Noosa wildlife-vehicle injuries investigation (2021 – 2023)

Final report and recommendations

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30th November 2023

Executive summary

This report was developed for Sandy Bolton MP (State Member for Noosa) in response to significant community concern regarding wildlife road injuries in the Noosa region. Current types of wildlife-vehicle collision mitigation have had low success and there is a need for a comprehensive assessment of current wildlife road-kill hotspots. This project aimed to map and classify key road-kill hotspots with a view to informing a best-practice mitigation program. It provides baseline data to inform further targeted on ground assessments of key roads and implementation of site-specific wildlife road-kill mitigation by state and local government agencies.

Data on wildlife road injuries and deaths were obtained from wildlife rescue organisations, online open access databases and members of the public for the period from January 2021 – July 2023. Only recent data records were used for the purposes of this report to ensure that the patterns and hotspots identified were current. From this data, 615 records of wildlife road injuries were analysed. A total of 57 different species were involved in wildlife-vehicle collisions in the study period, including 30 bird, 17 mammal and 9 reptile species including two threatened species. The most injured species were, respectively, eastern grey kangaroos, koalas, common ringtail possums, echidnas, and swamp wallabies. Survival rates were low: 75% animals are known to have died from their injuries and outcomes were unknown for a further 20%. Pomona, Cooroy and Doonan had the highest rates of wildlife injury records and four state managed roads had the highest number of records: Bruce Highway (Cooroy to Federal), Pomona-Kin Kin Rd, Eumundi-Noosa Rd, and Louis Bazzo Dr. Records of wildlife road injuries have increased since the beginning of 2021. This data is supported by observations of high numbers of injured and dead animals by wildlife carers and members of the public, that suggest wildlife injuries from vehicle collisions have increased. It is important to note that the numbers of wildlife road injuries presented herein are an underestimate (due to the incomplete nature of wildlife road injury data) and the actual number is likely to be far larger than represented here in this report.

This report establishes baseline information to inform state and local government mitigation of wildlife road collisions for the region. Eleven roads / locations, with 29 hotspots, are identified herein and recommendations are made for each of these according to road speed and class, traffic volumes, road users and target wildlife species. However, these recommendations are based on a combination of desktop assessment and local knowledge of the areas in question only and the exact type and location of mitigation measures needs to be finalised based on on-ground assessments by road managers (state & local). Due to the recent increases in wildlife road injuries mitigation is urgently required to reduce impacts on iconic and endangered species, particularly on the Bruce Highway, Pomona-Kin Kin Road, Eumundi-Noosa Road, and Louis Bazzo Drive.

There is significant concern in the local Noosa community about growing human impacts on wildlife and the region is well placed, with a highly engaged community, to significantly reduce the impacts of vehicle-wildlife collisions. There is an over reliance on community organisations to record and manage what is an increasing and urgent wildlife management issue in the region. There is also an urgent need to develop a central database for wildlife injuries in the region and support for wildlife carers and organisations to care for wildlife and collect comprehensive data on injuries to inform adaptive management. As a primary tourism region and designated Biosphere, the Noosa region has an opportunity to implement innovative and localised mitigation solutions, which seek to preserve the unique biodiversity and showcase environmental commitments. A collaboration between state government, Noosa Shire Council, Noosa Biosphere Reserve Foundation, Tourism Noosa, and local wildlife groups is recommended to develop a public education campaign that is reflective of Noosa

ideals. Importantly, this campaign should form part of a long-term strategy to preserve Noosa's biodiversity and run alongside on ground site-specific mitigation as outlined in this report.

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Project Background

There has been significant community concern regarding wildlife roadkill across the Noosa region. Current levels of mitigation have had low success and there is a need for a comprehensive assessment of key wildlife road-kill hotspots to form a baseline for key stakeholders and land managers and inform a best-practice response and mitigation program.

Aims & Scope

- Map key road-kill hotspots using data provided by TMR, Noosa Council and the community.
- Classify characteristics of identified road-kill hotspots that will influence effectiveness of mitigation, e.g., road type, driver speed, proximity to corridors and protected areas, wildlife movement patterns, based on currently available data.
- Provide recommendations for best-practice road-kill mitigation methods based on individual hotspot characteristics.

Project limitations

The analyses undertaken in preparing this report were limited to those detailed in the project brief and are subject and limited to the scope and timeframes set out in the report. This report was developed to act as a preliminary overview of wildlife roadkill mitigation priorities at the time of analysis for the Noosa region and is not intended to be used for other purposes. The author disclaims any liability for decisions made based on conclusions and recommendations provided in this report.

Roadkill data is difficult to collect, and this project relied on data collected by external sources. While significant efforts were made to access data from all available sources, some potential sources did not have or provide data. It is very likely that the numbers of road injuries represented here, underestimate the actual number that took place in the region. No on-ground assessment of the roads or hotspots took place as this was outside the project scope. In addition, no data was available from state or local governments on the type and position of existing road-kill mitigation methods in the region.

Wildlife-vehicle collision records

Data collection and collation

Data sources

There are many factors that limit the prevalence of accurate data on wildlife road injuries; accurate data are traditionally hard to collect due to unsafe conditions, varied means of recording and differences in collector expertise. Most roadkill records are collected by wildlife rescue organisations, who rely primarily on volunteers who are often stretched to capacity and time poor, with little support. For this reason, wildlife injury data is often not collected and available data are likely to be incomplete and an underestimation of actual roadkill rates (Teixeira, Coelho et al. 2013). While sourcing accurate data remains a challenge, this data is essential to mitigation methods and management and there is a growing number of new initiatives to make data collection easier for management authorities reflects this need (Englefield, Starling et al. 2020).

There was no single wildlife injury data set existing for the Noosa region, so data that were available in electronic form were accessed from a variety of sources and compiled for the period from January 2021 – August 2023 (32-month period). Eleven organisations and individuals known to attend wildlife-vehicle collisions in, or treat injured animals from, the Noosa region were contacted, in addition to relevant staff in the Department of Transport and Main Road (TMR) and Noosa shire council (NSC). Records were also downloaded from iNaturalist (https://www.inaturalist.org/projects/australia-s-untold-roadtoll-recording-roadkill-and-road-trauma).

Data from the following wildlife rescue organisations were used in this study: WILVOS, Wildcare, Wildlife Rescue Queensland, Wildlife Rescue Sunshine Coast, Australia Zoo Wildlife hospital. The wildlife rescue community on the Sunshine Coast is passionate and collaborative and discussions with multiple representatives from organisations confirmed that all stakeholders likely to have knowledge of and/or access to roadkill records for the region had been contacted. Where electronic records were not available, but organisations highlighted any roads or areas of concern, these were recorded from these communications.

Additionally, records were supplied from TMR and members of the public. Initial meetings were held with TMR and NSC staff to assess land managers perspectives of wildlife vehicle collisions issues, previous mitigation methods and key roads of interest to managers in the region. Data records are not attributable to sources in this report, due to data provision agreements. A total of 665 records were included in the initial data screening.

Data screening

Data accuracy and completeness varied widely between sources and therefore data were carefully screened prior to analysis. Of the 665 suitable records, 49 duplicates were identified and removed.

Species identification can vary based on the expertise of the person attending the animal, however most of the wildlife rescuers in the region are well trained and experienced, therefore we assumed species identifications were correct in records provided from these organisations. From other sources, if we could not confirm the identification with a photo, we classified each record according to broad animal groupings e.g., macropod or bird, as it is assumed most people would be able to identify an animal to this level. For records provided by photograph, species identifications were confirmed where possible, and locations mapped manually using Google Earth from information provided.

Most records provided addresses rather than coordinates. For these records, locations were manually mapped in Google Earth, placing the location on the road directly in front of the property address. Locations used were those provided that were listed as the rescue / attendance address, not the address of the person reporting the incident. Some records did not provide an exact address or information that was deemed accurate enough to map to a single location; in these cases, the record was classified either to the street or suburb level. Once all records were screened, they were deidentified for analysis and inclusion in this report. These records were then collated and georeferenced.

Wildlife Vehicle collisions summary

A total **of 57 different species were involved in wildlife vehicle collisions** in the study period, including 30 bird, 17 mammal and 9 reptile species (Appendix – Table A1). Of these, two species are classified as threatened species in Queensland: the koala (Endangered) and grey-headed flying fox (Vulnerable). Those records that did not provide a reliable species identification were classified according to broad taxon groupings. The **most recorded species were respectively eastern grey kangaroos, koalas, common ringtail possums, echidnas, swamp wallabies, kookaburras, common brushtail possums and red-necked wallabies**, all of which recorded a minimum of twenty recorded injuries.

Most animals died because of their injuries (75%) and outcomes were unknown for 20% of records. Of those animals that had outcomes recorded, only 19% were either sent to care or released (Fig. 1). It is important to note that these are initial outcomes, and some animals are likely to have died in care, so the mortality rates of these records are likely underestimated here. **Survival rates were lowest for macropods, possums & gliders, bats, and ground mammals** (Appendix 2). It should be reiterated that these records likely underestimate the extent of the wildlife injury on roads in the region by at least half and interviews conducted with carers during this study highlighted this.

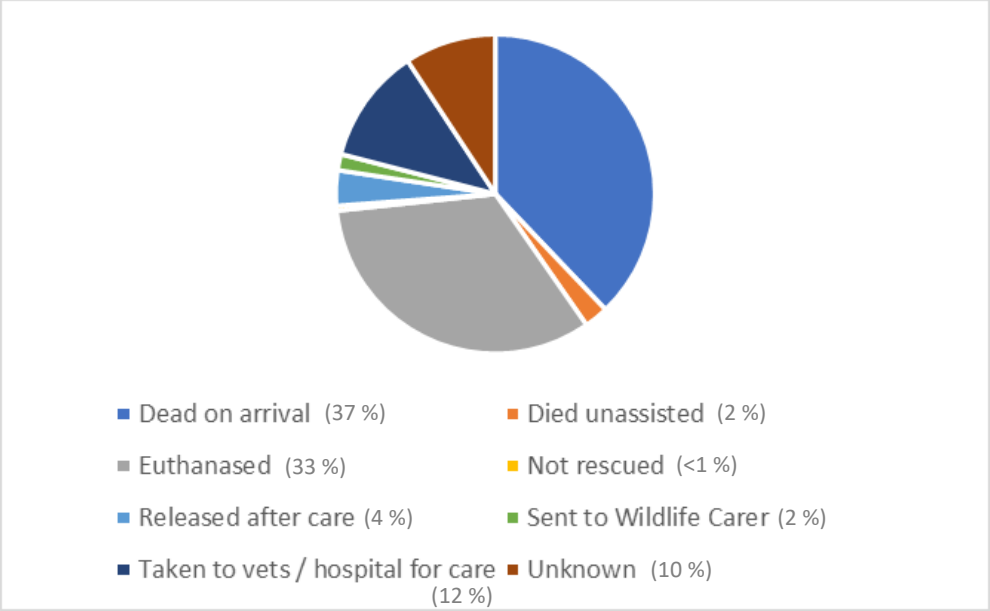

Figure 1. Initial outcomes for animals of wildlife vehicle collisions in the Noosa region (2021 – 2023).

In 2021, 210 wildlife injuries on roads were recorded (Average = 17.5 / month), with 228 recorded in 2022 (Average = 19/month). For the first seventh months of 2023, 178 injuries were recorded (Average = 25.5 per month), indicating an increase in monthly average rates of records of 32% in August 2023, over the study period. Records were summarised according to the month of injury for 2021 & 2022 data only (n = 432), as records for 2023 only covered half of the year (Fig. 2). More records occurred in the second half of the year (60%), with peaks between August and October and the lowest number in June. These data together show that records of **wildlife roadkill have increased in the Noosa region since the beginning of 2021**. This data is supported by observations of on ground carers and members of the public that suggest **wildlife injuries from vehicle collisions have increased.**

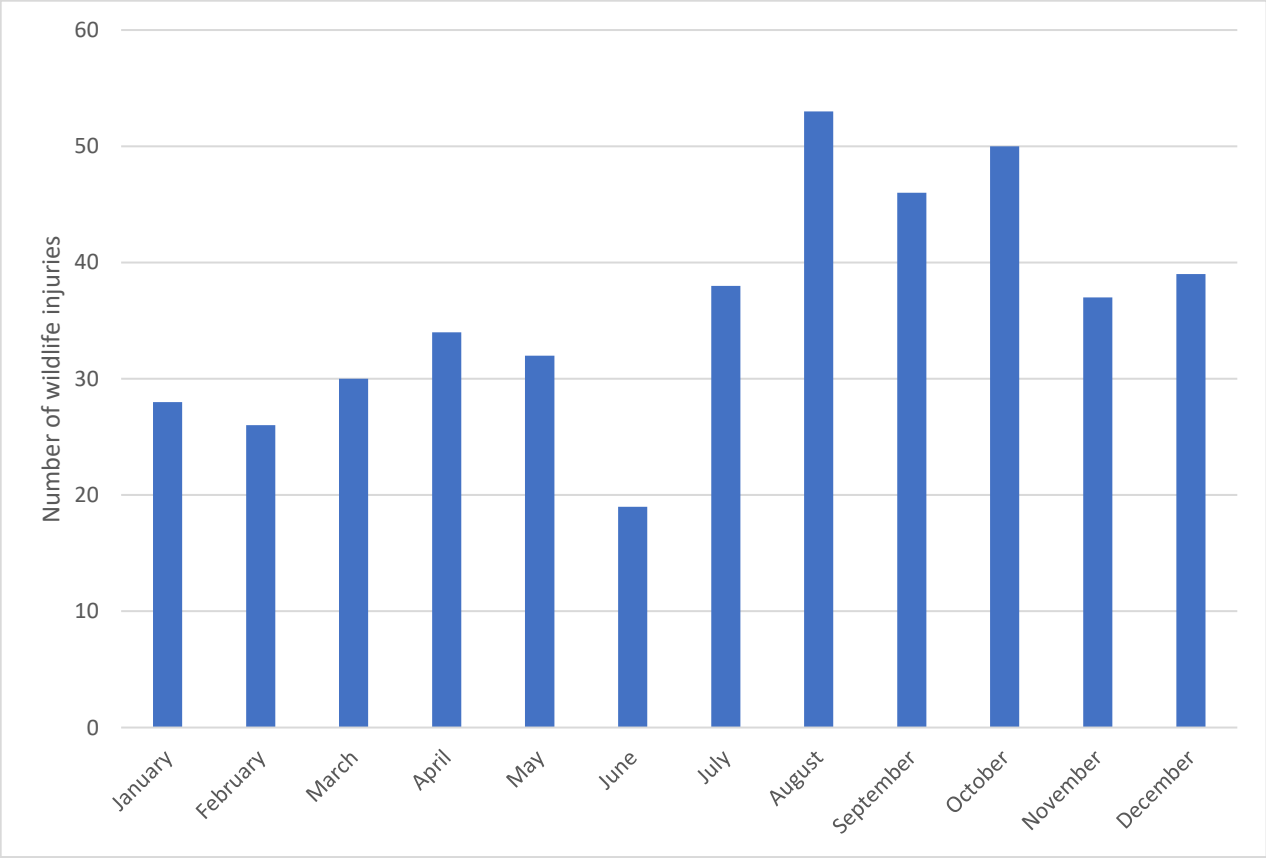

Figure 2. Injuries and/or deaths from wildlife-vehicle collisions per month recorded in the Noosa region in 2021 & 2022

All records (n = 609) were assessed by suburb and wildlife injuries were recorded in 31 suburbs. For the purposes of this report, some records are reported for the Eumundi region for records that are on roads that border NSC and Sunshine Coast council boundaries, many occurring on Eumundi Noosa Road. **Pomona, Cooroy and Doonan had the highest rates of injury records** (Table 1).

Table 1. Significant areas of wildlife road injuries in the Noosa region, showing suburbs with 15 or more from January 2021 – August 2023.

Suburb	**Number of wildlife road injuries / deaths**
Pomona	85
Cooroy	69
Doonan	60
Noosaville	37
Noosa heads	33
Tewantin	33
Eumundi	24
Cooroibah	26
Peregian springs	24
Cootharaba	24
Kin Kin	21
Peregian beach	21
Lake Macdonald	17
Cooran	15
Tinbeerwah	15
Pinbarren	15

Key roads were identified through analysis of the number of wildlife road injury records and interviews with key stakeholders. Eumundi-Noosa Road, Bruce Highway, Louis Bazzo Drive and Pomona-Kin Kin Road had the highest number of wildlife road injury records (Table 2).

Table 2. Key roads for wildlife vehicle collisions in the Noosa region. Roads highlighted in **bold** were those identified as hotspots through stakeholder engagement.

Road name	Number of wildlife road injury records
Eumundi-Noosa Rd	33
Bruce Highway	32
Louis Bazzo Dr	27
Pomona-Kin Kin Rd	26
Sunrise Rd	13
McKinnon Dr	12
David Low Way	12
Emu Mountain Rd	11
Cooroy-Noosa Rd	11
Sunshine Motorway	9
Old Bruce Highway	9
Lake Cooroibah Dr	9
Dath Henderson Rd	8
Black Mountain Rd	6
Beckmans Rd	6
Eenie Creek Rd	5
Pioneer Rd	5
Cootharaba Rd	5
Pound Rd	5
Yurol Forest Dr	5
Wust Rd	5
Gympie Tce	4
Gibson Rd	4
Noosa Dr	4
Ringtail Creek Rd	3
Weyba Downs Rd	2
Hilton Tce	2
Lake Weyba Dr	1
Walter Hay Dr	1
Noosa Pde	1
Hastings St	1

Wildlife road injury hotspots

Plotting data

369 records had sufficient location detail to be mapped to a specific location and analysed further to identify hotspots on key roads.

GIS analysis

Wildlife injury records were mapped and summarised according to key wildlife groups i.e., those with highest numbers of injury records across the region (Fig. 3). Areas of frequently recorded wildlife injuries (hotspots) were visualised using a Heatmap (Kernel Density Estimation) in QGIS (Fig. 4). Hotspots visualised were then assessed in two ways. Firstly, hotspots were assessed per key animal group i.e., koala, macropod, possum, and glider. Secondly, for roads with the highest wildlife injury records identified above, the number and location of hotspots were identified.

Assessing injuries at both the taxon and road level, rather than only at specific hotspots was done to account for the nature of the available data and information provided by wildlife groups for the Noosa region. This type of approach considers the large number of wildlife injury records that were i) included in this report but not able to be mapped with enough precision for hotspot mapping and ii) that many wildlife injuries are not recorded and therefore there may be other areas of high wildlife injury that are not accounted for in the hotspot data.

Roadkill mitigation recommendations presented in this report are based on the outcome of these two methods of assessment to reduce inherent bias from available and incomplete data. Areas of roads with injury records that dissect or are adjacent to wildlife reserves and / or key resident wildlife populations are also highlighted for mitigation. This is because they represent protected wildlife habitats that are likely to remain important areas for wildlife movements in the region in the future. This is especially significant for areas in the Noosa region where transitions from State Forests to National Parks are occurring in recognition of the need to further protect these habitats. Wildlife road injuries adjacent to these parks will remain a key risk to the wildlife, including endangered koalas, in these areas.

Injury location records mapped by key species affected

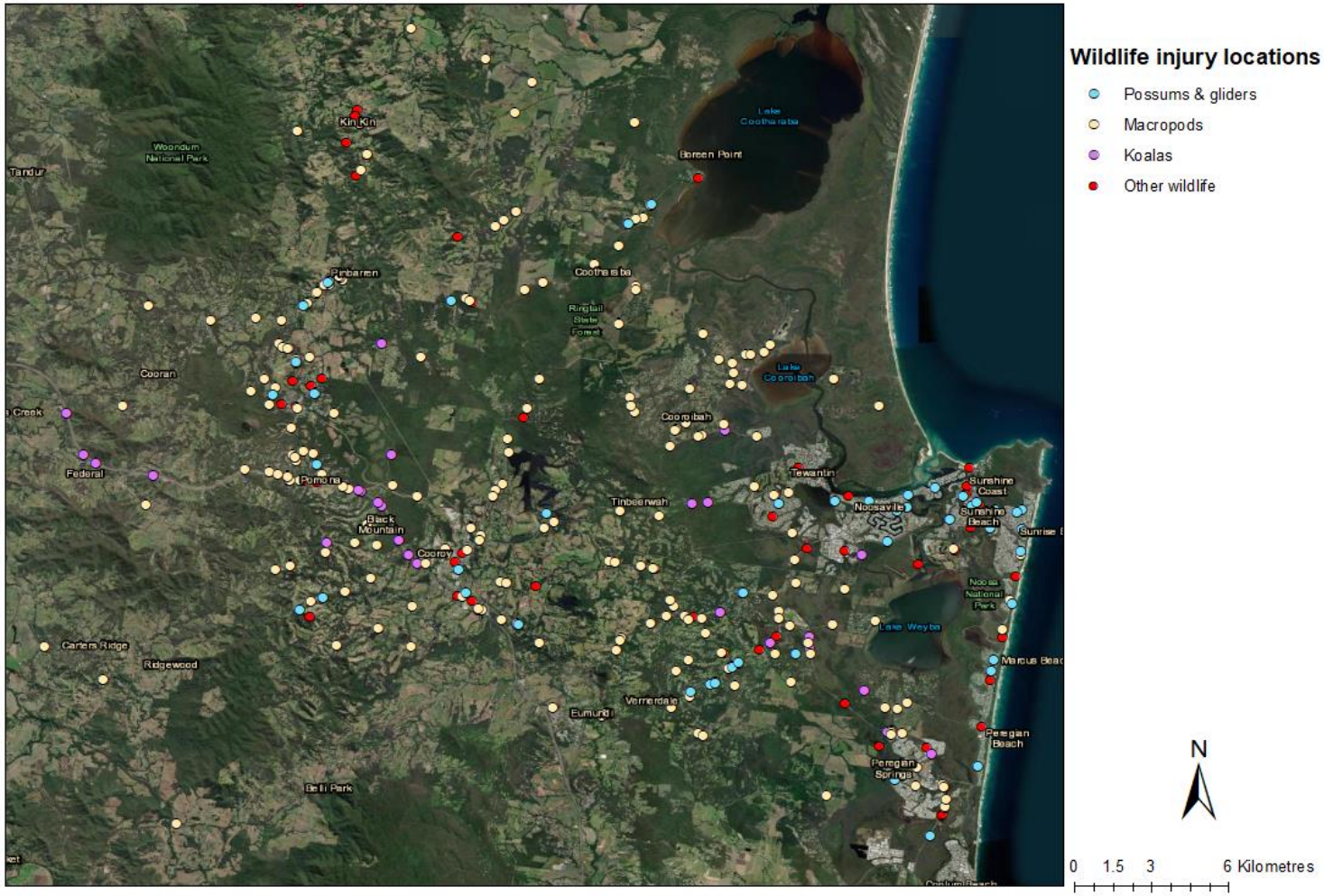

Figure 3. Map of the Noosa region showing wildlife injury locations from 2021 – July 2023

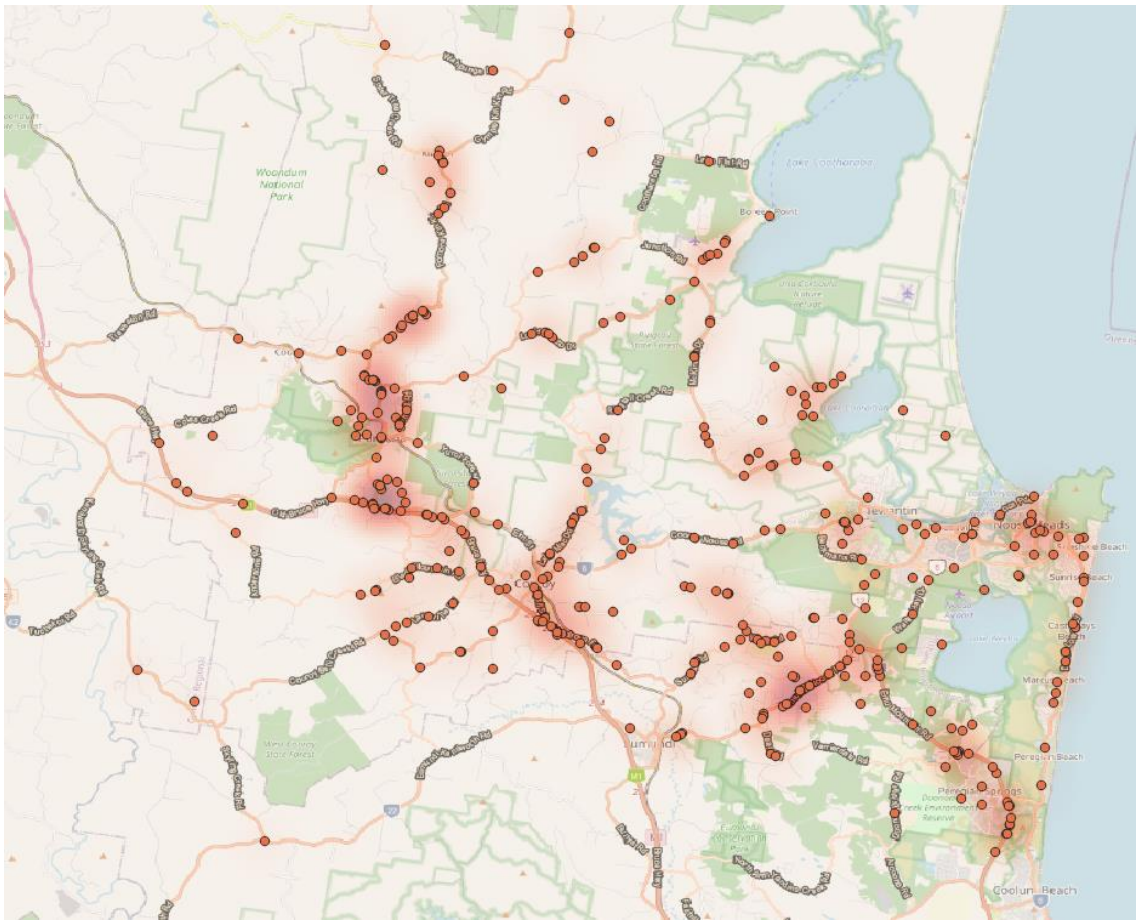

Figure 4. Wildlife injury location hotpots visualised across Noosa shire from 2021 – July 2023

Eleven roads / areas with 29 hotspots are considered here as high priority areas for wildlife roadkill mitigation methods in the Noosa Shire:

1. Bruce Highway (Cooroy to Black Mountain) / Old Bruce Highway (Pomona) (Fig. 5)
2. Eumundi-Noosa Rd (Doonan to Tewantin) (Figs. 9 & 10)
3. Louis Bazzo Drive (Pomona to Cootharaba) (Fig. 6)
4. Pomona – Kin-Kin Road (Pomona, Pinbarren, Kin Kin) (Figs. 5 & 6)
5. Sunrise Road / Dath Henderson Road / Wust Road (Doonan, Tinbeerwah) (Fig. 8)
6. McKinnon Drive (Fig. 7)
7. Emu Mountain Road / Sunshine Motorway (Peregian Springs, Weyba Downs) (Fig. 10)
8. Cooroy Noosa Road (Cooroy & Tinbeerwah) (Fig. 5)
9. Lake Cooroibah Drive (Cooroibah) (Fig. 7)
10. David Low Way (Marcus Beach, Sunrise Beach, Sunrise Beach, and Sunshine Beach) (Figs. 8 & 10)
11. Noosa heads / Noosaville, multiple roads (Fig. 8)

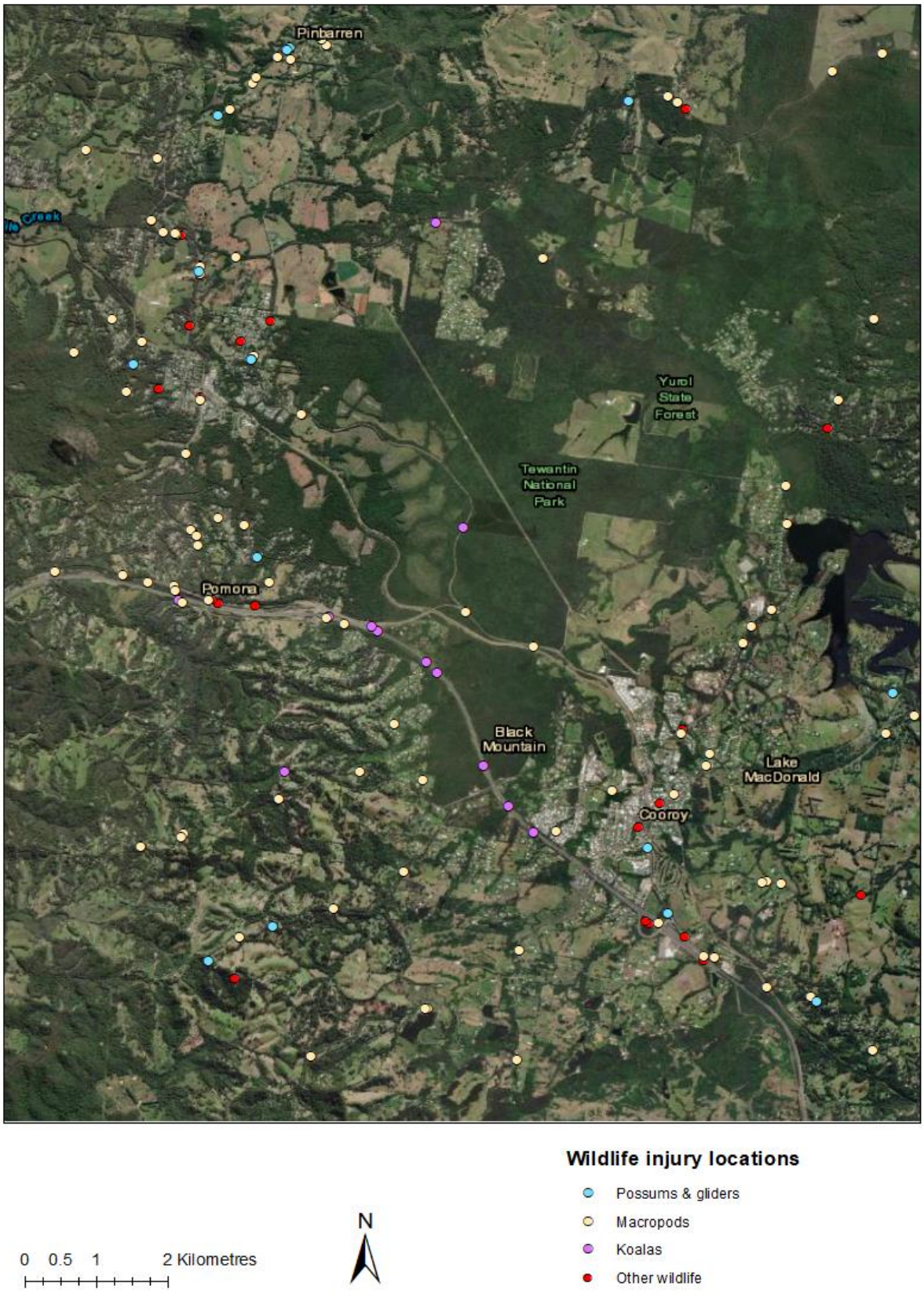

Figure 5. Wildlife injury record locations in northwestern Noosa shire, including the Bruce Highway, Pomona-Kin Kin Road, Louis Bazzo Drive and Cooroy-Noosa Road.

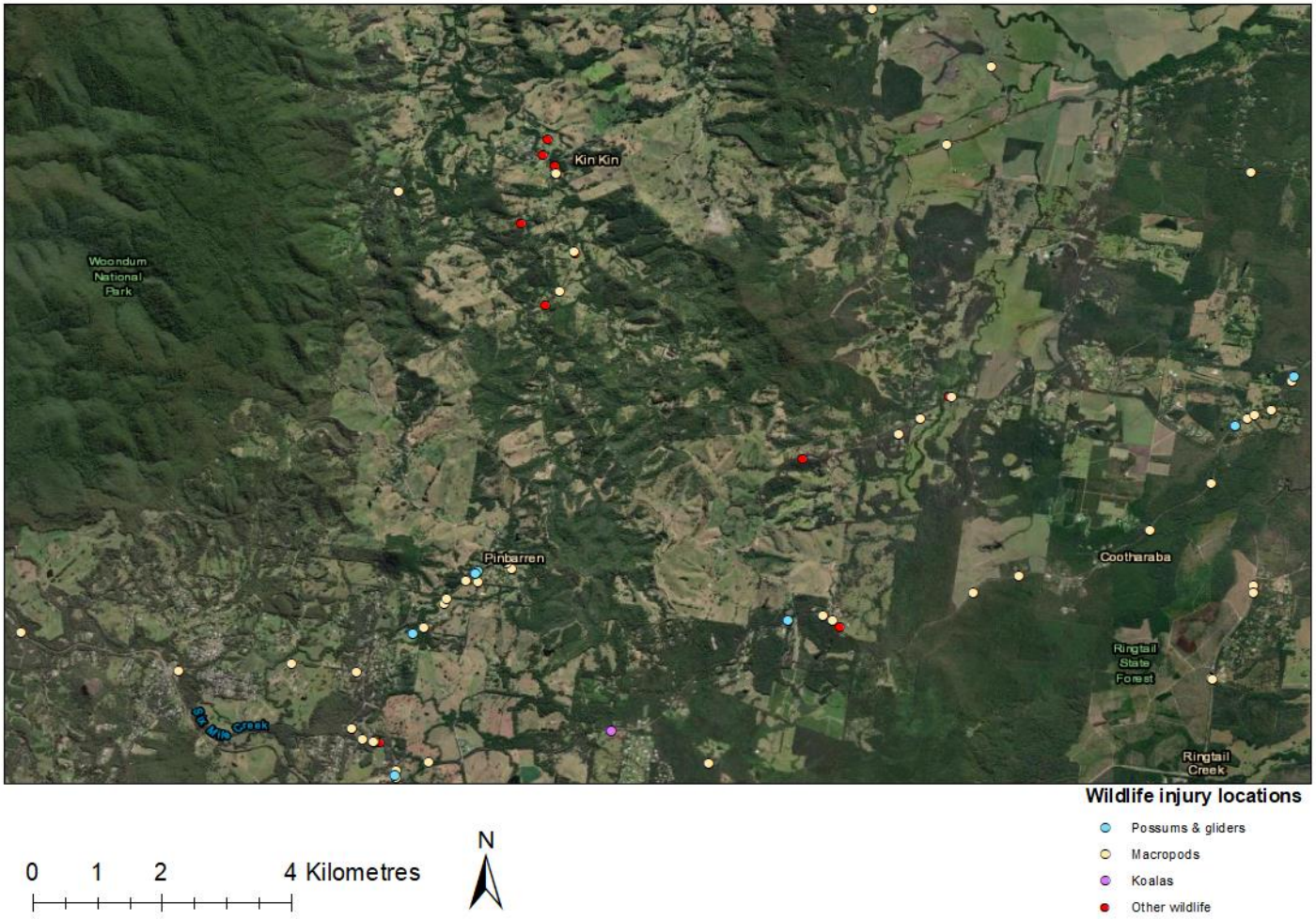

Figure 6. Wildlife injury record locations in the Kin Kin / Pinbarren area of Noosa shire, including Pomona-Kin Kin Road and Louis Bazzo Drive.

Figure 7. Wildlife injury record locations in the Cootharaba / Cooroibah area of Noosa shire, including Mackinnon Drive and Lake Cooroibah Drive.

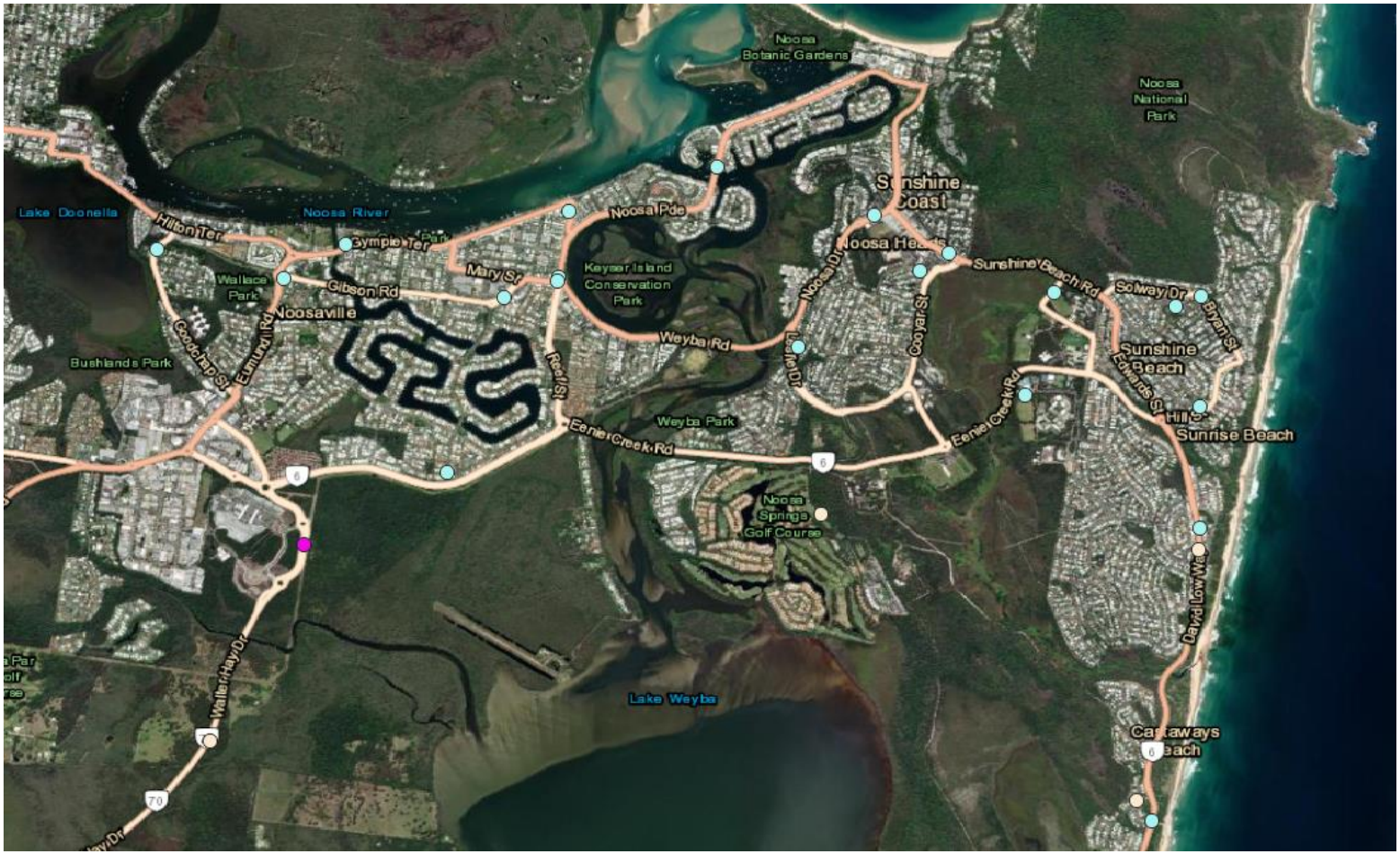

Figure 8. Wildlife injury record locations in the Tewantin / Noosa heads area of Noosa shire including David Low Way.

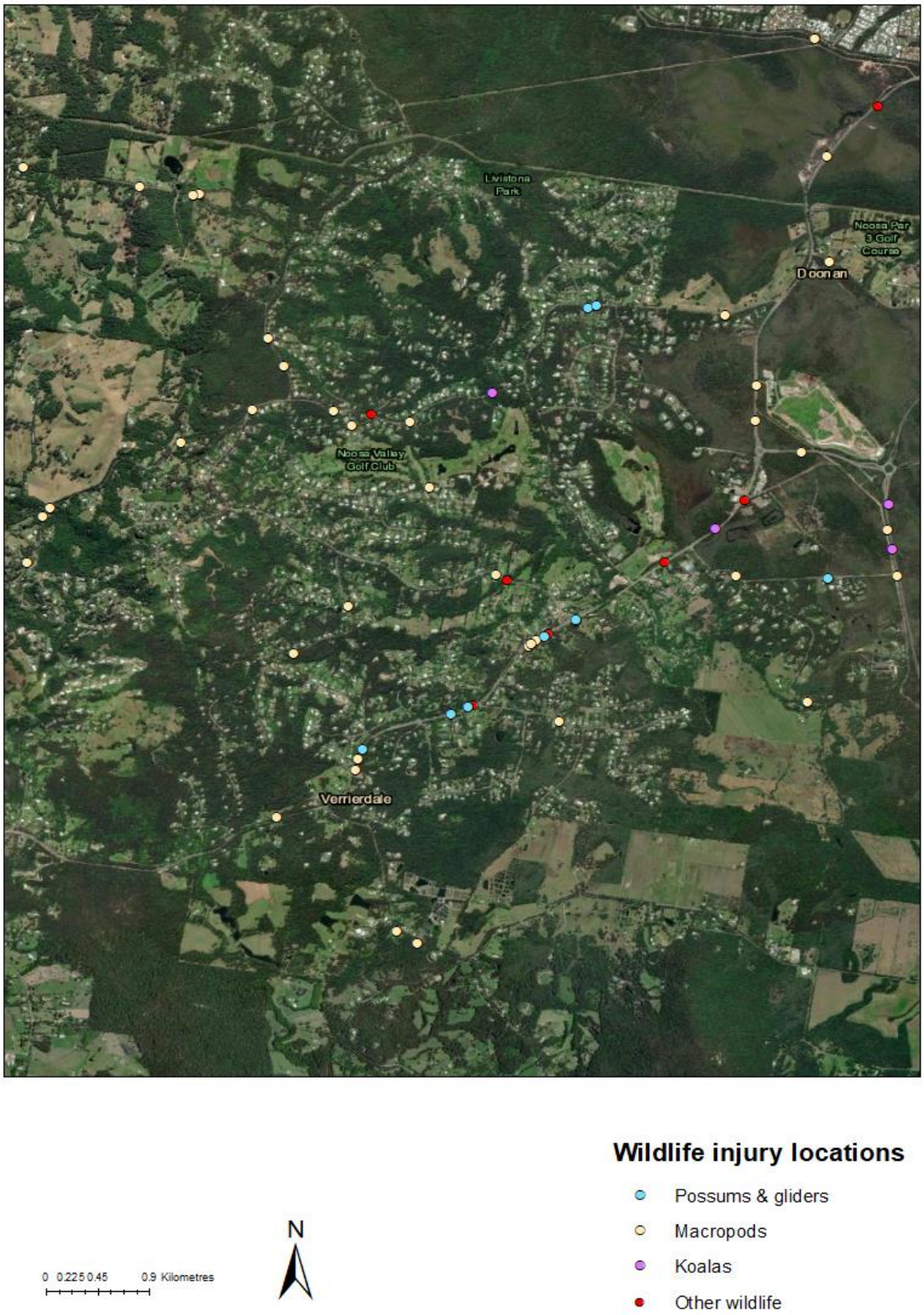

Figure 9. Wildlife injury record locations in the Doonan / Tinbeerwah area of Noosa shire, including Eumundi-Noosa Road, Sunrise Road and Dath Henderson road.

Figure 10. Wildlife injury record locations in the Peregian / Weyba Downs area of Noosa shire, including Eumundi-Noosa Road, Emu Mountain Road, Sunshine Motorway and David Low Way.

Macropod injuries

Macropod injuries occur across most of the Noosa shire, except for Noosa heads / Sunshine beach area. Macropods are by far the most recorded vehicle wildlife collisions in the region and pose the highest risk to human safety. Across Australia, macropods are the most involved wildlife in car crashes causing human injuries, fatalities, and property damage at a high economic cost (Rowden et al. 2008. Since recent research in SEQ indicates localised declines of macropods (Brunton et al. 2018) and that macropod collisions are increasing in the region, there is an urgent need for mitigation to avoid continuing macropod and human injury. Macropods may have home ranges from 10 to 150ha depending on the environment type (Descovich et al. 2016) however, their daily movement behaviours are usually habitual and occur over smaller areas where sufficient habitat is available (Brunton et al. 2018, Coulson et al. 2014). This means that identifying and monitoring key crossing points for resident macropod populations and applying targeted mitigation in these locations is a good approach to managing macropod-vehicle collisions at a local scale.

Koala injuries

Koala injuries were centred in 3 areas: Weyba Downs / Peregian Springs, Bruce Highway (Pomona – Federal) & Cooroy Noosa Road. While koala fencing is in place on the Bruce Highway, it is ineffective. Current static signage and seasonal VMS systems on Cooroy Noosa Rd are in place however koalas are still being killed on this road. Koalas are classified as endangered in Queensland, and with current population estimates for the region uncertain, any death on roads may have severe implications for local conservation efforts. Roads are widely recognised as a key risk factor to Southeast Queensland koala populations (Dexter et al. 2018) and management of road injury risk should be assessed at a local scale. A previous report on koala road injuries in the study area acknowledged the risk of road injury, recommending a reduced speed limit at key koala crossing areas, as well as koala exclusion fencing and underpasses for Cooroy Noosa Rd and McKinnon Dr (O2 Ecology, 2017). This report also recommended changes to speed limit zones (i.e., 60 – 80km/hr) to outside of crossing hotspot areas for Cooroy Noosa Rd and McKinnon Dr, as well as for other areas in the region. As the koala location data used for this study is out of date, it is likely that koalas may no longer persist in some area and that some crossing hotspots may not be accurate. Nonetheless, the information provided in this report would be of significant use to local koala road injury management.

Possum & glider injuries

Most possum injuries occurred in the Noosa Heads / Tewantin region. The roads in this area are not highlighted as roads with the highest wildlife injuries reported in this report, however the issue of possum deaths on roads is a significant one in this area. Additionally, glider and possum records occur on key wildlife injury roads Eumundi Noosa Road and David Low Way. Information provided from local wildlife rescuers indicates that the available records underestimate the number of possum deaths in these areas, so this is highlighted as a key mitigation consideration. In more fragmented landscapes such as urban areas, possums and gliders need to utilise built infrastructure such as buildings or power lines or to move down to the ground, placing them at higher risk of injury. In order to reduce this risk, aerial crossing structures such as bridges, poles and ropes present a simple and effective option to improve connectivity for arboreal mammals in these areas and have been proven to be utilised by many possum and glider species (Goldingay et al. 2013, Soanes et al. 2015). These structures can be installed on high speed and high-volume roads.

Wildlife-vehicle collision mitigation

Road characteristics influencing mitigation

Data on traffic volumes was provided by TMR and NSC for roads with high numbers of wildlife injuries and hotspots. For state managed roads, traffic data was supplied as average daily traffic volumes (2023). For council managed roads, data was provided as Austraffic Video Intersection counts of peak time periods in 2023. Traffic volumes for NSC managed roads are the total numbers of vehicles / 6.5 hr period (rather than over a 24-hour period) as this was the only data available. For David Low Way, an average of counts from six camera locations was used. No data was available from NSC for Dath Henderson Dr or Wust Rd. Data from TMR on the southern section of David Low way (Sunshine Coast Council region) is also provided for context.

Roads were categorised according to jurisdiction, class (QLD Roads & tracks, QLD Spatial catalogue), and predominant traffic users (Table 3). Roadkill hotspots on these roads were categorised and assessed according to road speed, road straightness, adjacent reserves and key wildlife species affected (Table 4).

Table 3. Road characteristics for high wildlife road-kill locations in the Noosa region

Road Name	Road Jurisdiction	Road class	Traffic volumes (average daily volumes / *vehicle count per 6.5 hrs*)	Predominant Traffic users
Bruce Highway (10A)	TMR	State Highway	22055	Visitor, local & industry
Eumundi-Noosa Rd (140)	TMR / NSC	Secondary road	13210	Visitor, local & industry
Louis Bazzo Dr (1412)	TMR / NSC	Secondary road	1850	Local & industry
Pomona-Kin Kin Rd (141)	TMR	Secondary road	1072	Local & industry
Sunrise, Dath Henderson & Wust Rds., Tinbeerwah	NSC	Connector road	**487 (Sunrise only)*	Local
Mackinnon Dr (1421)	TMR / NSC	Secondary road	4312	Local
Emu Mountain Rd / Sunshine Motorway (144)	TMR	Secondary road / Motorway	19405	Visitor & local traffic
Cooroy-Noosa Rd (142)	TMR	Secondary road	11943	Visitor & local
Lake Cooroibah Rd	NSC	Secondary road	na	Local traffic
David Low Way (Peregian to Sunshine Beach) (Coolum to Peregian)	NSC / TMR	Secondary road	**3636* 11364	Visitor & local
Noosa heads & Tewantin (various roads i.e., Gympie Terrace / Gibson Rd area)	NSC	Secondary road	na	Visitor & local

Table 4. Factors likely to influence road-kill mitigation in key wildlife roadkill areas in Noosa

Road Name	# of hotspots identified	# wildlife injuries	Maximum Road speed (km/hr) / straightness	Number of areas recommended for mitigation	Key fauna groups affected (in order of number of records)
Bruce Highway, Old Bruce Highway	5	32	110, 100 / mostly straight, 3 hotpots occur near curves	5	Koala, macropod, other
Eumundi-Noosa Rd	3	33	80 / All hotspots occur near curves	3	Macropod, possum & glider, koala, other
Louis Bazzo Dr	4	27	90 / Mostly winding	4	Macropod, possum & glider, koala, other
Pomona-Kin Kin Rd	5	26	80 / Mostly winding	3	Macropod, possum & glider, other
Sunrise Rd, Dath Henderson Rd, Wust Rd	3	26	70, 80, 50 / Mostly winding	3	Macropod
Mackinnon Dr	3	12	100 / mostly straight, 1 hotpot occurs near curve	3	Macropod, koala
Emu Mountain Rd / Sunshine Motorway	3	20	100 / mostly straight, all hotspots occur near curves	3	Macropod, koala
Cooroy-Noosa Rd	3	11	80 / mostly winding, 2 hotspots occur near curves	3	Macropod, koala
Lake Cooroibah Rd	1	9	70 / mostly winding, injuries occur near curves	2	Macropod
David Low Way (Peregian to Sunshine Beach) (Coolum to Peregian)	4	12	70 / Mostly straight	2	Possum & glider, macropod, other
Noosa heads / Tewantin	2	20+	50 – 60 / Mostly straight, occur across multiple roads and in-built areas	2	Possum & glider, other

Key wildlife road injury areas

Bruce Highway (Eumundi – Federal) / Old Bruce Highway (Pomona)

Key Risks

High speed road with large traffic volume adjacent to rural land, reserves, and large tracts of remnant vegetation. Higher risk of injury / death to wildlife and drivers from collisions.

Individual hotspot mitigation considerations (Fig. 12)

A: 110km/hr - Koala hotspot, occurs between two bends, koala fencing incomplete or unmaintained?

B: 110 km/ hr - Koala and macropod hotspot, injuries on Bruce Highway and Old Bruce Highway mostly on straight stretches, many locations to intersections, would be suited to speed reduction for Old Bruce Highway (100km/hr) – not sure if fencing is continuous – concrete barriers

C: 110 km/hr: Macropod hotspot, injuries adjacent to on and off ramps on motorway – issues with fencing here? Lower speeds (60km/hr) due to on/off ramps on Old Bruce Highway. no fencing here? concrete barriers in centre trap animals on road

D: 110 km/hr: Koala hotspot - koala fencing in place - incomplete or unmaintained? Road dissects large tract of intact vegetation.

E: 110 km/hr: Multiple species, including macropods. Injuries adjacent to on and off ramps on motorway – no fencing here- concrete barriers in centre trap animals on road

Mitigation recommendations

Wildlife inclusion fencing is in place but ineffective on the Bruce Highway (A, B, D). It is recommended that the fencing be assessed for damage and that a consistent maintenance regime be developed to ensure its completeness. In addition, macropod and koala escape routes should be installed at regular intervals and in areas adjacent to injury hotspots, if not currently present. For locations C & E, assessment of fencing with respect to on and off ramps is suggested. Finally, given that animals are still gaining access to the road despite the wildlife fencing, moveable interactive signage should be installed in peak traffic periods, particularly for those that coincide with peak wildlife movement and injury periods (November to February). For the Old Bruce Highway (B & C), a combination of lowered speed limits and bespoke localised wildlife signage would be most appropriate.

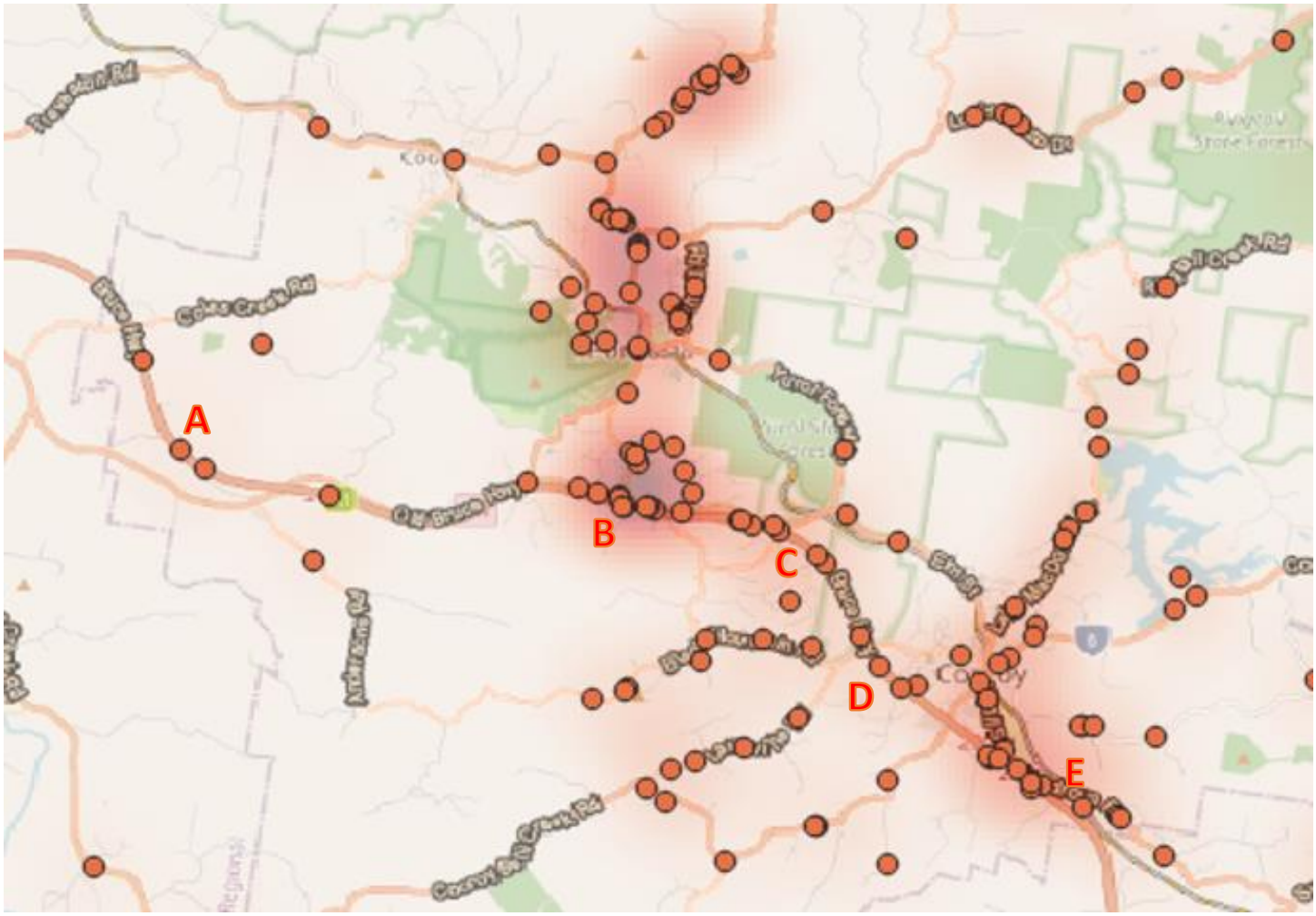

Figure 12. Key areas for wildlife-vehicle collision mitigation on the Bruce Highway (Cooroy – Federal) and Old Bruce Highway (Pomona), in the Noosa region.

Eumundi-Noosa Road

Key Risks

Moderate speed road with medium to large traffic volume adjacent to rural land, reserves, and large tracts of remnant vegetation, with low lighting. Eastern end dissects several key environmental reserves. High proportions of tourist traffic.

Individual hotspot mitigation considerations (Fig. 13)

A: 80km/hr – Macropod hotspot

B: 80km/ hr – Macropod & Possum & glider hotspot with resident adjacent macropod populations, hotpots occur after bends

C: 80 - 60 km/hr Adjacent to key reserve – Koala record, macropods, and scattered records of different fauna types

Mitigation recommendations

Most injuries occurred along areas that are adjacent to curves in the road, suggesting speed and visibility play a role in collisions. Assessment of roadside vegetation and nighttime lighting in the target areas (A, B & C) could improve driver reaction time. Vehicle activated wildlife warning signage located at either end of Section B would increase driver awareness especially important for a higher proportion of tourist drivers. A continuation of 60/km speed limit for Section C (Emu Mountain Road to Beckmans Road) is suggested as this area dissects key reserves and tracts of continuous bushland. As key entrance points to tourist areas, with both local and tourist traffic indicates the use, local and tourist education programs and bespoke localised wildlife signage, particularly for A & C.

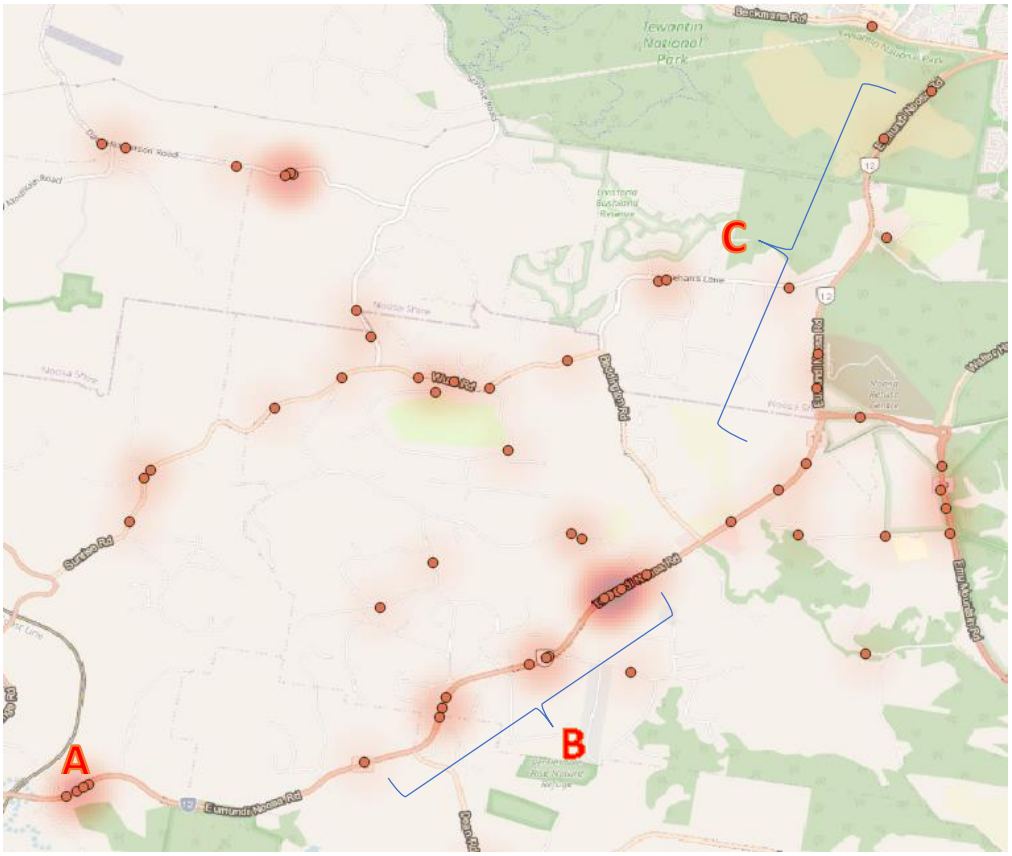

Figure 13. Key areas for wildlife-vehicle collision mitigation on Eumundi-Noosa Road

Louis Bazzo Drive

Key Risks

High speed road with medium traffic volume adjacent to rural land, reserves, and large tracts of remnant vegetation, with low lighting. Majority of road travels through environmental reserves with known koala and macropod populations.

Individual hotspot mitigation considerations (Fig. 14)

A: 90km/hr: Macropod hotspot, nearby to riparian corridor (Coorora creek) and in between curved sections

B: 90km/ hr: Koala injury record, nearby to riparian corridor (Six-mile creek) and large tracts of intact vegetation

C: 90 km/hr: Macropods and scattered records of different fauna types. Adjacent to key reserves (Ringtail Forest Reserve) and in winding road sections.

D: 90 km/hr: Macropods and possums & gliders of different fauna types. Dissects large tract of intact bushland and injuries occurred after road curves.

Mitigation options

Most injuries occurred along areas that are adjacent to curves in the road, suggesting speed and visibility play a role in collisions. Assessment of roadside vegetation and nighttime lighting in the target areas (B, C & D) could improve driver reaction time. A large proportion of traffic is local so public education campaigns and bespoke localised wildlife signage would also be suitable for all sections. A significant reduction in speed limit for the whole road, but in particular for Section D (Ringtail Forest Reserve to Boreen Point) is recommended as this area dissects key reserves and tracts of unfenced continuous bushland, which combined with poor visibility, creates a higher risk of injury / death to wildlife and drivers from collisions. Rope bridges for possums & gliders would be suitable for Sections C & D in areas where the road dissects reserves.

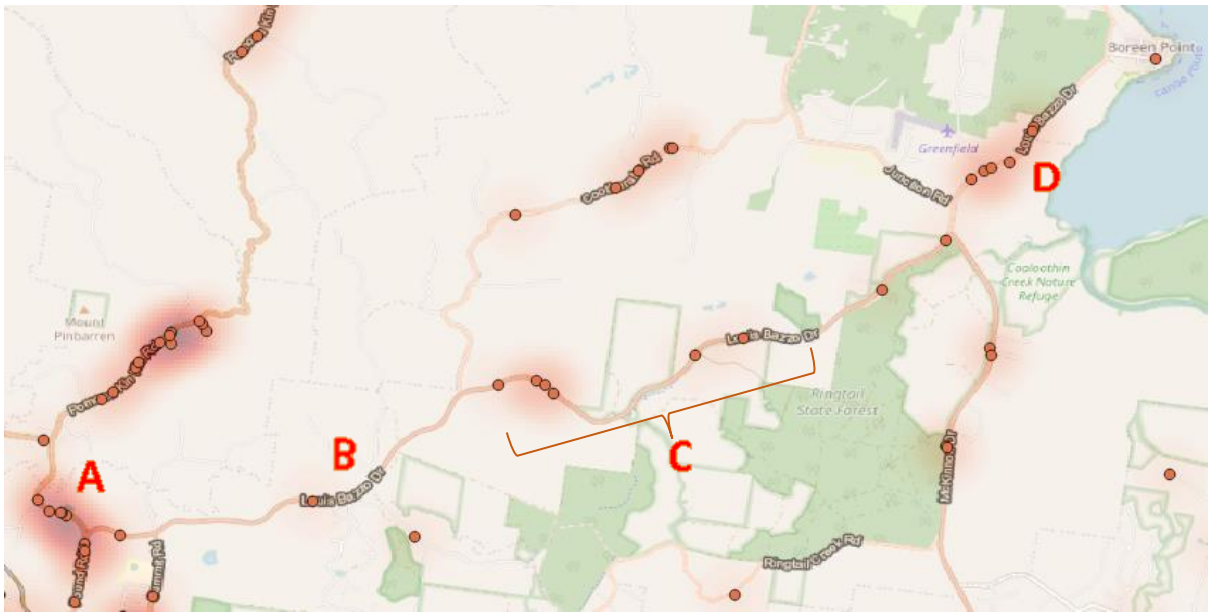

Figure 14. Key areas for wildlife-vehicle collision mitigation on Louis Bazzo Drive

Pomona-Kin Kin Road

Key Risks

Moderate speed road with low traffic volume, adjacent to rural land, reserves, and large tracts of remnant vegetation, with low lighting. Majority of road travels through environmental reserves with known koala and macropod populations. Recent increases in volumes of trucks, including those servicing the quarry, creates a higher risk for wildlife.

Individual hotspot mitigation considerations (Fig. 15)

A: 80km/hr: Macropod hotspot, nearby to conservation park and riparian corridor (Six Mile creek) and in between road curves.

B: 60 - 80km/ hr: Macropod hotspot, nearby to Woondum conservation park and riparian corridor (Pinbarren creek). Nearby to change in speed limit.

C: 60 - 80 km/hr: Macropods hotpot and other wildlife. Nearby to change in speed limit, amidst road curves.

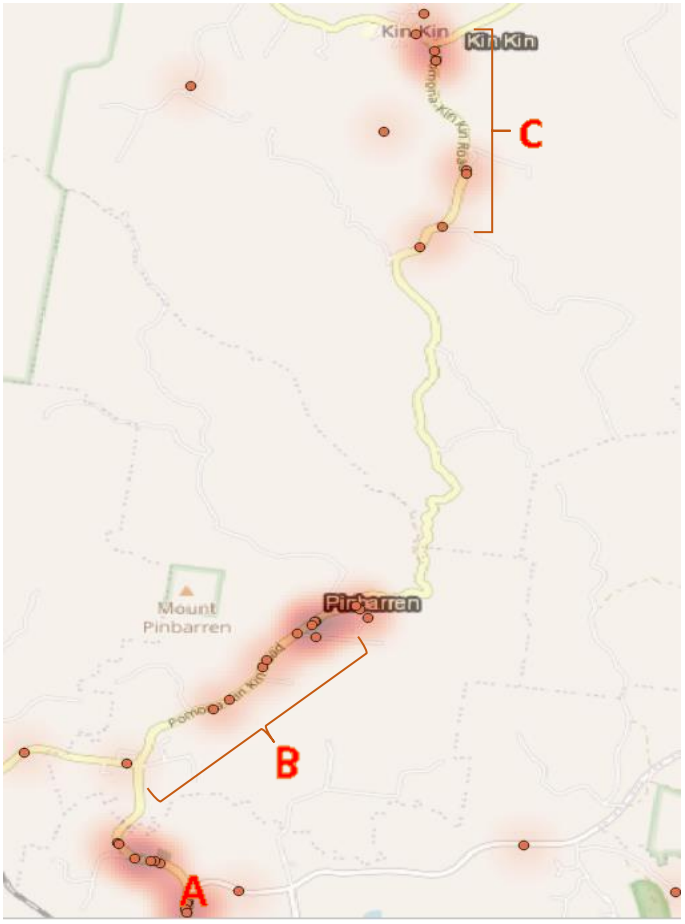

Figure 15. Key areas for wildlife-vehicle collision mitigation on Pomona Kin Kin Road

Mitigation options

Most injuries occurred along areas that are adjacent to curves in the road, suggesting speed and visibility play a role in collisions. Assessment of roadside vegetation and nighttime lighting in the target areas (B & C) could improve driver reaction time. A large proportion of traffic is local so public education campaigns targeted at both residential and industry, and bespoke localised wildlife signage would also be suitable for all sections. A reduction in speed limit for the whole road, but in particular for Sections A (Pound Road to Six Mile Creek Conservation Park) and C (Binalong Park to Sallwood Court) is recommended, as this area is adjacent to key reserves and tracts of unfenced continuous bushland, which combined with poor visibility, creates a higher risk of injury / death to wildlife and drivers from collisions. Extension of 60km/hr zone to the south of Pinbarren and south of Kin Kin is also recommended.

Tinbeerwah (Sunrise Rd/ Dath Henderson Rd / Wust Rd)

Key Risks

Low to Moderate speed roads with low traffic volumes, adjacent to rural residential properties, reserves, and large tracts of remnant vegetation, with low lighting. Significant macropod populations in area, including on Noosa Valley golf course.

Individual hotspot mitigation considerations (Fig. 16)

A: 70km/hr: Macropods, opposite large tract of bushland.

B: 50 km/ hr: Macropod populations present on golf course with tracts of remnant vegetation throughout. Golf course traffic.

C: 80 km/hr: Macropods, injuries at either end of long straight stretch.

Mitigation recommendations

Injuries occurred in A & B along areas that are adjacent to curves in the road, suggesting poor visibility plays a role in collisions. Assessment of roadside vegetation and nighttime lighting in all target areas is recommended. Most of the traffic is local so targeted local public education (residential & golf course), and bespoke localised wildlife signage would also be suitable for all sections. A reduction in speed limit on Section C is recommended as excessive speed is a likely cause of injuries along this street. Animal or vehicle activated signs would also be suitable.

Figure 16. Key areas for wildlife-vehicle collision mitigation on Sunrise, Wust and Dath Henderson Roads, in the Noosa shire

McKinnon Drive

Key Risks

Moderate speed road with low to medium traffic volume, adjacent to rural residential properties, reserves, and large tracts of remnant vegetation, with low lighting. Known koala and macropod populations.

Individual hotspot mitigation considerations (Fig. 17)

A: 80km/hr: macropods, known koala populations, static koala sign and seasonal koala VMS.

B: 80km/hr: resident macropod populations, future development earmarked for eastern side of Section B so displacement of eastern grey kangaroos into surrounding areas and roads is likely.

C: 80 km/hr: koala and macropods, static generic koala sign.

Mitigation recommendations

Majority of traffic local residential and industry so targeted local public education (residential & industry), and bespoke localised wildlife signage would be suitable for all sections. Most injuries occurred after long straight stretches at curves in the road, suggesting speed and visibility play a role in collisions. Assessment of roadside vegetation and nighttime lighting in the target areas (B & C) could improve driver reaction time. Site is suitable for virtual fences or animal/ vehicle activated warning signs. Reduction of speed limit at Louis Bazzo Drive end adjacent to Ringtail State Forest and opposite Tewantin National Park (Noosa Banks Dr. to Silverwood Dr.) is recommended due to the extent of reserves which will be an remain wildlife habitat stronghold for the future. The potential of wildlife crossing structures e.g., underpasses, overpasses and rope bridges should be investigated.

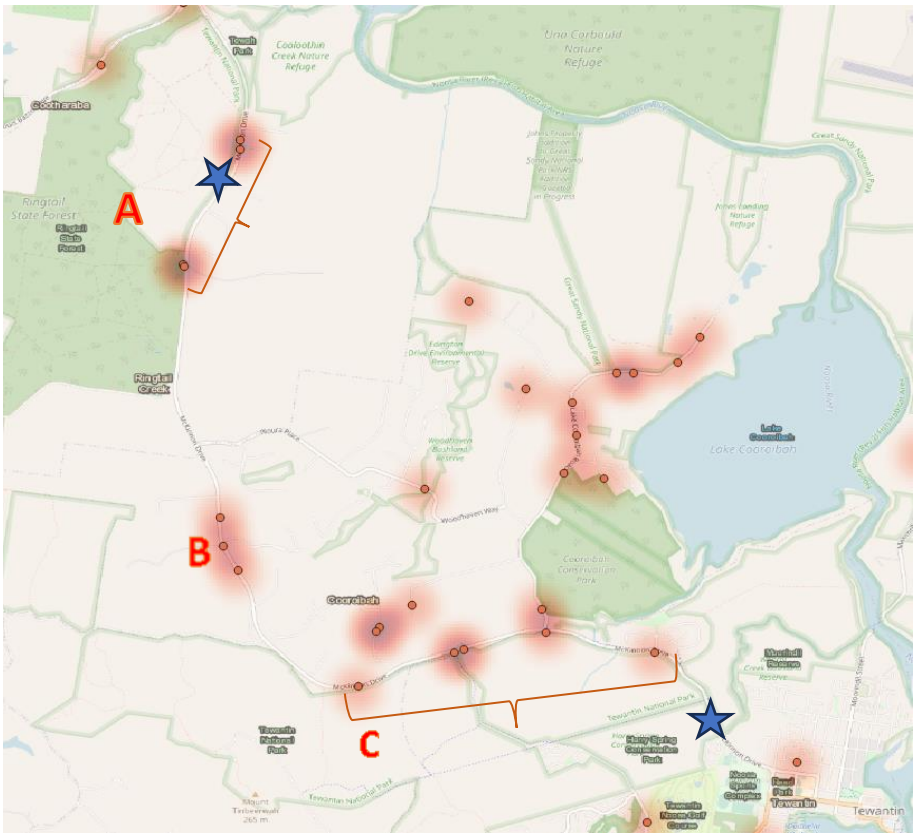

Figure 17. Key areas for wildlife-vehicle collision mitigation on McKinnon Drive, in the Noosa shire. Blue stars indicate approximate location of seasonal koala VMS.

Emu Mountain Rd / Sunshine Motorway

Key Risks

High speed road with high traffic volume, adjacent to residential properties, reserves, and large tracts of remnant vegetation, with low lighting. Known koala and macropod populations.

Individual hotspot mitigation considerations (Fig. 18)

A: 100km/hr: Koalas, macropods, road dissects national park

B: 100km/ hr: Koalas, macropods, road dissects national park

C: 100 km/hr: macropods, birds, road dissects national park / reserves

Mitigation options

Both A and B and the area in between is suitable for virtual fences or animal / vehicle activated warning signs. Given that both hotspots occur where the speed limit changes from 60 to 100 km / hr, an extended 60km/hr zone or more gradual increase in speed is recommended. Local and tourist traffic indicates the use of interactive signage and tourist education programs. As a key entrance points to tourist area, bespoke signage is particularly recommended for section A. Injuries occur at C on a bend, after two straight stretches of road suggesting visibility is an issue, therefore roadside vegetation management and or lighting in this area should be considered. These wildlife crossing points are likely to remain significant given they are the main connectivity between large tracts of national park; therefore, wildlife crossing structures should be considered.

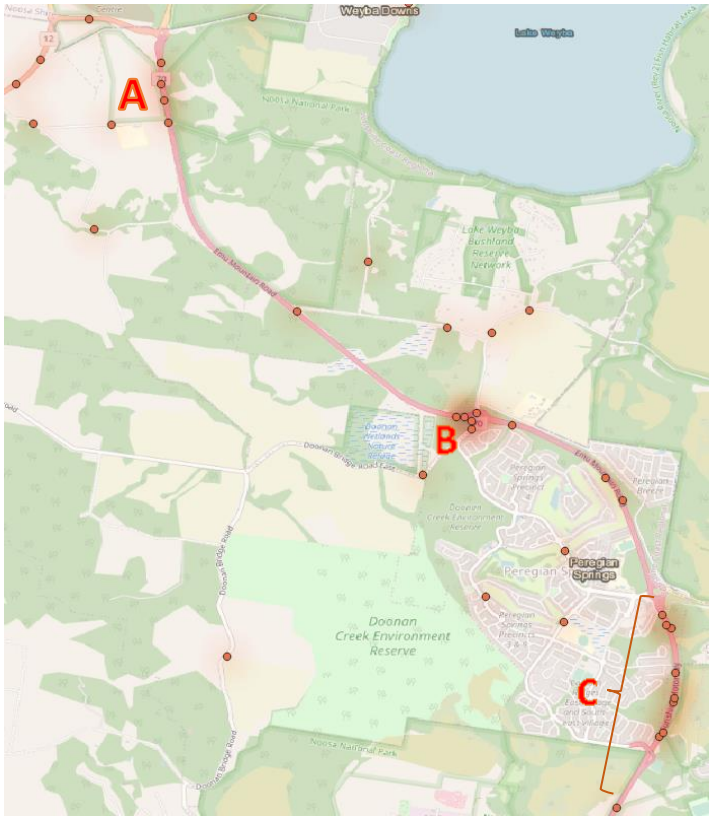

Figure 18. Key areas for wildlife-vehicle collision mitigation on Emu Mountain Rd and Sunshine Motorway in the Noosa shire

Cooroy-Noosa Road

Key Risks

Moderate speed road with medium to high traffic volume, adjacent to rural residential properties, reserves, and large tracts of remnant vegetation, with low lighting. Known koala and macropod populations.

Individual hotspot mitigation considerations (Fig. 19)

A: 60 km/hr: Macropods, Suburban leading to rural area. Seasonal koala VMS nearby.

B: 80km/ hr: Macropods, adjacent to wetland areas.

C: 80 km/hr: Macropods and koalas. Koala deaths occurred in April and Jun. Seasonal (spring / summer) koala VMS nearby.

Mitigation recommendations

Wildlife crossings are likely to occur regularly particularly at C and mitigation will remain significant here, given that the road dissects large tracts of national park/ forest reserve, with known endangered koala populations and resident macropod populations. Therefore, wildlife crossing structures (e.g., underpasses, overpasses), should be considered and are highly recommended for this road. The site is also suitable for virtual fences or animal/ vehicle activated warning signs, from the eastern end to Section B. Given that koala deaths are occurring outside of the season when VMS signs are in place, it is recommended that vehicle or animal activated koala signage be permanently installed. Local public education programs along with bespoke signage and/ or road markings at either end of the road are also recommended. Education signage at key public use areas such as the mountain bike carpark and entrance to Grange Rd (Jabiru Park) are also encouraged to educate visitors.

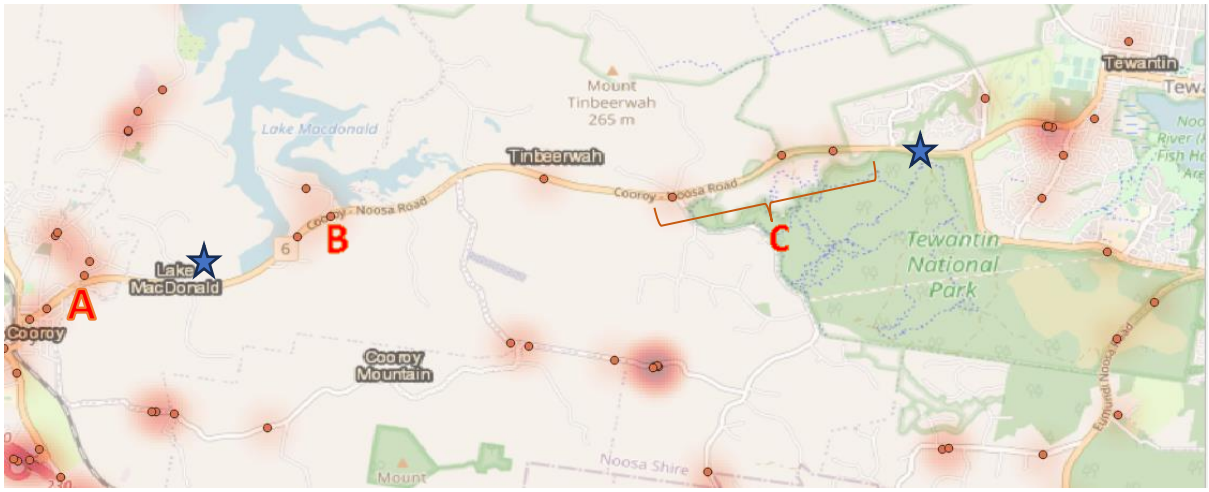

Figure 19. Key areas for wildlife-vehicle collision mitigation on Cooroy-Noosa Rd

Lake Cooroibah Drive

Key Risks

Low speed road, adjacent to rural residential properties, reserves, and large tracts of remnant vegetation, with low lighting. Known macropod populations.

Individual hotspot mitigation considerations (Fig. 20)

A: 70km/hr: Macropods, injuries occur around bends in road.

B: 70km/ hr: Macropods, injuries occur around bends in road.

Mitigation recommendations

Injuries occur near roads bends, suggesting visibility is an issue, therefore roadside vegetation management and or lighting in this area should be considered. While traffic volumes were not available for this road, they are likely to be low and consist of both local and tourist traffic. Bespoke signage and road markings and public and tourist education campaigns with operators (e.g., Glamping Noosa) are also recommended here. A reduction of speed limit to 60km/hr is recommended.

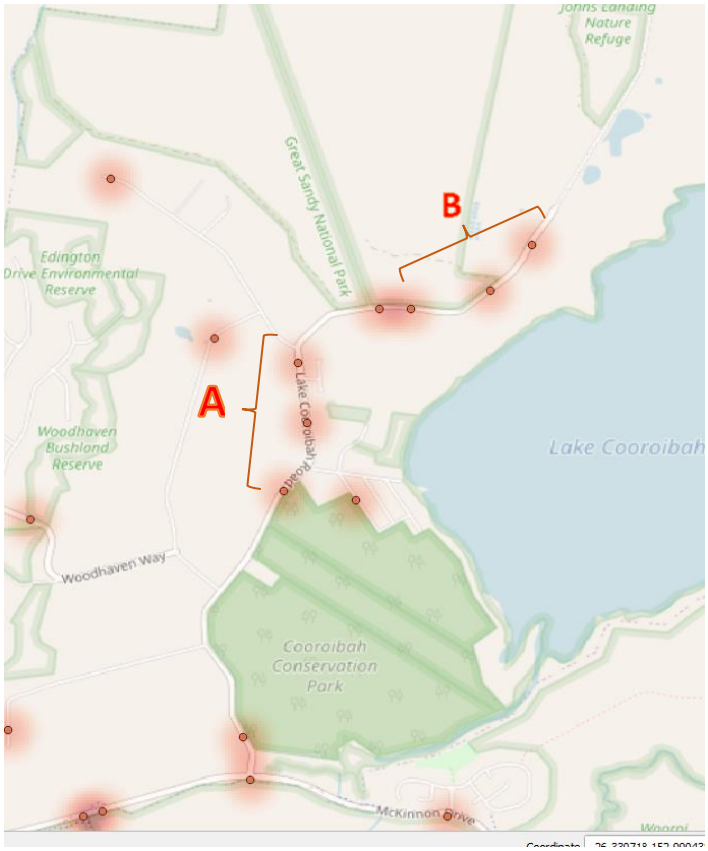

Figure 20. Key areas for wildlife-vehicle collision mitigation on Lake Cooroibah Drive.

David Low Way

Key Risks

Moderate speed road with medium traffic volume, adjacent to residential properties, reserves, and large tracts of remnant vegetation. High tourist volumes.

Individual hotspot mitigation considerations (Fig. 21)

A: 70km/hr: Macropods, possums, echidna.

B: 70 km/ hr: Macropods, possums, echidna.

Mitigation recommendations

Given the high proportion of tourist traffic on this road, bespoke signage and road markings are highly recommended. Many injuries occurred in areas after bends and adjacent to natural areas indicating visibility at these locations is poor so roadside vegetation and lighting should be assessed. Local public education in these areas is also recommended.

Figure 21. Key areas for wildlife-vehicle collision mitigation on David Low Way, in the Noosa shire

Noosa heads / Noosaville

Key Risks

Low speed roads adjacent to highly built areas of mostly residential and holiday properties.

Individual hotspot mitigation considerations (Fig. 22)

Given the high proportion of tourist traffic on this road, bespoke signage and road markings on key roads are highly recommended. Two key wildlife injury areas (Sunshine Beach Rd to Noosa Dr & Gibson Rd, Gympie Terrace, Weyba Rd) are highlighted here as suggested areas for bespoke signage however injuries are spread throughout many streets, suggesting public and tourist education should also play a role in reducing injuries. This area is a key hotpot for possum injuries and therefore key roads should be investigated for crossing structures for arboreal wildlife e.g., rope bridges. Exact locations of arboreal crossing structures should be guided by current wildlife injury locations, on ground assessment of sites and collaboration with local wildlife rescue organisation to ensure their effectiveness.

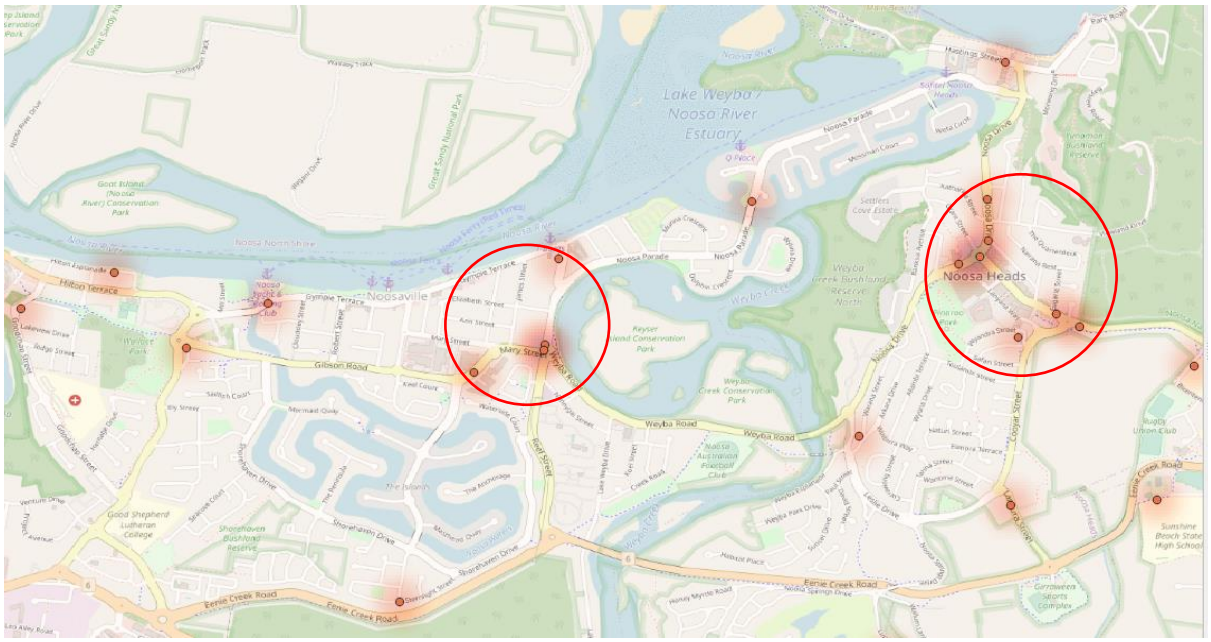

Figure 22. Key areas for wildlife-vehicle collision in the Noosa heads & Noosaville area of Noosa shire

Best practice roadkill mitigation options for the Noosa region

Implementing effective wildlife roadkill mitigation methods is crucial and it's essential to tailor mitigation methods to the target area, species, and geographical and logistical constraints. Factors influencing wildlife-vehicle collisions are varied and the choice of mitigation options applied, and their efficacy can also vary widely (Oddone Aquino and Nkomo 2021). While it is outside the scope of this report to provide an in-depth review of mitigation options, a brief overview of options relevant to the Noosa area and species involved is provided below. An extensive review of koala mitigation options was also previously undertaken for the Noosa area in 2017 (O2Ecology, 2017) and it is recommended that this document be reviewed against the current hotpots and mitigation recommendations contained herein.

While strong evidence of the efficacy of many mitigation types is still lacking in the scientific literature, there is plentiful research that shows reductions in wildlife-vehicle collisions after mitigation strategies are applied (Glista et al. 2008). Implementing some form of mitigation strategy clearly has a greater benefit to wildlife and human safety than failing to adopt any method, and for successful outcomes, using more than one type of mitigation is recommended due to the complex nature and varied causes contributing to roadkill's. The use of multiple types of mitigation methods has been proven to improve reductions in wildlife-vehicle collisions rather than single types of mitigation and more expensive measures, such as wildlife crossings and fencing, have been found to be more effective than cheaper options (Rytwinski, Soanes et al. 2016). While initial costs of mitigation may seem prohibitive, cost-benefit analyses on wildlife mitigation versus costs of human injuries and property damage demonstrate that higher cost mitigation methods present a cost-effective solution in the long term (Ascensão, Yogui et al. 2021). Current wildlife injury mitigation options relevant to the Noosa area are summarised under six categories, with each outlined briefly below:

Wildlife crossings

Wildlife crossing structures have been proven to significantly reduce wildlife-vehicle collisions (Clevenger, Chruszcz et al. 2001), by providing safe crossings for wildlife either under or over a road. They are particularly valuable for maintaining habitat connectivity and genetic diversity of wildlife populations where roadsides are fenced. On high speed and volume roads, these structures must be used with fencing to be effective, and fence integrity is of utmost importance (Markle et al. 2017). Incomplete or unmaintained fencing can lead to an increase in wildlife roadkill if animals become trapped on the road. For this reason, escape routes such gates and jump outs should also be included in the fencing design. Animal diggings, holes / breaks in fences and vegetation overhanging fences can all compromise their efficacy, and it is also important to regularly maintain and repair fences and structures.

Speed reduction

One of the most effective ways to reduce wildlife vehicle collisions is to reduce driving speeds, particularly in areas with high wildlife populations. Reduced speeds improve reaction times and limit the likelihood and severity of crashes for humans and wildlife (Forman and Alexander 1998). In roads where complete speed reduction is not possible, temporal, or zonal reduced speed limits can also be effective. Since the likelihood of collisions increases from dusk through to dawn, due to increased animal movements and decreased driver visibility, nighttime reductions in speed limits on roads that

intersect or are adjacent to reserves and high wildlife areas have been effectively applied (Hobday 2010). Similarly, installing traffic calming devices e.g., speed bumps, chicanes, rumble strips, in key crossing areas and collision hotspots can also reduce risk (van der Ree et al., 2015), as can implementing reduced speed limits on curved sections of roads. Lowering speeds helps drivers navigate curves safely and provides them with more reaction time in case of wildlife encounters. Finally, an essential part of speed reduction is adequate enforcement: where personnel resources are not available, mobile speed cameras can be implemented. Drivers may resist lowered speed limits however education signage or programs regarding human and wildlife safety can assist with public understanding of the need for slower speeds. Residents may be more inclined to adopt responsible driving habits and support conservation efforts in their area if they understand the need and it is likely to be more effective on already slow to moderate speed roads in combination with education, a slow roll out of reduced speeds with vehicle activated signage, prior to enforcement, could limit public objections.

Roadside management

Maintenance of roadsides can play a key role in reducing wildlife vehicle collisions (Milton, Dean et al. 2015). Roadside habitats with higher levels of moisture and or vegetation can attract animals to the roadside, particularly in dry seasons and macropods have been known to utilise roadside vegetation as habitat (Ben-Ami and Ramp 2013). Additionally roadside vegetation may obscure visibility by obstructing vision and reducing light on the roads. (Mader, 1984).

Further, lighting at wildlife crossing areas or reduced night-time speed limits may be appropriate in low lit areas (Hobday 2010), as poor lighting may increase likelihood of wildlife collisions (Green-Barber and Old 2019). Installing additional lighting at critical curves to improve visibility during nighttime is also recommended.

Animal detection / Warning signs

There is little research showing if standard static wildlife warning signage is effective in reducing wildlife vehicle collisions. However, signs that are active, and place and time specific, can be more effective (Huijser et al 2015). The effectiveness of warning signs and animal detection systems will vary depending on the target species and road conditions. The following types of road signs have been found to reduce wildlife vehicle collisions.

Signage that is novel, adaptive, and non-static is likely to be the most effective in reducing wildlife vehicle collisions. Dynamic message or vehicle activated signs can be highly effective, as they provide real-time information to drivers about wildlife on the road, making them more likely to slow down and be cautious. These can be solar-powered and are triggered by approaching vehicles. They display the drivers speed and can have customised images or messages. The signs can also be rotated to reduce driver fatigue. Similarly, warning Signs with flashing Lights can capture the attention of drivers, making them more aware of potential wildlife crossings. Signs that are activated by either animals or vehicle speed are likely to be much more effective than static signs (Bond & Jones 2013).

Innovative symbolic signs designed for the local area instead of using standard imagery are more culturally relevant and therefore likely to be more effective in conveying the message to drivers. Also, road pavement markings instead of signs can alert drivers to wildlife crossing areas and can be combined with speed mitigation devices such as rumble strips to increase their efficacy. Curved roads signage placement is important, and signs should be free of obstruction and close to key crossing and

/ or collision areas. Signs should consider reduced visibility and can be placed before and within curves can alert drivers to the presence of wildlife.

Educational initiatives

Driver behaviour and attitudes have a significant impact on wildlife-vehicle collision risk (Ramp, Wilson et al. 2016) and public education should form a part of all targeted mitigation efforts. Increased traffic in regions with high tourist traffic has also been shown to influence rates of roadkill (Rendall, Webb et al. 2021) therefore tourist education programs should be implemented in high tourism areas. Tourist education initiatives that engage tourism operators as well as tourism marketing to highlight unique local fauna and ways to help protect them could contribute to

Education techniques can include the development of public awareness campaigns to educate drivers about the importance of wildlife conservation and safe driving. Public awareness campaigns aimed at local communities can be particularly effective on low to medium volume traffic roads. Local campaigns conducted in other parts of Southeast Queensland have included temporary signage including roadside banners, media (radio, online new and social) campaigns and releases, workshops (school and public) and events. Research indicates that partnering with schools and community organisations to promote responsible behaviour can also be effective (van der Grift et al., 2019).

Educational initiatives have an additional impact of engaging local communities in conservation in their area which may have additional flow on effects. While some educational initiatives can have immediate impacts, significant behavioural change may take time to achieve. Current research into using social marketing to influence driver behaviour and understanding of wildlife issues shows promise as means to reduce roadkill rates of koalas in southeast Queensland (Pang, Zhang et al. 2023).

Wildlife warning systems

These systems are designed to change animal behaviour on roadsides but are not as well researched as other mitigation methods. Virtual wildlife fences have shown promise as a cost-effective roadkill mitigation option (www.wildlifesafetysolutions.com.au). These systems use audible and visual cues to deter animals from approaching roads, when triggered by car headlights (therefore they are only active at night) (Reeves, Burnett et al. 2022). While research on virtual wildlife fences is ongoing and inconclusive (Englefield, Candy et al. 2019, Fox, Potts et al. 2019, Coulson and Bender 2020, Stannard, Wynan et al. 2021), some studies have provided evidence of their varying effectiveness on different species and environments. Virtual fencing has been deployed at more than forty locations across Australia (www.wildlifesafetysolutions.com.au), however it is important to note that research into their efficacy is still ongoing and their effectiveness is likely to vary depending on the target species and road conditions. These systems are also only useful to mitigate nighttime road injuries, as the fences are activated by headlights and not active during the day (the devices charge using solar units during the day). Other devices such as warning reflectors on roads have been widely implemented due to their low cost (Riginos 2018, Benton 2018) however studies that have reported an effect on roadkill suggest a small effect (Ramp and Croft 2006). The efficacy of the above options is likely to depend on specific characteristics of the road as well as the target fauna species and should be implemented in conjunction with other mitigation methods. These types of systems are well suited to higher speed roads where fencing and other mitigation options are limited.

Recommendations for mitigation in key road-kill hotspots in the Noosa region based on recent wildlife-vehicle injury data collected are summarised in the table below. A combination of these methods, along with adaptive management, will be the most effective approach to reducing wildlife road injuries while considering both ecological and economic factors. Consultation with local councils within Southeast Queensland is encouraged as target species and causes of wildlife vehicle collisions are similar across the broader region. Within Southeast Queensland, many local councils are taking innovative approaches to reducing wildlife vehicle collisions (Brisbane City council 2023, Logan City council 2023) provide examples of integrated approaches for targeted wildlife injury hotspots using a combination of methods.

Table 5. Summary of roadkill mitigation options and ranked suitability (low, medium, or high) for key high roadkill areas in the Noosa region

Road Name	Educational initiatives (local & tourist)	Speed reduction / modification	Roadside management	Animal detection / warning signs	Wildlife warning systems	Wildlife crossings
Eumundi-Noosa Rd	High	Medium	High	High	Medium	High
Bruce Highway	Low	Low	Medium	High	Low	High
Louis Bazzo Dr	High	High	High	High	Medium	Medium
Pomona-Kin Kin Rd	Medium	High	High	High	Medium	Low
Sunrise / Wust/ Dath Henderson Dr	High	High	High	High	Low	Low
Cooroy-Noosa Rd	High	Medium	Low	High	High	High
Emu Mountain Rd / Sunshine Motorway	High	Medium	Low	High	High	High
Mackinnon Dr	Medium	High	Medium	High	High	High
David Low Way (Peregian to Sunshine Beach)	High	Low	Medium	High	Low	Medium
Lake Cooroibah Rd	Medium	High	High	High	Medium	Low
Noosa heads / Noosaville	High	Low	Medium	High	Low	High

Management recommendations for wildlife-vehicle collision mitigation in the Noosa region

As a primary tourism region and Biosphere, the Noosa region has an opportunity to implement innovative and localised mitigation solutions, which seek to preserve the unique biodiversity and showcase environmental commitments. Effective wildlife roadkill mitigation on roads with high tourist traffic requires a balanced approach that prioritises both conservation and the visitor experience.

Collaboration between relevant agencies, local communities, and the tourism industry is crucial in implementing and promoting these strategies effectively. Importantly, a multi-disciplinary approach is needed, including marketing, engineering, ecology, and public engagement, to address this complex issue. A collaboration between state government departments, Noosa Shire Council, Noosa Biosphere Reserve Foundation, Tourism Noosa, and local wildlife groups would enable a holistic approach to a complex yet growing issue. There is significant concern in the local Noosa community to growing human impacts on wildlife and the region is well placed, with a highly engaged community, to significantly reduce the impacts of vehicle-wildlife collisions.

It is vitally important that wildlife road injury data collection is centralised, as lack of data is a key limitation for designing effective mitigation. Both state and local governments in Noosa did not have any data collection process in place for the region and this is a significant shortfall in managing local wildlife populations that should be urgently addressed. There is a need for an open access online database to record wildlife injuries. Many local governments in Southeast Queensland have developed wildlife road injury databases providing invaluable information to guide their management programs and it may be possible to collaborate with other local councils or organisations to develop a data recording system. The state government has no central database for recording locations for animals removed by collection agencies on state roads. It is recommended that a system be developed with collection agents to log date, time, and location of such collections. There is an over reliance on community organisations to record and manage what is an increasing and urgent wildlife management issue in the region.

It is also important to acknowledge the significant social impact that wildlife vehicle collisions have on the local community. Wildlife-vehicle collisions are distressing for drivers and for those who attend to injured or killed animals. The number of injured and orphaned wildlife is increasing, and this requires significant resources which are mostly supplied by community volunteers and wildlife organisations. Wildlife carers and organisations should be considered an asset in the local community, and they need to be recognised and supported (Englefield, Starling et al. 2018) for their significant personal and monetary costs. The Noosa wildlife community is passionate and engaged, and more support is needed for organisations to both care for animals and to enable them to contribute to a central database of wildlife injuries, to allow for proactive and adaptive wildlife road injury management in the Noosa region.

Acknowledgements

I acknowledge the traditional custodians of the Noosa region, the Kabi Kabi people, and their connections to country. Thanks to Australia Zoo Wildlife Hospital, WILVOS, Wildcare, Wildlife Rescue Queensland, Wildlife Rescue Sunshine Coast and Debbie Campbell for wildlife injury data and to Rachel Lyons, William Watson, and Donna Brennan for sharing your insights. North coast TMR and Noosa Shire council provided traffic and road data. Cover photo credit: Clifford Clegg. Finally, thank you to all the wildlife carers and volunteers who give their time selflessly to help Noosa's wildlife.

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Appendix

Appendix 1. Wildlife-vehicle injury counts by species, for the Noosa region (2021-2023)

Wildlife Group/ Species	No of injuries
Bat	13
Black Flying Fox	7
Eastern Broad-nosed Bat	1
Gould's Long-eared Bat	1
Grey-Headed Flying Fox	1
Little Red Flying Fox	3
Bird	107
Australian Brush-turkey	3
Australian Magpie	5
Australian Raven	1
Barn owl	2
Black Faced Cuckoo Shrike	1
blue-faced honeyeater	2
Brush turkey	10
Cattle Egret	2
Crested Pigeon	1
Duck	1
Fan tailed cuckoo	1
Fig Bird	4
Galah	1
King Parrot	1
Laughing Kookaburra	24
Lewins Honeyeater	1
Little Corella	2
Little Kingfisher	1
Magpie lark	1
Noisy Minor	2
Pheasant coucal	1
Pied Currawong	1
Powerful Owl	1
Rainbow Lorikeet	8
Southern boobook owl	1
Spangled Drongo	1
Sulphur-crested Cockatoo	2
Tawny Frog Mouth	16
Unidentified kingfisher	1
Unidentified bird	3
Wedge-tailed eagle	2
White ibis	1
Wood Duck	2
Ground mammal	4
Bandicoot	4
Koala	40

Koala	40
Macropod	310
Agile Wallaby	2
Eastern Grey Kangaroo	168
Pademelon, Red-necked	2
Red-Necked Wallaby	22
Swamp Wallaby	32
Unidentified macropod	84
Monotreme	27
Short-beaked Echidna	27
Non-native	1
Cow	1
Possum & glider	84
Common Brushtail Possum	22
Common Ringtail Possum	36
Feathertail Glider	2
Short-eared Brushtail Possum	9
Unidentified Possum	15
Reptile	25
Bandy bandy	1
Broad-shelled Turtle	1
Carpet Python	12
Common tree snake	1
Eastern Brown Snake	2
Eastern Long-necked Turtle	1
Krefft's Turtle	1
Lace Monitor	3
Saw-shelled Turtle	1
Unidentified Turtle	2
Total	609

Appendix 2 - Survival rates by taxon groupings