



Yellow-bellied Glider Monitoring 2022

Oxley Highway to Kempsey, Pacific Highway Upgrade

Prepared for Transport for NSW

May 2023

Document control

Project no.:	1702
Project client:	Transport for NSW
Project office:	Port Macquarie
Document description:	Yellow-bellied Glider Monitoring 2022 Report
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Internal review:	Radika Michniewicz
Document status:	R1 Final Report
Local Government Area:	Kempsey and Port Macquarie Hastings

Document revision status

Author	Revision number	Internal review	Date issued
Jodie Danvers	D1	Radika Michniewicz	27/04/2023
Jodie Danvers	R0	Radika Michniewicz	27/04/2023
Jodie Danvers	R1	Radika Michniewicz	02/05/2023
Jodie Danvers	R1 Final Report		03/05/2023

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Cover photograph: Yellow-bellied Gliders (*Petaurus australis*) in a nest box north of the Project, immediately east of Tamban State Forest, summer 2018.

Executive summary

Context

This report documents findings for the 2022 monitoring period, the final of three operational monitoring periods for the Yellow-bellied Glider (*Petaurus australis*), as required for the Oxley Highway to Kempsey (OH2K) Pacific Highway Upgrade Project (the Project) and specified in the Oxley Highway to Kempsey (OH2K) Ecological Monitoring Program (EMP, TfNSW 2022). Transport for NSW (TfNSW) is required to manage and monitor the effectiveness of biodiversity mitigation measures implemented as part of the Project. The Yellow-bellied Glider is one of the threatened species identified as requiring monitoring during the operational phase of the Project.

Aims

The aim of the Yellow-bellied Glider monitoring program is to determine whether the Project is meeting the performance indicators for the species, and provide corrective actions where required.

Methods

Call playback and spotlighting surveys were carried out over three non-consecutive nights at three paired impact and reference sites (Ballengarra, Cairncross and Maria River). Call playback involved 10 minutes of active listening for vocalisations, intermittent call playback for 15 minutes followed by 10 minutes of active listening. Spotlighting was carried out along established 500 metre transects, with the observer walking at a rate of 30 minutes/500 metres.

Key results

During the 2022 monitoring period no Yellow-bellied Gliders were detected at either impact or reference sites. Monitoring to date (including additional data collected in association with the Project) has demonstrated presence of Yellow-bellied Gliders at the Ballengarra (not confirmed during baseline surveys) and Maria River impact sites. The species has not been recorded at the Cairncross impact site, where the species was recorded during two of the three baseline surveys.

Conclusions

Performance measures for the 2022 monitoring period were partially met. Surveys were undertaken before and after the Project's construction at impact and reference sites, successfully meeting two of the three performance measures. The continued presence of Yellow-bellied Gliders at sites where it was identified during baseline surveys was not met in 2022. However, to date has been met at the Maria River impact site only. The species has also been detected previously at the Ballengarra impact site (Niche 2020), where there were no confirmed records during the baseline surveys. Yellow-bellied Gliders were not recorded during surveys at the remaining three sites where the species was recorded during baseline surveys (Cairncross impact site, Ballengarra and Maria River reference sites).

Management implications

While the species has not been recorded during operational monitoring at the Cairncross impact site, where it was recorded during baseline surveys, further monitoring is not recommended as:

- The species was not recorded at the Maria River and Ballengarra reference sites, where it was recorded during baseline surveys, indicating that changes in detection rates at the survey transects cannot be attributed to the Project.
- The ongoing presence of species in habitat adjacent to the Project has been demonstrated, including at one site where it was not detected during baseline surveys (Ballengarra).

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1. Introduction

1.1 Context

The Oxley Highway to Kempsey (OH2K) section of the Pacific Highway Upgrade Project (the Project) was approved in 2012 subject to various Ministers Conditions of Approval (MCoA) and a Statement of Commitments (SoC). A subsequent approval with additional conditions of consent (CoA) was granted in 2014 by the then Commonwealth Department of Environment (DoE) for Matters of National Environmental Significance (MNES) listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1995* (EPBC Act). The Ecological Monitoring Program (hereafter referred to as the EMP) (TfNSW 2022) combines these approval conditions and defines the mitigation and offsetting requirements for threatened species and ecological communities impacted by the Project. The Yellow-bellied Glider (*Petaurus australis*) was one threatened species identified as requiring monitoring following the completion of the Projects' construction, during the operational phase.

1.1.1 Legal status

The Yellow-bellied Glider is listed as vulnerable under the New South Wales *Biodiversity Conservation Act 2016* (BC Act). In addition to the state listing the species was listed as vulnerable under the Commonwealth EPBC Act in March 2022. Monitoring of the species is required under the Project's approval for the State Government, however, given the recent listing under the EPBC Act, there are no requirements for the monitoring or reporting of this species under the Commonwealth Government approvals for the Project.

1.1.2 Monitoring framework

The design, methods and performance indicators that define the Yellow-bellied Glider monitoring program are specified in the EMP.

The EMP requires monitoring to occur in spring prior to commencement of construction and in August-December in Year 4, 6 and 8 (operational phase). To date, these monitoring events have been reported as follows:

- *Spring 2013*: Baseline report (Lewis 2014)
- *Spring 2018*: Year 4 (Niche 2019)
- *Spring 2020*: Year 6 (Niche 2021).
- *Spring 2022*: Year 8 (current report).

This report therefore represents the final of three reports required for the operational phase monitoring.

1.1.3 Baseline data

Baseline surveys were conducted in spring prior to the commencement of construction by Lewis Ecological in 2013 (Lewis 2014). Surveys confirmed presence of Yellow-bellied Gliders at four of the six monitoring sites on at least one occasion (Table 1). Individuals were primarily detected by calling, with only one site recording an observation.

Table 1: Baseline survey results for the Yellow-bellied Glider in the Project area

Site	Baseline results
Cairncross impact	Recorded during two surveys. Detected during spotlighting. Responded to call playback.
Cairncross reference	No Yellow-bellied Gliders confirmed (unconfirmed calls recorded).
Ballengarra impact	No Yellow-bellied Gliders confirmed (unconfirmed calls recorded).

Ballengarra reference	Recorded during a single survey. Responded to call playback.
Maria River impact	Recorded during a single survey. Responded to call playback.
Maria River reference	Recorded during all three surveys. Responded to call playback.

1.1.4 Purpose of this report

This report details the findings of the third of three operational monitoring events for the Yellow-bellied Glider. The aims of this report are to summarise the methods and results of the 2022 monitoring and determine if performance measures are being met, as per the EMP.

1.2 Performance Measures

The EMP specifies the following performance measures for the Yellow-bellied Glider:

- *Monitoring is undertaken before and after construction of the upgrade*
- *Monitoring is undertaken at impact and control sites*
- *Continued presence of Yellow-bellied Gliders at sites where it was identified during baseline surveys.*

1.3 Monitoring Timing

Monitoring is to be undertaken between August and December in Year 4, 6 and 8 of the Project’s operational phase. Surveys are to be undertaken in spring to coincide with high movement periods for the species, which breeds between July and September and disperses between spring and summer.

1.4 Reporting

As per the EMP, the annual reporting of monitoring results will include:

- Detailed description of monitoring methodology
- Results of the monitoring period
- Discussion of results, including how the results compare against performance measures, if any modifications to timing or frequency of monitoring periods or monitoring methodology are required and any other recommendations
- If contingency measures should be implemented.

All reports prepared under the EMP will be submitted to the NSW Department of Planning and Environment (DPE) and the NSW Environment Protection Authority (EPA).

1.5 Limitations

Road noise at impact sites may negatively impact the ability to hear Yellow-bellied Gliders calling at a distance, particularly at the Maria River impact site, where the transect lies adjacent to the highway and passes behind residential properties.

2. Survey Methods

2.1 Monitoring Sites

Monitoring was undertaken at impact and reference sites previously selected during baseline surveys (Lewis 2014) as shown in Figure 1. Impact sites were established within known Yellow-bellied Glider habitat and paired with reference sites of similar vegetation and habitat type.

Table 2: Yellow-bellied Glider paired monitoring sites (adapted from Table 5-1 of Lewis 2014)

Monitoring area	Treatment	Impact site	Paired reference site
Cairncross	Impact with mitigation (widened median)	Rawdon Creek Nature Reserve, west of carriageway	Cairncross State Forest approximately 10 kilometres west of impact site
Ballengarra	Impact with mitigation (aerial crossing structure)	Ballengarra State Forest, west of carriageway at Barry's Creek	Ballengarra State Forest approximately 5 kilometres west of impact site
Maria River	Impact with mitigation (reduced clearing limits)	Kalateenee State Forest, west of carriageway at Maria River	Maria River National Park approximately 5 kilometres east impact site

2.2 Survey Method

Surveys were undertaken in accordance with the EMP. At each monitoring site, call playback and spotlighting surveys were carried out over three non-consecutive nights in spring with a minimum of seven days between consecutive surveys.

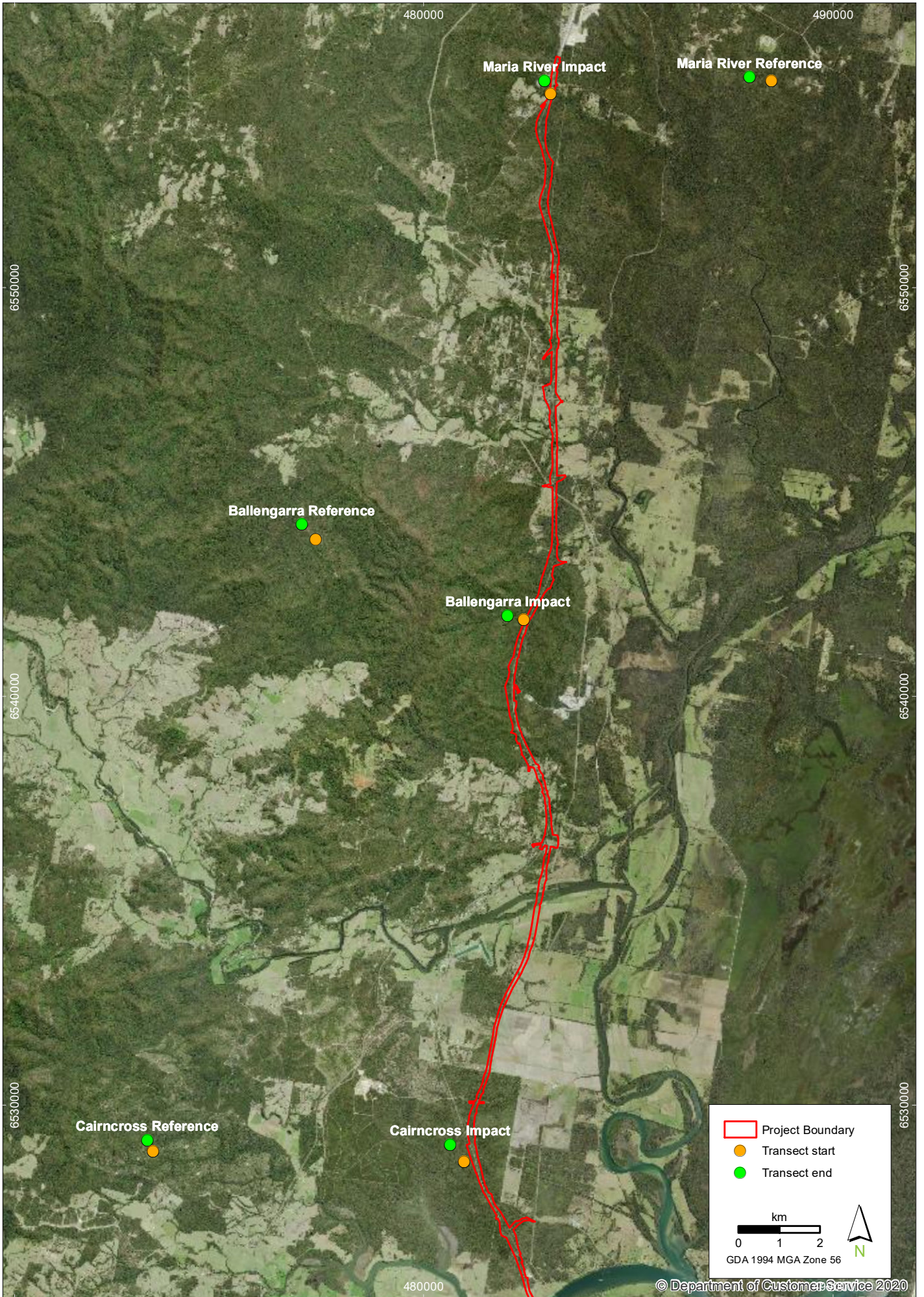
2.2.1 Call playback

Upon arrival at site, 10 minutes of active listening for vocalisations was carried out followed by call playback. As per baseline surveys, Yellow-bellied Glider calls were played intermittently for 15 minutes to provoke a response. Calls of the Powerful Owl, Masked Owl and Sooty Owl were then used when the Yellow-bellied Glider calls failed to elicit a response. Call playback was followed by another 10 minute period of active listening. Vocalisations of this species can be heard up to 400 metres away.

2.2.2 Spotlighting

Spotlighting was conducted along 500 metre transects, with the observer walking at a rate of 30 minutes/500 metres and continually listening for vocalisations. Transects were located along forest trails indicated by start and end points established during baseline surveys. Although this species is considered spotlight-shy, it may be detected by its frequent movements during foraging activities.

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Yellow-bellied Glider monitoring sites

Pacific Highway Upgrade - Oxley Highway to Kempsey: Yellow-bellied Glider Monitoring



FIGURE 1
Imagery: (c) LPI 2014

3. Results

Figure 2 shows the Yellow-bellied Glider 2018, 2020 and 2022 monitoring records, and includes additional incidental Yellow-bellied Glider observations collected during other ecological monitoring programs required by the Project.

3.1 Monitoring Results

3.1.1 2022 monitoring results

Results of call playback and spotlighting surveys are provided in Annex 1. A summary of the species detected at each site is provided below in Table 3.

Survey dates and weather conditions are provided in Annex 1. All surveys were undertaken during calm evenings without notable rainfall.

No Yellow-bellied Gliders were detected during spotlighting surveys during the 2022 surveys. A number of species, including the Sugar Glider (*Petaurus breviceps*), Grey-headed Flying-fox (*Pteropus poliocephalus*), Common Brushtail Possum (*Trichosurus vulpecula*), White-throated Nightjar (*Eurostopodus mystacalis*), Barn Owl (*Tyto alba*) and Tawny Frogmouth (*Podargus strigoides*) were observed during spotlighting surveys.

3.1.2 Cumulative monitoring results

A summary of the fauna species recorded during the Yellow-bellied Glider monitoring to date (excluding baseline surveys) is provided in Table 3.

Table 3: Summary of species detected during 2018, 2020 and 2022 surveys

Monitoring area	Impact site	Reference site
Cairncross	Feathertail Glider (<i>Acrobates pygmaeus</i>) Common Ringtail Possum Koala (<i>Phascolarctos cinereus</i>)	Sooty Owl (<i>Tyto tenebricosa</i>) Boobook (<i>Ninox novaeseelandiae</i>) Sugar Glider White-throated Nightjar Eastern Grey Kangaroo (<i>Macropus giganteus</i>) Grey-headed Flying-fox Barn Owl Tawny Frogmouth
Ballengarra	Yellow-bellied Glider (2018 monitoring) Sugar Glider Tawny Frogmouth (<i>Podargus strigoides</i>)	Macropod species Green-thighed Frog (<i>Litoria brevipalmata</i>) Laughing Kookaburra (<i>Dacelo novaeguineae</i>) Common Brushtail Possum White-throated Nightjar
Maria River	Common Brushtail Possum Echidna (<i>Tachyglossus aculeatus</i>) Sugar Glider Feathertail Glider (<i>Acrobates pygmaeus</i>) Yellow-bellied Glider (2020 monitoring) Tawny frogmouth	Common Ringtail Possum Common Brushtail Possum Koala (<i>Phascolarctos cinereus</i>) Sugar Glider

3.2 Additional Data

Nest boxes

Yellow-bellied Gliders have been recorded on seven occasions occupying nest boxes during the nest box monitoring program that forms part of the Project’s ecological monitoring requirements. Six of the seven nest boxes, listed in Table 4, occur within close proximity (within 100 metres) to two of the Yellow-bellied Glider impact sites; Maria River impact site and Ballengarra impact site (Figure 2).

Incidental records

During 2018 Giant Barred Frog surveys that form part of the Project’s ecological monitoring requirements, the Yellow-bellied Glider was heard calling from the Giant Barred Frog Maria River impact site (located approximately 105 metres to the east of the Yellow-bellied Glider Maria River impact site) and observed at the Giant Barred Frog Piper’s Creek reference site (approximately 6.2 kilometres south of the Yellow-bellied Glider Ballengarra reference site). The Yellow-bellied Glider was again recorded during 2022 Giant Barred Frog surveys at the Piper’s Creek reference site.

Table 4: Yellow-bellied Glider nest box records

Nest box type	No. Individuals	Survey period	Area
Large glider	2	Summer 2017	Maria River
Possum	2	Winter 2017	Maria River
Small Owl	1	Summer 2018	Maria River
Large Glider	1	Summer 2018	Ballengarra
Cockatoo	1	Summer 2020	Ballengarra
Large Glider	1	Summer 2020	Ballengarra
Small Glider	2-3	Winter 2022	5km north of Ballengarra

3.3 Comparison to Baseline Surveys

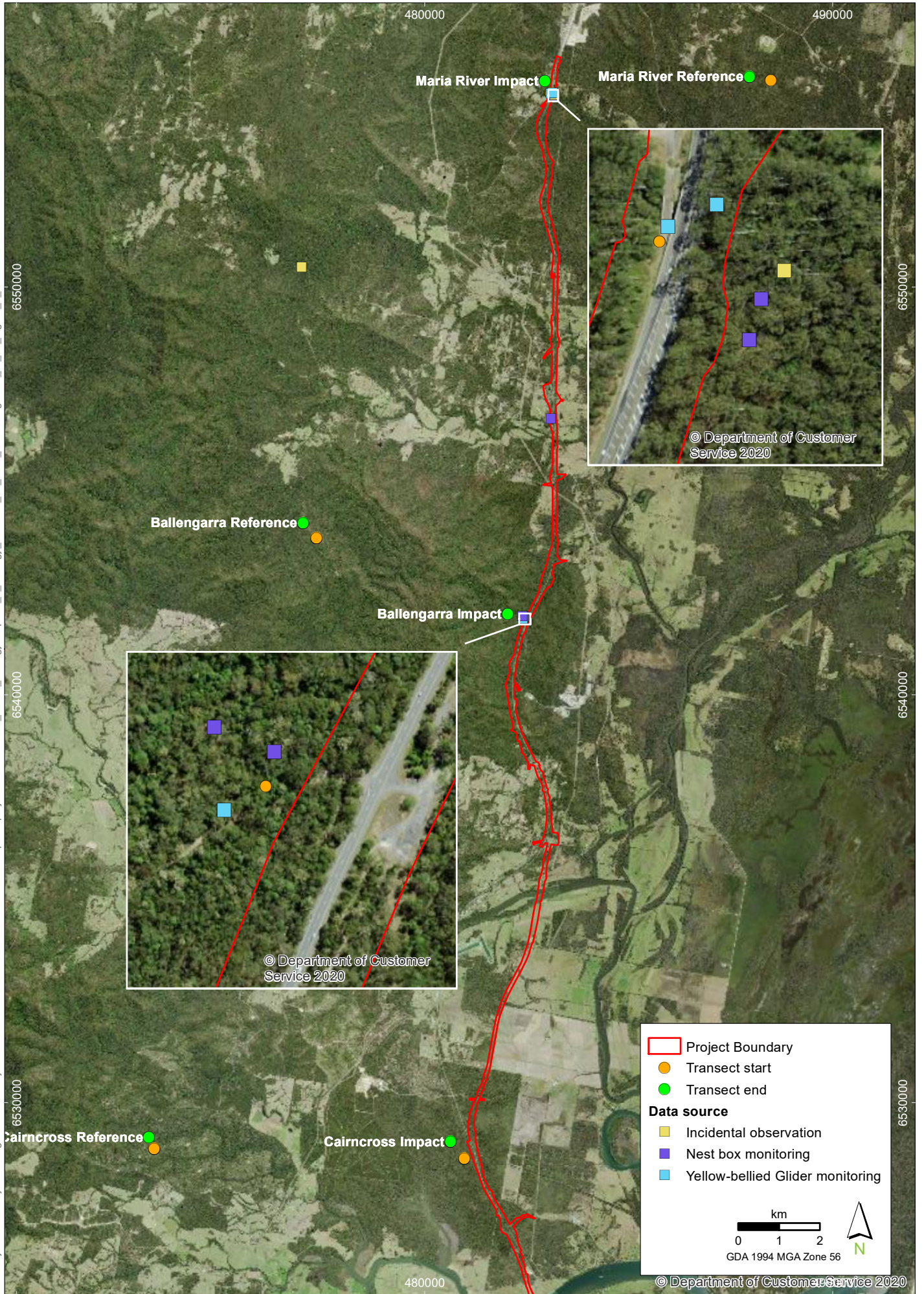
Table 5 provides a comparison of baseline survey results with the monitoring and additional records to date. The additional records have been included in the determination of ongoing presence of the species in monitoring areas. An additional record was considered as representing presence in a monitoring area when that record occurred within 500 metres of the transect location. This is based on a conservative estimate of Yellow-bellied Glider home ranges of 20 hectares and their call range (OEH 2017).

Table 5: Summary of Yellow-bellied Glider records across the Project area

Site	Baseline surveys (2013)	Operational monitoring	Additional data
Cairncross impact	Present (2)	0	0
Cairncross reference	0	0	0
Ballengarra impact	0	Present (1)	Present (3)
Ballengarra reference	Present (1)	0	0
Maria River impact	Present (1)	Present (1)	Present (4)
Maria River reference	Present (3)	0	0

(#) = Number of surveys recording/incidental records of Yellow-bellied Gliders.

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Yellow-bellied Glider records

Pacific Highway Upgrade - Oxley Highway to Kempsey: Yellow-bellied Glider Monitoring

4. Discussion

4.1 Performance Measures

A summary of the survey results in relation to the performance measures is provided in Table 6.

Table 6: Summary of performance measures

Performance measure	Discussion
Monitoring is undertaken before and after construction of the upgrade.	<p>This performance measure has been met.</p> <p>Baseline monitoring was undertaken prior to construction in 2013 (Lewis 2014) and after completion of the upgrade (operational) in spring 2018, 2020 and 2022. 2022 surveys represent the final monitoring period (Year 8).</p>
Monitoring is undertaken at Impact and Control sites.	<p>This performance measure has been met.</p> <p>Monitoring was undertaken at the paired impact-control (reference) sites established during baseline surveys.</p>
Continued presence of Yellow-bellied Gliders at sites where it was identified during baseline surveys.	<p>This performance measure has not been met.</p> <p>Yellow-bellied Gliders were confirmed at four of the six sites during the baseline surveys; Maria River impact and reference site, Cairncross impact site and Ballengarra reference site. The species was not recorded at Ballengarra impact or Cairncross reference sites during baseline surveys.</p> <p>Monitoring to date (including additional data) has demonstrated presence of Yellow-bellied Gliders at the Ballengarra (not confirmed during baseline surveys) and Maria River impact sites during 2018 and 2020 monitoring. However, presence was not detected during 2022 monitoring.</p> <p>The species has not been detected at the remaining three sites where it was identified during baseline surveys: Ballengarra and Maria River reference sites and Cairncross impact site. Therefore, this performance measure has not been met for these three sites.</p>

5. Recommendations

5.1 Contingency Measures and Recommendations

The EMP lists potential problems and contingency measures for various components of the monitoring program. Those that are considered relevant to the Yellow-bellied Glider monitoring are listed and discussed in Table 7.

While the species has not been recorded during operational monitoring at the Cairncross impact site, where it was recorded during baseline surveys, further monitoring is not recommended as:

- The species was not recorded at the Maria River and Ballengarra reference sites, where it was recorded during baseline surveys, indicating that changes in detection rates at the survey transects cannot be attributed to the Project.
- The ongoing presence of species in habitat adjacent to the Project has been demonstrated, including at one site where it was not detected during baseline surveys (Ballengarra).

Table 7: Contingency measures

Potential Problem	Contingency measure	Discussion of proposed measure
Decline in presence of target species recorded at impact sites after the upgrade has been complete, compared to change in control sites.	<p>The cause of decline in populations at impact sites will be investigated in consultation with EPA and DOTE within two weeks of results reported by ecologist.</p> <p>If the cause of decline is considered most likely attributed to the upgrade of the highway (and not another event such as bushfire), mitigation measures, such as the location and types of fauna crossings and fauna fencing will be reviewed within two months of the above consultation being completed.</p>	<p>While the species was not recorded at the Cairncross impact site, where it was recorded during baseline surveys, it was also not recorded at the Maria River and Ballengarra reference sites, where it was recorded during baseline surveys. This absence of records and change in detection rates cannot therefore be attributed to the Project as detection was lower at both impact and reference sites.</p> <p>Monitoring to date has confirmed presence at two of the three impact sites. A notable absence of records occurs at Cairncross impact site, where the species was recorded during two of the three baseline surveys. It should be noted however that the species has now been detected in close proximity to the Project corridor where it was not recorded during baseline surveys (Ballengarra), notably using nest boxes on both sides of the Project corridor.</p> <p>Additional records also demonstrate ongoing presence of the species in habitat immediately adjacent to the Project.</p> <p>This contingency measure is not considered relevant.</p>

References

Lewis (2014). *Oxley Highway to Kempsey. Pre-construction Baseline Monitoring: Winter-Summer*. Prepared by Lewis Ecological.

Niche (2019). *Yellow-bellied Glider monitoring 2018 – Oxley Highway to Kempsey Pacific Highway Upgrade*. Prepared by Niche Environment and Heritage Pty Ltd.

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TfNSW (2022). *Oxley Highway to Kempsey Pacific Highway Upgrade Ecological Monitoring Program. Roads and Maritime Update to report prepared by SMEC Hyder Joint Venture, February 2022*.

Annex 1 – Monitoring Results

Table 8: 2022 Yellow-bellied Glider monitoring results

Date	Site	Site type (reference/ impact)	ID type (seen/heard)	Fauna type	Species
31/10/2022	Cairncross	reference	heard	Mammal	Grey-heading Flying-fox
1/11/2022	Ballengarra	reference	seen	Mammal	Common Brushtail Possum
14/11/2022	Cairncross	reference	heard	Bird	White-throated Nightjar
15/11/2022	Maria River	reference	seen	Mammal	Sugar Glider
16/11/2022	Ballengarra	reference	heard	Bird	White-throated Nightjar
13/12/2022	Cairncross	reference	heard	Bird	Barn Owl
13/12/2022	Cairncross	reference	heard	Mammal	Sugar Glider
13/12/2022	Cairncross	reference	seen	Bird	Tawny Frogmouth
14/12/2022	Maria River	impact	seen	Bird	Tawny Frogmouth

Table 9: 2022 Yellow-bellied Glider survey conditions

Site	Replicate	Date	Temp (°C)	Rain (mm)	Wind (km/h)
Ballengarra SF impact	1	1/11/2022	20	0	13
Ballengarra SF reference	1	1/11/2022	21.3	0	22
Cairncross SF impact	1	31/10/2022	22.8	0	17
Cairncross SF reference	1	31/10/2022	22.8	0	17
Maria River SF impact	1	2/11/2022	13	0	9
Maria River SF reference	1	2/11/2022	17	0	13
Ballengarra SF impact	2	16/11/2022	16	0	19
Ballengarra SF reference	2	16/11/2022	15	0	7
Cairncross SF impact	2	14/11/2022	21	0	9
Cairncross SF reference	2	14/11/2022	21	0	7
Maria River SF impact	2	15/11/2022	21	0	0
Maria River SF reference	2	15/11/2022	21	0	6
Ballengarra SF impact	3	12/12/2022	23	0	9
Ballengarra SF reference	3	12/12/2022	23	0	9
Cairncross SF impact	3	13/12/2022	17	0	7
Cairncross SF reference	3	13/12/2022	17	0	7
Maria River SF impact	3	14/12/2022	16	0	9
Maria River SF reference	3	14/12/2022	19	0	9

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