

# **Oxley Highway to Kempsey EPBC 2012/6518**

Condition 8 Annual Report

Roads and Maritime Services | September 2018



## Document control

File name	18 0808 OH2K DoTEE CoA 8 Annual Report July 2017 - July 2018
Report name	Oxley Highway to Kempsey EPBC 2012/6518 Condition of Approval 8 Annual Report 22 July 2017 – 21 July 2018
Revision number	1

## Revision history

Revision	Date	Description	Approval
1	August 2018	Draft	
2	September 2018	Final	RMS

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# 1 Introduction

## 1.1. Purpose of this document

The purpose of this report is to address EPBC (2012/6518) Approval Condition 8, which requires the preparation of a report addressing compliance with each of the conditions of approval, including implementation of the:

- Biodiversity Offset Management Plan (BOMP)
- Flora and Fauna Management Plans (FFMP)
- Ecological Monitoring Plan (EMP).

This report covers the fourth period from 22 July 2017 to 21 July 2018.

The timing for compliance with certain approval conditions is linked to specific dates as follows:

- Date of the approval decision under sections 130(1) and 133 of the *Environment Protection and Biodiversity Conservation Act 1999* – 24 January 2015
- Commencement of the action – 22 July 2014
- Expiry of Commonwealth approval – 31 December 2063

## 1.2. Project staging

The Oxley Highway to Kempsey Pacific Highway Upgrade project is being constructed in three main stages:

- Stage 1: The Sancrox Traffic Arrangement works located about two kilometres north of the Oxley Highway / Pacific Highway intersection. Note that the construction of Stage 1 was completed in November 2015
- Stage 2: Kundabung to Kempsey (K2K) consisting of about 14 kilometres of dual carriageway, commencing north of Barrys Creek near Kundabung (chainage 24,000) and connecting to the Kempsey Bypass at Stumpy Creek (Chainage 37,800). Note that construction of Stage 2 was completed in October 2017
- Stage 3: Oxley Highway to Kundabung (OH2Ku) consisting of about 24 kilometres of dual carriageway, commencing just north of the Oxley Highway / Pacific Highway intersection (chainage 700) and connecting with the Kundabung to Kempsey stage just north of Barrys Creek (chainage 24,000). Note construction of Stage 3 was completed in March 2018.

In addition, there is an ultimate upgrade to the four lane Class M (motorway) standard highway. Due to estimated traffic volumes and availability of funding some sections of the Project will initially be constructed and operated as a Class A (arterial) standard highway. Upgrade of those sections of the Project from Class A to Class M standard will occur when it is warranted by an increase in traffic volumes, and when funding becomes available.

## 1.3. Modifications to the Conditions of Approval

No modifications to the Conditions of Approval were requested or approved during this reporting period.

## 2 Conditions of Approval

### 2.1. Condition 1

#### Condition 1

The person taking the action must not clear more than 211 hectares of Koala (*Phascolarctos cinerea*) habitat, 232 hectares of Grey-headed Flying-fox (*Pteropus poliocephalus*) habitat, 215 hectares of Spotted-tail Quoll (*Dasyurus maculatus*) habitat and 7.7 hectares of Giant-Barred Frog (*Mixophyes iteratus*) habitat within the project corridor of the proposed action.

Roads and Maritime is undertaking a progressive review of the total clearing area for the Oxley Highway to Kempsey project, incorporating the clearing for all three stages. Clearing for the three initial stages of the project (see Section 1.2) is now complete.

A progress report on the clearing quantities against the limits outlined in Condition 1 is detailed in Table 1.

**Table 1** Clearing quantities as at July 2018

EPBC Species	Total estimated clearing	Total clearing	EPBC Condition 1
Koala	196.8284	196.7656	211
Grey-headed flying fox	206.9144	206.8258	232
Spotted-tail Quoll	197.0330	196.2896	215
Giant-barred Frog	2.8512	2.8512	7.7

The final clearing totals are less than predicted by Roads and Maritime during the construction/clearing process (as reported in the 2017 report). This is due to a number of areas where clearing was reduced or avoided during the construction phase.

### 2.2. Condition 2

#### Condition 2

To assist in mitigating the impacts of the proposal on the Koala, Grey-headed Flying-fox, Spotted-tail Quoll and the Giant-Barred Frog during construction, the person taking the action must prepare and submit a Flora and Fauna Management Plan for each **stage** of the action, for the **Minister's** written approval prior to **commencement** of each **stage** of the action. The Flora and Fauna Management Plan for each **stage** must be approved by the **Minister** in writing prior to **commencement** of the relevant **stage**. These plans must include:

- a. Measures to be implemented to avoid, suppress and control the spread of weeds, plant pathogens and invasive species;
- b. Measures to avoid and minimise other indirect impacts that may result from the proposal during and after construction, including erosion and sedimentation;
- c. Measures to manage aquatic habitat on-site to at least maintain habitat values for the Giant Barred Frog;
- d. A detailed description of the pre-clearance surveys to be undertaken by a **suitably**

## Condition 2

**qualified expert** within all areas proposed for disturbance, including: hollow bearing trees, logs, existing culverts and bridges, no earlier than 48 hours prior to the removal of vegetation occurring in that area to ensure that the area is free of the Koala, Giant-Barred Frog, Grey-headed Flying-fox and Spotted-tail Quoll.

- e. Measures to relocate and/or ensure the **appropriate care of** individuals of the Koala, Giant-Barred Frog, Grey-headed Flying-fox and Spotted-tail Quoll that are identified during searches referred to in condition 2d; and
- f. Clear key milestones, monitoring, performance indicators, corrective actions and timeframes for the completion of all actions outlined in the plan.

A Flora and Fauna Management Plan has been prepared for each stage of the project. These plans were approved by the Minister on the following dates:

- Stage 1: Sancrox Interchange – 24 June 2014
- Stage 2: Kundabung to Kempsey – 22 October 2014
- Stage 3: Oxley Highway to Kundabung – 10 October 2014

The compliance status of the implementation of the Flora and Fauna Management Plans for each stage is detailed in Appendix A.

## 2.3. Condition 3

### Condition 3

To assist in mitigating the impacts of the proposal on the Koala, Spotted-tail Quoll and the Giant-Barred Frog, the person taking the action must construct and maintain **fauna crossings** and **fencing** in all **areas that are likely to benefit** these species for the duration of the impact of the action.

- a. The **fauna crossings** must:
  - i. be **effective** for the Koala, Spotted-tail Quoll and/or Giant Barred Frog (the relevant species targeted to use the **fauna crossing**);
  - ii. provide dry passage up to a 1 in 100 year Average Recurrence Interval (ARI) event for **dedicated fauna crossings** and up to a one in 1 year 72 hour ARI event for **combined fauna crossings**;
  - iii. include a minimum of 11 **dedicated fauna crossings** and 30 **combined fauna crossings** for the project;
  - iv. not increase in length more than 10 per cent from the lengths provided in Schedule 2 of this notice, and not reduce in width and height from the values provided in Schedule 2 of this notice without the written consent of the **Minister**;
  - v. be bridges in **areas that are likely to benefit** the Giant-Barred Frog.
- b. If a change to the **fauna crossing** design is proposed that does not meet the parameters described in Condition 3a), the person taking the action must:
  - i. provide evidence to the **Minister** that these will remain **effective** for the Koala, Spotted-tail Quoll or Giant-Barred Frog (as relevant for the **fauna crossing**) for the **Minister's** written approval prior to **commencement** of the **stage** relevant to that fauna crossing;

### Condition 3

or

- ii. provide written evidence to the **Minister** detailing how the resulting loss in connectivity will be compensated for with increased connectivity for the impacted species. This must be approved in writing by the **Minister**, prior to **commencement of stage 2 and stage 3**.
- c. **Fencing** must be constructed at a minimum the locations identified in Schedule 3 of this notice.

Detailed design for all fauna crossings on the project was completed during previous reporting periods and this design demonstrated that all fauna crossings complied with the parameters listed in Condition 3(a).

During construction on Stage 3 it was identified that combined culvert C4.50 did not appear to be meeting the requirements of Condition 3(a)(ii). The culvert is located in a floodplain and was found to remain wet following rain events, although it could not be conclusively confirmed that the culvert was dry following a one in 1 year 72 hour ARI event, as the level of this event was difficult to determine. Further investigation into this culvert found that it was initially reported in Schedule 2 as an 'incidental/ flood relief culvert' and the text was later changed to 'combined'. The culvert is functioning as a flood relief culvert and the water level does not subside until the water on the surrounding flood plain reduces. There is a combined fauna culvert at C4.48 (100m south) that meets the requirements of Condition 3(a)(ii) and Fernbank Creek Bridge starts 70m to the north.

This issue was raised with a DoTEE Post Approvals representative in February 2018. Roads and Maritime was advised to note this issue as a minor non-compliance in the subsequent annual report. Roads and Maritime was also advised that the Department would not be pursuing any compliance action given the minor nature of the issue.

Fauna fencing is now complete in all areas in accordance with Condition 3c.

## 2.4. Condition 4

### Condition 4

Prior to **commencement of stage 2 and stage 3** of the action, the **person taking the action** must submit an Ecological Monitoring Program for approval by the **Minister** that determines the effectiveness of the mitigation measures implemented as part of the project. The Ecological Monitoring Program must be approved in writing by the **Minister** prior to **commencement of stage 2 and stage 3**, and must include:

- a. The baseline data collected from surveys undertaken by a **suitably qualified expert** on the Koala, Spotted-tail Quoll and Giant-Barred Frog within all habitat areas outside areas to be cleared of vegetation for the proposed action, that are likely to contain these species and that are likely to be adversely impacted by the action (as determined by a **suitably qualified expert**). The data must address the densities, distribution, habitat use and movement patterns of these species;
- b. The methodology to be implemented for the ongoing monitoring of road kill, the species densities, distribution, habitat use and movement patterns, and the use of **fauna crossing** during construction and operation of the action, including the timing, and duration of the methodology;
- c. Goals and performance indicators to measure the success of proposed **fauna crossings**, which must be specific, measureable, achievable, realistic and timely

#### Condition 4

(SMART), and be compared against baseline data described in condition 4a)

- d. Details of contingency measures that would be implemented in the event of changes to densities, distribution, habitat use and movement patterns that are attributable to the construction or operation of the project.

Monitoring must continue until mitigation measures can be demonstrated to have been **effective** for the Koala, Spotted-tail Quoll, and Giant-Barred Frog.

Should monitoring associated with this condition demonstrate that the use of **fauna crossings** and/or **fencing** is not achieving its intended purpose or is having a detrimental effect upon Koala, Spotted-tail Quoll, and Giant-Barred Frog (as determined by **the Minister**), **the Minister** may require that the person taking the action implement alternative forms of mitigation and/or corrective actions to address the relevant impacts to Koala, Spotted-tail Quoll, and Giant-Barred Frog,. Such measures must be implemented as requested.

The Ecological Monitoring Program for the project was submitted to the Minister in a letter dated 29 April 2014 and approved by the Minister on 10 October 2014. Commencement dates for Stage 2 and Stage 3 were early to mid-November 2014.

The compliance status of the implementation of the Ecological Monitoring Program is detailed in Appendix B.

## 2.5. Condition 5

#### Condition 5

To compensate for the loss of 240 hectares of threatened species habitat the person taking the action must prepare and submit a Biodiversity Offset Management Plan (**BOMP**) for the **Minister's** written approval within 12 months of approval of the action. The BOMP must be approved in writing by the **Minister** within 12 months of approval of the action. The **BOMP** must include:

- a. the identification of the portions of the lands described as the "Proposed Biodiversity Offset Areas" in the Map at Schedule 1 of this notice that are necessary to achieve the outcomes required by the *Environmental Offsets Policy 2012* (or subsequent published revisions). This must include **offset attributes**, **shapefiles**, textual descriptions and maps to clearly define the location and boundaries of the offset area(s);
- b. the results of targeted field surveys within the offset sites (undertaken at any ecologically appropriate time of the year) to assess and describe habitat suitability and presence / absence of individuals in relation to the Koala, Grey-headed Flying-fox, Spotted-tail Quoll and Giant Barred frog;
- c. an assessment of the baseline population for the Koala, Spotted-tail Quoll, Giant-Barred Frog, and Grey-headed Flying-fox which are detected within the offset area during field surveys;
- d. a description of the current **quality** (prior to any management activities) of the offset area(s) identified in Condition 5a with reference to the Koala, Spotted-tail Quoll, Giant-Barred Frog, and Grey-headed Flying-fox;
- e. an assessment demonstrating how the offset area(s) achieve the outcomes required by the *Environmental Offsets Policy 2012* (or subsequent published revisions) and user guide;
- f. Should the offset sites identified in 5a not be sufficient to achieve the outcomes



## Condition 5

required by the *Environmental Offsets Policy 2012* (or subsequent published revisions) and user guide, as determined in writing by the **Minister**, the person taking the action must provide further suitable offset sites and include these as part of the **BOMP**;

- g. information about the Koala, Grey-headed Flying-fox, Spotted-tail Quoll, Grey-headed Flying-fox, and Giant Barred frog (in relation to ecology, biology and conservation status) to inform appropriate management actions;
- h. targeted management actions, regeneration and revegetation strategies to be undertaken on the offset area(s) to improve the ecological quality of these areas for the Koala, Grey-headed Flying-fox, Spotted-tail Quoll and Giant Barred frog
- i. clear performance objectives for management actions that will enable maintenance and enhancement of habitat within the offset area, as well as contribute to the better protection of individuals and / or populations of Koala, Spotted-tail Quoll, Giant-Barred Frog, and Grey-headed Flying-fox onsite;
- j. anticipated timeframes for achieving performance objectives.
- k. performance and completion criteria for evaluating the management of the offset area, including contingency actions, criteria for triggering contingency actions and a commitment to the implementation of these actions in the event that performance objectives are not met;
- l. a program to monitor and report on the effectiveness of these measures, and progress against the performance and completion criteria;
- m. details of who would be responsible for monitoring, reviewing, and implementing the **BOMP**.
- n. a description of funding arrangements or agreements including work programs and responsible entities;

The approved **BOMP** must be published on the NSW Roads and Maritime Services internet web site, within 1 month of the BOMP being approved.

The approved BOMP must be implemented.

The BOMP was submitted to the Department of the Environment for the approval of the Minister in a letter dated 16 January 2015. Approval from the Minister remains outstanding. See Section 3 for further detail.

## 2.6. Condition 6

### Condition 6

If an offset site proposed as a part of Condition 5 is already required to be protected as a result of a separate EPBC Act approval, only the management actions which can be demonstrated to be additional to those required for the separate approval, can be considered as an offset for this project. The legal protection of the site and management measures required for a separate approval cannot be considered a part of the offset, in accordance with the *Environmental Offsets Policy 2012* (or subsequent published revisions).

This requirement has been noted as part of the preparation of the BOMP, required under Condition 5.

## 2.7. Condition 7

### Condition 7

Within 12 months of approval of the Biodiversity Offset Management Plan (BOMP), the person taking the action must secure the offset area(s) identified in Condition 5a), under relevant conservation legislation. The legal instrument chosen must be registered on title, and must prevent any future development activities from occurring on the land protected, and ensure the active management of that land for the better protection of matters of national environmental significance for the duration of the impact of the action. Evidence of compliance with this condition must be provided to the **Department** within 30 days after the land(s) have been secured.

Approval from the Minister of the BOMP remains outstanding; as such compliance with this condition is not yet applicable.

## 2.8. Condition 8

### Condition 8

Within three months of every 12 month anniversary of the **commencement** of the action, the person taking the action must publish a report on their website addressing compliance with each of the conditions of this approval, including implementation of the BOMP, Flora and Fauna Management Plans and Ecological Monitoring Plan as specified in the conditions. Documentary evidence providing proof of the date of publication must be provided to the **Department** at the same time as the compliance report is published. Noncompliance with any of the conditions of this approval must be reported to the **Department** within 2 business days of becoming aware of the non-compliance. At any time within the life of this approval the **Minister** may agree, in writing, that further reporting is not required if compliance with all requirements has been demonstrated to the **Minister's** satisfaction.

This report has been prepared to satisfy the requirements of this condition. Evidence of the date of publication will be provided to the Department when this report is published on the Roads and Maritime project website.

All previous reports, and this report once published, can be found at the following link:

<http://www.rms.nsw.gov.au/projects/northern-nsw/oxley-highway-to-kempsey/project-documents.html>

## 2.9. Condition 9

### Condition 9

Within 30 days after the **commencement** of the action, the person taking the action must advise the **Department** in writing of the actual date of **commencement**.

In a letter to the Department, dated 19 August 2014, Roads and Maritime advised the Department of the actual date of commencement, being 22 July 2014.

## 2.10. Condition 10

### Condition 10

### Condition 10

The person taking the action must maintain accurate records substantiating all activities associated with or relevant to these conditions of approval, including measures taken to implement the **BOMP**, Ecological Monitoring Plan and Flora and Fauna Management Plans, and make them available upon request to the **Department**. Such records may be subject to audit by the **Department** or an independent auditor in accordance with section 458 of the EPBC Act, or used to verify compliance with the conditions of approval. Summaries of audits will be posted on the **Department's** website. The results of audits may also be publicised through the general media.

Roads and Maritime and its construction partners are maintaining accurate records for all activities relating to the conditions of approval, and the implementation of the BOMP, EMP and FFMPs. The potential audit by the Department is noted.

### 2.11. Condition 11

#### Condition 11

Upon the direction of the **Minister**, the person taking the action must ensure that an independent audit of compliance with the conditions of approval is conducted and a report submitted to the **Minister**. The independent auditor must be approved by the **Minister** prior to the **commencement** of the audit. Audit criteria must be approved by the **Minister** and the audit report must address the criteria to the satisfaction of the **Minister**.

The requirements of this condition are noted. A direction from the Minister under Condition 11 has not been received by Roads and Maritime during this reporting period.

### 2.12. Condition 12

#### Condition 12

If the person taking the action wishes to carry out any activity otherwise than in accordance with the **BOMP**, Ecological Monitoring Plan and Flora and Fauna Management Plans as specified in the conditions, the person taking the action must submit to the **Department** for the **Minister's** written approval a revised version of that Plan. The varied activity shall not commence until the **Minister** has approved the varied Plan in writing. The **Minister** will not approve a varied Plan unless the revised Plan would result in an equivalent or improved environmental outcome over time. If the **Minister** approves the revised Plan, that Plan must be implemented in place of the Plan originally approved.

Roads and Maritime submitted an update to the Ecological Monitoring Plan to the Department for approval on 3 May 2016. This update was approved by the Minister on 15 November 2016.

A minor update to the Stage 3 Flora and Fauna Management Plan was submitted to the Minister in a letter dated 16 November 2016 and approved by the Minister on 27 March 2017.

No updates to the Flora and Fauna Management Plans have been submitted to the Department for approval during this reporting period.

The BOMP has not yet been approved by the Department, and therefore the requirements of this condition are not yet applicable to this plan.

The status of compliance with these plans can be found in Section 3, 4 and 5 respectively.

## 2.13. Condition 13

### Condition 13

If the **Minister** believes that it is necessary or convenient for the better protection of listed threatened species and ecological communities to do so, the **Minister** may request that the person taking the action make specified revisions to the **BOMP**, Ecological Monitoring Plan and Flora and Fauna Management Plans, as specified in the conditions and submit the revised **BOMP**, Ecological Monitoring Plan and Flora and Fauna Management Plans for the **Minister's** written approval. The person taking the action must comply with any such request. The revised approved **BOMP**, Ecological Monitoring Plan and Flora and Fauna Management Plans must be implemented. Unless the **Minister** has approved the revised **BOMP**, Ecological Monitoring Plan and Flora and Fauna Management Plans then the person taking the action must continue to implement the **BOMP**, Ecological Monitoring Plan and Flora and Fauna Management Plans originally approved.

Noted.

No requests from the Minister under Condition 13 were received by Roads and Maritime in this reporting period.

## 2.14. Condition 14

### Condition 14

If, at any time after 5 years from the date of this approval, the person taking the action has not **substantially commenced** the action, then the person taking the action must not substantially commence the action without the written agreement of the **Minister**.

Commencement of the action occurred on 22 July 2014.

## 2.15. Condition 15

### Condition 15

Unless otherwise agreed to in writing by the **Minister**, the person taking the action must publish all plans referred to in these conditions of approval on their website. Each plan must be published on the website within 1 month of being approved.

The most recently approved versions of the Flora and Fauna Management Plans for each stage, and the Ecological Monitoring Plan, have been published on the project website, which can be found at the following address:

<http://www.rms.nsw.gov.au/projects/northern-nsw/oxley-highway-to-kempsey/project-documents.html>

### **3 Biodiversity Offset Management Plan**

The BOMP was submitted to the Department of the Environment for the approval of the Minister in a letter dated 16 January 2015. Approval from the Minister remains outstanding.

Following recent consultation with the Department, Roads and Maritime is prepared to resubmit the BOMP in Q4 of 2018.

## 4 Ecological Monitoring Plan

Table 2 outlines the monitoring requirements from the Ecological Monitoring Plan, relevant to matters of National Environmental Significance that were required to be conducted during the last reporting period.

This monitoring was conducted in accordance with the timing requirements outlined in Table 2. The results of these monitoring events, including evaluation of the project's compliance with the performance indicators, have been included in Appendix B.

In some instances, monitoring of a particular species or mitigation measure requires several monitoring events throughout the year. In these instances it is considered more informative to wait until all monitoring events have been conducted for that year, before reporting on the results. This allows analysis between seasons, further statistical analysis, etc to be conducted than if individual monitoring events are reported on. Table 2 also details those species/ mitigation measures where further monitoring is to be conducted in the remainder of 2018, and as such a combined report for all of the results for 2018 will be reported on in the 2018/19 annual report.

**Table 2** Ecological monitoring requirements during the last reporting period

Species monitored	Timing	Done/ yet to be done	Reporting
Koala	Spring/Summer	Year 3 monitoring (2017) done. Year 4 monitoring (spring/summer) to be done later 2018/ early 2019.	Year 3 included in this report. Year 4 in 2018/19 report.
Spotted-tail Quoll	Autumn	2018 (Year 4) monitoring done	Results included in this report.
Giant Barred Frog	Spring, Summer and Autumn	Spring 2017, Summer 2017/18 and Autumn 2018 done. Spring 2018 and summer 2018/19 still to be done.	Results of Spring 2017, Summer 2017/18 and Autumn 2018 included in this report.
Road kill	Weekly during construction, 12 weeks following commencement of operation.	Construction / post opening – July 2017 – June 2018. Spring 2018 and summer 2018/19 – to be done.	Construction and post-construction monitoring included in this report, operational monitoring for spring, summer and autumn to be prepared as one report for Year 4 (first year of operation). Included in 2018/19 annual report.
Pre-Clearing / Clearing	Pre- and during clearing	Kundabung to Kempsey	Results included in this report.
Fauna underpasses & fauna fencing	Autumn	Autumn – done Spring/summer – to be done	One report for Year 4 (first year of operation) to be included in 2018/19 annual report.

Table 3 lists the title of each of the monitoring reports where each of the EPBC reporting requirements in Table 2 have been addressed. These can all be found in Appendix B.

**Table 3** EPBC monitoring reports in Appendix B

Species monitored	Report title in Appendix B
Koala Spring/Summer (Year 3) monitoring	Koala Monitoring 2017

Species monitored	Report title in Appendix B
Spotted-tail Quoll Autumn monitoring	Spotted-tailed Quoll Monitoring 2018
Giant Barred Frog spring, summer and autumn monitoring	Giant Barred Frog Monitoring 2017/2018
Road kill construction monitoring and 12-week monitoring upon commencement of operation	Section 2 & Annexure 1 of Contractors Ecological Monitoring Report 2017/2018
Pre-Clearing / Clearing	Section 3 & Annexure 2 of Contractors Ecological Monitoring Report 2017/2018

Clearing for Stage 3 was completed during a previous reporting period and clearing for Stage 2 was completed during the last reporting period. As such, a report detailing the results of the pre-clearing and clearing monitoring and mitigation measures for Stage 2 has been provided in Appendix B (as per Table 3), with the report for Stage 3 in the 2017 report.

All the Ecological Monitoring Program performance measures for the monitoring events listed in Table 3 were met for the 2017/2018 reporting period, except:

- **Giant Barred Frog:** The performance measure relating to water quality monitoring was not met on one occasion (that was attributable to the project) at Cooperabung Creek. This area received water from both a construction water quality basin outlet (during wet weather events that exceeded the design capacity of the basin) and the construction site and both are considered to have contributed to the elevated levels. At the time a full review of the ERSED controls in this area was conducted, and additional controls installed including an additional, upstream sediment basin. The contribution of the project during subsequent monitoring events has reduced as restoration and landscaping activities are completed and establish.

A further three performance measures were not met, however these were not found to be attributed to the project:

- **Koala:** The performance measure relating to changes in distribution and habitat use has not been met. Koala presence and activity levels appear to have decreased between the baseline, and all following monitoring events. However this apparent decrease has occurred at both control and impact sites and in each of the monitoring surveys undertaken to date, impact sites recorded higher percentages of Koala presence than control sites. For this reason any decrease in Koala presence/activity cannot currently be directly or solely attributed to disturbance due to the Project.
- **Giant Barred Frog:** The performance measure relating to continued presence of Giant Barred Frogs during each survey event where it was identified during baseline surveys was not met at Pipers Creek in summer and autumn in 2018. However, as this decreasing trend is evident at both impact and reference sites, it is not possible to attribute these changes to the project.
- **Giant Barred Frog:** The performance measure relating to no change to densities, distribution, habitat use and movement patterns compared to baseline data was not met at Pipers Creek and Cooperabung Creek during the reporting period. However, as this decreasing trend is evident at both impact and reference sites, it is not possible to attribute these changes to the project.

## 5 Flora and Fauna Management Plans

The Flora and Fauna Management Plans for each stage were approved by the Minister on the following dates:

- Stage 1: Sancrox Traffic Arrangement – 24 June 2014
- Stage 2: Oxley Highway to Kundabung – 10 October 2014
- Stage 3: Kundabung to Kempsey – 22 October 2014

Table 3.3 of the Stage 2 Flora and Fauna Management Plan and Table 3.4.1 of the Stage 3 Flora and Fauna Management Plan contains the EPBC Act management measures to be complied with during these stages of the project. Accordingly, a summary of compliance with the mitigation measures outlined in these tables is included in Appendix A.

Construction of Stage 1 was completed in November 2015, and as such, compliance with the requirements of this FFMP are no longer being reported in Appendix A.

Construction of Stage 2 and Stage 3 was completed in October 2017 and March 2018 respectively. As such, this report details the close out of the requirements of the FFMP. Tracking of compliance against the FFMP will not be conducted in future annual reports, as these are construction documents.





# Appendix A Flora and Fauna Management Plans



Stage 2: Kundabung to Kempsey

EPBC CoA	Related Table 5-1 ID	Management Measure and/or Evidence of Compliance	Performance Indicator/Target	Timeframe	Responsibility	Compliance Status	Close out status
CoA 2a.	FF13	Weeds will be managed in accordance with the Weed and Pathogen Management Plan (Appendix K).	<p><b>Performance indicator:</b> As per Weed and Pathogen Management Plan (Appendix K)</p> <p><b>Performance target:</b> Completion of all mitigation measures outlined in the Weed and Pathogen Management Strategy within the prescribed timeframes.</p>	As per Weed and Pathogen Management Plan (Appendix K).	Environmental Manager	<p>A baseline noxious weed survey was conducted during the pre-construction surveys.</p> <p>All Class 3 noxious weeds identified during the survey (groundsel bush and coral tree) were sprayed in accordance with the Weed and Pathogen Management Plan, and recorded on weed spraying sheets.</p> <p>All works have been completed in areas with Chytrid Fungus as such the Chytrid Fungus washdown procedure is no longer being implemented.</p> <p>Weed monitoring was part of the weekly environmental checklist.</p>	Closed
	FF37	Washing procedures will be implemented to ensure that insect pests and their eggs/larvae are not present on equipment. The washing procedure will be undertaken in accordance with the process described in Guide 7 of the Roads and Maritime Biodiversity Guidelines.	<p><b>Performance indicator:</b> Washing procedures implemented in accordance with Guide 7 of the Roads and Maritime Biodiversity Guidelines.</p> <p><b>Performance target:</b> All plant and equipment is washed in accordance with Guide 7 of the RMS Biodiversity Guidelines prior to exiting known areas of pathogens</p>	Immediately prior to exiting known areas of pathogens.	Environmental Manager  Project Ecologist / suitably qualified expert	All machinery was washed down at the main compound before it entered site, to prevent the spread of insect pests and larvae. This was recorded on the plant checklist as the plant arrived at site.	Closed
	FF38	The spread of bacteria, viruses and diseases such as <i>Phytophthora cinnamomi</i> , amphibian chytrid fungus, myrtle rust and beak and feather disease will be addressed using the processes described in Weed and Pathogen Management Plan (Appendix K).	<p><b>Performance indicator:</b> As per Weed and Pathogen Management Plan (Appendix K)</p> <p><b>Performance target:</b> Completion of all mitigation measures outlined in the Weed and Pathogen Management Strategy within the prescribed timeframes.</p>	As per Weed and Pathogen Management Plan (Appendix K).	Environmental Manager	<p>The Chytrid Fungus washdown procedure was implemented at the known area of Chytrid infestation (Smiths Creek). This included the washing down of both footwear and machinery entering this area using a disinfecting agent. Chytrid Fungus was identified at Pipers Creek during the 2016/17 reporting period, however no works have been required in this area since.</p> <p><i>Phytophthora cinnamomi</i> was found to be present across the entire length of the site. As such, the process described in the Weed and Pathogen Management Plan (which predominantly focuses on preventing the spread throughout the site) was not considered relevant. Despite this, machinery was washed down prior to it leaving site.</p>	Closed
CoA 2b.	FF10	Revegetation/rehabilitation of all areas disturbed as part of the Project (that do not form part of permanent pavement or structures) will be undertaken progressively during construction to maintain and enhance key habitat areas in order to minimise the impact on Koala, Grey-headed flying fox, Spotted-tail Quoll and Giant Barred Frogs.	<p><b>Performance indicator:</b> Stabilisation of disturbed areas following completion of the works within that area.</p> <p><b>Performance Target:</b> Stabilisation of all disturbed areas within 14 days of completion of the works within that area.</p>	14 days after the completion of works within an area.	Environmental Manager  Construction Manager  Project/ Site Engineer	Revegetation/rehabilitation has been completed across the site. See image 1, 3 & 4.	Closed
	FF9	Native vegetation cleared from the construction footprint will be mulched and used along with retained topsoil for reuse in rehabilitation works and erosion control, as merchantable timber or for fauna habitat where appropriate.	<p><b>Performance indicator:</b> Use of timber as a result of clearing in rehabilitation works and erosion and sediment control (mulch), as merchantable timber or for fauna habitat, where appropriate.</p> <p><b>Performance target:</b> Mulch is utilised for rehabilitation works in all areas nominated in the landscape plans and for erosion and sediment controls.</p>	Daily (or as required).	Environmental Manager  Construction Manager  Project/ Site Engineer	<p>Merchantable timber recovered from State Forest areas was transferred to the Forestry Corporation, and suitable fauna habitat was relocated to adjacent vegetation. Some timber was recovered for use as fauna furniture in combined and dedicated fauna underpasses. See image 2.</p> <p>The remaining vegetation was mulched and the majority was used for erosion and sediment control, landscape beds, and mixed with topsoil for revegetation works.</p> <p>The remaining portion of mulch was transported offsite for re-use by various landowners for rehabilitation works.</p>	Closed
	SW10	The development of Environmental Work Method Statements (EWMS) to provide detailed guidance on construction methodologies and will meet the	<p><b>Performance indicator:</b> All works carried out in accordance with approved EWMS.</p>	Prepared and provided to relevant parties 10 days	Environmental Manager	Where Environmental Work Method Statements were required these were developed prior to the specific work activity commencing, and detailed the controls to be implemented, responsibilities, location, timing and details on how to implement controls.	Closed

	requirements of the specifications and Conditions of Approval. They will detail the controls to be implemented, responsibilities, location, timing and details on how to implement controls.	AND All high risk EWMS to be developed in consultation with relevant agencies.  <b>Performance target:</b> 100% of works carried out in accordance with approved EWMS AND Relevant agencies consulted in the development of all high risk EWMS	prior to commencement of the activity.	Environmental Manager	Environmental work method statements were developed for: <ul style="list-style-type: none"> <li>• Early works</li> <li>• Surveying</li> <li>• Site compound establishment</li> <li>• Design, construction and decommissioning of sediment basins</li> <li>• Clearing, grubbing and mulching</li> <li>• Concrete batch plant establishment and operation</li> <li>• Managing Phytophthora</li> <li>• Sealing and paving</li> <li>• Temporary waterway crossings</li> <li>• Topsoil stripping and stockpiling</li> <li>• Working near waterways</li> <li>• Smiths Creek bridge demolition</li> <li>• Water blasting and surface treatments at Maria River and Stumpy Creek</li> </ul> All high risk EWMSs were subject to agency consultation, generally through ERG meetings.	
SW17	Works will be programmed to minimise the extent and duration of disturbance to vegetation. This will include leaving clearing (undertaken by manual means) and initial earthworks in intermittent and permanent watercourses until subsequent works are about to commence.	<b>Performance indicator:</b> Vegetation retained in intermittent and permanent water courses until immediately before works are scheduled to commence.  <b>Performance target:</b> 100% of vegetation is retained in intermittent watercourses until immediately prior to construction in those areas.	Immediately prior to works scheduled to commence. As detailed in location specific Progressive Erosion and Sediment Control Plans (PESCPs).	Superintendent  Foreman  Environmental Advisor	Works were programmed to retain vegetation in intermittent and permanent watercourses until subsequent works were about to commence. When clearing was conducted in these areas, the cut stump method was used to retain groundcover and stumps in situ until subsequent works were about to commence. The need to conduct cut stump tree clearing in this areas was detailed on the ESCPs.	Closed
SW25	Catch drains, contour and diversion drains across exposed areas will be installed immediately (i.e. within 24 hours and prior to forecast rain events) following clearing, and re-established and maintained during topsoil removal and earthwork operations.	<b>Performance indicator:</b> Installation of erosion and sediment controls following clearing.  <b>Performance target:</b> 100% of the erosion and sediment controls on the ERSED plan installed within 24 hours or prior to forecast rain following clearing	Installed within 24 hours of clearing and prior to forecast rain events.	Superintendent  Foreman  Environmental Advisor	Erosion and sediment control plans were prepared progressively and regularly updated to reflect the stage of construction. Controls to be implemented during the clearing phase generally included windrowed vegetation and mulch, with priority around access to, and construction of, sediment basins. As such, these early erosion and sediment controls for the clearing phase were installed within 24 hours of clearing or prior to forecast rain, and then updated as the project moved into topsoil stripping.  These controls were reviewed during topsoil stripping and earthworks operations through the progressive erosion and sediment control plan process. Controls were then installed and maintained in accordance with the approved PESCP.	Closed
SW28	Erosion and sediment control structures will remain installed and maintained until sufficient vegetative cover is achieved. (i.e. 70% cover over 90% of the erodible catchment).	<b>Performance indicator:</b> All erosion and sediment controls maintained as 'Blue Book' requirements.  <b>Performance target:</b> 100% of all erosion and sediment controls maintained to the 'blue book' standard.	Weekly inspection until there is 70% cover over 90% of the erodible catchment.	Superintendent  Foreman  Environmental Advisor	Erosion and sediment controls were removed (unless to be upgraded, improved or replaced) once sufficient vegetative cover was achieved. The erosion and sediment control plans demonstrated this constant upgrading and improvement of controls, in accordance with the Blue Book.  Most erosion and sediment controls have now been removed, as sufficient vegetation cover is achieved.	Closed
SW35	Temporary crossings will: <ul style="list-style-type: none"> <li>• Be used for the shortest time required to complete their designed operational function and affected riparian vegetation will be rehabilitated as soon as possible to existing or better condition.</li> <li>• Use material that will not result in fine sediment material entering the waterway.</li> <li>• Where rock crossings are used, the rock will be of suitable size to prevent/reduce the likelihood of the material being washed away in a storm or flood event, with large sized rock on the lower side of crossings where water velocity increases.</li> </ul>	<b>Performance indicators:</b> Temporary creek crossing EWMS to be developed in consultation with relevant agencies AND Temporary Creek Crossing EWMS meets the requirements of SW 35.  <b>Performance targets:</b> No temporary creek crossing work to commence until relevant agencies have been consulted in development of the Temporary Creek Crossing EWMS. AND	EWMS prepared and provided to relevant agencies at least 10 days prior to construction of temporary creek crossings commencing.	Environment Manager  Temporary Works Manager	On this stage of the project, sacrificial pipes were installed at a number of permanent watercourses that require a culvert crossing. This allowed early removal of a number of temporary waterway crossings and significantly reduced the risk associated with maintaining clean water diversions through an active construction site.  Pipe sizes in Class 1, 2 and 3 waterways were agreed with the Department of Primary Industries (Fishing & Aquaculture) representative on site.  Hydrocarbon booms were installed in Pipers, Smiths, and Stumpy Creeks and Maria River during active construction works. These were shown on the ERSED plans for this stage of works.  No temporary crossing work commenced until agencies were consulted on the EWMS (the EWMS was subject to consultation in October 2014 and work commenced in November 2014). The Temporary Creek Crossing EWMS contained all the requirements of SW35.  All temporary waterway crossings have now been removed.	Closed

	<ul style="list-style-type: none"> <li>Pipes of sufficient size shall be used to provide fish passage in Class 1, 2 and 3 waterways.</li> <li>Hydrocarbon booms shall be placed downstream of platforms and temporary crossings to intercept oil and grease.</li> </ul>	Temporary Creek Crossing EWMS contains and meets all the requirements of SW35				
SW36	Scour protection will be installed at the base of permanent and temporary drainage outlets, and will be integrated where feasible into current banks to minimise impacts.	<p><b>Performance indicator:</b> Scour protection installed at the base of permanent and temporary drainage outlets.</p> <p><b>Performance target:</b> All permanent and temporary drainage outlets have scour protection installed at the base</p>	Prior to basin commission.	Foreman  Environmental Advisor	Outlets of temporary controls were installed as per an approved design, or in accordance with Blue Book requirements, which included scour protection. For example, basins were designed in accordance with the blue book, and included scour protection on the outlets.  All permanent drainage outlets have scour protection. All permanent drainage has now been completed.	Closed
SW37	Drainage works will be stabilised against erosion by appropriate selection of channel dimensions, slope and lining, and the inclusion, if necessary, of drop structures and energy dissipaters.	<p><b>Performance indicator:</b> Stabilisation of drainage works where required, by appropriate means.</p> <p><b>Performance target:</b> Where required, all drainage work is stabilised by appropriate means.</p>	Prior to any rainfall (events exceeding 10mm) event.	Foreman  Environment Advisor	All clean water drainage works on the project were stabilised through measures such as geofabric and/ or plastic, rock, temporary cover crop, or through permanent revegetation or other permanent finishes such as concrete.	
SW38	Culverts and permanent stream protection measures will be installed as early as possible in the construction program to facilitate transverse drainage during the early stages of construction.	<p><b>Performance indicator:</b> Installation of culverts and permanent stream protection measures.</p> <p><b>Performance target:</b> All culverts and permanent stream protection measures are installed during the early stages of construction.</p>	Prior to clearing within that catchment.	Foreman  Environment Advisor	On this stage of the project, sacrificial pipes were installed at a number of permanent watercourses that require a culvert crossing. This has allowed early removal of a number of temporary waterway crossings and significantly reduced the risk associated with maintaining clean water diversions through an active construction site.  Additionally, permanent culvert structures were prioritised in the early stages of construction. All culverts and bridges across the main alignment have now been completed.	
SW50	Sediment basins will be retained for a minimum of six months or until a 70% vegetative cover is achieved in its catchment; other satisfactory controls are in place and approved by the EM or the basin is otherwise redundant.	<p><b>Performance indicator:</b> All erosion and sediment controls maintained as 'Blue Book' requirements.</p> <p><b>Performance target:</b> All erosion and sediment controls maintained to the 'blue book' standard.</p>	Weekly inspection until there is 70% cover over 90% of the erodible catchment.	Environmental Manager	A small number of sediment basins are still in place and in use on the project. These will be removed once 70% vegetation cover is achieved in the corresponding catchment.  In some instances basins have been removed prior to achieving 70% vegetation cover. However in all cases this was due to the basin being redundant (ie too high compared to the surrounding cut), or because the progress of earthworks allowed this basin to be diverted to a larger sediment basin nearby.  Suitable erosion and sediment controls were implemented in place of these basins, as approved by the soil conservationist and the Environmental Manager through the PESCP process.	Closed
SW65	Erosion and sediment controls will be inspected at least daily (with maintenance and/or modifications made as necessary). Inspections and/or maintenance during wet-weather maybe increased where necessary.	<p><b>Performance indicator:</b> All erosion and sediment controls maintained as per 'Blue Book' requirements.</p> <p><b>Performance target:</b> All erosion and sediment controls maintained to the 'blue book' standard.</p>	Daily Visual Inspection Weekly Environmental Inspection Post Rainfall Inspection (where required)	Foreman Environmental Advisor	Informal inspections were undertaken daily during construction by the environmental team. Inspections were conducted by the environment team weekly, and during and post-rainfall. These inspections were captured on a weekly environmental checklist and provided to site teams for actioning.  Roads and Maritime and the Project Environmental Representative conducted fortnightly inspections, and agency representatives from the EPA and the Department of Primary Industries (Fishing and Aquaculture) conducted monthly inspections. During these inspections poorly operating controls were identified and their replacement actioned as part of the inspection close-out process. Actions required to ensure controls are maintained to Blue Book standard, had to be completed for the inspection report to be closed out.	Closed
SW67	Watercourse bed and banks to be monitored weekly and post rainfall during construction for indications of instability. Attention to monitoring for channel erosion will be completed during and following higher than normal flow conditions. Protection measures will be installed should increase intensity or erosion be identified.	<p><b>Performance indicator:</b> Monitor instability in watercourse beds and banks.</p> <p><b>Performance target:</b> All watercourse beds and banks inspected every week and after all rainfall</p>	Weekly Environmental Inspection Post Rainfall Inspection (where required) Within 5 days or 1 day of identification	Foreman  Environmental Manager	Watercourse bed and bank monitoring was included in both informal inspections, and weekly, during and post rainfall environmental inspections by the environment team.  See SW65 for frequency of environmental inspections, which included inspections both during and post rainfall events.	Closed

		Where increased intensity of erosion is identified that may have an impact on EPBC species or their habitat, these will be rectified within 5 days. If there is an immediate risk of impact on EPBC Act listed species, temporary rectification works will occur within 1 day.	<p><b>Performance indicator:</b> Rectification of identified increased intensity of erosion within watercourse beds and banks that may impact on EPBC species or their habitat.</p> <p><b>Performance target:</b> All areas of increased intensity of erosion within watercourse beds and banks that may impact on EPBC species or their habitat rectified within 5 days or 1 day (immediate risk).</p>	depending on the risk.			
<b>CoA 2c.</b>	N/A	<p>Measures to manage aquatic habitat on-site will be implemented as per the Giant Barred Frog Management Strategy (App C). These include:</p> <p><b>3.2 Management Strategies</b></p> <ol style="list-style-type: none"> <li>1. Identification and protection of Giant Barred Frog habitat;</li> <li>2. Pre-clearing Surveys to be implemented in four stages of: <ol style="list-style-type: none"> <li>a. Early works when establishing site controls (i.e. clearing limits for clearing and grubbing) including ;</li> <li>b. Pre-clearing survey within 5 days of commencing the clearing and grubbing program; <ol style="list-style-type: none"> <li>i. All Giant Barred Frogs captured will be relocated to the nearest side of the clearing limit: A permit is not required by NSW authorities for relocation of frogs and tadpoles).</li> </ol> </li> <li>c. Clearing supervision during the clearing and grubbing program; and</li> <li>d. De-watering procedures within areas identified as Giant Barred Frog habitat (i.e. creek diversions).</li> </ol> </li> </ol> <p>The dewatering process will be conducted in accordance with an Environmental Work Method Statement (EWMS) and the DECC (2008) Hygiene protocol for the control of disease in frogs Information Circular Number 6 (DECC 2008). All waterways and dams within those areas identified as Giant Barred Frog habitat will be subject to this dewatering process. Environmental Work Method Statement (EWMS) developed for all dewatering activities incorporating all measures outlined in section 3.2.2 iv of the GBF management strategy. Please note that the EWMS is a construction document and will be developed during construction. These will be developed by the environmental manager in consultation with the environmental review group (NSW EPA, fisheries, RMS and the JV)</p> <ol style="list-style-type: none"> <li>3. Frog fencing in areas of Giant</li> </ol>	<p><b>Performance indicators:</b> Identify all known GBF habitat AND Implement frog fencing. AND All pre-clearance surveys undertaken by a suitably qualified ecologist as outlined in the definition provided in the EPBC approval. AND All pre-clearing surveys carried out within 5 days and no greater than 48hrs prior to clearing and grubbing activities within known GBF habitat. AND Project Ecologist / suitably qualified expert supervise clearing and grubbing operations in known areas of GBF habitat. AND Dewatering eWMS developed in consultation with the project ERG AND Implement frog fencing around known areas of GBF habitat AND Implement procedure following positive find of GBF AND Identification of suitable land within the Biodiversity Offset Package which contains a population of GBF's. AND As per GBFMP AND As per the Water Quality Monitoring Plan AND Surveys for GBF and habitat carried out.</p> <p><b>Performance target:</b> 100% of the K2K sensitive area plans identify GBF habitat. AND</p>	<p>5 days prior to clearing in known areas of GBF habitat</p> <p>Within 5 days but no later than 48hrs of commencing clearing and grubbing in known areas of GBF habitat</p> <p>Daily in know areas of GBF habitat.</p> <p>10 days prior to commencement of de-watering activities in known areas of GBF habitat</p> <p>5 days prior to working in known areas of GBF habitat</p> <p>Immediately after positive finding GBF</p> <p>Prior to implementation of the Biodiversity Offset Package</p> <p>As per GBFMP</p>	<p>Environmental Manager Environmental Advisor Foreman Engineer</p>	<p>Giant Barred Frog habitat was identified as part of the pre-construction surveys. Frog fencing was implemented in these areas at least 5 days prior to the commencement of any construction works in these areas. This has now all been replaced with permanent frog fence. All pre-clearing surveys were undertaken by the Project Ecologist, who meets the definition a suitably qualified expert in EPBC 2012/6518. Pre-clearing surveys for the Giant Barred Frog were carried out on two non-consecutive nights at least 5 days prior to clearing. This is detailed in the Pre-clearing/ Clearing included in Appendix B. Pre-Clearing surveys for the Giant Barred Frog were conducted no greater than 48 hours prior to clearing, and these surveys and any relocations were recorded on the Permit to Clear. This information has also been collated in the Pre-clearing/ Clearing report. All clearing within areas of known Giant Barred Frog habitat was supervised by the Project Ecologist. This was recorded on the Permit to Clear for these areas. A dewatering EWMS was prepared in consultation with the ERG. Consultation took place in October 2014, and construction commenced in November 2014. There were no unexpected finds of Giant Barred Frogs within the construction area. As such, the unexpected finds process has not been required to be implemented. As required, water quality monitoring has continued as per the Water Quality Monitoring Program in areas of known Giant Barred Frog habitat, specifically Smiths Creek, Pipers Creek and Maria River. Results that exceed the trigger values were considered not attributable to construction as a close look at the raw data indicated that either the upstream values were very similar to the downstream values during these individual monitoring events or the downstream values were a reflection of the sampling location downstream (eg shallow and narrow) as opposed to an observable construction input. See the Giant Barred Frog Monitoring Report in Appendix B for detailed water quality monitoring results. Giant Barred Frog monitoring was conducted tri-annually during construction (to allow direct comparison with operational monitoring, which is tri-annually, rather than bi-annually). The results of this monitoring can be found in Appendix B.</p>	Closed

	<p>Barred Frog habitat considered in the context of:</p> <ol style="list-style-type: none"> <li>a. Temporary frog fencing; and</li> <li>b. Permanent frog fencing.</li> </ol> <ol style="list-style-type: none"> <li>4. An unexpected finds procedure to address instances where Giant Barred Frogs are detected during routine pre-clearing surveys or at other times during the project.</li> <li>5. Suitable land is identified within the Biodiversity Offset Package which contains a population of Giant barred Frogs. Note: The criteria for determining offset / compensatory habitat for the GBF will be contained in the Biodiversity Offset Management Plan and will comply with condition 5.</li> </ol> <p><b>Monitoring of the Management Strategies</b></p> <p>The monitoring program will be limited to Smiths Creek, Pipers Creek and Maria River. Between 1-2 reference sites will also be incorporated into this monitoring program. Alternative reference sites could include upstream locations where Smiths Creek Road crosses Smiths Creek and Old Coast Road where it crosses Pipers Creek.</p> <p><b>Frequency of Surveys</b></p> <p>The surveys will be undertaken in spring, summer and autumn following operation of the project, between Year 4 and Year 8 (i.e. 5 years; Table 4-1. Year 4 represents the commencement of operation of either stage of the project – Oxley Highway to Kundabung or Kundabung to Kempsey). A baseline survey will be undertaken prior to construction and consist of one survey in spring, summer and autumn (i.e. three surveys). This approach will provide cues on habitat use within and adjacent to the road corridor leading up to construction and provide the basis for comparing the overall performance of the project. The baseline survey and (survey report) is to be completed prior to the commencement of clearing and grubbing within 500 m of Giant Barred Frog habitat identified at Smiths Creek, Pipers Creek and Maria River.</p> <p>Baseline monitoring data for the GBF has been included in the updated Ecological Monitoring Program. Refer to App A of the CEMP for detailed maps of GBF habitat and 'no-go' zones.</p> <p><b>Frog and Tadpole Surveys</b></p> <p>Frog and Tadpole surveys provide an additional means to assess population structure and as to whether frogs are breeding at the site. The survey procedure is outlined in the GBFMP</p>	<p>All areas of known GBF habitat fenced at least 5 days prior to clearing commencing.</p> <p>AND</p> <p>All pre-clearing surveys carried out by a suitably qualified ecologist.</p> <p>AND</p> <p>All pre-clearing surveys carried out within 5 days and no greater than 48hrs prior to clearing and grubbing activities within known GBF habitat.</p> <p>AND</p> <p>All clearing and grubbing activities within known GBF habitat supervised by suitably qualified ecologist</p> <p>AND</p> <p>No dewatering works to commence until ERG is consulted on the Dewatering EWMS.</p> <p>AND</p> <p>Fencing installed around all known areas of GBF habitat at least 5 days prior to commencing work in GBF habitat.</p> <p>AND</p> <p>All unanticipated discoveries of the GBF immediately follow GBF finds procedure</p> <p>AND</p> <p>Biodiversity Offset strategy contains population of GBF or suitable habitat.</p> <p>AND</p> <p>All mitigation measures carried out as specified in the GBFMP</p> <p>AND</p> <p>All mitigation carried out as specified in the Water Quality Monitoring Plan</p> <p>AND</p> <p>All surveys for GBF and GBF habitat completed bi-annually during construction.</p>	<p>As per the Water Quality Monitoring Plan</p> <p>Bi-annually during construction</p> <p>5 days prior to clearing in known areas of GBF habitat</p> <p>Within 5 days but no later than 48hrs of commencing clearing and grubbing in known areas of GBF habitat</p> <p>Daily in know areas of GBF habitat.</p> <p>10 days prior to commencement of de-watering activities in known areas of GBF habitat</p> <p>5 days prior to working in known areas of GBF habitat</p> <p>Immediately after positive finding GBF</p> <p>Prior to implementation of the Biodiversity Offset Package</p> <p>As per GBFMP</p> <p>As per the Water Quality</p>	<p>RMS</p> <p>Environmental Manager Environmental Advisor</p>		
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	<p><b>Habitat Surveys</b></p> <p>Habitat surveys provide an opportunity to measure changes in the receiving environment over the life of the monitoring program.</p> <p>Habitat data would initially be collected each year during the spring sampling period and the need for additional habitat monitoring would be subject to review.</p> <p>A water quality monitoring program is in place. Implementation of the program has commenced and will continue for the duration of construction. This program includes water quality monitoring in GBF habitat, specifically Smiths creek, Pipers Creek and Maria River.</p> <p>During construction, habitat and frog survey data would be collected each year biannually.</p>		Monitoring Plan	Bi-annually during construction	RMS		
FF18	<p>The measures identified in the Giant Barred Frog Management Plan will be implemented and include:</p> <p>Surveys will be undertaken 24 hours in advance of clearing to determine the presence of individuals within localised clearing areas in the form of a clearing survey.</p> <p>Frog fencing will be installed at least 5 days prior to the commencement of clearing in Giant Barred Frog Habitat Areas.</p> <p>Dewatering will be undertaken in accordance with the hygiene protocol described in CoA 2(a).</p>	<p><b>Performance indicators:</b></p> <p>Surveys of GBF habitat undertaken in advance of clearing</p> <p>AND</p> <p>Frog fencing installed prior to the commencement of clearing in suitable areas.</p> <p>AND</p> <p>Dewatering undertaken in accordance with the hygiene protocol described in CoA 2(a).</p> <p><b>Performance targets:</b></p> <p>All surveys for GBF are completed prior to clearing GBF habitat</p> <p>AND</p> <p>All frog fencing installed around GBF habitat prior to clearing</p> <p>AND</p> <p>All dewatering of known GBF habitat undertaken in accordance with the hygiene protocol described in CoA 2 (a)</p>	<p>24 hours prior to clearing</p> <p>5 days prior to the commencement of clearing</p> <p>As required</p>	<p>Environmental Manager</p> <p>Project Ecologist / suitably qualified expert</p>	<p>Pre-clearing surveys for the Giant Barred Frog were carried out 24 hours prior to clearing and were recorded on the Permit to Clear.</p> <p>Frog fencing was implemented in these areas at least 5 days prior to the commencement of any construction works in these areas. Pre-clearing permits for the installation of frog fencing demonstrate that this occurred at least 5 days prior to clearing in these areas (it was done prior to Stage 1 clearing). This fencing has now been replaced with permanent fence.</p> <p>No dewatering has been conducted into GBF habitat from another area of site; therefore no hygiene protocols have been required for this activity.</p>	Closed	
FF6, FF34	<p>The limits of clearing are to be clearly marked on all relevant work plans and protective fencing erected to mark these limits (i.e. 'no-go' areas). Fencing will be installed 5 days prior to vegetation clearing activities occurring.</p> <p>Riparian and aquatic habitat (including known GBF habitat) will be protected from construction works through the installation of protective fencing prior to works commencing in the vicinity.</p>	<p><b>Performance indicators:</b></p> <p>The limits of clearing clearly marked on all relevant work plans and protective fencing erected to mark these limits.</p> <p>AND</p> <p>Installation of protective fencing around riparian and aquatic habitat.</p> <p><b>Performance targets:</b></p> <p>100% of relevant work plans contain clearing limits, an protective fencing erected along all limits of clearing at least 5 days prior to clearing commencing in that area.</p> <p>AND</p>	<p>5 days prior to vegetation clearing activities occurring</p> <p>5 days prior to vegetation clearing activities occurring near riparian and aquatic habitat</p>	<p>Project / Site Engineers</p> <p>Foreman / Leading Hands</p> <p>Environmental Manager</p>	<p>Clearing limits were marked on the sensitive area plans. The installation of clearing fencing occurred as part of the pre-construction surveys. Clearing fencing, including fencing to protect riparian, aquatic and Giant Barred Frog habitat, was installed in each area at least 5 days prior to clearing commencing in these areas (see above).</p>	Closed	

		All riparian and aquatic protection fencing installed at least 5 days prior to construction works commencing within the vicinity.				
FF23	Removal of frog habitat along drainage lines will not be undertaken during wet weather (i.e. during or within 48 hours of rain events exceeding 10 millimeters).	<b>Performance indicator:</b> No removal of frog habitat along drainage lines during 'wet weather'.  <b>Performance target:</b> All frog habitat removal to be completed during dry weather (i.e. not during or within 48 hrs of rain events exceeding 10 millimeters)	During or within 48 hours of rain events exceeding 10 millimeters.	Foreman/ Leading Hands  Environmental Manager  Project Ecologist / suitably qualified expert	No clearing in Giant Barred Frog habitat areas occurred during this reporting period.	Closed
FF33	Waterways (including known GBF habitat) will be protected from sediment impacts during construction, in accordance with the mitigation measures listed in the CSWMP and included within this table below (denoted by the 'SW' ID reference). Measures designed specifically to protect aquatic flora and fauna may include: <ul style="list-style-type: none"><li>Installation of in stream sediment curtains</li><li>Construction of temporary diversions</li></ul>	<b>Performance indicator:</b> If required, installation of in stream sediment curtains AND If required, construction of temporary diversions  <b>Performance targets:</b> Installation of sediment curtains in all streams where prescribed AND Installation of temporary diversions in all waterways, where prescribed	Any time prior to the commencement of in-stream works  Any time prior to the commencement of in-stream works	Environmental Manager Project Soil Conservationist Foreman	In stream works are now complete in all waterways.	Closed
FF35	Existing trees, grasses and ground cover will be retained within 15 meters of watercourses (including known GBF habitat) until immediately before construction commences in that area (i.e. 48 hours). All trees in these areas will be felled manually, leaving grasses and small understory species wherever possible.	<b>Performance indicator:</b> Retention of trees, grasses and groundcovers within 15 metres of watercourse  <b>Performance target:</b> All vegetation within 15 metres of a watercourse retained until immediately prior to construction	At least 48hrs prior to clearing operations within 15 meters of a watercourse	Environmental Advisor Foreman	Existing trees, grasses and groundcovers were retained within Pipers Creek and Smiths Creek until immediately prior to construction commenced in those areas. All trees in these areas were felled manually, and groundcovers retained where possible. Clearing is complete in these areas. No clearing was required within Maria River.	Closed
SW67	Watercourse bed and banks to be monitored weekly and post rainfall during construction for indications of instability. Attention to monitoring for channel erosion will be completed during and following higher than normal flow conditions. Protection measures will be installed should increase intensity or erosion be identified.  Where increased intensity of erosion is identified that may have an impact on EPBC species or their habitat, these will be rectified within 5 days. If there is an immediate risk of impact on EPBC Act listed species, temporary rectification works will occur within 1 day.	<b>Performance indicators:</b> Completion of Weekly Environmental Inspection and Post Rainfall Inspection as required and following higher than normal flow conditions. AND Rectification of identified increased intensity of erosion within watercourse beds and banks that may have an impact on EPBC species or their habitat.  <b>Performance targets</b> Completion of Environmental Inspections every week; and after all rain events, in all areas of work in and adjacent to watercourses AND All areas of increased intensity of erosion within watercourse beds and banks that may impact on EPBC species or their habitat rectified within 5 days or 1 day (immediate risk).	Weekly Environmental Inspection Post Rainfall Inspection (as required).  Within 5 days of identification (within one day when there is an immediate risk).	Environmental Advisor  Environmental Advisor / Foreman	Watercourse bed and bank monitoring was included in both informal inspections, and weekly, during and post rainfall environmental inspections by the environment team. See SW65 for frequency of environmental inspections, which included inspections both during and post rainfall events.	Closed

CoA 2d.	FF7	Prior to vegetation clearing, a suitably qualified ecologist will survey all areas to be cleared and will mark out any areas of significant vegetation (EECs, threatened species, riparian vegetation and mangroves) to be fenced and protected, in accordance with the methodology outlined in Section 4.3.1.	<p><b>Performance indicators:</b> Completion of Pre-Construction Surveys. AND Completion of Pre-Clearing Surveys.</p> <p><b>Performance targets:</b> Completion of pre-construction surveys in all areas of clearing 20 days prior to clearing. AND Completion of pre-clearing surveys in all areas of clearing at least 24 hours but no greater than 48 hours prior to clearing.</p>	20 days prior to clearing  At least 24 hours but no greater than 48 hrs prior to clearing.	Environmental Manager  Project Ecologist / suitably qualified expert	At least 20 days prior to all clearing, the Project Ecologist (who is suitably qualified), completed the pre-construction survey and surveyed all areas to be cleared. The survey included: <ul style="list-style-type: none"> <li>Confirmation of the accuracy of the sensitive area mapping, which includes areas of significant vegetation. No additional areas were identified for protection</li> <li>Noxious weed survey including, location of weed infestations, species of weed, weed class, patch size and weed mapping.</li> </ul> The Project Ecologist also completed pre-clearing surveys in all areas to be cleared at least 24 hours, but no greater than 48 hours, prior to clearing in that area. These surveys are recorded on the Permit to Clear for each area, and this has been discussed in the Pre-Clearing / Clearing Report.	Closed
	FF24	A suitably qualified expert will undertake pre-clearance surveys for native fauna immediately prior to clearing activities. Searches will be undertaken on, hollow bearing trees, logs, existing culverts and bridges. Searches will take place no earlier than 48 hours prior to the removal of vegetation occurring in that area to ensure that the area is free of the Koala, Giant-Barred Frog, Grey-headed Flying-fox, Spotted-tail Quoll, Little Eagle and other hollow dwelling species.	<p><b>Performance indicator:</b> Completion of Pre-Clearing Surveys.</p> <p><b>Performance target:</b> Completion of pre-clearing surveys in all areas of clearing at least 24 hours but no greater than 48 hours prior to clearing.</p>	At least 24 hours but no greater than 48 hrs prior to clearing.	Environmental Manager  Project Ecologist / suitably qualified expert	The Project completed pre-clearing surveys in all areas to be cleared at least 24 hours, but no greater than 48 hours, prior to clearing in that area. These surveys were recorded on the Permit to Clear for each area, and are discussed in the Pre-Clearing / Clearing Report.  The surveys included hollow bearing trees, logs, existing culverts, and bridges. These surveys also ensured that the area to be cleared was free of the Koala, Giant-Barred Frog, Grey-headed Flying-fox, Spotted-tail Quoll, Little Eagle and other hollow dwelling species.	Closed
	FF27	A two-stage clearing process will be implemented in all areas supporting identified fauna habitat such as hollow bearing trees, habitat trees and bushrock. <ul style="list-style-type: none"> <li>Non-habitat trees will be removed before habitat trees, allowing fauna an opportunity to move from the habitat trees.</li> <li>Non-habitat trees will be removed at least 48 hours before habitat trees are removed (unless otherwise agreed by the EPA).</li> <li>Felled (habitat) trees will be left for a short period of time (i.e. at least one hour except in instances approved by the Project Ecologist / suitably qualified expert) on the ground, to give any fauna remaining in the trees an opportunity to escape before further processing of the trees occurs. The Project Ecologist/ suitably qualified expert or wildlife handler will inspect the felled trees for resident species or injured wildlife. These will then be treated or relocated. Relocated wildlife will be moved the shortest possible distance to improve the likelihood of survival given this area is probably within the animals home range.</li> </ul>	<p><b>Performance indicator:</b> Completion of two-stage clearing in identified fauna habitat.</p> <p><b>Performance target:</b> Two-stage clearing conducted in all areas of fauna habitat.</p>	At least 24 hours but no greater than 48 hrs prior to clearing.	Environmental Manager  Project Ecologist / suitably qualified expert	All clearing was conducted in accordance with two stage clearing process. This is recorded on the Permit to Clear, and discussed in the Pre-Clearing / Clearing Report.	Closed
CoA 2e.	N/A	Procedures shall be implemented to ensure that fauna identified during pre-clearance surveys are treated and handled in an appropriate manner. These procedures are outlined in Appendix I of this CFFMP, the Fauna Handling and Rescue Procedure.	<p><b>Performance indicator:</b> Implementation of the Fauna Handling and Rescue Procedure (Appendix I of this CFFMP).</p> <p><b>Performance target:</b></p>	As required	Environmental Manager  Project Ecologist / suitably qualified expert	Number and type of fauna rescued during pre-clearing surveys was recorded on the Permit to Clear, and discussed in the Pre-Clearing /Clearing Report.  The Fauna Handling and Rescue Procedure was implemented for all fauna rescues during pre-clearing surveys and throughout construction.	Closed

		Implementation of the Fauna Handling and Rescue Procedure in all cases of identified fauna during pre-clearance surveys.				
FF4	A Project ecologist/ suitably qualified expert specific to the known threatened species found on site will be appointed prior to the commencement of construction.	<p><b>Performance indicator:</b> Presence of project ecologist/ suitably qualified expert during construction activities which have the potential to impact upon known locations of GBF.</p> <p><b>Performance target:</b> Project ecologist/suitably expert present during all construction activities that have the potential to impact upon known locations of GBF</p>	Appointment prior to the commencement of construction.	Environmental Manager  Project Ecologist/ suitably qualified expert	<p>The Project Ecologist (who meets the definition of a 'suitably qualified expert' in EPBC 2012/6518) was engaged in June 2014. Construction of this stage of the project commenced in mid-November 2014 and was completed in October 2017.</p> <p>The Project Ecologist appointed has specific experience in a range of threatened species, including but not limited to Giant Barred Frogs, Quolls and Koalas.</p> <p>The Project Ecologist was present for all clearing works that had the potential to impact on known locations of GBF, as documented in each Permit to Clear.</p>	Closed
FF26	During the proposed clearing works, the Project Ecologist/ suitably qualified expert or an experienced wildlife handler under the supervision of the Project Ecologist / suitably qualified expert will be present to retrieve and provide appropriate care of any displaced fauna and release the fauna into adjacent habitats safe from construction work.	<p><b>Performance indicators:</b> Implementation of the Fauna Handling and Rescue Procedure (Appendix I). AND Presence of suitably qualified individual during clearing activities.</p> <p><b>Performance target:</b> Implementation of the Fauna Handling and Rescue Procedure in all cases of identified fauna during all clearing works AND Suitably qualified individual present during all clearing activities</p>	At all times during clearing activities.		<p>The Project Ecologist was present during all clearing works conducted on the project to retrieve and provide appropriate care of any displaced fauna. Full detail of these works is included in the Pre-Clearing / Clearing Report.</p> <p>All rescued fauna were released into adjacent habitat, at the discretion of the Project Ecologist, to ensure they remained safe from ongoing construction work.</p>	Closed
FF28	Contact details for the Project Ecologist / suitably qualified expert, FAWNA, the Port Macquarie Koala Hospital and local veterinary hospitals will be maintained and kept at a convenient location on the Construction Site and must be available to the relevant management and supervisory personnel at all locations where clearing is being undertaken, to enable quick contact in the event of a fauna rescue.	<p><b>Performance indicators:</b> Contact details of details for the Project Ecologist / suitably qualified expert, FAWNA, the Port Macquarie Koala Hospital and local veterinary hospitals placed on notice boards in main office and crib sheds. AND Contact details of details for the Project Ecologist / suitably qualified expert, FAWNA, the Port Macquarie Koala Hospital and local veterinary hospitals incorporated in the Clearing and Grubbing EWMS.</p> <p><b>Performance targets:</b> Contact details for the Project Ecologist / suitably qualified expert, FAWNA, the Port Macquarie Koala Hospital and local veterinary hospitals placed on all notice boards in main office and crib sheds prior to clearing. AND Contact details of details for the Project Ecologist / suitably qualified expert, FAWNA, the Port Macquarie Koala Hospital and local veterinary</p>	<p>Prior to the commencement of construction.</p> <p>Provided to the relevant parties 10 days prior to clearing.</p>	Environmental Manager	<p>Contact details for the Project Ecologist / suitably qualified expert, FAWNA, the Port Macquarie Koala Hospital and local veterinary hospitals could be found on notice boards at the main compound and crib sheds. These have now been decommissioned.</p> <p>These contact details were also included in the Fauna Handling and Rescue Procedure. The Clearing and Grubbing EWMS contained the contact details of the Project Ecologist, FAWNA, the Port Macquarie Koala Hospital and local veterinary hospitals.</p>	Closed

		hospitals incorporated in the Clearing and Grubbing EWMS prior to clearing.					
FF22	Specific measures identified in the Pre-clearing checklist/Fauna Handling and Rescue Procedure will be followed. Specifically: <ul style="list-style-type: none"> <li>Clearing will be conducted in two stages (felling of non-habitat trees followed by habitat trees at least 24 hours later).</li> <li>Felling of habitat trees within koala habitat will only be undertaken in the presence of a suitably qualified koala spotter.</li> </ul>	<p><b>Performance indicators:</b> Clearing conducted in two stages (felling of non-habitat trees followed by habitat trees at least 24 hours later). AND Felling of habitat trees within koala habitat undertaken in the presence of a suitably qualified koala spotter.</p> <p><b>Performance targets:</b> All clearing conducted in 2 stages (felling of non-habitat trees followed by habitat trees at least 24hrs later) AND Presence of a suitably qualified koala spotter present for all felling of habitat trees within koala habitat</p>	All clearing activities.	Site Engineers  Foreman  Environmental Advisor  Project Ecologist / suitably qualified expert	All clearing, subject to safety requirements, was conducted in two stages in accordance with the Fauna Handling and Rescue procedure. This is recorded in the Permit to Clear and discussed in the Pre-Clearing / Clearing Report.  Felling of all habitat trees, within and outside koala habitat areas, was conducted under the direct supervision of the Project Ecologist, who is considered to be a suitably qualified koala spotter.	Closed	
CoA 2f.	N/A	Key milestones, monitoring actions, performance indicators and timeframes are identified in this table relating to Conditions 2.a and 2.e inclusive.  All nonconformities identified during surveillance, monitoring, inspections and audits must be closed out and signed off within the timeframe agreed with the Principal, the Project Environmental Representative, and relevant Authorities. Written responses to non-conformities identified must be provided to: <ul style="list-style-type: none"> <li>The Principal, the Project Environmental Representative and relevant regulatory Authorities within 5 working days; except</li> <li>Non-conformities identified in audits where a response must be provided within 7 working days.</li> </ul>	<p><b>Performance indicators:</b> Compliance with all mitigation measures (including timeframes) outlined within this table and approved Construction Environmental Management Plan. AND All non-conformities be closed out and signed off within the timeframe agreed with the Principal, the Project Environmental Representative, and relevant Authorities</p> <p><b>Performance targets:</b> Compliance with all mitigation measures outlined within this table (including timeframes) and approved CEMP AND All non-conformities closed out within the timeframe agreed with the Principal, the Project Representative and relevant authorities</p>	As outlined in this table.	Environmental Manager  RMS  Project Environmental Representative	There were no non-conformities with the mitigation measures outlined in the Flora and Fauna Management Plan during this reporting period.	Closed
		For each non-conformance identified, a corrective/preventative action (or actions) must be implemented. In addition, any environmental management improvement opportunities can be initiated because of incidents or emergencies, monitoring and measurement, audit findings or other reviews. Improvement opportunities may also result in the implementation of corrective / preventative actions.	<p><b>Performance indicator:</b> Written responses to non-conformities identified provided to:</p> <ul style="list-style-type: none"> <li>The Principal, the Project Environmental Representative and relevant regulatory Authorities; except</li> <li>Non-conformities identified in audits</li> </ul> <p><b>Performance target:</b> All identified non-conformities responded to in writing and provided to:</p> <ul style="list-style-type: none"> <li>The Principal, the Project Environmental Representative and relevant regulatory Authorities; except</li> </ul>	Provided to the Principal within 5 working days  Non-conformances identified and recorded in Monthly audits.		There were no non-conformities with the mitigation measures outlined in the Flora and Fauna Management Plan during this reporting period.	Closed

		<ul style="list-style-type: none"> <li>• Non-conformities identified in audits</li> </ul>				
	<p>Corrective / preventative actions and improvement opportunities will be recorded and managed via the Project Commitments Register, or other suitable designated database. Details entered will include detail of the issue, action required and timing and responsibilities. The record will be updated with date of close out and any necessary notes. The database will be reviewed regularly to ensure actions are closed out as required.</p> <p>Procedures for rectifying any non-compliance identified during environmental auditing, review of compliance or incident management are also documented in the Compliance Tracking Program.</p>	<p><b>Performance indicators</b> Up to date project commitments register, or other suitable designated data base. AND Non-compliances documented in the compliance tracking program.</p> <p><b>Performance targets:</b> Project commitments register or other suitable designated data base kept up to date at all times. AND All non-conformances documented in the compliance tracking program</p>	<p>Quarterly (otherwise as required).</p>		<p>A database (Incident Register in iTWOcx) was established to record all non-conformances and included detail of the issue, action required and timing and responsibilities.</p> <p>All non-conformances are identified in the six-monthly compliance reports prepared as part of the compliance tracking program. Six-monthly reports have so far been prepared in March (July 2014 – January 2015), September 2015 (January 2015 – July 2015), March 2016 (July 2015 – January 2016), September 2016 (January 2016 – July 2016), March 2017 (July 2016 – January 2017), September 2017 (January 2017 – July 2017) and May 2018 (July 2017 – March 2018) and provided to the EPA, DPI (Fishing &amp; Aquaculture) and the Department of Planning &amp; Environment. The reports are also available on the website at the following link: <a href="http://www.rms.nsw.gov.au/projects/northern-nsw/oxley-highway-to-kempsey/project-documents.html">http://www.rms.nsw.gov.au/projects/northern-nsw/oxley-highway-to-kempsey/project-documents.html</a></p>	<p>Closed</p>

Stage 3: Oxley Highway to Kundabung

ID	Management Action	Performance Indicator/Target	Monitoring/Timing	Responsibility	Compliance Status	Status
<i>General Measures</i>						
EPBC 1 FF 1	Training will be provided to all project personnel, including relevant sub-contractors on matters of NES as identified in section 3.4.2.	<b>Performance indicator:</b> Induction of staff on NES matters prior to commencement of works on site. <b>Performance target:</b> 100% of all staff inducted on NES matters prior to commencement of work on site.	Site induction prior to work on-site	Environmental Manager	The induction was undertaken by all staff prior to the staff member commencing work. The induction room contained training resources including sensitive area plans, examples of different flagging tape and key environmental issues. Section 5.4 of the induction detailed flora and fauna requirements. Specifically: <ul style="list-style-type: none"> <li>○ Report native fauna onsite and not to handle fauna</li> <li>○ All plant to be inspected and signed off as weed free. Need to clean down plant when changing location</li> <li>○ EWMS, staying within flagging tape, clearing permit, ecologist onsite during clearing, reporting koala sightings, Chytrid fungus washdown procedure.</li> </ul> Induction included an Environmental Induction Question sheet which all participants completed.	Closed
EPBC 2	Sensitive Area Plans showing site constraints (including matters of NES) shall be prominently displayed across the site. Sensitive Areas Plans form Appendix A6 of the CEMP.	<b>Performance indicator:</b> Display of Sensitive Area Plans at all primary and satellite compounds. <b>Performance target:</b> 100% of primary and satellite compounds have Sensitive Areas Plans displayed.	Prior to construction and for duration of construction.	Environmental Coordinators	A large full site sensitive area plan was provided within the training room at the main compound and was also available on the project drive, Environmental Manager's Office and design package EN01. In satellite compounds, sensitive area plans were available on the desks of the Foreman for those areas. The main compound and all satellite compounds have now been decommissioned.	Closed
EPBC 3 FF 7	Prior to vegetation clearing, a suitably qualified ecologist/expert will survey all areas to be cleared and will mark out any areas of significant vegetation (EECs, threatened species, riparian vegetation and mangroves) to be fenced and protected. Areas of weed infestation will also be identified and documented. These surveys will be completed no later than 20 working days prior to the commencement of clearing and will be limited to the time required to complete these surveys.	<b>Performance indicator:</b> Completion of pre-clearing survey including mark-out of clearing extents and identification of weed infestation prior to construction. <b>Performance target:</b> Completion of pre-clearing survey prior to construction including mark-out of clearing extents and identification of weed infestation in 100% of clearing areas.	No later than 20 days prior to commencement of clearing.	Environmental Manager Project Ecologist Environmental Coordinators	At least 20 days prior to clearing, the Project Ecologist (who is suitably qualified), completed the pre-clearing survey and surveyed all areas to be cleared. The survey included: <ul style="list-style-type: none"> <li>• Confirmation of the accuracy of the sensitive area mapping, which includes areas of significant vegetation. No additional areas were identified for protection</li> <li>• Noxious weed survey including, location of weed infestations, species of weed, weed class, patch size and weed mapping.</li> </ul>	Closed
EPBC 4 FF4	A Project ecologist / suitably qualified expert (an individual with tertiary qualifications and/or a minimum years demonstrated experience relevant to the task in question) will be appointed prior to construction where matters of NES are involved.	<b>Performance indicator:</b> Appointment of project ecologist/suitably qualified expert. <b>Performance target:</b> Appointment of project ecologist/suitably qualified expert prior to commencement of works.	Prior to the commencement of construction	Environmental Manager	Dr David Rohweder was the Project Ecologist. David has 18 years ecological experience and holds a PHD in applied science. David was appointed in August 2014, works commenced on this stage of the project in early November 2014 and were completed in March 2018.	Closed
EPBC 5 FF 5	Lend Lease will implement the construction ecological monitoring requirements for matters of NES during the construction phase as stipulated within the Ecological Monitoring Program.	<b>Performance indicator:</b> Completion of construction ecological monitoring requirements. <b>Performance target:</b> Completion of construction ecological monitoring requirements in accordance frequency stipulated in the EMP.	Timing and roles identified as per table 19 of the Ecological Monitoring Program found in Appendix K. Giant Barred Frog Monitoring will occur bi annually throughout construction.	Environmental Manager/ RMS	See Section 4 and Appendix B. All construction phase monitoring is now complete.	Closed
EPBC 6 FF 6	The limits of clearing are to be clearly marked on all relevant work plans and protective fencing erected to mark these limits (i.e. 'no-go' areas).	<b>Performance indicator:</b> Inclusion of sensitive areas on Sensitive Area Plans and limits of clearing on clearing drawings AND Completion of pre-clearing survey	Limits of clearing will be marked out prior to clearing commencing in that area.	Project / Site Engineers Foreman / Leading Hands Environmental Coordinators	Sensitive areas were shown on the sensitive area drawings and clearing limits were shown on ESCP, plans attached to pre-clearing permits, and on CT01 drawings (clearing drawings). All clearing extents were marked out in the field using clearing flagging prior to the commencement of clearing in these areas. See EPBC 3 for discussion on completion of the pre-clearing survey.	Closed

ID	Management Action	Performance Indicator/Target	Monitoring/Timing	Responsibility	Compliance Status	Status
		including mark-out of clearing extents and identification of weed infestation prior to construction. <b>Performance target:</b> 100% Sensitive Area Plans identify sensitive areas and 100% of clearing drawings identify clearing extents. AND Completion of pre-clearing survey prior to construction including mark-out of clearing extents and identification of weed infestation in 100% of clearing areas.	Fencing installed prior to vegetation clearing activities commencing in that area. Fencing and no-go signage inspected weekly, Until construction completion.			
CoA 2a.						
EPBC 7	Weeds will be managed in accordance with the management actions detailed in Section 7 of the weed and pathogen management plan (Appendix J)	<b>Performance indicator:</b> Completion of weed management actions outlined in Appendix J. <b>Performance target:</b> Completion of all weed management actions outlined in Appendix J in the timeframes specified.	As outlined in Appendix J.	Project / Site Engineers Foreman / Leading Hands Environmental Coordinators	Hire plant inspection reports were completed for all incoming plant and equipment onto the project. This includes a check for weed and pest infestation. Weed monitoring was documented in the weekly environmental inspection checklist. Weed mapping identified areas of weed infestation and weed free areas. Topsoil outside of the high weed infestation areas was identified for reuse. Weed control is being undertaken as part of revegetation works, and this will continue throughout the landscape maintenance period.	Closed
EPBC 8 FF36	Washing procedures for plant and equipment will be in accordance with the process described for machinery in Table 8.1 of Appendix J.	<b>Performance indicator:</b> Wash down of plant and equipment before entering site. <b>Performance target:</b> 100% of plant and equipment are washed down before entering site.	All plant prior to use on site.	Project / Site Engineers Foreman / Leading Hands Environmental Coordinators	A vehicle wash down facility was provided at the workshop. Boot washdown facilities were available at areas of GBF habitat prior to hardstand tracks and parking areas being implemented.	Closed
EPBC 9 FF37	The spread of bacteria, viruses and diseases such as Myrtle rust, <i>Phytophthora cinnamomi</i> , amphibian chytrid fungus and beak and feather disease will be addressed through washing of equipment. The washing procedure will be undertaken in accordance with the process described in Table 8.1 of Appendix J.	<b>Performance indicator:</b> Wash down of plant and equipment before entering site. AND Implementation of Chytrid Fungus wash down procedure in Appendix J. <b>Performance target:</b> 100% of plant and equipment washed down before entering site. AND Chytrid Fungus washdown procedure is implemented prior to the commencement of work in all areas required in the procedure.	All plant during construction prior to use on site.  As outlined in Appendix J.	Project Engineers Foreman / Leading Hands Environmental Coordinators	See EPBC 8.	Closed
EPBC 10	Weed management training will be provided to key staff on-site.	<b>Performance indicator:</b> Provision of weed management training to key staff on site. <b>Performance target:</b> 100% of key staff provided with weed management training during construction.	Induction for all personnel prior to commencing work on site.	Environmental Manager	Weed management training was provided through inductions, which was compulsory for all staff prior to commencing work. Further training was provided to key staff (eg clearing contractors) via toolboxes on the EWMS.	Closed
EPBC 11 FF 9 FF10	Revegetation/rehabilitation of areas disturbed as part of construction of the project that do not form part of the permanent pavement or structures will be undertaken progressively during and following construction to maintain and enhance habitat, particularly in identified regional corridors and key habitat areas. Re-vegetation and rehabilitation works will be completed as soon as possible following the completion of earthworks, with a preference for progressive stabilisation	<b>Performance indicator:</b> Direct seeding (hydromulch) of disturbed areas following completion of all construction activities. AND Completion of rehabilitation works in accordance with the approved Landscape design.	Direct seeding will be completed 14 days from completion of works (completion of all activities required to finalise and rehabilitate disturbed areas, including placement	Project / Site Engineers Foreman / Leading Hands Environmental Manager	Rehabilitation and revegetation has occurred progressively. These areas were hydromulched in accordance with the approved landscape design. Tubestock planting also occurred across most of the site, in accordance with the approved landscape design. Seed mixes in the approved landscape design were broadly representative of the adjacent vegetation communities. All landscaping works used the seed mix outlined in the approved landscape design. Additional seed, or different species of seed, was added in some locations where revegetation outcomes can be improved.	Closed



ID	Management Action	Performance Indicator/Target	Monitoring/Timing	Responsibility	Compliance Status	Status
	<p>of works.</p> <p>Vegetation species selected for rehabilitation will be representative of the vegetation communities adjacent to the specific area of works. Rehabilitation works shall be completed in accordance with the approved Landscape design and evidence of the application of native vegetation species shall be recorded and maintained throughout construction.</p> <p>Following completion of construction of the OH2Ku project, re-vegetation/rehabilitation areas should achieve a species diversity and quality similar to the vegetation community adjacent to the works.</p> <p>The success of re-vegetation of the disturbed areas will be assessed by the Landscape Representative and collated into a Landscaping Review to be completed following construction completion and provided to RMS.</p> <p>Where the works do not meet the standards specified above additional landscape planting or native seeding may be required to achieve the desired outcome.</p>	<p>AND</p> <p>Use in landscaping works seed mix representative of the vegetation community adjacent to the works.</p> <p><b>Performance target:</b> Direct seeding (hydromulch) of disturbed areas within 14 days of completion of all activities required to finalise and rehabilitate disturbed areas, including the placement of topsoil.</p> <p>AND</p> <p>Completion of all rehabilitation works in accordance with the approved Landscape design prior to Construction Completion.</p> <p>AND</p> <p>100% of landscaping works use seed mix representative of the vegetation community adjacent to the works.</p>	<p>of topsoil).</p> <p>Rehabilitation works will be completed prior to construction completion.</p> <p>Seed mixes will be selected prior to commencement of revegetation works in each area.</p> <p>Revegetation/rehabilitation areas will be assessed Six-monthly; during construction period and 36 month landscape maintenance period.</p> <p>As required by Landscape Review.</p>			
<i>CoA 2b.</i>						
EPBC 12 FF8	<p>Native vegetation cleared from the construction footprint will be mulched and used along with retained topsoil for reuse in rehabilitation works and erosion control.</p> <p>Mulch and topsoil will not be stockpiled in 'no-go' areas and cleared vegetation will not be pushed into 'no-go' areas.</p>	<p><b>Performance indicator:</b></p> <p>Use of mulch in accordance with landscaping plans and erosion and sediment control plans.</p> <p>AND</p> <p>Storage of mulch and topsoil within approved stockpile areas outside no-go areas.</p> <p><b>Performance targets:</b></p> <p>Mulch is utilised in all areas nominated in landscaping plans and erosion and sediment control.</p>	<p>Use of mulch for landscaping and erosion and sediment control will be monitored progressively.</p> <p>Locations of stockpiles will be checked as part of weekly inspections.</p>	<p>Project / Site Engineers</p> <p>Foreman / Leading Hands</p> <p>Environmental Coordinators</p>	<p>Mulch was used extensively across the site for erosion and sediment controls including perimeter bunds and blended with topsoil for rehabilitation.</p> <p>No mulch or topsoil was stored in no-go areas nor did cleared vegetation ever get pushed into no-go areas.</p>	Closed
EPBC 13 FF 31	<p>Permanent water quality control measures will be installed as early as possible in the construction program and at least prior to construction completion. The timeframe for 'construction completion' is variable and will depend on a range of construction delays such as weather and other unforeseen delays.</p> <p>As per SW25 temporary controls will be installed within 24 hours and prior to forecast rain events following clearing. Installation of permanent water quality control measures includes stormwater pits, kerbs and pipes, and permanent erosion protection measures such as scour protection and must be completed prior to construction completion. With the exception of temporary water quality basins installed in accordance with SW25, permanent water quality controls are linked to the completion of permanent built works.</p> <p>While a construction program can be submitted that outlines indicative timeframes for installation of some of these measures, Lend Lease cannot accurately predict a specific milestone for their installation in the construction program as it may be subject to construction delays due to a range of issues including weather, plant and machinery availability, and other unforeseen construction difficulties.</p>	<p><b>Performance indicator:</b></p> <p>Permanent controls installed and operating prior to completion of construction.</p> <p>AND</p> <p>Temporary controls in place and maintained during construction as per ESCP.</p> <p><b>Performance targets:</b></p> <p>100% of permanent controls installed and operational prior to the completion of construction.</p> <p>AND</p> <p>All temporary controls installed within 24 hours of clearing completion in that area and maintained as per ESCP.</p>	<p>Permanent controls prior to completion of works (completion of all activities required to finalise and rehabilitate disturbed areas, including placement of topsoil).</p> <p>Temporary controls installed within 24 hours and prior to forecast rain events following clearing.</p>	<p>Project / Site Engineers</p> <p>Foreman / Leading Hands</p>	<p>All permanent water quality control measures have been installed and this was completed prior to the completion of construction.</p> <p>All temporary controls were installed and maintained as per the ESCP. Controls were implemented within 24 hours of clearing, or sooner if rain was forecast. This was documented on the ESCP and checked during follow up environmental inspections.</p>	Closed

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EPBC 14 FF32	<p>Waterways will be protected from sediment impacts during construction, in accordance with the CEMP. Measures designed specifically to protect aquatic flora and fauna may include:</p> <ul style="list-style-type: none"> <li>• Installation of in stream sediment curtains.</li> <li>• Construction of temporary diversions.</li> </ul>	<p><b>Performance indicator:</b> Erosion and Sediment controls installed as per ESCP. AND Controls in waterways inspected and poorly operating/damaged controls repaired. <b>Performance targets:</b> All erosions and sediment controls installed as per ESCP. AND All controls in waterways inspected weekly and all poorly operating controls replaced.</p>	<p>Progressively.  Weekly</p>	<p>Project / Site Engineers Foreman / Leading Hands Environmental Coordinators</p>	<p>Erosion and sediment controls on-site were installed as per the Progressive Erosion and Sediment Control Plans. Almost all erosion and sediment controls have now been removed, as the site is stabilised with permanent revegetation. Inspections were conducted by the environment team weekly, and during and post-rainfall. Roads and Maritime and the Project Environmental Representative conducted fortnightly inspections, and agency representatives from the EPA and the Department of Primary Industries (Fishing and Aquaculture) conducted monthly inspections. During these inspections poorly operating controls were identified and their replacement actioned as part of the inspection close-out process.</p>	Closed
EPBC 15	<p>Water quality monitoring of matters of NES Habitat in Cooperabung Creek for the following parameters:</p> <ul style="list-style-type: none"> <li>• pH,</li> <li>• Dissolved oxygen,</li> <li>• Electrical conductivity,</li> <li>• Temperature,</li> <li>• Turbidity,</li> <li>• Total Suspended Solids,</li> <li>• Hydrocarbons,</li> <li>• Trace metals,</li> <li>• Nitrogen, and</li> <li>• Phosphorous</li> </ul>	<p><b>Performance indicator:</b> Water quality monitoring outlined in the Water Quality Management Plan. <b>Performance target:</b> 100% of water quality monitoring results are within trigger values in section 5 of Water Quality Management Plan (identified below). <i>High values:</i> if median values at the downstream site is <i>above</i> 80% of the recorded background water quality records (80<sup>th</sup> percentile). <i>Low values:</i> if median values at the downstream site are <i>below</i> the 20% of the recorded background water quality records (20<sup>th</sup> percentile). <i>Both values:</i> both the 80th and 20th percentile values of the upstream site can be compared with the median values of the downstream site.</p>	<p>Two wet events (where trigger rainfall events occur) and one dry event per month.</p>	<p>Roads and Maritime</p>	<p>Water quality monitoring was conducted in accordance with the Water Quality Monitoring Program during this reporting period. There was one instance where an exceedence of a trigger value at Cooperabung Creek was considered to be attributable to construction. See section 4 for further information.</p>	
EPBC 16 FF34	<p>Existing trees, grasses and ground cover will be retained within 15 metres of watercourses of known habitat of matters of NES (Cooperabung Creek) until immediately before construction commences in that area Works will be programmed to minimise the extent and duration of disturbance to vegetation where possible. This will include leaving clearing (unless undertaken manually or by other means that cause minimal disturbance (i.e. felling trees and leaving the stump in situ) and initial earthworks in intermittent and permanent watercourses until subsequent works are about to commence.</p>	<p><b>Performance indicators:</b> Retention of vegetation in Cooperabung Creek. AND Avoidance of clearing in all watercourses until subsequent works are about to commence, or felling of vegetation manually or with minimal disturbance. <b>Performance targets:</b> No less than 15m of vegetation retained within Cooperabung Ck until construction commences in those areas. AND 100% of clearing in all watercourses left until works are about to commence unless all vegetation is felled manually / with minimal disturbance.</p>	<p>Prior to construction commencing in that area.  Prior to construction commencing in watercourses.</p>	<p>Construction Manager Environmental Coordinators</p>	<p>Existing trees, grasses and ground cover were retained within 15 metres of Cooperabung Creek until immediately before construction commenced in that area and clearing was conducted manually. The need to retain stumps and groundcovers in these waterways was shown in ESCP for these areas, and confirmed through subsequent environmental inspections. The area of disturbance at Cooperabung Creek was greatly reduced during clearing, resulting in the retention of riparian vegetation under the footprint of the new Cooperabung Creek Bridge. See image 6.</p>	Closed

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EPBC 17 SW1	The potential for erosion during the construction of the Proposal would be appropriately managed in accordance with the measures contained within Managing Urban Stormwater: Soils and Construction Volume 1 (Landcom 2004) and Managing Urban Stormwater: Soils and Construction Volume 2D, Main Road Construction (DECC 2008b).	<b>Performance indicators:</b> Erosion control measures within the ESCPs are in accordance with the Blue Book. AND Controls inspected and poorly operating/damaged controls repaired. <b>Performance targets:</b> All erosion control measures nominated in the ESCPs are in accordance with the Blue Book. AND All controls inspected weekly and all poorly operating/ damaged controls repaired.	Prior to the commencement of construction in that area, or prior to changed work activities in that area.  Weekly.	Construction Manager Environmental Coordinators	Erosion and sediment controls within the ESCPs were in accordance with Managing Urban Stormwater: Soils and Construction Volume 1 (Landcom 2004) and Managing Urban Stormwater: Soils and Construction Volume 2D, Main Road Construction (DECC 2008b) (the Blue Book).  Inspections were conducted by the environment team weekly, and during and post-rainfall. Roads and Maritime and the Project Environmental Representative conducted fortnightly inspections, and agency representatives from the EPA and the Department of Primary Industries (Fishing and Aquaculture) conducted monthly inspections. During these inspections poorly operating controls were identified and their replacement actioned as part of the inspection close-out process.	Closed
EPBC 18 SW10	The following EWMS will be prepared where required and implemented to manage soil and water impacts which have a risk of impact on matters of NES : <ul style="list-style-type: none"> <li>• Temporary waterway crossings;</li> <li>• Culvert and transverse drainage construction;</li> <li>• Managing runoff from curing processes;</li> <li>• Clearing and grubbing;</li> <li>• Sediment basin design, construction and management;</li> <li>• Dewatering;</li> <li>• Construction of temporary creek diversions.</li> <li>• In stream works.</li> </ul>	<b>Performance indicators:</b> Preparation of EWMS for nominated activities. AND Construction activities undertaken in accordance with EWMS and staff tool boxed on requirements. <b>Performance targets:</b> No works commencing in these areas until an EWMS has been prepared for the activity. AND All construction activities conducted in accordance with the EWMS. AND 100% of staff toolboxed on EWMS requirements before starting work in those areas.	Prior to the commencement of the activity.  Ongoing.	Superintendent/Environment Manager/Foreman	Environmental Work Method Statements were prepared and implemented for temporary waterway crossings, culvert construction, clearing & grubbing, sediment basin design, construction & management, dewatering, and concrete paving (which covers curing runoff). Construction of temporary creek diversions and in stream works was covered in the Minor Temporary Waterway Crossings and Minor Working Platforms EWMS.  Construction Work Method Statements were also prepared for specific areas, for example Cooperabung Creek. These work methods were in accordance with the EWMS for the type of construction activity being undertaken, and also contained detailed information specific to the site under construction.  Relevant staff were toolboxed on the requirements of the EWMS prior to work commencing.	Closed
EPBC 19 SW25	Catch drains, contour banks and diversion drains across exposed areas will be installed immediately following clearing as per the ESCP, and re-established and maintained during topsoil removal and earthworks operations.  Temporary Erosion and Sediment (ERSED) controls will be installed within 24 hours and prior to forecast rain events following clearing.	<b>Performance indicators:</b> Installation of controls in accordance with the ESCP. AND Inspection of controls and identification of poorly operating/damaged controls. <b>Performance target:</b> 100% of controls in ESCP installed within 24 hours of completion of clearing in that area. AND All controls inspected weekly and all poorly operating/ damaged controls repaired.	Within 24 hours of the completion of clearing in that area.  Weekly.	Superintendent Foreman	See EPBC 14.	Closed
EPBC 20 SW28	Erosion and sediment control structures will remain installed and maintained until a minimum of 70% vegetative cover is achieved. This will be determined through consultation with a suitably qualified professional (Certified Professional in Erosion and Sediment Control).	<b>Performance indicators:</b> Installation of temporary erosion and sediment controls in accordance with ESCP. AND Inspection of controls at least weekly to identify operating/damaged controls.	Ongoing during construction	Superintendent Foreman	See EPBC 19 for compliance with the installation of controls as per the ESCP and inspection compliance.  Controls were only removed once these catchments were reviewed, and an updated PESCP was prepared in consultation with the Soil Conservationist. Almost all erosion and sediment controls have been removed, due to the extent of natural revegetation cover across the site.	Closed

ID	Management Action	Performance Indicator/Target	Monitoring/Timing	Responsibility	Compliance Status	Status
		<p>AND Removal of controls following consultation with suitably qualified professional.</p> <p><b>Performance targets:</b> 100% of controls are installed as per the ESCP.</p> <p>AND All controls inspected weekly and all poorly operating/ damaged controls repaired.</p> <p>AND No controls are removed until suitably qualified professional has been consulted.</p>	<p>Weekly</p> <p>Ongoing</p>			
EPBC 21 SW17	Works will be programmed to minimise the extent and duration of disturbance to vegetation. This will include leaving clearing (unless undertaken manually or by other means that cause minimal disturbance(i.e. felling trees and leaving the root ball ,soil structure and existing groundcovers in situ) and initial earthworks in intermittent and permanent watercourses until subsequent works are about to commence.	<p><b>Performance indicator:</b> Clearing in all watercourses.</p> <p><b>Performance target:</b> 100% of clearing in all watercourses left until works are about to commence unless all vegetation is felled manually / with minimal disturbance.</p>	Prior to construction commencing in watercourses.	Superintendent Foreman	Existing trees, grasses and ground cover were retained within 15 metres of watercourses until immediately before construction commenced in that area and clearing was conducted manually. The need to retain stumps and groundcovers in these waterways was shown in ESCP for these areas, and confirmed through subsequent environmental inspections.	Closed
EPBC 22 SW35	<p>Where temporary crossings are required, these shall be designed, constructed and maintained in accordance with Managing Urban Storm water Soils and Construction Volumes 2A and 2D Main Road Construction (DECC 2008) and section 5.3.4 of the guideline Managing Urban Storm water 4th edition March 2004, Volume 1 Soils and Construction (the 'Blue Book') and subject to the preparation of an EWMS identified in SW10 and SW33. Temporary crossings will:</p> <ul style="list-style-type: none"> <li>• Be 'fish friendly' with a lower section of the temporary crossing provided to act as an emergency spillway. Including the use of the adequate size and number of pipes set at bed level to facilitate fish passage in Class 1 -3 waterways.</li> <li>• Be used for the shortest time required to complete their designed operational function and affected riparian vegetation will be rehabilitated as soon as possible where the permanent design footprint does not overlay the temporary crossing location.</li> <li>• Use material that will not result in fine sediment material entering the waterway.</li> </ul> <p>Where rock crossings are used, the rock will be of suitable size to reduce the likelihood of the material being washed away in a storm or flood event, with large sized rock on the lower side of crossings where water velocity increases.</p>	<p><b>Performance indicators:</b> Design of temporary crossings. AND Construction and maintenance of temporary crossings. AND Rehabilitation of temporary crossings</p> <p><b>Performance targets:</b> 100% of temporary crossings designed in accordance with the Blue Book. AND 100% of temporary crossings constructed and maintained as per design. AND 100% of temporary crossings rehabilitated within 24 hours of removal.</p>	<p>Prior to construction of temporary crossing</p> <p>Ongoing</p> <p>Within 24 hours of the removal of the temporary crossing.</p>	Environment Manager Superintendent Engineers	<p>All temporary waterway crossings were designed in accordance with the Blue Book.</p> <p>All temporary waterway crossings have now been removed.</p> <p>Where temporary crossings were removed during this reporting period, rehabilitation commenced within 24 hours of complete removal. Staged crossing removal, or removal of a crossing that spanned several days, resulted in temporary ERSED controls being installed.</p>	Closed
EPBC 23 SW 36	Scour protection shall be installed at the base of permanent and temporary drainage outlets, and will be integrated where feasible into existing banks to minimise impacts.	<p><b>Performance indicator:</b> Installation of scour protection installed at the base of all drainage outlets.</p> <p><b>Performance target:</b> Scour protection installed at 100% of drainage outlets prior to commissioning.</p>	Prior to commissioning these structures.	Engineers	<p>Scour protection has been installed at the base of all drainage outlets prior to commissioning, as per the approved design drawings.</p> <p>Outlets of temporary controls were installed as per an approved design, or in accordance with Blue Book requirements, which includes scour protection. For example, basins were designed in accordance with the blue book, and include scour protection on the outlets.</p>	Closed

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EPBC 24 SW 37	Drainage works shall be stabilised against erosion by appropriate selection of channel dimensions, slope and lining, and the inclusion, if necessary, of drop structures and energy dissipaters.	<b>Performance indicators:</b> Preparation of ESCPs inclusive of erosion control measures. AND Erosion controls installed and maintained as per ESCPs. <b>Performance targets:</b> All erosion and sediment control measures installed are in ESCPs. AND 100% of erosion and sediment control plans prepared prior to works commencing in that area. AND 100% of erosion and sediment controls installed and maintained as per ESCPs.	Prior to commencing works in that area.  Ongoing.	Engineers	The PESCPs outlined all ERSED controls to be implemented within that section of the site. All PESCPs were prepared prior to work commencing in that area. See EPBC 14.	Closed
EPBC 25 SW 38	Culverts and permanent stream protection measures shall be installed as early as possible where the construction program permits, to facilitate transverse drainage during the early stages of construction.	<b>Performance indicator:</b> Timing of culvert construction. <b>Performance target:</b> Where traffic staging permits, 100% of culverts are constructed within the first 12 months of the construction programme.	Within 12 months of clearing in that location.	Superintendent Foreman Engineers	All aspects of the drainage culverts identified in Schedule 3 of EPBC 2012/6518 approval are complete, including revegetation. Not all culverts were completed within the first 12 months of the construction programme, however this was due to traffic staging (ie the traffic needs to be switched off the existing highway onto the new road for these to be completed). Construction of all bridge structures is complete. See image 7.	Closed
EPBC 26 SW 45	Operational water quality basins shall be constructed for use during construction of the project. Prior to the completion of construction, these, shall be converted to provide operational phase water quality management.	<b>Performance indicators:</b> Construction of operational water quality basins. AND Conversion of permanent basins to operational basins. <b>Performance targets:</b> 100% of operational basins constructed for use during construction. AND 100% of permanent basins are converted to operational basins prior to the completion of construction in that area.	During construction.  Prior to the completion of construction.	Engineer Superintendent	All operational basins were used at some stage during construction to manage water quality (the timing of which was subject to access and construction staging).	Closed
EPBC 27 SW 50	Sediment basins shall be retained for a minimum of six months or until a 70% vegetative cover is achieved in its catchment; other satisfactory controls are in place and approved by the EM in consultation with a suitably qualified soil conservationist or the basin is otherwise redundant.	<b>Performance indicator:</b> Retention of sediment basin. <b>Performance target:</b> No sediment basins are removed until management action criteria are achieved.	Minimum of six months or until management action criteria achieved.	Environmental Manager	All basin decommissioning requests were approved by the project Soil Conservationist. These were generally removed as 70% cover had been achieved in the catchment, they were redundant controls (ie no water could reach the sediment basin due to, for example, it being perched above construction works after the completion of a cutting) or no longer required under the Blue Book. Other satisfactory controls were installed after approval by the EM and review by the Soil Conservationist through the PESCP sign-off process. The EPA was also notified of basin decommissioning prior to this occurring. This notification included the revised PESCP.	Closed
EPBC 28 SW 65	Erosion and sediment controls shall be inspected informally at least daily (with maintenance and/or modifications made as necessary). Formal inspections will be conducted weekly with maintenance and/or modifications made as identified. Inspections and/or maintenance will also be undertaken daily during periods of rainfall and within 24 hours of the cessation of a rainfall event causing runoff to occur on or from the premises.	<b>Performance indicators:</b> Completion of informal and formal inspections. AND Completion of maintenance of erosion and sediment controls. <b>Performance targets:</b> Informal inspection conducted on	Informal inspections daily and formal inspections weekly for the duration of construction.  Ongoing.	Environmental Coordinators	Informal inspections were undertaken daily during construction, by the environmental team. Inspections were conducted by the environment team weekly, and during and post-rainfall. These inspections were captured on a weekly environmental checklist and provided to site teams for actioning. Roads and Maritime and the Project Environmental Representative conducted fortnightly inspections, and agency representatives from the EPA and the Department of Primary Industries (Fishing and Aquaculture) conducted monthly inspections. During these inspections poorly operating controls were identified and their	Closed

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		100% of work days. AND Formal inspections undertaken every week during construction. AND 100% of maintenance actions in inspection reports are undertaken.			replacement actioned as part of the inspection close-out process. Actions must have been completed for the inspection report to be closed out.	
EPBC 29 SW 66	A Project soil conservation specialist shall inspect the work areas, assess drainage and riparian conditions, prepare and /or review erosion and sediment control plans and provide advice to the Project team to maintain a high standard of erosion and sediment practices on site. Inspections will be undertaken typically on a fortnightly basis, or as required where high-risk activities are proposed, or where sensitive areas have the potential to be affected (SEPP 14 wetland, heritage sites). Inspections and timing will be reviewed regularly by the Environmental Manager in response to site conditions, risk profile and stage of the project.	<b>Performance indicators:</b> Engagement of project soil conservation specialist. AND Preparation and review of ESCPs by soil conservationist. AND Completion of inspections by soil conservationist. <b>Performance targets:</b> No construction works commence until soil conservation specialist engaged. AND 100% of ESCPs are prepared or reviewed by the soil conservationist prior to the commencement of work in that area. AND Soil conservationist inspections conducted every fortnight during construction. AND No high risk activities commence until soil conservation inspection has been conducted.	Prior to the commencement of construction.  Prior to the commencement of work in that area.  At least fortnightly.	Soil Conservation Specialist Environment Manager	Soil conservation specialist was engaged on 21 May 2014, construction commenced on this stage in early November 2014 and was completed in March 2018. All PESCPs were reviewed by the soil conservationist prior to being implemented.	Closed
<i>CoA 2c.</i>						
EPBC 30 SW 67	Watercourse bed and banks shall be monitored weekly and post rainfall during construction for indications of instability. Attention to monitoring for channel erosion will be completed during and following higher than normal flow conditions. Protection measures may be required should increased intensity or erosion be identified as a result of construction activities.	<b>Performance indicators:</b> Inspections for instability of watercourse bed and banks completed weekly and post rainfall. AND Protection measures implemented as recommended by these inspections. <b>Performance targets:</b> All watercourses inspected every week and after all rainfall events. AND 100% of the recommendations from these inspections implemented within 5 days (likely impact) or 48 hours (immediate risk).	Weekly and post rainfall Where increased erosion is observed and is likely to impact matters of NES in Cooperabung Creek, the erosion will be rectified within 5 working days. This timeframe may be extended if the cause of erosion is highly complex and requires detailed analysis, in this case a temporary preventative solution will be installed and maintained in lieu of	Soil Conservation Specialist Environmental Coordinators	Watercourse bed and bank monitoring was included in both informal inspections, and weekly environmental inspections by the environment team. The weekly environmental inspection checklist included a requirement to check "are beds of watercourses or banks showing signs of erosion caused by construction?" See EPBC 28 for frequency of environmental inspections, which included inspections both during and post rainfall events. No increased intensity or erosion was identified in any of these inspections, so there were no recommendations from this part of the inspections during construction.	Closed

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			<p>final rectification.</p> <p>If an immediate risk of impact to matters of NES species in Cooperabung Creek, i.e temporary rectification will be undertaken within 48 hours of the risk being identified.</p>			
<p>EPBC 31 FF7</p>	<p>Prior to vegetation clearing in areas of known or potential Habitat for matters of NES, suitably qualified ecologist/expert will survey all areas to be cleared and will mark out any areas of significant vegetation (EECs, threatened species, riparian vegetation and mangroves) to be fenced and protected. Areas of weed infestation will also be identified and documented.</p>	<p><b>Performance indicators:</b></p> <p>Suitably qualified expert surveys area to be cleared and marks significant vegetation no later than 20 working days prior to clearing commencing.</p> <p>AND</p> <p>Weed infestations identified and documented as part of these surveys.</p> <p><b>Performance targets:</b></p> <p>No clearing commences until surveyed by a suitably qualified expert no later than 20 working days prior to clearing.</p> <p>AND</p> <p>100% of weed infestations identified during these surveys are documented.</p>	<p>These surveys will be completed no later than 20 working days prior to the commencement of clearing and will be limited to the time required to complete these surveys.</p>	<p>Environmental Manager Project Ecologist</p>	<p>At least 20 days prior to clearing, the Project Ecologist (who is suitably qualified), completed this survey and surveyed all areas to be cleared. The survey included:</p> <ul style="list-style-type: none"> <li>Confirmation of the accuracy of the sensitive area mapping, which includes areas of significant vegetation No additional areas were identified for protection.</li> <li>Noxious weed survey including, location of weed infestations, species of weed, weed class, patch size and weed mapping.</li> </ul> <p>The results of these surveys were included in the Pre-Clearing &amp; Clearing Report for Stage 3, which was included in the 2016/17 Annual Report.</p>	<p>Closed</p>
<p>EPBC 32</p>	<p>Pre clearing surveys for Giant Barred Frog at Cooperabung Creek shall be undertaken in accordance with the following (as identified in section 3.2.2 of Appendix B):</p> <p>a) Within 48 hours of scheduled clearing/ground disturbance operations, the Project Ecologist will perform pre-clearing surveys over a minimum of two non consecutive nights (i.e. before clearing).</p> <p>b) Surveys are to last 1 person hour per hectare of habitat to be disturbed/removed and involve the use of call broadcast, spotlighting and active searches of litter, debris and logs.</p> <p>c) All Giant Barred Frogs captured will be relocated to the nearest side of the clearing limit with information collected on sex, breeding condition and snout-vent length. Alternative relocation sites may be considered provided they occur within the same drainage line. As a general rule, frogs should not be relocated further than 300 m from the capture site which should theoretically remain within an individual's home range.</p> <p>d) Frogs with a snout-vent length &gt;40 mm will be PIT3 tagged to document the performance measure of this as a suitable relocation strategy. Juvenile/sub adult frogs may be marked in accordance with the animal care and ethics licence of the Project Ecologist.</p> <p>e) A frog hygiene protocol will be adopted at sites with known Giant Barred Frog habitat. This protocol will be in accordance with Department of Environment and Climate Change DECC (now EPA) Hygiene protocol for the control of disease in frogs Information Circular Number 6 (DECC 2008). As part of this hygiene protocol the status of Chytrid fungus will be assessed by taking swab samples of captured frogs.</p>	<p><b>Performance indicators:</b></p> <p>Completion of pre-clearing surveys for the Giant Barred Frog.</p> <p>AND</p> <p>Relocation of captured Giant Barred Frogs outside the clearing limit.</p> <p>AND</p> <p>Implementation of Chytrid Fungus washdown procedure in Appendix J.</p> <p><b>Performance targets:</b></p> <p>No clearing / ground disturbance in Giant Barred Frog habitat unless pre-clearing survey conducted within 48 hours.</p> <p>AND</p> <p>100% of Giant Barred Frogs captured are relocated outside clearing limit.</p> <p>AND</p> <p>Chytrid Fungus washdown procedure is completed in all areas identified in Appendix J prior to work in those areas.</p>	<p>48 hours prior to clearing in Cooperabung Creek.</p> <p>During pre-clearing surveys.</p> <p>As outlined in Appendix J.</p>	<p>Environmental Manager Project Ecologist Environmental Coordinators</p>	<p>All pre-clearing surveys were undertaken in accordance with the requirements of the Giant Barred Frog Management Plan (in Appendix B of the FFMP).</p>	<p>Closed</p>

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EPBC 33	Relocation of Giant Barred Frogs shall be undertaken by a suitably qualified expert.	<b>Performance indicator:</b> Captured Giant Barred Frog relocated suitably qualified expert. <b>Performance target:</b> 100% of Giant Barred Frog relocations undertaken by a suitably qualified expert.	During pre-clearing surveys.	Project Ecologist Environmental Manager Environmental Coordinators	All Giant Barred Frog relocations were undertaken by the Project Ecologist who qualifies as a suitably qualified expert under EPBC 2012/6518. These were all at Cooperabung Creek.	Closed
EPBC 34 FF22	Clearing in Cooperabung Creek will be conducted outside of periods of wet weather to minimise impacts to habitat values consistent with the Giant Barred Frog Strategy.	<b>Performance indicator:</b> Clearing in Cooperabung Creek. <b>Performance target:</b> No clearing in Cooperabung Creek conducted in wet weather.	Prior to clearing commencing in these areas.	Project Ecologist Superintendent Environmental Coordinators	All clearing in Cooperabung Creek was completed during previous reporting periods.	Closed
EPBC 35 FF 33	Riparian and aquatic habitat in the vicinity of Cooperabung Creek shall be protected from construction works through the installation of protective temporary frog fencing and signage prior to works commencing. Protective fencing will be maintained until construction activities in that area are complete  Riparian vegetation impacted by construction would be rehabilitated.	<b>Performance indicators:</b> Installation of temporary frog fencing and signage adjacent to Cooperabung Creek. AND Commencement of rehabilitation of impacted riparian vegetation. <b>Performance targets:</b> No works commence in Cooperabung Creek until temporary frog fence and signage is installed. AND 100% of riparian vegetation rehabilitation commences within 24 hours of construction completion in that area.	Prior to works commencing in these areas.  Within 24 hours of construction completion in that area.	Project / Site Engineers Foreman / Leading Hands Environmental Manager Environmental Coordinators	Temporary frog fencing and signage was installed at Cooperabung Creek prior to work commencing in this area. Permanent fencing has now been installed and as such all temporary frog fencing has been removed.  Revegetation has also been completed through hydromulching and landscape planting.	Closed
EPBC 36	Dewatering procedures in Cooperabung Creek shall be in accordance with section 3.2.2(iv) of the Giant Barred Frog Management Strategy:  a) In accordance with an Environmental Work Method Statement (EWMS) and the DECC (2008) Hygiene protocol for the control of disease in frogs Information Circular Number 6 (DECC 2008). b) Where the water body is to be pumped dry, the intake pipe must be positioned in the deepest section. This will avoid further disturbance of the aquatic habitat prior to capture and relocation of aquatic fauna. c) Screening of the pump intake (5mm mesh size) will be installed to prevent tadpole entrainment. d) Dip netting will be undertaken to remove as many aquatic fauna as practical once the water body is shallow enough to be effectively waded through by field personnel. e) All tadpoles will be identified and sorted by species and/or genus and placed into separate holding containers. The size of these containers will be left to the discretion of the qualified expert. f) All tadpoles will be released into permanent/semi-permanent pools in adjacent habitats by the qualified expert. Tadpoles will be first acclimatised to the recipient sites water temperature by immersing bags or aquaria in the release pools to allow a gradual equilibrium of water temperature prior to release. g) In instances where there are numerous tadpoles from a wide range of species, preferential treatment will be given to Giant Barred Frog tadpoles due to their legislative status as an endangered species. The	<b>Performance indicators:</b> Development of dewatering EWMS for Cooperabung Creek. AND Implementation of Chytrid Fungus wash-down procedure in Appendix J. AND Dewatering works in these areas. <b>Performance targets:</b> No dewatering works conducted in Cooperabung Creek until dewatering EWMS developed. AND Chytrid Fungus washdown procedure is completed in all areas identified in Appendix J prior to work in those areas. AND 100% of dewatering activities in Cooperabung Creek conducted in accordance with the EWMS.	Prior to dewatering commencing in these areas.  As per Appendix J.  Ongoing.	Project / Site Engineers Foreman / Leading Hands Environmental Coordinators  Qualified expert (for tadpole relocation)	Dewatering EWMS was subject to agency consultation in October 2014. No dewatering in Cooperabung Creek was conducted prior to this time and all dewatering in these areas was conducted in accordance with this EWMS.  In addition the EWMS for Minor Temporary Waterway Crossings and Minor Working Platforms included these specific requirements for Cooperabung Creek.  All dewatering activities within Cooperabung Creek have complied with these requirements.	Closed






ID	Management Action	Performance Indicator/Target	Monitoring/Timing	Responsibility	Compliance Status	Status
	release of predatory species (i.e. eels) will not occur in areas where Giant Barred Frog tadpoles are being released. This will reduce the risk of additional predation and/or competition.					
EPBC 37	The sensitive area plans and clearing plans for the project in the vicinity of Cooperabung Creek shall identify clearing extents and known and potential Giant Barred Frog Habitat.	<p><b>Performance indicator:</b></p> <p>Inclusion of Giant Barred Frog habitat and clearing extents for Cooperabung Creek in Sensitive Area Plans and clearing plans.</p> <p><b>Performance target:</b></p> <p>100% of sensitive area plans identify Giant Barred Frog habitat, and 100% of clearing plans identify clearing extent in Cooperabung Creek.</p>	Prior to construction commencing in these areas.	Environmental Manager	The CT01 design package (clearing plans) identified the clearing extents in Cooperabung Creek.  Giant Barred Frog habitat at Cooperabung Creek was identified on the Sensitive Area Plans.	Closed
CoA 2d.						
EPBC 38 FF 23	A suitably qualified expert will undertake pre-clearance surveys for matters of NES immediately prior to clearing activities. Searches will be undertaken for nests, hollow bearing trees, logs & bat roosts within existing culverts and bridges. Searches will take place no earlier than 48 hours prior to the removal of vegetation occurring in that area to ensure that the area is free of the Koala, Giant-Barred Frog, Grey-headed Flying-fox, and Spotted-tail Quoll.	<p><b>Performance indicator:</b></p> <p>Completion of pre-clearance surveys for matter of NES.</p> <p><b>Performance target:</b></p> <p>100% of pre-clearance surveys are conducted no earlier than 48 hours prior to clearing commencing in that area.</p>	No earlier than 48 hours prior to clearing	Project / Site Engineers Construction Manager Project Ecologist Environmental Coordinators	Pre-clearing surveys for matters of NES were conducted no earlier than 48 hours prior to clearing commencing in that area. These surveys were documented in the Pre-Clearing/ Clearing Report for this stage, included in the 2016/17 Annual Report.	Closed
EPBC 39 FF24	During the proposed clearing works, the suitably qualified expert or an experienced wildlife handler under the supervision of the suitably qualified expert will be present to retrieve and provide appropriate care of any displaced matters of NES and release the fauna into adjacent habitats safe from construction work.	<p><b>Performance indicators:</b></p> <p>Clearing works undertaken with suitably qualified expert or experienced wildlife handler present.</p> <p>AND</p> <p>Relocation of fauna relocation conducted by suitably qualified expert or an experienced wildlife handler.</p> <p><b>Performance targets:</b></p> <p>Suitably qualified expert or experienced wildlife handler present for 100% of clearing works.</p> <p>AND</p> <p>100% of fauna relocation conducted by suitably qualified expert or wildlife handler.</p>	<p>During all clearing.</p> <p>During all clearing.</p>	Environmental Manager Superintendent Project Ecologist Environmental Coordinators	A suitably qualified expert or experienced wildlife handler was present during all clearing works.  All Giant Barred Frog relocations were conducted by a suitably qualified expert.	Closed
EPBC 40 FF25	<p>Clearing activities for the project will be undertaken in accordance with the following two stage process in all areas supporting identified matters of NES and fauna habitat such as hollow bearing trees, habitat trees and bushrock. This process will include but not be limited to:</p> <ul style="list-style-type: none"> <li>• Non-habitat trees will be removed before habitat trees, allowing fauna an opportunity to move from the habitat trees;</li> <li>• Habitat trees will be retained for a minimum of two night's after initial clearing, unless the Project Ecologist determines the tree can be removed one night after initial clearing safely; and</li> <li>• Felled habitat trees will be assessed by the Project Ecologist to determine if there is fauna remaining in the tree(s). Resident species or injured wildlife will be treated or relocated.</li> </ul> <p>In the event that a hazardous habitat tree is identified (a</p>	<p><b>Performance indicator:</b></p> <p>All clearing done in accordance with two stage clearing procedure and hazardous tree protocol.</p> <p><b>Performance target:</b></p> <p>100% of clearing done in accordance with two stage clearing procedure and hazardous tree protocol.</p>	During all clearing.	Environmental Manager Construction Manager Project Ecologist Environmental Coordinators	All clearing was conducted in accordance with the two stage clearing procedure and hazardous tree protocol. This clearing, and the clearing of any hazardous trees, is captured in the pre-clearing / clearing permits, and this information was collated in the Pre-Clearing/ Clearing Report for this stage, included in the 2016/17 Annual Report.	Closed



ID	Management Action	Performance Indicator/Target	Monitoring/Timing	Responsibility	Compliance Status	Status
	<p>risk to the safety of workers and/or flora and fauna), an assessment will be undertaken to identify any need for removal of the habitat tree prior to the minimum requirements stipulated above.</p> <p>This assessment will be undertaken with the Project Ecologist, the Clearing contractor, Lend Lease Environmental Manager, Lend Lease Safety Manager and a designated RMS Representative. If the tree is deemed a hazard to safety the following actions may be taken:</p> <ul style="list-style-type: none"> <li>▪ Removal of the tree immediately (if there is low risk to injury of wildlife during felling).</li> <li>▪ Removal of the tree within 24hrs of initial clearing if there is a high potential for significant fauna occupation.</li> <li>▪ Establishment of an exclusion zone around the tree, and felling 48hrs after initial clearing (if there is a high potential for significant fauna occupation and a high risk of injury to fauna during felling).</li> </ul> <p>Dead or hazardous trees identified on the clearing boundary or with the potential to cause construction and/or operational safety concerns will be subject to an assessment for removal. If the tree is deemed to unsafe to remain it will be felled following the initial clearing front in accordance with approved clearing methodologies. If the tree is identified as a habitat tree and compensatory habitat assessments (i.e additional nest boxes) will be investigated and implemented where required.</p>					
CoA 2e.						
EPBC 41 App H	Fauna handling and rescue activities involving matters of NES shall be undertaken in accordance with Appendix H of this FFMP.	<p><b>Performance indicator:</b> Fauna handling and rescue conducted as per Appendix H.</p> <p><b>Performance target:</b> All fauna handling and rescue done in accordance with Appendix H.</p>	As per Appendix H.	Environmental Manager Construction Manager Project Ecologist Environmental Coordinators	See EPBC 39.	Closed
EPBC 44 FF 27	Contact details for the suitably qualified expert, local NPWS officers, FAWNA, RSPCA, the Port Macquarie Koala Hospital and local veterinary hospitals will be made available at the main site compound and should be attached to clearing permits for Clearing and Grubbing. These documents will be held by supervisory personnel at all locations where clearing is being undertaken, to enable quick contact in the event of a fauna rescue.	<p><b>Performance indicator:</b> Inclusion of contact details at main site compound and attached to clearing permits.</p> <p><b>Performance target:</b> Contact details always available at main site compound and attached to 100% of clearing permits.</p>	Prior to commencement of clearing each day.	Environmental Coordinators Foreman	Relevant contact details were provided on all Clearing and Grubbing permits. Contact details were also available on the Environmental Manager's Office door and in the induction room, both of which were located at the main site compound. Clearing and Grubbing permits were held by supervisory personnel during clearing, to ensure these contact details were on hand if needed.	Closed
EPBC 45 FF21	<p>Where clearing activities coincide with the Koala breeding season and a Koala with joey are identified in the clearing footprint, the following will be employed in consultation with the suitably qualified expert:</p> <ul style="list-style-type: none"> <li>- Temporary no go area;</li> <li>- Use of appropriate fencing to direct the Koala and Joey in a single direction outside the footprint;</li> <li>- Follow procedure identified in Section 5 of Appendix H</li> </ul>	<p><b>Performance indicator:</b> Establishment of no go areas and provision of safe passage where a Koala with joey is identified during the breeding season.</p> <p><b>Performance target:</b> No-go area established and safe passage provided immediately once Koala and Joey detected.</p>	Immediately once Koala and Joey are detected in work area.	Project Ecologist Foreman / Leading Hands Environmental Coordinators	No koalas with joeys were identified within the clearing footprint during clearing.	Closed



## Images

#	Description	Image
<b>Stage 2</b>		
1	Tubestock planting at a dedicated fauna culvert	

#	Description	Image
2	Completed fauna furniture at a dedicated fauna culvert	 <p>The image shows the interior of a concrete culvert. The walls are light-colored concrete with a darker grey base. The floor is sandy and uneven. Several large, weathered logs are positioned horizontally across the width of the culvert, supported by vertical wooden posts. The logs are arranged in a series, creating a path through the culvert. The lighting is dim, with a bright light source at the far end of the culvert, creating a strong perspective effect.</p>
3	A completed dedicated fauna underpass	 <p>The image shows the exterior of a concrete fauna underpass. The structure is built into a grassy embankment. The concrete wall is light-colored and has a dark, arched opening. A wire fence runs along the top of the embankment. In the foreground, there is tall, dry grass and several young green plants. A wooden post is visible near the entrance of the underpass.</p>

#	Description	Image
4	<p>Good revegetation outcomes on a fill batter</p>	
<b>Stage 3</b>		
6	<p>Rehabilitation works under Cooperabung Creek bridge</p>	

#	Description	Image
7	Completed Hastings River Bridge	

## Appendix B Ecological Monitoring Program

<b>Species monitored</b>	<b>Report title</b>
Spotted-tail Quoll Autumn monitoring	Spotted-tailed Quoll Monitoring 2018
Giant Barred Frog spring, summer and autumn monitoring	Giant Barred Frog Monitoring 2017/2018
Road kill construction monitoring conducted in this reporting period	Section 2 & Annexure 1 of Contractors Ecological Monitoring Report 2017/2018
Koala spring/summer 2017 (year 3) monitoring	Koala Monitoring 2017
K2K Pre-Clearing / Clearing	Section 3 & Annexure 2 of Contractors Ecological Monitoring Report 2017/2018





# Spotted-tailed Quoll Monitoring 2018

**Oxley Highway to Kempsey, Pacific Highway Upgrade**

Prepared for Roads and Maritime Services

September 2018

## Document control

Project no.:	1702
Project client:	Roads and Maritime Services
Project office:	Port Macquarie
Document description:	Spotted-tailed Quoll Monitoring 2018 Report
Project Director:	Rhidian Harrington
Project Manager:	Radika Michniewicz
Authors:	Jodie Danvers
Internal review:	Radika Michniewicz and Amanda Griffith
Document status:	R1
Local Government Area:	Kempsey and Port Macquarie Hastings

## Document revision status

Author	Revision number	Internal review	Date issued
Jodie Danvers	D0	Radika Michniewicz	22/08/2018
Jodie Danvers	D1	Radika Michniewicz	1/09/2018
Radika Michniewicz	D2	Amanda Griffith	10/09/2018
Radika Michniewicz	R0		10/09/2018
Radika Michniewicz	R1		17/09/2018

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*Cover photograph:* Fauna captured on camera: Bandicoot recorded in Ballengarra State Forest Area (left); Koala (middle) and Brush-tailed Phascogale (right) recorded in Maria River State Forest Area.

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## Executive summary

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### **Context**

This report documents findings of the 2018 monitoring period, the first of three monitoring periods for the Spotted-tailed Quoll (*Dasyurus maculatus*), 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, RMS 2016). The NSW Roads and Maritime Services (Roads and Maritime) is required to manage and monitor the effectiveness of biodiversity mitigation measures implemented as part of the Project. The Spotted-tailed Quoll is one of the threatened species identified as requiring mitigation and monitoring during the operational phase of the Project.

### **Aim**

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

### **Method**

Monitoring was undertaken in accordance with the EMP, in three broad areas of Cairncross State Forest, Ballengarra State Forest and Maria River State Forest. Three different site types: reference, impact with mitigation and impact without mitigation, were monitored within each area. This design was replicated three times for each area, resulting in a total of nine, 100 hectare plots for each area. Within each plot there were four camera monitoring locations, resulting in 36 camera monitoring locations per area and 12 cameras per site type. Remotely triggered Scout Guard cameras were installed at the camera locations and were positioned facing a bait station and left for a minimum of 21 consecutive nights. Bait stations were baited with a mixture of fish and fish oil. Habitat attributes were recorded for each camera location, including vegetation type, hydrological and rocky features and abundance of hollows.

### **Key results**

The Spotted-tailed Quoll was not recorded during the 2018 monitoring period. These results are consistent with baseline findings. There were a total of 688 photo records, including 578 (84.0%) native fauna (including the threatened Koala and Brush-tailed Phascogale), 79 (11.5%) introduced predators (including Domestic Dogs), 17 (2.5%) non-predatory introduced fauna and 14 (2.0%) records of cars and people.

As part of the analogous underpass monitoring program undertaken as part of the OH2K EMP, a Spotted-tailed Quoll was recorded on 28 May 2018, 02:43H traversing underpass C36.40 (combined culvert C36.40) in a westerly direction. This underpass is immediately to the west of plot MM1 (Maria River State Forest, impact with mitigation site).

### **Conclusion**

Performance measures for the 2018 monitoring period have been met. The first round of monitoring was undertaken as per the EMP in year 4 (2018) at impact and control sites where monitoring was undertaken during baseline surveys.

### **Management implications**

Given that no Spotted-tailed Quolls were recorded during baseline or 2018 Spotted-tailed Quoll monitoring, and that a Spotted-tailed Quoll has been recorded using a combined fauna underpass in the vicinity of site MM1 (Maria River State Forest impact with mitigation site), there are no current recommendations based on the outcomes of the 2018 monitoring period.

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## 1. Introduction

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### 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 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) (RMS 2016) combines these approval conditions and defines the mitigation and offsetting requirements for threatened species and ecological communities impacted by the Project. The Spotted-tailed Quoll (*Dasyurus maculatus*) was one threatened species identified as requiring monitoring following the completion of the Project's construction, during the operational phase.

#### 1.1.1 Legal Status

The Spotted-tailed Quoll is listed as vulnerable under the New South Wales *Biodiversity Conservation Act 2016* (BC Act) and endangered under the Commonwealth EPBC Act. Monitoring of the species is required under the Project's approval.

#### 1.1.2 Monitoring Framework

The survey design, methodology and performance indicators that define the Spotted-tailed Quoll monitoring program are specified in the EMP. The EMP requires monitoring of the Spotted-tailed Quoll on three occasions in total: in autumn or winter (preferably between March and Mid-July) in Year 4, 6 and 8 (operational phase). This represents the first of the three monitoring periods – Year 4, autumn - winter 2018.

#### 1.1.3 Baseline Data

No Spotted-tailed Quoll were recorded during baseline surveys conducted by Lewis Ecological in August 2013 (Lewis 2014).

#### 1.1.4 Purpose of this Report

This report details the findings obtained from the first monitoring event for the Spotted-tailed Quoll.

The aims of this report are to summarise the methods and results of the 2018 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 Spotted-tailed Quoll:

- *Monitoring is undertaken in Year 4, 6 and 8 or until monitoring can demonstrate that mitigation measures are effective.*
- *Monitoring during Year 4, 6 & 8 is undertaken at the Impact and Control sites where monitoring was undertaken during baseline surveys, subject to ongoing landowner agreement.*

### 1.3 Monitoring Timing

Monitoring is to be undertaken during autumn or winter, but preferably March – mid-July.

## 1.4 Reporting

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

- Detailed description of monitoring methodology employed.
- 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 Director General of the Department of Planning and Environment and the Environment Protection Authority.

## 2. Methodology

### 2.1 Monitoring Sites

Monitoring was undertaken in the three broad areas identified in the EMP and included Cairncross State Forest, Ballengarra State Forest and Maria River State Forest. Three different site types (treatments) were monitored within each area:

- Reference: located greater than five kilometres from the project corridor and considered likely to be unaffected by the Project.
- Impact without mitigation: located where no specific Spotted-tailed Quoll mitigation has been proposed, i.e. no combined or dedicated fauna underpasses within 500 metres.
- Impact with mitigation: located within 500 metres of combined or dedicated fauna underpasses.

This design was replicated three times for each area, resulting in a total of nine 100 hectare plots for each area. Within each plot, four camera monitoring locations were established during baseline surveys, resulting in 36 camera monitoring locations per area and a total of 12 cameras per site type. Table 1 details the monitoring design and Figures 1 to 4 show the location of all monitoring camera locations along with bridges and underpasses in the area.

It should be noted that monitoring sites were established prior to the finalisation of the box culvert locations. This has resulted in a number of ‘impact without mitigation’ sites being located within 500 metres of a crossing structure. While the original classification established in the baseline study will be retained for the purpose of continuity and clarity, if a statistical comparison to detect difference between mitigation and no mitigation sites were required, the classification of these two site types would need to be re-assessed as all sites no longer fulfil their classification criteria.

**Table 1: Monitoring sites and treatment**

Area	Site type	Plot ID	Camera ID
Cairncross	Reference	CREF1	CREF1A, CREF1B, CREF1C, CREF1D
		CREF2	CREF2A, CREF2B, CREF2C, CREF2D
		CREF3	CREF3A, CREF3B, CREF3C, CREF3D
	Impact-no mitigation	CNM1	CNM1A, CNM1B, CNM1C, CNM1D
		CNM2	CNM2A, CNM2B, CNM2C, CNM2D
		CNM3	CNM3A, CNM3B, CNM3C, CNM3D
	Impact-mitigation	CM1	CM1A, CM1B, CM1C, CM1D
		CM2	CM2A, CM2B, CM2C, CM2D
		CM3	CM3A, CM3B, CM3C, CM3D
Ballengarra	Reference	BREF1	BREF1A, BREF1B, BREF1C, BREF1D
		BREF2	BREF2A, BREF2B, BREF2C, BREF2D
		BREF3	BREF3A, BREF3B, BREF3C, BREF3D
	Impact-no mitigation	BNM1	BNM1A, BNM1B, BNM1C, BNM1D
		BNM2	BNM2A, BNM2B, BNM2C, BNM2D
		BNM3	BNM3A, BNM3B, BNM3C, BNM3D
	Impact-mitigation	BM1	BM1A, BM1B, BM1C, BM1D
		BM2	BM2A, BM2B, BM2C, BM2D



		BM3	BM3A, BM3B, BM3C, BM3D
Maria River	Reference	MREF1	MREF1A, MREF1B, MREF1C, MREF1D
		MREF2	MREF2A, MREF2B, MREF2C, MREF2D
		MREF3	MREF3A, MREF3B, MREF3C, MREF3D
	Impact-no mitigation	MNM1	MNM1A, MNM1B, MNM1C, MNM1D
		MNM2	MNM2A, MNM2B, MNM2C, MNM2D
		MNM3	MNM3A, MNM3B, MNM3C, MNM3D
	Impact-mitigation	MM1	MM1A, MM1B, MM1C, MM1D
		MM2	MM2A, MM2B, MM2C, MM2D
		MM3	MM3A, MM3B, MM3C, MM3D

## 2.2 Survey Method

In accordance with the EMP, remotely triggered Scout Guard cameras were installed at the camera locations established during baseline surveys. Each camera location was approximately 500 metres apart, covering the 100 hectare plot. Cameras were positioned facing a bait station (PVC tubing pegged to the ground with bait cache located inside) and left operating continuously for a minimum of 21 consecutive nights. Stations were baited with a mixture of fish, flour and fish oil, with fish oil dripped on the ground directly surrounding the station as an additional attractant.

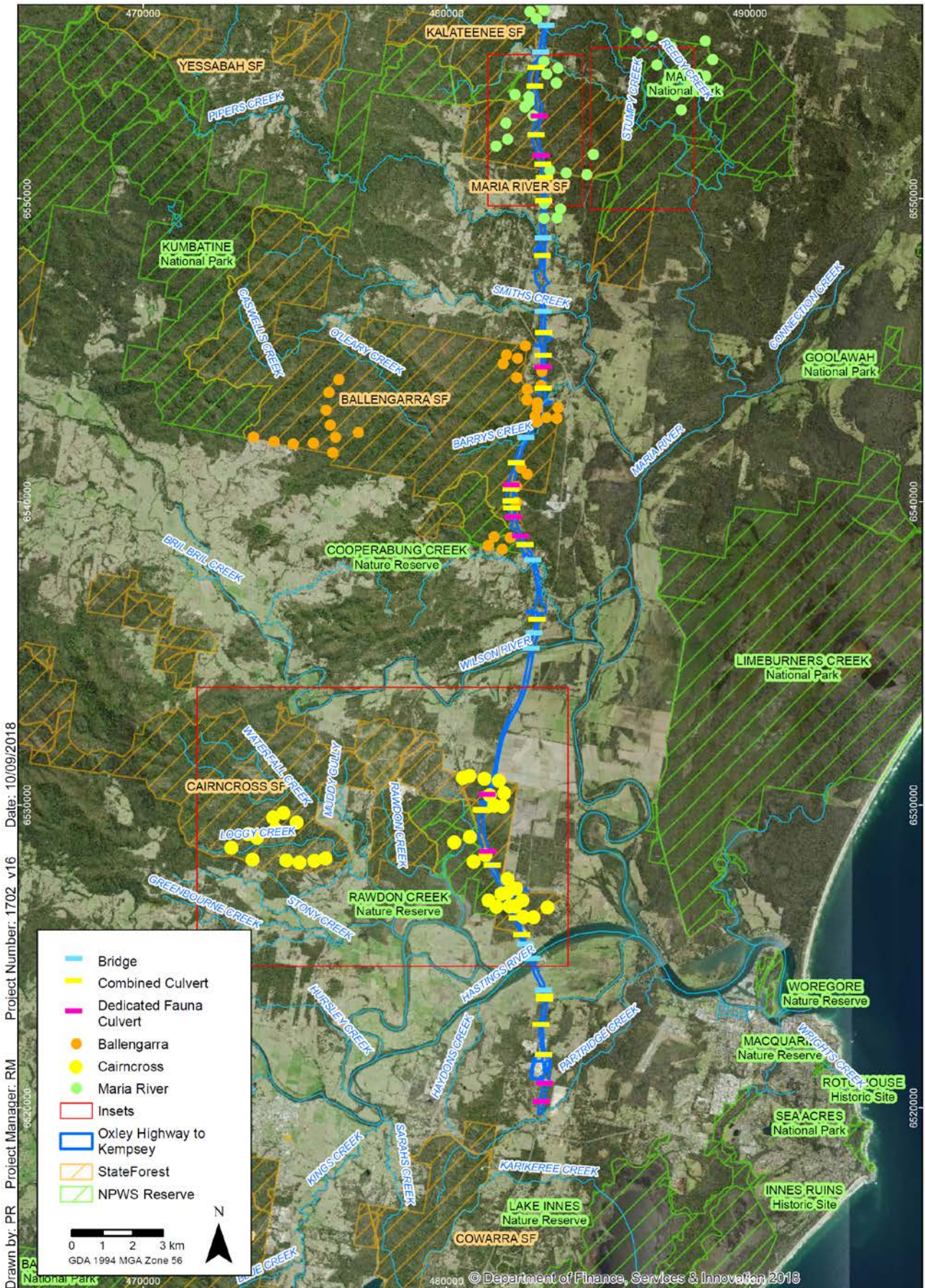
In accordance with the EMP, the following habitat attributes were recorded at each camera station:

- Structure and floristics of vegetation, including dominant species of each vegetation stratum, height and per cent cover.
- Presence and type of hydrological features and surface drainage features.
- Presence and type of rocky features.
- Abundance and type of tree and log hollows.

## 2.3 Analysis

Analysis of camera records was undertaken as for the baseline surveys (Lewis 2014). Namely, the maximum abundance or activity levels for any species within a given one hour period was one. The only exception to this was where the individuals could clearly be distinguished from another within that one hour period.

Monitoring results were analysed in accordance with the performance measures specified within the EMP. In the case of the Spotted-tailed Quoll, performance measures are based on survey completion only; they do not specifically relate to the detection of this species and statistical analysis of data is not required. However, the current assessment considers presence/absence results.



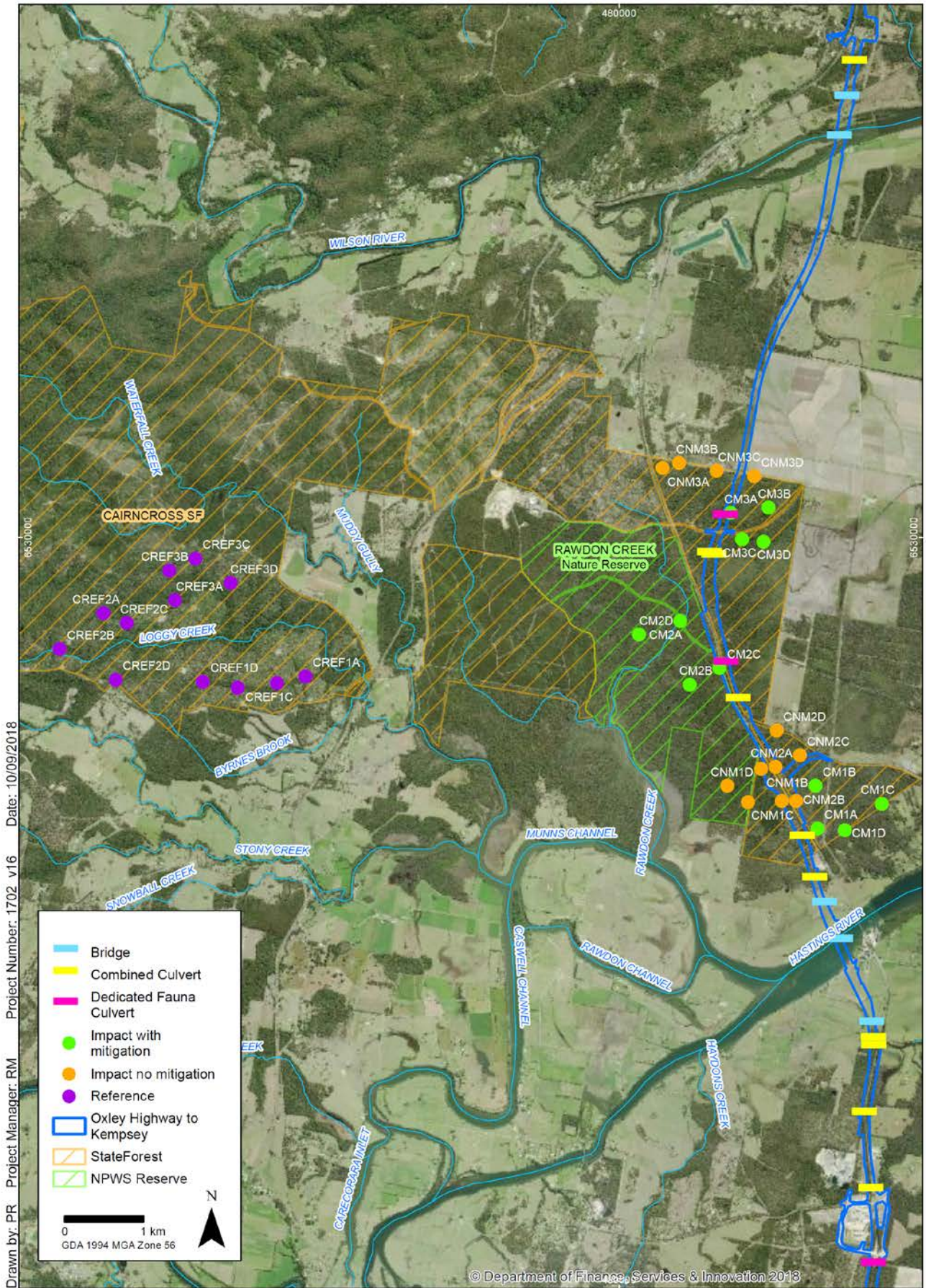
Overview of monitoring sites

Oxley Highway to Kempsey - Spotted-tailed Quoll Monitoring sites

FIGURE 1

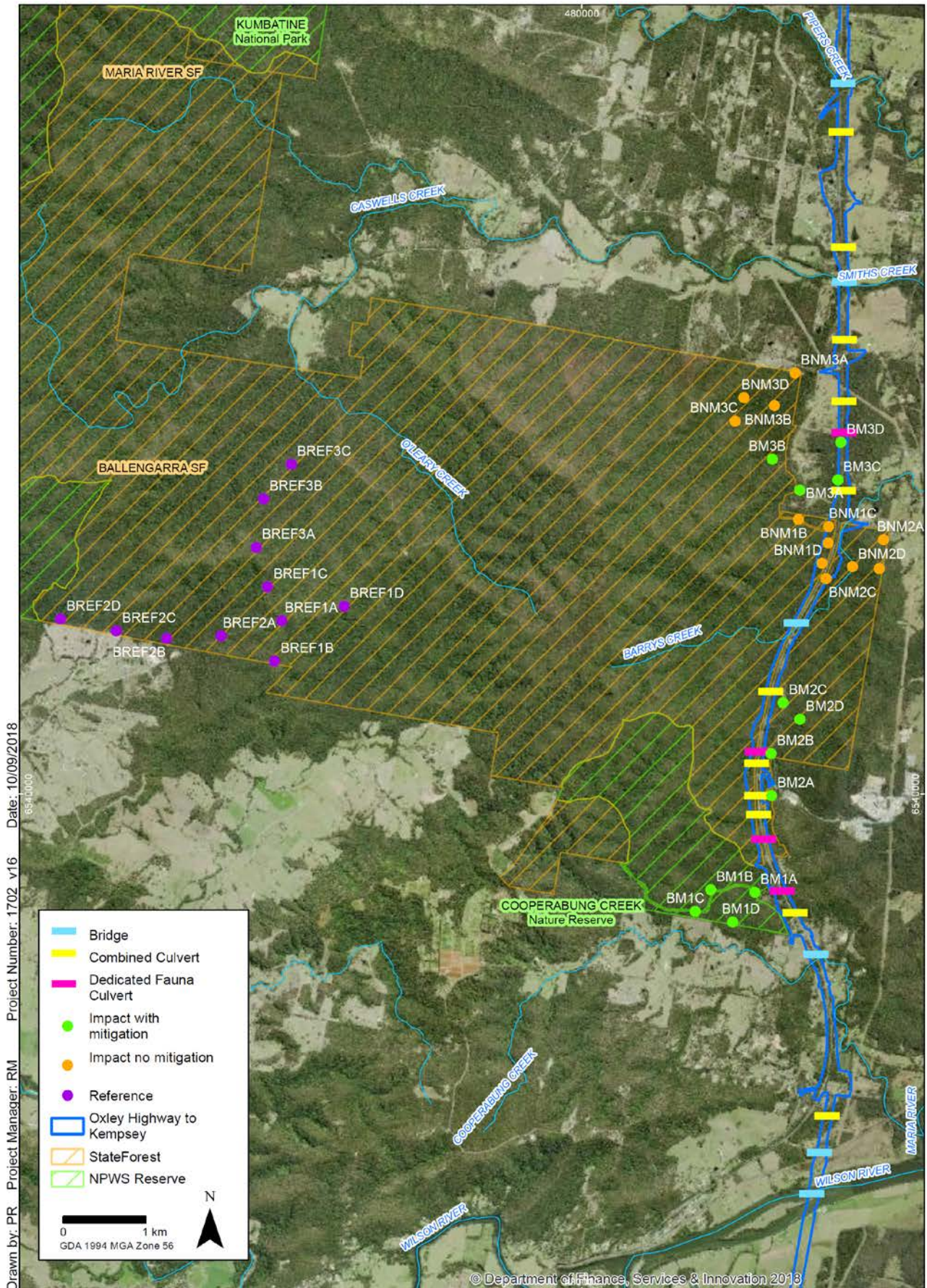
Imagery: (c) LPI NSW 2014-10-06

Path: T:\spatial\projects\1700\1702\_OH2K\_Ecology\Maps\PI\_5\_Ecology\_OH2K\PI\_52\_Quoll\1702\_PI52\_Quoll\_20180312\_Fig1\_Overview.mxd



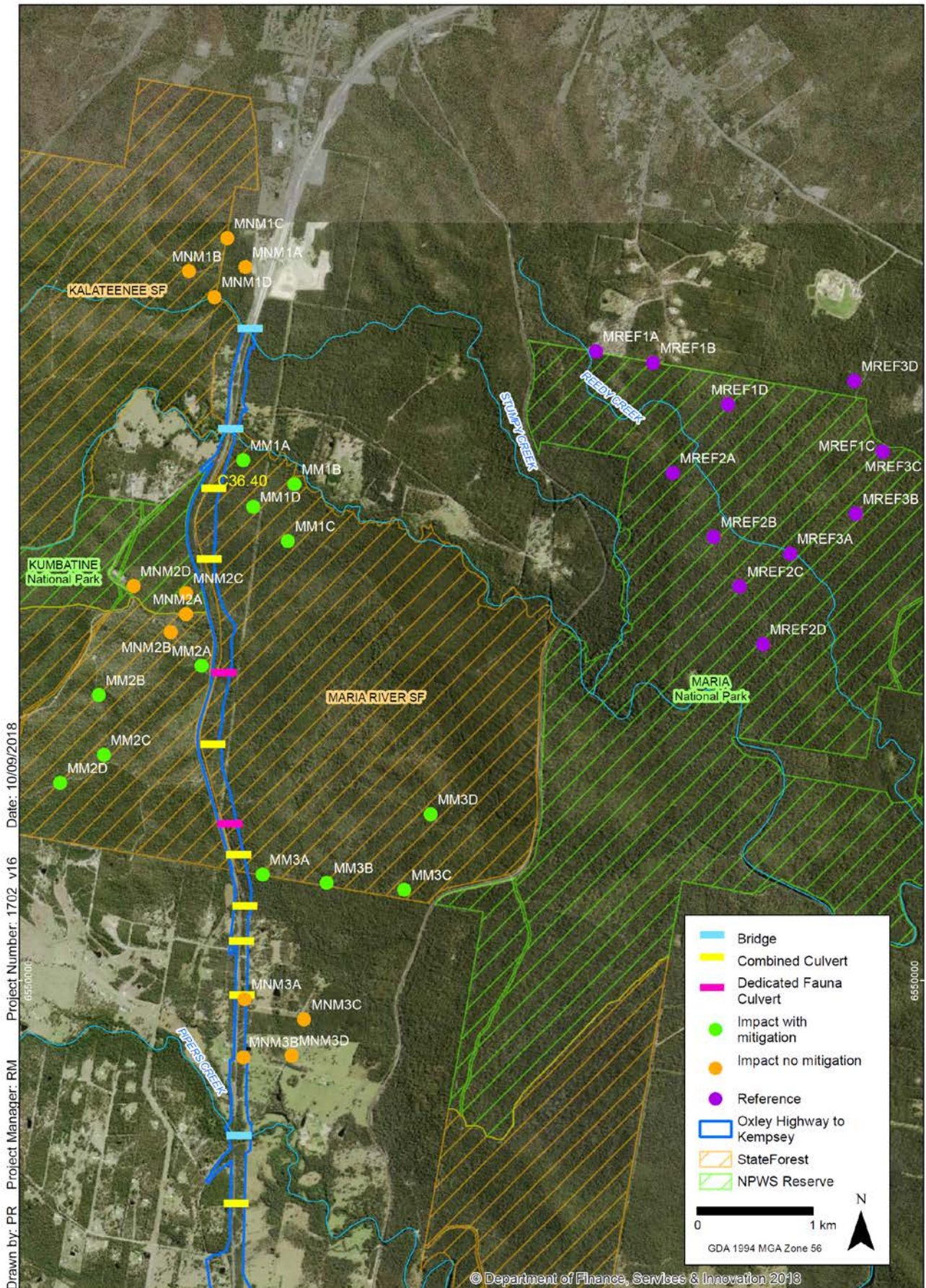
Cairncross State Forest camera locations  
Oxley Highway to Kempsey - Spotted-tailed Quoll Monitoring sites

**FIGURE 2**



Ballengarra State Forest camera locations  
Oxley Highway to Kempsey - Spotted-tailed Quoll Monitoring sites

FIGURE 3



Drawn by: PR Project Manager: RM Date: 10/09/2018 Project Number: 1702 v16

Maria River State Forest camera locations

Oxley Highway to Kempsey - Spotted-tailed Quoll Monitoring sites

FIGURE 4

## 3. Results

### 3.1 2018 Monitoring Results

Results of the 2018 monitoring are provided in Annex 1 and Annex 2 and a summary is provided in Table 2. There were a total of 12,329 camera triggers, resulting in 688 photo records. These included 578 (84.0%) native fauna, 79 (11.5%) introduced predators (including domestic dogs), 17 (2.5%) non-predatory introduced or domestic fauna and 14 (2.0%) records of cars and people. Graph 1 to Graph 3 show the number of records for the different groups. One camera (location CREF2C) was stolen during the surveys. Surveys were undertaken during the following periods:

- Cairncross: 5 April 2018 – 3 May 2018 (27-28 survey nights)
- Ballengarra: 9 May 2-18 – 5 June 2018 (21-27 survey nights)
- Maria River: 14 June 2018 – 26 July 2018 (33-42 survey nights)

#### 3.1.1 Spotted-tailed Quoll

No Spotted-tailed Quoll were recorded at any of the monitoring sites during the 2018 monitoring.

As part of monitoring of mitigation measures for the Project, remotely triggered Scout Guard cameras were deployed in a number of selected combined and dedicated fauna underpasses. A Spotted-tailed Quoll was recorded on 28 May 2018, 02:43H traversing underpass C36.40 (combined culvert C36.40) in a westerly direction. This underpass is immediately to the west of plot MM1 (Maria River impact with mitigation site 1, Figure 4).

#### 3.1.2 Other Fauna

##### ***Native fauna***

The most frequently recorded fauna from all sites were small mammals (rodents/dasyurids) and macropods, representing 32.4% and 23.5% of all records respectively. Of note was the detection of Koalas (vulnerable, BC Act and EPBC Act) at the Ballengarra mitigation and no mitigation sites, and within all three site types within the Maria River area. The threatened (vulnerable, BC Act) Brush-tailed Phascogale (*Phascogale tapoatafa*) was recorded on two occasions within Maria River National Park (MREF2).

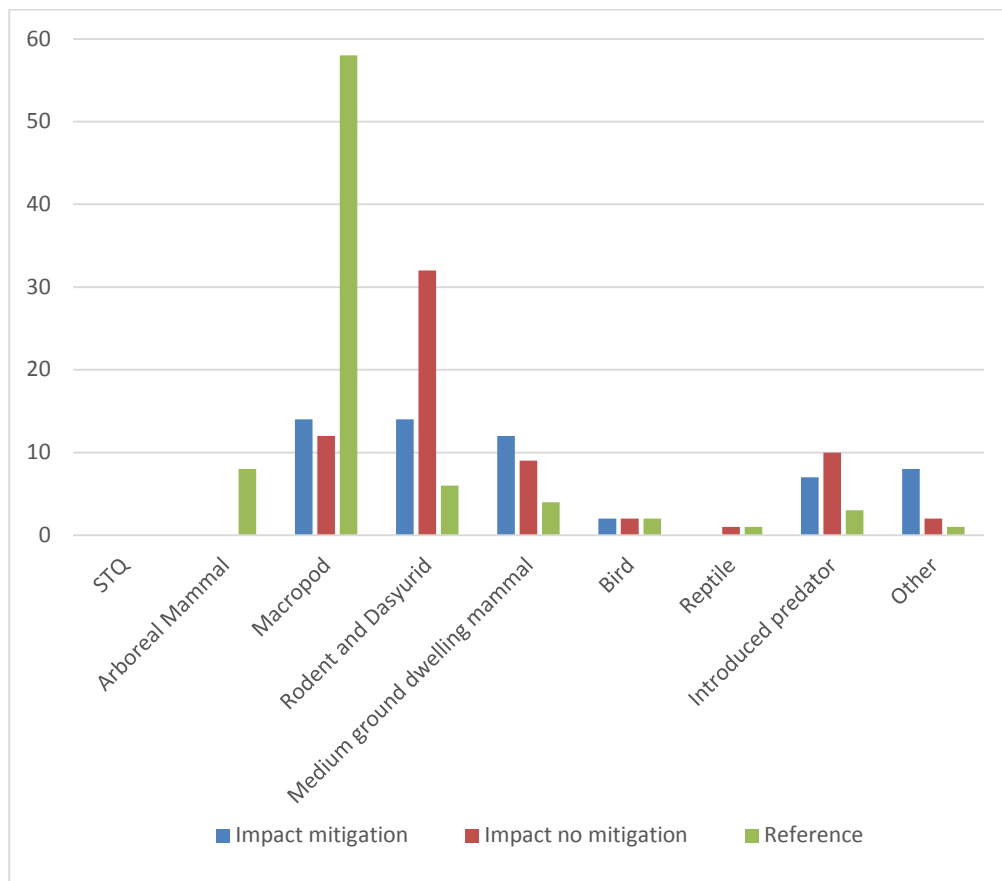
##### ***Predatory fauna***

Introduced predatory fauna, which may compete with the Spotted-tailed Quoll, included the European Red Fox (*Vulpes vulpes*), Cat (*Felis catus*), Wild (including Dingoes) and Domestic Dogs (*Canis familiaris*), and represented 11.5% of all records (of which 74.7% were Fox and Cat). All sites recorded predators on more than one occasion, with the Maria River area representing 45.6% of the predator records across all site types. High visitation by predators may be considered to be where visitation by exotic predators equates to greater than 25% of visitations or as visitations by exotic predators on more than 25% of the days monitored (Niche 2018). This is relevant for 13 of the 27 sites (CM1, CM3, CNM1, CNM2, BNM2, BNM3, BREF1, BREF2, MM3, MNM1, MNM2, MNM3 and MREF2) where predator records account for 25-100% of fauna records at one or more cameras within these sites.

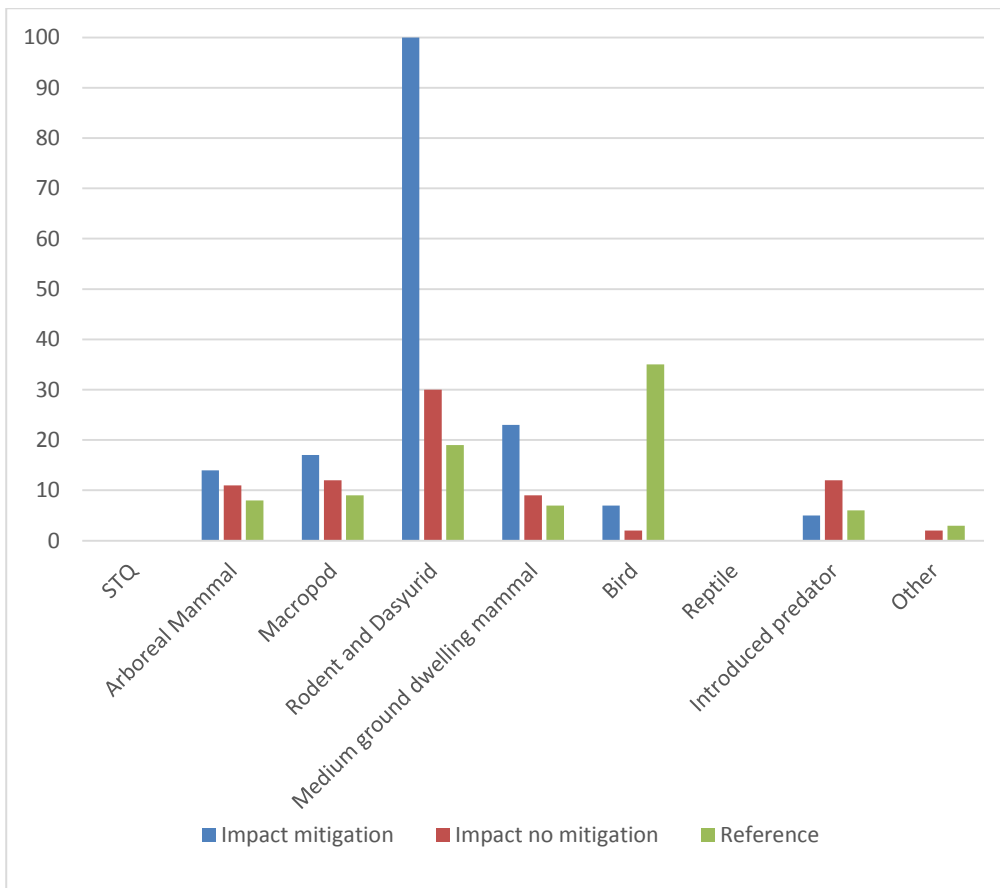
**Table 2: Summary of fauna records**

Area	Site Type	STQ	AM	M	R&D	MGD	Bird	R	IP	Other
CAIRNCROSS	Impact mitigation	0	0	14	14	12	2	0	7	8
	Impact no mitigation	0	0	12	32	9	2	1	10	2
	Reference	0	8	58	6	4	2	1	3	1
BALLENGARRA	Impact mitigation	0	14	17	100	23	7	0	5	0
	Impact no mitigation	0	11	12	30	9	2	0	12	2
	Reference	0	8	9	19	7	35	0	6	3
MARIA RIVER	Impact mitigation	0	6	26	3	4	4	0	10	0
	Impact no mitigation	0	2	4	11	1	3	0	17	15
	Reference	0	2	10	8	9	5	0	9	0
<b>Total</b>		<b>0</b>	<b>51</b>	<b>162</b>	<b>223</b>	<b>78</b>	<b>62</b>	<b>2</b>	<b>79</b>	<b>31</b>

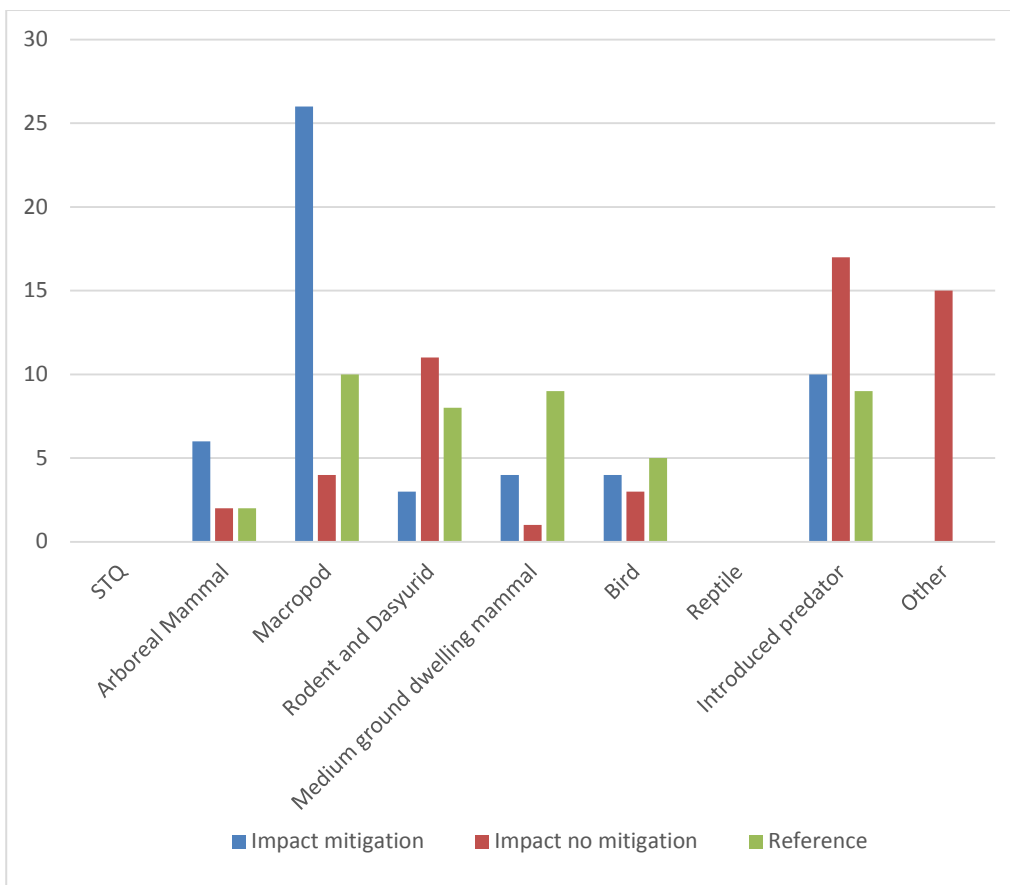
STQ = Spotted-tailed Quoll; AM = arboreal mammals (Possums and Koala); M = macropods; R&D = rodents and dasyurids; MGD = medium ground dwelling mammals (Echidna, Bandicoot); R = reptile; IP = Introduced predator (Fox, Cat, Wild and Domestic Dog); Other= non-native and non-fauna categories such as people, cars, cows, hares and horses.



**Graph 1: Cairncross area grouped records**



**Graph 2: Ballengarra area grouped records**



**Graph 3: Maria River area grouped records**



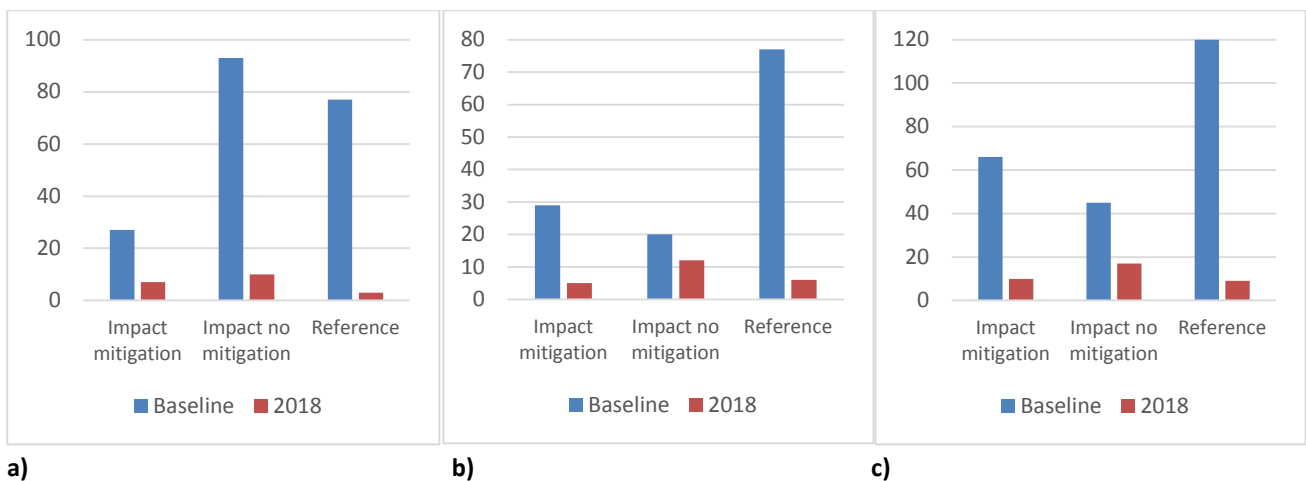
### 3.1.3 Comparison with Baseline

As in baseline surveys, the Spotted-tailed Quoll was not recorded at any of the monitoring sites during the 2018 monitoring.

Table 3 highlights the difference in record type between baseline and 2018 surveys. 2018 surveys resulted in a much lower false trigger rate, fewer images from the ‘other’ category and a much higher number of native fauna records. The number of introduced predators detected was also lower than during baseline surveys. Contrary to baseline results, introduced predator records within the reference sites were as low as or lower than impact sites for each area. Introduced predator records for each area are shown in Graph 4.

**Table 3: Comparison with baseline**

	Baseline	2018
Total triggers	28,270	12,329
Total records	1540	688
Native fauna records	46 (3.0%)	578 (84.0%)
Introduced predator records	554 (36.0%)	79 (11.5%)
Other	940 (61.0%)	31 (4.5%)



**Graph 4: Introduced predator records within a) Cairncross, b) Ballengarra and c) Maria River areas**

## 4. Discussion

### 4.1 Performance Measures

A summary of 2018 survey results in relation to the performance measures are provided in Table 4.

**Table 4: Summary of performance measures for the 2018 monitoring period.**

Performance measure	Discussion
Monitoring is undertaken in Year 4, 6 and 8 or until monitoring can demonstrate that mitigation measures are effective.	<p><b>This performance measure has been met for 2018.</b></p> <p>Monitoring has been undertaken in year 4 (2018) as per the EMP. One Spotted-tailed Quoll was recorded using a combined underpass in the vicinity of site MM1, demonstrating the use of an underpass by this species.</p>
Monitoring during Year 4, 6 & 8 is undertaken at Impact and Control sites where monitoring was undertaken during baseline surveys, subject to ongoing landowner consent.	<p><b>This performance measure has been met for 2018.</b></p> <p>Impact and Control sites used in baseline surveys were monitored.</p>

## 5. Recommendations

### 5.1 Contingency Measures

The EMP lists potential problems and contingency measures for various components of the monitoring program. Those relevant to the Spotted-tailed Quoll monitoring program are listed and discussed in Table 5.

**Table 5: 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>Spotted-tailed Quolls were not recorded during baseline surveys or in the 2018 monitoring at any sites.</p> <p>One Spotted-tailed Quoll was however recorded during underpass monitoring using an underpass in the vicinity of site MM1.</p> <p><b>These contingency measures are not considered relevant at this stage</b></p>

### 5.2 Recommendations

Given that no Spotted-tailed Quolls were recorded during baseline or 2018 Spotted-tailed Quoll monitoring, and that a Spotted-tailed Quoll has been recorded using a combined fauna underpass in the vicinity of site MM1 (Maria River State Forest impact with mitigation site), contingency measures are not considered relevant and, as such, there are no recommendations based on the outcomes of the 2018 monitoring period.

## References

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Lewis (2014). Pacific Highway Upgrade: Oxley Highway to Kempsey Pre-construction Spring and Summer Baseline Monitoring. Report prepared for RPS-RMS by Lewis Ecological Surveys.

Niche (2018). Fauna Underpass and Associated Fauna Fence Monitoring 2016/2017. Frederickton to Eungai Pacific Highway Upgrade. Prepared by Niche Environment and Heritage Pty Ltd for Roads and Maritime Services, Port Macquarie, NSW

RMS (2016). Oxley Highway to Kempsey Pacific Highway Upgrade Ecological Monitoring Program. Roads and Maritime Update to report prepared by SMEC Hyder Joint Venture, August 2016.

## Annex 1. Field Data – Camera Results

**Table 6: Cairncross area 2018 camera results**

Site	Installation date	Retrieval date	Nights	No. Images	Spotted-tailed Quoll	Red Fox	Feral Cat	Hare	Possum Brushtail	Bandicoot	Rodent_Das	Echidna	Wallaby	Kangaroo	Bird	Lace Monitor	Unk. mammal	Vehicles	Persons
CM1A	06/04/2018	03/05/2018	27	28	0	0	0	0	0	2	7	1	2	0	0	0	0	0	0
CM1B	06/04/2018	03/05/2018	27	24	0	3	0	0	0	0	0	0	5	0	0	0	0	0	0
CM1C	06/04/2018	03/05/2018	27	2573	0	0	0	0	0	0	0	0	1	0	0	0	0	0	3
CM1D	06/04/2018	03/05/2018	27	9	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
CM2A	06/04/2018	03/05/2018	27	20	0	0	0	0	0	0	3	0	1	0	0	0	0	0	2
CM2B	06/04/2018	03/05/2018	27	14	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
CM2C	06/04/2018	03/05/2018	27	14	0	0	0	0	0	0	4	1	0	0	1	0	0	0	0
CM2D	06/04/2018	03/05/2018	27	10	0	0	0	0	0	2	1	0	0	0	1	0	0	0	0
CM3A	05/04/2018	03/05/2018	28	43	0	4	0	0	0	2	0	2	6	0	0	0	0	0	0
CM3B	05/04/2018	03/05/2018	28	4	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
CM3C	05/04/2018	03/05/2018	28	42	0	3	0	0	0	0	0	0	2	0	0	0	0	0	0
CM3D	05/04/2018	03/05/2018	28	31	0	0	0	0	0	0	0	0	1	0	0	0	2	0	0
CNM1A	06/04/2018	03/05/2018	27	904	0	1	1	0	0	2	4	2	0	0	0	0	0	0	0
CNM1B	06/04/2018	03/05/2018	27	15	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
CNM1C	06/04/2018	03/05/2018	27	82	0	0	0	0	0	4	28	0	0	0	0	0	0	0	0
CNM1D	06/04/2018	03/05/2018	27	36	0	0	0	0	0	0	0	0	0	0	2	13	0	0	0
CNM2A	06/04/2018	03/05/2018	27	40	0	7	2	0	0	0	1	0	2	0	0	0	0	0	0
CNM2B	06/04/2018	03/05/2018	27	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CNM2C	06/04/2018	03/05/2018	27	6	0	1	0	0	0	0	0	0	2	0	0	0	0	0	0
CNM2D	06/04/2018	03/05/2018	27	18	0	0	1	0	0	0	2	1	4	0	0	0	0	0	0
CNM3A	05/04/2018	03/05/2018	28	14	0	0	0	0	0	1	0	1	2	0	0	0	0	0	0
CNM3B	05/04/2018	03/05/2018	28	8	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
CNM3C	05/04/2018	03/05/2018	28	14	0	0	0	0	0	0	4	0	1	0	0	0	0	0	0

Site	Installation date	Retrieval date	Nights	No. Images	Spotted-tailed Quoll	Red Fox	Feral Cat	Hare	Possum Brushtail	Bandicoot	Rodent_Das	Echidna	Wallaby	Kangaroo	Bird	Lace Monitor	Unk. mammals	Vehicle s	Persons
CNM3D	05/04/2018	03/05/2018	28	64	0	1	0	1	0	0	6	0	4	0	0	0	0	0	0
CREF1A	05/04/2018	03/05/2018	28	28	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
CREF1B	05/04/2018	03/05/2018	28	50	0	0	0	0	1	0	13	1	1	0	0	0	0	0	0
CREF1C	05/04/2018	03/05/2018	28	216	0	2	0	0	0	0	0	0	13	3	0	0	0	0	0
CREF1D	05/04/2018	03/05/2018	28	36	0	0	0	0	2	0	0	0	8	0	0	0	0	0	0
CREF2A	05/04/2018	03/05/2018	28	54	0	0	0	0	0	2	0	0	16	0	0	0	0	0	0
CREF2B	05/04/2018	03/05/2018	28	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CREF2C	05/04/2018	03/05/2018	28	Stolen															
CREF2D	05/04/2018	03/05/2018	28	22	0	0	1	0	0	0	0	0	4	1	1	2	0	0	0
CREF3A	05/04/2018	03/05/2018	28	12	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0
CREF3B	05/04/2018	03/05/2018	28	28	0	0	0	0	2	1	0	0	4	2	1	0	0	0	0
CREF3C	05/04/2018	03/05/2018	28	38	0	0	0	0	3	0	0	0	15	0	0	0	0	0	0
CREF3D	05/04/2018	03/05/2018	28	16	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0

**Table 7: Ballengarra area 2018 camera results**

Site	Installation date	Retrieval date	Nights	No. Images	Spotted-tailed Quoll	Possum Brushtail	Possum ringtail	Bandicoot	Rodent_Das	Koala	Wallaby	Kangaroo	Echidna	Bird	Red Fox	Feral Cat	Wild Dog	Unk mammal	Cow	Vehicles
BM1A	09/05/2018	05/06/2018	27	60	0	5	0	0	19	0	0	0	2	1	0	1	0	0	0	0
BM1B	09/05/2018	05/06/2018	27	4	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
BM1C	09/05/2018	05/06/2018	27	60	0	1	0	5	4	1	4	0	0	0	1	0	0	0	0	0
BM1D	09/05/2018	05/06/2018	27	106	0	4	0	0	25	0	1	0	0	0	0	0	0	0	0	0
BM2A	09/05/2018	05/06/2018	27	220	0	2	0	4	65	0	0	0	1	3	0	0	0	0	0	0
BM2B	11/05/2018	01/06/2018	21	40	0	0	0	4	11	0	2	0	0	0	0	0	0	0	0	0
BM2C	11/05/2018	01/06/2018	21	26	0	3	0	3	0	0	0	0	0	0	0	0	0	0	0	0
BM2D	11/05/2018	01/06/2018	21	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BM3A	09/05/2018	05/06/2018	27	22	0	0	0	5	0	0	0	0	0	0	2	0	0	0	0	0
BM3B	09/05/2018	05/06/2018	27	42	0	0	0	1	0	0	9	0	0	0	0	0	0	0	0	0
BM3C	09/05/2018	05/06/2018	27	94	0	0	0	0	22	0	0	0	0	3	0	0	0	0	0	0
BM3D	09/05/2018	05/06/2018	27	48	0	0	0	0	8	0	1	1	1	3	0	4	0	0	0	0
BNM1A	09/05/2018	05/06/2018	27	38	0	0	0	0	10	0	0	1	1	1	2	0	0	0	0	1
BNM1B	09/05/2018	05/06/2018	27	74	0	3	0	0	0	0	2	0	0	0	0	0	0	1	0	0
BNM1C	09/05/2018	05/06/2018	27	27	0	1	1	0	3	0	0	0	0	0	0	0	0	0	0	0
BNM1D	09/05/2018	05/06/2018	27	28	0	0	0	0	4	0	3	0	0	0	0	0	0	0	0	0
BNM2A	09/05/2018	05/06/2018	27	32	0	1	0	2	4	0	0	0	0	0	1	5	0	0	0	0
BNM2B	09/05/2018	05/06/2018	27	20	0	1	0	0	0	1	2	0	1	0	3	0	0	0	0	0
BNM2C	09/05/2018	05/06/2018	27	72	0	0	0	1	0	0	2	0	0	0	1	0	0	0	0	0
BNM2D	09/05/2018	05/06/2018	27	22	0	2	0	4	1	0	3	0	0	0	1	0	0	0	0	0
BNM3A	09/05/2018	05/06/2018	27	12	0	0	0	0	3	0	0	0	0	1	0	2	0	0	0	0
BNM3B	09/05/2018	05/06/2018	27	10	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0
BNM3C	09/05/2018	05/06/2018	27	42	0	0	0	0	10	0	0	0	0	0	0	7	0	0	0	0
BNM3D	09/05/2018	05/06/2018	27	12	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
BREF1A	09/05/2018	05/06/2018	27	12	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0

Site	Installation date	Retrieval date	Nights	No. Images	Spotted-tailed Quoll	Possum Brushtail	Possum ringtail	Bandicoot	Rodent_Das	Koala	Wallaby	Kangaroo	Echidna	Bird	Red Fox	Feral Cat	Wild Dog	Unk mammal	Cow	Vehicles
BREF1B	09/05/2018	05/06/2018	27	25	0	1	0	2	4	0	0	0	0	2	0	0	0	0	0	0
BREF1C	09/05/2018	05/06/2018	27	29	0	1	0	1	1	0	0	0	0	2	0	1	0	0	0	0
BREF1D	09/05/2018	05/06/2018	27	97	0	3	0	0	0	0	4	0	0	23	0	0	0	0	0	0
BREF2A	09/05/2018	05/06/2018	27	54	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
BREF2B	09/05/2018	05/06/2018	27	16	0	0	0	1	1	0	3	0	0	0	2	0	1	0	0	0
BREF2C	09/05/2018	05/06/2018	27	42	0	0	0	1	1	0	0	0	0	0	0	1	0	0	8	1
BREF2D	09/05/2018	05/06/2018	27	50	0	1	0	0	14	0	3	0	0	0	0	0	0	0	0	0
BREF3A	09/05/2018	05/06/2018	27	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BREF3B	09/05/2018	05/06/2018	27	14	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0
BREF3C	09/05/2018	05/06/2018	27	34	0	3	0	2	0	0	4	0	0	5	0	0	0	0	0	0
BREF3D	09/05/2018	05/06/2018	27	30	0	0	0	0	7	0	0	0	0	2	0	0	0	0	0	0



**Table 8: Maria River area 2018 camera results.**

Site	Install date	Retrieval date	Nights	No. Images	Spotted-tailed Quoll	Possum Brushtail	Bandicoot	Rodent_Das	Koala	Echidna	Wallaby	Kangaroo	Bird	Dingo	Wild Dog	Domestic Dog	Red Fox	Cat	Horse	Cow	Person
MM1A	14/06/2018	18/07/2018	34	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MM1B	14/06/2018	18/07/2018	34	78	0	0	0	0	3	0	7	0	0	0	0	0	1	0	0	0	0
MM1C	14/06/2018	18/07/2018	34	395	0	0	3	3	0	1	4	0	0	0	0	0	1	1	0	0	0
MM1D	14/06/2018	18/07/2018	34	24	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0
MM2A	15/06/2018	18/07/2018	33	28	0	0	0	0	0	0	5	2	0	0	0	0	1	0	0	0	0
MM2B	15/06/2018	18/07/2018	33	26	0	1	0	0	0	0	0	2	0	0	0	0	1	0	0	0	0
MM2C	15/06/2018	18/07/2018	33	9	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
MM2D	15/06/2018	18/07/2018	33	7	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0
MM3A	14/06/2018	18/07/2018	34	58	0	0	0	0	0	0	0	0	0	0	2	0	0	8	0	0	0
MM3B	14/06/2018	18/07/2018	34	4	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MM3C	14/06/2018	18/07/2018	34	140	0	0	0	0	0	0	4	0	2	0	0	0	0	0	0	0	0
MM3D	14/06/2018	18/07/2018	34	6	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
MNM1A	14/06/2018	18/07/2018	34	6	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2
MNM1B	14/06/2018	18/07/2018	34	4	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0
MNM1C	14/06/2018	18/07/2018	34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MNM1D	14/06/2018	18/07/2018	34	12	0	0	0	0	1	0	2	0	0	0	0	0	0	1	0	0	0
MNM2A	15/06/2018	18/07/2018	33	4	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
MNM2B	15/06/2018	18/07/2018	33	12	0	0	0	0	0	0	3	0	1	0	0	0	1	0	0	0	0
MNM2C	15/06/2018	18/07/2018	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MNM2D	15/06/2018	18/07/2018	33	12	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0
MNM3A	14/06/2018	18/07/2018	34	288	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0
MNM3B	14/06/2018	18/07/2018	34	26	0	0	0	0	0	0	0	0	0	0	0	3	0	3	0	0	0
MNM3C	15/06/2018	18/07/2018	33	4569	0	0	0	9	0	0	0	0	1	0	0	0	0	0	0	0	0
MNM3D	15/06/2018	18/07/2018	33	216	0	0	0	2	0	0	0	0	0	0	0	0	0	0	3	30	0
MREF1A	14/06/2018	26/07/2018	42	12	0	0	0	2	0	0	3	0	0	0	0	0	0	0	0	0	0

Site	Install date	Retrieval date	Nights	No. Images	Spotted-tailed Quoll	Possum Brushtail	Bandicoot	Rodent_Das	Koala	Echidna	Wallaby	Kangaroo	Bird	Dingo	Wild Dog	Domestic Dog	Red Fox	Cat	Horse	Cow	Person
MREF1B	14/06/2018	26/07/2018	42	8	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
MREF1C	14/06/2018	26/07/2018	42	47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MREF1D	14/06/2018	26/07/2018	42	34	0	3	2	1	0	0	2	0	0	0	0	0	0	0	0	0	0
MREF2A	14/06/2018	26/07/2018	42	12	0	0	0	3^	0	0	0	0	0	1	0	0	0	0	0	0	0
MREF2B	14/06/2018	26/07/2018	42	8	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0
MREF2C	14/06/2018	26/07/2018	42	32	0	0	0	0	0	0	0	0	4	3	3	0	1	0	0	0	0
MREF2D	14/06/2018	26/07/2018	42	72	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
MREF3A	14/06/2018	26/07/2018	42	18	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0
MREF3B	14/06/2018	26/07/2018	42	10	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0
MREF3C	14/06/2018	26/07/2018	42	24	0	0	4	0	0	0	3	1	1	0	0	0	0	0	0	0	0
MREF3D	14/06/2018	26/07/2018	42	14	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0

^ = Brush-tailed phascogale

## Annex 2. Field Data - Habitat Attributes

**Table 9: Cairncross area habitat attributes**

Site	Canopy dominant species	Canopy % cover	Canopy Height (m)	Midstory dominant species	Midst % cover	Midst Height (m)	Ground dominant species	Ground % cover	Ground Height (m)	Hydrology (present/absent and type)	Rocky features (present/absent and type)	Tree and log Hollows (type and abundance)
CM1A	Ironbark sp.	30	20	<i>Melaleuca</i> spp.	60	8	<i>Entolasia stricta</i>	70	0.4	Absent	Absent	Substantial log hollows and woody debris.
CM1B	<i>Eucalyptus eugenioides</i>	40	25	<i>Melaleuca linariifolia</i>	40	10	<i>Entolasia stricta</i>	70	0.4	Absent	Absent	Substantial log hollows and woody debris.
CM1C	<i>Eucalyptus pilularis</i>	50	25	<i>Melaleuca quinquenervia</i>	40	15	<i>Lomandra longifolia</i>	70	0.6	Adjacent drainage line	Absent	Occasional log hollows, some woody debris
CM1D	<i>Eucalyptus pilularis</i>	60	30	<i>Melaleuca sieberi</i>	20	12	<i>Entolasia stricta</i>	20	0.3	Absent	Absent	Substantial logs with hollows
CM2A	<i>Eucalyptus pilularis</i>	60	30	Mixed rainforest species	40	8	<i>Gahnia</i> sp.	40	1	Adjacent wet creek	Absent	Occasional log hollows
CM2B	<i>Eucalyptus pilularis</i>	40	25	<i>Allocasuarina littoralis</i>	80	15	<i>Pteridium esculentum</i>	50	0.8	Absent	Absent	Occasional log hollows
CM2C	<i>Corymbia intermedia</i>	60	25	<i>Allocasuarina littoralis</i>	80	12	<i>Lomandra</i> spp.	30	0.4	Absent	Absent	Absent
CM2D	<i>Eucalyptus pilularis</i>	40	25	<i>Allocasuarina littoralis</i>	80	15	<i>Lomandra</i> spp.	40	0.6	Adjacent wet creek	Absent	Occasional log hollows
CM3A	<i>Corymbia intermedia</i>	40	25	<i>Syncarpia glomulifera</i>	40	15	<i>Lomandra</i> spp.	90	0.5	Absent	Absent	Occasional log hollows
CM3B	<i>Eucalyptus pilularis</i>	40	35	<i>Melaleuca quinquenervia</i>	60	15	<i>Lomandra</i> spp.	90	0.7	Absent	Absent	Occasional log hollows
CM3C	<i>Eucalyptus pilularis</i>	70	30	<i>Allocasuarina littoralis</i>	40	15	<i>Imperata cylindrica</i>	70	0.5	Absent	Absent	Abundant logged timber frequent hollows.
CM3D	<i>Eucalyptus pilularis</i>	60	35	<i>Melaleuca linariifolia</i>	60	10	<i>Imperata cylindrica</i>	10	0.4	Absent	Absent	Substantial log hollows
CNM1A	<i>Eucalyptus pilularis</i>	20	25	<i>Eucalyptus</i> saplings	60	10	<i>Lomandra</i> sp.	80	0.6	Absent	Absent	Occasional log hollows and substantial woody debris.
CNM1B	<i>Eucalyptus pilularis</i>	30	30	<i>Allocasuarina littoralis</i>	80	12	<i>Pteridium esculentum</i>	90	0.9	Absent	Absent	Occasional log hollows and woody debris.

Site	Canopy dominant species	Canopy % cover	Canopy Height (m)	Midstory dominant species	Midst % cover	Midst Height (m)	Ground dominant species	Ground % cover	Ground Height (m)	Hydrology (present/absent and type)	Rocky features (present/absent and type)	Tree and log Hollows (type and abundance)
CNM1C	<i>Eucalyptus propinqua</i>	50	25	<i>Allocasuarina littoralis</i>	70	12	<i>Imperata cylindrica</i>	70	0.6	Absent	Absent	Occasional log hollows and woody debris.
CNM1D	<i>Eucalyptus pilularis</i>	30	25	<i>Allocasuarina littoralis</i>	80	15	<i>Lomandra longifolia</i>	15	0.6	Absent	Absent	Occasional log hollows
CNM2A	<i>Corymbia intermedia</i>	30	25	<i>Allocasuarina torulosa</i>	60	10	<i>Entolasia stricta</i>	60	0.4	Absent	Absent	Occasional log hollows
CNM2B	<i>Eucalyptus eugenioides</i>	60	30	<i>Eucalyptus saplings</i>	30	8	<i>Lomandra longifolia</i>	70	0.7	Absent	Absent	Substantial log hollows
CNM2C	<i>Corymbia gummifera</i>	40	25	<i>Allocasuarina torulosa</i>			<i>Imperata cylindrica</i>	60	0.6	Absent	Absent	Absent
CNM2D	<i>Eucalyptus pilularis</i>	40	30	<i>Allocasuarina littoralis</i>	60	12	<i>Pteridium esculentum</i>	80	1	Absent	Absent	Absent
CNM3A	<i>Eucalyptus pilularis</i>	60	30	<i>Eucalyptus tereticornis</i>	40	20	<i>Lomandra</i> spp.	60	0.6	Absent	Absent	Occasional log hollows
CNM3B	<i>Eucalyptus robusta</i>	50	25	<i>Allocasuarina littoralis</i>	50	20	<i>Gahnia</i> sp.	90	1.5	Absent	Absent	Absent
CNM3C	<i>Corymbia intermedia</i>	60	25	<i>Allocasuarina littoralis</i>	80	15	<i>Imperata cylindrica</i>	40	0.4	Absent	Absent	Absent
CNM3D	<i>Eucalyptus pilularis</i>	80	25	<i>Melaleuca</i> sp.	40	10	<i>Pteridium esculentum</i>	80	0.8	Absent	Absent	Absent
CREF1A	<i>Eucalyptus microcorys</i>	80	30	<i>Melaleuca quinquenervia</i>	40	15	<i>Lomandra</i> sp.	10	0.3	Adjacent wet creek	Absent	Substantial log hollows
CREF1B	<i>Corymbia intermedia</i>	40	25	<i>Melaleuca quinquenervia</i>	30	15	<i>Lomandra longifolia</i>	30	0.3	Adjacent wet creek	Absent	Substantial log hollows
CREF1C	<i>Corymbia intermedia</i>	20	25	<i>Allocasuarina torulosa</i>	15	10	<i>Lomandra longifolia</i>	10	0.3	20m from drainage	Absent	Abundant felled trees and logs
CREF1D	<i>Eucalyptus grandis</i>	60	35	<i>Allocasuarina torulosa</i>	30	10	<i>Lomandra longifolia</i>	30	0.3	Adjacent intermittent drainage line	Absent	Abundant felled trees and logs
CREF2A	<i>Eucalyptus grandis</i>	60	30	<i>Persoonia</i> sp.	50	80	<i>Lomandra longifolia</i>	40	0.2	Adjacent intermittent creek	Absent	Occasional log hollows
CREF2B	<i>Eucalyptus</i>	60	35	<i>Lophostemon</i>	20	20	<i>Lomandra</i>	50	0.5	Adjacent	Absent	Occasional log hollows

Site	Canopy dominant species	Canopy % cover	Canopy Height (m)	Midstory dominant species	Midst % cover	Midst Height (m)	Ground dominant species	Ground % cover	Ground Height (m)	Hydrology (present/absent and type)	Rocky features (present/absent and type)	Tree and log Hollows (type and abundance)
	<i>propinqua</i>			<i>confertus</i>			<i>longifolia</i>			intermittent creek		
CREF2C	<i>Eucalyptus siderophloia</i>	50	30	<i>Allocasuarina torulosa</i>	20	20	<i>Lomandra longifolia</i>	15	0.3	Absent	Absent	Minimal hollows
CREF2D	Ironbark sp.	60	30	<i>Lophostemon confertus</i>	50	20	<i>Blechnum</i> sp.	20	0.2	Adjacent intermittent creek	Absent	Occasional log hollows
CREF3A	<i>Eucalyptus grandis</i>	40	35	<i>Allocasuarina torulosa</i>	40	15	<i>Lomandra longifolia</i>	10	0.3	Adjacent intermittent creek	Absent	Occasional log hollows
CREF3B	<i>Eucalyptus grandis</i>	80	30	<i>Lophostemon confertus</i>	30	20	<i>Blechnum</i> sp.	10	0.2	Adjacent wet creek	Absent	Substantial fallen logs with occasional hollows
CREF3C	Mahogany sp.	40	25	<i>Eucalyptus teretecornis</i>	40	10	<i>Imperata cylindrica</i>	60	0.5	Absent	Absent	Occasional log hollows
CREF3D	<i>Eucalyptus grandis</i>	60	25	<i>Eucalyptus teretecornis</i>	60	15	<i>Pteridium esculentum</i>	70	0.4	Absent, low area possible pooling	Absent	Substantial fallen logs with occasional hollows

**Table 10: Ballengarra area habitat attributes**

Site	Canopy dominant species	Canopy % cover	Canopy Height (m)	Midstory dominant species	Midst % cover	Midst Height (m)	Ground dominant species	Ground % cover	Ground Height (m)	Hydrology (present/absent and type)	Rocky features (present/absent and type)	Tree and log Hollows (type and abundance)
BM1A	<i>Eucalyptus propinqua</i>	70	25	<i>Lophostemon confertus</i>	70	10	<i>Lomandra longifolia</i>	30	0.6	Adjacent wet creek	Absent	Substantial fallen timber and log hollows
BM1B	<i>Eucalyptus microcorys</i>	60	20	<i>Allocasuarina torulosa</i>	80	12	<i>Imperata cylindrica</i>	30	0.3	Adjacent dry drainage line	Absent	Substantial fallen timber and log hollows
BM1C	<i>Eucalyptus microcorys</i>	70	25	<i>Melaleuca quinquenervia</i>	80	12	<i>Gahnia</i> spp.	60	0.7	Absent	Absent	Occasional fallen timber and log hollow
BM1D	<i>Eucalyptus microcorys</i>	40	20	<i>Lophostemon confertus</i>	70	12	<i>Imperata cylindrica</i>	20	0.3	Absent	Absent	Occasional fallen timber and log hollow
BM2A	<i>Eucalyptus propinqua</i>	70	25	<i>Melaleuca sieberi</i>	60	8	<i>Entolasia stricta</i>	10	0.2	Adjacent dry drainage line	Absent	Abundant fallen timber and occasional hollow. Litter/dumping.
BM2B	<i>Eucalyptus microcorys</i>	80	25	<i>Eucalyptus microcorys</i>	65	5	<i>Lomandra</i> sp., <i>Gahnia</i> sp.	15	0.7	Adjacent dry drainage line	Absent	Occasional fallen timber /logs
BM2C	<i>Eucalyptus propinqua</i>	60	20	<i>Lophostemon confertus</i> , <i>Allocasuarina</i> sp.	40	8	<i>Lomandra</i> sp., <i>Imperata cylindrica</i>	40	0.5	Adjacent dry drainage line	Absent	Substantial fallen limbs and logs.
BM2D	<i>Eucalyptus microcorys</i>	40	18	<i>Allocasuarina</i> sp., Euc saplings	30	5	<i>Lomandra</i> sp.	10	0.4	Absent	Absent	Abundant logs and hollows
BM3A	<i>Eucalyptus microcorys</i>	50	20	<i>Lophostemon confertus</i>	70	10	<i>Lomandra longifolia</i>	10	0.8	Adjacent dry drainage line	Absent	Occasional fallen log hollows
BM3B	<i>Eucalyptus pilularis</i>	60	20	<i>Lophostemon confertus</i>	60	8	<i>Imperata cylindrica</i>	10	0.4	Adjacent moist gully	Absent	Minimal fallen timber no hollows
BM3C	<i>Eucalyptus pilularis</i>	60	15	<i>Lophostemon confertus</i>	60	8	<i>Imperata cylindrica</i>	70	0.8	Adjacent dry drainage line	Absent	Minimal fallen timber no hollows
BM3D	<i>Eucalyptus pilularis</i>	50	20	<i>Allocasuarina littoralis</i>	80	10	<i>Lomandra longifolia</i>	80	0.9	Adjacent dry drainage line	Absent	Minimal fallen timber no hollows
BNM1A	<i>Eucalyptus siderophloia</i>	60	20	<i>Allocasuarina littoralis</i>	50	10	<i>Gahnia</i> spp.	60	0.7	Adjacent dry drainage line	Absent	Abundant fallen timber no log hollows evident
BNM1B	<i>Eucalyptus microcorys</i>	70	22	<i>Melaleuca quinquenervia</i>	60	12	<i>Entolasia stricta</i>	50	0.2	Adjacent moist gully and dry drainage line	Absent	Substantial fallen old logs and hollows

Site	Canopy dominant species	Canopy % cover	Canopy Height (m)	Midstory dominant species	Midst % cover	Midst Height (m)	Ground dominant species	Ground % cover	Ground Height (m)	Hydrology (present/absent and type)	Rocky features (present/absent and type)	Tree and log Hollows (type and abundance)
BNM1C	<i>Syncarpia glomulifera</i>	60	30	<i>Allocasuarina littoralis</i>	70	10	<i>Pteridium esculentum</i>	80	0.8	Adjacent dry drainage line	Absent	Occasional fallen timber and limited hollows
BNM1D	<i>Corymbia gummifera</i>	50	20	<i>Allocasuarina littoralis</i>	50	8	<i>Lomandra</i> spp.	60	0.5	Absent	Absent	Numerous log hollows
BNM2A	<i>Eucalyptus propinqua</i>	60	20	<i>Lophostemon confertus</i>	60	10	<i>Imperata cylindrica</i>	70	0.3	Absent	Absent	Abundant fallen timber and log hollows available
BNM2B	<i>Eucalyptus siderophloia</i>	40	17	<i>Lophostemon confertus</i>	40	8	<i>Entolasia stricta</i>	60	0.3	Absent	Absent	Occasional fallen timber, log hollows
BNM2C	<i>Eucalyptus saligna</i>	50	25	<i>Melaleuca</i> spp.	60	10	<i>Lomandra longifolia</i>	80	1	Absent	Absent	Minimal fallen timber, one log hollow
BNM2D	<i>Syncarpia glomulifera</i>	70	25	Mixed rainforest species	80	10	<i>Lomandra</i> spp.	30	1	Adjacent wet creek	Absent	Numerous log hollows
BNM3A	<i>Eucalyptus paniculata</i>	30	20	<i>Allocasuarina</i> spp.	80	8	<i>Lomandra longifolia</i>	0.5	15	Absent	Absent	Minimal fallen timber, one log hollow
BNM3B	<i>Eucalyptus grandis</i>	80	30	<i>Melaleuca quinquenervia</i>	80	10	<i>Gahnia</i> spp.	50	1	Adjacent dry drainage line	Absent	Occasional fallen timber and log hollows
BNM3C	<i>Eucalyptus pilularis</i>	60	30	<i>Acacia</i> spp.	60	8	<i>Imperata cylindrica</i>	60	0.8	Absent	Absent	Substantial fallen logs and hollows
BNM3D	<i>Eucalyptus pilularis</i>	60	30	Mixed rainforest species	80	8	<i>Pteridium esculentum</i>	70	0.9	Adjacent moist gully	Absent	Occasional log hollow
BREF1A	<i>Eucalyptus microcorys</i>	60	25	<i>Allocasuarina torulosa</i>	40	12	<i>Imperata cylindrica</i>	30	0.4	Absent	Absent	Substantial fallen timber and hollow logs
BREF1B	<i>Allocasuarina torulosa</i>	60	25	<i>Lantana camara</i>	70	2	<i>Imperata cylindrica</i>	10	0.3	Adjacent gully drainage	Absent	Occasional fallen timber, large log hollow
BREF1C	<i>Corymbia gummifera</i>	50	20	<i>Allocasuarina torulosa</i>	60	12	<i>Lomandra</i> spp.	30	0.4	Absent	Absent	One hollow under burnt stag
BREF1D	<i>Eucalyptus carnea</i>	50	25	<i>Acacia</i> spp.	70	6	<i>Imperata cylindrica</i>	50	0.4	Absent	Absent	Occasional fallen log no hollows
BREF2A	<i>Eucalyptus propinqua</i>	60	30	<i>Melaleuca sieberi</i>	8	12	<i>Lomandra longifolia</i> , <i>Gahnia</i>	30	0.4	Adjacent wet creek	Absent	Minimal fallen timber no hollows

Site	Canopy dominant species	Canopy % cover	Canopy Height (m)	Midstory dominant species	Midst % cover	Midst Height (m)	Ground dominant species	Ground % cover	Ground Height (m)	Hydrology (present/absent and type)	Rocky features (present/absent and type)	Tree and log Hollows (type and abundance)
							sp.					
BREF2B	<i>Eucalyptus grandis</i>	70	35	<i>Melaleuca quinquenervia</i>	80	13	<i>Lantana camara</i>	50	2	Adjacent wet creek	Absent	Occasional fallen timber no hollows
BREF2C	Mahogany spp.	50	25	<i>Allocasuarina littoralis</i>	60	10	<i>Entolasia stricta</i>	60	0.5	Absent	Absent	Substantial fallen timber no hollows
BREF2D	<i>Eucalyptus propinqua</i>	70	30	<i>Melaleuca quinquenervia</i>	70	12	<i>Gahnia</i> spp.	40	0.6	Absent	Absent	Abundant fallen timber and hollow logs
BREF3A	<i>Corymbia intermedia</i>	60	25	<i>Allocasuarina torulosa</i>	70	15	<i>Imperata cylindrica</i>	40	0.3	Absent	Absent	Substantial fallen timber and hollow logs
BREF3B	<i>Eucalyptus carnea</i>	40	20	Eucalyptus saplings	40	8	<i>Lomandra longifolia</i>	40	0.4	Absent	Absent	Substantial fallen timber and hollow logs
BREF3C	<i>Corymbia intermedia</i>	60	30	<i>Allocasuarina torulosa</i>	70	12	<i>Lomandra</i> spp.	30	0.4	Absent	Absent	Substantial fallen timber and hollow logs
BREF3D	<i>Syncarpia glomulifera</i>	70	25	Eucalyptus saplings	80	8	<i>Imperata cylindrica</i>	10	0.3	Absent	Absent	Occasional fallen timber no hollows



**Table 11: Maria River area habitat attributes**

Site	Canopy dominant species	Canopy % cover	Canopy Height (m)	Midstory dominant species	Midst % cover	Midst Height (m)	Ground dominant species	Ground % cover	Ground Height (m)	Hydrology (present/absent and type)	Rocky features (present/absent and type)	Tree and log Hollows (type and abundance)
MM1A	<i>Eucalyptus microcorys</i>	40	25	Eucalyptus saplings	60	8	<i>Lomandra longifolia</i>	60	0.6	Adjacent wet drainage	Absent	Absent
MM1B	<i>Eucalyptus pilularis</i>	30	30	Eucalyptus saplings	60	8	<i>Imperata cylindrica</i>	90	0.7	Absent	Absent	Absent
MM1C	Stringybark	20	20	Eucalyptus saplings	50	10	<i>Imperata cylindrica</i>	90	0.4	Absent	Absent	Absent
MM1D	<i>Eucalyptus microcorys</i>	30	22	Eucalyptus saplings	40	10	<i>Imperata cylindrica</i>	80	0.4	Absent	Absent	Absent
MM2A	<i>Eucalyptus pilularis</i>	20	20	Eucalyptus saplings	40	8	Mixed native grasses	70	0.5	Absent	Absent	Occasional hollow log
MM2B	<i>Syncarpia glomulifera</i>	50	25	<i>Allocasuarina littoralis</i>	70	10	<i>Imperata cylindrica</i>	40	0.4	Absent	Absent	Numerous hollow logs
MM2C	<i>Corymbia gummifera</i>	10	25	<i>Allocasuarina littoralis</i>	20	8	<i>Lomandra</i> sp.	60	0.2	Absent	Absent	Substantial hollow logs
MM2D	<i>Eucalyptus paniculata</i>	30	20	<i>Lophostemon confertus</i>	60	8	Mixed native grasses	40	0.7	Absent	Absent	Occasional hollow log
MM3A	Mahogany sp.	30	20	Eucalyptus saplings	40	8	<i>Xanthorrhoea</i> sp.	80	0.8	Absent	Absent	Occasional hollow log
MM3B	<i>Eucalyptus pilularis</i>	40	22	<i>Melaleuca</i> sp.	50	10	<i>Imperata cylindrica</i>	90	0.5	Adjacent wet drainage	Absent	Substantial hollow logs
MM3C	Stringybark	15	22	Eucalyptus saplings	10	10	<i>Imperata cylindrica</i>	60	0.7	Absent	Absent	Occasional hollow log
MM3D	Stringybark	10	20	Eucalyptus saplings	60	12	<i>Xanthorrhoea</i> sp.	80	0.9	Adjacent wet drainage	Absent	Absent
MNM1A	<i>Eucalyptus propinqua</i>	20	18	<i>Allocasuarina littoralis</i>	70	8	<i>Imperata cylindrica</i>	20	0.4	Adjacent wet drainage and swampy area	Absent	Absent
MNM1B	<i>Eucalyptus pilularis</i>	40	28	<i>Allocasuarina littoralis</i>	50	8	Mixed native grasses	80	0.6	Absent	Absent	Occasional hollow log
MNM1C	<i>Eucalyptus propinqua</i>	30	22	<i>Melaleuca</i> spp.	70	15	Mixed native grasses	90	0.2	General wet area	Absent	Substantial hollow logs
MNM1D	<i>Syncarpia glomulifera</i>	60	30	<i>Melaleuca stypheloides</i>	80	12	<i>Lomandra</i> spp.	60	0.3	Adjacent wet Stumpy Creek	Absent	Occasional hollow log

Site	Canopy dominant species	Canopy % cover	Canopy Height (m)	Midstory dominant species	Midst % cover	Midst Height (m)	Ground dominant species	Ground % cover	Ground Height (m)	Hydrology (present/absent and type)	Rocky features (present/absent and type)	Tree and log Hollows (type and abundance)
MNM2A	<i>Eucalyptus pilularis</i>	70	25	<i>Allocasuarina littoralis</i>	10	8	<i>Imperata cylindrica</i>	10	0.3	Absent	Absent	Absent
MNM2B	Mahogany sp.	30	22	<i>Allocasuarina littoralis</i>	30	8	Mixed native grasses	50	0.4	Absent	Absent	Occasional hollow log
MNM2C	<i>Eucalyptus pilularis</i>	60	30	Eucalyptus saplings	10	8	Mixed native grasses and <i>Pteridium esculentum</i>	10	0.6	Absent	Absent	Absent
MNM2D	<i>Eucalyptus pilularis</i>	50	20	<i>Allocasuarina littoralis</i>	30	8	<i>Entolasia stricta</i>	15	0.3	Absent	Absent	Numerous hollow logs
MNM3A	Mahogany sp.	20	20	<i>Allocasuarina torulosa</i>	40	8	<i>Entolasia stricta</i>	60	0.4	Absent	Absent	Absent
MNM3B	Mahogany sp.	10	22	<i>Allocasuarina littoralis</i>	5	6	<i>Imperata cylindrica</i>	40	0.4	Adjacent dam	Absent	Absent
MNM3C	<i>Eucalyptus pilularis</i> plantation	60	20	Burnt <i>Allocasuarina littoralis</i>	5	8	<i>Imperata cylindrica</i>	80	0.7	Absent	Absent	Absent
MNM3D	<i>Eucalyptus propinqua</i>	60	25	<i>Melaleuca</i> spp.	70	8	Mixed native forbs and grasses	90	0.2	Adjacent dry creek	Absent	Occasional hollow log
MREF1A	<i>Eucalyptus pilularis</i>	50	25	<i>Allocasuarina littoralis</i>	60	10	<i>Entolasia stricta</i>	70	0.5	Adjacent drainage	Absent	Occasional hollow log
MREF1B	<i>Eucalyptus racemosa</i>	30	20	<i>Syncarpia glomulifera</i>	80	20	<i>Entolasia stricta</i>	60	0.5	Absent	Absent	Occasional hollow log
MREF1C	<i>Eucalyptus racemosa</i>	30	25	<i>Leptospermum</i> sp.	30	8	<i>Xanthorrhoea</i> sp.	80	0.6	Absent	Absent	Occasional hollow log
MREF1D	<i>Corymbia gummifera</i>	50	25	<i>Allocasuarina torulosa</i>	30	12	<i>Xanthorrhoea</i> sp.	70	0.7	Absent	Absent	Occasional hollow log
MREF2A	<i>Eucalyptus racemosa</i>	60	25	<i>Allocasuarina torulosa</i>	80	10	<i>Imperata cylindrica</i>	30	0.3	Absent	Absent	Occasional hollow log
MREF2B	Mahogany sp.	60	25	<i>Allocasuarina torulosa</i>	80	10	<i>Xanthorrhoea</i> sp.	80	0.6	Absent	Absent	Occasional hollow log
MREF2C	<i>Corymbia gummifera</i>	15	22	<i>Allocasuarina littoralis</i>	30	8	Mixed native grasses	80	0.4	Absent	Absent	Occasional hollow log

Site	Canopy dominant species	Canopy % cover	Canopy Height (m)	Midstory dominant species	Midst % cover	Midst Height (m)	Ground dominant species	Ground % cover	Ground Height (m)	Hydrology (present/absent and type)	Rocky features (present/absent and type)	Tree and log Hollows (type and abundance)
MREF2D	<i>Eucalyptus racemosa</i>	40	22	<i>Allocasuarina littoralis</i>	80	10	<i>Xanthorrhoea</i> sp.	90	0.6	Absent	Absent	Occasional hollow log
MREF3A	<i>Eucalyptus pilularis</i>	50	25	<i>Melaleuca stypheloides</i>	80	10	<i>Lomandra longifolia</i>	20	0.6	Wet creek	Absent	Absent
MREF3B	<i>Eucalyptus racemosa</i>	20	22	<i>Allocasuarina torulosa</i>	70	8	<i>Xanthorrhoea</i> sp.	80	0.6	Absent	Absent	Occasional hollow log
MREF3C	<i>Corymbia gummifera</i>	15	22	<i>Allocasuarina littoralis</i>	30	8	<i>Xanthorrhoea</i> sp.	80	0.6	Absent	Absent	Occasional hollow log
MREF3D	<i>Eucalyptus racemosa</i>	30	22	<i>Allocasuarina torulosa</i>	70	12	<i>Xanthorrhoea</i> sp.	70	0.6	Absent	Absent	Occasional hollow log



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# Giant Barred Frog Monitoring 2017/2018

**Oxley Highway to Kempsey, Pacific Highway Upgrade**

**Prepared for Roads and Maritime Services**

**September 2018**

## Document control

Project no.:	1702
Project client:	Roads and Maritime Services
Project office:	Port Macquarie
Document description:	Giant Barred Frog Monitoring 2017/2018 Report
Project Director:	Rhidian Harrington
Project Manager:	Radika Michniewicz
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Internal review:	Radika Michniewicz, Amanda Griffith
Document status:	R1
Local Government Area:	Kempsey and Port Macquarie-Hastings

Author	Revision number	Internal review	Date issued
Jodie Danvers	D0	Radika Michniewicz	2/07/2018
Radika Michniewicz	D1	Amanda Griffith	17/09/2018
Radika Michniewicz	R0		19/09/2018
Radika Michniewicz	R1		24/09/2018

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*Cover photograph: Giant Barred Frog (Photos: Matthew Stanton)*

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## Executive summary

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### **Context**

This report documents findings for the final two construction phase monitoring events, (spring 2017 and summer [January/February] 2018), and the first operational monitoring event (autumn 2018) for the Giant Barred Frog (*Mixophyes iteratus*), 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, RMS 2016). The NSW Roads and Maritime Services (Roads and Maritime) is required to manage and monitor the effectiveness of biodiversity mitigation measures implemented as part of the Project. The Giant Barred Frog is one of the threatened species identified as requiring mitigation and monitoring throughout the course of the construction and operational periods of the Project.

### **Aims**

The aim of the Giant Barred Frog monitoring program is to determine, through evaluation of the performance indicators outlined in the EMP, if the Project is having an impact on the species and whether corrective actions are required.

### **Methods**

Six sites (two reference and four impact) were monitored. Each monitoring location was surveyed in accordance with the monitoring method and design specified in the EMP. Surveys were undertaken after a sufficient rainfall trigger event (> 10 millimeters within a 24 hour period) and involved passive listening, call playback (upon arrival and at intervals during searches), active searching (within 20 metres of each creek bank) and habitat surveys.

### **Key results**

Surveys were undertaken on the 4-6 October 2017 (spring), 30 January – 1 February 2018 (summer) and 26 April and 30 April – 1 May 2018 (autumn) after suitable rainfall. A total of 136 Giant Barred Frogs were recorded during the 2017/2018 monitoring period and 38% (n = 41) of those captured were recaptures. Frogs were recorded at all sites during all seasons with the exception of Pipers Creek impact site where no frogs were recorded during the summer and autumn surveys.

All sites showed evidence of breeding via presence of juveniles or sub-adults, gravid females or reproductive males during at least one survey event.

Chytrid fungus was detected only at Smiths Creek impact site during the 2017/2018 monitoring period, however is considered to be present at all monitoring sites, where it has been detected previously.

All sites had at least one water quality parameter for one or more monthly results for which the median downstream value exceeded the 80<sup>th</sup> percentile of the upstream value.



### ***Conclusions***

Performance measures related to undertaking monitoring, the presence of Giant Barred Frogs and habitat use have to date been met.

The performance measure related to continued presence of Giant Barred Frogs during each survey event where it was identified during baseline surveys was met for five of the six sites. Giant Barred Frogs were not recorded at Pipers Creek impact site during the summer and autumn survey, despite being recorded during baseline surveys. Only a single frog was captured at Pipers Creek impact site (during the spring surveys) in the 2017/2018 monitoring period.

The water quality performance measure was met for all parameters except turbidity at Cooperabung Creek that exceeded the ANZECC upper limit on one occasion, which coincided with wet weather events where surface water entered the waterway through a project-specific clean water drain and construction water quality basin. Other values above the 80<sup>th</sup> percentile trigger value were not considered to be attributable to construction activities.

### ***Management implications***

It is recommended that:

- Monitoring continue as per the EMP. If further monitoring fails to detect the species at Pipers Creek impact site, corrective actions may be required.

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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 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) (RMS 2016) combines these approval conditions and defines the mitigation and offsetting requirements for threatened species and ecological communities impacted by the Project. The Giant Barred Frog (*Mixophyes iteratus*) was one threatened species identified as requiring mitigation and monitoring through the course of the Project's construction and operational period.

### 1.1.1 Legal status

The Giant Barred Frog is listed as endangered under the New South Wales *Biodiversity Conservation Act 2016* (BC Act) and Commonwealth EPBC Act. Monitoring of the species is required under the Project's approval.

### 1.1.2 Monitoring framework

The design, methods and performance indicators that define the Giant Barred Frog monitoring program are specified in the EMP and Giant Barred Frog Management Strategy (GBFMS, Lewis 2013). Where there are discrepancies between the EMP and the GBFMS, the EMP takes precedence (Section 1.2 RMS 2016).

The EMP required monitoring of the Giant Barred Frog three times a year (spring, summer and autumn) in years 1, 2 and 3 once substantial construction commenced. Following completion of the Project, surveys are to be undertaken for five consecutive years, in spring, summer and autumn of year 4, 5, 6, 7 and 8 (operation phase) or until mitigation measures can be demonstrated to have been effective. To date, these monitoring events have been undertaken and reported as follows:

- Construction phase monitoring:
  - *Autumn 2015*: Niche 2015a.
  - *Spring 2015, summer and autumn 2016*: Niche 2016.
  - *Spring 2016, summer and autumn 2017*: Niche 2017.
  - *Spring 2017, summer 2018*: current report.
- Operational phase monitoring:
  - *Autumn 2018*: current report.

This report addresses the final two monitoring events required during the construction phase of the Project and the first monitoring event of the operational phase of the Project. This report therefore represents the fourth of nine monitoring reports for the Giant Barred Frog. The next round of operational monitoring will occur in spring 2018.

### 1.1.3 Baseline data

The EMP specifies the following regarding the Giant Barred Frog:

*“The Giant Barred Frog was recorded at Maria River and suitable habitat was identified at Smiths Creek, Pipers Creek and Cooperabung Creek during surveys undertaken to inform the Environmental Assessment*

*(GHD 2010). Targeted surveys undertaken over eight nights between late November 2012 and late January 2013, involving spotlighting, call- playback and tadpole searches, identified the Giant Barred Frog at Cooperabung Creek (south), Cooperabung Creek downstream at Haydons Wharf Road, Smiths Creek, Pipers Creek and Maria River. Areas of suitable habitat for the Giant Barred Frog were also identified at both Stumpy Creek and Barrys Creek”*

The EMP lists six sites to be monitored:

- Four impact sites: Cooperabung Creek, Smiths Creek, Pipers Creek, and Maria River.
- Two reference sites: Sun Valley Road (where it crosses Cooperabung Creek), and Old Coast Road (where it crosses Pipers Creek).

Baseline surveys (Niche 2015b) recorded a total of 152 Giant Barred Frogs, at all six monitoring sites in spring and summer and at four sites in autumn. Frogs were absent from the Maria River impact site and Pipers Creek reference site during the autumn 2014 baseline survey.

#### **1.1.4 Purpose of this report**

This report details the findings from the final monitoring surveys for the construction phase of the Project and the first operational monitoring event.

The purpose of this report is to summarise the methods and results of the spring 2017, summer 2018 and autumn 2018 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 Giant Barred Frog:

- *Monitoring is undertaken during baseline surveys and Years 1 – 8 or until monitoring can demonstrate that mitigation measures are effective.*
- *Monitoring during Years 1 – 8 is undertaken at the Impact and Control sites where baseline monitoring was undertaken, subject to landowner agreement.*
- *Continued presence of Giant Barred Frogs during each survey event in Years 1 – 8 at sites where it was identified during baseline surveys, subject to access due to landowner agreement.*
- *Mitigation measures are effective as defined in the EPBC approval when all monitoring events are considered at Year 8.*
- *Median values of all downstream water quality monitoring at GBF habitat or potential habitat locations during construction and operation (Year 1 – 6) is less than the 80th percentile value of the upstream site (where 80th percentile is the value at which median values at the downstream site are above 80% of the recorded background water quality records), where this change is found to be attributable to construction or operation.*
- *No change to densities, distribution, habitat use and movement patterns compared to baseline data during monitoring in Years 1 – 8, and then when all monitoring events are considered at Year 8.*

### **1.3 Monitoring Timing**

Monitoring is to occur three times a year: spring, summer and autumn. Monitoring is to occur in the middle of the season, within one week of rainfall of 10 millimeters within a 24 hour period.

## 1.4 Reporting

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

- Detailed description of monitoring methodology employed.
- 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 Director General of the Department of Planning and Environment and the Environment Protection Authority.

## 1.5 Limitations

The following limitations to the monitoring procedure were encountered:

- As reported in Niche 2017, increasing density of Lantana (*Lantana camera*) at a number of sites, notably Maria River impact site and Pipers Creek impact site, is hampering survey efforts. Safe navigation of the creek lines has become difficult due to low visibility and steep creek banks. Giant Barred Frogs have become difficult to detect and impossible to access in areas due to this Lantana growth. Giant Barred Frogs were not detected during autumn and summer surveys at Pipers Creek impact site.



## 2. Methodology

---

### 2.1 Monitoring Sites

Monitoring was undertaken at the four impact and two reference sites. Each site consists of a one kilometre transect along the creek line.

Where possible, impact site transects extend 450 metres upstream and 450 metres downstream of the Project footprint (assumes Project boundary width of 100 metres) and are divided into 10 x 100 metre zones, resulting in four to five zones downstream of the Project footprint, one within the Project footprint, and four to five upstream of the Project footprint. As for previous monitoring events, the Cooperabung Creek impact site was not surveyed for the full kilometre as access agreements with landowners could not be obtained for the final zone downstream, and for the first two zones upstream.

The two reference sites are located several kilometres upstream of the Project footprint within Cooperabung Creek and Pipers Creek.

The location of all monitoring sites is shown in Figure 1, with detailed locations for each site transect provided in Figure 2 to Figure 7.

### 2.2 Giant Barred Frog Survey Method

Surveys were undertaken in accordance with the EMP after sufficient rainfall events.

A two hour minimum search time at each site was employed, however access and movement difficulties due to dense vegetation often resulted in increased survey time. Surveys involved passive listening, call playback (upon arrival and at intervals during searches), active searching (within 20 metres of creek bank) and habitat surveys. In accordance with the EMP, the following habitat data was collected within each of the 100 metre zones:

- Overstorey vegetation cover (OS, expressed as a cover percentage out of 100%).
- Shrub cover (expressed as a cover percentage out of 100%).
- Ground cover (expressed as a cover percentage out of 100%).
- Leaf litter cover (expressed as a cover percentage out of 100%).
- Bare soil/earth (expressed as a cover percentage out of 100%).
- Presence of cattle (based on hoof marks, manure and whether it is recent or aged evidence).
- Number of pools and riffles within the zone.
- Approximate depth of the deepest pool within the zone.
- Number of breaches in frog fencing, if applicable.

The position of all observed Giant Barred Frogs was recorded and, where possible, individuals were captured. Captured individuals were checked for recapture status and fitted with a Passive Integrated Transponder (PIT) tag if the individual was previously unknown. In accordance with the EMP, the following data were collected for captured individuals:

- Location according to demarcated survey zone.
- Distance from stream edge.
- Sex (male, female, unknown).
- Breeding condition with:
  - Males assessed on the colouration of their nuptial pads (i.e. no colour, light, moderate, dark).

- Females based on whether they are gravid or not gravid (egg bearing).
- Snout-vent length (millimetres).
- Weight (grams).
- General condition of the frog, including a swab sample to test for the presence of Chytrid fungus.

Temperature and humidity (either by windwatch or hygrometer), % cloud cover and broad wind level (scale of 0-3 where 0 = no wind) were recorded for each survey. Rainfall (millimeters) within the previous 24 hours was recorded from the Port Macquarie Airport (BOM Station No. 060183), Maria River (BOM Station No. 560003) and Kundabung AWS (Roads and Maritime Station No. RMSN3AWS).

## 2.3 Water Quality

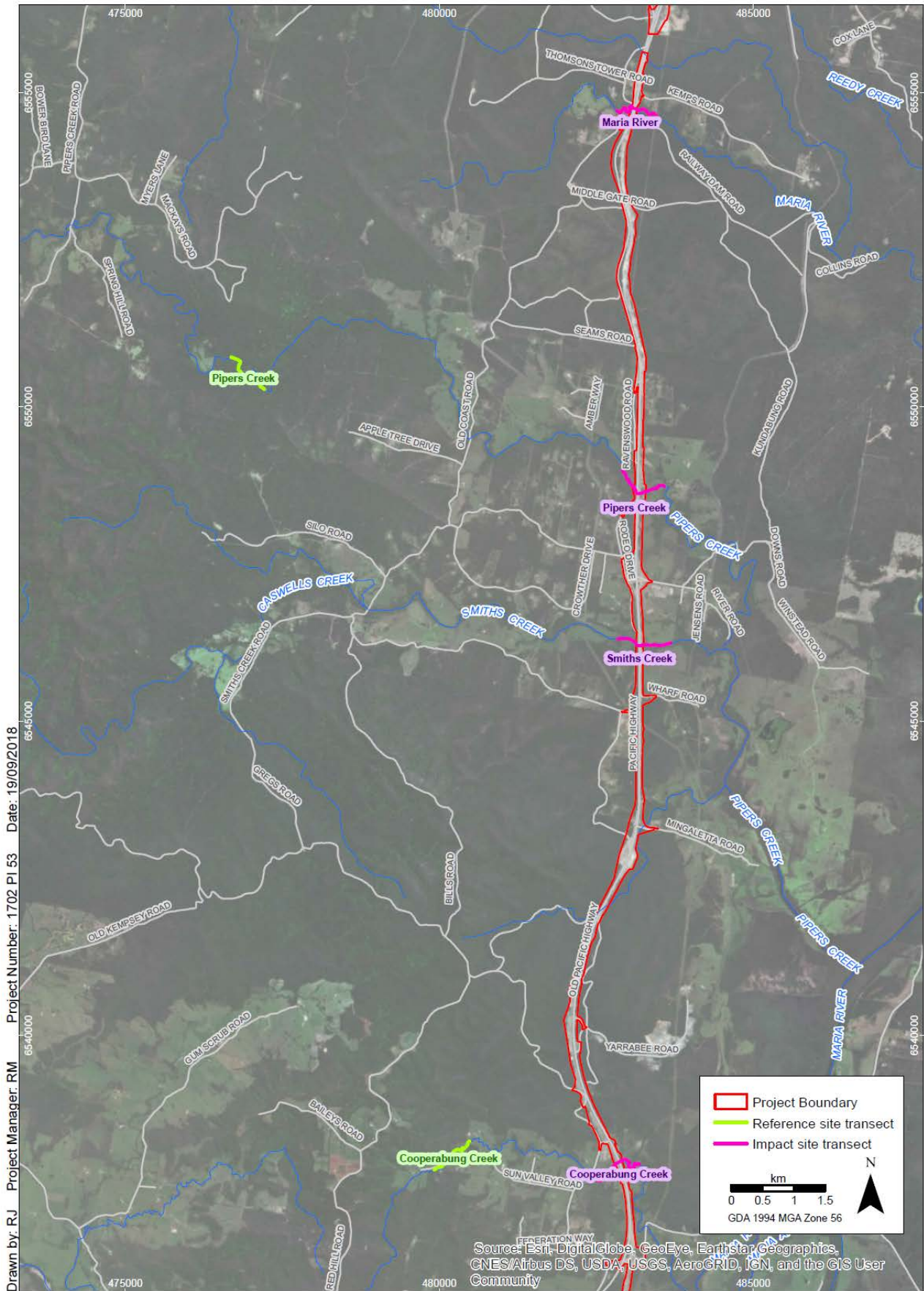
Water quality monitoring was undertaken by Roads and Maritime Services between 22 July 2017 and 29 March 2018 (RMS 2018). This report summarises water quality data from both upstream and downstream sites for Cooperabung Creek, Smiths Creek, Pipers Creek, and Maria River.

The median water quality value for downstream sites was compared with the site specific trigger values developed for the upstream site based on: the 80<sup>th</sup> percentile and, where relevant, the 20<sup>th</sup> percentile (where parameters have a lower acceptable limit e.g. EC, DO, pH, NTU), as well as the ANZECC default trigger values for physical and chemical stressors for south-east Australian slightly disturbed, freshwater ecosystems. Trigger values were derived from 24 sampling events up to and including the month indicated, where data was available.

## 2.4 Analysis

The Minimum Number Known Alive (MNA) (see Sutherland 2006) was calculated for each of the sites. The MNA is based on the number of new individuals encountered over multiple visits, where any new animals are summed, providing an aggregate total. As this method does not account for any migration out of the population or any death, it may over-estimate the total population size if counts are completed over a long period of time. As baseline studies were commenced in 2013 it is possible that considering cumulative records over these last five years may overestimate the actual population. Data is provided for the annual new captures and a cumulative MNA over the years is also provided, however this data should be approached with caution, as the lifespan of the Giant Barred Frog may not extend beyond four or five years (Michael Mahony unpublished data).

Changes in Giant Barred Frog density within the zones and distribution along transects across the years were investigated by considering mean annual records within each specific zone. In addition, movement of individuals between zones was examined for recaptured frogs.



Giant Barred Frog Monitoring Sites: overview  
Pacific Highway Upgrade - Oxley Highway to Kempsey

**FIGURE 1**



Imagery: (c) LPI DigitalGlobe 2015

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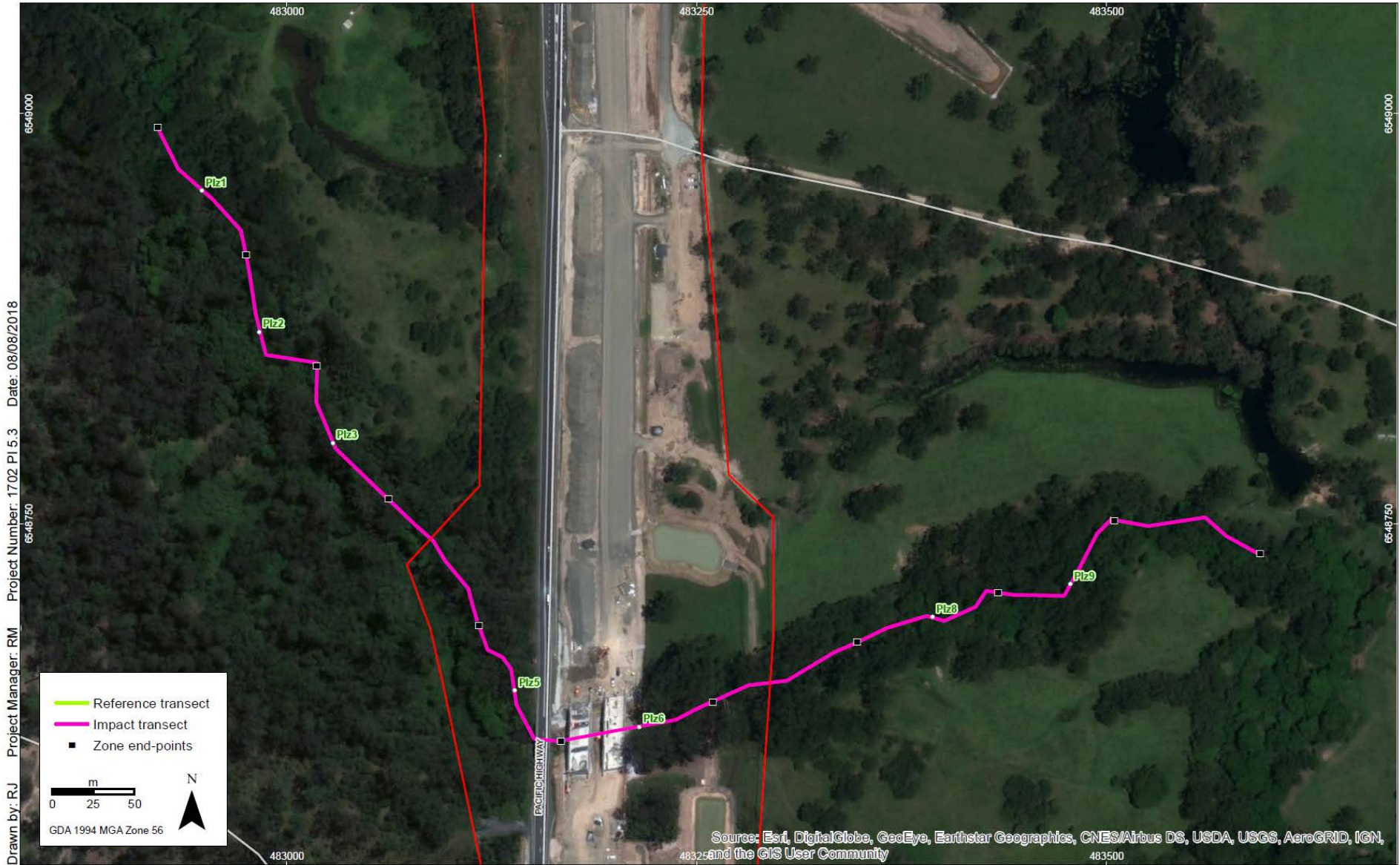
Giant Barred Frog monitoring: Cooperabung Creek impact site  
Pacific Highway Upgrade - Oxley Highway to Kempsey

**FIGURE 2**  
Imagery: (c) DigitalGlobe



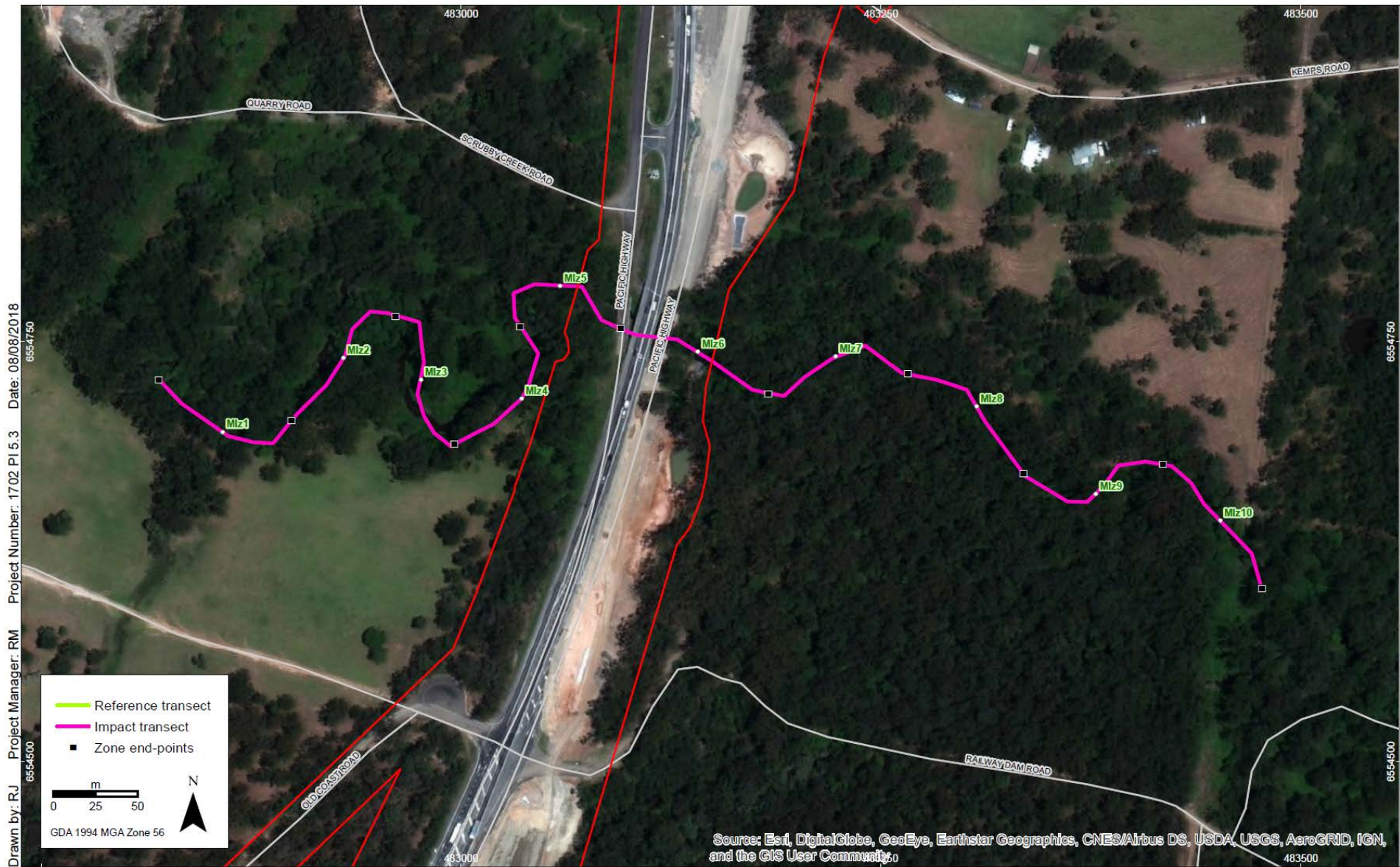
Giant Barred Frog monitoring: Smiths Creek impact site  
Pacific Highway Upgrade - Oxley Highway to Kempsey

**FIGURE 3**  
Imagery: (c) DigitalGlobe



Giant Barred Frog monitoring: Pipers Creek impact site  
 Pacific Highway Upgrade - Oxley Highway to Kempsey

**FIGURE 4**  
 Imagery: (c) DigitalGlobe



Giant Barred Frog monitoring: Maria River impact site  
 Pacific Highway Upgrade - Oxley Highway to Kempsey

**FIGURE 5**  
 Imagery: (c) DigitalGlobe



Giant Barred Frog monitoring: Cooperabung Creek reference site  
Pacific Highway Upgrade - Oxley Highway to Kempsey

**FIGURE 6**  
Imagery: (c) DigitalGlobe





Giant Barred Frog monitoring: Pipers Creek reference site  
 Pacific Highway Upgrade - Oxley Highway to Kempsey

**FIGURE 7**  
 Imagery: (c) DigitalGlobe

### 3. Results

#### 3.1 2017/2018 Giant Barred Frog Monitoring Results

Field data are presented in Annex 1 and Annex 2. Survey dates and trigger rainfall events measured at Port Macquarie Airport (060183) weather station were as follows:

- 4-6 October 2017 (spring): 15.6 millimeters.
- 30 January – 1 February 2018 (summer): 9.8 millimeters.
- 26 April and 30 April – 1 May 2018 (autumn): 55.4 millimeters.

##### 3.1.1 Survey results

A total of 136 Giant Barred Frogs were recorded during the 2017/2018 monitoring surveys. Frogs were recorded at five of the six sites during all three monitoring events and were recorded at Pipers Creek impact site during spring surveys only (Table 1). Of the 136 frogs recorded, 107 were captured, of which 41 were recaptures (38%).

There were more records during spring surveys than summer and autumn at all sites. Pipers Creek reference site recorded the greatest mean number of frogs. No frogs were recorded at Pipers Creek impact site during summer and autumn and a single frog was recorded during spring.

The cumulative MNA is highest at the Pipers Creek reference site (MNA = 137) and Smiths Creek reference site (MNA = 103). As mentioned in Section 2.4, this estimate of MNA is likely an overestimate of the population as calculation of the MNA does not take dispersal or deaths into account.

**Table 1: Giant Barred Frogs recorded at each site during 2017/2018 surveys**

Monitoring	2017-2018	Cooperabung Creek impact	Smiths Creek impact	Pipers Creek impact	Maria River impact	Cooperabung Creek reference	Pipers Creek reference
Construction	Spring (2017)	6	25	1	18	3	24
	Summer (Jan/Feb 2018)	4	4	0	14	2	20
	Mean number of frogs per visit	10.0	14.5	0.5	16.0	2.5	22
	Standard Error (SE)	1.4	14.8	0.7	2.8	0.7	2.8
	New captures	5	22	1	25	3	27
Operational	Autumn (2018)	2	8	0	1	1	4
	New captures	2	7	0	0	1	3
	Cumulative MNA	52	103	40	88	72	137

### 3.1.2 Evidence of breeding

Table 2 presents records of breeding evidence. All sites showed evidence of breeding via the presence of juveniles or sub-adults, gravid females or reproductive males during at least one survey event during 2017/2018.

**Table 2: Breeding evidence records 2017/2018**

		Juveniles	Sub-adults	Gravid females	Nuptial pads
Cooperabung Creek impact	Spring			3	1
	Summer			3	
	Autumn		1		
Maria River impact	Spring		2	7	2
	Summer		1	2	2
	Autumn				
Pipers Creeks impact	Spring		1		
	Summer				
	Autumn				
Smiths Creek impact	Spring		3	2	7
	Summer		1		
	Autumn	1			1
Cooperabung Creek reference	Spring			3	
	Summer	1			
	Autumn	1			
Pipers Creek reference	Spring		6	4	9
	Summer	1		5	10
	Autumn		2		

### 3.1.3 Weather conditions

The prevailing weather conditions encountered during the field surveys are summarised in Table 3. Additional details of the prevailing micrometeorological conditions at the six sites during the field surveys are presented in Annex 1.

**Table 3: Weather conditions: spring 2017, summer 2018 and autumn 2018**

Date	Min temp (°C)	Max temp (°C)	Humidity (%)	Rainfall 24 hours (mm)	Rainfall 7 days (mm)	Rainfall 30 days (mm)
04/10/2017	13.7	25.8	85	4.4	20.2	24.8
05/10/2017	12.3	25.2	92	0	20.2	24.8
06/10/2017	16.5	27.3	95	0.2	20.4	25
30/01/2018	17.9	29.1	87	0	12.4	53.2
31/01/2018	18.6	27.4	81	0	12.4	49
01/02/2018	18.6	24.1	61	0.4	12.8	48.8
26/04/2018	14.8	25.5	83	0.2	57.6	61.4
30/04/2018	14.3	21.1	91	3.8	92	97
01/05/2018	11.5	23.3	76	0.4	91.8	97.4

### 3.1.4 Chytrid fungus

Chytrid fungus sampling was carried out during all monitoring events. Table 4 presents current and previous monitoring event results. During the current monitoring period Chytrid fungus was detected during spring at Smiths Creek impact site only. Chytrid fungus was not detected during the summer and autumn monitoring surveys at any of the sites.

Chytrid fungus was not detected at the remaining five sites in the 2017/2018 monitoring, however it has been previously detected at these sites during either baseline surveys or previous monitoring events. It is presumed that once present, this pathogen will remain at a location on a permanent basis.

Chytrid fungus is therefore considered to be present at all monitoring sites.

**Table 4: Chytrid fungus detection/presence at each site for all surveys conducted to date**

	Cooperabung Creek Impact	Smiths Creek Impact	Pipers Creek Impact	Maria River Impact	Cooperabung Creek Reference	Pipers Creek Reference
<b>Baseline</b>	not detected	<b>detected</b>	not detected	not detected	<b>detected</b>	not detected
<b>2015/2016</b>	not detected	not detected	<b>detected</b>	<b>detected</b>	not detected	<b>detected</b>
<b>2016/2017</b>	<b>detected</b>	not detected	not detected	not detected	<b>detected</b>	<b>detected</b>
<b>2017/2018</b>	not detected	<b>detected</b>	not detected	not detected	not detected	not detected

### 3.1.5 Habitat use

Habitat information collected for each site is presented in Annex 1. Microhabitat use was highly variable. Frogs were recorded on and buried within leaf litter, using flood debris as shelter, within the creeks, on rocks and under logs and vegetation.

No frogs were found to have breached the frog fences at any sites (i.e observed on the wrong side of the fence). It is also noted that no exotic fish were observed at any of the sites during the 2017/2018 monitoring period.

### 3.2 Comparison with Previous Surveys

Both construction and operational monitoring surveys were undertaken during the 2017/2018 period, however only construction monitoring surveys (i.e. spring 2018 and summer [January/February 2018]) have been included in the comparison between baseline and previous construction surveys where means have been calculated. The autumn 2018 operational surveys will be included in future analyses, once additional operational surveys have been completed.

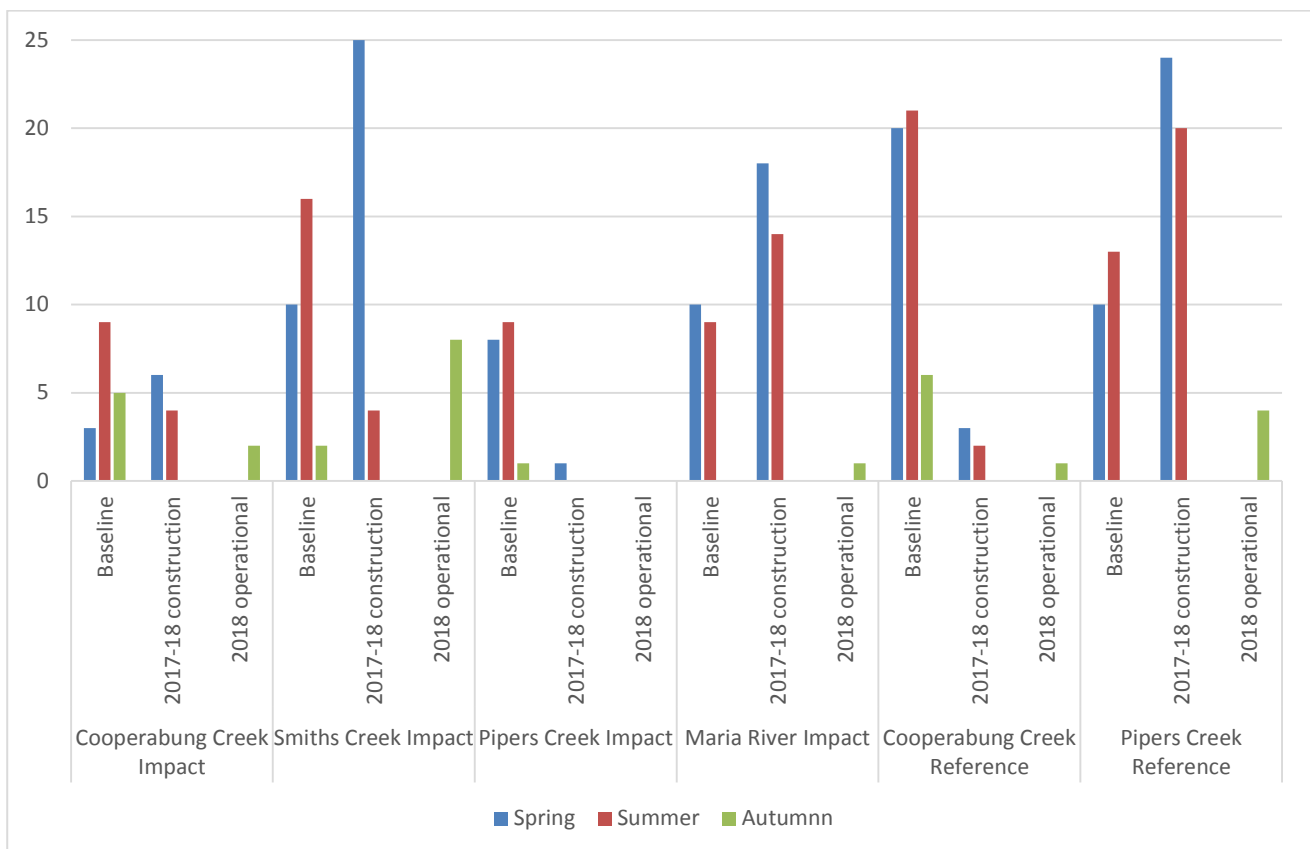
#### 3.2.1 Baseline and 2017/2018 surveys

Graph 1 presents the Giant Barred Frog records for baseline and the 2017/2018 construction and operational monitoring surveys.

Baseline surveys recorded the Giant Barred Frog at all six monitoring sites in spring and summer and at four sites in autumn. Giant Barred Frogs were not recorded at the Maria River impact site and Pipers Creek reference site during the autumn 2014 baseline survey.

The 2017/2018 monitoring recorded Giant Barred Frogs at all six monitoring sites in spring and at five sites in summer and autumn. Giant Barred Frogs were not recorded at Pipers Creek impact site during the summer and autumn 2018 surveys.

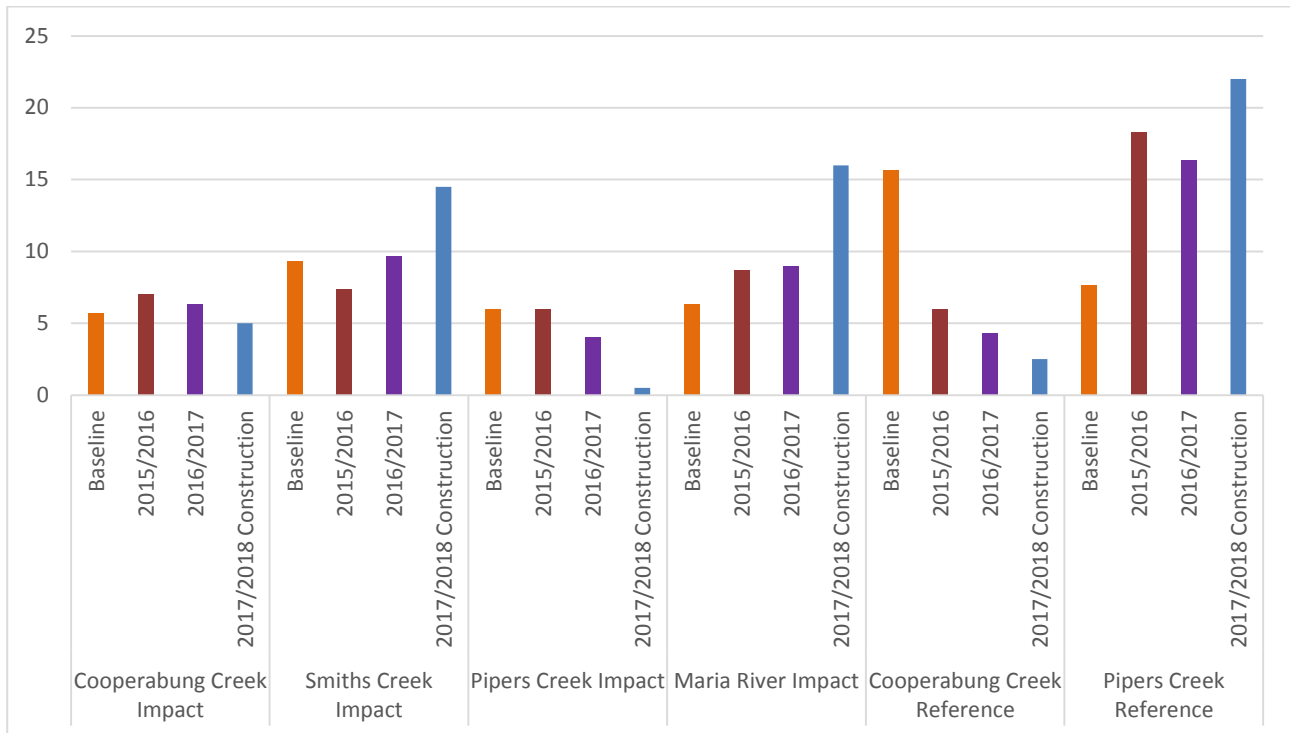
Giant Barred Frogs were therefore recorded during all 2017/2018 surveys at the two sites (one impact site) where they were not recorded during the autumn baseline surveys (Pipers Creek reference site and Maria River impact site), however they were not recorded at the Pipers Creek impact site in the summer and autumn 2017/2018 surveys, where they were recorded during baseline surveys.



**Graph 1: Giant Barred Frog records: baseline and 2017/2018 monitoring**

### 3.2.2 Annual mean records

For the comparison of means, only 2017/2018 construction monitoring has been included (i.e. spring 2018 and summer 2018). The mean number of records each year is shown in Graph 2. Giant Barred Frog records at Smiths Creek impact, Maria River impact and Pipers Creek reference sites have all increased since baseline surveys. Cooperabung Creek impact, Pipers Creek impact and Cooperabung Creek reference sites all show a decreasing trend in mean number of frogs recorded. As this decreasing trend is evident at both impact and reference sites, it is not possible to attribute these changes to the Project.



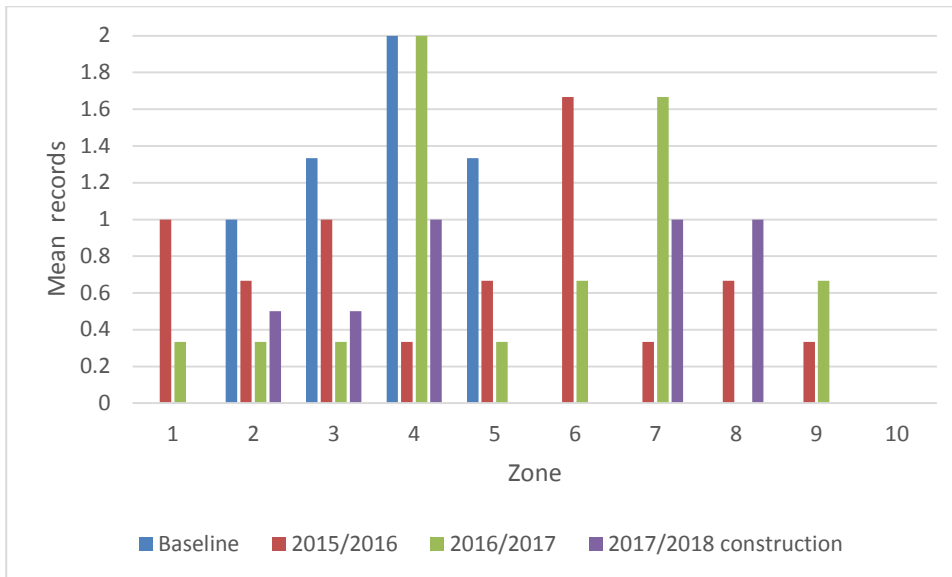
**Graph 2: Mean annual Giant Barred Frog records by site**

### 3.3 Density and Distribution

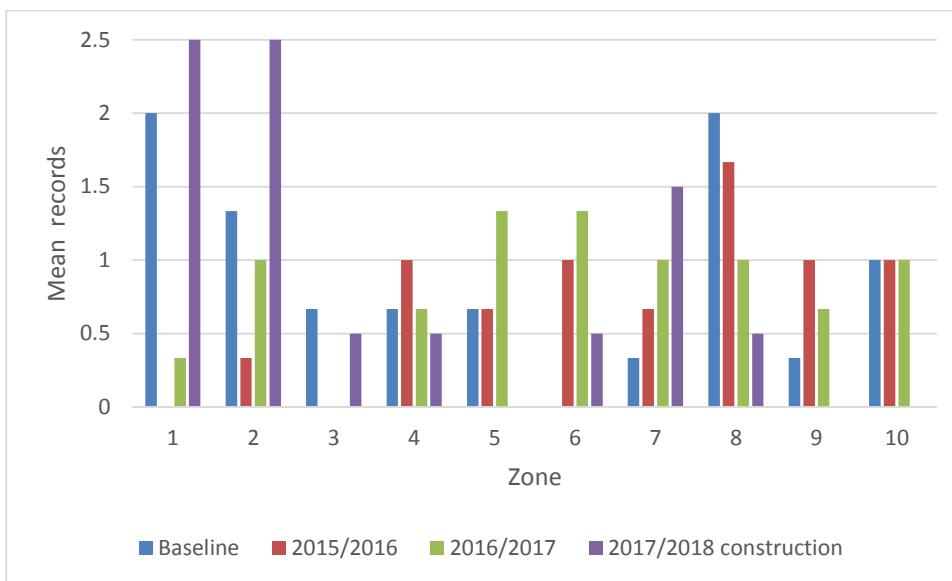
Graph 3 - Graph 8 present the density (annual mean number of Giant Barred Frog records per zone) and distribution of Giant Barred Frog records along the survey transect for each site and each monitoring period. Figure 8 - Figure 13 show the total number of captures within each zone over all monitoring periods.

The density of Giant Barred Frogs has been considered as the mean number of records per year per zone (Graph 3 to Graph 8). While the zones may vary in size slightly due to the nature of the creek’s bank formation and the non-linear nature of the creekline, the zones themselves are consistent between years. As such comparisons can be made within the same zone between years to help identify trends in changing frog numbers. There is no consistent trend evident at any site for frogs to be found in any particular zone. Density appears to be highly variable across the years and along the transect and there is no evidence of lower frog densities within zones 5 and 6, i.e. under the carriageway and immediately adjacent.

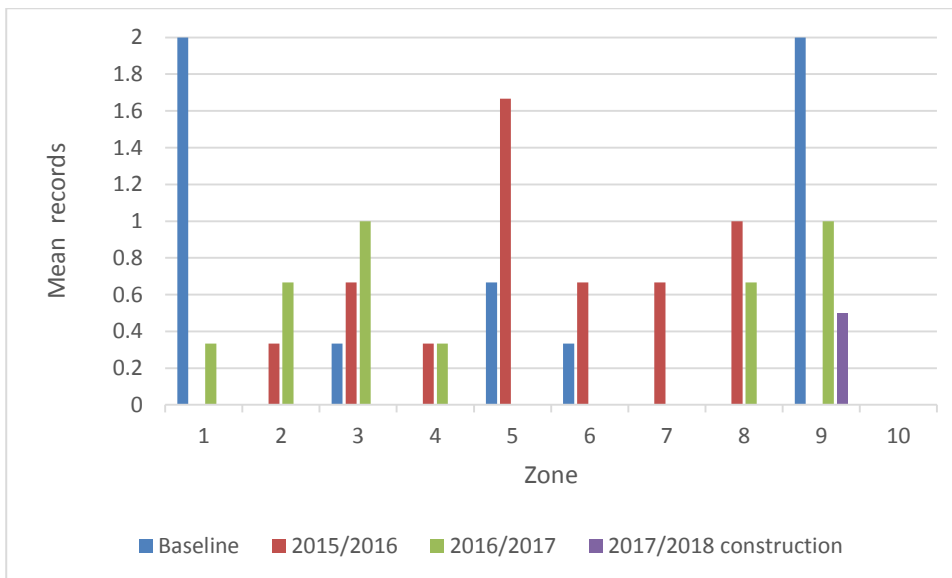
Figure 8 - Figure 13 consider all capture records, whereby capture records (including recaptures) are shown as count ranges, where larger circles indicate larger frog counts. While density data indicates that frog distribution along the transects varies from year to year, when considering all years, frogs mostly appear to be using the entire length of the transect and there is no evidence of frogs being recorded only in one particular zone. In addition, there is no evidence of frogs being absent from zones 5 and 6. While capture frequency within zones directly under the carriageway consistently fall into the lower range category (1-7 frogs), the low capture frequency range occurs regularly along transects and at all sites.



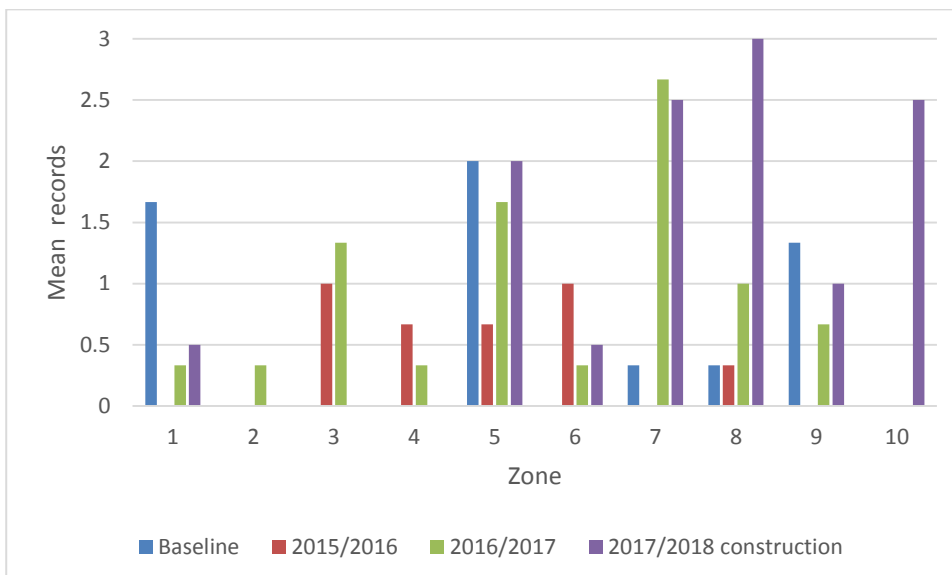
**Graph 3: Cooperabung Creek impact site: mean number of Giant Barred Frogs per zone**



**Graph 4: Smiths Creek impact site: mean number of Giant Barred Frogs per zone**

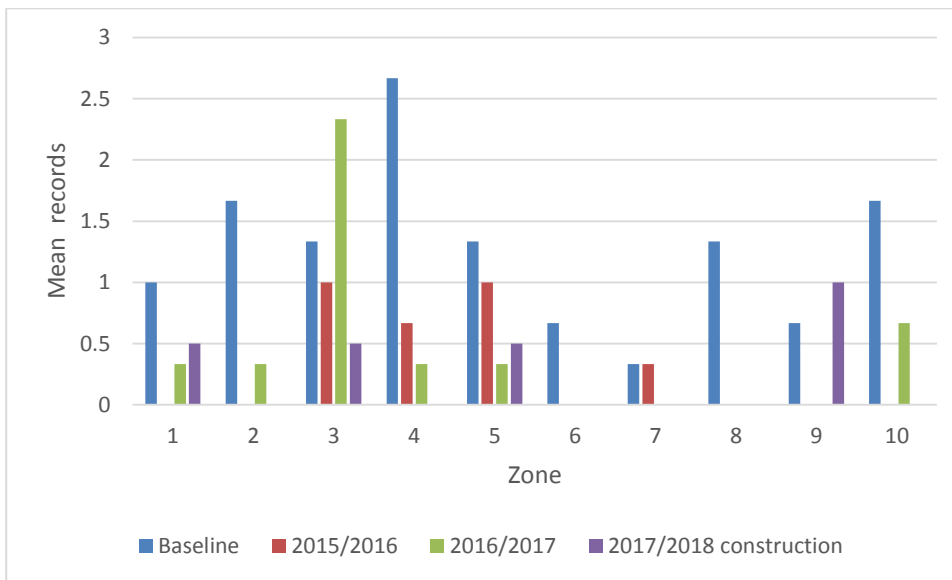


**Graph 5: Pipers Creek impact site: mean number of Giant Barred Frogs per zone**

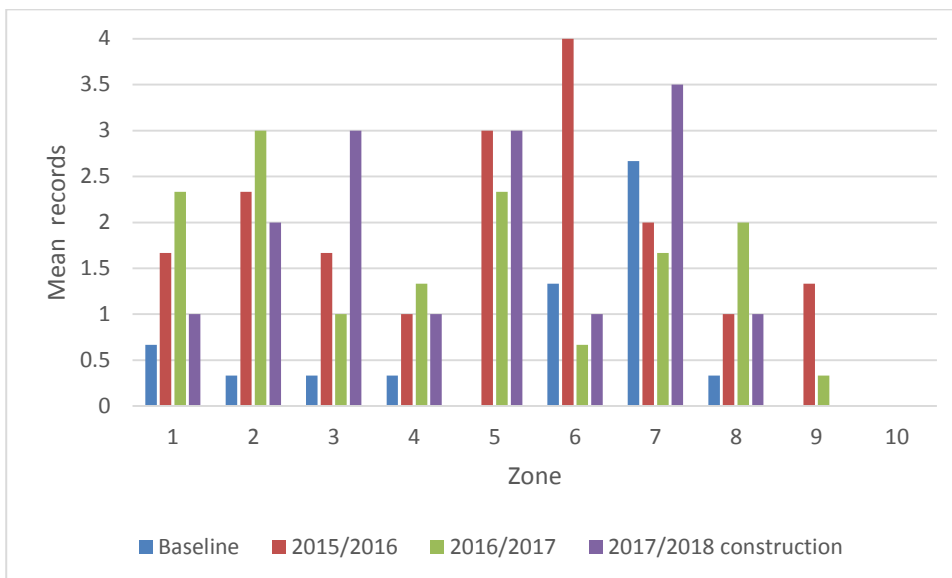


**Graph 6: Maria River impact site: mean number of Giant Barred Frogs per zone**





**Graph 7: Cooperabung Creek reference site: mean number of Giant Barred Frogs per zone**



**Graph 8: Pipers Creek reference site: mean number of Giant Barred Frogs per zone**

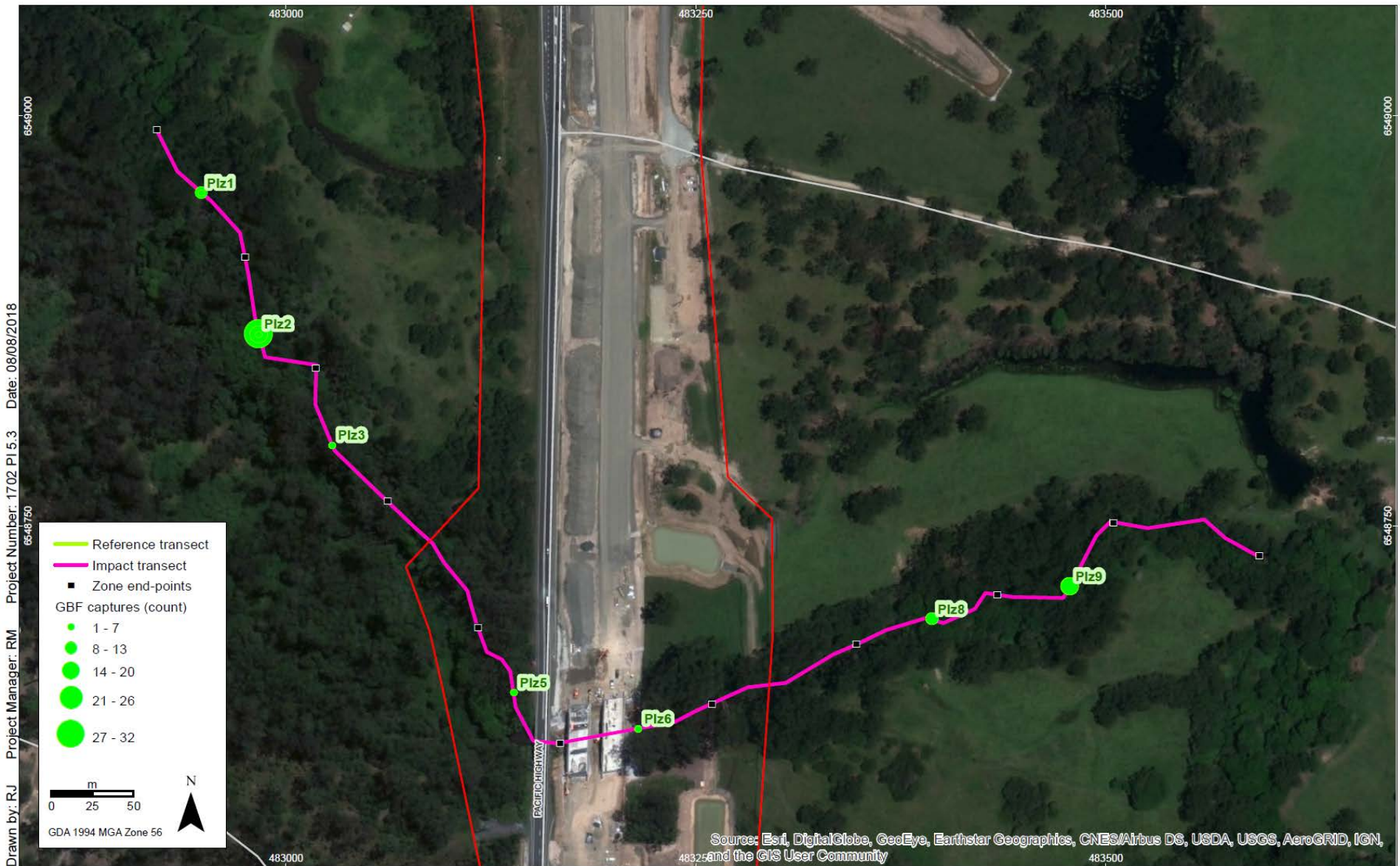


Giant Barred Frog capture distribution: Cooperabung Creek impact site  
Pacific Highway Upgrade - Oxley Highway to Kempsey



Giant Barred Frog capture distribution: Smiths Creek impact site  
Pacific Highway Upgrade - Oxley Highway to Kempsey

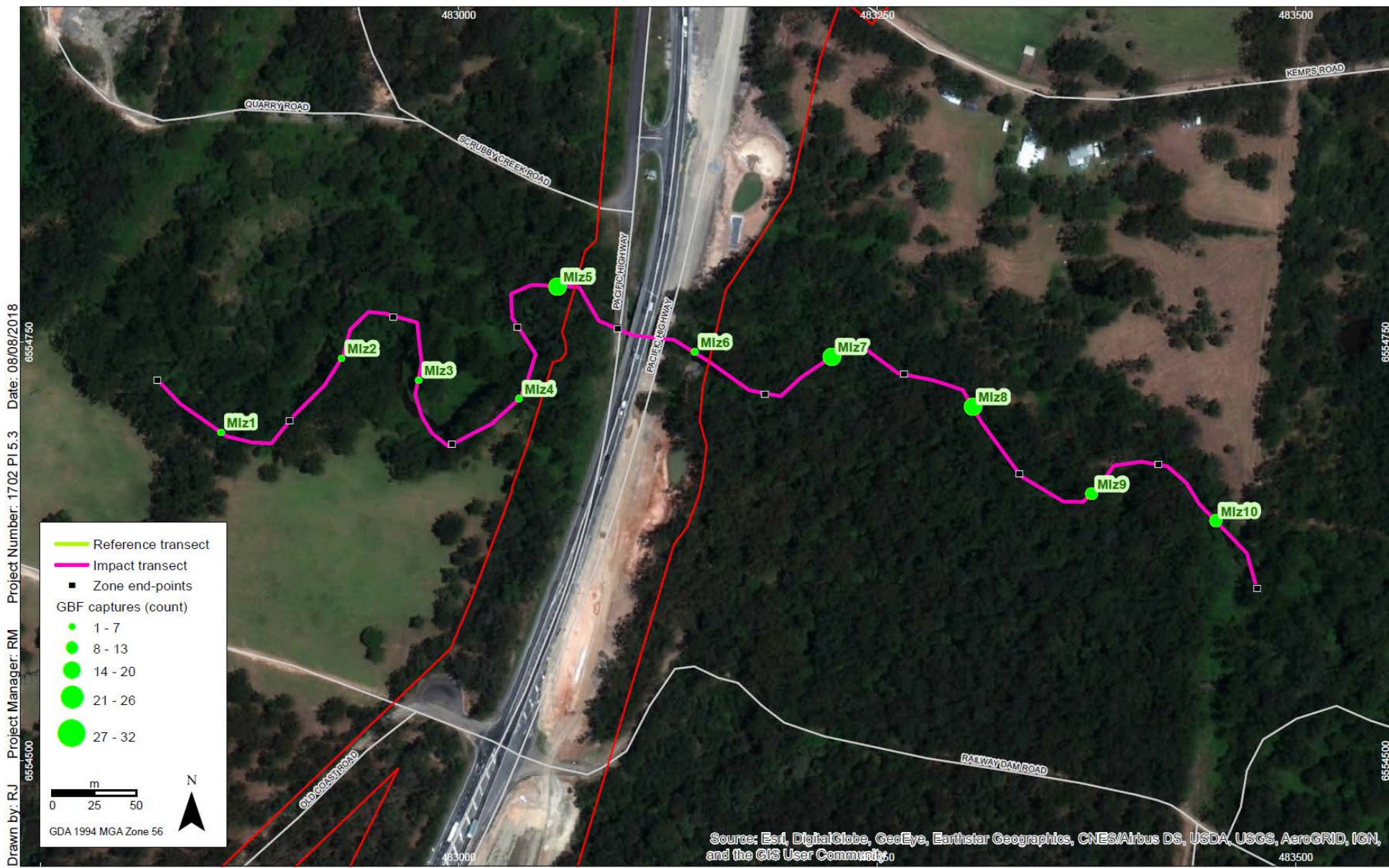
**FIGURE 9**  
Imagery: (c) DigitalGlobe



Giant Barred Frog capture distribution: Pipers Creek impact site  
Pacific Highway Upgrade - Oxley Highway to Kempsey

**FIGURE 10**

Imagery: (c) DigitalGlobe



Giant Barred Frog capture distribution: Maria River impact site  
 Pacific Highway Upgrade - Oxley Highway to Kempsey

**FIGURE 11**  
 Imagery: (c) DigitalGlobe





Giant Barred Frog capture distribution: Cooperabung Creek reference site  
Pacific Highway Upgrade - Oxley Highway to Kempsey

**FIGURE 12**  
Imagery: (c) DigitalGlobe



Drawn by: RJ  
Project Manager: RM  
Project Number: 1702 PI.5.3  
Date: 08/08/2018

Giant Barred Frog capture distribution: Pipers Creek reference site  
Pacific Highway Upgrade - Oxley Highway to Kempsey



**FIGURE 13**  
Imagery: (c) DigitalGlobe

### 3.4 Movement

Recapture data of PIT tagged individuals was used to determine movements along the transects, and notably, from one side of the carriageway to the other at the impact sites. It should be noted that this analysis does not imply that individuals that have not been found on opposite sides of the carriageway have not traversed at some time. Graph 9 - Graph 14 show the movement patterns of individual recaptured Giant Barred Frogs at each site and the data is summarised for each site below. As reference sites by their nature do not traverse the carriageway, a transect midpoint has been included to provide an indication of movements along the transects and permit comparison between reference and impact sites. The reference midpoint was chosen as the arbitrary crossing location to provide similar recapture circumstances to the impact sites (i.e. equal zones on either side). It should however be noted that comparisons made between impact and reference sites do not take into account other potentially confounding factors such as site specific population ecology. Capture order is indicated by the numbers beside each capture point and a single capture point indicates recaptures within the same zone (order not indicated).

A total of 72 individuals have been recaptured on at least one occasion over all monitoring events. Of these, 43 recaptures have occurred at the impact sites. Thirteen (30%) of these individuals from impact sites have been captured on opposite sides of the carriageway over successive monitoring events.

*Cooperabung Creek impact site:* Nine Giant Barred Frogs have been recaptured over all monitoring periods. Of these individuals, four (44%) have been captured on opposite sides of the carriageway, including one individual (ID#7) that traversed on at least two occasions.

*Smiths Creek impact site:* Fourteen frogs have been recaptured over all monitoring periods. Of these individuals, three (21%) have been captured on opposite sides of the carriageway.

*Pipers Creek impact site:* Eleven Giant Barred Frogs have been recaptured over all monitoring periods. Of these individuals, three (27%) have been captured on opposite sides of the carriageway.

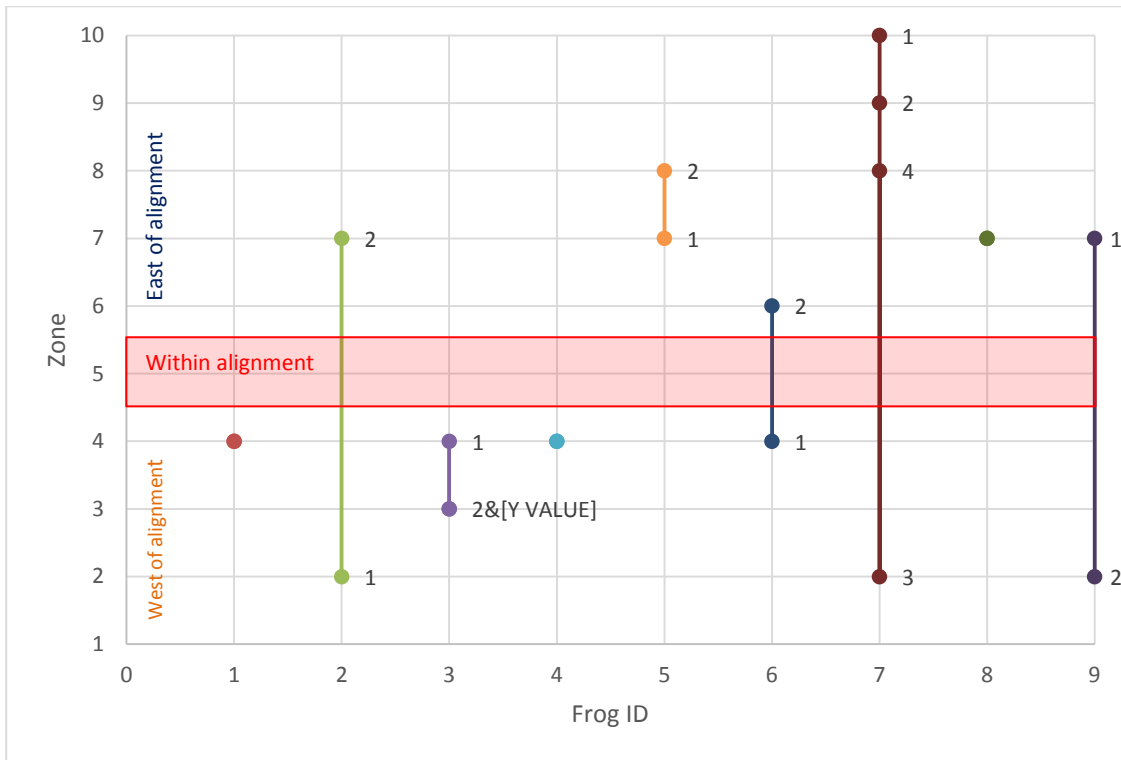
*Maria River impact site:* Nine Giant Barred Frogs have been recaptured over all monitoring periods. Of these individuals, four (44%) have been captured on opposite sides of the carriageway.

*Cooperabung Creek reference site:* Eight Giant Barred Frogs have been recaptured over all monitoring periods. Of these individuals, two (25%) have been captured on opposite sides of the transect midpoint.

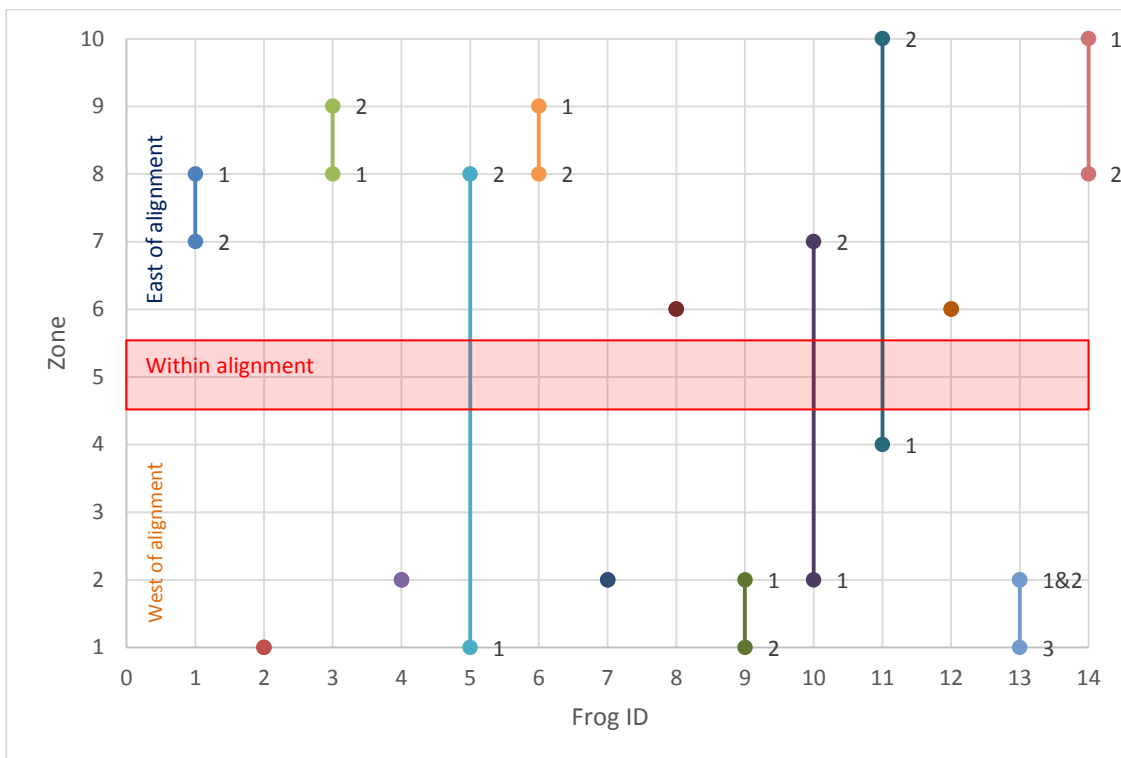
*Pipers Creek reference site:* Twenty-one Giant Barred Frogs have been recaptured over all monitoring periods. Of these individuals, eight (38%) have been captured on opposite sides of the transect midpoint.

At the impact sites, while the monitored waterways continue uninterrupted under the carriageway, there is a distinct change in streamside vegetation within the area immediately under the carriageway. At all impact sites streamside vegetation ranges from completely absent to very limited, represented by small clumps of shrubs and/or *Lomandra* spp. The streamside habitat in these areas is limited to the large rocks and boulders deposited during construction of the Project. Despite this abrupt change in streamside habitat immediately under the carriageway, a number of Giant Barred Frogs have been recorded traversing the carriageway. The percentages of Giant Barred Frogs found to have traversed the impact site midpoints do not appear to differ substantially from the percentages of Giant Barred Frogs found to have traversed the reference site midpoints.

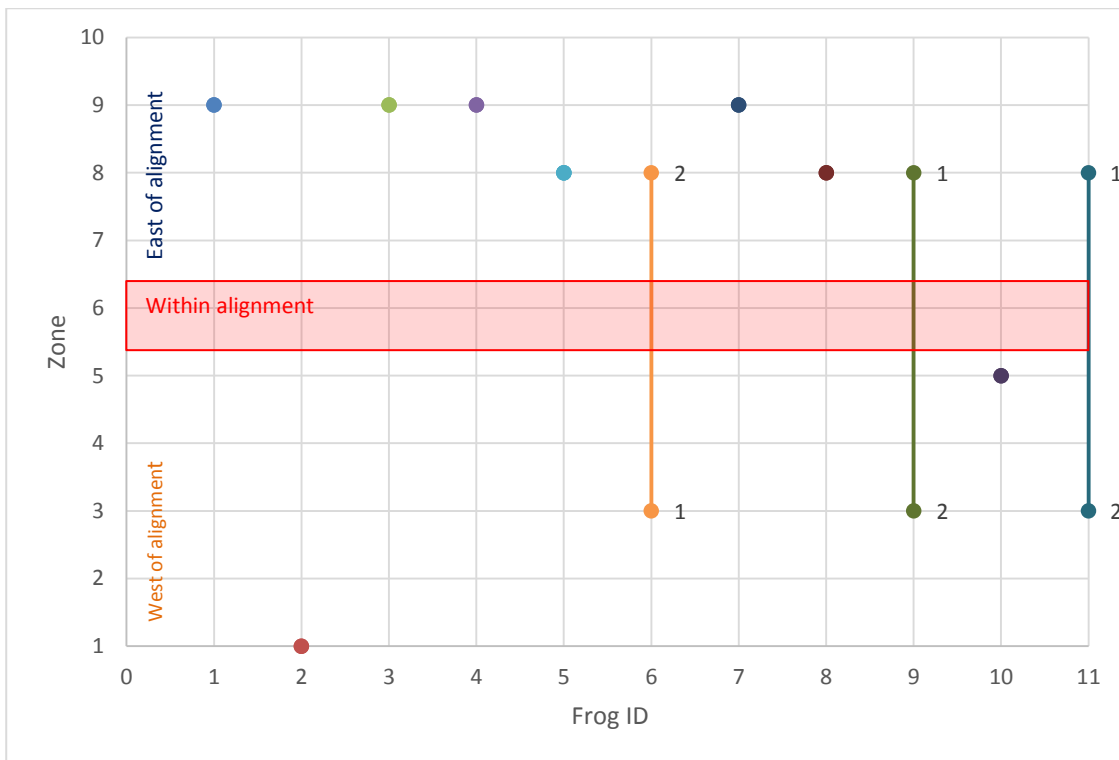




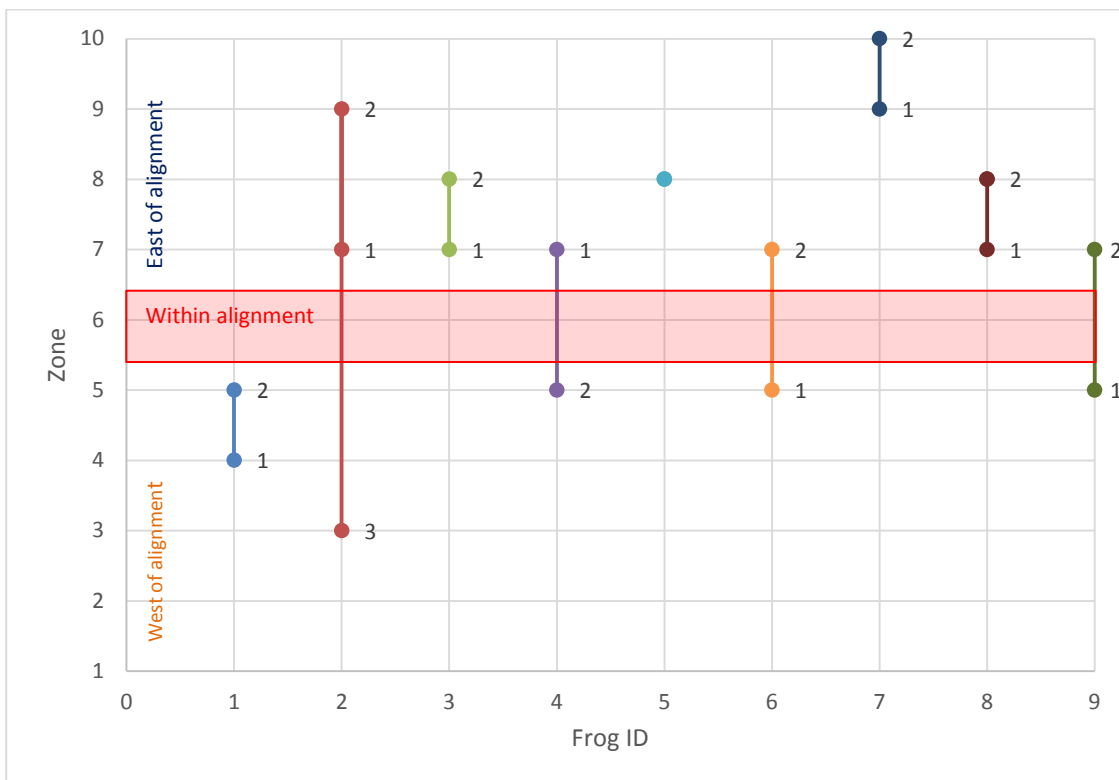
Graph 9: Cooperabung Creek Impact site: recapture movement patterns



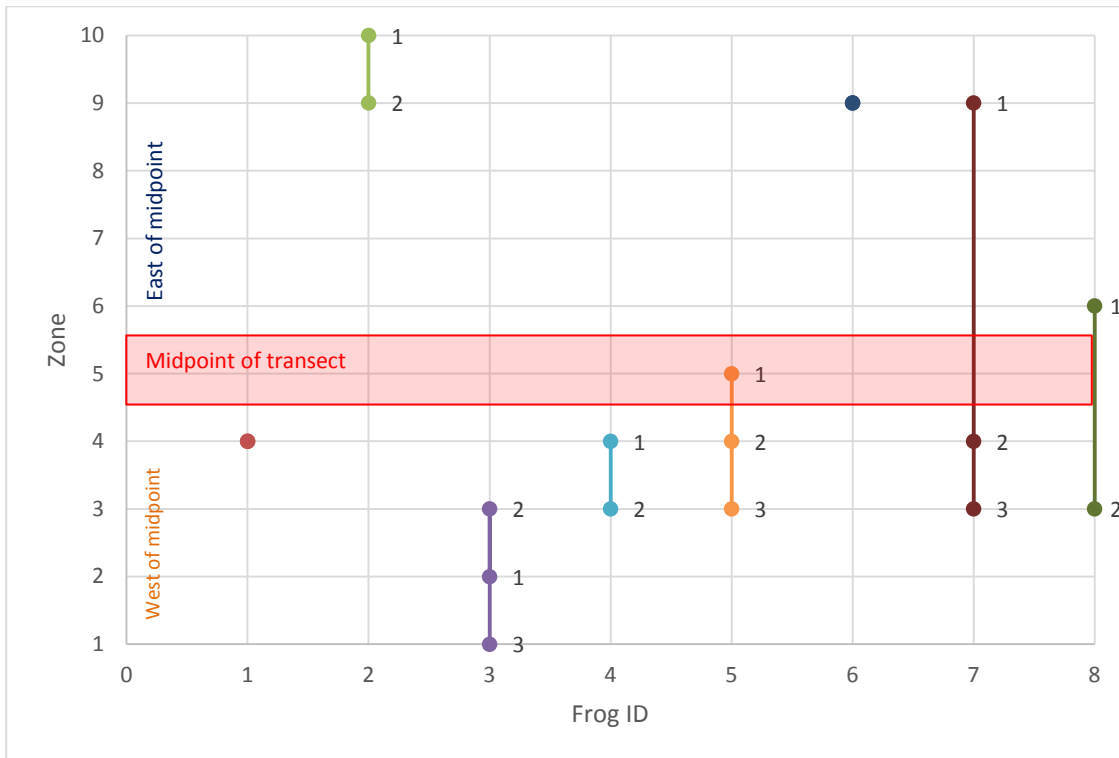
Graph 10: Smiths Creek Impact site: recapture movement patterns



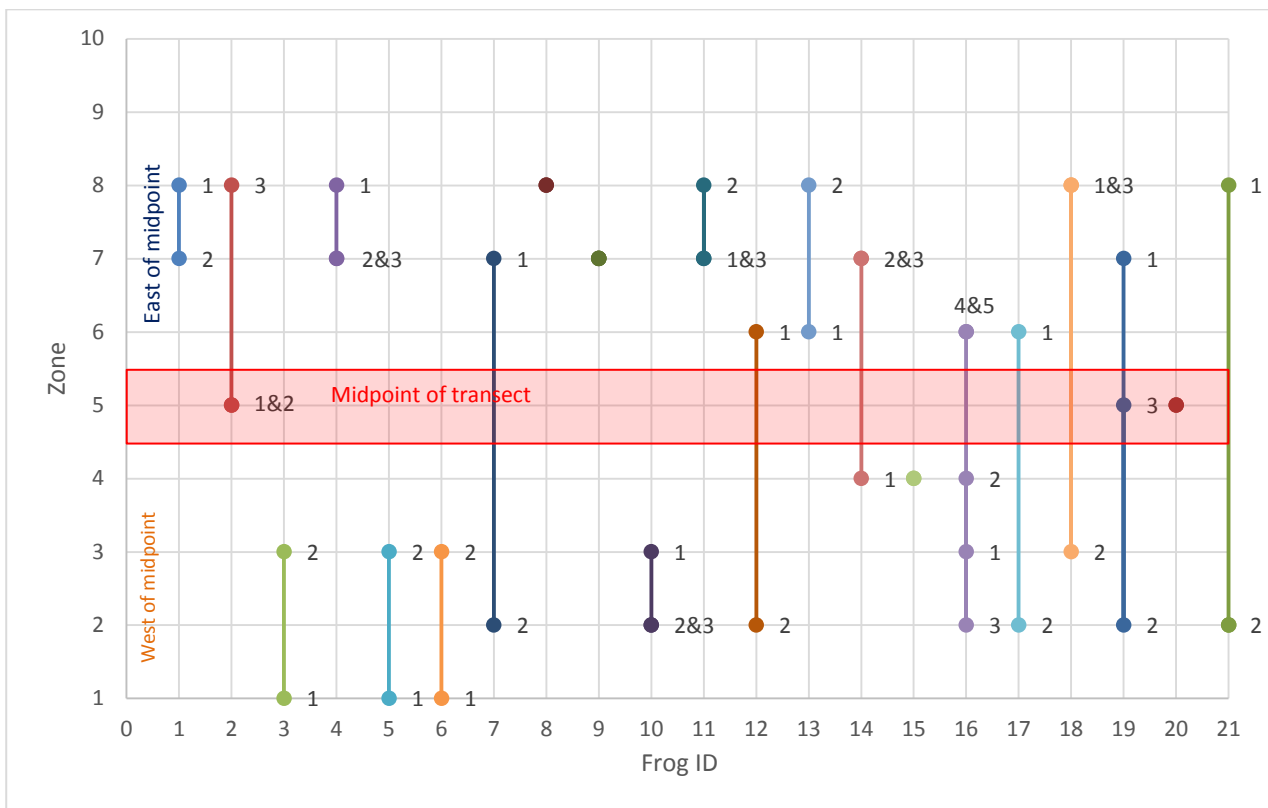
**Graph 11: Pipers Creek Impact site: recapture movement patterns**



**Graph 12: Maria River Impact site: recapture movement patterns**



**Graph 13: Cooperabung Creek Reference site: recapture movement patterns**



**Graph 14: Pipers Creek Reference site: recapture movement patterns**

### 3.5 Water Quality

Water quality monitoring was undertaken by Roads and Maritime. Data included in this report represents the final construction monitoring period, from 22 July 2017 to 29 March 2018 (RMS 2018). Presented here is a summary of the data collected for Cooperabung Creek, Smiths Creek, Pipers Creek and Maria River, for the purpose of assessing the water quality in relation to desired parameters and the water quality performance measures specified in the EMP. Annex 3 presents data extracted from the water quality reports. It shows only those sampling results where the calculated median downstream value exceeded (was above the 80<sup>th</sup> percentile) or was below (below the 20<sup>th</sup> percentile) desired threshold values or of the upstream site.

#### 3.5.1 Parameters

Table 5 presents the number of occasions downstream median values were greater than the 80<sup>th</sup> percentile, and of these, the number that exceeded the ANZECC trigger value. All sites had at least one parameter for one or more monthly results, for which the median downstream value exceeded the 80<sup>th</sup> percentile of the upstream value. These are discussed below.

*Electrical conductivity:* Downstream median values were higher than the upstream trigger values regularly throughout the 12 months. These values, while slightly elevated, were well within ANZECC guideline trigger values. According to RMS 2018, differences between upstream and downstream values occurred when there was with no visible flow, sample points persisting as isolated ponds, or in some cases dry upstream conditions at the time of sampling. The water quality monitoring report considered impacts attributable to construction to be negligible to minor.

*Dissolved oxygen:* Downstream median values were below or above the calculated upstream 80<sup>th</sup> and 20<sup>th</sup> percentile trigger value only at Smiths Creek and Maria River. At Smiths Creek the variability coincided with algae outbreaks and both these sites were noted as having little to no flow or existing as isolated ponds. The water quality monitoring report considered impacts attributable to construction to be negligible.

*pH:* Downstream median values were generally within, or close to, the calculated upstream 80<sup>th</sup> and 20<sup>th</sup> percentile trigger values and were generally consistent between upstream and downstream sampling locations. pH levels were within the default ANZECC trigger value range. The water quality monitoring report considered impacts attributable to construction to be negligible.

*Turbidity:* Downstream turbidity was variable throughout the year and for sites. The ANZECC upper limit default trigger value was exceeded on one occasion at Cooperabung Creek and Pipers Creek. At Cooperabung Creek, incidences where elevated levels were recorded coincided with wet weather events where surface water entered the waterway through a project-specific clean water drain. RMS 2018 states *“This area receives water from both a construction water quality basin outlet and the construction site (including an ancillary facility associated with the project) and are considered to have contributed to the elevated levels at times. It is expected the contribution of the project during subsequent operational monitoring periods would reduce as restoration and landscaping activities are completed and establish.”* . At Pipers Creek where exceedances occurred, levels during individual sampling events were higher upstream than downstream. Turbidity impacts from the Project are considered negligible at Smiths Creek and Maria River. RMS 2018 states: *“Observations made during sampling events and the subsequent monitoring results suggested construction activities have had a minor to moderate impact on turbidity levels in some waterways. This is expected to decline substantially in the subsequent operational reporting period as landscaping and restoration across the project establishes”*.

**Nitrogen and Phosphorus:** Downstream nitrogen and phosphorus values were variable throughout the year and for sites. Levels were generally consistent with upstream values. Differences between upstream and downstream was generally when the sampling points constituted isolated ponds. The elevated level recorded at Cooperabung Creek in March 2018 appears to be an isolated occurrence and was considered likely due to contamination during the collection. Water quality monitoring reporting considered impacts attributable to construction to be negligible.

**Metals:** There was limited variation in the level of metals with the exception of aluminium, iron, manganese and zinc. Levels were generally consistent with upstream values. Differences between upstream and downstream values was generally when the sampling points constituted isolated ponds. The water quality monitoring report considered elevated metal parameters unlikely to be attributable to construction related activities.

The water quality monitoring report suggested that results were not inconsistent with the variability and levels experienced during the pre-construction and previous construction monitoring periods.

**Table 5: Triggered water quality parameters per site**

Parameter	# DS > 80th % US (# DS > ANZECC)			
	Cooperabung Creek	Smiths Creek	Pipers Creek	Maria River
Temperature °C	2	2	2	3
Electrical Conductivity uS/cm	6	4	1	5
Dissolved oxygen %	0	1 (2)	0	1 (5)
pH	0	1	0	1
Turbidity (NTU)	4 (1)	3	1 (1)	0
Total suspended solids mg/L	3	5	3	0
Aluminium mg/L	0	0	1 (1)	0
Arsenic mg/L	0	1	1	1
Cadmium mg/L	0	0	0	0
Chromium mg/L	0	0	1 (1)	1 (1)
Copper mg/L	0	1 (1)	0	1 (1)
Iron mg/L	0	2	0	0
Lead mg/L	0	0	0	0
Manganese mg/L	5	5	1	4
Mercury mg/L	0	0	0	0
Nickel mg/L	0	3	1	3
Silver mg/L	0	0	0	0
Zinc mg/L	0	4 (2)	2 (2)	4 (4)
Total nitrogen mg/L	1	1 (1)	1 (1)	0
Total phosphorus mg/L	1	0	2	1 (1)

## 4. Discussion

### 4.1 Performance Measures

A summary of Year 1 (2015/2016), Year 2 (2016/2017) and Year 3 (2017/2018) survey results in relation to the performance measures is provided in Table 6.

**Table 6: Performance measures and discussion of 2017/2018 results.**

Performance measure	Discussion
Monitoring is undertaken during baseline surveys and Years 1 – 8 or until monitoring can demonstrate that mitigation measures are effective.	<b>This performance measure has been met for Baseline, Year 1 (2015/2016), Year 2 (2016/2017) and Year 3 (2017/2018).</b> Giant Barred Frog monitoring has been undertaken at all six sites according to the EMP to date.
Monitoring during Year 1 – 8 is undertaken at the Impact and Control sites where baseline monitoring was undertaken, subject to landowner agreement.	<b>This performance measure has been met for Year 1 (2015/2016), Year 2 (2016/2017) and Year 3 (2017/2018).</b> Giant Barred Frog monitoring has been undertaken at all six baseline sites, where landowner agreement permitted.
Continued presence of Giant Barred Frogs during each survey event in Year 1 – 8 at sites where it was identified during baseline surveys, subject to access due to landowner agreement.	<b>This performance measure has been met for all sites in Year 1 (2015/2016), 5 of 6 sites in Year 2 (2016/2017) and Year 3 (2017/2018).</b> Baseline: Giant Barred Frogs were recorded at all six monitoring sites in spring and summer and at four sites in autumn. Giant Barred Frogs were not recorded at the Maria River impact site and Pipers Creek reference site during the autumn 2014 baseline survey. Year 1 (2015/2016): Giant Barred Frogs were detected at all six sites during all surveys. Year 2 (2016/2017): Giant Barred Frogs were detected at all six sites in spring and summer and five sites in autumn. Not recorded at Pipers Creek impact site during the autumn 2017 survey where it was detected during baseline surveys. Year 3 (2017/2018): Giant Barred Frogs were detected at all six sites in spring and five sites in summer and autumn. Not recorded at Pipers Creek impact site during summer and autumn 2018.
Mitigation measures are effective as defined in the EPBC approval when all monitoring events are considered at Year 8.	This performance measure is not yet applicable. Initial results (review of movement patterns of re-captured individuals) indicate that Giant Barred Frogs are moving across the road. It is unknown if they used the underpasses, however, no breaches of the frog fencing were observed during surveys.
Median values of all downstream water quality monitoring at GBF habitat or potential habitat locations during construction and operation (Year 1 – 6) is less than the 80th percentile value of the upstream site (where 80th percentile is the value at which median values at the downstream site are above 80% of the recorded background water quality records), where this change is found to be attributable to construction or operation.	<b>This performance measure has been met for all parameters except turbidity at Cooperabung Creek.</b> RMS 2018 states: <i>“Observations made during sampling events and the subsequent monitoring results suggested construction activities have had a minor to moderate impact on turbidity levels in some waterways. This is expected to decline substantially in the subsequent operational reporting period as landscaping and restoration across the project establishes”.</i>
No change to densities, distribution, habitat use and movement patterns compared to baseline data during monitoring in Year 1 – 8, and then when all monitoring events are considered at Year 8.	<b>This performance measure has been met for all sites except Pipers Creek impact site and Cooperabung Creek impact site.</b> The number and location of Giant Barred Frogs recorded varied between season and year at all sites. Cooperabung Creek impact, Pipers Creek impact and Cooperabung Creek reference sites all show a decreasing trend in mean records and densities. However, as this decreasing trend is evident at both impact and reference sites, it is not possible to attribute these changes to the Project at this stage. Within-year movement patterns that would permit comparison between baseline and subsequent monitoring events is not possible due to lack of data (surveys and captures are too infrequent), however, assessment of movement patterns of recaptured individuals over all surveys show that 30% of recaptured frogs have been found to traverse from one side of the carriageway to the other.

## 5. Recommendations

### 5.1 Contingency Measures

The EMP lists potential problems and contingency measures for various components of the monitoring program. Those that are considered relevant to the Giant Barred Frog monitoring program are listed and discussed in Table 7.

**Table 7: Contingency measures**

Potential problem	Contingency measure proposed in EMP	Discussion of proposed measure
Decline in presence of target species recorded at Impact sites after the upgrade has been completed, when compared to change in Control sites.	<p>The cause of the decline in populations at impacts 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>The mean number of Giant Barred Frogs at Smiths Creek impact site, Maria River impact site and Pipers Creek reference site have all increased since baseline surveys. Cooperabung Creek impact, Pipers Creek impact and Cooperabung Creek reference all show a decreasing trend in mean records. As this decreasing trend is evident at both impact and reference sites, it is not possible to attribute these changes to the Project.</p> <p>This decline however is noted and, in particular at Pipers Creek impact site, will be considered in future monitoring events.</p> <p><b>This contingency measure is not yet considered relevant.</b></p>

### 5.2 Recommendations

A summary of those performance indicators that were not met in the 2017/2018 monitoring period, recommended corrective actions and general recommendations are provided in Table 8.

**Table 8: Recommendations**

Performance measure	Action
Continued presence of Giant Barred Frogs during each survey event in Year 1 – 8 at sites where it was identified during baseline surveys, subject to access due to landowner agreement.	<p><b>This performance measure has been met for 5 of 6 sites in Year 3 (2017/2018).</b></p> <p>Giant Barred Frogs were not recorded at Pipers Creek impact site during the summer and autumn 2018 survey, where it was detected during baseline surveys. In addition, average frog captures at this site have declined since baseline surveys. However, as this decreasing trend is evident at both impact and reference sites, it is not possible to attribute these changes to the Project at this stage. While frog detection can vary between survey events and Pipers Creek impact site has generally recorded lower numbers of frogs relative to the other sites, only a single frog was captured during the 2017/2018 monitoring period. As above, this decline is noted and will be considered in future monitoring events. It is recommended that monitoring continue as per the EMP.</p>
Median values of all downstream water quality monitoring at GBF habitat or potential habitat locations during construction and operation (Year 1 – 6) is less than the 80th percentile value of the upstream site, where this change is found to be attributable to construction or operation.	<p><b>This performance measure has been met for all parameters except turbidity at Cooperabung Creek.</b></p> <p>Short-term elevations are reflective of environmental variability and ongoing weather conditions and are therefore considered unlikely to have an impact on Giant Barred Frogs. The water quality monitoring report (RMS 2018) considered impacts attributable to construction to be negligible to minor for all parameters excluding turbidity at Cooperabung Creek. RMS 2018 states: <i>“Observations made during sampling events and the subsequent monitoring results suggested construction activities have had a minor to moderate impact on turbidity levels in some waterways. This is expected to decline substantially in the subsequent operational reporting period as landscaping and restoration across the project establishes”.</i></p> <p>Recommendations are to continue the review of water quality results and potential impacts on the Giant Barred Frog.</p>

Performance measure	Action
Chytrid fungus hygiene protocol	Chytrid fungus is considered to be present at all six sites. As construction is now complete construction hygiene protocols are no longer relevant to the monitoring.
Chytrid fungus swabbing	As Chytrid fungus is present at all monitoring sites, consideration should be given to discontinuing the additional swabbing process to reduce the time and handling of individuals of this species. The swabbing of frogs has been conducted to inform the presence of the fungus and implement control measures to prevent its transfer from infected sites to non-infected sites. Given that it has now been recorded from all sites and construction is complete, this attempt to control its spread within Giant Barred Frog sites is no longer relevant, and monitoring of the sites to inform where control measures need to be employed is of little value.



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## Annex 1 – 2017/2018 data summary for each monitoring site

### Cooperabung Creek impact site

**Table 9: Summary of surveys and prevailing abiotic variables: Cooperabung Creek impact site**

Date	Time		Air temp. °C	Water temp. °C	Humidity %	Stream depth (cm)	Wind (0-3, 0= no wind)	Cloud cover %	Rain (mm)
06/10/2017	Start	10:45:00 PM	17.7	17.8	73	20	0	40	0
06/10/2017	Finish	12:45:00 AM	17.6	17.8	76	20	0	60	0
30/01/2018	Start	1:35:00 AM	23	19	69	20	0	0	0
30/01/2018	Finish	3:38:00 AM	19.2	19	70	20	0	0	0
30/04/2018	Start	11:07:00 PM	17.7	18	81	40	0	40	0
30/04/2018	Finish	1:00:00 AM	18	18	80	20	0	50	0

**Table 10: Habitat details: Cooperabung Creek impact site**

Zone	OS %	Sh %	G %	LL %	BE %	Cattle	Pools	Riffles	DoP (cm)	FB	EF	Frogs detected*
5	60	85	90	50	10	No	1	1	40			
6	70	60	100	100	0	No	1	0	40			
7	50	20	100	95	0	No	1	0	50			2
8	85	65	50	50	50	No	1	1	20			2
9	100	60	80	80	20	No	1	0	20			
10	80	10	100	60	0	No	1	0	40			
4	70	5	100	100	0	No	1	0	40			3
3	90	10	100	95	0	No	2	1	20			1
2	90	20	100	95	0	No	1	0	20			2
1	95	20	100	95	0	No	1	0	20			

\*Two additional frogs were identified without locations. OS = overstorey cover, Sh = Shrub cover, G = Ground cover, LL = leaf litter cover, BE = bare earth, DoP = depth of deepest pool, FB = fence breach, EF = exotic fish

**Table 11: Summary of captures: Cooperabung Creek impact site**

	Spring 2017	Summer 2018	Autumn 2018
Number of frogs recorded	6	4	2
Number of adult males	3	1	0
Number of adult females	3	3	1
Number of sub-adults	0	0	1
Number of juveniles	0	0	0
Number of recaptures	3	2	0
Number of frogs with Chytrid/ swabbed	0/5	0/3	0/3

**Habitat:** Microhabitat within these zones included flood debris as overhang shelter, grass and leaf litter. Frogs were located on litter.

### Smiths Creek impact site

**Table 12: Summary of surveys and prevailing abiotic variables: Smiths Creek impact site**

Date	Time		Air temp. °C	Water temp. °C	Humidity %	Stream depth (cm)	Wind (0-3, 0= no wind)	Cloud cover %	Rain (mm)
06/10/2017	Start	7:10:00 PM	20.8	18.8	71	200	0	100	0
06/10/2017	Finish	10:20:00 PM	17.6	18.8	76	100	0	10	0
01/02/2018	Start	11:00:00 PM	21	20	70	10	0	90	0
01/02/2018	Finish	1:45:00 AM	21	20	70	40	0	60	0
26/04/2018	Start	6:00:00 PM	25.5	19	58	10	0	50	0
26/04/2018	Finish	8:47:00 PM	19.4	19	77	40	0	40	0

**Table 13: Habitat details: Smiths Creek impact site**

Zone	OS %	Sh %	G %	LL %	BE %	Cattle	Pools	Riffles	DoP (cm)	FB	EF	Frogs detected*
1	70	5	90	95	10	No	1	0	200			5
2	95	45	95	95	5	No	1	1	200			8
3	95	95	50	50	60	No	1	0	200			3
4	45	50	90	90	5	No	1	0	200			2
5	90	90	100	95	0	No	1	0	200			
6	90	100	95	95	5	No	2	2	40			2
7	40	95	100	90	0	Yes	2	2	80			3
8	35	100	100	100	0	Yes	1	0	100			2
9	95	100	100	95	0	Yes	1	0	50			
10	80	10	10	10	90	Yes	1	0	50			

\*Twelve additional frogs were identified without locations. OS = overstorey cover, Sh = Shrub cover, G = Ground cover, LL = leaf litter cover, BE = bare earth, DoP = depth of deepest pool, FB = fence breach, EF = exotic fish

**Table 14: Summary of captures: Smiths Creek impact site**

	Spring 2017	Summer 2018	Autumn 2018
Number of frogs recorded	25	4	8
Number of adult males	13	2	1
Number of adult females	3	1	5
Number of sub-adults	3	1	0
Number of juveniles	0	0	1
Number of recaptures	5	2	1
Number of frogs with Chytrid/ swabbed	1/14	0/3	0/5

**Habitat:** Microhabitat within these zones included flood debris as overhang shelter, grass and leaf litter.

### Pipers Creek impact site

**Table 15: Summary of surveys and prevailing abiotic variables: Pipers Creek impact site**

Date	Time	Air temp. °C	Water temp. °C	Humidity %	Stream depth (cm)	Wind (0-3, 0= no wind)	Cloud cover %	Rain (mm)	
05/10/2017	Start	9:46:00 PM	18.8	19.8	81	150	0	90	0
05/10/2017	Finish	11:10:00 PM	18.8	19.8	82	150	0	95	0
01/02/2018	Start	8:00:00 PM	23.1	19	70	15	1	90	1
01/02/2018	Finish	10:05:00 PM	20.9	19	70	10	0	95	0
30/04/2018	Start	8:22:00 PM	18.9	18	75	30	0	80	1
30/04/2018	Finish	10:40:00 PM	18.9	18	76	40	0	50	0

**Table 16: Habitat details: Pipers Creek impact site**

Zone	OS %	Sh %	G %	LL %	BE %	Cattle	Pools	Riffles	DoP (cm)	FB	EF	Frogs detected*
10	15	60	80	60	20	No	1	0	120			
9	95	5	90	85	10	Yes	2	1	40			1
8	85	15	60	20	50	Yes	2	0	50			
7	50	20	70	60	30	Yes	2	2	60			
6	30	100	100	100	0	No	1	0	50			
5	60	40	90	85	10	No	1	0	150			
4	85	30	95	80	5	No	1	0	120			
3	95	65	90	100	10	No	1	0	100			
2	95	80	100	100	0	No	1	0	120			
1	20	95	100	90	0	No	1	0	100			

OS = overstorey cover, Sh = Shrub cover, G = Ground cover, LL = leaf litter cover, BE = bare earth, DoP = depth of deepest pool, FB = fence breach, EF = exotic fish

**Table 17: Summary of captures: Pipers Creek impact site**

	Spring 2017	Summer 2018	Autumn 2018
Number of frogs recorded	1	0	0
Number of adult males	0	0	0
Number of adult females	0	0	0
Number of sub-adults	1	0	0
Number of juveniles	0	0	0
Number of recaptures	0	0	0
Number of frogs with Chytrid/ swabbed	0/1	0/0	0/0

**Habitat:** Microhabitat use included above and partially buried within leaf litter, and on bare ground.

### Maria River impact site

**Table 18: Summary of surveys and prevailing abiotic variables: Maria River impact site**

Date	Time		Air temp. °C	Water temp. °C	Humidity %	Stream depth (cm)	Wind (0-3, 0= no wind)	Cloud cover %	Rain (mm)
05/10/2017	Start	7:00:00 PM	23	19.8	71	80	0	80	0
05/10/2017	Finish	9:20:00 PM	19.1	19.8	79	110	0	90	0
31/01/2018	Start	8:00:00 PM	24.2	22	75	40	3	85	1
31/01/2018	Finish	12:30:00 AM	19	22	75	50	1	85	0
01/05/2018	Start	5:45:00 PM	20.8	18	60	30	0	30	0
01/05/2018	Finish	8:20:00 PM	17	18	60	30	0	50	0

**Table 19: Habitat details: Maria River impact site**

Zone	OS %	Sh %	G %	LL %	BE %	Cattle	Pools	Riffles	DoP (cm)	FB	EF	Frogs detected*
1	0	0	10	5	90	No	1	0	80			1
2	80	70	100	95	15	No	1	0	50			
3	90	10	60	90	35	No	2	2	20			
4	80	80	55	65	50	No	3	2	40			
5	25	30	90	85	25	No	2	1	100			4
6	90	40	95	95	2	No	1	1	100			1
7	20	0	10	20	90	No	1	0	100			6
8	95	100	100	100	0	No	1	0	100			6
9	60	5	50	45	50	Yes	2	1	100			2
10	95	100	100	100	0	No	1	0	100			5

\*Eight additional frogs were identified without locations. OS = overstorey cover, Sh = Shrub cover, G = Ground cover, LL = leaf litter cover, BE = bare earth, DoP = depth of deepest pool, FB = fence breach, EF = exotic fish

**Table 20: Summary of captures: Maria River impact site**

	Spring 2017	Summer 2018	Autumn 2018
Number of frogs recorded	18	14	1
Number of adult males	5	4	0
Number of adult females	10	9	1
Number of sub-adults	2	0	0
Number of juveniles	0	1	0
Number of recaptures	3	4	1
Number of frogs with Chytrid/ swabbed	0/11	0/11	0/1

**Habitat:** Microhabitat within these zones included flood debris as overhang shelter, grass and leaf litter. Lantana is very abundant along both side of the river banks and is the dominant vegetation from MIz1 to MIz5.

### Cooperabung Creek reference site

**Table 21: Summary of surveys and prevailing abiotic variables: Cooperabung Creek reference site**

Date	Time		Air temp. °C	Water temp. °C	Humidity %	Stream depth (cm)	Wind (0-3, 0= no wind)	Cloud cover %	Rain (mm)
04/10/2017	Start	11:32:00 PM	16.9	18.4	65	20	0	40	0
04/10/2017	Finish	1:00:00 AM	16.9	18	73	40	0	60	0
31/01/2018	Start	1:20:00 AM	20.5	20	66	20	1	90	0
31/01/2018	Finish	3:15:00 AM	19.4	20	68	20	0	80	0
30/04/2018	Start	6:13:00 PM	19.2	19	65	30	0	60	0
30/04/2018	Finish	8:02:00 PM	18.9	19	70	30	0	70	0

**Table 22: Habitat details: Cooperabung Creek reference site**

Zone	OS %	Sh %	G %	LL %	BE %	Cattle	Pools	Riffles	DoP (cm)	FB	EF	Frogs detected*
1	15	10	95	80	5	No	1	1	20			1
2	85	20	90	85	5	Yes	3	2	10			
3	30	5	60	70	20	Yes	3	2	30			1
4	80	15	75	60	40	Yes	3	2	10			
5	95	30	90	80	20	No	2	3	10			1
6	60	10	95	75	10	No	2	2	20			
7	80	5	80	60	20	Yes	2	2	15			
8	15	5	60	30	25	Yes	2	3	25			1
9	90	40	95	85	5	No	2	2	50			2
10	95	10	100	90	0	No	3	2	40			

OS = overstorey cover, Sh = Shrub cover, G = Ground cover, LL = leaf litter cover, BE = bare earth, DoP = depth of deepest pool, FB = fence breach, EF = exotic fish

**Table 23: Summary of captures: Cooperabung Creek reference site**

	Spring 2017	Summer 2018	Autumn 2018
Number of frogs recorded	3	2	1
Number of adult males	0	1	0
Number of adult females	3	1	0
Number of sub-adults	0	0	0
Number of juveniles	0	0	1
Number of recaptures	1	1	0
Number of frogs with Chytrid/ swabbed	0/4	0/1	0/1

**Habitat:** Microhabitat found being used included above and partially buried within leaf litter (some of which included Lomandra shelters) and on rock.

**Pipers Creek reference site**

**Table 24: Summary of surveys and prevailing abiotic variables: Pipers Creek reference site**

Date	Time		Air temp. °C	Water temp. °C	Humidity %	Stream depth (cm)	Wind (0-3, 0= no wind)	Cloud cover %	Rain (mm)
04/10/2017	Start	7:13:00 PM	22.9	18.4	62	10	0	40	0
04/10/2017	Finish	10:40:00 PM	18.9	18.4	71	40	0	20	0
30/01/2018	Start	8:05:00 PM	28.4	18	84	10	0	0	1
30/01/2018	Finish	12:30:00 AM	21.7	18	84	30	0	0	0
01/05/2018	Start	9:15:00 PM	17.9	16	68	10	0	70	0
01/05/2018	Finish	12:30:00 AM	15.5	16	75	20	0	70	0

**Table 25: Habitat details: Pipers Creek reference site**

Zone	OS %	Sh %	G %	LL %	BE %	Cattle	Pools	Riffles	DoP (cm)	FB	EF	Frogs detected*
5	40	20	90	30	5	No	1	2	40			2
4	60	25	95	40	5	No	2	2	20			4
3	90	15	85	45	10	No	3	2	40			7
2	85	40	90	40	5	No	2	2	60			2
1	90	20	80	55	10	No	2	1	40			7
6	95	30	95	65	5	No	1	1	40			3
7	95	65	85	75	15	No	2	1	25			7
8	90	10	90	85	5	No	2	1	45			3
9	95	60	100	95	0	No	2	2	20			
10	80	20	100	100	0	No	2	1	40			

\*Twelve additional frogs were identified without locations. OS = overstorey cover, Sh = Shrub cover, G = Ground cover, LL = leaf litter cover, BE = bare earth, DoP = depth of deepest pool, FB = fence breach, EF = exotic fish

**Table 26: Summary of captures: Pipers Creek reference site**

	Spring 2017	Summer 2018	Autumn 2018
Number of frogs recorded	23	20	4
Number of adult males	9	12	0
Number of adult females	7	5	2
Number of sub-adults	6	0	0
Number of juveniles	0	1	2
Number of recaptures	9	8	1
Number of frogs with Chytrid/ swabbed	0/16	0/17	0/3

**Habitat:** Microhabitat within these zones included above, partially buried and completely buried within leaf litter, sheltering under *Lomandra*, and within holes in the bank.

## Annex 2 - Giant Barred Frog individual capture data

L = length (mm); W = weight (g); DW = distance to water (m); S = swabbed for Chytrid fungus; Z = Zone; I = impact; U = unknown; M = male; F = female; J = juvenile

Location	Season	Sex	Age	Reproductive Status	L	W	DW	Pit_Tag_Co	First Time Capture/Recapture	S	Z	Activity	Microhabitat	
I	Cooperabung Ck	Autumn	U	SA	n/a	65	55	1	00079FFFF1	First time	Y	4	sitting	woody debris
I	Cooperabung Ck	Autumn	F	Adult	non-gravid	92	150	4	00079EA4D8	First time	Y	2	sitting	base of tree
I	Cooperabung Ck	Spring	M	Adult	no nuptials	68.0	53.0	6.0	0007A3D445	First time	Y		sitting	on litter
I	Cooperabung Ck	Spring	M	Adult	no nuptials	79.0	79	4.0	0007A3D360	First time	Y	4	sitting	on soil on bank
I	Cooperabung Ck	Spring	F	Adult	slightly gravid	99.0	138.0	10.0	00079206F9	First time	Y	7	sitting	Grass and leaf litter
I	Cooperabung Ck	Spring	M?	Adult	light nuptials	69.0	55	1.0	00079205FF	Recapture	Y	8	sitting	on leaf litter
I	Cooperabung Ck	Spring	F	Adult	moderatley gravid	88.0	130.0	2.0	000791E8C5	Recapture	Y	8	sitting	on leaf litter
I	Cooperabung Ck	Spring	F	Adult	slightly gravid	96.0	145	10.0	00077E808F	Recapture	Y	4	sitting	under lomandra
I	Cooperabung Ck	Summer	F	Adult	moderatley gravid	88		5	0007A3C81C	First time	Y	2	sitting	clearing
I	Cooperabung Ck	Summer	M	Adult					Not captured			3	calling	
I	Cooperabung Ck	Summer	F	Adult	gravid	102		6	00007A3B78C	Recapture	Y		sitting	on leaf litter
I	Cooperabung Ck	Summer	F	Adult	gravid	98		3	00079206F9	Recapture	Y	7	sitting	on rocks
R	Cooperabung Ck	Autumn	Juv	Juv		49	25	2	too small	First time	Y	8	jumping	grass
R	Cooperabung Ck	Spring	F	Adult	slightly gravid	80	90	2	0007A3AC9A	First time	Y	5	sitting	on leaf litter
R	Cooperabung Ck	Spring	F	Adult	slightly gravid	99.1	170	2	00076345D6	First time	Y	9	sitting	on leaf litter
R	Cooperabung Ck	Spring	F	Adult	moderatley gravid	93.1	130	6	000763550A	Recapture	Y	1	sitting	in grass
R	Cooperabung Ck	Summer	M	Adult	non-gravid	92	115	4	00077E7E2D	Recapture		9	sitting	leaf litter
R	Cooperabung Ck	Summer	F	Adult	no nuptials			1	escape	Escaped	N	3	swimming	creek
I	Maria River	Autumn	F	Adult	non-gravid	97	140	4	0007AI021C	Recapture	Y	7	sitting	leaf litter
I	Maria River	Spring	M	Adult	dark nuptials	62	64	2	000763528D	First time	Y		sitting	on leaf litter/ under sticks
I	Maria River	Spring	M	Adult	light nuptials	65	61	5	000791RB9C	First time	Y		sitting	on leaf litter
I	Maria River	Spring	F	Adult	moderatley gravid	110	170	3	0007A3C58C	First time	Y	10	buried	in leaf litter
I	Maria River	Spring	M	Adult	no nuptials	68	88	5	0007635877	First time	Y		sitting	on leaf litter
I	Maria River	Spring	F	Adult	slightly gravid	95	120	5	0007926104	First time	Y	10	sitting	log
I	Maria River	Spring	F	Adult	slightly gravid	97	130	5	000791E94F	First time	Y	10	sitting	on leaf litter
I	Maria River	Spring	F	Adult	slightly gravid	90	130	3	000791EBE3	First time	Y	9	buried	under leaf litter
I	Maria River	Spring	U	SA		65	58	3	000791EA9B	First time	Y	10	sitting	on leaf litter
I	Maria River	Spring	M?	Adult	no nuptials	68	60	2	00077E6BEA	Recapture	Y	8	sitting	on leaf litter
I	Maria River	Spring	F	Adult	slightly gravid	90	140	10	00077E7F84	Recapture	Y	10	sitting	on leaf litter
I	Maria River	Spring	F	Adult	slightly gravid	93	130	4	000791E955	Recapture	Y		sitting	on dirt
I	Maria River	Spring	F	Adult					Not captured	N			sitting	in hole
I	Maria River	Spring	F	Adult					Not captured	N			sitting	steep bank
I	Maria River	Spring	F	Adult			2		Not captured	N	9		buried	under leaf litter
I	Maria River	Spring	F	Adult			2		Not captured	N	5		sitting	base of tree
I	Maria River	Spring	U	SA			0.5		Not captured	N	5		sitting	on dirt
I	Maria River	Spring	M?	Adult			1.5		Not captured	N	5		sitting	on dirt



	Location	Season	Sex	Age	Reproductive Status	L	W	DW	Pit_Tag_Co	First Time Capture/Recapture	S	Z	Activity	Microhabitat
I	Maria River	Spring	U	U										
I	Maria River	Summer	M	Adult	light nuptials	75	68	2	00079EA579	First time	Y	7	sitting	leaf litter
I	Maria River	Summer	U	Juv		33	8	2.5	too small	First time	Y	8	half buried	leaf ualfer
I	Maria River	Summer	F	Adult	non-gravid	106	160	1	0007A0F30C	First time	Y	7	sitting	leaf litter
I	Maria River	Summer	F	Adult	non-gravid	88	107	2	0007A0F75D	First time	Y	7	sitting	leaf litter
I	Maria River	Summer	F	Adult	slightly gravid	98	151	3	0007A0F84B	First time	Y	6	sitting	leaf litter
I	Maria River	Summer	F	Adult	slightly gravid	101	161	3.5	0007A10E56	First time	Y	8	sitting	leaf litter
I	Maria River	Summer	F	Adult		110	90	3	0007A1002F	First time	Y	8	sitting	leaf litter
I	Maria River	Summer	F	Adult	gravid		203	1.5	escape	Escaped	N	8	sitting	leaf litter
I	Maria River	Summer	M	Adult	light nuptials	76	62	2	00077E6A06	Recapture	Y	7	sitting	under lomandra
I	Maria River	Summer	F	Adult	non-gravid	96	165	5	00077E6C90	Recapture	Y	5	sitting	leaf litter
I	Maria River	Summer	F	Adult	non-gravid	100	130	3.5	0007A1021C	Recapture	Y	7	sitting	leaf litter
I	Maria River	Summer	F	Adult	non-gravid	101	162	2	000791E955	Recapture	Y	8	sitting	leaf litter
I	Maria River	Summer	M	Adult						Not captured	N	1	calling	
I	Maria River	Summer	M	Adult						Not captured X3	N		calling	lantana, lomandra, wood debris
I	Pipers Ck	Spring	U	SA				1.5		Not captured	N	9	sitting	base of tree
R	Pipers Ck	Autumn	U	SA		42	20	3	too small	First time	Y	5	sitting	bare ground
R	Pipers Ck	Autumn	U	SA		47	20	10	too small	First time	Y	6	sitting	edge, flood debris
R	Pipers Ck	Autumn	F	Adult	non-gravid	103	150	10	0007A0B46E	First time	Y	3	sitting	on log
R	Pipers Ck	Autumn	F	Adult	non-gravid	106	140	20	000791EC27	Recapture	Y	8	sitting	leaf litter
R	Pipers Ck	Spring	M	Adult	dark nuptials	68.8	75	1	000763548D	First time	Y	1	calling	under lomandra
R	Pipers Ck	Spring	M	Adult	dark nuptials	64	60	3	000791E9A4	First time	Y	7	sitting	leaf litter
R	Pipers Ck	Spring	M	Adult	dark nuptials	58.3	52	2	00076345D0	First time	N		sitting	leaf litter
R	Pipers Ck	Spring	U	Adult	light nuptials	83.3	82	3	000791EA04	First time	Y		sitting	on debris
R	Pipers Ck	Spring	M	Adult	mod. Nuptials	74.3	60	2.5	0007A3FC20	First time	N		sitting	In lomandra
R	Pipers Ck	Spring	F	Adult	non-gravid	100	130	9	000791EA94	First time	Y	3	jumping	leaf litter
R	Pipers Ck	Spring	F	Adult	slightly gravid	93	130	2.5	0007634B19	First time	Y		sitting	leaf litter
R	Pipers Ck	Spring	U	SA		49.4	21	2	0007A0138D	First time	Y		sitting	open ground
R	Pipers Ck	Spring	U	SA		48	20	2	too small	First time	Y	3	sitting	lomandra
R	Pipers Ck	Spring	U	SA		54	28	8	000792062D	First time	Y		sitting	on bank
R	Pipers Ck	Spring	U	SA		51	20	4	too small	First time	Y	7	sitting	leaf litter
R	Pipers Ck	Spring	U	SA		47	20	3	too small	First time	Y	7	sitting	leaf litter
R	Pipers Ck	Spring	U	SA		35	18	5	too small	First time	N	8	sitting	leaf litter
R	Pipers Ck	Spring	M	Adult	dark nuptials	74.4	61	3.5	00077E7D76	Recapture	Y		calling	open ground
R	Pipers Ck	Spring	M	Adult	dark nuptials	65	68	5	000791AEB3	Recapture	Y		sitting	on mossy bank
R	Pipers Ck	Spring	M	Adult	light nuptials	72	67	3	90118001372640	Recapture	Y	5	sitting	under lomandra
R	Pipers Ck	Spring	M	Adult	light nuptials	62	54	10	900118001373646	Recapture	N		sitting	leaf litter
R	Pipers Ck	Spring	F	Adult	non-gravid	97	130	3	900118001373862	Recapture	Y	3	sitting	under lomandra
R	Pipers Ck	Spring	F	Adult	non-gravid	90	96	10	00077E8057	Recapture	Y		sitting	leaf litter
R	Pipers Ck	Spring	F	Adult	slightly gravid	85.5	95	10	900118001373280	Recapture	Y		sitting	on tree root

	Location	Season	Sex	Age	Reproductive Status	L	W	DW	Pit_Tag_Co	First Time Capture/Recapture	S	Z	Activity	Microhabitat
R	Pipers Ck	Spring	F	Adult	slightly gravid	89.5	125	1	00077E6D03	Recapture	Y	7	sitting	under leaf litter
R	Pipers Ck	Spring	F	Adult	slightly gravid	90	140	1	0007633E02	Recapture	Y	7	sitting	under leaf litter
R	Pipers Ck	Spring	M	Adult	no nuptials					Not captured	N		buried	under leaf litter
R	Pipers Ck	Summer	M	Adult	dark nuptials	67		3	0007A3DF2B	First time	Y	3	jumping	leaf litter
R	Pipers Ck	Summer	F	Adult	Gravid	93		0.5	0007A2F5D0	First time	Y	5	jumping	lomandra
R	Pipers Ck	Summer	M	Adult	light nuptials	73		1	0007A3A948	First time	Y	2	sitting	lomandra
R	Pipers Ck	Summer	M	Adult	light nuptials	73		0.5	0007A39BC4	First time	Y	5	sitting	open ground
R	Pipers Ck	Summer	M	Adult	mod. Nuptials	68		3.5	000792060E1	First time	Y	3	sitting	leaf litter
R	Pipers Ck	Summer	F	Adult	moderatley gravid	92		2	0007A3F08B	First time	Y	4	sitting	leaf litter
R	Pipers Ck	Summer	F	Adult	moderatley gravid	77		0.5	0007A3AF73	First time	Y	7	sitting	under lomandra
R	Pipers Ck	Summer	F	Adult	slightly gravid	72		1.5	0007A3FE00	First time	Y	2	sitting	leaf litter
R	Pipers Ck	Summer	M	Adult		70		0.5	00079FF851	First time	Y	5	sitting	lomandra
R	Pipers Ck	Summer	U	Juv		37		1	too small	First time	Y	6	sitting	lomandra
R	Pipers Ck	Summer	M	Adult	light nuptials	75		2.5	00077E7D76	Recapture	Y	2	sitting	ground
R	Pipers Ck	Summer	M	Adult	light nuptials	67		2	0007A0138D	Recapture	Y	2	sitting	leaf litter
R	Pipers Ck	Summer	M	Adult	light nuptials	74		2	900118001375092	Recapture	Y	3	jumping	ground
R	Pipers Ck	Summer	M	Adult	light nuptials	76		1.5	00079206C4	Recapture	Y	5	sitting	under lomandra
R	Pipers Ck	Summer	M	Adult	light nuptials	62		4	0007922E21	Recapture	Y	5	sitting	litter
R	Pipers Ck	Summer	M	Adult	light nuptials	77		1	000791EBA3	Recapture	Y	6	sitting	bank
R	Pipers Ck	Summer	M	Adult	no nuptials	76		1.5	900118001372640	Recapture	Y	8	sitting	leaf litter
R	Pipers Ck	Summer	F	Adult	slightly gravid	83		3	900118001373646	Recapture	Y	7	sitting	leaf litter
R	Pipers Ck	Summer	U	Adult				1		Not captured	N	4	sitting	open ground
R	Pipers Ck	Summer	M	Adult				2	escape	Escaped	N	1	calling	under leaf litter
I	Smiths Ck	Autumn	M	Adult	light nuptials	87	122	6	0007A0E288	First time	Y	2	sitting	leaf litter
I	Smiths Ck	Autumn	Juv	Juv	n/a	41	20	4	too small	First time	Y	3	sitting	In log
I	Smiths Ck	Autumn	U	Adult	no nuptials	76	70	5	0007A0CE0B	First time	Y	3	sitting	leaf litter
I	Smiths Ck	Autumn	F	Adult	non-gravid	84	145	3.5	0007A09A12	First time	Y	4	sitting	leaf litter
I	Smiths Ck	Autumn	F	Adult	non-gravid	87	115	2.5	000763552D	First time	Y	2	sitting	leaf litter
I	Smiths Ck	Autumn	F	Adult	non-gravid	88	124	3.5	0007A10A88	First time	Y	2	sitting	leaf litter
I	Smiths Ck	Autumn	F	Adult				0.5		Not captured	N	6	sitting	bare ground
I	Smiths Ck	Autumn	F	Adult	non-gravid	93	169	2.5	0007D1E29B	Recapture	Y	8	sitting	bare ground
I	Smiths Ck	Spring	M	Adult	dark nuptials	70	62	4	00077E8024	First time	Y		sitting	on litter
I	Smiths Ck	Spring	M	Adult	light nuptials	69.0	48	2.0	0007A3AF91	First time	Y	3	buried	undel leaf litter
I	Smiths Ck	Spring	F	Adult	moderatley gravid	103	145	10	0007634726	First time	Y		sitting	grass and leaf litter
I	Smiths Ck	Spring	M?	Adult	no nuptials	66	50	2.5	0007A3D61A	First time	N	7	sitting	on leaf litter
I	Smiths Ck	Spring	M	Adult	no nuptials	85	94	5	000791EC29	First time	Y		sitting	on litter
I	Smiths Ck	Spring	F?	Adult	slightly gravid	98	86	9	0007A2F5CD	First time	Y		sitting	on litter
I	Smiths Ck	Spring	U							First time	Y	1	sitting	on litter
I	Smiths Ck	Spring	U	SA		62	40	5	0007834B16	First time	Y		sitting	on litter in tree buttress
I	Smiths Ck	Spring	U	SA		68	58	13.0	0007A01C1A	First time	Y		sitting	litter base of tree

Location	Season	Sex	Age	Reproductive Status	L	W	DW	Pit_Tag_Co	First Time Capture/Recapture	S	Z	Activity	Microhabitat
I Smiths Ck	Spring	U	SA		66	48	5	0007A3C780	First time	Y		sitting	on log
I Smiths Ck	Spring	M	Adult	dark nuptials	81	86.0	7.0	0007A3C879	Recapture	Y	2	sitting	on litter base of tree
I Smiths Ck	Spring	M	Adult	light nuptials	70.0	40	11.0	00077E6A31	Recapture	Y	2	sitting	on leaf litter
I Smiths Ck	Spring	M?	Adult	light nuptials	68	49	4.0	0007634E98	Recapture	Y	7	sitting	on leaf litter
I Smiths Ck	Spring	M	Adult	no nuptials	72	80	15	000763394C	Recapture	Y	2	sitting	on leaf litter
I Smiths Ck	Spring	M?	Adult	no nuptials	67	50	5.0	0007A0F7D7	Recapture	Y	6	sitting	on leaf litter
I Smiths Ck	Spring	U							Not captured				
I Smiths Ck	Spring	M?	Adult	light nuptials	61.0	40.0	12.0		Not captured	Y	1	sitting	on leaf litter
I Smiths Ck	Spring	M	Adult	light nuptials	67.0	50.0	5.0		Not captured	Y	1	sitting	on leaf litter
I Smiths Ck	Spring	M	Adult						Not captured		2	calling	buried
I Smiths Ck	Spring	M	Adult				3.0		Not captured	Y		sitting	on ground
I Smiths Ck	Spring	F	Adult				10.0		Not captured	Y		sitting	on ground
I Smiths Ck	Spring	U	Adult				2.0		Not captured		4	buried	under litter
I Smiths Ck	Spring	U	Adult				2.0		Not captured	N	7	jumping	under logs
I Smiths Ck	Spring	U					8		Not captured	N		sitting	on litter base of tree
I Smiths Ck	Spring	U	Adult		66	50	3	not marked	First time	Y		sitting	on litter
I Smiths Ck	Summer	M	Adult	no nuptials	82	87	5	0007D23D8C	First time	Y	2	sitting	tree base
I Smiths Ck	Summer	M	Adult	no nuptials	80	85	2	0007A3C879	Recapture	Y	1	half buried	leaf litter
I Smiths Ck	Summer	F	Adult	no nuptials	87	103	20	0007634EE6	Recapture	Y	8	sitting	leaf litter
I Smiths Ck	Summer	U	SA				1.5		Not captured		1	sitting	on log

## Annex 3 - Water Quality data (extracted from RMS 2018)

**Table 27: Triggered water quality parameters: Cooperabung Creek**

Parameter	ANZECC trigger value	Median DS (US 20 <sup>th</sup> % - 80 <sup>th</sup> %)							
		Aug 17	Sept 17	Oct 17	Nov 17	Dec 17	Jan 18	Feb 18	Mar 18
Temperature °C	NA	13.4 (15.0-20.8)	14.6 (15.4-20.8)			23.7 (15.6-22.7)	23.8 (15.6-23.6)		
Electrical Conductivity uS/cm	125 – 2200		299 (188.0-248.4)	333 (188.0-256.6)	371 (188.0-287.8)	356 (188.0-305.2)		488 (200.2-321.8)	371.5 (201.0-321.8)
Dissolved oxygen %	85 – 110								
pH	6.5 – 8								
Turbidity (NTU)	6 – 50	7 (8.5-17.5)			48 (8.9-18.7)	47 (8.9-17.7)	8 (8.4-16.4)	21.9 (9.2-21.7)	57.8 (9.2-27.6)
Total suspended solids mg/L	-				14 (5-8)	11 (5-7)			18 (5-7)
Aluminium mg/L	0.055	0.02 (0.03-0.24)	0.01 (0.03-0.24)	0.01 (0.03-0.19)					
Arsenic mg/L	0.024								
Cadmium mg/L	0.0002								
Chromium mg/L	0.001								
Copper mg/L	0.0014								
Iron mg/L	ID		0.14 (0.37-0.71)	0.14 (0.37-0.82)				0.20 (0.37-0.98)	0.35 (0.37-0.98)
Lead mg/L	0.0034								
Manganese mg/L	1.9	0.150 (0.024-0.117)	0.156 (0.024-0.117)	0.226 (0.027-0.187)		0.336 (0.033-0.270)	0.322 (0.033-0.310)	0.770 (0.033-0.310)	0.454 (0.033-0.310)
Mercury mg/L	0.0006								
Nickel mg/L	0.011								
Silver mg/L									
Zinc mg/L	0.008								
Total nitrogen mg/L	0.5	0.1 (0.2-0.5)	0.1 (0.2-0.5)						1.2 (0.2-0.4)
Total phosphorus mg/L	0.05		0.09 (0.01-0.02)						

ID = insufficient representative data (ANZECC)

Values in black = < 20<sup>th</sup> % Values in red = > 80<sup>th</sup> % Shaded cells = outside/above ANZECC trigger

**Table 28: Triggered water quality parameters: Smiths Creek**

Parameter	ANZECC trigger value	Median DS (US 20 <sup>th</sup> % - 80 <sup>th</sup> %)							
		Aug 17	Sept 17	Oct 17	Nov 17	Dec 17	Jan 18	Feb 18	Mar 18
Temperature °C	NA	10.9 (14.6-23.9)	13.4 (14.1-23.8)			21.9 (14.1-21.5)	25.2 (14.1-22.9)		
Electrical Conductivity uS/cm	125 – 2200				326 (190.2-280.2)	511 (179.6-267.2)	270 (200.2-265.6)	642 (212.2-300.4)	
Dissolved oxygen %	85 – 110	92 (17.0-84.0)						29.2 (33.3-81.9)	16.9 (31.7-81.7)
pH	6.5 – 8		7.3 (6.9-7.2)			6.8 (6.9-7.3)			
Turbidity (NTU)	6 – 50	9 (11.7-26.5)		8 (11.5-22.5)	33 (11.5-20.9)	16 (10.3-17.8)	26 (10.3-20.2)	28.2 (10.3-20.8)	
Total suspended solids mg/L	-				16 (5-8)	12 (5-7)	11 (5-9)	12 (5-9)	16 (5-11)
Aluminium mg/L	0.055					0.01 (0.02-0.12)			
Arsenic mg/L	0.024								0.002 (0.001-0.001)
Cadmium mg/L	0.0002								
Chromium mg/L	0.001								
Copper mg/L	0.0014				0.002 (0.001-0.001)				
Iron mg/L	ID						1.88 (0.38-1.31)		2.02 (0.38-1.14)
Lead mg/L	0.0034								
Manganese mg/L	1.9			0.319 (0.012-0.224)	0.269 (0.012-0.268)		0.824 (0.012-0.734)	0.875 (0.012-0.499)	0.468 (0.012-0.391)
Mercury mg/L	0.0006								
Nickel mg/L	0.011								
Silver mg/L									
Zinc mg/L	0.008				0.010 (0.005-0.008)		0.008 (0.005-0.007)	0.008 (0.005-0.007)	0.011 (0.005-0.008)
Total nitrogen mg/L	0.5	0.1 (0.2-0.7)	0.1 (0.2-0.6)				0.6 (0.2-0.5)		
Total phosphorus mg/L	0.05								

ID = insufficient representative data (ANZECC)

Values in black = < 20<sup>th</sup> % Values in red = > 80<sup>th</sup> % Shaded cells = outside/above ANZECC trigger

**Table 29: Triggered water quality parameters: Pipers Creek**

Parameter	ANZECC trigger value	Median DS (US 20 <sup>th</sup> % - 80 <sup>th</sup> %)							
		Aug 17	Sept 17	Oct 17	Nov 17	Dec 17	Jan 18	Feb 18	Mar 18
Temperature °C	NA	10.9 (14.4-24.1)	13.1 (13.4-23.8)			22.5 (13.4-21.6)	24.9 (13.4-23.1)		
Electrical Conductivity uS/cm	125 – 2200						254 (254.6-404.4)	441 (273.0-430.2)	
Dissolved oxygen %	85 – 110								
pH	6.5 – 8								7.5 (6.9-7.4)
Turbidity (NTU)	6 – 50		7 (11.8-36.9)	9 (11.1-29.6)					77.7 (11.2-28.8)
Total suspended solids mg/L	-				18 (5-8)		12 (5-9)		17 (5-12)
Aluminium mg/L	0.055		0.01 (0.02-0.16)				0.24 (0.02-0.16)		
Arsenic mg/L	0.024				0.002 (0.001-0.001)				
Cadmium mg/L	0.0002								
Chromium mg/L	0.001					0.003 (0.001-0.001)			
Copper mg/L	0.0014								
Iron mg/L	ID		0.14 (0.35-0.64)						0.36 (0.43-0.69)
Lead mg/L	0.0034								
Manganese mg/L	1.9					0.339 (0.036-0.328)			
Mercury mg/L	0.0006								
Nickel mg/L	0.011								0.002 (0.001-0.001)
Silver mg/L									
Zinc mg/L	0.008			0.019 (0.005-0.010)					0.021 (0.005-0.010)
Total nitrogen mg/L	0.5	0.2 (0.3-0.7)	0.1 (0.3-0.7)	0.2 (0.3-0.6)			0.8 (0.3-0.7)		
Total phosphorus mg/L	0.05					0.03 (0.01-0.02)	0.03 (0.01-0.02)		

ID = insufficient representative data (ANZECC)

Values in black = < 20<sup>th</sup> % Values in red = > 80<sup>th</sup> % Shaded cells = outside/above ANZECC trigger

**Table 30: Triggered water quality parameters: Maria River**

Parameter	ANZECC trigger value	Median DS (US 20 <sup>th</sup> % - 80 <sup>th</sup> %)							
		Aug 17	Sept 17	Oct 17	Nov 17	Dec 17	Jan 18	Feb 18	Mar 18
Temperature °C	NA	11.3 (14.8-24.2)	12.7 (13.9-24.0)			22.7 (13.9-22.2)	24.3 (13.9-22.4)	23.8 (13.9-23.6)	
Electrical Conductivity uS/cm	125 – 2200	290 (192.0-274.0)	275 (192.0-274.0)	289 (192.0-279.4)	411 (220.2-356.6)		209 (212.6-412.8)	431 (204.8-412.8)	
Dissolved oxygen %	85 – 110	44 (15.9-43.2)				25 (29.4-73.0)	27 (27.1-70.5)	15.9 (25.0-70.5)	13.8 (27.1-70.5)
pH	6.5 – 8								7.4 (6.6-7.3)
Turbidity (NTU)	6 – 50	11 (12.5-42.0)	9 (11.7-42.0)						8.2 (12.1-30.9)
Total suspended solids mg/L	-								
Aluminium mg/L	0.055				0.02 (0.03-0.26)	0.01 (0.02-0.26)			0.02 (0.04-0.32)
Arsenic mg/L	0.024								0.002 (0.001-0.001)
Cadmium mg/L	0.0002								
Chromium mg/L	0.001							0.004 (0.001-0.001)	
Copper mg/L	0.0014						0.002 (0.001-0.001)		
Iron mg/L	ID				0.27 (0.56-1.39)	0.43 (0.56-1.39)			
Lead mg/L	0.0034								
Manganese mg/L	1.9			0.301 (0.079-0.253)		0.336 (0.076-0.238)		0.350 (0.076-0.224)	0.302 (0.076-0.208)
Mercury mg/L	0.0006								
Nickel mg/L	0.011		0.002 (0.001-0.001)	0.002 (0.001-0.001)			0.002 (0.001-0.001)		
Silver mg/L									
Zinc mg/L	0.008		0.029 (0.005-0.008)		0.009 (0.005-0.008)		0.036 (0.005-0.009)		0.025 (0.005-0.009)
Total nitrogen mg/L	0.5		0.3 (0.5-0.9)		0.3 (0.5-0.8)	0.3 (0.5-0.7)		0.3 (0.5-0.8)	
Total phosphorus mg/L	0.05		0.08 (0.02-0.05)		0.01 (0.02-0.05)				

ID = insufficient representative data (ANZECC)

Values in black = < 20<sup>th</sup> % Values in red = > 80<sup>th</sup> % Shaded cells = outside/above ANZECC trigger



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# Contractor Ecological Monitoring Report 2017/2018

**Oxley Highway to Kempsey, Pacific Highway Upgrade**

**Prepared for Roads and Maritime Services**

**September 2018**

**Document control**

Project no.: 1702 (PI7)

Project client: Roads and Maritime Services

Project office: Port Macquarie

Document description: Contractor Ecological Monitoring Report 2017/2018

Project Director: Rhidian Harrington

Project Manager: Radika Michniewicz

Authors: Radika Michniewicz

Internal review: Amanda Griffith

Document status: R1

Local Government Area: Port Macquarie-Hastings and Kempsey

Author	Revision	Internal review	Date issued
Radika Michniewicz	D0	Amanda Griffith	12/09/2018
Radika Michniewicz	R0		18/09/2018
Radika Michniewicz	R1		24/09/2018

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*Cover photograph:* OH2K dual carriageway and widened median.

## 2. Road Kill

The road kill monitoring results for the 2017/2018 monitoring period are based on data collected by Roads and Maritime Services. Monitoring data is provided in Annex 1.

### 2.1 Monitoring Framework and Timing

The monitoring framework provided within the EMP and the reporting status is shown in Table 2. The 2017/2018 monitoring period encompassed both construction monitoring (weekly) and 12-week post-opening monitoring (12 weekly surveys once the road had been opened to traffic). As the Project opened in three stages, weekly monitoring continued along the entire length of the Project to fulfil both weekly post-opening monitoring requirements (opened sections) and weekly construction monitoring requirements (un-opened sections), with monitoring of opened sections of the Project discontinuing upon completion of the 12-week post-opening monitoring period for that section. Monitoring ceased, as per the EMP, 12 weeks after the opening of the final stage of the Project. The opening dates and 12-week post-opening monitoring periods for the three stages were as follows:

- Ku2K (opened 31 October 2017): 3 November 2017 – 25 January 2018.
- OH2Ku Stage 1 (opened 17 November 2017): 17 November 2017 – 9 February 2018.
- OH2Ku Stage 2 (opened 29 March 2018): 30 March 2018 – 15 June 2018.

**Table 2: Road kill monitoring**

Project Phase	Monitoring event: report	Timing of survey	Location
Baseline	<i>spring 2013, summer 2014, autumn 2014:</i> Niche 2015	Weekly during October (spring), January (summer) and April (autumn) prior to commencement of construction (12 weeks)	Entire length of existing highway in Project area
During clearing operations	<i>November 2014- July 2015:</i> Niche 2015	Daily	Portion of existing highway adjacent to clearing operations
One month following clearing operations			
For the duration of construction	<i>8 August 2015 – 22 July 2016:</i> Niche 2016a <i>27 July 2016 – 28 July 2017:</i> Niche 2017a <i>4 August 2017 – March 29 2018:</i> current report	Weekly (Note: as the opening of the Project occurred in three stages, weekly monitoring of the Project continued in the unopened sections of the Project to satisfy construction monitoring requirements.)	Entire length of existing highway in Project area
Within one month of opening of the Project	Twelve week post-opening periods were as follows: <ul style="list-style-type: none"> <li>• Ku2K: from 3 November 2017</li> <li>• OH2Ku Stage 1: from 17 November 2017</li> <li>• OH2Ku Stage 2: from 30 March 2018</li> </ul> All in current report.	Weekly for 12 weeks. If this period does not coincide with the season (i.e. October (spring), January (summer) and April (autumn) in which baseline surveys were undertaken, also undertake weekly surveys during the first survey period (April, October or January) to occur after the opening of the Project (to allow for comparison to baseline results).	Entire length of completed Project
Upon completion of the Project (operation phase)		Weekly during October (spring), January (summer) and April (autumn (12 weeks) in Year 4, 5, 6 and 8, or until mitigation measures can be demonstrated to have been effective as defined in the EPBC approval.	Entire length of completed Project

### 2.2 Performance Measures

The EMP specifies the following performance indicators for road kill monitoring:

- *“Lower rates of road kill in proximity (i.e. areas of the main carriageways within areas adjacent to installed fauna fencing, and within 100m of rope bridges and fauna underpasses) to fauna fencing, rope bridges and fauna underpasses than in sections of the upgrade not near wildlife crossing structures or fauna fences in Years 1 – 6 & 8 monitoring events.*
- *Reduced incidence of road kill from baseline conditions during monitoring events in Years 1 – 6 & 8 and when all monitoring events are considered at Year 8.*
- *Fauna exclusion fencing is installed at a minimum in the locations identified in Schedule 3 of the EPBC approval at Year 4.”*

## **2.3 Monitoring Sites**

The entire length of the OH2K section of the existing highway was monitored during construction. Once sections of the Project became operational, these sections were progressively removed from monitoring upon completion of the 12-week post-opening surveys of each opened section.

## **2.4 Methods**

The survey method described within the EMP was employed for all surveys and is provided below.

*“Baseline road kill surveys will involve a vehicle being driven along the entire length of the existing highway in the Project area and identifying dead wildlife (road kill) seen on the roads and within three metres of the road edge. Both driver and passenger will search the left-hand side of the road and its verge for road kill. When a road kill is observed from the vehicle, a closer inspection of the carcass will be undertaken where access is possible and where safety limitations permit. If safe access is not possible, due to local traffic conditions, binoculars will be used to try to identify carcasses. Road kill fauna will be identified to species level where possible, with reference to field guides. Those too seriously damaged to be accurately identified will be recorded as “unknown”. Upon identification of the road kill, the animal should be removed if safe to do so, so as to avoid double counting during subsequent surveys”.*

For each road kill observed, the following attributes were recorded:

- Geographic coordinates of the road kill location.
- Species of road kill where possible.

The EMP also notes that: *“If the animal is identified as a TSC Act or EPBC Act threatened species, the following information will also be recorded:*

- *Sex and age class (juvenile or adult) where possible and safety limitations permit.*
- *Presence of pouch young (for marsupials) where possible and safety limitations permit.*

*In addition, for TSC Act or EPBC Act threatened species, local habitat attributes will be recorded at a point five metres from the road verge at the road kill location, including:*

- *Structure and floristics of vegetation, including dominant species of each vegetation stratum, height and per cent cover*
- *Presence and type of hydrological and surface drainage features*
- *Presence and type of rocky features*
- *Abundance and type of tree and log hollows*
- *Presence, type and abundance of foraging resources*
- *Presence and type of microhabitats.”*

## **2.5 Key Results**

As the 2017/2018 monitoring period included both construction and post-opening monitoring, results are presented and discussed separately for these two types of data.

### **2.5.1 2017/2018 construction monitoring**

Construction monitoring was undertaken from 4 August 2017 – 28 March 2018. Construction monitoring surveys included the entire length of the Project for the period of 4 August 2017 – 30 October 2017, after which construction monitoring surveys continued on those sections of the Project that remained unopened, until the final section became operational on 29 March 2018. As the road length subject to construction monitoring decreased over the monitoring timeframe, the collected data have been considered separately to account for the three different road lengths monitored. Only the construction data considering the entire length of the Project (i.e. 4 August 2017 – 30 October 2017) have been used in comparisons with previous road kill rates. Figure 1 shows the location of all road kill records for the entire 2017/2018 construction monitoring period (i.e. 4 August 2017 – 28 March 2018). A summary of road kill rates for all monitoring periods is provided in Table 5.

#### ***Construction monitoring – entire Project (4 August 2017 – 30 October 2017)***

There were a total of 39 road kill records from 4 August 2017 – 30 October 2017, including 12 identifiable species and an average weekly road kill of 3.0 (number of weeks = 13). For this period, monitoring occurred in winter and spring only, with an average weekly road kill of 3.3 (13 road kill over 4 weeks) in winter and 2.9 (26 road kill over 9 weeks) in spring.

#### ***Construction monitoring – OH2Ku Stage 1 and OH2Ku Stage2 (1 November 2017 – 16 November 2017)***

There were a total of seven road kill records from 1 November 2017 – 16 November 2017 in these sections of the Project, including three identified species and an average weekly road kill of 3.5 (number of weeks = 2). Seasonal averages have not been considered due to the limited time frame of this monitoring period.

#### ***Construction monitoring – OH2Ku Stage2 (November 17 2017 - 28 March 2018)***

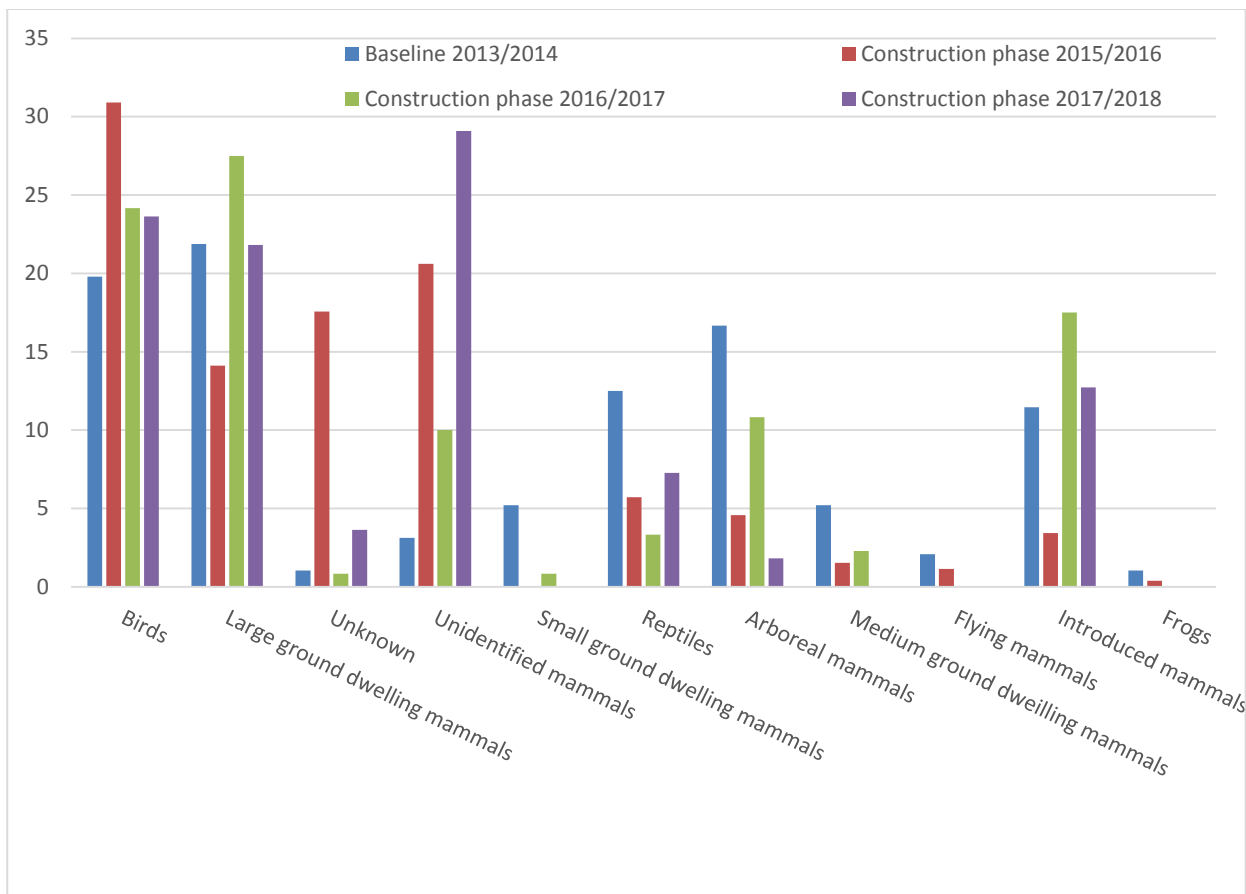
There were a total of nine road kill records from November 17 2017 - 28 March 2018 in this section of the Project, including three identified species and an average weekly road kill of 0.5 (number of weeks = 19). For this period, monitoring occurred in spring, summer and autumn, with an average weekly road kill of 0 (0 road kill over two weeks) in spring, 0.5 (seven road kill over 13 weeks) in summer and 0.5 (two road kill over four weeks) in autumn.

**Fauna results**

The baseline report (Lewis 2014) defined fauna categories for analysis as follows:

- Arboreal mammals
- Flying mammals (i.e. bats)
- Introduced mammals
- Small ground dwelling mammals
- Medium ground dwelling mammals
- Large ground dwelling mammals
- Frogs
- Reptiles
- Birds

‘Unknown’ and ‘unidentified mammal’ categories were included to account for those species that could not be identified. The percentage of road kill records for each category for the current and previous monitoring periods are presented in Graph 1. Birds (24% of road kill, n = 13), large ground dwelling mammals (Kangaroos and Wallabies) (22% of road kill, n = 12), and introduced mammals (13%, n = 7) were the most commonly recorded fauna groups (excluding unidentified mammals) in 2017/2018, which is similar to previous monitoring periods. A high proportion of road kill could not be identified to species level (33% of road kill, n = 18). There is no clear trend that demonstrates a change in the percentage of records for each category over the monitoring periods. All construction monitoring data (i.e. 4 August 2017 – 28 March 2018) have been included.



**Graph 1: Comparison of road kill fauna categories for each monitoring period**

### Threatened fauna

There were no threatened fauna identified as road kill during the 2017/2018 construction monitoring surveys. A dead male Koala was located behind the temporary fauna fence in the vicinity of Cooperabung Range Road in April 2018. This individual was considered to be the victim of a predatory attack, most likely a dog. Table 3 lists the threatened species identified as road kill throughout the Project to date.

**Table 3: Threatened species**

Monitoring type (report)	Monitoring period	Threatened species identified as road kill (number recorded)
Baseline (Lewis 2014)	2013-2014	<ul style="list-style-type: none"> <li>• Koala</li> <li>• Grey-headed Flying Fox (2)</li> </ul>
Clearing (Niche 2015)	2014-2015	<ul style="list-style-type: none"> <li>• Koala (4)</li> <li>• Grey-headed Flying Fox</li> <li>• Masked Owl (2)</li> <li>• Spotted-tail Quoll</li> </ul>
Construction (Niche 2016b)	2015-2016	<ul style="list-style-type: none"> <li>• Koala (3)</li> </ul>
Construction (Niche 2017b)	2016-2017	<ul style="list-style-type: none"> <li>• Koala (2)</li> </ul>
Construction (current)	2017-2018	Nil

### 2.5.2 2017/2018 12-week post-opening monitoring

Results for the 12-week post-opening surveys for each of the three sections are presented separately in Table 4. There were a total of 54 road kill records during the 12-week post-opening surveys when considering all sections together. OH2Ku Stage 1 reported the highest weekly road kill rate and the highest per kilometre road kill rate. Condensing the road kill records into 12 weekly results for the entire length of the Project (i.e. all week 1 records, all week 2 records, etc.) resulted in a weekly road kill rate of 4.5. This rate is lower than baseline rate of 8.0. Figure 2 shows the distribution of road kill records during the 12-week post-opening monitoring.

**Table 4: 12-week post-opening monitoring**

Section	Approximate section length (km)	Number of road kill	Number of identified species	Weekly road kill rate	Per kilometre road kill rate
Ku2K	14	10	6	0.8	0.71
OH2Ku Stage 1	18	38	12	3.2	2.11
OH2Ku Stage 2	5	6	4	0.5	1.2

### 2.5.3 Road kill and mitigation measures

While the entire length of the Project is now operational, operational road kill monitoring is due to commence in spring 2018. Operational data is required to effectively assess road kill patterns in relation to fauna crossings. As such, an assessment of road kill with regards to mitigation measures has not been undertaken for the 2017/2018 monitoring period.



### 2.5.4 Comparison with baseline and previous monitoring

Baseline surveys were undertaken prior to the commencement of construction for 12 weeks in spring 2013, summer 2014 and autumn 2014. Monitoring took place weekly for four weeks in each of the seasons as required by the EMP. Baseline surveys recorded 96 animals as road kill during the three monitoring events, representing 33 species and an average weekly road kill for spring, summer and autumn of 9.5, 11.7 and 3.3 respectively.

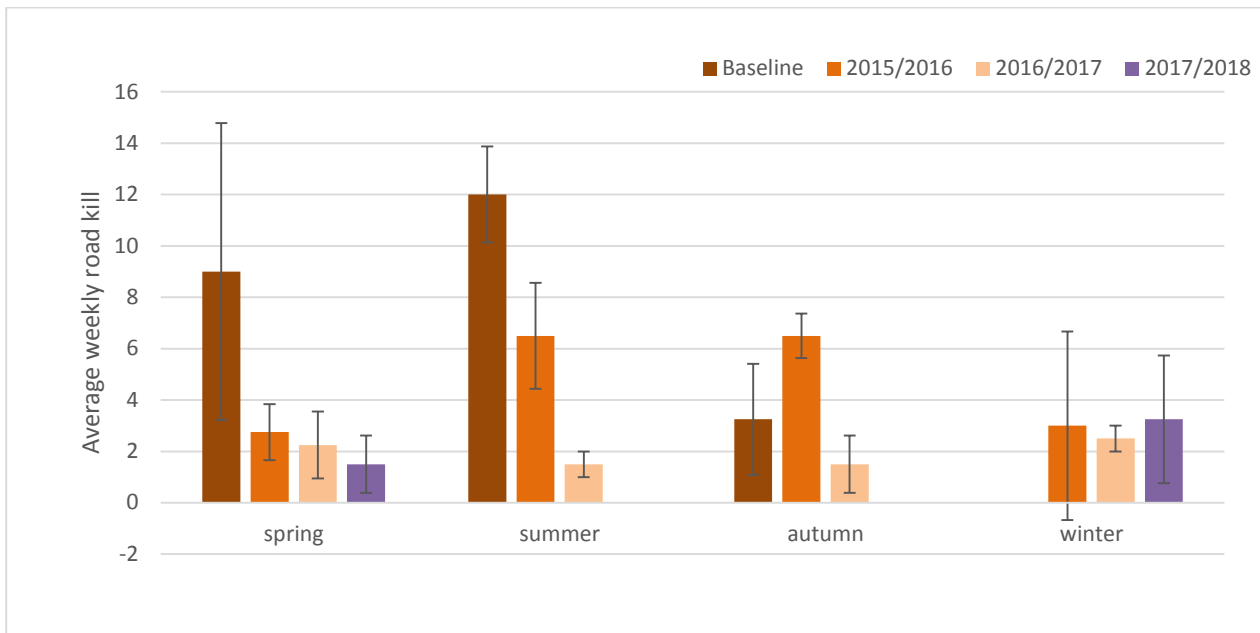
The average weekly road kill for the baseline surveys and construction monitoring periods for all survey events is presented in Table 5. Graph 2 shows the seasonal average weekly road kill for each of the same four week period in baseline and construction monitoring periods. The location of road kill records for baseline (12 weeks) and 2017/2018 entire length monitoring periods (13 weeks) are shown in Figure 3. Note this figure includes only those records from surveys that included the entire length of the Project, which were not undertaken at the same time of year.

In order to compare the results of the baseline surveys with that of subsequent monitoring periods, the average weekly road kill for the four survey weeks undertaken in each season of the baseline surveys (spring (October), summer (January), autumn (May)), should be compared to the same four weeks of each subsequent monitoring event. No road kill surveys were undertaken in winter during the baseline monitoring. However, as only the results of surveys that considered the entire length of the highway are comparable to baseline surveys, just the period from 4 August 2017 – 30 October 2017 could be compared to baseline results. This period encompassed only winter and spring surveys. As winter surveys were not undertaken during baseline monitoring, only the spring results could be directly compared to road kill rates for the 2017/2018 monitoring period. Spring road kill rates were lower in the 2017/2018 monitoring period (1.5) than during baseline (9.5).

**Table 5: Weekly road kill rates for baseline, construction and 12-week post-opening monitoring for monitoring undertaken along the entire Project alignment**

Monitoring period		Spring (n)	Summer (n)	Autumn (n)	Winter (n)	Annual (n)
Baseline	2013/2014	9.5 (4)	11.8 (4)	3.3 (4)	No surveys	8.0 (12)
	2015/2016 (all surveys)	4.2 (13)	5.8 (14)	6.7 (13)	4.1 (12)	5.0 (52)
Construction phase	2015/2016 (4 weeks)	2.75 (4)	6.5 (4)	6.5 (4)	3.0 (4)	
	2016/2017 (all surveys)	3.3 (13)	2.6 (13)	2.0 (12)	2.2 (14)	2.3 (52)
	2016/2017 (4 weeks)	4.0 (4)	1.5 (4)	1.5 (4)	2.5 (4)	
	2017/2018 (all surveys)	2.9 (9)	No surveys*	No surveys*	3.3 (4)	3.0 (13)
	2017/2018 (4 weeks)	1.5 (4)	No surveys*	No surveys*	3.3 (4)	
12-week post-opening	2017/2018 (all sections combined)					4.5 (12)

n = number of survey weeks; \* = construction partially complete



**Graph 2: Average ( $\pm$ SD, n = 4) weekly road kill per season, for baseline and construction monitoring**

## 2.6 Discussion

A summary of the 2017/2018 survey results in relation to the performance measures is provided in Table 6.

**Table 6: Performance measures**

Performance Measures	Discussion
Lower rates of road kill in proximity (i.e. areas of the main carriageways within areas adjacent to installed fauna fencing, and within 100m of rope bridges and fauna underpasses) to fauna fencing, rope bridges and fauna underpasses than in sections of the upgrade not near wildlife crossing structures or fauna fences in Year 1 – 6 & 8 monitoring events.	<b>This performance measure was not assessed for the 2017/2018 monitoring period.</b> While the entire length of the Project is now operational, operational road kill monitoring is due to commence in spring 2018. Operational data is required to effectively assess road kill patterns in relation to fauna crossings.
Reduced incidence of road kill from baseline conditions during monitoring events in Years 1 – 6 & 8 and when all monitoring events are considered at Year 8.	<b>This performance measure was met for the 2017/2018 construction phase.</b> Overall there has been a decline in the recorded average weekly road kill between baseline and the subsequent construction monitoring events and between the annual baseline and the 12-week post-opening monitoring. No threatened species were recorded as road kill during the 2017/2018 construction or 12-week post-opening surveys.
Fauna exclusion fencing is installed at a minimum in the locations identified in Schedule 3 of the EPBC approval at Year 4.	<b>This performance measure has been met.</b> Roads and Maritime have advised that all fauna fencing as identified in Schedule 3 of the EPBC approval has been installed.

## **2.7 Recommendations**

### **2.7.1 Contingency measures**

The EMP lists potential problems and contingency measures for various components of the monitoring program, however specific contingency measures for road kill have not been provided within the EMP. Road kill results will however be considered in relation to future underpass and fauna fence monitoring, as per the EMP.

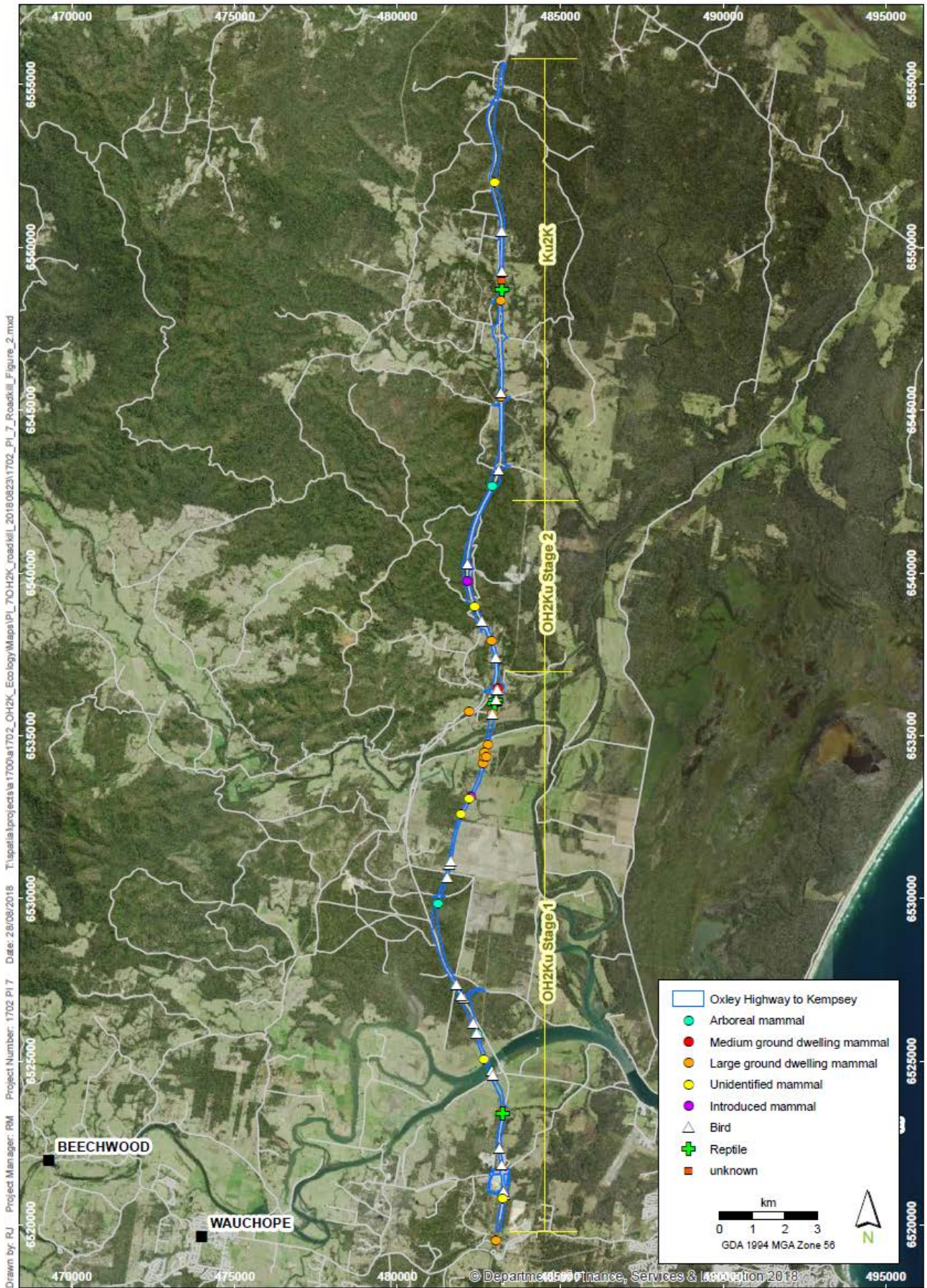
### **2.7.2 Recommendations**

Current trends indicate an overall reduction in road kill incidence during construction activities and immediately after opening of the road to traffic. No threatened species were identified as road kill in the 2017/2018 monitoring period. As such there are no current recommendations based on the outcomes of the 2017/2018 monitoring period. The current results, for the most part, represent monitoring undertaken during the construction and post-construction/early operational phase of the road. It is considered too early at this stage to assess the relationship between mitigation measures (such as fauna underpasses and crossings) and road kill rates or patterns. Operational road kill monitoring is due to commence in spring 2018 and will provide further information as to the effectiveness of these measures.



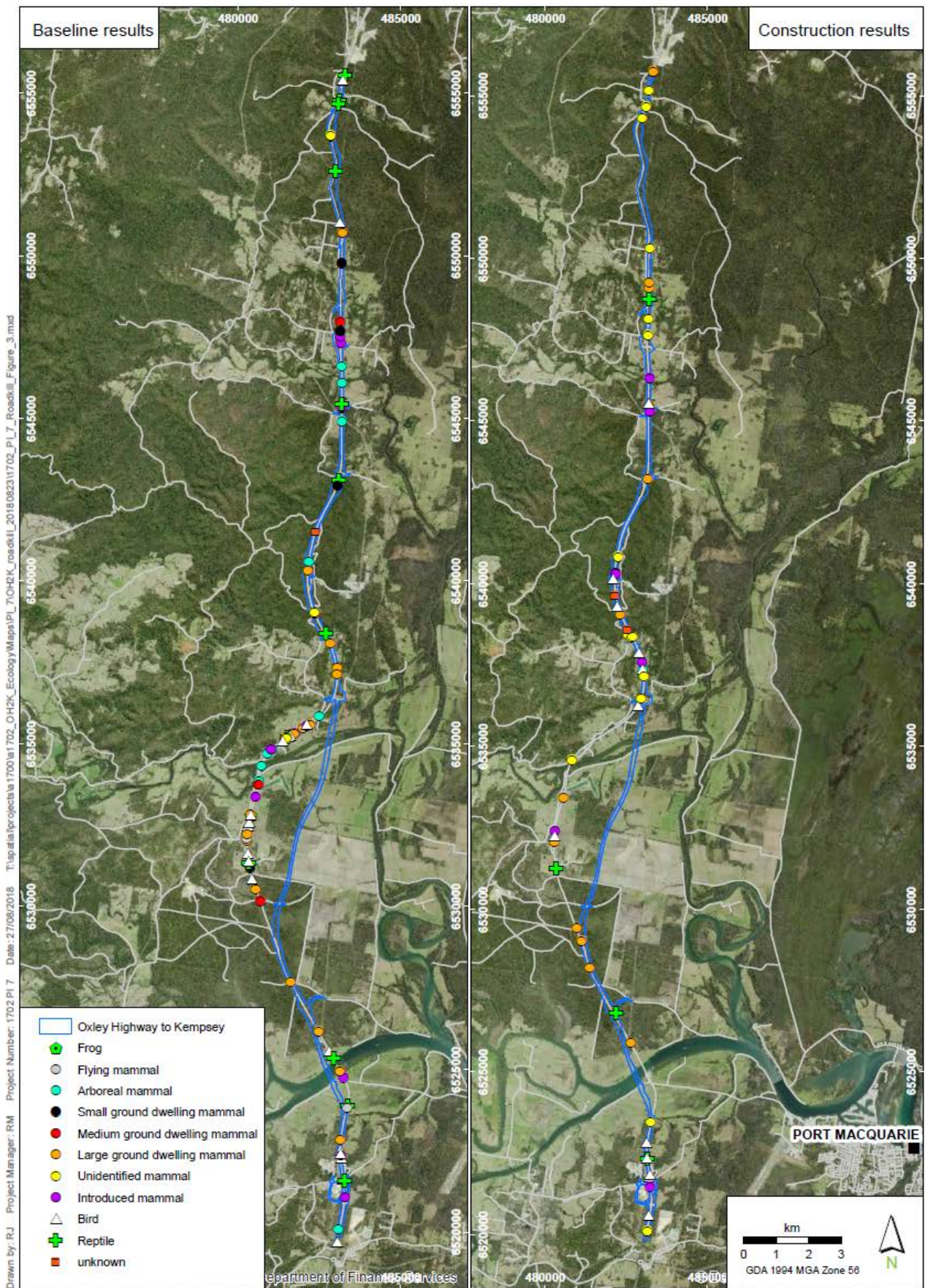
Distribution of road kill records: all construction monitoring 2017/2018

Pacific Highway Upgrade – Oxley Highway to Kempsey



Distribution of road kill records: 12-week post-opening monitoring 2017/2018

Pacific Highway Upgrade – Oxley Highway to Kempsey



Distribution of road kill records: baseline vs 2017/2018 construction monitoring (entire alignment monitoring only)

### 3. Pre-clearing and Clearing Procedures

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Reporting for pre-clearing and clearing procedures for the OH2Ku section was completed in 2016/2017 and was reported in Niche 2017b. A single report has been provided for all clearing undertaken in the Ku2K section of the Project (Lewis 2018). The report is provided in Annex 2 and the results are summarised below.

#### 3.1 Monitoring Framework and Timing

The EMP specifies that pre-clearing flora and fauna surveys will be conducted prior to Stage 1 removal of vegetation (i.e. non-habitat trees) and that inspections of habitat trees and fauna rescue procedures will be undertaken during Stage 2 clearing. The EMP details pre-clearing and clearing procedures and details the data required to be collected for target species and activities.

#### 3.2 Performance Measures

The EMP specifies the performance measures for pre-clearing and clearing.

***“The performance of pre-clearing and clearing procedures will be assessed against:***

- *Low rates of fauna injury and mortality resulting from clearing operations, and no mortality of TSC Act and EPBC Act threatened species.*
- *Stop work implemented immediately when fauna observed and successful capture and release of fauna displaced by clearing operations (ie being released within 1 hour without mortality, unless the animal is injured and is instead managed in accordance with the Fauna Handling and Rescue Procedure in the FFMP).*
- *Immediate contact with Project Ecologist / Suitably Qualified Expert or wildlife carer when injured fauna are identified.*
- *Accurate quantification of fauna habitat features and hollow-bearing trees being removed against the predicted quantities identified in the Nest Box Management Plan.”*

#### 3.3 Monitoring Sites

This report refers to clearing surveys undertaken in the Ku2K section only. OH2Ku clearing was reported in Niche 2017b.

#### 3.4 Key Results

Clearing for the Ku2K project commenced on the 18 November 2014 and was completed by 3 February 2017, with *ad hoc* clearing events continuing until 21 May 2018. The results presented below have been extracted from the report and summarised in order to more clearly address the performance measures, as per the EMP.

### 3.4.1 Fauna injury/mortality and capture/release results

#### **Terrestrial fauna**

A total of 432 individual animals, comprising 32 species, were captured and relocated. Fifteen individuals, comprising eight species (including one case of destroyed eggs), died during clearing operations. Deaths occurred by vehicle strike and during habitat tree removal. The 15 dead individuals represents 3.5% of the number of individuals relocated.

#### **Aquatic fauna**

A total of 2,633 aquatic fauna were captured and relocated to nearby waterways. Most of the captures were native fish with 1,384 individuals (52.6%) comprised of Striped Gudgeon (*Gobiomorphus australis*), Empire Gudgeon (*Hypseleotris compressa*) and Firetail Gudgeon (*Hypseleotris galii*). Frogs and their tadpoles (Hylid (tree frogs) and Myobatrachid (ground dwelling) species accounted for a further 1,167 (44.3%) captures. Threatened Green-thighed Frog (*Litoria brevipalmata*) tadpoles were captured and relocated.

#### **Threatened fauna**

Twelve threatened fauna species were recorded, including two species of frog (Giant Barred Frog *Mixophyes iteratus*, Green-thighed Frog), one species of reptile (Stephens Banded Snake *Hoplocephalus stephensii*), six species of mammal (Little Bent-wing Bat *Miniopterus australis*, Eastern Bent-wing Bat *Miniopterus schreibersii*, Southern Myotis *Myotis macropus*, Grey-headed Flying-fox *Pteropus poliocephalus*, Yellow-bellied Glider *Petaurus australis*, and Koala *Phascolarctos cinereus*) and six species of bird (Black-necked Stork *Ephippiorhynchus asiaticus*, Square-tailed Kite *Lophoictinia isura*, Sooty Owl *Tyto tenebricosa*, Little Lorikeet *Glossopsitta pusilla*, Glossy Black Cockatoo *Calyptorhynchus lathami*, Varied Sitella *Daphoenositta chrysoptera*). All species are listed on the NSW BC Act and three (Giant Barred Frog, Grey-headed Flying-fox, Koala) are currently listed on the Commonwealth EPBC Act. There were no reported deaths or injuries of threatened fauna.

### 3.4.2 Stop work procedures and injured fauna protocol

One individual was euthanased on site and two cracked eggs were discarded. All other captured fauna were relocated to adjacent habitat without requiring treatment or care.

The unexpected finds procedure was implemented upon the identification of the Stephen's Banded Snake. In the single instance where a Koala was found, a 100 metre exclusion zone was established, whereupon the individual remained for the day and dispersed of its own accord that evening.



### 3.4.3 Fauna habitat features and hollow-bearing trees

#### *Hollow-bearing trees*

The *Nest Box Plan of Management* (NBPoM, Lewis 2013a) identified a total of 603 hollow-bearing trees in the road corridor along the entire OH2K section of the upgrade. Initial habitat surveys marked 198 hollow-bearing trees with 1176 functional hollows for removal within the Ku2K section. Clearing involved the actual removal of 244 hollow-bearing trees with 718 functional hollows. The number of hollow-bearing trees removed was greater than originally expected, however resulted in the loss of fewer functional hollows than expected. The majority of the additional hollow-bearing tree removal occurred in zone X (+22) where clearing limits were increased and in zone T (+13) where calculations were based on M class clearing footprints (not A class).

#### *Nest box calculations*

Re-calculation of the number of nest boxes required resulted in the addition of 101 nest boxes, resulting in an increase from 156 (installed Stage 1) to 257 (Stage 2), three more than the 254 required by the NBPoM.

### 3.5 Discussion

A summary of the Ku2K clearing survey results in relation to the performance indicators is provided in Table 7. The general conclusion by Lewis 2018 was that management goals were achieved, however data from the pre-clearing surveys could have been better used to inform subsequent temporary works locations.

**Table 7: Pre-clearing and clearing procedures performance measures**

Performance indicators of success	Discussion
Low rates of fauna injury and mortality resulting from clearing operations, and no mortality of TSC Act and EPBC Act threatened species.	<b>This performance indicator has been met for terrestrial and aquatic fauna.</b> Reported mortality of native fauna resulting from clearing operations was low at 3.5 % of the recorded number of successfully relocated terrestrial fauna. No aquatic fauna mortalities were reported. <b>This performance indicator has been met for threatened fauna.</b> No threatened fauna mortalities due to clearing operations were reported.
Stop work implemented immediately when fauna observed and successful capture and release of fauna displaced by clearing operations (i.e. being released within 1 hour without mortality, unless the animal is injured and is instead managed in accordance with the Fauna Handling and Rescue Procedure in the FFMP).	<b>This performance indicator has been met.</b> A total of 432 individuals were successfully captured and released. Stop work and unexpected find procedures were implemented for a Koala and Stephen’s Banded Snake.
Immediate contact with Project Ecologist / Suitably Qualified Expert or wildlife carer when injured fauna are identified.	<b>This performance indicator has been met.</b> Injured fauna were euthanased where appropriate. No fauna required external care.
Accurate quantification of fauna habitat features and hollow-bearing trees being removed against the predicted quantities identified in the Nest Box Management Plan.	<b>This performance indicator has been met.</b> Quantification of all removed hollow-bearing trees and functional hollows was undertaken during clearing. Stage 2 calculations were based on this quantification and resulted in the addition of 101 nest boxes (three more than required by the NBPoM).

### 3.6 Recommendations

The EMP lists potential problems and contingency measures for various components of the monitoring program. Those that are considered to be relevant to the pre-clearing and clearing procedures for the Ku2K section are listed and discussed in Table 8.

A number of points were raised that should be considered in future clearing operations. These are discussed in detail in Lewis 2018 and are summarised below.

- Sensitive area maps should be updated monthly during clearing operations so that new information from pre-clearing surveys can assist additional assessments.
- A minimum 40 ton limit should be imposed for harvesters felling hollow-bearing trees due to the inability of lighter harvesters to adequately lower habitat trees exceeding 500 millimetres diameter at breast height.
- The retention time for hollow-bearing trees should be maintained at two nights. There should also be a maximum retention time period of 21 days applied to avoid other fauna from taking up tree hollows.
- The retention time for all other habitat features should be at the discretion of the Project Ecologist.
- Operators of machinery should have proven experience with lowering of habitat trees.
- Large senescent hollow-bearing trees or stags that cannot be felled gently should be trapped for a minimum of two nights following isolation and prior to felling.
- The use of targeted spotlighting should be adopted to ensure Green-thighed Frogs are adequately surveyed.

**Table 8: Pre-clearing and clearing procedures contingency measures**

Potential Problem	Contingency Measure proposed in EMP	Action
Previously undetected fauna is located prior to clearing.	Notify Environmental Manager and EPA within 24 hours. Project ecologist to record location of species immediately with GPS. Project ecologist to relocate and release fauna into suitable adjoining habitat. Obtain approval from relevant authorities to relocate threatened species if required, at least 24 hours before relocation is conducted.	An unexpected find of a Stephen’s Banded Snake occurred. The unexpected find procedure was implemented and the individual was released into suitable habitat without incident. <b>This contingency measure was relevant and appropriate action was taken.</b>
Previously undetected flora species is located prior to clearing.	Notify Environmental Manager and EPA. Project ecologist to record location of species with GPS. Delineate threatened species with highly visible tape to protect it from clearing. Seek approval from relevant authorities to translocate species if required.	No previously undetected flora species were identified during pre-clearing surveys. <b>This potential problem was not encountered.</b>
Identification of previously undocumented EEC.	Notify Environmental Manager and EPA. Project ecologist to delineate boundaries of the EEC with a GPS and highly visible tape. Consult with relevant authorities for management of additional EEC	No previously undetected EEC was reported. <b>This potential problem was not encountered.</b>
High rates of fauna injury and mortality resulting from clearing operations	Immediately commence review of clearing procedures and complete review prior to clearing recommencing. Modify habitat tree retention times and/or Stage 2 (habitat tree felling) clearing procedures prior to clearing recommencing. Review approach of clearing contractor prior to clearing recommencing.	Reported mortality of native fauna resulting from clearing operations was low at 3.5 % of the recorded number of successfully relocated terrestrial fauna. No aquatic fauna mortalities were reported. <b>This potential problem was not encountered</b>

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## Annex 1. Road Kill monitoring 2017/2018

Data presented as provided by Roads and Maritime Services.

Week Number	Monitoring type	Section	Season	Date	Start Time	Finish Time	Location description	Latitude	Longitude	Species	Assigned Vertebrate Group
100	Construction		winter	04/08/2017			Near OH2K GTHF ponds	481114	6529022	Eastern Grey Kangaroo	Large ground dwelling mammal
100	Construction		winter	04/08/2017			Carlyle exit	483196	6549252	Swamp Wallaby	Large ground dwelling mammal
100	Construction		winter	04/08/2017	7:30	8:30	south end of OH2K	483134	6520087	unknown	Unidentified mammal
101	Construction		winter	11/08/2017			Sancrox off ramp	483231	6521819	unknown	Bird
101	Construction		winter	11/08/2017			North of SB rest area	483148	6543208	Eastern Grey Kangaroo	Large ground dwelling mammal
101	Construction		winter	11/08/2017			North stumpy creek	483317	6555742	Eastern Grey Kangaroo	Large ground dwelling mammal
101	Construction		winter	11/08/2017	7:30	8:30	OH2K site office	482630	6525870	Swamp Wallaby	Large ground dwelling mammal
101	Construction		winter	11/08/2017			Kemps Rd	483190	6555153	unknown	Unidentified mammal
101	Construction		winter	11/08/2017			near site 5B	483175	6548117	unknown	Unidentified mammal
101	Construction		winter	11/08/2017			Near C32.66	483220	6550298	unknown	Unidentified mammal
102	Construction		winter	18/08/2017			North end of NB overtaking lanes	480293	6532252	Kookaburra	Bird
102	Construction		winter	18/08/2017	7:30	8:30	North end of NB overtaking lanes	480307	6532388	Fox	Introduced mammal
102	Construction		winter	18/08/2017			old coast rd turnoff	482987	6554303	unknown	Unidentified mammal
103	Construction		winter	25/08/2017			none noted			none noted	None
104	Construction		spring	01/09/2017	7:30	8:30	Yarrabee Rd	482172	6540292	Rabbit	Introduced mammal
105	Construction		spring	08/09/2017	7:30	8:30	between Cooperabung creek and Haydens Wharf rd	482998	6537359	Possum	Arboreal mammal
105	Construction		spring	08/09/2017	7:30	8:30	between Cooperabung creek and Haydens Wharf rd	482998	6537359	unknown	Bird
105	Construction		spring	08/09/2017	7:30	8:30	near C27.51	483188	6545534	Wood Duck	Bird
105	Construction		spring	08/09/2017	7:30	8:30	near C27.51	483188	6545534	Wood Duck	Bird
105	Construction		spring	08/09/2017	7:30	8:30	Smiths creek	483217	6546320	Rabbit	Introduced mammal

Week Number	Monitoring type	Section	Season	Date	Start Time	Finish Time	Location description	Latitude	Longitude	Species	Assigned Vertebrate Group
106	Construction		spring	15/09/2017	7:30	8:30	Cooperabung creek	482887	6537874	unknown	Bird
106	Construction		spring	15/09/2017	7:30	8:30	Cooperabung range	482210	6539287	unknown	Bird
106	Construction		spring	15/09/2017	7:30	8:30	Wharf Rd	483216	6545436	Eastern Grey Kangaroo	Large ground dwelling mammal
106	Construction		spring	15/09/2017	7:30	8:30	south of SB overtaking lanes	481367	6528179	Eastern Grey Kangaroo	Large ground dwelling mammal
107	Construction		spring	22/09/2017	7:30	8:30	Sancrox	483216	6521460	Rabbit	Introduced mammal
107	Construction		spring	22/09/2017	7:30	8:30	Upper Smiths Creek Rd	483212	6545283	Rabbit	Introduced mammal
107	Construction		spring	22/09/2017	7:30	8:30	North OH2K GThF pond	480963	6529403	Eastern Grey Kangaroo	Large ground dwelling mammal
107	Construction		spring	22/09/2017	7:30	8:30	Carlyle exit	483199	6549077	Eastern Grey Kangaroo	Large ground dwelling mammal
107	Construction		spring	22/09/2017	7:30	8:30	south Maria river	483098	6554660	unknown	Unidentified mammal
108	Construction		spring	29/09/2017	7:30	8:30	north of Sancrox	483131	6522323	Magpie	Bird
108	Construction		spring	29/09/2017	7:30	8:30	north of Sancrox	483131	6522323	Diamond Python	Reptile
108	Construction		spring	29/09/2017	7:30	8:30	south of truck pullover	480332	6531245	Land Mullet	Reptile
108	Construction		spring	29/09/2017	7:30	8:30	North pipers creek	483207	6548753	Red Bellied Black Snake	Reptile
108	Construction		spring	29/09/2017	7:30	8:30	south of Wilson River	480842	6534576	unknown	Unidentified mammal
109	Construction		spring	06/10/2017	7:30	8:30	SB Kundabung off ramp	483169	6547644	unknown	Unidentified mammal
110	Construction		spring	13/10/2017			none noted				
111	Construction		spring	20/10/2017	7:30	8:30	south Sancrox bridge	483193	6520569	unknown	Bird
111	Construction		spring	20/10/2017	7:30	8:30	North Wilson river bridge	480826	6534561	unknown	Unidentified mammal
112	Construction		spring	27/10/2017	7:30	8:30	north Sancrox	483126	6522798	Common Myna	Bird
112	Construction		spring	27/10/2017	7:30	8:30	Haydens Wharf	482855	6536243	unknown	Bird
112	Construction		spring	27/10/2017	7:30	8:30	South Hastings river crossover	483240	6523445	unknown	Unidentified mammal
113	Construction	OH2Ku stage 1	spring	03/11/2017	7:30	8:30	North end of NB overtaking lanes	480276	6532049	Eastern Grey Kangaroo	Large ground dwelling mammal
113	Construction	OH2Ku stage 1	spring	03/11/2017	7:30	8:30	sports club turnoff	480560	6533401	Eastern Grey Kangaroo	Large ground dwelling mammal
113	Construction	OH2Ku stage 1	spring	03/11/2017	7:30	8:30	Hastings Interchange	482178	6526800	Goanna	Reptile
113	Construction	OH2Ku stage 2	spring	03/11/2017	7:30	8:30	Cooperabung range	482532	6538583	unknown	Unknown
113	Construction	OH2Ku stage 2	spring	03/11/2017	7:30	8:30	sth Yarrabee	482137	6539644	unknown	Unknown

Week Number	Monitoring type	Section	Season	Date	Start Time	Finish Time	Location description	Latitude	Longitude	Species	Assigned Vertebrate Group
113	Opening	Ku2K	spring	03/11/2017	7:30	8:30	Opposite Hambly	483203	6548975	unknown	Unknown
114	Construction	OH2Ku stage 1	spring	10/11/2017	7:30	8:30	Sancrox on ramp	483197	6521743	Magpie	Bird
114	Construction	OH2Ku stage 1	spring	10/11/2017	7:30	8:30	South Haydens Wharf Rd	482953	6536469	unknown	Unidentified mammal
115	Opening	OH2Ku stage 1	spring	17/11/2017	7:30	8:30	South Hastings River Road	483240	6523453	Eastern Grey Kangaroo	Large ground dwelling mammal
116	Opening	OH2Ku stage 1	spring	24/11/2017	7:30	8:30	opposite OH2K compound	482453	6525843	Possum	Arboreal mammal
116	Opening	OH2Ku stage 1	spring	24/11/2017	7:30	8:30	Wilson's floodplain	481590	6531059	Kookaburra	Bird
116	Opening	OH2Ku stage 1	spring	24/11/2017	7:30	8:30	north Sancrox	483261	6521014	Pigeon	Bird
116	Opening	OH2Ku stage 1	spring	24/11/2017	7:30	8:30	north Sancrox	483129	6522346	Wood Duck	Bird
116	Opening	OH2Ku stage 1	spring	24/11/2017	7:30	8:30	Haydens Wharf	483073	6536423	Wood Duck	Bird
116	Opening	OH2Ku stage 1	spring	24/11/2017	7:30	8:30	OH2K compound	482432	6525881	Wood Duck	Bird
116	Opening	OH2Ku stage 1	spring	24/11/2017	7:30	8:30	Haydens Wharf	483076	6536465	Long Nosed Bandicoot	Medium ground dwelling mammal
116	Opening	OH2Ku stage 1	spring	24/11/2017	7:30	8:30	south Sancrox bridge	483232	6520790	unknown	Unidentified mammal
117	Opening	OH2Ku stage 1	summer	01/12/2017	7:30	8:30	Hastings river drive interchange	481950	6527018	Magpie	Bird
117	Opening	OH2Ku stage 1	summer	01/12/2017	7:30	8:30	north railway overbridge	482915	6535681	Eastern Grey Kangaroo	Large ground dwelling mammal
117	Opening	OH2Ku stage 1	summer	01/12/2017	7:30	8:30	north railway overbridge	482915	6535681	Eastern Grey Kangaroo	Large ground dwelling mammal
117	Opening	OH2Ku stage 1	summer	01/12/2017	7:30	8:30	Wilson's floodplain	482627	6534164	Eastern Grey Kangaroo	Large ground dwelling mammal
117	Opening	OH2Ku stage 1	summer	01/12/2017	7:30	8:30	Wilson's floodplain	482665	6534360	Eastern Grey Kangaroo	Large ground dwelling mammal
117	Opening	OH2Ku stage 1	summer	01/12/2017	7:30	8:30	Haydens Wharf	483023	6536092	Carpet Python	Reptile
117	Opening	OH2Ku stage 1	summer	01/12/2017	7:30	8:30	Haydens Wharf	482972	6535977	Carpet Python	Reptile
118	Opening	Ku2K	summer	08/12/2017	7:30	8:30	opposite wharf road	483187	6545416	Eastern Grey Kangaroo	Large ground dwelling mammal
118	Opening	OH2Ku stage 1	summer	08/12/2017	7:30	8:30	8110SB	482032	6526949	Kookaburra	Bird
118	Opening	OH2Ku stage 1	summer	08/12/2017	7:30	8:30	7300SB	482336	6526186	Magpie	Bird
118	Opening	OH2Ku stage 1	summer	08/12/2017	7:30	8:30	1850SB	483281	6520921	Magpie	Bird
118	Opening	OH2Ku stage 1	summer	08/12/2017	7:30	8:30	8600NB	481802	6527375	Plover	Bird
118	Opening	OH2Ku stage 1	summer	08/12/2017	7:30	8:30	South Wilson's River bridge	482254	6533156	Cat	Introduced mammal
119	Construction	OH2Ku stage 2	summer	15/12/2017	7:30	8:30	Yarrabee Rd	482090	6540158	unknown	Bird

Week Number	Monitoring type	Section	Season	Date	Start Time	Finish Time	Location description	Latitude	Longitude	Species	Assigned Vertebrate Group
119	Opening	Ku2K	summer	15/12/2017	7:30	8:30	HVIB	482978	6551980	unknown	Unidentified mammal
120	Opening	Ku2K	summer	20/12/2017	7:30	8:30	NB Rest area off ramp	482919	6542660	Sugar Glider	Arboreal mammal
120	Opening	Ku2K	summer	20/12/2017	7:30	8:30	NB Rest area on ramp	483101	6543153	Tawny Frog Mouth	Bird
121	Construction	OH2Ku stage 2	summer	28/12/2017	7:30	8:30	Cooperabung Range	482540	6538432	unknown	Unidentified mammal
121	Opening	Ku2K	summer	28/12/2017	7:30	8:30	ch32600	483197	6550498	Magpie	Bird
121	Opening	Ku2K	summer	28/12/2017	7:30	8:30	PCAR - south	483203	6549258	Wood Duck	Bird
121	Opening	OH2Ku stage 1	summer	28/12/2017	7:30	8:30	Wilson River Floodplain	482198	6533068	unknown	Unidentified mammal
121	Opening	OH2Ku stage 1	summer	28/12/2017	7:30	8:30	Wilson River Floodplain	481957	6532594	unknown	Unidentified mammal
122	Opening	Ku2K	summer	02/01/2018	7:30	8:30	opposite wharf road	483185	6545525	Magpie	Bird
122	Opening	OH2Ku stage 1	summer	02/01/2018	7:30	8:30	south end of widen median	481245	6529851	Sugar Glider	Arboreal mammal
122	Opening	OH2Ku stage 1	summer	02/01/2018	7:30	8:30	north railway overbridge	482910	6535680	unknown	Bird
123	Construction	OH2Ku stage 2	summer	12/01/2018	7:30	8:30	Cooperabung range	482303	6539039	Swamp Wallaby	Large ground dwelling mammal
123	Opening	OH2Ku stage 1	summer	12/01/2018	7:30	8:30	sth Fernbank creek	483225	6523416	Red bellied Black Snake	Reptile
123	Opening	OH2Ku stage 1	summer	12/01/2018	7:30	8:30	nth end of Hastings bridge	482653	6525076	unknown	Unidentified mammal
124	Construction	OH2Ku stage 2	summer	16/01/2018	7:30	8:30	Cooperabung Drive	482654	6538339	unknown	Unidentified mammal
124	Construction	OH2Ku stage 2	summer	16/01/2018	7:30	8:30	North Yarrabee Quarry	482243	6540818	unknown	Unidentified mammal
124	Opening	Ku2K	summer	16/01/2018	7:30	8:30	sth Pipers Creek	483169	6548363	Eastern Grey Kangaroo	Large ground dwelling mammal
124	Opening	Ku2K	summer	16/01/2018	7:30	8:30	Nth Pipers Creek	483206	6548693	freshwater turtle	Reptile
124	Opening	OH2Ku stage 1	summer	16/01/2018	7:30	8:30	South Haydens Wharf Rd	483025	6536111	Magpie	Bird
124	Opening	OH2Ku stage 1	summer	16/01/2018	7:30	8:30	Haydens Wharf	483100	6536384	Eastern Grey Kangaroo	Large ground dwelling mammal
124	Opening	OH2Ku stage 1	summer	16/01/2018	7:30	8:30	north railway overbridge	482191	6535748	Eastern Grey Kangaroo	Large ground dwelling mammal
124	Opening	OH2Ku stage 1	summer	16/01/2018	7:30	8:30	Donut	483028	6519489	Eastern Grey Kangaroo	Large ground dwelling mammal
125	Opening	OH2Ku stage 1	summer	25/01/2018	7:30	8:30	sth of tea tree farm	481527	6530664	Magpie	Bird
125	Opening	OH2Ku stage 1	summer	25/01/2018	7:30	8:30	Tea tree farm	481633	6531170	Pigeon	Bird
125	Opening	OH2Ku stage 1	summer	25/01/2018	7:30	8:30	Hastings River Bridge	482888	6524706	Wood Duck	Bird
125	Opening	OH2Ku stage 1	summer	25/01/2018	7:30	8:30	Hastings River Bridge	482934	6524587	Wood Duck	Bird



Week Number	Monitoring type	Section	Season	Date	Start Time	Finish Time	Location description	Latitude	Longitude	Species	Assigned Vertebrate Group
125	Opening	OH2Ku stage 1	summer	25/01/2018	7:30	8:30	Wilson River Floodplain	482781	6534730	Eastern Grey Kangaroo	Large ground dwelling mammal
125	Opening	OH2Ku stage 1	summer	25/01/2018	7:30	8:30	Wilson River Floodplain	482672	6534505	Eastern Grey Kangaroo	Large ground dwelling mammal
125	Opening	OH2Ku stage 1	summer	25/01/2018	7:30	8:30	Wilson River Floodplain	482728	6534366	Eastern Grey Kangaroo	Large ground dwelling mammal
126	Construction	OH2Ku stage 1	summer	02/02/2018			none noted				
127	Construction	OH2Ku stage 2	summer	09/02/2018	7:30	8:30	Yarrabee Rd	482147	6540331	Fox	Introduced mammal
127	Construction	OH2Ku stage 2	summer	09/02/2018	7:30	8:30	NB adjacent to Cooperabung Drive	482678	6538360	unknown	Unidentified mammal
127	Opening	OH2Ku stage 1	summer	09/02/2018	7:30	8:30	Sancrox NB on ramp	483196	6521822	unknown	Bird
128	Construction	OH2Ku stage 2	summer	16/02/2018			none noted				
129	Construction	OH2Ku stage 2	summer	23/02/2018			none noted				
130	Construction	OH2Ku stage 2	autumn	02/03/2018	7:30	8:30	south of Cooperabung Close	482987	6537582	Rabbit	Introduced mammal
131	Construction	OH2Ku stage 2	autumn	09/03/2018			none noted				
132	Construction	OH2Ku stage 2	autumn	16/03/2018	7:30	8:30	Between Haydens Wharf and Cooperabung Creek	483042	6537152	unknown	Unidentified mammal
133	Construction	OH2Ku stage 2	autumn	23/03/2018			none noted				
134	Opening	OH2Ku stage 2	autumn	30/03/2018			none noted				
135	Opening	OH2Ku stage 2	autumn	06/04/2018			none noted				
136	Opening	OH2Ku stage 2	autumn	13/04/2018			none noted				
137	Opening	OH2Ku stage 2	autumn	20/04/2018			none noted				
138	Opening	OH2Ku stage 2	autumn	26/04/2018	7:30	8:30	Between Haydens Wharf and Cooperabung Creek	483018	6537413	Galah	Bird
138	Opening	OH2Ku stage 2	autumn	26/04/2018	7:30	8:30	Yarrabee turnoff	482138	6539747	Fox	Introduced mammal
139	Opening	OH2Ku stage 2	autumn	04/05/2018			none noted				
140	Opening	OH2Ku stage 2	autumn	11/05/2018			none noted				
141	Opening	OH2Ku stage 2	autumn	18/05/2018			none noted				
142	Opening	OH2Ku stage 2	autumn	26/05/2018	7:30	8:30	Yarrabee bridge	482144	6540262	Magpie	Bird
142	Opening	OH2Ku stage 2	autumn	26/05/2018	7:30	8:30	south side of Cooperabung range	482583	6538519	Magpie	Bird

Week Number	Monitoring type	Section	Season	Date	Start Time	Finish Time	Location description	Latitude	Longitude	Species	Assigned Vertebrate Group
142	Opening	OH2Ku stage 2	autumn	26/05/2018	7:30	8:30	south side of Cooperabung creek	482891	6537934	Swamp Wallaby	Large ground dwelling mammal
142	Opening	OH2Ku stage 2	autumn	26/05/2018	7:30	8:30	top of Cooperabung range	482371	6538954	unknown	Unidentified mammal
143	Opening	OH2Ku stage 2	autumn	01/06/2018			none noted				
144	Opening	OH2Ku stage 2	autumn	08/06/2018			none noted				
145	Opening	OH2Ku stage 2	autumn	15/06/2018			none noted				
146	opening	OH2Ku stage 2	autumn	22/06/2018			none noted				
147	opening	OH2Ku stage 2	autumn	29/06/2018			none noted				

## Annex 2. Pre-clearing and clearing monitoring Ku2K (Lewis 2018)

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Field data is provided within the report.



# PACIFIC HIGHWAY UPGRADE: KUNDABUNG TO KEMPSEY

Post Clearing Report (Version 3)

September 2018



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.....  
Ben Lewis  
(B. Applied Science Hons)

...18 September 2018.....

Date



## ACKNOWLEDGEMENTS

Ben Lewis (Lewis Ecological Surveys) – Field Surveys, Report Author and Report Review.

Andrew Smith (Lewis Ecological Surveys) – Field Surveys.

Chris Jackson (Lewis Ecological Surveys) - Field Surveys.

Brendan Schembri (Lewis Ecological Surveys) - Field Surveys.

Tim Donner (Lewis Ecological Surveys) - Field Surveys.

Adrian Vanesse (Geoview) – GIS and map production.

## Photography - Lewis Ecological Surveys © else stated

Title Page – Stephens Banded Snake (*Hoplocephalus stephensii*) captured during staged tree hollow removal at Cut 20 (ch. 34800).

Report to be cited as: Lewis, B.D. (2018). Pacific Highway Upgrade: Kundabung to Kempsey: Post Clearing Ecological Report: Report prepared for K2K Joint Venture by Lewis Ecological Surveys. ©

Project Number: 2431718i

**Document Control:**

Date	Status	No. Copies	Format	Dispatched	Client	Client Contact
13.08.2018	Version 1	1	PDF	Email	K2K Joint Venture	Servaes Van Der Meulen Servaes.VanDerMeulen@mcdgroup.com
31.08.2018	Version 2	1	PDF	Email	K2K Joint Venture	Servaes Van Der Meulen Servaes.VanDerMeulen@mcdgroup.com
18.09.2018	Version 3	1	PDF	Email	K2K Joint Venture	Servaes Van Der Meulen Servaes.VanDerMeulen@mcdgroup.com

**Revision History**

Date	Status	Author	Reviewer	Organisation
17.08.2018	Version 1	Ben Lewis	Aleesha Doolan	Roads and Maritime Services
31.08.2018	Version 1	Ben Lewis	Servaes Van Der Meulen	K2K Joint Venture
14.09.2018	Version 2	Ben Lewis	Servaes Van Der Meulen	K2K Joint Venture

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## 1.0 INTRODUCTION

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### 1.1 Background

During the construction of the Kundabung to Kempsey Pacific Highway Upgrade project (K2K project), Lewis Ecological Surveys was engaged by the McConnell Dowell-OHL joint venture contractor (JV) to provide ecological services. The following report discusses the procedures and results of ecological tasks undertaken during the clearing phase.

Clearing for the K2K project commenced on the 18 November 2014 and substantive clearing was completed by 3 February 2017. Ad hoc clearing events continued up until the 21 May 2018. This report is a requirement of the Kundabung to Kempsey Fauna and Flora Management Plan, Roads and Maritime Services (RMS) G40 Specification, Section 2.7 *Post Clearing Report* and the G36 Specification. Reporting requirements specified in G36 and G40 and the relevant section/s of this report are summarised in Table 1-1.

### 1.2 Study Area

The K2K Project extends for a length of 13 km from Barrys Creek (Mingaletta) in the south to the southern interchange of the Kempsey Bypass. The alignment follows the existing highway in the south with a small deviation as it passes through Maria River State Forest before joining the existing highway again at Maria River (Figure 1-1).

**Table 1-1:** Reporting requirements specified in G36 and G40 and relevant sections of the clearing report.

Component	Requirement	Relevant Section
G36 a)	An assessment of habitat trees and the handling of fauna affected by the clearing activities undertaken in accordance with this clause.	Sections 2, 3, 4, 5 & Appendix A.
G36 b)	The clearing and structures removal operations, including procedures, dates, times, weather, areas and information on the fauna specialist(s) present during the clearing and structures removal operations.	Section 2; Appendix A; Plate 2-3.
G36 c)	Any live animals that were sighted, captured, released, injured or shocked including location of fauna within clearing footprint (recorded with GPS) and release locations.	Section 3; Table 3-2 to 3-12; Table 3-9; Appendix A. Plate 3-2 to 3-8.
G36 d)	Dead animals that were found as a result of clearing and structures removal operations and fauna rescue.	Section 3.6; Table 3-9; Plate 3-11 and 3-12; Appendix A
G36 e)	Trees being used for breeding or roosting by fauna, including their species, locations, sizes, heights and depths of hollows in trees.	Section 3-4; Appendix A.
G36 f)	Bridge or culvert structure being used for breeding or roosting by fauna, including their species. Locations, sizes, gap heights and depths.	Section 3.3.6; Table 3-6 and Table 3-7. Plate 3-5
G36 g)	A register of hollow-bearing trees and comparison of this data to the Nest Box Plan (assess the adequacy of nest boxes installed and how they are mitigating the loss of tree hollows).	Appendix A – Table A1 Habitat Tree Register
G36 h)	Photo images of rescued fauna.	Plate 3-2 to 3-8
G36 i)	Records of road-kill during the clearing period.	Section 3.6.2; Appendix A – Table A3; Plate 3-12.
G36 j)	An analysis of the effectiveness of the clearing methods and fauna rescue procedures adopted.	Sections 4; Table 4-1.
G36 k)	Recommendations for future pre-clearing assessments and/or fauna rescue procedures.	Section 5.
G40 1)	An assessment of the habitat and handling of fauna.	Sections 2, 3, 4 & 5.
G40 2)	Information on clearing operations, dates, procedures, areas.	Appendix A.
G40 3)	Live animal sightings, captures, any releases or injured/shocked wildlife.	Section 3.3; Appendix A.
G40 4)	Any dead animals located.	Section 3.6; Appendix A- Tables A1-4; Plate 3-11 and 3-12.
G40 5)	Photographs of rescued fauna.	Plate 3-2 to 3-8 plus updates during Environmental Representative Group Meetings.

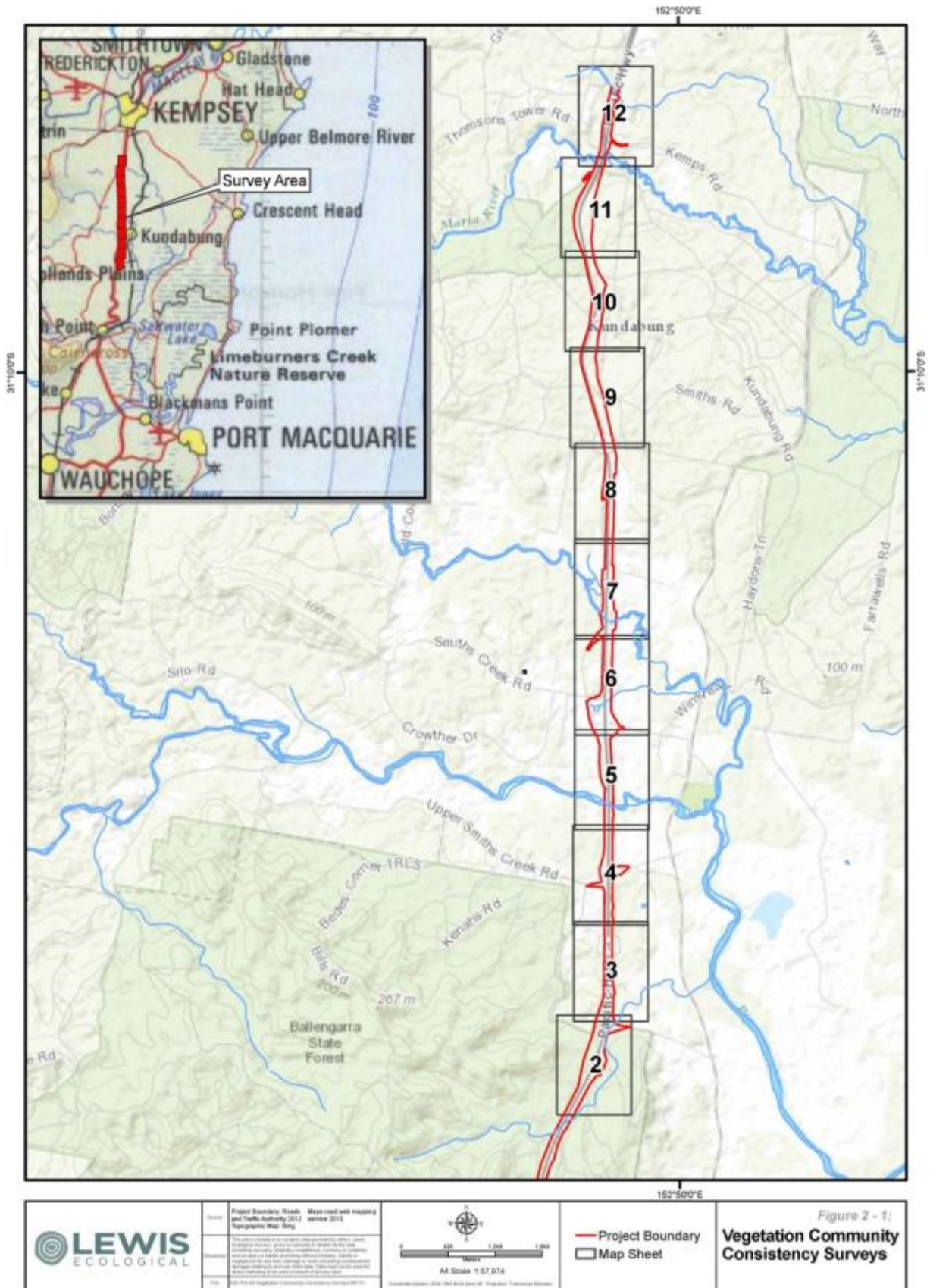


Figure 1-1. Location of the Kundabung to Kempsey Project.

## 2.0 SURVEY METHODS

### 2.1 Terrestrial Fauna

#### 2.1.1 Habitat Resource Surveys

Prior to the commencement of clearing, each specific area of the alignment was traversed on foot to identify and mark up fauna habitat resources, including but not limited to hollow-bearing trees (HBT), trees containing nests, dreys or arboreal termitaria with cavities, large hollow logs and bush rock suitable for relocation. The HBT survey included remarking of trees identified as part of the Nest Box Plan of Management (Lewis 2013a) and any additional trees that were suspected as potentially containing tree hollows.

All of the identified habitat features were marked with red and white hazard tape and between two to four large "H" were spray painted in pink paint (Plate 1-1). Habitat resource surveys were performed in September and October 2014 or in the case of design refinements and temporary works areas, at least 24 hours prior to the commencement of clearing.



Plate 2-1. Potential hollow bearing tree (HBT) showing their field identification for the clearing and grub program.

## 2.1.2 Frog Surveys

Frogs were targeted during all diurnal pre-clear surveys (refer section 2.1.5), as part of targeted surveys in areas of potential habitat and targeted surveys in areas of mapped threatened frog habitat (Lewis 2013b; Lewis 2013c). Two species of threatened frog have been recorded in the K2K alignment, Giant Barred Frog (*Mixophyes iteratus*) and Green-thighed Frog (*Litoria brevipalmata*) (Lewis 2013b, c). Giant Barred Frog habitat was identified at Barrys Creek, Smiths Creek, Pipers Creek, Maria River and Stumpy Creek (Figure 1-1). Habitat at Barrys Creek and Stumpy Creek was identified as moderate likelihood whilst frogs had been confirmed previously at the remaining four sites (Lewis 2013b). Green-thighed Frog habitat was identified sporadically throughout the entire Project, with particularly hot spots identified at ch. 30600 (Pipers Creek) and ch. 33600 (Maria River State Forest; Lewis 2013c). The frog hygiene protocol, as described in the Construction Flora and Fauna Management Sub-Plan (FFMP) of the Construction Environmental Management Plan (CEMP), was applied during all frog surveys.

### i. Giant Barred Frog

Surveys for Giant Barred Frog were conducted on two separate occasions with the first of these comprising some additional pre construction surveys at Barrys Creek and Stumpy Creek in spring 2014. The second round of surveys were performed immediately prior to clearing with the first survey performed on the evening before the Giant Barred Frog exclusion fencing was installed. Once this fencing had been installed in accordance with the Giant Barred Frog management strategy (Lewis 2013b), two further nocturnal surveys were performed on non-consecutive nights within 5 days of clearing operations commencing. The sporadic nature of clearing within these areas resulted in numerous Giant Barred Frog surveys (i.e. >20 surveys) being conducted at Smiths and Pipers Creek habitat areas meant the areas were sampled on multiple occasions. This also included surveys after flooding had washed out portions of the frog fence.

Daytime or diurnal surveys were performed within the exclusion areas identified for clearing, as well as where the frog exclusion fence was to be installed. This type of survey involved an active search of the leaf litter, splitting and rolling logs, and extensive searching beneath and around *Lomandra longifolia* clumps. These surveys occurred prior to each scheduled clearing event or where floods had breached and removed the frog fence, the whole process was repeated. Clearing within the identified Giant Barred Frog habitat areas was supervised by an ecologist whom periodically inspected the clearing front and clumps of vegetation removed. This procedure was generally tool boxed with the clearing contractor and site works foreman. In areas of dense ground cover, such as Native Grape (*Cissus antartica*), *Lomandra* and *Lantana camara*, operators were asked to remove small patches of ground cover to enable systematic inspection of patches as clearing progressed.

Captured frogs were housed individually in clip-seal plastic bags, with a small amount of leaf litter and water. Data collected on each captured frog included: sex, snout-vent length and breeding condition before being micro chipped and released a short distance beyond the frog exclusion fence, still within the area of known frog habitat.

Any dewatering works in Giant Barred Frog habitat involved the dip-netting of tadpoles, particularly at Smiths Creek and Pipers Creek where temporary rock platforms were constructed within the main channel.

## ii. Green-thighed Frog

Targeted surveys for Green-thighed Frog occurred as part of the nocturnal pre-clearing surveys. Typically, this involved spotlighting the ground cover during pre-clear surveys performed either just prior to sunrise or on the evening before. Some surveys also coincided with heavy rainfall, however, such rainfall events normally resulted in substantive delays to clearing operations but were useful in identifying additional breeding habitat and identified areas where spawn, tadpoles or metamorphs would require relocation (Plate 2-2).



Plate 2-2. Example of a flooded depression (ch. 32600) that was subject to targeted surveys for Green-thighed Frogs.

Active searches were also performed for Green-thighed Frog in accordance with the approved management strategy (Lewis 2013c). Within areas of identified Green-thighed Frog habitat, active searches using a rake or wrecking bar were performed at a rate of 15 minutes per hectare of habitat. Similar to the Giant Barred Frog habitat areas, an ecologist supervised all of the clearing in mapped Green-thighed Frog habitat. In some areas, particularly the southern end of Maria State Forest, more than 20 active surveys were performed due to the sporadic nature of clearing.

Captured frogs were housed individually in clip-seal plastic bags, with a small amount of leaf litter and water. Data

collected on each captured frog included: sex, snout-vent length and breeding condition before being released a short distance beyond the frog exclusion fence, still within the area of known frog habitat.

### 2.1.3 Micro Bats

Most of the 21 structures identified in the Microbat Management Strategy (MMS) (Lewis 2013d) as containing known or potential habitat were inspected and excluded for microbats between the 14 and 30 September 2014. Maria River Bridge and south bound Stumpy Creek bridge were not subject to exclusion works as no substantive works were planned for these structures. For the remaining 19 structures, the exclusion method proposed in the MMS was adopted. Once both the south and northbound carriageways had been completed, 21 existing but redundant culverts were identified for grout filling in August 2016. All 21 of these were subjected to the exclusion process outlined in the MMS during the field works undertaken between 14 and 17 September 2016. Some house and shed demolition works were also supervised during their dismantling for signs of micro bats (Plate 2-3).



Plate 2-3. House being dismantled near Rodeo Drive was subject to micro bat inspections and works supervision.

Culverts were accessed in the early evening between 1800 and 2000 hours to determine if bats had departed for the evening. Sites containing bats were initially inspected to confirm that all individuals had left the roost. All known and potential roost sites were then excluded by inserting expandable foam into crevices and lifting lugs. On the following day, culverts were inspected to look for roosting microbats and to check the exclusion material. A further inspection occurred the following day to assess microbat presence, roost location and exclusion material. Nest boxes installed in habitat adjoining each culvert were inspected as part of quarterly monitoring surveys (i.e. Lewis 2014b,c; 2015a,b,c) with all of the boxes installed by RMS approximately 6 to 9 months prior to clearing.

### 2.1.4 Habitat Tree Inspections

Generally, habitat trees were left *in-situ* for a minimum of 48 hours (2 nights) after surrounding vegetation had been cleared. In some instances, the retention period was longer due to inclement weather, equipment breakdown or clearing logistics. At other times, safety requirements associated with retaining isolated trees from a newly formed clearing front adjoining the highway necessitated their removal sooner. As a general rule, the ecologist was involved in this decision making process and the EPA informed of the situation and the action proposed.

The majority of HBTs were felled using a harvester or, in the case of very large trees, a combination of harvester and a bulldozer (Plate 2-4). A small number of trees, mainly in difficult to access areas were felled using a chainsaw. Examples of this occurred around some of the creek lines (i.e. Pipers Creek and Smiths Creek), close to the existing highway or services. The JV obtained approval from EPA prior to using hand-held chainsaws to fell any HBTs.



Plate 2-4. Clearing of habitat tree using harvester and dozer at ch. 33100.

In most cases, trees were felled with the root ball intact so as to act like a pendulum in slowing the rate of fall. The ability to control the fall of HBTs was dependent on operator skill, machine size and tree size. Many trees were too large to be control felled as the two harvesters were approximately 30-35 ton in size.

The initial inspection of tree hollows focused on the most visible ones and these were quickly inspected before a more thorough investigation of the felled tree. As a general rule, HBTs were felled in a manner to avoid direct impact of the hollow and ideally away from windrows, uneven ground and the limit of clearing. All hollows were inspected with a torch



to illuminate the cavity. At times, limbs were cross-cut with a chainsaw to enable closer inspection, particularly trunk hollows. As a consequence, inspections times varied depending on size of tree, number of hollows and overall complexity or difficulty in thoroughly checking them. In general, it ranged from as little as a minute through to 15-20 minutes for larger more difficult trees. Information collected on each HBT included:

- Type of tree;
- Hollow type (limb, trunk);
- Hollow size (small <50mm; medium 50-150mm, large 150-300mm) including estimated depth;
- Fauna species found and the number of individuals present;
- Fate of captured fauna including any injuries; and
- Evidence of previous use. This was based on the following features:
  - Wear or chew marks at the hollow entrance;
  - Leaf nests; and
  - Feathers, scats, fur, eggs or egg shell;

The shape and size of nesting material, the size of the entrance hole, type of tree and animal signs (i.e. fur, feathers, scats) were used to determine which species might have used the hollow.

In instances where fauna were detected in hollows, they were either left in the hollow (by temporarily sealing openings) or captured and placed in cotton bags or a carry cage. Frogs were housed individually in plastic clip-seal bags with a small amount of water and leaf litter. Hollows containing fauna were typically plugged with a cotton bag and placed between the Limit of Clearing (LoC) and the project boundary. Fauna were only left *in-situ* if they were uninjured, if the tree could be left undisturbed and if there was minimal activity nearby. Hollows were unplugged at dusk and re-inspected the following morning. In cases where there was no adjoining forest or animal/s were suspected of being injured a saw was used to trim retained sections of tree to enable extraction of fauna. Captured fauna and occupied hollows were placed into the adjoining forest, or the closest area of suitable forest (i.e. appropriate area and habitat type for the subject species) within 100m of the LoC boundary. All gliders that exited hollows were transferred to nest boxes, which were installed temporarily in habitat near the point of capture. In some instances, particularly for Feathertail Gliders, exfoliating bark was used as a suitable relocation point. Reptiles were typically placed at fallen ground logs, in dense ground cover or beneath decorticating bark that was thought to provide adequate refuge. Frogs were released on drainage lines or at dams within the same catchment from which they were captured. The maximum distance between point of capture and point of release was 100m and most individuals were released immediately adjacent to their point of capture (i.e. <50m).

### 2.1.5 Koala Management

Koala were managed in accordance with the procedures outlined in the Flora and Fauna Management Plan (FFMP; McConnell Dowell – OHL Joint Venture 2014). Essentially, the Project Ecologist performed a series of pre-clearing surveys which included predawn spotlighting of the forecast clearing area and this was followed up with a visual search of

that area immediately prior to and during the clearing. In instances where Koala was found, the area was excluded from all day works and a 100 m exclusion zone established until the individual left of its own accord. This approach addressed the following Flora and Fauna Commitments and Conditions of Approval:

**Minimise impacts on native fauna during construction. F12** *A suitably qualified ecologist will undertake preclearance surveys. Searches will include nests and large hollow-bearing trees and target habitats of hollow-dwelling species, koalas and frogs. Fauna species found in pre-clearance surveys will be relocated to suitable habitat as close as possible to the area in which they were found.*

**CoA 2 (d)** *A detailed description of the pre-clearance surveys to be undertaken by a suitably qualified expert within all areas proposed for disturbance, including: hollow bearing trees, logs, existing culverts and bridges, no earlier than 48 hours prior to the removal of vegetation occurring in that area to ensure that the area is free of the Koala, Giant-Barred Frog, Grey-headed Flying-fox and Spotted-tail Quoll.*

*(e) Measures to relocate and/or ensure the appropriate care of individuals of the Koala, Giant-Barred Frog, Grey-headed Flying-fox and Spotted-tail Quoll that are identified during searches referred to in condition 2d;*

**Wildlife Protection FF22** Should clearing activities coincide with the Koala breeding season (September to February), specific measures identified in the Pre-clearing checklist/Fauna Handling and Rescue Procedure will be followed.

#### 2.1.6 Cane Toad (*Bufo marinus*) Surveys

Cane Toad monitoring surveys were performed in February and March of 2015 between Kundabung Interchange (ch.29300) and Pipers Creek (ch.30600) with particular attention around the Kundabung Rest Area (ch. 29800E). Weekly surveys were performed following the detection of a single toad at the rest area on the 10 February 2015. This involved call broadcast and visual search of waterbodies including construction basins so that any population could be identified and managed.

#### 2.1.7 Road Kill Monitoring

Road kill monitoring was performed in two ways. Firstly, as a weekly survey within four weeks of the clearing operations commencing with the first of these surveys performed on the 27 October 2014. During these surveys, the entire alignment was driven at speeds of usually 60-80 kmph shortly after dawn and all road kill wildlife were recorded and their location chainage noted. The second stage of road kill monitoring was performed during the clearing phase with the live carriageway surveyed each morning shortly after dawn within 250 m of the clearing front. This monitoring continued for up to 30 days after the clearing operation has ceased. A total of 232 surveys were performed in this way, commencing on the 18 November 2014 to 10 February 2017.

## 2.2 Aquatic Fauna

Prior to reclaiming dams, establishing temporary water crossings and constructing construction pads in watercourses the following aquatic fauna rescue procedure was implemented:

1. Waterbody identified with construction for reclamation;

2. Release point for captures identified. This was often the closest water source or within the same small sub catchment;
3. Waterbody pumped using either water carts (staggered dewatering) or a 2-6 inch pump was used to pump water and/or redivert;
4. Water pumped to <1 m in depth;
5. A dip net was used to catch aquatic vertebrates (i.e. fish, eels, turtles and tadpoles) over the next few hours and occasionally on the following day;
6. Vertebrates were temporarily housed into group specific aquaria. For example, small fish were not housed with eels; tadpoles were housed in separate aquaria;
7. Transported to the release point; and
8. Place aquaria in recipient water body and introduce small volumes of water to assist in acclimatising until such a time the aquaria could be emptied into the recipient site.

Twenty-nine water bodies were subject to this process including Smiths Creek, Pipers Creek and Stumpy Creek. Maria River was not subject to any aquatic fauna rescue given no construction works were planned to impact on the stream channel.

### 2.3 Threatened Flora

Searches for threatened flora, recorded in, or predicted to occur in, the study area were conducted during the G40 surveys and as part of each pre-clearing survey. Species listed in the FFMP were targeted (Table 2-1).

**Table 2-1.** Threatened or otherwise significant plant species.

Scientific name	Common name	EPBC Act	TSC Act	Occurrence
<i>Acronychia littoralis</i>	Scented acronychia	Endangered	Endangered	Potential
<i>Arthraxon hispidus</i>	Hairy-joint Grass	Vulnerable	Vulnerable	Potential
<i>Maundia triglochinoidea</i>	Maundia	-	Vulnerable	Recorded from Barrys Creek (Mingaletta during surveys in 2012)
<i>Melaleuca biconvexa</i>	Biconvex Paperbark	Vulnerable	Vulnerable	Potential
<i>Parsonsia dorrigoensis</i>	Milky Silkpod	Endangered	Vulnerable	Potential
<i>Phaius australis</i>	Southern Swamp Orchid	Endangered	Endangered	Potential
<i>Phaius tankervilleae</i>	Swamp Orchid	Endangered	Endangered	Potential

## 3.0 RESULTS

### 3.1 Native Plant Communities

Seven native plant community types were impacted by the clearing operations (Table 3-1). The main plant community types impacted were the Moist Slopes Forest (45.53 ha), Dry Ridgetop Forest (18.26 ha), Moist Gully Forest (10.36 ha) and Moist Floodplain Forest (8.47 ha). No new plant community types were recorded nor impacted by the clearing operations.

**Table 3-1.** Summary of native plant community types removed by the K2K Upgrade.

Native Plant Community Type	Area (ha)
<b>Sub-Tropical Coastal Floodplain Forest EEC</b>	
Moist Floodplain Closed Forest with Rainforest Elements	0.07
Riparian Forest	5.90
<b>Swamp Sclerophyll Forest EEC</b>	
Paperbark Swamp Forest	0.56
Swamp Mahogany/Forest Red Gum Swamp Forest	0.00
<b>Swamp Oak Floodplain Forest EEC</b>	
Swamp Oak Forest	0.00
<b>Freshwater Wetland EEC</b>	
Freshwater Wetland	0.00
<b>Other</b>	
Moist Floodplain Forest	8.47
Moist Gully Forest	10.36
Moist Slopes Forest	45.53
Dry Ridgetop Forest	18.25
Mangroves and Seagrass	0.00
<b>Total</b>	<b>89.15</b>

### 3.2 Threatened Flora

Between the 18 November 2014 and the 21 May 2018, 427 pre-clearing surveys were undertaken (Appendix A). The only threatened plant recorded during this time was a population of *Maundia* (*Maundia triglochoides*) recorded 30 m downstream of Barrys Creek and the Mingaletta Road deviation works - ch. 25400 (Plate 3-1). Cursory monitoring of this population found it to remain approximately 30 m downstream of the proposed Mingaletta Road where it maintained a size of 100 m<sup>2</sup>. This species was not recorded during the Environmental Assessment for the Oxley Highway to Kempsey Upgrade (GHD 2010) but was predicted to occur based on habitat.



Plate 3-1 *Maundia* (*Maundia triglochinooides*) recorded during pre-clear surveys downstream of chainage 25400.

### 3.3 Terrestrial Fauna

#### 3.3.1 Pre-clearing Surveys

Between the 18 November 2014 and the 21 May 2018, 427 pre-clearing surveys were undertaken (Appendix A). During these surveys, 61 species (birds excluded) were recorded and comprised 16 species of frog, 19 species of reptile and 26 species of mammal (Table 3-2; Plate 3-2). Thirty-two species (52%) comprising 432 individuals were captured and relocated during the pre-clearing surveys including multiple captures of the threatened Giant barred Frog and Green-thighed Frog (see Section 3-3-3).



Plate 3-2. Examples of fauna captured during pre-clearing predawn surveys; Leaf-tailed Gecko (*Saltuarius moritzi*) from ch. 32950 and Perons Tree Frog (*Litoria peronii*) from Pipers Creek (30600).

**Table 3-2:** Species of vertebrate captured or recorded during pre-clearing, active frog searches, HBT removal and incidental records as part of the Kundabung to Kempsey.v = Listed as vulnerable by the NSW *Threatened Species Conservation Act 1995*.e = Listed as endangered under the NSW *Threatened Species Conservation Act 1995*.

\* = Exotic or introduced species

√ = denotes detection.

Species Name	Common Name	Pre-clearing Survey	Microbat Exclusion	Frog Surveys	Incidentals	HBT Removal	General Clearing Supervision	Aquatic Surveys/ Dewatering
<b>Frogs</b>								
<i>Adelotis brevis</i>	Tusked Frog	√		√				
<i>Bufo marinus</i> *	Cane Toad*				√			
<i>Crinia signifera</i>	Common Froglet	√		√	√		√	√
<i>Limnodynastes peroni</i>	Striped Marsh Frog	√		√	√		√	√
<i>Limnodynastes tasmaniensis</i>	Spotted Marsh Frog	√		√				
<i>Litoria brevipalmata</i> <sup>v</sup>	<b>Green-thighed Frog<sup>v</sup></b>	√		√			√	√
<i>Litoria caerulea</i>	Common Green Tree Frog	√		√		√		
<i>Litoria dentata</i>	Bleating Tree Frog	√		√		√		√
<i>Litoria fallax</i>	Eastern Dwarf Tree Frog	√		√	√		√	√
<i>Litoria gracilentia</i>	Graceful Tree Frog	√		√		√		
<i>Litoria latopalmata</i>	Broad-palmed Frog	√		√			√	√
<i>Litoria nasuta</i>	Striped Rocket Frog	√		√			√	
<i>Litoria peronii</i>	Peron's Tree Frog	√		√		√		
<i>Litoria wilcoxii</i>	Stony Creek Frog	√		√				
<i>Mixophyes fasciolatus</i>	Great Barred Frog	√		√				
<i>Mixophyes iteratus</i> <sup>e</sup>	<b>Giant Barred Frog<sup>e</sup></b>	√		√				
<i>Pseudophryne coriacea</i>	Red-backed Toadlet	√		√				

Species Name	Common Name	Pre-clearing Survey	Microbat Exclusion	Frog Surveys	Incidentals	HBT Removal	General Clearing Supervision	Aquatic Surveys/ Dewatering
<i>Uperoleia laevis</i>	Smooth Toadlet				√		√	
<b>Reptiles</b>								
<i>Amphibolurus muricatus</i>	Jacky Lizard				√		√	
<i>Cacophis krefftii</i>	Dwarf Crowned Snake	√					√	
<i>Calyptotis ruficauda</i>	Red-tailed Calyptotis	√					√	
<i>Chelodina longicollis</i>	Snake-necked Turtle				√			√
<i>Cryptophis nigrescens</i>	Eastern Small-eyed Snake	√		√		√		
<i>Ctenotus rubusta</i>	Striped Skink	√					√	
<i>Dendrelaphis punctulata</i>	Common Green Tree Snake	√				√		
<i>Egernia mcphreei</i>	Eastern Crevice Skink	√				√		
<i>Emydura macquarii</i>	Murray River Turtle							√
<i>Eulamprus tenuis</i>	Bar-sided Skink	√				√		
<i>Hemiaspis signata</i>	Black-bellied Swamp Snake	√					√	
<i>Hemisphaeriodon gerrardii</i>	Pink Tongue Lizard					√		
<b><i>Hoplocephalus stephensi</i> v</b>	<b>Stephens Banded Snake v</b>					√		
<i>Intellagama lesueurii</i>	Eastern Water Dragon	√	√	√	√		√	√
<i>Lampropholis delicata</i>	Garden Skink	√			√		√	
<i>Morelia spilota</i>	Diamond Python	√				√		
<i>Pogona barbata</i>	Common Bearded Dragon	√			√		√	
<i>Pseudechis porphyriacus</i>	Red-bellied Black Snake				√		√	
<i>Pseudonaja textilis</i>	Eastern Brown Snake	√						
<i>Ramphotyphlops nigrescens</i>	Blackish Blind Snake	√			√	√		

Species Name	Common Name	Pre-clearing Survey	Microbat Exclusion	Frog Surveys	Incidentals	HBT Removal	General Clearing Supervision	Aquatic Surveys/ Dewatering
<i>Saltuarius moritzi</i>	Moritz's Leaf-tailed Gecko	√				√		
<i>Tiliqua scincoides</i>	Eastern Blue Tongue Lizard	√					√	√
<i>Varanus varius</i>	Lace Monitor	√				√		
<b>Mammals</b>								
<i>Acrobates pygmaeus</i>	Feather-tail Glider	√				√		
<i>Antechinus stuartii</i>	Brown Antechinus	√	√			√		
<i>Felis catus</i> *	Feral Cat *	√						
<i>Isodon macrourus</i>	Northern Brown Bandicoot	√					√	
<i>Lepus europaeus</i> *	European Hare *	√			√		√	
<i>Macropus giganteus</i>	Eastern Grey Kangaroo	√			√			
<i>Macropus rufogriseus</i>	Red-necked Wallaby	√			√		√	
<i>Miniopterus australis</i> <sup>v</sup>	Little Bent-wing Bat <sup>v</sup>	√	√					
<i>Miniopterus schreibersii</i> <sup>v</sup>	Eastern Bent-wing Bat <sup>v</sup>	√	√					
<i>Mus musculus</i> *	House Mouse *	√					√	
<i>Myotis macropus</i> <sup>v</sup>	Southern Myotis <sup>v</sup>	√	√				√	
<i>Oryctolagus cuniculus</i> *	European Rabbit *	√			√			
<i>Perameles nasuta</i>	Long-nosed Bandicoot	√						
<i>Petauroides volans</i>	Greater Glider	√						
<i>Petaurus australis</i> <sup>v</sup>	Yellow-bellied Glider <sup>v</sup>	√						
<i>Petaurus breviceps</i>	Sugar Glider	√				√		
<i>Phascolarctos cinereus</i> <sup>v</sup>	Koala <sup>v</sup>	√						
<i>Pseudocheirus peregrinus</i>	Common Ringtail Possum	√				√		
<i>Pteropus poliocephalus</i> <sup>v</sup>	Grey-headed Flying Fox <sup>v</sup>	√						
<i>Rattus fuscipes</i>	Bush Rat	√				√		
<i>Rattus</i> *	Black Rat *	√			√		√	



Species Name	Common Name	Pre-clearing Survey	Microbat Exclusion	Frog Surveys	Incidentals	HBT Removal	General Clearing Supervision	Aquatic Surveys/ Dewatering
<i>Sminthopsis murina</i>	Common Dunnart	√						
<i>Trichosurus vulpecula</i>	Common Brushtail Possum	√			√	√		
<i>Vespadelus spp.</i>	Forest Bat	√						
<i>Vespadelus vulturnus</i>	Little Forest Bat					√		
<i>Vulpes vulpes</i> *	Red Fox *	√						
<i>Wallabia bicolor</i>	Swamp Wallaby	√			√		√	
<b>Birds</b>								
<i>Accipiter novaehollandiae</i>	Grey Goshawk	√						
<i>Aegotheles cristatus</i>	Australian Owlet Nightjar	√				√		
<i>Ephippiorhynchus asiaticus</i> <sup>e</sup>	Black-necked Stork <sup>e</sup>						√	
<i>Lophoictinia isura</i> <sup>v</sup>	Square-tailed Kite <sup>v</sup>	√					√	
<i>Ninox boobook</i>	Southern Boobook	√						
<i>Oriolus sagittatus</i>	Olive-backed Oriole	√						
<i>Philemon corniculatus</i>	Noisy Friarbird	√					√	
<i>Podargus strigoides</i>	Tawny Frogmouth	√					√	
<i>Tyto tenebricosa</i> <sup>v</sup>	Sooty Owl <sup>v</sup>	√						
<i>Daphoenositta chrysoptera</i> <sup>v</sup>	Varied Sitella <sup>v</sup>	√			√		√	
<i>Calyptorhynchus lathami</i> <sup>v</sup>	Glossy Black Cockatoo <sup>v</sup>	√						
<i>Glossopsitta pusilla</i> <sup>v</sup>	Little Lorikeet <sup>v</sup>	√			√			

### 3.3.2 Threatened Fauna

Twelve threatened fauna species were recorded during the clearing phase (Table 3-2). They include two species of frog, one species of reptile and three species of mammal and six species of bird. All species are listed on the NSW *Threatened Species Conservation Act 1995* (TSC Act) and three are currently listed on the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act; Table 3-2).

Giant Barred Frog was recorded at Smiths Creek, Pipers Creek and Maria River (Table 3-3). All three sites were previously identified as containing populations outlined in the Giant Barred Frog Management Strategy (Lewis 2013b). Green-thighed Frog was recorded from three main locations associated with Smiths Creek, Pipers Creek and Maria River State Forest (Table 3-3). Most of these locations were previously documented in the Green-thighed Frog Management Strategy (Lewis 2013c). More detail is provided below in Section 3.3.

Stephens Banded Snake was recorded during the clearing of habitat trees in Maria River State Forest (ch. 34975; Table 3-3; Plate 3-3). The habitat tree was a senescent Pink Bloodwood (*Corymbia intermedia*) with a height of 19 m and a dbh



(diameter at breast height) of 650 mm. The individual was found during a visual inspection of a trunk hollow that had an entrance diameter of 350 mm and a depth of 250 mm with an estimated height above ground of approximately 8 m.

**Plate 3-3.** Stephens Banded Snake retained in catch bag prior to release at ch.34975E.

Habitat in this area was mapped as Moist Slopes Forest in the Environmental Assessment (GHD 2010; Plate 3-4). The overstorey features Pink Bloodwood, White Stringybark, Tallowwood and Coastal Blackbutt with a somewhat dense low and mid stratum of Turpentine and Paperbark on the lower slope and along the drainage line with increasing amount of *Allocasuarina* on the lower slope. The drainage line is an unnamed tributary of Maria River and habitat fitting the above description extends for hundreds of meters in either direction. The areas was mapped in the Nest Box Plan of Management as containing numerous hollow bearing trees, an artefact of its southern aspect and its close location to the existing Pacific Highway carriageway probably has created a retained buffer from past timber harvesting operations.

The Environmental Assessment (GHD 2010) had considered the potential effects of the Proposal on this species and its habitat in accordance to Appendix 3 of the *Draft Guidelines for Threatened Species Assessment* under Part 3A of the Environmental Planning and Assessment Act 1979 (DEC & DPI 2005), however, it had discounted the species' likelihood as marginal noting "if this species does occur, the widening of the road corridor would increase the fragmentation of Stephens' banded snake habitat within the study area and potentially increase the risk of road death" . Based on this information the species has not been considered in the in the JV CEMP, or more specifically, the FFMP. This FFMP did however, have an "unexpected finds procedure" and this was implemented.



**Plate 3-4.** Clearing operations at the time of the unexpected Stephens Banded Snake find.

Yellow-bellied Glider was recorded on one occasion (16<sup>th</sup> July 2015) when an individual was spotlighted in the riparian zone of Maria River (ch. 36950; Table 3-3). Individuals have been recorded using nest boxes in this area adjacent to the clearing corridor (Lewis 2017). Grey-headed Flying Fox was recorded during 14 pre-clearing surveys and sporadically across the project, spanning from Mingaletta (ch.25000) north to Maria River (ch. 37000; Appendix A). No flying fox camps were recorded during the clearing works and similarly no road kills were attributed to the clearing works.

Three species of threatened microchiropteran bat were recorded during the pre clear and associated clearing operations (Table 3-3). Little Bent-wing Bat was recorded from a number of culvert and bridge structures with 386 individuals recorded between Mingaletta and Maria River (Plate 3-5). This included three culverts located between Mobbs Drive and

Upper Smiths Creek Road that required grouting. Eastern Bent-wing Bat was recorded from Maria River Bridge with at least three individuals confirmed (Table 3-3). Southern Myotis was recorded from Pipers Creek where two individuals were observed using an old swallow or martin nest on the headstock of the bridge (Table 3-3).



Plate 3-5. Little Bent-wing Bats recorded from culverts at Mingaletta.



Koala was recorded on a single occasion during a pre-clear survey between Railway Dam Road and Maria River on the 13 July 2015 (ch.30675; Plate 3-6; Table 3-3). In accordance with the CEMP and specifically the FFMP, a 100 m exclusion zone was established. The adult female remained in a mid storey Coastal Blackbutt for the day before dispersing in an easterly direction that evening. Koala was not encountered again during the pre clear surveys or as part of clearing supervision works. There were however, two additional Koala records with one individual crossing the Old Pacific Highway carriageway (ch. 25200) that was being used as a haul road in late winter 2016 and another individual near Barrys Creek (24100) reported in 2017. None of these were injured.

Plate 3-6. Koala recorded during predawn spotlighting between Railway Dam Road and Maria River.

The six threatened birds were not captured but rather recorded via direct observations or their calls during pre clear or clearing supervision surveys (Table 3-3). An adult Black-necked Stork was recorded repeatedly soaring above the clearing front during works associated with Kemps Road bus bay in November 2017 (Ch.37300). Square-tailed Kite was repeatedly recorded around Wharf and Upper Smiths Creek Road (27200-27500). Sooty Owl was recorded calling on the 24 February 2015 during predawn spotlighting surveys in the southern part of Maria River State Forest (Ch. 33150-33360). Road kill specimens have been previously recorded in this area indicating the moist forested gullies provide important foraging and dispersal habitat. Little Lorikeets were regularly recorded traversing above the canopy in winter and spring. Most of these observations comprised between 2-10 individuals as they rapidly flew over the canopy of vegetation in the clearing footprint as opposed to foraging within it (Table 3-3). Glossy Black Cockatoo were recorded on a number of occasions totalling 17 individuals in the southern end of Maria River State Forest where the optic fibre corridor required realignment (Table 3-3). This species was not encountered during the clearing operations but rather during habitat searches and morning pre-clearing checks. Varied Sitella was regularly observed and heard as small foraging parties of approximately 4-10 individuals moved through and adjacent to the clearing fronts. The most notable areas being; Barrys Creek to Mingaletta Road; Pipers Creek and Maria River State Forest between ch. 32600 to 36000 (Table 3-3).

**Table 3-3: Summary of threatened species recorded during and immediately after the clearing phase of K2K.**

V = vulnerable, E = endangered.

Species Name	Common Name	Status		No. Individuals; No. Sites; Comments
		NSW	C'Vealth	
<b>Reptiles</b>				
<i>Hoplocephalus stephensii</i>	Stephens Banded Snake	V		One individual from ch. 34975 mapped as Moist Slopes Forest in the Environmental Assessment (GHD 2010).
<b>Frogs</b>				
<i>Litoria brevipalmata</i>	Green-thighed Frog	V		94 individuals from three main areas: Smiths Creek (28000-28400); Pipers Creek (30200-31000) and Maria River State Forest (32600-34000).
<i>Mixophyes iteratus</i>	Giant Barred Frog	E	E	Nine individuals from Pipers Creek and Smiths Creek. Individuals recorded from Maria River were outside clearing limits and not captured.
<b>Mammals</b>				
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V	15 individuals from scattered locations between Mingaletta and Maria River. No flying fox camps recorded and no kills were attributed to construction works.
<i>Miniopterus australis</i>	Little Bent-wing Bat	V		386 Individuals recorded at the following structures; Culvert 599031, 599035, 599036, 599039 and Maria River Bridge. Also recorded from interim or redundant culverts requiring grouting at Ch. 25800, 26740 and 26850.
<i>Miniopterus schreibersii</i>	Eastern Bent-wing Bat	V		At least three individuals confirmed at Maria River Bridge.
<i>Myotis macropus</i>	Southern Myotis	V		Two individuals recorded from Pipers Creek during predawn and dawn related surveys around Pipers Creek bridge
<i>Phascolarctos cinereus</i>	Koala	V	V	One female recorded from Railway Dam Road on the 13 <sup>th</sup> July 2015. Exclusion zone implemented and the individual left of its own accord the following evening.
<i>Petaurus australis</i>	Yellow-bellied Glider	V		One individual recorded during spotlight surveys from Pipers Creek in May 2015 and from Maria River in July 2015. No individuals recorded from tree hollows.
<b>Birds</b>				
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork	E		Individual soaring over Kemps Road repeatedly in November 2017.
<i>Lophoictinia isura</i>	Square-tailed Kite	V		Individual often observed soaring around Upper Smiths Creek Road and Wharf Road in 2014-2015.
<i>Tyto tenebricosa</i>	Sooty Owl	V		One individual recorded near the site calling at the 24 <sup>th</sup> February in southern part of Maria River State Forest – Ch. 33150-33360.
<i>Glossopsitta pusilla</i>	Little Lorikeet	V		Small groups of 2-10 individuals regularly observed in rapid flight over the Project.
<i>Calyptorhynchus lathami</i>	Glossy Black Cockatoo	V		17 individuals at three sites in Maria River State Forest
<i>Daphoenositta chrysoptera</i>	Varied Sitella	V		Recorded regularly as small foraging parties of approximately 4-10 individuals, sometimes in mixed feeding flocks. Most notable areas being: <ul style="list-style-type: none"> <li>• Barrys Creek to Mingaletta Road;</li> <li>• Pipers Creek</li> <li>• Maria River State Forest from 32600 to 36000</li> </ul>

### 3.3.3 Threatened Frog Surveys

Threatened frog surveys recorded two species, the Giant Barred Frog and the Green-thighed Frog.

#### i. Giant Barred Frog

Giant Barred Frog was recorded at Smiths Creek, Pipers Creek and Maria River (Table 3-3). All three sites were previously identified as containing populations outlined in the Giant Barred Frog Management Strategy (Lewis 2013b). The frogs recorded at Maria River were adjacent to the clearing works and consequently, they were not captured. No Giant Barred Frogs were recorded at Barrys Creek or Stumpy Creek which had been identified as 'moderate' suitability in the Giant Barred Frog Management Strategy (Lewis 2013b).

In total, nine Giant Barred Frogs were captured during pre-clearing surveys with seven individuals from Smiths Creek and two individuals from Pipers Creek (Table 3-4). All of the captured adult frogs were identified as males. At Smiths Creek, two sub adults and a juvenile were captured during surveys performed in late autumn and mid winter (Table 3-4; Plate 3-7). Tadpoles suspected as being those of the Giant Barred Frog were captured and relocated at Pipers Creek. No Giant Barred Frog tadpoles were recorded during dewatering or aquatic rescue works at Barrys Creek, Smiths Creek and Stumpy Creek. No dewatering was performed at Maria River as the twin bridges had been constructed and only some minor works associated with bridge deck and cleaning of the concrete were performed.



Plate 3-7. Sub adult Giant Barred Frog (*Mixophyes iteratus*) captured during "winter" surveys at Smiths Creek (Ch. 28200).

Table 3-4. Summary of the Giant Barred Frog surveys conducted during the clearing phase of the K2K upgrade.

Site name	Date	Chainage	Giant Barred Frog Recorded (Yes/No)	Microchip No.	Swab No. (Chytrid)	Length (mm)	Weight (g)	Sex (M/F/U)	Relocation Point
Barrys Creek	12-Nov-14	24400-25400	No						
Barrys Creek	14-Nov-14	24400-25400	No						
Pipers Creek	3-Feb-15	30450-30650	No						
Pipers Creek	3-Feb-15	30650-30850	No						
Pipers Creek	4-Feb-15	30650-30750	No						
Pipers Creek	5-Feb-15	30450-30650	No						
Pipers Creek	11-Feb-15	30600-31000	Yes	000735B461		72.5	40	Male	Relocated downstream
Pipers Creek	20-Feb-15	30600	No						
Pipers Creek	2-Mar-15	30600	Yes	00073576C1		80.5	45	Male	Relocated downstream
Pipers Creek	11-Mar-15	30600	No						
Pipers Creek	13-Mar-15	30600	No						
Pipers Creek	16-Mar-15	30600	No						
Pipers Creek	17-Mar-15	30600	No						
Pipers Creek	26-Mar-15	30600	No						
Pipers Creek	30-Mar-15	30600	No						
Pipers Creek	17-Feb-15	30600-31000	No						
Pipers Creek	18-Feb-15	30600-31000	No						
Pipers Creek	18-Feb-15	30600-31000	No						
Pipers Creek	5-Dec-15	30600	No						
Smiths Creek	7-Jan-15	28200	No						
Smiths Creek	19-Feb-15	28200-28400	Yes	0007357AA5	13912	71.5	39	Male	Relocated downstream
Smiths Creek	26-Feb-15	28250-28450	Yes	000735A09D	13912	69.5	33	Male	Relocated 200m down stream
Smiths Creek	9-Mar-15	28200	No						
Smiths Creek	31-Mar-15	28200	Yes	000735C497		64	39	Male (1st yr adult)	Relocated upstream
Smiths Creek	1-Apr-15	28200	Yes	0007359537	13G12	72	50	Male	
Smiths Creek	8-Apr-15	28200	No						
Smiths Creek	9-Apr-15	28200	No						
Smiths Creek	18-May-15	28200	Yes	0007356B6F		58	27	Sub adult	Relocated upstream beyond frog fence
Smiths Creek	6-Jul-16	28300-28400	No						
Smiths Creek	17-Jul-16	28150-28300	No						
Smiths Creek	21-Jul-16	28150-28300	Yes	000735B9FF		39	15	Juvenile	Relocated upstream to just outside of temporary frog fence
Smiths Creek	21-Jul-16	28150-28300	Yes	0007357BBB		56	22	Sub adult	Relocated upstream to just outside of temporary frog fence



Site name	Date	Chainage	Giant Barred Frog Recorded (Yes/No)	Microchip No.	Swab No. (Chytrid)	Length (mm)	Weight (g)	Sex (M/F/U)	Relocation Point
Smiths Creek	07-October-2016	28200-28300	No						
Smiths Creek	10-Apr-17	28200-28400	No						
Smiths Creek - Schedule Bridge Demolition	5-May-17	28100-28300	No						
Smiths Creek - Schedule Bridge Demolition	8-May-17	28100-28300	No						
Maria River	13-Jul-15	36900-37100	No						
Maria River	14-Jul-15	36900-37100	No						
Maria River	15-Jul-15	36900-37100	No						
Maria River	9-Aug-16	36900-37100	No						
Maria River	27-Jul-17	36900-37100	No						
Maria River	29-Jul-17	36900-37100	No						
Maria River	19-Oct-17	36900-37100	No						
Stumpy Creek	12-Nov-14	37800	No						
Stumpy Creek Basin Works	10-Jan-18	37800-37900	No						
Stumpy Creek Basin Works	11-Jan-18	37800-37900	No						
Stumpy Creek Bridge Access Clearing Works	18-Dec-17	37700-37800	No						

## ii. Green-thighed Frog

Green-thighed Frog was recorded during 18 pre-clearing and/or clearing supervision surveys from three main locations described here as:

- adjacent to the riparian zone at Smiths Creek (ch. 28000-28600);
- Pipers Creek (30200-31000) and
- Southern half of Maria River State Forest (ch. 32600-34000; Table 3-5).

Pre-clearing surveys coincided with a number of breeding events and this eventuated in some areas being excluded from clearing until the tadpoles reached metamorphosis and could be captured and relocated as juveniles or froglets. This occurred at Pipers Creek north, close to where basin 30600E is now constructed, the Telstra services easement between ch. 30700-31000), 32600E where some compensatory frog ponds were constructed but not subject to monitoring, and at a number of small ephemeral drainages to the north between ch.32900-33400.

Pre-clearing and clearing supervision surveys captured and relocated 94 Green-thighed Frogs. This included both male and female adults as well as a number of juveniles or froglets (Plate 3-8). Dewatering at some of the ephemeral ponds yielded

both Green-thighed Frogs as froglets, metamorphs and tadpoles. These surveys typically recorded a number of other common frog fauna as adults, froglets and tadpoles including Tylers Tree Frog (*Litoria tyleri*), Perons Tree Frog (*Litoria peronii*), Eastern Sedge Frog (*Litoria fallax*), Broad-palmed Frog (*Litoria latopalmata*), Rocket Frog (*Litoria nasuta*) and Striped Marsh Frog (*Limnodynastes peroni*). Sixty tadpoles were also relocated from these breeding ponds with a number of these identified as Green-thighed Frog tadpoles.



Plate 3-8. Adult male Green-thighed Frog (*Litoria brevipalmata*) captured during targeted predawn spotlight surveys in Maria River State Forest (ch. 33600).

Table 3-5. Summary of surveys when Green-thighed Frogs were recorded.

Site/Area	Date	Chainage	No. Frogs	Details
Smiths Creek	13-Mar-15	28050-28250	12	Froglets relocated to the west where most of calling and breeding took place.
Southern side of Smiths Creek	27-Feb-15	28200-28250	1	Adult male relocated downstream.
Pipers Creek and north towards Fish Farm	17-Feb-15	30600-31000	1	Adult female relocated further to the east.
Pipers Creek and north towards Fish Farm	26-Feb-15	30600-31000	10	Metamorphs and juveniles captured around breeding pond identified for removal. Frogs relocated 200m downstream of Pipers Creek.
Pipers Creek and north towards Fish Farm	27-Feb-15	30600-31050	2	Adult females swabbed for chytrid. Frogs relocated further to the east.
Pipers Creek and north towards Fish Farm	3-Feb-15	30650-30850	2	Adult males captured and relocated to the east
North of Pipers Creek	28-Feb-15	30650-31030	2	Adult females relocated to the east
Pipers Creek and north towards Fish Farm	5-Feb-15	30650-31650	1	Adult female captured and relocated.
North of Pipers Creek	24-Feb-15	30800-30900	15	Metamorphs and juveniles captured around breeding pond identified for removal. Frogs relocated 200m down stream of Pipers Creek.
North of Pipers Creek	26-Feb-15	30800-30900	11	Metamorphs and juveniles captured around breeding pond identified for removal. Frogs relocated 200m down stream of Pipers Creek.
North of Pipers Creek	26-Feb-15	30800-30900	7	Metamorphs and juveniles captured around breeding pond identified for removal. Frogs relocated 200m down stream of Pipers Creek.
North of Pipers Creek	27-Feb-15	30800-30900	3	Froglets relocated downstream + 42 tadpoles with number of these <i>Litoria brevipalmata</i> .
North of Pipers Creek	28-Feb-15	30800-30900	1	Adult male relocated to east. Also 18 tadpoles.

Site/Area	Date	Chainage	No. Frogs	Details
Southern end of Maria River State Forest	12-Mar-15	32600-32700	5	Froglets relocated upstream to the east.
Southern end of Maria River State Forest	20-Jan-15	32600-33300	18	Calling and amplexing frogs - breeding along several flooded drainage lines in groups of 2-7
Southern end of Maria River State Forest	16-Jan-15	32700-33200	1	Adult male from ch.33000. Relocated upslope to east.
Optic Fibre Corridor	3-Mar-15	32900-33400	1	Adult male relocated to the east.
Bloodwood rest area in Maria River State Forest	12-Jan-15	36300-37000	1	Adult female relocated to the east
			<b>Total</b>	<b>94 + tadpoles</b>

### 3.3.4 Cane Toad (*Bufo marinus*) Surveys

One adult Cane Toad (*Bufo marinus*) was recorded at the Kundabung Rest Area (ch. 29850) on the 10 February 2015 (Plate 3-9). Subsequent monitoring of this area and for several hundred metres (29300-30600) found no further toads. The toad was euthanised in accordance with Animal Care and Ethics Licence Number 07-8393.



Plate 3-9. Adult Cane Toad captured from Kundabung Rest Area on the 10 February (Photograph: Tim Yorston).

### 3.3.6 Microbat Exclusion

Microbat exclusion was performed in accordance with the approved Microbat Management Strategy (Lewis 2013d). Most of the culverts identified in the microbat management strategy were subject to roost exclusion works in mid and late September 2014 (Table 3-6). Pre-dusk inspections recorded a number of Little Bent-wing Bats using culverts around Barrys Creek (599031), Mingaletta (599035 + 599036) and further north towards Smiths Creek (599039). Apart from Culvert 599035 near Mobbs Drive, bats tended to disperse after the first night of exclusion works. At this culvert, more bats were observed than expected, so the exclusion took place in stages and this is why a number of bats remained in the some of the

outer joins and grab holes after the first night.

The installation of lay flat hose over the bridge scuppers at Pipers Creek and Smiths Creek proved effective at excluding bats whilst still allowing unimpeded drainage from the bridge deck. No bats were recorded using the scuppers during the exclusion process, this being attributed to the periodic rain around the time of the works which is thought to provide a deterrent. The only bat recorded at these two bridges was two Southern Myotis (*Myotis macropus*) using a disused Swallow nest at Pipers Creek. These two bats were recorded shortly after the felling of a large Sydney Blue Gum (*Eucalyptus salignus*) after the exclusion period and remained in the area over two days before dispersing of its own accord.

**Table 3-6:** Microbats recorded during exclusion of two culverts within the K2K project corridor.

Structure & Reference	16 <sup>th</sup> September 2014	17 <sup>th</sup> September 2014	18 <sup>th</sup> September 2014	22 <sup>nd</sup> September 2014	23 <sup>rd</sup> September 2014	29 <sup>th</sup> September 2014	30 <sup>th</sup> September 2014
<b>Culverts</b>							
599031	Little Bent-wing Bat x 2 using central pipe join	No bats	No bats				
599033 (Mingaletta)	Bat Scats only	No bats	No bats				
599035	Little Bent-wing Bat x 11	Little Bent-wing Bat x 3	No bats	No bats			
599036	Little Bent-wing Bat x 2	No bats	No bats	No bats			
Private Access Driveway (Mobbs Lane)	Bat scats only	No bats	No bats				
599038	Bat Scats only	No bats	No bats				
599039	Little Bent-wing Bat x 2	No bats					
599041				No bats	No bats		
599046				No bats	No bats		
599043 Smiths Creek Overflow	No bats	No bats					
599050						No bats	No bats
599051						No bats	No bats
599052 Kundabung	No bats	No bats					
<b>Bridges</b>							
Smiths Creek Bridge	No bats						
Pipers Creek Bridge	Southern Myotis x 2 * Scuppers were sealed in late September. ** Some strategic removal of Swallow nests and final checks in 2017 as part of bridge washing.					No bats	No bats
Maria River Bridge (South bound)	Little Bent-wing Bats x ~ 120 Eastern Bent-wing Bat x at least 3 * No exclusion performed – just some strategic surveys in early 2017 ahead of bridge washing.						
Maria River Bridge (North bound)	No exclusion required. No construction works. Periodic checks performed.						
Maria River – Doolan Historic Bridge	No exclusion required. No construction works. Periodic checks performed.						
Stumpy Creek (North bound)	Only minor works, checks for signs of bats.					No bats	No bats
Stumpy Creek (South bound)	No bats * No exclusion performed – just some strategic surveys in early 2017 ahead of bridge washing.					No bats	No bats

Some additional microbat roost exclusions were required at culverts which had been constructed as part of the staged construction and were redundant structures in the final design. In all, 21 of these structures were identified and the roost exclusion procedures developed in the micro bat management strategy was implemented (Table 3-7). Little Bent-wing Bats were found inhabiting three of the structures, between ch. 25800 to 26850 in the southern zone. Close to 250 Little Bent-wing Bats were displaced from three culverts over a couple of nights. Nearby structures B11174, B11175 and 599038 provided the majority of alternative roost sites within a few hundred metres. Subsequent inspections of these structures found numbers of bats had in fact increased during the exclusion process indicating that some of the bats probably relocated to these structures.

**Table 3-7.** Microbat exclusion works performed at incidental structures identified for grout filling.

Approx Ch. of Culvert	Status of Culvert	14 <sup>th</sup> September 2016	15 <sup>th</sup> September 2016	16 <sup>th</sup> September	17 <sup>th</sup> September
Southern Zone					
24450	East end buried. West end covered in geofab. Culvert lies inside of full pavement reinstatement zone.	No bats	No bats		
24680	East end buried. West end covered in geofab. Culvert lies outside full pavement reinstatement zone by approx. 10m	No Bats	No Bats		
25050	Culvert extended at both ends. Currently used to handle drainage overflow from sed basin. Southbound lies under new pavement. Northbound is MA4 respray. Northbound rest stop exit in pavement reinstatement area.	No bats	No Bats		
25230	Both ends of culvert buried. 1/3 of line in full pavement reinstatement zone.	No bats	No Bats		
25470	Plywood dynabolted to western headwall to seal. 2/3 of line falls within the full pavement reinstatement zone	No bats	No Bats		
25800	East end buried under median. Bats living inside. Culvert lies inside full pavement reinstatement zone	~170 Little Bent-wing Bats. Individuals using joins and grabs holes throughout culvert.	1 bat partly entangled in Geotextile fabric used as a blind. Unfurled and released into adjacent culvert with other Little Bent-wing Bats.	No bats	No bats

Approx Ch. of Culvert	Status of Culvert	14 <sup>th</sup> September 2016	15 <sup>th</sup> September 2016	16 <sup>th</sup> September	17 <sup>th</sup> September
26740	Culvert through under new pavement. Culvert lies outside pavement reinstatement zone by approx. 10m		~70 Little Bent-wing Bats. Individuals using joins and grabs holes throughout culvert.	No bats	No bats
26850	East end of culvert buried under median. Culvert lies outside pavement reinstatement zone			~ 8 Little Bent-wing Bats. Using the central pipe joins in darker zone.	No bats
27470	Culvert through under new pavement. Culvert lies outside pavement reinstatement zone by approx. 15m			No bats	No bats
27980	East end of line buried in median. Culvert lies inside pavement reinstatement zone			No bats	No bats
28390	Culvert currently inaccessible. Culvert lies outside pavement reinstatement zone			No bats	No bats
<b>Northern Zone</b>		<b>22<sup>nd</sup> September 2016</b>	<b>23<sup>rd</sup> September 2016</b>	<b>24<sup>th</sup> September</b>	
30000	Line buried. Culvert lies outside pavement reinstatement zone.	No bats	No bats		
30900	Culvert buried. Culvert lies inside pavement reinstatement zone	No bats	No bats		
30920	Requires checking. Culvert lies inside pavement reinstatement zone	No bats	No bats		
31850	Culvert buried. Culvert lies inside pavement reinstatement zone	No bats	No bats		
32320	Culvert buried. Culvert lies inside pavement reinstatement zone	No bats	No bats		
36540	West end buried in cutting. Culvert lies inside new pavement zone	No bats	No bats		
36560	Culvert buried in cutting. Culvert lies in new pavement zone	No bats	No bats		
36830	Culvert outlets to existing pits. Culvert in new pavement zone	No bats	No bats		
36900	Culverts lie inside new pavement zone		No bats	No bats	
37250	Requires checking. Culvert lies in new pavement zone		No bats	No bats	

### 3.4 Habitat Tree Removal

#### 3.4.1 Habitat Resource Survey

Four hundred and fifty six (456) habitat trees were marked during the G40 habitat resource surveys (Lewis 2014). They included hollow-bearing Trees (HBTs) and trees containing nests and possum dreys. The number of trees marked up included those hollow bearing trees marked during the initial survey used to develop the Nest Box Plan of Management (Lewis 2013a). An additional 55 habitat trees were marked during pre-clear surveys due to changes in the clearing limits to facilitate temporary works or design changes. Together, this culminated in 511 trees identified with red and white hazard tape and a pink spray painted H (Plate 2-1).

#### 3.4.2 Hollow Characteristics

During clearing, 303 habitat trees were inspected, of which 201 (66%) contained 728 functional hollows (Appendix A). Structurally, limb or branch hollows were more common than trunk hollows with 603 versus 125. Within the limb hollow category, small hollows were slightly more common (238) than medium ones (197). The most common trunk hollow size was small (67) followed by medium (32) and then large (26).

#### 3.4.3 Hollow Characteristics

Two hundred and eight (208) non hollow bearing habitat trees were removed under ecological supervision. Of these, 57 contained nests comprising 19 stick nests (i.e. Corvid, Magpie) and 38 cup shaped nests (i.e. Passerines and honeyeaters, particularly Friarbirds) constructed of bark and leaves. One hundred and twelve (112) trees contained termitaria with visible cavities and 39 trees contained dreys constructed by Common Ringtail Possums.

#### 3.4.4 Species Recorded in Habitat Trees

Fifty-six (56) habitat trees contained vertebrate fauna whilst a further 81 trees displayed evidence of use. When this was compared to the number of counted functional hollows, 137 or 27% of the 511 habitat trees were occupied or showed some form of evidence by vertebrate fauna.

A total of 107 individuals and 21 species were captured during HBT removal (Table 3-2; Appendix B). Species richness was comprised of seven mammals, 10 reptile (38%), one bird (15%) and three frog (11%) species. Commonly captured fauna included Feather-tail Glider (23 individuals), Sugar Glider (21 individual), Blackish Blind Snake (15 individuals), Carpet Python (8 individuals) and *Egernia mcpheii* (3 individuals). Less common species were Pink Tongued Lizard (2 individuals), Stephens Banded Snake (1 individual) and Little Forest Bat (1 individual).

Threatened species captured during the HBT removal was limited to the Stephens Banded Snake (1 individual). This species is currently listed as Vulnerable by the *Threatened Species Conservation (TSC) Act 1995*.

### 3.5 Habitat Redistribution

During the tree felling process, some of the higher quality tree hollows were removed from the tree or entire sections were relocated into adjacent habitat (Table 3-8; Plate 3-10). This occurred on 20 occasions over the entire extent of the Project, from Barrys Creek (ch. 24700) to Stumpy Creek (ch. 37800). Few relocations occurred in the middle reaches around Kundabung and Ravenswood due to the adjacent areas being largely cleared lands. For example, the large Blue Gum stump removed from Pipers Creek was transported to ch.34450 to improve ground habitat cover for fauna. On a small number of occasions, some of these features were used as fauna furniture at fauna underpass structures to improve habitat values for ground dwelling and scansorial fauna. For example, ch.27500 near Wharf Road.

As part of the staged removal of non-habitat trees, some of the ground habitat logs identified for closer inspection were also salvaged and relocated to adjacent habitat. This occurred on 14 occasions, particularly in areas where the carriageway bisected state forest (i.e. Ballengarra State Forest and Maria River State Forest). A substantive fire in spring of 2016 burnt a number of these relocated habitat features (pers. obs).



Plate 3-10. Ground log marked up for clearing supervision and relocation.



Table 3-8. Summary of habitat redistribution during the K2K Upgrade.

Chainage	Side of Carriageway	Feature	Comment
24700	East	Pink Bloodwood hollow sections relocated to the east	HBT 361 in Nest Box Plan of Management
24750	East	Ground log	Checked and relocated to beyond clearing limit.
24800	East	Large habitat tree	Large hollow sections relocated using harvester
24830	East	Large stag	Section relocated to the east. HBT365 in Nest Box Plan of Management
24850	East	Large White Mahogany with hollow sections salvaged	Hollow sections relocated to the east. HBT369 in Nest Box Plan of Management
24850	West	Weathered ground log	Relocated across slope to the west. Broke into a number of sections so relocated as a pile of smaller logs
24950	West	Large habitat tree	Large hollow sections relocated using harvester. HBT 373 in Nest Box Plan of Management
25080	East	Large fallen ground log	Relocated into Barrys Creek riparian zone
27450	West	Large habitat tree	Sections used as fauna furniture around egress
31100	West	Decayed trunk section with exfoliating bark	Used as ground habitat bordering riparian zone of Pipers Creek flood channel
32470	East	Some smaller hollow sections relocated to north	Large Small fruited Grey Gum (HBT460) in Nest Box Plan of Management.
32800	East	Large ground log with deep fissures	A number of Leaf-tailed Gecko ( <i>Saltuarius moritzii</i> ) captured in this area including this log.
32950	East	Large ground log	Relocated to the east or upslope
33350	East	Large Coastal Blackbutt directionally felled into area of least impact	Clearing in Telstra services corridor where tree canopy was wider than the approved easement. Directional felling to area of least impact under Project Ecologist supervision
33400	East	Large Coastal Blackbutt directionally felled into area of least impact	Clearing in Telstra services corridor where tree canopy was wider than the approved easement. Directional felling to area of least impact under Project Ecologist supervision
33500	East	Large Coastal Blackbutt directionally felled into area of least impact	Clearing in Telstra services corridor where tree canopy was wider than the approved easement. Directional felling to area of least impact under Project Ecologist supervision
33650	East	Hollow and large trunk sections of Pink Bloodwood	Used as ground habitat logs adjacent to Smiths Road
34450	East	Large Sydney Blue Gum stump from Pipers Creek (30600)	Relocated as ground habitat in Maria River State Forest
34550	West	Habitat tree/stag felled and left <i>in situ</i>	Weather stag left in situ as ground habitat
34820	East	Pink Bloodwood Habitat Tree	HBT520 in Nest Box Plan – Tree with Stephens Banded Snake – relocated to the east.
35070	East	Stag	HBT 529 in Nest Box Plan of Management – sections relocated to the east
35170	East	Tallowwood	HBT 535 south of Middlegate Road – sections relocated to the east
35300	East	Ground habitat log	Moved further to the east.
35350	East	Ground habitat logs x 2	Checked and relocated to the east using harvester
35460	East	Ground habitat log	Broke up into number of section but relocated and piled up
35680	East	Ground habitat log	Checked and relocated to the east using harvester
35810	East	Ground habitat log	Checked and relocated to the east using harvester
35930	East	Large stag	Relocated to western side – HBT575 in Nest Box Plan of Management
36070	East	Ground habitat log	Checked and relocated to the east using harvester
36370	East	Ground habitat log	Checked and relocated to the east using harvester
36450	East	Large Small-fruited Grey Gum	HBT586 in Nest Box Plan – Hollow sections relocated
36575	East	Ground habitat logs x 2	Checked and relocated to the east using harvester
36800	West	Ironbark Stump - Hollow	Relocated as ground habitat with large hollow section suitable as an interim den site for Spotted-tailed Quoll.
37800	West	Large trunk section of Coastal Blackbutt	Relocated as sturdy ground habitat for fauna dispersing under the local service road bridge at Stumpy Creek

### 3.6 Construction Related Injuries and Mortality

#### 3.6.1 Clearing Operations

Fifteen (15) individuals comprising eight species died during mainline clearing (Table 3-9, Appendix B). Nine of these individuals comprising four species (Brown Antechinus, Feathertail Glider, Eastern Forest Bat, Blackish Blind Snake) died from habitat tree removal whilst another five individuals comprising three species were found during general clearing operations (Plate 3-11). The eggs (2) from a Sacred Kingfisher nest were also destroyed as a result of the clearing operations.

The number of individuals attributed to the clearing operations represented 2.8% of terrestrial fauna relocated from the pre-clearing surveys and habitat tree removal. Most (65%) of the mortality was attributed to the HBT removal, particularly those larger trees for which the machinery on site could not lower to the ground, very weathered trees often referred to as “stags” that break apart during the felling, or inexperienced operators simply cutting and directionally felling as opposed to lowering the tree. Fourteen percent of mortalities were attributed to individuals found as road kill within 250 m of the clearing operations. The remaining mortality was attributed to general clearing operations.



Plate 3-11. Eastern Small-eyed Snake recorded during stage 1 clearing operations at ch. 26350 (north of Mobbs Drive).

**Table 3-9:** Fauna injuries and mortality during the clearing phase of the K2K Pacific Highway Upgrade.

Species & No.	Chainage	Location Description	Injuries	Cause of Death
Brown Antechinus (1 ad + 4 young)	25300	100 m south of Mingaletta Road	Crush injury during habitat tree removal	Habitat tree cut and pushed not lowered by the inexperienced operator.
Feather-tail Glider (1 young) – adult and two other young not injured	26100	Mobbs Drive area	Scratch on leg of one of the young during habitat tree removal	Seemed fine and released in leaf nest using short term placement of nest box
Sacred Kingfisher ( two eggs)	26300	North of Mobbs Drive	Eggs cracked during habitat tree removal	Earlier stage of development
Eastern Small-eyed Snake	26350	North of Mobbs Drive	Crush injury during stage 1 habitat removal	Crush injury
Feather-tail Glider x 1 (ad)	29350	Kundabung Road North Side in Services Corridor	Crush injury during habitat tree removal	Manual fall of tree with chainsaw resulting in crush injury
Red-necked Wallaby x 1 (ad)	29670	Smiths Creek Road	Vehicle strike at clearing front	Hit by site work car leading up to clearing operations
Northern Brown Bandicoot x 1 (ad)	30900	Between Pipers Creek and Ravenswood Drive	Crush injury during stage 1 clearing	Struck by mulcher mowing grassed area
Sugar Glider x 1 (ad)	31400	400 m north of Fish Farm	Road strike at clearing front directly related to clearing	Phased reduction of habitat forced animal to move west at day break where it was struck by vehicle
Eastern Blue Tongue Lizard x 1 (ad)	33050	Gate 16 works and batter reshaping	Crush injury during stage 1 habitat removal	Struck during batter reshaping works
Blackish Blind Snake x 1	34100	400 m north of Smiths Road	Crush injury during habitat tree removal	Stag disintegrated during felling
Blackish Blind Snake x 1	35070	300 m south of Middle Gate Road	Crush injury during habitat tree removal	Stag disintegrated during felling
Eastern Forest Bat x 1 (ad)	36100	500m south of Railway Dam Road	Crush injury during habitat tree removal	Directional fall tree at limit of clearing which fell hard across other felled trees

### 3.6.2 Road Kill Monitoring Associated With Clearing Operations

Weekly road kill pre-construction monitoring was performed between mid October (13/10/14) and mid November (10/11/14) recorded 25 individuals comprising 14 mammals (8 species) including two Koala, seven reptiles (3 species) and four birds (3 species; Appendix C; Figure 3-1). No frogs were recorded during this part of the monitoring as the conditions were generally dry at or around the time of sampling. The two Koala were struck on the edge of the north bound lane at ch. 26300 and consisted of an adult female and an almost independent young (Plate 3-12). Two additional Koala were recorded just prior to these surveys in September with an adult male from ch.37850 and what appeared to be an adult female from ch.25400.



Plate 3-12. Koala recorded during the pre-construction weekly road kill monitoring at ch. 26300.

## Pre-Construction Weekly Road Kill Monitoring

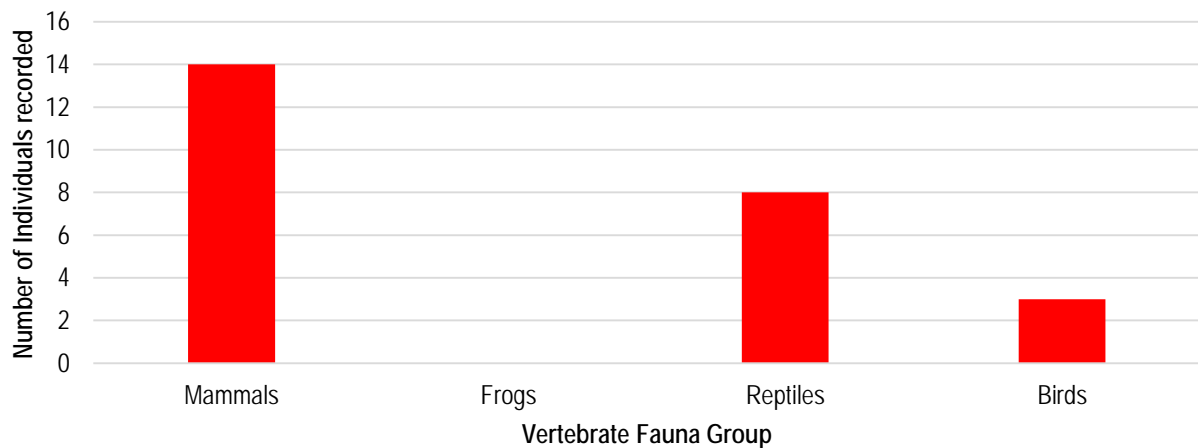


Figure 3-1. Pre-construction weekly road kill monitoring performed in October and November 2014.

Road kill monitoring (223 sample days) performed in the vicinity (250 m) of the clearing operations recorded 313 individuals comprising 27 species (Appendix C; Figure 3-2). This included 47 mammals comprising 12 species with more commonly recorded fauna including Eastern Grey Kangaroo, Red-necked Wallaby, Swamp Wallaby, Northern Brown Bandicoot, Common Ringtail Possum and Common Brushtail Possum. A number of exotic European Rabbit and European Hare were also recorded, particularly around Mobbs Drive, Kundabung and Ravenswood. Marsupial gliders were restricted to a single Sugar Glider with this particular individual observed during the predawn spotlight survey (ch.31400 - Ravenswood) and struck whilst attempting to glide over the existing Pacific Highway. Interestingly,

no Koala were recorded, yet four individuals had been collected as road kill between September and October, just a month or two prior to clearing operations commencing.

Fifteen reptiles were recorded during the monitoring and comprised six species; Lace Monitor; Blackish Blind Snake, Diamond Python, Dwarf-crowned Snake, Eastern Water Dragon and Eastern Blue Tongue Lizard. Most reptiles were recorded during the warmer months, particularly with the onset of spring and warmer weather. Seventeen birds comprising eight species were recorded and included Tawny Frogmouth, Boobook Owl, White-throated Nightjar, Pacific Black Duck, Lewins Honeyeater and Australian Magpie. Precise frog counts and their identification were not possible due to the safety requirements for maintaining set distances away from live traffic (K2K Safety Team pers. comm). The cursory counts showed frogs comprised the majority of the recorded road kill fauna with 235 (75%) individuals and based on various sizes and colours there would have been at least four to five species and probably more. Importantly, none of the observed frogs looked large enough to be considered barred frogs (*Mixophyes spp.*).

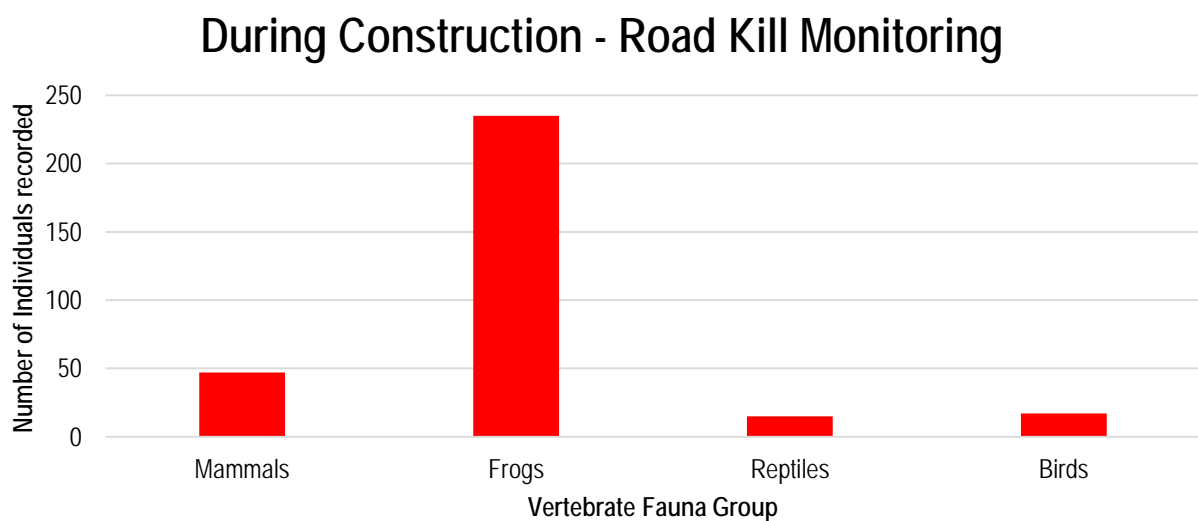


Figure 3-2. Numbers of road kill fauna recorded during construction monitoring.

### 3.7 Aquatic Fauna

Twenty nine (29) aquatic fauna rescues were performed during the construction with 2633 aquatic vertebrates successfully captured and relocated to nearby waterways (Figure 3-3; Appendix D). Most of the captures were native fish with 1384 individuals comprising Striped Gudgeon (*Gobiomorphus australis*), Empire Gudgeon (*Hypseleotris compressa*) and Firetail Gudgeon (*Hypseleotris galii*). Frogs and their tadpoles also comprised a considerable part of the captures with 1167 individuals of both Hylid (tree frogs) and Myobatrachid (ground dwelling) species. Some of these were identified as belonging to threatened frogs, with *Litoria brevipalmata* tadpoles captured and relocated at Pipers Creek north (ch. 30800) and near the southern boundary of Maria River State Forest (ch. 32600). At both locations, the tadpoles were confirmed against metamorphs and juveniles also captured around the pond. The three *Mixophyes* tadpoles captured at Pipers Creek may have been *Mixophyes iteratus* as both species inhabit this drainage line.

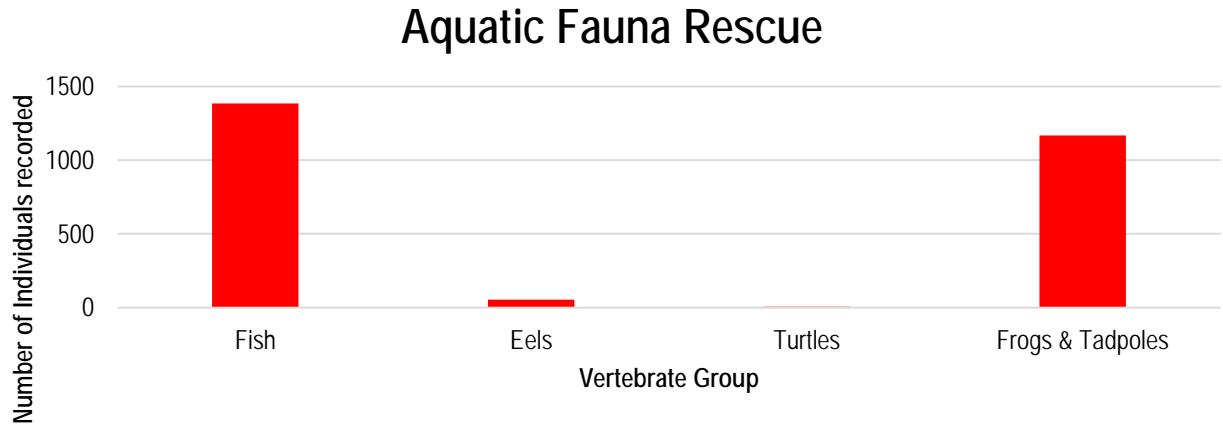


Figure 3-3. Aquatic vertebrate captures during the construction phase of K2K project.

## 4.0 DISCUSSION

### 4.1 Achievement of Mitigation Goals

An assessment of compliance with management goals relevant to the clearing phase is presented in Table 4-1. The conclusion of this assessment is that management goals were generally achieved. Whilst 14 individuals died during the clearing operations, more than 100 individuals of threatened species were successfully captured and relocated. More must be done however with regard to temporary works and how these potentially impact on threatened species. For example, data from pre-clearing surveys was not directly incorporated into relevant species management plans and relied upon during the environmental assessment for temporary works. The timely incorporation of new and additional data into the threatened species management plans is particularly important so that impacts can be minimised.

**Table 4-1.** Assessment of Management Goals.

Document or Plan	Management Goal	Outcome During Clearing
Giant Barred Frog Management Strategy	<p>Avoid, minimise, mitigate and monitor impacts to Giant Barred Frog via a series of actions. They include:</p> <p>Identification and protection of Giant Barred Frog habitat;</p> <p>2. Pre-clearing Surveys to be implemented in four stages of: (i.) Early works when establishing site controls (i.e. clearing limits for clearing and grubbing); (ii) Pre-clearing survey within 5 days of commencing the clearing and grubbing program; (iii) Clearing supervision during the clearing and grubbing program; and (iv) De-watering procedures within areas identified as Giant Barred Frog habitat (i.e. creek diversions).</p> <p>3. Frog fencing in areas of Giant Barred Frog habitat considered in the context of temporary and permanent frog fencing;</p> <p>4. An unexpected finds procedure to address instances where Giant Barred Frogs are detected during routine pre-clearing surveys or at other times during the project.</p> <p>5. Suitable land is identified within the Biodiversity Offset Package which contains a population of Giant barred Frogs.</p> <p>Actions 1, 2, 3 and 4 relevant to this post clearing report.</p>	<p><b><u>1. Identification and protection of Giant Barred Frog habitat</u></b></p> <p>Follow up early works surveys were performed in October and November 2014 at Barrys Creek and Stumpy Creek where the management strategy identified these areas as moderate habitat.</p> <p>At the remaining known locations, Smiths Creek, Pipers Creek and Maria River, temporary frog fencing installed under the supervision and associated surveys of the Project Ecologist.</p> <p><b><u>2. Pre-clearing Surveys</u></b></p> <p>Forty-eight (48) pre-clearing surveys captured nine Giant Barred Frogs from Smiths Creek and Pipers Creek. Frogs were recorded at Maria River but outside the temporary frog fencing and thus didn't require capture.</p> <p><b><u>3. Frog Fencing</u></b></p> <p>Temporary frog fencing was installed for 200 m either side of Smiths Creek, Pipers Creek and Maria River. Informed by additional pre-clearing surveys, no fencing was installed at Barrys Creek whilst Stumpy Creek received permanent frog fencing when it was not required.</p> <p><b><u>4. Unexpected finds procedure</u></b></p> <p>No Giant Barred Frogs were recorded outside of their previously documented areas despite 427 pre-clearing surveys.</p>
Green-thighed Frog Management Strategy	<p>Avoid, minimise, mitigate and monitor impacts to Green-thighed Frog via a series of actions. They include:</p> <p>Identification of Green-thighed Frog habitat</p>	<p><b><u>1. Protection of existing habitat</u></b></p> <p>Limit of clearing defined and minimised in most instances. With regard to stockpile locations near areas</p>

Document or Plan	Management Goal	Outcome During Clearing
	<p>Protection of existing habitat Pre-clearing surveys Creation of breeding ponds Design and installation of permanent frog fencing Unexpected finds procedure linking to strategies 2-5 and 7 Monitoring of the breeding pond areas and associated frog fencing Actions 1, 2, 3 and 6 relevant to this post clearing report.</p>	<p>of sensitive habitat:</p> <ul style="list-style-type: none"> <li>the stockpile adjacent to the ch33600 GtF ponds is 53m to the south of the ponds and located on a section of redundant state forest road;</li> <li>the area to the north of the 30800 GtF mapped habitat was within the project clearing footprint required for carriageway construction and service relocation (power lines and optic fibre); and</li> <li>pre-clearing surveys were undertaken in these areas.</li> </ul> <p><b><u>2. Protection of existing habitat</u></b> At some locations existing habitat was protected via temporary fencing and later permanent fencing in accordance with the strategy.</p> <p><b><u>3. Pre-clearing surveys</u></b> 427 pre-clearing surveys completed. Many of these in areas of known and potential Green-thighed Frog habitat. Some areas were surveyed in excess of 20 occasions over a number of months.  Ninety four (94) Green-thighed Frogs were recorded from three main areas; adjacent to the riparian zone at Smiths Creek (ch. 28000-28600), Pipers Creek (30200-31000) and the southern half of Maria River State Forest (ch. 32600-34000).</p> <p><b><u>6. Unexpected finds procedure linking to strategies 2-5 and 7</u></b> Pre-clearing surveys recorded Green-thighed Frogs on southern side of Smiths Creek (28100E) and the southern part of Maria River State Forest (ch. 32600-33200).  At Smiths Creek, both a temporary and later a permanent frog fence was installed. At Maria River State Forest, compensatory ponds were installed at ch.32650E. Frog fencing was not installed given the distance these ponds are located away from the main carriageway and the lack of suitable habitat on the western side of the road.</p>
Micro Bat Management Strategy	<p>Strategy developed to avoid, minimise and mitigate impacts to microbats and identified roost sites, including short and long term management measures including:</p> <p>Installation of additional roosts Implementing additional field surveys Planned roost exclusion Seasonal limitation of construction works Protection of existing habitat Previously unconsidered structures and unexpected finds Monitoring Requirements</p>	<p>One Eastern Forest Bat (<i>Vespadelus pumilis</i>) was killed during HBT removal.</p> <p><b><u>3. Planned Roost Exclusion</u></b> No microbats were killed during work on culverts identified in the Microbat Management Plan.</p> <p><b><u>4. Seasonal limitation</u></b> Planned roost exclusion took place in September 2014 so as to avoid seasonal limitation. Activities (i.e. bridge washing) at Pipers Creek, Maria River and Stumpy Creek took place within roost exclusion work times or under the advice of the Project Ecologist. No micro</p>



Document or Plan	Management Goal	Outcome During Clearing
	Activities 3, 4, 5 and 6 are considered relevant to this post clearing report.	bats were injured or displaced during these events.  <b>5. Protection of existing habitat</b> Scuppers on the retained Pipers Creek Bridge were re-instated once construction activities had been completed.
Nest Box Plan of Management	Offset the short term loss of tree hollows by installing 60% of the nominated nest boxes prior to or during the clearing works.  Restore or ensure an equitable amount of nest boxes are provided in areas adjacent to the clearing footprint once clearing works have been completed.	156 nest boxes were installed in spring 2014 just prior to clearing commencing.  Post clearing calculations of actual hollows removed revealed the need for an additional 100 nest boxes (see Table A-5). These were installed in March and August 2017.
Construction Flora and Fauna Management Sub-Plan	Conserve native plant community types via reducing the limit of clearing to essential works.	Design reviews and G40 specification walks of the installed pennant flagged limits of clearing were performed in all areas to ensure the limits of clearing were correct and up to date. Project Ecologist was involved to provide ecological advice including unsound trees.
	Identify and protect areas of significant vegetation.	Qualified ecologist performed field survey of existing vegetation communities and to mark out the extent of endangered ecological communities and threatened plant surveys (Smith and Lewis 2014). Moreover, 427 pre-clearing surveys were performed.
	Manage impacts on threatened plant species where possible.	Pre construction vegetation community consistency and targeted threatened plant survey performed (Lewis and Smith 2014).  427 pre-clearing surveys performed.  Recorded Maundia population in Barrys Creek remained in similar area and size.
	Areas of weed infestation will also be identified and documented	A pre construction noxious weed was undertaken just prior to construction commencing (Lewis and Smith 2014).
	Minimise impacts on native fauna during construction.	427 pre-clearing surveys that resulted in the captured of 432 animals (32 species) that were subsequently relocated into adjacent habitat.  Two-staged clearing process was followed.  No Koala were injured during the clearing. Exclusion zones including signage were established on 13 July 2015 when Koala was spotlighted during predawn surveys at ch.36675E.  No koala/vehicle collisions occurred during the clearing phase.  Temporary Koala exclusion fencing installed between 24100-26500 and 32600-33600 to reduce risk of road strike during construction.
	Minimise adverse impacts on aquatic habitat and fish species	Twenty nine (29) aquatic fauna rescues were performed during the construction with 2633 aquatic vertebrates successfully captured and relocated to nearby waterways.

## 4.2 Success of Clearing Phase Fauna Mitigation

### 4.2.1 Clearing Method

Staged clearing involving the removal of trees without hollows and other habitat features (i.e. termitaria, nests and dreys) so that hollow bearing/habitat trees could be retained and left standing for two nights proved useful in reducing the mortality of vertebrate fauna. Due to the staggered nature of clearing, often hollow bearing trees were retained in an exposed state over several days, however, in some cases this extended to several weeks or more due to the mobilisation of machinery to other locations, breakdowns and site shut downs. Over time, this transformation from a closed forest or dry sclerophyll forest to a woodland environment can actually attract other species, particularly highly mobile fauna like parrots, lorikeets and micro bats. To avoid this, a maximum retention time of 21 days in G40 specification would prove useful.

The results show that the first stage of clearing (i.e. all non-HBT) is insufficient to force all animals away from the clearing zone. This is not a surprising outcome given the influence of competition on habitat use and the importance of viable hollows for hollow dependent fauna (Gibbons & Lindenmayer 2002). Competition for space in adjoining vegetation that already contains occupied home ranges will influence the ability of fauna to relocate. This is made more difficult when total canopy separation between HBTs cannot be achieved (i.e. too many in any given area or it is at the limit of clearing) and this in turn reduces the success at encouraging passive dispersal of wildlife over the next two nights. Ultimately, this dispersal can be measured by way of the overall nest box performance as they play a pivotal role in accommodating displaced fauna with the first round of monitoring during winter 2016 and summer 2017 showing 62% occupancy (Lewis 2017).

The utilisation of harvesters in the felling of HBTs had varied success. They were particularly effective during the controlled felling of small (<300 mm dbh) and medium (300-600 mm dbh) habitat trees but less so as trees started to exceed 600 mm dbh and tree canopy heights above 15 m. Whilst the size of the harvester and operator capability play an integral role in determining the fate or success of the controlled felling, only larger harvesters weighing in excess of 40 ton can lower larger habitat trees (i.e. >600mm dbh and canopy height >15 m). The use of excavators or bulldozers to assist these lighter harvesters had mixed outcomes and this was also dependant on the structural integrity of the habitat tree. For example, weather stags would often break apart once they were leaned past 60-70 degrees. Ripping further away from the trunk to create a larger root ball proved a useful counterweight in reducing the intensity of the fall, however, this tended to create more handling for the clearing contractor as more dirt had to be removed during the sheering process ahead of grinding.

Harvesters did prove particularly useful in relocating habitat features such as large fallen ground logs, to cut sections from hollow bearing trees and to relocate sections of felled habitat trees containing fauna. They were also useful at searching large log piles of ground logs (i.e. log dump sites) as large cumbersome pieces could easily be removed and inspected. This proved useful at reducing the stress and any associated mortality when trying to extract fauna

from hollows.

On four occasions where harvesters and bulldozers were unavailable or could not physically access the site, HBTs were felled with a chainsaw. This was carried out with permission from the EPA. Falling trees with hand-held saws increases the risk of mortality, as the impact tends to be greater than if a tree is pushed with the root ball attached. The felling of one large Blue Gum at Pipers Creek (ch. 30600) resulted in a two Southern Myotis taking refuge in a disused Swallow nest on the bridge now used now as Ravenswood Road. The felling of another smaller habitat tree around buried services resulted in the death of a Feathertail Glider. The felling of two large Flooded Gum at Smiths Creek yielded a number of tree frogs and a Diamond Python, none of which were injured.

#### 4.2.2 Impacts on Fauna

A total of 89.15 ha of native vegetation was removed during the clearing phase including 406 habitat trees with 201 confirmed HBTs containing 728 functional hollows. On the K2K Project, 27% of all habitat trees contained either fauna or past evidence of use. Whilst the proportion of use is markedly lower than the neighbouring OH2Ku Project with 49.3% (SES 2015) and Kempsey Bypass with 41% (Lewis 2014), the fauna occupancy was tallied across all habitat trees and not just HBTs. Similarly, occupancy rates or signs of use would be expected if just occupancy rates were calculated for tree hollows and no other habitat features. For example, there were a lot of nests and termitaria marked up as habitat trees given clearing was programmed in spring and summer when many birds nest and kingfishers would excavate cavities in the termitaria.

The K2K Project had a similar proportion of trees with functional hollows to tree inspected (66%) to Oxley Highway to Kundabung (70%) and Kempsey Bypass (61%). On the K2K Project, there was an almost identical number of HBT identified in the nest box plan compared to those that were actually removed during the substantive clearing. In reality, there is likely to have been slightly more HBTs removed as not every hollow could be verified when trees had fallen hard and the limbs had been substantially damaged. For example, many habitat trees were suspected of containing small and medium limb hollows, however, these are the first to disintegrate during a heavy tree fall. If they could not be found, they could not be quantified.

The relatively low occupancy rate and signs of use on the K2K Project does suggest a possible surplus of hollows or the population of hollow dependant fauna is quite low. There are a number of factors that could influence this finding, particularly in relation to habitat productivity and the distribution of foraging resources at the time of clearing operations. The 21 species recorded during habitat tree inspections is less than that recorded on the adjacent OH2Ku Project (28 species) but comparable to the 23 species recorded on the Kempsey Bypass. In comparison with the Kempsey Bypass and the K2K project, the OH2Ku project was almost twice as long, traversing a greater variety of landforms and habitat types.

Mammals, reptiles and to a lesser extent frogs dominated the pre-clearing surveys with many of the captures and

relocations being attributed to frogs and reptiles. These surveys accounted for all of the threatened frog captures including the 94 Green-thighed Frogs and nine Giant Barred Frogs. Pre-clearing surveys also proved useful at capturing a number of the nocturnal reptiles such as the Leaf-tailed Gecko but they only serve to inform what mammals or birds may be using tree hollows, nests or dreys immediately prior to clearing. During the habitat tree removal, reptiles and mammals dominated the number of fauna captures whilst birds and frogs made up 19% of species richness. Small animals like tree skinks (*Egernia* and *Eulamprus spp*) and Feathertail Glider can remain in isolated trees over a number of days and thus the 48 hour waiting period does not allow sufficient dispersal time.

#### 4.2.3 Construction Related Injuries and Mortality

The method of clearing was considered reasonably successful at reducing impacts on local fauna. Whilst 15 individuals comprising nine species died as a result of mainline clearing, none of these were threatened fauna. This is comparable to adjacent Kempsey Bypass where 19 individuals comprising 10 species died as a result of clearing operations. One of the key successes on the K2K Project was the capture and relocation of threatened fauna (Green-thighed Frog, Giant Barred Frog, and Stephens Banded Snake) with 04 individuals without injury. All of the Giant Barred Frogs were micro-chipped and their ultimate fate or success of the relocations is subject to monitoring efforts currently being performed by the RMS.

Mortality rates appear most attributable to large senescent trees, particularly dead stags that often break during the felling process. The phased reduction of habitat resources also causes fauna to disperse and in the case of the K2K Project this meant that some fauna will inevitably move across the existing carriageway and place them at risk of road strike. There was a clear example of this with a Sugar Glider around 400 m north of the fish farm choose to move in a westerly direction at dawn and was struck by a vehicle. Whilst the felling of non-habitat trees can be controlled by progressively working away from live roads, this illustrates some mortality will always arise during substantive clearing events.

#### 4.3 Adequacy of Survey Methods Employed

The survey methods applied during the clearing phase of the K2K project follow standard procedures applied during most of the Pacific Highway upgrades. This included predawn spotlighting to target Koala and other nocturnal fauna, pre-clear inspections involving visual observations and active searches, clearing supervision in sensitive areas such as known Green-thighed Frog and Giant Barred Frog habitat, micro bat roost exclusion surveys, inspections of felled habitat trees, aquatic fauna rescues and road traverses to document road kill. These methods resulted in the capture and relocation of 3172 native vertebrates including 432 individuals from 32 species during the pre-clearing surveys, 107 individuals from 21 species during the habitat tree removal and 2633 aquatic fauna. Survey effort was substantial having been extended from November 2014 through to May 2018 with a total of 511 habitat trees inspected, 427 pre-clear surveys, 66 targeted threaten frog surveys and 29 aquatic fauna rescues. Five ecological staff were involved in the project and 1-2 ecologists were on site most days between early October 2014 and July 2015.

Twelve threatened species were recorded during the clearing phase. Of these species, seven (Giant Barred Frog, Green-thighed Frog, Stephens Banded Snake, Little Bent-wing Bat, Eastern Bent-wing Bat, Southern Myotis and Koala) were considered in direct threat of clearing operations and all were relocated or dispersed without mortality. Overall, the results of fauna rescue during clearing is positive and has satisfied the management goals of key management documents, particularly the Flora and Fauna Management Sub-Plan, Giant Barred Frog Management Strategy, Green-thighed Frog Management Strategy and Microbat Management Strategy that relate to minimising the impact of clearing on fauna.

## 5.0 RECOMMENDATIONS

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Some recommendations include:

1. The post clearing report should be prepared at the end of clearing operations, not at the end of mainline clearing.
2. Sensitive area maps should be updated monthly during clearing operations so that new information from pre clearing surveys can assist additional assessments.
3. A minimum 40 ton limit should be imposed for harvesters felling HBTs. Lighter harvesters cannot achieve the task of lowering habitat trees exceeding 500 mm dbh to the ground.
4. The retention time for HBTs should be maintained at 2 nights. There should also be a maximum time period of 21 days applied in G40 specification *Clearing and Grubbing* so as to avoid other fauna from taking up tree hollows.
5. The retention time for all other habitat features should be at the discretion of the Project Ecologist. Habitat features including dreys and bird nests may need to be removed during the initial clearing to reduce the risk of possums dispersing during the initial clearing event. Similarly, active nests may need to be retained until the chicks have fledged.
6. Operators of machinery should have proven experience with lowering of habitat trees.
7. Large senescent or stag HBTs that cannot be felled gently should be trapped for a minimum of two nights following isolation and prior to felling.
8. The use of targeted spotlighting for a set 60 min per hectare of habitat should be adopted to ensure Green-thighed Frogs are adequately surveyed for during clearing operations. Without it, they are simply not being effectively surveyed.

## 6.0 REFERENCES

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## Appendix A – Field Data

Table A1 – Habitat and fauna capture register during the K2K Upgrade including injuries and fauna release.

Habitat Seq. Num.	Date	Tree species	HBT Ref No.	Habitat Feature	Ent. Diam. (mm)	Depth (mm)	Redist.	Fauna recorded	No.	Signs of use	Injured	Type of injuries	Taken into care	Fauna Release location	Easting	Northing	Ch.	SoC	Notes
1	21-November-2014	White Mahogany	425	Limb Hollow	40	150	No	No fauna	0	None	NA	NA	NA	NA	483103	6542923	24950	East	Sth of Mingaletta Rd
1	21-November-2014	White Mahogany	425	Limb Hollow	60	250	No	No fauna	0	None	NA	NA	NA	NA	483103	6542923	24950	East	Sth of Mingaletta Rd
1	21-November-2014	White Mahogany	425	Limb Hollow	50	200	No	No fauna	0	None	NA	NA	NA	NA	483103	6542923	24950	East	Sth of Mingaletta Rd
1	21-November-2014	White Mahogany	425	Limb Hollow	70	200	No	No fauna	0	None	NA	NA	NA	NA	483103	6542923	24950	East	Sth of Mingaletta Rd
1	21-November-2014	White Mahogany	425	Trunk Hollow	200	1500	No	No fauna		NA	NA	NA	NA	NA	NA		24900-24600	East	Sth of Mingaletta Rd
2	21-November-2014	Stag	426	Trunk Hollow	200	400	No	No fauna	0	Brush-tail Possum	NA	NA	NA	NA	483123	6542933	24970	East	Sth of Mingaletta Rd
3	21-November-2014	Stag	427	Limb Hollow	40	170	No	No fauna	0	None	NA	NA	NA	NA	483113	6542963	24980	East	Sth of Mingaletta Rd
3	21-November-2014	Stag	427	Limb Hollow	70	260	No	No fauna	0	None	NA	NA	NA	NA	483113	6542963	24980	East	Sth of Mingaletta Rd
4	24-November-2014	Stag	429	Trunk Hollow	150	500	No	A. Stuartii	7	leaf nest	No	Only babies	Yes	JV organised a carer	483113	6542963	24900-24600	East	Sth of Mingaletta Rd
5	24-November-2014	Pink Bloodwood	428	Limb Hollow	100	600	No	No fauna	0	NA	NA	NA	NA	NA	483121	6542974	24900-24600	East	Sth of Mingaletta Rd
5	24-November-2014	Pink Bloodwood	428	Limb Hollow	70	400	No	No fauna	0	NA	NA	NA	NA	NA	483121	6542974	24900-24600	East	Sth of Mingaletta Rd
6	27-November-2014	Forest Red Gum	367	Limb Hollow	60	200	No	No fauna	0	NA	NA	NA	NA	NA	483098	6542727	24700-24900	East	Sth of Mingaletta Rd
7	27-November-2014	Stag	366	Limb Hollow	50	2000	No	Bar-sided Skink	1	No	No	No	No	release adjacent to site >100 m away from clearing	483105	6542740	24700-24900	East	Sth of Mingaletta Rd
8	27-November-2014	Brush Box	na	Limb Hollow	100	350	No	Bar-sided Skink	1	No	No	No	No	release adjacent to site >100 m away from clearing	483024	483024	24700-24900	East	Sth of Mingaletta Rd
8	27-November-2014	Brush Box	na	Limb Hollow	40	200	No	Diamond Python	1	No	No	No	No	release adjacent to site >100 m away from clearing	483024	483024	24700-24900	East	Sth of Mingaletta Rd
9	28-November-2014	Stag	na	Termitaria	none	none	No	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	24800-24537	East	Sth of Mingaletta Rd
10	28-November-2014	White Stringybark	na	Termitaria	none	none	No	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	24800-24537	East	Sth of Mingaletta Rd
11	28-November-2014	White Stringybark	na	Termitaria	none	none	No	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	24800-24537	East	Sth of Mingaletta Rd
12	28-November-2014	White Stringybark	na	Limb Hollow	40	200	No	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	24800-24537	East	Sth of Mingaletta Rd
13	28-November-2014	Stag	na	Limb Hollow	40	100	No	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	24800-24537	East	Sth of Mingaletta Rd
13	28-November-2014	Stag	na	Limb Hollow	30	150	No	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	24800-24537	East	Sth of Mingaletta Rd
14	28-November-2014	Stag	na	Limb Hollow	40	150	No	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	24800-24537	East	Sth of Mingaletta Rd
14	28-November-2014	Stag	na	Limb Hollow	40	100	No	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	24800-24537	East	Sth of Mingaletta Rd
15	28-November-2014	White Mahogany	na	Limb Hollow	30	120	No	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	24800-24700	East	Sth of Mingaletta Rd
15	28-November-2014	White Mahogany	na	Limb Hollow	30	120	No	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	24800-24700	East	Sth of Mingaletta Rd
16	28-November-2014	White Mahogany	na	None	none	none	No	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	24800-24700	East	Sth of Mingaletta Rd
17	28-November-2014	Stag	na	Trunk Hollow	70	200	No	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	24800-24700	East	Sth of Mingaletta Rd
17	28-November-2014	Stag	na	Trunk Hollow	80	300	No	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	24800-24700	East	Sth of Mingaletta Rd
17	28-November-2014	Stag	na	Limb Hollow	40	160	No	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	24800-24700	East	Sth of Mingaletta Rd



Habitat Seq. Num.	Date	Tree species	HBT Ref No.	Habitat Feature	Ent. Diam. (mm)	Depth (mm)	Redist.	Fauna recorded	No.	Signs of use	Injured	Type of injuries	Taken into care	Fauna Release location	Easting	Northing	Ch.	SoC	Notes
17	28-November-2014	Stag	na	Limb Hollow	30	100	No	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	24800-24700	East	Sth of Mingaletta Rd
18	28-November-2014	White Mahogany	na	None	none	none	No	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	24800-24700	East	Sth of Mingaletta Rd
19	28-November-2014	Coastal Blackbutt	na	Limb Hollow	40	150	No	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	24800-24700	East	Sth of Mingaletta Rd
20	28-November-2014	Stag	na	Trunk Hollow	200	500	No	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	24800-24700	East	Sth of Mingaletta Rd
20	28-November-2014	Stag	na	Limb Hollow	40	200	No	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	24800-24700	East	Sth of Mingaletta Rd
21	28-November-2014	White Mahogany	na	Limb Hollow	40	200	No	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	24800-24700	East	Sth of Mingaletta Rd
22	28-November-2014	Stag	na	Limb Hollow	30	100	No	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	35600-35200	East	Jones Rest to Middle Gate Rd
22	28-November-2014	Stag	na	Limb Hollow	40	200	No	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	35600-35200	East	Jones Rest to Middle Gate Rd
22	28-November-2014	Stag	na	Limb Hollow	40	100	No	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	35600-35200	East	Jones Rest to Middle Gate Rd
23	28-November-2014	Pink Bloodwood	na	Trunk Hollow	200	250	No	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	35600-35200	East	Jones Rest to Middle Gate Rd
24	28-November-2014	White Stringybark	na	Limb Hollow	40	100	No	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	35600-35200	East	Jones Rest to Middle Gate Rd
24	28-November-2014	White Stringybark	na	Limb Hollow	100	200	No	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	35600-35200	East	Jones Rest to Middle Gate Rd
24	28-November-2014	White Stringybark	na	Limb Hollow	30	100	No	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	35600-35200	East	Jones Rest to Middle Gate Rd
24	28-November-2014	White Stringybark	na	Limb Hollow	40	150	No	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	35600-35200	East	Jones Rest to Middle Gate Rd
25	28-November-2014	Coastal Blackbutt	na	Limb Hollow	40	180	No	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	35600-35200	East	Jones Rest to Middle Gate Rd
25	28-November-2014	Coastal Blackbutt	na	Limb Hollow	40	100	No	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	35600-35200	East	Jones Rest to Middle Gate Rd
25	28-November-2014	Coastal Blackbutt	na	Limb Hollow	30	150	No	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	35600-35200	East	Jones Rest to Middle Gate Rd
25	28-November-2014	Coastal Blackbutt	na	Limb Hollow	30	100	No	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	35600-35200	East	Jones Rest to Middle Gate Rd
26	28-November-2014	Coastal Blackbutt	na	Limb Hollow	40	90	No	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	35600-35200	East	Jones Rest to Middle Gate Rd
27	28-November-2014	Stag	na	Trunk Hollow	100	200	No	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	35600-35200	East	Jones Rest to Middle Gate Rd
28	28-November-2014	White Stringybark	na	Termitaria	na	na	No	No fauna	0	Yes - cavity excavated	NA	NA	NA	NA	Not recorded	Not recorded	35600-35200	East	Jones Rest to Middle Gate Rd
29	28-November-2014	Stag	na	Trunk Hollow	40	180	No	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	35600-35200	East	Jones Rest to Middle Gate Rd
30	28-November-2014	Stag	na	None	na	na	na	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	35600-35200	East	Jones Rest to Middle Gate Rd
31	28-November-2014	Stag	na	None	na	na	na	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	35600-35200	East	Jones Rest to Middle Gate Rd
32	28-November-2014	Coastal Blackbutt	na	Limb Hollow	30	100	na	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	35600-35200	East	Jones Rest to Middle Gate Rd
32	28-November-2014	Coastal Blackbutt	na	Limb Hollow	30	100	na	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	35600-35200	East	Jones Rest to Middle Gate Rd
33	28-November-2014	White Stringybark	na	Limb Hollow	40	120	na	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	35600-35200	East	Jones Rest to Middle Gate Rd
34	28-November-2014	Stag	na	None	na	na	na	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	35600-35200	East	Jones Rest to Middle Gate Rd

Habitat Seq. Num.	Date	Tree species	HBT Ref No.	Habitat Feature	Ent. Diam. (mm)	Depth (mm)	Redist.	Fauna recorded	No.	Signs of use	Injured	Type of injuries	Taken into care	Fauna Release location	Eastings	Northing	Ch.	SoC	Notes
35	28-November-2014	White Stringybark	na	Limb Hollow	40	130	na	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	35600-35200	East	Jones Rest to Middle Gate Rd
36	28-November-2014	Hollow Log	na	Hollow Log - missing (already cleared)	na	na	na	Na	na	na	na	na	na	na	na	na	35600-35200	East	Jones Rest to Middle Gate Rd - removed without inspection by ecologist
37	28-November-2014	White Mahogany	na	None	na	na	na	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	35600-35200	East	Jones Rest to Middle Gate Rd
38	28-November-2014	White Mahogany	na	None	na	na	na	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	35600-35200	East	Jones Rest to Middle Gate Rd
39	28-November-2014	White Mahogany	na	None	na	na	na	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	35600-35200	East	Jones Rest to Middle Gate Rd
40	28-November-2014	White Mahogany	na	None	na	na	na	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	35600-35200	East	Jones Rest to Middle Gate Rd
41	28-November-2014	Coastal Blackbutt	na	Limb Hollow	40	200	No	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	35600-35200	East	Jones Rest to Middle Gate Rd
42	28-November-2014	Coastal Blackbutt	na	None	na	na	na	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	35600-35200	East	Jones Rest to Middle Gate Rd
43	28-November-2014	Coastal Blackbutt	na	None	na	na	na	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	35600-35200	East	Jones Rest to Middle Gate Rd
44	28-November-2014	White Stringybark	na	None	na	na	na	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	35600-35200	East	Jones Rest to Middle Gate Rd
45	28-November-2014	Stag	na	None	na	na	na	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	35600-35200	East	Jones Rest to Middle Gate Rd
46	28-November-2014	Pink Bloodwood	na	None	na	na	na	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	35600-35200	East	Jones Rest to Middle Gate Rd
47	28-November-2014	White Stringybark	na	Limb Hollow	40	200	No	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	35600-35200	East	Jones Rest to Middle Gate Rd
47	28-November-2014	White Stringybark	na	Limb Hollow	30	100	No	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	35600-35200	East	Jones Rest to Middle Gate Rd
48	28-November-2014	White Stringybark	na	none	na	na	na	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	35600-35200	East	Jones Rest to Middle Gate Rd
49	28-November-2014	White Stringybark	na	none	na	na	na	No fauna	0	None	NA	NA	NA	NA	Not recorded	Not recorded	35600-35200	East	Jones Rest to Middle Gate Rd
50	02-December-2014	Hollow Log	na	Hollow Log	100	400	Yes	No fauna	0	None	NA	NA	NA	NA	483101	6542814	24537-24800	East	Sth of Mingaletta Rd - GPS 1103
51	02-December-2014	Stag	na	Trunk	300	10000	No	<i>Cyclodo morphus gerrardii</i> x 2 , <i>Eulamprus tenuis</i> x 1	3	Active	No	NA	NA	>20m outside clearance limit into a hollow log	483005	6542634	24537-24800	Easter n side	Sth of Mingaletta Rd - GPS 1104
51	02-December-2014	Stag	na	Limb	80	1000	No	No fauna	0	None	NA	NA	NA	NA	483005	6542634	24537-24800	Easter n side	Sth of Mingaletta Rd - GPS 1104
52	02-December-2014	Stag	na	None	NA	NA	NA	No fauna	0	None	NA	NA	NA	NA	483009	6542611	24537-24800	Easter n side	Sth of Mingaletta Rd
53	02-December-2014	Stag	361	Limb	500	1000	No	No fauna	0	None	NA	NA	NA	NA	482984	6542671	24537-24800	Easter n side	Sth of Mingaletta Rd
53	02-December-2014	Stag	361	Limb	100	250	No	No fauna	0	None	NA	NA	NA	NA	482984	6542671	24537-24800	Easter n side	Sth of Mingaletta Rd
54	02-December-2014	White Mahogany	360	Limb	200	1000	No	<i>E. tenuis</i> x1	1	None	No	NA	NA	>20m outside clearance limit into a hollow log	482981	6542683	24537-24800	Easter n side	Sth of Mingaletta Rd
54	02-December-2014	White Mahogany	360	Termitaria	na	na	No	No fauna	1	None	No	NA	NA	NA	482981	6542683	24537-24800	Easter n side	Sth of Mingaletta Rd
55	02-December-2014	Pink Bloodwood	362	Limb	200	500	No	No fauna	0	None	NA	NA	NA	NA	482960	6542669	24537-24800	Easter n side	Sth of Mingaletta Rd
55	02-December-2014	Pink Bloodwood	362	Limb	70	280	No	No fauna	0	None	NA	NA	NA	NA	482960	6542669	24537-24800	Easter n side	Sth of Mingaletta Rd

Habitat Seq. Num.	Date	Tree species	HBT Ref No.	Habitat Feature	Ent. Diam. (mm)	Depth (mm)	Redist.	Fauna recorded	No.	Signs of use	Injured	Type of injuries	Taken into care	Fauna Release location	Easting	Northing	Ch.	SoC	Notes
56	02-December-2014	Stag	NA	NA	NA	NA	NA	None	0	No	NA	NA	NA	NA				Easter n side	Termite plug
57	02-December-2014	White Mahogany	NA	Trunk	200	400	No	None	0	No	NA	NA	NA	NA				Easter n side	
58	02-December-2014	Stag	NA	Limb	50	100	No	None	0	No	NA	NA	NA	NA				Easter n side	
59	02-December-2014	Coastal Blackbutt	NA	Limb	50	100	No	None	0	No	NA	NA	NA	NA				Easter n side	
59	02-December-2014	Coastal Blackbutt	NA	Limb	50	100	No	None	0	No	NA	NA	NA	NA				Easter n side	
59	02-December-2014	Coastal Blackbutt	NA	Limb	50	150	No	None	0	No	NA	NA	NA	NA				Easter n side	
60	02-December-2014	White Stringybark	NA	Limb	50	100	No	None	0	No	NA	NA	NA	NA				Easter n side	
60	02-December-2014	White Stringybark	NA	Limb	70	250	No	None	0	No	NA	NA	NA	NA				Easter n side	
60	02-December-2014	White Stringybark	NA	Limb	150	450	No	None	0	No	NA	NA	NA	NA				Easter n side	
61	02-December-2014	Coastal Blackbutt	na	na	na	na	na	None	0	No	NA	NA	NA	NA				Easter n side	
62	02-December-2014	Stag	na	na	na	na	na	None	0	No	NA	NA	NA	NA				Easter n side	Termite plug
63	02-December-2014	White Mahogany	na	Trunk	200	400	No	None	0	No	NA	NA	NA	NA				Easter n side	
64	02-December-2014	Stag	na	Limb	50	100	No	None	0	No	NA	NA	NA	NA				Easter n side	
65	02-December-2014	Coastal Blackbutt	na	Limb	50	100	No	None	0	No	NA	NA	NA	NA				Easter n side	
65	02-December-2014	Coastal Blackbutt	na	Limb	50	100	No	None	0	No	NA	NA	NA	NA				Easter n side	
66	02-December-2014	White Stringybark	na	Limb	50	100	No	None	0	No	NA	NA	NA	NA				Easter n side	
66	02-December-2014	White Stringybark	na	Limb	70	250	No	None	0	No	NA	NA	NA	NA				Easter n side	
66	02-December-2014	White Stringybark	na	Limb	150	450	No	None	0	No	NA	NA	NA	NA				Easter n side	Blind hollow
67	02-December-2014	Coastal Blackbutt	na	na	na	na	No	None	0	No	NA	NA	NA	NA				Easter n side	
68	03-December-2014	White Mahogany	363	Limb	100	150	No	None	0	No	NA	NA	NA	NA	483024	6542767	24500-24537	Easter n side	Sth of Mingaletta Rd
68	03-December-2014	White Mahogany	363	Limb	100	100	No	None	0	No	NA	NA	NA	NA	483024	6542767	24500-24537	Easter n side	Sth of Mingaletta Rd
69	03-December-2014	Stag	364	Limb	400	400	No	None	0	Leaf nest	NA	NA	NA	NA	483032	6542770	24500-24537	Easter n side	Sth of Mingaletta Rd
69	03-December-2014	Stag	364	Trunk	300	1700	No	<i>Antechinus stuartii</i> (1 adult + 7 young)	8	Leaf nest	No	NA	No	left in nest box at the base of a tree with a basal hollow 70 m away from the clearance limit at ch. 24950,	483032	6542770	24500-24537	Easter n side	Sth of Mingaletta Rd
70	03-December-2014	Stag	365	Limb	150	300	No	None	1	None	NA	NA	No	leaf at base of stag tree 75 m from clearance limit	483049	6542784	24500-24537	Easter n side	Sth of Mingaletta Rd
70	03-December-2014	Stag	365	Limb	180	250	No	None	0	None	NA	NA	NA	NA	483049	6542784	24500-24537	Easter n side	Sth of Mingaletta Rd
70	03-December-2014	Stag	365	Limb	250	250	No	None	0	None	NA	NA	NA	NA	483049	6542784	24500-24537	Easter n side	Sth of Mingaletta Rd
70	03-December-2014	Stag	365	Limb	450	1600	No	<i>Cyclodorus gerrardii</i>	2	Live capture	No	NA	NA	20 m to east of clearing footprint around fallen ground timber	483049	6542784	24500-24537	Easter n side	Sth of Mingaletta Rd

Habitat Seq. Num.	Date	Tree species	HBT Ref No.	Habitat Feature	Ent. Diam. (mm)	Depth (mm)	Redist.	Fauna recorded	No.	Signs of use	Injured	Type of injuries	Taken into care	Fauna Release location	Easting	Northing	Ch.	SoC	Notes
70	03-December-2014	Stag	365	Limb	350	400	No	None	0	None	NA	NA	NA	NA	483049	6542784	24500-24537	Easter n side	Sth of Mingaletta Rd
70	03-December-2014	Stag	365	Limb	100	200	No	None	0	None	NA	NA	NA	NA	483049	6542784	24500-24537	Easter n side	Sth of Mingaletta Rd
70	03-December-2014	Stag	365	Limb	150	100	No	None	0	None	NA	NA	NA	NA	483049	6542784	24500-24537	Easter n side	Sth of Mingaletta Rd
70	03-December-2014	Stag	365	Trunk	150	800	No	<i>Eulamprus tenuis</i>	1	Live capture	No	None	No	20 m to east of clearing footprint around fallen ground timber	483049	6542784	24500-24537	Easter n side	Sth of Mingaletta Rd
70	03-December-2014	Stag	365	Trunk	150	100	No	None	0	None	NA	NA	NA	NA	483049	6542784	24500-24537	Easter n side	Sth of Mingaletta Rd
70	03-December-2014	Stag	365	Trunk	200	900	No	None	0	None	NA	NA	NA	NA	483049	6542784	24500-24537	Easter n side	Sth of Mingaletta Rd
71	04-December-2014	Stag	na	Trunk	400	650	No	None	0	None	NA	NA	NA	NA					
71	04-December-2014	Stag	na	Limb	180	200	No	None	0	No	NA	NA	NA	NA					
72	04-December-2014	Stag	na	Limb	100	200	No	None	0	No	NA	NA	NA	NA					
73	04-December-2014	Coastal Blackbutt	na	None	na	na	No	None	0	No	NA	NA	NA	NA					Blind hollow
74	04-December-2014	Pink Bloodwood	na	Limb	300	300	No	None	0	No	NA	NA	NA	NA					
74	04-December-2014	Pink Bloodwood	na	Limb	150	500	No	None	0	No	NA	NA	NA	NA					
74	04-December-2014	Pink Bloodwood	na	Limb	150	200	No	None	0	No	NA	NA	NA	NA					
75	04-December-2014	Stag	na	Trunk	100	400	No	None	0	No	NA	NA	NA	NA					Ants nest
75	04-December-2014	Stag	na	Limb	200	100	No	None	0	No	NA	NA	NA	NA					Ants nest
75	04-December-2014	Stag	na	Limb	200	200	No	None	0	Leaf nest	NA	NA	NA	NA					
75	04-December-2014	Stag	na	Limb	50	200	No	None	0	No	NA	NA	NA	NA					
75	04-December-2014	Stag	na	Limb	40	150	No	None	0	No	NA	NA	NA	NA					
76	04-December-2014	Coastal Blackbutt	na	Limb	300	1700	No	None	0	No	NA	NA	NA	NA					HBT number faded
76	04-December-2014	Coastal Blackbutt	na	Limb	250	1000	No	None	0	No	NA	NA	NA	NA					
76	04-December-2014	Coastal Blackbutt	na	Limb	250	900	No	None	0	No	NA	NA	NA	NA					
76	04-December-2014	Coastal Blackbutt	na	Limb	50	200	No	None	0	No	NA	NA	NA	NA					
76	04-December-2014	Coastal Blackbutt	na	Limb	50	200	No	None	0	No	NA	NA	NA	NA					
76	04-December-2014	Coastal Blackbutt	na	Limb	70	400	No	None	0	No	NA	NA	NA	NA					
76	04-December-2014	Coastal Blackbutt	na	Limb	150	1100	No	None	0	No	NA	NA	NA	NA					Ants nest
76	04-December-2014	Coastal Blackbutt	na	Limb	200	50	No	None	0	No	NA	NA	NA	NA					Ants nest
76	04-December-2014	Coastal Blackbutt	na	Limb	150	100	No	None	0	No	NA	NA	NA	NA					
76	04-December-2014	Coastal Blackbutt	na	Trunk	80	300	No	None	0	No	NA	NA	NA	NA					
76	04-December-2014	Coastal Blackbutt	na	Trunk	100	900	No	None	0	No	NA	NA	NA	NA					
76	04-December-2014	Coastal Blackbutt	na	Trunk	150	400	No	None	0	No	NA	NA	NA	NA					
77	04-December-2014	Stag	na	Trunk	300	500	No	None	0	Old birds nest in hollow	NA	NA	NA	NA					
78	04-December-2014	Stag	na	Trunk	150	300	No	None	0	Leaf nest	NA	NA	NA	NA					
79	04-December-2014	Red Mahogany	na	Termitaria	NA	NA	No	None	0	Old kingfisher nest	NA	NA	NA	NA					
80	04-December-2014	Coastal Blackbutt	na	Limb	100	100	No	None	0	No	NA	NA	NA	NA					
80	04-December-2014	Coastal Blackbutt	na	Limb	70	100	No	None	0	No	NA	NA	NA	NA					
81	04-December-2014	Pink Bloodwood	na	Limb	50	150	No	<i>Eulamprus tenuis</i>	2	No	No	NA	No	100 metres east of chainage 35300	483112	6553224			
81	04-December-2014	Pink Bloodwood	na	Limb	400	400	No	None	0	No	NA	NA	NA	NA					
82	04-December-2014	White Mahogany	553	Limb	100	300	No	None	0	No	NA	NA	NA	NA					HBT number faded
82	04-December-2014	White Mahogany	553	Limb	70	350	No	None	0	No	NA	NA	NA	NA					
82	04-December-2014	White Mahogany	553	Limb	70	150	No	None	0	No	NA	NA	NA	NA					
82	04-December-2014	White Mahogany	553	Limb	50	200	No	None	0	No	NA	NA	NA	NA					
83	04-December-2014	Stag	NONE	na	na	na	na	None	0	No	NA	NA	NA	NA					

Habitat Seq. Num.	Date	Tree species	HBT Ref No.	Habitat Feature	Ent. Diam. (mm)	Depth (mm)	Redist.	Fauna recorded	No.	Signs of use	Injured	Type of injuries	Taken into care	Fauna Release location	Easting	Northing	Ch.	SoC	Notes
84	04-December-2014	Stag	NONE	na	na	na	na	None	0	No	NA	NA	NA	NA					
85	04-December-2014	Stag	554	Trunk	150	300	No	None	0	No	NA	NA	NA	NA					
85	04-December-2014	Stag	554	Limb	350	200	No	None	0	Leaf nest	NA	NA	NA	NA				East	HBT number faded
86	04-December-2014	Coastal Blackbutt	550	Limb	250	300	No	None	0	No	NA	NA	NA	NA					
86	04-December-2014	Coastal Blackbutt	550	Limb	200	200	No	None	0	No	NA	NA	NA	NA					Ants nest
86	04-December-2014	Coastal Blackbutt	550	Limb	100	200	No	None	0	No	NA	NA	NA	NA					
86	04-December-2014	Coastal Blackbutt	550	Limb	50	300	No	None	0	No	NA	NA	NA	NA					
87	04-December-2014	Stag	555	Limb	50	100	No	None	0	No	NA	NA	NA	NA					HBT number faded
88	04-December-2014	Coastal Blackbutt	547	Limb	50	100	No	None	0	No	NA	NA	NA	NA					
88	04-December-2014	Coastal Blackbutt	547	Limb	70	150	No	None	0	No	NA	NA	NA	NA					
89	04-December-2014	Coastal Blackbutt	560	Limb	200	600	No	None	0	Leaf nest	NA	NA	NA	NA					HBT number faded
89	04-December-2014	Coastal Blackbutt	560	Limb	150	400	No	None	0	No	NA	NA	NA	NA					
89	04-December-2014	Coastal Blackbutt	560	Limb	70	800	No	None	0	No	NA	NA	NA	NA					
90	04-December-2014	Pink Bloodwood	545	Limb	70	100	No	<i>Eulamprus tenuis</i>	1	No	No	None	No	100 metres East of chainage 35300	483112	6553224			HBT number faded
90	04-December-2014	Pink Bloodwood	545	Limb	100	200	No	None	0	No	NA	NA	NA	NA					
91	04-December-2014	Pink Bloodwood	547	Limb	50	90	No	None	0	No	NA	NA	NA	NA					HBT number faded
92	04-December-2014	Coastal Blackbutt	548	Limb	300	500	No	None	0	No	NA	NA	NA	NA					HBT number faded
92	04-December-2014	Coastal Blackbutt	548	Limb	200	100	No	None	0	No	NA	NA	NA	NA					Ants nest
92	04-December-2014	Coastal Blackbutt	548	Limb	150	100	No	None	0	No	NA	NA	NA	NA					Ants nest
92	04-December-2014	Coastal Blackbutt	548	Limb	100	300	No	None	0	No	NA	NA	NA	NA					
92	04-December-2014	Coastal Blackbutt	548	Limb	100	100	No	None	0	No	NA	NA	NA	NA					
92	04-December-2014	Coastal Blackbutt	548	Limb	60	100	No	None	0	No	NA	NA	NA	NA					
92	04-December-2014	Coastal Blackbutt	548	Limb	40	150	No	None	0	No	NA	NA	NA	NA					
92	04-December-2014	Coastal Blackbutt	548	Limb	40	150	No	None	0	No	NA	NA	NA	NA					
93	04-December-2014	Stag	na	Trunk	400	650	No	None	0	No	NA	NA	NA	NA					
93	04-December-2014	Stag	na	Limb	180	200	No	None	0	No	NA	NA	NA	NA					
94	04-December-2014	Stag	na	Limb	100	200	No	None	0	No	NA	NA	NA	NA					
95	04-December-2014	Coastal Blackbutt	na	None	na	na	No	None	0	No	NA	NA	NA	NA					Blind hollow
96	04-December-2014	Pink Bloodwood	549	Limb	300	300	No	None	0	No	NA	NA	NA	NA					
96	04-December-2014	Pink Bloodwood	549	Limb	150	500	No	None	0	No	NA	NA	NA	NA					
96	04-December-2014	Pink Bloodwood	549	Limb	150	200	No	None	0	No	NA	NA	NA	NA					
97	04-December-2014	Stag	555	Trunk	100	400	No	None	0	No	NA	NA	NA	NA					Ants nest
97	04-December-2014	Stag	555	Limb	200	100	No	None	0	No	NA	NA	NA	NA					Ants nest
97	04-December-2014	Stag	555	Limb	200	200	No	None	0	Leaf nest	NA	NA	NA	NA					Old glider nest
97	04-December-2014	Stag	555	Limb	50	200	No	None	0	No	NA	NA	NA	NA					
97	04-December-2014	Stag	555	Limb	40	150	No	None	0	No	NA	NA	NA	NA					
98	04-December-2014	Coastal Blackbutt	552	Limb Hollow	300	1700	No	None	0	No	NA	NA	NA	NA					HBT number faded
98	04-December-2014	Coastal Blackbutt	552	Limb Hollow	250	1000	No	None	0	No	NA	NA	NA	NA					
98	04-December-2014	Coastal Blackbutt	552	Limb Hollow	250	900	No	None	0	No	NA	NA	NA	NA					
98	04-December-2014	Coastal Blackbutt	552	Limb Hollow	50	200	No	None	0	No	NA	NA	NA	NA					
98	04-December-2014	Coastal Blackbutt	552	Limb Hollow	50	200	No	None	0	No	NA	NA	NA	NA					
98	04-December-2014	Coastal Blackbutt	552	Limb Hollow	70	400	No	None	0	No	NA	NA	NA	NA					
98	04-December-2014	Coastal Blackbutt	552	Limb Hollow	150	1100	No	None	0	No	NA	NA	NA	NA					Ants nest
98	04-December-2014	Coastal Blackbutt	552	Limb Hollow	200	50	No	None	0	No	NA	NA	NA	NA					Ants nest
98	04-December-2014	Coastal Blackbutt	552	Limb Hollow	150	100	No	None	0	No	NA	NA	NA	NA					
98	04-December-2014	Coastal Blackbutt	552	Trunk	80	300	No	None	0	No	NA	NA	NA	NA					
98	04-December-2014	Coastal Blackbutt	552	Trunk	100	900	No	None	0	No	NA	NA	NA	NA					
98	04-December-2014	Coastal Blackbutt	552	Trunk	150	400	No	None	0	No	NA	NA	NA	NA					
99	04-December-2014	Stag	na	Trunk	300	500	No	None	0	Old birds nest in hollow	NA	NA	NA	NA					Old not recent

Habitat Seq. Num.	Date	Tree species	HBT Ref No.	Habitat Feature	Ent. Diam. (mm)	Depth (mm)	Redist.	Fauna recorded	No.	Signs of use	Injured	Type of injuries	Taken into care	Fauna Release location	Easting	Northing	Ch.	SoC	Notes
100	04-December-2014	Stag	na	Trunk	150	300	No	None	0	Leaf nest	NA	NA	NA	NA					
101	04-December-2014	Red Mahogany	na	Termitaria	na	na	No	None	0	Old kingfisher nest	NA	NA	NA	NA					
102	04-December-2014	Coastal Blackbutt	na	Limb	100	100	No	None	0	No	NA	NA	NA	NA					
102	04-December-2014	Coastal Blackbutt	na	Limb	70	100	No	None	0	No	NA	NA	NA	NA					
103	04-December-2014	Pink Bloodwood	na	Limb	50	150	No	<i>Eulamprus tenuis</i>	2	No	No	NA	No	100 metres East of chainage 35300	483112	6553224			
103	04-December-2014	Pink Bloodwood	na	Limb	400	400	No	None	0	No	NA	NA	NA	NA					
104	04-December-2014	Coastal Blackbutt	563	Limb	100	300	No	None	0	No	NA	NA	NA	NA					HBT number faded
104	04-December-2014	Coastal Blackbutt	563	Limb	70	350	No	None	0	No	NA	NA	NA	NA					
104	04-December-2014	Coastal Blackbutt	563	Limb	70	150	No	None	0	No	NA	NA	NA	NA					
104	04-December-2014	Coastal Blackbutt	563	Limb	50	200	No	None	0	No	NA	NA	NA	NA					
105	04-December-2014	Stag	na	None	na	na	na	None	0	No	NA	NA	NA	NA					
106	04-December-2014	Stag	na	None	na	na	na	None	0	No	NA	NA	NA	NA					
107	04-December-2014	Stag	561	Trunk	150	300	No	None	0	No	NA	NA	NA	NA					
107	04-December-2014	Stag	561	Limb	350	200	No	None	0	Leaf nest	NA	NA	NA	NA					HBT number faded
108	04-December-2014	Coastal Blackbutt	550	Limb	250	300	No	None	0	No	NA	NA	NA	NA					
108	04-December-2014	Coastal Blackbutt	550	Limb	200	200	No	None	0	No	NA	NA	NA	NA					Ants nest
108	04-December-2014	Coastal Blackbutt	550	Limb	100	200	No	None	0	No	NA	NA	NA	NA					
108	04-December-2014	Coastal Blackbutt	550	Limb	50	300	No	None	0	No	NA	NA	NA	NA					
109	04-December-2014	Stag	546	Limb	50	100	No	None	0	No	NA	NA	NA	NA					HBT number faded
110	04-December-2014	Coastal Blackbutt	547	Limb	50	100	No	None	0	No	NA	NA	NA	NA					
110	04-December-2014	Coastal Blackbutt	547	Limb	70	150	No	None	0	No	NA	NA	NA	NA					
111	04-December-2014	Coastal Blackbutt	552	Limb	200	600	No	None	0	Leaf nest	NA	NA	NA	NA					HBT number faded
111	04-December-2014	Coastal Blackbutt	552	Limb	150	400	No	None	0	No	NA	NA	NA	NA					
111	04-December-2014	Coastal Blackbutt	552	Limb	70	800	No	None	0	No	NA	NA	NA	NA					
112	04-December-2014	Pink Bloodwood	545	Limb	70	100	No	<i>Eulamprus tenuis</i>	1	No	No	None	No	100 metres East of chainage 35300	483112	6553224			HBT number faded
112	04-December-2014	Pink Bloodwood	545	Limb	100	200	No	None	0	No	NA	NA	NA	NA					
113	04-December-2014	Pink Bloodwood	549	None	na	na	No	None	0	No	NA	NA	NA	NA					Blind hollows
114	04-December-2014	Coastal Blackbutt	551	Limb	300	500	No	None	0	No	NA	NA	NA	NA					HBT number faded
114	04-December-2014	Coastal Blackbutt	551	Limb	200	100	No	None	0	No	NA	NA	NA	NA					Ants nest
114	04-December-2014	Coastal Blackbutt	551	Limb	150	100	No	None	0	No	NA	NA	NA	NA					Ants nest
114	04-December-2014	Coastal Blackbutt	551	Limb	100	300	No	None	0	No	NA	NA	NA	NA					
114	04-December-2014	Coastal Blackbutt	551	Limb	100	100	No	None	0	No	NA	NA	NA	NA					
114	04-December-2014	Coastal Blackbutt	551	Limb	60	100	No	None	0	No	NA	NA	NA	NA					
114	04-December-2014	Coastal Blackbutt	551	Limb	40	150	No	None	0	No	NA	NA	NA	NA					
115	06-December-2014	White Mahogany	363	Limb	40	1000	No	None	0	None	NA	NA	NA	NA	483049	6542833	25100-24800	Easter n side	Sth of Mingaletta Rd
116	06-December-2014	White Mahogany	360	Limb	200	400	No	<i>Trichosurus vulpecula</i>	1	None	No	None	No	Released into a tree 50m away from clearance limit	483047	6542840	25100-24800	Easter n side	Sth of Mingaletta Rd
116	06-December-2014	White Mahogany	360	Limb	40	200	No	None	0	None	NA	NA	NA	NA					
117	06-December-2014	Pink Bloodwood	na	Limb	40	150	No	No fauna	0	None	NA	NA	NA	NA	483050	6542856	25100-24800	Easter n side	Sth of Mingaletta Rd
118	06-December-2014	White Mahogany	na	None	na	na	No	No fauna	0	None	NA	NA	NA	NA	483075	6542875	25100-24800	Easter n side	Sth of Mingaletta Rd
119	06-December-2014	Stag	529	Trunk	200	500	No	None	0	Old birds nest in hollow	NA	NA	NA	NA				Easter n side	South of Middlegate Road
119	06-December-2014	Stag	529	Limb	150	700	No	None	0	Leaf nest	NA	NA	NA	NA				Easter n side	South of Middlegate Road

Habitat Seq. Num.	Date	Tree species	HBT Ref No.	Habitat Feature	Ent. Diam. (mm)	Depth (mm)	Redist.	Fauna recorded	No.	Signs of use	Injured	Type of injuries	Taken into care	Fauna Release location	Easting	Northing	Ch.	SoC	Notes
119	06-December-2014	Stag	529	Limb	80	150	No	None	0	Leaf nest	NA	NA	NA	NA				Easter n side	South of Middlegate Road
120	06-December-2014	Pink Bloodwood	520	Limb	350	250	No	<i>Hoplocephalus stephensi</i>	1	No	No	None	No	Unexpected finds - Released approximately 34850E	483073	6552745	34850	Easter n side	South of Middlegate Road. Unexpected finds procedure outlined in the FFMP adopted.
120	06-December-2014	Pink Bloodwood	520	Limb	150	250	No	None	0	No	NA	NA	NA	NA				Easter n side	South of Middlegate Road
120	06-December-2014	Pink Bloodwood	520	Limb	70	200	No	None	0	No	NA	NA	NA	NA				Easter n side	South of Middlegate Road
121	06-December-2014	Pink Bloodwood	525	Limb	150	200	No	None	0	No	NA	NA	NA	NA				Easter n side	South of Middlegate Road
121	06-December-2014	Pink Bloodwood	525	Limb	70	100	No	None	0	No	NA	NA	NA	NA				Easter n side	South of Middlegate Road
121	06-December-2014	Pink Bloodwood	525	Limb	50	100	No	None	0	No	NA	NA	NA	NA				Easter n side	South of Middlegate Road
122	06-December-2014	Pink Bloodwood	526	Limb	80	100	No	None	0	No	NA	NA	NA	NA				Easter n side	South of Middlegate Road
122	06-December-2014	Pink Bloodwood	526	Limb	50	150	No	None	0	No	NA	NA	NA	NA				Easter n side	South of Middlegate Road
122	06-December-2014	Pink Bloodwood	526	Limb	50	100	No	None	0	No	NA	NA	NA	NA				Easter n side	South of Middlegate Road
123	09-December-2014	Stag	358	Limb	100	500	No	None	0	leaf litter - old	NA	NA	NA	NA	482906	6542536	35600-35200	Easter n side	Sth of Mingaletta Rd
123	09-December-2014	Stag	358	Limb	150	400	No	None	0	No	NA	NA	NA	NA	482906	6542536	35600-35200	Easter n side	Sth of Mingaletta Rd
124	09-December-2014	Pink Bloodwood	NA	Termite nest	none	none	No	None	0	None	NA	NA	NA	NA	482865	6542450	35600-35200	Easter n side	Sth of Mingaletta Rd
125	09-December-2014	Stag	NA	Trunk	200	250	No	None	0	No	NA	NA	NA	NA					South of Middlegate Road
126	09-December-2014	Stag	NA	Trunk	100	150	No	None	0	No	NA	NA	NA	NA					South of Middlegate Road
126	09-December-2014	Stag	NA	Trunk	50	400	No	None	0	No	NA	NA	NA	NA					Ants nest
127	09-December-2014	White Mahogany	530	Trunk	800	1700	No	None	0	No	NA	NA	NA	NA					South of Middlegate Road
127	09-December-2014	White Mahogany	530	Trunk	150	1300	No	None	0	No	NA	NA	NA	NA					South of Middlegate Road
127	09-December-2014	White Mahogany	530	Trunk	150	800	No	None	0	No	NA	NA	NA	NA					Ants nest
127	09-December-2014	White Mahogany	530	Trunk	80	1000	No	None	0	No	NA	NA	NA	NA					South of Middlegate Road
127	09-December-2014	White Mahogany	530	Limb	250	900	No	None	0	No	NA	NA	NA	NA					Ants nest
127	09-December-2014	White Mahogany	530	Limb	250	800	No	None	0	No	NA	NA	NA	NA					Ants nest
127	09-December-2014	White Mahogany	530	Limb	200	150	No	None	0	Leaf nest	NA	NA	NA	NA					Ants nest
127	09-December-2014	White Mahogany	530	Limb	100	700	No	None	0	No	NA	NA	NA	NA					South of Middlegate Road
127	09-December-2014	White Mahogany	530	Limb	100	700	No	None	0	No	NA	NA	NA	NA					South of Middlegate Road
127	09-December-2014	White Mahogany	530	Limb	100	600	No	None	0	No	NA	NA	NA	NA					South of Middlegate Road
127	09-December-2014	White Mahogany	530	Limb	80	700	No	None	0	No	NA	NA	NA	NA					South of Middlegate Road
127	09-December-2014	White Mahogany	530	Limb	50	100	No	None	0	Leaf nest	NA	NA	NA	NA					South of Middlegate Road
127	09-December-2014	White Mahogany	530	Limb	40	200	No	None	0	No	NA	NA	NA	NA					South of Middlegate Road
127	09-December-2014	White Mahogany	530	Limb	40	100	No	None	0	No	NA	NA	NA	NA					South of Middlegate Road
128	09-December-2014	Red Mahogany	532	Trunk	800	300	No	None	0	No	NA	NA	NA	NA					South of Middlegate Road
128	09-December-2014	Red Mahogany	532	Limb	250	200	No	None	0	No	NA	NA	NA	NA					South of Middlegate Road
128	09-December-2014	Red Mahogany	532	Limb	200	200	No	None	0	No	NA	NA	NA	NA					Ants nest
128	09-December-2014	Red Mahogany	532	Limb	150	350	No	None	0	No	NA	NA	NA	NA					Ants nest
128	09-December-2014	Red Mahogany	532	Limb	70	600	No	None	0	No	NA	NA	NA	NA					South of Middlegate Road
128	09-December-2014	Red Mahogany	532	Limb	50	200	No	None	0	No	NA	NA	NA	NA					South of Middlegate Road
128	09-December-2014	Red Mahogany	532	Limb	50	100	No	None	0	No	NA	NA	NA	NA					South of Middlegate Road
129	09-December-2014	Stag	529	Limb	100	600	No	None	0	No	NA	NA	NA	NA					South of Middlegate Road
130	09-December-2014	Tallowwood	NA	Termitaria	NA	NA	No	None	0	No	NA	NA	NA	NA					South of Middlegate Road

Habitat Seq. Num.	Date	Tree species	HBT Ref No.	Habitat Feature	Ent. Diam. (mm)	Depth (mm)	Redist.	Fauna recorded	No.	Signs of use	Injured	Type of injuries	Taken into care	Fauna Release location	Easting	Northing	Ch.	SoC	Notes
131	09-December-2014	Stag	NA	Termitaria	NA	NA	No	None	0	No	NA	NA	NA	NA					South of Middlegate Road
132	09-December-2014	Stag	536	Limb	100	200	No	None	0	No	NA	NA	NA	NA					South of Middlegate Road
133	09-December-2014	Pink Bloodwood	534	Limb	150	700	No	None	0	No	NA	NA	NA	NA					South of Middlegate Road
133	09-December-2014	Pink Bloodwood	534	Limb	40	150	No	None	0	No	NA	NA	NA	NA					South of Middlegate Road
134	09-December-2014	Stag	539	Limb	40	600	No	None	0	No	NA	NA	NA	NA					South of Middlegate Road
135	09-December-2014	Pink Bloodwood	538	Limb	50	150	No	None	0	No	NA	NA	NA	NA					South of Middlegate Road
136	09-December-2014	Stag	539	Trunk	600	700	No	None	0	Old birds nest in hollow	NA	NA	NA	NA					South of Middlegate Road
137	09-December-2014	Stag	546	Limb	200	400	No	None	0	No	NA	NA	NA	NA					South of Middlegate Road
138	09-December-2014	White Stringybark	524	Trunk	700	1400	No	None	0	Brush-tailed Possum Scat and Leaf nest	NA	NA	NA	NA					South of Middlegate Road
139	09-December-2014	Coastal Blackbutt	522	Limb	200	700	No	<i>Eulamprus tenuis</i>	2	No	No	None	No	Approx. 80 metres east of 35100	483071	6552994	35100	East	South of Middlegate Road
139	09-December-2014	Coastal Blackbutt	522	Limb	70	100	No	None	0	No	NA	NA	NA	NA					
140	09-December-2014	White Stringybark	523	Trunk	350	450	No	None	0	No	NA	NA	NA	NA					HBT number faded
140	09-December-2014	White Stringybark	523	Limb	50	200	No	None	0	No	NA	NA	NA	NA					
141	09-December-2014	Pink Bloodwood	525	Trunk	600	1400	No	<i>Eulamprus tenuis</i>	1	No	No	None	No	Approx. 80 metres east of 35100	483051	6552974	35100	East	HBT number faded
142	09-December-2014	Stag	527	Trunk	200	300	No	None	0	No	NA	NA	NA	NA					
142	09-December-2014	Stag	527	Limb	100	100	No	None	0	No	NA	NA	NA	NA					
143	09-December-2014	Stag	521	Limb	50	300	No	None	0	No	NA	NA	NA	NA					
144	09-December-2014	Stag	539	Trunk	400	1600	No	None	0	No	NA	NA	NA	NA					HBT number faded
145	10-December-2014	Stag	510	Trunk	400	1800	No	<i>Ramphotyphlops nigrescens</i>	1	No	No	None	No	Approx. 80 metres east of 34900	483101	6552803	34900	East	HBT number faded. Specimen was recovered from within the humus of the rotten trunk, utilising a tunnel. Based on capture location, it would have been approximately 2.3 metres high when the stag was felled. The stag itself was highly senescent, with large features spreading from the bottom of the tree. No active ant nest were recorded within the stag.
146	10-December-2014	Stag	511	Trunk	400	1800	No	<i>Ramphotyphlops nigrescens</i>	1	No	No	None	No	Approx. 80 metres east of 34900	483101	6552803	34900	East	HBT number faded. Specimen was recovered from within the humus of the rotten trunk, utilising a tunnel. Based on capture location, it would have been approximately 2.3 metres high when the stag was felled. The stag itself was highly senescent, with large features spreading from the bottom of the tree. No active ant nest were recorded within the stag.
147	11-December-2014	Ground Log	NA	Hollow log	100	4000	Yes	No fauna	0	None	NA	NA	NA	NA	483100	6543034	25100-24800	East n side	Sth of Mingaletta Rd
148	11-December-2014	Stag	366	Limb	50	4000	No	No fauna	0	None	NA	NA	NA	NA	483102	6543023	25100-24800	East n side	Sth of Mingaletta Rd
149	11-December-2014	Stag	365	Fissures	10	1000	No	No fauna	0	None	NA	NA	NA	NA	483099	6542947	25100-24800	East n side	Sth of Mingaletta Rd
150	11-December-2014	Stag	na	Limb	150	2000	No	None	0	No	NA	NA	NA	NA					South of Middlegate Road
151	11-December-2014	Stag	512	Trunk	300	1500	No	<i>Ramphotyphlops proximus</i>	1	No	Yes	Laceration	No	Animal euthanized	482995	6552544	34850	East	Stag disintegrated during felling. Animal was not located during the subsequent search through the debris. It had made its way under the harvester tracks and was injured when the harvester moved. Very large specimen with strange colouring.
152	11-December-2014	Stag	518	Trunk	200	300	No	None	0	No	NA	NA	NA	NA					South of Middlegate Road



Habitat Seq. Num.	Date	Tree species	HBT Ref No.	Habitat Feature	Ent. Diam. (mm)	Depth (mm)	Redist.	Fauna recorded	No.	Signs of use	Injured	Type of injuries	Taken into care	Fauna Release location	Easting	Northing	Ch.	SoC	Notes
152	11-December-2014	Stag	518	Limb	100	150	No	None	0	No	NA	NA	NA	NA					South of Middlegate Road
152	11-December-2014	Stag	518	Limb	100	100	No	None	0	No	NA	NA	NA	NA					South of Middlegate Road
153	11-December-2014	Pink Bloodwood	519	Limb	100	100	No	None	0	No	NA	NA	NA	NA					South of Middlegate Road
154	11-December-2014	Coastal Blackbutt	NA	Termitaria	na	na	No	None	0	No	NA	NA	NA	NA					South of Middlegate Road
155	11-December-2014	White Stringybark	524	Limb	400	250	No	None	0	No	NA	NA	NA	NA					South of Middlegate Road
155	11-December-2014	White Stringybark	524	Limb	50	150	No	None	0	No	NA	NA	NA	NA					South of Middlegate Road
155	11-December-2014	White Stringybark	524	Limb	40	150	No	None	0	No	NA	NA	NA	NA					Ants nest
156	11-December-2014	Stag	NA	Termitaria	na	na	na	None	0	No	NA	NA	NA	NA					
157	11-December-2014	Tallowwood	516	Trunk	40	150	No	None	0	No	NA	NA	NA	NA					Canopy damage during stage 1 clearing
157	11-December-2014	Tallowwood	516	Trunk	30	100	No	None	0	No	NA	NA	NA	NA					Canopy damage during stage 1 clearing
158	11-December-2014	Stag	521	Limb	60	250	No	None	0	No	NA	NA	NA	NA					
159	11-December-2014	White Stringybark	NA	Limb	90	300	No	None	0	No	NA	NA	NA	NA					
160	11-December-2014	White Stringybark	na	Termitaria	na	na	No	None	0	No	NA	NA	NA	NA					Canopy damage during stage 1 clearing
161	11-December-2014	Pink Bloodwood	520	Limb	200	200	No	None	0	No	NA	NA	NA	NA					Termite plug
161	11-December-2014	Pink Bloodwood	520	Limb	100	200	No	None	0	No	NA	NA	NA	NA					
162	11-December-2014	White Stringybark	523	Trunk	350	1900	No	None	0	Shredded bark - probably Brushtial Possum	NA	NA	NA	NA					Larger mammal nest, most likely Brush-tailed Possum
163	11-December-2014	Turpentine	502	Limb	60	150	No	None	0	No	NA	NA	NA	NA					
164	11-December-2014	Turpentine	503	Limb	150	150	No	None	0	No	NA	NA	NA	NA					
165	11-December-2014	Stag	505	Limb	100	200	No	<i>Egernia mcpheei</i>	1	No	No	None	No	Approx. 50 metres east of CH34650	482926	6552161	34650	East	
166	11-December-2014	Red Mahogany	NA	Limb	50	200	No	None	0	No	NA	NA	NA	NA					
166	11-December-2014	Red Mahogany	NA	Limb	50	200	No	None	0	No	NA	NA	NA	NA					
167	12-December-2014	Paperbark	514	None	na	na	No	None	0	No	NA	NA	NA	NA					Canopy damage during stage 1 clearing - difficult to determine if it had hollows
168	12-December-2014	Stag	NA	Limb	200	200	No	<i>Ramphot yphlops nigrescens</i>	0	No	No	None	No	Approx. 50 metres east of CH34850	483057	6552603	34850	East	Specimen was recovered from within the humus of the rotten trunk, utilising a tunnel. Based on capture location, it would have been approximately 1.1 metres high when the stag was felled. The stag itself was highly senescent, with large features spreading from the bottom of the tree. No active ant nest were recorded within the stag.
169	12-December-2014	Stag	NA	None	NA	NA	No	None	0	No	NA	NA	NA	NA					
170	12-December-2014	Stag	NA	Trunk	150	800	No	<i>Ramphot yphlops nigrescens</i>	1	No	No	None	No	Approx. 50 metres east of CH34850	483057	6552603	34850	East	Specimen was recovered from within the humus of the rotten trunk, utilising a tunnel. Based on capture location, it would have been approximately 0.5 metres high when the stag was felled. The stag itself was highly senescent, with large features spreading from the bottom of the tree. No active ant nest were recorded within the stag.
171	12-December-2014	White Mahogany	513	Trunk	200	100	No	None	0	No	NA	NA	NA	NA					Ants nest
172	12-December-2014	Coastal Blackbutt	508	Trunk	100	150	No	None	0	No	NA	NA	NA	NA					
172	12-December-2014	Coastal Blackbutt	508	Trunk	200	200	No	None	0	No	NA	NA	NA	NA					
173	12-December-2014	Stag	511	Limb	200	300	No	None	0	No	NA	NA	NA	NA					
173	12-December-2014	Stag	511	Limb	150	400	No	None	0	Leaf Nest	NA	NA	NA	NA					
173	12-December-2014	Stag	511	Limb	150	400	No	None	0	Leaf Nest	NA	NA	NA	NA					
173	12-December-2014	Stag	511	Limb	100	600	No	None	0	No	NA	NA	NA	NA					
173	12-December-2014	Stag	511	Limb	100	500	No	None	0	No	NA	NA	NA	NA					
173	12-December-2014	Stag	511	Limb	50	300	No	None	0	No	NA	NA	NA	NA					

Habitat Seq. Num.	Date	Tree species	HBT Ref No.	Habitat Feature	Ent. Diam. (mm)	Depth (mm)	Redist.	Fauna recorded	No.	Signs of use	Injured	Type of injuries	Taken into care	Fauna Release location	Easting	Northing	Ch.	SoC	Notes
174	12-December-2014	Stag	510	Trunk	150	150	No	None	0	No	NA	NA	NA	NA					Native bee hive plug, 1 trunk hollow with three separate entrances
174	12-December-2014	Stag	510	Trunk	100	2300	No	None	0	Leaf nest	NA	NA	NA	NA					
174	12-December-2014	Stag	510	Trunk	100	1700	No	None	0	Leaf nest	NA	NA	NA	NA					
175	12-December-2014	Coastal Blackbutt	501	Limb	200	700	No	None	0	No	NA	NA	NA	NA					Hollow orientation meant that it had filled with water over night. Canopy damage during stage 1 clearing
175	12-December-2014	Coastal Blackbutt	501	Trunk	300	100	No	None	0	No	NA	NA	NA	NA					
176	12-December-2014	Stag	NA	None	NA	NA	No	None	0	No	NA	NA	NA	NA					Blind hollows
177	12-December-2014	Pink Bloodwood	NR	Trunk	800	300	No	<i>Varanus varius</i>	1	No	No	None	No	Approx. 70 metres east of Ch 34450	483024	6552387	34450	East	Sub adult
178	12-December-2014	White Mahogany	530	Limb	100	400	No	None	0	No	NA	NA	NA	NA					HBT number faded
178	12-December-2014	White Mahogany	530	Limb	100	100	No	None	0	No	NA	NA	NA	NA					
178	12-December-2014	White Mahogany	530	Limb	50	200	No	None	0	No	NA	NA	NA	NA					
179	12-December-2014	Pink Bloodwood	534	Limb	50	150	No	None	0	No	NA	NA	NA	NA					
180	12-December-2014	Prickly-leaved Paperbark	NA	None	na	na	No	None	0	No	NA	NA	NA	NA					Canopy damage during stage 1 clearing
181	12-December-2014	Stag	505	Trunk	1000	600	No	<i>Antechinus stuartii</i> - sub adult male	1	No	No	None	No	Approx. 50 metres east of 34900	483074	6552614	34900	East	The stag was still surrounded by mid-stratum vegetation. It was close to the road and required traffic control to clear. As such, it was cleared following protocols approved by Enviro team. i.e. it could be cleared but the site ecologist was required to check all trees brought down surrounding the habitat tree even if they were not habitat trees
182	12-December-2014	Coastal Blackbutt	508	Limb	60	150	No	None	0	No	NA	NA	NA	NA					
183	13-December-2014	White Mahogany	NA	Termitaria	NA	NA	No	None	0	No	NA	NA	NA	NA					
184	13-December-2014	Stag	554	Limb	100	200	No	<i>Ramphotyphlops nigrescens</i>	1	No	No	None	No	Approx. 30 metres east of 34150	483013	6552230	34150	East	Specimen was recovered from within the humus of the rotten trunk. Based on capture location, it would have been approximately 2.5 metres high when the stag was felled. The stag itself was highly senescent, with large features spreading from the bottom of the tree. No active ant nest were recorded within the stag.
185	13-December-2014	Stag	555	Limb	200	700	No	None	0	No	NA	NA	NA	NA					
185	13-December-2014	Stag	555	Limb	100	450	No	None	0	No	NA	NA	NA	NA					
185	13-December-2014	Stag	555	Limb	100	200	No	None	0	No	NA	NA	NA	NA					
185	13-December-2014	Stag	555	Limb	70	150	No	None	0	No	NA	NA	NA	NA					
186	13-December-2014	Coastal Blackbutt	552	Limb	80	150	No	None	0	No	NA	NA	NA	NA					Canopy damage during stage 1 clearing
186	13-December-2014	Coastal Blackbutt	552	Limb	50	350	No	None	0	No	NA	NA	NA	NA					
187	13-December-2014	Coastal Blackbutt	NA	None	NA	NA	No	None	0	No	NA	NA	NA	NA					
188	13-December-2014	Coastal Blackbutt	550	Limb	100	300	No	None	0	No	NA	NA	NA	NA					
189	13-December-2014	Pink Bloodwood	549	Trunk	80	150	No	None	0	No	NA	NA	NA	NA					
189	13-December-2014	Pink Bloodwood	549	Limb	50	200	No	None	0	No	NA	NA	NA	NA					
190	13-December-2014	Stag	556	Limb	100	100	No	None	0	No	NA	NA	NA	NA					
190	13-December-2014	Stag	556	Limb	80	150	No	None	0	No	NA	NA	NA	NA					
190	13-December-2014	Stag	556	Limb	80	100	No	None	0	No	NA	NA	NA	NA					
191	13-December-2014	Pink Bloodwood	547	Limb	80	100	No	None	0	No	NA	NA	NA	NA					
192	13-December-2014	Coastal Blackbutt	560	Trunk	100	150	No	None	0	No	NA	NA	NA	NA					
193	13-December-2014	Stag	505	Trunk	250	500	No	None	0	No	NA	NA	NA	NA					
193	13-December-2014	Stag	505	Limb	150	250	No	None	0	No	NA	NA	NA	NA					
194	13-December-2014	Coastal Blackbutt	501	Limb	50	150	No	None	0	No	NA	NA	NA	NA					
195	13-December-2014	Stag	557	Limb	200	200	No	None	0	Leaf Nest	NA	NA	NA	NA					
196	13-December-2014	Stag	561	Trunk	150	200	No	None	0	No	NA	NA	NA	NA					

Habitat Seq. Num.	Date	Tree species	HBT Ref No.	Habitat Feature	Ent. Diam. (mm)	Depth (mm)	Redist.	Fauna recorded	No.	Signs of use	Injured	Type of injuries	Taken into care	Fauna Release location	Easting	Northing	Ch.	SoC	Notes
196	13-December-2014	Stag	561	Limb	100	200	No	None	0	No	NA	NA	NA	NA					
197	15-December-2014	Habitat stump	NA	Stump - fissures	na	na	No	No fauna	0	None	NA	NA	NA	NA	483081	6543147	25100-24800	Easter n side	Sth of Mingaletta Rd
198	15-December-2014	Habitat stump	NA	Stump - fissures	na	na	No	No fauna	0	None	NA	NA	NA	NA	483164	6543113	25100-24800	Easter n side	Sth of Mingaletta Rd
199	15-December-2014	White Mahogany	NA	Termitaria	na	na	No	No fauna	0	None	NA	NA	NA	NA	483091	6543032	25100-24800	Easter n side	Sth of Mingaletta Rd
200	16-December-2014	Stag	NR	Fissures	na	na	No	No fauna	0	None	NA	NA	NA	NA	483211	6543469	25350-25750	Easter n side	Between Mingaletta Rd and Mobbs Dr
201	16-December-2014	Stag	564	Trunk	350	3700	No	<i>Ramphot yphlops nigrescens</i>	1	No	No	None	No	Approximately 5 metres east of 34100	482940	482940	34100	East	Large stage that had fallen onto a senescent Coastal Blackbutt outside the clearing limit. Black to be retained despite being close to clearing limit. Stag removed for safety reasons
201	16-December-2014	Stag	564	Limb	300	1700	No	<i>Eulamprus tenuis</i>	1	No	No	None	No	Approximately 5 metres east of 34100	482940	482940	34100	East	
202	16-December-2014	Stag	566	Limb	40	200	No	None	1	No	NA	NA	NA	NA					
202	16-December-2014	Stag	566	Limb	40	300	No	None	1	No	NA	NA	NA	NA					
203	16-December-2014	White Stringybark	NA	Termitaria	na	na	No	None	0	No	NA	NA	NA	NA					
204	16-December-2014	White Stringybark	559	Limb	40	300	No	None	0	No	NA	NA	NA	NA					
204	16-December-2014	White Stringybark	559	Trunk	40	150	No	None	0	No	NA	NA	NA	NA					
205	16-December-2014	White Stringybark	558	Trunk	150	300	No	None	0	No	NA	NA	NA	NA					
205	16-December-2014	White Stringybark	558	Trunk	150	200	No	None	0	No	NA	NA	NA	NA					
205	16-December-2014	White Stringybark	558	Termitaria	na	na	No	None	0	No	NA	NA	NA	NA					
206	16-December-2014	White Stringybark	567	Limb	100	200	No	None	0	No	NA	NA	NA	NA					Canopy damage during stage 1 clearing
206	16-December-2014	White Stringybark	567	Limb	50	250	No	None	0	No	NA	NA	NA	NA					
207	16-December-2014	White Stringybark	574	Limb	50	200	No	None	0	No	NA	NA	NA	NA					
207	16-December-2014	White Stringybark	574	Limb	50	200	No	None	0	No	NA	NA	NA	NA					
208	16-December-2014	Coastal Blackbutt	563	Limb	80	200	No	None	0	No	NA	NA	NA	NA					
209	16-December-2014	Pink Bloodwood	565	Trunk	50	250	No	None	0	No	NA	NA	NA	NA					Ants nest
209	16-December-2014	Pink Bloodwood	565	Limb	100	400	No	None	0	No	NA	NA	NA	NA					
209	16-December-2014	Pink Bloodwood	565	Limb	50	200	No	None	0	No	NA	NA	NA	NA					Ants nest
209	16-December-2014	Pink Bloodwood	565	Limb	40	150	No	None	0	No	NA	NA	NA	NA					Ants nest
210	16-December-2014	Stag	570	Limb	80	350	No	None	0	No	NA	NA	NA	NA					Ants nest
210	16-December-2014	Stag	570	Limb	80	300	No	None	0	No	NA	NA	NA	NA					Ants nest
210	16-December-2014	Stag	570	Limb	50	250	No	None	0	No	NA	NA	NA	NA					
211	17-December-2014	Coastal Blackbutt	NA	Limb	100	150	No	None	0	No	NA	NA	NA	NA					
212	17-December-2014	Pink Bloodwood	NR	Limb	50	250	No	None	0	No	NA	NA	NA	NA					
212	17-December-2014	Pink Bloodwood	NR	Limb	50	200	No	None	0	No	NA	NA	NA	NA					
213	17-December-2014	Coastal Blackbutt	NR	Limb	100	150	No	None	0	No	NA	NA	NA	NA					
214	17-December-2014	Pink Bloodwood	NR	Limb	50	250	No	None	0	No	NA	NA	NA	NA					
214	17-December-2014	Pink Bloodwood	NR	Limb	50	200	No	None	0	No	NA	NA	NA	NA					
215	18-December-2014	Diehard Stringybark	NR	Limb	150	700	No	None	0	No	NA	NA	NA	NA					
215	18-December-2014	Diehard Stringybark	NR	Limb	80	40	No	None	0	No	NA	NA	NA	NA					
216	18-December-2014	White Stringybark	NA	Termitaria	na	na	No	None	0	No	NA	NA	NA	NA					
217	18-December-2014	Coastal Blackbutt	581	LH	50	100	No	None	0	No	NA	NA	NA	NA					Native bee hive plug
218	18-December-2014	White Stringybark	567	Trunk	450	2200	No	None	0	rutty smell	NA	NA	NA	NA					Rutty smell similar to a brush tail possum roost. Very good hollow
218	18-December-2014	White Stringybark	567	Limb	150	600	No	None	0	No	NA	NA	NA	NA					Canopy of this tree was damaged when the previous HBT (coastal blackbutt) was felled
218	18-December-2014	White Stringybark	567	Limb	90	450	No	None	0	No	NA	NA	NA	NA					
219	18-December-2014	Stag	572	Trunk	100	350	No	None	0	Leaf Nest	NA	NA	NA	NA					Beetle carapaces in leaf nest
219	18-December-2014	Stag	572	Limb	100	400	No	None	0	No	NA	NA	NA	NA					

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220	18-December-2014	Tallowwood	NA	Termitaria	na	na	No	None	0	Kingfisher nest	NA	NA	NA	NA					Old nest not in use
221	18-December-2014	White Stringybark	NA	Termitaria	na	na	No	None	0	Kingfisher nest	NA	NA	NA	NA					Old nest not in use
222	18-December-2014	White Stringybark	569	Limb	50	500	No	None	0	No	NA	NA	NA	NA					
222	18-December-2014	White Stringybark	569	Limb	80	150	No	None	0	No	NA	NA	NA	NA					
222	18-December-2014	White Stringybark	569	Termitaria	na	na	No	None	0	No	NA	NA	NA	NA					
223	18-December-2014	Pink Bloodwood	565	None	na	na	No	None	0	No	NA	NA	NA	NA					Blind hollows
224	18-December-2014	White Stringybark	574	Limb	50	200	No	None	0	No	NA	NA	NA	NA					
225	18-December-2014	White Stringybark	575	Termitaria	na	na	No	None	0	No	NA	NA	NA	NA					
226	18-December-2014	Coastal Blackbutt	581	Limb	100	250	No	None	0	No	NA	NA	NA	NA					Termitaria had also been present on this tree but had been knocked off during stage 1 clearing
227	07-January-2015	White Stringybark	580	Limb	100	150	No	None	0	No	NA	NA	NA	NA					
227	07-January-2015	White Stringybark	580	Limb	50	200	No	None	0	No	NA	NA	NA	NA					Native bee hive in hollow
227	07-January-2015	White Stringybark	580	Limb	50	150	No	None	0	No	NA	NA	NA	NA					
227	07-January-2015	White Stringybark	580	Limb	100	100	No	None	0	No	NA	NA	NA	NA					Ant nest in hollow
228	07-January-2015	White Stringybark	NA	Termitaria	na	na	No	None	0	No	NA	NA	NA	NA					
229	07-January-2015	White Stringybark	NA	Termitaria	na	na	No	None	0	No	NA	NA	NA	NA					
230	07-January-2015	Pink Bloodwood	NA	Termitaria	na	na	No	None	0	No	NA	NA	NA	NA					
231	07-January-2015	White Stringybark	587	Limb	100	150	No	None	0	No	NA	NA	NA	NA					
232	07-January-2015	White Stringybark	587	Limb	100	150	No	None	0	No	NA	NA	NA	NA					Termite plug
233	07-January-2015	White Stringybark	NA	Termitaria	na	na	No	None	0	No	NA	NA	NA	NA					
234	07-January-2015	White Stringybark	NR	Limb	70	100	No	None	0	No	NA	NA	NA	NA					
235	07-January-2015	White Stringybark	NA	Termitaria	na	na	No	None	0	No	NA	NA	NA	NA					
236	07-January-2015	White Stringybark	NA	Termitaria	na	na	No	None	0	Kingfisher nest	NA	NA	NA	NA					Looked recent but no signs of continued use
237	07-January-2015	Coastal Blackbutt	497	Limb	100	150	No	Microbat*	1	No	NA	NA	NA	NA	482953	6551776		East	*** A microbat was observed flying out of the canopy of this tree after it was felled. It was dark black and of size and shape of a <i>Chalinolobus gouldi</i> , though I.D could not be confirmed. The bat did not fly out from the vicinity of any other hollows
237	07-January-2015	Coastal Blackbutt	497	Limb	80	250	No	None	0	No	NA	NA	NA	NA					
237	07-January-2015	Coastal Blackbutt	497	Limb	50	200	No	None	0	No	NA	NA	NA	NA					
238	07-January-2015	Coastal Blackbutt	NR	None	na	na	No	None	0	No	NA	NA	NA	NA					
239	07-January-2015	White Stringybark	NR	Limb	60	200	No	None	0	No	NA	NA	NA	NA					
240	07-January-2015	Coastal Blackbutt	NR	None	na	na	No	None	0	No	NA	NA	NA	NA					
241	07-January-2015	White Stringybark	NR	Limb	100	250	No	None	0	No	NA	NA	NA	NA					
242	07-January-2015	Coastal Blackbutt	NR	Limb	100	200	No	None	0	No	NA	NA	NA	NA					
242	07-January-2015	Coastal Blackbutt	NR	Limb	80	200	No	None	0	No	NA	NA	NA	NA					
243	07-January-2015	Stag	NR	Limb	80	150	No	None	0	No	NA	NA	NA	NA					
244	07-January-2015	White Stringybark	NA	Termitaria	na	na	No	None	0	No	NA	NA	NA	NA					
245	07-January-2015	Stag	561	Trunk	150	200	No	<i>Ramphotyphlops nigrescens</i>	1	No	NA	NA	NA	50 metres east of 35800	483023	6553279	35800	East	Ramphotyphlops was located within main stem of stag amongst rotting humus
245	07-January-2015	Stag	561	Limb	100	400	No	None	0	No	NA	NA	NA	NA					

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246	07-January-2015	Grey Ironbark	562	Trunk	150	5000	No	None	0	Leaves and other nesting material within hollow and distinctive mammal rut smell	NA	NA	NA	NA					Healthy tree with just about every limb hollowed out. Had harvester cut though many limbs but still could not find any mammals despite obvious recent use
246	07-January-2015	Grey Ironbark	562	Trunk	80	200	No	None	0	No	NA	NA	NA	NA					
246	07-January-2015	Grey Ironbark	562	Limb	200	5000	No	None	0	Mammal rut smell	NA	NA	NA	NA					
246	07-January-2015	Grey Ironbark	562	Limb	200	700	No	None	0	No	NA	NA	NA	NA					
246	07-January-2015	Grey Ironbark	562	Limb	150	4700	No	None	0	No	NA	NA	NA	NA					
246	07-January-2015	Grey Ironbark	562	Limb	100	700	No	None	0	No	NA	NA	NA	NA					
246	07-January-2015	Grey Ironbark	562	Limb	100	700	No	None	0	No	NA	NA	NA	NA					
247	07-January-2015	Coastal Blackbutt	531	Limb	200	700	No	None	0	No	NA	NA	NA	NA					
247	07-January-2015	Coastal Blackbutt	531	Limb	200	150	No	None	0	No	NA	NA	NA	NA					
247	07-January-2015	Coastal Blackbutt	531	Limb	150	650	No	None	0	No	NA	NA	NA	NA					
247	07-January-2015	Coastal Blackbutt	531	Limb	150	400	No	None	0	No	NA	NA	NA	NA					
247	07-January-2015	Coastal Blackbutt	531	Limb	150	200	No	None	0	No	NA	NA	NA	NA					
247	07-January-2015	Coastal Blackbutt	531	Limb	100	200	No	None	0	No	NA	NA	NA	NA					
247	07-January-2015	Coastal Blackbutt	531	Limb	100	200	No	None	0	No	NA	NA	NA	NA					
247	07-January-2015	Coastal Blackbutt	531	Limb	80	200	No	None	0	No	NA	NA	NA	NA					
247	07-January-2015	Coastal Blackbutt	531	Limb	80	150	No	None	0	No	NA	NA	NA	NA					
248	07-January-2015	Coastal Blackbutt	537	Fissures	na	na	No	None	0	No	NA	NA	NA	NA					Fissures along main trunk of tree, very shallow
249	07-January-2015	Stag	536	Limb	100	300	Yes	<i>Litoria caerulea</i>	1	No	No	NA	No	50 metres east of 35800	48303 3	6553118	35800	East	Limb with hollow containing frog was cut from tree and moved to release location with frog in situ
249	07-January-2015	Stag	536	Limb	100	200	Yes	<i>Eulamprus tenuis</i>	2	No	No	NA	No	50 metres east of 35800	48303 3	6553118	35800	East	Limb with hollow containing frog was cut from tree and moved to release location with frog in situ
249	07-January-2015	Stag	536	Limb	100	200	No	None	0	No	NA	NA	NA	NA					
250	07-January-2015	Pink Bloodwood	NR	None	na	na	No	None	0	No	NA	NA	NA	NA					
251	07-January-2015	Tallowwood	583	Trunk	200	200	No	None	0	No	NA	NA	NA	NA					
251	07-January-2015	Tallowwood	583	Trunk	90	400	No	None	0	No	NA	NA	NA	NA					
252	07-January-2015	Spotted Gum	540	Limb	100	150	No	None	0	No	NA	NA	NA	NA					
253	07-January-2015	Coastal Blackbutt	542	Limb	80	150	No	None	0	No	NA	NA	NA	NA					
254	07-January-2015	White Mahogany	530	Limb	800	200	No	None	0	No	NA	NA	NA	NA					
255	07-January-2015	White Stringybark	NA	Termitaria	na	na	No	None	0	No	NA	NA	NA	NA					
256	07-January-2015	Coastal Blackbutt	NR	None	na	na	No	None	0	No	NA	NA	NA	NA					
257	07-January-2015	Stag	539	Limb	100	150	No	None	0	Leaf Nest	NA	NA	NA	NA					
257	07-January-2015	Stag	539	Limb	100	150	No	None	0	No	NA	NA	NA	NA					Native Beehive
258	07-January-2015	Coastal Blackbutt	543	None	na	na	No	None	0	No	NA	NA	NA	NA					
259	07-January-2015	Stag	529	Trunk	400	900	No	None	0	No	NA	NA	NA	NA					Limbs damaged during stage 1 grubbing
259	07-January-2015	Stag	529	Trunk	250	1100	No	None	0	No	NA	NA	NA	NA					
260	07-January-2015	White Stringybark	NR	Limb	100	250	No	None	0	Leaf Nest	NA	NA	NA	NA					
261	07-January-2015	Grey Ironbark	NR	Limb	100	100	No	None	0	No	NA	NA	NA	NA					
262	08-January-2015	Hollow Log	NA	Ground log	150	9500	Yes	None	0	No	NA	NA	NA	NA					
263	08-January-2015	Hollow Log	NA	Ground log	300	11500	Yes	None	0	No	NA	NA	NA	NA					Log has been marked for re-distribution. Log will temporarily stored next to access road until machine access over optic fibre is established.
264	08-January-2015	Hollow Log	NA	Ground log	250	8500	Yes	None	0	Leaf Nest	NA	NA	NA	NA					

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265	08-January-2015	Hollow Log	NA	Ground log	300	9000	Yes	<i>Saltuarius moritzi</i>	5	No	NA	NA	No	Approximately 50 metres east of 32950	483205	6550909	32950	East	
266	10-January-2015	Pink Bloodwood	NR	Limb	30	100	No	No fauna	0	No	NA	NA	NA	Approximately 50 metres east of 32950			33600	Easter n side	Smiths Road in Maria River State Forest
267	10-January-2015	Pink Bloodwood	NR	Limb	30	70	No	No fauna	0	No	NA	NA	NA	Approximately 50 metres east of 32950			33600	Easter n side	Smiths Road in Maria River State Forest
268	10-January-2015	White Stringybark	NR	Limb	160	450	No	No fauna	0	No	NA	NA	NA	Approximately 50 metres east of 32950			33600	Easter n side	Smiths Road in Maria River State Forest
269	13-January-2015	Stag	NR	Trunk	400	2000	No	Pink-tongued Skink	1	yes- leaf nest	No	Small scratch	No	>20m outside clearance limit into a hollow log	483220	6544100	25800-26600	Easter n side	Nth of Mobbs Dr
270	13-January-2015	Stag	NR	Fissures	na	na	No	None	0	No	NA	NA	NA	NA			25800-26600	Easter n side	Nth of Mobbs Dr
271	13-January-2015	Coastal Blackbutt	NR	Limb	40	700	No	Feather-tailed Glider adult + 3 young	4	yes- leaf nest	Yes	Small scratch on one of the young	No	>20m outside clearance limit into a hollow log	483210	6544164	25800-26600	Easter n side	Nth of Mobbs Dr
272	13-January-2015	Pink Bloodwood	NA	Termite nest	40	300	No	Sacred Kingfisher eggs	2	chamber	Yes	both eggs cracked	No	Eggs discarded	483203	6544197	25800-26600	Easter n side	Nth of Mobbs Dr
273	13-January-2015	Coastal Blackbutt	NR	None	na	na	No	No fauna	0	No	NA	NA	NA	NA			25800-26600	Easter n side	Nth of Mopbbs Dr
274	15-January-2015	Pink Bloodwood	534	Limb	20	300	No	No fauna	0	leaf nest	NA	NA	NA	NA				Easter n side	Between Kundabung rest area and Kundabung Rd
275	15-January-2015	Coastal Blackbutt	533	Limb	40	200	No	No fauna	0	leaf nest	NA	NA	NA	NA				Easter n side	Between Kundabung rest area and Kundabung Rd
275	15-January-2015	Coastal Blackbutt	533	Limb	50	100	No	No fauna	0	No	NA	NA	NA	NA					
275	15-January-2015	Coastal Blackbutt	533	Limb	40	300	No	No fauna	0	No	NA	NA	NA	NA					
276	15-January-2015	White Stringybark	532	Trunk	300	300	No	Blackish Blind snakes	2	leaf nest	no obvious	No	No	Released in habitat to east	483033	6553041	35180	Easter n side	Between Kundabung rest area and Kundabung Rd
277	15-January-2015	Forest Red Gum	NA	Termite	na	na	No	No fauna	0	No	NA	NA	NA				25350-25550	Wester n Side	Stock pile side next to Mingaletta Rd
278	16-January-2015	Forest Red Gum	NR	none	na	na	No	No fauna	0	No	NA	NA	NA	NA			30000-30180	Easter n Side	Nth of Kundabung rest area
279	17-January-2015	Coastal Blackbutt	NR	Limb	20	200	No	No fauna	0	No	NA	NA	NA	NA			26495-26600	Easter n Side	Sth of Gate 5
280	17-January-2015	Coastal Blackbutt	NR	Limb	50	1000	No	No fauna	0	No	NA	NA	NA	NA			26495-26600	Easter n Side	Sth of Gate 5
281	19-January-2015	Stag	NR	Fissures	na	na	No	No fauna	0	No	NA	NA	NA	NA			26631-27000	Easter n Side	Between Gate 5 and Power line
282	19-January-2015	Stag	NR	Trunk	50	300	No	<i>Egernia mcphreei</i>	1	Leaf nest	No	None	No	Released adjacent to site at hollow ground log	483202	6544994	26631-27000	Easter n Side	Between Gate 5 and Power line
283	19-January-2015	Coastal Blackbutt	NA	Termite	na	na	No	None	0	Chamber with feathers	NA	NA	NA	NA			26631-27000	Easter n Side	Probably Sacred kingfisher - Between Gate 5 and Power line
284	19-January-2015	Small-fruited Grey Gum	NA	None	na	na	No	None	0	No	NA	NA	NA	NA			26631-27000	Easter n Side	Between Gate 5 and Power line
285	19-January-2015	Coastal Blackbutt	NA	None	na	na	No	None	0	No	NA	NA	NA	NA			26631-27000	Easter n Side	Between Gate 5 and Power line
286	19-January-2015	Grey Ironbark	NA	None	na	na	No	None	0	No	NA	NA	NA	NA			26631-27000	Easter n Side	Between Gate 5 and Power line
287	19-January-2015	White Mahogany	NA	None	na	na	No	None	0	No	NA	NA	NA	NA			26631-27000	Easter n Side	Between Gate 5 and Power line
288	05-February-2015	Red Mahogany	NA	Trunk	30	100	No	Sugar Glider	4	Leaf nest	No	No	No	Released from same location before dark	483265	6548909.275	30950	Easter n side	Utility works at Fish Farm
289	11-February-2015	Coastal Blackbutt	NA	Limb	20	500	No	None	0	Leaf nest	NA	NA	NA	NA			33200	Easter n side	Utility

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289	11-February-2015	Coastal Blackbutt	NA	Limb	30	200	No	None	0	No	NA	NA	NA	NA					
289	11-February-2015	Coastal Blackbutt	NA	Limb	50	200	No	None	0	No	NA	NA	NA	NA					
290	12-February-2015	Turpentine	NA	Nest box tree removal	na	na	na	No fauna	0	None	NA	NA	NA	NA			33700	Easter n side	Utility
290	12-February-2015	Turpentine	NA	Nest box tree removal	na	na	na	No fauna	0	None	NA	NA	NA	NA			33700	Easter n side	Utility
291	14-February-2015	Pink Bloodwood	NA	Termitaria	na	na	na	No fauna	0	No chamber	NA	NA	NA	NA			32950-33000	Easter n side	Maria SF
291	14-February-2015	Pink Bloodwood	NR	Limb	20	200	No	<i>Litoria gracilent a</i> (not in hollow - in tree canopy)	1	None	No	None	No	Relocated adjacent to site outside clearing limit - 100 m	483214	6550837	32950-33000	Easter n side	Maria SF
292	14-February-2015	Coastal Blackbutt	NR	None	na	na	na	No fauna	0	None	NA	NA	NA	NA			32950-33000	Easter n side	Maria SF
293	14-February-2015	Pink Bloodwood	NA	Termitaria	na	na	na	No fauna	0	No chamber	NA	NA	NA	NA			32950-33000	Easter n side	Maria SF
294	14-February-2015	White Mahogany	NR	Limb	10	50	No	No fauna	0	none	NA	NA	NA	NA			32950-33000	Easter n side	Maria SF
295	14-February-2015	Pink Bloodwood	NR	Limb	10	50	No	No fauna	0	none	NA	NA	NA	NA			32950-33000	Easter n side	Maria SF
296	14-February-2015	Pink Bloodwood	NR	None	na	na	na	No fauna	0	No chamber	NA	NA	NA	NA			32950-33000	Easter n side	Maria SF
297	14-February-2015	Pink Bloodwood	NR	Limb	50	1000	No	No fauna	0	none	NA	NA	NA	NA			32950-33000	Easter n side	Maria SF
298	14-February-2015	Pink Bloodwood	NR	None	na	na	na	No fauna	0	No chamber	NA	NA	NA	NA			32950-33000	Easter n side	Maria SF
299	14-February-2015	Tallowwood	NR	None	na	na	na	No fauna	0	No chamber	NA	NA	NA	NA			32950-33000	Easter n side	Maria SF
300	16-February-2015	Coastal Blackbutt	NR	Fissures	20	1000	No	No fauna	0	none	NA	NA	NA	NA			32950-33000	Easter n side	Maria SF
301	16-February-2015	Coastal Blackbutt	NR	Basal hollow	100	2000	No	No fauna	0	none	NA	NA	NA	NA			32950-33000	Easter n side	Maria SF
302	16-February-2015	White Stringybark	NR	Limb	50	1000	No	No fauna	0	<i>Antechinus scats</i>	NA	NA	NA	NA			32950-33000	Easter n side	Maria SF
303	16-February-2015	Pink Bloodwood	NR	None	na	na	na	No fauna	0	No	NA	NA	NA	NA			32950-33000	Easter n side	Maria SF
304	16-February-2015	Pink Bloodwood	NR	Trunk	400	2000	No	No fauna	0	none	NA	NA	NA	NA			32950-33000	Easter n side	Maria SF
305	16-February-2015	Grey Ironbark	NR	None	na	na	na	No fauna	0	None	NA	NA	NA	NA			32950-33000	Easter n side	Maria SF
306	16-February-2015	White Stringybark	NA	Nest boxes	Owl and possum box		Stored for redistribution	No fauna	0	none	NA	NA	NA	NA			32950-33000	Easter n side	Maria SF - Owl and Possum Boxes taken down
307	16-February-2015	Coastal Blackbutt	NA	None	na	na	na	No fauna	0	None	NA	NA	NA	NA			32950-33000	Easter n side	Maria SF
308	17/02/2015	White Stringybark	NR	LH	100	100	No	None	0	NA	NA	NA	NA	NA					
309	17/02/2015	White Stringybark	NR	LH	na	na	No	None	0	NA	NA	NA	NA	NA					
310	17/02/2015	Coastal Blackbutt	NR	LH	100	150	No	None	0	NA	NA	NA	NA	NA					
311	18-February-2015	Stag	NR	None	na	na	na	No fauna	0	None	NA	NA	NA	NA			26200	Easter n side	Sth of Gate 5
312	18-February-2015	Grey Gum	NR	None	na	na	na	No fauna	0	None	NA	NA	NA	NA			27000-27450	Easter n side	Nth of Gate 5

Habitat Seq. Num.	Date	Tree species	HBT Ref No.	Habitat Feature	Ent. Diam. (mm)	Depth (mm)	Redist.	Fauna recorded	No.	Signs of use	Injured	Type of injuries	Taken into care	Fauna Release location	Eastings	Northing	Ch.	SoC	Notes
313	18-February-2015	Grey Gum	NR	Stick nest	600	2000	No	No fauna	0	looked unused for a long period	NA	NA	NA	NA			27000-27450	Easter n side	Nth of Gate 5
314	18-February-2015	Grey Gum	NR	None	na	na	na	No fauna	0	None	NA	NA	NA	NA			27000-27450	Easter n side	Nth of Gate 5
315	18-February-2015	Grey Gum	NR	None	na	na	na	No fauna	0	None	NA	NA	NA	NA			27000-27450	Easter n side	Nth of Gate 5
316	18-February-2015	Stag	NR	None	na	na	na	No fauna	0	None	NA	NA	NA	NA			27000-27450	Easter n side	Nth of Gate 5
317	18-February-2015	Stag	NR	None	na	na	na	No fauna	0	None	NA	NA	NA	NA			27000-27450	Easter n side	Nth of Gate 5
318	18-February-2015	Pink Bloodwood	NA	Termitaria	na	na	na	No fauna	0	None	NA	NA	NA	NA			27000-27450	Easter n side	Nth of Gate 5
319	18-February-2015	Pink Bloodwood	NA	Termitaria	na	na	na	No fauna	0	None	NA	NA	NA	NA			27000-27450	Easter n side	Nth of Gate 5
320	02-March-2015	Coastal Blackbutt	NA	None	na	na	na	No fauna	0	None	NA	NA	NA	NA			30670-30800	Easter n side	Nth of Pipers Creek
321	03-March-2015	Stump/stag	NA	Stump	150	600	No	No fauna	0	None	NA	NA	NA	NA			30670-30800	Easter n side	Nth of Pipers Creek
322	03-March-2015	Red Ash	NR	Fissures	na	na	na	Lace Monitor + Red-bowed Finch	2	None	No	None	No	Released adjacent to site	483181	6548669	30670-30800	Easter n side	Nth of Pipers Creek
323	06-March-2015	Stag	NR	Limb	50	100	No	No fauna	0	none	NA	NA	NA	NA			30950-31000	Easter n side	Sth of Hambly Drive Way
324	06-March-2015	Pink Bloodwood	NR	None	na	na	na	No fauna	0	None	NA	NA	NA	NA			30950-31000	Easter n side	Sth of Hambly Drive Way
325	06-March-2015	Forest Red Gum	NR	None	na	na	na	No fauna	0	None	NA	NA	NA	NA			30950-31000	Easter n side	Sth of Hambly Drive Way
326	06-March-2015	Forest Red Gum	NR	Fissures	40	400	No	No fauna	0	None	NA	NA	NA	NA			30950-31000	Easter n side	Sth of Hambly Drive Way
327	06-March-2015	Pink Bloodwood	NR	Fissures	40	2000	No	<i>Egernia macphee i</i>	1	none	No	NA	No	relocated 200m down stream of Pipers Creek - at base of tree with fissures	483196	6548894	30950-31000	Easter n side	Sth of Hambly Drive Way
328	06-March-2015	Stag	NR	Termitaria	na	na	No	No fauna	0	Cavity - past excavation	NA	NA	NA	NA			30950-31000	Easter n side	Sth of Hambly Drive Way
328	06-March-2015	Stag	NR	Limb	30	400	No	No fauna	0	None	NA	NA	NA	NA					
329	06-March-2015	Stag	NR	Fissures	na	na	No	No fauna	0	none	NA	NA	NA	NA			29050	Easter n side	South of Kundabung Interchange
330	06-March-2015	Stag	NR	Limb	30	50	No	No fauna	0	none	NA	NA	NA	NA			29050	Easter n side	South of Kundabung Interchange
331	06-March-2015	Stag	NR	Limb	30	70	No	No fauna	0	none	NA	NA	NA	NA			29050	Easter n side	South of Kundabung Interchange
332	09-March-2015	Stag	NA	Termitaria	na	na	No	No fauna	0	None	NA	NA	NA	NA			28700-29300	Easter n side	Box culvert to Kundabung Rd
333	09-March-2015	Stag	NR	None	na	na	No	No fauna	0	None	NA	NA	NA	NA			28700-29300	Easter n side	Box culvert to Kundabung Rd
334	09-March-2015	Stag	NR	None	na	na	No	No fauna	0	None	NA	NA	NA	NA			28700-29300	Easter n side	Box culvert to Kundabung Rd
335	09-March-2015	White Mahogany	NR	None	na	na	No	No fauna	0	None	NA	NA	NA	NA			28700-29300	Easter n side	Box culvert to Kundabung Rd
336	09-March-2015	Stag	NR	Termite + Trunk + Limb	na	na	No	No fauna	0	No excavation	NA	NA	NA	NA			28700-29300	Easter n side	Box culvert to Kundabung Rd
336	09-March-2015	Stag	NR	Trunk	40	400	No	No fauna	0	Leaf nest	NA	NA	NA	NA					



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336	09-March-2015	Stag	NR	Limb	30	300	No	No fauna	0	Plastics - poss. Black Rat	NA	NA	NA	NA					
337	09-March-2015	White Mahogany	NR	Termitaria	na	na	No	No fauna	0	None	NA	NA	NA	NA			28700-29300	Eastern side	Box culvert to Kundabung Rd
338	09-March-2015	Small-fruited Grey Gum	NR	None	na	na	na	No fauna	0	None	NA	NA	NA	NA			28700-29300	Eastern side	Box culvert to Kundabung Rd
339	09-March-2015	Stag	NR	Limb	40	400	No	No fauna	0	None	NA	NA	NA	NA			28700-29300	Eastern side	Box culvert to Kundabung Rd
340	09-March-2015	Small-fruited Grey Gum	NR	None	na	na	na	No fauna	0	None	NA	NA	NA	NA			28700-29300	Eastern side	Box culvert to Kundabung Rd
341	09-March-2015	Small-fruited Grey Gum	NR	None	na	na	na	No fauna	0	None	NA	NA	NA	NA			28700-29300	Eastern side	Box culvert to Kundabung Rd
342	09-March-2015	Stag	NR	Fissures	na	na	na	No fauna	0	None	NA	NA	NA	NA			28700-29300	Eastern side	Box culvert to Kundabung Rd
343	09-March-2015	Small-fruited Grey Gum	NR	Termitaria	na	na	na	No fauna	0	No excavation	NA	NA	NA	NA			28700-29300	Eastern side	Box culvert to Kundabung Rd
344	09-March-2015	Small-fruited Grey Gum	NR	None	na	na	na	No fauna	0	None	NA	NA	NA	NA			28700-29300	Eastern side	Box culvert to Kundabung Rd
345	09-March-2015	White Mahogany	NR	Termitaria	na	na	na	No fauna	0	No excavation	NA	NA	NA	NA			28700-29300	Eastern side	Box culvert to Kundabung Rd
346	09-March-2015	Small-fruited Grey Gum	NR	None	na	na	na	No fauna	0	None	NA	NA	NA	NA			28700-29300	Eastern side	Box culvert to Kundabung Rd
347	09-March-2015	Small-fruited Grey Gum	NR	None	na	na	na	No fauna	0	None	NA	NA	NA	NA			28700-29300	Eastern side	Box culvert to Kundabung Rd
348	09-March-2015	Small-fruited Grey Gum	NR	None	na	na	na	No fauna	0	None	NA	NA	NA	NA			28700-29300	Eastern side	Box culvert to Kundabung Rd
349	09-March-2015	Small-fruited Grey Gum	NR	None	na	na	na	No fauna	0	None	NA	NA	NA	NA			28700-29300	Eastern side	Box culvert to Kundabung Rd
350	09-March-2015	Stag	NR	Termitaria	na	na	na	No fauna	0	None	NA	NA	NA	NA			28700-29300	Eastern side	Box culvert to Kundabung Rd
351	09-March-2015	Stag	NR	None	na	na	na	No fauna	0	None	NA	NA	NA	NA			31050-31150	Eastern side	Nth of Hambly Drive Way
352	09-March-2015	White Mahogany	NR	Termitaria	na	na	na	No fauna	0	None	NA	NA	NA	NA			31050-31150	Eastern side	Nth of Hambly Drive Way
353	09-March-2015	White Mahogany	NR	None	na	na	na	No fauna	0	None	NA	NA	NA	NA			31050-31150	Eastern side	Nth of Hambly Drive Way
354	09-March-2015	Stag	NR	Limb	40	150	No	No fauna	0	none	NA	NA	NA	NA			31050-31150	Eastern side	Nth of Hambly Drive Way
355	09-March-2015	Stag	NR	None	na	na	na	No fauna	0	None	NA	NA	NA	NA			31050-31150	Eastern side	Nth of Hambly Drive Way
356	09-March-2015	White Mahogany	NR	Termitaria	na	na	na	No fauna	0	No excavation	NA	NA	NA	NA			31050-31150	Eastern side	Nth of Hambly Drive Way
357	09-March-2015	Small-fruited Grey Gum	NR	Limb	50	200	No	No fauna	0	none	NA	NA	NA	NA			31050-31150	Eastern side	Nth of Hambly Drive Way
358	10-March-2015	White Mahogany	NR	Limb	40	150	No	No fauna	0	none	NA	NA	NA	NA			28700-29300	Eastern side	Box culvert to Kundabung Rd
358	10-March-2015	White Mahogany	NR	Limb	60	250	No	No fauna	0	none	NA	NA	NA	NA					
358	10-March-2015	White Mahogany	NR	Trunk	60	800	No	No fauna	0	none	NA	NA	NA	NA					
359	10-March-2015	Coastal Blackbutt	NR	Limb	100	50	No	None	0	NA	NA	NA	NA	NA					
360	10-March-2015	Coastal Blackbutt	NR	Limb	100	120	No	None	0	NA	NA	NA	NA	NA					
361	10-March-2015	Coastal Blackbutt	NR	Limb	80	100	No	None	0	NA	NA	NA	NA	NA					
362	10-March-2015	Pink Bloodwood	NR	Limb	100	100	No	None	0	NA	NA	NA	NA	NA					
363	11-March-2015	Tallowwood	NR	Limb	40	300	No	<i>Acrobates pygmaeus</i>	1	No	No	None	No	Vegetation adjacent to Murrays Dam	483207	6549388	31400	East	Glider found in crevice in fork of trunk amongst leaf detritus

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364	11-March-2015	Grey Ironbark	NR	Limb	100	150	No	None	0	NA	NA	NA	NA	NA						
365	11-March-2015	Small-fruited Grey Gum	608	None	na	na	No	None	0	NA	NA	NA	NA	NA						Bee hive, potential hollows could not be examined or measured
366	12-March-2015	White Stringybark	NR	Limb	150	200	No	None	0	NA	NA	NA	NA	NA						
367	12-March-2015	White Mahogany	NR	Termitaria	na	na	No	None	0	NA	NA	NA	NA	NA						
368	12-March-2015	Stag	NR	Limb	100	300	No	None	0	Feathers	NA	NA	NA	NA						
368	12-March-2015	Stag	NR	Trunk	50	100	No	None	0	NA	NA	NA	NA	NA						
369	12-March-2015	Stag	NR	Trunk	150	350	No	None	0	NA	NA	NA	NA	NA						
369	12-March-2015	Stag	NR	Limb	80	100	No	None	0	NA	NA	NA	NA	NA						
370	12-March-2015	White Stringybark	NR	Limb	80	50	No	None	0	NA	NA	NA	NA	NA						Ant nest in hollow
371	12-March-2015	White Stringybark	NR	Limb	150	100	No	None	0	NA	NA	NA	NA	NA						
372	13-March-2015	Forest Red Gum	NR	Limb	20	50	No	No fauna	0	None	NA	NA	NA	NA			28500-28750	Eastern side	Nth of Smiths Creek	
373	13-March-2015	Small-fruited Grey Gum	NA	None	0	0	No	None	0	None	NA	NA	NA	NA			28500-28750	Eastern side	Nth of Smiths Creek	
374	13-March-2015	Small-fruited Grey Gum	NA	None	0	0	No	None	0	None	NA	NA	NA	NA			28500-28750	Eastern side	Nth of Smiths Creek	
375	13-March-2015	Small-fruited Grey Gum	NR	Limb	40	200	No	<i>Litoria dentata</i>	2	scats + leaf nest	No	NA	NO	relocated adjacent to site 20 m outside clearing limit	483211	6546580	28500-28750	Eastern side	Nth of Smiths Creek	
376	13-March-2015	White Stringybark	NR	Limb	180	150	No	None	0	None	NA	NA	NA	NA						Ant nest in hollow
377	13-March-2015	White Stringybark	NA	Termitaria	na	na	No	None	0	None	NA	NA	NA	NA						
378	13-March-2015	Coastal Blackbutt	NR	None	na	na	No	None	0	None	NA	NA	NA	NA						
379	16-March-2015	Forest Red Gum	NR	Limb	50	1000	No	No fauna	0	None	NA	NA	NA	NA			27200	Western	Fowler property	
380	16-March-2015	Sydney Blue Gum	NR	None	na	na	No	None	0	None	NA	NA	NA	NA						
381	16-March-2015	Sydney Blue Gum	NR	Limb	100	250	No	None	0	None	NA	NA	NA	NA						
382	16-March-2015	Tallowwood	NR	None	na	na	No	None	0	None	NA	NA	NA	NA						
383	16-March-2015	Tallowwood	NR	Limb	150	350	No	None	0	None	NA	NA	NA	NA						
384	16-March-2015	Sydney Blue Gum	NR	None	na	na	No	None	0	None	NA	NA	NA	NA						
385	18-March-2015	White Stringybark	NR	Limb	50	150	No	None	0	NA	NA	NA	NA	NA						
385	18-March-2015	White Stringybark	NR	Limb	na	na	No	None	0	NA	NA	NA	NA	NA						Blind hollow
386	18-March-2015	Grey Ironbark	NR	None	na	na	No	None	0	NA	NA	NA	NA	NA						Blind hollow
387	18-March-2015	Stag	NR	Trunk	250	600	No	<i>Ramphotyphlops nigrescens</i>	1	NA	Yes	Crush	No	Animal deceased	483136	6551210	33300	East	Animal crushed during felling of stag	
388	18-March-2015	Coastal Blackbutt	NR	Limb	100	200	No	None	0	NA	NA	NA	NA	NA						
389	18-March-2015	Coastal Blackbutt	NR	Limb	140	260	No	None	0	NA	NA	NA	NA	NA						
390	18-March-2015	Stag	NR	Trunk	350	400	No	<i>Eulamprus tenuis</i>	1	NA	No	None	No		483143	6551105	33300	East		
390	18-March-2015	Stag	NR	Limb	100	50	No	None	0	NA	NA	NA	NA	NA						
391	18-March-2015	Coastal Blackbutt	NR	Limb	80	150	No	None	0	NA	NA	NA	NA	NA						
392	18-March-2015	Coastal Blackbutt	NR	Limb	100	200	No	None	0	NA	NA	NA	NA	NA						
393	18-March-2015	White Mahogany	NR	Limb	200	300	No	None	0	NA	NA	NA	NA	NA						
394	18-March-2015	White Stringybark	NR	Termitaria	na	na	No	None	0	No excavation	NA	NA	NA	NA						
395	18-March-2015	Grey Ironbark	NR	None	na	na	No	None	0	NA	NA	NA	NA	NA						Ant nest in hollow
396	18-March-2015	Stag	NR	Fissures	na	na	No	None	0	NA	NA	NA	NA	NA						
397	18-March-2015	Coastal Blackbutt	NR	Limb	100	100	No	None	0	NA	NA	NA	NA	NA						
398	18-March-2015	Stag	NR	Fissures	na	na	No	None	0	NA	NA	NA	NA	NA						
399	18-March-2015	Pink Bloodwood	NR	None	na	na	No	None	0	NA	NA	NA	NA	NA						Blind hollow
400	18-March-2015	White Stringybark	NR	Limb	150	100	No	None	0	NA	NA	NA	NA	NA						
401	18-March-2015	Grey Ironbark	NR	Trunk	100	100	No	None	0	NA	NA	NA	NA	NA						

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402	18-March-2015	Grey Ironbark	NR	Limb	200	150	No	None	0	Leaf nest	NA	NA	NA	NA					Leaf nest (glider?)
403	18-March-2015	Grey Ironbark	NR	Trunk	80	150	No	None	0	NA	NA	NA	NA	NA					
404	18-March-2015	Coastal Blackbutt	NR	Limb	150	100	No	None	0	NA	NA	NA	NA	NA					
405	18-March-2015	Ironbark	NR	Limb	100	100	No	None	0	NA	NA	NA	NA	NA					
406	18-March-2015	Coastal Blackbutt	NR	Limb	250	150	No	None	0	NA	NA	NA	NA	NA					
407	19-March-2015	Flooded Gum	NR	Limb	40	500	No	No fauna	0	none	NA	NA	NA	NA			28200	Easter n side	Sth of Smiths Creek
407	19-March-2015	Flooded Gum	NR	Limb	60	1000	No	None	0	None	NA	NA	NA	NA					
408	20-March-2015	Forest Red Gum	NA	Possum Drey	na	na	No	No fauna	0	Old drey	NA	NA	NA	NA			27900-28000	Easter n side	Adjacent to the Heavy Vehicle inspection area
409	20-March-2015	Broad-leaved Paperbark	NA	Drey	na	na	No	No fauna	0	Old drey	NA	NA	NA	NA			27900-28000	Easter n side	Adjacent to the Heavy Vehicle inspection area
410	20-March-2015	Forest Red Gum	NA	None	na	na	No	No fauna	0	No	NA	NA	NA	NA			27900-28000	Easter n side	Adjacent to the Heavy Vehicle inspection area
411	20-March-2015	Acacia	NA	Drey	na	na	No	No fauna	0	Old drey	NA	NA	NA	NA			27900-28000	Easter n side	Adjacent to the Heavy Vehicle inspection area
412	20-March-2015	Red Ash	NA	Drey	na	na	No	No fauna	0	Old drey	NA	NA	NA	NA			27900-28000	Easter n side	Adjacent to the Heavy Vehicle inspection area
413	20-March-2015	Scribbly Gum	NA	None	na	na	No	No fauna	0	No	NA	NA	NA	NA			27900-28000	Easter n side	Adjacent to the Heavy Vehicle inspection area
414	20-March-2015	Scribbly Gum	NA	None	na	na	No	No fauna	0	No	NA	NA	NA	NA			27900-28000	Easter n side	Adjacent to the Heavy Vehicle inspection area
415	20-March-2015	Stag	NA	Fissures	na	na	No	No fauna	0	No	NA	NA	NA	NA			27900-28000	Easter n side	Adjacent to the Heavy Vehicle inspection area
416	20-March-2015	Scribbly Gum	NR	Trunk	30	100	No	No fauna	0	No	NA	NA	NA	NA			27900-28000	Easter n side	Adjacent to the Heavy Vehicle inspection area
417	24-March-2015	Stag	NR	None	na	na	No	No fauna	0	No	NA	NA	NA	NA			34700	Easter n side	In drainage line
418	27-March-2015	Stag	NR	None	na	na	No	No fauna	0	No	NA	NA	NA	NA			27450-27900	Easter n side	Nth of Wharf Rd
419	27-March-2015	Red Mahogany	NR	None	na	na	No	No fauna	0	No	NA	NA	NA	NA			27450-27900	Easter n side	Nth of Wharf Rd
420	27-March-2015	Black She-oak	NR	Drey	na	na	No	No fauna	0	No	NA	NA	NA	NA			27450-27900	Easter n side	Nth of Wharf Rd
421	27-March-2015	Stag	NR	Trunk	50	100	No	No fauna	0	No	NA	NA	NA	NA			27450-27900	Easter n side	Nth of Wharf Rd
422	27-March-2015	Broad-leaved Paperbark	NR	Old drey	na	na	No	No fauna	0	No	NA	NA	NA	NA			27450-27900	Easter n side	Nth of Wharf Rd
423	27-March-2015	Pink Bloodwood	NR	None	na	na	No	No fauna	0	No	NA	NA	NA	NA			27450-27900	Easter n side	Nth of Wharf Rd
424	27-March-2015	Scribbly Gum	NR	None	na	na	No	No fauna	0	No	NA	NA	NA	NA			27450-27900	Easter n side	Nth of Wharf Rd
425	27-March-2015	Scribbly Gum	NR	None	na	na	No	No fauna	0	No	NA	NA	NA	NA			27450-27900	Easter n side	Nth of Wharf Rd
426	27-March-2015	Scribbly Gum	NR	Limb	40	300	No	No fauna	0	No	NA	NA	NA	NA			27450-27900	Easter n side	Nth of Wharf Rd
427	27-March-2015	Paperbark	NA	Old drey	na	na	No	No fauna	0	No	NA	NA	NA	NA			27450-27900	Easter n side	Nth of Wharf Rd
428	27-March-2015	Paperbark	NA	Old drey	na	na	No	No fauna	0	No	NA	NA	NA	NA			27450-27900	Easter n side	Nth of Wharf Rd
429	27-March-2015	Paperbark	NA	Old drey	na	na	No	No fauna	0	No	NA	NA	NA	NA			27450-27900	Easter n side	Nth of Wharf Rd
430	27-March-2015	Coastal Blackbutt	NA	None	na	na	No	No fauna	0	No	NA	NA	NA	NA			27450-27900	Easter n side	Nth of Wharf Rd
431	27-March-2015	Coastal Blackbutt	NA	None	na	na	No	No fauna	0	No	NA	NA	NA	NA			27450-27900	Easter n side	Nth of Wharf Rd

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432	27-March-2015	Coastal Blackbutt	NA	None	na	na	No	No fauna	0	No	NA	NA	NA	NA			27450-27900	Easter n side	Nth of Wharf Rd
433	27-March-2015	Coastal Blackbutt	NA	None	na	na	No	No fauna	0	No	NA	NA	NA	NA			27450-27900	Easter n side	Nth of Wharf Rd
434	27-March-2015	White Stringybark	NA	None	na	na	No	No fauna	0	No	NA	NA	NA	NA			27450-27900	Easter n side	Nth of Wharf Rd
435	30-March-2015	Coastal Blackbutt	NA	None	na	na	No	No fauna	0	No	NA	NA	NA	NA			27450-27900	Easter n side	Nth of Wharf Rd
436	30-March-2015	Coastal Blackbutt	NA	None	na	na	No	No fauna	0	No	NA	NA	NA	NA			27450-27900	Easter n side	Nth of Wharf Rd
437	30-March-2015	White Mahogany	NA	None	na	na	No	No fauna	0	No	NA	NA	NA	NA			27000-27400	Easter n side	Sth of Wharf Rd
438	30-March-2015	Pink Bloodwood	NA	Stick nest	na	na	No	No fauna	0	birds nest - see pics	NA	NA	NA	NA			27000-27400	Easter n side	Sth of Wharf Rd
General clearing obs.	30-March-2015	10 HBTs	NA					Pink-tongued Lizard	1	No	NA	NA	NA	Moved into adjacent habitat	483078	6547212	29300	West	South of Kundabung Road
General clearing obs	30-March-2015	9 HBTs	NA					Australian Owllet Nightjar	1	No	NA	NA	NA	Flew off after the tree has been felled	483090	6547192	29300	West	
439	08-April-2015	Flooded Gum	NA	None	na	na	No	No fauna	0	No	NA	NA	NA				28250		Large flooded gum on northern bank of Smiths Creek
General clearing obs	09-April-2015	Grass mowing	NA					<i>Litoria fallax</i>	136	No	NA	NA	NA	Further to the west	483159	483159	28400	wester n	Stockpile area at end of Rodeo Drive
General clearing obs	09-April-2015	Grass mowing	NA					<i>Hemiaspis signata</i>	1	No	NA	NA	NA	Further to the west	483159	483159	28400	wester n	Stockpile area at end of Rodeo Drive
440	12-April-2015	Turpentine	NA	Nest boxes	na	na	No	No fauna	0	No	NA	NA	NA				25350-25500	Easter n side	Mingaletta Rd + Barrys Creek
441	13-April-2015	Stag	NR	Limb	40	100	No	No fauna	0	none	NA	NA	NA	NA			25850	Easter n side	Mobbs Dr
442	14-April-2015	Pink Bloodwood	NR	None	na	na	No	No fauna	0	No	NA	NA	NA				25350-25500	Easter n side	Mingaletta Rd + Barrys Creek
443	15-April-2015	Pink Bloodwood	NR	Limb	50	300	No	No fauna	0	No	NA	NA	NA				25350-25500	Easter n side	Mingaletta Rd + Barrys Creek
443	15-April-2015	Pink Bloodwood	NR	Limb	60	300	No	No fauna	0	No	NA	NA	NA						
444	16-April-2015	Pink Bloodwood	NR	Fissures	na	na	No	No fauna	0	No	NA	NA	NA				25350-25500	Easter n side	Mingaletta Rd + Barrys Creek
445	17-April-2015	White Mahogany	NR	None	na	na	No	No fauna	0	No	NA	NA	NA				25350-25500	Easter n side	Mingaletta Rd + Barrys Creek
446	18-April-2015	Flooded Gum	NR	Limb	70	1000	No	No fauna	0	No	NA	NA	NA				25350-25500	Easter n side	Mingaletta Rd + Barrys Creek
446	18-April-2015	Flooded Gum	NR	Limb	30	300	No	No fauna	0	No	NA	NA	NA						
447	19-April-2015	Flooded Gum	NR	Trunk	80	500	No	Sugar Glider	1	active hollow	No	NA	No	Hollow with gliders placed outside of clearing limit	483181	6543399	25350-25500	Easter n side	Mingaletta Rd + Barrys Creek
448	20-April-2015	Forest Red Gum	NR	Trunk	300	100	No	No fauna	0	Leaf nest	NA	NA	NA	NA			28400-28800	Wester n Side	Nth of Smiths Creek
449	20-April-2015	Tallowwood	NR	None	na	na	No	No fauna	0	No	NA	NA	NA	NA			28400-28800	Wester n Side	Nth of Smiths Creek
450	20-April-2015	Tallowwood	NR	Trunk	30	350	No	Sugar Glider	3	leaf nest	No	NA	No	Sugar gliders placed in nest box Ch. 28700	483163	6546699	28400-28800	Wester n Side	Nth of Smiths Creek
451	20-April-2015	Forest Red Gum	NR	None	na	na	No	No fauna	0	No	NA	NA	NA	NA			28400-28800	Wester n Side	Nth of Smiths Creek

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452	20-April-2015	Stag	NR	None	na	na	No	No fauna	0	No	NA	NA	NA	NA			28400-28800	Western Side	Nth of Smiths Creek
453	20-April-2015	Scribbly Gum	NR	None	na	na	No	No fauna	0	No	NA	NA	NA	NA			28400-28800	Western Side	Nth of Smiths Creek
454	20-April-2015	Flooded Gum	NR	Limb	50	800	No	No fauna	0	No	NA	NA	NA	NA			25350-25500	Eastern side	Mingaletta Rd + Barrys Creek
455	21-April-2015	White Mahogany	NR	Limb	30	300	No	No fauna	0	No	NA	NA	NA	NA			255050-25300	Western Side	Sth of Mingaletta Rd
456	21-April-2015	Stag	NR	Limb	30	100	No	No fauna	0	No	NA	NA	NA	NA			255050-25300	Western Side	Sth of Mingaletta Rd
456	21-April-2015	Stag	NR	Limb	40	200	No	No fauna	0	No	NA	NA	NA	NA			255050-25300	Western Side	Sth of Mingaletta Rd
457	21-April-2015	Flooded Gum	NR	Trunk	600	2000	No	No fauna	0	No	NA	NA	NA				25350-25500	Eastern side	Mingaletta Rd + Barrys Creek
458	23-April-2015	Stag	372	Limb	40	200	Yes	No fauna	0	scats + Greater Glider tree	NA	NA	NA	Adjacent to site on a Hollow-bearing tree			24820-25100	Western Side	Sth of Mingaletta Rd - rest area
458	23-April-2015	Stag	372	Limb	30	100	Yes	No fauna	0	No	NA	NA	NA				24820-25100	Western Side	
458	23-April-2015	Stag	372	Limb	60	300	Yes	No fauna	0	No	NA	NA	NA				24820-25100	Western Side	
458	23-April-2015	Stag	372	Trunk	30	100	Yes	No fauna	0	No	NA	NA	NA				24820-25100	Western Side	
458	23-April-2015	Stag	372	Trunk	60	250	Yes	<i>Eulamprus tenuis</i>	3	No	NA	NA	NA	West in moist gully – 70 m	482995	6542908	24820-25100	Western Side	
458	23-April-2015	Stag	372	Trunk	100	2000	Yes	No fauna	0	No	NA	NA	NA				24820-25100	Western Side	
459	23-April-2015	Stag	NR	None	na	na	No	No fauna	0	No	NA	NA	NA				24820-25100	Western Side	Sth of Mingaletta Rd - rest area
460	23-April-2015	Stag	NR	Limb	300	1000	No	No fauna	0	No	NA	NA	NA				24820-25100	Western Side	Sth of Mingaletta Rd - rest area
460	23-April-2015	Stag	NR	Limb	60	300	No	No fauna	0	No	NA	NA	NA						
461	23-April-2015	Stag	NR	Trunk	200	500	No	No fauna	0	No	NA	NA	NA				24820-25100	Western Side	Sth of Mingaletta Rd - rest area
461	23-April-2015	Stag	NR	Limb	50	200	No	No fauna	0	No	NA	NA	NA						
462	23-April-2015	Stag	NR	Trunk	50	200	No	No fauna	0	No	NA	NA	NA				24820-25100	Western Side	Sth of Mingaletta Rd - rest area
463	23-April-2015	Stag	NR	Limb	70	1000	No	No fauna	0	No	NA	NA	NA				24820-25100	Western Side	Sth of Mingaletta Rd - rest area
463	23-April-2015	Stag	NR	Limb	50	100	No	No fauna	0	No	NA	NA	NA						
463	23-April-2015	Stag	NR	Limb	100	300	No	No fauna	0	No	NA	NA	NA						
464	23-April-2015	Pink Bloodwood	NR	limb	50	1000	No	<i>Eulamprus tenuis</i>	1	No	No	NA	no	Adjacent to site on a Hollow-bearing tree	482990	6542828	24820-25100	Western Side	Sth of Mingaletta Rd - rest area
464	23-April-2015	Pink Bloodwood	NR	limb	50	500	No	No fauna	0	No	NA	NA	NA						
464	23-April-2015	Pink Bloodwood	NR	limb	70	300	No	No fauna	0	No	NA	NA	NA						
464	23-April-2015	Pink Bloodwood	NR	limb	50	500	No	No fauna	0	No	NA	NA	NA						
465	28-April-2015	Stag	NR	Limb	150	1500	No	No fauna	0	No	NA	NA	NA				24750-24900	Western Side	Sth of Mingaletta Rd - rest area
466	28-April-2015	Stag	NR	Trunk	400	3000	No	No fauna	0	No	NA	NA	NA				24750-24900	Western Side	Sth of Mingaletta Rd - rest area
467	28-April-2015	Pink Bloodwood	NR	Limb	150	2000	No	Micro bat - possibly flew from a hollow	1	No	NA	NA	NA	NA	482944	6542789	24750-24900	Western Side	Sth of Mingaletta Rd - rest area
467	28-April-2015	Pink Bloodwood	NR	Limb	100	1000	No	No fauna	0	No	NA	NA	NA						
467	28-April-2015	Pink Bloodwood	NR	Limb	70	800	No	No fauna	0	No	NA	NA	NA						

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468	28-April-2015	Stag	NR	Limb	70	1000	No	No fauna	0	No	NA	NA	NA				24750-24900	Western Side	Sth of Mingaletta Rd - rest area
468	28-April-2015	Stag	NR	Trunk	120	1000	No	No fauna	0	No	NA	NA	NA						
469	28-April-2015	Small-fruited Grey Gum	NR	None	na	na	No	No fauna	0	No	NA	NA	NA				24750-24900	Western Side	Sth of Mingaletta Rd - rest area
470	28-April-2015	Stag	NR	Trunk	70	200	No	No fauna	0	No	NA	NA	NA				24750-24900	Western Side	Sth of Mingaletta Rd - rest area
471	01-June-2015	Flooded Gum	NR	None	na	na	No	<i>Litoria tyleri</i>	2	No	NA	NA	NA	40 m upstream on northern bank	483127	6546274	28400	West	Smiths Creek - north
471	01-June-2015	Flooded Gum	NR	Limb	30	150	No	<i>Litoria dentata</i>	1	No	NA	NA	NA	40 m upstream on northern bank	483127	6546274	28400	West	Smiths Creek - north
472	02-June-2015	White Stringybark	NR	None	na	na	No	No fauna	0	No	NA	NA	NA						
473	02-June-2015	Small-fruited Grey Gum	NR	Limb	30	200	No	Feathertail Glider	1	In use	Yes	Crush	No	Died on site - habitat tree felled with chainsaw	482995	6547291	29300	West	Manual fall of habitat tree in services corridor
474	03-June-2015	Stag	NR	trunk	80	1000	No	No fauna	0	old rub and wear marks	NA	NA	NA				28630	west	Stag outside of clearing limits but considered an unsound tree - Culvert 28.60 works
475	03-June-2015	Red Mahogany	NR	Limb	40	200	No	No fauna	0	No	NA	NA	NA						
475	03-June-2015	Red Mahogany	NR	Limb	60	300	No	<i>Egernia mcphreei</i>	2	No	NA	NA	NA		482858	6548135	30300	West	Ravenswood Service Road works
476	10-June-2015	White Stringybark	NR	Trunk	200	4000	No	No fauna	0	No	NA	NA	NA				35900-36135	Eastern side	Nth of Gate 17
476	10-June-2015	White Stringybark	NR	Limb	100	1000	No	No fauna	0	No	NA	NA	NA						
477	10-June-2015	Stag	NR	Trunk	100	200	No	No fauna	0	No	NA	NA	NA				35900-36135	Eastern side	Nth of Gate 17
478	10-June-2015	Stag	NR	Limb	100	1000	No	No fauna	0	No	NA	NA	NA				35900-36135	Eastern side	Nth of Gate 17
478	10-June-2015	Stag	NR	Limb	50	1000	No	No fauna	0	No	NA	NA	NA						
478	10-June-2015	Stag	NR	Limb	200	2000	No	No fauna	0	No	NA	NA	NA						
479	10-June-2015	White Mahogany	NR	None	0	0	No	No fauna	0	No	NA	NA	NA				35900-36135	Eastern side	Nth of Gate 17
480	10-June-2015	Pink Bloodwood	NR	None	na	na	No	No fauna	0	No	NA	NA	NA				35900-36135	Eastern side	Nth of Gate 17
481	10-June-2015	White Stringybark	NR	Limb	20	200	No	No fauna	0	No	NA	NA	NA				35900-36135	Eastern side	Nth of Gate 17
482	10-June-2015	Small-fruited Grey Gum	NR	Limb	20	200	No	No fauna	0	No	NA	NA	NA				35900-36135	Eastern side	Nth of Gate 17
483	10-June-2015	White Stringybark	NR	Limb	30	200	No	No fauna	0	No	NA	NA	NA				35900-36135	Eastern side	Nth of Gate 17
483	10-June-2015	White Stringybark	NR	Trunk	30	50	No	No fauna	0	No	NA	NA	NA				35900-36135	Eastern side	Nth of Gate 17
484	10-June-2015	Red Mahogany	NR	None	na	na	No	No fauna	0	No	NA	NA	NA				35900-36135	Eastern side	Nth of Gate 17
485	10-June-2015	Red Mahogany	NA	Termitaria	na	na	No	No fauna	0	No chamber	NA	NA	NA				35900-36135	Eastern side	Nth of Gate 17
486	10-June-2015	Red Mahogany	NA	Limb	50	400	No	No fauna	0	Bark nest - relocated outside clearing limit	NA	NA	NA				35900-36135	Eastern side	Nth of Gate 17
487	10-June-2015	White Mahogany	NA	Limb	100	200	No	No fauna	0	No	NA	NA	NA				35900-36135	Eastern side	Nth of Gate 17
488	10-June-2015	Stag	NA	Limb	50	200	No	No fauna	0	No	NA	NA	NA				24750-25375	Western Side	Sth of Gate 1
489	10-June-2015	Stag	NA	None	na	na	No	No fauna	0	No	NA	NA	NA				24750-25375	Western Side	Sth of Gate 1
490	02-July-2015	White Mahogany	NA	None	na	na	No	No fauna	0	No	NA	NA	NA				29284-30650	Western Side	Rodeo Dr

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491	02-July-2015	Grey Gum	NA	None	na	na	No	No fauna	0	No	NA	NA	NA				29284-30650	Western Side	Rodeo Dr
492	02-July-2015	Stag	NA	Fissures	na	na	No	No fauna	0	None	NA	NA	NA				29284-30650	Western Side	Rodeo Dr
493	02-July-2015	Allocasuarina	NA	Old drey	na	na	No	No fauna	0	old	NA	NA	NA				29284-30650	Western Side	Rodeo Dr
494	02-July-2015	Ground Log	NA	Ground log	na	na	Yes	No fauna	0	No	NA	NA	NA				29284-30650	Western Side	Rodeo Dr
495	02-July-2015	Grey Ironbark	NA	None	na	na	No	No fauna	0	No	NA	NA	NA				29284-30650	Western Side	Rodeo Dr
496	02-July-2015	Stag	NA	None	na	na	No	No fauna	0	No	NA	NA	NA				29284-30650	Western Side	Rodeo Dr
497	02-July-2015	Tallowwood	NA	None	na	na	No	No fauna	0	No	NA	NA	NA				29284-30650	Western Side	Rodeo Dr
498	02-July-2015	White Mahogany	NA	Termitaria	na	na	No	No fauna	0	Old chamber	NA	NA	NA				29284-30650	Western Side	Rodeo Dr
499	02-July-2015	Grey Ironbark	NA	Fissures	na	na	No	No fauna	0	None	NA	NA	NA				29284-30650	Western Side	Rodeo Dr
500	02-July-2015	Tallowwood	NA	Trunk	25	400	No	Feathertail Glider	0	active hollow	No	NA	No	Placed in nest box adjacent to the site	482923	6548267	29284-30650	Western Side	Rodeo Dr
501	02-July-2015	Red Mahogany	NS	None	na	na	No	No fauna	0	No	NA	NA	NA				29284-30650	Western Side	Rodeo Dr
502	07-July-2015	Pink Bloodwood	NR	None	na	na	No	No fauna	0	No	NA	NA	NA						
503	07-July-2015	Stag	NR	Trunk	100	3000	No	No fauna	0	Old glider nest	NA	NA	NA				36300-36700	East	Joan's Rest to Railway Dam Road
504	2-Jun-16	Small-fruited Grey Gum	NR	Limb	30	50	No	No fauna	0	No	NA	NA	NA				29700-29950	Eastern side	Kundabung Rest Area
505	11-August-2016	Scribbly Gum	NR	Limb	30	50	No	No fauna	0	No	NA	NA	NA						
506	11-August-2016	Scribbly Gum	NR	Limb	20	50	No	No fauna	0	No	NA	NA	NA						
507	11-August-2016	Scribbly Gum	NR	Limb	60	50	No	No fauna	0	No	NA	NA	NA						
508	11-August-2016	Allocasuarina	NR	Poosum Drey	na	na	No	No fauna	0	Old use	NA	NA	NA						
509	15-August-2016	Scribbly Gum	NR	Limb	30	50	No	No fauna	0	No	NA	NA	NA						
510	15-August-2016	Coastal Blackbutt	NR	Limb	30	50	No	No fauna	0	No	NA	NA	NA						
510	15-August-2016	Coastal Blackbutt	NR	Limb	40	100	No	No fauna	0	No	NA	NA	NA						
511	15-August-2016	Coastal Blackbutt	NR	Limb	20	50	No	No fauna	0	No	NA	NA	NA						
511	15-August-2016	Coastal Blackbutt	NR	Limb	40	150	No	No fauna	0	No	NA	NA	NA						
512	15-August-2016	Coastal Blackbutt	NR	Limb	30	70	No	No fauna	0	Yes old feathertail nest	NA	NA	NA						
General clearing obs	16-August-2016							<i>Litoria fallax</i>	7	No	NA	NA	NA	Relocated to the west	483179	6545963	28000	West	Smiths Creek south
General clearing obs	16-August-2016							<i>Litoria gracilent a</i> (not in hollow - in tree canopy)	3	No	NA	NA	NA	Relocated to the west	483179	6546112	28100	West	Smiths Creek south
General clearing obs	16-August-2016							<i>Rattus fuscipes</i>	1	No	NA	NA	NA	Left site further to west	483178	6546162	28170	West	Smiths Creek south
General clearing obs	17-August-2016							<i>Lamprol holis delicata</i>	5	No	NA	NA	NA		483178	6546162	28170	West	Smiths Creek south

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General clearing obs	17-August-2016							<i>Calyptotis ruficauda</i>	2	No	NA	NA	NA		483143	6545148	27200	West	South Smiths Creek Road
General clearing obs	17-August-2016							Bearded Dragon	1	No	NA	NA	NA		483149	6545103	27200	West	South Smiths Creek Road
513	23-August-2016	Coastal Blackbutt	NR	Limb	30	50	No	No fauna	0	No	NA	NA	NA						
513	23-August-2016	Coastal Blackbutt	NR	Limb	30	150	No	No fauna	0	No	NA	NA	NA						
514	30-August-2016	Stump	NR	Fissures	na	na	No	<i>Egernia mcphreei</i>	1	No	No	NA	NA	Release into adjacent timber pile to the north east	483028	6551581	33700	East	East of Cut 18
General clearing obs	25-October-2016							Northern Brown Bandicoot	1	No	Yes	Mulcher/ Crush Injuries	No	Died on site	483153	6549036	30900	West	Flushed in long grass during mowing/mulching - corrective action to mow from roadside heading west only
General clearing obs	08-November-2016							Eastern Water Dragon	1	No	No	NA	NA	Moved outside of works area	483145	6554787	37050	East	Maria River basin outlet works
515	19-July-2017	White Stringybark		Trunk	50	1000	Yes	Nil	0	Sugar Glider nest	NA	NA	NA				32750	East	Powerline easement area in southern part of Maria State Forest
515	19-July-2017	White Stringybark		Trunk	70	150	Yes	Nil	0	No	NA	NA	NA				32750	East	Powerline easement area in southern part of Maria State Forest
515	19-July-2017	White Stringybark		Trunk	50	650	Yes	Nil	0	No	NA	NA	NA				32750	East	Powerline easement area in southern part of Maria State Forest
515	19-July-2017	White Stringybark		Trunk	80	150	Yes	Nil	0	No	NA	NA	NA				32750	East	Powerline easement area in southern part of Maria State Forest
516	8-Aug-17	Stag		Trunk	60	500	Yes	Nil	0	No	NA	NA	NA				37800	West	Stumpy Creek Unsound Trees
516	8-Aug-17	Stag		Trunk	60	300	Yes	Nil	0	No	NA	NA	NA				37800	West	Stumpy Creek Unsound Trees
516	8-Aug-17	Stag		Trunk	40	200	Yes	Nil	0	No	NA	NA	NA				37800	West	Stumpy Creek Unsound Trees
517	09-November-2017	Coastal Blackbutt		Limb	60	450	Yes	Nil	0	No	NA	NA	NA				37250	East	Kempsey Road Bus Bay
517	09-November-2017	Coastal Blackbutt		Limb	40	150	Yes	Nil	0	No	NA	NA	NA				37250	East	Kempsey Road Bus Bay
517	09-November-2017	Coastal Blackbutt		Limb	30	200	Yes	Nil	0	No	NA	NA	NA				37250	East	Kempsey Road Bus Bay
518	17-Jan-18	Stag		Limb	300	800	Yes	Nil	0	No	NA	NA	NA				34450	West	Dangerous tree adjacent pull over bay south of Cut 20
518	17-Jan-18	Stag		trunk	80	500	Yes	Nil	0	Old glider nest	NA	NA	NA				34450	West	Dangerous tree adjacent pull over bay south of Cut 20
519	19-Jan-18	Acacia		Exfoliating bark				Long-eared Bat	1	Utilised	No	NA	NA	Took flight during the day	483238	6546556	28500	East	Trees being gently pushed with a backhoe
General clearing obs	18-August-2017							<i>Litoria gracilent a</i> (not in hollow - in tree canopy)	1	No	NA	NA	NA	Relocated to the west	483183	6546132	28130	West	Smiths Creek south
General clearing obs	10th-April-2017							<i>Litoria fallax</i>	5	Utilised	No			Adjacent or further to the west	483179	6546271	28300	West	Smiths Creek North Side
520	13th January 2017	Tallowwood		Limb	50	200	No	no	0	No	NA	NA	NA				36500	West	~250 m south of Old Coast Road
520	13th January 2017	Tallowwood		Limb	30	150	No	no	0	No	NA	NA	NA				36500	West	~250 m south of Old Coast Road
521	13th January 2017	Ironbark		Fissures	20	100	No	No	0	No	NA	NA	NA				36500	West	~250 m south of Old Coast Road
521	13th January 2017	Ironbark		Limb	200	250	No	No	0	No	NA	NA	NA				36500	West	~250 m south of Old Coast Road
522	1st-December-2016	Turpentine	NA	Basal	400	400	Yes	No	0	no	NA	NA	NA				34800		Dangerous tree removal following bushfire in November



Habitat Seq. Num.	Date	Tree species	HBT Ref No.	Habitat Feature	Ent. Diam. (mm)	Depth (mm)	Redist.	Fauna recorded	No.	Signs of use	Injured	Type of injuries	Taken into care	Fauna Release location	Easting	Northing	Ch.	SoC	Notes
523	1st-December-2016	White Stringybark	NA	Limb	100	250	Yes	No	0	no	NA	NA	NA				35350	West	Dangerous tree removal following bushfire in November. Tree was chainsaw so hard fell to ground smashing a lot of hollows
523	1st-December-2016	White Stringybark	NA	Limb	70	350	yes	No	0	Yes - Glider nest	NA	NA	NA				35350	West	Dangerous tree removal following bushfire in November. Tree was chainsaw so hard fell to ground smashing a lot of hollows
523	1st-December-2016	White Stringybark	NA	Limb	50	250	yes	No	0	no	NA	NA	NA				35350	West	Dangerous tree removal following bushfire in November. Tree was chainsaw so hard fell to ground smashing a lot of hollows
524	2nd December-2016	White Mahogany	NA	Limb	60	220	Yes	No	0	no	NA	NA	NA				34800	West	Dangerous tree removal following bushfire in November
525	2nd December-2016	Coastal Blackbutt	NA	Limb	50	150	Yes	No	0	no	NA	NA	NA				34900	West	Dangerous tree removal following bushfire in November
526	3rd December 2016	Coastal Blackbutt	NA	Limb	70	1000	Yes	No	0	no	NA	NA	NA				34000	West	Dangerous tree removal following bushfire in November. Just before old bloodwood rest area access
526	3rd December 2016	Coastal Blackbutt	NA	Limb	50	250	Yes	No	0	no	NA	NA	NA				34000	West	Dangerous tree removal following bushfire in November. Just before old bloodwood rest area access
526	3rd December 2016	Coastal Blackbutt	NA	Limb	30	200	Yes	No	0	no	NA	NA	NA				34000	West	Dangerous tree removal following bushfire in November. Just before old bloodwood rest area access
526	3rd December 2016	Coastal Blackbutt	NA	Limb	50	200	Yes	No	0	no	NA	NA	NA				34000	West	Dangerous tree removal following bushfire in November. Just before old bloodwood rest area access
526	3rd December 2016	Coastal Blackbutt	NA	Limb	70	150	Yes	No	0	no	NA	NA	NA				34000	West	Dangerous tree removal following bushfire in November. Just before old bloodwood rest area access
526	3rd December 2016	Coastal Blackbutt	NA	Limb	50	200	Yes	No	0	no	NA	NA	NA				35700	West	Near old Gate 17 entrance.
526	3rd December 2016	Coastal Blackbutt	NA	Limb	40	100	Yes	No fauna	0	no	NA	NA	NA				33600	East n side	Smiths Road in Maria River State Forest
526	3rd December 2016	Coastal Blackbutt	NA	Limb	110	300	Yes	No fauna	0	no	NA	NA	NA				33600	East n side	Smiths Road in Maria River State Forest
527	09-November-2017	White Stringybark	NA	Termitaria	na	na	No	No fauna	0	no	NA	NA	NA				37350	East n side	Kemps Road Bus Bay Works
528	3rd December 2016	White Stringybark	NA	Termitaria	na	na	Yes	No fauna	0	no	NA	NA	NA						
529	3rd December 2016	White Stringybark	NA	Termitaria	na	na	Yes	No fauna	0	no	NA	NA	NA						
530	23-April-2015	Pink Bloodwood	NR	Limb	350	1000	No	No fauna	0	no	NA	NA	NA						
530	23-April-2015	Pink Bloodwood	NR	Limb	400	750	No	No fauna	0	no	NA	NA	NA						
530	23-April-2015	Pink Bloodwood	NR	Limb	110	500	No	No fauna	0	no	NA	NA	NA						
531	23-April-2015	Stag	NR	limb	50	200	No	No fauna	0	no	NA	NA	NA				28630	west	Stag outside of clearing limits but considered an unsound tree - Culvert 28.60 works
531	23-April-2015	Stag	NR	limb	75	350	No	No fauna	0	no	NA	NA	NA				28630	west	Stag outside of clearing limits but considered an unsound tree - Culvert 28.60 works
532	23-April-2015	Stag	NR	limb	30	150	No	No fauna	0	no	NA	NA	NA				28630	west	Stag outside of clearing limits but considered an unsound tree - Culvert 28.60 works
532	23-April-2015	Stag	NR	limb	50	500	No	No fauna	0	no	NA	NA	NA				28630	west	Stag outside of clearing limits but considered an unsound tree - Culvert 28.60 works
533	13-July-2015	Coastal Blackbutt	NR	Limb	40	190	No	No fauna	0	no	NA	NA	NA				36300-36700	East	Joan's Rest to Railway Dam Road
534	13-July-2015	Coastal Blackbutt	NR	nil - blind hollows	na	na	No	No fauna	0	no	NA	NA	NA				36300-36700	East	Joan's Rest to Railway Dam Road
535	13-July-2015	Coastal Blackbutt	NR	limb	160	200	No	No fauna	0	no	NA	NA	NA				36300-36700	East	Joan's Rest to Railway Dam Road
535	13-July-2015	Coastal Blackbutt	NR	Limb	200	150	No	No fauna	0	no	NA	NA	NA				36300-36700	East	Joan's Rest to Railway Dam Road

Habitat Seq. Num.	Date	Tree species	HBT Ref No.	Habitat Feature	Ent. Diam. (mm)	Depth (mm)	Redist.	Fauna recorded	No.	Signs of use	Injured	Type of injuries	Taken into care	Fauna Release location	Easting	Northing	Ch.	SoC	Notes
535	13-July-2015	Coastal Blackbutt	NR	Limb	50	150	No	No fauna	0	no	NA	NA	NA				36300-36700	East	Joan's Rest to Railway Dam Road
536	13-July-2015	Stag	NR	Limb	50	150	No	No fauna	0	no	NA	NA	NA				36300-36700	East	Joan's Rest to Railway Dam Road
537	13-July-2015	Stag	NR	fissures	na	na	No	No fauna	0	no	NA	NA	NA				36300-36700	East	Joan's Rest to Railway Dam Road
538	13-July-2015	Coastal Blackbutt	NR	nil- blind hollows	na	na	No	No fauna	0	no	NA	NA	NA				36300-36700	East	Joan's Rest to Railway Dam Road
539	13-July-2015	Coastal Blackbutt	NR	Limb	30	120	No	No fauna	0	no	NA	NA	NA				36300-36700	East	Joan's Rest to Railway Dam Road

Table A2: Pre-clearing surveys conducted during the clearing phase of the K2K Project.

Survey Sequence Number	Date	Spotlight	Habitat search	Pre-Clear Walk Through	Chainage	Side of carriage way	Site name	Species detected	No.	notes
1	18-Nov-14	Yes	Yes	Yes	24800-25375	East	Mingaletta South	Sugar Glider x 1; Diamond Python x 1; Common Ringtail Possum x 1; Lampropholis delicata x 5; Calyptotis ruficauda x 2	10	Spotlighted and active searching
2	19-Nov-14	Yes	No	No	24950-25350	East	Mingaletta South	Brush-tailed Possum (1), Ring-tailed Possum (1), Long-nosed Bandicoot (1)	3	75 min of spotlighting
3	19-Nov-14	No	Yes	Yes	24950-25350	East	Mingaletta South	<i>Lampropholis delicata</i>	50	3 hours of active searching
4	24-Nov-14	No	Yes	Yes	24100-24900	Eastern	Barrys Creek	<i>Lampropholis delicata</i>	5	Relocated to outside clearing limit
5	24-Nov-14	Yes	Yes	Yes	24900-24600	Eastern	Sth of Mingaletta Rd	<i>Lampropholis delicata</i>	2	Relocated to outside clearing limit to the east
6	24-Nov-14	Yes	Yes	Yes	35300-35800	Eastern	Middle Gate Road to Joan's Rest	<i>Lampropholis delicata</i>	7	Relocated to outside clearing limit to the east
7	25-Nov-14	Yes	Yes	Yes	24500-24100	Eastern	Sth of Mingaletta Rd	<i>Lampropholis delicata</i>	1	Translocated >30 m outside clearance limit
8	25-Nov-14	Yes	Yes	Yes	35300-35800	Eastern	Middle Gate Road to Joan's Rest	<i>Lampropholis delicata</i>	4	Relocated to outside clearing limit to the east
9	26-Nov-14	Yes	Yes	Yes	24537-24900	Eastern	Sth of Mingaletta Rd	<i>Lampropholis delicata</i>	1	Translocated >30 m outside clearance limit
10	26-Nov-14	Yes	Yes	No	35300-35800	Eastern	Middle Gate Road to Joan's Rest	No fauna	3	Relocated to outside clearing limit to the east
11	27-Nov-14	Yes	Yes	Yes	24537-24900	Eastern	Sth of Mingaletta Rd	<i>Limnodynastes peronii</i>	1	Translocated >30 m outside clearance limit
12	27-Nov-14	Yes	Yes	No	35300-35800	Eastern	Middle Gate Road to Joan's Rest	<i>Lampropholis delicata</i> (3); <i>Calyptotis ruficauda</i> (2)	5	Relocated to outside clearing limit to the east
13	28-Nov-14	Yes	Yes	No	35300-35800	Eastern	Middle Gate Road to Joan's Rest	No fauna		
14	28-Nov-14	Yes	Yes	Yes	24900-24700	Eastern	Sth of Mingaletta Rd	No fauna		
15	2-Dec-14	Yes	Yes	Yes	34800-35250	East	Maria River - Middle Gate Road	Nil		1 hr 15 min spotlighting and same amount of time active search
16	2-Dec-14	Yes	Yes	Yes	24537-24800	Eastern	Sth of Mingaletta Rd	<i>Limnodynastes peronii</i>	1	Translocated >30 m outside clearance limit
17	3-Dec-14	Yes	Yes	Yes	34900-35200	East	Maria River - Middle Gate Road	Brush-tailed Possum (1); Eastern Brown Snake (juv) x 1	2	Relocated approx. 100 metres east of 34900
18	3-Dec-14	Yes	Yes	Yes	24500-24537	Eastern	Sth of Mingaletta Rd	No fauna		
19	4-Dec-14	Yes	Yes	Yes	34680-34900	East	Maria River - Middle Gate Road	<i>Mixophyes fasciolatus</i> (5), <i>Adelotus brevis</i> (4)	9	
20	5-Dec-14	Yes	Yes	Yes	34680-35200	East	Maria River - Middle Gate Road	<i>Mixophyes fasciolatus</i> (2), <i>Litoria peronii</i> (2), <i>L. fallax</i> (3); <i>Cryptophis nigricens</i>		Frogs were relocated approx. 100 metres west of 34700; Snake relocated approx. 100 metres west of 34950
21	5-Dec-14	Yes	Yes	Yes	24500-24600	East	Mingaletta	Brush-tailed Possum (1); <i>Limnodynastes peroni</i> (1)	2	Frog was relocated to edge of Barrys Creek
22	6-Dec-14	No	Yes	Yes	35200-35400	East	Maria River - Middle Gate Road	Nil		Spotlighting of habitat tree area prior to clearing
23	6-Dec-14	No	Yes	Yes	25100-24800	Eastern	Sth of Mingaletta Rd	<i>Varanus varius</i>	1	In tree. Tree marked up as per other habitat trees and 10m exclusion zone of hazard tape put up around the tree.

Survey Sequence Number	Date	Spotlight	Habitat search	Pre-Clear Walk Through	Chainage	Side of carriage way	Site name	Species detected	No.	notes
24	8-Dec-14	Yes	Yes	Yes	34450-34640	East	Maria River - Middle Gate Road	<i>Varanus varius</i> , <i>Pogona barbata</i>	2	1 hr 15 spotlight followed by two separate active searches and walks totalling 3.5 hrs - captured reptiles released further to the east.
25	8-Dec-14	Yes	Yes	Yes	25100-24800	Eastern	Sth of Mingaletta Rd	No fauna		
26	9-Dec-14	Yes	Yes	Yes	34200-34640	East	Maria River - Middle Gate Road	<i>Varanus varius</i>	1	
27	9-Dec-14	No	Yes	Yes	25100-24800	Eastern	Sth of Mingaletta Rd	No fauna		
28	10-Dec-14	Yes	Yes	Yes	34000-34640	East	Maria River - Middle Gate Road	<i>Saltuarius moritzi</i> x 2, <i>Mixophyes fasciolatus</i>	3	Recorded during predawn spotlighting and relocated further to the east.
29	10-Dec-14	No	Yes	Yes	25100-24850	Eastern	Sth of Mingaletta Rd	No fauna		
30	10-Dec-14	Yes	No	No	33700-34050	Eastern	Smiths Road in Maria River State Forest	<i>Sminthopsis murina</i>	1	spotlighted
31	11-Dec-14	Yes	Yes	Yes	34000-34200	East	Maria River - Middle Gate Road	<i>Egernia mcphreei</i>	1	observed basking on dead log next to creek but not captured
32	11-Dec-14	Yes	Yes	Yes	25350-25550 + 25100-24850	Eastern	Nth and Sth of Mingaletta Rd	No fauna		
33	12-Dec-14	Yes	Yes	Yes	34000-34200	East	Maria River - Middle Gate Road	<i>Egernia mcphreei</i>	2	Captured in shattered stump - relocated approx. 60 metres east of 34050
34	13-Dec-14	No	Yes	Yes	33700-34200	East	Maria River - Middle Gate Road	Nil	0	
35	15-Dec-14	No	Yes	Yes	25350-25550 + 25100-24850	Eastern	Nth and Sth of Mingaletta Rd	No fauna		
36	16-Dec-14	No	Yes	Yes	33500-33800	East	Cut 19	Nil	0	
37	16-Dec-14	Yes	Yes	Yes	25350-25750	Eastern	Between Mingaletta rd. and Mobbs Dr	No fauna		
38	17-Dec-14	Yes	Yes	Yes	25500-25750	Eastern	Between Mingaletta rd. and Mobbs Dr	Common Brushtail Possum (1); Limnodynastes peroni (1); Pseudophyrne coreacea (1)	3	
39	5-Jan-15	Yes	Yes	Yes	24250-24600	Eastern	Barrys Creek to Mingaletta	Nil	0	
40	5-Jan-15	Yes	Yes	Yes	29350-30000	Eastern	Kundabung Rest Area and south	Limnodynastes peroni (1); Common Ringtail Possum (1)	2	Frog relocated to the east, possum not captured
41	5-Jan-15	Yes	Yes	Yes	33000-33700	Eastern	Central Maria River SF	Nil	0	
42	6-Jan-15	Yes	Yes	Yes	24250-24600	Eastern	Barrys Creek to Mingaletta	Common Brushtail Possum (1)	1	Perched in low canopy at edge of clearing limit - not captured
43	6-Jan-15	Yes	Yes	Yes	29350-30000	Eastern	Kundabung Rest Area and south	Common Blue Tongue Lizard (1)	1	Relocated to the north and east around 100 m
44	6-Jan-15	Yes	Yes	Yes	29500-30000	Eastern	Kundabung	<i>Cryptophis nigricens</i>	1	Large adult (approx. 1 metre) snake captured @ 29600 and relocated approx. 150 metres west of 29750
45	6-Jan-15	Yes	Yes	Yes	33000-33800	Eastern	Central Maria River SF - Bloodwood	1 <i>Litoria brevipalmata</i> , 2 <i>Crinia signifera</i> , 1 <i>Cryptophis nigricens</i> , 2 <i>Saltuarius moritzi</i>	5	Two pre-clearance checks with another in afternoon in same area followed by an evening spotlight (2100-2230hrs) as opposed to a predawn one.

Survey Sequence Number	Date	Spotlight	Habitat search	Pre-Clear Walk Through	Chainage	Side of carriage way	Site name	Species detected	No.	notes
46	7-Jan-15	Yes	Yes	Yes	Ch 26170-25800	Eastern	North of Mobbs Dr	Brush-tailed Possum + Eastern Grey Kangaroo + Blackish Blind Snake	1	The Kangaroo left the site, The possum went into hollow of marked habitat tree. Clearing operators were notified. Blind snake had been killed during the previous day by a dozer
47	7-Jan-15	Yes	Yes	Yes	Ch 35700-35900	Eastern	Joan's Rest Area	Dendrelaphis punctulatus; Ramphotylops nigrescens; Eulamprus tenuis; Litoria caerulea	5	The snake was pulled out from an unused possum drey approx. 1.8 metres of ground in Allocasuarina. The blind snake, skinks and frog were relocated approx. 50 metres east of 35800
48	8-Jan-15	No	Yes	Yes	Ch 25350-25750	Eastern	between Mingaletta rd. and Mobbs Dr - on eastern side of fence	<i>Lampropholis delicata</i> and <i>Calyptotis ruficanda</i>	12	those that could be captured where translocated outside of impact area
49	8-Jan-15	Yes	Yes	Yes	33000-34000	Eastern	Bloodwood rest area in Maria River SF	Micro bat (1); Tawny Frogmouth (1); Litoria latopalmata (2)	4	Frogs relocated to the east.
50	9-Jan-15	Yes	Yes	Yes	29300-30000	Eastern	Kundabung Road north to Kundabung Rest Area	Red-necked Wallaby (1)	1	Moved off to the east
51	9-Jan-15	Yes	Yes	Yes	Ch 26170-25800	Eastern	North of Mobbs Dr	Brush-tailed Possum + <i>Lampropholis delicata</i>	1	the possum ran off site, 2 relocated off site, several skinks were relocated off site
52	10-Jan-15	Yes	Yes	Yes	25800-26300	Eastern	Mobbs Drive and north	Micro bat (2)	2	Not captured just flying
53	10-Jan-15	Yes	Yes	Yes	29300-30000	Eastern	Kundabung Road north to Kundabung Rest Area	Nil	0	
54	10-Jan-15	Yes	Yes	Yes	33200-34000	Eastern	Bloodwood rest area in Maria River SF	Tawny Frogmouth (1); Feathertail Glider (1); Boobook (1)	3	No fauna captured, just observed.
55	12-Jan-15	Yes	Yes	Yes	29300-30000	Eastern	Kundabung Road north to Kundabung Rest Area	Nil	0	
56	12-Jan-15	yes	yes	Yes	26150-26600 + 25800-25600	Eastern	nth and sth of Mobbs Dr	Red-backed Toadlet	2	Was not able to locate for relocation.
57	12-Jan-15	Yes	Yes	Yes	36300-37000	Eastern	Bloodwood rest area in Maria River SF	Litoria brevipalmata (1), Mixophyes fasciolatus (2)	3	Relocated to the east
58	13-Jan-15	No	Yes	Yes	33200-33800	Eastern	Bloodwood rest area in Maria River SF	Varanus varius	1	Climbed into tree which was then marked as a habitat tree until the individual vacated the area.
59	13-Jan-15	No	Yes	Yes	26150-26631 + 25350-25650	Eastern	nth and sth of Mobbs Dr	<i>Lampropholis delicata</i> and <i>Calyptotis ruficanda</i>	5	those that could be captured where translocated outside of impact area
60	14-Jan-15	Yes	Yes	Yes	32600-33100	Eastern	Maria River SF - south	<i>S. moritzi</i>	5	From fallen ground logs being broken up - 1 large fissured ground log identified for habitat redistribution
61	15-Jan-15	Yes	Yes	Yes	24300-24550	Western	Mingaletta Stockpile Site	Litoria fallax (2); Litoria peronii (2); Limnodynastes peronii (3); Pseudophyrne coracea (1); Tawny Frogmouth (1)	9	Frogs captured and relocated. Likely to be more fauna associated with dam.

Survey Sequence Number	Date	Spotlight	Habitat search	Pre-Clear Walk Through	Chainage	Side of carriage way	Site name	Species detected	No.	notes
62	15-Jan-15	Yes	Yes	Yes	29300-30000	Eastern	Kundabung Road north to Kundabung Rest Area	Nil	0	
63	15-Jan-15	Yes	Yes	Yes	32600-33300	Eastern	Maria River SF - south	Litoria latopalmata (2)	2	Relocated to the east
64	15-Jan-15	Yes	Yes	Yes	32700 to 32400 + 32700-33300	Eastern	Maria River SF - south	Nil	0	General clearing supervision followed
65	15-Jan-15	Yes	Yes	Yes	Ch 25350-25550	Western	Stock pile site - Mingaletta Rd	2 x Lim peroni, 4 x Pseud corecea, numerous Lit fallax, 3 Lamp delicata, 1 x Lace Monitor	2	Lace monitor chased off site.
66	16-Jan-15	Yes	Yes	Yes	27250-27450	Eastern	Wharf Road and south	Nil		
67	16-Jan-15	Yes	Yes	Yes	26631-27000	Eastern	Nth of Mobbs Dr	1 x Ringtail Possum 2x Lampropholus delicata	3	
68	16-Jan-15	No	Yes	Yes	30180-30475	Eastern	Nth of Kundabung Rest Area	No fauna		
69	16-Jan-15	Yes	Yes	Yes	32700-33200	Eastern	Maria River SF - south	Sugar Glider (1); Leaf-tailed Gecko (2); Litoria brevipalmata (1); Tawny Frogmouth (1); Mixophyes fasciatus (1); Limnodynastes peroni (2)	8	Litoria brevipalmata from 33000. Captured fauna relocated to the east.
70	17-Jan-15	Yes	Yes	Yes	26216-26496	Eastern	Nth of Mobbs Dr	2 x lim peroni + 2 x lamp delicata	4	relocated adjacent to site
71	17-Jan-15	No	Yes	Yes	30180-30450	Eastern	Nth of Kundabung Rest Area	small-eyed snake - dead in area cleared previous day	1	
72	17-Jan-15	Yes	No	Yes	32700-33400	Eastern	Maria SF	2 x lim peronii, 1 x leaf-tailed Gecko	2	relocated adjacent to site
73	19-Jan-15	No	Yes	Yes	Ch 26216-26600 + 26631-27000	Eastern	sth and nth of Gate 5	3 x Lamp delicata	3	relocated adjacent to site
74	19-Jan-15	Yes	Yes	Yes	30180-30450	Eastern	Kundabung Rest Area and north	Nil		
75	19-Jan-15	Yes	Yes	Yes	32700-33200	Eastern	Maria River SF - south	Nil		
76	19-Jan-15	Yes	Yes	Yes	Ch25350-24950	Western	Sth of stock pile	Greater Glider	1	Located in very large habitat tree.
77	20-Jan-15	Yes	Yes	No	30180-30600	Eastern	Kundabung Rest Area to Pipers Creek	Litoria tyleri (3); Limnodynastes peroni (2); Litoria dentata (1)	6	Captured and relocated to east noting clearing unlikely to occur and many more frogs on site

Survey Sequence Number	Date	Spotlight	Habitat search	Pre-Clear Walk Through	Chainage	Side of carriage way	Site name	Species detected	No.	notes
78	20-Jan-15	Yes	Yes	No	32600-33300	East	Maria River SF - South end	11 x L. brevipalmata, L. gracilentata x 11, M. fasciolatus x 6, Lim. Peronii x 7, C. signifera x 2, P. coriacea x 1 recorded at 32700. Majority of individuals outside footprint along a flowing drainage line. 7 x L. brevipalmata, M. fasciolatus x 1, Lim. Peronii x 3, C. signifera x 2, P. coriacea x 2 recorded at 33250 and relocated to opposite side of highway where same species were heard calling.	53	Frogs weren't captured and relocated given the prevailing weather conditions and likelihood clearing would then be postponed for some time
79	20-Jan-15	No	Yes	Yes	25800-27000	Eastern	Nth of Mobbs Dr	Several C. signifera + Lit. gracilentata calling from a ditch on the western side of the road Ch. 26200		
80	30-Jan-15	yes	Yes	Yes	28250-28500	Eastern and western	Smiths Creek	<i>Litoria fallax</i>	1	Relocated to adjacent pond area.
81	2-Feb-15	yes	Yes	Yes	28250-28500	Eastern and western	Smiths Creek	>20 Lim peroni calling		
82	3-Feb-15	Yes	Yes	Yes	30450-30650	Eastern	Sth of Pipers Creek	1 x water dragon, House Mouse, >20 Lim peroni, 5 Lamp delicata		Water dragon relocated
83	3-Feb-15	Yes	Yes	Yes	30650-30850	Eastern	Pipers Creek and north towards Fish Farm	<i>Litoria wilcoxii</i> x 1; <i>Litoria brevipalmata</i> x 2; <i>Limnodynastes peroni</i> (1)	4	Captured and relocated to the east
84	4-Feb-15	Yes	Yes	Yes	Ch 30650-30750	Eastern	Nth of Pipers Creek - Hambly Property	1 X <i>Antechinus stuartii</i>		
85	5-Feb-15	Yes	Yes	Yes	30650-31650	Eastern	Pipers Creek and north for 1 km	<i>Litoria brevipalmata</i> (1); Tawny Frogmouth (1); Sugar Glider (1); Feathertail Glider (1); Red-necked Wallaby (1)	5	Frogs captured and relocated - mammals not.
86	5-Feb-15	Yes	Yes	Yes	Ch 30450-30650	Eastern	Sth of Pipers Creek	Water Dragon + >20 Lim peroni		outside clearing for frog fence
87	6-Feb-15	No	Yes	Yes	Ch 31050-32450	Eastern	Fish farm north	No fauna		
88	7-Feb-15	Yes	Yes	Yes	Ch 31050-32450	Eastern	Fish farm north	No fauna		
89	9-Feb-15	Yes	Yes	Yes	32000-32769	Eastern	Ravenswood	Tawny Frogmouth (1); <i>Limnodynastes peroni</i> (2)	3	Frogs relocated to the east
90	10-Feb-15	No	Yes	Yes	30600-31000	Eastern	Pipers Creek Basin and associated stockpile areas	<i>Litoria nasuta</i> (1)	1	Relocated further east beyond frog fence
91	10-Feb-15	No	Yes	Yes	32769-33400	Eastern	Maria River SF - Optic Fibre Corridor	No fauna		
92	11-Feb-15	No	Yes	Yes	25750-26660	Eastern	Sth of Gate 5	No fauna		
93	11-Feb-15	yes	No	Yes	30550-30650	Eastern	sth of Pipers Creek	>20 Lim peroni and Lit fallax calling + cat		3 and 2 relocated outside frog fence

Survey Sequence Number	Date	Spotlight	Habitat search	Pre-Clear Walk Through	Chainage	Side of carriage way	Site name	Species detected	No.	notes
94	11-Feb-15	Yes	No	Yes	30600-31000	Eastern	Pipers Creek North	Mixophyes iteratus (1); Litoria wilcoxii (1)	2	Mixophyes iteratus PIT tagged - Ref 000735B461
95	11-Feb-15	Yes	No	Yes	33200-33500	Eastern	Nth of the Lambardo property	2 Red-backed Toadlet		adjacent to site
96	12-Feb-15	No	Yes	Yes	25800-25900	Eastern	Sth of Gate 5	No fauna		
97	12-Feb-15	Yes	No	Yes	30600-31000	Eastern	Pipers Creek North	Nil		
98	12-Feb-15	yes	No	Yes	32600-32800	Eastern	Nth of the Lambardo property	1 Mix fas, 1 x Pseud coriacea		Relocated to adjacent pond area.
99	13-Feb-15	Yes	Yes	Yes	32170-32500	Eastern	Sth of Lambardo Property	Limnodynastes peroni (1)	1	Relocated to adjacent pond area.
100	13-Feb-15	Yes	Yes	Yes	32500-32885	Eastern	Adjacent Lambardos	Limnodynastes peroni (2); Tawny Frogmouth (1)	3	Relocated to adjacent pond area.
101	14-Feb-15	No	Yes	Yes	30600-30800	Eastern	Pipers Creek north within excluded frog fence area	Rattus fuscipes (1)	1	Observed but not caught
102	14-Feb-15	No	Yes	Yes	32070-32170	Eastern	Ravenswood north area	Nil		
103	14-Feb-15	No	Yes	Yes	32170-32050	Eastern	sth of Lambardo Property	No fauna		
104	14-Feb-15	No	Yes	Yes	33000-32900	Eastern	Nth of the Lambardo property	No fauna		
105	16-Feb-15	Yes	Yes	Yes	25750-27000	Eastern	Gate 5 to powerline easement	No fauna		
106	16-Feb-15	Yes	Yes	Yes	31761-32070	Eastern	Ravenswood north area	No fauna		
107	16-Feb-15	Yes	Yes	Yes	32950-33360	Eastern	Maria SF utility	No fauna		
108	17-Feb-15	Yes	yes	Yes	27450-27000	Eastern	Powerline easement to Wharf Rd	No fauna		
109	17-Feb-15	Yes	yes	Yes	30600-31000	East	Pipers Creek north to Fish Farm Gate	Limnodynastes peronii (9); Litoria brevipalmata(1); Pseudochirus peregrinus (1)	11	Frogs were relocated to the east beyond RMS boundary/clearing limit. The possum could not be caught.
110	17-Feb-15	Yes	yes	Yes	31350-31750	Eastern	Kundabung	No fauna		
111	17-Feb-15	Yes	no	Yes	37000-30450	Eastern	Sth Pipers Creeks	3 Lim peronii + 2 Lit fallax		Relocated to adjacent pond area.
112	18-Feb-15	yes	yes	Yes	26200-27450	Eastern	Sth of gate 5 to Wharf Rd	Limnodynastes peroni (1); Dwarf Crowned snake (1)	2	Frog relocated to adjacent pond area. Snake relocated 75m east.
113	18-Feb-15	No	Yes	Yes	29200-29300	Western	139 Rodeo Dr	1 Lim peronii		
114	18-Feb-15	yes	yes	Yes	30800-31200	Eastern	North from Pipers Creek past the fish farm entrance	Dendrelaphis punctulata (1), Limnodynastes peroni (3), Crinia signifera (2)	6	1 x Dendrelaphis punctulata, 3 x Limnodynastes peronii, 2 x Crinia signifera. Frogs relocated east of frog fence, snake relocated to riparian veg east of existing frog fences.
115	19-Feb-15	yes	yes	Yes	28050-28250	Eastern	Sth of Smiths Creek	Mixophyes iteratus (1); Limnodynastes peroni (2)	3	GBF was pit tagged etc. and released 100 downstream - Ref 0007357AA5
116	19-Feb-15	yes	No	Yes	30550-30650	Eastern	sth of Pipers Creek	2 Lim peronii + Antechinus stuartii (1)		Relocated to adjacent pond area. A. stuartii could not be captured
117	20-Feb-15	yes	No	Yes	28050-28250	Eastern	Sth of Smiths Creek	1 Lim peronii		Relocated to adjacent pond area.
118	20-Feb-15	yes	No	Yes	30550-30650	Eastern	sth of Pipers Creek	1 Lim peronii		Relocated to adjacent pond area.
119	20-Feb-15	yes	No	Yes	30600-30800	Eastern	nth of Pipers Creek	1 x Lim peronii, 2 x Rattus rattus	3	Rats were not captured
120	23-Feb-15	yes	yes	Yes	27000-27600	Eastern	Powerline easement to nth of Wharf Rd	Sugar Glider	1	Tree marked up as a habitat tree



Survey Sequence Number	Date	Spotlight	Habitat search	Pre-Clear Walk Through	Chainage	Side of carriage way	Site name	Species detected	No.	notes
121	23-Feb-15	yes	yes	Yes	31500-31050	Eastern	Murray's Dam to Hambly Property	Eastern Grey Kangaroo, Lim peronii	1	EGK hopped off site, frog related
122	23-Feb-15	yes	yes	Yes	33360-33150	Eastern	Telstra utility stump car area	Lim peronii	2	relocated adjacent to site
123	24-Feb-15	yes	yes	Yes	31500-31050	Eastern	Murray's Dam to Hambly Property	Lim peronii + 2 hares		frog relocated adjacent to site
124	24-Feb-15	yes	yes	Yes	33360-33150	Eastern	Telstra utility stump car area	Sooty Owl calling from NE + Pseud coriacea to the sth		
125	25-Feb-15	No	Yes	Yes	28300-29000	Western	Smiths Creek riparian zone to Kundabung Interchange	Nil		
126	26-Feb-15	Yes	Yes	Yes	28050-28250	Eastern	Sth side of Smiths Creek	1 x Lim peronii (relocated) + 1 X Grey Goshawk		Captures of 4 X Lit. Fallax + 23 X Lit. dentata + 1 GFT
127	26-Feb-15	Yes	Yes	Yes	28250-28450	Eastern	Nth side of Smiths Creek	1 X Mix. iteratus + 1 x Mix. fasciolatus (baged)		
128	26-Feb-15	Yes	Yes	Yes	30600-31000	Eastern	Pipers Creek north to fish farm entrance	Litoria brevipalmata (10)	10	10 juveniles captured and relocated from breeding site at 30700E to east of frog fence
129	27-Feb-15	Yes	Yes	Yes	28200-28250	Eastern	Sth side of Smiths Creek	1 x GTF + 21 Lit dentata		translocated 100m down stream
130	27-Feb-15	Yes	yes	Yes	28250-28325	Eastern	Nth side of Smiths Creek	No fauna		27-Feb-15
131	27-Feb-15	Yes	yes	Yes	30600-31050	Eastern	pipers Creek to Fish Farm Entrance	Litoria brevipalmata (2); Limnodynastes peroni (3); Litoria latopalmata (2)	7	Both the Litoria brevipalmata were adults and swabbed for chytrid. Frogs relocated further to the east.
132	28-Feb-15	Yes	Yes	Yes	30342-30670	Eastern	Sth of Pipers Creek	2x Lit fallax + 1 x Lit peronii		relocated outside fence
133	28-Feb-15	Yes	Yes	Yes	30650-31030	Eastern	Nth of Pipers Creek	Litoria brevipalmata (2); Limnodynastes peroni (3); Litoria latopalmata (2)	7	Relocated to the east
134	2-Mar-15	No	yes	Yes	29600-30100	Eastern	Eastern of the Kundabung Rest Area - Boundary fence line	No fauna		
135	2-Mar-15	Yes	yes	Yes	30450-30650	Eastern	Sth Pipers Creek	2 x Lim peronii + 1 x Lit fallax		relocated over frog fence
136	2-Mar-15	Yes	yes	Yes	30600-31050	Eastern	Pipers Creek north to fish farm access	Mixophyes iteratus (1); Litoria nasuta (1)	2	Mixophyes was PIT tagged (Ref 00073576C1)
137	3-Mar-15	Yes	Yes	Yes	28650-29300	Eastern	Sth of Kundabung Rd to Box culvert	3 x Eastern Grey Kangaroo - left site - went south		Red-bellied Black Snake - escaped at box culvert
138	3-Mar-15	Yes	Yes	Yes	29500-30100	Eastern	Eastern of the Kundabung Rest Area - Boundary fence line	No fauna		
139	3-Mar-15	Yes	Yes	Yes	30450-30560	Eastern	Sth Pipers Creek	3 x Lim peronii + 2 X Lit fallax - relocated outside frog fence		
140	3-Mar-15	Yes	Yes	Yes	31030-31200	Eastern	Fish farm north	Nil		
141	3-Mar-15	Yes	Yes	Yes	32900-33400	Eastern	Optic Fibre Corridor	Leaf-tailed Gecko (2); Litoria brevipalmata (1); Limnodynastes peroni (1); Sugar Glider (1)	5	Frogs and gecko relocated to the east, glider not captured
142	3-Mar-15	No	Yes	Yes	25400	Eastern	Mingaletta	Nil		

Survey Sequence Number	Date	Spotlight	Habitat search	Pre-Clear Walk Through	Chainage	Side of carriage way	Site name	Species detected	No.	notes
143	4-Mar-15	Yes	Yes	Yes	28000-29300	Eastern	Sth of Kundabung Rd to Box culvert	Brush-tailed Possum - outside clearing limit in H tree + GHFF - feeding on blossom		
144	4-Mar-15	Yes	Yes	Yes	30670-31050	Eastern	Pipers Creek to Hambly drive way	1 lim peronii - relocated over fence + Feather-tailed Glider - in retained Ironbark Tree		
145	4-Mar-15	Yes	Yes	Yes	31030-31200	Eastern	Fish farm north	Nil		
146	4-Mar-15	Yes	Yes	Yes	32700-33400	Eastern	Optic Fibre Corridor	Tawny Frogmouth (1)	1	
147	5-Mar-15	Yes	Yes	Yes	28700-29300	Eastern	Sth of Kundabung Rd to Box culvert	2 sugar gliders + 1 dead Lamp delicata		
148	6-Mar-15	Yes	Yes	Yes	31050-31550	Eastern	Hambly driveway + Murrays Dam	1 Sugar Glider + Tawny Frog Mouth		
149	6-Mar-15	Yes	Yes	Yes	28500-29300	Eastern	Smiths Creek north to Kundabung Interchange	Limnodynastes peroni; Litoria fallax (2)	3	Relocated to small residual patches of vegetation
150	6-Mar-15	Yes	Yes	No	32700-33400	Eastern	Optic Fibre Corridor	Nil		
151	9-Mar-15	Yes	yes	Yes	30600-30800	Eastern	Pipers Creek on north side	Litoria wilcoxii (2); Limnodynastes peroni (1)	3	Relocated to the east
152	9-Mar-15	Yes	yes	Yes	28250-29300	Eastern	Kundabung Rd to Smiths Creek	1 x Lim peronii		
153	9-Mar-15	Yes	yes	Yes	31500-31882	Eastern	Ravenswood	Nil		
154	9-Mar-15	No	yes	Yes	32700-33400	Eastern	Optic Fibre Corridor	Nil		
155	10-Mar-15	yes	yes	Yes	28250-29300	Eastern	Kundabung Rd to Smiths Creek	5 x Lit dentata (relocated over frog fence) + 2 X Swamp Wallaby - moved along out of site		
156	10-Mar-15	yes	Yes	Yes	31800-32600	Eastern	Ravenswood	Sugar Glider (1); Limnodynastes peroni (2); Litoria nasuta (3)	6	Sugar Glider recorded using Grey Gum at Ch 31800 was later recorded as road kill at dawn. Frogs relocated to east of clearing limit.
157	10-Mar-15	yes	Yes	Yes	30400-30800	Eastern	Pipers Creek North and South	Limnodynastes peroni (5); Litoria nasuta (2); Litoria wilcoxii (1)	8	Relocated to the east
158	10-Mar-15	No	Yes	Yes	31500-32400	Eastern	Ravenswood east	Eastern Small-eyed Snake (1); Lampropholis delicata (7); Pogona barbata (1)	9	All relocated to the east
159	10-Mar-15	No	Yes	Yes	32600-33400	Eastern	Optic Fibre Corridor	Nil		
160	11-Mar-15	Yes	yes	Yes	27000-27300	Western	Fowlers Utility Easement	Nil		
161	11-Mar-15	Yes	yes	Yes	28250-28420	Eastern	Nth side of Smiths Creek	Nth - 1 X Lim peronii + Lit tyleri + Sth - 3 x Lim peronii (relocated) + Lit caerulea + Lit peronii on outside fence		
162	11-Mar-15	Yes	yes	Yes	30450-30670	Eastern	Sth side of Pipers Creek	2 x Lim peronii (put over fence) + 1 x dentata on outside of fence - fence intact		
163	11-Mar-15	Yes	yes	Yes	30670-30870	Eastern	Nth side of Pipers Creek	Litoria tyleri (1); Limnodynastes peroni (5); Mixophyes fasciatus (2)	8	Relocated to the east

Survey Sequence Number	Date	Spotlight	Habitat search	Pre-Clear Walk Through	Chainage	Side of carriage way	Site name	Species detected	No.	notes
164	11-Mar-15	Yes	Yes	Yes	31400-33000	Eastern	Ravenswood	Adelotus brevis (1); Limnodynastes peroni (2); Pseudophryne coriacea (1)	4	Frogs relocated to the east
165	11-Mar-15	Yes	Yes	Yes	31800-33000	Eastern	Optic Fibre Corridor	Sugar Glider (1); Australian Owlet Nightjar (1); Litoria latopalmata (3)	5	Frogs relocated upslope to the east
166	12-Mar-15	Yes	yes	Yes	28250-29300	Eastern	Kundabung Rd to Smiths Creek	Litoria wilcoxii - Female- relocated down stream		
167	12-Mar-15	Yes	Yes	Yes	32600-33500	Eastern	Southern Maria SF	Feral Cat (1); Red-necked Wallaby (1); Limnodynastes peroni (1)	3	Only the Limno peronii was captured and relocated, other two flushed out of the area.
168	13-Mar-15	Yes	yes	Yes	28050-28250	Eastern	Smith Creek - Sth	Relocated - 2x Lit fallax + 10 x Lit dentata + 1 x Lit brevipalmata + 12 x Lit gracilentata + 1 x Lit caerulea + 2 x Lim peronii		
169	13-Mar-15	Yes	yes	Yes	30450-30670	Eastern	Piper Creek - Sth	1 x Lim peronii	1	
170	13-Mar-15	Yes	yes	Yes	30600-33600	Eastern	Pipers Creek north to Maria River SF	Litoria nasuta x 1; Mixophyes fasciolatus (1); Limnodynastes peroni (1)	3	Frog relocated outside frog fence area
171	13-Mar-15	Yes	yes	Yes	27840-28200	Western	Smiths Creek frog fence works	Limnodynastes peroni (2); Litoria dentata (1); Mixophyes fasciularis (1)	4	Relocated to the west
172	16-Mar-15	Yes	No	Yes	30450-30670	Eastern	Sth Pipers Creek	No fauna		
173	16-Mar-15	Yes	yes	No	32500-33500	Eastern	Maria River SF - southern 1 km	Limnodynastes peroni (2)	2	Relocated into adjacent forest to the east
174	16-Mar-15	Yes	yes	No	30600-30800	Eastern	Pipers Creek north	Litoria wilcoxii (1)	1	Relocated downstream
175	17-Mar-15	Yes	Yes	No	30600-30800	Eastern	Pipers Creek	<b>Myotis macropus</b>	3	Bats taken up roosting in abandoned swallow nest on existing Pipers Creek bridge - Unusual roost may have something to do with the felling of very large Blue Gum into the creek previous day
176	17-Mar-15	Yes	Yes	Yes	27800-28250	Eastern	Sth side of Smiths Creek	3 x Lit. dentata + 1 x Lit. fallax - relocated + 2 x Rattus fuscipes - in fenced area		During clearing - Relocated 1 x Lit gracilentata 1 x Water Dragon (Intellagama lesueurii), 1 x Diamond Python (Morelia spilota), 1x Dwarf Crowned Snake (Cacophis krefftii) down stream
177	17-Mar-15	Yes	yes	Yes	27950-28275	Eastern	Smith Creek	Lit dentata	3	relocated over frog fence
178	17-Mar-15	Yes	Yes	Yes	32500-33500	Eastern	Maria River SF - southern 1 km	Nil		
179	18-Mar-15	Yes	Yes	Yes	27450-28250	Eastern	Wharf Rd to Smiths Creek	1 x Antechinus stuartii + Diamond Python	1	Relocated Diamond Python to area near power line easement Sth of Wharfs Rd
180	18-Mar-15	Yes	Yes	Yes	32500-33500	Eastern	Optic Fibre Corridor			

Survey Sequence Number	Date	Spotlight	Habitat search	Pre-Clear Walk Through	Chainage	Side of carriage way	Site name	Species detected	No.	notes
181	18-Mar-15	Yes	Yes	Yes	30100-30600	Eastern	Pipers Creek south to Kundabung Rest area	Litoria gracilentata (1); Litoria nasuta (1); Limnodynastes peroni (2); Eastern Water Dragon (1); Lampropholis delicata (2); Hemiaspis signata (1)	8	Relocated to the east
182	18-Mar-15	Yes	Yes	Yes	34700-34800	Eastern	Southern end of Cut 20	Nil		
183	19-Mar-15	Yes	Yes	Yes	27450-28250	Eastern	Wharf Rd to Smiths Creek	5 x Lamp delicata		
184	19-Mar-15	Yes	Yes	Yes	32650-36000	Eastern	Maria River SF	Vespadelus spp (1); Limnodynastes peroni (5); Litoria nasuta (1);	7	Bat flew from stag being checked with wrecking bar; frogs were relocated to beyond the clearing limits.
185	20-Mar-15	Yes	Yes	Yes	27000-27900	Eastern	Nth and Sth of Wharf Rd	No fauna		
186	20-Mar-15	Yes	Yes	Yes	27100-27300	Western	Boundary fence line	No fauna		
187	20-Mar-15	Yes	Yes	Yes	33000-36000	Eastern	Maria River SF	Litoria peronii (1); Crinia signifera (1)	2	Scattered remnants of vegetation requiring clearing as part of Stage II works
188	20-Mar-15	Yes	Yes	Yes	30600-31000	Eastern	pipers Creek to Fish Farm Entrance	Litoria latopalmata (1); Limnodynastes peroni (1)	2	Relocated to the east
189	23-Mar-15	Yes	Yes	Yes	27000-27900	Eastern	Nth and Sth of Wharf Rd	Ring-tailed Possum		In drey outside the clearing limit
190	24-Mar-15	No	Yes	Yes	34717-34733	Eastern	1 paperbark tree - habitat	No fauna		
191	25-Mar-15	Yes	Yes	Yes	27200-27330	Western	Boundary fence line - upper Smiths Creek Rd	No fauna		
192	25-Mar-15	Yes	Yes	Yes	28050-28350	Eastern	Smiths Creek - Nth and Sth	1 X Mix fasciolatus + 2 x Lim peronii		
193	25-Mar-15	Yes	Yes	Yes	29300-29650	Western	Kundabung Motel	Common Ring-tailed Possum	1	in drey - edge of clearing limit and retained vegetation
194	25-Mar-15	Yes	Yes	Yes	30400-30800	Eastern	Pipers Creek either side	Litoria peronii (1); Mixophyes fasciatus (1)	2	Relocated to the east
195	26-Mar-15	Yes	Yes	Yes	27300-27330	Western	Boundary fence line - upper Smiths Creek Rd	No fauna		
196	26-Mar-15	Yes	Yes	Yes	28050-28350	Eastern	Smiths Creek - Nth and Sth	8 X Lit dentata		
197	26-Mar-15	No	Yes	Yes	28450-28950	Western	Kundabung Interchange area - west	R. nigrescens (1)	1	Blind snake recorded from old rotten stump.
198	26-Mar-15	Yes	Yes	Yes	29400-29550	Western	Kundabung Motel area	Litoria caerulea (1); Crinia signifera (3); Limnodynastes peroni (4); Eastern Grey Kangaroo (8)	16	Frogs relocated to dam area to north. Eastern Grey Kangaroo moved of their own accord, flushed further to the west.
199	26-Mar-15	Yes	Yes	Yes	30400-30800	Eastern	Pipers Creek	Limnodynastes peroni (6), Litoria nasuta (1); Litoria peronii (2); Eastern Water Dragon (1), Myotis macropus (2)	12	Frogs captured and relocated downstream; Water Dragon and bats not captured. Myotis temporarily roosting under bridge which enabled them to be identified.
200	26-Mar-15	No	Yes	Yes	31350-31500	Eastern	Murray Stockpile Site	Nil		
201	27-Mar-15	Yes	Yes	Yes	28050-28250	Eastern	Smiths Creek - Sth	No fauna		

Survey Sequence Number	Date	Spotlight	Habitat search	Pre-Clear Walk Through	Chainage	Side of carriage way	Site name	Species detected	No.	notes
202	27-Mar-15	Yes	Yes	Yes	31600-32000	Eastern	Services at Murray property	Crinia signifera (1); Litoria fallax (1); Litoria wilcoxii (1); Litoria peronii (1); Sugar Glider (1)	5	Frogs captured and relocated - Sugar Glider observed
203	27-Mar-15	Yes	Yes	Yes	29000-29400	Western	Kundabung Motel	Nil		
204	27-Mar-15	No	Yes	Yes	28600	Eastern	Culvert 28.60	Nil		
205	30-Mar-15	Yes	Yes	Yes	26650-27800	Eastern	Nth and Sth of Wharf Rd	No fauna		
206	30-Mar-15	Yes	Yes	Yes	29450-29850	Western	Kundabung Motel south towards Smiths Creek	Eastern Water Dragon (1); Litoria gracilentia (1); Common Ringtail Possum (1)	3	
207	30-Mar-15	Yes	Yes	Yes	29800-30670	Eastern	Kundabung rest area to Pipers Creek	No fauna		Cane Toad survey
208	30-Mar-15	Yes	Yes	Yes	30450-30750	Eastern	Pipers Creek	Eastern Water Dragon (1)	1	
209	31-Mar-15	Yes	Yes	Yes	25350-25450	Eastern	Mingaletta RD	No fauna		
210	31-Mar-15	Yes	Yes	Yes	25650-25950	Eastern	Mobbs Dr	No fauna		
211	31-Mar-15	Yes	Yes	Yes	28450-28800	Western	Rodeo Drive - South	Sugar Glider (2); Litoria latopalmata (2)	4	Gliders spotlighted but not captured, frogs captured in drainage lines associated with Culvert 28.60
212	1-Apr-15	Yes	Yes	Yes	25650-25950	Eastern	Mobbs Dr	Mix. fasciolatus	1	
213	1-Apr-15	Yes	Yes	Yes	28050-28250	Eastern	Smith Creek - Sth	Frog on outside of fence - 8 x Lit gracilentia 1 x Lit peronii, 5 x Lit dentata, 1 X Lit caerulea		
214	1-Apr-15	Yes	Yes	Yes	28300-29100	Western	Smiths Creek north towards Kundabung Motel	Litoria latopalmata (2); Limnodynastes peroni (1); Antechinus stuartii (3); Mus musculus (2); Saultuaris moritzi (1)	9	House mice were destroyed; remainder released into adjacent habitat.
215	8-Apr-15	Yes	Yes	Yes	25350-25750	Eastern	Mobbs Dr	No fauna		
216	8-Apr-15	Yes	Yes	Yes	28200-29000	Western	Smiths Creek north to Kundabung Motel	Litoria fallax (2); Antechinus stuartii (1); Eastern Grey Kangaroo (3)	6	Frogs relocated to beyond frog fence or clearing limit whilst Eastern Grey Kangaroo moved of their own accord further to the west.
217	9-Apr-15	Yes	Yes	Yes	28200-29100	Western	Smiths Creek to Rodeo Drive	Litoria latopalmata (1); Common Brushtail Possum (1); Limnodynastes peroni (5); Litoria nasuta (1)	8	Captured and relocated further to the west. The possum eventually scaled the frog fence.
218	9-Apr-15	Yes	Yes	Yes	25400-25500	Eastern	Barrys Creek - Mingaletta	Nil		
219	9-Apr-15	Yes	No	No	30400-30800	Eastern	Pipers Creek	Limnodynastes peroni (2); Limnodynastes tasmaniensis (1)	3	
220	10-Apr-15	Yes	Yes	Yes	29350-29700	Western	Smiths Creek to Rodeo Drive	Sugar Glider (1);		
221	13-Apr-15	Yes	Yes	Yes	25700-26000	Eastern	Mobbs Dr - Boundary fence line	5 x Red-necked Wallabies - outside area		
222	13-Apr-15	Yes	Yes	Yes	28600-29100	Western	Rodeo Drive - Kundabung Interchange	Litoria dentata	31	Collected from around edge of dam identified for dewatering

Survey Sequence Number	Date	Spotlight	Habitat search	Pre-Clear Walk Through	Chainage	Side of carriage way	Site name	Species detected	No.	notes
223	14-Apr-15	Yes	Yes	Yes	25700-25850	Eastern	Mobbs Dr - Boundary fence line	No fauna		
224	14-Apr-15	Yes	Yes	Yes	28300-28800	Western	Smiths Creek north towards Kundabung Interchange	Feathertail Glider (3); Eastern Grey Kangaroo (2); Feral Cat (1)	6	
225	15-Apr-15	Yes	Yes	Yes	28200-28800	Western	Smiths Creek north towards Kundabung Interchange	Antechinus stuartii (1); Limnodynastes peroni (2)	3	
226	16-Apr-15	Yes	Yes	Yes	25700-25800	Eastern	Mobbs Dr - Boundary fence line	No fauna		
227	16-Apr-15	Yes	Yes	Yes	28250-29000	Western	Smiths Creek to Kundabung Interchange	Sugar Glider (1); Litoria wilcoxii (1)	2	
228	17-Apr-15	Yes	Yes	Yes	28200-29650	Western	Smiths Creek to Smiths Creek Road	Limnodynastes peroni (3)	3	Relocated to near retained dam near motel.
229	20-Apr-15	Yes	Yes	Yes	24834-25364	Western	Sth of Mingaletta Rd- Powerline easement + mainline	C. signifera + micro bats		
230	20-Apr-15	Yes	Yes	Yes	28300-29000	Eastern	Smiths Creek to Kundabung Interchange	Nil		
231	21-Apr-15	Yes	Yes	Yes	24834-25364	Western	Sth of Mingaletta Rd- Powerline easement + mainline	P. coreacea + micro bats		
232	21-Apr-15	Yes	Yes	Yes	25350-25450	Eastern	Mobbs Dr - Boundary fence line	No fauna		
233	22-Apr-15	Yes	Yes	Yes	24750-25364	Western	Sth of Mingaletta Rd- Powerline easement + mainline	No fauna		
234	22-Apr-15	Yes	Yes	Yes	25350-25500	Eastern	Mobbs Dr - Boundary fence line	No fauna		
235	23-Apr-15	Yes	Yes	Yes	24500-25100	Western	Sth of Mingaletta Rd- mainline	Greater Glider		
236	24-Apr-15	Yes	Yes	Yes	24670-25100	Western	Sth of Mingaletta Rd- mainline	Feathertail Glider (1); Eastern Grey Kangaroo (3)	4	
237	28-Apr-15	Yes	Yes	Yes	24675-25100	Western	Sth of Mingaletta Rd- mainline	No fauna		
238	28-Apr-15	Yes	No	Yes	28635-28655	Eastern	St of Kundabung Rd	No fauna		
239	28-Apr-15	Yes	No	Yes	30085-31118	Eastern	Nth of Kundabung Rest Area	No fauna		
240	29-Apr-15	Yes	Yes	Yes	24100-24700	Western	Sth of rest area	No fauna		
241	30-Apr-15	Yes	Yes	Yes	25350-25500	Eastern	Nth of Mingaletta Rd - Barrys Creek	No fauna		
242	5-May-15	Yes	Yes	Yes	33545-34500	Eastern	Fauna fence line	Fox		
243	6-May-15	Yes	Yes	Yes	33545-34500	Eastern	Fauna fence line	Red-necked Wallaby + C. signifera - outside limit		
244	7-May-15	Yes	Yes	Yes	24100-25200	western	Sth of Mingaletta Rd- mainline	C. signifera- outside limit		
245	7-May-15	Yes	Yes	Yes	33545-34500	Eastern	Fauna fence line	C. signifera- outside limit		
246	8-May-15	Yes	Yes	Yes	25075-25375	Western	Mingaletta West	Nil		
247	11-May-15	Yes	yes	Yes	25300-25500	Eastern	Barrys creek and Mingaletta Rd	C. signifera - outside clearing limit		
248	11-May-15	Yes	yes	Yes	29250-30100	Western	Kundabung Interchange North	Nil		
249	11-May-15	Yes	yes	Yes	30550-30650	Eastern	Pipers Creek additional works	Nil		
250	11-May-15	Yes	yes	Yes	26650-27000	Eastern	Fowlers	Nil		

Survey Sequence Number	Date	Spotlight	Habitat search	Pre-Clear Walk Through	Chainage	Side of carriage way	Site name	Species detected	No.	notes
251	12-May-15	Yes	Yes	Yes	25300-25500	Eastern	Nth MINGALETTA Rd + Barrys Creek + Power line easement	C. signifera + fox - outside		
252	12-May-15	Yes	Yes	Yes	30600-30650	Eastern	Sth of Pipers Creek	C. signifera - outside		
253	13-May-15	Yes	Yes	Yes	25300-25400	Eastern	Mingaletta Rd	No fauna		
254	13-May-15	Yes	Yes	Yes	26600-27000	Eastern	Boundary fence line - Sth of Wharf Rd	C. signifera - outside		
255	14-May-15	Yes	Yes	Yes	25350-24134	Western	Sth of MINGALETTA Rd to the end of the job	No fauna		
256	14-May-15	Yes	Yes	Yes	30500-30600	Eastern	Pipers Creek Basing outlet	No fauna		
257	15-May-15	Yes	Yes	Yes	30150-30650	Eastern	Pipers Creek south	No fauna		
258	17-May-15	Yes	No	No	30600-30650	Eastern	Pipers Creek basin outlet	Litoria wilcoxii	1	Released downstream beyond frog fence
259	18-May-15	Yes	Yes	Yes	30600-30650	Eastern	Pipers Creek Basin	Nil		
260	18-May-15	Yes	Yes	Yes	37800-37850	Eastern	Stumpy Creek	Limnodynastes peroni (2)	2	
261	18-May-15	Yes	Yes	Yes	36700-36800	Western	Old Coast Road - fauna fence and turn around bus bay	Grey-headed Flying Fox	1	
262	19-May-15	Yes	Yes	Yes	36700-36800	Western	Old Coast Road - fauna fence and turn around bus bay	Nil		
263	19-May-15	Yes	Yes	Yes	35900-36300	Eastern	Joan's Rest north - Gate 17 North	Sugar Glider (1)	1	
264	19-May-15	Yes	Yes	Yes	28200-28400	Western	Smiths Creek	Litoria dentata (1); Limnodynastes peroni (1)	2	
265	21-May-15	Yes	Yes	Yes	30600-30650	Eastern	Pipers Creek Basin	Nil		
266	26-May-15	Yes	Yes	Yes	35650-35850	Eastern	Joan's Rest north - Gate 17 North	Nil		
267	26-May-15	Yes	Yes	Yes	30600-30650	Eastern	Pipers Creek Basin	Nil		
268	27-May-15	Yes	Yes	Yes	29000-29700	Western	Kundabung Interchange to Smiths Creek Road	Crinia signifera (3)	3	Relocated to west near dam to be retained
269	27-May-15	Yes	Yes	Yes	35650-35850	Eastern	Joan's Rest north - Gate 17 North	Crinia signifera (1); Tawny Frogmouth (1)	2	
270	27-May-15	Yes	Yes	Yes	31175-31250	Western	Ravenswood Drive - Boundary Fence Interface with Residence	Nil		
271	28-May-15	Yes	Yes	Yes	26100-26670	Western	Sth of Fowlers	Nil		
272	28-May-15	Yes	Yes	Yes	31000-31100	Western	Ravenswood Drive - Boundary Fence Interface with Residence	Nil		
273	28-May-15	Yes	Yes	Yes	37800-37850	Eastern	Stumpy Creek	Litoria fallax	1	
274	28-May-15	Yes	Yes	Yes	35650-35850	Eastern	Joan's Rest north - Gate 17 North	Common Ringtail Possum	1	
275	29-May-15	Yes	Yes	Yes	33500-33800	Western	Fauna fence and minor widening works	Nil		
276	29-May-15	Yes	Yes	Yes	37700-37900	Eastern	Stumpy Creek either side	Nil		
277	29-May-15	Yes	Yes	Yes	28150-28300	Western	Smiths Creek	Litoria fallax (3); Litoria gracilentia (8)	11	Released upstream in long grass and swamp areas
278	1-Jun-15	Yes	Yes	Yes	29300-29800	Western	Kundabung Interchange	Nil fauna	0	
279	1-Jun-15	Yes	Yes	Yes	34600-34480	East	Cut 20 area	Nil fauna	0	
280	1-Jun-15	Yes	Yes	Yes	28200-28400	Western	Smiths Creek	Limnodynastes peroni (2)	2	
281	1-Jun-15	Yes	Yes	Yes	33600-33700	Western	Cut 18 West	Nil	0	

Survey Sequence Number	Date	Spotlight	Habitat search	Pre-Clear Walk Through	Chainage	Side of carriage way	Site name	Species detected	No.	notes
282	2-Jun-15	Yes	Yes	Yes	28680-29300	Western	Kundabung Interchange area	Nil fauna	0	
283	2-Jun-15	Yes	Yes	Yes	35850-36050	East	Joan's Rest north	Micro bat (1); Red-necked Wallaby (1)	2	
284	2-Jun-15	Yes	No	No	34800-35000	West	Cut 20 area	Nil		
285	2-Jun-15	Yes	No	No	33600-33700	Western	Cut 18 West	Nil	0	
286	2-Jun-15	Yes	Yes	No	34700-34800	East	Cut 18 East - Powerline Easement	Nil	0	
287	3-Jun-15	Yes	Yes	Yes	28550-28700	East	Additional clearing at culvert 28.60	Nil		
288	3-Jun-15	Yes	Yes	Yes	35700-35900	East	Gate 17 North	Sugar Glider (1); Limnodynastes peroni (1)	2	
289	4-Jun-15	No	Yes	Yes	35850-36150	East	Joan's Rest north	Nil		
290	5-Jun-15	Yes	Yes	Yes	35950-36150	East	Joan's Rest north	Australian Owlet Nightjar	1	
291	10-Jun-15	Yes	Yes	Yes	24700-25374	West	Mingaletta west	Feathertail Glider (1); Eastern Grey Kangaroo (1)	2	
292	10-Jun-15	Yes	Yes	Yes	25375-25600	West	Mingaletta west	Nil	0	Mobbs Drive to Mingaletta fencing works
293	11-Jun-15	Yes	yes	Yes	24750-25750	Western	Sth and Nth of Gate 1	C. signifera + P. coreacea + Lampropholius delicata		
294	11-Jun-15	Yes	yes	Yes	36050-36150	Western	Basin area	Nil		
295	12-Jun-15	Yes	Yes	Yes	25350-25850	Eastern	North of Wharf Road	Nil		
296	15-Jun-15	Yes	yes	Yes	24450-25650	Western	Sth and Nth of Gate 1	No fauna		
297	15-Jun-15	Yes	No	Yes	28050-28250	Western + East	Smith's Creek	No fauna		
298	15-Jun-15	Yes	yes	Yes	36050-36150	Western	Basin area	Australian Owlet Nightjar	1	
299	16-Jun-15	Yes	Yes	Yes	24400-24700	Western	Sth of Gate 1	No fauna		
300	16-Jun-15	Yes		Yes	28050-28250	Western + East	Smith's Creek	Litoria peronii (1)	1	
301	16-Jun-15	Yes	Yes	No	32900-33200	Eastern	Gate 16 works area	Nil		
302	17-Jun-15	Yes	Yes	Yes	24400-24700	Western	Sth of Gate 1	No fauna		
303	17-Jun-15	Yes		Yes	32800-33100	Eastern	Gate 16	Lim. peronii x 1		
304	19-Jun-15	Yes	Yes	Yes	32800-33100	Eastern	Optic Fibre Corridor	Nil		
305	22-Jun-15	Yes	Yes	Yes	31000-31500	Eastern	Gate 14 and powerline easement	Nil		
306	23-Jun-15	Yes	Yes	Yes	32800-33100	Eastern	Gate 16	Nil		
307	23-Jun-15	Yes	Yes	Yes	28100-28300	Both	Smiths Creek	Limnodynastes peroni (1); Litoria wilcoxii (1)	2	Relocated to outside the temporary frog exclusion fence
308	24-Jun-15	Yes	Yes	Yes	32800-33100	Eastern	Gate 16	Nil		
309	24-Jun-15	Yes	Yes	Yes	36900-37130	Eastern	Railway Dam Road area and north through Maria River	Micro bats (60); Sugar Glider (1)	61	Bats roosting under Maria River Bridge ( <i>Miniopterus spp.</i> ).
310	25-Jun-15	Yes	Yes	Yes	28100-28300	Eastern	Smiths Creek	Nil		
311	25-Jun-15	Yes	Yes	Yes	29700-30500	Western	Rodeo Drive north to Pipers Creek	Tawny Frogmouth	1	
312	25-Jun-15	Yes	Yes	Yes	37000-37400	Eastern	Maria River to Kemp's Road	Common Ringtail Possum (1); Eastern Grey Kangaroo (2)	3	Not captured
313	26-Jun-15	Yes	Yes	Yes	36150 nth	Eastern	Railway Dam Road south	Nil		
314	26-Jun-15	Yes	Yes	Yes	30450	Western	Rodeo Drive/Ravenswood	Nil		
315	26-Jun-15	Yes	Yes	Yes	36900-37130	Eastern	Maria River	Microbats (60)	60	Miniopterus using the Maria River bridges



Survey Sequence Number	Date	Spotlight	Habitat search	Pre-Clear Walk Through	Chainage	Side of carriage way	Site name	Species detected	No.	notes
316	29-Jun-15	Yes	Yes	Yes	29824-30650	Western	Rodeo Dr	1 x Ringtail Possum + 1 x Tawny Frog Mouth + 2 x Eastern Grey Kangaroo		
317	29-Jun-15	Yes	Yes	Yes	36100-36900	Eastern	Railway Dam Road and south	Feathertail Glider (1)	1	
318	29-Jun-15	Yes	Yes	Yes	36900-37130	Eastern	Railway Dam Road to Maria River	Nil		
319	29-Jun-15	Yes	Yes	Yes	33970-34138	Eastern	Maria River State Forest - Cut 19	Nil		
320	29-Jun-15	Yes	Yes	Yes	34763-35008	Eastern	Cut 20 area	Nil		
321	30-Jun-15	Yes	Yes	Yes	29824-30650	Western	Rodeo Dr	1 x Feathertail Glider, 3x Ringtail Possum, 1 Domestic Cat, 1 Eastern Grey Kangaroo		
322	30-Jun-15	Yes	Yes	Yes	25350-26400	Western	Stockpile 12 to Fowlers	Sugar Glider (1); <i>Limnodynastes peroni</i> (1)	2	Works associated with fauna fence
323	1-Jul-15	Yes	Yes	Yes	25650-26400	Western	Stockpile 12 to Fowlers	Nil		Works associated with fauna fence
324	1-Jul-15	Yes	Yes	Yes	29284-30650	Western	Rodeo Dr	Tawny Frogmouth (1)	1	
325	2-Jul-15	Yes	Yes	Yes	25800-26400	Western	Stockpile 12 to Fowlers	Sugar Glider (1)	1	
326	2-Jul-15	Yes	Yes	Yes	29824-30650	Western	Rodeo Dr	No fauna found	0	
327	3-Jul-15	Yes	Yes	Yes	25200-26000	Western	Stockpile 12 and north	Tawny Frogmouth	1	
328	6-Jul-15	Yes	Yes	Yes	29800-30500; 36150 + 34700 area	Both	Rodeo Drive, Powerline Easement for VMS	Sugar Glider (1); Southern Boobook (1)	2	
329	7-Jul-15	Yes	Yes	Yes	36150-36550	East	Joan's Rest to Railway Dam Road	Feathertail Glider (1); Red-necked Wallaby (1)	2	
330	8-Jul-15	Yes	Yes	Yes	36150-36550	East	Joan's Rest to Railway Dam Road	Nil	0	
331	9-Jul-15	Yes	Yes	Yes	36150-36550	East	Joan's Rest to Railway Dam Road	Common Ringtail Possum	1	
332	10-Jul-15	Yes	Yes	Yes	25550-26000	West	Upper Smiths Creek Road	Nil		
333	10-Jul-15	Yes	Yes	Yes	36150-36900	East	Joan's Rest to Maria River	Common Ringtail Possum (1); micro bat (1); Common Brushtail Possum (1)	3	
334	13-Jul-15	Yes	Yes	Yes	25600-26000	East	Stockpile 12 north	Sugar Glider (1)	1	Fauna fence related works
335	13-Jul-15	Yes	Yes	Yes	36000-36750	East	Joan's Rest to Maria River	Koala (36700); Sugar Glider (1); Tawny Frogmouth (1)	3	Koala exclusion procedure implemented - Koala left the following evening
336	14-Jul-15	Yes	Yes	Yes	36200-36750	East	Joan's Rest to Railway Dam Road	Tawny Frogmouth (1); Australian Owlet Nightjar (1); Microbat (2)	4	None of them captured
337	15-Jul-15	Yes	Yes	Yes	36200-37300	East	Maria River area	Nil	0	
338	15-Jul-15	Yes	Yes	Yes	Mockingbird Quarry	Entire Site	Mockingbird Quarry	<i>Limnodynastes peroni</i> (1); <i>Crinia signifera</i> (3); Common Brushtail Possum (1)	5	Frogs relocated to across the road
339	16-Jul-15	Yes	Yes	Yes	36600-37300	East	Railway Dam Road north into Maria River	Yellow-bellied Glider (1); Grey-headed Flying Fox (2); Sugar Glider (1)	4	No captures, just observations

Survey Sequence Number	Date	Spotlight	Habitat search	Pre-Clear Walk Through	Chainage	Side of carriage way	Site name	Species detected	No.	notes
340	17-Jul-15	Yes	Yes	Yes	36600-37750	East	Stumpy Creek south to Maria River	Common Ringtail Possum (2); Limnodynastes peronii (2); Crinia signifera (1); Tawny Frogmouth (1)	6	Frogs captured and relocated into adjacent compensatory habitat land
341	20-Jul-15	Yes	Yes	Yes	26248-27000	West	Fowlers	Northern Brown Bandicoot	1	Moved to the west
342	20-Jul-15	No	No	No	37300-37750	East	Stumpy Creek to Maria River	Nil		Clearing occurring without pre clear surveys performed between ch. 37350-37800
	21-Jul-15	Niche took over role as Project Ecologist until June 2016		Yes						
343	16-Dec-15	Yes	Yes	Yes	30620-30680	West	Pipers Creek Bridge	No fauna	0	Frog fence reinstalment works at pipers Creek
344	3-Mar-16	No	Yes	Yes	30200-30300	West	Ravenswood Frog Pond Construction	Nil	0	Day pre start and supervise frog pond construction works
345	2-Jun-16	Yes	Yes	Yes	29700-29950	East	Kundabung - old rest area	Feathertail Glider x 1; C. signifera x 1 (w)	2	
346	6-Jul-16	Yes	yes	Yes	28300-28400	East	Smiths Creek north side	Limnodynastes peronii x 2; Litoria fallax x 3	5	Small overflow works around property boundary
347	15-Jul-16	Yes	Yes	Yes	28900-29150	West	Rodeo Drive - South	Sugar Glider x 1; Lampropholis delicata x 2	3	Minor clearing with pozzitrack for fence line construction
348	17-Jul-16	Yes	No	Yes	28150-28300	West	Smiths Creek	Litoria wilcoxii x 3; Limnodynastes peronii x 4	7	Follow up surveys of the GBF exclusion zone prior to works commencing again
349	21-Jul-16	Yes	Yes	Yes	27350-28300	West	Menzies north to Smith Creek	Mixophyes iteratus x 2; Limnodynastes x 3; Litoria wilcoxii x 1; Common Ringtail Possum x 1	7	Clearing for installation of permanent boundary fencing and associated frog fencing
350	27-Jul-16	Yes	Yes	Yes	29300-29400	West	Kundabung Motel area	Eastern Grey Kangaroo x 1	1	Minor fence line works
351	1-Aug-16	Yes	Yes	Yes	26950 -27300	West	Top corner of Fowlers	Calyptotis ruficaudia	2	Just south of Upper Smiths Creek road
352	2-Aug-16	Yes	Yes	Yes	26950 -28000	West	Fowlers through to Menzies	Sugar Glider x 1; Tawny Frogmouth x 1; Micro bat x 2	4	North and south of Upper Smiths Creek Road
353	8-Aug-16	Yes	Yes	Yes	27350-28000	West	Menzies north to Smith Creek	Tawny Frogmouth x 1; Feathertail Glider x 1; Common Ringtail Possum x 1; Eastern Grey Kangaroo x 2	5	Clearing for M-Class Stock Pile Sites
354	9-Aug-16	Yes	Yes	Yes	27350-28000	West	Menzies north to Smith Creek	Tawny Frogmouth x 1; micro bat x 1	2	Clearing for M-Class Stock Pile Sites
355	10-Aug-16	Yes	Yes	Yes	27350-28000	West	Menzies north to Smith Creek	Eastern Grey Kangaroo x 1	1	Clearing for M-Class Stock Pile Sites
356	11-Aug-16	Yes	Yes	Yes	27350-28000	West	Menzies north to Smith Creek	Micro bat x 2; Tawny Frogmouth x 1	3	Clearing for M-Class Stock Pile Sites
357	15-Aug-16	Yes	Yes	Yes	27300-28200	West	Menzies north to Smith Creek	Micro bat x 1; Eastern Grey Kangaroo x 3	4	Clearing for M-Class Stock Pile Sites
358	16-Aug-16	Yes	Yes	Yes	27300-28200	West	Menzies north to Smith Creek	nil	0	Clearing north into Smiths Creek

Survey Sequence Number	Date	Spotlight	Habitat search	Pre-Clear Walk Through	Chainage	Side of carriage way	Site name	Species detected	No.	notes
359	17-Aug-16	Yes	Yes	Yes	24350-24500 + 27000-27300	West	South of Upper Smiths Creek Road + Culvert 1	Pseudophyrne coreacea x 2; Sugar Glider x 1; Tawny Frogmouth x 1; Red-necked Wallaby x 1	5	Clearing for Upper Smiths Creek Road plus Culvert 1 inlet works
360	18-Aug-16	Yes	Yes	Yes	24350-24500 + 27000-27350	West	South of Upper Smiths Creek Road + Culvert 1	Sugar Glider x 1	1	Clearing for Upper Smiths Creek Road plus Culvert 1 inlet works
361	19-Aug-16	Yes	Yes	Yes	26700-27300	West	South of Upper Smiths Creek Road to vicinity of Culvert 5	Grey-headed Flying Fox x 2	2	Clearing for Upper Smiths Creek Road
362	22-Aug-16	Yes		Yes	27000-27350	West	South of Upper Smiths Creek Road to vicinity of Culvert 5	Grey-headed Flying Fox x 3	3	
363	23-Aug-16	Yes		Yes	27000-27350	West	South of Upper Smiths Creek Road to vicinity of Culvert 5	Nil	0	
364	29-August-2016	Yes	Yes	Yes	25800-26900	West	Culvert 5 heading south to Culvert 3	Grey-headed Flying Fox x 2; Tawny Frogmouth x 1; Boobook x 1	4	Widening works associated with north bound
365	30-August-2016	Yes	Yes	Yes	25800-26800	West	Culvert 5 heading south to Culvert 3	Sugar Glider x 1	1	Widening works associated with north bound
366	30-August-2016	No	Yes	Yes	33650-33720	East	Smiths Road area of Cut 18	Nil	0	Works associated with power to south bound heavy vehicle checking station
367	31-August-2016	Yes	Yes	Yes	24100-25000 + 26300-26800	West	Culvert 5 heading south to Culvert 3	Common Ringtail Possum x 1; Tawny Frogmouth x 1	2	Widening works associated with north bound
368	01-September-2016	Yes	Yes	Yes	24100-24700	West	Culvert 2 and 3 areas plus south of culvert 1	Grey-headed Flying Fox x 1	1	Widening works associated with north bound
369	07-October-2016	Yes		Yes	28200-28300	West	Smiths Creek drainage works	Litoria peronii x 1; Litoria wilcoxii x 1	2	Drainage works associated with Smiths Creek
370	19-October-2016	No	Yes	Yes	28600	East	Minor Culvert extension Works	Nil		Minor extension works to outlet of Culvert 28.60
371	20-October-2016	Yes	Yes	Yes	32450-32700	West	Ravenswood Tie in and Stockpile area	Eastern Blue Tongue x 1	1	Adult
372	20-October-2016	No	Yes	Yes	31000-31200	West	Ravenswood culvert and batter widening works	Nil	0	
373	24-October-2016	Yes	Yes	Yes	29900-30100+31600-32600	West	Culvert 1/2/3 + Ravenswood Stockpile			
374	25-October-2016		Yes	Yes	31600-33100	West	Culvert and widening works north from Ravenswood area	Microbat x 1; Swamp Wallaby x 1	2	Ravenswood tie in works plus culverts heading north and stockpile
375	31-October-2016	No	Yes	Yes	30600-30800; 31300-31750	West	Ravenswood Tie in and south towards Pipers Creek	Nil		
376	01-November-2016	Yes	Yes	Yes	30800-31800	West	Ravenswood Tie In and north including culverts and batter widening works to 32500	Feathertail Glider x 1; Litoria fallax x 1	2	
377	02-November-2016	Yes	yes	Yes	36000-36950; 30800-31800	West	Ravenswood Tie In and north including culverts and batter widening works to 32500	Limnodynastes peroni (1); Litoria nasuta (1); Lampropholis delicata (2)	4	

Survey Sequence Number	Date	Spotlight	Habitat search	Pre-Clear Walk Through	Chainage	Side of carriage way	Site name	Species detected	No.	notes
378	03-November-2016	Yes	yes	Yes	30800-31800	West	Ravenswood Tie In and north including culverts and batter widening works to 32500	Limnodynastes peronii x 2; Litoria fallax x 1; Litoria nasuta x 1	4	
379	08-November-2016	No	Yes	Yes	37050	East	Maria River basin outlet works	Nil		
380	17-November-2016	No	Yes	Yes	36900-37050	East	Maria River Abutment works	Nil		
381	18-November-2016	No	Yes	Yes	32600-32800	West	Ravenswood north and stockpile area	Lampropholis delicata x 3	3	Minor works associated with service road and stockpiles
382	9-Jan-17	No	Yes	Yes	37100-37400	West	Old Coast Road local road access works	Nil		
383	11-Jan-17	Yes	Yes	Yes	36300-36600	West	Old Coast Road south for 300 m	Grey-headed Flying Fox x 1; Feathertail Glider x 1; Lampropholis delicata x 3	5	Ancillary works
384	12-Jan-17	Yes	Yes	Yes	36300-36900	West	A few hundred metres to north and south of Old Coast road	Feathertail Glider x 1; Tawny frogmouth x 1	2	
385	13-Jan-17	Yes	Yes	Yes	36300-36900	West	A few hundred metres to north and south of Old Coast road	Grey-headed Flying Fox	1	
386	16-Jan-17	Yes	Yes	Yes	31800-32000	West	Clearing for Ravenswood culverts	Litoria nasuta x 1; Limnodynastes peroni x 2	3	Clearing for culvert and batter widening works
387	18-Jan-17	Yes	Yes	Yes	29600-29700 + 31800-32000 + Gate 9N	West	Smith Creek bus top + Ravenswood culvert and Gate 9N	Tawny Frogmouth x 1; Red-necked Wallaby x 1	2	
388	19-Jan-17	Yes	Yes	Yes	30600-30900 + 29800	West + East	Pipers Creek frog fence area plus Scaysbrook on property works	Swamp Wallaby x 1; Litoria nasuta x 1	2	
389	20-Jan-17	Yes	Yes	Yes	31800-32100	West	Ravenswood culvert and batter widening works	Nil		
390	23-Jan-17	Yes	Yes	Yes	31800-32100	West	Ravenswood culvert and batter widening works	Nil		
391	24-Jan-17	Yes	Yes	Yes	31800-32100	West	Ravenswood culvert and batter widening works	Nil		
392	25-Jan-17	Yes	No	Yes	29650-30550	West	Gate 9N works	Ctenopus robustus x 2; Amphibolorus muricatus x 1	3	Clearing for batter widening and drainage works
393	30-Jan-17	Yes	Yes	Yes	29600-30400	West	Gate 9N works to basin at 30600W	Micro bat x 1	1	Clearing for batter widening and drainage works
394	31-Jan-17	Yes	No	Yes	29700-30300	West	Smiths Creek Road bus stop and 29700 to 30300	Nil	0	
395	1-Feb-17	Yes	Yes	Yes	29700-30300	West	Gate 9N and Smiths Creek Bus stop VMS board access works at 35050	Amphibolorus muricatus x 1	1	
396	1-Feb-17	Yes	Yes	Yes	34990-35510	West	Maria River State Forest for VMS Access	Nil	0	Patch of ~20 Allocasuarina requiring clearing to check access to VMS board
397	3-Feb-17	No	Yes	Yes	30700	West	Pipers Creek M Class Stockpile and Drainage Works	Nil	0	

Survey Sequence Number	Date	Spotlight	Habitat search	Pre-Clear Walk Through	Chainage	Side of carriage way	Site name	Species detected	No.	notes
398	10-Feb-17	No	Yes	Yes	29200-29300	West	Kundabung Interchange Additional Clearing	Nil	0	
399	13-Feb-17	No	No	Yes	32450	West	Old Ravenswood Road access - north			Remote clearing advice given based on area description and photographs provided
400	27-Feb-17	Yes	Yes	Yes	25600	West	Cut 4 additional works	Nil	0	Cut 4 works
401	10-Apr-17	Yes	Yes	Yes	28200-28400	West	Smiths Creek North Frog Fence	Litoria wilcoxii x 4; Litoria fallax x 3	7	Permanent frog fence installation works
402	26-Apr-17	Yes	Yes	Yes	32900-33100	West	Stockpile site	Red-necked Wallaby x 1; micro bat x 1; Litoria nasuta x 1; Pseudophyrne coreacea x 1	4	Stockpile works
403	28-Apr-17	Yes	Yes	Yes	32900-33100	West	Stockpile site	Nil	4	Stockpile works
404	5-May-17	Yes	No	Yes	28100-28300	Both	Smiths Creek - Schedule Bridge Demolition	Litoria wilcoxii x 3; Limnodynastes x 2	5	Smiths Creek Bridge Demolition
405	8-May-17	Yes	No	Yes	28100-28300	Both	Smiths Creek - Schedule Bridge Demolition	Litoria wilcoxii x 1	1	Smiths Creek Bridge Demolition
406	11-May-17	No	Yes	Yes	32000-32450	West	South of old Ravenswood North Access	Nil		
407	12-May-17	Yes	Yes	Yes	32700-32800 + 33500-33750	East and West	Carlyle Road Vegetation Near Powerline Easement + Fauna Fence on Cut 18W	Saltuarius moritzi	1	
408	26-May-17	No	Yes	Yes	30600-30700	East	Installation of permanent frog fence and removal of old on north bank - east side of Pipers Creek	Limnodynastes peroni; Lampropholis delicata x 5	6	
409	18-Jul-17	No	Yes	Yes	27200	West	Upper Smiths Creek Road Fence works	nil		
410	19-Jul-17	Yes	Yes	Yes	32700-32800 + 29400-29600	East	exotic Pine Removal from EEC at Kundabung Interchange + Caryles Powerline Easement	Nil	0	
411	27-Jul-17	Yes	Yes	Yes	37000-37100 + 27250	West	Maria River Frog Fence tie into bridge + Upper Smiths Creek bus bay area dangerous limbs removal	Limnodynastes peroni x 1; Crinia signifera x 2	3	Install of permanent frog fence at Maria River
412	1-Aug-17	Yes	Yes	Yes	25500-26900	West	RMS Variation batter works	Common Ringtail Possum x 1; Tawny Frogmouth x 1	2	
413	2-Aug-17	Yes	Yes	Yes	25500-26900	West	RMS Variation batter works	Tawny Frogmouth x 1; micro bat x 2	3	
414	3-Aug-17	Yes	Yes	Yes	25500-26900	West	RMS Variation batter works	Sugar Glider x 1	1	
415	4-Aug-17	Yes	Yes	Yes	24100-24350	West	RMS Variation batter works	Nil	0	
416	8-Aug-17	Yes	No	Yes	37800	West	Unsound trees at Stumpy Creek	Nil	0	
417	28-Aug-17	Yes	Yes	Yes	27260-27300	West	Gate 6 South Batter Reshaping Works	Nil	0	
418	19-Oct-17	Yes	Yes	Yes	3690000-367000	West	Maria River Permanent Frog Fence Install south side	Nil	0	

Survey Sequence Number	Date	Spotlight	Habitat search	Pre-Clear Walk Through	Chainage	Side of carriage way	Site name	Species detected	No.	notes
419	8-Nov-17	Yes	Yes	Yes	37250	East	Kemps Road Bus Bay	Nil		
420	9-Nov-17	Yes	No	Yes	37250	East	Kemps Road Bus Bay	Black-necked Stork	1	Soaring repeatedly over head during clearing operations
421	18-Dec-17	Yes	Yes	Yes	37700-37800	West	Stumpy Creek Bridge Access Clearing Works	Lampropholis delicata x 3; Litoria fallax x 1; Limnodynastes peroni x 1	5	Minor clearing works to access the scour protection works beneath Stumpy Creek bridge
422	10-Jan-18	Yes	Yes	Yes	37800-37900	West	Stumpy Creek Basin Works	Litoria fallax x 3; Litoria tyleri x 1	4	Works cancelled as site foreman didn't show up to work
423	11-Jan-18	Yes	Yes	Yes	37800-37900	West	Stumpy Creek Basin Works	Litoria fallax x 2	2	
424	17-Jan-18	No	Yes	Yes	34450	West	Dangerous tree works south of Cut 20	Nil	0	Dangerous tree no cleared during original clear and grub operations. Was previously identified during the G40 Walks
425	19-Jan-18	No	No	Yes	28200-28850	East	Culvert Outlet 28.60 works and overhanging wattles on boundary	Nil	0	Outlet works associated with optic fibre and clearing of trees overhanging property fence
426	18-May-18	Yes	Yes	Yes	37400-37600	West	Clearing for fence line property boundary works between dog kennels and stumpy creek	Nil	0	
427	21-May-18	No	Yes	Yes	30150-30400	East	Clearing for fauna fence extensions on southern side of Pipers Creek	Lampropholis delicata	3	
									804	

Table A-3. Road kill register for pre construction and during construction for K2K Project.

Program Status	Date	Day	Location Chainage - Surveyed	Site name	Species detected	Total for Day/Period
Pre-construction	27-Oct-14	Monday	24900	Mingaletta	Echidna	1
Pre-construction	27-Oct-14	Monday	25800	Mingaletta	Common Ringtail Possum	1
Pre-construction	27-Oct-14	Monday	29800	Kundabung	Red-necked Wallaby	1
Pre-construction	27-Oct-14	Monday	30550	Pipers Creek	Eastern Water Dragon	1
Pre-construction	27-Oct-14	Monday	33400	Ravenswood North	Common Ringtail Possum	1
Pre-construction	27-Oct-14	Monday	36800	Maria River	Blackish Blind Snake	1
Pre-construction	10-Nov-14	Monday	29000	Kundabung	Torresian Crow	1
Pre-construction	10-Nov-14	Monday	25400	Mingaletta	Yellow-faced Honeyeater	1
Pre-construction	10-Nov-14	Monday	31600	Ravenswood central	Yellow-faced Honeyeater	1
Pre-construction	10-Nov-14	Monday	32600	Ravenswood north	Swamp Wallaby	1
Pre-construction	10-Nov-14	Monday	31500	Ravenswood central	Grey Goshawk	1
Pre-construction	10-Nov-14	Monday	30300	Kundabung	Northern Brown Bandicoot	1
Pre-construction	17-Nov-14	Monday	26300	Mingaletta	Koala x 2	2
Pre-construction	17-Nov-14	Monday	28000	Smiths Creek	Common Ringtail Possum	1
Pre-construction	17-Nov-14	Monday	27500	Smiths Creek	Diamond Python	1
Pre-construction	17-Nov-14	Monday	28300	Smiths Creek	Diamond Python	1
Pre-construction	17-Nov-14	Monday	28700	Smiths Creek	Common Brushtail Possum	1
Pre-construction	17-Nov-14	Monday	31700	Smiths Creek	Unidentified	1
Pre-construction	17-Nov-14	Monday	37600	Smiths Creek	Common Ringtail Possum	1
Pre-construction	17-Nov-14	Monday	31750	Smiths Creek	European Rabbit	1
Pre-construction	24-Nov-14	Monday	25800	Mobbs Drive	Diamond Python	1
Pre-construction	24-Nov-14	Monday	28350	Smiths Creek	Diamond Python	1
Pre-construction	24-Nov-14	Monday	30800	Pipers Creek	Swamp Wallaby	1
Pre-construction	24-Nov-14	Monday	33500	Bloodwood Rest Area	Blackish Blind Snake	1
					<b>Pre-construction</b>	<b>25</b>
During Construction	24-Nov-14	Monday	Ch 24700 - 25750 + 34500-35500	Sth of Mobbs Dr + Joan's Rest area in Maria SF	None	0
During Construction	25-Nov-14	Tuesday	Ch 24700 - 25750 + 34500-35500	Sth of Mobbs Dr + Joan's Rest area in Maria SF	Diamond Python	1
During Construction	26-Nov-14	Wednesday	Ch 24700 - 25750 + 34500-35500	Sth of Mobbs Dr + Joan's Rest area in Maria SF	No new road kills	0
During Construction	27-Nov-14	Thursday	Ch 24700 - 25750 + 34500-35500	Sth of Mobbs Dr + Joan's Rest area in Maria SF	No new road kills	0
During Construction	28-Nov-14	Friday	Ch 24700 - 25750 + 34500-35500	Sth of Mobbs Dr + Joan's Rest area in Maria SF	No new road kills	0
During Construction	1-Dec-14	Monday	Ch 24700 - 25750 + 34500-35500	Sth of Mobbs Dr + Joan's Rest area in Maria SF	No new road kills	0
During Construction	2-Dec-14	Tuesday	Ch 24700 - 25750 + 34500-35500	Sth of Mobbs Dr + Joan's Rest area in Maria SF	No new road kills	0
During Construction	3-Dec-14	Wednesday	Ch 24700 - 25750 + 34500-35500	Sth of Mobbs Dr + Joan's Rest area in Maria SF	No new road kills	0
During Construction	4-Dec-14	Thursday	Ch 24700 - 25750 +	Sth of Mobbs Dr + Joan's Rest area in Maria SF	No new road kills	0

Program Status	Date	Day	Location Chainage - Surveyed	Site name	Species detected	Total for Day/Period
			34500-35500			
During Construction	5-Dec-14	Friday	Ch 24700 - 25750 + 34500-35500	Sth of Mobbs Dr + Joan's Rest area in Maria SF	No new road kills	0
During Construction	6-Dec-14	Saturday	Ch 24700 - 25750 + 34500-35500	Sth of Mobbs Dr + Joan's Rest area in Maria SF	No new road kills	0
During Construction	8-Dec-14	Monday	Ch 24700 - 25750 + 34500-35500	Sth of Mobbs Dr	Dwarf-crowned Snake - <i>Cacophis krefftii</i> (25400)	1
During Construction	9-Dec-14	Tuesday	Ch 24700 - 25750 + 34500-35500	Sth of Mobbs Dr	No new road kills	0
During Construction	10-Dec-14	Wednesday	Ch 24700 - 25750 + 34500-35500	Sth of Mobbs Dr	No new road kills	0
During Construction	11-Dec-14	Thursday	Ch 24700 - 25750 + 34500-35500	Sth of Mobbs Dr	No new road kills	0
During Construction	12-Dec-14	Friday	Ch 24700 - 25750 + 34500-35500	Sth of Mobbs Dr	No new road kills	0
During Construction	15-Dec-14	Monday	Ch 24700 - 25750 + 34500-35500	Sth of Mobbs Dr	No new road kills	0
During Construction	16-Dec-14	Tuesday	Ch 24700 - 25750 + 34500-35500	Sth of Mobbs Dr	No new road kills	0
During Construction	17-Dec-14	Wednesday	Ch 24700 - 25750 + 34500-35500	Sth of Mobbs Dr	No new road kills	0
During Construction	18-Dec-14	Thursday	Ch 24700 - 25750 + 34500-35500	Sth of Mobbs Dr	No new road kills	0
During Construction	19-Dec-14	Friday	Ch 24700 - 25750 + 34500-35500	Sth of Mobbs Dr	No new road kills	0
During Construction	22-Dec-14	Monday	Ch 24700 - 25750 + 34500-35500	Sth of Mobbs Dr	No new road kills	0
During Construction	23-Dec-14	Tuesday	Ch 24700 - 25750 + 34500-35500	Sth of Mobbs Dr	Common Brushtail Possum	1
During Construction	24-Dec-14	Wednesday	No surveys performed			
During Construction	25-Dec-14	Thursday	No surveys performed			
During Construction	26-Dec-14	Friday	No surveys performed			
During Construction	27-Dec-14	Saturday	No surveys performed			
During Construction	28-Dec-14	Sunday	No surveys performed			
During Construction	29-Dec-14	Monday	No surveys performed			
During Construction	30-Dec-14	Tuesday	No surveys performed			
During Construction	31-Dec-14	Wednesday	No surveys performed			
During Construction	1-Jan-15	Thursday	No surveys performed			
During Construction	2-Jan-15	Friday	No surveys performed			



Program Status	Date	Day	Location Chainage - Surveyed	Site name	Species detected	Total for Day/Period
During Construction	3-Jan-15	Saturday	No surveys performed			
During Construction	4-Jan-15	Sunday	No surveys performed			
During Construction	5-Jan-15	Monday	Ch. 25350 - 27000 + 32600-35000	Mingaletta and Maria River	<i>Ramphotyphlops nigrescens</i> X 1 (33900); Red-necked Wallaby x 1 ad (35600); Swamp Wallaby (24750); Swamp Wallaby (25400)	4
During Construction	6-Jan-15	Tuesday	30500-35000	Pipers Creek through to Maria River	Eastern Grey Kangaroo - sub adult x 1 (31700)	1
During Construction	7-Jan-15	Wednesday	Ch 26170-25350 + 33500-36000	Nth of Mingaletta Rd	No new road kill animals	0
During Construction	8-Jan-15	Thursday	Ch 26170-25350	Nth of Mingaletta Rd	Eastern Grey Kangaroo (25500)	1
During Construction	9-Jan-15	Friday	Ch 26170-25350	Nth of Mingaletta Rd	No new road kill animals	0
During Construction	10-Jan-15	Saturday	ch. 24200-36000	Most of project	No new road kills	0
During Construction	12-Jan-15	Monday	ch. 24200-36000	Most of project	No new road kill animals	0
During Construction	13-Jan-15	Tuesday	Ch 26631-25350 + 33000-36000	Nth of Mingaletta Rd + Maria River SF	No new road kill animals	0
During Construction	14-Jan-15	Wednesday	Ch 26631-25350 + 32600-36000	Nth of Mingaletta Rd + Maria River SF	No new road kill animals	0
During Construction	15-Jan-15	Thursday	Ch 26631-25350 + 32600-36000	Nth of Mingaletta Rd + Maria River SF	No new road kill animals	0
During Construction	16-Jan-15	Friday	Ch 26631-25350 + 32600-36000	Nth of Mingaletta Rd + Maria River SF	No new road kill animals	0
During Construction	17-Jan-15	Saturday	Ch 26631-25350 + 32600-36000	Nth of Mingaletta Rd + Maria River SF	No new road kill animals	0
During Construction	19-Jan-15	Monday	Ch 26631-25350 + 32600-36000	Nth of Mingaletta Rd + Maria River SF	No new road kill animals	0
During Construction	20-Jan-15	Tuesday	Ch 26631-25350 + 32600-36000	Nth of Mingaletta Rd + Maria River SF	No new road kill animals	0
During Construction	21-Jan-15	Wednesday	Ch. 25350 - 27000 + 32600-35000	Nth of Mingaletta Rd + Maria River SF	No new road kill animals	0
During Construction	22-Jan-15	Thursday	24100-36000	Barrys Creek to Joan's Rest	Hundreds of frogs	100
During Construction	23-Jan-15	Friday	24100-36000	Barrys Creek to Joan's Rest	Hundreds of frogs	100
During Construction	24-Jan-15	Saturday	24100-36000	Barrys Creek to Joan's Rest	No new road kill	0
During Construction	26-Jan-15	Monday	24100-36000	Barrys Creek to Joan's Rest	No new road kill	0
During Construction	27-Jan-15	Tuesday	24100-36000	Barrys Creek to Joan's Rest	No new road kill	0
During Construction	28-Jan-15	Wednesday	24100-36000	Barrys Creek to Joan's Rest	No new road kill	0
During Construction	29-Jan-15	Thursday	24100-36000	Barrys Creek to Joan's Rest	No new road kill	0
During Construction	30-Jan-15	Friday	Ch. 24100 - 27400, 29150-30850, 32450-	Mingaletta, Kundabung, Jones Rest	Common Brushtail Possum (28600)	1

Program Status	Date	Day	Location Chainage - Surveyed	Site name	Species detected	Total for Day/Period
			35900			
During Construction	2-Feb-15	Monday	Ch. 24100 - 35900	Mingaletta, Kundabung, Jones Rest	No new road kill	0
During Construction	3-Feb-15	Tuesday	Ch. 24100 - 35900	Mingaletta, Kundabung, Jones Rest	No new road kill	0
During Construction	4-Feb-15	Wednesday	Ch. 24100 - 35900	Mingaletta, Kundabung, Jones Rest	No new road kill animals	0
During Construction	5-Feb-15	Thursday	Ch. 24100 - 35900	Mingaletta, Kundabung, Jones Rest	No new road kill animals	0
During Construction	6-Feb-15	Friday	Ch. 24100 - 35900	Mingaletta, Kundabung, Jones Rest	No new road kill animals	0
During Construction	7-Feb-15	Saturday	Ch. 24100 - 35900	Mingaletta, Kundabung, Jones Rest	Lace Monitor (24500)	1
During Construction	9-Feb-15	Monday	Ch. 24100 - 35900	Mingaletta, Kundabung, Jones Rest	Red-necked Wallaby (34800); Diamond Python (36000); <i>Vespadelus pumilis</i> (26400)	3
During Construction	10-Feb-15	Tuesday	Ch. 24100 - 35900	Mingaletta, Kundabung, Jones Rest	No new road kill animals	0
During Construction	11-Feb-15	Wednesday	Ch. 24100 - 35900	Mingaletta, Kundabung, Jones Rest	No new road kill animals	0
During Construction	12-Feb-15	Thursday	Ch. 24100 - 27400, 29150-30850, 32450-35900	Mingaletta, Kundabung, Maria SF	No new road kill animals	0
During Construction	13-Feb-15	Friday	Ch. 24100 - 27400, 29150-30850, 32450-35900	Mingaletta, Kundabung, Maria SF	No new road kill animals	0
During Construction	14-Feb-15	Saturday	Ch. 24100 - 27400, 29150-30850, 32450-35900	Mingaletta, Kundabung, Maria SF	No new road kill animals	0
During Construction	16-Feb-15	Monday	Ch. 24100 - 27400, 29150-30850, 32450-35900	Mingaletta, Kundabung, Maria SF	No new road kill animals	0
During Construction	17-Feb-15	Tuesday	Ch. 24100 - 27400, 29150-30850, 32450-35900	Mingaletta, Kundabung, Maria SF	Common Ringtail Possum (24500)	1
During Construction	18-Feb-15	Wednesday	Ch. 24100 - 27400, 29150-30850; 32450-35900	Mingaletta, Kundabung	Red-necked Wallaby (30100)	1
During Construction	19-Feb-15	Thursday	Ch. 24100 - 27400, 29150-30850; 32000-36000	Mingaletta, Kundabung	No new road kill animals	0
During Construction	20-Feb-15	Friday	Ch. 24100 - 27400, 29150-30850, 32450-35900	Mingaletta, Kundabung, Maria SF	Eastern Blue Tongue Lizard (33900)	0
During Construction	23-Feb-15	Monday	Ch. 24100 - 27400, 29150-30850, 32450-35900	Mingaletta, Kundabung, Maria SF	Lace monitor (34700); Tawny Frogmouth (27600)	2
During Construction	24-Feb-15	Tuesday	Ch. 24100 - 27400, 29150-30850, 32450-35900	Mingaletta, Kundabung, Maria SF	No new road kill animals	0
During Construction	25-Feb-15	Wednesday	Ch. 24100 - 27400, 29150-	Mingaletta, Kundabung, Maria SF	No new road kill animals	0

Program Status	Date	Day	Location Chainage - Surveyed	Site name	Species detected	Total for Day/Period
			30850, 32450-35900			
During Construction	26-Feb-15	Thursday	Ch. 24100 - 27400, 29150-30850, 32450-35900	Mingaletta, Kundabung, Maria SF	Lace monitor (25400) + Wild Dog (29600)	2
During Construction	27-Feb-15	Friday	Ch. 24100 - 27400, 29150-30850, 32450-35900	Mingaletta, Kundabung, Maria SF	No new road kill animals	0
During Construction	2-Mar-15	Monday	24100-36000	Barrys Creek through to Joan's Rest (Maria River State Forest)	No new road kill animals	0
During Construction	3-Mar-15	Tuesday	24100-36000	Barrys Creek through to Joan's Rest (Maria River State Forest)	No new road kill animals	0
During Construction	4-Mar-15	Wednesday	24100-36000	Barrys Creek through to Joan's Rest (Maria River State Forest)	No new road kill animals	0
During Construction	5-Mar-15	Thursday	24100-36000	Barrys Creek through to Joan's Rest (Maria River State Forest)	No new road kill animals	0
During Construction	6-Mar-15	Friday	24100-36000	Barrys Creek through to Joan's Rest (Maria River State Forest)	No new road kill animals	0
During Construction	9-Mar-15	Monday	24100-36000	Barrys Creek through to Joan's Rest (Maria River State Forest)	Diamond Python (34600) - sub adult; European Hare (32550)	2
During Construction	10-Mar-15	Tuesday	Ch. 24100 - 27400, 29150-31800, 32450-35900	Barrys Creek, Kundabung/Pipers/Ravenswood and Maria	Red-necked Wallaby (32850) - ad; Red-necked Wallaby (34850) - ad; Sugar Glider ch. 31800	3
During Construction	11-Mar-15	Wednesday	Ch. 24100 - 27400, 29150-31800, 32450-35900	Nth of Smiths Creek	Unidentified mammal (34500); Blue-tongue Lizard (28500); White-throated Nightjar (26400)	3
During Construction	12-Mar-15	Thursday	24100-36000	Barrys Creek through to Joan's Rest (Maria River State Forest)	Red-necked Wallaby (34300) - ad; Magpie x 2 (29100)	3
During Construction	13-Mar-15	Friday	24100-36000	Barrys Creek through to Joan's Rest (Maria River State Forest)	No new road kill animals	0
During Construction	16-Mar-15	Monday	24100-36000	Barrys Creek through to Joan's Rest (Maria River State Forest)	Swamp Wallaby (24150)	1
During Construction	17-Mar-15	Tuesday	24100-36000	Barrys Creek through to Joan's Rest (Maria River State Forest)	No new road kill animals	0
During Construction	18-Mar-15	Wednesday	24100-36000	Barrys Creek through to Joan's Rest (Maria River State Forest)	Northern Brown Bandicoot (29000)	1
During Construction	19-Mar-15	Thursday	24100-36000	Barrys Creek through to Joan's Rest (Maria River State Forest)	Blackish Blind Snake (27900)	1
During Construction	20-Mar-15	Friday	24100-36000	Barrys Creek through to Joan's Rest (Maria River State Forest)	No new road kill animals	0
During Construction	23-Mar-15	Monday	24100-36650	Barrys Creek to Railway Dam Rd (Maria River)	No new road kill animals	0
During Construction	24-Mar-15	Tuesday	24100-36000	Barrys Creek to Railway Dam Rd (Maria River)	No new road kill animals	0
During Construction	25-Mar-15	Wednesday	24100-36000	Barrys Creek to Railway Dam Rd (Maria River)	Northern Brown Bandicoot (30750)	1
During Construction	26-Mar-15	Thursday	24100-36650	Barrys Creek to Railway Dam Rd (Maria River)	No new road kill animals	0
During Construction	27-Mar-15	Friday	24100-36650	Barrys Creek to Railway Dam Rd (Maria River)	No new road kill animals	0
During Construction	28-Mar-15	Saturday	24100-36650	Barrys Creek to Railway Dam Rd (Maria River)	No new road kill animals	0
During Construction	30-Mar-15	Monday	24100-36650	Barrys Creek to Railway Dam Rd (Maria River)	Common Brushtail Possum (26650)	1
During Construction	31-Mar-15	Tuesday	28200-31000 + 32000-37000	Barrys Creek to Railway Dam Rd (Maria River)	Pacific Black Duck, Blackish Blind Snake	2

Program Status	Date	Day	Location Chainage - Surveyed	Site name	Species detected	Total for Day/Period
During Construction	1-Apr-15	Wednesday	24100-36650	Barrys Creek to Railway Dam Rd (Maria River)	No new road kill animals	0
During Construction	2-Apr-15	Thursday	24100-36650	Barrys Creek to Railway Dam Rd (Maria River)	No new road kill animals	0
During Construction	3-Apr-15	Friday	24100-36650	Barrys Creek to Railway Dam Rd (Maria River)	No new road kill animals	0
During Construction	6-Apr-15	Monday	24100-36650	Barrys Creek to Railway Dam Rd (Maria River)	No new road kill animals	0
During Construction	7-Apr-15	Tuesday	24100-36650	Barrys Creek to Railway Dam Rd (Maria River)	Small corpses likely to have been frogs but couldn't stop due to safety	15
During Construction	8-Apr-15	Wednesday	28200-37000	Barrys Creek to Railway Dam Rd (Maria River)	Eastern Long-necked Tortoise @ 32350, Eastern Grey Kangaroo @ ~ 28050	2
During Construction	9-Apr-15	Thursday	24100-36650	Barrys Creek to Railway Dam Rd (Maria River)	No new road kill animals	0
During Construction	10-Apr-15	Friday	24100-36650	Barrys Creek to Railway Dam Rd (Maria River)	Tawny Frogmouth (28000)	1
During Construction	13-Apr-15	Monday	24100-36650	Barrys Creek to Railway Dam Rd (Maria River)	No new road kill animals	0
During Construction	14-Apr-15	Tuesday	24100-36650	Barrys Creek to Railway Dam Rd (Maria River)	No new road kill animals	0
During Construction	15-Apr-15	Wednesday	24100-36600	Barrys Creek to Railway Dam Rd (Maria River)	Tawny Frog Mouth - Eastern Side of Road ch. 28100 (Nth of the Heavy vehicle inspection area) + Sugar Glider found on the Eastern side of Road Ch. 30750 (Nth of Pipers Creek)- adjacent the concrete barriers	2
During Construction	16-Apr-15	Thursday	24100-36600	Barrys Creek to Railway Dam Rd (Maria River)	No new road kill animals	0
During Construction	17-Apr-15	Friday	24100-36600	Barrys Creek to Railway Dam Rd (Maria River)	No new road kill animals	0
During Construction	20-Apr-15	Monday	24100-36600	Barrys Creek to Railway Dam Rd (Maria River)	No new road kill animals	0
During Construction	21-Apr-15	Tuesday	24100-36650	Barrys Creek to Railway Dam Rd (Maria River)	Tawny Frogmouth (32000)	1
During Construction	22-Apr-15	Wednesday	24100-36600	Barrys Creek to Railway Dam Rd (Maria River)	No new road kill animals	0
During Construction	23-Apr-15	Thursday	24100-36600	Barrys Creek to Railway Dam Rd (Maria River)	No new road kill animals	0
During Construction	24-Apr-15	Friday	24100-36600	Barrys Creek to Railway Dam Rd (Maria River)	No new road kill animals	0
During Construction	27-Apr-15	Monday	No surveys performed			
During Construction	28-Apr-15	Tuesday	24100-36600	Barrys Creek through to Joan's Rest (Maria River State Forest)	1 x Red-necked Wallaby (western lane - ch.29800) + 2 x Hare (ch. 32300 + 30200)	3
During Construction	29-Apr-15	Wednesday	24100-36600	Barrys Creek through to Joan's Rest (Maria River State Forest)	No new road kill animals	0
During Construction	30-Apr-15	Thursday	24100-36600	Barrys Creek through to Joan's Rest (Maria River State Forest)	No new road kill animals	0
During Construction	1-May-15	Friday	24100-36600	Barrys Creek through to Joan's Rest (Maria River State Forest)	No new road kill animals	0
During Construction	4-May-15	Monday	24100-36600	Barrys Creek through to Joan's Rest (Maria River State Forest)	Rattus fuscipes (30750); Lewins Honeyeater (24400)	2
During Construction	5-May-15	Tuesday	24100-36600	Barrys Creek through to Joan's Rest (Maria River State Forest)	Chelidonia longicollis (28450); Torresian Crow (31100)	2
During Construction	6-May-15	Wednesday	24100-36600	Barrys Creek through to Joan's Rest (Maria River State Forest)	Tawny Frogmouth (25750)	1

Program Status	Date	Day	Location Chainage - Surveyed	Site name	Species detected	Total for Day/Period
During Construction	7-May-15	Thursday	24100-36600	Barrys Creek through to Joan's Rest (Maria River State Forest)	No new road kill animals	0
During Construction	8-May-15	Friday	24100-36600	Barrys Creek through to Joan's Rest (Maria River State Forest)	Red-necked Wallaby (34100 - Bloodwood Rest Area)	1
During Construction	11-May-15	Monday	24100-38000	Barrys Creek through to Railway Dam Road (Maria River State Forest)	European Rabbit (25750)	1
During Construction	12-May-15	Tuesday	24100-38000	Barrys Creek through to Railway Dam Road (Maria River State Forest)	Swamp Wallaby (30300) - ad on road side of installed concrete barriers	1
During Construction	13-May-15	Wednesday	24100-38000	Barrys Creek through to Railway Dam Road (Maria River State Forest)	No new road kill animals	0
During Construction	14-May-15	Thursday	24100-38000	Barrys Creek through to Railway Dam Road (Maria River State Forest)	No new road kill animals	0
During Construction	15-May-15	Friday	24100-38000	Barrys Creek through to Railway Dam Road (Maria River State Forest)	No new road kill animals	0
During Construction	16-May-15	Saturday	24100-38000	Barrys Creek through to Railway Dam Road (Maria River State Forest)	Common Brushtail Possum (35500)	1
During Construction	18-May-15	Monday	24100-38000	Barrys Creek to Stumpy Creek	No new road kill animals	0
During Construction	19-May-15	Tuesday	24100-38000	Barrys Creek to Stumpy Creek	No new road kill animals	0
During Construction	20-May-15	Wednesday	24100-38000	Barrys Creek to Stumpy Creek	No new road kill animals	0
During Construction	21-May-15	Thursday	24100-38000	Barrys Creek to Stumpy Creek	Wet and number of small corpses on road believe to be frogs - could inspect due to safety requirements	10
During Construction	22-May-15	Friday	24100-38000	Barrys Creek to Stumpy Creek	Wet and number of small corpses on road believe to be frogs (def. some Limnodynastes peroni) - could inspect due to safety requirements	10
During Construction	25-May-15	Monday	24100-38000	Barrys Creek to Stumpy Creek	Eastern Grey Kangaroo (37300) - juv	1
During Construction	26-May-15	Tuesday	24100-38000	Barrys Creek to Stumpy Creek	No new road kill animals	0
During Construction	27-May-15	Wednesday	24100-38000	Barrys Creek to Stumpy Creek	Swamp Wallaby (25850)	1
During Construction	28-May-15	Thursday	24100-38000	Barrys Creek to Stumpy Creek	No new road kill animals	0
During Construction	29-May-15	Friday	24100-38000	Barrys Creek to Stumpy Creek	Swamp Wallaby (34700) Adult; Microbat (ch.27000) - suspect a Chalinolobus gouldi	2
During Construction	30-May-15	Saturday	24100-38000	Barrys Creek to Stumpy Creek	European Hare (29100) - Kundabung Interchange	1
During Construction	1-Jun-15	Monday	24100-38000	Barrys Creek to Stumpy Creek	No new road kill animals	0
During Construction	2-Jun-15	Tuesday	24100-38000	Barrys Creek to Stumpy Creek	No new road kill animals	0
During Construction	3-Jun-15	Wednesday	24100-38000	Barrys Creek to Stumpy Creek	No new road kill animals	0
During Construction	4-Jun-15	Thursday	24100-38000	Barrys Creek to Stumpy Creek	No new road kill animals	0
During Construction	5-Jun-15	Friday	24100-38000	Barrys Creek to Stumpy Creek	Red-necked Wallaby (33400) - adult male; European Hare (31800); un	4

Program Status	Date	Day	Location Chainage - Surveyed	Site name	Species detected	Total for Day/Period
					id macropod at ch.30000 been removed and where concrete barriers located; Blue Tongue Lizard (37750) Stumpy Creek where clearing occurred last week	
During Construction	8-Jun-15	Monday	24100-38000	Barrys Creek to Stumpy Creek	No new road kill animals	0
During Construction	9-Jun-15	Tuesday	24100-38000	Barrys Creek to Stumpy Creek	No new road kill animals	0
During Construction	10-Jun-15	Wednesday	24100-38000	Barrys Creek to Stumpy Creek	Tawny Frogmouth (31200)	1
During Construction	11-Jun-15	Thursday	24100-38000	Barrys Creek to Stumpy Creek	Tawny Frogmouth (31200)	1
During Construction	12-Jun-15	Friday	No surveys performed			
During Construction	15-Jun-15	Monday	24100-38000	Barrys Creek to Stumpy Creek	No new road kill animals	0
During Construction	16-Jun-15	Tuesday	24100-38000	Barrys Creek to Stumpy Creek	No new road kill animals	0
During Construction	17-Jun-15	Wednesday	24100-38000	Barrys Creek to Stumpy Creek	European Rabbit (32000)	1
During Construction	18-Jun-15	Thursday	24100-38000	Barrys Creek to Stumpy Creek	No new road kill animals	0
During Construction	19-Jun-15	Friday	24100-38000	Barrys Creek to Stumpy Creek	No new road kill animals	0
During Construction	22-Jun-15	Monday	24100-38000	Barrys Creek to Stumpy Creek	No new road kill animals	0
During Construction	23-Jun-15	Tuesday	24100-38000	Barrys Creek to Stumpy Creek	Swamp Wallaby (36000)	1
During Construction	24-Jun-15	Wednesday	24100-38000	Barrys Creek to Stumpy Creek	No new road kill animals	0
During Construction	25-Jun-15	Thursday	24100-38000	Barrys Creek to Stumpy Creek	No new road kill animals	0
During Construction	26-Jun-15	Friday	24100-38000	Barrys Creek to Stumpy Creek	No new road kill animals	0
During Construction	29-Jun-15	Monday	24100-38000	Barrys Creek to Stumpy Creek	Eastern Grey Kangaroo (between Mobbs Dr and Mingaletta Rd - in merge lane)	1
During Construction	30-Jun-15	Tuesday	24100-38000	Barrys Creek to Stumpy Creek	No new road kill animals	0
During Construction	1-Jul-15	Wednesday	24100-38000	Barrys Creek to Stumpy Creek	European Hare (25100)	1
During Construction	2-Jul-15	Thursday	24100-38000	Barrys Creek to Stumpy Creek	No new road kill animals	0
During Construction	3-Jul-15	Friday	24100-38000	Barrys Creek to Stumpy Creek	Northern Brown Bandicoot (37600) - adult in southbound; Tawny Frogmouth (36450); Northern Brown Bandicoot (27550)	3
During Construction	5-Jul-15	Sunday	24100-38000	Barrys Creek to Stumpy Creek	No new road kill animals	0
During Construction	6-Jul-15	Monday	24100-38000	Barrys Creek to Stumpy Creek	No new road kill animals	0
During Construction	7-Jul-15	Tuesday	24100-38000	Barrys Creek to Stumpy Creek	No new road kill animals	0
During Construction	8-Jul-15	Wednesday	24100-38000	Barrys Creek to Stumpy Creek	No new road kill animals	0
During Construction	9-Jul-15	Thursday	24100-38000	Barrys Creek to Stumpy Creek	No new road kill animals	0
During Construction	10-Jul-15	Friday	24100-38000	Barrys Creek to Stumpy Creek	No new road kill animals	0

Program Status	Date	Day	Location Chainage - Surveyed	Site name	Species detected	Total for Day/Period
During Construction	13-Jul-15	Monday	24100-38000	Barrys Creek to Stumpy Creek	Red-necked Wallaby (30300) - Ad - Kundabung Concrete Barriers	1
During Construction	14-Jul-15	Tuesday	24100-38000	Barrys Creek to Stumpy Creek	No new road kill animals	0
During Construction	15-Jul-15	Wednesday	24100-38000	Barrys Creek to Stumpy Creek	No new road kill animals	0
During Construction	16-Jul-15	Thursday	24100-38000	Barrys Creek to Stumpy Creek	No new road kill animals	0
During Construction	17-Jul-15	Friday	24100-38000	Barrys Creek to Stumpy Creek	Southern Boobook (34100)	1
During Construction	18-Jul-15	Saturday	24100-38000	Barrys Creek to Stumpy Creek	No new road kill animals	0
During Construction	20-Jul-15	Monday	24100-38000	Barrys Creek to Stumpy Creek	No new road kill animals	0
During Construction	21/07/2015 till 1st June 2016	Tuesday	Niche Took Over Roll of Project Ecologist - Appoint by K2K JV			
During Construction	2-Jun-16	Thursday	29000-30600	Kundabung - old rest area	No new road kill animals	0
During Construction	15-Jul-16	Friday	28900-29150	Rodeo Drive - South Side	No new road kill animals	0
During Construction	8-Aug-16	Monday	27350-28000	M-Class Stockpile Sites - Menzies	No new road kill animals	0
During Construction	9-Aug-16	Tuesday	27000-28250	M-Class Stockpile Sites - Menzies	No new road kill animals	0
During Construction	10-Aug-16	Wednesday	27000-28250	M-Class Stockpile Sites - Menzies	No new road kill animals	0
During Construction	11-Aug-16	Thursday	27000-28250	M-Class Stockpile Sites - Menzies	No new road kill animals	0
During Construction	15-Aug-16	Monday	No surveys performed			
During Construction	16-Aug-16	Tuesday	No surveys performed			
During Construction	17-Aug-16	Wednesday	24100-24700 + 27000-28250	Culvert 1 + Widening works for Upper Smiths Creek Road north to Smiths Creek	No new road kill animals	0
During Construction	18-Aug-16	Thursday	24100-24700 + 27000-28250	Culvert 1 + Widening works for Upper Smiths Creek Road north to Smiths Creek	No new road kill animals	0
During Construction	19-Aug-16	Friday	24100-24700 + 27000-28250	Culvert 1 + Widening works for Upper Smiths Creek Road north to Smiths Creek	No new road kill animals	0
During Construction	22-Aug-16	Monday	26500-28000	Widening works from Culvert 5 to Smiths Creek Bridge	No new road kill animals	0
During Construction	23-Aug-16	Tuesday	26500-28000	Widening works from Culvert 5 to Smiths Creek Bridge	No new road kill animals	0
During Construction	29-August-2016	Monday	26000-28000	Widening works Barrys Creek to Smiths Creek west side	No new road kill animals	0
During Construction	30-August-2016	Tuesday	26000-28000	Widening works Barrys Creek to Smiths Creek west side	No new road kill animals	0
During Construction	31-August-2016	Wednesday	26000-28000	Widening works Barrys Creek to Smiths Creek west side	No new road kill animals	0
During Construction	01-September-2016	Thursday	24000-28000	Widening works Barrys Creek to Smiths Creek west side	Lewins Honeyeater	1
During Construction	02-September-2016	Friday	24000-28000	Widening works Barrys Creek to Smiths Creek west side	Boobook Owl	1
During Construction	20-October-	Thursday	32450-32700	Ravenswood Tie in and Stockpile area	No new road kill animals	0

Program Status	Date	Day	Location Chainage - Surveyed	Site name	Species detected	Total for Day/Period
	2016					
During Construction	24-October-2016	Monday	29900-30100+31600-32600	Culvert 1/2/3 + Ravenswood Stockpile	No new road kill animals	0
During Construction	25-October-2016	Tuesday	31600-33100	Culvert and widening works north from Ravenswood area	No new road kill animals	0
During Construction	11-Jan-17	Wednesday	36300-36600	Old Coast Road south for 300 m	No new road kill animals	0
During Construction	12-Jan-17	Thursday	36300-36900	A few hundred metres to north and south of Old Coast road	No new road kill animals	0
During Construction	13-Jan-17	Friday	36300-36900	A few hundred metres to north and south of Old Coast road	No new road kill animals	0
During Construction	16-Jan-17	Monday	31800-32000	Clearing for Ravenswood culverts	No new road kill animals	0
During Construction	18-Jan-17	Wednesday	29600-29700 + 31800-32000 + Gate 9N	Smith Creek bus stop + Ravenswood culvert and Gate 9N	No new road kill animals	0
During Construction	19-Jan-17	Thursday	30600-30900 + 29800	Pipers Creek frog fence area plus Scaysbrook on property works	No new road kill animals	0
During Construction	20-Jan-17	Friday	31800-32100	Ravenswood culvert and batter widening works	No new road kill animals	0
During Construction	23-Jan-17	Monday	31800-32100	Ravenswood culvert and batter widening works	No new road kill animals	0
During Construction	24-Jan-17	Tuesday	31800-32100	Ravenswood culvert and batter widening works	No new road kill animals	0
During Construction	25-Jan-17	Wednesday	29650-30550	Gate 9N works	No new road kill animals	0
During Construction	30-Jan-17	Monday	29700-30400	Gate 9N works to basin at 30600W	No new road kill animals	0
During Construction	31-Jan-17	Tuesday	29700-30300	Smiths Creek Road bus stop and 29700 to 30300	No new road kill animals	0
During Construction	1-Feb-17	Wednesday	29700-30300	Gate 9N and Smiths Creek Bus stop VMS board access works at 35050	No new road kill animals	0
During Construction	3-Feb-17	Friday	30100	Pipers Creek M Class Stockpile and Drainage Works	No new road kill animals	0
During Construction	10-Feb-17	Friday	29200-29300	Kundabung Interchange Additional Clearing	No new road kill animals	0
					<b>During Construction Totals</b>	<b>313</b>

Table A-4. Summary of dewatering activities during the K2K Project.

Date	Day	Chainage	Site name	Species detected
12-Jan-15	Monday	34700	Maria SF	Striped Gudgeon (50); Empire Gudgeon (12); Firetail Gudgeon (5); Long-finned Eel (1), <i>Cherax destructor</i> (2)
09-Feb-15	Monday	26300	Mingaletta	Striped Gudgeon (10); Firetail Gudgeon (17); Empire Gudgeon (12), Long-finned Eel (2)
12-Feb-15	Thursday	30900	Fish farm	Myobatrachid (~200) and Hylid (~100) tadpoles
17-Feb-15	Tuesday	29600	Sth Kundabung Rest Area	<i>Limnodynastes peroni</i> (1); Myobatrachid egg masses (2) egg masses collected.
18-Feb-15	Wednesday	26300	Mingaletta	Striped Gudgeon (20); Firetail Gudgeon (7); Empire Gudgeon (2), Long-finned Eel (7); <i>Cherax destructor</i> (1)
26-Feb-15	Thursday	34700	Maria River State Forest	Striped Gudgeon (4); Firetail Gudgeon (12); <i>Cherax destructor</i> (1)
27-Feb-15	Friday	30800	Nth of Pipers Creek	Myobatrachid (~20) and Hylid (~25) tadpoles
28-Feb-15	Saturday	30800	Nth of Pipers Creek	Myobatrachid (~10) and Hylid (~15) tadpoles



Date	Day	Chainage	Site name	Species detected
02-Mar-15	Monday	30800	Nth of Pipers Creek	Myobatrachid (~50) and Hylid (~35) tadpoles + Eastern Water Dragon (1)
03-Mar-15	Tuesday	30800	Nth of Pipers Creek	Hylid tadpoles (6)
04-Mar-15	Wednesday	30900	Pipers Creek to Hambly driveway	Myobatrachid (~200) and Hylid (~200) tadpoles
05-Mar-15	Thursday	30900	Pipers Creek to Hambly driveway	Myobatrachid (~60) and Hylid (~70) tadpoles
06-Mar-15	Friday	30900	Pipers Creek to Hambly driveway	Myobatrachid (~20) and Hylid (~40) tadpoles
14-Mar-15	Tuesday	30670	Pipers Creek	Fire-tailed Gudgeon (50); Striped Gudgeon (35); Empire Gudgeon (30); Mullet (120); Long-finned Eel (5); Murray River Turtle (3); <i>Mixophyes</i> tadpoles (3)
15-Mar-15	Wednesday	30670	Pipers Creek	Fire-tailed Gudgeon (10); Striped Gudgeon (5); Empire Gudgeon (2); Mullet (1); Long-finned Eel (2)
17-Mar-15	Tuesday	32600	Southern Maria River SF	Myobatrachid (~15) and Hylid (~40) tadpoles - number of these likely to be <i>Litoria brevipalmata</i>
18-Mar-15	Wednesday	28670	Box Culvert - Fill 10	Striped Gudgeon (11); Firetail Gudgeon (27)
19-Mar-15	Thursday	28670	Box Culvert - Fill 10	Firetail Gudgeon (5); <i>Cherax destructor</i> (2)
13-Apr-15	Monday	29300	Kundabung Interchange	<i>Litoria dentata</i> (30); Fire-tail Gudgeon (300), Short-finned Eel (17), <i>Litoria dentata</i> tadpoles (20)
14-Apr-15	Tuesday	29300	Kundabung Interchange	Macquarie Turtle (2); Short-finned Eel (2); Fire-tailed Gudgeon (15), <i>Litoria fallax</i> (1)
07-May-15	Thursday	29600	Kundabung Motel - east side - culvert sump pump out	Long-finned Eel (3); Striped Gudgeon (30); Empire Gudgeon (11); <i>Limnodynastes</i> tadpoles (4)
12-Jun-15	Friday	34700	Cut 20 Sth	Short-finned Eels (3); Striped Gudgeon (30); Fire-tail Gudgeon (20); Empire Gudgeon (50)
15-Jun-15	Monday	34700	Cut 20 Sth	Short-finned Eels (6), <i>Cherax destructor</i> (2), Striped Gudgeon (25), Firetail Gudgeon (20), Empire Gudgeon (50)
01-Jul-15	Wednesday	28200	Smiths Creek	Short-finned Eel (1); Striped Gudgeon (12); Empire Gudgeon (15)
19-Jan-17	Friday	28600	Tributary of Smiths Creek	Striped Gudgeon (8); Empire Gudgeon (40)
08-May-17	Monday	28200	Smiths Creek	Long-finned Eels (5); Striped Gudgeon (120); Fire-tail Gudgeon (45); Empire Gudgeon (35)
11-Aug-17	Friday	37800	Stumpy Creek	Fire-tailed Gudgeon (20); Striped Gudgeon (30); Empire Gudgeon (10)
11-Jan-18	Thursday	37850	Stumpy Creek - Basin works	<i>Limnodynastes peroni</i> (2)
19-Jan-18	Friday	28600	Tipping Drainage Line	Empire Gudgeon (40); Striped Gudgeon (8)

Table A-5. Post clearing nest box calculations following substantive clearing on the K2K Project.

Zone	Ch.	Area removed (ha)	No. HBT Removed	No. Functional Hollows	No. Nest Boxes required	Area Actually Removed	Number of HBT Actually Removed	No. Functional Hollows	Stage 2 Post Clearing Calculation (Minimum Number Requirements) including retention of 20% error for loss during felling process	Side Of Carriageway	Design Type									Numbers in Zone and Side of Carriageway	Notes Comments	
											Scansorial Mammals	Microchiropteran Bats	Small Gliders	Larger Gliders	Possums	Small Owls	Black Cockatoo/ Large Parrots	Medium-sized Parrots	Large Forest Owl			
											1	2	3	4	5	6	7	8	9			
S	24100-24600	9.15	29	241	37	3.1	16	63	24	Eastern	3	0	2	2	4	0	1	2	1	15	More boxes have been installed then required. As a consequence no additional boxes were installed in this area during the remaining 40% install (Stage II). Also an error in chainage recording which should have been 24600 in the NBPoM. This was corrected during nest box monitoring events. Variability in calcs also attributed to working on M class for the NBPoM whilst A class being constructed.	
										Western	1	0	1	2	3	1	0	0	0	8	Some minor amendments with nest box relocations occurred due to changes in clearing footprint. Updated on Sep2017GIS layer	
T	24600-25450	6.8	34	259	50	11.9	47	188	19	Eastern	3	3	7	6	1	2	1	2	1	26	More boxes have been installed then required. NBPoM working on M class clearing footprints, not A class and hence variability in some of the design footprints. Nonetheless, additional boxes were installed during Stage II focusing around the glider poles at ch. 25200	
										Western	3	2	1	4	5	0	0	1	0	16	Six additional boxes installed adjacent to western glider poles as part of Stage II install works. Viewed to augment hollow resources in this area which are somewhat limited adjacent to the poles for up to 100 m.	
U	25150-25750	4.8	11	163	46	4.2	13	35	10	Eastern	3	3	5	3	4	1	0	2	1	22	More installed than what was required. Again due to M versus A class design. Also some amalgamation in chainage zones, however, this zone had a more Mingaletta Road focus and this is where most of the nest boxes were installed.	
										Western	0	0	0	0	0	0	0	0	0	0	0	0
V	28500-29300	7.45	18	121	20	4.1	14	32	9	Eastern	0	0	0	0	0	0	0	0	0	0	0	Main hollow bearing trees were retained along eastern RMS boundary and consequent all boxes were installed on western side.
										Western	5	2	3	1	5	0	0	2	0	18	An additional 6 nest boxes installed further to the north towards Kundabung Interchange during Stage II due to higher occupancy rates of fauna recorded using tree hollows during clearing works and nest boxes during earlier rounds of monitoring.	
W	31300-32250	3.8	9	58	19	4.28	9	21	6	Eastern	0	3	0	0	3	0	0	0	0	6	Reduced number of boxes had to be installed on eastern side as there was very little retained vegetation in RMS corridor due to service roads. All boxes were installed within RMS road corridor due to uncertainty about being able to access these in the future and the uncertainty regarding clearing of western boundary.	
										Western	6	2	0	1	4	0	0	1	0	14	All boxes were installed during Stage II as there was uncertainty regarding the final clearing strings and proposed clearing of fence lines by adjacent private property owner	

Zone	Ch.	Area removed (ha)	No. HBT Removed	No. Functional Hollows	No. Nest Boxes required	Area Actually Removed	Number of HBT Actually Removed	No. Functional Hollows	Stage 2 Post Clearing Calculation (Minimum Number Requirements) including retention of 20% error for loss during felling process	Side Of Carriageway	Design Type	Scansorial Mammals	Microchiropteran Bats	Small Gliders	Larger Gliders	Possums	Small Owls	Black Cockatoo/ Large Parrots	Medium-sized Parrots	Large Forest Owl	Numbers in Zone and Side of Carriageway	Notes Comments	
												1	2	3	4	5	6	7	8	9			
X	32650-33600	7.6	19	70	15	8.74	42	117	16	Eastern	5	2	1	1	5	0	3	5	2	24	Additional 15 boxes installed as part of Stage II installation works and to compensate for increased clearing limits, relocation of Optic Fibre and broad range of fauna recorded using this area including Squirrel Glider during post approval spotlighting for Koala baseline surveys, Sooty Owl during morning pre-clearing surveys and high numbers of Leaf-tailed Geckos.		
										Western	0	0	0	0	0	0	0	0	0	0	0	0	Remained a linear strip apart from northern limit where new zone created to tie into aerial crossing structure 250 m to north.
New Zone Created	33600-34300	no data in NBPoM	no data in NBPoM	no data in NBPoM	no data in NBPoM	5.6	11	27	6	Eastern	3	0	0	1	4	0	1	0	1	10	New zone created to adjacent for increased clearing and install of fauna mitigation devices. Six boxes installed adjacent to aerial crossing as part of Stage II installation and remaining four boxes in gully to the north (2 possum, 1 x large cockatoo and 1 x large forest owl).		
										Western	3	0	0	1	2	0	0	0	0	0	6	Six boxes installed adjacent aerial crossing	
Y	34400-35300	9.98	53	164	26	6.48	61	151	30	Eastern	4	4	2	5	9	2	1	2	1	30	10 Additional boxes installed during stage II calculations. Most of these were located on eastern side of fauna crossing ch. 34850E. An additional two boxes were located on ridge a 250m north to augment existing boxes following wildfire event in Nov 2016		
										Western	0	0	0	0	0	0	0	0	0	0	0	0	Retained linear strip and within this zone sufficient numbers of retained HBTs which historically bordered the old Pacific Highway
Z	35900-36600	5.6	18	73	17	4.34	27	65	18	Eastern	7	2	2	4	5	0	0	1	0	21	Stage II calculations revealed the additional 40% were required and this combined with glider poles and aerial rope crossing some eight boxes were installed as part of Stage II works on either side of the fauna poles/rope bridges. An additional 2 boxes were installed in original area as part of stage II installation bring total of newly installed boxes to 10.		
										Western	8	0	0	5	3	0	0	0	0	0	16	All 16 were installed as part of Stage II focusing on areas adjacent to poles and rope bridges plus further north where clearing strings were expanded after stage I installation south of Railway Dam Road.	
AA	36700-37000	1.55	7	27	24	1.1	4	19	21	Eastern	6	2	3	6	5	1	0	1	1	25	An additional 8 boxes were installed following the final clearing and stage 2 calculations combined with the discovery of threatened Yellow-bellied Gliders and the retained Maria River roadside vegetation being used to maintain glider connectivity.		
										Western	0	0	0	0	0	0	0	0	0	0	0	0	No hollow bearing trees removed in that area.
										Totals	60	25	27	42	62	7	7	19	8	257	Three more than the required 254 stated in the NBPoM.		

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# Koala Monitoring 2017

**Year 3 Surveys – Oxley Highway to Kempsey, Pacific Highway Upgrade**

Prepared for Roads and Maritime Services

July 2018

## Document control

Project no.:	1702
Project client:	Roads and Maritime Services
Project office:	Port Macquarie
Document description:	Koala Monitoring 2017
Project Director:	Rhidian Harrington
Project Manager:	Radika Michniewicz
Authors:	Radika Michniewicz
Internal review:	Amanda Griffith
Document status:	Rev1
Local Government Area:	Port Macquarie Hastings and Kempsey

Author	Revision	Internal review	Date Issued
R Michniewicz	D0	Amanda Griffith	2/07/2018
R Michniewicz	R0		3/07/2018
R Michniewicz	R1		14/08/2018

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*Cover photograph: Koalas from the Port Macquarie area, Radika Michniewicz*

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## Executive Summary

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### **Context**

This report documents findings from the spring-summer 2017 monitoring period for the Koala, as required for the Oxley Highway to Kempsey (OH2K) Pacific Highway upgrade project (the Project).

### **Aims**

The aim of the Koala monitoring program is to determine whether the Project is having an impact on Koala populations within the study area.

### **Methods**

Each monitoring location was surveyed in accordance with the monitoring method and design specified in the Oxley Highway to Kempsey Pacific Highway Upgrade Ecological Monitoring Program (EMP, RMS 2016). Surveys were undertaken in October and November 2017.

### **Key results**

A total of 93 plots across 31 clusters were surveyed in spring 2017. Koalas were found to be present within 16 of the 31 clusters (52%). The mean SAT activity level for clusters, measured as the percentage of trees at each plot with scats present, was 1.8% (SD = 2.8) and ranged from 0 to 12.2%. The presence and activity level of Koalas has increased in 2017 in comparison to the 2016 surveys and were at a level similar to the 2015 surveys, but still much decreased from baseline surveys.

Koalas were found to be using resources within the areas affected by wildfires in November 2016. Eight of the 11 plots not surveyed in 2016 due to the fires recorded Koala activity in 2017.

Koalas were recorded more frequently at impact sites (60%) than at control sites (44%), which is consistent with results observed in the previous monitoring events. There was no significant change in the difference between Koala presence at control and impact clusters between 2017 and baseline surveys. Similarly there was no significant change in the difference between Koala presence at mitigation and no mitigation clusters between 2017 and baseline surveys. Average plot activity levels for each treatment type have not decreased from the baseline surveys beyond the recommended 10% tolerance level.

### **Conclusions**

Performance measures relating to survey requirements have been met.

The performance measure relating to changes in distribution and habitat use has not been met as Koala presence and activity levels appear to have decreased between the baseline, and all following monitoring events. However this apparent decrease has occurred at both control and impact sites. In each of the monitoring surveys undertaken to date, impact sites recorded higher percentages of Koala presence than control sites. In addition, presence and activity levels increased in 2017 compared to 2016 are similar to those observed in 2015 and, in accordance with Lewis 2014, have not decreased from the baseline surveys beyond the recommended 10% tolerance level. As such, while changes have occurred (as specified in the performance measure), these changes cannot be attributed to the Project.

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## 1. Introduction

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### 1.1 Context

The Oxley Highway to Kempsey 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 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) (RMS 2016) combines these approval conditions and defines the mitigation and offsetting requirements for threatened species and ecological communities impacted by the Project. The Koala was identified as requiring mitigation and monitoring during the Project's construction and operational periods.

#### 1.1.1 Legal Status

The Koala (*Phascolarctos cinereus*) is listed as vulnerable under both the NSW *Biodiversity Conservation Act* (BC Act 2016) and the Commonwealth EPBC Act. Monitoring of the species is required under the Project's approval.

#### 1.1.2 Monitoring Framework

The design, methods and performance indicators that define the Koala monitoring program are specified in the EMP. The monitoring program specifies that monitoring of all sites would occur in Year 1, 2 and 3 (construction phase) once substantial construction had commenced. Following the completion of the Project, monitoring will continue in Year 4, 5, 6 and 8 (operation phase) or until the mitigation measures can be demonstrated to have been effective for the Koala.

To date, these monitoring events have been conducted and reported as follows:

- *Spring-summer 2015*: Niche 2016.
- *Spring-summer 2016*: Niche 2017.
- *Spring-summer 2017*: current report.

This report represents the third and final of the three required construction monitoring reports. Operational monitoring is due to commence in spring-summer 2018.

#### 1.1.3 Baseline Data

In accordance with the EMP, baseline surveys for the Koala were undertaken in 2014 to provide baseline data that could be used to identify changes in habitat use before and after construction of the Project, and to determine whether changes can be reasonably attributed to the Project. Baseline monitoring was conducted by Lewis Ecological prior to the commencement of construction (Lewis 2014). Remote cameras were also opportunistically deployed (targeting other threatened species) in August 2013, while spotlighting and Spot Assessment Technique (SAT) plot surveys were undertaken in spring 2013.

### 1.1.4 Purpose of this Report

This report details the findings obtained from the 2017 monitoring period, following on from the baseline, 2015 and 2016 surveys. As mentioned previously, it represents the third and final monitoring report for the construction phase of the Project.

The aim of this report is to summarise the methods and results of the spring-summer 2017 monitoring, and to compare the results with the baseline surveys to determine whether performance measures are being met and comment on whether additional measures should be considered.

## 1.2 Performance measures

The approved EMP specifies the following performance measures for the Koala (RMS 2016):

- *Monitoring is undertaken during baseline surveys from Year 1 – Year 6 & 8, or until mitigation measures are demonstrated to be effective.*
- *Monitoring during Year 1 – Year 6 & 8 is undertaken at the Impact and Control sites where monitoring was undertaken during baseline surveys, subject to ongoing landowner agreement. Where landowner agreement cannot be obtained and the process in Section 3.1.2 of the EMP has been followed, this performance indicator will also be considered to have been met.*
- *Mitigation measures are demonstrated to be effective as defined in the EPBC approval when all monitoring events are considered at Year 8.*
- *Fauna fence is installed at a minimum in areas identified in Schedule 3 of the EPBC approval at Year 4.*
- *No changes to densities, distribution, habitat use and movement patterns compared to baseline data during monitoring in Year 1 – 6 & 8, and then when all monitoring events are considered at Year 8.*

## 1.3 Monitoring timing

Monitoring is to occur once a year during spring-summer.

## 1.4 Reporting

Annual reporting of monitoring results will outline:

- A detailed description of the monitoring methodology employed.
- Results of the monitoring surveys.
- Discussion of the 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 Director General of the NSW Department of Planning and Environment and the NSW Environment Protection Authority (EPA).

## 2. Survey Methodology

### 2.1 Monitoring design

In accordance with the baseline monitoring surveys, eight broad areas within a 20 kilometre radius of the Project were surveyed. These eight areas include South Sancrox, North Sancrox, Cairncross State Forest (South), Cairncross State Forest (North), Cooperabung Hill, Mingaletta Road to Smiths Creek, Kundabung Road to North of Pipers Creek and Maria River State Forest. Within each of these areas three types of monitoring sites were established:

- **Type A:** Impact - sites with mitigation. Mitigation sites are located within 500 metres of sufficiently large culverts (>1.8 metres, to allow Koalas to pass under the Highway) that are paired with floppy top fencing.
- **Type B:** Impact - sites where mitigation has not been proposed or only partial mitigation is proposed. Partial mitigation sites are where only floppy top fencing is present but with obvious openings at interchanges or entry/exit points.
- **Type C:** Control or reference sites located in areas at least three kilometres, and often 5-10 kilometres from the Project.

Each type of site (A, B or C) is represented by a cluster of three SAT plots within each of the eight areas, resulting in nine SAT plots per area giving a total of 72 baseline SAT plots, established by Lewis (2014) (with the exception of Cairncross State Forest (South) that had an additional type B cluster and Mingaletta to Smiths Creek where no type B cluster was established). Of these 72 plots, 24 were mitigation (type A), three part mitigation and 21 no mitigation (type B), and 24 control sites (type C). To ensure a balanced monitoring design between impact sites (mitigated and not mitigated) and control sites, an additional 24 control plots (type C) were established during the first monitoring event in 2015 (Niche 2016). In accordance with the baseline monitoring design these additional 24 control plots were established at least three kilometres from the Project and were grouped in clusters of three plots, one cluster for each of the eight broad areas.

In 2015, eight of the baseline plots had to be relocated to nearby locations because they had been established in the construction site itself or because they were located on private property and access was not possible. Three of the baseline monitoring plots that could not be accessed could not be relocated because there weren't any suitable sites nearby. These three plots were all part of the same cluster (impact, no mitigation) located in the North Sancrox area.

Details of all 96 monitoring plots are presented in Table 1 and the location of the 93 accessible monitoring plots are shown in Figure 1.

**Table 1: Koala SAT Monitoring plots**

Area	Type	Type Sub Category	Data Source	Plot Name	Easting	Northing
South Sancrox	Impact	No Mitigation	Baseline	1 Sancrox East - Cassegrains	483348	6521736
	Impact	No Mitigation	Baseline	2 Sancrox East - Cassegrains	483455	6521789
	Impact	No Mitigation	Baseline	3 Sancrox East - Cassegrains	483412	6521882
	Impact	Mitigation	Baseline_Niche relocation	1 Sancrox South	483299	6520671
	Impact	Mitigation	Baseline_Niche relocation	2 Sancrox South	483254	6520383
	Impact	Mitigation	Baseline_Niche relocation	3 Sancrox South	483196	6520217

Area	Type	Type Sub Category	Data Source	Plot Name	Easting	Northing
	Control	Control	Baseline	1 Cowarra State Forest	480608	6519056
	Control	Control	Baseline	2 Cowarra State Forest	480658	6519496
	Control	Control	Baseline	3 Cowarra State Forest	481305	6519136
	Control	New Control	Niche	COWARRA NC1	479706	6518522
	Control	New Control	Niche	COWARRA NC2	479788	6517922
	Control	New Control	Niche	SAT COWARRA NC3	479795	6518227
North Sancrox	Impact*	No Mitigation	Baseline	1 Sancrox North - Expressway Spares	483042	6521731
	Impact*	No Mitigation	Baseline	2 Sancrox North - Expressway Spares	482869	6521683
	Impact*	No Mitigation	Baseline	3 Sancrox North - Expressway Spares	482999	6521818
	Impact	Mitigation	Baseline	1 Fernbank Creek	483101	6523362
	Impact	Mitigation	Baseline	2 Fernbank Creek	483032	6523223
	Impact	Mitigation	Baseline	3 Fernbank Creek	483056	6523123
	Control	Control	Baseline	1 Lake Innes	488124	6518469
	Control	Control	Baseline	2 Lake Innes	488047	6518398
	Control	Control	Baseline	3 Lake Innes	488228	6518390
	Control	New Control	Niche	COWARRA NC3 -SAT COW4	479674	6516436
	Control	New Control	Niche	SAT COW5	479704	6516174
	Control	New Control	Niche	SAT COW6	479667	6515913
Cairncross State Forest (South)	Impact	No Mitigation	Baseline	1 Cairncross State Forest (South)	482428	6526536
	Impact	No Mitigation	Baseline	2 Cairncross State Forest (South)	482385	6526644
	Impact	No Mitigation	Baseline	3 Cairncross State Forest (South)	482393	6526416
	Impact	No Mitigation	Baseline	16 Cairncross State Forest (south)	481655	6527256
	Impact	No Mitigation	Baseline	17 Cairncross State Forest (south)	481590	6527316
	Impact	No Mitigation	Baseline	18 Cairncross State Forest (south)	481637	6527175
	Impact	Mitigation	Baseline	4 Cairncross State Forest (South)	482249	6525930
	Impact	Mitigation	Baseline	5 Cairncross State Forest (South)	482125	6526077
	Impact	Mitigation	Baseline	6 Cairncross State Forest (South)	482488	6526226
	Control	Control	Baseline	1 Limeburners Creek ""The Hatch""	487011	6529909
	Control	Control	Baseline	2 Limeburners Creek ""The Hatch""	487014	6529455
	Control	Control	Baseline	3 Limeburners Creek ""The Hatch""	487035	6528694
	Control	New Control	Niche	SAT PEVI1	476817	6528422
	Control	New Control	Niche	SAT PEVI2	476730	6528225
	Control	New Control	Niche	Cairncross NC1	475996	6528211
Cairncross State Forest (north)	Impact	No Mitigation	Baseline_Niche relocation	7 Cairncross State Forest (North)	481346	6530835
	Impact	No Mitigation	Baseline	8 Cairncross State Forest (North)	481695	6530786
	Impact	No Mitigation	Baseline	9 Cairncross State Forest (North)	481184	6530864

Area	Type	Type Sub Category	Data Source	Plot Name	Easting	Northing
	Impact	Mitigation	Baseline	10 Cairncross State Forest (north)	481238	6530264
	Impact	Mitigation	Baseline	11 Cairncross State Forest (north)	481173	6530319
	Impact	Mitigation	Baseline	12Cairncross State Forest (north)	481438	6530335
	Control	Control	Baseline	13 Cairncross State Forest (Pembrooke)	473751	6528881
	Control	Control	Baseline	14 Cairncross State Forest (Pembrooke)	473464	6528969
	Control	Control	Baseline	15 Cairncross State Forest (Pembrooke)	473424	6529115
	Control	New Control	Niche	SAT RR1	475284	6532709
	Control	New Control	Niche	SAT RR2	475113	6532603
	Control	New Control	Niche	SAT RR3	474816	6532732
Cooperabung Hill	Impact	No Mitigation	Baseline	1 Cooperabung	482793	6537012
	Impact	No Mitigation	Baseline	2 Cooperabung	482755	6537093
	Impact	No Mitigation	Baseline	3 Cooperabung	482876	6537115
	Impact	Mitigation	Baseline_Niche relocation	4 Cooperabung	482481	6539327
	Impact	Mitigation	Baseline_Niche relocation	5 Cooperabung	482364	6539761
	Impact	Mitigation	Baseline	6 Cooperabung	482364	6538610
	Control	Control	Baseline	1 Cooperabung Hill (Gum Scrub)	475489	6541854
	Control	Control	Baseline	2 Cooperabung Hill (Gum Scrub)	475570	6541903
	Control	Control	Baseline	3 Cooperabung Hill (Gum Scrub)	475838	6541962
	Control	New Control	Niche	SAT FL1	473693	6542127
	Control	New Control	Niche	SAT ST1	473346	6543256
	Control	New Control	Niche	SAT ST2	473682	6542890
Mingaletta to Smiths Creek	Impact	Mitigation	Baseline	1 Mingaletta-Smiths Creek	483304	6543632
	Impact	Mitigation	Baseline	2 Mingaletta-Smiths Creek	483444	6543585
	Impact	Mitigation	Baseline	3 Mingaletta-Smiths Creek	483100	6543670
	Control	Control	Baseline	1 Ballengara State Forest (Gregs Road)	477750	6543274
	Control	Control	Baseline	2 Ballengara State Forest (Gregs Road)	477644	6543623
	Control	Control	Baseline	3 Ballengara State Forest (Gregs Road)	477551	6543709
	Control	New Control	Niche	SAT BR1	477010	6544693
	Control	New Control	Niche	SAT BR2	476890	6544832
	Control	New Control	Niche	SAT BR3	476777	6544973
Kundabung Road to North of Pipers Creek	Impact	No Mitigation	Baseline	1 Kundabung	483095	6549036
	Impact	No Mitigation	Baseline	2 Kundabung	482873	6549112
	Impact	No Mitigation	Baseline	3 Kundabung	483285	6549374
	Impact	Mitigation	Baseline	4 Kundabung	483369	6550655
	Impact	Mitigation	Baseline	5 Kundabung	483331	6550938
	Impact	Mitigation	Baseline	6 Kundabung	483083	6550608

Area	Type	Type Sub Category	Data Source	Plot Name	Easting	Northing
	Control	Control	Baseline	1 Kumbatine National Park	476044	6549609
	Control	Control	Baseline	2 Kumbatine National Park	476165	6549738
	Control	Control	Baseline	3 Kumbatine National Park	475889	6549468
	Control	New Control	Niche	SAT MAC1	476538	6552784
	Control	New Control	Niche	SAT MAC2	476558	6552361
	Control	New Control	Niche	SAT MAC3	476481	6552612
Maria River State Forest	Impact	Part Mitigation	Baseline_Niche relocation	1 Maria River	483074	6554460
	Impact	Part Mitigation	Baseline	2 Maria River	482836	6554330
	Impact	Part Mitigation	Baseline_Niche relocation	3 Maria River	482993	6554024
	Impact	Mitigation	Baseline	4 Maria River	482886	6552623
	Impact	Mitigation	Baseline	5 Maria River	482754	6552462
	Impact	Mitigation	Baseline	6 Maria River	483135	6552449
	Control	Control	Baseline	1 Maria River National Park	486965	6554366
	Control	Control	Baseline	2 Maria River National Park	486971	6554479
	Control	Control	Baseline	3 Maria River National Park	487004	6554203
	Control	New Control	Niche	SAT CO1	486292	6552230
	Control	New Control	Niche	SAT CO3	486811	6552227
	Control	New Control	Niche	SAT MAR 1	486811	6552454

\* could not be surveyed due to private landowner access restrictions.

## 2.2 Methods

### 2.2.1 Koala Spot Assessment Technique

Surveys were undertaken following the SAT methodology (Phillips and Callaghan 2011) in accordance with the EMP monitoring procedure for Koala population monitoring. The SAT method involves a radial assessment of Koala activity within the immediate area surrounding a tree that is known to have been used by the species or is considered to be of importance to the species. The following describes the application of this technique:

1. Locate and mark a tree that is:
  - a) A tree of any species beneath which one or more Koala faecal pellets have been observed; and/or
  - b) A tree in which a Koala has been observed; and/or
  - c) Any other tree known or considered to be important for Koalas or of interest for other assessment purposes.
2. Identify and mark the 29 nearest trees to the tree marked initially.
3. Undertake a search for Koala faecal pellets beneath each of the 30 marked trees. Visually inspect the ground surface beneath trees to a distance of one metre from the trunk. If no pellets are observed, rake the leaf litter within the prescribed search area. Two person minutes per tree should be dedicated to the search for faecal pellets. The search should be ended once a single pellet is found or the search time has expired (whichever happens first). Faecal pellets should not be removed from the site unless verification is necessary.

4. Calculate the activity level of a site as the percentage of surveyed trees within the site (of 30 trees) that have a Koala faecal pellet recorded within its search area. The result is used to assess whether the site supports “Low”, “Medium (normal)” or “High” Koala activity.
5. Record the presence (or absence) of scats, along with a number of other attributes including the species of the tree under which the scat was located.

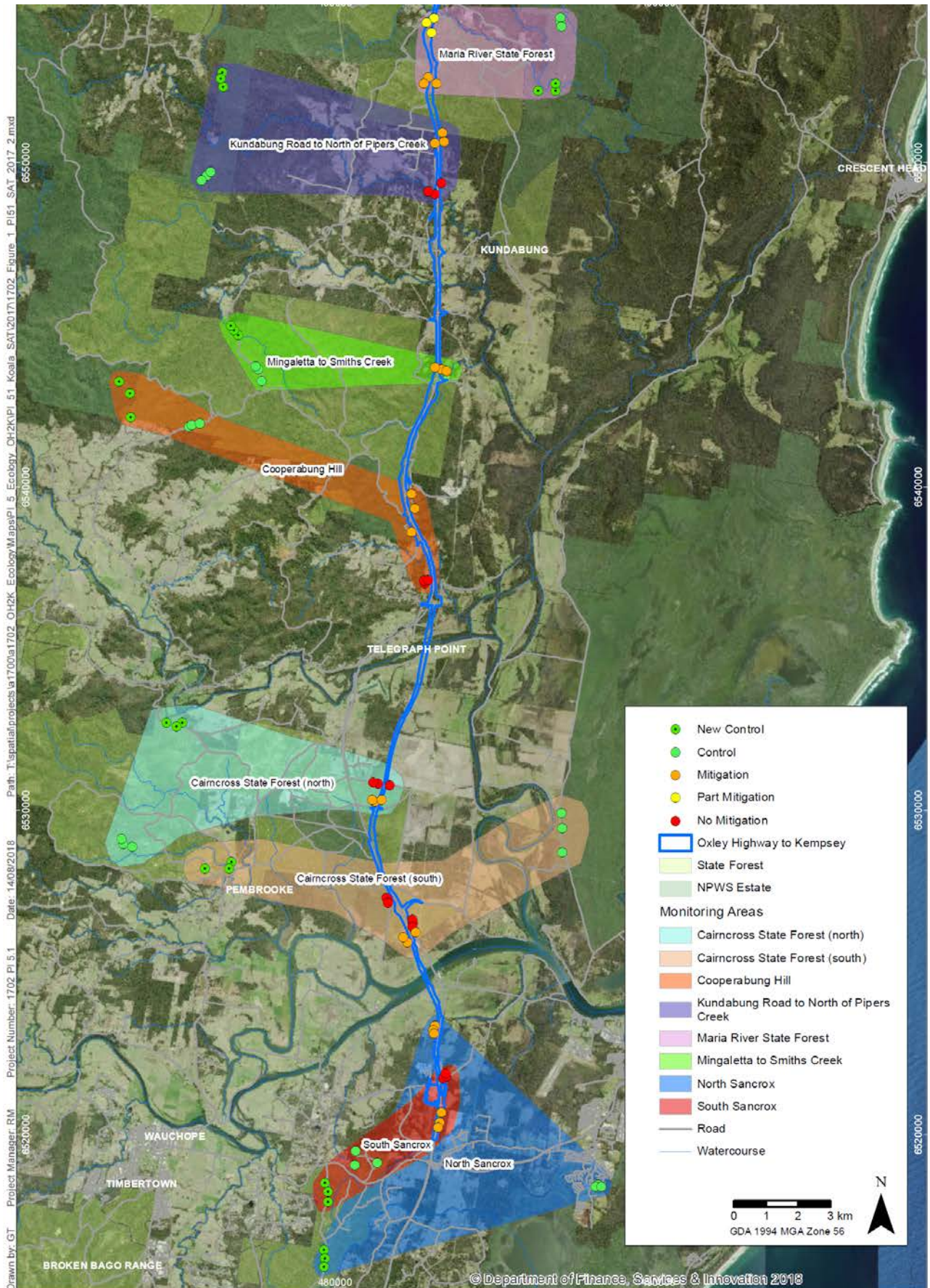
The selection criteria trees (SCTs) of each plot were marked (tagged) and have been used as the centre tree for the radial searches during each survey event.



### 2.2.2 Analysis

General SAT plot presence and activity results are presented for plot, cluster and area. More detailed analyses of impact vs. control sites and mitigation vs. no mitigation sites were undertaken using cluster presence/absence results. Plots within the same cluster are not independent from each other and therefore cannot be used for most statistical analyses. Between year activity levels were compared using mean plot activity results.

Based on the methods used to collect the data and the location of the plots, it was determined that a Chi-square test was the most suitable statistical test to assess differences in Koala presence between areas, treatments and years. This test compares the proportion of plots with and without Koala scats and so is suitable for presence/absence data. The Chi-square test also allows for analysis of data where sample sizes between categories may differ, as is the case here where there are an unequal number of impact and control sites.



Koala SAT plot locations 2017  
Oxley Highway to Kempsey - PI 5.1 Koala report

**FIGURE 1**  
Imagery: (c) LPI 2012-2014

## 3. Results and Discussion

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### 3.1 SAT plots

Surveys were undertaken from 31 October to 29 November 2017. Field data for each SAT plot are presented in Annex 1. It was noted that on a number of occasions the marked tree did not correspond with the previous monitoring SCT (selection criteria tree) species. As such, for clarity of results and to facilitate future monitoring, the DBH (diameter at breast height) is provided for the marked tree, and this tree will be considered as the SCT for the current and future monitoring events. All of the 93 accessible SAT plots were surveyed across the eight monitoring areas (Figure 1). The eleven plots not surveyed in 2016 due to wildfires were monitored in 2017.

#### 3.1.1 Koala Presence

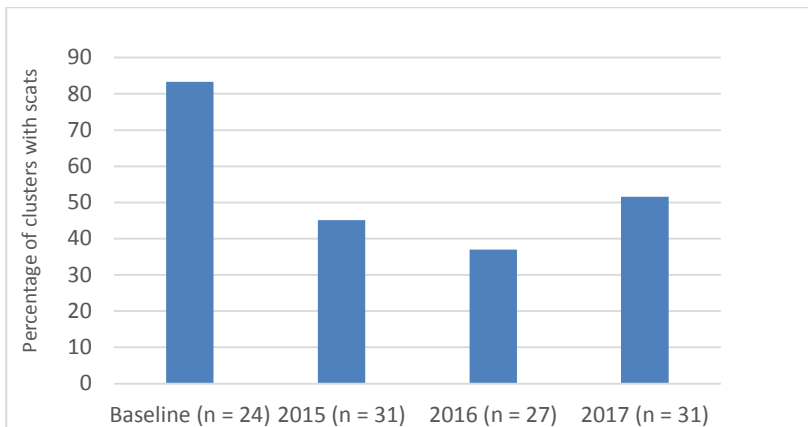
A total of 2,790 trees were assessed across the 93 plots (30 at each plot). Of the 93 surveyed plots, Koala scats were recorded from 27% (25 of 93) of the individual plots. When grouped according to cluster, Koala scats were recorded at 52% of clusters across the survey areas (16 of 31). Graph 1 shows the percentage of clusters with scats present for each monitoring period to date. Graph 2 shows the percentage of clusters within each area with scats present, for each monitoring period to date. Figure 2 shows the SAT plot cluster present/absent results (map reference ID for each cluster is listed in Table 4).

Of particular note was the presence of scats at more than half of the plots (six of 11 plots) that were not surveyed in 2016 due to wildfires that resulted in the complete loss of canopy in many areas. Two of these plots were within the Kundabung Rd to north of Pipers Ck area and nine were from Maria River State Forest area. Previously, baseline and 2015 surveys recorded presence at four and one of these plots respectively (note only eight were surveyed in these years as three of the 11 were new controls and not monitored during baseline surveys) The substantial canopy regrowth and prevalence of young leaves on the trees in these areas may have encouraged rapid re-use of these areas by Koalas after the fires. The wildfires occurred in November 2016, indicating that the Koalas have returned to these areas within a year.

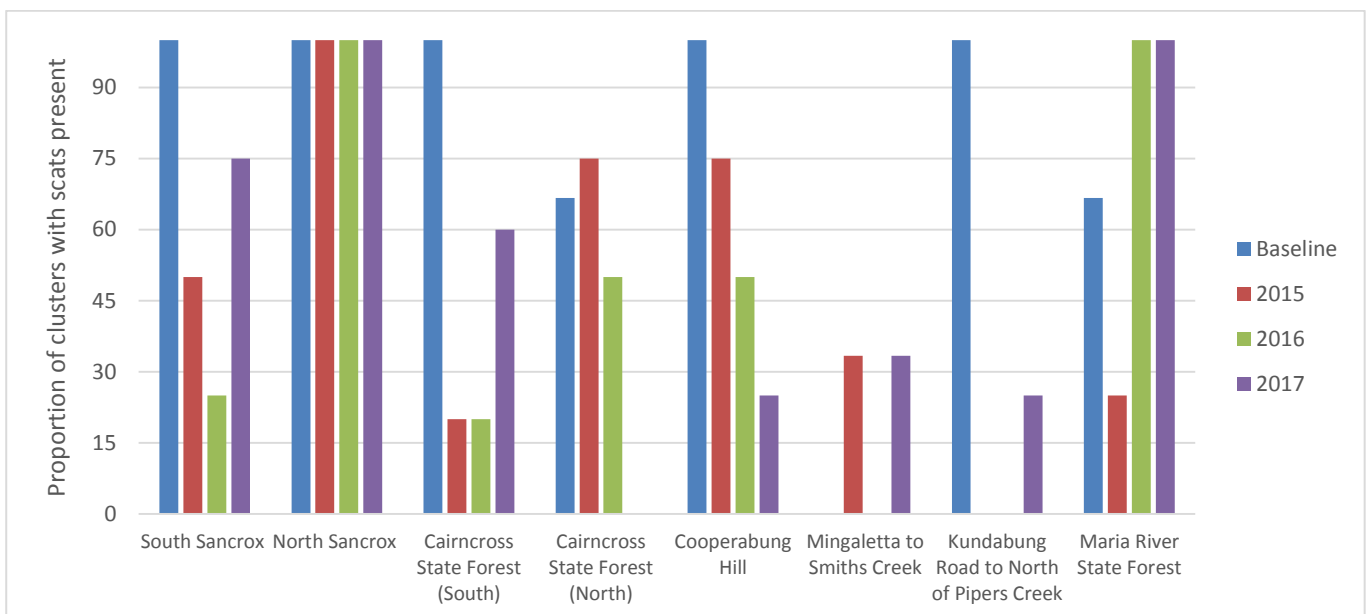
Koalas were notably absent within the Cairncross State Forest (north) area. Scats have been consistently recorded within this area during previous monitoring events but were not detected at any plot during the current monitoring event.

Koala presence was mainly recorded in the northern and southern areas, with activity in the northern area possibly being influenced by regenerating vegetation after the wildfire.

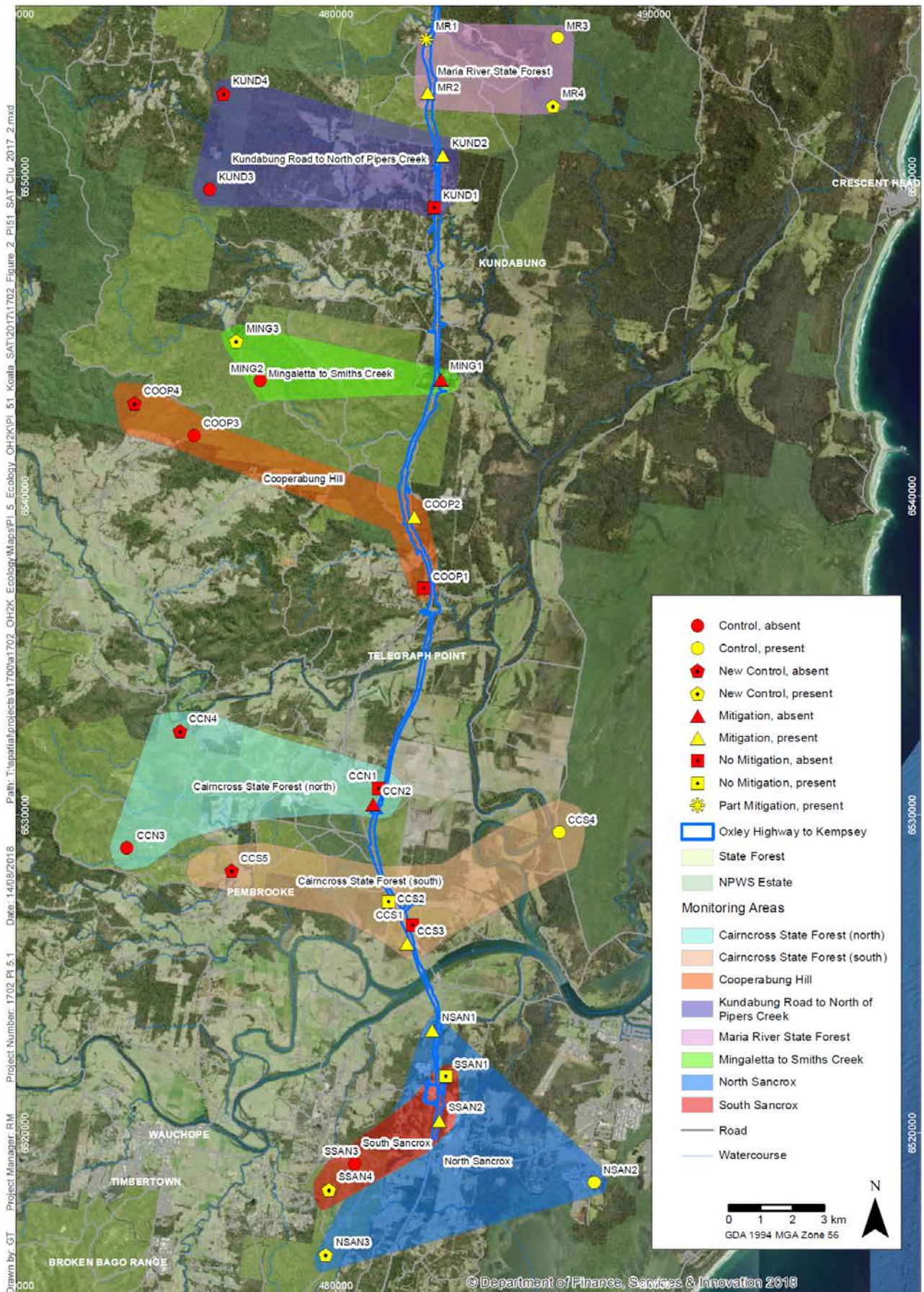
**Graph 1: Percentage of clusters with scats present for each monitoring event to date**



**Graph 2: Koala presence in areas across all monitoring events**







Koala SAT cluster results 2017  
Oxley Highway to Kempsey - PI 5.1 Koala report

**FIGURE 2**  
Imagery: (c) LPI 2012-2014

### 3.1.2 SAT Activity Levels

A summary of the SAT activity level for clusters (n = 31) and areas (n = 8) in all monitoring events is provided in Table 2 and Table 3. Results of the 2017 SAT plot surveys and activity levels are shown in Table 4.

#### **Cluster and plot activity**

The mean SAT activity level for all clusters, measured as the percentage of trees at each plot with scats present, was 1.8% (SD2.8) and ranged from 0 to 12.2%. This is higher than the mean activity recorded for clusters in 2016 (0.7% ± SD1.1), but lower than the mean activity recorded in 2015 (2.0% ± SD3.0) and during baseline surveys (4.9% ± SD6.9).

Considering the activity level within active plots only, i.e. plots where scats were found to be present, the average activity level was 6.8% (SD5.3), which is higher than the mean activity recorded for active plots in 2016 (4.0% ± SD1.4), but lower than the mean activity recorded for active plots in 2015 (8.0% ± SD6.3) and during baseline surveys (10.1% ± SD9.0).

The EMP requires interpretation of site activity levels to assess areas as supporting low, medium or high Koala activity. Phillips and Callaghan (2011) used Atlas data to calculate activity levels of sites where faecal pellets were recorded. These data were then used to define categories of habitat use in populations of varying densities. The Port Macquarie-Hastings and Kempsey LGAs support a significant Koala population, including a concentrated population in the coastal areas, east of the Pacific Highway and south of Hastings River, as well as pockets of higher density/activity in surrounding areas, including Maria River National Park (BioLink 2013, PMHC 2017). While Phillips and Callaghan (2011) use an arbitrary definition of population densities (low = ≤ 0.1 Koala/hectare), the study area naturally consists of areas of varying densities. Discussions with Port Macquarie-Hastings Council confirmed that population density varies throughout the region and therefore one general population density cannot be attributed to all sites. In addition, as site specific density data is not available for all sites, it is not possible to designate the sites as being low or high density populations according to Phillips and Callaghan. However, in compliance with the EMP, if we consider the habitat use category of Phillips and Callaghan (2011) for low density populations on the east coast, as per the baseline studies (Lewis 2014), using activity levels of SAT plots where faecal pellets were recorded, average SAT plot activity has consistency fallen into to the “medium (normal)” use category (3.3% - 12.6%) for populations in an east coast, low density area.

**Table 2: Summary of SAT activity levels**

	Baseline	2015	2016	2017
Number of clusters with scats present (n = clusters surveyed)	20 (83%, n= 24)	14 (45%, n = 31)	10 (37%, n= 27)	16 (52%, n = 31)
Average activity per cluster (n = clusters surveyed)	4.9% (SD6.9, n = 24)	2.0% (SD3.5, n = 31)	0.7% (SD1.1, n = 27)	1.8% (SD2.8, n = 31)
Average activity per active cluster (n = active clusters)	5.9% (SD7.1, n = 20)	4.4% (SD4.0, n = 14)	1.9% (SD1.1, n = 10)	3.5% (SD3.0, n = 16)
Average activity per active plot (n = plots with activity)	10.1% (SD9.0, n = 35)	8.0% (SD6.3 n = 23)	4.0% (SD1.4, n = 14)	6.8% (SD5.3, n = 25)
Average activity per area (n = 8)	4.8% (SD4.7)	2.1% (SD2.3)	0.9% (SD0.9)	1.9% (SD2.0)

### Area activity

Table 3 and Graph 3 show Koala activity at each of the eight monitoring areas. Area activity is the mean activity of all surveyed plots. SAT plot activity was highest at the following locations:

- North Sancrox (5.6%): scats were recorded at all three clusters in the North Sancrox area including Fernbank Creek, Lake Innes and Cowarra State Forest, with scats being recorded at all three plots at the Fernbank Creek impact site cluster.
- Maria River State Forest (3.9%): scats were recorded at all four clusters. Three of the four clusters were recovering from the 2016 wildfires.

The 2017 SAT activity levels were relatively consistent with previous monitoring events.

North Sancrox has consistently recorded the highest activity and Mingaletta to Smiths Creek generally lower activity levels. A notable reduction in apparent activity was within the Cairncross State Forest (north) area; no scats were recorded in 2017 but scats have been recorded during each previous monitoring event.

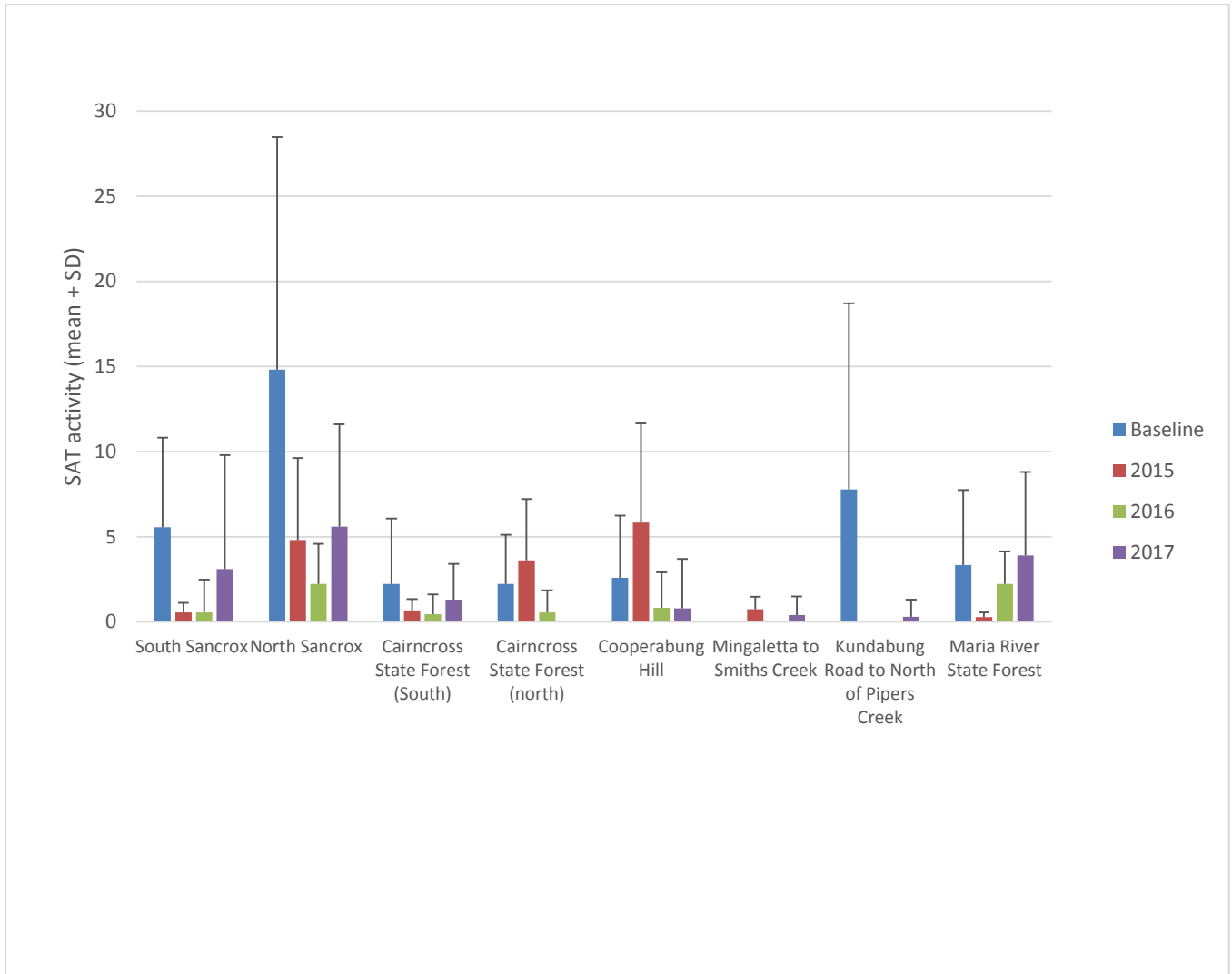
2017 activity levels appear to have increased from the 2016 monitoring in almost all areas and are similar to that recorded during the 2015 monitoring, but remain much lower than activity levels recorded during baseline surveys.

**Table 3: Area activity levels**

MonitArea	Baseline	2015	2016	2017
South Sancrox	5.6% (SD5.3)	0.6% (SD1.3)	0.6% (SD1.9)	3.1% (SD6.7)
North Sancrox	14.8 (SD13.7)	4.8% (SD5.0)	2.2% (SD2.4)	5.6% (SD6.0)
Cairncross State Forest (South)	2.2% (SD3.8)	0.7% (SD1.9)	0.4% (SD1.2)	1.3% (SD2.1)
Cairncross State Forest (north)	2.2% (SD2.9)	3.6% (SD5.9)	0.6% (SD1.3)	0
Cooperabung Hill	2.6% (SD3.6)	5.8% (SD8.8)	0.8% (SD2.1)	0.8% (SD2.9)
Mingaletta to Smiths Creek	0	0.7% (SD2.2)	0	0.4% (SD1.1)
Kundabung Road to North of Pipers Ck	7.8% (SD10.9)	0	0	0.3% (SD1.0)
Maria River State Forest	3.3% (SD4.4)	0.3% (SD1.0)	2.2% (SD1.9)	3.9% (SD4.9)



Graph 3: Koala activity across the eight monitoring areas



**Table 4: Koala SAT plots results Baseline – 2017**

Area	Type	Data Source	Site ID	Map ref	Activity (%)				Scat presence (per cluster)			
					Baseline	2015	2016	2017	Baseline	2015	2016	2017
South Sancrox	No Mitigation	Baseline	SANCROX E1	SSAN1	10.0	3.3	0.0	23.3	present	present	absent	present
			SANCROX E2		0.0	0.0	0.0	0.0				
			SANCROX E3		0.0	0.0	0.0	0.0				
	Mitigation	Baseline_Niche relocation	SANCROX S1	SSAN2	13.3	0.0	0.0	3.3	present	absent	absent	present
			SANCROX S2		3.3	0.0	0.0	0.0				
			SANCROX S3		10.0	0.0	0.0	0.0				
	Control	Baseline	COWARRA SF1	SSAN3	0.0	0.0	0.0	0.0	present	absent	present	absent
			COWARRA SF2		3.3	0.0	0.0	0.0				
			COWARRA SF3		10.0	0.0	6.7	0.0				
New Control	Niche	SAT COWARRA NC1	SSAN4	-	0.0	0.0	0.0	Not monitored	present	absent	present	
		SAT COWARRA NC2		-	3.3	0.0	6.7					
		SAT COWARRA NC3		-	0.0	0.0	3.3					
North Sancrox	No Mitigation	Baseline	SANCROX N1	-	3.3	-	-	-	present	No access	No access	No access
			SANCROX N2		0.0	-	-	-				
			SANCROX N3		0.0	-	-	-				
	Mitigation	Baseline	FERNBANK CK1	NSAN1	33.3	0.0	3.3	16.7	present	present	present	present
			FERNBANK CK2		30.0	0.0	6.7	6.7				
			FERNBANK CK3		23.3	6.7	3.3	13.3				
	Control	Baseline	LAKE INNES1	NSAN2	26.7	13.3	0.0	3.3	present	present	present	present
			LAKE INNES2		13.3	6.7	3.3	6.7				
			LAKE INNES3		3.3	6.7	0.0	0.0				
New Control	Niche	SAT COW4	NSAN3	-	10.0	0.0	3.3	Not monitored	present	present	present	
		SAT COW5		-	0.0	0.0	0.0					
		SAT COW6		-	0.0	3.3	0.0					

Area	Type	Data Source	Site ID	Map ref	Activity (%)				Scat presence (per cluster)			
					Baseline	2015	2016	2017	Baseline	2015	2016	2017
Cairncross State Forest (South)	No Mitigation	Baseline	CAINCROSS SF1	CCS1	0.0	0.0	0.0	0.0	present	present	absent	absent
			CAINCROSS SF2		3.3	6.7	0.0	0.0				
			CAINCROSS SF3		0.0	3.3	0.0	0.0				
	No Mitigation	Baseline	CAINCROSS SF16	CCS2	0.0	0.0	3.3	3.3	present	absent	present	present
			CAINCROSS SF17		0.0	0.0	3.3	0.0				
			CAINCROSS SF18		13.3	0.0	0.0	6.7				
	Mitigation	Baseline	CAINCROSS SF4	CCS3	3.3	0.0	0.0	3.3	present	absent	absent	present
			CAINCROSS SF5		3.3	0.0	0.0	0.0				
			CAINCROSS SF6		0.0	0.0	0.0	0.0				
	Control	Baseline	LIMEBURNERS CK1	CCS4	0.0	0.0	0.0	3.3	present	absent	absent	present
			LIMEBURNERS CK2		3.3	0.0	0.0	0.0				
			LIMEBURNERS CK3		0.0	0.0	0.0	3.3				
New Control	Niche	SAT PEVI1	CCS5	-	0.0	0.0	0.0	Not monitored	absent	absent	absent	
		SAT PEVI2		-	0.0	0.0	0.0					
		SAT PEVI3		-	0.0	0.0	0.0					
Cairncross State Forest (north)	No Mitigation	Baseline_Niche relocation	CCN1	0.0	3.3	0.0	0.0	absent	present	absent	absent	
		Baseline		CAINCROSS SF8	0.0	20.0	0.0					0.0
		Baseline		CAINCROSS SF9	0.0	10.0	0.0					0.0
	Mitigation	Baseline	CAINCROSS SF10	CCN2	3.3	0.0	0.0	0.0	present	present	present	absent
			CAINCROSS SF11		3.3	0.0	3.3	0.0				
			CAINCROSS SF12		6.7	3.3	0.0	0.0				
	Control	Baseline	CAINCROSS SF13	CCN3	6.7	3.3	3.3	0.0	present	present	present	absent
			CAINCROSS SF14		0.0	0.0	0.0	0.0				
			CAINCROSS SF15		0.0	3.3	0.0	0.0				
		Niche	SAT RR1	CCN4	-	0.0	0.0	0.0		absent	absent	absent

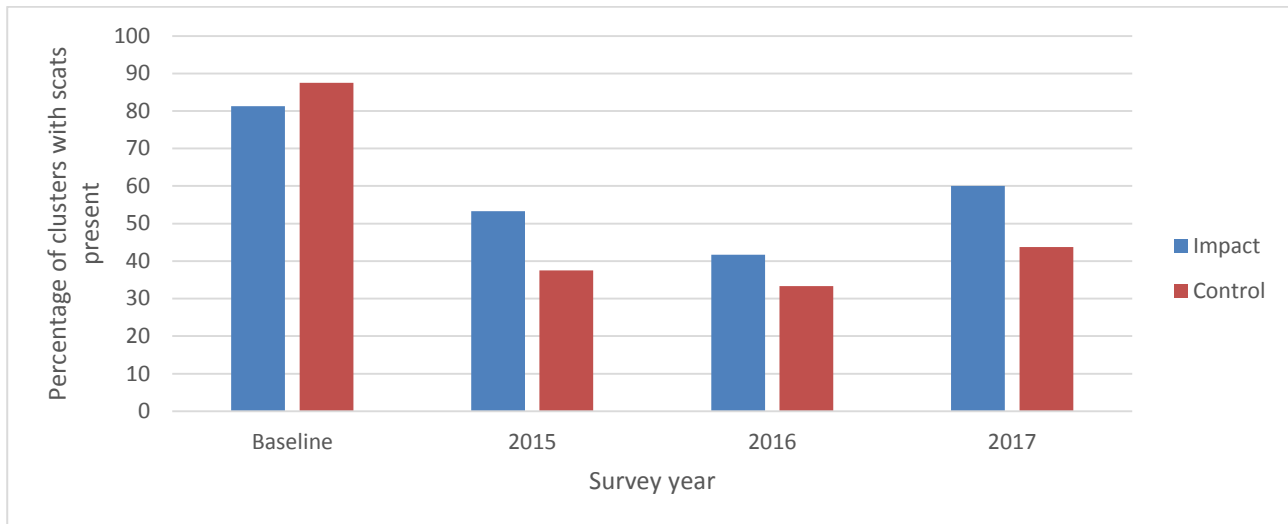
Area	Type	Data Source	Site ID	Map ref	Activity (%)				Scat presence (per cluster)			
					Baseline	2015	2016	2017	Baseline	2015	2016	2017
	New Control		SAT RR2		-	0.0	0.0	0.0	Not monitored			
			SAT RR3		-	0.0	0.0	0.0				
Cooperabung Hill	No Mitigation	Baseline	COOPERABUNG1	COOP1	3.3	3.3	0.0	0.0	present	present	present	absent
			COOPERABUNG2		0.0	23.3	3.3	0.0				
			COOPERABUNG3		10.0	0.0	0.0	0.0				
	Mitigation	Baseline_Niche relocation	COOPERABUNG4	COOP2	0.0	3.3	6.7	0.0	present	present	present	present
			COOPERABUNG5		3.3	3.3	0.0	10.0				
			COOPERABUNG6		0.0	0.0	0.0	0.0				
	Control	Baseline	COOP HILL1	COOP3	6.7	0.0	0.0	0.0	present	absent	absent	absent
			COOP HILL2		0.0	0.0	0.0	0.0				
			COOP HILL3		0.0	0.0	0.0	0.0				
New Control	Niche	SAT FL1	COOP4	-	16.7	0.0	0.0	Not monitored	present	absent	absent	
		SAT ST1		-	0.0	0.0	0.0					
		SAT ST2		-	20.0	0.0	0.0					
Mingaletta to Smiths Creek	Mitigation	Baseline	MIN-SMITHS CK1	MING1	0.0	0.0	0.0	0.0	absent	absent	absent	absent
			MIN-SMITHS CK2		0.0	0.0	0.0	0.0				
			MIN-SMITHS CK3		0.0	0.0	0.0	0.0				
	Control	Baseline	BALLENGARA SF1	MING2	0.0	0.0	0.0	0.0	absent	absent	absent	absent
			BALLENGARA SF2		0.0	0.0	0.0	0.0				
			BALLENGARA SF3		0.0	0.0	0.0	0.0				
	New Control	Niche	SAT BR1	MING3	-	6.7	0.0	0.0	Not monitored	present	absent	present
			SAT BR2		-	0.0	0.0	3.3				
			SAT BR3		-	0.0	0.0	0.0				
		Baseline	KUNDABUNG 1	KUND1	0.0	0.0	0.0	0.0	present	absent	absent	absent

Area	Type	Data Source	Site ID	Map ref	Activity (%)				Scat presence (per cluster)			
					Baseline	2015	2016	2017	Baseline	2015	2016	2017
Kundabung Road to North of Pipers Creek	No Mitigation		KUNDABUNG 2		10.0	0.0	0.0	0.0				
			KUNDABUNG 3		0.0	0.0	0.0	0.0				
	Mitigation	Baseline	KUNDABUNG 4	KUND2	33.3	0.0	fire	0.0	present	absent	fire	present
			KUNDABUNG 5		13.3	0.0	fire	3.3			fire	
			KUNDABUNG 6		10.0	0.0	0.0	0.0			absent	
	Control	Baseline	KUMBATINE NP1	KUND3	3.3	0.0	0.0	0.0	present	absent	absent	absent
			KUMBATINE NP2		0.0	0.0	0.0	0.0				
			KUMBATINE NP3		0.0	0.0	0.0	0.0				
	New Control	Niche	SAT MAC1	KUND4	-	0.0	0.0	0.0	Not monitored	absent	absent	absent
			SAT MAC2		-	0.0	0.0	0.0				
SAT MAC3			-		0.0	0.0	0.0					
Maria River State Forest	Part Mitigation	Baseline_Niche relocation	MARIA RIVER 1	MR1	0.0	0.0	fire	0.0	present	absent	no access - fire	present
		Baseline	MARIA RIVER 2		3.3	0.0	fire	0.0			no access - fire	
		Baseline_Niche relocation	MARIA RIVER 3		6.7	0.0	fire	16.7			no access - fire	
	Mitigation	Baseline	MARIA RIVER 4	MR2	0.0	0.0	fire	6.7	absent	present	no access - fire	present
			MARIA RIVER 5		0.0	0.0	fire	0.0				
			MARIA RIVER 6		0.0	3.3	fire	0.0				
	Control	Baseline	MARIA NP1	MR3	0.0	0.0	0.0	3.3	present	absent	present	present
			MARIA NP2		10.0	0.0	3.3	0.0				
			MARIA NP3		10.0	0.0	3.3	3.3				
	New Control	Niche	SAT CO1	MR4	-	0.0	fire	6.7	Not monitored	absent	no access - fire	present
SAT CO3			-		0.0	fire	3.3					
SAT MAR 1			-		0.0	fire	6.7					

### 3.2 Impact v control cluster analysis

As for the previous years 2016 and 2015, a higher percentage of impact clusters had scats present than did control clusters (60% cf 44%), (Graph 4). If we compare the Koala presence/absence results between control and impact clusters there is no significant difference in Koala presence at impact and control clusters between the 2017 surveys and baseline, 2015, or 2016 surveys ( $X^2 = 0.128$ ,  $df = 3$ ,  $p > 0.05$ ;  $X^2 = 0.938$ ,  $df = 3$ ,  $p > 0.05$ ; and  $X^2 = 0.771$ ,  $df = 3$ ,  $p > 0.05$  respectively).

**Graph 4: Koala presence at control and impact clusters**



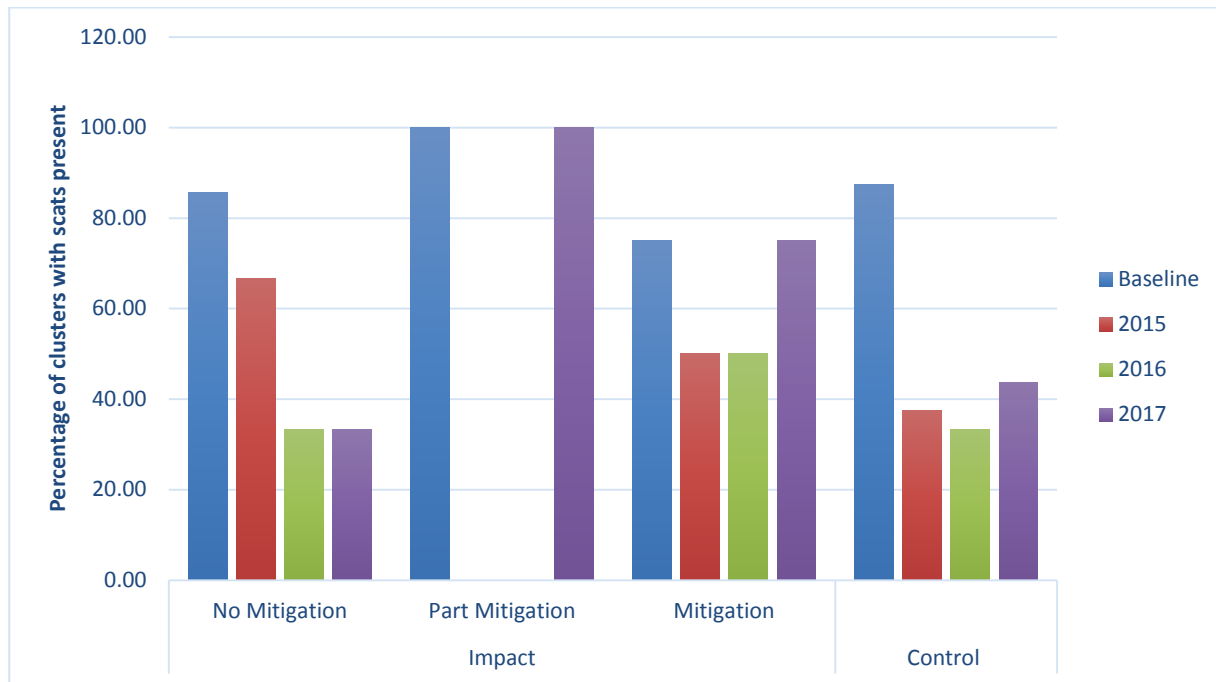
### 3.3 Mitigation v no mitigation analysis

#### 3.3.3 Presence/absence Analysis

Comparing Koala presence between mitigation and no-mitigation clusters shows no significant difference between the 2017 surveys and baseline, 2015, or 2016 surveys ( $X^2 = 0.0002$ ,  $df = 3$ ,  $p > 0.05$ ;  $X^2 = 0.00006$ ,  $df = 3$ ,  $p > 0.05$ ; and  $X^2 = 0.185$ ,  $df = 3$ ,  $p > 0.05$  respectively). Graph 5 shows the percentage of clusters with scats present within different cluster types. There is no overall apparent trend between impact sites with mitigation or without mitigation. While mitigation clusters appear to have a higher presence percentage in 2016 and 2017 than no mitigation clusters, the presence percentage at clusters with no mitigation is similar to the presence percentage at control clusters during these years. This suggests that any difference is likely site specific and not related to construction activities.

The apparent increase in percentage presence in 2017 at mitigation clusters is likely due, in part, to the 11 plots that were not surveyed in 2016. Seven of these plots were mitigation plots, all of which recorded scats in 2017. In addition, North Sancrox has consistently been recorded as a high activity area and has only a mitigation cluster, without a balancing no-mitigation cluster.

Graph 5: Koala presence and cluster type



### 3.3.4 Activity Analysis

Koala activity (mean activity of plots) for the cluster types is provided in Table 5 and is shown for each area in Graph 6 (mean activity of all plots within each cluster type for each area). When considering all plots, average activity levels have decreased from baseline levels for all treatments, including control plots. Lewis 2014 recommends that analyses should:

*“Ensure any future comparison of Koala activity levels take into account the following baseline data and with a 10% tolerance level to account for variability:*

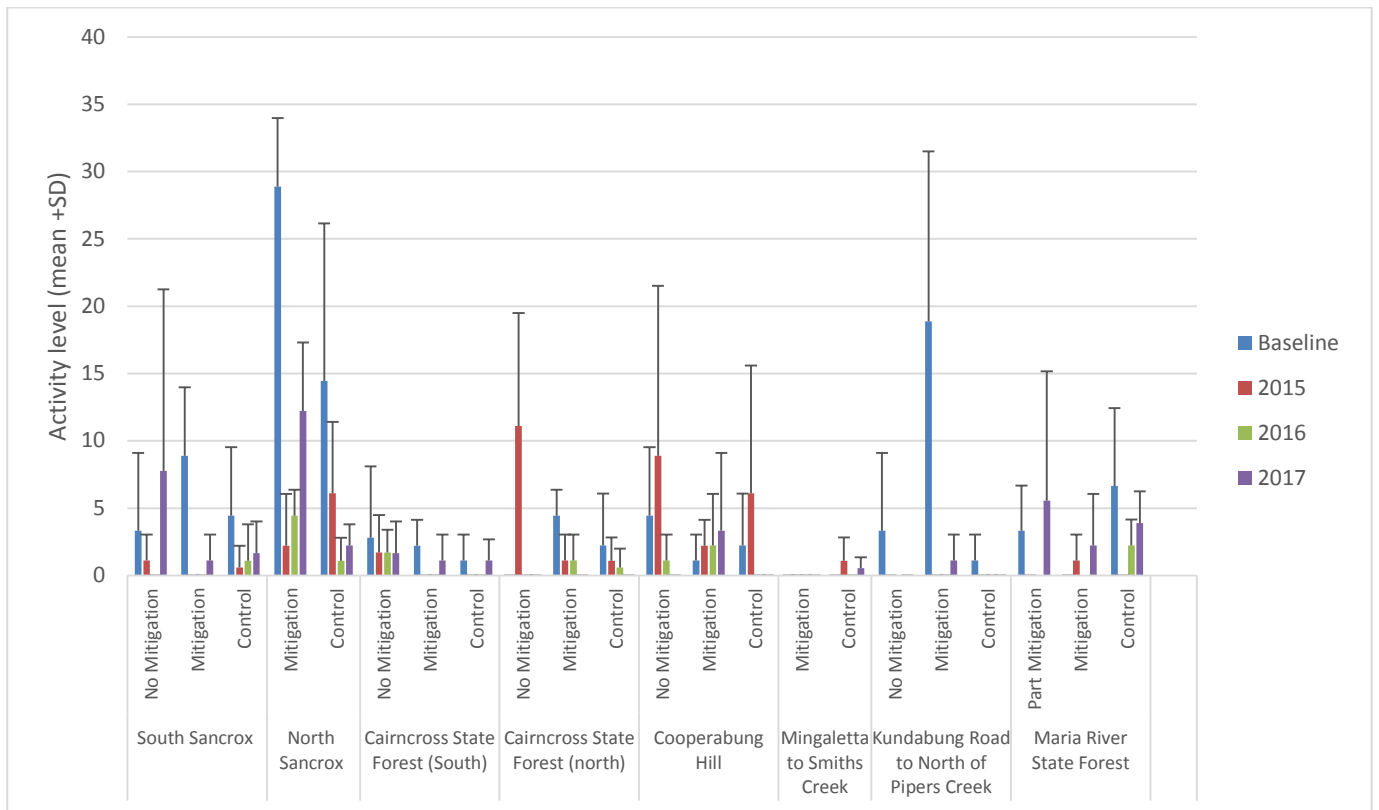
- a. Broader study area set at 5% activity;
- b. The three treatment classes of Mitigation set at 8.05%, control reference set at 4.03% and no mitigation set at 2.64%.”

Activity levels for each treatment type have not decreased from the baseline surveys beyond the recommended 10% tolerance level. Nor is there a greater than 10% difference between treatment types.

Table 5: Control, mitigation and no mitigation cluster activity levels

	Control				Mitigation				No Mitigation			
	Baseline	2015	2016	2017	Baseline	2015	2016	2017	Baseline	2015	2016	2017
Activity levels of all plots (n = plots surveyed)	4.0 (24) (SD6.4)	1.9 (38) (SD4.5)	0.5 (45) (SD1.4)	1.2 (48) (SD2.1)	8.1 (24) (SD11.0)	0.8 (24) (SD1.8)	1.2 (19) (SD2.3)	2.6 (24) (SD4.7)	2.6 (24) (SD4.2)	3.5 (21) (SD6.6)	0.6 (18) (SD1.3)	2.4 (21) (SD6.2)
Activity levels of active plots (n = active plots)	8.8 (11) (SD6.9)	9.0 (10) (SD5.9)	3.9 (6) (SD1.4)	4.4 (13) (SD1.6)	12.9 (15) (SD11.5)	4.0 (5) (SD1.5)	4.7 (5) (SD1.8)	7.9 (8) (SD5.0)	7.0 (9) (SD3.9)	9.2 (8) (SD8.1)	3.3 (3) (SD0.0)	12.5 (4) (SD9.2)

**Graph 6. Mean Koala activity for cluster type within areas (mean ± SD)**



### 3.3.5 Tree Species Use

A total of 2,790 trees were surveyed within the 93 plots. Koala scats were recorded at 51 (1.8%) of the trees surveyed. Surveyed trees included 29 identified tree species. The most commonly surveyed tree species were Tallowwood (*Eucalyptus microcorys*, 20.5%), and Pink Bloodwood (*Corymbia intermedia*, 10.4%), together representing 31% of all trees surveyed. Koala scats were recorded at nine (31.0%) different species (Table 6). Considering the percentage of individual tree species where scats were recorded, Koala scats were most commonly recorded beneath Scribbly Gum (*Eucalyptus signata*, 6.0%), Prickly-leaved Tea Tree (*Melaleuca styphelioides*, 5.9%), Tallowwood (*Eucalyptus microcorys*, 4.7%), and Small-fruited Grey Gum (*E. propinqua*). Diameter at breast height for SCTs are provided in Annex 1.

The baseline study (Lewis 2014) suggests comparing activity levels at Tallowwood trees given that they are widespread, are frequently surveyed and yielded relatively high activity scores (i.e. 9.5%) during baseline surveys. Use of Tallowwoods (percent of surveyed Tallowwoods with scats) was recorded at 2.68%, 0.75% and 4.7% in 2015, 2016 and 2017 respectively. As such, since the baseline surveys, activity at Tallowwood trees appears to have decreased, which could be expected considering the overall decrease in observed activity since the baseline studies were undertaken.



**Table 6: Summary of tree species used by Koala during the SAT surveys**

Common name	Species name	Total trees assessed	No. trees with Koala scats	Proportional use (% scats per tree species)
Prickly-leaved Tea Tree	<i>Melaleuca styphelioides</i>	17	1	5.9
Coastal Blackbutt	<i>Eucalyptus pilularis</i>	262	3	1.2
Pink Bloodwood	<i>Corymbia intermedia</i>	290	5	1.7
Tallowwood	<i>Eucalyptus microcorys</i>	572	27	4.7
Turpentine	<i>Syncarpia glomulifera</i>	198	4	2.0
White Stringy bark	<i>Eucalyptus globoidea</i>	155	3	1.9
Thin-leaved Stringybark	<i>Eucalyptus eugenioides</i>	76	3	4.0
Red Bloodwood	<i>Corymbia gummifera</i>	135	1	0.7
Scribbly Gum	<i>Eucalyptus signata</i>	67	4	6.0

### 3.3.6 Weather Conditions

Weather conditions during the field surveys (Kempsey weather station 059007) are provided in Table 7.

**Table 7: Weather conditions during spring-summer 2017**

Time	Rainfall (mm)	Temp (°C) (max)	Temp (°C) (min)	Wind speed at 9am (km/h)
31/10/2017	0	24.4	14.9	28
2/11/2017	0	24.8	8.2	2
3/11/2017	0	28.9	11.6	7
6/11/2017	25.4	31.7	17.3	15
7/11/2017	11.4	23.3	12.1	22
8/11/2017	1.6	*	11.2	15
9/11/2017	*	23.3	*	19
22/11/2017	3.6	24.2	13.3	13
23/11/2017	11.0	25.4	14.7	2
24/11/2017	0.2	27.3	12.8	6
27/11/2017	0	27.7	15.4	0
28/11/2017	2.0	27.9	16.6	4
29/11/2017	0.2	25.5	17.8	6

\* no data available

## 4. Discussion

### 4.1 Performance Measures

A summary of 2017 survey results in relation to the performance measures are provided in Table 8.

**Table 8. Performance measures**

Performance measure	Response
Monitoring is undertaken during baseline surveys and from Year 1 – Year 6 & 8, or until mitigation measures are demonstrated to be effective.	<b>This performance measure has been met.</b> To date, SAT plot monitoring has been undertaken during baseline, Year 1 (2015), Year 2 (2016) and Year 3 (2017) of the Project.
Monitoring during Year 1 – Year 6 & 8 is undertaken at the Impact and Control sites where monitoring was undertaken during baseline surveys, subject to ongoing landowner agreement. Where landowner agreement cannot be obtained and the process in Section 3.1.2 of the EMP has been followed, this performance indicator will also be considered to have been met	<b>This performance measure has been met.</b> Monitoring was undertaken at the same sites as surveyed in 2015.  In 2015, eight of the baseline plots had to be relocated to nearby locations because they had been established in the construction site itself or because they were located on private property and access was not possible. Three of the baseline monitoring plots that could not be accessed could not be relocated because there weren't any suitable sites nearby. These three plots were all part of the same cluster (impact, no mitigation) located in the North Sancrox area.  Details of all 96 monitoring plots are presented in Table 1 and the location of the 93 accessible monitoring plots are shown in Figure 1.
Mitigation measures are demonstrated to be effective as defined in the EPBC approval when all monitoring events are considered at Year 8.	Not applicable for Year 3.
Fauna fence is installed at a minimum in areas identified in Schedule 3 of the EPBC approval at Year 4.	Not applicable for Year 3.
No changes to densities, distribution, habitat use and movement patterns compared to baseline data during monitoring in Year 1 – 6 & 8, and then when all monitoring events are considered at Year 8.	<b>This performance measure has not been met.</b>  <i>Distribution and habitat use</i>  While the 2017 monitoring results indicate a reduction in the presence and activity of Koalas across the Project area from the baseline surveys this result is consistent across both the impact and control sites with no significant difference in the proportion of sites with scats between the impact and control sites. Any observed decrease in Koala presence/activity cannot therefore be directly attributed to disturbance due to the Project. In addition, presence and activity levels increased in 2017 compared to 2016 are similar to those observed in 2015 and, in accordance with Lewis 2014, have not decreased from the baseline surveys beyond the recommended 10% tolerance level. As such, while changes have occurred (as specified in the performance measure), these changes cannot be attributed to the Project.  <i>Movement patterns and density</i>  SAT plots do not provide any data on movement patterns. Neither do SAT plots provide any data on density, as it is not possible to determine the number of Koalas from scat records. Supplementing the SAT surveys with a direct survey technique such as spotlighting surveys would provide more robust data on Koala density against which the performance measure relating to this variable may be assessed.

## 5. Recommendations

### 5.1 Contingency Measures

The EMP lists potential problems and contingency measures for various components of the monitoring program. Those that are considered to be relevant to the Koala monitoring program are listed and discussed in Table 9.

**Table 9: Contingency measures**

Potential problem	Contingency measure proposed in EMP	Discussion of proposed measure
Decline in presence of target species recorded at Impact sites after the upgrade has been completed, when compared to change in Control sites.	<ul style="list-style-type: none"> <li>Investigate cause of decline in consultation with EPA and DoTE within two weeks of results reported by ecologist.</li> <li>If the cause of the decline is considered most likely attributable to the upgrade of the highway, mitigation measures will be reviewed within two months of the above consultation.</li> </ul>	<p><b>This contingency measure is not considered relevant.</b></p> <p>At this stage the potential problem outlined in the EMP cannot be assessed as the upgrade is in the final construction phase. Operational monitoring will provide insights into any changes in activity and presence at the impact and control sites.</p> <p>To date, no significant change has been detected in the difference in Koala presence at control and impact sites between baseline and subsequent monitoring surveys.</p>

## References

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Niche (2017). Koala Monitoring 2016. Year 2 surveys - Oxley Highway to Kempsey Pacific Highway Upgrade. Prepared for Roads and Maritime Services.

Phillips, S. and Callaghan, J. (2011). The Spot Assessment Technique: a tool for determining localised levels of habitat use by Koalas *Phascolarctos cinereus*. Australian Zoologist 35 (3), 774-780.

PMHC (2017). Draft Koala Recovery Strategy 2017. Port Macquarie-Hastings Council.

RMS (2016). Oxley Highway to Kempsey Pacific Highway Upgrade Ecological Monitoring Program. Roads and Maritime Update to report prepared by SMEC Hyder Joint Venture, August 2016.

## Annex 1. Koala SAT results – 2017 monitoring

On a number of occasions the marked tree did not correspond with the baseline and 2015 monitoring SCT (selection criteria tree) species. As such, for clarity of results and to facilitate future monitoring, the DBH is provided for the marked tree, and this tree will be considered as the “New SCT” for the current and future monitoring events. DBH = diameter at breast height, Radial = radial distance of search area from New SCT.

Area N	Monitoring area	Treatment	Treatment sub-category	Site_ID	Easting	Northing	Activity	Previous SCT	New SCT	DBH (cm)	Radial (m)	Notes
1	South Sancrox	Impact	No Mitigation	SANCROX E1	483348	6521736	23.3	Tallowwood	Tallowwood	46	30	
1	South Sancrox	Impact	No Mitigation	SANCROX E2	483455	6521789	0.0	Tallowwood	Thin-leaved Stringybark	35	12	
1	South Sancrox	Impact	No Mitigation	SANCROX E3	483412	6521882	0.0	Tallowwood	Tallowwood	44	25	
1	South Sancrox	Impact	Mitigation	SANCROX S1	483299	6520671	3.3	Tallowwood	Blackbutt	53	40	
1	South Sancrox	Impact	Mitigation	SANCROX S2	483254	6520383	0.0	Tallowwood	Thin-leaved Stringybark	56	45	
1	South Sancrox	Impact	Mitigation	SANCROX S3	483196	6520217	0.0	Tallowwood	Flooded Gum	60	25	
1	South Sancrox	Control	Control	COWARRA SF1	480608	6519056	0.0	Tallowwood	Small-fruited Grey Gum	60	25	
1	South Sancrox	Control	Control	COWARRA SF2	480658	6519496	0.0	Tallowwood	Blackbutt	98	30	
1	South Sancrox	Control	Control	COWARRA SF3	481305	6519136	0.0	Tallowwood	Small-fruited Grey Gum	33	20	
1	South Sancrox	Control	New Control	SAT COWARRA NC1	479706	6518522	0.0	Tallowwood	Blackbutt	69	20	
1	South Sancrox	Control	New Control	SAT COWARRA NC2	479788	6517922	6.7	Tallowwood	Tallowwood	48	20	
1	South Sancrox	Control	New Control	SAT COWARRA NC3	479795	6518227	3.3	Tallowwood	Blackbutt	56	20	
2	North Sancrox	Impact	No Mitigation	SANCROX N1	483042	6521731		Swamp Mahogany				No access
2	North Sancrox	Impact	No Mitigation	SANCROX N2	482869	6521683		Tallowwood				No access
2	North Sancrox	Impact	No Mitigation	SANCROX N3	482999	6521818		Tallowwood				No access
2	North Sancrox	Impact	Mitigation	FERNBANK CK1	483101	6523362	16.7	Tallowwood	Tallowwood	71	30	
2	North Sancrox	Impact	Mitigation	FERNBANK CK2	483032	6523223	6.7	Tallowwood	Tallowwood	48	35	
2	North Sancrox	Impact	Mitigation	FERNBANK CK3	483056	6523123	13.3	Tallowwood	Tallowwood	45	30	
2	North Sancrox	Control	Control	LAKE INNES1	488124	6518469	3.3	Tallowwood	Tallowwood	71	35	
2	North Sancrox	Control	Control	LAKE INNES2	488047	6518398	6.7	Swamp Mahogany	Swamp Mahogany	108	45	
2	North Sancrox	Control	Control	LAKE INNES3	488228	6518390	0.0	Swamp Mahogany	Thin-leaved Paperbark	78	20	
2	North Sancrox	Control	New Control	SAT COW4	479674	6516436	3.3	Tallowwood	Blackbutt	67	20	

Area N	Monitoring area	Treatment	Treatment sub-category	Site_ID	Easting	Northing	Activity	Previous SCT	New SCT	DBH (cm)	Radial (m)	Notes
2	North Sancrox	Control	New Control	SAT COW5	479704	6516174	0.0	Tallowwood	Tallowwood	26	15	
2	North Sancrox	Control	New Control	SAT COW6	479667	6515913	0.0	Tallowwood	Tallowwood	53	20	
3	Cairncross State Forest (South)	Impact	No Mitigation	CAIRNCROSS SF1	482428	6526536	0.0	Tallowwood	Tallowwood	35	30	
3	Cairncross State Forest (South)	Impact	No Mitigation	CAIRNCROSS SF2	482385	6526644	0.0	Tallowwood	Tallowwood	53	25	
3	Cairncross State Forest (South)	Impact	No Mitigation	CAIRNCROSS SF3	482393	6526416	0.0	Tallowwood	Tallowwood	28	25	
3	Cairncross State Forest (south)	Impact	No Mitigation	CAIRNCROSS SF16	481655	6527256	3.3	Tallowwood	Tallowwood	37	25	
3	Cairncross State Forest (south)	Impact	No Mitigation	CAIRNCROSS SF17	481590	6527316	3.3	Tallowwood	Tallowwood	67	30	
3	Cairncross State Forest (south)	Impact	No Mitigation	CAIRNCROSS SF18	481637	6527175	6.7	Tallowwood	Tallowwood	53	25	
3	Cairncross State Forest (South)	Impact	Mitigation	CAIRNCROSS SF4	482249	6525930	3.3	Tallowwood	Tallowwood	60	35	
3	Cairncross State Forest (South)	Impact	Mitigation	CAIRNCROSS SF5	482125	6526077	0.0	Tallowwood	Tallowwood	69	35	
3	Cairncross State Forest (South)	Impact	Mitigation	CAIRNCROSS SF6	482488	6526226	0.0	Tallowwood	Blackbutt	73	35	
3	Cairncross State Forest (South)	Control	Control	LIMEBURNERS CK1	487011	6529909	3.3	Scribbly Gum	Scribbly Gum	102	45	Not tagged
3	Cairncross State Forest (South)	Control	Control	LIMEBURNERS CK2	487014	6529455	0.0	Scribbly Gum	Scribbly Gum	11	45	Not tagged
3	Cairncross State Forest (South)	Control	Control	LIMEBURNERS CK3	487035	6528694	3.3	Scribbly Gum	Scribbly Gum	51	50	Not tagged
3	Cairncross State Forest (South)	Control	New Control	SAT PEVI1	476817	6528422	0.0	Tallowwood	Sydney Blue Gum	60	20	
3	Cairncross State Forest (South)	Control	New Control	SAT PEVI2	476730	6528225	0.0	Tallowwood	Sydney Blue Gum	41	25	
3	Cairncross State Forest (South)	Control	New Control	SAT PEVI3	475996	6528211	0.0		Sydney Blue Gum	56	30	
4	Cairncross State Forest (north)	Impact	No Mitigation	CAIRNCROSS SF7	481346	6530835	0.0	Blackbutt	Blackbutt	66	35	
4	Cairncross State Forest (north)	Impact	No Mitigation	CAIRNCROSS SF8	481695	6530786	0.0	Forest Red Gum	Forest Red Gum	56	35	
4	Cairncross State Forest (north)	Impact	No Mitigation	CAIRNCROSS SF9	481184	6530864	0.0	Tallowwood	Blackbutt	66	45	
4	Cairncross State Forest (north)	Impact	Mitigation	CAIRNCROSS SF10	481238	6530264	0.0	Swamp Mahogany	Swamp Mahogany	37	40	
4	Cairncross State Forest (north)	Impact	Mitigation	CAIRNCROSS SF11	481173	6530319	0.0	Tallowwood	Tallowwood	65	35	
4	Cairncross State Forest (north)	Impact	Mitigation	CAIRNCROSS SF12	481438	6530335	0.0	Tallowwood	Tallowwood	75	35	
4	Cairncross State Forest (north)	Control	Control	CAIRNCROSS SF13	473751	6528881	0.0	Tallowwood	Small-fruited Grey Gum	44	30	
4	Cairncross State Forest (north)	Control	Control	CAIRNCROSS SF14	473464	6528969	0.0	Tallowwood	Sydney Blue Gum	55	35	
4	Cairncross State Forest (north)	Control	Control	CAIRNCROSS SF15	473424	6529115	0.0	Tallowwood	Sydney Blue Gum	81	30	
4	Cairncross State Forest (north)	Control	New Control	SAT RR1	475284	6532709	0.0	Tallowwood	Tallowwood	81	35	

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4	Cairncross State Forest (north)	Control	New Control	SAT RR2	475113	6532603	0.0	Tallowwood	Small-fruited Grey Gum	54	40	
4	Cairncross State Forest (north)	Control	New Control	SAT RR3	474816	6532732	0.0	Tallowwood	Tallowwood	66	35	
5	Cooperabung Hill	Impact	No Mitigation	COOPERABUNG1	482793	6537012	0.0	Tallowwood	Tallowwood	69	55	
5	Cooperabung Hill	Impact	No Mitigation	COOPERABUNG2	482755	6537093	0.0	Tallowwood	Small-fruited Grey Gum	50	60	
5	Cooperabung Hill	Impact	No Mitigation	COOPERABUNG3	482876	6537115	0.0	Tallowwood	Tallowwood	52	45	
5	Cooperabung Hill	Impact	Mitigation	COOPERABUNG4	482481	6539327	0.0	Tallowwood	Tallowwood	34	35	
5	Cooperabung Hill	Impact	Mitigation	COOPERABUNG5	482364	6539761	10.0	Forest Red Gum	Tallowwood	24	40	
5	Cooperabung Hill	Impact	Mitigation	COOPERABUNG6	482364	6538610	0.0	Tallowwood	Tallowwood	76	30	
5	Cooperabung Hill	Control	Control	COOP HILL1	475489	6541854	0.0	Tallowwood	Tallowwood	42	20	
5	Cooperabung Hill	Control	Control	COOP HILL2	475570	6541903	0.0	Tallowwood	Tallowwood	35	35	
5	Cooperabung Hill	Control	Control	COOP HILL3	475838	6541962	0.0	Tallowwood	Tallowwood	43	45	
5	Cooperabung Hill	Control	New Control	SAT FL1	473693	6542127	0.0		Tallowwood	46	50	
5	Cooperabung Hill	Control	New Control	SAT ST1	473346	6543256	0.0		Tallowwood	61	20	
5	Cooperabung Hill	Control	New Control	SAT ST2	473682	6542890	0.0		Tallowwood	30	20	
6	Mingaletta to Smiths Creek	Impact	Mitigation	MIN-SMITHS CK1	483304	6543632	0.0	Tallowwood	Blackbutt	41	20	
6	Mingaletta to Smiths Creek	Impact	Mitigation	MIN-SMITHS CK2	483444	6543585	0.0	Tallowwood	Tallowwood	56	45	
6	Mingaletta to Smiths Creek	Impact	Mitigation	MIN-SMITHS CK3	483100	6543670	0.0	Tallowwood	Small-fruited Grey Gum	38	40	
6	Mingaletta to Smiths Creek	Control	Control	BALLENGARA SF1	477750	6543274	0.0	Tallowwood	Tallowwood	34	25	
6	Mingaletta to Smiths Creek	Control	Control	BALLENGARA SF2	477644	6543623	0.0	Small-fruited Grey Gum	Small-fruited Grey Gum	30	25	GBC chewed cones: 1-3 mths.
6	Mingaletta to Smiths Creek	Control	Control	BALLENGARA SF3	477551	6543709	0.0	Tallowwood	Tallowwood	42	25	
6	Mingaletta to Smiths Creek	Control	New Control	SAT BR1	477010	6544693	0.0	Tallowwood	Sydney Blue Gum	38	25	
6	Mingaletta to Smiths Creek	Control	New Control	SAT BR2	476890	6544832	0.0	Tallowwood	Sydney Blue Gum	49	24	
6	Mingaletta to Smiths Creek	Control	New Control	SAT BR3	476777	6544973	0.0	Tallowwood	Flooded Gum	61	45	
7	Kundabung Road to North of Pipers Creek	Impact	No Mitigation	KUNDABUNG 1	483095	6549036	0.0	Tallowwood	Tallowwood	48	50	
7	Kundabung Road to North of Pipers Creek	Impact	No Mitigation	KUNDABUNG 2	482873	6549112	0.0	Tallowwood	Tallowwood	75	50	
7	Kundabung Road to North of Pipers Creek	Impact	No Mitigation	KUNDABUNG 3	483285	6549374	0.0	Tallowwood	Tallowwood	38	35	
7	Kundabung Road to North of Pipers Creek	Impact	Mitigation	KUNDABUNG 4	483369	6550655	0.0	Tallowwood	Blackbutt	78	50	Extensive post-fire

Area N	Monitoring area	Treatment	Treatment sub-category	Site_ID	Easting	Northing	Activity	Previous SCT	New SCT	DBH (cm)	Radial (m)	Notes
												regen. Macropod scats indicating fauna use.
7	Kundabung Road to North of Pipers Creek	Impact	Mitigation	KUNDABUNG 5	483331	6550938	3.3	Tallowwood	Blackbutt	41	25	Post-fire regen. Macropod scats.
7	Kundabung Road to North of Pipers Creek	Impact	Mitigation	KUNDABUNG 6	483083	6550608	0.0	Forest Red Gum	Grey Ironbark	55	80	
7	Kundabung Road to North of Pipers Creek	Control	Control	KUMBATINE NP1	476044	6549609	0.0	Tallowwood	Tallowwood	33	20	
7	Kundabung Road to North of Pipers Creek	Control	Control	KUMBATINE NP2	476165	6549738	0.0	Tallowwood	Tallowwood	37	40	GBC presence chewed cones 1-3mths.
7	Kundabung Road to North of Pipers Creek	Control	Control	KUMBATINE NP3	475889	6549468	0.0	Tallowwood	Tallowwood	57	40	
7	Kundabung Road to North of Pipers Creek	Control	New Control	SAT MAC1	476538	6552784	0.0	Tallowwood	Red Mahogany	86	35	
7	Kundabung Road to North of Pipers Creek	Control	New Control	SAT MAC2	476558	6552361	0.0	Stringy-bark	Spotted Gum	61	45	
7	Kundabung Road to North of Pipers Creek	Control	New Control	SAT MAC3	476481	6552612	0.0	Spotted Gum	Spotted Gum	56	40	
8	Maria River State Forest	Impact	Part Mitigation	MARIA RIVER 1	483074	6554460	0.0	Tallowwood	Pink Bloodwood	33	35	Moderate native post-fire regen. Extensive lantana growth throughout.
8	Maria River State Forest	Impact	Part Mitigation	MARIA RIVER 2	482836	6554330	0.0	Tallowwood	Tallowwood	53	40	Moderate native post-fire regen. Macropod scat present.
8	Maria River State Forest	Impact	Part Mitigation	MARIA RIVER 3	482993	6554024	16.7	Tallowwood	Tallowwood	26	45	Prev. burnt. Substantial ground and canopy regen.
8	Maria River State Forest	Impact	Mitigation	MARIA RIVER 4	482886	6552623	6.7	Tallowwood	Thin-leaved Stringybark	40	35	Moderate post-fire regen. Macropod scats indicating fauna use.
8	Maria River State Forest	Impact	Mitigation	MARIA RIVER 5	482754	6552462	0.0	Tallowwood	Tallowwood	65	20	Moderate post-fire regen. Macropod scats indicating fauna use.
8	Maria River State Forest	Impact	Mitigation	MARIA RIVER 6	483135	6552449	0.0	Tallowwood	Tallowwood	39	35	Prev. burnt. Extensive groundcover and initial canopy regen.



Area N	Monitoring area	Treatment	Treatment sub-category	Site_ID	Easting	Northing	Activity	Previous SCT	New SCT	DBH (cm)	Radial (m)	Notes
8	Maria River State Forest	Control	Control	MARIA NP1	486965	6554366	3.3	Tallowwood	Pink Bloodwood	30	35	
8	Maria River State Forest	Control	Control	MARIA NP2	486971	6554479	0.0	Tallowwood	Tallowwood	63	45	
8	Maria River State Forest	Control	Control	MARIA NP3	487004	6554203	3.3	Tallowwood	Tallowwood	35	30	
8	Maria River State Forest	Control	New Control	SAT CO1	486292	6552230	6.7		White Stringybark	66	30	Previously burnt. Substantial native groundcover regen. Initial canopy regen.
8	Maria River State Forest	Control	New Control	SAT CO3	486811	6552227	3.3	Blackbutt	Tallowwood	73	30	Previously burnt. Extensive regen.
8	Maria River State Forest	Control	New Control	SAT MAR 1	486811	6552454	6.7		Tallowwood	89	30	Previously burnt. Substantial native groundcover regen. Initial canopy regen.

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## **Niche Environment and Heritage**

A specialist environmental and heritage consultancy.

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