

Pacific Highway Upgrade Warrell Creek to Nambucca Heads

Operational phase road-kill
monitoring – autumn 2021.

Document Review

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Table of contents

1. Introduction.....	1
1.1 Background.....	1
1.2 Study area.....	2
2. Methods	3
2.1 Safety	3
2.2 Road mortality surveys.....	3
2.2 Data summary and analysis	4
3. Results	5
3.1 Weather conditions	5
3.2 Species richness and abundance	5
3.3 Opportunistic road-kill information.....	12
3.4 Distribution of road-kill	12
4. Discussion	17
4.1 Autumn 2021.....	17
4.2 Flying-fox impacts	17
4.3 Effectiveness of fauna fencing	17
5. Recommendations	18
6. References	18
Appendix A – Field Survey Data	20

List of tables

Table 1: Weather conditions during each sample event. *preceding 24 hours. All data was obtained from the Bureau of Meteorology Coffs Harbour weather station except for rainfall data which was obtained from Bellwood station.....	5
Table 2: Species of vertebrate fauna recorded during seasonal road-kill surveys throughout the operational phase of the WC2NH upgrade. * denotes threatened species; ** = stage 2a only; Sum = summer; Aut = autumn; Win = winter; Spr = spring.....	6
Table 3: Recommendations following the summer 2021 operational phase road-kill monitoring and Transport for NSW response.	18

List of plates

Plate 1: Work vehicle with signage, flashing amber light and indicators.	3
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List of figures

Figure 1: Location of the WC2NH alignment.	2
Figure 2: Number of road-kills recorded in each sample week during the summer 2021 sample period.	11
Figure 3: Number of road-killed flying-foxes from all sample periods. * denotes threatened species. **Stage 2a only.	11
Figure 4: Location of road-killed fauna recorded in autumn 2021.	13
Figure 5: Location of road-killed fauna recorded in autumn 2021.....	14
Figure 6: Location of road-killed fauna recorded in autumn 2021.....	15
Figure 7: Location of road-killed fauna recorded in autumn 2021.....	16

1. Introduction

1.1 Background

In 2015, Transport for NSW (formerly NSW Roads and Maritime Service), in conjunction with Acciona Ferrovial Joint Venture (AFJV), commenced the upgrade of the Pacific Highway between Warrell Creek and Nambucca Heads (WC2NH). The WC2NH project was opened to traffic in two stages: stage 2a – 13.5km section from Lower Warrell Creek Bridge to Nambucca Heads opened on 18 December 2017; and stage 2b – 6.25km section from the southern end of the project to the Lower Warrell Creek bridge opened in late June 2018.

The upgrade included a number of mitigation measures to minimise vehicle collisions with native wildlife. The types of structures constructed to mitigate road-kill included:

- Fauna fencing to exclude fauna from the road corridor and to guide fauna towards connectivity structures.
- Fauna drop-down structures (escape ramps) along the fauna fencing.
- Fauna connectivity structures, including underpasses, bridges, rope bridges and glide poles.

Several fauna fence designs were installed to target threatened species including:

- **Type 1** - Chainmesh fence 1.8 m tall with floppy top feature, which is designed to exclude a range of native mammal species such as macropods, possums, spotted-tail quoll (*Dasyurus maculatus*) and koala (*Phascolarctos cinereus*). A total of 18.03km of this fence type occurs at the site.
- **Type 3** - Small gauge mesh fence with sheet metal return angled away from the highway (combined with fauna floppy top fence), which is designed to exclude green-thighed frog (*Litoria brevipalmata*) and giant barred frog (*Mixophyes iteratus*) from the road corridor. A total of 1.32km of type 3 fauna fence occurs at the site, overlapping with the type 1 fencing.
- **Type 4** - Chainmesh fence 4 m tall through the Macksville Flying-fox camp Paperbark Swamp Forest community designed to discourage grey-headed flying-fox (*Pteropus poliocephalus*) from flying within range of passing traffic when exiting or entering the roost. A total of 1km of type 4 fence occurs at the site.

Sandpiper Ecological Surveys (SES) has been engaged by Transport for NSW (TfNSW) to deliver the WC2NH operational ecological and water quality monitoring program, which includes seasonal road-kill surveys over the entire upgrade length.

Monitoring of road-killed fauna is a requirement of the approved WC2NH koala, spotted-tailed quoll and grey-headed flying-fox management plans and the Ecological Monitoring Program (RMS 2018a). Priority species for road-kill surveys are grey-headed flying-fox, koala, spotted-tailed quoll, and giant barred frog. Monitoring is required for the first five years of operation and includes weekly surveys for the first 12 weeks of operation and four surveys (at weekly intervals) each season thereafter. Due to the staged opening of the project, monitoring of stage 2a commenced in December 2017 with monitoring of stage 2b commencing in July 2018. The 12-week monitoring period for stage 2b ended on 30 September 2018 and Sandpiper Ecological commenced seasonal monitoring in October 2018. Previous road-kill monitoring was conducted by Geolink (2018a, b, c, d).

The aim of road-kill monitoring is to:

- report on any vertebrate road-kill following opening to traffic; and
- assess the effectiveness of fauna fence in preventing fauna being killed by vehicles while attempting to cross the WC2NH upgrade.

The results of monitoring in 2018, 2019 and 2020 have been previously reported on (Sandpiper Ecological 2018, 2019, 2020). The following report covers the autumn 2021 monitoring event and includes the entire WC2NH alignment.

1.2 Study area

The WC2NH project covers a total length of 19.75km and extends from Warrell Creek in the south to Nambucca Heads in the north (Figure 1).

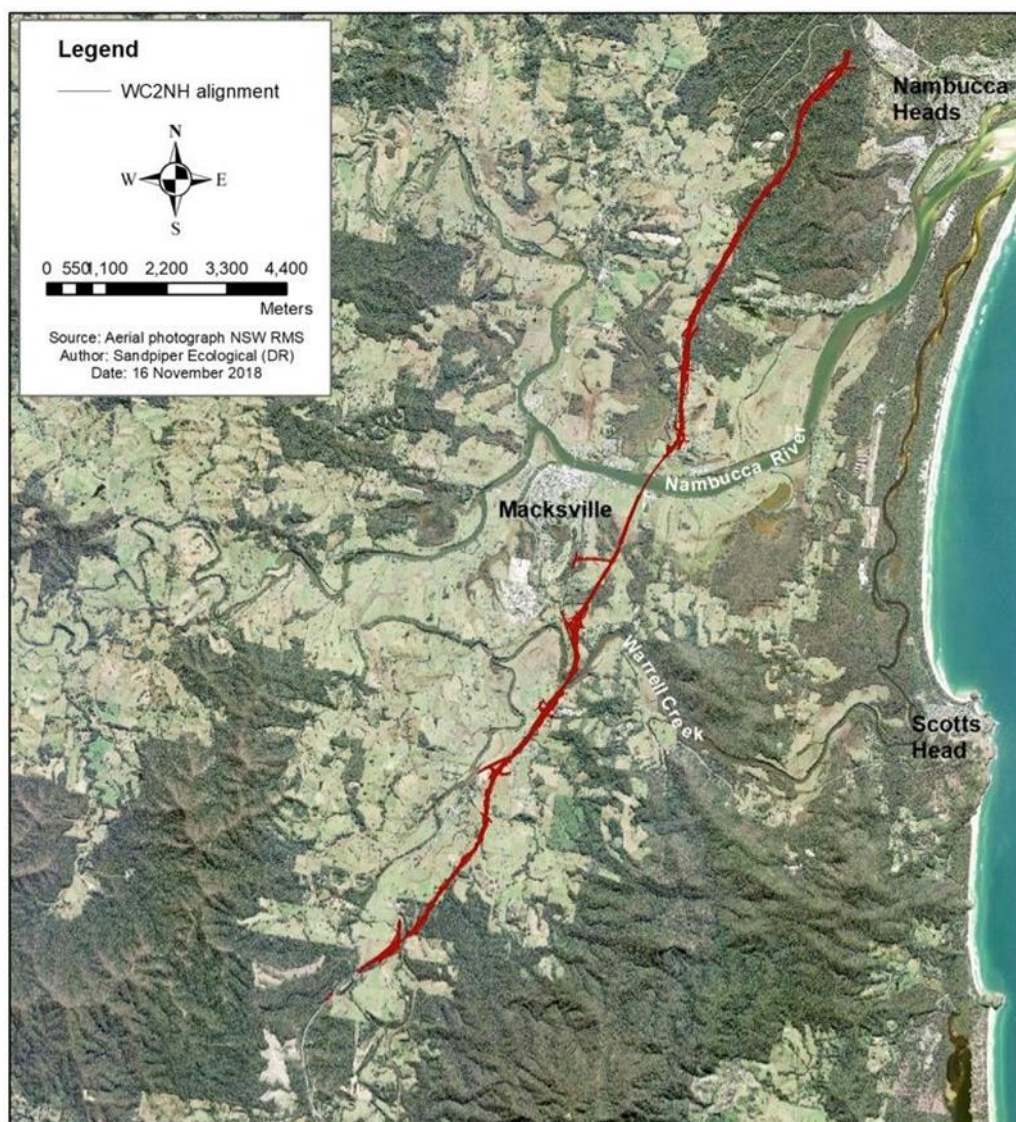


Figure 1: Location of the WC2NH alignment.

2. Methods

2.1 Safety

To ensure compliance with the updated TfNSW Traffic Control at Worksites Manual (TfNSW 2020) the road mortality survey method was revised. The updated guidelines require vehicles to be parked 3m from (& behind) wire rope, 11m from the fog line if there is no wire rope, and pedestrians to walk 3m behind wire rope. These distance restrictions could not be achieved using the former method and the method was revised prior to the autumn 2021 survey.

2.2 Road mortality surveys

Surveys were conducted by a two-person team from a constantly moving vehicle driven at 80-90km/hr in the left lane. The vehicle was equipped with an amber (flashing) light and warning sign (Plate 1). The team consisted of a driver and an ecologist passenger with experience identifying road-killed fauna. Surveys were undertaken weekly and commenced within three hours of sunrise. During each survey, the ecologist scanned the road surface and road shoulder for fauna. When road-killed fauna were detected the species or fauna group was recorded into an audio recorder with the record number, and a “drop pin” showing the site location was placed on an Ipad running Motion-X. Fauna records considered likely to be an unidentified target species (i.e. spotted-tailed quoll, koala, grey-headed flying-fox, giant barred frog) were inspected more closely from a safe location. At the completion of each survey, the audio recordings were played back and data were uploaded to Microsoft Excel on a desktop computer, with GPS coordinates downloaded from the Ipad.



Plate 1: Work vehicle with signage, flashing amber light and indicators.

Data collected on each road-kill included:

- Geographic coordinate
- Presence/absence of fauna exclusion fence adjacent the record (recorded from GIS)
- Species/fauna group
- Date of survey
- Road-kill location – north or southbound carriageway

Data collected for threatened species listed on the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* and/or the *Biodiversity Conservation (BC) Act 2016*, included, where possible: sex and age (juvenile/adult); presence of pouch young if applicable; presence of flightless young (flying-foxes); distance to a fauna connectivity structure; distance to a drop-down structure if applicable; damage to fauna fencing; weather conditions; if the animal was a flying-fox – distance to nearest camp, distance to nearest canopy vegetation, and presence of flowering food trees in median or roadside vegetation.

Broad size classes used to group fauna included:

- Small mammal – rodent, phascogale, sugar glider
- Medium mammal – bandicoot, potoroo, brushtail possum
- Large mammal – wallabies and kangaroos
- Small bird – noisy miner, honeyeaters
- Medium bird – magpies, pigeons, frogmouth, swamp hen, ducks
- Large bird – ibis, large forest owl, egret

All road-kills were cross-referenced with the previous survey data to identify possible duplicates. The consistent use of at least one team member across all surveys, GPS coordinates of each specimen, detailed carcass descriptions, and detailed location descriptions assisted with identifying duplicates. Distance to connectivity structure, and distance to escape structure was determined via GIS. All other data were uploaded to an iPad in the field.

2.2 Data summary and analysis

Data from the autumn 2021 survey were uploaded to Microsoft Excel. The autumn data were compared with results from summer 2021 to further assist in identifying duplicate records. Data were then plotted to show the total number of road-kills in autumn 2021 and the number of road-kills in different fauna groups each week of the survey. The location of autumn 2021 road-kills was overlaid on the WC2NH alignment to show distribution, and the data compared to road-kills recorded in summer, autumn, winter and spring 2018, 2019, 2020 and summer 2021 (Sandpiper Ecological 2018, 2019, 2020, 2021).

3. Results

3.1 Weather conditions

Heavy rain occurred during the second sample and affected survey accuracy. Weather conditions were fine and visibility good during other sample events (Table 1).

Table 1: Weather conditions during each sample event. *preceding 24 hours. All data was obtained from the Bureau of Meteorology Coffs Harbour weather station except for rainfall data, which was obtained from Bellwood station.

Date	Average Relative Humidity (%)	Rainfall (mm)*	Max Temperature (°C)	Max Wind Speed (km/h)	Visibility during survey	Rain during survey
1/4/21	70	0	25.2	48	Good	Nil
9/4/21	73	28	26.2	30	Poor	Heavy
16/4/21	60	0	24.8	41	Good	Nil
23/4/21	40	0	21.8	35	Good	Nil

3.2 Species richness and abundance

A total of 37 road-killed fauna were recorded during the autumn 2021 sample period. Fauna included 14 native species and two introduced species (fox and European hare), as well as eight fauna groups (Table 2). Birds were the most diverse group represented by seven species and two groups. Mammals were represented by five species and four groups, excluding introduced species, and reptiles featured two species and two group (snake & lizard).

Unidentified Chelidae spp (freshwater turtle) was the most frequently detected species with four records, followed by three records for small mammal (Table 2). Two grey-headed flying-fox were recorded, one at Warrell Creek and one at the Nambucca River. The change in survey method, coupled with degradation of carcasses and heavy rain during March and April made identification to species level difficult in some cases, resulting in a substantial increase in unidentified fauna groups (Table 2). For example, small and medium bird, small and medium mammal and unidentified reptile comprised 27% of all records. No frogs were recorded during the summer year 3 surveys.

Of the 37 road-kill records, 14 (38%) were species expected to be blocked by exclusion fence (i.e. medium and large mammals). Although not all of these were recorded in fenced sections of the alignment. The remaining 22 records, including birds, small mammals, and reptiles are species that readily move through or over exclusion fencing.

Table 2: Species of vertebrate fauna recorded during seasonal road-kill surveys throughout the operational phase of the WC2NH upgrade. * denotes threatened species; ** = stage 2a only; Sum = summer; Aut = autumn; Win = winter; Spr = spring.

Species	Sum 17/18 **	Aut 18 **	Win 18 **	Spr 18	Sum 19	Aut 19	Win 19	Spr 19	Sum 20	Aut 20	Win 20	Spr 20	Sum 21	Aut 21	Total
Birds															
Australian magpie	6	1		1				2	2	1			1		14
Grey butcherbird			1												1
Magpie-lark	2		1		1		1		1		1	1		1	9
Australian white ibis			1						1					1	3
Cattle egret				1						1					2
Little pied cormorant					1										1
Buff-banded rail					1										1
Purple swamphen	3		2	2		1		2	3		1	1		3	18
Wonga pigeon														1	1
White-headed pigeon										1					1
Crested pigeon	2														2
Galah	7				1			3							11
Rainbow lorikeet								1							1
Eastern grass owl*				1											1
Australian boobook			1	1			1				1				4
Masked owl*	1				1		1					1			4
Eastern barn owl			11	3		1	5	2	1						23
Tawny frogmouth	1	3	1	2		6		4		1		1	1	1	21
Australian owl-nightjar					1					1					2
Laughing kookaburra	3		2	1		2		3	1	1	2	1			16

Species	Sum 17/18 **	Aut 18 **	Win 18 **	Spr 18	Sum 19	Aut 19	Win 19	Spr 19	Sum 20	Aut 20	Win 20	Spr 20	Sum 21	Aut 21	Total
Forest kingfisher	1														1
Australian wood duck	20			2	2		1	2				2	1		30
Pacific black duck	2		1												3
Whistling kite				1											1
Black-shouldered kite					1	1									2
Torresian crow					1								1		2
Pied currawong				1									1		2
Black-faced cuckoo-shrike								1							1
Noisy miner													3	1	4
Dollarbird					2										1
Green catbird					1								1		2
Australasian figbird										1					1
Black bittern*						1									1
Eastern yellow robin						1									1
Pheasant coucal							1		1					1	3
Masked lapwing							1								1
Welcome swallow								1							1
Red-browed finch										1					1
Duck spp.						1				1					2
Tyto spp.										1					1
Small bird								2						1	3
Medium bird				1	2	2	2	2	6	1	1			2	18
Unidentifiable bird	5	4	1		3						2	2	1		18

Species	Sum 17/18 **	Aut 18 **	Win 18 **	Spr 18	Sum 19	Aut 19	Win 19	Spr 19	Sum 20	Aut 20	Win 20	Spr 20	Sum 21	Aut 21	Total
Total birds	53	8	22	17	18	16	13	25	16	11	8	9	10	12	214
Mammals															
Short-beaked echidna				3				2		1	2	1			9
Black flying-fox	2	1			7	1	1							1	12
Grey-headed flying-fox*					8			5	2					2	17
<i>Pteropus</i> spp.					3	8	1		1	1				1	15
Short-eared brushtail possum													1		1
Common brushtail possum			1	2						1					4
<i>Trichosurus</i> spp.									1	1	1				3
Common ringtail possum					1			1							2
Eastern grey kangaroo				3			1								4
Red-necked wallaby			6		8	2	8	3	7	1	8	3	1	1	48
Swamp wallaby	2	1		1		1	1			1	1	2	1		11
Wallaby spp.						2			3			2		1	8
Macropod spp.	3		2	1	1					2	1				10
Northern brown bandicoot	1		1		1	1	1	2	2	3	3		1	2	18
Bandicoot spp.						1		4				1		2	8
<i>Chalinolobus</i> spp. (microbat)				1											1
Microbat spp.					1										1
Swamp rat														1	1
Rodent spp.						2						1			3
Small mammal					2						1		1	3	7

Species	Sum 17/18 **	Aut 18 **	Win 18 **	Spr 18	Sum 19	Aut 19	Win 19	Spr 19	Sum 20	Aut 20	Win 20	Spr 20	Sum 21	Aut 21	Total
Medium mammal				2	4	2	4	5	2	2	2			2	25
Large mammal				1	1			1			1				4
Unidentified Mammal	1			3											4
Total mammals	10	2	10	17	36	20	17	23	18	13	20	10	5	16	196
Reptiles															
Common blue-tongued skink	1			2	1				2				1		7
Carpet python	1			2	1	1		1					1		7
Common tree snake	1	2						1							4
Eastern long-neck turtle	1			6						1		2			10
Macquarie river turtle	5	1					1								7
Unidentified <i>Chelidae</i> spp.	6							1				1	2	4	14
Red-bellied black snake	1														1
Eastern water dragon	1			1											2
Eastern bearded dragon												1		1	3
Blackish blind snake						1									1
Yellow-faced whipsnake				1											1
Unidentified reptile								2		1				2	5
Total reptiles	17	3	0	12	2	2	1	5	2	2	0	4	4	7	50
Frogs															
Green tree frog	2														2
Striped marsh frog	3														3
Medium frog				3											3
Large frog				1											1

Species	Sum 17/18 **	Aut 18 **	Win 18 **	Spr 18	Sum 19	Aut 19	Win 19	Spr 19	Sum 20	Aut 20	Win 20	Spr 20	Sum 21	Aut 21	Total
Total frogs	5	0	0	4	0	0	0	0	0	0	0	0	0		9
Introduced species															
Cat	1														1
Dog													1		1
European fox	3	1	1	2	1	1	2							1	12
European hare	2			1						1		1		1	6
Rabbit	1														1
Black rat	1					1									2
House mouse					1										1
Rock pigeon			1	1											2
Domestic goose				1								1			2
Total introduced species	8	1	2	5	2	2	2	0	0	1	0	2	1	2	25
Total	93	14	34	55	57	40	33	53	36	27	28	25	20	37	552

Over the autumn 2021 sample period the number of road-kill recorded each week fluctuated from 10 in week one to three in week two and 14 in week three (Figure 2). The low number recorded in week two is attributed to heavy rain and poor visibility during the survey.

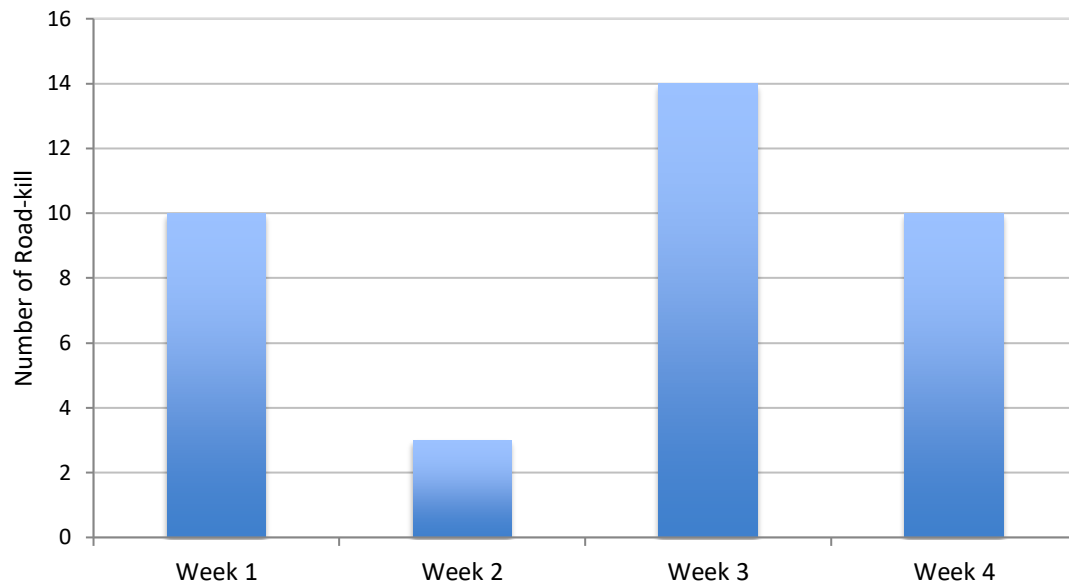


Figure 2: Number of road-kills recorded in each sample week during the summer 2021 sample period.

The number of road-killed flying-foxes has varied over the monitoring period (Figure 3). Black flying-fox, grey-headed flying-fox and total number of flying-foxes peaked during summer 2019 with seven, eight and 18 road-kills, respectively. Numbers have fluctuated and largely declined since then, with no flying-foxes recorded in winter and spring 2020, and summer 2021 (Figure 3). Four road-killed flying-foxes were recorded in autumn 2021, including two grey-headed flying-fox.

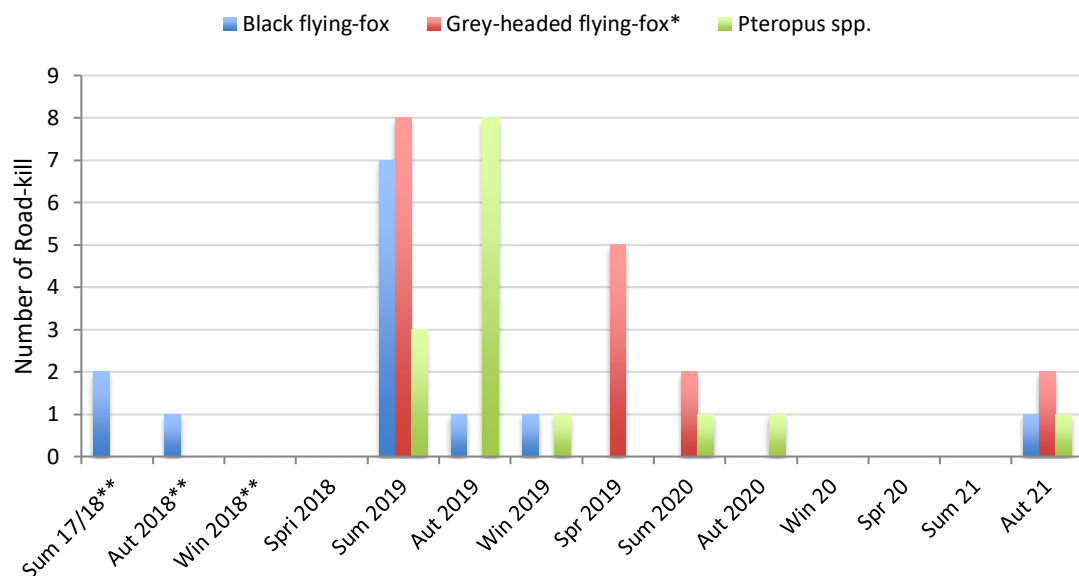


Figure 3: Number of road-killed flying-foxes from all sample periods. * denotes threatened species. **Stage 2a only.

3.3 Opportunistic road-kill information

No opportunistic road-kill was recorded during autumn 2021.

3.4 Distribution of road-kill

Fauna road-kills were recorded across the entire WC2NH alignment during autumn 2021 (Figures 4-7). More than half of the records (57%) were recorded from just south of Warrell Creek to just north of the Nambucca River. During the autumn 2021 period, 22 road-kills were recorded in areas with exclusion fence, 13 in areas without an exclusion fence and two in an area with an exclusion fence on only one side of the carriageway (Figures 4-7). Eight of the fenced section records (22% of all records) were species that should be blocked by the fence (i.e. medium and large mammals). Five records (14% of all records) in sections without fence or with an exclusion fence on one side, were of species expected to be blocked by an exclusion fence.

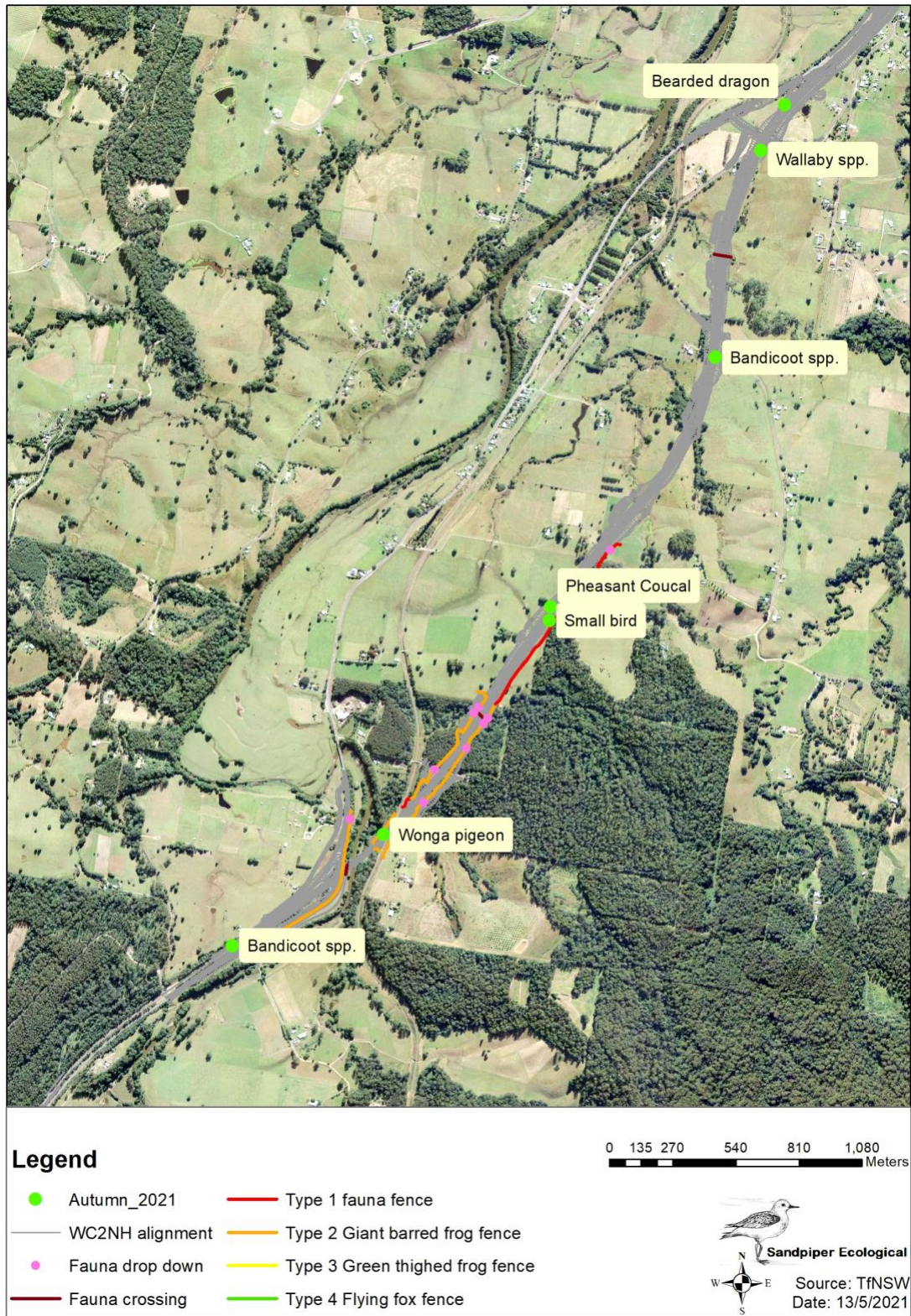


Figure 4: Location of road-killed fauna recorded in autumn 2021.

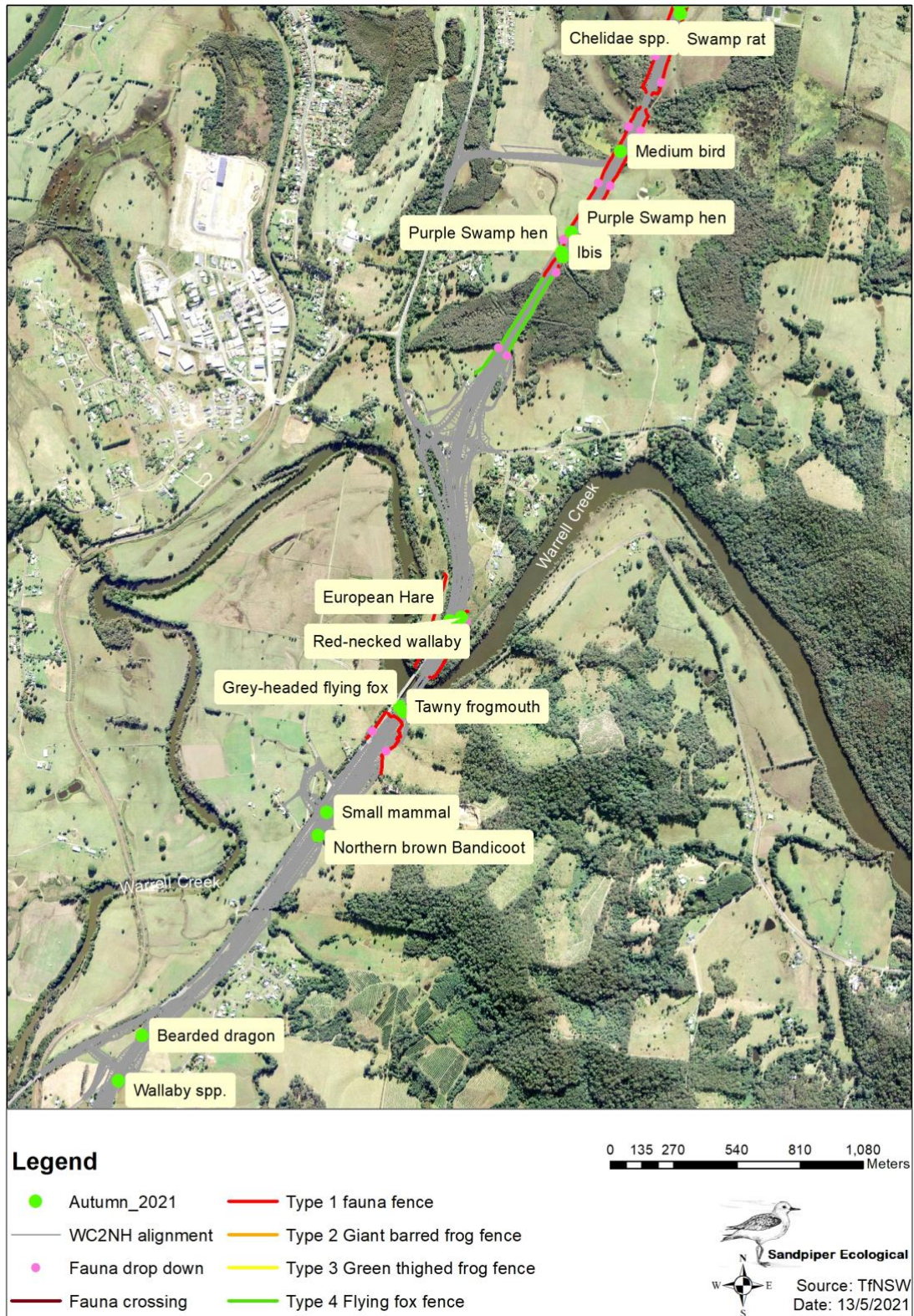


Figure 5: Location of road-killed fauna recorded in autumn 2021.

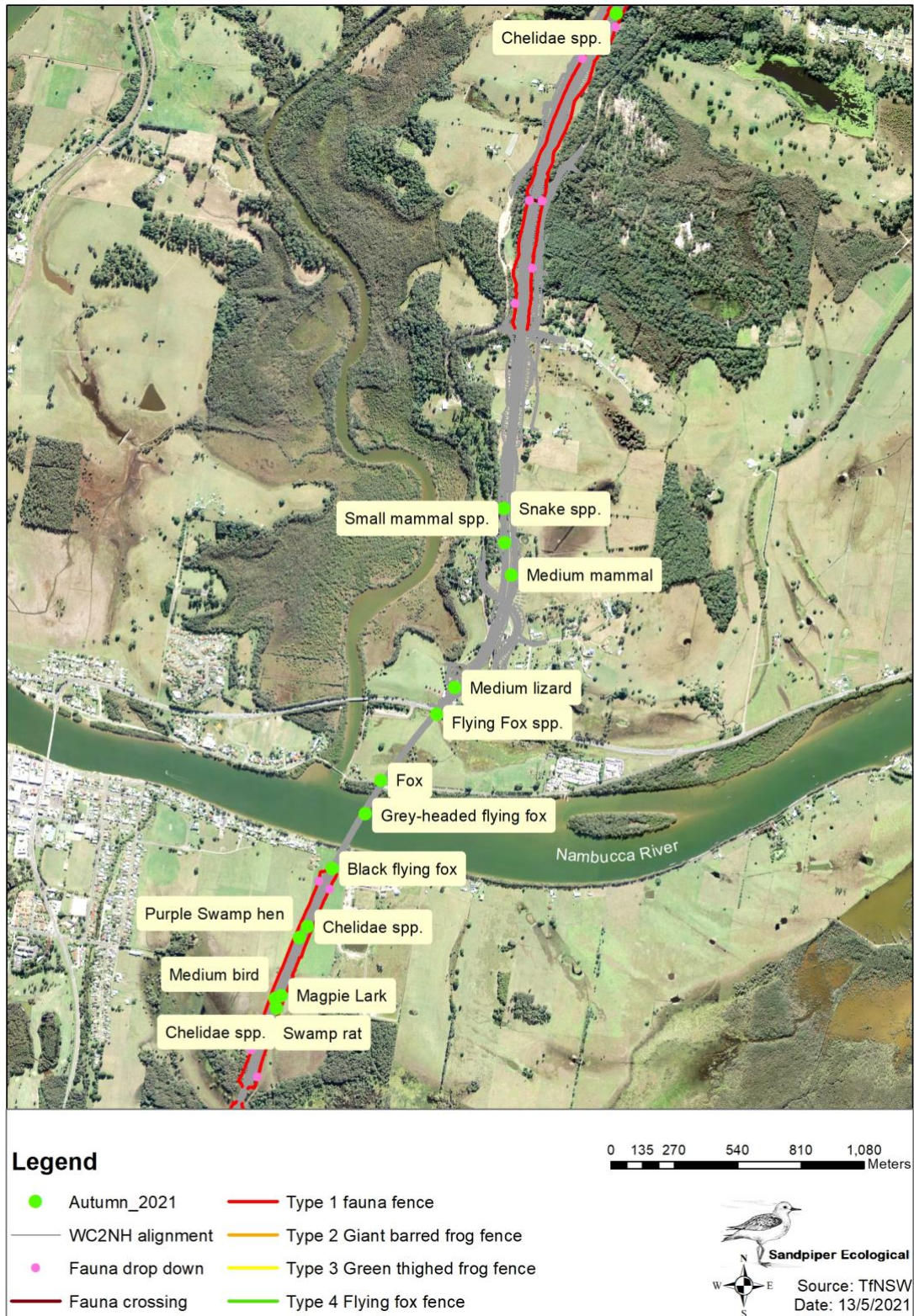


Figure 6: Location of road-killed fauna recorded in autumn 2021.

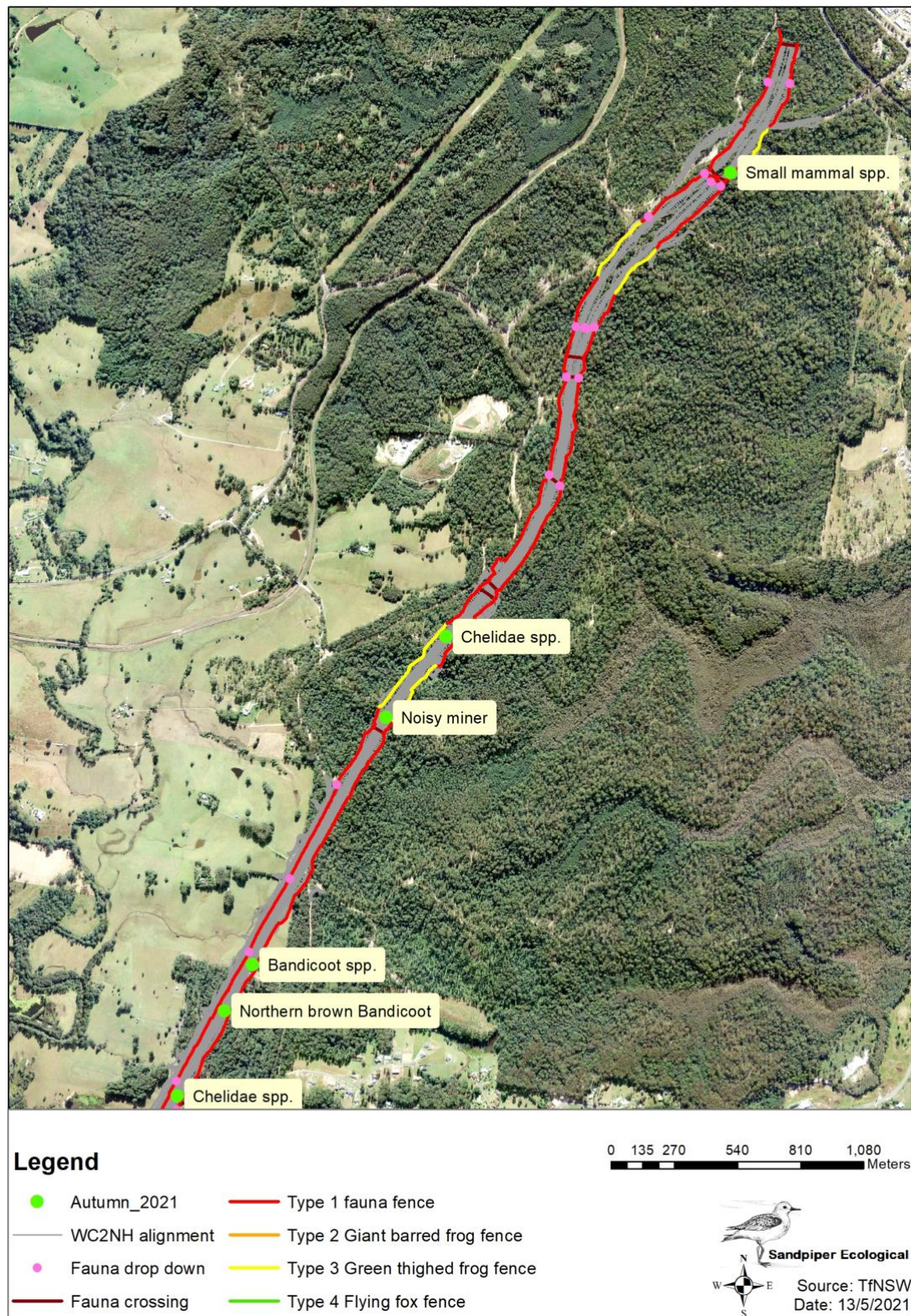


Figure 7: Location of road-killed fauna recorded in autumn 2021.

4. Discussion

4.1 Autumn 2021

Road-kill monitoring of the WC2NH alignment in autumn 2021 indicates that fauna continue to be killed by vehicles 2.5 years after the entire alignment was open to traffic. The number of road-kills recorded in autumn 2021 (37 individuals) is the highest since spring 2019 (53 individuals) and similar to summer 2020 (36 individuals). The autumn result breaks the trend of decreasing road-kill abundance since summer 2020. The exact reason for the increase is unclear although it shows that the new method has not had a negative impact on detection of road-kills. Greater numbers of all fauna groups, except frogs, was recorded in autumn 2021. Mammals increased from an average of 12 in the preceding four surveys to 16, reptiles from an average of 2.5 in the preceding four surveys to 7 and birds from an average of 9.4 in the preceding four surveys to 12 in autumn.

One threatened species, grey-headed flying-fox, was recorded on two occasions in autumn. Both individuals were near major watercourses, one at Nambucca River and the other at Warrell Creek. The location of these records is consistent with most previous grey-headed flying-fox records. Grey-headed flying-fox is listed as vulnerable under the *EPBC Act 1999*, and the *BC Act 2016*.

The reason for an increase in road-kill is unknown and the result may reflect normal variation rather than being associated with any actual increase in road-strike probability. The only way to confirm patterns of seasonal abundance and clarify the reasons for fluctuations is through further monitoring.

Contrary to previous samples, the number of road-kill peaked in week three rather than week one. The likely reason for this is heavy rain prior to and during the autumn survey. Heavy rain washes carcasses, particularly small animals, into drains where they are harder to detect or are removed from the road surface all together.

Road-kill hotspots identified in autumn 2021 are consistent with previous surveys. The area from just south of Warrell Creek to just north of the Nambucca River contained 62% of all road-kills. This area includes the Nambucca River and Gumma Floodplain, which has consistently recorded a high incidence of road-kill (Sandpiper Ecological 2018, 2019, 2020). Birds and mammals comprised the majority of road-kills in all surveys to date.

4.2 Flying-fox impacts

Four road-killed flying-foxes were recorded in autumn 2021. This included two grey-headed flying-foxes, one black flying-fox and one unidentified flying-fox species. All were associated with bridges and waterways and did not occur near the dedicated flying-fox exclusion fence. These are the first flying-fox road-kill recorded since autumn 2020. Exact reasons for the increase are unclear, and could be related to normal fluctuation, weather conditions or local population size.

4.3 Effectiveness of fauna fencing

The spatial pattern of road-kill occurrence is broadly consistent with that of previous samples, although abundance north of Mattick Road, in a fully fenced section, was greater than previous surveys. Contrary to previous surveys the road-kill rate of species expected to be blocked by the fence was higher in areas with exclusion fence on both sides (8 individuals) than in areas without exclusion fence (6 individuals). Two records in areas with fence occurred near the fence end suggesting fauna

had walked around the fence onto the carriageway. Four of the remaining six records were freshwater turtles (Chelidae). Type A exclusion fence should block adult turtles and individuals may be accessing the carriageway via small gaps at open drains. The wet conditions in autumn 2021 may have increased movement and individuals may be using open drains to disperse from spill basins. Narrow gaps at the base of open drain gates may be of sufficient size for turtles to pass under. Open drains should be targeted during the winter exclusion fence inspection.

5. Recommendations

Recommendations relating to the autumn 2021 operational phase road-kill monitoring are summarised in Table 3.

Table 3: Recommendations following the autumn 2021 operational phase road-kill monitoring and Transport for NSW response.

Number	Recommendation	Transport for NSW Response
1.	Continue seasonal road-kill surveys using the revised method applied in the autumn year 3 (2021) survey	Agree to be adopted
2.	Ensure open drains are targeted during the winter 2021 exclusion fence inspection to identify potential escape points for freshwater turtles.	Agree to be adopted

6. References

Geolink (2018a). *Roadkill monitoring report: WC2NH Stage 2A*. Report prepared for NSW Roads and Maritime Services.

Geolink (2018b). *Roadkill monitoring summary report: autumn (April) 2018*. Letter report prepared for NSW Roads and Maritime Services.

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Sandpiper Ecological (2020). Pacific Highway Upgrade, Warrell Creek to Nambucca Heads: Year 2 operational phase road-kill monitoring- annual report 2020. Report prepared for Transport for NSW.

Appendix A – Field Survey Data

Table A1: Autumn 2021 roadkill results. Obs = Observers; LA = Luke Andrews, NM = Nirvarna Makings; DR = David Rohweder; xing = crossing

Date	Observers	Start time	End time	Carriageway	Species	Probability	Sex & age class	Presence of pouch or back young	RK general location	Easting	Northing	Cleared off Rd (Y/N)
1/4/21	NM/LA	900	1100	SB	Flying Fox spp.	D	unknown	unknown	At start of NB bridge	494100	6603124	N
1/4/21	NM/LA	900	1100	SB	Chelidae spp.	D	unknown	unknown	350m S of NB bridge	493550	6602217	N
1/4/21	NM/LA	900	1100	SB	Bandicoot spp.	D	unknown	unknown	50 s of rosewood road	490821	6596429	N
1/4/21	NM/LA	900	1100	NB	Bearded dragon	Pr	unknown	unknown	150m N of Albert drive	491119	6597509	N
1/4/21	NM/LA	900	1100	NB	Small mammal	Pr	unknown	unknown	5N of Quarry access road	491907	6598462	N
1/4/21	NM/LA	900	1100	NB	Ibis	Pr	unknown	unknown	On Gumma floodplain bridge 2	492911	6600853	N
1/4/21	NM/LA	900	1100	NB	Medium bird	D	unknown	unknown	150 S of Gumma floodplain bridge 1	493162	6601284	N
1/4/21	NM/LA	900	1100	NB	Grey-headed flying fox	Pr	unknown	unknown	Middle of NB bridge	493797	6602700	N
1/4/21	NM/LA	900	1100	NB	Medium lizard	D	unknown	unknown	North end of NB bridge	494178	6603238	N
1/4/21	NM/LA	900	1100	NB	Snake spp.	D	unknown	unknown	450 N of southern Old coast road bridge	494388	6604002	N
9/4/21	DR	915	1040	SB	Bandicoot spp.	D	Unknown	Unknown	Nth Mattick Rd	495188	6606676	N
9/4/21	DR	915	1040	SB	Swamp rat	Pr	Unknown	Unknown	Gumma floodplain	493381	6601764	N
9/4/21	DR	915	1040	SB	Red-necked wallaby	D	Unknown	Unknown	Nth Warrell Ck	492482	6599294	N
16/4/21	DR/LA	9:00	1100	SB	Small mammal spp.	D	Unknown	Unknown	Nambucca SF	497233	6610062	N
16/4/21	DR/LA	9:00	1100	SB	Black flying fox	D	Unknown	Unknown	Nambucca River bridge	493656	6602465	N
16/4/21	DR/LA	9:00	1100	SB	Northern brown Bandicoot	D	Unknown	Unknown	Sth quarry access road	491870	6598362	N
16/4/21	DR/LA	9:00	1100	SB	Grey-headed flying fox	D	Unknown	Unknown	Warrell Ck bridge	492235	6598893	N
16/4/21	DR/LA	9:00	1100	SB	Wallaby spp.	D	Unknown	Unknown	Alignment	491017	6597315	N
16/4/21	DR/LA	9:00	1100	NB	Chelidae spp.	D	Unknown	Unknown	Nth Mattick Rd	494867	6606115	N
16/4/21	DR/LA	9:00	1100	NB	Bandicoot spp.	D	Unknown	Unknown	Sth end of project	488757	6593914	N
16/4/21	DR/LA	9:00	1100	NB	Wonga pigeon	D	Unknown	Unknown	South railway bridge	489402	6594388	N
16/4/21	DR/LA	9:00	1100	NB	Small mammal spp.	Pr	Unknown	Unknown	Nth Nambucca R	494391	6603857	N
16/4/21	DR/LA	9:00	1100	NB	Purple Swamp hen	D	Unknown	Unknown	Gumma floodplain	493516	6602170	N
16/4/21	DR/LA	9:00	1100	NB	Purple Swamp hen	D	Unknown	Unknown	Alignment	492953	6600937	N
16/4/21	DR/LA	9:00	1100	NB	Pheasant Coucal	Pr	Unknown	Unknown	Alignment	490118	6595363	N

Date	Observers	Start time	End time	Carriageway	Species	Probability	Sex & age class	Presence of pouch or back young	RK general location	Easting	Northing	Cleared off Rd (Y/N)
16/4/21	DR/LA	9:00	1100	NB	Tawny frogmouth	D	Unknown	Unknown	Warrell Ck bridge	492219	6598914	N
16/4/21	DR/LA	9:00	1100	NB	Fox	D	Unknown	Unknown	Nambucca River bridge	493863	6602842	N
23/4/21	LA/NM	8:45	10:30	NB	Chelidae spp.	D	Unknown	Unknown	Nambucca SF	496014	6608079	N
23/4/21	LA/NM	8:45	10:30	NB	Noisy miner	D	Unknown	Unknown	Nambucca SF	495759	6607733	N
23/4/21	LA/NM	8:45	10:30	NB	Medium bird	D	Unknown	Unknown	Gumma floodplain	493411	6601911	N
23/4/21	LA/NM	8:45	10:30	SB	Northern brown Bandicoot	D	Unknown	Unknown	Nth Mattick Rd	495067	6606479	N
23/4/21	LA/NM	8:45	10:30	SB	Medium mammal	D	Unknown	Unknown	Nth Nambucca R	494420	6603719	N
23/4/21	LA/NM	8:45	10:30	SB	Magpie Lark	D	Unknown	Unknown	Gumma floodplain	493438	6601923	N
23/4/21	LA/NM	8:45	10:30	SB	Chelidae spp.	D	Unknown	Unknown	Gumma floodplain	493418	6601871	N
23/4/21	LA/NM	8:45	10:30	SB	Purple Swamp hen	D	Unknown	Unknown	Gumma floodplain bridge	492915	6600834	N
23/4/21	LA/NM	8:45	10:30	SB	European Hare	D	Unknown	Unknown	Nth Warrell Ck	492432	6599280	N
23/4/21	LA/NM	8:45	10:30	SB	Small bird	D	Unknown	Unknown	Nth Upper Warrell Creek	490112	6595304	N

Table A2: Autumn 2021 road-kill results continued.

Date	Species	Fauna fence P/A & proximity	Fence condition	Proximity to xing structure	Proximity to drop-down	If FlyFox, proximity to camp; prox to canopy veg, prox to food
1/4/21	Flying Fox spp.	A	NA	NA	NA	9km
1/4/21	Chelidae spp.	P	Good	277	185	NA
1/4/21	Bandicoot spp.	A	NA	NA	NA	NA
1/4/21	Bearded dragon	A	NA	NA	NA	NA
1/4/21	Small mammal	A	NA	400	400	NA
1/4/21	Ibis	A	NA	NA	NA	NA
1/4/21	Medium bird	P	Good	NA	NA	NA
1/4/21	Grey-headed flying fox	A	NA	NA	NA	10km
1/4/21	Medium lizard	A	NA	NA	NA	NA
1/4/21	Snake spp.	A	NA	NA	NA	NA
9/4/21	Bandicoot spp.	P	Good	222	222	NA
9/4/21	Swamp rat	P	Good	262	194	NA
9/4/21	Red-necked wallaby	P	Good	294	26m	NA
16/4/21	Small mammal spp.	P	Good	67	67	NA
16/4/21	Black flying fox	A	Good	NA	NA	10.2km
16/4/21	Northern brown Bandicoot	A	NA	NA	NA	NA
16/4/21	Grey-headed flying fox	A	NA	NA	NA	14km
16/4/21	Wallaby spp.	A	NA	NA	NA	NA
16/4/21	Chelidae spp.	P	Good	415	57	NA
16/4/21	Bandicoot spp.	A	NA	NA	NA	NA
16/4/21	Wonga pigeon	P	Good	NA	NA	NA
16/4/21	Small mammal spp.	A	NA	NA	NA	NA
16/4/21	Purple Swamp hen	P	Good	NA	NA	NA
16/4/21	Purple Swamp hen	P	Good	NA	NA	NA
16/4/21	Pheasant Coucal	P	Good	NA	NA	NA
16/4/21	Tawny frogmouth	A	NA	NA	NA	NA
16/4/21	Fox	A	NA	NA	NA	NA
23/4/21	Chelidae spp.	P	Good	NA	NA	NA
23/4/21	Noisy miner	P	Good	NA	NA	NA
23/4/21	Medium bird	P	Good	NA	NA	NA
23/4/21	Northern brown Bandicoot	P	Good	10m	10m	NA
23/4/21	Medium mammal	A	NA	NA	NA	NA
23/4/21	Magpie Lark	P	Good	NA	NA	NA
23/4/21	Chelidae spp.	P	Good	374	240	NA
23/4/21	Purple Swamp hen	A	NA	NA	NA	NA
23/4/21	European Hare	P	Good	290	55	NA
23/4/21	Small bird	P	Good	NA	NA	NA