214	Nil	Corymbia maculata
	6/12/21	3	AE	19.3	95	100	Nil	Light	7%	2150	2220	Nil	Nil

Transect	Date	Order	Obs	Temp	Hum	Cloud %	Wind	Rain	Moon (%)	Start	Finish	Fauna	Flowering
GN-ce	2/12/21	4	AE	21	83	100	nil	nil	11%	2146	2214	Nil	Nil
	6/12/21	8	LA	19	97	50%	Nil	Nil	7%	0130	0200	Nil	Nil
GN-cw	2/12/21	4	LA	21	87	0%	nil	Nil	11%	2146	2214	Nil	Corymbia maculata
	6/12/21	2	NM	19	97	90%	Nil	Light	7%	2055	2125	Nil	Nil
GN-ie	2/12/21	5	LA	22	87	0%	nil	Nil	11%	2251	2321	Nil	Nil
	6/12/21	7	AE	19	97	50%	Nil	Nil	7%	0130	0200	Nil	Nil
GN-iw	2/12/21	5	AE	21	83	0%	nil	nil	11%	11:45	12:15	Nil	Nil
	6/12/21	2	NM	19	97	90%	Nil	Light	7%	2055	2125	Nil	Nil
GS-ie	2/12/21	6	AE	22	87	0%	nil	Nil	11%	0014	0044	Nil	Nil
	6/12/21	1	LA	19	97	100%	Nil	Light showers	7%	2020	2050	Ni	Spotted gum
GS-iw	2/12/21	6	LA	22	87	0%	nil	Nil	11%	0014	0044	CBTP Se 50s40w	Nil
	6/12/21	2	LA	19	97	100%	Nil	Light showers	7%	2053	2123	Ni	Spotted gum
GS-ce	2/12/21	7	AE	22	87	0%	nil	Nil	11%	0053	0123	GG SE 400s15e	Nil
	20/12/21	5	LA/AE	19.8	91	100	Nil	Nil	90	1201	1216	Nil	Nil
GS-cw	2/12/21	7	LA	22	87	0%	nil	Nil	11%	0051	0121	Nil	Nil
	6/12/21	1	NM/AE	19	97	90%	Nil	Light	7%	2015	2030	Nil	Nil
G-r-n	20/12/21	3	LA/AE	20.9	91	100	Nil	Nil	92	2311	2319	Cbtp SE 300n20w	Spotted gum
	22/12/21	1	LA/AE	19.7	88	50%	Nil	Nil	90	2040	2055	Nil	Nil
G-r-s	20/12/21	4	LA/AE	20.9	91	100	Nil	Nil	90	2331	2346	Nil	Nil
	22/12/21	2	LA/AE	19.7	88	50%	Nil	Nil	90	2103	2118	Nil	Nil

Appendix B – Rope bridge fauna detections

Table B1: Results of 2021 rope bridge and glide pole fauna detections in sections 3-11. SqG = squirrel glider; SuG = sugar glider; FtG = Feathertail Glider; E = moved east; W = moved west; CC = complete crossing; IC = incomplete crossing; NC = non-crossing movement; NDM = non-directional movement; EXM = exploratory movement; D = definite; Pr = probable; Po = Possible.

Site	Cam	Loc	Date	Time	Species	Accuracy	Movement Direction	Crossing Type
Glide pole fauna detections								
GP10east	W02	Roadside	25/1/22	158	FtG	D	NDM	NC
GP10east	W02	Roadside	16/1/22	419	SqG	Pr	Towards	NC
GP10east	W02	Roadside	12/12/21	144	FtG	D	Towards	Launch
GP10east	W02	Roadside	29/11/21	127	FtG	D	EXM	NC
GP10east	W02	Roadside	7/11/21	2442	FtG	D	NDM	NC
GP10east	W701	Roadside	27/1/22	2435	FtG	D	Towards	Launch off cam
GP10east	W701	Roadside	14/1/22	441	FtG	D	Towards	NC
GP10east	W701	Roadside	10/1/22	207	FtG	D	Towards	Prob launch off cam
GP10east	W701	Roadside	30/12/21	357	FtG	D	Towards	Prob launch
GP10east	W701	Roadside	25/12/21	1248	FtG	D	Towards	NC
GP10east	W701	Roadside	24/12/21	2327	FtG	D	Towards	Launch off cam
GP10east	W701	Roadside	19/12/21	235	FtG	D	Towards	Launch off cam
GP10east	W701	Roadside	14/12/21	219	FtG	D	EXM	NC
GP10east	W701	Roadside	9/12/21	241	FtG	D	Towards	Launch off cam
GP10east	W701	Roadside	9/12/21	238	FtG	D	Towards	Launch off cam
GP10west	W01	Roadside	24/7/21	1747	SqG	D	EXM	NC
GP10west	W01	Roadside	16/7/21	1607	FtG	D	Away	Launch off arm
GP10west	W01	Roadside	11/7/21	2139	FtG	D	Towards	Launch off cam
GP8	W11	Median	17/4/21	149	SqG	D	EXM	CC
GP8	W11	Median	27/1/22	311	Petaurus spp	D	Towards	CC
GP8	W11	Median	27/1/22	310	Petaurus spp	D	EXM	CC
GP8	W11	Median	21/1/22	450	Petaurus spp	D	EXM	CC
GP8	W11	Median	20/1/22	338	Petaurus spp	Pr	NDM	CC
GP8	W11	Median	19/1/22	431	Petaurus spp	D	NDM	CC
GP8	W11	Median	18/1/22	418	Petaurus spp	Pr	Launch towards	CC
GP8	W11	Median	15/1/22	241	Petaurus spp	Pr	NDM	CC
GP8	W11	Median	14/1/22	235	Petaurus spp	Pr	Towards	CC
GP8	W11	Median	11/12/21	2408	Petaurus spp	D	EXM	CC
GP8	W11	Median	27/11/21	122	SqG	D	EXM	CC
GP8	W11	Median	29/8/21	2329	SqG	Pr	EXM	CC
GP8	W11	Median	29/8/21	2328	Petaurus spp	D	EXM	CC
GP9	W14	Median	11/9/21	2240	SqG	D	EXM	CC
GP7east	W15	Roadside	26/1/22	2251	SqG	D	Towards	NC
GP7east	W15	Roadside	26/1/22	2250	Petaurus spp	D	Towards	NC
GP7east	W15	Roadside	24/1/22	154	FtG	D	EXM	NC
GP7east	W15	Roadside	30/11/21	2421	SuG	D	EXM	NC
GP7east	W15	Roadside	16/11/21	204	SqG	D	EXM	NC

Site	Cam	Loc	Date	Time	Species	Accuracy	Movement Direction	Crossing Type
GP7east	W15	Roadside	4/11/21	2152	FtG	D	EXM	NC
GP7east	W15	Roadside	4/11/21	232	SqG	D	EXM	NC
GP7east	W15	Roadside	3/11/21	140	FtG	D	EXM	NC
GP7east	W15	Roadside	9/10/21	312	FtG	D	EXM	NC
GP7east	W15	Roadside	25/9/21	2012	FtG	D	EXM	NC
GP7east	W15	Roadside	13/9/21	2304	FtG	D	EXM	NC
GP7east	W15	Roadside	4/9/21	2355	FtG	D	Towards	Launch off cam
GP7east	W15	Roadside	11/8/21	2300	SqG	D	EXM	NC
GP7west	W16	Roadside	15/1/22	2247	SuG	Pr	Towards	NC
GP7west	W16	Roadside	11/1/22	2257	FtG	D	EXM	NC
GP7west	W16	Roadside	9/1/22	2322	Petaurus spp	D	EXM	NC
GP7west	W16	Roadside	3/1/22	2231	FtG	D	EXM	NC
GP7west	W16	Roadside	23/12/21	2455	Petaurus spp	D	EXM	NC
GP7west	W16	Roadside	14/12/21	227	FtG	D	EXM	NC
GP7west	W16	Roadside	18/11/21	228	Antechinus spp	D	EXM	NC
GP7west	W16	Roadside	2/11/21	108	SqG	D	EXM	NC
GP7west	W16	Roadside	29/9/21	107	FtG	D	EXM	NC
GP7west	W16	Roadside	17/9/21	2426	FtG	D	EXM	NC
GP7west	W16	Roadside	14/9/21	2032	SqG	D	EXM	NC
GP7west	W16	Roadside	30/8/21	2224	FtG	D	EXM	NC
GP4east	W19	Roadside	29/11/21	2202	FtG	D	EXM	NC
GP4east	W19	Roadside	24/9/21	1848	Antechinus spp	Pr	EXM	NC
GP4west	W20	Roadside	29/9/21	2455	FtG	D	EXM	NC
GP4west	W20	Roadside	15/11/21	249	SuG	D	EXM	NC
GP4west	W20	Roadside	8/11/21	2445	FtG	Pr	Towards	Launch off arm
GP4west	W20	Roadside	7/11/21	431	FtG	D	EXM	NC
GP4west	W20	Roadside	7/11/21	249	FtG	D	EXM	NC
GP4west	W20	Roadside	6/11/21	2443	FtG	D	EXM	NC
GP4west	W20	Roadside	4/11/21	2128	FtG	D	EXM	NC
GP4west	W20	Roadside	4/10/21	148	FtG	D	EXM	NC
GP4west	W20	Roadside	29/9/21	2458	Brown antechinus	D	EXM	NC
GP4west	W20	Roadside	25/9/21	2023	SqG	D	Towards	Launch off arm
GP4west	W20	Roadside	14/9/21	254	SqG	D	NDM	NC
GP4west	W20	Roadside	12/9/21	2350	FtG	Pr	Towards	Launch off cam
GP4west	W20	Roadside	10/9/21	203	FtG	Pr	EXM	NC
GP4west	W20	Roadside	10/9/21	201	FtG	D	Towards	Launch off cam
GP4west	W20	Roadside	8/9/21	2444	FtG	D	NDM	NC
GP4west	W20	Roadside	4/9/21	2015	FtG	D	EXM	NC
GP4west	W20	Roadside	2/9/21	2243	FtG	D	EXM	NC
GP4west	W20	Roadside	30/7/21	2250	FtG	D	EXM	NC
GP4west	W20	Roadside	10/6/21	2147	FtG	D	EXM	NC
GP4west	W20	Roadside	5/6/21	2402	FtG	D	EXM	NC
GP4west	W20	Roadside	31/5/21	2252	FtG	D	EXM	NC
GP4west	W20	Roadside	7/6/21	2404	FtG	D	EXM	NC
GP6	W26	Median	7/1/22	2215	FtG	Pr	EXM	CC

Site	Cam	Loc	Date	Time	Species	Accuracy	Movement Direction	Crossing Type
GP6	W26	Median	2/1/22	2210	SqG	D	EXM	CC
GP6	W26	Median	21/12/21	2311	SqG	Pr	EXM	CC
GP6	W26	Median	10/12/21	2302	Petaurus spp	Pr	EXM	CC
Rope bridge fauna detections								
RB5west	W22	NA	4/10/21	232	Petaurus spp	Pr	Towards	CC
RB5west	W22	NA	3/10/21	207	Unid mammal	D	Towards	CC
RB5east	W23	NA	22/1/22	2323	Unid mammal	D	EXM	NC
RB5east	W23	NA	3/10/21	129	Petaurus spp	Pr	Towards	CC
RB6east	w24	NA	19/8/21	440	Unid mammal	D	EXM	NC
RB6west	W25	NA	7/9/21	312	Unid mammal	D	Towards	CC
RB6west	W25	NA	3/8/21	350	Unid mammal	D	EXM	NC
RB6west	W25	NA	3/8/21	1857	Unid mammal	D	EXM	NC
RB7east	W17	NA	10/11/21	300	Petaurus spp	Pr	NDM	NC
RB7east	W17	NA	8/11/21	228	Petaurus spp	Pr	NDM	NC
RB7east	W17	NA	8/9/21	2309	Unid mammal	D	Towards	CC
RB7east	W17	NA	5/9/21	321	Unid mammal	D	Towards	CC
RB7east	W17	NA	15/8/21	211	Petaurus spp	D	Towards	CC
RB7east	W17	NA	14/8/21	2223	Unid mammal	D	EXM	NC
RB7west	W18	NA	4/9/21	2407	Unid mammal	D	EXM	NC
RB7west	W18	NA	13/6/21	345	Petaurus spp	Pr	EXM	NC
RB9west	W13	NA	5/11/21	2158	Unid mammal	D	Towards	NC
RB9west	W13	NA	1/11/21	302	Unid mammal	D	Towards	NC
RB9west	W13	NA	3/10/21	2442	Petaurus spp	Pr	Towards	CC
RB9west	W13	NA	15/8/21	157	Unid mammal	D	EXM	NC
RB11east	W3	NA	7/7/21	2123	Unid mammal	D	EXM	NC
Trial period fauna detections								
RB11east	NR	NR	10/2/21	430	SqG	D	EXM	NC
RB11west	NR	NR	7/2/21	129	SqG	Pr	EXM	NC
RB12west	NR	NR	10/10/21	2024	Unid mammal	D	NDM	NC
RB9west	NR	NR	22/2/21	220	Acrobates spp	D	EXM	NC
GP10	NR	NR	3/2/21	2233	FtG	D	EXM	NC
GP10	NR	NR	5/2/21	103	FtG	D	EXM	NC
GP10	NR	NR	5/2/21	2246	FtG	D	EXM	NC
GP10	NR	NR	6/2/21	2151	FtG	D	EXM	NC
GP10	NR	NR	6/2/21	2241	FtG	D	EXM	NC
GP10	NR	NR	7/2/21	226	FtG	D	EXM	NC
GP10	NR	NR	7/2/21	230	FtG	D	EXM	NC
GP10	NR	NR	8/2/21	218	FtG	D	EXM	NC
GP10	NR	NR	8/2/21	306	FtG	D	Towards	Launch off arm
GP10	NR	NR	10/2/21	2006	FtG	D	Away	Launch off arm
GP10	NR	NR	10/2/21	2219	FtG	D	EXM	NC
GP10	NR	NR	11/2/21	2302	FtG	D	EXM	NC
GP10	NR	NR	12/2/21	2434	FtG	D	Away	Launch off arm
GP10	NR	NR	12/2/21	148	FtG	D	EXM	NC
GP10	NR	NR	12/2/21	218	FtG	D	EXM	NC
GP10	NR	NR	12/2/21	2254	FtG	D	EXM	NC

Site	Cam	Loc	Date	Time	Species	Accuracy	Movement Direction	Crossing Type
GP10	NR	NR	13/2/21	2415	FtG	D	EXM	NC
GP10	NR	NR	15/2/21	2051	FtG	D	Away	Launch off arm

Appendix C – Glide assessment – Parker Road median

Table C1: Assessment of glide potential at the Parker Road median. Blue shading denotes a viable glide using a glide angle of 1.94. * = launch point was at least 3m from top of tree and 5m from trunk; ** height of the carriageway above base of launch tree was subtracted from the launch height.

Tree No	Location	Easting	Northing	Departure species	Landing species	Launch height*	Horizontal distance	Glide distance (height x 1.94)	Land height (m)	Comments
1	NB west	505862	6693062	White stringybark	Stringybark	17.8	34.5	34.532	0.016	Landing trees are shrubs <10cm dbh
2	NB west	505896	6692969	White stringybark	Bloodwood	18.8	34.5	36.472	1.016	
3	NB west	505990	6692755	Iron bark (poor health)	Spotted gum	15	48.8	29.1	- 10.154	Allowed for 2m carriageway height**
4	NB west	506008	6692725	Iron bark	Spotted gum	20.3	41	39.382	- 0.834	Shrubs (3-4m tall) in landing path; subtracted 1.5m for carriageway height
5	NB west	506083	6692601	Iron bark	Iron bark	21.3	39.4	41.322	0.990	3-4m tall shrubs in landing path
6	NB west	506064	6692627	Ironbark	Ironbark	22.2	45	43.068	-0.995	3-4m tall shrubs in landing path
Averages						19.233	40.533	37.312		
8	NB median	505917	6693002	Needle bark stringybark	Needle bark stringybark	18.6	37.4	36.084	- 0.678	Added 2m for lower Rd height; dead crown
9	NB median	506025	6692786	Spotted gum	Spotted gum	18		NA	NA	Subtract 2m for carriageway height; no obvious landing tree; shrubs in glide path

Tree No	Location	Easting	Northing	Departure species	Landing species	Launch height*	Horizontal distance	Glide distance (height x 1.94)	Land height (m)	Comments
10	NB median	506044	6692747	Stag	Ironbark	19.8	40.4	38.412	- 1.024	Subtracted 2m for carriageway; 3-4m shrubs in glide path
11	NB median	506068	6692709	Spotted gum	Ironbark	23.5	46.6	45.59	- 0.520	Subtract 2.5m due to carriageway height
12	NB median	506098	6692657	Ironbark	Ironbark	20.6	46.8	39.964	- 3.523	Subtracted 2m for carriageway height
Averages						20.1	42.8	40.012		
7	SB median	505895	6693083	Needle bark stringybark	Needle bark stringybark	17.3	41.2	33.562	- 3.937	Added 1.5 m due to road height; dead crown on glide tree
13	SB median	506124	6692636	Ironbark	Spotted gum	18.8	54.9	36.472	- 9.498	Subtracted 2m for carriageway
14	SB median	506106	6692671	Ironbark	Spotted gum	27.4	49.4	53.156	1.936	Subtracted 2m for carriageway; shrubs on Rd edge but probably outside glide path
15	SB median	506099	6692686	Spotted gum	Ironbark	23.8	49.2	46.172	- 1.560	Subtracted 2m for carriageway; shrubs on Rd edge but probably outside glide path
16	SB median	506091	6692699	Ironbark	Ironbark	23.8	56.4	46.172	- 5.272	Subtracted 2m for carriageway
17	SB median	506069	6692750	Ironbark	Ironbark	23	45.2	44.62	- 0.298	Subtracted 2m for carriageway

Tree No	Location	Easting	Northing	Departure species	Landing species	Launch height*	Horizontal distance	Glide distance (height x 1.94)	Land height (m)	Comments
18	SB median	506007	6692882	Ironbark	Ironbark	21.8	39	42.292	1.696	Subtracted 2m for carriageway; 3-4m shrubs in glide path
19	SB median	505956	6692989	Bloodwood	Bloodwood	19.5	41.4	37.83	- 1.840	Added 1.5m due to carriageway height
Averages						21.925	47.0875	42.534		
20	SB east	506000	6692986	Needle bark stringybark	Needle bark stringybark	15.8	41	30.652	- 5.334	Added 1m due to carriageway height; shrubs in glide path
21	SB east	506070	6692841	White stringybark	Spotted gum	17.5	46.8	33.95	- 6.623	Subtracted 2.5m due to carriageway height
22	SB east	506093	6692804	Spotted gum	Spotted gum	25.5	54.4	49.47	- 2.541	Subtracted 2.5m due to carriageway height
23	SB east	506106	6692762	Spotted gum	Ironbark	21.4	39	41.516	1.296	No subtraction - carriageway 2.5m higher
24	SB east	506136	6692711	Ironbark	Ironbark	21.4	50.6	41.516	- 4.682	No subtraction - carriageway 2.5m higher
25	SB east	506169	6692662	Spotted gum	Ironbark	21	54	40.74	- 6.835	3m shrubs on edge of carriageway 23m from glide pt
Averages						20.433	47.633	39.640		