

Oxley Highway to Kempsey

2017-18 Annual Ecological Monitoring Report

Roads and Maritime Services | November 2018



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Introduction

Purpose

This report provides an update on the ecological issues associated with the Oxley Highway to Kempsey Pacific Highway upgrade. This report covers the period from 22 July 2017 to 21 July 2018. This report has been prepared in accordance with the Oxley Highway to Kempsey Ecological Monitoring Program (Roads and Maritime 2016), for submission to the Department of Planning and Environment and Environment Protection Authority (EPA). This report includes Koala, Spotted-tailed Quoll, Giant Barred Frog, Squirrel Glider, *Maundia triglochoides*, Green-thighed Frog pond, nest box, bat box, road kill, pre-clearing and clearing surveys, and landscape monitoring undertaken in 2017/18.

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, for example, analysis between seasons and further statistical analysis to be conducted than if individual monitoring events are reported on. Table 1 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 ecological monitoring report.

Table 1 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.
Squirrel Glider	Winter	Winter 2018 done	Results of this monitoring are included in this report.
Maundia	Spring – final survey	Spring 2017 completed	Final survey included in this monitoring report
Green-thighed Frog	Summer (although ultimately rainfall dependent)	Completed in Autumn 2018	Results included in this report.
Nest Box	Winter and Summer	Winter 2017, Summer 2017/18 and Winter 2018 complete. No further monitoring required in 2018/19.	Results for these three monitoring events are included in this report.
Bat box	Winter and Summer	Winter 2017, Summer 2017/18 and	Results for these three

Species monitored	Timing	Done/ yet to be done	Reporting
		Winter 2018 complete. No further monitoring required in 2018/19.	monitoring events are 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.

Statutory and planning framework

Approval for the Oxley Highway to Kempsey Pacific Highway upgrade was granted by the then Department of Planning & Infrastructure on 8 February 2012. Roads and Maritime has constructed and opened the project in stages. The three main stages of the project are:

- Stage 1 - The Sancrox Traffic Arrangement works located about two kilometres north of the Oxley Highway / Pacific Highway intersection. This section of the project opened to traffic on 30 November 2015
- Stage 2 - Kundabung to Kempsey Stage 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). This stage of the project opened to traffic on 31 October 2017.
- Stage 3 - Oxley Highway to Kundabung Stage 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). This stage of the project opened to traffic in two parts initially on 17 November 2017 and finally in its entirety on 29 March 2018.

The Oxley Highway to Kempsey Pacific Highway upgrade approval included the requirement to develop an ecological monitoring program:

The Proponent shall develop an Ecological Monitoring Program to monitor the effectiveness of the biodiversity mitigation measures implemented as part of the project. The program shall be developed by a suitably qualified and experienced ecologist in consultation with the OEH and DPI (Fishing and Aquaculture) and shall include but not necessarily be limited to:

- a) *an adaptive monitoring program to assess the effectiveness of the mitigation measures identified in conditions B1, B4, B7 and B31(b) and allow amendment to the measures if necessary. The monitoring program shall nominate performance parameters and criteria against which effectiveness will be measured and include operational road kill surveys to assess the effectiveness of fauna crossings and exclusion fencing implemented as part of the project;*
- b) *mechanisms for developing additional monitoring protocols to assess the effectiveness of any additional mitigation measures implemented to address additional impacts in the case of design amendments or unexpected threatened species finds during construction (where these additional impacts are generally consistent with the biodiversity impacts identified for the project in the documents listed under condition A1);*
- c) *monitoring shall be undertaken during construction (for construction-related impacts) and from opening of the project to traffic (for operation/ ongoing impacts) until such time as the effectiveness of mitigation measures can be demonstrated to have been achieved over a minimum of three successive monitoring periods (i.e 6 years) after opening of the project to traffic, unless otherwise agreed by the Director General. The monitoring period may be reduced with the agreement of the Director General in consultation with the OEH and DPI (Fishing and Aquaculture), depending on the outcomes of the monitoring;*
- d) *provision for the assessment of the data to identify changes to habitat usage and whether this can be directly attributed to the project;*
- e) *details of contingency measures that would be implemented in the event of changes to habitat usage patterns directly attributable to the construction or operation of the project; and*
- f) *provision for annual reporting of monitoring results to the Director General and the OEH and DPI (Fishing and Aquaculture), or as otherwise agreed by those agencies.*

The Program shall be submitted to the Director General for approval no later than 6 weeks prior to the commencement of construction that would result in the disturbance of native vegetation (unless otherwise agreed by the Director General).

The initial Oxley Highway to Kempsey Ecological Monitoring Program was approved by the Department of Planning & Environment on 25 January 2014. This was updated in 2016 and approved by the Department of Planning & Environment on 6 December 2016.

The ecological monitoring program includes the provision for annual reporting to the Director General and EPA.

Appendix A Koala



Koala Monitoring 2017

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

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Project Director:	Rhidian Harrington
Project Manager:	Radika Michniewicz
Authors:	Radika Michniewicz
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Niche Environment and Heritage

A specialist environmental and heritage consultancy.

Head Office

Level 1, 19 Sorrell Street
Parramatta NSW 2150
All mail correspondence to:
PO Box 2443
North Parramatta NSW 1750
Email: info@niche-eh.com

Sydney

0488 224 888

Central Coast

0488 224 999

Illawarra

0488 224 777

Armidale

0488 224 094

Newcastle

0488 224 160

Mudgee

0488 224 025

Port Macquarie

0488 774 081

Brisbane

0488 224 036

Cairns

0488 284 743

Executive Summary

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

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.

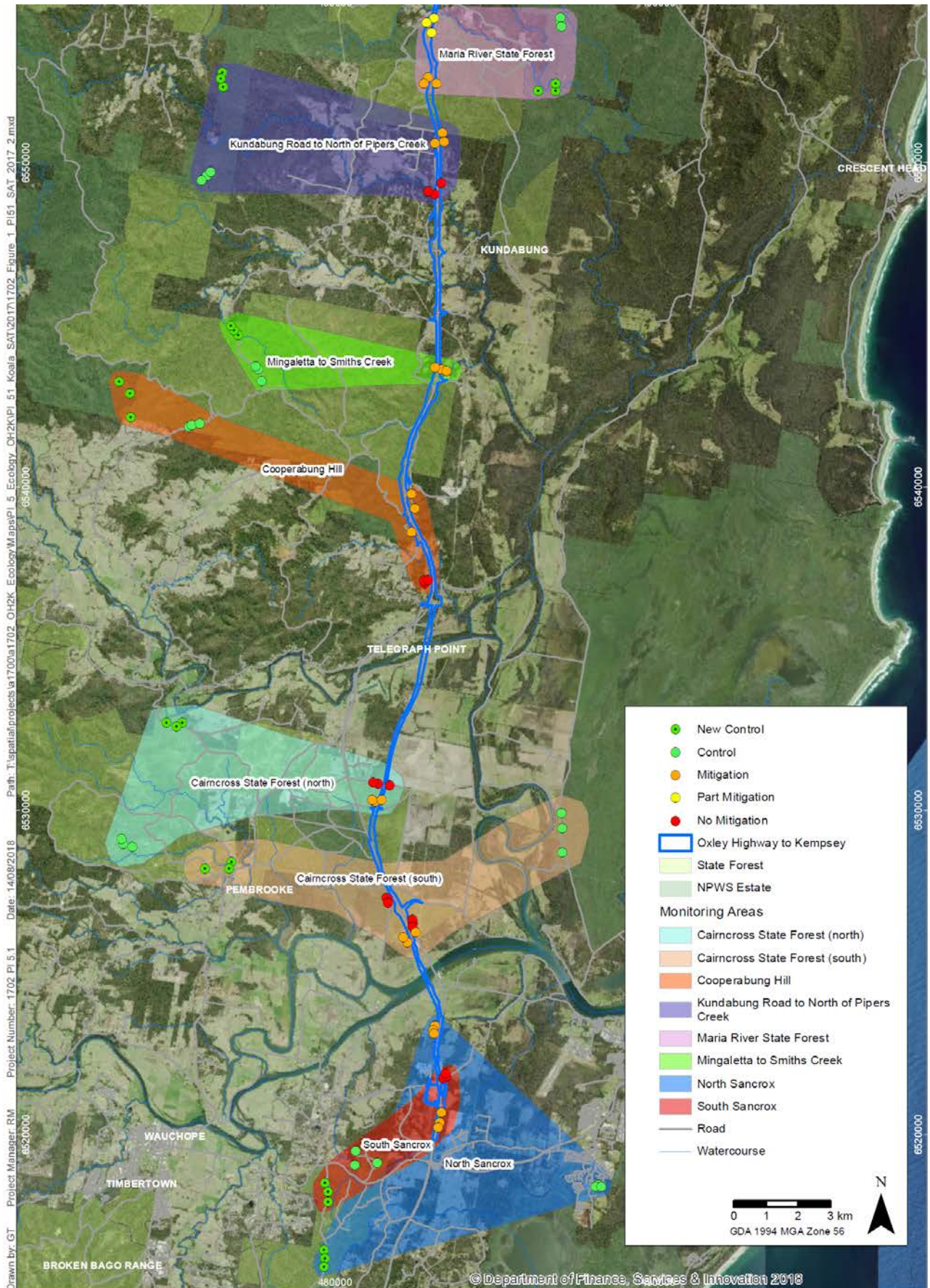
4. Calculate the activity level of a site as the percentage of surveyed trees within the site (of 30 trees) that have a Koala faecal pellet recorded within its search area. The result is used to assess whether the site supports “Low”, “Medium (normal)” or “High” Koala activity.
5. Record the presence (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

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

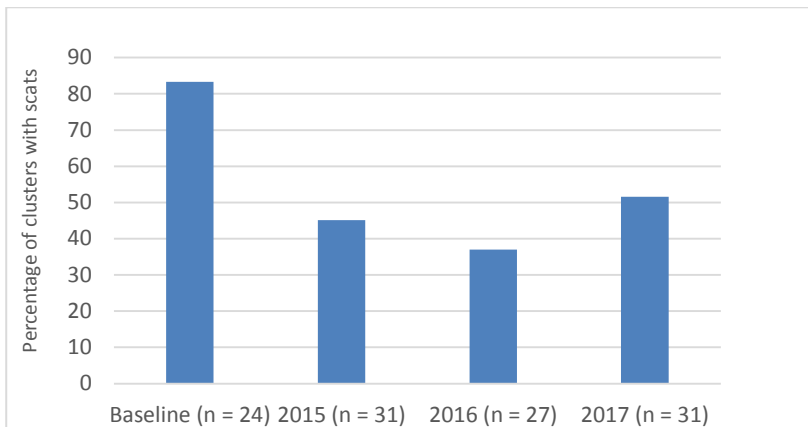
A total of 2,790 trees were assessed across the 93 plots (30 at each plot). Of the 93 surveyed plots, Koala scats were recorded from 27% (25 of 93) of the individual plots. When grouped according to cluster, Koala scats were recorded at 52% of clusters across the survey areas (16 of 31). Graph 1 shows 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.

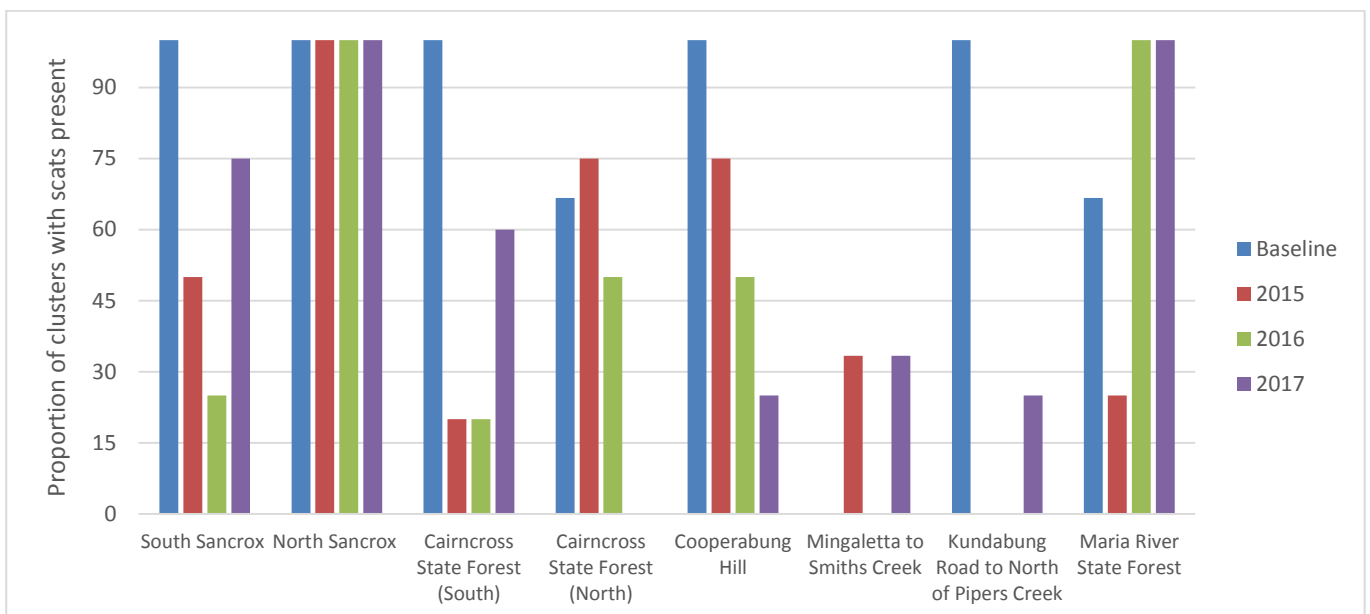
Koalas were notably absent within the Cairncross State Forest (north) area. Scats have been consistently recorded within this area during previous monitoring events but were not detected at any plot during the current monitoring event.

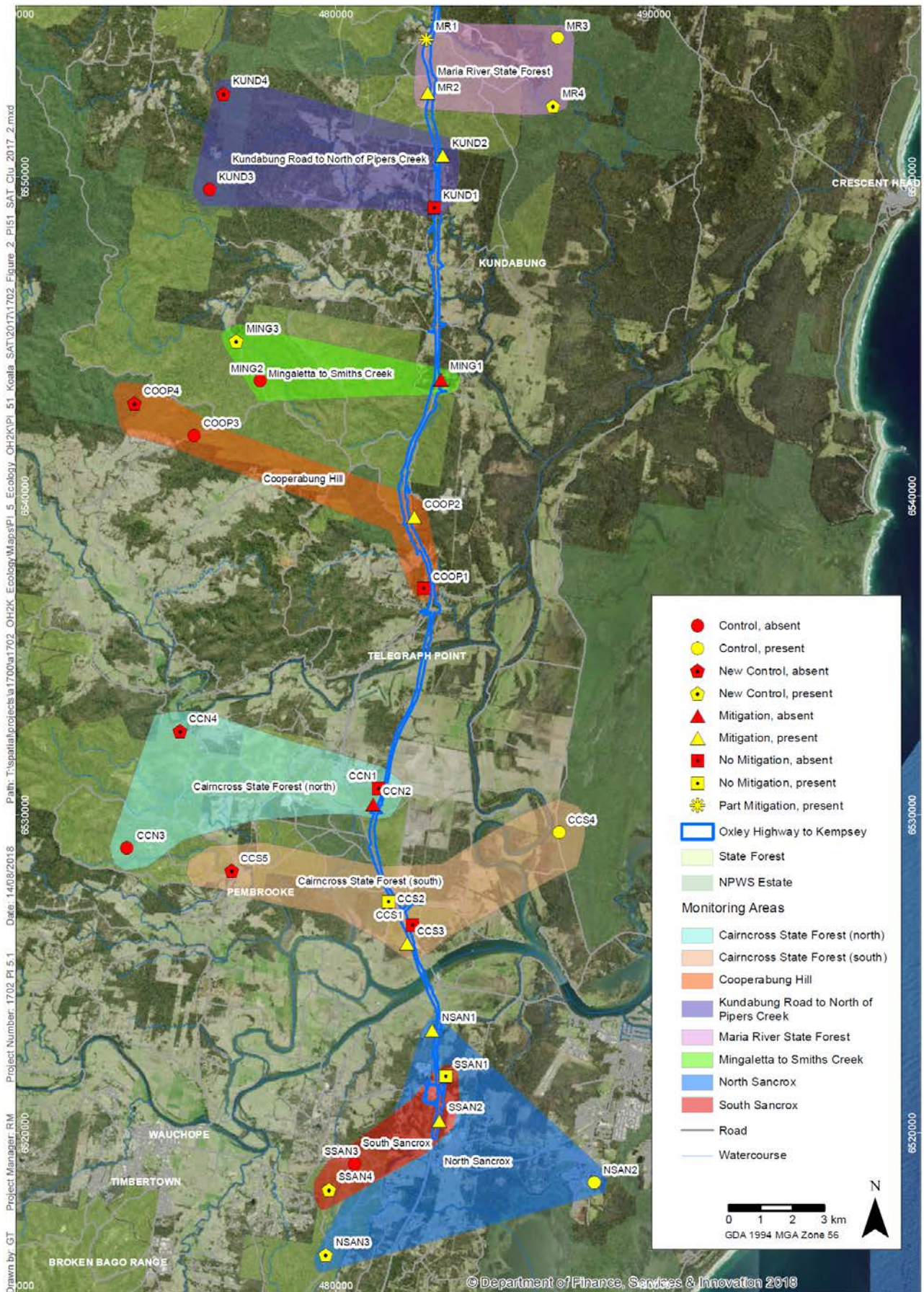
Koala presence was mainly recorded in the northern and southern areas, with activity in the northern area possibly being influenced by regenerating vegetation after the wildfire.

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

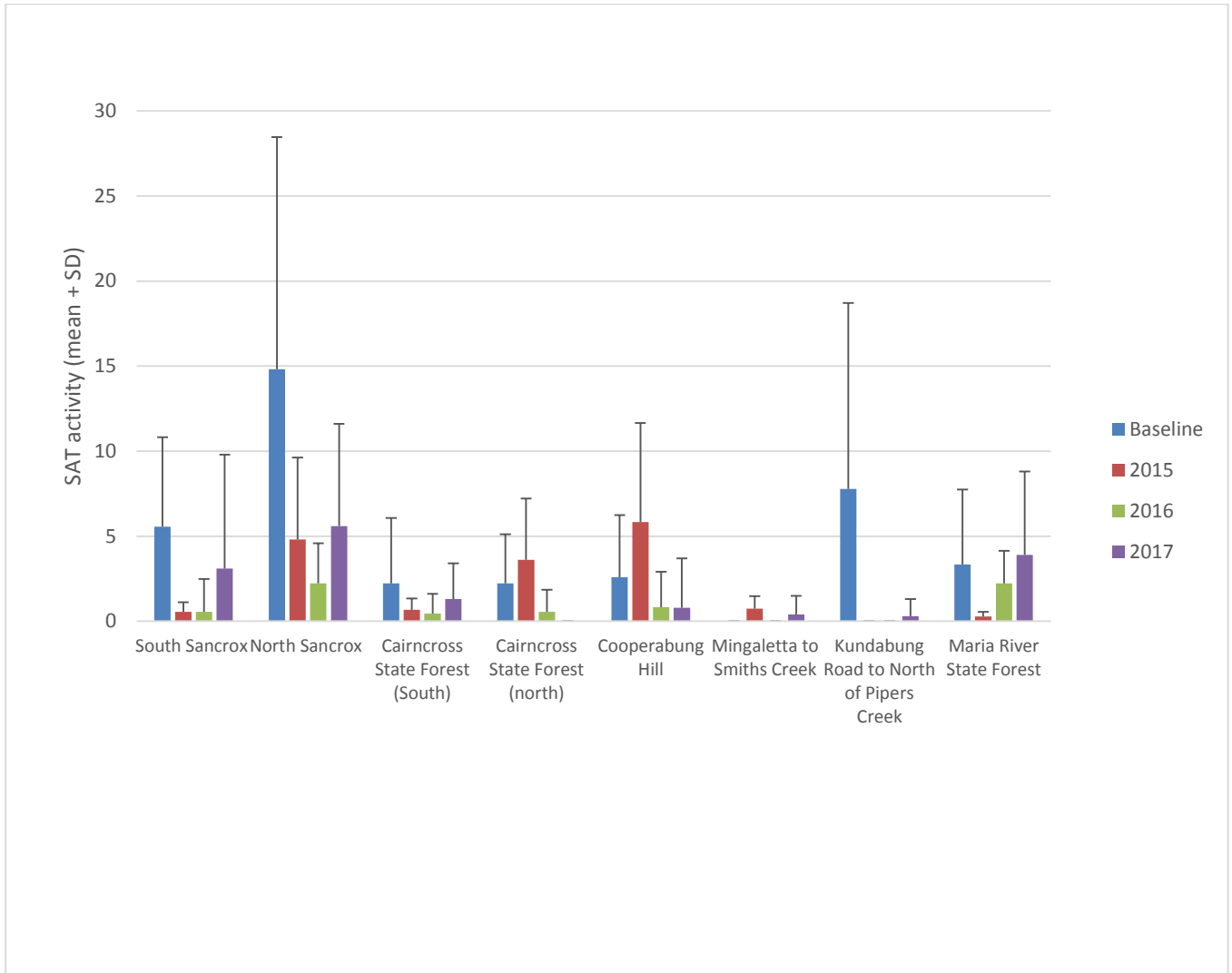


Table 4: Koala SAT plots results Baseline – 2017

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

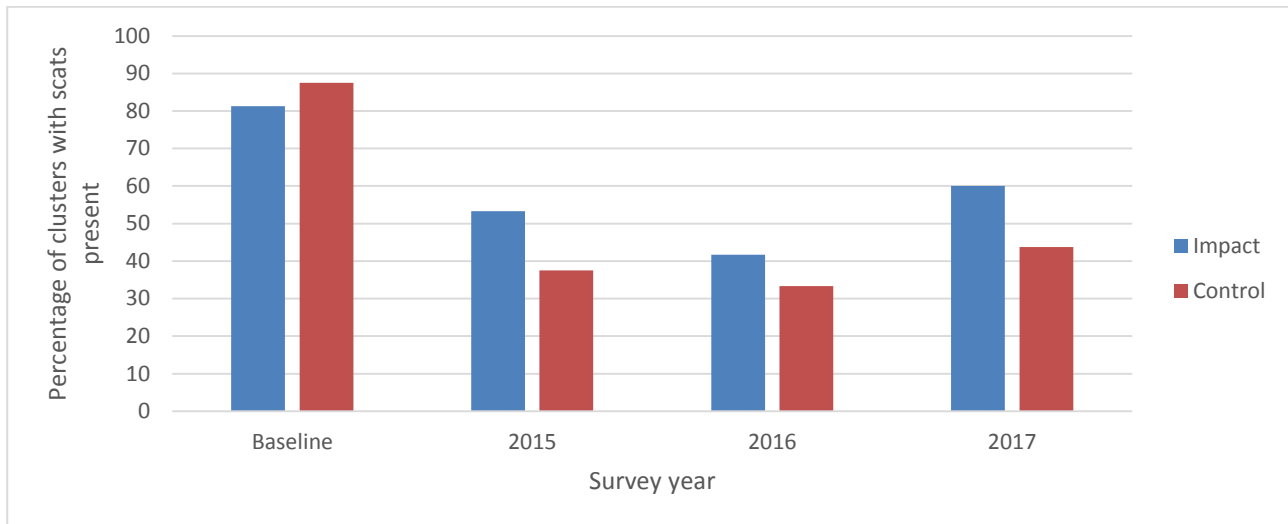
Area	Type	Data Source	Site ID	Map ref	Activity (%)				Scat presence (per cluster)			
					Baseline	2015	2016	2017	Baseline	2015	2016	2017
	New Control		SAT RR2		-	0.0	0.0	0.0	Not monitored			
			SAT RR3		-	0.0	0.0	0.0				
Cooperabung Hill	No Mitigation	Baseline	COOPERABUNG1	COOP1	3.3	3.3	0.0	0.0	present	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



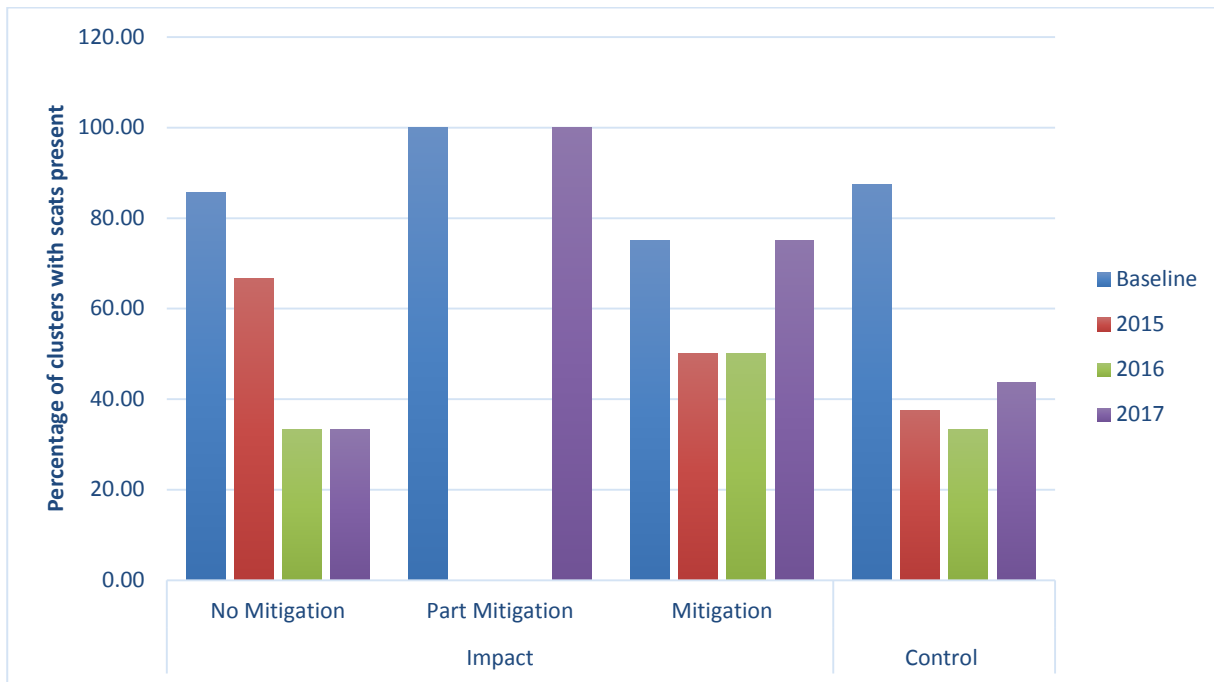
3.3 Mitigation v no mitigation analysis

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:

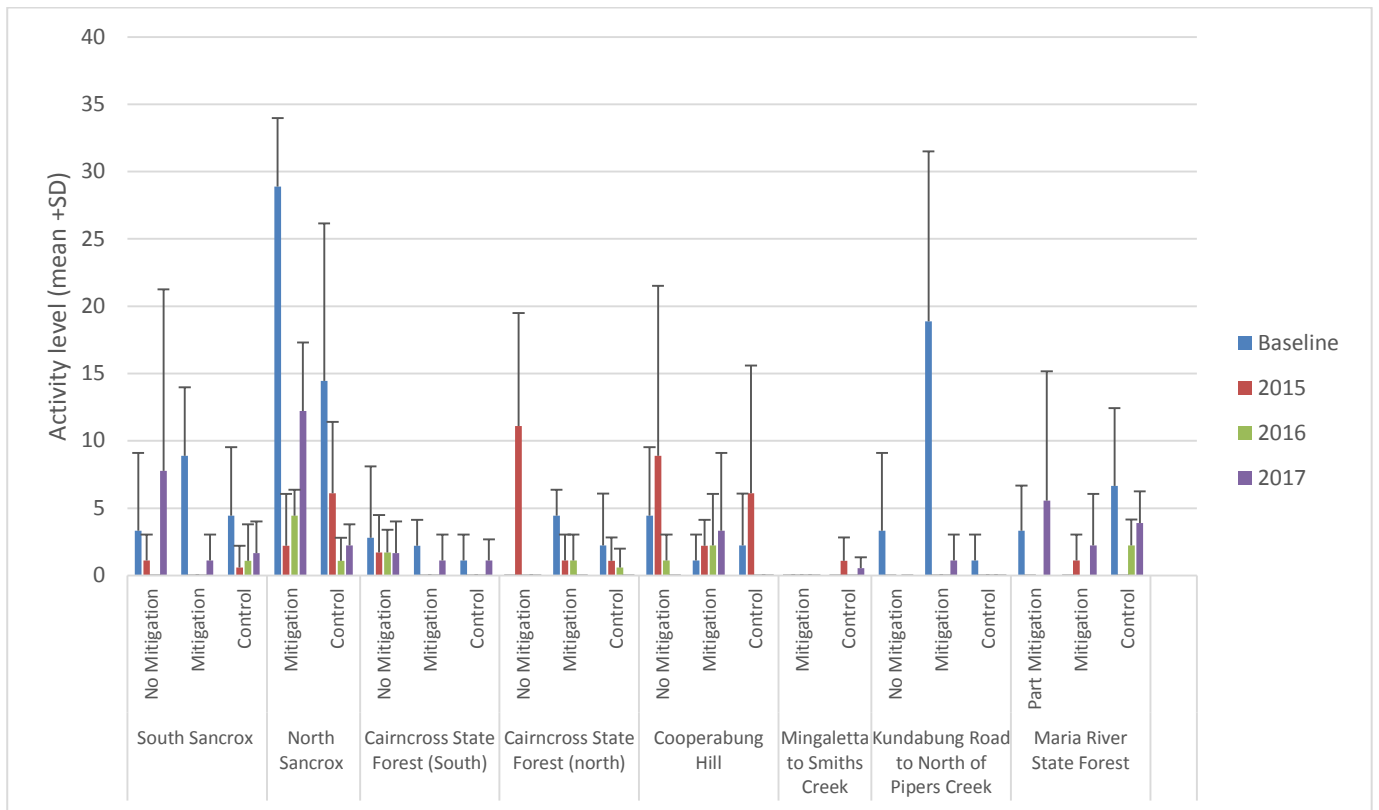
- a. Broader study area set at 5% activity;
- b. The three treatment classes of Mitigation set at 8.05%, control reference set at 4.03% and no mitigation set at 2.64%.”

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.	This performance measure has been met. 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	This performance measure has been met. 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.	This performance measure has not been met. <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"> Investigate cause of decline in consultation with EPA and DoTE within two weeks of results reported by ecologist. 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. 	<p>This contingency measure is not considered relevant.</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

Biolink (2013). Port Macquarie-Hastings Koala Habitat and Population Assessment. Final report prepared by Biolink Ecological Consultants for Port Macquarie-Hastings Council.

Lewis, B.D (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 (2016). Koala Monitoring. Year 1 surveys - Oxley Highway to Kempsey Pacific Highway Upgrade. Prepared for Roads and Maritime Services.

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	

Area N	Monitoring area	Treatment	Treatment sub-category	Site_ID	Easting	Northing	Activity	Previous SCT	New SCT	DBH (cm)	Radial (m)	Notes
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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Head Office

Niche Environment and Heritage
PO Box W36 Parramatta NSW 2150
Email: info@niche-eh.com

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Appendix B Spotted-tail Quoll



Spotted-tailed Quoll Monitoring 2018

Oxley Highway to Kempsey, Pacific Highway Upgrade

Prepared for Roads and Maritime Services

September 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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Head Office

Level 1, 460 Church Street
Parramatta NSW 2150
All mail correspondence to:
PO Box 2443
North Parramatta NSW 1750
Phone: **02 9630 5658**
Email: info@niche-eh.com

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Executive summary

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

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.

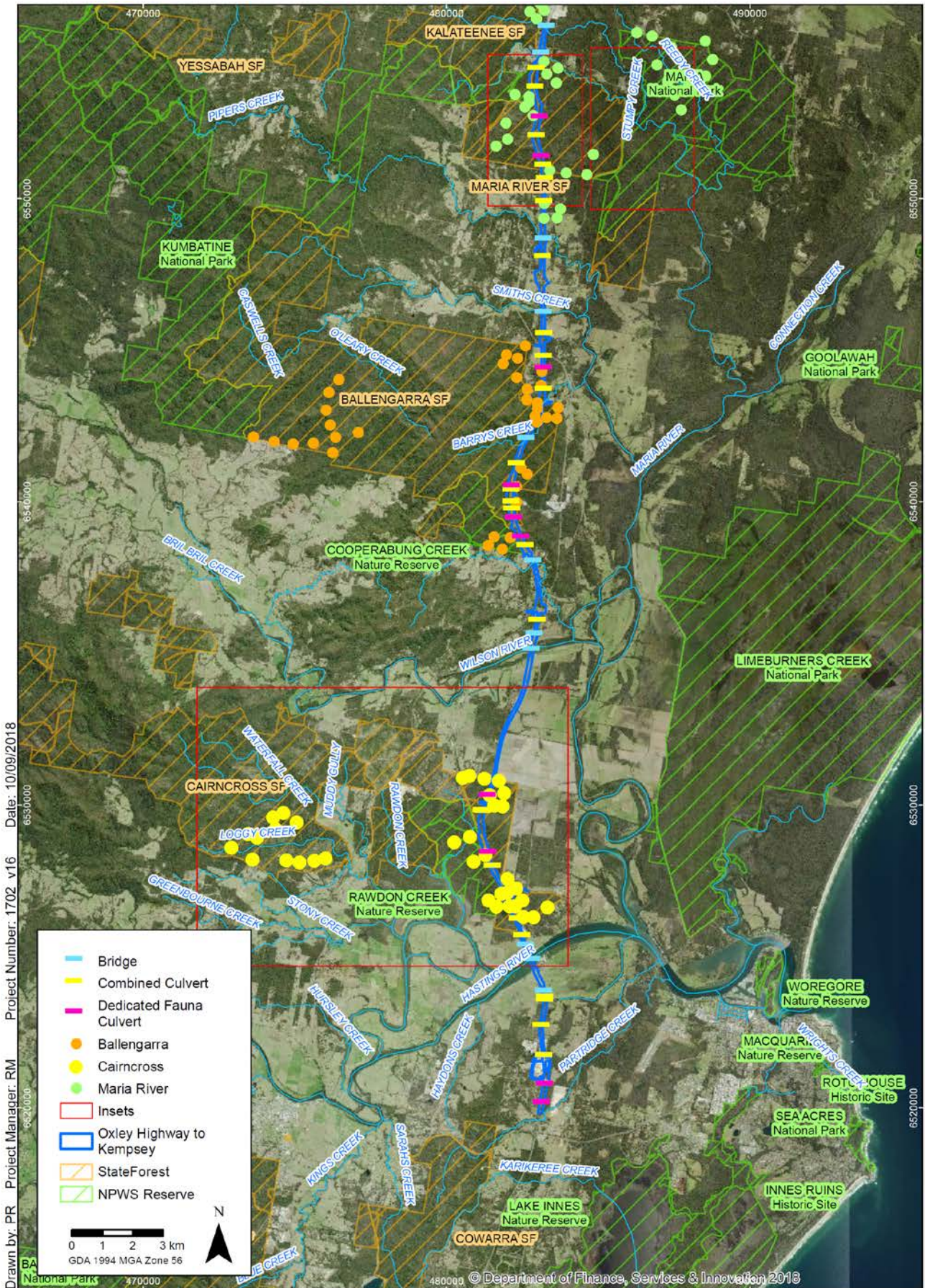
In accordance with the EMP, the following habitat attributes were recorded at each camera station:

- 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.



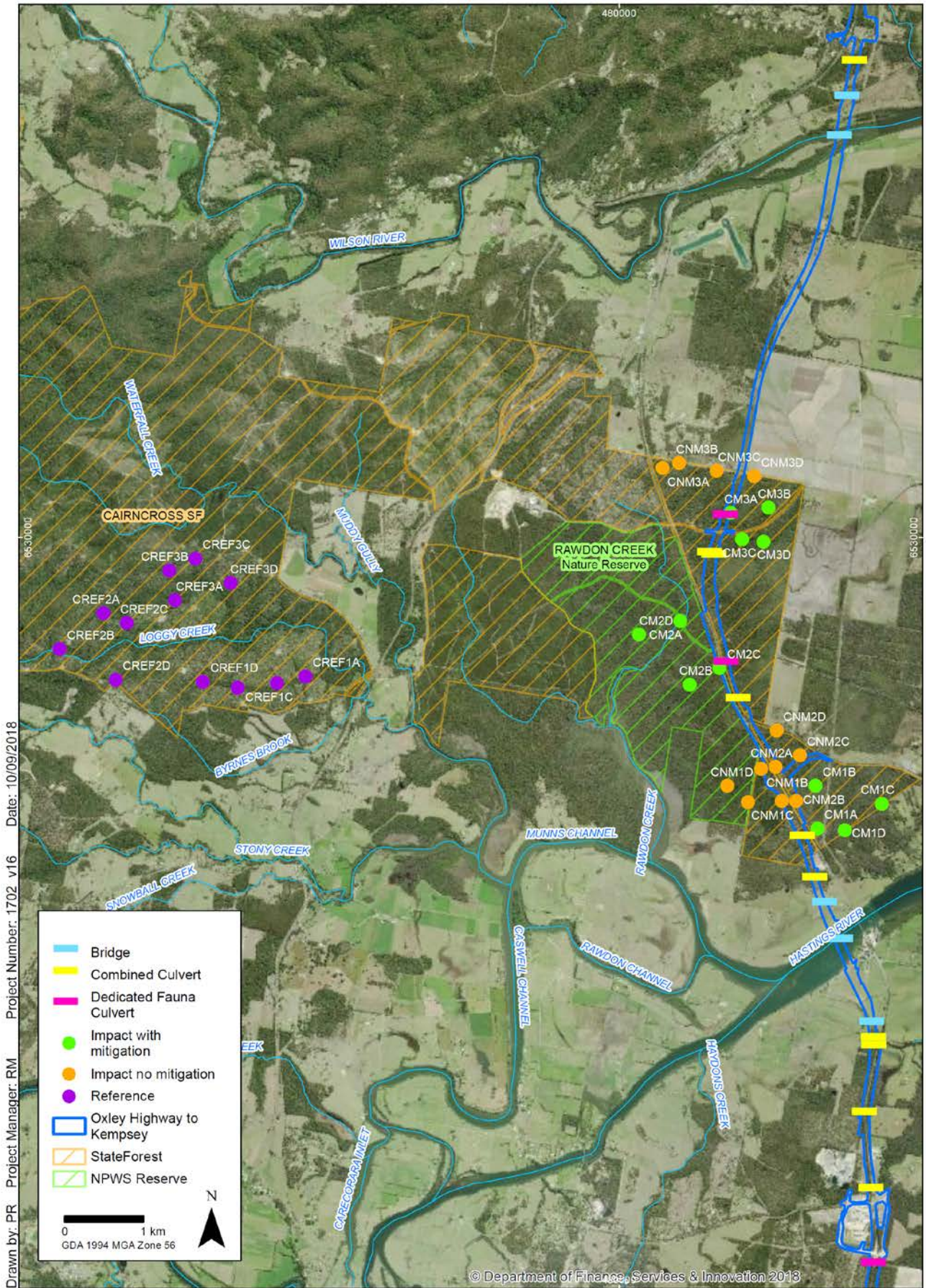
Overview of monitoring sites

Oxley Highway to Kempsey - Spotted-tailed Quoll Monitoring sites

FIGURE 1

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

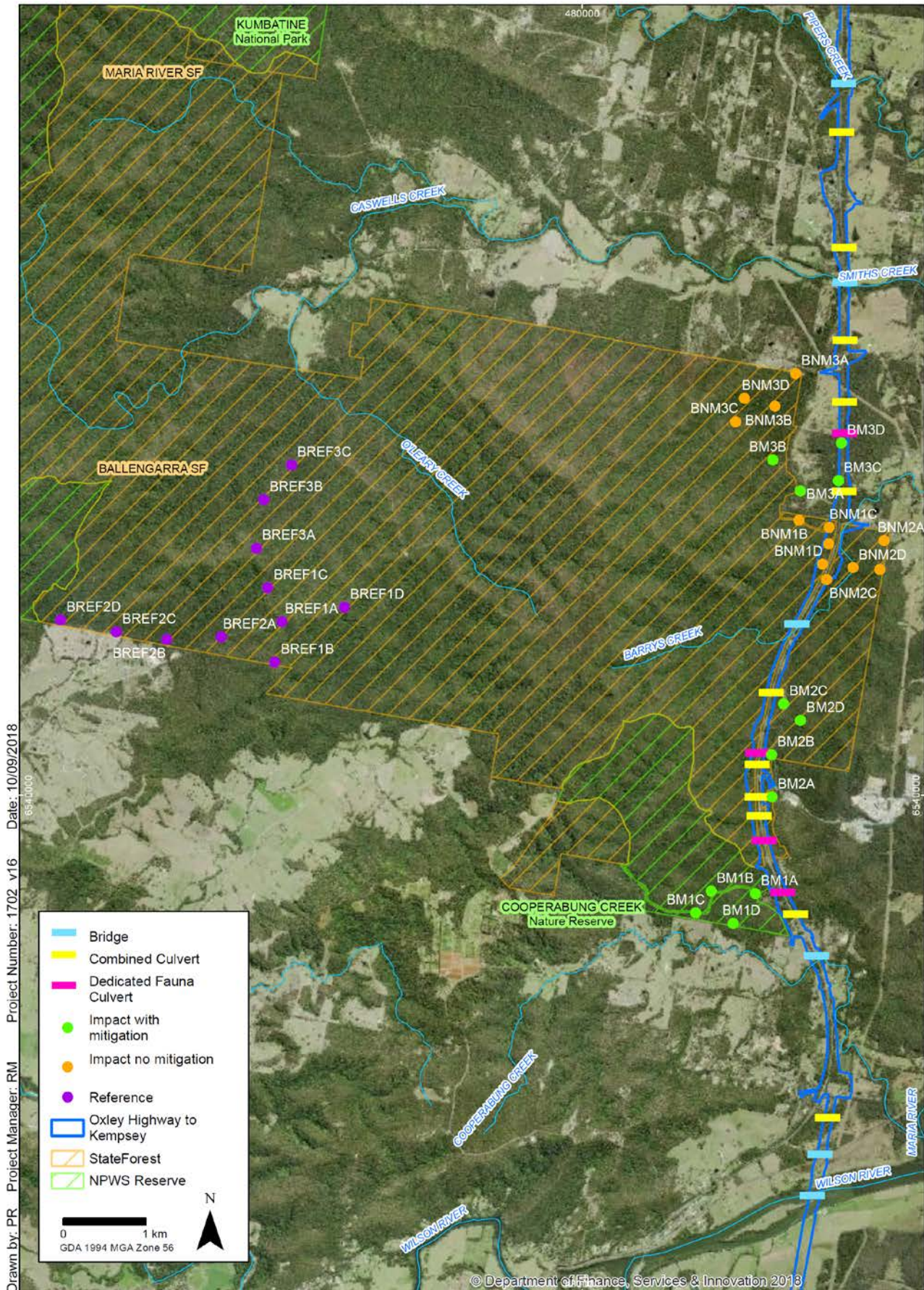
Path: T:\spatial\projects\1700\1702_OH2K_Ecology\Maps\PI_5_Ecology_OH2K\PI_52_Quoll\1702_PI52_Quoll_20180312_Fig1_Overview.mxd



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

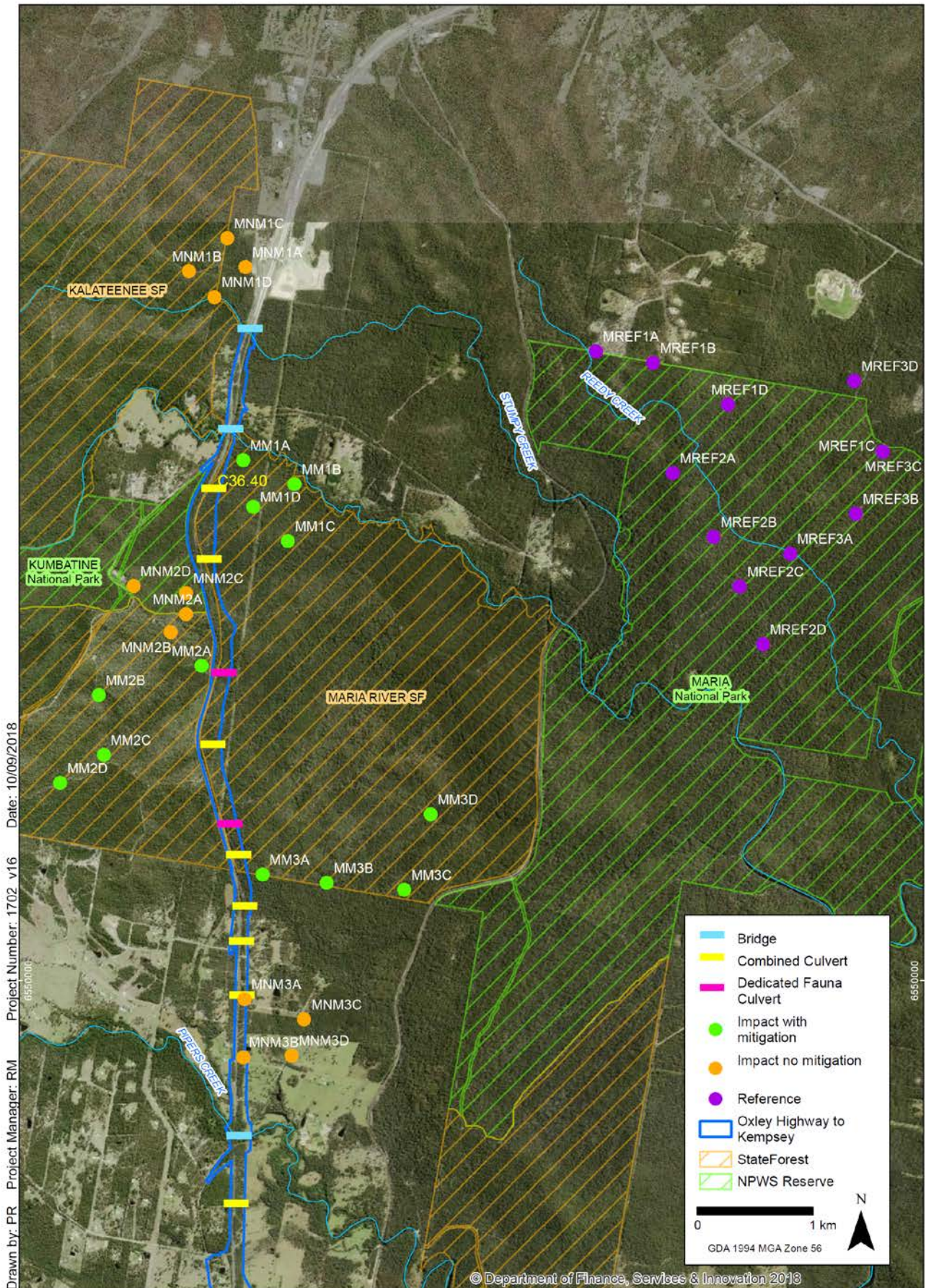
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Cairncross State Forest camera locations
Oxley Highway to Kempsey - Spotted-tailed Quoll Monitoring sites



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

FIGURE 3



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).

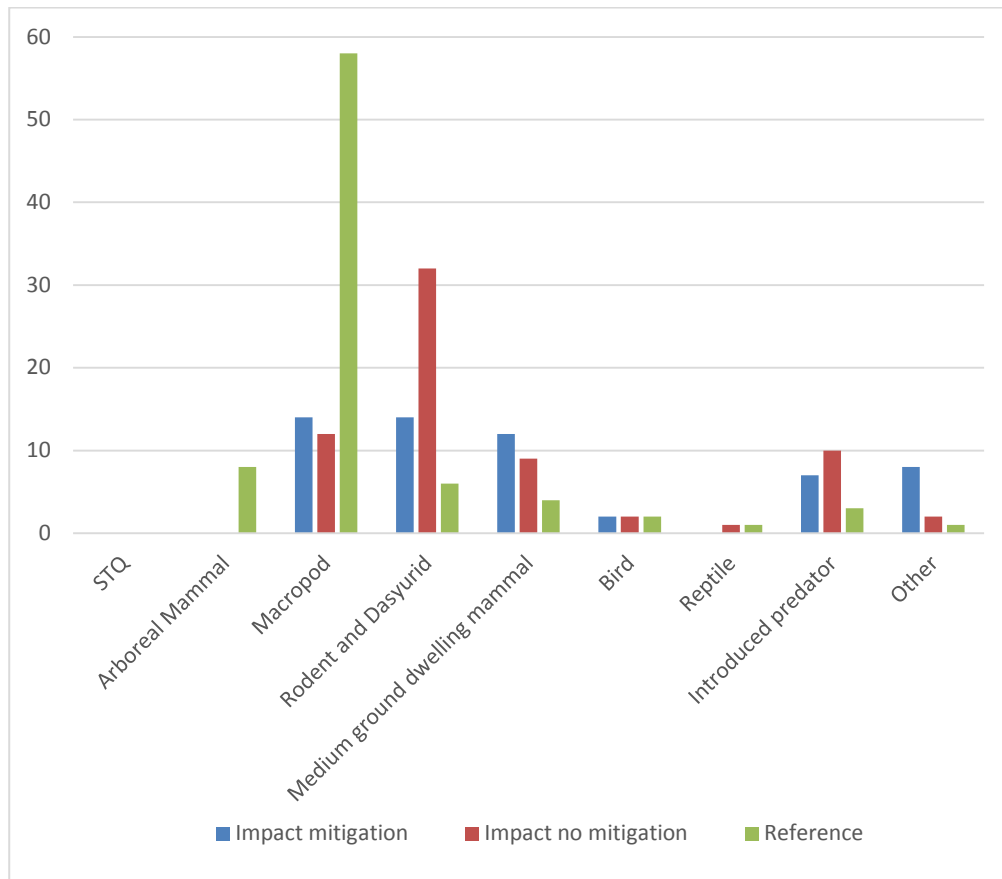
Predatory fauna

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.

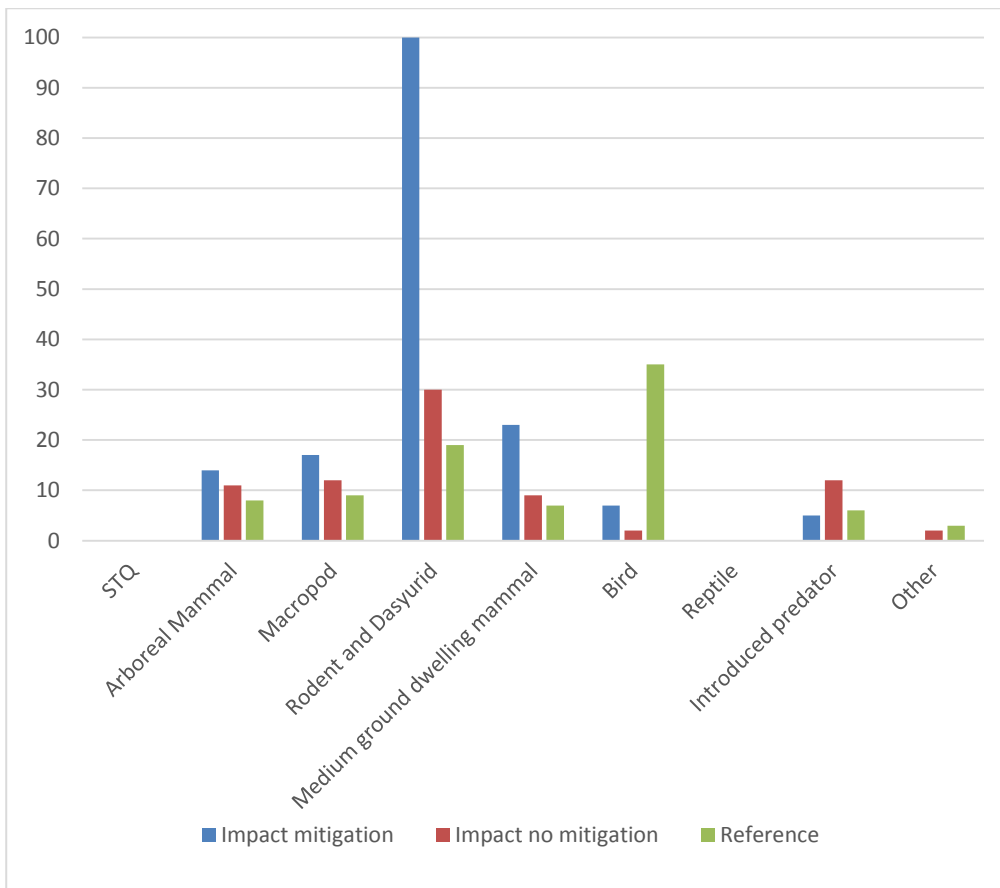
Table 2: Summary of fauna records

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
Total		0	51	162	223	78	62	2	79	31

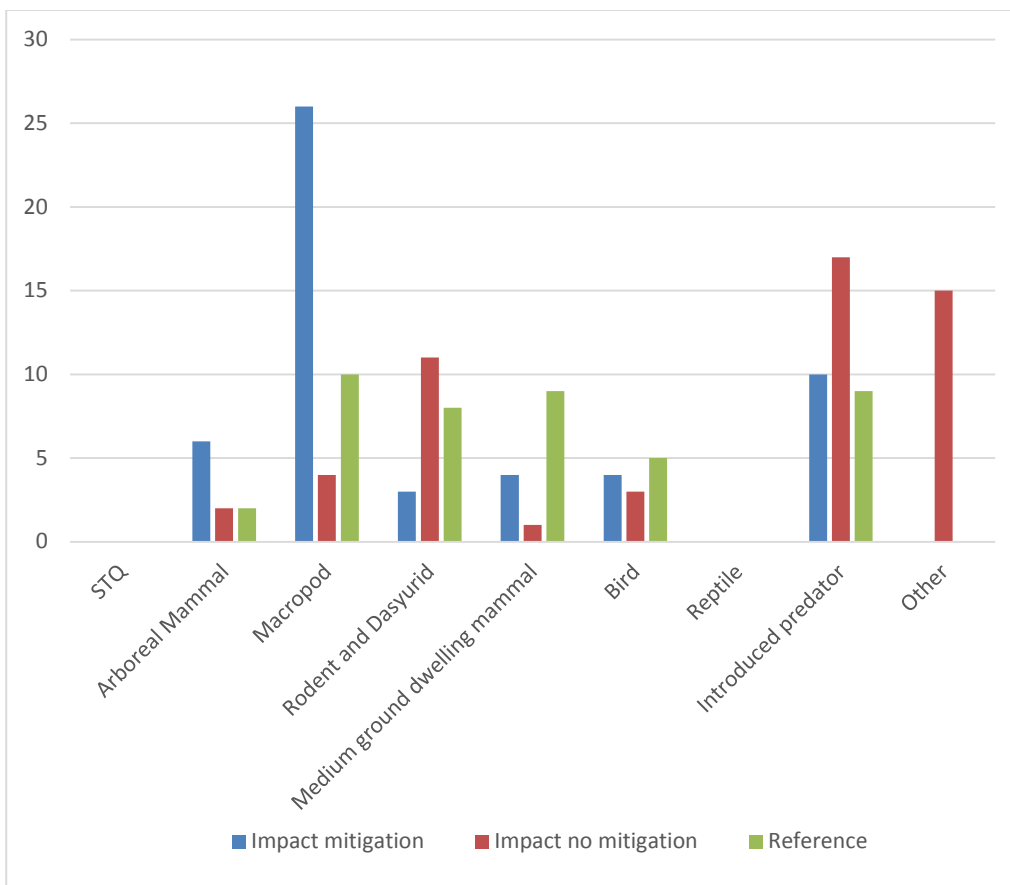
STQ = Spotted-tailed Quoll; AM = arboreal mammals (Possums and Koala); M = macropods; R&D = rodents and dasyurids; MGD = medium ground dwelling mammals (Echidna, Bandicoot); R = reptile; IP = Introduced predator (Fox, Cat, Wild and Domestic Dog); Other= non-native and non-fauna categories such as people,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



Graph 1: Cairncross area grouped records



Graph 2: Ballengarra area grouped records



Graph 3: Maria River area grouped records

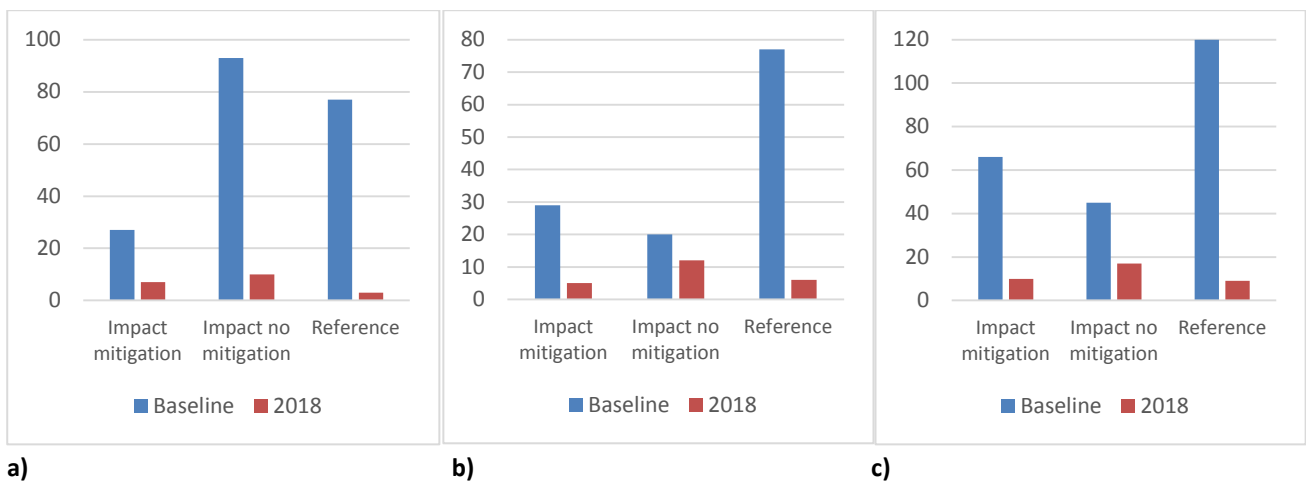
3.1.3 Comparison with Baseline

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>This performance measure has been met for 2018.</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>This performance measure has been met for 2018.</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>These contingency measures are not considered relevant at this stage</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

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

Niche Environment and Heritage

A specialist environmental and heritage consultancy.

Head Office

Niche Environment and Heritage

PO Box 2443 North Parramatta NSW 1750

Email: info@niche-eh.com

All mail correspondence should be through our Head Office

Appendix C Giant Barred Frog



Giant Barred Frog Monitoring 2017/2018

Oxley Highway to Kempsey, Pacific Highway Upgrade

Prepared for Roads and Maritime Services

September 2018

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Authors:	Jodie Danvers, Radika Michniewicz
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Cover photograph: Giant Barred Frog (Photos: Matthew Stanton)

Niche Environment and Heritage

A specialist environmental and heritage consultancy.

Head Office

Level 1, 460 Church Street
North Parramatta NSW
1750

All mail correspondence to:

PO Box 2443

North Parramatta NSW
1750

Email: info@niche-eh.com

Sydney

0488 224 888

Central Coast

0488 224 999

Illawarra

0488 224 777

Armidale

0488 224 094

Newcastle

0488 224 160

Mudgee

0488 224 025

Port Macquarie

0488 774 081

Brisbane

0488 224 036

Cairns

0488 284 743

Executive summary

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 80th 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 80th 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

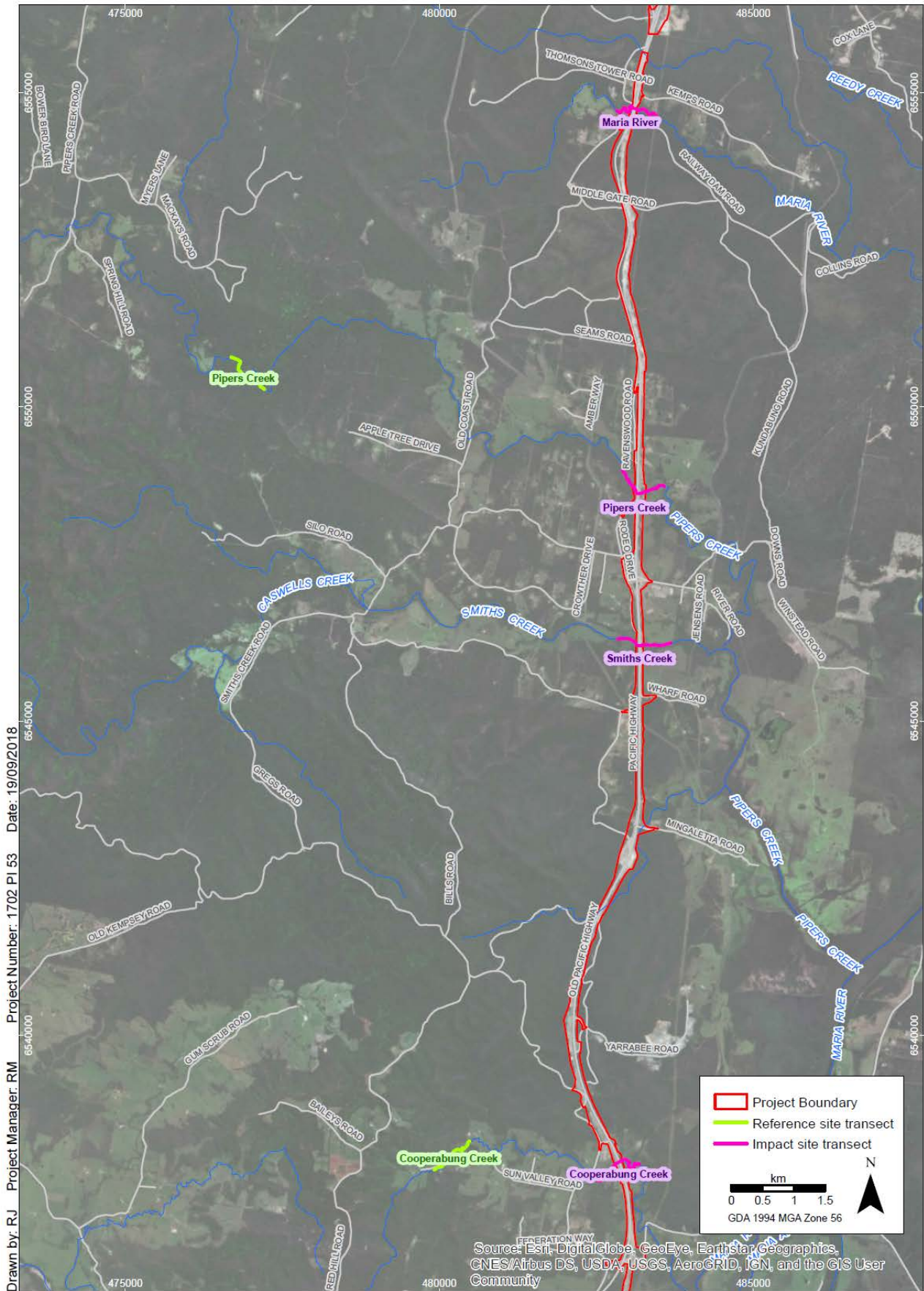
Water quality monitoring was undertaken by Roads and Maritime Services between 22 July 2017 and 29 March 2018 (RMS 2018). This report summarises water quality data from both upstream and downstream sites for Cooperabung Creek, Smiths Creek, Pipers Creek, and Maria River.

The median water quality value for downstream sites was compared with the site specific trigger values developed for the upstream site based on: the 80th percentile and, where relevant, the 20th 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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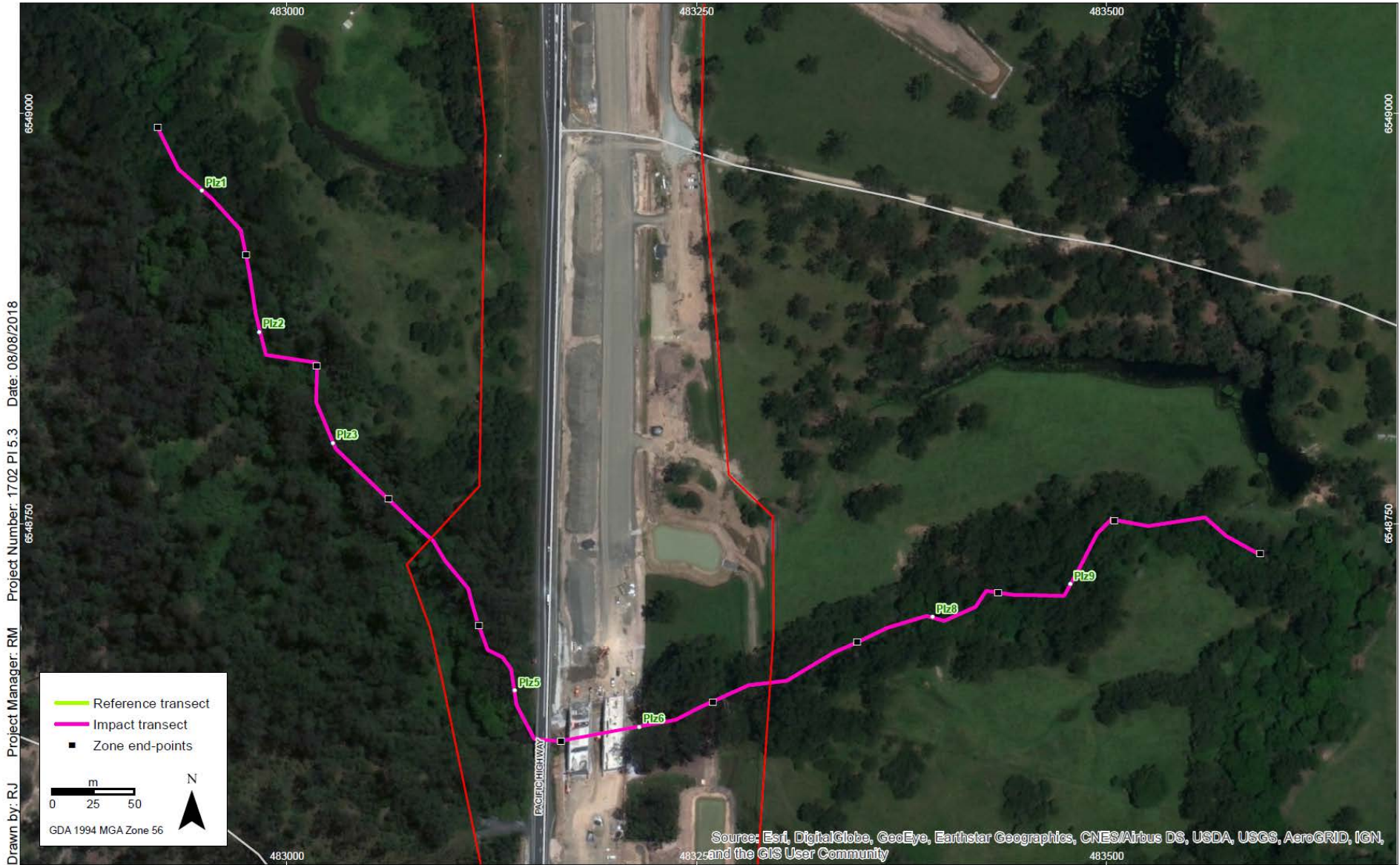
Giant Barred Frog monitoring: Cooperabung Creek impact site
 Pacific Highway Upgrade - Oxley Highway to Kempsey

FIGURE 2
 Imagery: (c) DigitalGlobe



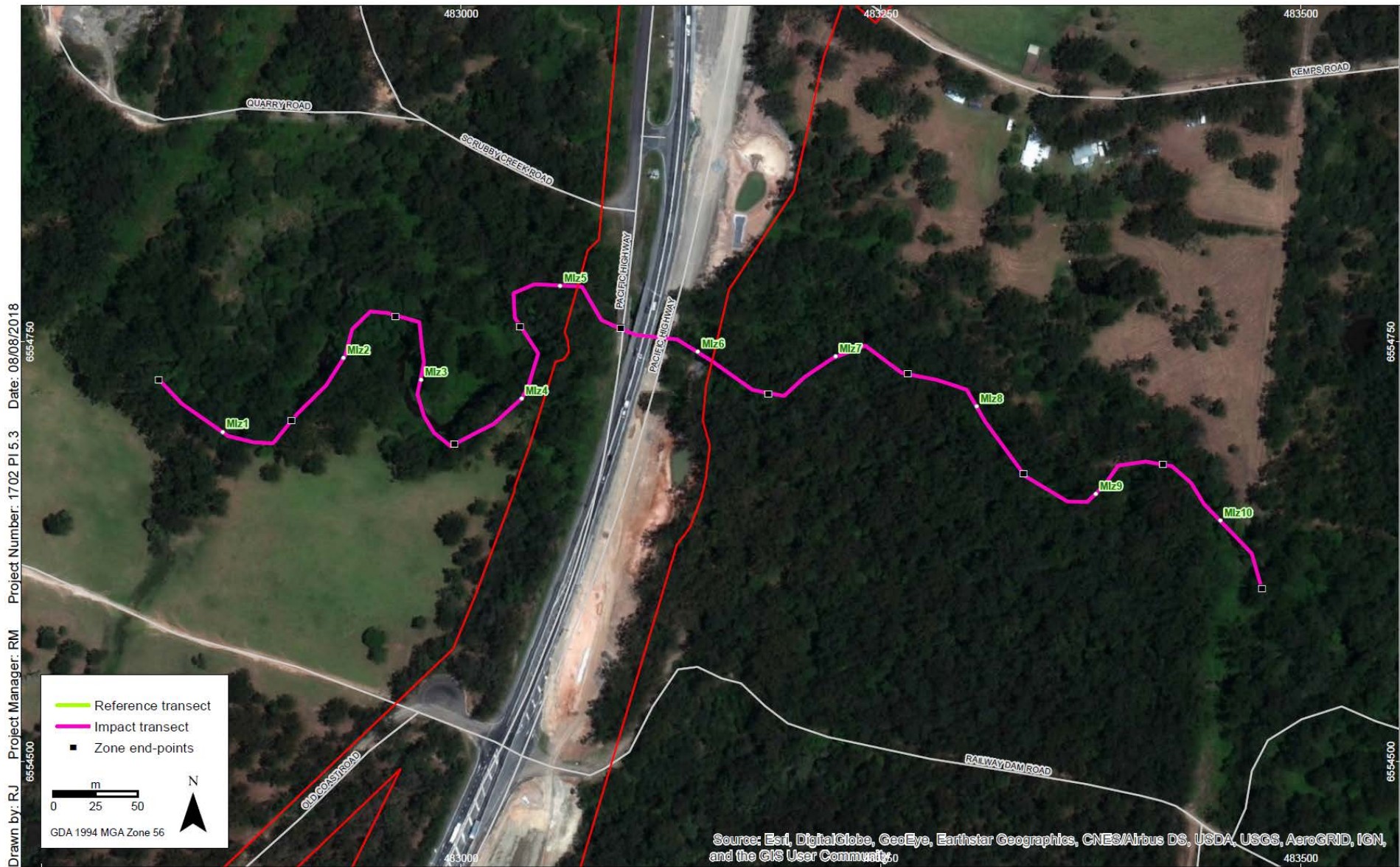
Giant Barred Frog monitoring: Smiths Creek impact site
Pacific Highway Upgrade - Oxley Highway to Kempsey

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
Baseline	not detected	detected	not detected	not detected	detected	not detected
2015/2016	not detected	not detected	detected	detected	not detected	detected
2016/2017	detected	not detected	not detected	not detected	detected	detected
2017/2018	not detected	detected	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.

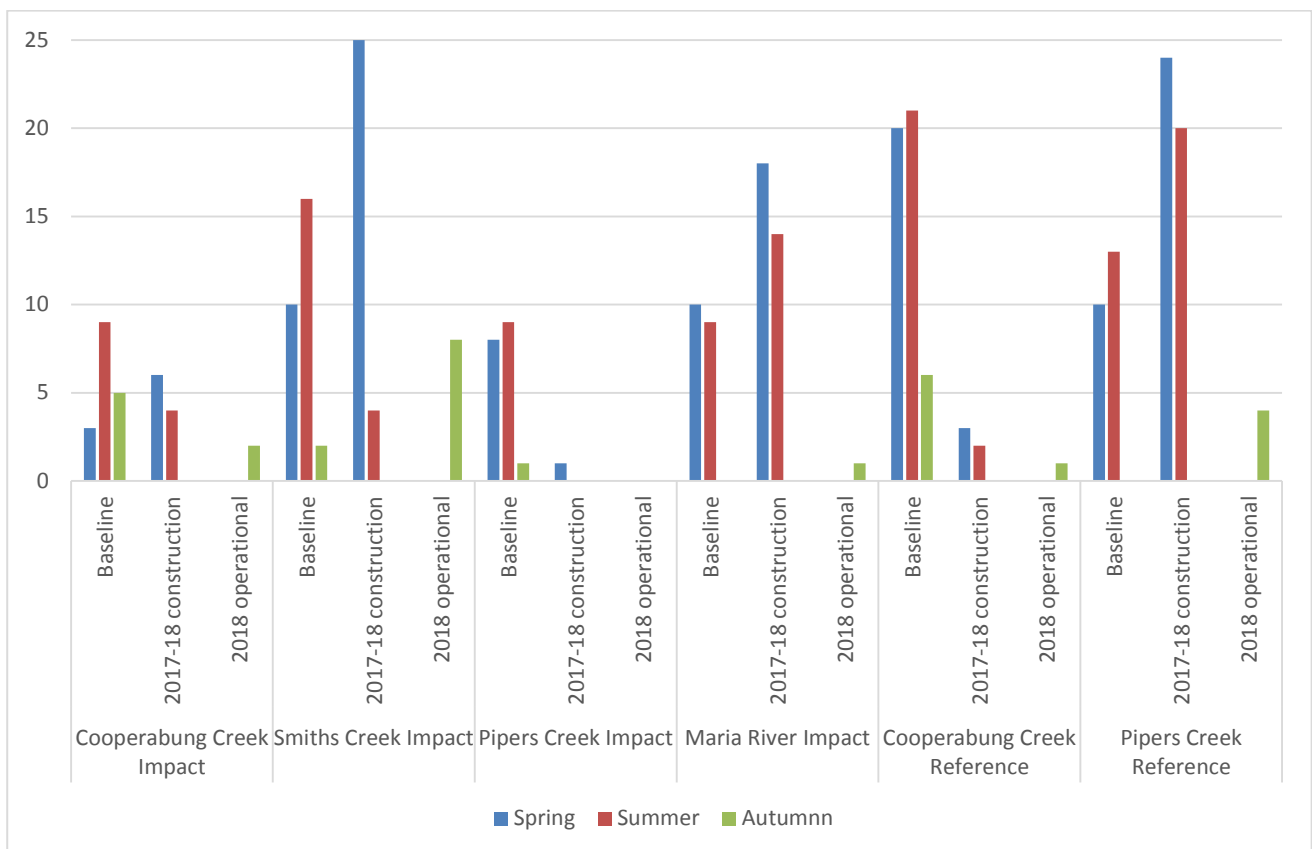
3.2.1 Baseline and 2017/2018 surveys

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.

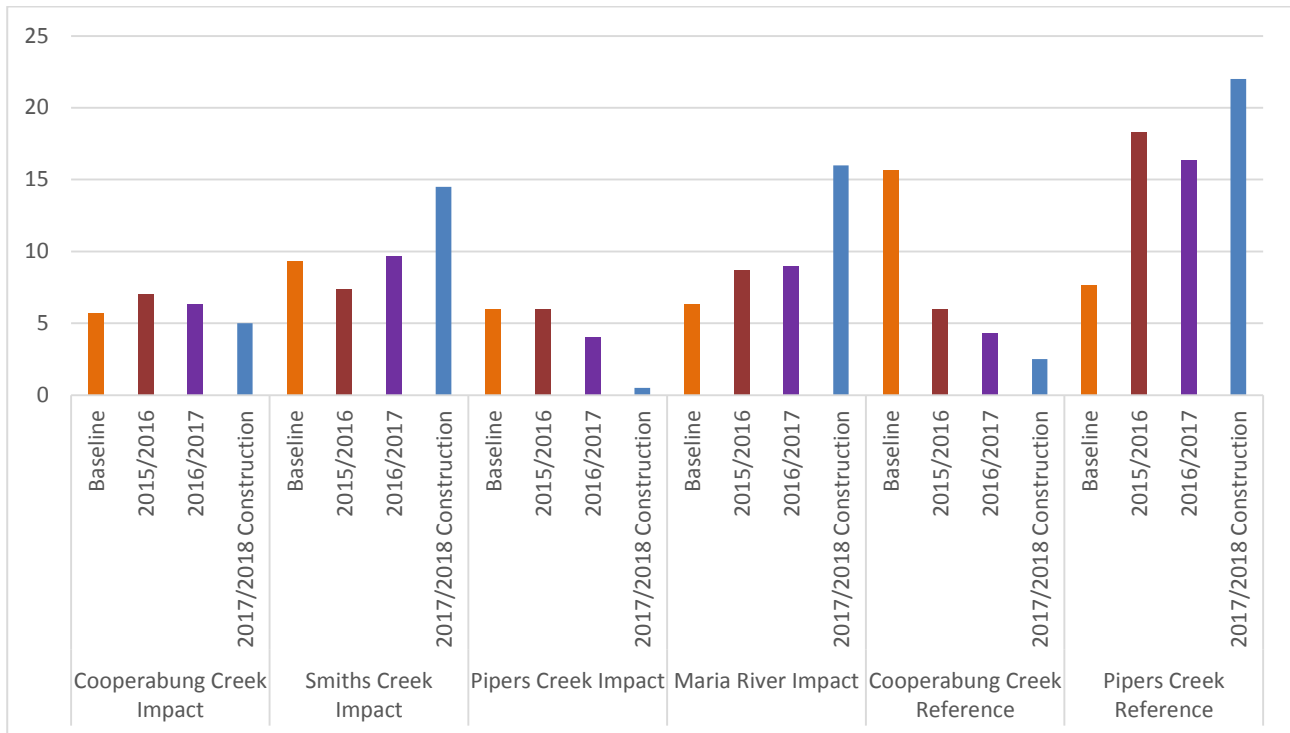
Giant Barred Frogs were therefore recorded during all 2017/2018 surveys at the two sites (one impact site) where they were not recorded during the autumn baseline surveys (Pipers Creek reference site and Maria River impact site), however they were not recorded at the Pipers Creek impact site in the summer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



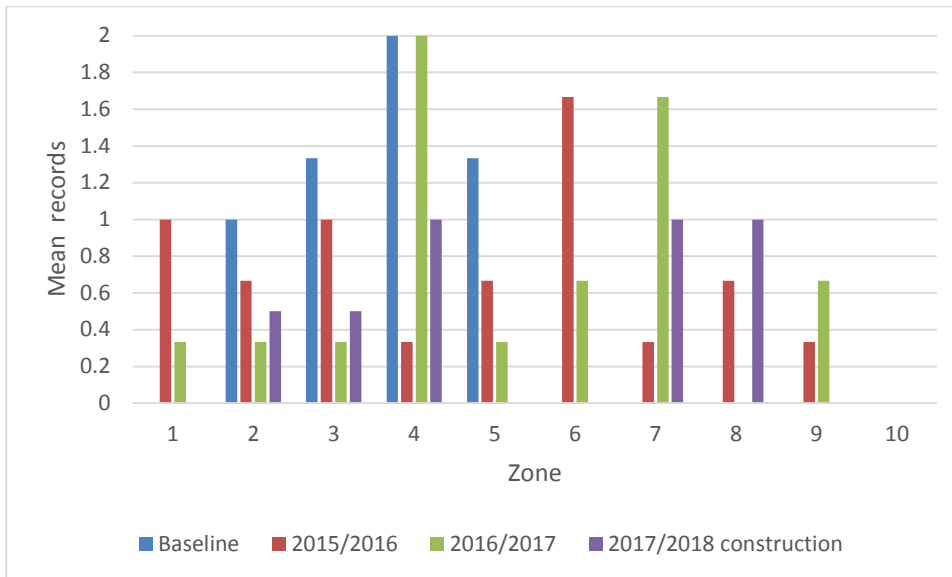
Graph 2: Mean annual Giant Barred Frog records by site

3.3 Density and Distribution

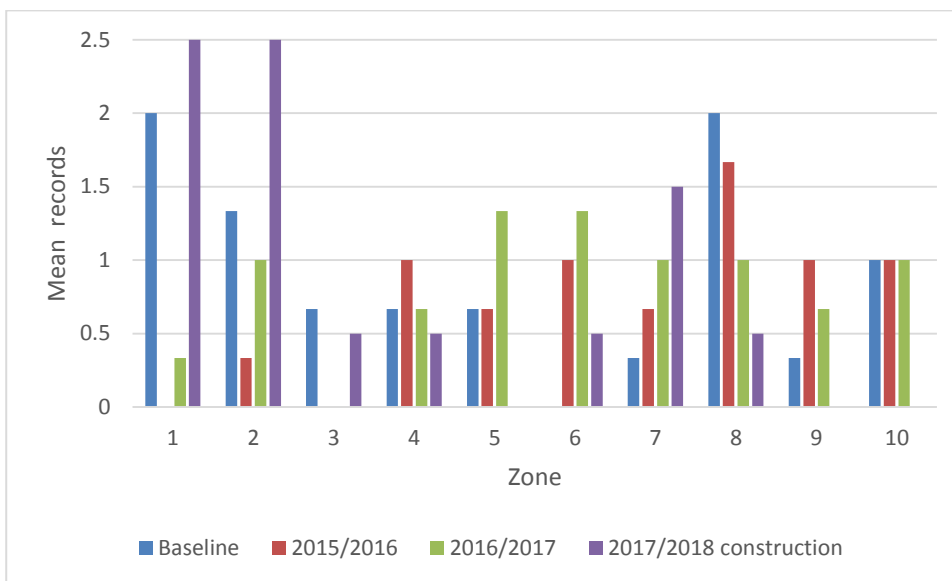
Graph 3 - Graph 8 present the density (annual mean number of Giant Barred Frog records per zone) and distribution of Giant Barred Frog records along the survey transect for each site and each monitoring period. Figure 8 - Figure 13 show the total number of captures within each zone over all monitoring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

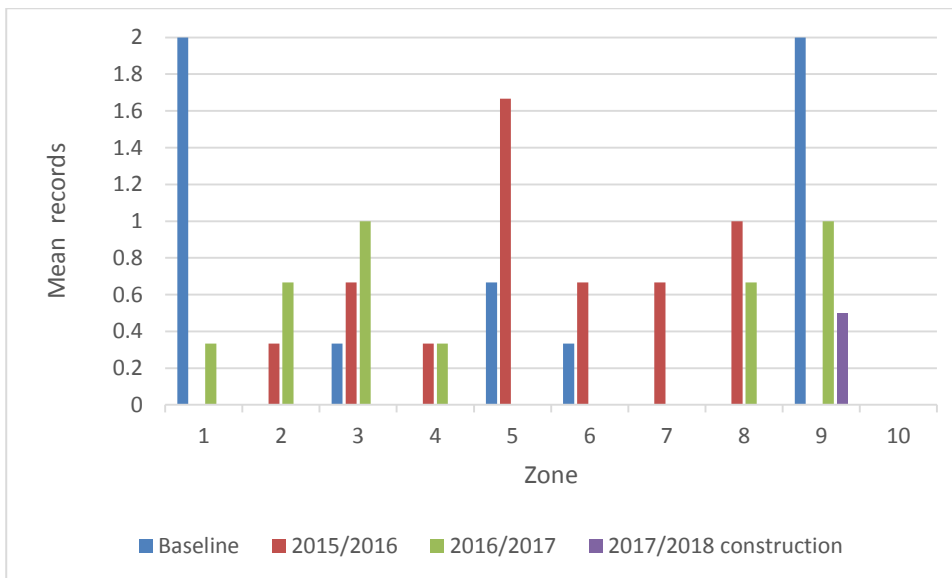
Figure 8 - Figure 13 consider all capture records, whereby capture records (including recaptures) are shown as count ranges, where larger circles indicate larger frog counts. While density data indicates that frog distribution along the transects varies from year to year, when considering all years, 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.



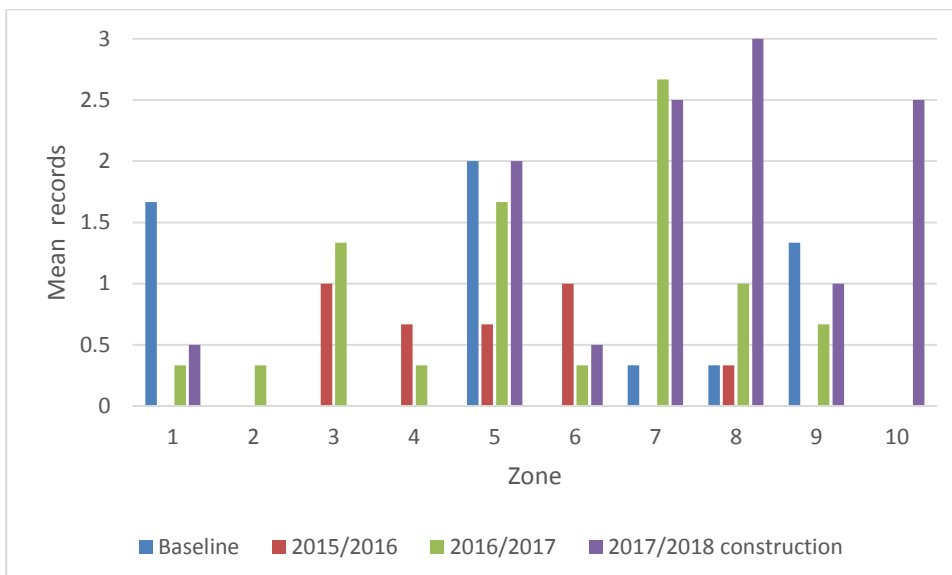
Graph 3: Cooperabung Creek impact site: mean number of Giant Barred Frogs per zone



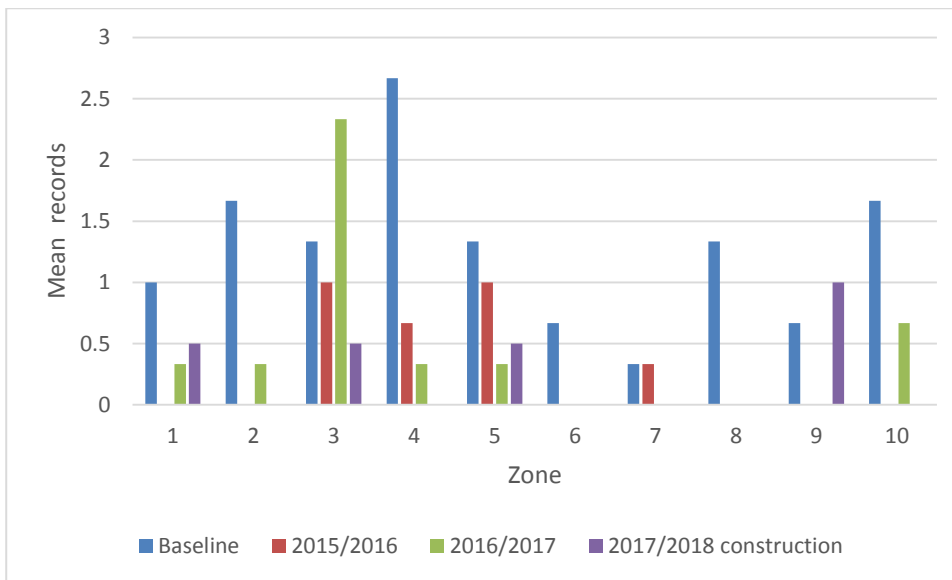
Graph 4: Smiths Creek impact site: mean number of Giant Barred Frogs per zone



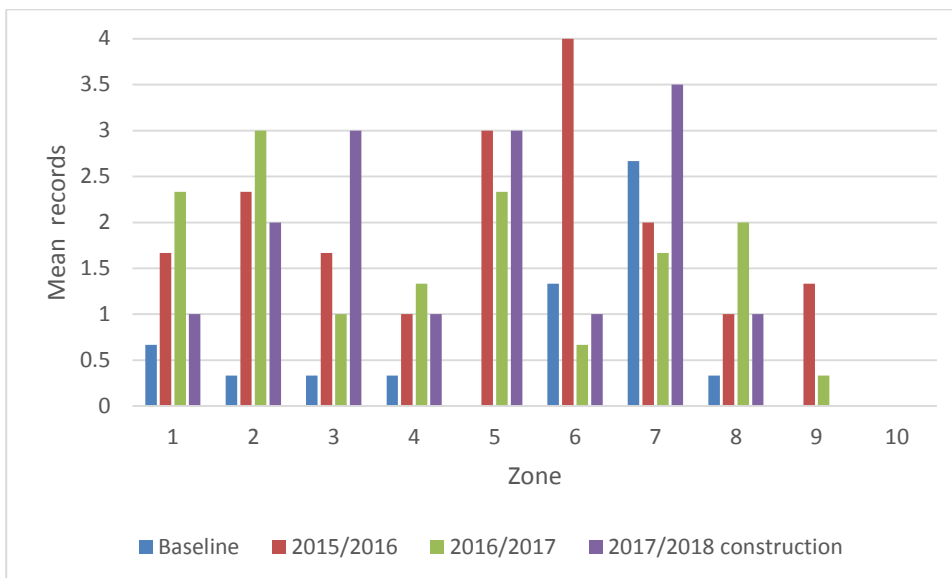
Graph 5: Pipers Creek impact site: mean number of Giant Barred Frogs per zone



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

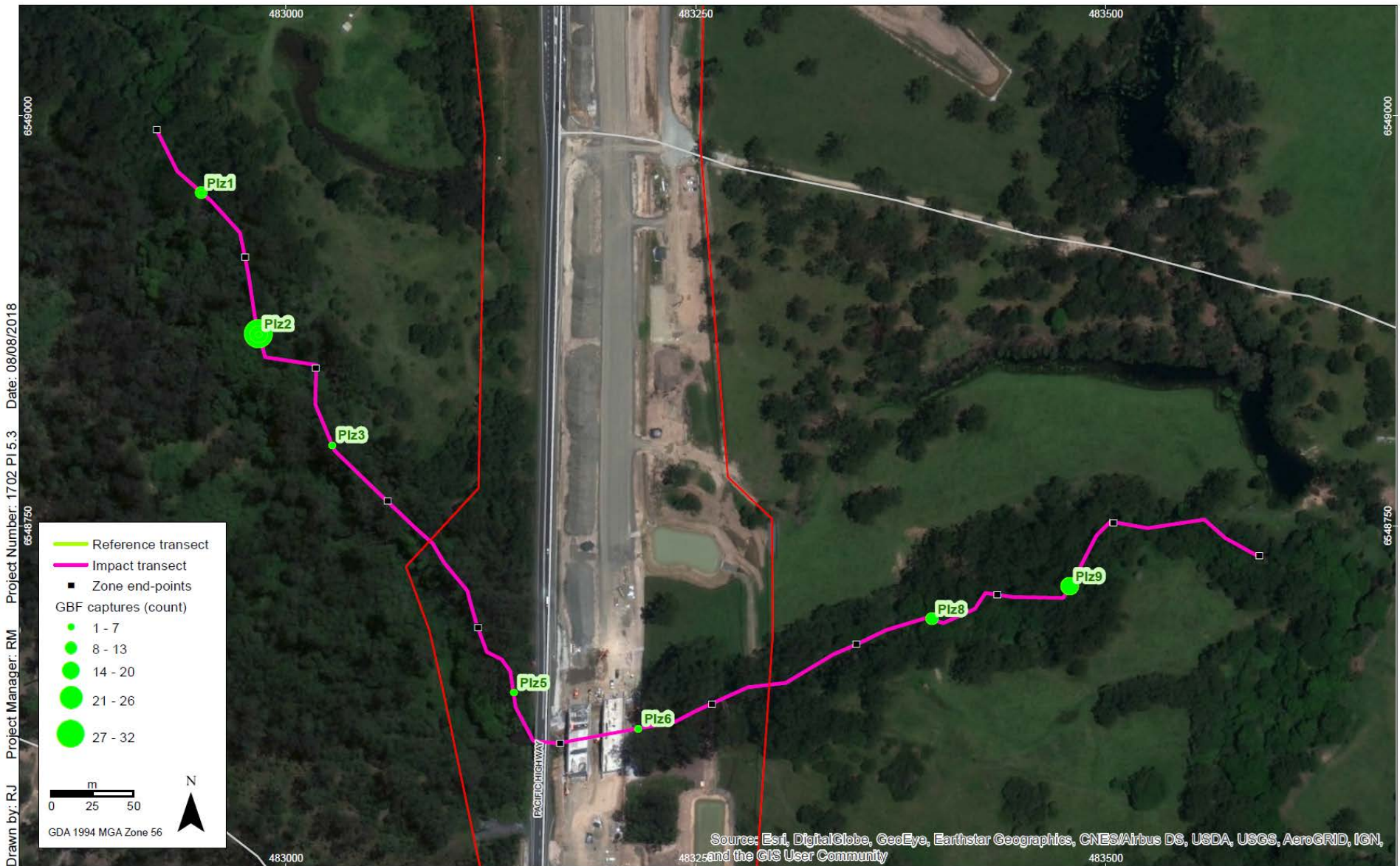


Giant Barred Frog capture distribution: Cooperabung Creek impact site
Pacific Highway Upgrade - Oxley Highway to Kempsey



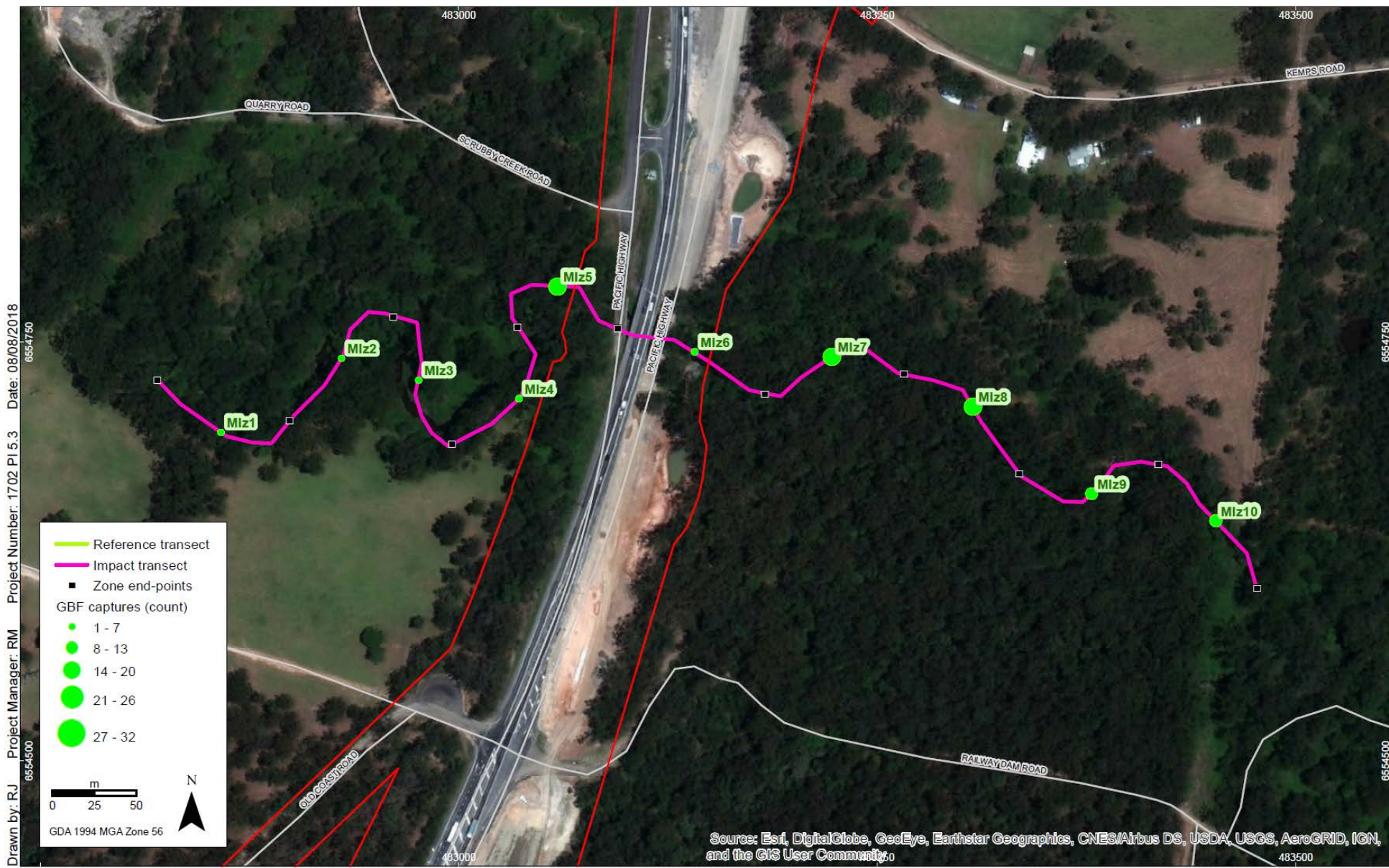
Giant Barred Frog capture distribution: Smiths Creek impact site
Pacific Highway Upgrade - Oxley Highway to Kempsey

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





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

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

FIGURE 12
Imagery: (c) DigitalGlobe





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.

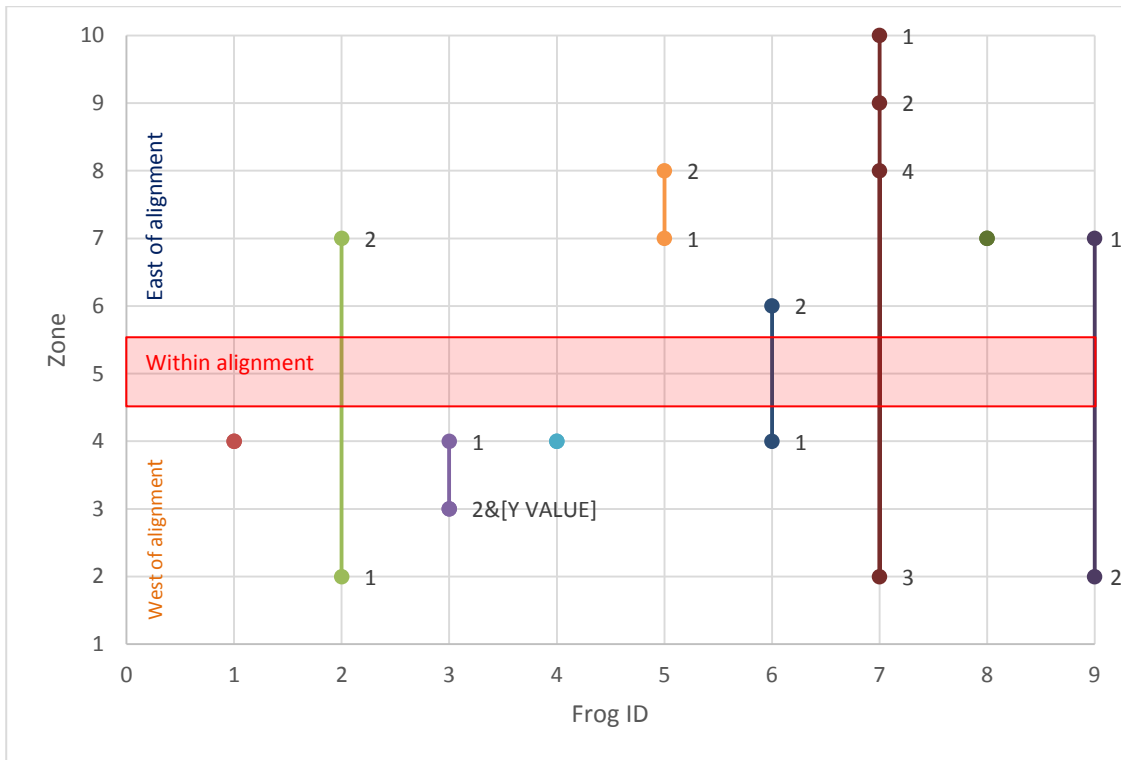
Pipers Creek impact site: Eleven Giant Barred Frogs have been recaptured over all monitoring periods. Of these individuals, three (27%) have been captured on opposite sides of the carriageway.

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.

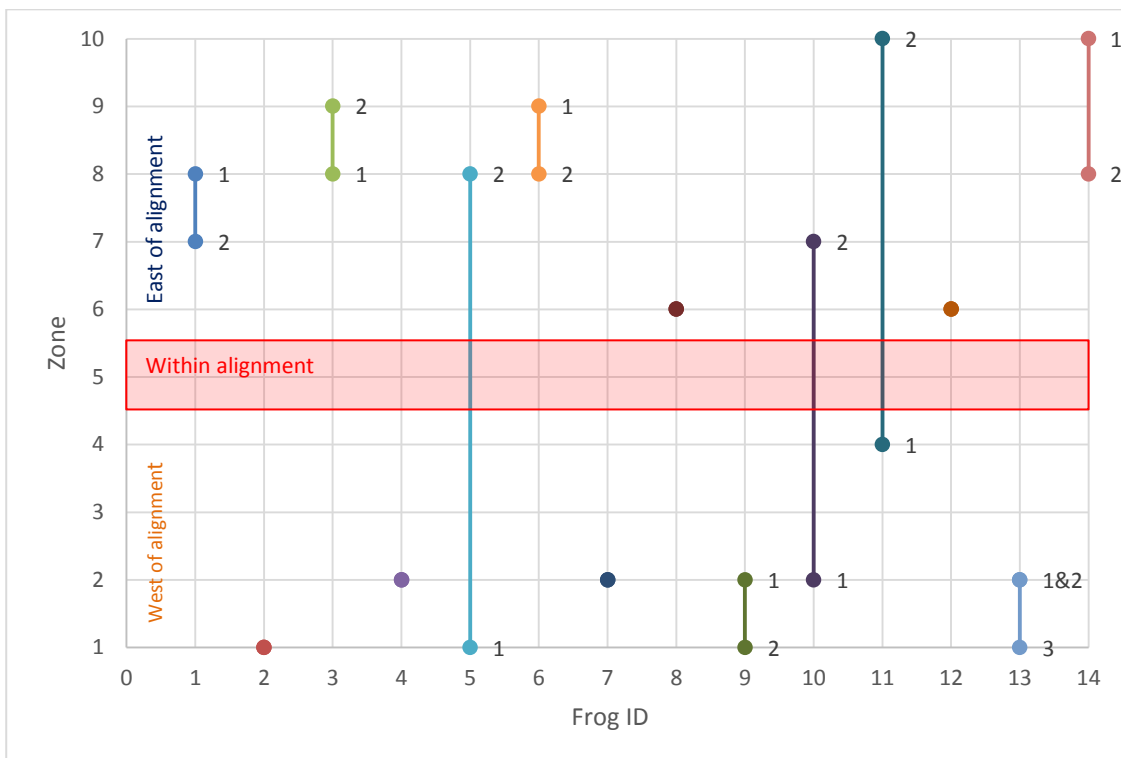
Cooperabung Creek reference site: Eight Giant Barred Frogs have been recaptured over all monitoring periods. Of these individuals, two (25%) have been captured on opposite sides of the transect midpoint.

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.

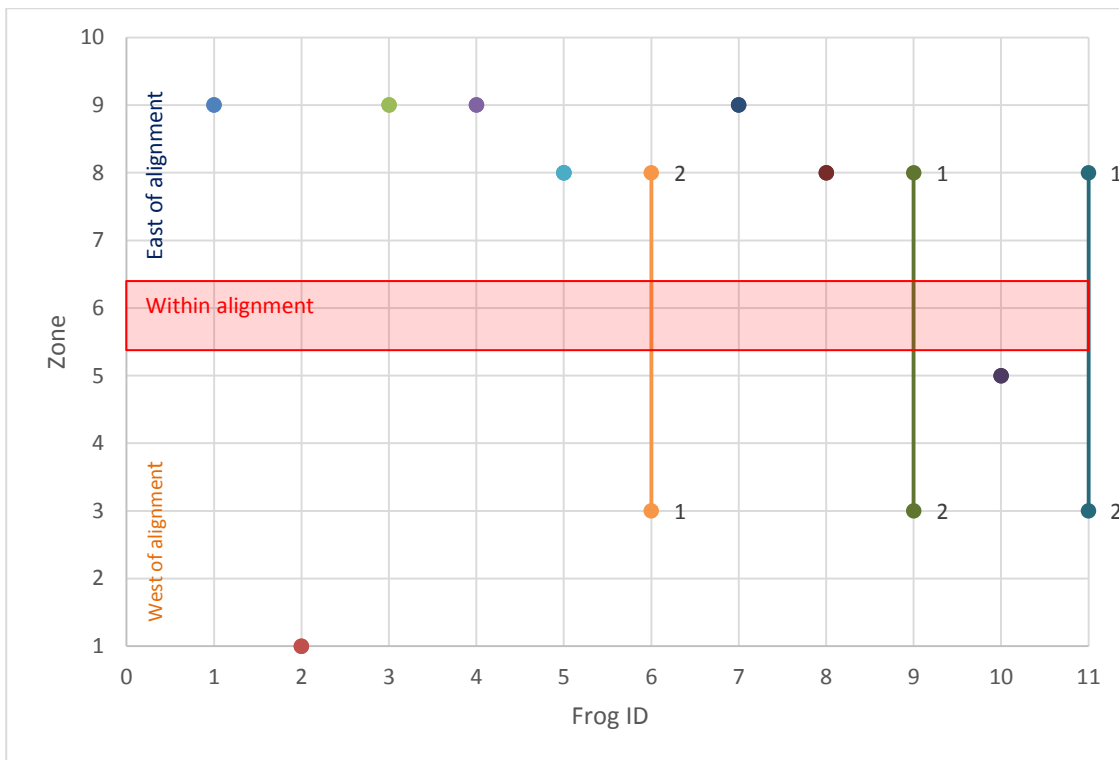
At the impact sites, while the monitored waterways continue uninterrupted under the carriageway, there is a distinct change in streamside vegetation within the area immediately under the carriageway. At all impact sites streamside vegetation ranges from completely absent to very limited, represented 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.



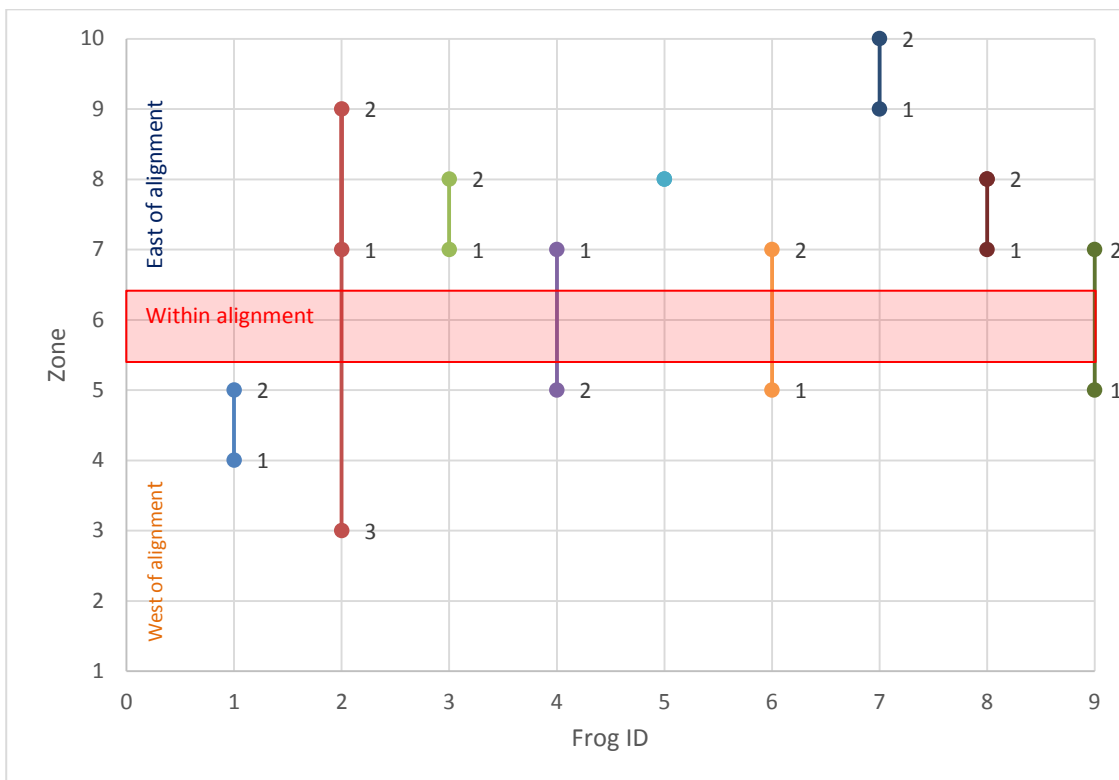
Graph 9: Cooperabung Creek Impact site: recapture movement patterns



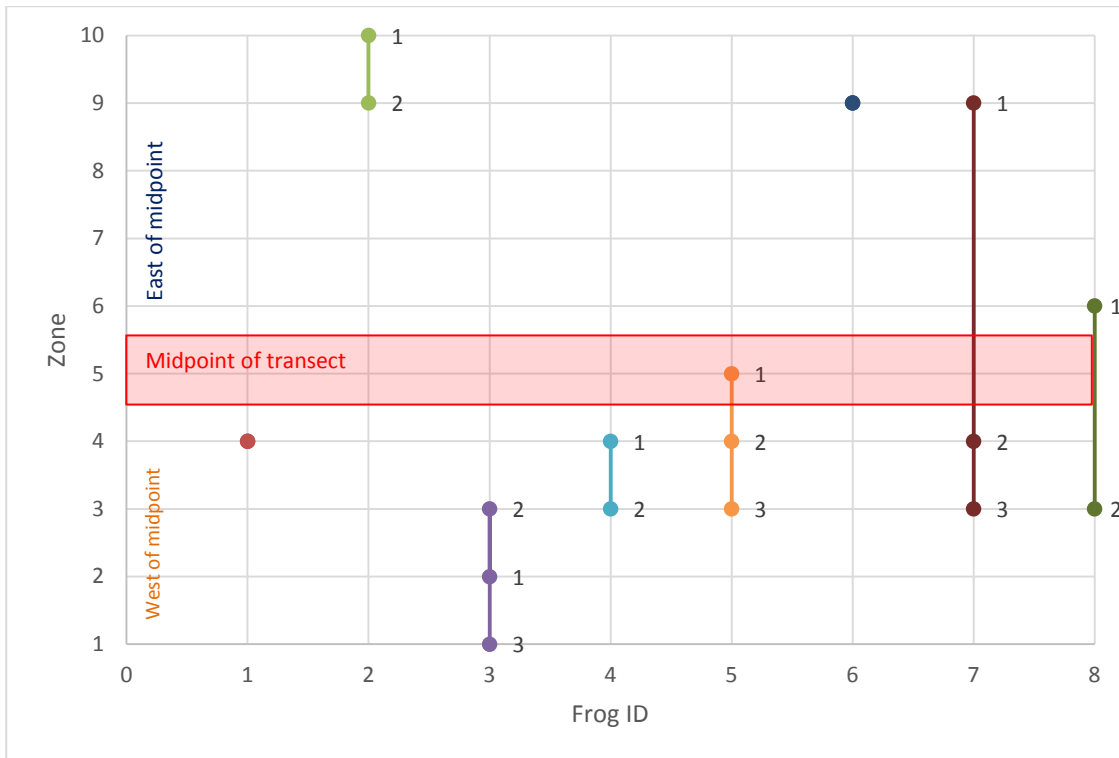
Graph 10: Smiths Creek Impact site: recapture movement patterns



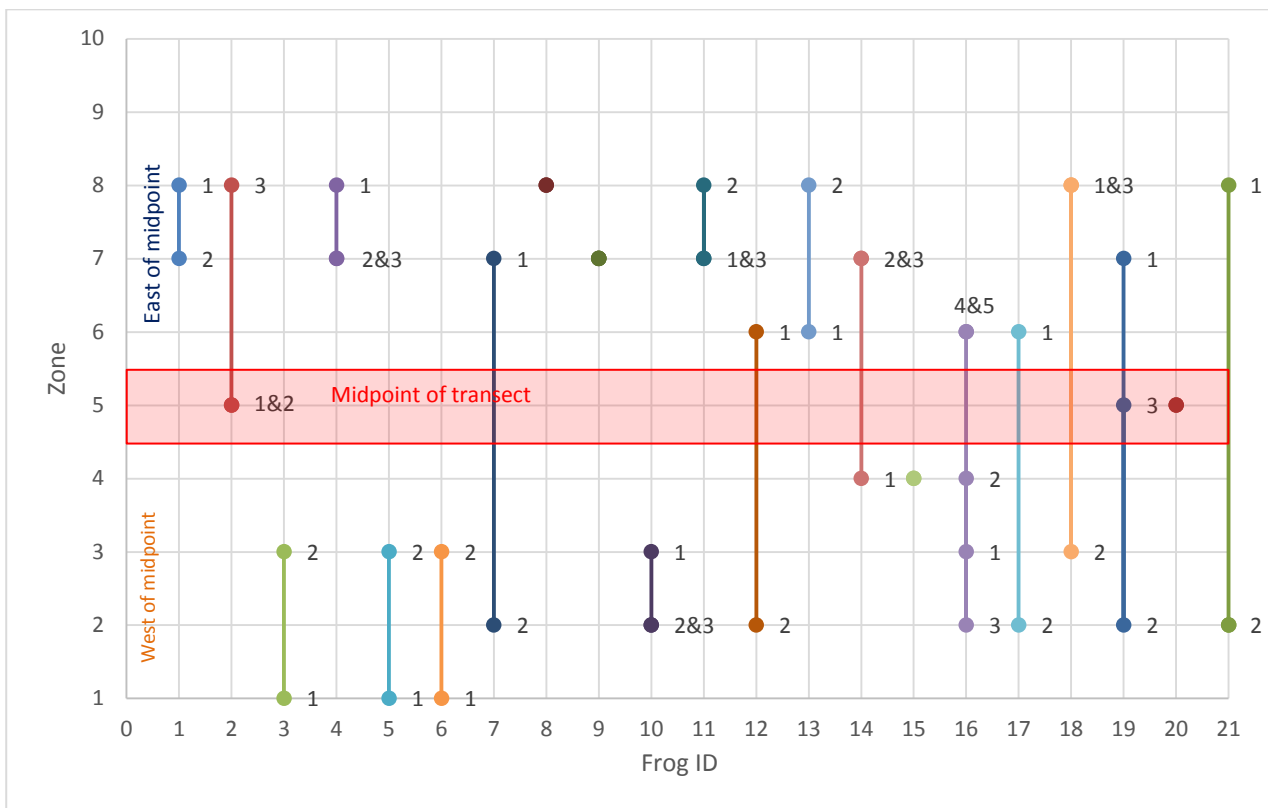
Graph 11: Pipers Creek Impact site: recapture movement patterns



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 80th percentile) or was below (below the 20th 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 80th 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 80th 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 80th and 20th 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 80th and 20th 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.	This performance measure has been met for Baseline, Year 1 (2015/2016), Year 2 (2016/2017) and Year 3 (2017/2018). 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.	This performance measure has been met for Year 1 (2015/2016), Year 2 (2016/2017) and Year 3 (2017/2018). 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.	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). 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.	This performance measure has been met for all parameters except 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>
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.	This performance measure has been met for all sites except Pipers Creek impact site and Cooperabung Creek impact site. 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>This contingency measure is not yet considered relevant.</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>This performance measure has been met for 5 of 6 sites in Year 3 (2017/2018).</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>This performance measure has been met for all parameters except turbidity at Cooperabung Creek.</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.

References

DECC 2008. Department of Environment and Climate Change (NSW). Hygiene protocol for the control of disease in frogs. Information Circular Number 6. DECC (NSW), Sydney South.

Kruger, K.M. & Hero, J.M. (2007). Large-scale seasonal variation in the prevalence and severity of chytridiomycosis. *Journal of Zoology* 271: 352-359.

Lend Lease (2014). Construction Flora and Fauna Management Sub-Plan: Oxley Highway to Kundabung. Prepared by Lend Lease for the Roads and Maritime Service, Sydney.

Lewis (2013). Pacific Highway Upgrade: Oxley Highway to Kempsey Giant Barred Frog Management Strategy. Prepared for Roads and Maritime Services by Lewis Ecological Surveys.

MacDonnell Dowell OHL JV (2014). Construction Flora and Fauna Management Sub-Plan: Kundabung to Kempsey. Prepared by MacDonnell Dowell OHL JV for the Roads and Maritime Service, Sydney.

Niche (2015a). Giant Barred Frog monitoring: 2015 Autumn survey – Oxley Highway to Kempsey, Pacific Highway Upgrade. Report prepared for Roads and Maritime Services by Niche Environment and Heritage Pty Ltd.

Niche (2015b). Giant Barred Frog monitoring: Baseline Surveys – Oxley Highway to Kempsey, Pacific Highway Upgrade. Report prepared for Roads and Maritime Services by Niche Environment and Heritage Pty Ltd.

Niche (2016). Giant Barred Frog monitoring: 2015/2016 – Oxley Highway to Kempsey, Pacific Highway Upgrade. Report prepared for Roads and Maritime Services by Niche Environment and Heritage Pty Ltd.

Niche (2017). Giant Barred Frog monitoring: 2016/2017 – Oxley Highway to Kempsey, Pacific Highway Upgrade. Report prepared for Roads and Maritime Services by Niche Environment and Heritage Pty Ltd.

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.

RMS (2018). Oxley Highway to Kempsey Upgrade Project Construction water quality monitoring report - 22 July 2017 to 29 March 2018. Roads and Maritime Services NSW.

Sutherland, W. (2006). *Ecological Census Techniques: a Handbook*, Cambridge University Press, Cambridge.

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	000791AEB A3	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 th % - 80 th %)							
		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 = < 20th % Values in red = > 80th % Shaded cells = outside/above ANZECC trigger

Table 28: Triggered water quality parameters: Smiths Creek

Parameter	ANZECC trigger value	Median DS (US 20 th % - 80 th %)							
		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 = < 20th % Values in red = > 80th % Shaded cells = outside/above ANZECC trigger

Table 29: Triggered water quality parameters: Pipers Creek

Parameter	ANZECC trigger value	Median DS (US 20 th % - 80 th %)							
		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 = < 20th % Values in red = > 80th % Shaded cells = outside/above ANZECC trigger

Table 30: Triggered water quality parameters: Maria River

Parameter	ANZECC trigger value	Median DS (US 20 th % - 80 th %)							
		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 = < 20th % Values in red = > 80th % Shaded cells = outside/above ANZECC trigger

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PO Box W36 Parramatta NSW 2150
Email: info@niche-eh.com

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Appendix D Squirrel Glider



Squirrel Glider Monitoring 2018

Oxley Highway to Kempsey, Pacific Highway Upgrade

Prepared for Roads and Maritime Services

September 2018

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Niche Environment and Heritage

Excellence in your environment.
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Head Office

Level 1, 460 Church Street
Parramatta NSW 2150
All mail correspondence to:
PO Box 2443
North Parramatta NSW 1750
Phone: **02 9630 5658**
Email: **info@niche-eh.com**

Locations

Sydney
Central Coast
Illawarra
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Cover photograph: Squirrel Glider in Ballengara State Forest

Executive summary

Context

This report documents findings for the 2018 monitoring period, the first of three monitoring periods for the Squirrel Glider (*Petaurus norfolcensis*), 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 Squirrel Glider is one of the threatened species identified as requiring monitoring during the operational phase of the Oxley Highway to Kempsey (OH2K) Pacific Highway Upgrade.

Aim

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

Method

Monitoring sites were established in four broad areas. Each site consisted of an impact site with a paired control site. Surveys were undertaken in accordance with the EMP and involved arboreal trapping for four consecutive nights using 20 Elliot B traps deployed at each control and impact site over approximately two hectares of habitat. Traps were baited with a mixture of oats, honey and peanut butter.

Key Results

No Squirrel Gliders were recorded during the 2018 monitoring. Species recorded included the Black Rat (*Rattus rattus*), Bush Rat (*Rattus fuscipes*) and Brown Antechinus (*Antechinus stuartii*).

Conclusion

Monitoring was undertaken after completion of the Project at both impact and monitoring sites and capture results revealed no difference between impact and control sites (no captures). All performance measures have been met for the 2018 monitoring period.

Management implications

Given that no Squirrel Gliders have been previously recorded within the Project area and monitoring to date has also been unsuccessful at detecting this species, there are no recommendations based on the outcomes of the 2018 monitoring period.

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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 Squirrel Glider (*Petaurus norfolcensis*) 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 Squirrel Glider is listed as vulnerable under the New South Wales *Biodiversity Conservation Act 2016* (BC 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 Squirrel Glider monitoring program are specified in the EMP. The EMP requires monitoring of the Squirrel Glider on three occasions in total: between April and August in Years 4, 6 and 8, after the completion of construction. This represents the first of the three monitoring periods – year 4, winter 2018.

1.1.3 Baseline Data

While the EMP notes that the Squirrel Glider has not been identified within the Project area, the environmental assessment considered the species as highly likely to occur in the area (GHD 2010, GHD 2011). Baseline surveys (not required by the EMP) were undertaken by Niche in autumn 2014 (Niche 2015). No Squirrel Gliders were recorded during those baseline surveys.

1.1.4 Purpose of this Report

This report details the findings obtained from the first monitoring period for the Squirrel Glider. The aims of this report are to summarise the methods and results of the 2018 monitoring and determine if performance measures have been met, as per the EMP.

1.2 Performance Measures

The EMP specifies the following performance measures for the Squirrel Glider:

- *Monitoring is undertaken after the construction of the upgrade.*
- *Monitoring is undertaken at Impact and Control sites.*
- *There is no significant difference between in presence of Squirrel Glider between Impact and Control sites during the operation phase of the Project.*

1.3 Monitoring Timing

Monitoring is to occur annually between April and August, ideally in gaps in flowering resource availability.

1.4 Reporting

As per the EMP, the 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.

1.5 Limitations

The performance measure specifies: *“no significant difference between in presence of Squirrel Glider between Impact and Control sites during the operation phase of the Project”*. Undertaking statistical analysis of trapping results to determine a statistically significant difference between control and impact sites would require a high trapping success rate to achieve reasonable sample sizes and sufficient statistical power. In the absence of high trapping success, statistical analyses cannot be undertaken.

2. Methodology

2.1 Monitoring Sites

Monitoring sites were established within four broad areas containing Moist Slopes Forest and Dry Ridgetop Forest habitat, where the species was considered likely to occur (GHD 2010, GHD 2011). They included:

- Cairncross State Forest: Site 1
- Ballengarra State Forest South: Site 2
- Ballengarra State Forest North: Site 3
- Maria River State Forest: Site 4

Each site consisted of an impact site and a paired control site. Control sites were located a minimum of 500 metres to one kilometre, where access permitted, from the paired impact site within continuous vegetation. Trap locations are shown in Figure 1 - Figure 5.

2.2 Survey Method

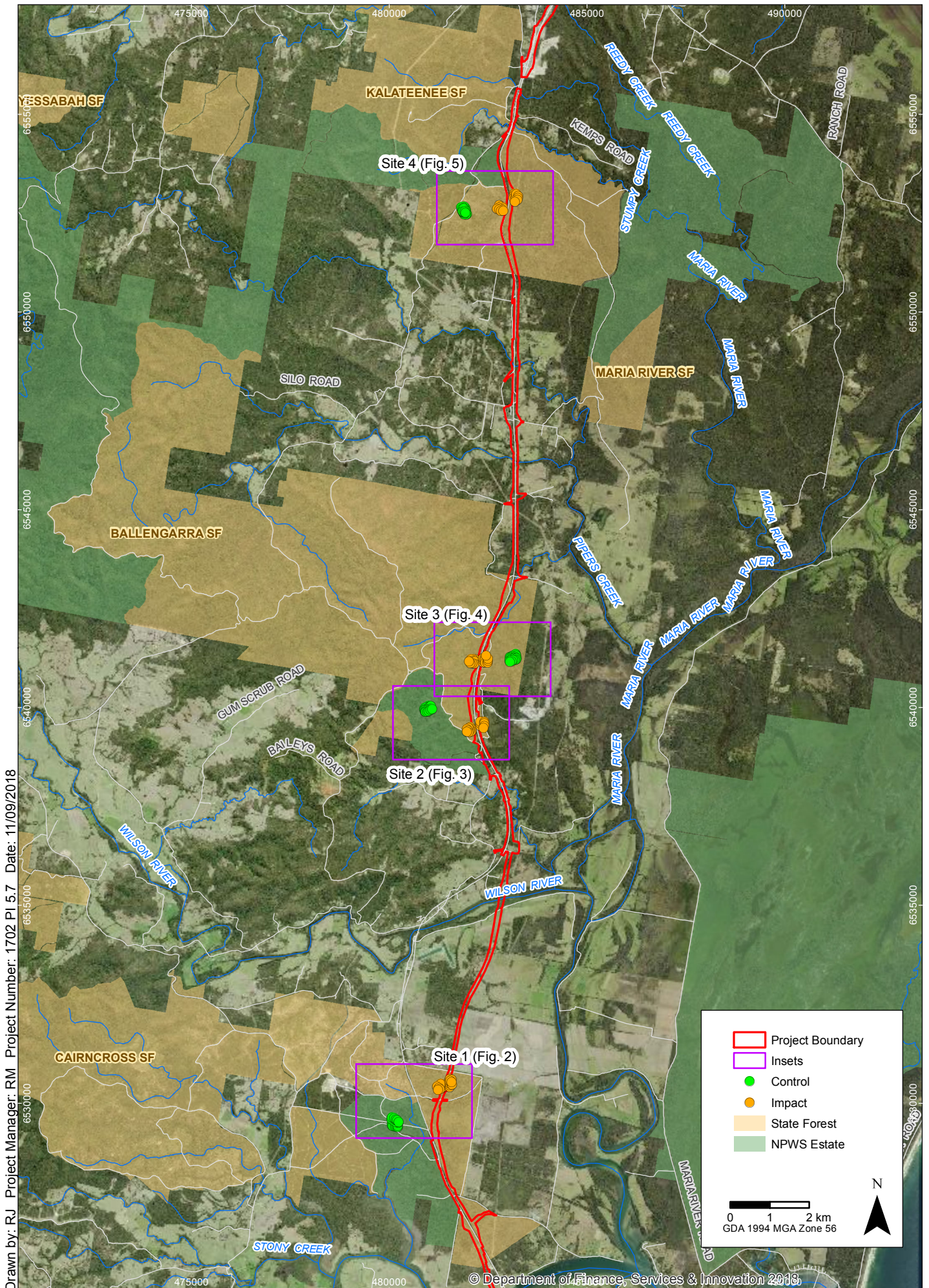
In accordance with the EMP, arboreal trapping was undertaken using a grid configuration of 20 tree-mounted Elliot B traps distributed over approximately two hectares of habitat for four consecutive nights at each control and each impact site. At impact sites, 10 traps were deployed on either side of the carriageway. Traps were positioned on brackets and installed approximately two to three metres above the ground on a range of mature canopy species and baited with a mixture of oats, peanut butter and honey. The host tree was sprayed with a mixture of honey water above the trap as an additional attractant. Traps were checked each morning and bait was replaced as necessary.

The following details were recorded for any captured fauna where this could be determined with minimal animal handling:

- Trap location
- Sex
- Age class
- Mass
- Breeding condition.

2.3 Analysis

Monitoring results were analysed in accordance with the performance indicators specified within the EMP. However, as discussed in Section 1.5, undertaking statistical analysis of trapping results to determine a statistically significant difference between control and impact sites requires a relatively high trapping success rate to achieve reasonable sample sizes and sufficient statistical power. Trapping success was not sufficient during the current surveys to allow for such analysis. As such, trapping results are presented as capture numbers in this instance.

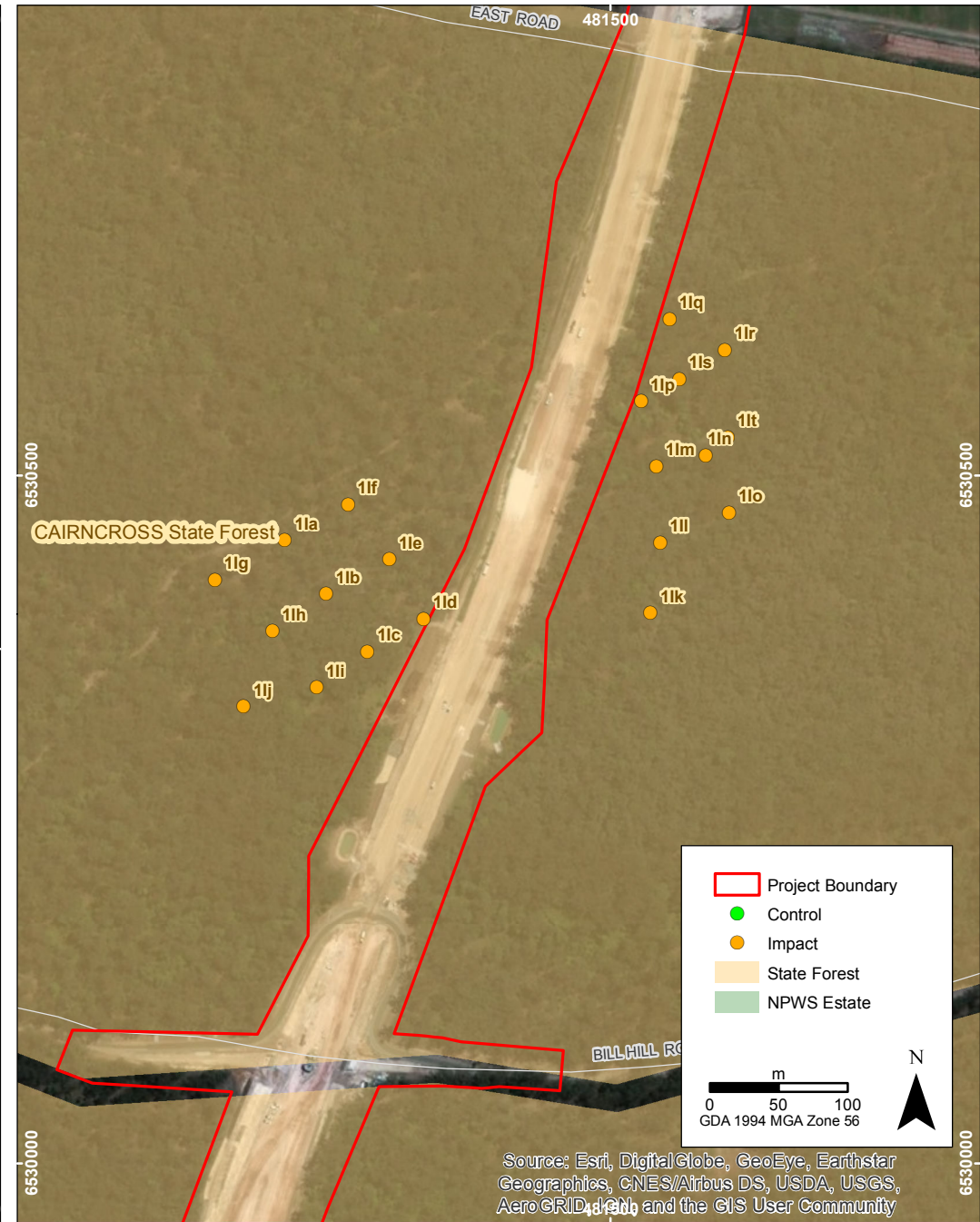


Overview of monitoring sites

Squirrel Glider Monitoring: Pacific Highway Upgrade – Oxley Highway to Kempsey

FIGURE 1

Imagery: (c) LPI 2014-6-10



Cairncross State Forest: Site 1 trap locations
Squirrel Glider Monitoring: Pacific Highway Upgrade – Oxley Highway to Kempsey

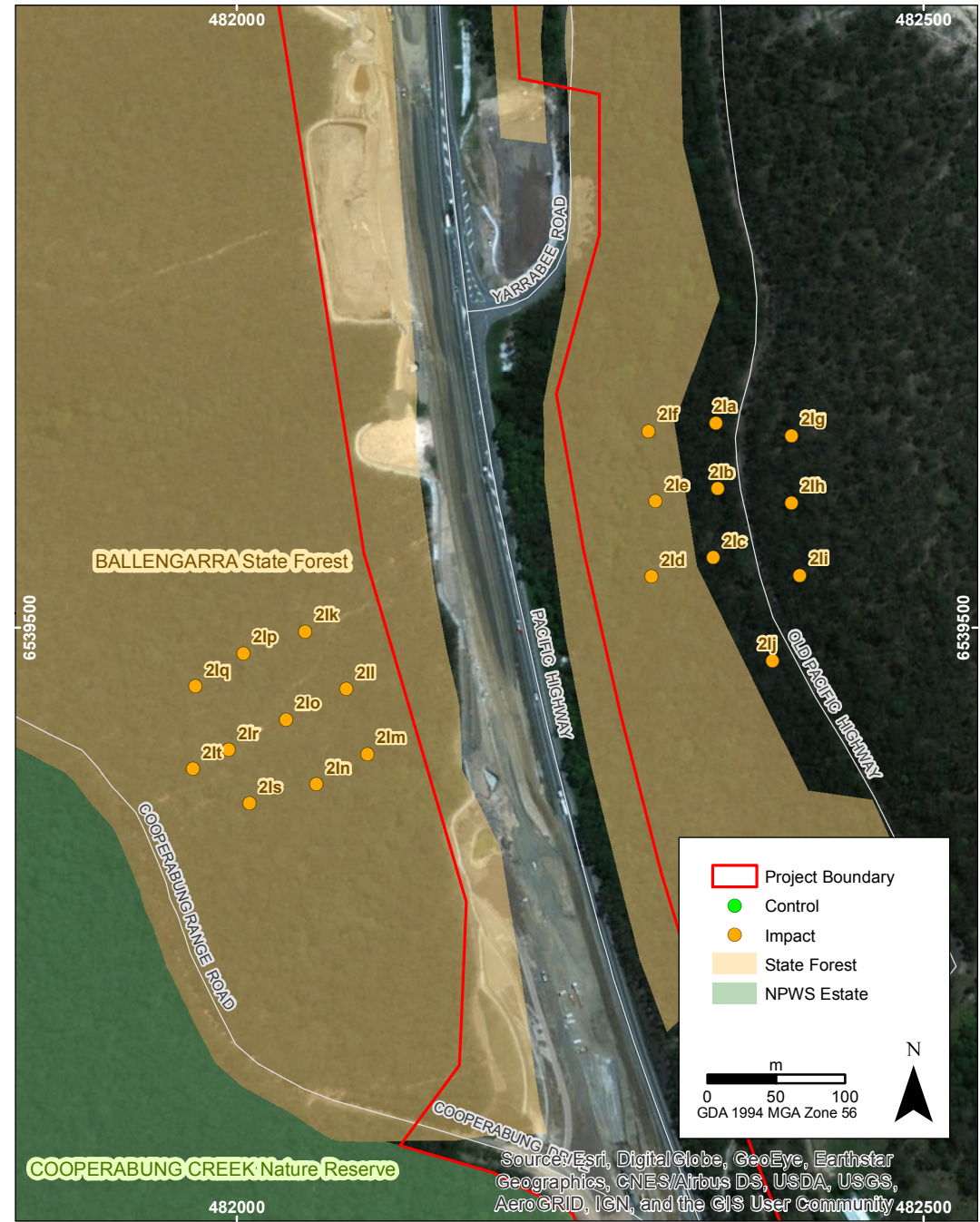
FIGURE 2

Imagery: (c) DigitalGlobe 2015-11-25

Drawn by: RJ Project Manager: RM Project Number: 1702.PI.5.7 Date: 29/08/2018

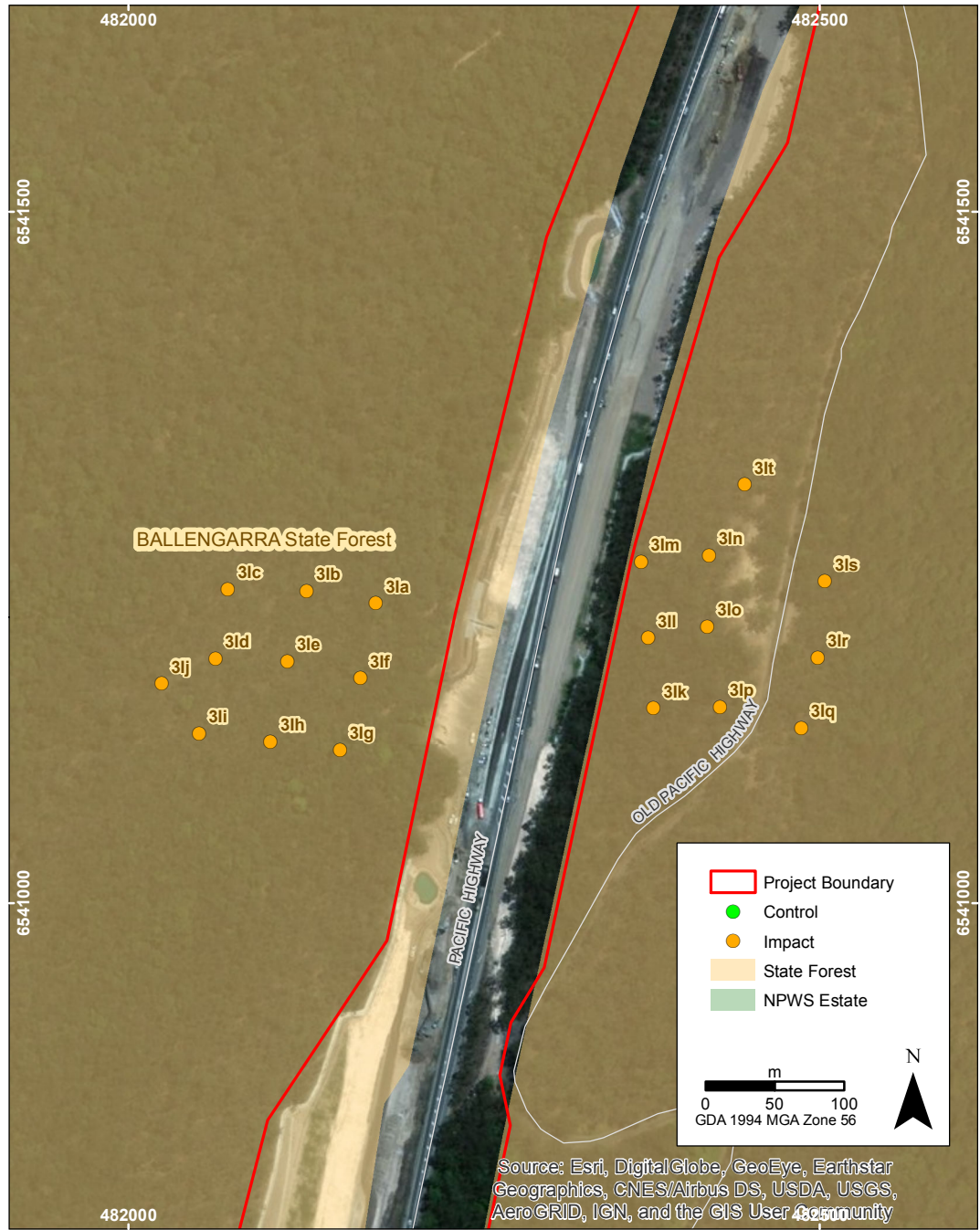
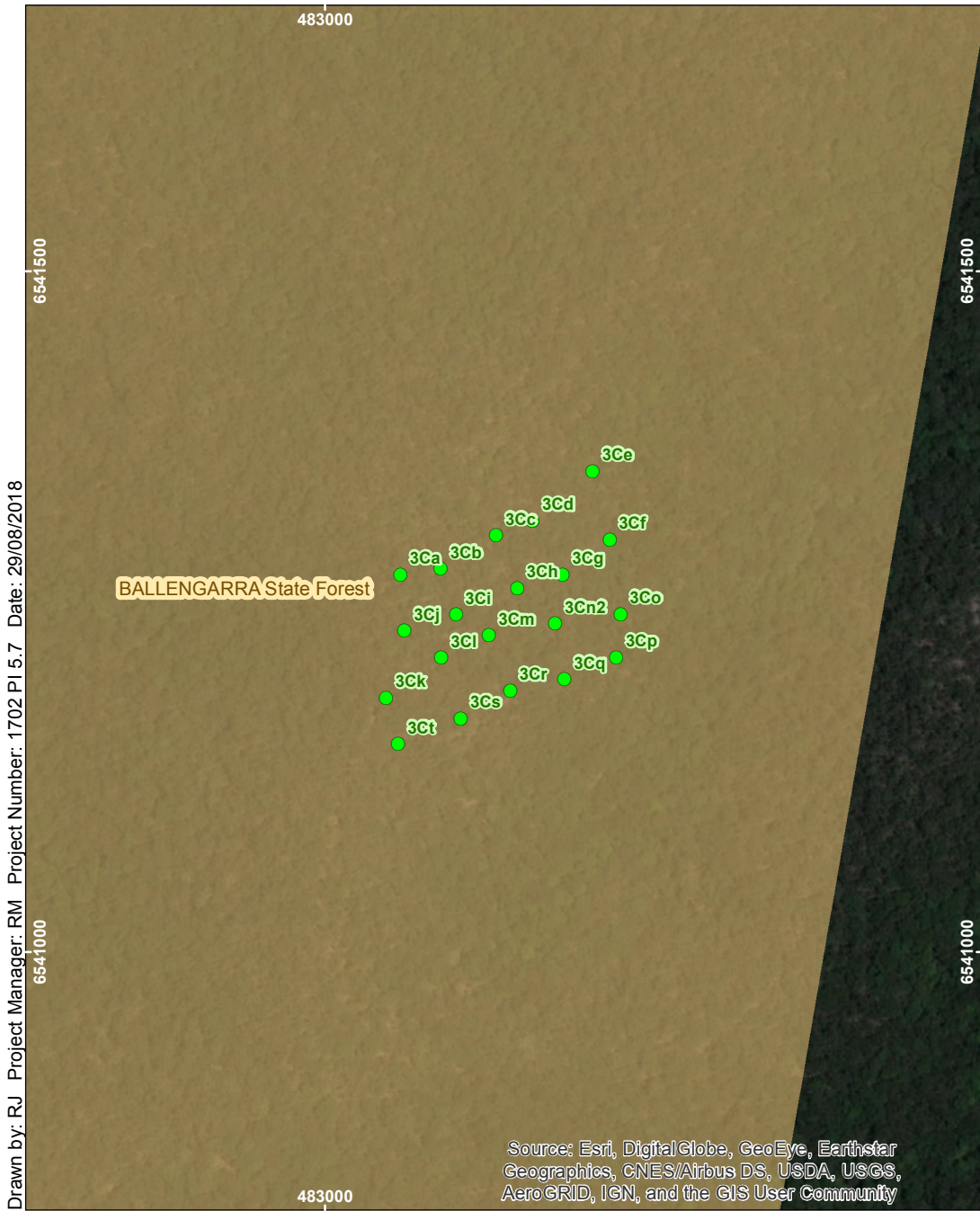


Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

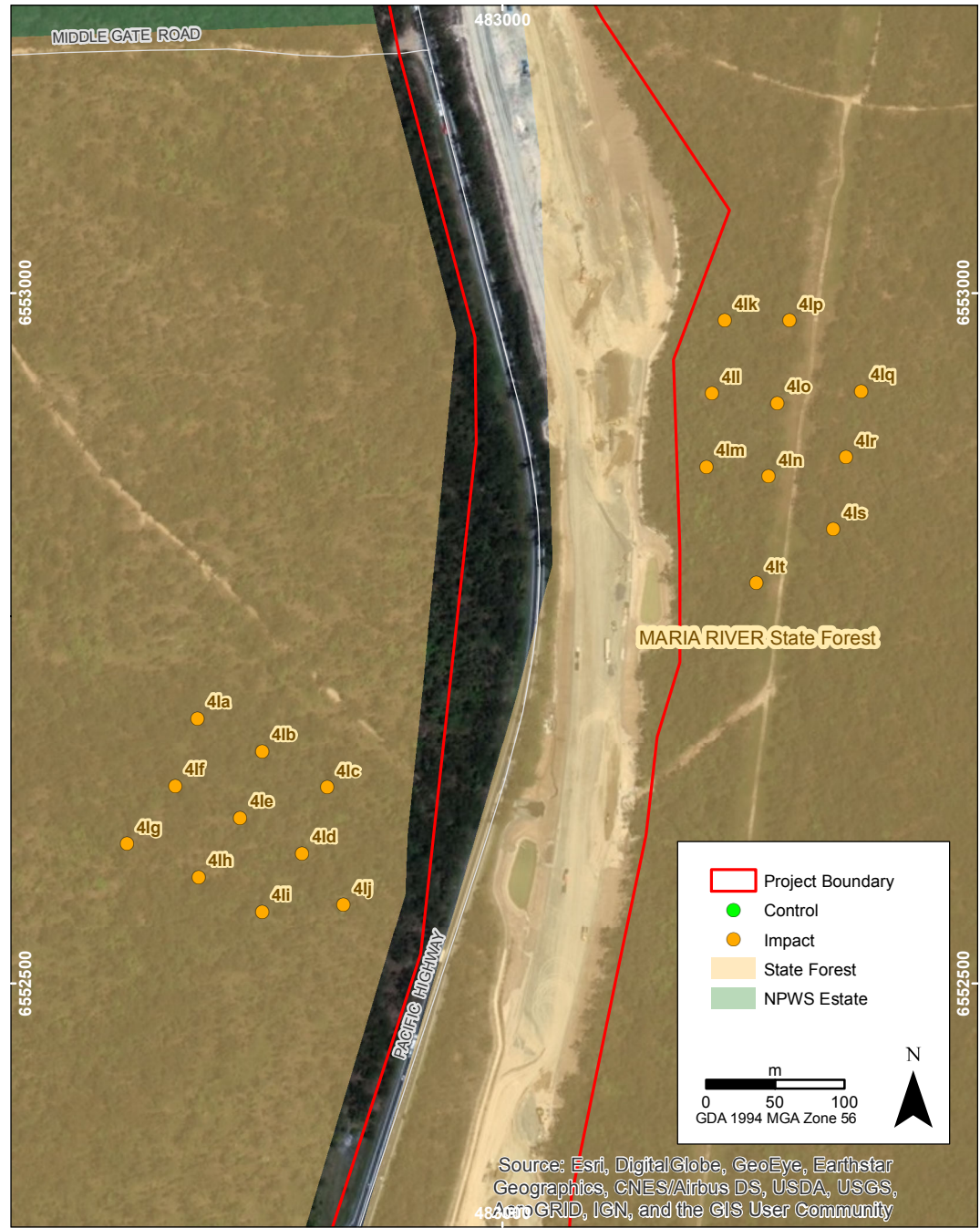
Balengarra State Forest South: Site 2 trap locations
Squirrel Glider Monitoring: Pacific Highway Upgrade – Oxley Highway to Kempsey



Ballengarra State Forest North: Site 3 trap locations
 Squirrel Glider Monitoring: Pacific Highway Upgrade – Oxley Highway to Kempsey

FIGURE 4

Imagery: (c) DigitalGlobe 2015-11-25



Project Boundary
● Control
● Impact
 State Forest
 NPWS Estate

0 50 100
 m
 GDA 1994 MGA Zone 56

N

Maria River State Forest: Site 4 trap locations
 Squirrel Glider Monitoring: Pacific Highway Upgrade – Oxley Highway to Kempsey

3. Results

3.1 Timing and Conditions

Trapping was undertaken from 2 July-7 July 2018 for Sites 1 and 4 and from 9 July-13 July 2018 for Sites 2 and 3. Due to time and weather constraints, the Site 1 control site was deployed and retrieved a day later than the impact site. Table 1 shows the weather conditions recorded at Port Macquarie Airport (station ID 060139).

Table 1: Weather conditions 2018

Date range	Min temp (°C)	Max temp (°C)	Rainfall (mm)
2/7/18 – 7/7/18	8.4	24.7	76
9/7/18 – 13/7/2018	5.3	19.7	0

3.2 Trapping Results

Results of the trapping are presented in Table 2 and are summarised in Table 3.

No Squirrel Gliders were captured during the 2018 monitoring period. A total of three species were recorded including the native Brown Antechinus (*Antechinus stuartii*), including male and female pairs in the same trap on two occasions at Site 1 (impact) and Site 2 (impact) and Bush Rat (*Rattus fuscipes*) and the introduced Black Rat (*Rattus rattus*).

Site 1 had the highest number of captures (14), most of these (13) occurred at the impact site and consisted of eight Antechinus and five Black Rats; only one Antechinus was recorded at the control site. Five individuals were recorded at Site 3 (one at the impact site and four at the control site) all of which were native species. Sites 2 and 4 had the lowest number of captures (one each) – only one individual Black Rat at the site 4 control site and one Brown Antechinus at the Site 2 impact site.

Table 2: 2018 arboreal trapping results.

Site	Date	Site type	SOC	Trap ID	Species	Sex	Age
1	07/07/2018	Control	W	1Ck	<i>Antechinus stuartii</i>	M	adult
1	03/07/2018	Impact	W	1lc	<i>Rattus rattus</i>	F	adult
1	04/07/2018	Impact	W	1lj	<i>Rattus rattus</i>	M	adult
1	05/07/2018	Impact	W	1lj	<i>Rattus rattus</i>	unk	adult
1	04/07/2018	Impact	E	1lk	<i>Antechinus stuartii</i>	M	adult
1	05/07/2018	Impact	E	1lo	<i>Antechinus stuartii</i>	unk	adult
1	03/07/2018	Impact	E	1lp	<i>Antechinus stuartii</i>	M	adult
1	04/07/2018	Impact	E	1lp	<i>Rattus rattus</i>	F	adult
1	05/07/2018	Impact	E	1lp	<i>Antechinus stuartii</i>	unk	adult
1	04/07/2018	Impact	E	1lq	<i>Antechinus stuartii</i>	F	adult
1	06/07/2018	Impact	E	1lq	<i>Rattus rattus</i>	F	adult
1	06/07/2018	Impact	E	1lr	<i>Antechinus stuartii</i>	M&F	adult
1	04/07/2018	Impact	E	1ls	<i>Antechinus stuartii</i>	M	adult
1	06/07/2018	Impact	E	1lt	<i>Antechinus stuartii</i>	M	adult

2	12/07/2018	Impact	W	2Ir	<i>Antechinus stuartii</i>	M&F	adult
3	13/07/2018	Control	E	3Cb	<i>Antechinus stuartii</i>	unk	adult
3	13/07/2018	Control	E	3Co	<i>Antechinus stuartii</i>	unk	adult
3	13/07/2018	Control	E	3Cp	<i>Antechinus stuartii</i>	M	adult
3	12/07/2018	Control	E	3Cq	<i>Antechinus stuartii</i>	unk	adult
3	12/07/2018	Impact	E	3le	<i>Rattus fuscipes</i>	unk	adult
4	04/07/2018	Control	W	4Co	<i>Rattus rattus</i>	M	young adult

SOC = side of carriageway; E = east of carriageway; W = west of carriageway; M = male; F = female, unk = unknown

Table 3: Capture summary

Site	Site type	Squirrel Gliders	Total Captures	Number of species
1	Impact	0	13	2
	Control	0	1	1
2	Impact	0	1	1
	Control	0	0	0
3	Impact	0	1	1
	Control	0	4	1
4	Impact	0	0	0
	Control	0	1	1

3.3 Additional Data

Hair tubes

As part of the Project’s monitoring requirements for the Brush-tailed Phascogale, hair tube surveys were undertaken at the same sites during the same survey period. Hair tube results showed evidence of *Rattus* spp. (rodents) and the Common Brushtail Possum (*Trichosurus vulpecula*) (data not yet reported on).

Nest boxes

Squirrel Gliders are known to occur within about one kilometre of Sites 1, 2 and 4 having been recorded during inspections of installed nest boxes in 2017 (Niche 2018a) and 2018 (Niche 2018b). Squirrel Gliders were observed occupying nest boxes in the Maria River State Forest, approximately 700 metres south of Site 4; in Ballengarra State Forest, approximately 500 m south of Site 2; and in Cairncross State Forest, approximately one kilometre south of Site 1.

4. Discussion

4.1 Performance Measures

A summary of the 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 after construction of the upgrade.	This performance measure has been met for 2018. The final stage of the Project became operational on 29 March 2018. The first round of monitoring has been undertaken as per the EMP.
Monitoring is undertaken at Impact and Control sites.	This performance measure has been met for 2018. Impact and Control sites were established and monitored.
There is no significant difference in presence of Squirrel Glider between Impact and Control sites during the operation phase of the project.	This performance measure has been met for 2018. No Squirrel Gliders were recorded at either the control or impact sites in 2018, therefore there is no apparent difference between impact and control sites at this stage.

5. Recommendations

5.1 Contingency Measures/Recommendations

The EMP lists potential problems and contingency measures for various components of the monitoring program, however specific contingency measures for the Squirrel Glider have not been provided within the EMP. Given that no Squirrel Gliders have been previously recorded within the Project area and monitoring has also been unsuccessful at detecting this species at this stage, contingency measures are not considered relevant and, as such, there are no current recommendations based on the outcomes of the 2018 monitoring period.

References

GHD (2010). Oxley Highway to Kempsey Upgrading the Pacific Highway Environmental Assessment. Report prepared by GHD on behalf of RTA, September 2010.

GHD (2011). Pacific Highway Upgrade - Oxley Highway to Kempsey. Supplementary Flora and Fauna Assessment. Report prepared by GHD on behalf of RTA, February 2011.

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.

Niche (2015). Squirrel Glider monitoring, Baseline Autumn 2014 Surveys – Oxley Highway to Kempsey Pacific Highway Upgrade. Prepared by Niche Environment and Heritage Pty Ltd.

Niche (2018a). Contractor Ecological Monitoring report 2017/2018 – Oxley Highway to Kempsey Pacific Highway Upgrade. Prepared by Niche Environment and Heritage Pty Ltd for Roads and Maritime Services, Port Macquarie, NSW

Niche (2018b). Nest box monitoring 2017/2018 - Oxley Highway to Kempsey, Pacific Highway Upgrade. Prepared by Niche Environment and Heritage Pty Ltd for Roads and Maritime Services, Port Macquarie, NSW.

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Head Office

Niche Environment and Heritage

PO Box 2443 North Parramatta NSW 1750

Email: info@niche-eh.com

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Appendix E *Maundia triglochinodes*



Oxley Highway to Kempsey, Pacific Highway Upgrade

Prepared for Roads and Maritime Services

January 2018

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Internal review:	Amanda Griffith
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Radika Michniewicz	R0		21/12/2017
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Cover photograph: *Maundia triglochinos*

Niche Environment and Heritage

A specialist environmental and heritage consultancy.

Head Office

Level 1, 19 Sorrell Street
Parramatta NSW 2150
All mail correspondence to:
PO Box 2443
North Parramatta NSW 1750
Email: info@niche-eh.com

Sydney

0488 224 888

Central Coast

0488 224 999

Illawarra

0488 224 777

Armidale

0488 224 094

Newcastle

0488 224 160

Mudgee

0488 224 025

Port Macquarie

0488 774 081

Brisbane

0488 224 036

Cairns

0488 284 743

Executive summary

Context

This report documents results of the spring 2017 monitoring period for *Maundia triglochinosoides* (Maundia) as required for the Oxley Highway to Kempsey (OH2K) Pacific Highway upgrade project (the Project).

Aim

The aim of the Maundia monitoring program is to determine whether the Project is meeting the performance indicators for the species, and provide corrective actions where required, as required by the Ecological Monitoring Program (EMP) (RMS 2016).

The aim of this report is to provide a summary of the results of the fourth and final monitoring event for this species and provide an overall summary and comparison of all monitoring events in order to determine if performance measures have been met, as per the EMP.

Methods

Three paired 'impact - control' monitoring sites were identified to Niche by Roads and Maritime in February 2015. The method used during the spring 2017 monitoring period was consistent with previous monitoring events. However an additional, more detailed, cover abundance estimate (5% increments) was implemented in the 2015/2016 monitoring period to permit detection of a substantial difference (15% change) in cover abundance, as required by the EMP.

Key results

Maundia was recorded at two of the three impact sites (MI01 and MI02) during the spring 2017 surveys.

Recruitment was observed at MI01. However, it should be noted that water depth and clarity, and density of vegetation at a monitoring site greatly impacts the ability to observe recruiting individuals of the species as the juveniles can be hidden beneath the water's surface and amongst vegetation. As such failure to detect recruiting individuals is not necessarily an indication of the absence of recruitment.

Flowering was not recorded during the 2017 spring surveys.

Conclusions

The Maundia performance measures relating to cover extent and flowering have been met for the spring 2017 monitoring period. Although comparison to pre-impact data is not possible, at the three sites where Maundia has been recorded by Niche, MI01, MC01, MI02, the percent cover abundance is relatively consistent across the monitoring periods (Niche 2015, Niche 2016, Niche 2017 and current report). The substantial differences in flowering recorded between MI01 and MC01 in previous monitoring events cannot be directly attributed to the road impact alone, but more likely are the result of varying environmental conditions between paired control and impact sites.

Sediment control, exclusion fencing and signage was reported to be absent on a number of occasions during the monitoring program.

Management implications

Monitoring of *Maundia* populations has found there to be no adverse impact of the Project on these populations. As such, continued monitoring is not considered necessary.

The occasional absence of mitigation measures during construction could be addressed by improving the process by which these measures are regulated during the construction process in future projects.

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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 1999* (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. *Maundia triglochinos* was one threatened plant species identified as requiring mitigation and monitoring throughout the Projects' construction and post construction periods.

1.1.1 Legal status

Maundia triglochinos (Maundia) is listed as vulnerable under the NSW *Biodiversity Conservation Act 2016* (BC Act) (previously listed under the repealed NSW *Threatened Species Conservation Act 1995* (TSC Act)). Monitoring of the species is required under the Project's approval.

1.1.2 Monitoring framework

The EMP specifies the following regarding monitoring:

"Monitoring would commence in the summer of Year 1 (construction phase) and be undertaken three times a year (summer, autumn and spring) until Year 4 (operation phase) of the Project."

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

- *Summer and autumn 2015*: Niche 2015.
- *Spring 2015, summer and autumn 2016*: Niche 2016.
- *Spring 2016, summer and autumn 2017*: Niche 2017.
- *Spring 2017*: current report.

The spring 2017 survey is the final survey for Maundia, as required by the EMP. This report therefore represents the fourth of four necessary reports for Maundia.

1.1.3 Baseline data

The EMP presents locations within the Project corridor where Maundia was recorded and details the potential impact area of these sub-populations. The EMP states the following:

"Three distinct sub-populations of M. triglochinos were recorded in the project area (Table 20)." These populations are listed below in Table 1. Three paired 'impact-control' sites were established within the vicinity of these recorded populations and form the basis of the ongoing monitoring in accordance with the EMP. Baseline data regarding the presence of Maundia at the chosen monitoring sites is not available.

Table 1: *Maundia triglochinos* in the project area (as per Table 20 in the EMP)

Location	<i>M. triglochinos</i> potentially impacted by the project
Fernbank Creek (Ch.4450-5080)	0.75 ha
Wilson River Floodplain – wetlands (Ch.15,890)	0.03 ha
Wilson River Floodplain – canal (Ch.13,900-14,100)	0.09 ha
Barry's Creek	-
Total	0.87 ha

1.1.4 Purpose of this report

This report complies with the monitoring requirements described within the EMP and details the findings obtained from the final survey of the third annual monitoring period specified in the EMP following the baseline surveys. It represents the fourth and final monitoring report for the construction phase of the Project.

The aim of this report is to provide a summary of the results of the final survey of the third monitoring period for this species and provide an overall summary and comparison of all monitoring events in order to determine if performance measures have been met, as per the EMP.

1.2 Performance measures

The EMP specifies the following performance indicators for *Maundia*:

Indicators of success will focus on the following:

- *Exclusion fencing with signage identifying these as 'no go' zones (during construction).*
- *Sediment control fencing in place (during construction).*
- *Flowering and/or seeding is consistent with paired control and/or nearest reference site.*

Signs of the habitat protection procedure not working will be based on the following:

- *Breached exclusion fencing.*
- *No signage in place identifying the sensitive nature of the location as threatened species habitat.*
- *A significant (if statistics are used) or substantial difference (i.e. 15% allowance) between paired monitoring sites with regard to flowering/seeding and overall extent or recruitment over subsequent monitoring events that cannot be attributed to environmental factors.*

1.3 Monitoring timing

The monitoring program specifies that monitoring would commence in the summer of Year 1 (construction phase) and be undertaken three times a year in summer, autumn and spring until Year 4 (operation phase) of the Project.

1.4 Reporting

Annual reporting of monitoring results will outline:

- 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 and have been noted previously (Niche 2016):

- Detection of *Maundia* was not possible or limited in areas where water depth was relatively high (above 5 centimetres). The number and cover abundance of seedlings and recruiting individuals could not be recorded in such areas.
- The absence of *Maundia* from the control sites presented difficulties in site-pair comparisons.
- The absence of abundance data for the initial three populations listed in the EMP and the selected impact-control sites, prevents pre- and post-impact comparisons. All comparisons made within the framework of this monitoring program can only be made within a post-impact timeframe.
- Other variables, including shade, soil quality, water temperature, width of the habitat at each monitoring site, flora competition or water flow rate, that may impact upon the population were not recorded as part of the monitoring program.

2. Methods

2.1 Monitoring sites

Monitoring design is consistent with that specified in the EMP. Three paired impact-control monitoring sites were established for the monitoring of Maundia. Each site includes one impact location within the Project boundary and one control location outside the Project boundary. The site locations are shown in Figure 1, with details provided in Table 2. These sites correspond to the three original sub-populations identified in the EMP. All six locations were surveyed during the three monitoring events, however the assessment of MC01 was undertaken from the boundary fence as access to this property has not been granted.

Table 2: Paired impact –control monitoring sites

Site	Chainage (Location)	Description	Easting of Impact Plot (MI)	Northing of Impact Plot (MI)	Easting of Control Plot (MC)	Northing of Control Plot (MC)
1	4,450 - 5,080	Hastings River floodplain	483251	6523788	483113	6523992
2	13,900 – 14,100	Wilson River floodplain	481919	6532555	481900	6532520
3	15,890	Wilson River drainage channel	482762	6534479	482775	6534886

2.2 Survey method

For consistency, the survey method used in previous monitoring events was employed during the spring 2017 surveys. Due to the population structure (i.e. grouped versus linear) at some monitoring sites, a quadrat was employed as opposed to a linear transect for the surveys. The following data was collected at each of the monitoring sites:

- Current extent of cover using the Braun-Blanquet scale (20 m X 20 m quadrat or 400 m²).
- Average water depth, estimated for the quadrat.
- The extent of flowering or seeding (per cent of total number of observed plants within quadrat).
- Signs of recruitment.
- Signs of disturbance (i.e. cattle) and to what extent/area.
- Photo from installed specific photo point.

As implemented in the 2015/2016 monitoring period, cover abundance was also recorded as percent cover using smaller increments (5% increments) than that specified in the Braun-Blanquet scale. This was to allow the assessment of a “substantial difference” (i.e. 15% allowance) in cover abundance between paired monitoring sites as required in the EMP. Previously, it was not possible to determine whether a substantial difference between sites exists for sites with a Braun-Blanquet Scale score of ‘3’ (i.e. 5-25% cover) or above, as the percent range exceeds the 15% threshold for detecting change.

In addition, to be able to address the performance measures, the following information was recorded:

- Presence of exclusion fencing and “no go” zone signage and / or sensitive zone fencing.
- Presence of sediment control fencing.

The Braun-Blanquet scale used in this monitoring program is provided in Table 3. The scale is a standard used frequently in flora assessments.

Table 3: Braun-Blanquet cover abundance scale

Score	Cover Abundance Category
1	1-5% cover - rare
2	1-5% cover - common
3	6-25% cover
4	26-50% cover
5	51-75% cover
6	76-100% cover

2.3 Analysis

The majority of the performance indicators provided in the EMP, against which the results are assessed are observation based. However the assessment of flowering/seeding and cover extent specifies:

“A significant (if statistics are used) or substantial difference (i.e. 15% allowance) between paired monitoring sites with regard to flowering/seeding and overall extent or recruitment.”

The EMP recommends that impact and control sites would be paired to enable a paired t-test or a non-parametric equivalent (e.g. Mann Whitney) in order to determine if the site meets performance measures. Many of the paired impact-control sites established in the EMP are spatially close to each other and are unlikely to be independent. For example, most control sites located downstream of their paired impact site continue to be influenced by livestock grazing, while the impact site is no longer subject to this land use activity (due to Project boundary fencing) and this could be a reason for any observed changes.

Site independence is a fundamental assumption required by all statistical analyses. Additionally, the dataset is non-normal and could not be normalised with standard transformations. Therefore the use of statistical analyses for this data is not appropriate and a *substantial difference (i.e. 15% allowance)* has been used as the basis for identifying changes.

3. Results

3.1 Maundia presence

Spring 2017 field data is provided in Annex 1 and a summary of the results has been provided in Table 4. Photo monitoring is provided in Annex 2.

Maundia was recorded at two of the three impact sites (MI01 and MI02) during the spring 2017 surveys. Of the control sites, MC01 has previously recorded Maundia, however during the current survey it was noted that a recent dry period resulted in extensive grazing at this control site that resulted in the absence of detectable individuals above the water level. Maundia has not been detected at sites MC02, MI03 and MC03 during any of the monitoring surveys.

Site 1

Maundia was recorded at MI01 in spring 2017, as in 2016/2017 and 2015/2016. The Braun-Blanquet cover abundance score at MI01 was 2, with a coverage abundance (based of 5% estimate increments) of 5.0% (compared to an average abundance of $10.0 \pm 4\%$ in 2015/2016, and $7.5 \pm 2.5\%$ in 2016/2017). It was noted however that while this monitoring site recorded a relatively low cover abundance, adjacent areas (within 30 metres) contained patches of Maundia with 80 – 90% cover abundance.

At paired control site MC01, Maundia was not recorded in spring 2017. Previously, Maundia was recorded only in spring in 2016/2017 and in spring and summer 2015/2016, with a Braun-Blanquet score of 3 on each occasion. It was noted however that due to a recent dry period and the presence of cattle on this control site, this area was grazed completely to the ground prior to a heavy rainfall and the spring 2017 survey. At the time of surveys this control site had a water depth of approximately 40 cm, preventing any observation of regrowth.

Site 2

Maundia was recorded at MI02 in spring 2017 with a Braun-Blanquet cover abundance score of 2, representing a cover abundance of 10%. Previously it has been recorded at this site in spring 2016 and autumn 2017. It was first recorded at this site in autumn 2016. The Braun-Blanquet cover abundance score was 2 in both seasons in 2016/2017, representing an average cover abundance estimate of $5 \pm 0\%$. In 2015/2016, cover abundance was also low, with a Braun-Blanquet score of 1, representing a cover abundance estimate of <5%.

Maundia was not recorded at MC02, the paired control site, during surveys in the current monitoring period. Similarly, Maundia has not been recorded at this persistently dry site during any previous monitoring event by Niche.

Site 3

Maundia was not recorded at MI03 or MC03 during the spring 2017 survey, nor during the previous monitoring periods.

3.2 Recruitment

Recruitment was recorded in spring 2017 at MI01. Previously, recruitment was recorded in spring 2016 at MI01 and MI02. Recruitment has not been recorded at any of the control sites to date.

It should be noted that water depth and clarity, and density of vegetation at a monitoring site greatly impacts the ability to observe recruiting individuals of the species. Sites MC01, MI02, MI03 and MC03 all recorded depths above 35 cm.

3.3 Flowering/Seeding

Flowering was not recorded during the 2017 spring surveys. Previously, flowering has been recorded only at site 1.

Table 4: Summary of Maundia presence, recruitment and flowering

Report	Niche 2015		Niche 2016			Niche 2017			Current
	Su2015	Aut2015	Sp2015	Su2016	Aut2016	Sp2016	Su2017	Aut2017	Sp2017
MI01	P F	P	P F	P F	P	P R F	A	P	P R
MC01	N	N	P F	P F	N	P F	N	N	N
MI02	N	N	N	N	P	P R	N	P	P
MC02	N	N	N	N	N	N	N	N	N
MI03	N	N	N	N	N	N	N	N	N
MC03	N	N	N	N	N	N	N	N	N

P = individuals present; F = flowering recorded; R = recruitment recorded; N = Maundia not recorded

3.4 Mitigation measures and disturbance monitoring

A summary of all mitigation measures in place at each location is presented in Annex 1.

3.4.1 Mitigation measures

It should be noted that due to the stage of construction of the Project, impact sites 1 and 2 are now currently no-longer subject to direct Project-related construction activities. Site 3 (impact and control sites) are adjacent to a service road that appears to still be in use and so may still be subject to construction-related impacts

Site 1

Exclusion fencing and barbed wire fencing was present at this site. Sediment control was not observed during the current survey.

Site 2

Exclusion fencing and sediment control were not recorded at MI02. However it was noted that this site now falls into an area that is protected by a fauna fence and is therefore distanced from any construction related direct impacts.

Site 3

Exclusion fencing was in place at MI03, however this site had no sediment control during the current survey.

3.4.2 Disturbance

Site 1

- MI01: There were no observed signs of direct disturbance on the site.
- MC01: While the site was covered in water at the time of the current survey, the presence of cattle has resulted in substantial grazing of this population.

Site 2

- MI02/MC02: There were no observed signs of direct disturbance at these sites.

Site 3

- MI03: Recent activity at this sites appears to be revegetation with native plant stock around the bank edges. The water was observed to have an oily slick in areas and an accumulation of a dense film on the surface.
- MC03: The area appears to have undergone low level burning.

4. Discussion

A summary of the spring 2017 survey results and previous monitoring events in relation to the performance measures are provided in Table 5 and Table 6.

Table 5: Performance indicators of success

Performance indicators of success	Discussion
Exclusion fencing with signage identifying these as 'no go' zones (during construction)	This performance indicator has been met in spring 2017 and partially met in previous monitoring events. Exclusion fencing was present at MI01 and MI03 during the spring 2017 surveys. It is noted that a fauna fence is in place at MI02, excluding it from direct construction impacts. Exclusion fencing was reported to be absent at some sites during previous monitoring events.
Sediment control fencing in place (during construction)	This performance indicator has not been met in spring 2017 and partially met in previous monitoring events. Sediment control was absent from all impact sites. However, sediment control is no longer in place at MI01 as construction activities are now removed from this area. Sediment control at MI02 is not required due to its distance from the road verge, and construction activities adjacent to MI03 are limited as the highway is near completion and permanent stabilisation works have commenced. Sediment control was reported to be absent at some sites during previous monitoring events. The absence of or variation in sediment control (sediment retention structure as opposed to sediment control fencing) has been addressed in previous reports.
Flowering and/or seeding is consistent with paired control and/or nearest reference site.	This performance indicator has been met in spring 2017 (by considering absence of flowering individuals in both impact and control sites as consistency across paired sites) and partially met in previous monitoring events. Site 1 was the only paired impact-control site that recorded flowering/seeding. A large difference (over 15%) in flowering was recorded between MI01 and MC01 in 2016/2017 and 2015/2016. However, as discussed previously, this difference cannot be directly attributed to the Project, and is more likely the result of environmental variables between paired control and impact sites (discussed in Niche 2016).

Table 6: Performance indicators of unsuccessful mitigation

Performance indicators of unsuccessful mitigation	Discussion
Breached exclusion fencing	This performance indicator of unsuccessful mitigation was not met in spring 2017 or in previous monitoring events.
No signage in place identifying the sensitive nature of the location as threatened species habitat	This performance indicator of unsuccessful mitigation was met in spring 2017 and in previous monitoring events. The impact sites did not have signage in place identifying the sensitive nature of the locations during a number of monitoring events.
A significant (if statistics are used) or substantial difference (i.e. 15% allowance) between paired monitoring sites with regard to flowering/seeding and overall extent or recruitment over subsequent monitoring events that cannot be attributed to environmental factors.	This performance indicator of unsuccessful mitigation has not been met for any site in spring 2017 or in previous monitoring events. This comparison can only be made for Site 1 as it is the only site where Maundia has been detected at both the impact and control sites. During spring 2017 Maundia was only observed at the impact site and individuals were not observed flowering. Previously, higher cover abundance and higher flowering percent have been observed at the control site. However these differences were attributed to environmental factors (Niche 2016, Niche 2017). Although comparison with pre-impact data is not possible, at the three sites where Maundia has been recorded by Niche, MI01, MC01, MI02, the percent cover abundance has been relatively consistent across the monitoring periods (Niche 2015, Niche 2016, Niche 2017 and current report).

5. Recommendations

The absence of abundance data for the initial three populations listed in the EMP prevents pre- and post-impact comparisons. All comparisons made within the framework of this monitoring program can only be made within a post-impact timeframe.

5.1 Contingency Measures / Recommendations

The EMP lists potential problems and contingency measures for various components of the monitoring program, however specific contingency measures for Maundia have not been provided within the EMP. As such, problems encountered during the monitoring have been addressed by considering suitable corrective actions.

Although comparison to pre-impact data is not possible, at the three sites where Maundia was recorded by Niche, MI01, MC01, MI02, the percent cover abundance was relatively consistent across the monitoring periods (Niche 2015, Niche 2016, Niche 2017 and current report). As such, no corrective actions are considered necessary as flowering, recruitment and extent, has been consistent across the years at the same sites.

As some construction activities continue at a low level, it is suggested that consideration be given to recommended actions presented in Table 7. Recommended actions listed in Table 7 are contingent on the ongoing presence of construction activities at the specified sites.

Table 7: Recommendations

Performance indicators of success	Action
Exclusion fencing with signage identifying these as 'no go' zones	<ul style="list-style-type: none">Mitigation measures should be installed/kept in place until all construction activities have ceased. Notably, at Site 3, the continued use of the adjacent service road should be considered as necessitating the retention of such measures.Apparent lapses in retention of mitigation measures encountered during construction should be addressed by reconsidering the process by which these measures are regulated / corrected during construction in future construction plans/projects.
Sediment control fencing in place	
Signage identifying the sensitive nature of the location as threatened species habitat	

6. References

Lend Lease (2014). Pacific Highway Upgrade – Oxley Highway to Kundabung – Construction Flora and Fauna Management Sub Plan. Prepared by Lend Lease for the Roads and Maritime Services, Sydney.

Morrison, D.A. (2002). How to improve statistical analysis in parasitology research publications. *International Journal for Parasitology* 32: 1065-1070.

Niche (2015). OH2K Pacific Highway Upgrade *Maundia triglochinos* monitoring 2015. Prepared by Niche Environment and Heritage Pty Ltd for Roads and Maritime Services, Port Macquarie, NSW.

Niche (2016). *Maundia triglochinos* monitoring 2015/2016 – Oxley Highway to Kempsey, Pacific Highway Upgrade. Prepared by Niche Environment and Heritage Pty Ltd for Roads and Maritime Services, Port Macquarie, NSW.

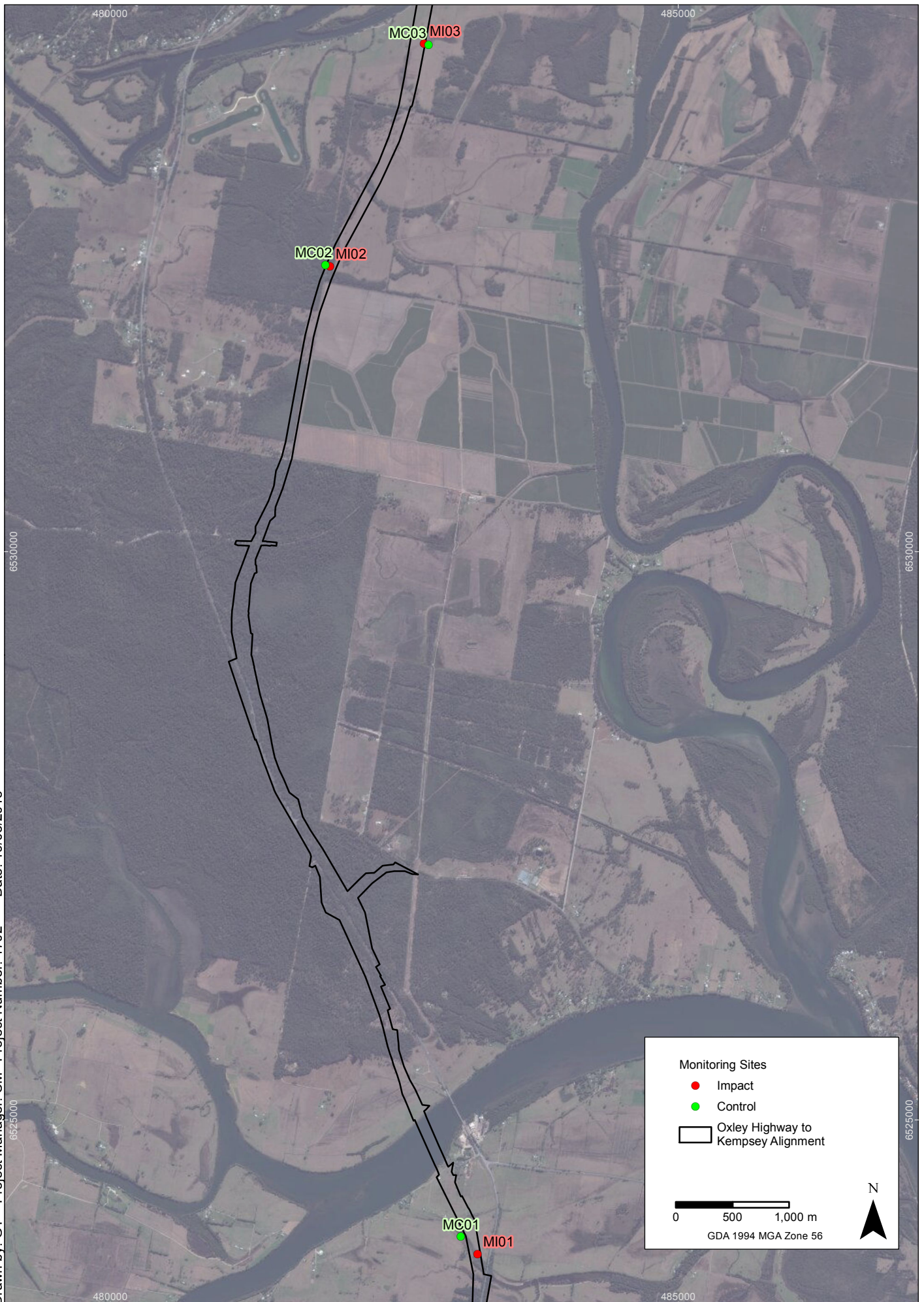
Niche (2017). *Maundia triglochinos* monitoring 2016/2017 – Oxley Highway to Kempsey, Pacific Highway Upgrade. Prepared by Niche Environment and Heritage Pty Ltd for Roads and Maritime Services, Port Macquarie, NSW.

OEH (2016). *Maundia triglochinos* – online profile.

<http://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10511>

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.

Drawn by: GT Project Manager: CM Project Number: 1702 Date: 19/03/2015



OH2K Maundia Monitoring Locations Site Plan (Overview)

Pacific Highway Upgrade - Oxley Highway to Kempsey & Frederickton to Eungai

Annex 1 - 2016/2017 Monitoring results

Summary of *Maundia triglochinos* results. Results for the current (spring 2017) monitoring period are in bold. For comparative purposes, data from the previous 2016/2017 monitoring periods has been retained.

Site N.	Site Name	Design	Inspection Date				Maundia present				Braun-Blanquet Score				% Cover (5% increment)				Water Depth (cm)				Flowering/ Seeding (% of individuals)				Recruitment			
			Sp	S	A	Sp	Sp	S	A	Sp	Sp	S	A	Sp	Sp	S	A	Sp	Sp	S	A	Sp	Sp	S	A	Sp	Sp	S	A	Sp
1	MI01	impact	07/11/2016	16/02/2017	19/05/2017	19/10/2017	Y	Y	Y	Y	2	1	3	2	5	<5	10	5	0-50	0	10-40	15	10	0	0	0	Y	0	0	Y
1	MC01*	control	08/11/2016	16/02/2017	19/05/2017	19/10/2017	Y	N	N	N	3	0	0	0	20	0	0	0	0-50	0	>30	40	90	0	0	0	0	0	0	0
2	MI02	impact	09/11/2016	16/02/2017	19/05/2017	19/10/2017	Y	N	Y	Y	2	0	2	2	5	0	5	10	0-10	0	100	40	N	0	0	0	Y	0	0	0
2	MC02	control	10/11/2016	16/02/2017	19/05/2017	19/10/2017	N	N	N	N	0	0	0	0	0	0	0	0	0	0	0	0	N	0	0	0	0	0	0	0
3	MI03	impact	11/11/2016	16/02/2017	19/05/2017	19/10/2017	N	N	N	N	0	0	0	0	0	0	0	0	100-200	0	>30	50	N	0	0	0	0	0	0	0
3	MC03	control	12/11/2016	16/02/2017	19/05/2017	19/10/2017	N	N	N	N	0	0	0	0	0	0	0	0	100-200	0	>30	35	N	0	0	0	0	0	0	0









Y = Yes, N = No, * = site survey undertaken from fence boundary due to access restrictions









Summary of Mitigation Measures and Disturbance









Site	Site Name	Design	Inspection Date				Signs of disturbance				Exclusion fencing "no go" zone in place				Sediment control fencing in place			
			Sp	S	A	Sp	Sp	Sum	Aut	Sp	Spr	Sum	Aut	Sp	Spr	Sum	Aut	Sp
1	MI01	impact	07/11/2016	16/02/2017	19/05/2017	19/10/2017	Salvinia spraying and shade from the bridge	Previous Salvinia spraying knocked out Maundia		None observed	N	Y	Y (barbed wire fencing)	Y(barbed wire fencing and flagging)	Y	N	Y	N
1	MC01	control	08/11/2016	16/02/2017	19/05/2017	19/10/2017	Cattle trampling and eating Maundia	Heavily grazed paddock	Cattle	Previous cattle grazing	N	N	N	N	NA	NA	NA	NA
2	MI02	impact	09/11/2016	16/02/2017	19/05/2017	19/10/2017	None observed	None observed		None observed	Fauna fence	Fauna fence	Fauna fence	Fauna fence	N	N	N	N
2	MC02	control	10/11/2016	16/02/2017	19/05/2017	19/10/2017	NA	Weed spraying and slashing along fence		None observed	NA	NA	NA	NA	NA	NA	NA	NA
3	MI03	impact	11/11/2016	16/02/2017	19/05/2017	19/10/2017	Construction work on drainage line - earth movement	Prone to grazing and slashing		Oil film and accumulation of dense sediment film. Revegetation	N	Yes, around drain	Y	Y	Y	Some sediment bags	N	N (gravel mound at service road side)
3	MC03	control	12/11/2016	16/02/2017	19/05/2017	19/10/2017	None observed	Erosion, new rocks, drainage channel has been moved since last monitoring. Sprayed and slashing.	This control site is very close to construction	Low level burning across area and around drainage line	N	Some flags	Y	Y	Y	Matting and rocks	Fallen down	N

NA = not applicable to control sites that are removed from construction zones, excluding site MC03 which is within 30 m of construction, **Sp** = current spring 2017 survey results

Annex 2 - 2016/2017 Photo Monitoring

Site ID	Spring (November 2016)	Summer (February 2017)	Autumn (May 2017)	Spring (October 2017)
MI01				
MC01				

Site ID	Spring (November 2016)	Summer (February 2017)	Autumn (May 2017)	Spring (October 2017)
MI02				
MC02				

Site ID	Spring (November 2016)	Summer (February 2017)	Autumn (May 2017)	Spring (October 2017)
MI03				
MC03				

Niche Environment and Heritage

A specialist environmental and heritage consultancy.

Head Office

Niche Environment and Heritage

PO Box 2443 North Parramatta NSW 1750

Email: info@niche-eh.com

All mail correspondence should be through our Head Office

Appendix F Green-thighed Frog Ponds



Green-thighed Frog Monitoring 2017/2018

Breeding Ponds

Oxley Highway to Kempsey, Pacific Highway Upgrade

Prepared for Road and Maritime Services

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Niche Environment and Heritage

A specialist environmental and heritage consultancy.

Head Office

Level 1, 460 Church Street
Parramatta NSW 2150
All mail correspondence to:
PO Box 2443
North Parramatta NSW 1750
Email: info@niche-eh.com

Sydney

0488 224 888

Central Coast

0488 224 999

Illawarra

0488 224 777

Armidale

0488 224 094

Newcastle

0488 224 160

Mudgee

0488 224 025

Port Macquarie

0488 774 081

Brisbane

0488 224 036

Cairns

0488 284 743

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Cover photograph: Green-thighed Frog located at Constructed Pond Site 3W (Photo: M. Stanton)

Executive summary

Context

This report documents the 2017/2018 monitoring period, the second of five monitoring periods for the Green-thighed Frog breeding ponds, as required for the Oxley Highway to Kempsey (OH2K) Pacific Highway upgrade project (the Project). 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, including installation of 25 breeding ponds for the Green-thighed Frog (at five sites). Monitoring of ponds is to be performed in accordance with the methodology presented in the Ecological Monitoring Program (EMP) (RMS 2016).

Aims

The aim of the Green-thighed Frog breeding ponds monitoring is to determine if Green-thighed Frogs are using the purpose-built compensatory breeding habitat and thus determine whether the Project is meeting the performance indicators for the species. Corrective actions are also to be provided where required.

Methods

Surveys were undertaken in accordance with the EMP in two stages. Stage 1 surveys focussed on adult frog detection after a sufficient rainfall trigger, and Stage 2 surveys focussed on tadpole detection (indicating successful breeding). Stage 1 surveys involved a 30-minute nocturnal active search at the Collombatti reference site and at each of the constructed pond sites, as well as a peripheral habitat search. Stage 2 surveys involved a 20-minute active search of the ponds and adjacent vegetation and dip-netting of ponds. During Stage 2 surveys, pond depth was recorded, presence of fish and predatory larvae noted, and a photo was taken from a designated reference point.

Key results

Stage 1 surveys were undertaken on the 22nd and 23rd March 2018 after rainfall that was deemed suitable by the Project Ecologist (24 hour rainfall at sites: from 70.8-175.2 mm; cumulative rainfall over 72 hours: from 75.8-258.8 mm). Stage 2 surveys were undertaken on the 26th and 27th April 2018, 35 days after Stage 1 surveys.

Green-thighed Frogs were recorded at Site 3W only. At Site 3W individuals were observed in two ponds (ponds 2 and 4) and adjacent habitat, and were heard calling in the vicinity of all ponds. Green-thighed Frogs were not detected at the Collombatti reference site. All 25 ponds contained water, Sites 1 (E&W) and 4 (E&W) ranged from 20-50 cm, while Site 3W recorded water depth of up to 100 cm. As Stage 1 surveys were undertaken over two nights, Site 3W, where frogs were detected on the first night, was revisited on the second night to ensure continued activity. Green-thighed Frogs were still active at Site 3 on the second survey night.

During Stage 2 surveys Green-thighed Frog tadpoles were identified at Site 3W from ponds 2 (one tadpole) and 4 (three tadpoles). All ponds at Site 1 (E&W) and four ponds at Site 3W held water, while all ponds at Site 4 (E&W) were either dry or had been recently dry (holding less than 10 cm). A rainfall event just prior to Stage 2 surveys (55.4 mm over 24 hours) resulted in re-filling of ponds that would have otherwise been presumably dry or drying, somewhat confounding the water retention results of Stage 2 surveys. Due to survey limitations, conclusions could not be drawn regarding the retention of water beyond the recommended hydroperiod.

Gambusia (*Gambusia holbrooki*) was identified at the Collombatti reference site. No exotic fish were recorded at the impact sites, although a number of ponds holding water contained predatory invertebrates.

Conclusions

Performance indicators of success have been met for Site 3W only, with the continued presence of Green-thighed Frogs calling from pond edges and the presence of tadpoles, indicating a successful breeding event. The remaining sites (Sites 1 (E&W) and 4 (E&W), i.e. 20 of the 25 constructed ponds) have met the performance indicators for unsuccessful mitigation: Green-thighed Frogs continue to be absent from Sites 1 (E&W) and 4 (E&W); and Site 4 (E&W) ponds are not retaining water for a sufficient amount of time to enable tadpoles to reach metamorphosis.

Management implications

Contingency measures and corrective actions provided in the EMP and Green-thighed Frog Management Strategy respectively, are considered relevant for a number or all ponds at all three monitoring sites. A number of recommendations to meet performance criteria should be considered and include:

- Laying a semi-permeable layer within the ponds to improve water retention.
- Reviewing vegetation structure and density surrounding ponds and undertaking necessary clearing/replanting.
- Reviewing surrounding drainage.

Pond improvement works are planned for Site 4 (E&W) and are scheduled to be completed prior to the third monitoring event.

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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 (RMS 2016) (hereafter referred to as the EMP) combines these approval conditions and defines the mitigation and offsetting requirements for threatened species and ecological communities impacted by the Project. The Green-thighed Frog (*Litoria brevipalmata*) was identified as requiring mitigation and monitoring through the course of the Projects' construction and post-construction period.

1.1.1 Legal Status

The Green-thighed Frog is listed as vulnerable under the New South Wales *Biodiversity Conservation Act 2016* (BC Act). Monitoring of the species is required under the Project's approval.

1.1.2 Monitoring Framework

Green-thighed Frog monitoring is to be performed in accordance with the EMP and the Green-thighed Frog Management Strategy (Lewis 2013), with the EMP taking precedence where inconsistencies occur. Construction involved direct and indirect impacts on known Green-thighed Frog habitat areas, which prevented post-construction monitoring. Therefore monitoring is of purpose-built constructed breeding ponds, as per the EMP.

The EMP states: *"Monitoring will be undertaken on five occasions commencing in Years 3-7 (construction and operation phase). Each monitoring event should be at least 10-12 months apart but ultimately dependant on rainfall events."*, and that *"The first round of monitoring (Year 3) is to commence once the vegetation on the edges of the constructed ponds is considered sufficient (>20% groundcover), to be determined by a suitably qualified Ecologist."*

The Green-thighed Frog Management Strategy requires a two-component approach to Green-thighed Frog monitoring:

- monitoring of breeding ponds, and
- monitoring the integrity of the frog fences.

The monitoring of frog fencing will be undertaken as part of the fauna fence monitoring (in conjunction with underpass monitoring periods). These results will be detailed in the reporting for the fauna fence monitoring component of the Project and are summarised in this report.

The 2017/2018 monitoring represents the second of five monitoring events. To date, these monitoring events have been reported as follows:

- 2016/2017: Niche 2017.
- 2017/2018: current report.

1.1.3 Baseline Data

Green-thighed Frogs were identified from seven locations during baseline surveys (Lewis 2013), however no tadpoles, metamorphs or juvenile Green-thighed Frogs were recorded at identified breeding sites 57 days after rain events enabled identification of adult frogs. As construction of the Project directly or indirectly impacted seven known habitat areas, frog breeding ponds were proposed at these locations. The Green-thighed Frog Management Strategy (Lewis 2013) states:

“Frog breeding ponds will be constructed at four locations, two within the Oxley Highway to Kundabung Upgrade section and two within the Kundabung to Kempsey section.”

The EMP provides a summary of the location of the proposed breeding ponds:

- *“Ch.9050-9350. Five ponds to be constructed on each side of the carriageway.*
- *Ch.11550. Five ponds to be constructed on each side of the carriageway (Project Ecologist to investigate the suitability of ponds in consultation with RMS and the EPA and be guided by the results of pre-clearing surveys).*
- *Ch.30660. Five ponds to be constructed on the western side of the carriageway.*
- *Ch.33650. Five ponds to be constructed on each side of the carriageway.”*

It was determined in consultation with the EPA that the construction of 10 ponds at Ch. 11550 was not warranted due to several surveys finding no record of Green-thighed Frogs in the area around Ch. 11550. In addition, it was determined that breeding habitat remained available locally outside the project boundary. As such, monitoring has been undertaken of ponds constructed at the remaining three areas.

1.1.4 Purpose of this Report

This report complies with the monitoring requirements described within the approved EMP and the Green-thighed Frog Management Strategy (Lewis 2013), and details the findings from the second monitoring period. It represents the second of five monitoring events.

The aims of this report are to summarise the methods and results of the 2017/2018 monitoring, determine if performance measures are being met, and to comment on the need for contingency measures, as per the EMP.

1.2 Performance measures

The Green-thighed Frog Management Strategy and the EMP specify a number of performance indicators against which the success of the compensatory habitat will be measured. These are listed in Table 1 along with their inclusion in the relevant document.

Table 1: Performance indicators

	GThF MS	EMP
Performance indicators of success		
Continued presence of Green-thighed Frog at two/three or more of the three/four breeding pond sites.	✓	✓
Green-thighed Frogs calling from the edge of the constructed ponds.	✓	✓
The presence of tadpoles, juveniles or metamorphs at the frog breeding ponds during Stage 2 surveys.	✓	✓
Signs of the mitigation being unsuccessful		
Absence of Green-thighed Frogs from one or more of the four sites (GThF MS) Absence of Green-thighed Frogs from the area (EMP)	✓	✓
Ponds not holding water for a sufficient time to enable tadpoles to reach metamorphosis.	✓	✓
Ponds holding water for too long and representing unsuitable habitat (i.e. permanent versus ephemeral).	✓	✓
Exotic fish fauna recorded in breeding ponds.	✓	

GThF MS = Green-thighed Frog Management Strategy (Lewis 2013); EMP = Ecological Monitoring Program (RMS 2016).

1.3 Monitoring timing

The EMP specifies that:

“Monitoring will be undertaken on five occasions commencing in Years 3-7 (construction and operation phase). Each monitoring event should be at least 10-12 months apart but ultimately dependant on rainfall events. On each occasion the site would be surveyed for 30 minutes during Stage 1 and for 20 minutes during stage 2 (see section 4.9.3). Four of the five monitoring events are to occur during the operational phase of the Project (Years 4-7). The first round of monitoring (Year 3) is to commence once the vegetation on the edges of the constructed ponds is considered sufficient (>20% groundcover), to be determined by a suitably qualified Ecologist. The timing would be staggered accordingly for either stage of the Upgrade.”

1.4 Reporting

Annual reporting of monitoring results are required 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:

- A definitive statement as to the fulfilment of performance indicators relating to ponds drying too soon or holding water for too long cannot be made for some or all of the ponds, due to surveys requiring Stage 2 surveys to be undertaken 30-40 days after Stage 1 and the minimum water retention period of 30 days and maximum water retention period of 60 days. As such, data concerning the presence of water in the ponds prior to or after Stage 2 surveys cannot be captured without additional surveys, which are beyond the identified scope.

2. Survey Methods

2.1 Monitoring sites

The monitoring site locations are shown in Figures 1 to 4. These sites correspond to the proposed pond locations as required by the EMP and are described in Table 2. The Collombatti site was used as the reference site.

Table 2: Survey sites

Site Name (map ID)	Proposed frog pond sites (EMP)
Collombatti Reference (Ref)	As required by Stage 1 surveys: <i>“Upon the study area receiving the required rainfall, a reference site would be visited to determine the extent of Green-thighed Frog activity”</i>
1E	Ch.9050-9350. Five ponds to be constructed on each side of the carriageway (10 in total)
1W	
3W	Ch.30660. Five ponds to be constructed on the western side of the carriageway
4E	Ch.33650. Five ponds to be constructed on each side of the carriageway (10 in total)
4W	

2.2 Survey method

The survey method described within the EMP (extracted from the Green-thighed Frog Management Strategy) was employed for all surveys and is provided below.

“Monitoring of the constructed breeding ponds would ideally be undertaken on a rainfall event basis when 24-hour rainfall totals exceed 75 millilitres or a cumulative total of 150 millilitres over a 72-hour period. Such rainfall events would be monitored via the Bureau of Meteorology (BOM) website, specifically the Port Macquarie (Station No. 060183) and/or Kempsey (Station No. 059017) weather stations. Where sufficient rainfall is unlikely to occur during the monitoring period, the Project Ecologist will determine whether smaller rainfall events are suitable to conduct a monitoring event. The suitability of the rainfall trigger chosen would be subject to the reference site visit outlined in Stage 1 below. Surveys would be performed using a two-stage process outlined below.

a) Stage 1 – Determining Presence and Breeding Activity

Upon the study area receiving the required rainfall, a reference site would be visited to determine the extent of Green-thighed Frog activity.

The survey would comprise a 30 minute nocturnal active search at each of the four breeding pond areas (sites) using a hand held spotlight. Peripheral habitats (i.e. <50 m) would also be surveyed at this time. Upon the completion of Stage 1 surveys the next stage would be implemented.

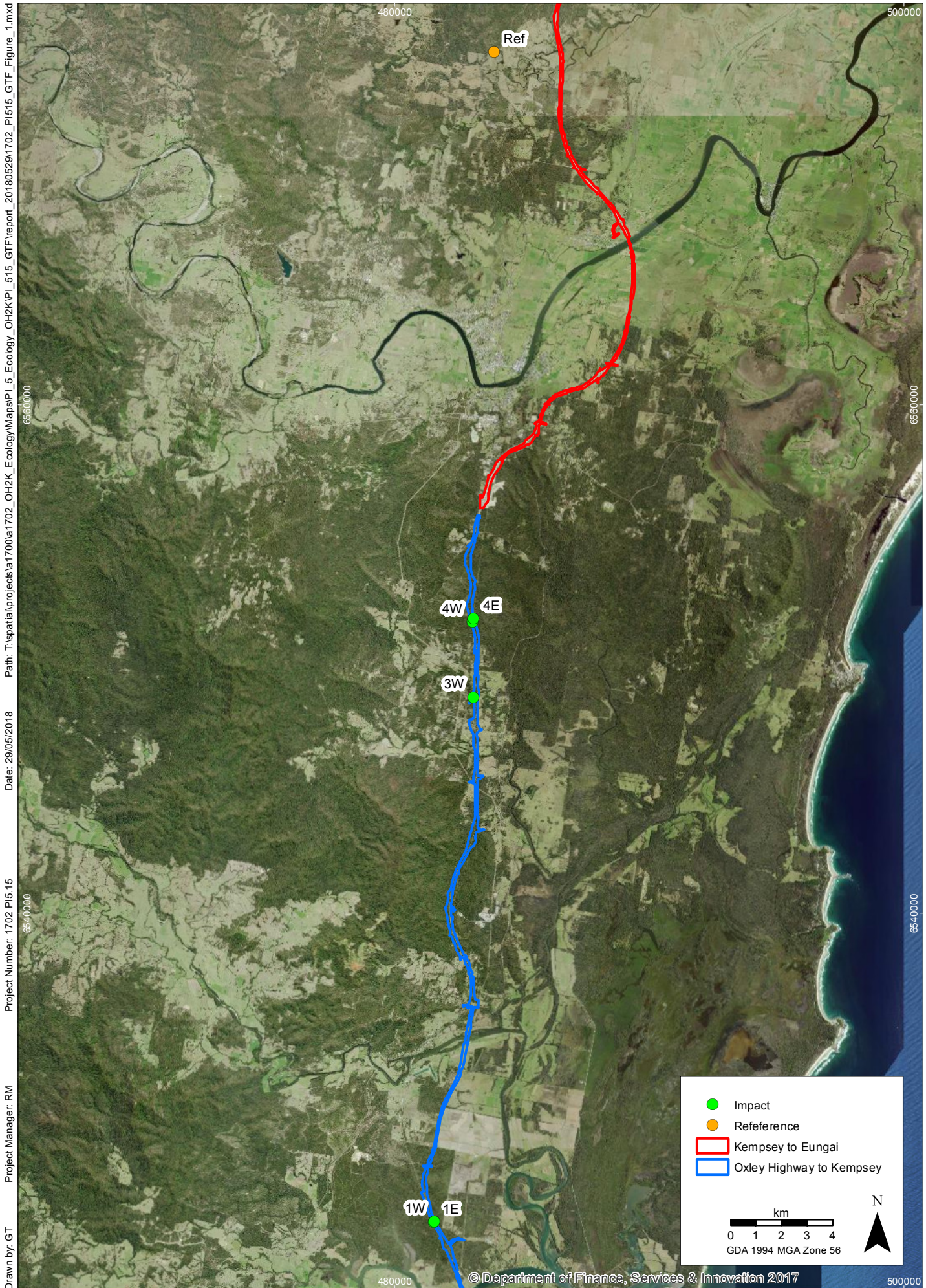
b) Stage 2 – Determining the Success of the Breeding Event

All sites would be subject to follow-up surveys between 30-40 days after the initial census to assess the outcome of the breeding event. This follow up survey will comprise:

- *A 20 minute active search for metamorphs and juvenile frogs around the pond edge and vegetation immediately adjacent to the pond (i.e. <10 m).*
- *Dip-netting of the constructed pond and subsequent tadpole identification. Specific attention will be given toward identifying the presence of fish (both native and exotic) along with predatory invertebrates such as dytiscid larvae.*
- *The depth of the ponds would be measured from the permanently installed water staff.*
- *Photo taken from a designated photo point (to be established during the first Stage 2 survey)."*

2.3 Analysis

Monitoring results are to be analysed in accordance with the performance indicators specified within the EMP. In the case of the Green-thighed Frog, performance measures are based on presence/absence results and pond habitat quality and do not require statistical comparison between survey events.



Drawn by: GT
 Project Manager: RM
 Project Number: 1702 PI.5.15
 Date: 29/05/2018
 Path: T:\spatial\projects\1700\1702_OH2K_Ecology\Maps\PI_5_Ecology_OH2K\PI_515_GTF\report_20180529\1702_PI515_GTF_Figure_1.mxd

● Impact
● Reference
 Kempsey to Eungai
 Oxley Highway to Kempsey

km
 0 1 2 3 4
 GDA 1994 MGA Zone 56

N

© Department of Finance, Services & Innovation 2017

Green-thighed Frog monitoring sites
 Oxley Highway to Kempsey - PI 5.15 GTF Ponds

FIGURE 1

Imagery: (c) LPI 2014-10-06

Path: T:\spatial\projects\1700a\1702_OH2K_Ecology\Maps\PI_5_Ecology_Ch2K\PI_515_GTF\report_20180529\1702_PI515_GTF_Figure_2_site_1.mxd
Date: 30/05/2018
Project Number: 1702 PI.5.15
Project Manager: RM
Drawn by: GT



● Monitoring sites
▭ Oxley Highway to Kempsey

0 10 20 30
m
GDA 1994 MGA Zone 56

N

Green-thighed Frog monitoring Site 1
Oxley Highway to Kempsey - PI 5.15 GTF Ponds

FIGURE 2

Imagery: (c) NearMap 2017-12-13

Drawn by: GT Project Manager: RM Project Number: 1702 PI.15 Date: 30/05/2018 Path: T:\spatial\projects\1700a1702_OH2K_Ecology\Maps\PI_5_Ecology_Map\PI_515_GTF\report_20180529\1702_PI515_GTF_Figure_3_site_3.mxd



Source: Esri, DigitalGlobe, GeoEye, CNES/Airbus DS, USDA, USGS, A Community

Green-thighed Frog monitoring Site 3
Oxley Highway to Kempsey - PI 5.15 GTF Ponds

FIGURE 3
Imagery: (c) DigitalGlobe 2015-11-25

Drawn by: GT Project Manager: RM Date: 30/05/2018 Project Number: 1702 PI.5.15 Path: T:\spatial\projects\1700a\1702_OH2K_Ecology\Maps\PI_5_Ecology\Maps\PI_5_GTF\report_20180529\1702_PI515_GTF_Figure_4_site_4.mxd



Green-thighed Frog monitoring Site 4
Oxley Highway to Kempsey - PI 5.15 GTF Ponds

FIGURE 4

Imagery: (c) DigitalGlobe 2015-11-25

3. Results

Field data from Stage 1 and Stage 2 monitoring for all sites are provided in Annex 1. Photo monitoring results are provided in Annex 2.

3.1 Frog fence monitoring

As mentioned, frog fence monitoring is detailed within the fauna fence reporting of the Project. Minor maintenance issues, such as small gaps under sections of the fence and around rocks and vegetation growth encroaching on fences, were identified where wire mesh fences had been installed. More notably, where neoprene fences were installed, a number of substantial issues were identified. At a number of locations neoprene fences had begun tearing at screw attachment points, joins in the neoprene were not holding (screws coming out or neoprene tearing away) resulting in areas of neoprene fences falling away from the fauna fence completely. These issues will be detailed and discussed within the fauna fence monitoring report. Roads and Maritime has advised that the neoprene sheeting will be removed and replaced with vermin-proof mesh, as approved on the Pacific Highway Upgrade between Woolgoolga and Ballina.

3.2 Stage 1 - determining presence and breeding activity

3.2.1 Conditions

Suitable rainfall, as specified within the EMP, did not occur until March 2018. As such, Stage 1 surveys were undertaken on the 22nd and 23rd March 2018, when rainfall was deemed suitable by the Project Ecologist. Rainfall at the sites in the previous 24 hours ranged from 70.8 mm to 175.2 mm with cumulative rainfall over 72 hours ranging from 75.8 mm to 258.8 mm. Air temperatures ranged from 19°C to 22°C. As Stage 1 surveys were undertaken over two nights, Site 3W, where frogs were detected on the first night, was revisited on the second night to ensure continued activity. Green-thighed Frogs were still active at this site on the second survey night.

It is important to note that the ponds at Site 4E were being modified to improve water retention at the time of the rainfall trigger event. The bases of the ponds had been excavated and were in the process of having clay / bentonite liners installed. These works were not completed prior to the rainfall, but are scheduled to be completed prior to the next monitoring event.

3.2.2 Nocturnal active searches

Adult Green-thighed Frogs were identified at Site 3W only. Numerous Green-thighed Frogs were heard calling within the vicinity of ponds 1 to 5 and individual frogs were observed in ponds 2 and 4. Two additional individuals were observed in adjoining habitat, within 10 metres of pond 5. Overall, approximately 20 individuals were heard calling at Site 3W, with the majority calling from the adjacent swamplands.

A number of frog species were heard calling at all sites visited, including the Collombatti reference site, Site 1, Site 3W and Site 4. Other species identified include the Striped Marsh Frog (*Limnodynastes peronii*), Common Froglet (*Crinia signifera*), Whirring Tree Frog (*Litoria revelata*), Eastern Dwarf Tree Frog (*Litoria fallax*), Rocket Frog (*Litoria nasuta*), Peron's Tree Frog (*Litoria peronii*), Great Barred Frog (*Myxophyes fasciolatus*) and Dainty Tree Frog (*Litoria gracilentata*).

3.2.3 Pond depth during Stage 1

There was a range of water depths observed in the ponds during Stage 1 surveys. Site 1W ponds contained 30-40cm of water, Site 1E (E&W) and Site 4 (E&W) recorded depths between 20-50 cm, and Site 3W ponds held 80-100 cm of water. Table 3 presents Stage 1 water depths.

3.2.4 Vegetation structure and other observations

All Green-thighed Frogs were found on/in proximity to *Lomandra* spp. Site 3W appears to have a more established vegetation structure than other sites, with differences in cover or complexity of canopy and ground covering vegetation layers, including presence of *Lomandra* spp. within the ground layer. It is possible that invasive grass species present at many ponds is too dense and possibly unsuitable for Green-thighed Frogs, a species that requires leaf litter for foraging (OEH 2018) and a more open low ground vegetation (Hero 2004), such as ferns and mat rushes.

3.3 Stage 2 - determining the success of the breeding event

Stage 2 surveys were undertaken on the 26th and 27th April 2018, 35 days after Stage 1 surveys.

3.3.1 Active searches and dip-netting

A number of tadpoles were caught at the Collombatti reference site, Site 1 (E&W) and Site 3W, while the majority of ponds at Site 4 (E&W) were either dry or judged to have been recently dry. Four tadpoles from Site 3W (ponds 2 and 4) were identified as Green-thighed Frog tadpoles. The remaining tadpoles were identified as either *Limnodynastes* spp., Whirring Tree Frogs, Dainty Tree Frogs or *Crinia* spp. Thus, Site 3W was the only site where Green-thighed Frog tadpoles were recorded.

3.3.2 Predatory fish and invertebrates

Gambusia (*Gambusia holbrooki*) was identified at the Collombatti reference site. Predatory beetles and beetle larvae were detected at Sites 1 (E&W, 2 ponds) and 3W (3 ponds) while dragonfly nymph were detected at Site 1 (E&W, 4 ponds). Predator presence is summarised as follows:

- Site 1E: two of five ponds with at least one predator type.
- Site 1W: four of five ponds with at least one predator type.
- Site 3W: three of five ponds with at least one predator type, including ponds 2 and 4 where Green-thighed Frog tadpoles were found.
- Site 4E: no predators detected (ponds dry or recently dry).
- Site 4W: no predators detected (ponds dry or recently dry).

3.3.3 Pond depth during Stage 2

Table 3 provides the Stage 1 and Stage 2 water levels, including the hydroperiod requirements according to Lewis 2013. According to Lewis 2013, ponds should have a maximum depth of 400 mm and hold water for between 30-40 days at sunny exposed sites or 50-60 days at shaded locations. The constructed ponds can be classed as both sunny exposed sites and shaded sites (see Table 3). Water should therefore be retained up to 40 days in exposed ponds or 60 days in shaded ponds. Stage 2 surveys were undertaken 35 days after Stage 1.

Water levels during Stage 2 surveys were as follows:

- Site 1E - all five constructed ponds held water (23-30 cm deep).
- Site 1W - all five constructed ponds held water (35-40 cm deep).
- Site 3W - four of five constructed ponds held water (15 - 40 cm deep).
- Site 4E - four of five constructed ponds held water (2-5 cm deep).
- Site 4W - one of five constructed ponds held water (10 cm deep).

Minimum water retention period – 30 days

As surveys were undertaken 35 days after Stage 1, the presence of water at 30 days cannot be stated for those ponds that were dry during Stage 2 surveys. As such, conclusions as to the likelihood of water presence at 30 days have been drawn based on individual pond conditions, weather and recent rainfall. Stage 2 water depth was impacted by rainfall immediately prior to surveys. Port Macquarie Airport Weather Station recorded 55.4 mm of rainfall over 24 hours, the day prior to surveys. It was evident that Site 4 (E&W) ponds and Site 3W pond 5, which were either dry or held 10 cm or less and contained no predatory fish or invertebrates, had been recently dry. It is therefore considered likely that these ponds did not hold water for the minimum required 30 or 50 days (depending on sun exposure; Lewis 2013 and see Table 7). All Site 1 (E&W) ponds and four Site 3W ponds retained water for the minimum required period (i.e. more than 30 days).

Maximum water retention period – 40-60 days

Given that Stage 2 surveys were undertaken 35 days after Stage 1 surveys and Lewis 2013 states a suitable hydroperiod of up to 40 days for exposed sites or up to 60 days for shaded sites, it is not possible to state if ponds held water beyond the suggested hydroperiod. In addition, as water retention is dependent not only on pond permeability but on weather conditions and local rainfall, it is difficult to draw conclusions regarding the likelihood of ponds to dry within the recommended hydroperiod.

While assessment of water levels after Stage 2 was not possible due to survey limitations, it was considered likely that ponds with water levels of 30 cm or above during Stage 2 monitoring would have retained water for periods beyond 40 days, but this is difficult to estimate beyond 60 days (maximum hydroperiod prescribed by Lewis 2013). Research has shown that an extended hydroperiod is unlikely to impact the breeding of this species, as long as the pond is ephemeral (Lemckert *et al.* 2006, and Lemckert pers. comm.). Therefore, water retention within ponds somewhat beyond the preferred hydroperiod is not considered as important to the survival of this species as the retention of water for long enough to allow for metamorphosis.

Table 3: Pond water retention assessment

Site	Hydroperiod (Lewis 2013)	Site condition	Pond	Stage 1 water depth (cm)	Stage 2 water depth (cm) at 35 days	Minimum water retention period assessment	Maximum water retention period assessment
1W	Ponds to support water for up to 30-40 days	Sunny exposed ponds. Established vegetation surrounding ponds.	1	30-40	40	Water retention for minimum required period successful	NA
			2	30-40	35	Water retention for minimum required period successful	NA
			3	30-40	40	Water retention for minimum required period successful	NA
			4	30-40	40	Water retention for minimum required period successful	NA
			5	30-40	40	Water retention for minimum required period successful	NA
1E	Ponds to support water for up to 30-40 days	Sunny ponds with vegetation immediately adjacent to east. Established vegetation immediately surrounding ponds.	1	20-50	30	Water retention for minimum required period successful	NA
			2	20-50	30	Water retention for minimum required period successful	NA
			3	20-50	24	Water retention for minimum required period successful	NA
			4	20-50	23	Water retention for minimum required period successful	NA
			5	20-50	30	Water retention for minimum required period successful	NA
3W	Ponds to support water for up to 30-60 days depending on whether the location is shaded or unshaded.	Sunny ponds with vegetation immediately adjacent to the west	1	100+	30	Water retention for minimum required period successful	NA
			2	100+	26	Water retention for minimum required period successful	NA
			3	100	17	Water retention for minimum required period successful	NA
			4	100	20	Water retention for minimum required period successful	NA
			5	100	0	Water retention for minimum required period considered unsuccessful	Not exceeded
4W	Ponds to support water for 30 days.*	Mostly exposed ponds with limited canopy cover. Minimal ground cover immediately surrounding ponds.	1	20	10	Water presence considered to be from recent rainfall. Water retention for minimum required period considered unsuccessful	Not exceeded
			2	20	0	Water retention for minimum required period considered unsuccessful	Not exceeded
			3	20	0	Water retention for minimum required period considered unsuccessful	Not exceeded
			4	50	0	Water retention for minimum required period considered unsuccessful	Not exceeded
			5	50	0	Water retention for minimum required period considered unsuccessful	Not exceeded

Site	Hydroperiod (Lewis 2013)	Site condition	Pond	Stage 1 water depth (cm)	Stage 2 water depth (cm) at 35 days	Minimum water retention period assessment	Maximum water retention period assessment
4E	Ponds to support water for 30 days.*	Shaded ponds amongst surrounding open woodland. Little to no ground cover immediately surrounding ponds.	1	50	5	Water presence considered to be from recent rainfall. Water retention for minimum required period considered unsuccessful	Not exceeded
			2	20	0	Water retention for minimum required period considered unsuccessful	Not exceeded
			3	40	5	Water presence considered to be from recent rainfall. Water retention for minimum required period considered unsuccessful	Not exceeded
			4	30	5	Water presence considered to be from recent rainfall. Water retention for minimum required period considered unsuccessful	Not exceeded
			5	20	2	Water presence considered to be from recent rainfall. Water retention for minimum required period considered unsuccessful	Not exceeded

NA = data not available due to survey limitations; *As per Lewis 2013, ponds at sunny exposed sites should hold surface water for between 30-40 days, and between 50-60 days at shaded locations. Discussions with Roads and Maritime concluded that Site 4 (E&W) ponds should be classified as shaded or only partly shaded. Metamorphosis may occur within 28 days (Lewis 2013) and field records show metamorphosis occurring at an exposed site within 40 days (Lemckert *et al.* 2006). As such, in accordance with Table 3-1 of the Green-thighed Frog Management Plan (Lewis 2013; as suggested for Site 2 ponds), it is considered that ponds at site 4 (E&W) should support water for 30-60 days to allow for a range of sunny and shaded locations, to provide enough time for metamorphosis to occur.

3.4 Cumulative results

Summary results of monitoring events to date are provided in Table 4. To date, Green-thighed Frogs have not been detected at Site 1 (E&W) or Site 4(E&W), while Site 3W has shown success in both monitoring periods. Site 4 ponds are considered to have shown insufficient water retention in both monitoring periods. „Water retention post-survey is however difficult to determine due to the survey design and is considered less important than detection of insufficient water retention, and is not included in the cumulative results.

Table 4: Cumulative monitoring results

Site (pond)	2016/2017			2017/2018		
	# GTF	#GTF TP	Pond WR	# GTF	#GTF TP	Pond WR
Ref	1	0	-	0	0	-
1W(1)	0	0	Y	0	0	Y
1W(2)	0	0	Y	0	0	Y
1W(3)	0	0	Y	0	0	Y
1W(4)	0	0	Y	0	0	Y
1W(5)	0	0	Y	0	0	Y
1E(1)	0	0	Y	0	0	Y
1E(2)	0	0	Y	0	0	Y
1E(3)	0	0	Y	0	0	Y
1E(4)	0	0	Y	0	0	Y
1E(5)	0	0	Y	0	0	Y
3W(1)	0	0	Y	C	0	Y
3W(2)	0	0	Y	1, C	1	Y
3W(3)	0	0	Y	C	0	Y
3W(4)	1	0	Y	1, C	3	Y
3W(5)	1	0	Y	C	0	TS
4W(1)	0	0	TS	0	0	TS
4W(2)	0	0	TS	0	0	TS
4W(3)	0	0	TS	0	0	TS
4W(4)	0	0	TS	0	0	TS
4W(5)	0	0	TS	0	0	TS
4E(1)	0	0	TS	0	0	TS
4E(2)	0	0	TS	0	0	TS
4E(3)	0	0	TS	0	0	TS
4E(4)	0	0	TS	0	0	TS
4E(5)	0	0	TS	0	0	TS

C = heard calling in vicinity of pond; #GTF TP = number of Green-thighed Frog tadpoles; Pond WR = minimum water retention period met; Y = Yes; TS = water not retained for the minimum period.

4. Discussion

A discussion of the 2017/2018 monitoring results in relation to the performance measures detailed in the EMP and the Green-thighed Frog management Strategy (Lewis 2013) is provided in Table 5 and Table 6.

Table 5: Performance indicators of success

Performance indicators of success	Discussion
Continued presence of Green-thighed Frog at two or more of the three breeding pond sites.	This performance measure has not been met. Green-thighed Frogs were heard calling and identified at only one (Site 3W) of the three breeding pond sites.
Green-thighed Frogs calling from the edge of the constructed ponds.	This performance measure has been met for one of the three sites. Green-thighed Frogs were heard calling at Site 3W only.
The presence of tadpoles, juveniles or metamorphs at the frog breeding ponds during Stage 2 surveys.	This performance measure has been met for one of the three sites. Green-thighed Frog tadpoles were observed in two constructed ponds at Site 3W.

Table 6: Signs of the mitigation being unsuccessful

Performance indicators of unsuccessful mitigation	Discussion
Absence of Green-thighed Frogs from one or more of the three sites (GThF MS). Absence of Green-thighed Frogs from the area (EMP).	This performance indicator of unsuccessful mitigation has been met. Green-thighed Frogs were not recorded at two of the three breeding pond sites or within the broader area.
Ponds not holding water for a sufficient time to enable tadpoles to reach metamorphosis.	This performance indicator of unsuccessful mitigation has been met for 11 of the 25 constructed ponds. According to Lewis 2013, ponds should have a maximum depth of 400 mm and hold water for between 30-40 days at sunny exposed sites or 50-60 days at shaded locations. Water should therefore be retained for at least 30 and up to 60 days in these ponds. Stage 2 surveys were undertaken 35 days after Stage 1. The majority of Site 1 and Site 3 ponds (14 ponds) contained water during Stage 1 and Stage 2 surveys, i.e. they held water long enough for breeding cycles to occur as per Lewis 2013. This performance indicator of unsuccessful mitigation has therefore not been met for these sites. However during Stage 2 surveys, Site 4W and 4E ponds, and pond 5 at Site 3W, were found to be dry or only holding 10 cm or less, likely due to recent rain. It is therefore considered likely that these ponds did not hold water for the minimum required 30 or 50 days (depending on sun exposure; Lewis 2013). This performance indicator of unsuccessful mitigation has therefore been met for these 11 ponds.
Ponds holding water for too long and representing unsuitable habitat (i.e. permanent versus ephemeral).	This performance indicator of unsuccessful mitigation cannot be assessed due to survey limitations. Given that Stage 2 surveys were undertaken 35 days after Stage 1 surveys and Lewis 2013 states a suitable hydroperiod of up to 40 days for exposed sites or up to 60 days for shaded sites, it is not possible to state if ponds have held water beyond the suggested hydroperiod.
Exotic fish fauna recorded in breeding ponds (GThF MS).	This performance indicator of unsuccessful mitigation has been not been met. No exotic fish were recorded in constructed ponds for the 2018 monitoring period. Other predatory invertebrates were however recorded in a number of ponds.

GThF MS = Green-thighed Frog Management Strategy (Lewis 2013); EMP = Ecological Monitoring Program (RMS 2016).

5. Recommendations

5.1 Contingency Measures

The EMP lists potential problems and contingency measures for various components of the monitoring program. Those considered relevant to the Green-thighed 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
Ponds not used by Green-thighed frog.	Survey adjacent areas to confirm frogs remain in area. Review/modify ponds to improve potential site suitability problems.	Green-thighed Frogs have not been recorded at Site 1 (E&W) or Site 4 (E&W) during any surveys. This contingency measure is considered relevant.
Ponds not holding water long enough to enable breeding to succeed.	Review/modify ponds either by placing a semi permeable layer or further excavation.	A number of ponds were dry at Stage 2 surveys, as per Table 6 Table 6. This contingency measure is considered relevant.
Ponds holding water for too long encouraging competition from non-target frog fauna.	Improve drainage.	This cannot be assessed due to survey limitations.
Exotic fish species recorded in breeding ponds.	Modify pond to ensure it dries out.	No exotic fish were observed. This contingency measure is considered not relevant.

5.2 Recommendations

Recommendations in Table 8 below are provided to address the proposed contingency measures identified in the EMP and corrective actions provided in the Green-thighed Frog Management Strategy. The recommended actions and considerations below were also made in the 2016/2017 monitoring report (Niche 2017) and were taken into consideration by Roads and Maritime.

Following recommendations in the previous report, works to improve water retention of the ponds at Site 4 (E&W) were commenced on the 18th August 2017. Initial works to decrease the permeability of the material forming the ponds proved unsuccessful. As a result, works were again commenced at Site 4E mid-March 2018. This work was put on hold following the trigger rainfall of the 2018 monitoring event. Similar works are planned for Site 4W. These amelioration works are scheduled to be completed prior to the 2018/2019 monitoring period. To ensure the provision of functional ponds prior to the next monitoring event, Roads and Maritime plan to monitor water retention in the Site 4 (E&W) ponds after rainfall events until the amelioration works are deemed successful (i.e. holding water for a minimum of 30 days at sunny exposed sites and 50 days at shaded sites).

Table 8: Signs of the mitigation being unsuccessful and corrective actions

Performance indicators of unsuccessful mitigation	Action described in GThF MS	Recommendation
<p>Absence of Green-thighed Frogs from one or more of the four sites (GThF MS)</p> <p>Absence of Green-thighed Frogs from the area (EMP).</p>	<p>The corrective action for this would be to firstly, implement additional surveys of adjacent areas to confirm Green-thighed Frogs remain in that general area, and secondly, undertake a review and if deemed necessary modify the ponds to improve any site suitability problems.</p>	<p>Applies to: Site 1 (E&W) and Site 4 (E&W)</p> <p>Consider additional surveys in habitat that is adjacent to monitoring sites and that is deemed suitable for Green-thighed Frogs by the project ecologist to assist in determining the continued presence and activity of the Green-thighed Frog in the general area.</p> <p>Consider necessary modifications to ponds as described in Niche 2017.</p> <p>Consider reviewing vegetation structure in and around ponds and undertaking necessary clearing/replanting.</p>
<p>Ponds not holding water for a sufficient time to enable tadpoles to reach metamorphosis.</p>	<p>The corrective action for this would involve a review and if deemed necessary, modify the ponds by placing a semi permeable layer or further excavation.</p>	<p>Applies to: all ponds at Site 4E and Site 4W</p> <p>Roads and Maritime should continue planned amelioration works at these sites with consideration of previously recommended mitigations (Niche 2017), in conjunction with site visits to monitor the success of these works prior to the next monitoring event.</p> <p>Applies to: All ponds at Site 1.</p> <p>Install water staff with graduated water depth indicators to permit accurate assessment of water depth.</p>
<p>Ponds holding water for too long and representing unsuitable habitat (i.e. permanent versus ephemeral).</p>	<p>The corrective action for this would be to improve drainage to ensure the pond dries out.</p>	<p>Cannot be accurately assessed due to survey limitations.</p> <p>Consider interim site visits to determine water presence in the constructed ponds. An extended hydroperiod may be acceptable, providing the pond dries at least once each year to prevent the build up of predators (Lemckert <i>et al.</i> 2006; Lemckert pers. comm.).</p>

GThF MS = Green-thighed Frog Management Strategy (Lewis 2013); EMP = Ecological Monitoring Program (RMS 2016)

References

Hero J-M., Hines H., Meyer E., Lemckert F., Newell D., Clarke J. (2004). *Litoria brevipalmata*. The IUCN Red List of Threatened Species 2004: e.T12144A3325725.

<http://dx.doi.org/10.2305/IUCN.UK.2004.RLTS.T12144A3325725.en>. Downloaded on **27 July 2018**

Ledlin, D. (1997). Ecology of the Green-thighed Frog (*Litoria brevipalmata*). B. Env. Sc (Honours) Thesis. The University of Newcastle.

Lemckert F., Mahony M., Brassil T., Slatyer C. (2006). The Biology of the threatened Green-thighed frog *Litoria brevipalmata* (Anura: Hylidae) in the central and mid-north coastal areas of New South Wales. Australian Zoologist, Vol. 33, p.337-344.

Lewis (2013). Pacific Highway Upgrade: Oxley Highway to Kempsey Green-thighed Frog Management Strategy. Prepared for Roads and Maritime Services by Lewis Ecological Surveys.

Niche (2017). Green-thighed Frog Monitoring 2017 Oxley Highway to Kempsey Pacific Highway Upgrade. Prepared by Niche for Roads and Maritime Services.

OEH (2018). Green-thighed Frog –profile. Office of Environment and Heritage threatened species profiles. <http://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10485>

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. 2017/2018 monitoring results

Table 9: Stage 1 Results

Site	Pond	Date	Time	GTF observed from pond	GTF calling from pond	GTF observed 10-100 m from pond	GTF calling 10-100 m from pond	Comments/ Other species/ Habitat notes	Water Depth (cm)	Rainfall mm (24hrs)	Rainfall mm (72hrs)	Air Temp (C)	Humidity	Wind	Cloud Cover %
Collombatti Ref site		23/03/2018	19:22	0	N	0		Whirring Tree Frog, Striped Marsh Frog, Great Barred frog, Green tree Frog, Clicking Froglet, Emerald-spotted Tree frog	100	175.2	258.8	21	82	0	80
1 W	1	22/03/2018	20:30	0	N	0		Striped Marsh Frog, Eastern Froglet, Rocket Frog	30-40	70.8	75.8	22	82	3	100
	2			0	N	0	30-40								
	3			0	N	0	30-40								
	4			0	N	0	30-40								
	5			0	N	0	30-40								
1 E	1	22/03/2018	21:00	0	N	0		Striped Marsh Frog, Eastern Froglet, Rocket Frog, Dainty Tree Frog	20-50	70.8	75.8	22	82	2	100
	2			0	N	0	20-50								
	3			0	N	0	20-50								
	4			0	N	0	20-50								

Site	Pond	Date	Time	GTF observed from pond	GTF calling from pond	GTF observed 10-100 m from pond	GTF calling 10-100 m from pond	Comments/ Other species/ Habitat notes	Water Depth (cm)	Rainfall mm (24hrs)	Rainfall mm (72hrs)	Air Temp (C)	Humidity	Wind	Cloud Cover %
	5			0	N	0			20-50						
3 W	1	22/03/2018	21:49	0	Y	0	Y (1)	Other species heard: Common Froglet, Dainty Tree Frog, Person's tree Frog, Striped Marsh Frog, Eastern Dwarf Tree Froglet. Around 20 individuals total heard calling at site (10-100 m from ponds). Water overflowing from ponds into adjacent habitat.	100+	91.6	98.2	20	82	1	100
	2			1	Y	0	Y (2)		100+						
	3			0	Y	0	Y (3)		100						
	4			1	Y	0	Y		100						
	5			0	N	2	Y		100						
4 W	1	22/03/2018	23:00	0	N	0	N	No frogs calling.	20	80.6	83.6	21	80	1	90
	2			0	N	0	N		20						
	3			0	N	0	N		20						
	4			0	N	0	N		50						
	5			0	N	0	N		50						
4 E	1	23/03/2018	0:30	0	N	0	N	No frogs calling near ponds. 100 m north other frog species were heard calling, e.g. Striped Marsh Frog.	50	175.2	258.8	19	80	0	5
	2			0	N	0	N		20						
	3			0	N	0	N		40						
	4			0	N	0	N		30						
	5			0	N	0	N		20						
















Table 10: Stage 2 Results
















Site	Pond	Water Depth (cm)	Site Photo	Pond Photo	No. GTF (juv)	No. of tadpoles caught	Tadpoles identified	Presence of Fish	Predatory Invertebrates	Comments
Reference	Collombatti	30-40	2293		0	50	Striped Marsh Frog, Dainty Tree Frog & Whirring Tree Frog	Yes - Gambusia	Beetle larvae	
1W	1	40	2264	2263	0	1	Unidentified call	No	Beetles	Ponds 1-5 from north to south.
	2	35		2265	0	0		No	Dragonfly nymph	
	3	40		2266	0	0		No	Dragonfly nymph	
	4	40		2267	0	0		No	Dragonfly nymph	Macroalgae issue (stonewart)
	5	40	2269	2268	0	4	Striped Marsh Frog	No	Nil	
1E	1	30	2271 – facing N	2270	0	0		No	Dragonfly nymph	Algae present. Adult Striped Marsh Frog in pond.
	2	30		2272	0	0		No	Nil	
	3	24		2275	0	6	<i>Crinia</i> sp.	No	Nil	
	4	23		2276	0	1	<i>Crinia</i> sp.	No	Nil	
	5	30	2278 - facing S	2277	0	0		No	Beetles	Part shade and no shade at other ponds.
3W	1	30	2280 - facing N	2279	0	15	Tree frog possible Whirring Tree Frog	No	Flat beetles	Roadside has been mown right to drainage line.
	2	26		2281	1	20+	<i>Crinia</i> sp. Green-thighed Frog	No	Diving beetle larvae	










Site	Pond	Water Depth (cm)	Site Photo	Pond Photo	No. GTF (juv)	No. of tadpoles caught	Tadpoles identified	Presence of Fish	Predatory Invertebrates	Comments
	3	17		2282	0	15+	<i>Crinia</i> sp. and unidentified	No	Nil	
	4	20		2283	3	50	<i>Crinia</i> sp., Green-thighed Frog	No	Beetles	
	5	0	2285-facing S	2284	0	0		No	Nil	Adjacent habitat where GTF found Stage 1 was also dry.
4W	1	10	2287-facing N	2286	0	0		No	Nil	Water most likely from recent rain.
	2	0		2288	0	0		No	Nil	
	3	0		2289	0	0		No	Nil	
	4	0		2290	0	0		No	Nil	
	5	0	2292-facing S	2291	0	0		No	Nil	
4E	1	5	2338	2239	0	0		No	Nil	
	2	0		2340	0	0		No	Nil	
	3	5		2341	0	0		No	Nil	
	4	5		2343	0	0		No	Nil	
	5	2	2344	2342	0	0		No	Nil	






Annex 2. Photo monitoring

Table 11: Individual pond photos

Site	Pond 1	Pond 2	Pond 3	Pond 4	Pond 5
1W 2017					
1W 2018					
1E 2017					

Site	Pond 1	Pond 2	Pond 3	Pond 4	Pond 5
1E 2018					
3W 2017					
3W 2018					

Site	Pond 1	Pond 2	Pond 3	Pond 4	Pond 5
4E 2017		*	*	*	*
4E 2018					
4W 2017				*	*

Site	Pond 1	Pond 2	Pond 3	Pond 4	Pond 5
4W 2018					

NA = not applicable, * group pond photos provided in Table 12.

Table 12: Site photos

Site ID	Summer 2017	2018
Collombatti Reference		
Site 1W		

Site 1W-
looking
back



Site 1E



Site 3W



Site 4W



Site 4E



Niche Environment and Heritage

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Head Office

Niche Environment and Heritage
PO Box W36 Parramatta NSW 2150
Email: info@niche-eh.com

All mail correspondence should be through our Head Office

Appendix G Nest Box



Nest Box Monitoring 2017/2018

Oxley Highway to Kempsey, Pacific Highway Upgrade

Prepared for Roads and Maritime Services

October 2018

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Excellence in your environment.
ABN: 19 137 111 721

Head Office

Level 1, 460 Church Street
Parramatta NSW 2150
All mail correspondence to:
PO Box 2443
North Parramatta NSW 1750
Phone: **02 9630 5658**
Email: **info@niche-eh.com**

Locations

Sydney
Central Coast
Illawarra
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Cover photograph: Sugar Gliders in small glider nest box (left) and Common Brushtail Possum in large glider nest box (right) recorded during winter 2018 surveys.

Executive Summary

Context

This report documents findings for the 2017/2018 monitoring period, the first of three operational monitoring periods for nest boxes, 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.

Aims

The aim of this report is to summarise the methods and results of the summer 2017/2018 and winter 2018 monitoring and determine if performance measures have been met, as per the EMP.

Methods

Monitoring was undertaken in accordance with the EMP, in summer from 16 January 2018 – 28 February 2018 and in winter from 28 June 2018 – 30 August 2018. Each nest box was visually inspected using a wireless camera attached to the end of an extendable pole, or by a tree climber when inspection from the ground was not possible. Details recorded for each box included: occupation by fauna, species if present, signs of use by fauna, box condition, any maintenance required, changes to surrounding landscape and daily weather conditions.

Key Results

There were a total of 514 nest boxes monitored in summer and winter during the 2017/2018 monitoring period. A total of 273 nest boxes in summer (53.1%) and 292 (56.9%) in winter were occupied or showed signs of use by native vertebrate fauna.

Eighteen species of native fauna have been identified using nest boxes to date, including three threatened species; the Yellow-bellied Glider (*Petaurus australis*), Greater Glider (*Petauroides volans*) and Squirrel Glider (*Petaurus norfolcensis*).

Pest species were recorded using 5.4% and 2.9% of boxes in winter and summer respectively. Only 3.5% of boxes required maintenance. Maintenance work included replacement due to deterioration or falling from the tree and fixing broken/damaged lids. However, installation issues were observed during inspections, namely the use of a wiring system that could damage the host tree or reduce the longevity of the boxes.

Conclusions

All performance measures excluding design-specific use have been met. These include use of nest boxes by a wide range of native fauna, low rates of use by pest species and low rates of required box maintenance. Design-specific use was met by five of the nine nest box types, with Scan, SG, LG, Poss and MB boxes all recording use by target species. Nest box types Parr, Co, SO and LFO have not shown signs of use by target fauna.

Management Implications

A number of recommendations have been made, including maintenance or replacement of damaged and lost boxes.

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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.

1.1.1 Monitoring framework

The EMP specifies that nest boxes were to be installed in Year 1 (2015) and Year 2 (2016) (construction phase), with monitoring to commence in summer and winter shortly after the installation period (2016) and continue in Year 4 (2018), Year 6 (2020) and Year 8 (2022). For the Nest Box Monitoring the Project has been divided into two sections:

- Oxley Highway to Kundabung (Ch. 0 - 24040), hereafter referred to as OH2Ku.
- Kundabung to Kempsey (Ch. 24040 - 37850), hereafter referred to as Ku2K.

To date, five monitoring events have been undertaken and reported on as follows:

- Construction monitoring:
 - *Event 1-winter 2016*: Niche 2017 (and see Lewis 2017a and Sandpiper 2017a).
 - *Event 2-summer 2017*: Niche 2017 (and see Lewis 2017a and Sandpiper 2017b).
 - *Event 3-winter 2017*: Niche 2018a (and see Lewis 2017b and Sandpiper 2017c).
- Operational monitoring:
 - *Event 4-summer 2018*: current report.
 - *Event 5-winter 2018*: current report.

Events 1 and 2 were the first biannual inspections after installation. Event 3 (winter 2017) was an additional biannual monitoring event due to the installation of nest boxes occurring six months ahead of the scheduled first monitoring event, and was the last construction monitoring event. Event 4 (summer 2018) and Event 5 (winter 2018) represent the first of three years (Years 4, 6 and 8) of biannual operational monitoring.

1.1.2 Purpose of this report

This report complies with the monitoring requirements described within the EMP and details the findings obtained from the first two operational monitoring events, summer 2017/2018 and winter 2018.

The aim of this report is to summarise the methods and results of the summer 2017/2018 and winter 2018 monitoring and determine if performance measures are being met, as per the EMP.

1.1.3 Performance measures

The EMP specifies the performance measures for nest boxes as follows:

Indicators of success of nest boxes include:

- *Use of nest boxes by a wide range of native fauna species.*
- *Use of nest boxes designed for specific species by those same species.*
- *Low rate of use of nest boxes by introduced fauna species.*
- *Low level of maintenance of nest boxes.*

1.1.4 Monitoring timing

As per the EMP, monitoring is to be undertaken in summer and winter of 2018, 2020 and 2022. The EMP states the following regarding monitoring timing:

“Nest boxes will be installed in Year 1 and 2 (construction phase). Monitoring will commence in summer and winter shortly after the installation period (Year 2) and will continue in summer and winter of Year 4, Year 6, Year 8. A pre-handover maintenance inspection will be undertaken at Year 8.”

1.1.5 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.

2. Survey Methods

2.1 Nest Boxes Monitored

The *Nest Box Plan of Management* (NBPoM, Lewis 2013a) describes the number, type and distribution of nest boxes required to mitigate the loss of hollows, and the ongoing management of the nest boxes. The boxes were installed in two phases: 60% prior to or during clearing to provide temporal refuge habitat and the remaining 40% once a final count of functional tree hollows was made during the clearing supervision. Phase 2 calculations required an additional four boxes for OH2Ku and 101 for Ku2K. The number of nest boxes installed and monitored are provided in Table 1. Phase 2 installations for OH2Ku were undertaken prior to Event 2, and are now complete for Ku2K, with the final 101 boxes installed in winter 2017.

In Event 4 and 5, eight boxes from the Ku2K section of the Project were not located and four boxes were replaced (after being burnt) with new box numbers, however the old (burnt) box numbers were still included in the total nest box count of 257, but these no longer exist, i.e. only 97 boxes (including those eight not found) were installed, instead of the required 101.

The nest boxes were installed in zones to provide clusters of nest boxes in areas requiring mitigation for the loss of hollows. Figure 1 shows the location of nest boxes.

Table 1: Nest boxes installed and monitored

	Specified in the NBPoM	Phase 1 installation Event 1 (winter 2016)	Phase 2 calculation	Boxes required	Event 2	Event 3	Event 4	Event 5
OH2Ku	469	263	4	267	269*	269	269	269
Ku2K	254	156	101	257	156^	205+	245#	245#
	723	419		524	425	474	514	514

* = two extra boxes were installed due to Masked Owl observations during clearing; + = this excludes the four boxes that were burnt and discontinued and replaced with new boxes and box numbers; ^ = 53 of the phase 2 nest boxes were installed after Event 2, prior to Event 3 monitoring, the remaining 48 were installed after Event 3 and were monitored for the first time during summer 2018 (Event 4). # = eight boxes were not located and four boxes that had been burnt had been included in the total required nest box count of 257 but do not exist.

2.2 Methods

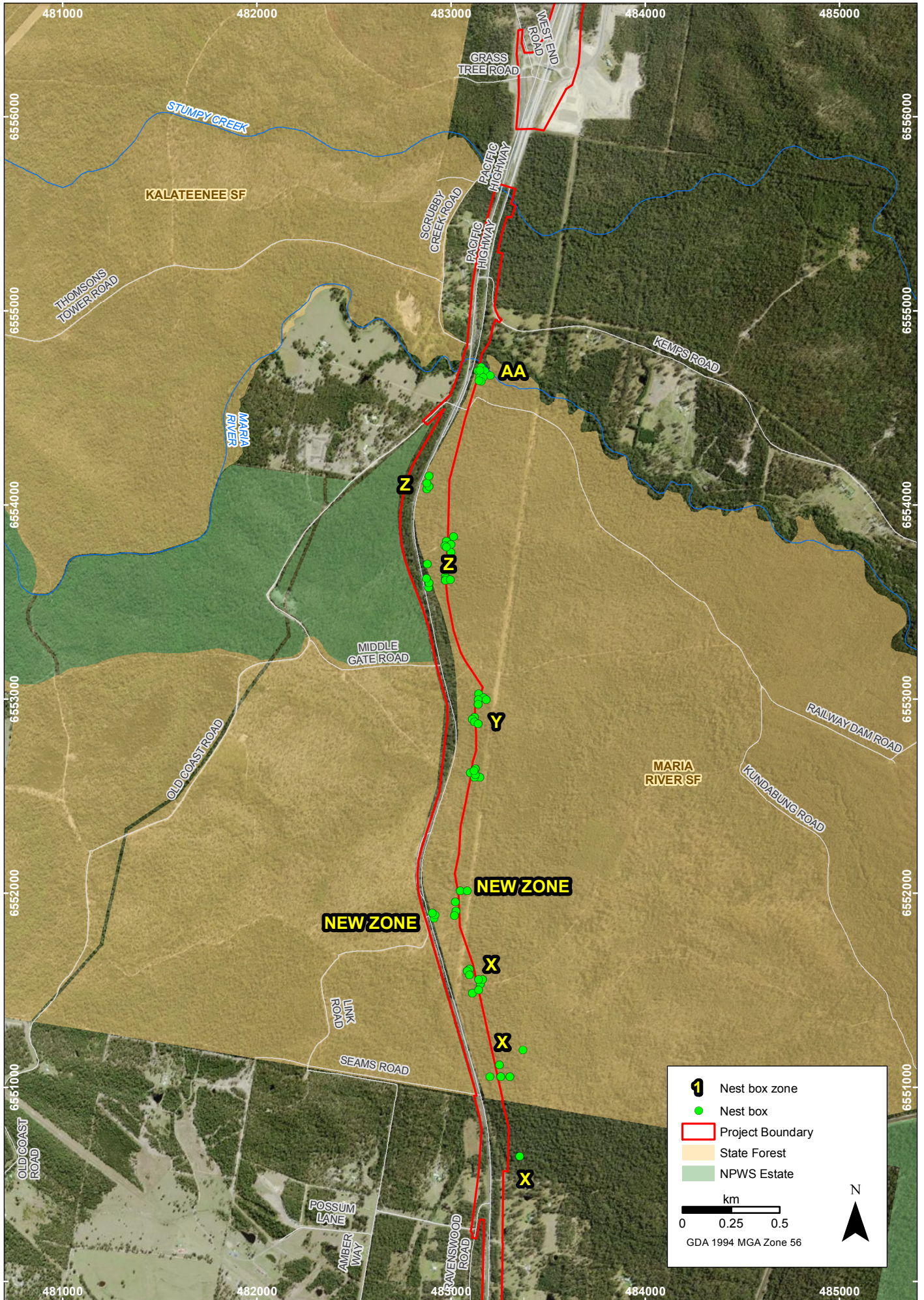
The EMP, in accordance with the NBPoM, states that monitoring will involve a visual inspection of each nest box, and at each monitoring period, the following information will be collected:

- *Inspection date, weather conditions (rain, wind, cloud cover, ambient temperature) and time each nest box was inspected.*
- *Nest box identification number.*
- *If the nest box is occupied by native fauna, and if so, the species. If the nest box is not occupied by a native species, record any signs of use by native species, such as feathers, droppings, scats, hair or nesting material.*
- *If the nest box is occupied by a pest species such as European bees, or Common Myna.*
- *Deterioration of the nest box and if any maintenance required.*
- *Any changes to the surrounding habitats, such as clearing or installation of wildlife crossing structures.*

The maintenance regime will involve:

- *The removal of pest species such as Common Myna, Common Starlings and European Bees.*
- *The replacement of fallen, damaged or deteriorated nest boxes.*
- *The repositioning or relocation of nest boxes that show no sign of use after several successive monitoring periods*
- *The removal of excess nesting material that may block access to the nest box over time.*

Drawn by: MH Project Manager: RM Project Number: 1702 PI 5.14 Date: 27/09/2018



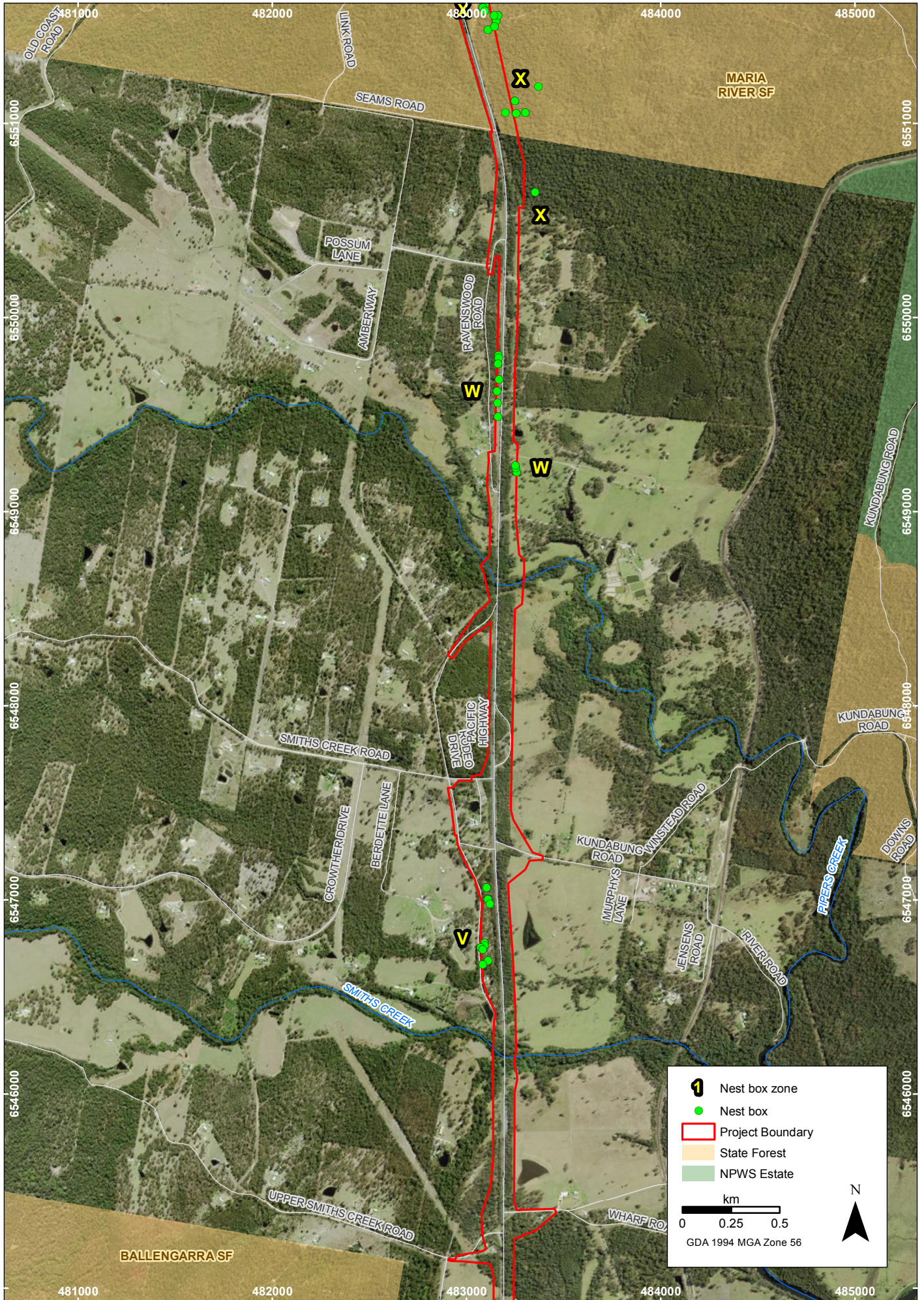
Nest Box Locations

Pacific Highway Upgrade – Oxley Highway to Kempsey

FIGURE 1.1

Imagery: (c) LPI 2014-6-10

Drawn by: MH Project Manager: RM Project Number: 1702 PI 5.14 Date: 27/09/2018

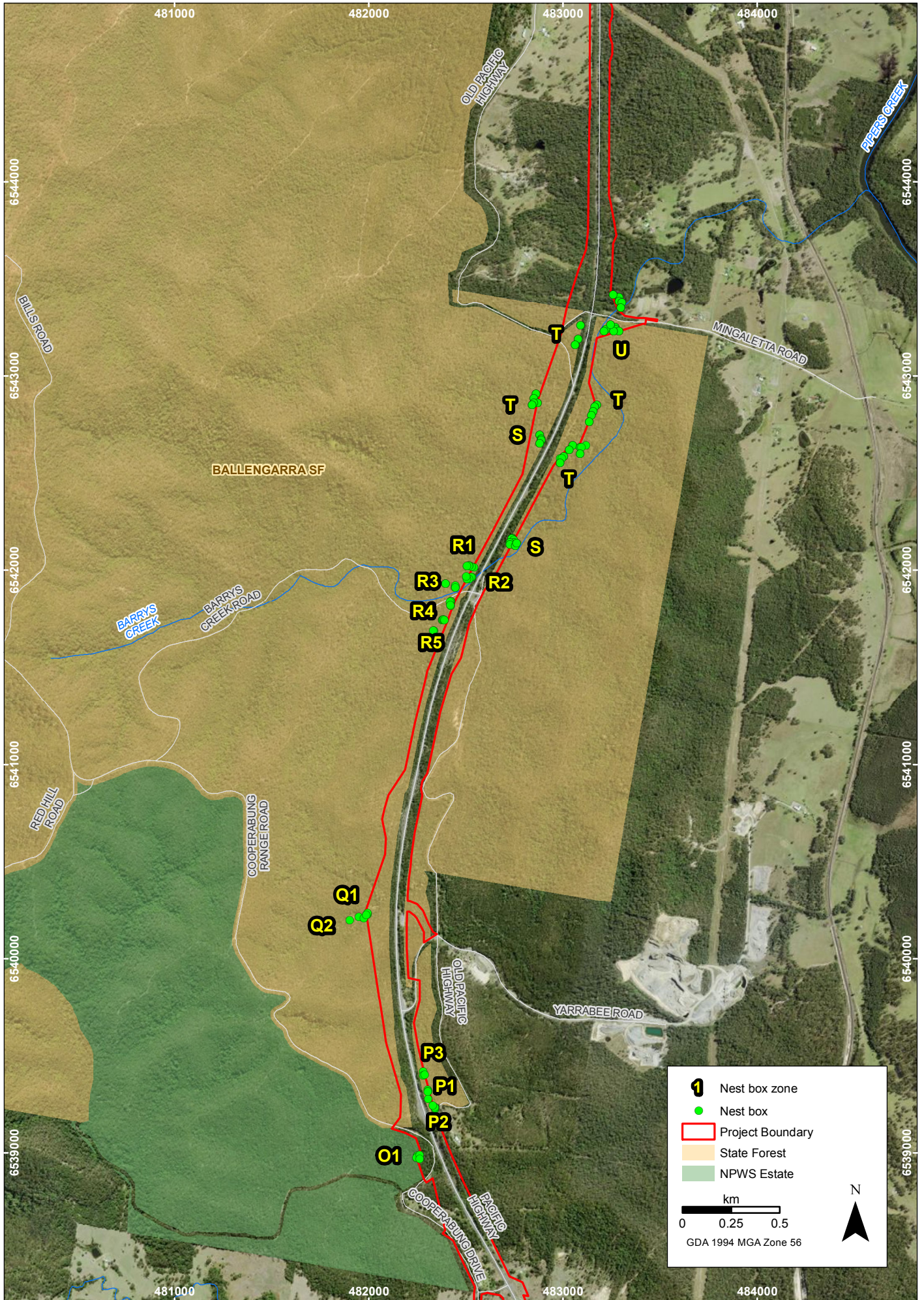


Nest Box Locations

Pacific Highway Upgrade – Oxley Highway to Kempsey

FIGURE 1.2

Imagery: (c) LPI 2014-6-10

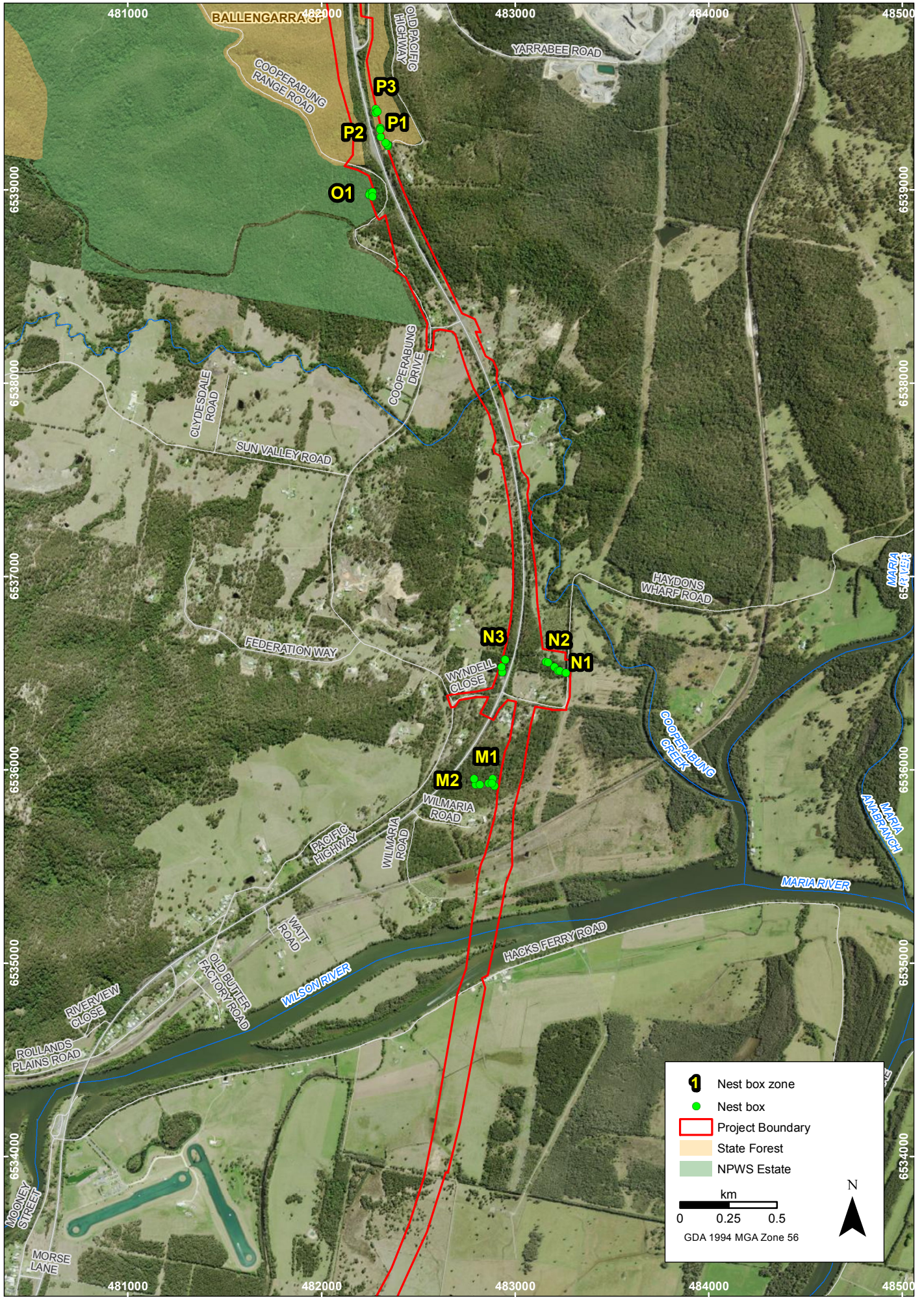


Nest Box Locations

Pacific Highway Upgrade – Oxley Highway to Kempsey

FIGURE 1.3

Imagery: (c) LPI 2014-6-10



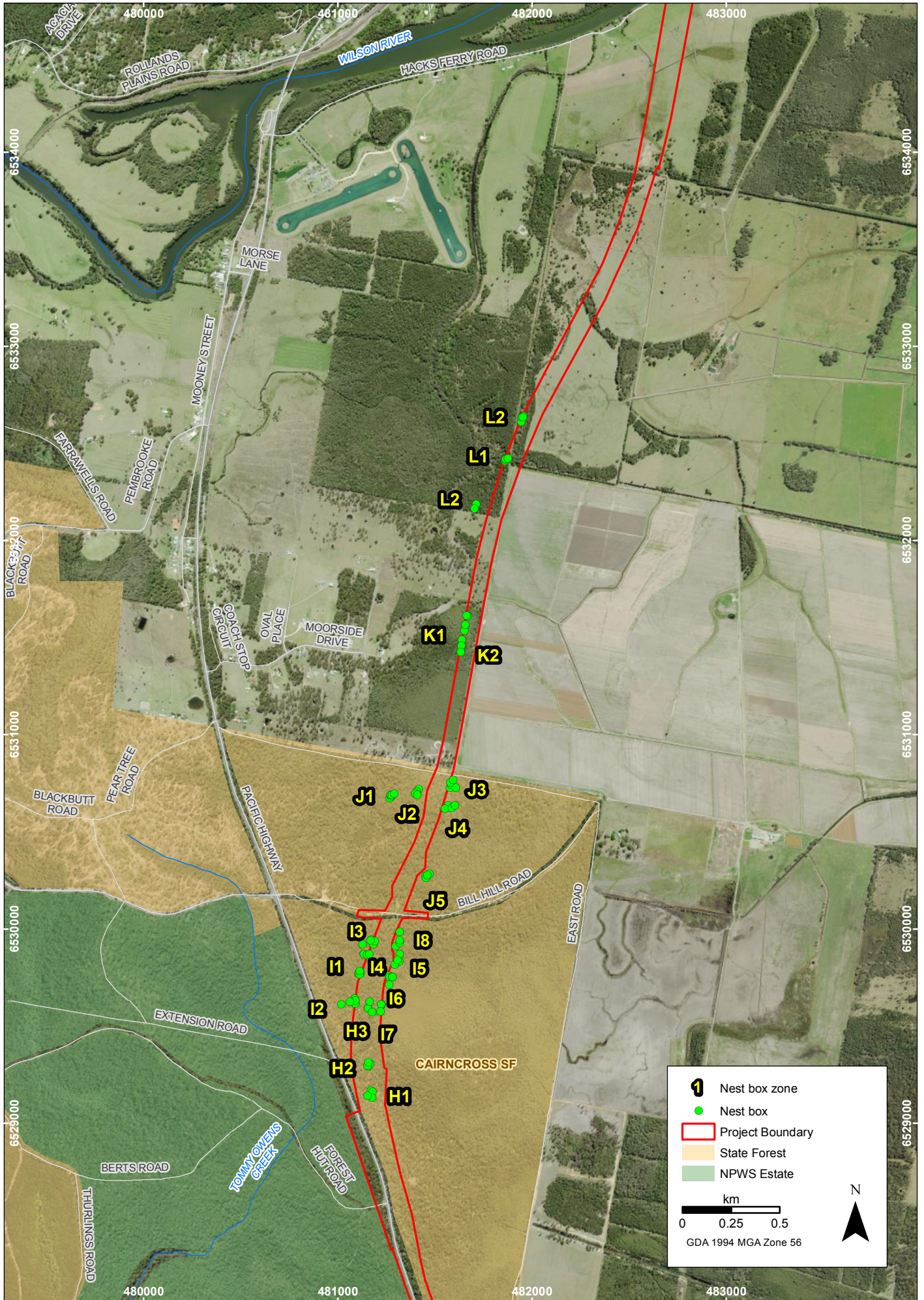
Nest Box Locations

Pacific Highway Upgrade – Oxley Highway to Kempsey

FIGURE 1.4

Imagery: (c) LPI 2014-6-10

Drawn by: MH Project Manager: RM Project Number: 1702 PI 5.14 Date: 27/09/2018



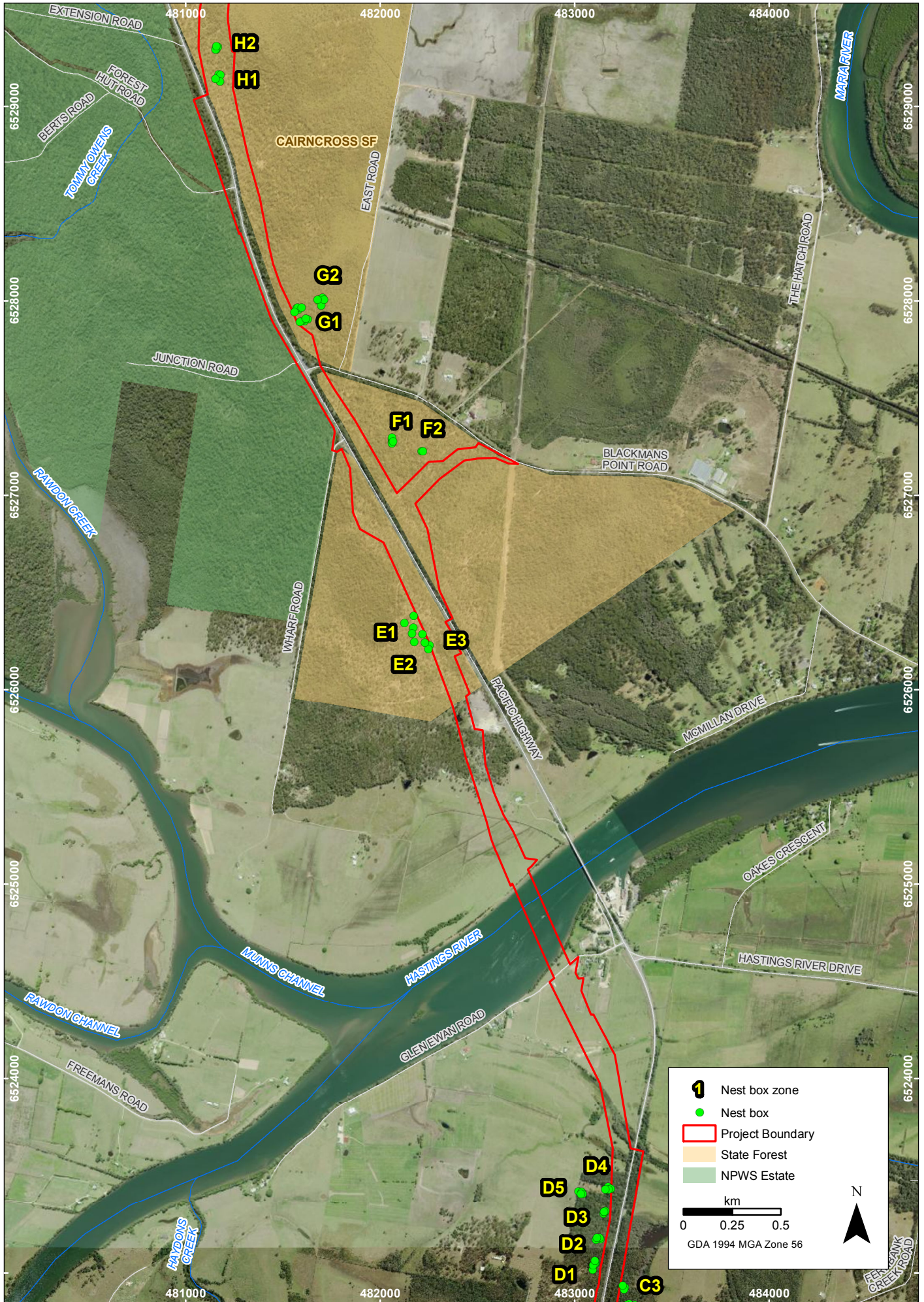
Nest Box Locations

Pacific Highway Upgrade – Oxley Highway to Kempsey

FIGURE 1.5

Imagery: (c) LPI 2014-6-10

Drawn by: MH Project Manager: RM Project Number: 1702 PI 5.14 Date: 27/09/2018



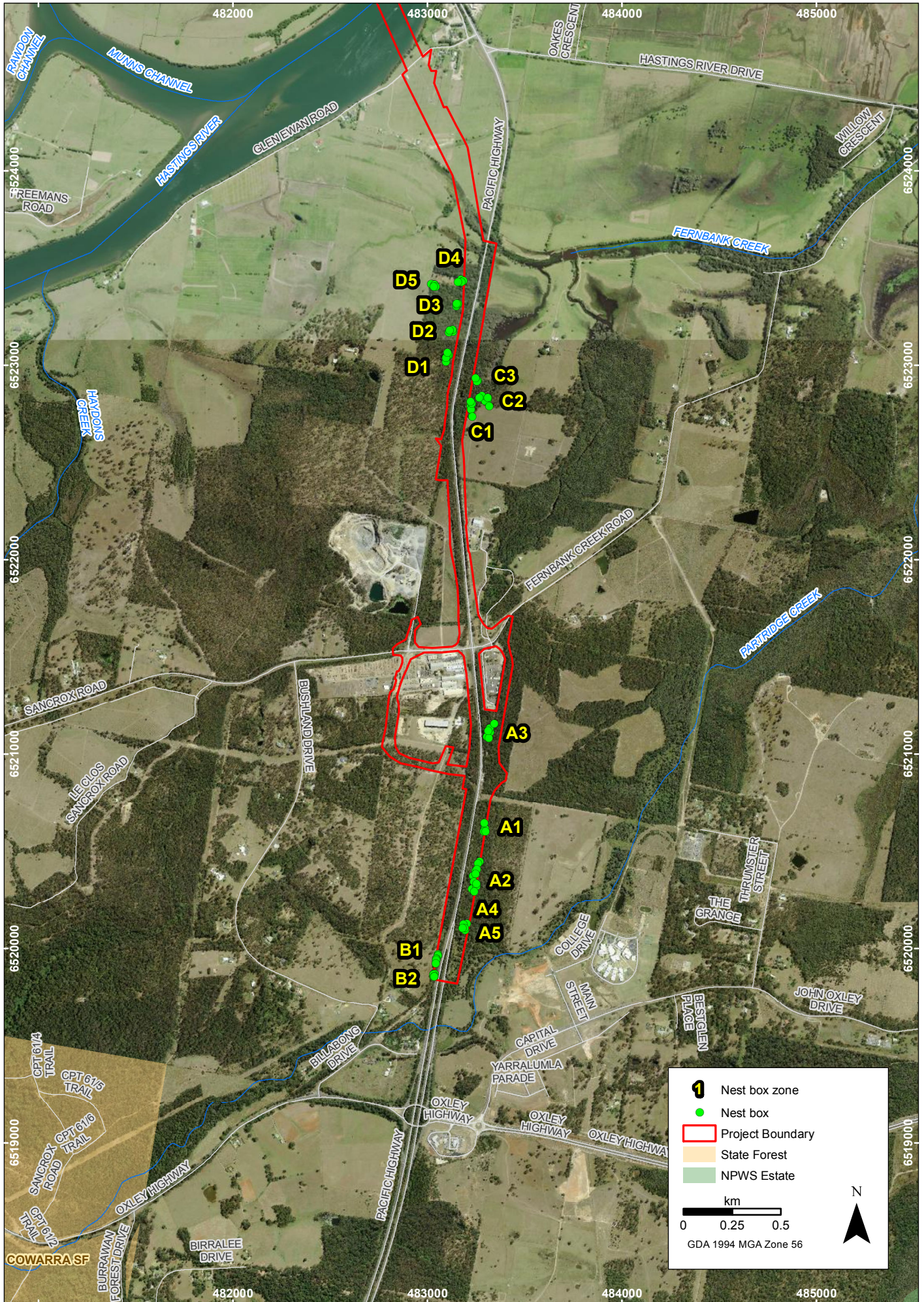
Nest Box Locations

Pacific Highway Upgrade – Oxley Highway to Kempsey

FIGURE 1.6

Imagery: (c) LPI 2014-6-10

Drawn by: MH Project Manager: RM Project Number: 1702 PI 5.14 Date: 27/09/2018



Nest Box Locations

Pacific Highway Upgrade – Oxley Highway to Kempsey

FIGURE 1.7

Imagery: (c) LPI 2014-6-10

3. Results

3.1 2017/2018 Seasonal Results

Summer and winter inspection results and survey weather conditions are provided in Annex 1, Annex 2 and Annex 3, respectively. To provide an overall representation of nest box results for the entire Project, OH2Ku and Ku2K results have been combined.

3.1.1 Event 4 – summer 2018

Summer surveys were undertaken between 16 January 2018 and 28 February 2018. A total of 514 nest boxes were monitored. Of these, 38 (7.4%) were occupied by native vertebrate fauna at the time of surveys and a further 235 (45.7%) showed signs of use by native vertebrate fauna. A total of 273 nest boxes (53.1%) were therefore either occupied or showed signs of use by native vertebrate fauna during the 2018 summer surveys.

3.1.2 Event 5 – winter 2018

Winter surveys were undertaken between 28 June 2018 and 30 August 2018. A total of 514 nest boxes were monitored. Of these, 48 (9.4%) were occupied by native vertebrate fauna at the time of surveys and a further 244 (47.6%) showed signs of use by native vertebrate fauna. A total of 292 nest boxes (56.9%) were therefore either occupied or showed signs of use by native vertebrate fauna during the 2018 winter surveys.

3.2 2017/2018 Native Fauna Use

Eleven species from three fauna groups were recorded occupying nest boxes during Event 4 and Event 5. These included:

- Mammals:
 - Arboreal mammals: Common Brushtail Possum (*Trichosurus vulpecula*), Yellow-bellied Glider (*Petaurus australis*), Sugar Glider (*Petaurus breviceps*), Squirrel Glider (*Petaurus norfolcensis*) and Common Ringtail Possum (*Pseudocheirus peregrinus*).
 - Scansorial mammals: Antechinus (*Antechinus sp.*).
- Birds: Australian Owlet Nightjar (*Aegotheles chrisoptus*), White-throated Treecreeper (*Cormobates leucophaea*) and Scaly-breasted Lorikeet (*Trichoglossus chlorolepidotus*).
- Reptiles: Lace Monitor (*Varanus varius*) and Carpet Python (*Morelia spilota*).

Of particular note was the detection of the Yellow-bellied Glider recorded on two occasions in a small owl and a large glider type box, and Squirrel Glider in small glider and scansorial type boxes. Both of these species are listed as vulnerable under the NSW *Biodiversity Conservation Act 2016* (BC Act). Use of nest boxes by native fauna is further discussed in Section 3.6.2.

3.3 2017/2018 Design Specific Use

The NBPoM proposed the installation of the following types of species-specific nest boxes:

- Scansorial fauna (Antechinus) (Scan)
- Small gliders (Feathertail Glider and Sugar Glider) (SG)
- Larger gliders (Squirrel Glider, Yellow-bellied Glider, Greater Glider) (LG)
- Possums (Common Brushtail Possum, Short-eared Possum and Common Ringtail Possum) (Poss)
- Microchiropteran bats (fluttering and direct flying species that utilise tree hollows) (MB)

- Medium sized parrots/lorikeets (Parr)
- Cockatoo (Black Cockatoos)(Co)
- Small Owls (Southern Boobook and Barn Owl) (SO)
- Large Forest Owls (Masked Owl, Sooty Owl, Powerful Owl) (LFO)

Fauna observed to be occupying nest boxes at the time of monitoring have been grouped into the above target groups and their nest box use is provided in Table 2.

Possums and reptiles were recorded in a variety of nest box types and sizes. Scansorial fauna were found only in SG boxes while the majority of small gliders (Sugar Gliders) were found in Scan and SG boxes. Large gliders (Squirrel Gliders and Yellow-bellied Gliders) were recorded in Scan, SG, LG and SO boxes, with Squirrel Gliders only occupying the smaller Scan and SG boxes, and Yellow-bellied Gliders occupying the larger LG and SO boxes. Cockatoo, small owl and large forest owl nest boxes were not used by their target fauna in Event 4 or Event 5. These species were also not recorded using nest boxes during the current monitoring events. Cumulative design-specific use is discussed in Section 3.8.4

Table 2: 2017/2018 nest box use by target species

Fauna group	Nest box type								
	Scansorial Fauna (Scan)	Small Glider (SG)	Large Glider (LG)	Possum (Poss)	Microbat (MB)	Parrot/Lorikeet (Parr)	Cockatoo (Co)	Small Owl (SO)	Large Forest Owl (LFO)
Scansorial fauna		6							
Small gliders	11	7	1	1		1			
Large gliders	3	2	1					1	
Possums			8	20		1	3		2
Microbats					1				
Parrots/lorikeets		2							
Cockatoos									
Small owls									
Large forest owls									
Other birds				2		1		2	
Reptiles		2	2	1		3		1	

3.4 2017/2018 Use by Invasive/Exotic Species

The NBPoM identifies native and non-native pest species including the European Bee (*Apis mellifera*), exotic birds including Common Myna (*Acridotheres tristis*) and Common Starling (*Sturnus vulgaris*), and termites and ants. These fauna are considered pests for the nest box program as they compete with native/target fauna for nesting resources, create nests/hives that exclude target fauna, and introduce maintenance and longevity issues.

Evidence of exotic bird use was recorded in Zone W, within three adjacent possum boxes (Box 129, 130 and 131). These boxes contained untidy nests with rubbish (pieces of plastic and food packaging) and various feathers and were considered likely to be nests of the Common Myna. European Bees were recorded in six boxes (1.2%) in summer and four boxes (0.8%) in winter. Including ant species, a total of 28 boxes (5.4%) in summer (Event 4) and 15 boxes (2.9%) in winter (Event 5) were occupied by pest species.

3.5 2017/2018 Maintenance

3.5.1 Box condition

Overall, boxes were found to be in good condition with a total of 18 boxes requiring maintenance after Event 4 or Event 5 (3.5%), four of which were attended to in July 2018. Maintenance actions included fixing broken lids and replacing boxes that had been damaged by fire or had substantially deteriorated. A number of potential installation issues that were observed during inspections are currently being discussed with Roads and Maritime. In collaboration with Niche, Roads and Maritime are currently endeavouring to find the best approach for amendment. Table 3 lists the structural maintenance issues encountered during Event 4 and Event 5.

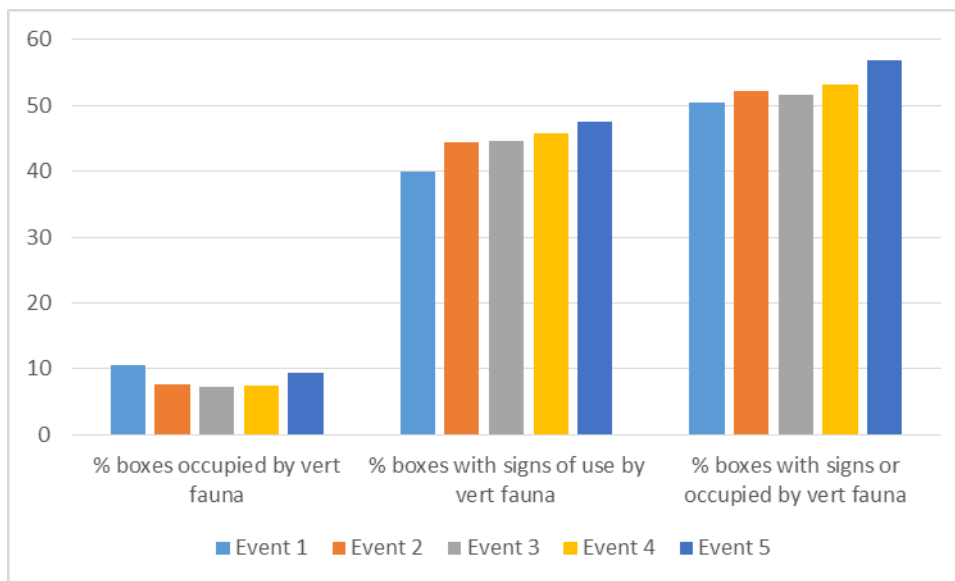
Table 3: 2017/2018 box maintenance

Section	Zone/ cluster	Box # / NBT	Box type	season of maintenance note	Box condition	Maintenance action required	Notes	Action taken
Ku2K	AA	6	Parr	Event 4 and 5	Burnt bottom	Replace		
Ku2K	NEW ZONE	90	Scan	Event 4	Lid held closed	Clear branches		
Ku2K	S	75	Scan	Event 4 and 5	Lid stuck	Fix lid		
Ku2K	T	67	LFO	Event 5	Broken	Replace	Box had fallen from the tree	
Ku2K	V	34	SG	Event 5	Lid stuck unable to inspect	Fix lid		
Ku2K	X	83	Parr	Event 5	Lid not straight	Fix lid		
Ku2K	Y	24	Poss	Event 4	Poor - rotten on inside	Replace	Wood decay fungi inside the box.	
Ku2K	Z	109	LG	Event 4 and 5	Broken hinges	Fix lid		
Ku2K	Z	124	LG	Event 5	Lid screwed shut	Fix lid		
OH2Ku	A1	180	SG	Event 4	Lid stuck closed	Fix lid		July 2018. Lid opened but may be re-occurring due to native bee hive
OH2Ku	A2	173	SG	Event 5	Poor - lid fell off	Fix lid	Lid hinges rusted off and lid fell down.	
OH2Ku	A4	187	Parr	Event 5	Poor - lid fell off	Fix lid	Lid fell to ground.	
OH2Ku	A5	188	Scan	Event 5	Lid broken	Fix lid		
OH2Ku	A5	189	SG	Event 5	Hinge broken	Fix lid		
OH2Ku	A5	191	Poss	Event 5	Lid loose	Fix lid		
OH2Ku	E3	196	Scan	Event 4	Hanging at an angle	Straighten		July 2018. Box straightened
OH2Ku	M2	250	Poss	Event 4	Lid stuck closed	Fix lid		July 2018. Lid freed.
OH2Ku	R1	322	LFO	Event 4	Lid stuck closed	Fix lid		July 2018. Lid freed.

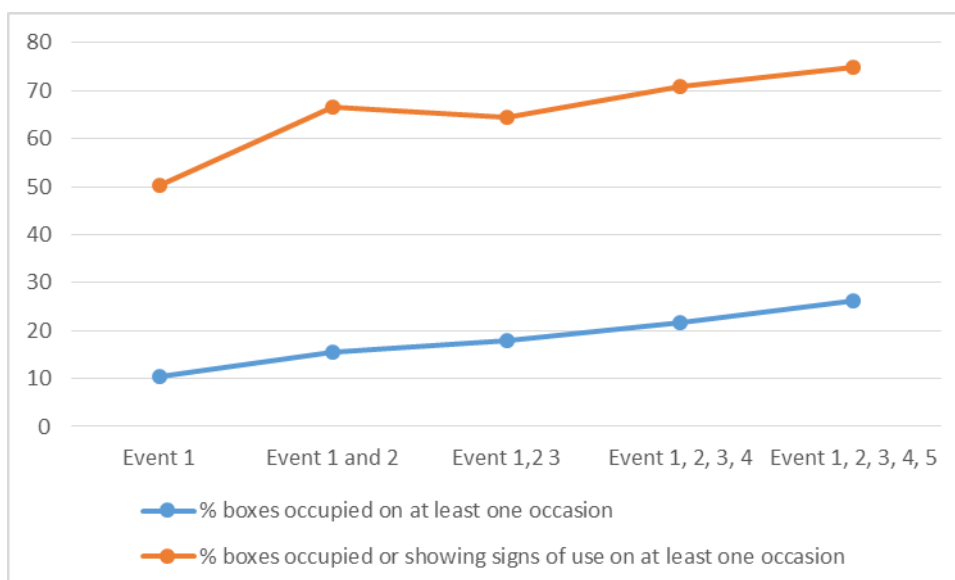
3.6 All Monitoring Events

3.6.1 Occupation rate

Graph 1 shows the rate of occupation and signs of use by native vertebrate fauna for all individual monitoring events to date, while Graph 2 shows the cumulative occupation for all monitoring events. The highest occupation rate by vertebrate fauna was recorded during Event 1 (10.5%), however there has been a gradual increase from Event 1 in the percentage of boxes that have shown signs of use by native vertebrate fauna. While the recorded occupancy during any one monitoring event appears to be consistently around 10%, Graph 2 shows that over 25% of boxes have been occupied on at least one occasion during inspections and that over 75% of boxes have been occupied or have shown signs of use on at least one occasion during inspections.



Graph 1: Nest box occupation and signs of use by native fauna



Graph 2: Cumulative occupation of nest boxes by native fauna

3.6.2 Native fauna use

Table 4 lists the native vertebrate fauna recorded during the current and previous surveys, with threatened species highlighted in bold. Two threatened species were recorded during Event 4 and 5: the Yellow-bellied Glider and the Squirrel Glider, both listed as vulnerable under the BC Act.

The Yellow-bellied Glider was recorded in zone AA NBT03 (small owl box) in Event 3 and Event 4; and zone AA NBT08 (large glider box) in Event 2. The Yellow-bellied Glider was also recorded during Event 4 in a new location, zone R3 NBT330 (large glider box).

The Squirrel Glider was detected during Event 3 in zone NEW ZONE NBT96 (possum box) and Event 4 in zone C2 NBT219 (small glider box) and G3 NBT209 (scansorial box). A number of additional glider records during Event 4 and 5 were recorded as possible Squirrel Gliders, however identification could not be confirmed.

The threatened Greater Glider (listed as vulnerable under the EPBC Act) has not been detected since Event 2 (zone R1 box 322, large forest owl box, and zone R3 box 334, large glider box).

Table 4: Nest box fauna

Fauna Group	Species	Event 1	Event 2	Event 3	Event 4	Event 5
Arboreal mammals	Short-eared Possum (<i>Trichosurus caninus</i>)		✓			
	Common Brushtail Possum (<i>Trichosurus vulpecula</i>)	✓	✓	✓	✓	✓
	Yellow-bellied Glider (<i>Petaurus australis</i>)		✓	✓	✓	
	Sugar Glider (<i>Petaurus breviceps</i>)	✓	✓	✓	✓	✓
	Greater Glider (<i>Petauroides volans</i>)		✓			
	Common Ringtail Possum (<i>Pseudocheirus peregrinus</i>)	✓	✓			✓
	Feathertail Glider (<i>Acrobates pygmaeus</i>)	✓	✓	✓		
	Squirrel Glider (<i>Petaurus norfolcensis</i>)			✓	✓	
Scansorial mammals	Brown Antechinus (<i>Antechinus stuartii</i>)	✓	✓	✓	✓	✓
Flying mammals	Gould's Long-eared Bat (<i>Nyctophilus gouldi</i>)	✓	✓	✓		
	Chocolate Wattled Bat (<i>Chalinolobus morio</i>)		✓			
	Lesser Long-eared Bat (<i>Nyctophilus geoffroyi</i>)			✓		
Birds	Australian Owlet Nightjar (<i>Aegotheles chrisoptus</i>)	✓	✓	✓	✓	✓
	Scaly-breasted Lorikeet (<i>Trichoglossus chlorolepidotus</i>)		✓	✓	✓	✓
	Eastern Rosella (<i>Platycercus eximius</i>)			✓		
	White-throated Treecreeper (<i>Cormobates leucophaea</i>)			✓		✓
Reptiles	Lace Monitor (<i>Varanus varius</i>)	✓	✓	✓	✓	✓
	Carpet Python (<i>Morelia spilota</i>)		✓		✓	✓

3.6.3 Cumulative design-specific use

The cumulative fauna records (Events 1, 2, 3, 4 and 5) and their nest box use are provided in Table 5.

Scansorial fauna have been recorded occupying the smaller Scan, SG and MB boxes, while small gliders have been found occupying all box types except for the largest cockatoo and owl boxes. Large gliders (Squirrel Gliders and Yellow-bellied Gliders) have been recorded in Scan, SG, Poss, LG and SO boxes, with Squirrel Gliders only occupying the smaller Scan and SG boxes, with one record in a Poss box, and Yellow-bellied Gliders occupying the larger LG and SO boxes. Possums have been recorded occupying all but the smallest nest boxes. The two Lorikeet records were from the same SG box, and other birds (White-throated Treecreeper and Owlet Nightjars) have been found occupying a range of box types. Similarly, reptiles have been found occupying a range of nest box types.

Overall, box types Scan, SG, LG, Poss and MB have all recorded occupancy by their target fauna group. Parr type boxes were used by non-target fauna, with the two Lorikeet records occurring in SG boxes, which are similar in dimensions to, but with a smaller entrance and shallower, than the Parr boxes. Box types Co, SO and LFO were not used by their target fauna, and as mentioned previously, these bird groups have not been recorded using nest boxes.

Table 5: Cumulative nest box use by target species

Fauna group	Nest box type								
	Scansorial Fauna (Scan)	Small Glider (SG)	Large Glider (LG)	Possum (Poss)	Microbat (MB)	Parrot/Lorikeet (Parr)	Cockatoo (Co)	Small Owl (SO)	Large Forest Owl (LFO)
Scansorial fauna	1	8			1			1	
Small gliders	23	24	1	1	2	5			
Large gliders	3	2	3	1				2	1
Possums			17	33		2	4	1	4
Microbats					6				
Parrots/lorikeets		4							
Cockatoos									
Small owls									
Large forest owls									
Other birds	1		1	2		4		6	1
Reptiles	1	2	3	1	1	7	1	3	

4. Discussion

4.1 Performance Measures

A summary of Event 4 and Event 5 monitoring results in relation to the performance indicators are provided in Table 6. Cumulative results have also been used in the assessment of results against performance indicators due to the expected gradual uptake of nest boxes by fauna.

Table 6: Performance measures and discussion

Performance indicators of success	Discussion
Use of nest boxes by a wide range of native fauna species.	This performance indicator has been met. Eleven species were identified during Event 4 and 5 and 18 native vertebrate fauna species, including three threatened species, have been recorded occupying boxes to date. Notable absentees were larger forest birds. Hollow-dependant hylid tree frogs were not observed, however some of these species may prefer hollows that retain water, which nest boxes are designed not to do.
Use of nest boxes designed for specific species by those same species.	This performance indicator has been met by 5 of the 9 nest box types to date. Nest box types Scan, SG, LG, Poss and MB boxes have all recorded use by target species. Nest box types Parr, Co, SO and LFO have not shown signs of use by target fauna (however these nest box types were used by other vertebrate fauna groups). The target fauna of these boxes were not recorded using any nest box type, with the exception of two Lorikeet records from the same SG box in consecutive inspections. This is discussed further in Table 8.
Low rate of use of nest boxes by introduced fauna species.*	This performance indicator has been met. Exotic birds were recorded using three nest boxes (0.6%) and 1.2% of nest boxes in winter and 0.8% in summer showed signs of use by European Bees.
Low level of maintenance of nest boxes.*	This performance indicator has been met. Only 3.5% of boxes required maintenance/replacement.

*= as per the bat roost boxes (Niche 2015), these levels/rates were not specified in the EMP, as such an arbitrary level/rate of $\leq 10\%$ has been assigned.

5. Recommendations

5.1 Contingency Measures and Recommendations

The EMP lists potential problems and contingency measures for various components of the monitoring program. Those that are considered to be relevant to the nest box monitoring program are listed and discussed in Table 7 and recommendations are discussed in Table 8.

Table 7: Contingency measures

Potential Problem	Contingency Measure proposed in EMP	Discussion of proposed measure
Nest box being used by non-target species.	Review number and design of next boxes.	<p>All nest box types showed use by non-target vertebrate fauna. As generalists, reptiles were expected, and observed to use a range of nest box types.</p> <p>LG boxes showed a relatively high use by possums which may exclude/compete with the targeted large gliders. Additional monitoring events are required to determine a trend or an increase in use of other box types by possums. Future consideration of exclusion methods for Brushtail Possums, such as installing metal guards around trees, to prevent predation and resource competition may be required, but at this stage is not considered necessary.</p> <p>At this stage, the level of use by non-target native vertebrate fauna is not considered to warrant contingency measures.</p> <p>At this stage, the use of 5.4% of nest boxes in summer and 2.9% in winter by non-target pests is not considered to warrant contingency measures. However should future monitoring observe ongoing and/or increasing use by these species, contingency measures may be required.</p> <p>This contingency measure is not considered relevant.</p>
Nest boxes become occupied by exotic or invasive fauna such as European Bees.	Review/modify nest box design to exclude undesirable species, treat nest boxes to deter/eradicate pest species, or relocate nest boxes.	<p>Exotic birds were recorded using three adjacent nest boxes (0.6%) and less than 2% of nest boxes currently show signs of use by European Bees.</p> <p>This contingency measure is not considered relevant.</p>
Poor uptake or usage by native fauna species.	Review the types and numbers of nest box designs, their location or positioning within the tree.	<p>Eighteen native vertebrate fauna species, including three threatened species, have been recorded occupying nest boxes to date. 78% of nest boxes have been occupied during inspections or shown signs of use by native vertebrate fauna on at least one occasion to date. However, as discussed in Table 8 large forest birds have not been recorded using nest boxes. This contingency measure is not considered relevant for the majority of target native species.</p>
Nest boxes deteriorating rapidly and requiring maintenance.	Identify causes of nest box failure, modify design and construct accordingly.	<p>Only 3.5% of boxes required maintenance/replacement. Maintenance included replacement due to deterioration or falling from the tree and fixing broken/damaged lids. This contingency measure is not considered relevant.</p>

Table 8: Recommendations

Issue to be addressed	Recommendation
Ku2K nest box numbers	It is recommended that nest boxes be installed to meet the minimum required number based on Phase 2 calculations, taking into consideration boxes that have been burnt or cannot be located.
Absence of large forest birds from nest boxes (Cockatoos and Owls)	<p>The NBPoM notes that there is limited evidence to suggest that black cockatoos will use artificial nest boxes and that evidence of artificial nest boxes by owl species is also limited. Anecdotal observations and literature, such as Goldingay and Stevens (2009), indicates that research regarding artificial hollow use by native bat and bird species is limited. In addition, nest box monitoring of nearby sections of the Pacific Highway Upgrade have not recorded use of nest boxes by cockatoos or owls (Niche 2018b, Sandpiper 2017d).</p> <p>Nest boxes have been installed and monitored for two years. It is possible that, with time, use of nest boxes by these previously unrecorded species may occur. As such, at this stage specific corrective actions have not been recommended. However, it is noted that given the apparent low likelihood of use, discussions with the NSW EPA to address the suitability of nest boxes as a mitigation measure and possible alternative mitigation measures for these birds groups may be required in time. These discussions should consider:</p> <ul style="list-style-type: none"> • A review of recent literature regarding the use of nest boxes by these bird groups to determine their effectiveness as compensatory habitat and likelihood of uptake. • A review of literature regarding alternative habitat compensation measures for these bird groups, including the installation of suitable felled natural hollows or chainsaw hollows (Griffiths <i>et al.</i> 2017). • A review of the NBPoM data to assess the species-specific habitat lost and the required level of habitat compensation.
In accordance with the EMP's maintenance regime:	
The removal of pest species such as Common Myna, Common Starlings and European Bees.	It is recommended that three boxes that recorded use by the Common Myna during Event 4 and Event 5 (Zone W, Poss boxes 129, 130 and 131) be cleared of nest material.
The replacement of fallen, damaged or deteriorated nest boxes	Box replacement and/or maintenance required for a total of 14 boxes as listed in Table 3.
The repositioning or relocation of nest boxes that show no sign of use after several successive monitoring periods	The overall use rate of the nest boxes after Event 5 monitoring is similar to other Pacific Highway Upgrade Projects (Sandpiper 2017d), and to date, 74.9% of boxes have shown signs of use on at least one occasion. Of the 514 boxes inspected, 130 have shown no signs of use to date. However, of these 130, 60 were installed during Phase 2 installations in 2017. Given the increasing rate of use of nest boxes, and that this rate is expected to further increase with time since installation, relocation of unused nest boxes is not yet recommended.
The removal of excess nesting material that may block access to the nest box over time	At this stage there are no nest boxes requiring removal of nest material.

References

- Goldingay, R.L. and Stevens, J.R. (2009). Use of artificial tree hollows by Australian birds and bats. *Wildlife Research* 36: 81 – 97.
- Griffiths, S.R., Lentini, P.E., Semmens, K., Watson, S.J., Lumsden, L.F. and Robert, K.A. (2018). Chainsaw-Carved Cavities Better Mimic the Thermal Properties of Natural Tree Hollows than Nest Boxes and Log Hollows. *Forests* 9: 235.
- Lewis, B.D. (2017a). Kundabung to Kempsey Nest Box Monitoring: Year 1. Report prepared for the K2K Joint Venture by Lewis Ecological Surveys.
- Lewis, B.D. (2017b). Kundabung to Kempsey Nest Box Monitoring: Year 2 Winter. Report prepared for the K2K Joint Venture by Lewis Ecological Surveys.
- Niche (2015). OH2K Pacific Highway Upgrade. Annual Ecological Monitoring Report 2015. Prepared by Niche Environment and Heritage Pty Ltd for Roads and Maritime Services, Port Macquarie, NSW.
- Niche (2017). OH2K Pacific Highway Upgrade. Annual Ecological Monitoring Report 2017. Prepared by Niche Environment and Heritage Pty Ltd for Roads and Maritime Services, Port Macquarie, NSW.
- Niche (2018a). OH2K Pacific Highway Upgrade. Contractor Ecological Monitoring Report 2018. Prepared by Niche Environment and Heritage Pty Ltd for Roads and Maritime Services, Port Macquarie, NSW.
- Niche (2018b). Nest Box 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.
- Sandpiper (2017a). Pacific Highway Upgrade: Oxley Highway to Kundabung Nest box monitoring – winter 2016. Letter report prepared for Lendlease Engineering by Sandpiper Ecological Surveys.
- Sandpiper (2017b). Pacific Highway Upgrade: Oxley Highway to Kundabung Nest box monitoring – summer 2017. Letter report prepared for Lendlease Engineering by Sandpiper Ecological Surveys.
- Sandpiper (2017c). Pacific Highway Upgrade: Oxley Highway to Kundabung Nest box monitoring – winter 2017. Letter report prepared for Lendlease Engineering by Sandpiper Ecological Surveys.
- Sandpiper (2017d). Nest Box Monitoring Report. Pacific Highway Upgrade: Woolgoolga to Ballina Section 1 – Autumn 2017 (Year 2). Report prepared by Sandpiper Ecological Surveys.

Annex 1 – Summer 2018 nest box monitoring

Section	Zone/ cluster	Box # / NBT	Box type	Check Date	Time	Inspect type	Vert Fauna Y/N	Species	Native /Pest	Vert signs of use	Box Cond	Box maintenance required	Changes in surrounds	Notes
Ku2K	AA	1	Scan	07/02/2018	9:27	Camera	P			Euc leaf nest	Good	Nil	Previous fire regen	
Ku2K	AA	1	MB	07/02/2018	9:30	Camera	N			Nil	Good	Nil	Previous fire regen	
Ku2K	AA	2	SG	07/02/2018	9:20	Camera	N	Ants	P	Nil	Good	Clear out	Previous fire regen	ant nest
Ku2K	AA	2	Parr	07/02/2018	9:22	Camera	N			Nil	Good	Nil	Previous fire regen	
Ku2K	AA	3	SO	26/02/2018	11:11	Tree climber	Y	Yellow-bellied Glider	N	occupied	Good	Nil	Nil	YBG fled box
Ku2K	AA	3	Poss	07/02/2018	9:37	Camera	N			Nil	Good	Nil	Previous fire regen	
Ku2K	AA	4	Scan	07/02/2018	9:18	Camera	P			Euc leaf nest	Good	Nil	Previous fire regen	
Ku2K	AA	4	Poss	07/02/2018	9:15	Camera	N	Ants	P	Nil	Good	Clear out	Previous fire regen	Active ant nest
Ku2K	AA	5	LFO	26/02/2018	11:22	Tree climber	N			Leaves and bird droppings	Good	Nil	Nil	
Ku2K	AA	5	Poss	26/02/2018	11:22	Tree climber	N			Nil	Good	Continue to monitor	Nil	Water getting into the box and pooling causing wood decay.
Ku2K	AA	6	MB	07/02/2018	9:08	Camera	N			Nil	Good	Nil	Previous fire regen	
Ku2K	AA	6	Parr	07/02/2018	9:07	Camera	N			Nil	Burnt	Replace	Previous fire regen	
Ku2K	AA	6	Scan	07/02/2018	9:06	Camera	N			Nil	Good	Nil	Previous fire regen	
Ku2K	AA	7	SG	07/02/2018	8:38	Camera	N			Nil	Good	Nil	Previous fire regen	
Ku2K	AA	7	Poss	07/02/2018	8:40	Camera	Y	Common Brush-tail Possum x 2	N	occupied	Good	Nil	Previous fire regen	

Section	Zone/cluster	Box # / NBT	Box type	Check Date	Time	Inspect type	Vert Fauna Y/N	Species	Native /Pest	Vert signs of use	Box Cond	Box maintenance required	Changes in surrounds	Notes
Ku2K	AA	8	LG	26/02/2018	10:50	Tree climber	N			Fresh leaves	Good	Nil	Nil	
Ku2K	AA	9	Poss	07/02/2018	not located		not located				Unk		Previous fire regen	
Ku2K	AA	9	Scan	07/02/2018	not located		not located				Unk		Previous fire regen	
Ku2K	AA	94	Scan	26/02/2018	10:10	Tree climber	N			Nil	Good	Nil	Nil	Appears to be insufficient wiring to support the box. No protective hose on the wire.
Ku2K	AA	94	SG	07/02/2018	9:00	Camera	N			Euc leaf nest	Good	Nil	Previous fire regen	
Ku2K	AA	95	Scan	07/02/2018			not located				Unk			Appears to have been burnt as hanging mark on tree
Ku2K	AA	95	Scan	07/02/2018			not located				Unk			Appears to have been burnt as hanging mark on tree
Ku2K	NEW ZONE	90	Scan	06/02/2018	13:01	Camera	Y	Sugar or Squirrel Glider	N	occupied	Good	Clear branches	Nil	Branches holding lid closed.
Ku2K	NEW ZONE	90	Poss	06/02/2018	13:22	Camera	N			Nil	Good	Nil	Nil	
Ku2K	NEW ZONE	91	Scan	06/02/2018	13:23	Camera	N			Nil	Good	Nil	Nil	
Ku2K	NEW ZONE	91	Poss	06/02/2018	13:26	Camera	N			Nil	Good	Nil	Nil	
Ku2K	NEW ZONE	92	LG	26/02/2018	8:30	Tree climber	N			conical leaf nest	Good	Nil	Nil	
Ku2K	NEW ZONE	92	Scan	06/02/2018	13:30	Camera	P			Euc leaf nest	Good	Nil	Nil	
Ku2K	NEW ZONE	96	Co	26/02/2018	16:58	Tree climber	N			Nil	Good	Nil	Nil	Appears to be insufficient wiring to support the box and the box is not correctly aligned/positioned.
Ku2K	NEW ZONE	96	Poss	26/02/2018	16:58	Tree climber	N			leaf litter	Good	Nil	Nil	Appears to be insufficient wiring to support the box and the box is not correctly aligned/positioned.
Ku2K	NEW ZONE	97	LFO	26/02/2018	17:20	Tree climber	N			Nil	Good	Nil	Nil	
Ku2K	NEW ZONE	97	Poss	26/02/2018	17:20	Tree climber	N			leaf litter	Good	Nil	Nil	Box appears to have been installed with soil inside which will potentially rot the timber.

Section	Zone/cluster	Box # / NBT	Box type	Check Date	Time	Inspect type	Vert Fauna Y/N	Species	Native /Pest	Vert signs of use	Box Cond	Box maintenance required	Changes in surrounds	Notes
Ku2K	NEW ZONE	98	Scan	26/02/2018	15:55	Tree climber	N			Nil	Good	Nil	Nil	
Ku2K	NEW ZONE	98	LG	26/02/2018	15:55	Tree climber	N			leaf litter	Good	Nil	Nil	
Ku2K	NEW ZONE	99	SG	06/02/2018	15:21	Camera	N			Nil	Good	Nil	Nil	
Ku2K	NEW ZONE	99	Poss	06/02/2018	15:25	Camera	N			Nil	Good	Nil	Nil	
Ku2K	NEW ZONE	100	LG	26/02/2018	16:22	Tree climber	N			Leaves	Good	Nil	Nil	
Ku2K	NEW ZONE	100	Poss	26/02/2018	16:22	Tree climber	N			Nil	Good	Nil	Nil	The box is not correctly aligned/positioned and there is no hose on the hanging wire. The wire appears to have some sharp edges/ends.
Ku2K	S	58	LG	05/02/2018	9:06	Camera	N			Nil	Good	Nil	Nil	
Ku2K	S	58	Scan	05/02/2018	8:54	Camera	N	Ants	P	Nil	Good	Clean out	Nil	Ant nest
Ku2K	S	59	SG	05/02/2018	9:15	Camera	N	Ants	P	Nil	Good	Clean out	Nil	Ant nest
Ku2K	S	59	Poss	05/02/2018	9:10	Camera	N			Nil	Good	Nil	Nil	
Ku2K	S	60	LG	05/02/2018	9:20	Camera	N			Nil	Good	Nil	Nil	
Ku2K	S	60	Poss	05/02/2018	9:16	Camera	N			Nil	Good	Nil	Nil	
Ku2K	S	61	Poss	05/02/2018	9:36	Camera	N			Nil	Good	Nil	Nil	
Ku2K	S	61	SO	05/02/2018	9:40	Camera	N			Nil	Good	Nil	Nil	
Ku2K	S	72	LG	08/02/2018	16:30	Camera	N			Nil	Good	Nil	Nil	
Ku2K	S	72	Poss	08/02/2018	16:25	Camera	N			Nil	Good	Nil	Nil	
Ku2K	S	73	LG	08/02/2018	16:09	Camera	N			Nil	Good	Nil	Nil	Honeycomb
Ku2K	S	73	Poss	08/02/2018	16:15	Camera	N			Nil	Good	Nil	Nil	
Ku2K	S	74	Co	28/02/2018	10:48	Tree climber	N	Ants	P	Nil	Good	Nil	Nil	Active ants
Ku2K	S	75	Parr	08/02/2018	15:45	Camera	N			Leaf litter	Good	Nil	Nil	
Ku2K	S	75	Scan	08/02/2018	15:46	Camera	N	Insects	P	Nil	Good	Lid wedged shut - clear out	Nil	Infested with insects
Ku2K	S	76	Scan	08/02/2018	16:07	Camera	N			Nil	Good	Nil	Nil	Insect debris

Section	Zone/ cluster	Box # / NBT	Box type	Check Date	Time	Inspect type	Vert Fauna Y/N	Species	Native /Pest	Vert signs of use	Box Cond	Box maintenance required	Changes in surrounds	Notes
Ku2K	S	76	Poss	08/02/2018	16:04	Camera	N			Leaf litter	Good	Nil	Nil	
Ku2K	S	77	LFO	28/02/2018	10:37	Tree climber	Y	Common Brush-tail Possum	N	Occupied	Good	Nil	Nil	
Ku2K	S	77	Poss	08/02/2018	16:00	Camera	N			Nil	Good	Nil	Nil	
Ku2K	S	78	SG	08/02/2018	15:48	Camera	N			Nil	Good	Nil	Nil	Insect debris
Ku2K	S	78	Parr	08/02/2018	15:50	Camera	N			Nil	Good	Nil	Nil	
Ku2K	S	79	Scan	08/02/2018	15:38	Camera	N			Old euc leaf nest	Good	Nil	Nil	
Ku2K	S	79	SG	08/02/2018	15:39	Camera	N			Nil	Good	Nil	Nil	
Ku2K	T	48	Poss	05/02/2018	10:30	Camera	N			Nil	Good	Nil	Nil	
Ku2K	T	48	MB	05/02/2018	10:26	Camera	N			Nil	Good	Nil	Nil	
Ku2K	T	49	MB	05/02/2018	10:14	Camera	N			Nil	Good	Nil	Nil	
Ku2K	T	49	LG	05/02/2018	10:18	Camera	N			Nil	Good	Nil	Nil	
Ku2K	T	50	Scan	05/02/2018	10:19	Camera	N			Nil	Good	Nil	Nil	
Ku2K	T	50	Poss	05/02/2018	10:22	Camera	N			Nil	Good	Nil	Nil	
Ku2K	T	51	Poss	05/02/2018	10:02	Camera	N			Nil	Good	Nil	Nil	
Ku2K	T	51	LG	05/02/2018	10:03	Camera	N	Ants	P	Nil	Good	Clear out	Nil	Infested
Ku2K	T	52	Parr	05/02/2018	9:54	Camera	N			Euc leaf nest	Good	Nil	Nil	
Ku2K	T	52	SG	05/02/2018	9:58	Camera	N	Ants	P	Nil	Good	Clear out	Nil	Ants nest
Ku2K	T	53	Scan	05/02/2018	16:19	Camera	N			leaf litter	Good	Nil	Nil	
Ku2K	T	53	SG	05/02/2018	16:21	Camera	N			conical leaf nest	Good	Nil	Nil	
Ku2K	T	54	SG	05/02/2018	16:13	Camera	N	Ants	P	Nil	Good	Clear out	Nil	Ants nest
Ku2K	T	54	LG	05/02/2018	16:15	Camera	N			Nil	Good	Nil	Nil	
Ku2K	T	55	Scan	05/02/2018	16:04	Camera	N			Euc leaf nest	Good	Nil	Nil	
Ku2K	T	55	Parr	05/02/2018	16:06	Camera	N			Nil	Good	Nil	Nil	
Ku2K	T	56	Scan	05/02/2018	15:56	Camera	N			Nil	Good	Nil	Nil	
Ku2K	T	56	SG	05/02/2018	15:54	Camera	N	Ants	P	Nil	Good	Clear out	Nil	Active ant nest
Ku2K	T	57	MB	05/02/2018	16:00	Camera	N			Nil	Good	Nil	Nil	
Ku2K	T	57	LG	05/02/2018	16:01	Camera	N			Nil	Good	Nil	Nil	

Section	Zone/ cluster	Box # / NBT	Box type	Check Date	Time	Inspect type	Vert Fauna Y/N	Species	Native /Pest	Vert signs of use	Box Cond	Box maintenance required	Changes in surrounds	Notes
Ku2K	T	62	Co	28/02/2018	9:49	Tree climber	N			Leaves	Good	Nil	Nil	Limited tree growth room in wire
Ku2K	T	63	SG	08/02/2018	16:15	Camera	N	Ants	P	Nil	Good	Clear out	Nil	Active ant nest
Ku2K	T	63	LG	08/02/2018	16:17	Camera	N			Nil	Good	Nil	Nil	
Ku2K	T	64	LG	08/02/2018	13:58	Camera	N			Nil	Good	Nil	Nil	
Ku2K	T	64	SG	08/02/2018	13:55	Camera	N			Euc leaf nest	Good	Nil	Nil	
Ku2K	T	65	SO	08/02/2018	14:02	Camera	N			leaf litter	Good	Nil	Nil	
Ku2K	T	66	SG	08/02/2018	14:22	Camera	N	Ants	P	Nil	Good	Nil	Nil	Active ants no nest
Ku2K	T	66	Parr	08/02/2018	14:25	Camera	N	Ants	P	Nil	Good	Nil	Nil	Active ants no nest
Ku2K	T	67	Poss	08/02/2018	14:29	Camera	N			Nil	Good	Nil	Nil	
Ku2K	T	67	LFO	08/02/2018	14:33	Camera	N			Nil	Good	Nil	Nil	
Ku2K	T	68	LG	08/02/2018	15:02	Camera	N			Nil	Good	Nil	Nil	
Ku2K	T	68	SG	08/02/2018	16:50	Camera	N			Euc leaf nest	Good	Nil	Nil	
Ku2K	T	69	MB	08/02/2018	16:47	Camera	N			leaf litter	Good	Nil	Nil	
Ku2K	T	70	SO	28/02/2018	10:07	Tree climber	N			Nil	Good	Nil	Nil	
Ku2K	T	71	MB	08/02/2018	14:44	Camera	N			Nil	Good	Nil	Nil	
Ku2K	T	71	LG	08/02/2018	14:52	Camera	Y			Nil	Good	Nil	Nil	Active ants no nest
Ku2K	T	119	LG	26/02/2018	7:25	Tree climber	N			fresh leaves	Good	Nil	Nil	The box is sitting in fork of branch instead of hanging from the wire and the wire does not appear to be securely fastened.
Ku2K	T	119	Poss	05/02/2018	10:58	Camera	N			Nil	Good	Nil	Nil	
Ku2K	T	120	Poss	05/02/2018	10:51	Camera	N			Nil	Good	Nil	Nil	
Ku2K	T	120	Scan	05/02/2018	10:50	Camera	N			Euc leaves	Good	Nil	Nil	
Ku2K	T	121	Scan	05/02/2018	10:40	Camera	N			Nil	Good	Nil	Nil	
Ku2K	T	121	LG	05/02/2018	10:48	Camera	N			Nil	Good	Nil	Nil	
Ku2K	U	37	Poss	28/02/2018	9:26	Tree climber	N			Nil	Good	Nil	Nil	
Ku2K	U	37	LFO	28/02/2018	9:21	Tree climber	Y	Common Brushtail	N	occupied	Good	Nil	Nil	

Section	Zone/ cluster	Box # / NBT	Box type	Check Date	Time	Inspect type	Vert Fauna Y/N	Species	Native /Pest	Vert signs of use	Box Cond	Box maintenance required	Changes in surrounds	Notes
								Possum						
Ku2K	U	38	Scan	05/02/2018	15:50	Camera	N			leaf litter	Good	Nil	Nil	
Ku2K	U	38	SG	05/02/2018	14:56	Camera	P			Euc leaf nest	Good	Nil	Nil	
Ku2K	U	39	LG	05/02/2018	14:32	Camera	N			leaf litter	Good	Nil	Nil	
Ku2K	U	39	Poss	05/02/2018	14:38	Camera	N			leaf litter	Good	Nil	Nil	
Ku2K	U	40	SG	05/02/2018	14:59	Camera	P			Euc leaf nest	Good	Nil	Nil	
Ku2K	U	40	Parr	05/02/2018	15:03	Camera	N			Nil	Good	Nil	Nil	
Ku2K	U	41	MB	05/02/2018	13:55	Camera	N			Nil	Good	Nil	Nil	
Ku2K	U	41	Poss	05/02/2018	13:51	Camera	N			Euc leaf litter	Good	Nil	Nil	
Ku2K	U	42	MB	05/02/2018	12:04	Camera	N			Nil	Good	Nil	Nil	
Ku2K	U	42	SO	05/02/2018	12:06	Camera	N			Nil	Good	Nil	Nil	
Ku2K	U	43	Parr	05/02/2018	12:15	Camera	N			Nil	Good	Nil	Nil	
Ku2K	U	43	MB	05/02/2018	12:10	Camera	N			Nil	Good	Nil	Nil	
Ku2K	U	44	Scan	05/02/2018	12:35	Camera	N	Ants	P	Nil	Good	Clear out	Nil	Active ants nest
Ku2K	U	44	SG	05/02/2018	12:35	Camera	N			Nil	Good	Nil	Nil	
Ku2K	U	45	SG	05/02/2018	12:38	Camera	N			Nil	Good	Nil	Nil	
Ku2K	U	45	LG	05/02/2018	12:40	Camera	N			Nil	Good	Nil	Nil	
Ku2K	U	46	LG	05/02/2018	12:26	Camera	N			Nil	Good	Nil	Nil	
Ku2K	U	46	Scan	05/02/2018	12:20	Camera	N			Euc leaf nest	Good	Nil	Nil	
Ku2K	U	47	Scan	05/02/2018	12:28	Camera	N			woody debris	Good	Nil	Nil	
Ku2K	U	47	Poss	05/02/2018	12:30	Camera	N	Ants	P	Nil	Good	Clear out	Nil	Active ant nest
Ku2K	U	93	Scan	05/02/2018	11:57	Camera	N	Ants	P	Nil	Good	Clear out	Nil	Active ant nest
Ku2K	U	93	Poss	05/02/2018	12:00	Camera	N			Nil	Good	Nil	Nil	
Ku2K	V	31	Scan	06/02/2018	9:25	Camera	N			Nil	Good	Nil	Nil	
Ku2K	V	31	SG	06/02/2018	9:20	Camera	Y	Scaly Breasted Lorikeet chicks	N	occupied - adult returned after inspection	Good	Nil	Nil	Ants in nest
Ku2K	V	32	SG	06/02/2018	9:32	Camera	N			shells, feathers (Scaly Breasted Lorikeet)	Good	Nil	Nil	
Ku2K	V	32	Parr	06/02/2018	9:30	Camera	P			Euc leaf nest	Good	Nil	Nil	

Section	Zone/ cluster	Box # / NBT	Box type	Check Date	Time	Inspect type	Vert Fauna Y/N	Species	Native /Pest	Vert signs of use	Box Cond	Box maintenance required	Changes in surrounds	Notes
Ku2K	V	33	Scan	06/02/2018	9:35	Camera	N			Nil	Good	Nil	Nil	
Ku2K	V	33	MB	06/02/2018	9:37	Camera	N			Nil	Good	Nil	Nil	
Ku2K	V	34	SG	06/02/2018	9:41	Camera	P			conical leaf nest	Good	Nil	Nil	
Ku2K	V	34	Poss	06/02/2018	9:39	Camera	N			Nil	Good	Nil	Nil	
Ku2K	V	35	MB	06/02/2018	9:48	Camera	P			Fresh euc leaves	Good	Nil	Nil	
Ku2K	V	35	Parr	06/02/2018	9:50	Camera	N			Shredded barks	Good	Nil	Nil	
Ku2K	V	36	Scan	06/02/2018	9:54	Camera	N			Euc leaf nest	Good	Nil	Nil	
Ku2K	V	36	Poss	06/02/2018	9:58	Camera	N			Nil	Good	Nil	Nil	
Ku2K	V	126	LG	06/02/2018	8:47	Camera	N			Nil	Good	Nil	Nil	
Ku2K	V	126	Poss	06/02/2018	8:45	Camera	N			Nil	Good	Nil	Nil	
Ku2K	V	127	LG	06/02/2018	8:38	Camera	N			Nil	Good	Nil	Nil	lid was open
Ku2K	V	127	Scan	06/02/2018	8:35	Camera	N			Nil	Good	Nil	Nil	
Ku2K	V	128	Scan	06/02/2018	9:08	Camera	N			Nil	Good	Nil	Nil	
Ku2K	V	128	Poss	06/02/2018	9:10	Camera	Y	Common Brush-tail Possum	N	occupied	Good	Nil	Nil	
Ku2K	W	112	Scan	06/02/2018	12:11	Camera	N			Nil	Good	Nil	Nil	
Ku2K	W	112	MB	06/02/2018	12:13	Camera	N			Nil	Good	Nil	Nil	
Ku2K	W	113	LG	06/02/2018	12:09	Camera	N			Nil	Good	Nil	Nil	
Ku2K	W	113	Scan	06/02/2018	12:02	Camera	N			Nil	Good	Nil	Nil	
Ku2K	W	114	Poss	06/02/2018	11:59	Camera	N			Nil	Good	Nil	Nil	
Ku2K	W	114	Scan	06/02/2018	11:58	Camera	N			Nil	Good	Nil	Nil	
Ku2K	W	115	Poss	06/02/2018	11:51	Camera	N			Nil	Good	Nil	Nil	
Ku2K	W	115	Parr	06/02/2018	11:51	Camera	N			Nil	Good	Nil	Nil	
Ku2K	W	116	Scan	06/02/2018	11:43	Camera	N			Euc leaves	Good	Nil	Nil	
Ku2K	W	116	Poss	06/02/2018	11:46	Camera	N			Nil	Good	Nil	Nil	
Ku2K	W	117	Poss	06/02/2018	11:40	Camera	N			Old bird nest, possible dead bird, debris, ants	Good	Nil	Nil	
Ku2K	W	117	SG	06/02/2018	11:36	Camera	N			Fresh euc leaves	Good	Nil	Nil	

Section	Zone/ cluster	Box # / NBT	Box type	Check Date	Time	Inspect type	Vert Fauna Y/N	Species	Native /Pest	Vert signs of use	Box Cond	Box maintenance required	Changes in surrounds	Notes
Ku2K	W	118	Scan	06/02/2018	11:30	Camera	N			Nil	Good	Nil	Nil	
Ku2K	W	118	MB	06/02/2018	11:26	Camera	N			Nil	Good	Nil	Nil	
Ku2K	W	129	Poss	06/02/2018	16:42	Camera	N			Nest with rubbish and various feathers. Likely Common Myna nest.	Good	Nil	Nil	
Ku2K	W	129	MB	06/02/2018	16:30	Camera	N			Nil	Good	Nil	Nil	
Ku2K	W	130	Poss	06/02/2018	16:27	Camera	N			Nest with rubbish and various feathers. Likely Common Myna nest.	Good	Nil	Nil	
Ku2K	W	130	MB	06/02/2018	16:28	Camera	N			Nil	Good	Nil	Nil	
Ku2K	W	131	Poss	06/02/2018	16:32	Camera	N			Nest with rubbish and various feathers. Likely Common Myna nest.	Good	Nil	Nil	
Ku2K	W	131	MB	06/02/2018	16:30	Camera	N			Nil	Good	Nil	Nil	
Ku2K	X	26	SG	08/02/2018	10:12	Camera	N			Nil	Good	Nil	Nil	
Ku2K	X	26	Parr	08/02/2018	10:14	Camera	N			Nil	Good	Nil	Nil	
Ku2K	X	27	Scan	08/02/2018	10:10	Camera	N			Euc leaf nest	Good	Nil	Nil	
Ku2K	X	27	Parr	08/02/2018	10:11	Camera	N			Nil	Good	Nil	Nil	Mud wasp nest
Ku2K	X	28	Poss	08/02/2018	10:06	Camera	N			Nil	Good	Nil	Nil	
Ku2K	X	28	MB	08/02/2018	10:04	Camera	N			Euc leaf nest	Good	Nil	Nil	
Ku2K	X	29	Co	08/02/2018	not located		not located				Unk			
Ku2K	X	30	Poss	08/02/2018	not located		not located				Unk			
Ku2K	X	30	LFO	08/02/2018	not located		not located				Unk			
Ku2K	X	80	SG	08/02/2018	9:12	Camera	N			Nil	Good	Nil	Nil	
Ku2K	X	80	LG	08/02/2018	9:15	Camera	N			Nil	Good	Nil	Nil	
Ku2K	X	81	MB	08/02/2018	8:50	Camera	N			Nil	Good	Nil	Nil	

Section	Zone/cluster	Box # / NBT	Box type	Check Date	Time	Inspect type	Vert Fauna Y/N	Species	Native /Pest	Vert signs of use	Box Cond	Box maintenance required	Changes in surrounds	Notes
Ku2K	X	81	Parr	08/02/2018	8:52	Camera	N			Nil	Good	Nil	Nil	
Ku2K	X	82	SG	08/02/2018	9:02	Camera	N			Nil	Good	Nil	Nil	
Ku2K	X	82	Poss	08/02/2018	9:05	Camera	N			Nil	Good	Nil	Nil	
Ku2K	X	83	LG	08/02/2018	9:43	Camera	N			Euc leaf nest	Good	Nil	Nil	
Ku2K	X	83	Parr	08/02/2018	9:33	Camera	N			Nil	Good	Nil	Nil	
Ku2K	X	84	Scan	08/02/2018	9:18	Camera	N			Conical leaf nest	Good	Nil	Nil	
Ku2K	X	84	Parr	08/02/2018	9:22	Camera	N			Few fresh euc leaves and entrance hole chewed	Good	Nil	Nil	
Ku2K	X	101	Poss	26/02/2018	7:34	Tree climber	N			Nil	Good	Nil	Nil	
Ku2K	X	101	Co	26/02/2018	7:14	Tree climber	N			leaves and dirt	Good	Nil	Post fire regeneration	
Ku2K	X	102	Poss	26/02/2018	7:45	Tree climber	N			Nil	Good	Nil	Post fire regeneration	
Ku2K	X	102	LFO	26/02/2018	7:45	Tree climber	N			fresh leaves	Good	Nil	Post fire regeneration	
Ku2K	X	103	Poss	26/02/2018	8:37	Tree climber	N			Nil	Good	Nil	Post fire regeneration	
Ku2K	X	103	Co	26/02/2018	8:27	Tree climber	N			Nil	Good	Nil	Post fire regeneration	
Ku2K	X	132	Co	08/02/2018	not located		not located				Unk			
Ku2K	Y	16	MB	07/02/2018	14:22	Camera	N			Nil	Good	Nil	post fire regen	
Ku2K	Y	16	Parr	07/02/2018	14:25	Camera	N			Leaf litter	Good	Nil	post fire regen	
Ku2K	Y	17	Scan	07/02/2018	14:30	Camera	N			Nil	Good	Nil	post fire regen	
Ku2K	Y	17	Parr	07/02/2018	14:34	Camera	N			Nil	Good	Nil	post fire regen	
Ku2K	Y	18	LG	07/02/2018	14:19	Camera	N	European Honey Bees	P	Nil	Good	Nil	Nil	Infested beehive
Ku2K	Y	18	Scan	07/02/2018	14:17	Camera	N			Euc leaf nest	Good	Nil	Nil	
Ku2K	Y	19	Scan	07/02/2018	14:11	Camera	N			Nil	Good	Nil	Nil	
Ku2K	Y	19	SO	07/02/2018	14:14	Camera	N			Leaf litter	Good	Nil	Nil	

Section	Zone/ cluster	Box # / NBT	Box type	Check Date	Time	Inspect type	Vert Fauna Y/N	Species	Native /Pest	Vert signs of use	Box Cond	Box maintenance required	Changes in surrounds	Notes
Ku2K	Y	20	SG	07/02/2018	14:05	Camera	N			Nil	Good	Nil	Nil	Mud wasp nest
Ku2K	Y	20	Scan	07/02/2018	14:03	Camera	N			Nil	Good	Nil	Nil	
Ku2K	Y	21	SG	NA										This NBT was discontinued and became NBT 86
Ku2K	Y	21	Poss	NA										This NBT was discontinued and became NBT 86
Ku2K	Y	22	Scan	07/02/2018	13:54	Camera	N			Euc leaf nest	Good	Nil	Nil	
Ku2K	Y	22	Parr	07/02/2018	13:56	Camera	N			Euc leaf nest	Good	Nil	Nil	
Ku2K	Y	23	LG	NA										This NBT was discontinued and became NBT 89
Ku2K	Y	23	Poss	NA										This NBT was discontinued and became NBT 89
Ku2K	Y	24	Poss	26/02/2018	15:02	Tree climber	N			Nil	Poor	Replace. See notes	Nil	Wood decay fungi inside the box.
Ku2K	Y	24	Co	26/02/2018	15:02	Tree climber	N			egg shells	Ok	Nil	Nil	There appears to be insufficient wiring to secure a large box and there is no hose on the wire.
Ku2K	Y	25	Poss	07/02/2018	13:31	Camera	N			Nil	Good	Nil	Nil	
Ku2K	Y	25	LFO	07/02/2018	13:33	Camera	N			woody debris	Good	Nil	Nil	
Ku2K	Y	85	Poss	26/02/2018	14:06	Tree climber	N			Nil	Good	Nil	Nil	
Ku2K	Y	85	Scan	26/02/2018	14:06	Tree climber	N			fresh leaves	Good	Nil	Nil	
Ku2K	Y	86	MB	26/02/2018	14:22	Tree climber	N			Nil	Good	Nil	Nil	
Ku2K	Y	86	LG	26/02/2018	14:22	Tree climber	N			Nil	Good	Nil	Nil	
Ku2K	Y	87	MB	07/02/2018	13:18	Camera	N			Nil	Good	Nil	Nil	
Ku2K	Y	87	SG	07/02/2018	13:14	Camera	Y	Sugar or Squirrel Glider	N	occupied	Good	Nil	Nil	
Ku2K	Y	88	LG	07/02/2018	13:02	Camera	N			Nil	Good	Nil	Nil	
Ku2K	Y	88	SG	07/02/2018	13:04	Camera	N			Euc leaves	Good	Nil	Nil	

Section	Zone/cluster	Box # / NBT	Box type	Check Date	Time	Inspect type	Vert Fauna Y/N	Species	Native /Pest	Vert signs of use	Box Cond	Box maintenance required	Changes in surrounds	Notes
Ku2K	Y	89	LG	26/02/2018	14:42	Tree climber	N	European Honey Bees	P	Nil	Good	Clear out	Nil	Bee hive
Ku2K	Y	89	Poss	26/02/2018	14:42	Tree climber	N			Nil	Good	Nil	Nil	The wiring appears to be tangled and tied off on a dead limb. Protective hose is absent.
Ku2K	Z	10	Parr	26/02/2018	12:18	Tree climber	N			Nil	Good	Nil	Nil	Some Plywood delaminating allowing water into the box
Ku2K	Z	10	LG	26/02/2018	12:18	Tree climber	N			fresh leaves	Good	Nil	Nil	
Ku2K	Z	11	MB	07/02/2018	11:23	Camera	N			Nil	Good	Nil	Nil	
Ku2K	Z	11	Poss	07/02/2018	11:25	Camera	N			Nil	Good	Nil	Post fire regen	
Ku2K	Z	12	Scan	07/02/2018	12:02	Camera	N			Nil	Good	Nil	Nil	
Ku2K	Z	12	Parr	07/02/2018	12:04	Camera	N			Nil	Good	Nil	Nil	
Ku2K	Z	13	Poss	07/02/2018	11:51	Camera	N			Nil	Good	Nil	Post fire regen	
Ku2K	Z	13	SG	07/02/2018	11:58	Camera	N			Euc leaves	Good	Nil	Post fire regen	
Ku2K	Z	14	LG	07/02/2018	11:40	Camera	N			Nil	Good	Nil	Post fire regen	
Ku2K	Z	14	MB	07/02/2018	11:31	Camera	N			Nil	Good	Nil	Post fire regen	
Ku2K	Z	15	Scan	07/02/2018	11:45	Camera	N			Nil	Good	Nil	Post fire regen	
Ku2K	Z	15	Parr	07/02/2018	11:48	Camera	N			Nil	Good	Nil	Post fire regen	
Ku2K	Z	104	LG	06/02/2018	14:00	Camera	N			Nil	Good	Nil	Nil	
Ku2K	Z	104	Scan	06/02/2018	13:58	Camera	N			Nil	Good	Nil	Nil	
Ku2K	Z	105	Poss	06/02/2018	13:56	Camera	N			Nil	Good	Nil	Nil	
Ku2K	Z	105	Scan	06/02/2018	13:52	Camera	N			Nil	Good	Nil	Nil	
Ku2K	Z	106	Poss	06/02/2018	13:47	Camera	N			Nil	Good	Nil	Nil	
Ku2K	Z	106	SG	06/02/2018	13:50	Camera	N			Nil	Good	Nil	Nil	
Ku2K	Z	107	Poss	26/02/2018	8:58	Tree climber	N				Good	Nil	Nil	Protective hose absent from wire. Tying of wire appears hazardous. Nest box appears to be held by inadequate wiring.
Ku2K	Z	107	LG	26/02/2018	8:58	Tree climber	Y	unidentified skink	N	occupied	Good	Nil	Nil	Box appears to be resting on branches. Protective hose is absent. Appears to be limited room in the wire to allow

Section	Zone/ cluster	Box # / NBT	Box type	Check Date	Time	Inspect type	Vert Fauna Y/N	Species	Native /Pest	Vert signs of use	Box Cond	Box maintenance required	Changes in surrounds	Notes
														for tree growth. Wire appears to have sharp edges/ends and appears to be incorrectly tied.
Ku2K	Z	108	SG	07/02/2018	11:07	Camera	N			Nil	Good	Nil	Nil	
Ku2K	Z	108	Poss	07/02/2018	11:09	Camera	N			Nil	Good	Nil	Nil	
Ku2K	Z	109	Scan	26/02/2018	12:32	Tree climber	N			Nil	Good	Nil	Nil	Wiring appears inadequate.
Ku2K	Z	109	LG	26/02/2018	12:32	Tree climber	N			Nil	Good	Fix lid	Nil	Inadequate wiring to support box. The box has broken hinges and the lid is wired shut. Bee hive.
Ku2K	Z	110	SG	07/02/2018	11:14	Camera	N			Nil	Good	Nil	Post fire regen	
Ku2K	Z	110	Poss	07/02/2018	11:15	Camera	N			Nil	Good	Nil	Post fire regen	
Ku2K	Z	111	LG	26/02/2018	13:09	Tree climber	N			Nil	Good	Nil	Nil	Wiring appears inadequate.
Ku2K	Z	111	SG	26/02/2018	13:09	Tree climber	N			leaves	Good	Nil	Nil	Wiring appears inadequate.
Ku2K	Z	122	Poss	06/02/2018	14:22	Camera	N			Leaf litter	Good	Nil	Nil	
Ku2K	Z	122	Scan	06/02/2018	14:20	Camera	N			Nil	Good	Nil	Nil	
Ku2K	Z	123	LG	26/02/2018	9:19	Tree climber	Y	Lace Monitor	N	occupied	Good	Nil	Nil	
Ku2K	Z	123	SG	26/02/2018	9:19	Tree climber	N			Nil	Good	Nil	Nil	
Ku2K	Z	124	LG	26/02/2018	9:34	Tree climber	N			Nil	Good	Fix lid	Nil	The alignment of the box excludes larger fauna from entering the box. Lid hinges are broken and the lid is screwed shut. Box resting in fork of tree. Appears to be insufficient loops in the wire.
Ku2K	Z	124	Scan	26/02/2018	9:34	Tree climber	N			Nil	Good	Nil	Nil	
Ku2K	Z	125	SG	26/02/2018	9:55	Tree climber	N			Nil	Good	Nil	Nil	
Ku2K	Z	125	Scan	26/02/2018	9:55	Tree	N			Nil	Good	Nil	Nil	

Section	Zone/ cluster	Box # / NBT	Box type	Check Date	Time	Inspect type	Vert Fauna Y/N	Species	Native /Pest	Vert signs of use	Box Cond	Box maintenance required	Changes in surrounds	Notes
						climber								
OH2Ku	A1	165	Scan	23/01/2018	14:49	Camera	N			Nil	Good	Nil	Nil	
OH2Ku	A1	180	SG	23/01/2018	14:38	Camera	Unk			Unk	Good	Fix lid	Nil	Lid jammed shut.
OH2Ku	A1	181	Poss	23/01/2018	14:47	Camera	N			Nil	Good	Nil	Nil	
OH2Ku	A1	182	Poss	23/01/2018	14:57	Camera	N			euc leaves	Good	Nil	Nil	
OH2Ku	A1	380	LG	23/01/2018	14:41	Camera	N			leaf litter	Good	Nil	Nil	
OH2Ku	A2	172	Scan	23/01/2018	15:31	Camera	N			few euc leaves	Good	Nil	Nil	
OH2Ku	A2	173	SG	23/01/2018	15:17	Camera	P			conical leaf nest	Good	Nil	Nil	
OH2Ku	A2	174	LG	23/01/2018	15:24	Camera	N			Nil	Good	Nil	Nil	
OH2Ku	A2	176	Parr	23/01/2018	15:39	Camera	N			leaf litter and bark	Good	Nil	Nil	
OH2Ku	A2	178	SO	23/01/2018	15:30	Camera	N			leaf litter	Good	Nil	Nil	
OH2Ku	A2	186	Poss	23/01/2018	15:33	Camera	N			Nil	Good	Nil	Nil	
OH2Ku	A3	179	Scan	19/01/2018	8:35	Camera	N			conical leaf nest	Good	Nil	Nil	
OH2Ku	A3	380	Scan	19/01/2018	8:33	Camera	Y	2x Sugar Glider	N	occupied	Good	Nil	Nil	
OH2Ku	A3	381	SG	19/01/2018	8:25	Camera	N			euc leaf nest	Good	Nil	Nil	
OH2Ku	A3	382	Parr	19/01/2018	8:10	Camera	N			woody debris and chewed entrance	Good	Nil	Nil	
OH2Ku	A3	383	Poss	19/01/2018	8:30	Camera	Y	Common Brush-tail Possum	N	occupied	Good	Nil	Nil	
OH2Ku	A3	384	Co	28/02/2018	1453	Tree climber	N			old leaves	Good	Nil	Nil	
OH2Ku	A4	183	Scan	23/01/2018	15:50	Camera	N			euc leaf and ant nest	Good	Nil	Nil	
OH2Ku	A4	184	SG	23/01/2018	16:10	Camera	N			euc leaf and ant nest	Good	Nil	Nil	
OH2Ku	A4	185	Poss	23/01/2018	15:56	Camera	N			leaf litter	Good	Nil	Nil	
OH2Ku	A4	186	LG	23/01/2018	15:53	Camera	N			wood shavings and debris	Good	Nil	Nil	
OH2Ku	A4	187	Parr	23/01/2018	16:00	Camera	N			ant nest and euc leaf	Good	clear out	Nil	
OH2Ku	A5	168	LG	23/01/2018	17:05	Camera	N			Nil	Good	Nil	Nil	
OH2Ku	A5	171	Small owl	28/02/2018	15:15	Tree climber	N			Nil	Good	Nil	Nil	Honeycomb

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OH2Ku	A5	188	Scan	23/01/2018	17:03	Camera	N			ant nest and leaf nest	Good	Nil	Nil	
OH2Ku	A5	189	SG	23/01/2018	16:57	Camera	N			euc leaf nest	Good	Nil	Nil	
OH2Ku	A5	191	Poss	23/01/2018	16:58	Camera	N			Nil	Good	Nil	Nil	
OH2Ku	B1	397	SG	24/01/2018	9:58	Camera	P			conical leaf nest	Good	Nil	Fauna fence installed to east	Installed on trees that fall on western side of property boundary but can be inspected from RMS alignment
OH2Ku	B1	398	Poss	24/01/2018	9:57	Camera	N			Nil	Good	Nil	Fauna fence installed to east	Installed on trees that fall on western side of property boundary but can be inspected from RMS alignment
OH2Ku	B1	399	Scan	24/01/2018	9:55	Camera	Y	Multiple Sugar Gliders	N	occupied	Good	Nil	Fauna fence installed to east	Installed on trees that fall on western side of property boundary but can be inspected from RMS alignment
OH2Ku	B1	400	Parr	24/01/2018	9:50	Camera	P			leaf and bark nest	Good	Nil		Fauna fence installed to east
OH2Ku	B1	401	Scan	24/01/2018	9:52	Camera	P			conical leaf nest	Good	Nil		Fauna fence installed to east
OH2Ku	B1	402	Poss	24/01/2018	9:49	Camera	N			Nil	Good	Nil		Fauna fence installed to east
OH2Ku	B1	403	MB	24/01/2018	9:47	Camera	N			Nil	Good	Nil		Fauna fence installed to east
OH2Ku	B2	167	SG	24/01/2018	9:30	Camera	P			conical leaf nest and chewed bark	Good	Nil		Fauna fence installed to east - parrot box not SG
OH2Ku	B2	404	SG	24/01/2018	9:45	Camera	P			euc leaf nest	Good	Nil		Fauna fence installed to east
OH2Ku	B2	405	Scan	24/01/2018	9:12	Camera	N			euc leaf litter	Good	Nil		Fauna fence installed -this box on hwy side of fence
OH2Ku	B2	406	LG	24/01/2018	9:40	Camera	N			leaf litter and bark	Good	Nil		Fauna fence installed to east
OH2Ku	B2	407	Cock	28/02/2018	16:23	Tree climber	N			Nil	Good	Nil		Fauna fence installed to east
OH2Ku	B2	408	Poss Add	24/01/2018	9:17	Camera	Y	Common Brushtail Possum	Native	occupied	Good	Nil		Fauna fence installed to east
OH2Ku	C1	222	SG	19/01/2018	9:31	Camera	P			old euc leaf nest	Good	Nil	Nil	
OH2Ku	C1	223	Poss	19/01/2018	9:34	Camera	N			melaleuca leaf nest	Good	Nil	Nil	
OH2Ku	C1	224	Scan	19/01/2018	9:27	Camera	Y	2x Sugar Glider	N	occupied	Good	Nil	Nil	
OH2Ku	C1	225	LG	19/01/2018	9:18	Camera	N			grass and melaleuca nest	Good	Nil	Nil	

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OH2Ku	C1	226	Parr	19/01/2018	9:48	Camera	N			leaf litter and mud wasp nest	Good	Nil	Nil	
OH2Ku	C2	216	LG	19/01/2018	10:11	Camera	N			leaves and honeycomb	Good	clear out	Nil	
OH2Ku	C2	217	Parr	19/01/2018	10:07	Camera	N			old leaves	Good	clear out	Nil	
OH2Ku	C2	218	Poss	19/01/2018	10:56	Camera	P			full of grass nest	Good	Nil	Nil	
OH2Ku	C2	219	SG	19/01/2018	10:14	Camera	Y	Squirrel Glider	N	occupied	Good	Nil	Nil	
OH2Ku	C2	220	Scan	19/01/2018	11:00	Camera	N			leaf litter	Good	Nil	Nil	
OH2Ku	C2	221	LG	19/01/2018	9:56	Camera	Y	Ringtail Possum	N	occupied	Good	Nil	Nil	
OH2Ku	C3	227	Poss	19/01/2018	8:59	Camera	Y	Ringtail Possum	N	occupied	Good	Nil	Nil	
OH2Ku	C3	228	SG	19/01/2018	9:02	Camera	P			euc leaf and other leaf nest	Good	Nil	Nil	
OH2Ku	C3	229	Scan	19/01/2018	8:56	Camera	P			euc leaf nest	Good	Nil	Nil	
OH2Ku	D1	355	LG	19/01/2018	13:23	Camera	Y	Common Brushtail Possum	N	occupied	Good	Nil	Nil	
OH2Ku	D1	356	Poss	19/01/2018	13:40	Camera	N			melaleuca leaves and bark	Good	Nil	Nil	
OH2Ku	D1	357	SG	19/01/2018	13:33	Camera	N			conical leaf nest	Good	Nil	Nil	
OH2Ku	D1	358	PARR	19/01/2018	13:28	Camera	N			melaleuca leaf	Good	Nil	Nil	
OH2Ku	D1	359	Scan	19/01/2018	13:40	Camera	P			conical leaf nest	Good	Nil	Nil	
OH2Ku	D2	360	SG	19/01/2018	14:00	Camera	N			leaf litter	Good	Nil	Nil	
OH2Ku	D2	361	Poss	19/01/2018	13:49	Camera	Y	Common Brushtail Possum	N	occupied	Good	Nil	Nil	
OH2Ku	D2	362	Scan	19/01/2018	14:02	Camera	N			leaf litter	Good	Nil	Nil	
OH2Ku	D2	363	MB	19/01/2018	13:55	Camera	Y	Unidentified microbat	N	occupied flew out just prior to inspection	Good	Nil	Nil	
OH2Ku	D2	364	SG	19/01/2018	13:54	Camera	N			leaf litter	Good	Nil	Nil	
OH2Ku	D3	365	SG	19/01/2018	14:06	Camera	N			Nil	Good	clear out	Nil	Pest activity
OH2Ku	D3	366	Scan	19/01/2018	14:13	Camera	N			leaf litter	Good	Nil	Nil	

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OH2Ku	D3	367	Parr	19/01/2018	14:16	Camera	N			Nil	Good	Nil	Nil	
OH2Ku	D3	368	Poss	19/01/2018	14:24	Camera	N			Nil	Good	Nil	Nil	
OH2Ku	D3	378	SG	19/01/2018	14:22	Camera	N			euc leaf nest	Good	Nil	Nil	
OH2Ku	D4	369	Parr	19/01/2018	14:40	Camera	N			Nil	Good	Nil	Nil	
OH2Ku	D4	371	Scan	19/01/2018	14:41	Camera	N			leaf litter	Good	Nil	Nil	
OH2Ku	D4	372	LG	19/01/2018	14:45	Camera	Y	Common Brush-tail Possum	N	occupied	Good	Nil	Nil	
OH2Ku	D4	373	Poss	19/01/2018	14:53	Camera	N			conical leaf nest	Good	Nil	Nil	
OH2Ku	D4	376	SG	19/01/2018	14:34	Camera	N			leaf litter	Good	Nil	Nil	
OH2Ku	D5	374	Poss	19/01/2018	15:20	Camera	N			minimal leaf litter	Good	Nil	Nil	
OH2Ku	D5	375	Scan	19/01/2018	15:25	Camera	P			conical leaf nest	Good	Nil	Nil	
OH2Ku	D5	377	LG	19/01/2018	15:15	Camera	Y	Brush-tail Possum x2	N	occupied	Good	Nil	Nil	
OH2Ku	D5	378	MB	19/01/2018	15:05	Camera	N			Nil	Good	Nil	Nil	
OH2Ku	D5	379	Parr	19/01/2018	15:10	Camera	N			melaleuca leaf nest	Good	Nil	Nil	
OH2Ku	E1	200	SO	16/01/2018	10:34	Camera	N			leaf litter and bark	Good	Nil	Nil	
OH2Ku	E1	201	SG	16/01/2018	10:21	Camera	N			leaf nest and empty wasp nest	Good	Nil	Nil	
OH2Ku	E2	198	Parr	16/01/2018	10:43	Camera	N	Ants	P	Nil	Good	Clear ants	Nil	infested
OH2Ku	E2	199	Poss	16/01/2018	11:00	Camera	N			leaf litter	Good	Nil	Nil	
OH2Ku	E3	193	SG	16/01/2018	11:09	Camera	P			conical leaf nest	Good	Nil	Nil	
OH2Ku	E3	194	MB	16/01/2018	11:13	Camera	N			Nil	Lid stuck	Nil	Nil	
OH2Ku	E3	195	Poss add	16/01/2018	11:04	Camera	N			leaf litter	Good	Nil	Nil	
OH2Ku	E3	196	Scan	16/01/2018	11:10	Camera	P			conical leaf nest	Good	needs straightening	Nil	
OH2Ku	E3	274	Co	28/02/2018	13:14	Tree climber	Y	Common Brush-tail Possum	N	occupied	Good	Nil	Nil	
OH2Ku	F1	160	SO	16/01/2018	12:14	Camera	N			Nil	Good	Nil	Nil	

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OH2Ku	F1	161	Poss	16/01/2018	12:10	Camera	N			Nil	Good	Nil	Nil	
OH2Ku	F1	162	LFO	28/02/2018	14:02	Tree climber	N			Nil	Good	Nil	Nil	Honeycomb
OH2Ku	F1	166	Scan	16/01/2018	12:20	Camera	N	Euro bees	P	Nil	Good	Clear out	Nil	infested
OH2Ku	F1	504	SG	16/01/2018	12:10	Camera	N			Nil	Good	Nil	Nil	
OH2Ku	F2	163	Poss	16/01/2018	12:28	Camera	Y	Owlet Nightjar	N	pair sighted, head protruding from hole.	Good	Nil	Nil	
OH2Ku	F2	164	SG	16/01/2018	12:30	Camera	N	Euro bees	P	Nil	Good	Clear out	Nil	bees swarming
OH2Ku	G1	197	LG	16/01/2018	14:39	Camera	N			Nil	Good	Clear out	Nil	honeycomb
OH2Ku	G1	202	MB	16/01/2018	13:43	Camera	N			Nil	Good	Nil	Nil	
OH2Ku	G1	203	Poss	16/01/2018	13:42	Camera	N			leaf litter and bark	Good	Nil	Nil	
OH2Ku	G1	204	Scan	16/01/2018	13:29	Camera	N			leaf nest	Good	Nil	Nil	
OH2Ku	G1	206	SG	16/01/2018	13:36	Camera	N			bark	Good	Nil	Nil	
OH2Ku	G2	211	LG	16/01/2018	15:02	Camera	N			leaf litter	Good	Nil	Nil	
OH2Ku	G2	212	Poss	16/01/2018	14:26	Camera	N			shredded bark	Good	Nil	Nil	
OH2Ku	G2	213	Parr	16/01/2018	14:30	Camera	N			bark and leaf litter	Good	Nil	Nil	
OH2Ku	G2	214	SG	16/01/2018	14:59	Camera	N			leaf and bark nest	Good	Nil	Nil	
OH2Ku	G2	215	Scan	16/01/2018	14:29	Camera	N			leaf litter	Good	Nil	Nil	
OH2Ku	G3	206	Poss	16/01/2018	14:09	Camera	N			shredded bark	Good	Nil	Nil	
OH2Ku	G3	207	SG	16/01/2018	14:04	Camera	N			Nil	Good	Nil	Nil	fresh honeycomb
OH2Ku	G3	208	LG	16/01/2018	14:10	Camera	N			leaf litter full	Good	Nil	Nil	
OH2Ku	G3	209	Scan	16/01/2018	13:55	Camera	Y	Squirrel Glider	N	Occupied (multiple individual likely).	Good	Nil	Nil	
OH2Ku	G3	210	SO	16/01/2018	14:18	Camera	N	Euro bees	P	Nil	Good	Clear out	Nil	bees swarming
OH2Ku	H1	385	LG	17/01/2018	11:07	Camera	N			bark shredded	Good	Nil	Nil	
OH2Ku	H1	386	SG	17/01/2018	11:10	Camera	Y	Antechinus sp.	N	leaf litter- occupied ran out on inspection	Good	Nil	Nil	
OH2Ku	H1	387	Parr	17/01/2018	11:20	Camera	N			Nil	Good	Nil	Nil	
OH2Ku	H1	388	Poss	17/01/2018	11:17	Camera	N			leaf litter	Good	Nil	Nil	
OH2Ku	H2	389	MB	17/01/2018	11:01	Camera	N			Nil	Good	Nil	Nil	

Section	Zone/ cluster	Box # / NBT	Box type	Check Date	Time	Inspect type	Vert Fauna Y/N	Species	Native /Pest	Vert signs of use	Box Cond	Box maintenance required	Changes in surrounds	Notes
OH2Ku	H2	390	SG	17/01/2018	10:52	Camera	N			leaf nest	Good	Nil	Nil	
OH2Ku	H2	391	LG	17/01/2018	10:58	Camera	N			Nil	Good	Nil	Nil	
OH2Ku	H2	392	SG	17/01/2018	10:56	Camera	N			leaf litter	Good	Nil	Nil	
OH2Ku	H3	393	Cock	28/02/2018	12:04	Tree climber	N			Leaf nest	Good	Nil	Nil	
OH2Ku	H3	394	Poss	28/02/2018	12:05	Tree climber	N			Nil	Good	Nil	Nil	
OH2Ku	H3	395	SG	17/01/2018	10:42	Camera	N			Nil	Good	Nil	Nil	
OH2Ku	H3	396	LG	17/01/2018	10:35	Camera	N			bark	Good	Nil	Nil	
OH2Ku	I1	290	Scan	17/01/2018	13:18	Camera	N	Ants	P	Nil	Good	Nil	Nil	
OH2Ku	I1	292	SG	17/01/2018	13:02	Camera	N			Nil	Good	clear out	Nil	
OH2Ku	I1	293	SG	17/01/2018	13:27	Camera	N			old leaf	Good	Nil	Nil	
OH2Ku	I1	294	Poss	17/01/2018	13:06	Camera	N			bark	Good	Nil	Nil	
OH2Ku	I2	288	LG	17/01/2018	13:35	Camera	N			Nil	Good	Nil	Nil	
OH2Ku	I2	289	Parr	17/01/2018	13:46	Camera	N			leaf nest	Good	Nil	Nil	
OH2Ku	I2	291	MB	17/01/2018	13:51	Camera	N			Nil	Good	Nil	Nil	
OH2Ku	I2	295	SG	17/01/2018	13:33	Camera	N			old conical leaf nest	Good	Nil	Nil	
OH2Ku	I2	296	Scan	17/01/2018	13:43	Camera	N			leaf litter	Good	Nil	Nil	
OH2Ku	I3	283	SO	17/01/2018	12:40	Camera	N			bark	Good	Nil	Nil	
OH2Ku	I3	284	Poss	17/01/2018	12:40	Camera	N			bark	Good	Nil	Nil	
OH2Ku	I3	285	LG	17/01/2018	12:36	Camera	N			leaf litter	Good	Nil	Nil	
OH2Ku	I3	286	SG	17/01/2018	12:47	Camera	N			lots of leaf litter	Good	Nil	Nil	
OH2Ku	I3	287	Scan	17/01/2018	12:53	Camera	P			conical leaf nest	Good	Nil	Nil	
OH2Ku	I4	279	LG	17/01/2018	12:26	Camera	N			leaf litter	Good	Nil	Nil	
OH2Ku	I4	280	MB	17/01/2018	12:24	Camera	N			Nil	Good	Nil	Nil	
OH2Ku	I4	281	Parr	17/01/2018	12:20	Camera	N			leaf litter, old wasp nest	Good	Nil	Nil	
OH2Ku	I4	282	Poss	17/01/2018	12:30	Camera	N			leaf litter	Good	Nil	Nil	
OH2Ku	I5	297	SG	17/01/2018	9:01	Camera	N			pest debris, old honeycomb	Good	clear out	Nil	

Section	Zone/ cluster	Box # / NBT	Box type	Check Date	Time	Inspect type	Vert Fauna Y/N	Species	Native /Pest	Vert signs of use	Box Cond	Box maintenance required	Changes in surrounds	Notes
OH2Ku	I5	298	Poss	17/01/2018	8:57	Camera	N			Nil	Good	Nil	Nil	
OH2Ku	I5	299	Add. Poss	17/01/2018	9:04	Camera	N			Nil	Good	Nil	Nil	
OH2Ku	I5	300	SO	17/01/2018	8:47	Camera	N			euc leaves and honeycomb	Good	Nil	Nil	
OH2Ku	I5	301	LG	17/01/2018	8:55	Camera	N			few scattered leaves	Good	Nil	Nil	
OH2Ku	I6	307	Poss	17/01/2018	9:26	Camera	N			euc leaf nest	Good	Nil	Nil	
OH2Ku	I6	308	SG	17/01/2018	9:23	Camera	P			leaf nest and honeycomb	Good	clear out	Nil	
OH2Ku	I6	309	Parr	17/01/2018	9:17	Camera	Y	Common Brushtail Possum	N	occupied	Good	Nil	Nil	
OH2Ku	I6	310	Scan	17/01/2018	9:13	Camera	P			euc leaf nest	Good	Nil	Nil	
OH2Ku	I6	311	LG	17/01/2018	9:37	Camera	N			pest activity, woody debris	Good	clear out	Nil	
OH2Ku	I7	312	Parr	17/01/2018	10:04	Camera	N			leaf litter	Good	Nil	Nil	
OH2Ku	I7	313	LG	17/01/2018	10:00	Camera	N			woody debris	Good	Nil	Nil	
OH2Ku	I7	314	LG	17/01/2018	9:55	Camera	N			pest activity and old honeycomb	Good	clear out	Nil	
OH2Ku	I7	315	MB	17/01/2018	10:15	Camera	N			Nil	deteriorated	Nil	Nil	slight deterioration of back chamber
OH2Ku	I8	316	LG	17/01/2018	8:41	Camera	N	Ants	P	leaf, debris, ants nest	Good	clear out	Nil	
OH2Ku	I8	317	Poss	17/01/2018	8:36	Camera	N			euc leaves	Good	Nil	Nil	
OH2Ku	I8	318	Parr	17/01/2018	8:33	Camera	N			woody debris	Good	Nil	Nil	
OH2Ku	I8	319	Co	28/02/2018	11:26	Tree climber	Y	Common Brushtail Possum	N	occupied	Good	Nil	Nil	
OH2Ku	J1	253	Poss add	16/01/2018	16:06	Camera	N			leaf litter	Good	Nil	Nil	
OH2Ku	J1	254	Mb	16/01/2018	15:56	Camera	N			Nil	Good	Nil	Nil	
OH2Ku	J1	255	SO	16/01/2018	16:01	Camera	N			Nil	deteriorated	clear out	Nil	pest use - wasp nest debris. Box replaced 21/2/2018. Old box left in place, new one installed above.

Section	Zone/ cluster	Box # / NBT	Box type	Check Date	Time	Inspect type	Vert Fauna Y/N	Species	Native /Pest	Vert signs of use	Box Cond	Box maintenance required	Changes in surrounds	Notes
OH2Ku	J1	256	LG	16/01/2018	16:11	Camera	N			woody debris	Good	Nil	Nil	
OH2Ku	J1	257	Scan	16/01/2018	16:09	Camera	N			Nil	deteriorated	clear out	Nil	pest use - bee hive
OH2Ku	J1	258	Poss	16/01/2018	16:15	Camera	N			leaf nest	Good	Nil	Nil	
OH2Ku	J2	259	LG	16/01/2018	16:46	Camera	N			woody debris	Good	Nil	Nil	
OH2Ku	J2	260	Poss	16/01/2018	16:35	Camera	Y	Common Brushtail Possum	N	occupied	Good	Nil	Nil	
OH2Ku	J2	261	Scan	16/01/2018	16:30	Camera	N			Leaf, honeycomb, saw dust	Good	clear out	Nil	
OH2Ku	J2	262	SG	16/01/2018	16:25	Camera	P			leaf nest and old honeycomb	Good	Nil	Nil	
OH2Ku	J2	263	Parr	16/01/2018	16:32	Camera	N			leaf and bark	Good	Nil	Nil	
OH2Ku	J3	264	LG	17/01/2018	15:40	Camera	N			Nil	Good	clear out	Nil	wasp nest
OH2Ku	J3	265	SG	17/01/2018	15:32	Camera	P			euc leaf nest	Good	Nil	Nil	
OH2Ku	J3	266	SG	17/01/2018	15:48	Camera	N	Euro bees	P	Nil	Good	clear out	Nil	Active bee hive
OH2Ku	J3	267	Scan	17/01/2018	15:52	Camera	N			melaleuca leaves	Good	Nil	Nil	
OH2Ku	J3	268	Poss	17/01/2018	16:00	Camera	N			melaleuca leaves	Good	Nil	Nil	
OH2Ku	J4	269	LG	17/01/2018	15:08	Camera	N			leaf nest	Good	Nil	Nil	
OH2Ku	J4	270	Poss	17/01/2018	13:13	Camera	N			melaleuca leaves	Good	Nil	Nil	
OH2Ku	J4	271	Parr	17/01/2018	15:05	Camera	N			leaf litter	Good	Nil	Nil	
OH2Ku	J4	272	SG	17/01/2018	15:28	Camera	P			euc leaf nest	Good	Nil	Nil	
OH2Ku	J4	273	Scan	17/01/2018	15:19	Camera	N			euc leaves and honeycomb	Good	clear out	Nil	
OH2Ku	J5	275	LG	17/01/2018	14:49	Camera	N			minimal leaf litter	Good	Nil	Nil	
OH2Ku	J5	276	LG	17/01/2018	14:45	Camera	N			Nil	Good	Nil	Nil	
OH2Ku	J5	277	Scan	17/01/2018	14:44	Camera	P			full of leaf litter	Good	Nil	Nil	
OH2Ku	J5	276B	MB	17/01/2018	14:34	Camera	N			Nil	Good	Nil	Nil	
OH2Ku	K1	302	SG	21/02/2018		visual	N			Nil	Reinstalled in new location	Nil	New location	Inspection data received from RMS
OH2Ku	K1	303	Scan	21/02/2018		visual	N			reptile scat, tree snake	Reinstalled	Nil	New location	Inspection data received from RMS

Section	Zone/ cluster	Box # / NBT	Box type	Check Date	Time	Inspect type	Vert Fauna Y/N	Species	Native /Pest	Vert signs of use	Box Cond	Box maintenance required	Changes in surrounds	Notes
											in new location			
OH2Ku	K1	304	Scan	21/02/2018		visual	N			Antechinus den	Reinstalled in new location	Nil	New location	Inspection data received from RMS
OH2Ku	K1	305	Poss	21/02/2018		visual	N			Possum scats	Reinstalled in new location	Nil	New location	Inspection data received from RMS
OH2Ku	K1	306	SG	21/02/2018		visual	N			Nil	Reinstalled in new location	Nil	New location	Inspection data received from RMS. Old European Bee hive
OH2Ku	K2	502	Scan	28/02/2018	12:00	Camera	N			Old dry leaf litter	Good	Nil	Nil	
OH2Ku	K2	503	Scan	28/02/2018	12:10	Camera	N			Nil	Good	Nil	Nil	
OH2Ku	K2	505	Poss	28/02/2018	12:20	Camera	N			Nil	Good	Nil	Nil	
OH2Ku	L1	347	SG	24/01/2018	11:20	Camera	Y	Sugar Glider	N	occupied	Good	Nil	Nil	
OH2Ku	L1	348	MB	24/01/2018	11:25	Camera	N			Nil	Good	Nil	Nil	
OH2Ku	L1	349	Poss	24/01/2018	11:31	Camera	N			leaf litter	Good	Nil	Nil	
OH2Ku	L1	350	Scan	24/01/2018	11:35	Camera	P			leaf nest	Good	Nil	Nil	
OH2Ku	L2	351	LG	24/01/2018	11:46	Camera	N			leaf litter	Good	Nil	Nil	
OH2Ku	L2	352	Parr	24/01/2018	11:55	Camera	N			shredded bark	Good	Nil	Nil	
OH2Ku	L2	353	SG	24/01/2018	11:50	Camera	P			conical leaf nest	Good	Nil	Nil	
OH2Ku	L2	354	Poss	24/01/2018	11:52	Camera	N			bark	Good	Nil	Nil	
OH2Ku	L2	500	LFO	24/01/2018	12:20	Camera	N			Nil	Good	Nil	Nil	
OH2Ku	L2	501	Poss	24/01/2018	12:13	Camera	Y	Common Brushtail Possum x2	N	occupied - with young possum.	Good	Nil	Nil	
OH2Ku	M1	246	LG	22/01/2018	8:33	Camera	N			melaleuca leaf nest	Good	Nil	Nil	
OH2Ku	M1	248	Scan	22/01/2018	8:49	Camera	N			euc leaf nest	Good	Nil	Nil	
OH2Ku	M1	249	SG	22/01/2018	8:42	Camera	P			euc leaf nest	Good	Nil	Nil	
OH2Ku	M1	251	Poss	22/01/2018	8:36	Camera	N			melaleuca leaf nest	Good	Nil	Nil	
OH2Ku	M2	247	SG	22/01/2018	8:58	Camera	P			conical leaf nest	Good	Nil	Nil	
OH2Ku	M2	250	Poss	22/01/2018	9:00	Camera	N			melaleuca leaf nest	Good	lid stuck closed	Nil	

Section	Zone/ cluster	Box # / NBT	Box type	Check Date	Time	Inspect type	Vert Fauna Y/N	Species	Native /Pest	Vert signs of use	Box Cond	Box maintenance required	Changes in surrounds	Notes
										and bark				
OH2Ku	M2	252	MB	22/01/2018	8:54	Camera	N			Nil	Good	Nil	Nil	
OH2Ku	N1	355b	Scan	22/01/2018	11:14	Camera	N			full of leaf litter and scats in corner	Good	Nil	Nil	
OH2Ku	N1	356b	Poss	22/01/2018	11:16	Camera	N			full of leaf and bark	Good	Needs Veg removal and clear out	Nil	
OH2Ku	N1	357b	Parr	22/01/2018	10:59	Camera	N			chewed entrance and conical leaf nest	Good	Nil	Nil	
OH2Ku	N1	358b	SG	22/01/2018	11:04	Camera	Y	Carpet python	N	occupied- conical leaf nest	Good	Nil	Nil	
OH2Ku	N1	361b	Poss add	22/01/2018	10:52	Camera	N			bark shredded	Good	Nil	Nil	
OH2Ku	N1	362b	SO	22/01/2018	10:52	Camera	N			Nil	Good	Nil	Nil	Box replaced 21/2/2018. Old box removed, new one installed in place.
OH2Ku	N2	359b	Scan	22/01/2018	11:22	Camera	N			bark shredded	Good	Nil	Nil	
OH2Ku	N2	360b	LG	22/01/2018	11:19	Camera	Y	Common Brushtail Possum	N	occupied	Good	Nil	Nil	
OH2Ku	N3	363	Scan	22/01/2018	9:58	Camera	N			old euc leaf nest and muss wasp	Good	clear out	Nil	
OH2Ku	N3	364	Poss	22/01/2018	9:55	Camera	N			old euc leaf nest	Good	Nil	Nil	
OH2Ku	N3	366	Sg	22/01/2018	9:41	Camera	N			old euc and melaleuca leaf nest	Good	Nil	Nil	
OH2Ku	N3	365b	LG	22/01/2018	9:47	Camera	N			latrine stick and leaf nest, dead animal?	Good	clear out	Nil	
OH2Ku	O1	230	SG	22/01/2018	12:19	Camera	N			conical leaf nest	Good	Nil	Nil	
OH2Ku	O1	231	LG	22/01/2018	12:14	Camera	N			Nil	Good	Nil	Nil	
OH2Ku	O1	232	SG	22/01/2018	12:16	Camera	N			Nil	Good	Nil	Nil	
OH2Ku	O1	233	Poss	22/01/2018	11:52	Camera	Y	Fledgling Bird probable owlet nightjar chick x2	N	occupied	Good	Nil	Nil	
OH2Ku	O1	234	Scan	22/01/2018	12:13	Camera	N			leaves and bark	Good	Nil	Nil	

Section	Zone/ cluster	Box # / NBT	Box type	Check Date	Time	Inspect type	Vert Fauna Y/N	Species	Native /Pest	Vert signs of use	Box Cond	Box maintenance required	Changes in surrounds	Notes
OH2Ku	P1	235	Poss	22/01/2018	14:27	Camera	N			bark	Good	Nil	Nil	
OH2Ku	P1	236	Parr	22/01/2018	14:14	Camera	P			euc leaf nest	Good	Nil	Nil	
OH2Ku	P1	237	SG	22/01/2018	14:30	Camera	P			euc leaf nest	Good	Nil	Nil	
OH2Ku	P1	238	Scan	22/01/2018	14:33	Camera	Y	Sugar Glider	N	occupied	Good	Nil	Nil	
OH2Ku	P2	239	LG	22/01/2018	14:55	Camera	N			leaf litter	Good	Nil	Nil	
OH2Ku	P2	240	SG	22/01/2018	15:05	Camera	P			conical leaf nest	Good	Nil	Nil	
OH2Ku	P2	242	Parr	22/01/2018	15:02	Camera	N	Ants	P	Nil	Good	clear out	Nil	Infested
OH2Ku	P2	243	Scan	22/01/2018	14:57	Camera	P			conical leaf nest	Good	Nil	Nil	
OH2Ku	P3	241	Scan	22/01/2018	15:20	Camera	N	Ants	P	Nil	Good	clear out	Nil	Infested
OH2Ku	P3	244	Poss	22/01/2018	15:12	Camera	N			Bark	Good	Nil	Nil	
OH2Ku	P3	245	Scan	22/01/2018	15:16	Camera	N			leaf litter	Good	Nil	Nil	
OH2Ku	Q1	367	LG	23/01/2018	8:54	Camera	N			Nil	Good	Nil	Nil	
OH2Ku	Q1	368	Scan	23/01/2018	8:58	Camera	N			leaves, insect debris	Deteriorating	clear out	Nil	
OH2Ku	Q1	369	Po	23/01/2018	9:00	Camera	N			leaf litter	Good	Nil	Nil	
OH2Ku	Q1	370	LFO	28/02/2018	17:00	Tree climber	N			Nil	Good	Nil	Nil	
OH2Ku	Q1	371	Poss	23/01/2018	8:48	Camera	N			leaf litter	Good	Nil	Nil	
OH2Ku	Q2	372	LG	23/01/2018	9:05	Camera	N			woody debris/ saw dust	Good	Nil	Nil	
OH2Ku	R1	320	Poss	23/01/2018	12:41	Camera	N			woody debris	Good	Nil	Nil	
OH2Ku	R1	321	MB	23/01/2018	12:34	Camera	N			Nil	Good	Nil	Nil	
OH2Ku	R1	322	LFO	23/01/2018	12:30	Camera	N			Nil	Good	Fix lid - stuck	Nil	
OH2Ku	R1	323	Add poss.	23/01/2018	12:31	Camera	N			bark	Good	Nil	Nil	
OH2Ku	R1	324	Scan	23/01/2018	12:14	Camera	N			leaves, bark and scats	Good	Nil	Nil	
OH2Ku	R2	325	SG	23/01/2018	12:48	Camera	N			leaves, bracken fern	Good	Nil	Nil	
OH2Ku	R2	326	Scan	23/01/2018	12:52	Camera	N			fresh leaf nest	Good	Nil	Nil	
OH2Ku	R2	327	MB	23/01/2018	12:58	Camera	N			Nil	Good	Nil	Nil	
OH2Ku	R2	328	Parr	23/01/2018	13:00	Camera	N			tallow bark	Good	Nil	Nil	

Section	Zone/ cluster	Box # / NBT	Box type	Check Date	Time	Inspect type	Vert Fauna Y/N	Species	Native /Pest	Vert signs of use	Box Cond	Box maintenance required	Changes in surrounds	Notes
OH2Ku	R2	329	Poss	23/01/2018	13:01	Camera	N			leaves and bark	Good	Nil	Nil	
OH2Ku	R3	330	LG	23/01/2018	11:18	Camera	Y	Yellow-bellied Glider	N	occupied	Good	Nil	Nil	
OH2Ku	R3	331	Poss	23/01/2018	11:13	Camera	N			bark	Good	Nil	Nil	
OH2Ku	R3	332	Co	28/02/2018	17:30	Tree climber	N			Nil	Good	Nil	Nil	
OH2Ku	R3	333	add Poss	23/01/2018	11:37	Camera	N			Nil	Good	Nil	Nil	
OH2Ku	R3	334	LG	23/01/2018	11:05	Camera	N			Nil	Good	Nil	Nil	
OH2Ku	R4	335	Scan	23/01/2018	10:53	Camera	N			leaf and bark nest	Good	Nil	Nil	
OH2Ku	R4	336	SG	23/01/2018	10:56	Camera	P			euc leaf nest	Good	Nil	Nil	
OH2Ku	R4	337	Parr	23/01/2018	11:00	Camera	N			leaf litter	Good	Nil	Nil	
OH2Ku	R4	338	LG	23/01/2018	10:45	Camera	N			empty	Good	Nil	Nil	
OH2Ku	R4	339	Poss	23/01/2018	10:50	Camera	N			leaf litter	Good	Nil	Nil	
OH2Ku	R5	340	LG	23/01/2018	10:00	Camera	N			Nil	Good	clear out	Nil	insect debris
OH2Ku	R5	341	Poss	23/01/2018	10:03	Camera	N			woody debris and nest	Good	Nil	Nil	
OH2Ku	R5	342	Parr	23/01/2018	9:57	Camera	N	Ants	P	Nil	Good	Nil	Nil	Ants and leaves
OH2Ku	R5	343	MB	23/01/2018	10:05	Camera	N			Nil	Good	Nil	Nil	
OH2Ku	R5	344	SG	23/01/2018	10:10	Camera	N			old leaf nest and insect debris	Good	Nil	Nil	
OH2Ku	R6	345	Scan	23/01/2018	10:29	Camera	N			euc leaf and mud wasp	Good	Nil	Nil	
OH2Ku	R6	346	LG	23/01/2018	10:25	Camera	N			leaf litter	Good	Nil	Nil	

Annex 2 – Winter 2018 nest box monitoring

Section	Zone/ cluster	Box #	Box type	Check Date	Time	Inspect type	Vert Fauna Y/N	Species	Native /Pest	Vert Signs of use	Box Cond	Maintenance required	Changes in surrounds	Notes
Ku2K	AA	1	Scan	30/07/2018	9:40	GoPro Camera	P			conical euc leaf nest	Good	Nil	Nil	
Ku2K	AA	1	MB	30/07/2018	9:37	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	AA	2	SG	30/07/2018	9:33	GoPro Camera	N			old euc leaves	Good	Nil	Nil	
Ku2K	AA	2	Parr	30/07/2018	9:31	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	AA	3	SO	28/08/2018	9:18	Tree Climber	N			Nil	Good	Nil	Nil	only two turns to connect wire
Ku2K	AA	3	Poss	28/08/2018	9:16	Tree Climber	N			euc leaves	Good	Nil	Nil	honeycomb
Ku2K	AA	4	Scan	30/07/2018	9:26	GoPro Camera	N			old euc leaves	Good	Nil	Nil	
Ku2K	AA	4	Poss	30/07/2018	9:27	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	AA	5	LFO	28/08/2018	9:01	Tree Climber	N			Nil	Good	Nil	Nil	wire almost fully stretched
Ku2K	AA	5	Poss	28/08/2018	8:58	Tree Climber	N			Nil	Good	Nil	Nil	wire almost fully stretched
Ku2K	AA	6	MB	30/07/2018	9:22	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	AA	6	Parr	30/07/2018	9:21	GoPro Camera	N			Nil	burnt bottom	replace box	Nil	
Ku2K	AA	6	Scan	30/07/2018	9:20	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	AA	7	SG	30/07/2018	9:15	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	AA	7	Poss	30/07/2018	9:16	GoPro Camera	N			old euc leaves	Good	Nil	Nil	
Ku2K	AA	8	LG	28/08/2018	8:40	Tree Climber	N	Bees	P	Nil	Good	Nil	Nil	active Beehive
Ku2K	AA	9	Poss				Not located					replace		awaiting replacement
Ku2K	AA	9	Scan				Not located					replace		awaiting replacement
Ku2K	AA	94	Scan	28/08/2018	8:31	Tree Climber	N			Nil	Good	Nil	Nil	
Ku2K	AA	94	SG	28/08/2018	8:32	Tree Climber	N			euc leaf nest	Good	Nil	Nil	
Ku2K	AA	95	Scan				Not located					replace		awaiting replacement
Ku2K	AA	95	Scan				Not located					replace		awaiting replacement
Ku2K	NEW	90	Scan	30/07/2018	12:16	GoPro Camera	P			euc leaf nest	Good	Nil	Nil	

Section	Zone/ cluster	Box #	Box type	Check Date	Time	Inspect type	Vert Fauna Y/N	Species	Native /Pest	Vert Signs of use	Box Cond	Maintenance required	Changes in surrounds	Notes
	ZONE													
Ku2K	NEW ZONE	90	Poss	30/07/2018	12:14	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	NEW ZONE	91	Scan	30/07/2018	12:21	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	NEW ZONE	91	Poss	30/07/2018	12:20	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	NEW ZONE	92	LG	29/08/2018	11:01	Tree Climber	Y	Sugar or Squirrel Glider	N	occupied	Good	Nil	Nil	
Ku2K	NEW ZONE	92	Scan	30/07/2018	12:23	GoPro Camera	N			euc leaf nest	Good	Nil	Nil	
Ku2K	NEW ZONE	96	Co	28/08/2018	15:31	Tree Climber	N			Nil	Good	Nil	Nil	
Ku2K	NEW ZONE	96	Poss	28/08/2018	15:20	Tree Climber	Y	Sugar or Squirrel Glider	N	occupied	Good	Nil	Nil	fled Box
Ku2K	NEW ZONE	97	LFO	28/08/2018	15:49	Tree Climber	N			Nil	Good	Nil	Nil	box sitting in fork.
Ku2K	NEW ZONE	97	Poss	28/08/2018	15:52	Tree Climber	N			leaf litter	Good	Nil	Nil	
Ku2K	NEW ZONE	98	Scan	28/08/2018	15:08	Tree Climber	Y	Sugar or Squirrel Glider	N	occupied	Good	Nil	Nil	
Ku2K	NEW ZONE	98	LG	28/08/2018	15:06	Tree Climber	N			leaf litter	Good	Nil	Nil	
Ku2K	NEW ZONE	99	SG	28/08/2018	14:30	Tree Climber	N			Nil	Good	Nil	Nil	insect nest
Ku2K	NEW ZONE	99	Poss	28/08/2018	14:28	Tree Climber	N			Nil	Good	Nil	Nil	
Ku2K	NEW ZONE	100	LG	28/08/2018	14:44	Tree Climber	N			euc leaf	Good	Nil	Nil	
Ku2K	NEW ZONE	100	Poss	28/08/2018	14:36	Tree Climber	N			Nil	Good	Nil	Nil	loosely hanging, wire around limb
Ku2K	S	58	LG	02/08/2018	10:24	BullAnt Camera	N			Nil	Good	Nil	Nil	insect debris

Section	Zone/ cluster	Box #	Box type	Check Date	Time	Inspect type	Vert Fauna Y/N	Species	Native /Pest	Vert Signs of use	Box Cond	Maintenance required	Changes in surrounds	Notes
Ku2K	S	58	Scan	02/08/2018	9:14	GoPro Camera	N			Nil	Good	Nil	Nil	insect debris
Ku2K	S	59	SG	02/08/2018	9:00	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	S	59	Poss	02/08/2018	9:01	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	S	60	LG	02/08/2018	10:21	BullAnt Camera	N			Nil	Good	Nil	Nil	old ant nest
Ku2K	S	60	Poss	02/08/2018	9:03	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	S	61	Poss	02/08/2018	9:06	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	S	61	SO	02/08/2018	9:05	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	S	72	LG	02/08/2018	14:42	BullAnt Camera	N			euc leaves	Good	Nil	Nil	
Ku2K	S	72	Poss	02/08/2018	13:24	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	S	73	LG	02/08/2018	14:44	BullAnt Camera	N			Nil	Good	Nil	Nil	
Ku2K	S	73	Poss	02/08/2018	13:21	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	S	74	Co	30/08/2018	11:16	Tree Climber	N			few leaves	Good	Nil	Nil	
Ku2K	S	75	Parr	02/08/2018	13:28	GoPro Camera	N			euc leaf nest	Good	Nil	Nil	
Ku2K	S	75	Scan	02/08/2018	13:25	GoPro Camera	unk			unk	lid stuck	fix lid	Nil	
Ku2K	S	76	Scan	02/08/2018	13:36	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	S	76	Poss	02/08/2018	13:38	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	S	77	LFO	30/08/2018	11:34	Tree Climber	N			euc leaves	Good	Nil	Nil	no hose
Ku2K	S	77	Poss	02/08/2018	13:39	GoPro Camera	N			Nil	Good	Nil	Nil	wire tied off completely with stick. No room for expansion.
Ku2K	S	78	SG	02/08/2018	15:30	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	S	78	Parr	02/08/2018	15:31	GoPro Camera	N			euc leaves	Good	Nil	Nil	
Ku2K	S	79	Scan	02/08/2018	13:43	GoPro Camera	N			euc leaves	Good	Nil	Nil	
Ku2K	S	79	SG	02/08/2018	13:45	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	T	48	Poss	02/08/2018	9:32	GoPro Camera	Y	Lace Monitor	N	occupied	Good	Nil	Nil	
Ku2K	T	48	MB	02/08/2018	9:31	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	T	49	MB	02/08/2018	9:27	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	T	49	LG	02/08/2018	9:29	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	T	50	Scan	02/08/2018	9:26	GoPro Camera	N	Ants	P	Nil	Good	Nil	Nil	ant nest

Section	Zone/ cluster	Box #	Box type	Check Date	Time	Inspect type	Vert Fauna Y/N	Species	Native /Pest	Vert Signs of use	Box Cond	Maintenance required	Changes in surrounds	Notes
Ku2K	T	50	Poss	02/08/2018	9:25	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	T	51	Poss	02/08/2018	9:22	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	T	51	LG	02/08/2018	10:11	BullAnt Camera	N	Ants	P	Nil	Good	Nil	Nil	ant nest
Ku2K	T	52	Parr	02/08/2018	9:21	GoPro Camera	N			Nil	Good	Nil	Nil	ant debris
Ku2K	T	52	SG	02/08/2018	9:20	GoPro Camera	N			euc leaf nest	Good	Nil	Nil	
Ku2K	T	53	Scan	02/08/2018	12:45	GoPro Camera	N	Ants	P	euc leaf nest	Good	Nil	Nil	
Ku2K	T	53	SG	02/08/2018	12:44	GoPro Camera	N	Ants	P	Leaf nest	Good	Nil	Nil	
Ku2K	T	54	SG	02/08/2018	12:41	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	T	54	LG	02/08/2018	11:27	BullAnt Camera	N			Nil	Good	Nil	Nil	
Ku2K	T	55	Scan	02/08/2018	12:38	GoPro Camera	N			leaf litter	Good	Nil	Nil	
Ku2K	T	55	Parr	02/08/2018	12:37	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	T	56	Scan	02/08/2018	12:36	GoPro Camera	N			conical euc leaf nest	Good	Nil	Nil	
Ku2K	T	56	SG	02/08/2018	12:35	GoPro Camera	N	Ants	P	Nil	Good	Nil	Nil	ant nest
Ku2K	T	57	MB	02/08/2018	11:30	BullAnt Camera	N			Nil	Good	Nil	Nil	
Ku2K	T	57	LG	02/08/2018	11:33	BullAnt Camera	N			Nil	Good	Nil	Nil	
Ku2K	T	62	Co	30/08/2018	10:06	Tree Climber	N			few leaves	Good	Nil	Nil	no apparent room for tree expansion in wiring
Ku2K	T	63	SG	02/08/2018	12:17	GoPro Camera	N	Ants	P	Nil	Good	Nil	Nil	
Ku2K	T	63	LG	02/08/2018	11:45	BullAnt Camera	N			Nil	Good	Nil	Nil	insect debris
Ku2K	T	64	LG	02/08/2018	11:41	BullAnt Camera	N			Nil	Good	Nil	Nil	
Ku2K	T	64	SG	02/08/2018	12:26	GoPro Camera	N			conical euc leaf nest	Good	Nil	Nil	
Ku2K	T	65	SO	02/08/2018	12:29	GoPro Camera	N			leaf litter	Good	Nil	Nil	
Ku2K	T	66	SG	02/08/2018	12:12	GoPro Camera	N	Ants	P	Nil	Good	Nil	Nil	
Ku2K	T	66	Parr	02/08/2018	12:14	GoPro Camera	N			Nil	Good	Nil	Nil	insect debris. wired around dead limb
Ku2K	T	67	Poss	02/08/2018	12:21	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	T	67	LFO	02/08/2018	12:20	Box fallen	Not avail			not avail	broken fell down	replace	Nil	
Ku2K	T	68	LG	02/08/2018	11:48	BullAnt Camera	N			Nil	Good	Nil	Nil	

Section	Zone/ cluster	Box #	Box type	Check Date	Time	Inspect type	Vert Fauna Y/N	Species	Native /Pest	Vert Signs of use	Box Cond	Maintenance required	Changes in surrounds	Notes
Ku2K	T	68	SG	02/08/2018	12:08	GoPro Camera	N			euc leaf nest	Good	Nil	Nil	
Ku2K	T	69	MB	02/08/2018	12:06	GoPro Camera	N			euc leaf nest	Good	Nil	Nil	
Ku2K	T	70	SO	30/08/2018	10:36	Tree Climber	N			few leaves	Good	Nil	Nil	
Ku2K	T	71	MB	02/08/2018	12:01	BullAnt Camera	N			Nil	Good	Nil	Nil	
Ku2K	T	71	LG	02/08/2018	11:58	BullAnt Camera	N			euc leaf nest	Good	Nil	Nil	
Ku2K	T	119	LG	29/08/2018	10:13	Tree Climber	N			Nil	Good	Nil	Nil	no hose
Ku2K	T	119	Poss	29/08/2018	10:11	Tree Climber	N			leaves	Good	Nil	Nil	no hose
Ku2K	T	120	Poss	02/08/2018	9:46	GoPro Camera	N			Nil	Good	Nil	Nil	no hose on hanging wire
Ku2K	T	120	Scan	02/08/2018	9:47	GoPro Camera	N			fresh conical euc leaf nest	Good	Nil	Nil	no hose on hanging wire
Ku2K	T	121	Scan	02/08/2018	9:42	GoPro Camera	N			Nil	Good	Nil	Nil	no hose on hanging wire
Ku2K	T	121	LG	02/08/2018	9:57	BullAnt Camera	N			Nil	Good	Nil	Nil	no hose on hanging wire
Ku2K	U	37	Poss	29/08/2018	16:00	Tree Climber	Y	Brushtail Possum	N	occupied	Good	Nil	Nil	
Ku2K	U	37	LFO	29/08/2018	15:58	Tree Climber	N	Ants	P	Nil	Good	Nil	Nil	
Ku2K	U	38	Scan	31/07/2018	14:32	GoPro Camera	N			old leaf	Good	Nil	Nil	
Ku2K	U	38	SG	31/07/2018	14:30	GoPro Camera	N			euc leaf nest	Good	Nil	Nil	
Ku2K	U	39	LG	31/07/2018	14:16	BullAnt Camera	N			euc leaf nest	Good	Nil	Nil	
Ku2K	U	39	Poss	31/07/2018	14:22	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	U	40	SG	31/07/2018	14:35	GoPro Camera	N			old leaf	Good	Nil	Nil	
Ku2K	U	40	Parr	31/07/2018	14:36	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	U	41	MB	31/07/2018	14:43	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	U	41	Poss	31/07/2018	14:45	GoPro Camera	N			old leaf	Good	Nil	Nil	
Ku2K	U	42	MB	31/07/2018	14:58	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	U	42	SO	31/07/2018	14:56	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	U	43	Parr	31/07/2018	14:53	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	U	43	MB	31/07/2018	14:54	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	U	44	Scan	31/07/2018	15:05	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	U	44	SG	31/07/2018	15:06	GoPro Camera	N	Ants	P	Nil	Good	Nil	Nil	

Section	Zone/ cluster	Box #	Box type	Check Date	Time	Inspect type	Vert Fauna Y/N	Species	Native /Pest	Vert Signs of use	Box Cond	Maintenance required	Changes in surrounds	Notes
Ku2K	U	45	SG	31/07/2018	15:12	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	U	45	LG	31/07/2018	15:22	BullAnt Camera	N			Nil	Good	Nil	Nil	
Ku2K	U	46	LG	29/08/2018	16:20	Tree Climber	N			Nil	Good	Nil	Nil	insect debris
Ku2K	U	46	Scan	31/07/2018	14:50	GoPro Camera	N			old leaf	Good	Nil	Nil	
Ku2K	U	47	Scan	31/07/2018	15:03	GoPro Camera	N			leaf litter	Good	Nil	Nil	
Ku2K	U	47	Poss	31/07/2018	15:01	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	U	93	Scan	31/07/2018	15:08	GoPro Camera	N			old leaf	Good	Nil	Nil	water markings inside box.
Ku2K	U	93	Poss	31/07/2018	15:09	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	V	31	Scan	30/07/2018	14:03	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	V	31	SG	30/07/2018	14:04	GoPro Camera	N			euc leaf nest	Good	Nil	Nil	
Ku2K	V	32	SG	30/07/2018	14:06	GoPro Camera	Y	Lorikeet possible	N	eggs	Good	Nil	Nil	
Ku2K	V	32	Parr	30/07/2018	14:05	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	V	33	Scan	30/07/2018	14:08	GoPro Camera	N			leaves	Good	Nil	Nil	
Ku2K	V	33	MB	30/07/2018	14:09	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	V	34	SG	30/07/2018	14:11	GoPro Camera	unk			unk	unk	fix lid	Nil	lid stuck unable to inspect
Ku2K	V	34	Poss	30/07/2018	14:12	GoPro Camera	N			Nil	Good	Nil	Nil	wiring may not have allowance for expansion - unclear knotting
Ku2K	V	35	MB	30/07/2018	14:17	GoPro Camera	P			conical euc leaf nest	Good	Nil	Nil	
Ku2K	V	35	Parr	30/07/2018	14:18	GoPro Camera	N			old leaf	Good	Nil	Nil	
Ku2K	V	36	Scan	30/07/2018	14:22	GoPro Camera	N			euc leaf nest	Good	Nil	Nil	
Ku2K	V	36	Poss	30/07/2018	14:21	GoPro Camera	Y	Brushtail Possum	N	occupied	Good	Nil	Nil	
Ku2K	V	126	LG	30/07/2018	14:49	BullAnt Camera	N			Nil	Good	Nil	Nil	
Ku2K	V	126	Poss	30/07/2018	13:49	GoPro Camera	N			Nil	Good	Nil	Nil	no hose on hanging wire
Ku2K	V	127	LG	30/07/2018	13:53	GoPro Camera	N			Nil	Good	Nil	Nil	no hose on hanging wire
Ku2K	V	127	Scan	30/07/2018	13:54	GoPro Camera	N			Nil	Good	Nil	Nil	no hose on hanging wire
Ku2K	V	128	Scan	30/07/2018	13:27	GoPro Camera	N			Nil	Good	Nil	Nil	no hose on hanging wire
Ku2K	V	128	Poss	30/07/2018	13:55	GoPro Camera	N			leaf litter	Good	Nil	Nil	no hose on hanging wire

Section	Zone/ cluster	Box #	Box type	Check Date	Time	Inspect type	Vert Fauna Y/N	Species	Native /Pest	Vert Signs of use	Box Cond	Maintenance required	Changes in surrounds	Notes
Ku2K	W	112	Scan	30/07/2018	13:27	GoPro Camera	Y	No ID- dead possible glider.	N	no nest	Good	Nil	Nil	no hose on hanging wire
Ku2K	W	112	MB	30/07/2018	13:24	GoPro Camera	N			Nil	Good	Nil	Nil	no hose on hanging wire
Ku2K	W	113	LG	30/07/2018	15:47	BullAnt Camera	N			Nil	Good	Nil	Nil	
Ku2K	W	113	Scan	30/07/2018	13:21	GoPro Camera	N			fresh conical euc leaf nest	Good	Nil	Nil	no hose on hanging wire
Ku2K	W	114	Poss	30/07/2018	13:17	GoPro Camera	N			Nil	Good	Nil	Nil	no hose on hanging wire and sitting in fork of tree instead of hanging
Ku2K	W	114	Scan	30/07/2018	13:19	GoPro Camera	N			Nil	Good	Nil	Nil	no hose on hanging wire
Ku2K	W	115	Poss	30/07/2018	13:15	GoPro Camera	N			Nil	Good	Nil	Nil	no hose on hanging wire
Ku2K	W	115	Parr	30/07/2018	13:13	GoPro Camera	N			Nil	Good	Nil	Nil	no hose on hanging wire
Ku2K	W	116	Scan	30/07/2018	13:03	GoPro Camera	N			leaf litter	Good	Nil	Nil	no hose on hanging wire
Ku2K	W	116	Poss	30/07/2018	13:09	GoPro Camera	N			Nil	Good	Nil	Nil	no hose on hanging wire
Ku2K	W	117	Poss	30/07/2018	12:58	GoPro Camera	N			grass nest with feather and plastic	Good	Nil	Nil	no hose on hanging wire
Ku2K	W	117	SG	30/07/2018	13:00	GoPro Camera	P			conical euc leaf nest	Good	Nil	Nil	no hose on hanging wire
Ku2K	W	118	Scan	30/07/2018	12:54	GoPro Camera	N			old euc leaves	Good	Nil	Nil	
Ku2K	W	118	MB	30/07/2018	12:51	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	W	129	Poss	31/07/2018	12:36	BullAnt Camera	N			melaleuca leaf or grass	Good	Nil	Nil	no hose on hanging wire
Ku2K	W	129	MB	31/07/2018	12:40	BullAnt Camera	N			Nil	Good	Nil	Nil	no hose on hanging wire
Ku2K	W	130	Poss	31/07/2018	12:31	BullAnt Camera	N			old bird nest	Good	Nil	Nil	wiring wrapped around limb
Ku2K	W	130	MB	31/07/2018	12:30	BullAnt Camera	N			Nil	Good	Nil	Nil	
Ku2K	W	131	Poss	31/07/2018	12:34	BullAnt Camera	N			rubbish and leaf litter	Good	Nil	Nil	no hose on hanging wire
Ku2K	W	131	MB	31/07/2018	12:33	BullAnt Camera	N			Nil	Good	Nil	Nil	no hose on hanging wire
Ku2K	X	26	SG	31/07/2018	11:40	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	X	26	Parr	31/07/2018	11:37	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	X	27	Scan	31/07/2018	11:42	GoPro Camera	N			euc leaf nest	Good	Nil	Nil	
Ku2K	X	27	Parr	31/07/2018	11:41	GoPro Camera	N			Nil	Good	Nil	Nil	

Section	Zone/ cluster	Box #	Box type	Check Date	Time	Inspect type	Vert Fauna Y/N	Species	Native /Pest	Vert Signs of use	Box Cond	Maintenance required	Changes in surrounds	Notes
Ku2K	X	28	Poss	31/07/2018	11:44	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	X	28	MB	31/07/2018	11:43	GoPro Camera	N			euc leaf nest	Good	Nil	Nil	
Ku2K	X	29	Co		Not located		Not located							awaiting replacement
Ku2K	X	30	Poss		Not located		Not located							awaiting replacement
Ku2K	X	30	LFO		Not located		Not located							awaiting replacement
Ku2K	X	80	SG	31/07/2018	12:13	BullAnt Camera	N			Nil	Good	Nil	Nil	wire encircling tree and Wire from burnt box has been left around tree
Ku2K	X	80	LG	31/07/2018	12:12	BullAnt Camera	N			Nil	Good	Nil	Nil	wire encircling tree
Ku2K	X	81	MB	31/07/2018	11:51	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	X	81	Parr	31/07/2018	11:50	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	X	82	SG	31/07/2018	11:49	GoPro Camera	N			Nil	Good	Nil	Nil	wire from burnt box has been left around tree
Ku2K	X	82	Poss	31/07/2018	11:48	GoPro Camera	N			Nil	Good	Nil	Nil	wire from burnt box has been left around tree
Ku2K	X	83	LG	31/07/2018	12:00	BullAnt Camera	N			euc leaves	Good	Nil	Nil	
Ku2K	X	83	Parr	31/07/2018	12:08	BullAnt Camera	N			Nil	lid not straight	fix lid	Nil	wire encircling tree
Ku2K	X	84	Scan	31/07/2018	11:54	GoPro Camera	N			euc leaf nest	Good	Nil	Nil	
Ku2K	X	84	Parr	31/07/2018	11:52	GoPro Camera	N			euc leaf nest	Good	Nil	Nil	wire encircling tree
Ku2K	X	101	Poss	29/08/2018	14:57	Tree Climber	N			Nil	Good	Nil	Nil	
Ku2K	X	101	Co	29/08/2018	14:53	Tree Climber	N			leaf nest	Good	Nil	Nil	
Ku2K	X	102	Poss	29/08/2018	14:37	Tree Climber	N			Nil	Good	Nil	Nil	
Ku2K	X	102	LFO	29/08/2018	14:35	Tree Climber	N			leaf litter	Good	Nil	Nil	
Ku2K	X	103	Poss	29/08/2018	15:15	Tree Climber	N			Nil	Good	Nil	Nil	
Ku2K	X	103	Co	29/08/2018	15:13	Tree Climber	N			Nil	Good	Nil	Nil	
Ku2K	X	132	Co		Not located		Not located							awaiting replacement

Section	Zone/ cluster	Box #	Box type	Check Date	Time	Inspect type	Vert Fauna Y/N	Species	Native /Pest	Vert Signs of use	Box Cond	Maintenance required	Changes in surrounds	Notes
Ku2K	Y	16	MB	31/07/2018	10:26	GoPro Camera	N			Nil	Good	Nil	Nil	difficult to see wiring because of regrowth
Ku2K	Y	16	Parr	31/07/2018	10:24	GoPro Camera	N			euc leaves	Good	Nil	Nil	wiring obscured by regrowth
Ku2K	Y	17	Scan	31/07/2018	10:31	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	Y	17	Parr	31/07/2018	10:29	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	Y	18	LG	31/07/2018	9:46	BullAnt Camera	N	Euro bees	P	Nil	Good	Nil	Nil	Active Beehive
Ku2K	Y	18	Scan	31/07/2018	9:47	BullAnt Camera	N			euc leaf nest	Good	Nil	Nil	
Ku2K	Y	19	Scan	31/07/2018	10:00	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	Y	19	SO	31/07/2018	9:58	GoPro Camera	N			few euc leaves	Good	Nil	Nil	
Ku2K	Y	20	SG	31/07/2018	10:06	GoPro Camera	N			Nil	Good	Nil	Nil	sitting in tree fork
Ku2K	Y	20	Scan	31/07/2018	10:08	GoPro Camera	N			euc leaves	Good	Nil	Nil	wire encircling tree
Ku2K	Y	21	SG	Does not exist		This NBT was discontinued and became NBT 86								
Ku2K	Y	21	Poss	Does not exist		This NBT was discontinued and became NBT 86								
Ku2K	Y	22	Scan	31/07/2018	10:15	GoPro Camera	N			conical euc leaf nest	Good	Nil	Nil	wire encircling tree
Ku2K	Y	22	Parr	31/07/2018	10:10	GoPro Camera	N			mud wasps and euc leaves	Good	Nil	Nil	
Ku2K	Y	23	LG	This NBT was discontinued and became NBT 89		This NBT was discontinued and became NBT 89								
Ku2K	Y	23	Poss	This NBT was discontinued and became NBT 89		This NBT was discontinued and became NBT 89								
Ku2K	Y	24	Poss	28/08/2018	13:10	Tree Climber	N			Nil	Good	Nil	Nil	
Ku2K	Y	24	Co	28/08/2018	13:08	Tree Climber	N			Nil	Good	Nil	Nil	
Ku2K	Y	25	Poss	31/07/2018	10:52	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	Y	25	LFO	31/07/2018	10:51	GoPro Camera	N			woody debris	Good	Nil	Nil	

Section	Zone/ cluster	Box #	Box type	Check Date	Time	Inspect type	Vert Fauna Y/N	Species	Native /Pest	Vert Signs of use	Box Cond	Maintenance required	Changes in surrounds	Notes
Ku2K	Y	85	Poss	28/08/2018	11:53	Tree Climber	N			leaf	Good	Nil	Nil	
Ku2K	Y	85	Scan	28/08/2018	11:55	Tree Climber	N			conical euc leaf nest	Good	Nil	Nil	
Ku2K	Y	86	MB	28/08/2018	12:19	Tree Climber	N			Nil	Good	Nil	Nil	
Ku2K	Y	86	LG	28/08/2018	12:18	Tree Climber	N			Nil	Good	Nil	Nil	
Ku2K	Y	87	MB	31/07/2018	10:56	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	Y	87	SG	31/07/2018	10:58	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	Y	88	LG	28/08/2018	12:28	tree climber	N			Nil	Good	Nil	Nil	sitting in fork
Ku2K	Y	88	SG	31/07/2018	10:46	GoPro Camera	N			conical euc leaf nest	Good	Nil	Nil	
Ku2K	Y	89	LG	28/08/2018	13:32	Tree Climber	N			Nil	Good	Nil	Nil	old honeycomb and old wasp nest. In fork
Ku2K	Y	89	Poss	28/08/2018	13:33	Tree Climber	N			Nil	Good	Nil	Nil	wire around dead limb
Ku2K	Z	10	Parr	28/08/2018	9:57	Tree Climber	N			Nil	Good	Nil	Nil	
Ku2K	Z	10	LG	28/08/2018	9:54	Tree Climber	N			fresh euc leaves	Good	Nil	Nil	tree may not live (tree climber note)
Ku2K	Z	11	MB	30/07/2018	11:36	GoPro Camera	N			nil	Good	Nil	Nil	
Ku2K	Z	11	Poss	30/07/2018	11:35	GoPro Camera	N			nil	Good	Nil	Nil	wired incorrectly
Ku2K	Z	12	Scan	30/07/2018	11:48	GoPro Camera	N			nil	Good	Nil	Nil	wire encircling tree
Ku2K	Z	12	Parr	30/07/2018	11:47	GoPro Camera	N			nil	Good	Nil	Nil	wire encircling tree
Ku2K	Z	13	Poss	30/07/2018	11:52	GoPro Camera	Y	Brushtail Possum	N	occupied	Good	Nil	Nil	wiring questionable
Ku2K	Z	13	SG	30/07/2018	11:54	GoPro Camera	N			old leaf	Good	Nil	Nil	wiring questionable
Ku2K	Z	14	LG	31/07/2018	9:20	BullAnt Camera	N			Nil	Good	Nil	Nil	
Ku2K	Z	14	MB	31/07/2018	11:40	GoPro Camera	N			Nil	Good	Nil	Nil	wire encircling tree
Ku2K	Z	15	Scan	31/07/2018	11:42	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	Z	15	Parr	31/07/2018	11:44	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	Z	104	LG	02/08/2018	10:46	BullAnt Camera	N			Nil	Good	Nil	Nil	
Ku2K	Z	104	Scan	30/07/2018	10:56	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	Z	105	Poss	30/07/2018	11:01	GoPro Camera	Y	Brushtail Possum	N	occupied	Good	Nil	Nil	
Ku2K	Z	105	Scan	30/07/2018	10:58	GoPro Camera	N			Nil	Good	Nil	Nil	

Section	Zone/ cluster	Box #	Box type	Check Date	Time	Inspect type	Vert Fauna Y/N	Species	Native /Pest	Vert Signs of use	Box Cond	Maintenance required	Changes in surrounds	Notes
Ku2K	Z	106	Poss	30/07/2018	11:08	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	Z	106	SG	30/07/2018	11:06	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	Z	107	Poss	29/08/2018	12:06	Tree Climber	N			Nil	Good	Nil	Nil	Lace Monitor on tree
Ku2K	Z	107	LG	29/08/2018	12:01	Tree Climber	N			Nil	Good	Nil	Nil	
Ku2K	Z	108	SG	30/07/2018	11:19	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	Z	108	Poss	30/07/2018	11:17	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	Z	109	Scan	28/08/2018	10:35	Tree Climber	N			Nil	Good	Nil	Nil	sitting in fork
Ku2K	Z	109	LG	28/08/2018	10:33	Tree Climber	N			Nil	Lid broken	fix lid	Nil	bad wiring could fall and lid broken.
Ku2K	Z	110	SG	30/07/2018	11:23	GoPro Camera	N			Nil	Good	Nil	Nil	wire almost fully stretched
Ku2K	Z	110	Poss	30/07/2018	11:24	GoPro Camera	Y	Brushtail Possum	N	occupied	Good	Nil	Nil	wire almost fully stretched
Ku2K	Z	111	LG	28/08/2018	10:58	Tree Climber	N			Nil	Good	Nil	Nil	
Ku2K	Z	111	SG	28/08/2018	11:00	Tree Climber	N			leaves	Good	Nil	Nil	
Ku2K	Z	122	Poss	30/07/2018	10:44	GoPro Camera	N			old leaves	Good	Nil	Nil	
Ku2K	Z	122	Scan	30/07/2018	10:45	GoPro Camera	N			Nil	Good	Nil	Nil	
Ku2K	Z	123	LG	29/08/2018	12:28	Tree Climber	N			leaves	Good	Nil	Nil	
Ku2K	Z	123	SG	29/08/2018	12:29	Tree Climber	N			Nil	Good	Nil	Nil	
Ku2K	Z	124	LG	29/08/2018	12:41	Tree Climber	N			Nil	Good	fix lid	Nil	lid screwed shut and no hose
Ku2K	Z	124	Scan	29/08/2018	12:46	Tree Climber	N			Nil	Good	Nil	Nil	no hose
Ku2K	Z	125	SG	29/08/2018	13:01	Tree Climber	N			Nil	Good	Nil	Nil	no hose
Ku2K	Z	125	Scan	29/08/2018	13:06	Tree Climber	N			Nil	Good	Nil	Nil	no hose
OH2Ku	A1	165	Scan	14/08/2018	12:40	GoPro Camera	N			Nil	Good	Nil	Nil	
OH2Ku	A1	180	SG	14/08/2018	12:44	unable to inspect	unk			unk	lid stuck closed	Nil	Nil	spring not attached to wire, insects swarming - beehive
OH2Ku	A1	181	Poss	14/08/2018	12:47	GoPro Camera	N			Nil	Good	Nil	Nil	spring not attached to wire
OH2Ku	A1	182	Poss	14/08/2018	12:36	GoPro Camera	N			euc leaves	Good	Nil	Nil	
OH2Ku	A1	380	LG	14/08/2018	12:46	GoPro Camera	N			wood shavings and gravel	Good	Nil	Nil	

Section	Zone/ cluster	Box #	Box type	Check Date	Time	Inspect type	Vert Fauna Y/N	Species	Native /Pest	Vert Signs of use	Box Cond	Maintenance required	Changes in surrounds	Notes
OH2Ku	A2	172	Scan	14/08/2018	13:09	GoPro Camera	N			few euc leaves	Good	Nil	Nil	
OH2Ku	A2	173	SG	14/08/2018	12:57	GoPro Camera	N			conical euc leaf nest	poor - lid fell off	reattach lid	Nil	lid hinges rusted off and lid fell down.
OH2Ku	A2	174	LG	30/08/2018	15:15	Tree Climber	N			few leaves	Good	Nil	Nil	rear opening lid difficult to inspect with pole.
OH2Ku	A2	176	Parr	14/08/2018	13:15	GoPro Camera	N			leaves and debris	Good	Nil	Nil	
OH2Ku	A2	178	SO	14/08/2018	13:07	GoPro Camera	N			leaves and debris	Good	Nil	Nil	
OH2Ku	A2	186	Poss	14/08/2018	13:12	GoPro Camera	N			Nil	Good	Nil	Nil	
OH2Ku	A3	179	Scan	07/08/2018	14:16	GoPro Camera	N			conical euc leaf nest	Good	Nil	Nil	
OH2Ku	A3	380	Scan	07/08/2018	14:20	GoPro Camera	Y	Sugar Gliders	N	occupied	Good	Nil	Nil	multiple gliders
OH2Ku	A3	381	SG	07/08/2018	14:15	GoPro Camera	N			conical euc leaf nest	Good	Nil	Nil	
OH2Ku	A3	382	Parr	07/08/2018	14:13	GoPro Camera	N			euc leaves, entrance chewed	Good	Nil	Nil	
OH2Ku	A3	383	Poss	07/08/2018	14:18	GoPro Camera	N			shredded bark and leaves	Good	Nil	Nil	
OH2Ku	A3	384	Co	30/08/2018	16:00	Tree Climber	N			euc leaves	Good	Nil	Nil	
OH2Ku	A4	183	Scan	14/08/2018	13:19	GoPro Camera	N			euc leaf nest	Good	Nil	Nil	hose is at side of wire.
OH2Ku	A4	184	SG	14/08/2018	13:27	GoPro Camera	N			euc leaf and bark	Good	Nil	Nil	
OH2Ku	A4	185	Poss	14/08/2018	13:24	GoPro Camera	N			wood shavings	Good	Nil	Nil	
OH2Ku	A4	186	LG	14/08/2018	13:22	GoPro Camera	N			wood shavings	Good	Nil	Nil	
OH2Ku	A4	187	Parr	14/08/2018	13:29	GoPro Camera	N			euc leaves and wood shavings	poor - lid fell off	reattach lid	Nil	lid fell to ground.
OH2Ku	A5	168	LG	14/08/2018	13:40	visual	N	Euro bees	P	Nil	Good	Nil	Nil	bees swarming
OH2Ku	A5	171	Small owl	14/08/2018	13:54	GoPro Camera	N			leaves and debris	Good	Nil	Nil	
OH2Ku	A5	188	Scan	14/08/2018	13:42	GoPro Camera	N			conical euc leaf nest	lid broken	repair lid	Nil	
OH2Ku	A5	189	SG	14/08/2018	13:48	GoPro Camera	N			conical euc leaf nest	hinge broken	repair lid	Nil	
OH2Ku	A5	191	Poss	14/08/2018	13:46	GoPro Camera	N			Nil	lid lose	repair lid	Nil	

Section	Zone/ cluster	Box #	Box type	Check Date	Time	Inspect type	Vert Fauna Y/N	Species	Native /Pest	Vert Signs of use	Box Cond	Maintenance required	Changes in surrounds	Notes
OH2Ku	B1	397	SG	15/08/2018	14:04	GoPro Camera	N			conical euc leaf nest	Good	Nil	Nil	
OH2Ku	B1	398	Poss	15/08/2018	14:02	GoPro Camera	N			Nil	Good	Nil	Nil	
OH2Ku	B1	399	Scan	15/08/2018	14:03	GoPro Camera	N			leaf litter	Good	Nil	Nil	no room in wire for tree growth
OH2Ku	B1	400	Parr	15/08/2018	13:57	GoPro Camera	N			Nil	Good	Nil	Nil	no room in wire for tree growth
OH2Ku	B1	401	Scan	15/08/2018	13:59	GoPro Camera	N			conical euc leaf nest	Good	Nil	Nil	no room in wire for tree growth
OH2Ku	B1	402	Poss	15/08/2018	13:56	GoPro Camera	N			Nil	Good	Nil	Nil	no room in wire for tree growth
OH2Ku	B1	403	MB	15/08/2018	13:55	GoPro Camera	N			Nil	Good	Nil	Nil	
OH2Ku	B2	167	SG	15/08/2018	14:07	GoPro Camera	N			conical euc leaf nest	Good	Nil	Nil	
OH2Ku	B2	404	SG	15/08/2018	13:54	GoPro Camera	N			old leaf	Good	Nil	Nil	no room in wire for tree growth
OH2Ku	B2	405	Scan	15/08/2018	13:53	GoPro Camera	N			conical euc leaf nest	Good	Nil	Nil	no room in wire for tree growth
OH2Ku	B2	406	LG	15/08/2018	13:51	GoPro Camera	N			chewed bark	Good	Nil	Nil	no room in wire for tree growth
OH2Ku	B2	407	Cock	29/08/2018	8:08	Tree Climber	Y	Brush-tail Possum	N	occupied	Good	Nil	Nil	
OH2Ku	B2	408	Poss Add	15/08/2018	13:49	GoPro Camera	N			Nil	Good	Nil	Nil	
OH2Ku	C1	222	SG	14/08/2018	11:28	GoPro Camera	Y	Antechinus sp.	N	occupied	Good	Nil	Nil	
OH2Ku	C1	223	Poss	14/08/2018	11:32	GoPro Camera	N	Euro bees	P	Nil	Good	Nil	Nil	bee hive
OH2Ku	C1	224	Scan	14/08/2018	11:26	GoPro Camera	N			euc leaf nest	Good	Nil	Nil	
OH2Ku	C1	225	LG	14/08/2018	11:24	GoPro Camera	Y	Brush-tail Possum	N	occupied	Good	Nil	Nil	
OH2Ku	C1	226	Parr	14/08/2018	11:36	GoPro Camera	Y	Lace Monitor	N	occupied	Good	Nil	Nil	
OH2Ku	C2	216	LG	14/08/2018	11:49	GoPro Camera	N			bark	Good	Nil	Nil	
OH2Ku	C2	217	Parr	14/08/2018	11:42	GoPro Camera	P			euc leaf nest	Good	Nil	Nil	
OH2Ku	C2	218	Poss	14/08/2018	11:58	GoPro Camera	Y	Ringtail Possum	N	occupied	Good	Nil	Nil	
OH2Ku	C2	219	SG	14/08/2018	11:50	GoPro Camera	N			conical euc leaf nest	Good	Nil	Nil	
OH2Ku	C2	220	Scan	14/08/2018	12:01	GoPro Camera	Y	Sugar Gliders	N	occupied	Good	Nil	Nil	
OH2Ku	C2	221	LG	14/08/2018	11:40	GoPro Camera	Y	Ringtail Possum	N	occupied	Good	Nil	Nil	

Section	Zone/ cluster	Box #	Box type	Check Date	Time	Inspect type	Vert Fauna Y/N	Species	Native /Pest	Vert Signs of use	Box Cond	Maintenance required	Changes in surrounds	Notes
OH2Ku	C3	227	Poss	14/08/2018	11:14	GoPro Camera	Y	Ringtail Possum	N	occupied	Good	Nil	Nil	melaleuca bark, Allocas leaf nest
OH2Ku	C3	228	SG	14/08/2018	11:18	GoPro Camera	Y	Sugar Gliders	N	occupied	Good	Nil	Nil	
OH2Ku	C3	229	Scan	14/08/2018	11:12	GoPro Camera	N			euc leaf nest	Good	Nil	Nil	scats on side
OH2Ku	D1	355	LG	14/08/2018	10:23	GoPro Camera	N			chewed bark, wasp nest	Good	Nil	Nil	
OH2Ku	D1	356	Poss	14/08/2018	10:19	GoPro Camera	N			chewed bark	Good	Nil	Nil	
OH2Ku	D1	357	SG	14/08/2018	10:21	GoPro Camera	P			conical euc leaf nest	Good	Nil	Nil	
OH2Ku	D1	358	PARR	14/08/2018	10:23	GoPro Camera	N			Allocasuarina leaf nest	Good	Nil	Nil	
OH2Ku	D1	359	Scan	14/08/2018	10:18	GoPro Camera	N			conical euc leaf nest	Good	Nil	Nil	
OH2Ku	D2	360	SG	14/08/2018	10:14	GoPro Camera	N			conical euc leaf nest	Good	Nil	Nil	scats in corner
OH2Ku	D2	361	Poss	14/08/2018	10:11	GoPro Camera	Y	Brushtail Possum	N	occupied	Good	Nil	Nil	
OH2Ku	D2	362	Scan	14/08/2018	10:09	GoPro Camera	N			euc leaf nest	Good	Nil	Nil	
OH2Ku	D2	363	MB	14/08/2018	10:13	Torch	N			Nil	Good	Nil	Nil	
OH2Ku	D2	364	SG	14/08/2018	10:12	GoPro Camera	N			euc leaf	Good	Nil	Nil	
OH2Ku	D3	365	SG	14/08/2018	10:03	GoPro Camera	N			conical euc leaf nest	Good	Nil	Nil	
OH2Ku	D3	366	Scan	14/08/2018	10:01	GoPro Camera	N			euc leaf nest	Good	Nil	Nil	
OH2Ku	D3	367	Parr	14/08/2018	9:58	GoPro Camera	N			shredded bark and chewed entrance	Good	Nil	Nil	
OH2Ku	D3	368	Poss	14/08/2018	9:55	GoPro Camera	N			shredded bark	Good	Nil	Nil	
OH2Ku	D3	378	SG	14/08/2018	9:59	GoPro Camera	N			euc leaf nest	Good	Nil	Nil	
OH2Ku	D4	369	Parr	14/08/2018	9:21	GoPro Camera	N			leaf and bark	Good	Nil	Nil	entrance chewed
OH2Ku	D4	371	Scan	14/08/2018	9:19	GoPro Camera	Y	Sugar Glider	N	occupied	Good	Nil	Nil	
OH2Ku	D4	372	LG	14/08/2018	9:17	GoPro Camera	N			euc leaves	Good	Nil	Nil	
OH2Ku	D4	373	Poss	14/08/2018	9:28	GoPro Camera	Y	Brushtail Possum	N	occupied	Good	Nil	Nil	
OH2Ku	D4	376	SG	14/08/2018	9:23	GoPro Camera	Y	Possible Squirrel Glider	N	occupied	Good	Nil	Nil	
OH2Ku	D5	374	Poss	14/08/2018	9:39	GoPro Camera	Y	Brushtail	N	occupied	Good	Nil	Nil	

Section	Zone/ cluster	Box #	Box type	Check Date	Time	Inspect type	Vert Fauna Y/N	Species	Native /Pest	Vert Signs of use	Box Cond	Maintenance required	Changes in surrounds	Notes
								Possum						
OH2Ku	D5	375	Scan	14/08/2018	9:47	GoPro Camera	N			euc leaves	Good	Nil	Nil	
OH2Ku	D5	377	LG	14/08/2018	9:35	GoPro Camera	Y	Brushtail Possum	N	occupied	Good	Nil	Nil	
OH2Ku	D5	378	MB	14/08/2018	9:33	Torch	N			Nil	Good	Nil	Nil	
OH2Ku	D5	379	Parr	14/08/2018	9:40	Visual	Y	White- throated Tree Creeper	N	occupied	Good	Nil	Nil	pair observed entering box
OH2Ku	E1	200	SO	16/08/2018	11:02	GoPro Camera	Y	Lace Monitor	N	occupied	Good	Nil	Nil	
OH2Ku	E1	201	SG	16/08/2018	10:58	GoPro Camera	N			conical euc leaf nest	Good	Nil	Nil	
OH2Ku	E2	198	Parr	16/08/2018	11:07	GoPro Camera	N			Nil	Good	Nil	Nil	old honeycomb
OH2Ku	E2	199	Poss	16/08/2018	11:05	GoPro Camera	N			flattened euc leaves	Good	Nil	Nil	
OH2Ku	E3	193	SG	16/08/2018	11:13	GoPro Camera	Y	Sugar Glider	N	occupied	Good	Nil	Nil	
OH2Ku	E3	194	MB	16/08/2018	11:12	Torch	N			Nil	Good	Nil	Nil	
OH2Ku	E3	195	Poss add	16/08/2018	11:16	GoPro Camera	N			flattened euc leaves	Good	Nil	Nil	
OH2Ku	E3	196	Scan	16/08/2018	11:22	GoPro Camera	N			Allocasuarina leaf nest	Good	Nil	Nil	
OH2Ku	E3	274	Co	30/08/2018	13:55	Tree Climber	N			few leaves	Good	Nil	Nil	Box sitting in fork.
OH2Ku	F1	160	SO	09/08/2018	14:26	GoPro Camera	Y	Owlet Nightjar	N	occupied	Good	Nil	Nil	
OH2Ku	F1	161	Poss	09/08/2018	14:24	GoPro Camera	N			Nil	Good	Nil	Nil	
OH2Ku	F1	162	LFO	30/08/2018	14:39	Tree Climber	N			leaves	Good	Nil	Nil	honeycomb
OH2Ku	F1	166	Scan	09/08/2018	14:28	GoPro Camera	N			Nil	Good	Nil	Nil	old honeycomb
OH2Ku	F1	504	SG	09/08/2018	14:25	GoPro Camera	N			Nil	Good	Nil	Nil	
OH2Ku	F2	163	Poss	09/08/2018	14:20	GoPro Camera	N			euc leaves	Good	Nil	Nil	
OH2Ku	F2	164	SG	09/08/2018	14:17	GoPro Camera	Y	Lace Monitor	N	occupied	Good	Nil	Nil	
OH2Ku	G1	197	LG	16/08/2018	11:54	GoPro Camera	N			euc leaf, bark, old honeycomb	Good	Nil	Nil	
OH2Ku	G1	202	MB	16/08/2018	11:50	Torch	N			Nil	Good	Nil	Nil	
OH2Ku	G1	203	Poss	16/08/2018	11:46	GoPro Camera	N			shredded bark	Good	Nil	Nil	
OH2Ku	G1	204	Scan	16/08/2018	11:48	GoPro Camera	N			conical euc leaf nest	Good	Nil	Nil	

Section	Zone/ cluster	Box #	Box type	Check Date	Time	Inspect type	Vert Fauna Y/N	Species	Native /Pest	Vert Signs of use	Box Cond	Maintenance required	Changes in surrounds	Notes
OH2Ku	G1	206	SG	16/08/2018	11:52	GoPro Camera	N			deep euc leaf with latrine	Good	Nil	Nil	
OH2Ku	G2	211	LG	16/08/2018	12:09	GoPro Camera	N			euc leaf and bark	Good	Nil	Nil	
OH2Ku	G2	212	Poss	16/08/2018	12:05	GoPro Camera	N			shredded bark	Good	Nil	Nil	
OH2Ku	G2	213	Parr	16/08/2018	11:59	GoPro Camera	N			euc leaf nest and shredded bark	Good	Nil	Nil	
OH2Ku	G2	214	SG	16/08/2018	12:01	GoPro Camera	Y	Antechinus sp.	N	occupied	Good	Nil	Nil	multiple individuals
OH2Ku	G2	215	Scan	16/08/2018	12:10	GoPro Camera	N			conical euc leaf nest	Good	Nil	Nil	
OH2Ku	G3	206	Poss	16/08/2018	12:20	GoPro Camera	N			shredded bark	Good	Nil	Nil	multiple
OH2Ku	G3	207	SG	16/08/2018	12:22	GoPro Camera	Y	Antechinus sp.	N	occupied	Good	Nil	Nil	
OH2Ku	G3	208	LG	16/08/2018	12:18	GoPro Camera	N			old honeycomb and shredded bark	Good	Nil	Nil	
OH2Ku	G3	209	Scan	16/08/2018	12:24	GoPro Camera	Y	Sugar Glider	N	occupied	Good	Nil	Nil	multiple
OH2Ku	G3	210	SO	16/08/2018	12:15	GoPro Camera	N			euc leaves and debris	Good	Nil	Nil	
OH2Ku	H1	385	LG	28/06/2018	11:44	GoPro Camera	N			shredded bark	Good	Nil	Nil	
OH2Ku	H1	386	SG	28/06/2018	11:51	GoPro Camera	N			euc leaf nest	Good	Nil	Nil	
OH2Ku	H1	387	Parr	28/06/2018	11:53	GoPro Camera	N			woody debris	Good	Nil	Nil	
OH2Ku	H1	388	Poss	28/06/2018	11:47	GoPro Camera	P			euc leaf nest	Good	Nil	Nil	
OH2Ku	H2	389	MB	28/06/2018	12:10	GoPro Camera	N			Nil	Good	Nil	Nil	
OH2Ku	H2	390	SG	28/06/2018	12:03	GoPro Camera	N			euc leaf nest.	Good	Nil	Nil	
OH2Ku	H2	391	LG	28/06/2018	12:06	GoPro Camera	N			Nil	Good	Nil	Nil	
OH2Ku	H2	392	SG	28/06/2018	12:09	GoPro Camera	Y	Sugar Glider	N	occupied	Good	Nil	Nil	
OH2Ku	H3	393	Cock	30/08/2018	13:12	Tree Climber	N			euc leaves and bark	Good	Nil	Nil	
OH2Ku	H3	394	Poss	28/06/2018	12:19	GoPro Camera	N			Nil	Good	Nil	Nil	
OH2Ku	H3	395	SG	09/08/2018	10:14	GoPro Camera	N			Nil	Good	Nil	Nil	
OH2Ku	H3	396	LG	09/08/2018	10:17	GoPro Camera	N			shredded bark	Good	Nil	Nil	
OH2Ku	I1	290	Scan	28/06/2018	9:58	GoPro Camera	N			Nil	Good	Nil	Nil	
OH2Ku	I1	292	SG	28/06/2018	9:52	GoPro Camera	N			Nil	Good	Nil	Nil	

Section	Zone/ cluster	Box #	Box type	Check Date	Time	Inspect type	Vert Fauna Y/N	Species	Native /Pest	Vert Signs of use	Box Cond	Maintenance required	Changes in surrounds	Notes
OH2Ku	I1	293	SG	28/06/2018	10:02	GoPro Camera	N			leaves and latrine	Needs clearin g	clear out box	Nil	photo - old hose and debris in box
OH2Ku	I1	294	Poss	28/06/2018	9:54	GoPro Camera	N			leaf and bark debris	Good	Nil	Nil	
OH2Ku	I2	288	LG	28/06/2018	10:42	GoPro Camera	N			Nil	Good	Nil	Nil	
OH2Ku	I2	289	Parr	28/06/2018	10:33	GoPro Camera	N			conical leaf nest	Good	Nil	Nil	
OH2Ku	I2	291	MB	28/06/2018	10:21	Torch	N			Nil	Good	Nil	Nil	
OH2Ku	I2	295	SG	28/06/2018	10:37	GoPro Camera	Y	Sugar Glider	N	occupied	Good	Nil	Nil	
OH2Ku	I2	296	Scan	28/06/2018	10:27	GoPro Camera	N			euc leaves	Good	Nil	Nil	
OH2Ku	I3	283	SO	28/06/2018	9:37	GoPro Camera	N			leaves and bark	Good	Nil	Nil	
OH2Ku	I3	284	Poss	28/06/2018	9:39	GoPro Camera	N			leaves and bark	Good	Nil	Nil	
OH2Ku	I3	285	LG	28/06/2018	9:28	GoPro Camera	N			leaves and bark	Good	Nil	Nil	
OH2Ku	I3	286	SG	28/06/2018	9:42	GoPro Camera	N			conical euc leaf nest	Good	Nil	Nil	
OH2Ku	I3	287	Scan	28/06/2018	9:46	GoPro Camera	Y	Sugar Gliders	N	occupied	Good	Nil	Nil	multiple
OH2Ku	I4	279	LG	28/06/2018	9:22	GoPro Camera	N			leaves and bark	Good	Nil	Nil	
OH2Ku	I4	280	MB	28/06/2018	9:21	GoPro Camera	N			Nil	Good	Nil	Nil	
OH2Ku	I4	281	Parr	28/06/2018	9:19	GoPro Camera	N			leaves and bark	Good	Nil	Nil	
OH2Ku	I4	282	Poss	28/06/2018	9:25	GoPro Camera	N			leaves and bark	Good	Nil	Nil	
OH2Ku	I5	297	SG	09/08/2018	11:31	GoPro Camera	N			Nil	Good	Nil	Nil	old beehive
OH2Ku	I5	298	Poss	09/08/2018	11:38	GoPro Camera	N			Nil	Good	Nil	Nil	
OH2Ku	I5	299	Add. Poss	09/08/2018	11:30	GoPro Camera	N			bark, old wasp nest	Good	Nil	Nil	
OH2Ku	I5	300	SO	09/08/2018	11:40	GoPro Camera	N			euc leaf	Good	Nil	Nil	
OH2Ku	I5	301	LG	09/08/2018	11:34	GoPro Camera	N			old euc leaf	Good	Nil	Nil	
OH2Ku	I6	307	Poss	09/08/2018	11:24	GoPro Camera	N			euc leaf and bark	Good	Nil	Nil	
OH2Ku	I6	308	SG	09/08/2018	11:15	GoPro Camera	N			Allocasuarina leaf nest	Good	Nil	Nil	
OH2Ku	I6	309	Parr	09/08/2018	11:18	GoPro Camera	N			bark and saw dust	Good	Nil	Nil	
OH2Ku	I6	310	Scan	09/08/2018	11:21	GoPro Camera	N			euc leaf	Good	Nil	Nil	
OH2Ku	I6	311	LG	09/08/2018	11:10	GoPro Camera	N			bark and insect debris	Good	Nil	Nil	

Section	Zone/ cluster	Box #	Box type	Check Date	Time	Inspect type	Vert Fauna Y/N	Species	Native /Pest	Vert Signs of use	Box Cond	Maintenance required	Changes in surrounds	Notes
OH2Ku	I7	312	Parr	09/08/2018	10:50	GoPro Camera	N			conical euc leaf nest	Good	Nil	Nil	
OH2Ku	I7	313	LG	09/08/2018	10:53	GoPro Camera	N			shredded bark	water damag e	Nil	Nil	monitor box state
OH2Ku	I7	314	LG	09/08/2018	10:57	GoPro Camera	N			shredded bark	water damag e	Nil	Nil	monitor box state
OH2Ku	I7	315	MB	09/08/2018	10:47	Torch	N			Nil	Good	Nil	Nil	
OH2Ku	I8	316	LG	09/08/2018	11:50	GoPro Camera	N			Nil	Good	Nil	Nil	
OH2Ku	I8	317	Poss	09/08/2018	11:52	GoPro Camera	N			euc leaf	Good	Nil	Nil	
OH2Ku	I8	318	Parr	09/08/2018	11:54	GoPro Camera	N			Nil	Good	Nil	Nil	bee hive
OH2Ku	I8	319	Cockat oo	30/08/2018	12:57	Tree Climber	N			Euc leaves	Good	Nil	Nil	
OH2Ku	J1	253	Poss add	07/08/2018	13:04	GoPro Camera	N			chewed bark	Good	Nil	Nil	
OH2Ku	J1	254	Mb	07/08/2018	13:02	Torch	N			Nil	Good	Nil	Nil	
OH2Ku	J1	255	SO	07/08/2018	13:01	GoPro Camera	Y	Owlet Nightjar	N	occupied	Good	Nil	Nil	replaces lower box which has active bee hive.
OH2Ku	J1	256	LG	07/08/2018	13:10	GoPro Camera	N			Nil	Good	Nil	Nil	
OH2Ku	J1	257	Scan	07/08/2018	13:08	GoPro Camera	N			Nil	Good	Nil	Nil	old ant nest
OH2Ku	J1	258	Poss	07/08/2018	13:20	GoPro Camera	Y	Brushtail Possum	N	occupied	Good	Nil	Nil	
OH2Ku	J2	259	LG	07/08/2018	13:38	GoPro Camera	N			Nil	Good	Nil	Nil	
OH2Ku	J2	260	Poss	07/08/2018	13:41	GoPro Camera	N			leaf	Good	Nil	Nil	
OH2Ku	J2	261	Scan	07/08/2018	13:50	GoPro Camera	N			Nil	Good	Nil	Nil	
OH2Ku	J2	262	SG	07/08/2018	13:47	GoPro Camera	N			conical leaf nest and insect debris	Good	Nil	Nil	
OH2Ku	J2	263	Parr	07/08/2018	13:45	GoPro Camera	Y	Sugar Gliders	N	occupied	Good	Nil	Nil	multiple
OH2Ku	J3	264	LG	09/08/2018	13:07	GoPro Camera	N			Nil	Good	Nil	Nil	water damage inside
OH2Ku	J3	265	SG	09/08/2018	13:00	GoPro Camera	N			fresh conical euc leaf nest	Good	Nil	Nil	
OH2Ku	J3	266	SG	09/08/2018	13:02	GoPro Camera	N			leaf	Good	Nil	Nil	

Section	Zone/ cluster	Box #	Box type	Check Date	Time	Inspect type	Vert Fauna Y/N	Species	Native /Pest	Vert Signs of use	Box Cond	Maintenance required	Changes in surrounds	Notes
OH2Ku	J3	267	Scan	09/08/2018	13:05	GoPro Camera	N			scats	Good	Nil	Nil	
OH2Ku	J3	268	Poss	09/08/2018	12:55	GoPro Camera	N			woody debris	Good	Nil	Nil	
OH2Ku	J4	269	LG	09/08/2018	13:14	GoPro Camera	N			leaves	Good	Nil	Nil	
OH2Ku	J4	270	Poss	09/08/2018	13:17	GoPro Camera	N			woody debris	Good	Nil	Nil	
OH2Ku	J4	271	Parr	09/08/2018	13:26	GoPro Camera	Y	Lace Monitor	N	occupied	Good	Nil	Nil	
OH2Ku	J4	272	SG	09/08/2018	13:24	GoPro Camera	N			leaves	Good	Nil	Nil	
OH2Ku	J4	273	Scan	09/08/2018	13:22	GoPro Camera	N			woody debris	Good	Nil	Nil	
OH2Ku	J5	275	LG	09/08/2018	13:51	GoPro Camera	N			Nil	Good	Nil	Nil	
OH2Ku	J5	276	LG	09/08/2018	13:55	GoPro Camera	N			Nil	Good	Nil	Nil	
OH2Ku	J5	277	Scan	09/08/2018	13:58	GoPro Camera	N			conical euc leaf nest	Good	Nil	Nil	
OH2Ku	J5	276B	MB	09/08/2018	13:47	Torch	N			Nil	Good	Nil	Nil	
OH2Ku	K1	302	SG	15/08/2018	9:07	GoPro Camera	N			Nil	Good	Nil	Nil	
OH2Ku	K1	303	Scan	15/08/2018	9:04	GoPro Camera	N			Nil	Good	Nil	Nil	
OH2Ku	K1	304	Scan	15/08/2018	9:01	GoPro Camera	N			leaves and wasp nest	Good	Nil	Nil	
OH2Ku	K1	305	Poss	15/08/2018	9:00	GoPro Camera	N			Nil	Good	Nil	Nil	
OH2Ku	K1	306	SG	15/08/2018	9:03	GoPro Camera	N			Nil	Good	Nil	Nil	old honeycomb
OH2Ku	K2	502	Scan	15/08/2018	9:10	GoPro Camera	N			old leaves and scats	Good	Nil	Nil	
OH2Ku	K2	503	Scan	15/08/2018	9:09	GoPro Camera	N			old leaves	Good	Nil	Nil	
OH2Ku	K2	505	Poss	15/08/2018	9:10	GoPro Camera	N			Nil	Good	Nil	Nil	old honeycomb
OH2Ku	L1	347	SG	15/08/2018	9:29	GoPro Camera	Y	Sugar Gliders	N	occupied	Good	Nil	Nil	
OH2Ku	L1	348	MB	15/08/2018	9:35	Torch	N			Nil	Good	Nil	Nil	
OH2Ku	L1	349	Poss	15/08/2018	9:36	GoPro Camera	Y	Brush-tail Possum	N	occupied	Good	Nil	Nil	
OH2Ku	L1	350	Scan	15/08/2018	9:39	GoPro Camera	N			old leaf litter	Good	Nil	Nil	
OH2Ku	L2	351	LG	15/08/2018	9:55	GoPro Camera	Y	Brush-tail Possum	N	occupied	Good	Nil	Nil	
OH2Ku	L2	352	Parr	15/08/2018	9:48	GoPro Camera	N			leaves	Good	Nil	Nil	
OH2Ku	L2	353	SG	15/08/2018	9:51	GoPro Camera	N			conical euc leaf nest	Good	Nil	Nil	
OH2Ku	L2	354	Poss	15/08/2018	9:52	GoPro Camera	N			feathers, egg shell and	Good	Nil	Nil	

Section	Zone/ cluster	Box #	Box type	Check Date	Time	Inspect type	Vert Fauna Y/N	Species	Native /Pest	Vert Signs of use	Box Cond	Maintenance required	Changes in surrounds	Notes
										leaves				
OH2Ku	L2	500	LFO	15/08/2018	13:15	GoPro Camera	N			Nil	Good	Nil	Nil	
OH2Ku	L2	501	Poss	15/08/2018	13:18	GoPro Camera	N			Nil	Good	Nil	Nil	
OH2Ku	M1	246	LG	07/08/2018	12:12	GoPro Camera	N			leaf and bark	Good	Nil	Nil	
OH2Ku	M1	248	Scan	07/08/2018	12:19	GoPro Camera	N			old leaf	Good	Nil	Nil	
OH2Ku	M1	249	SG	07/08/2018	12:15	GoPro Camera	N			conical leaf nest	Good	Nil	Nil	
OH2Ku	M1	251	Poss	07/08/2018	12:07	GoPro Camera	N			leaf, bark, feathers	Good	Nil	Nil	
OH2Ku	M2	247	SG	07/08/2018	12:25	GoPro Camera	N			conical leaf nest	Good	Nil	Nil	
OH2Ku	M2	250	Poss	07/08/2018	12:57	GoPro Camera	N			Nil	Good	Nil	Nil	
OH2Ku	M2	252	MB	07/08/2018	12:31	Torch	N			chewed bark	Good	Nil	Nil	
OH2Ku	N1	355b	Scan	03/08/2018	11:32	GoPro Camera	N			euc leaves and insect nest	Good	Nil	Nil	
OH2Ku	N1	356b	Poss	03/08/2018	11:35	GoPro Camera	P			leaf and melaleuca bark	Good	Nil	Nil	box full to entry hole
OH2Ku	N1	357b	Parr	03/08/2018	11:21	GoPro Camera	Y	Carpet Python	N	occupied	Good	Nil	Nil	Carpet Python basking on box and moved inside
OH2Ku	N1	358b	SG	03/08/2018	11:19	GoPro Camera	N			euc leaf nest	Good	Nil	Nil	
OH2Ku	N1	361b	Poss ad	03/08/2018	11:14	GoPro Camera	N			shredded bark and leaves	Good	Nil	Nil	
OH2Ku	N1	362b	SO	03/08/2018	11:17	GoPro Camera	N			shredded bark and leaves	Good	Nil	Nil	
OH2Ku	N2	359b	Scan	03/08/2018	11:40	GoPro Camera	N			euc leaves and wasp nest	Good	Nil	Nil	
OH2Ku	N2	360b	LG	03/08/2018	11:39	GoPro Camera	N			shredded leaves	Good	Nil	Nil	
OH2Ku	N3	363	Scan	07/08/2018	11:20	GoPro Camera	N			euc leaf nest	Good	Nil	Nil	wasp nest
OH2Ku	N3	364	Poss	07/08/2018	11:18	GoPro Camera	N			old euc leaves	Good	Nil	Nil	
OH2Ku	N3	366	Sg	07/08/2018	11:15	GoPro Camera	N			conical leaf nest	Good	Nil	Nil	
OH2Ku	N3	365b	LG	07/08/2018	11:23	GoPro Camera	N			old bird nest	Good	Nil	Nil	latrine in corner
OH2Ku	O1	230	SG	07/08/2018	9:06	GoPro Camera	N			conical leaf nest	Good	Nil	Nil	
OH2Ku	O1	231	LG	07/08/2018	9:01	GoPro Camera	N			shredded bark and leaves	Good	Nil	Nil	

Section	Zone/ cluster	Box #	Box type	Check Date	Time	Inspect type	Vert Fauna Y/N	Species	Native /Pest	Vert Signs of use	Box Cond	Maintenance required	Changes in surrounds	Notes
OH2Ku	O1	232	SG	07/08/2018	9:03	GoPro Camera	N			Nil	Good	Nil	Nil	
OH2Ku	O1	233	Poss	07/08/2018	9:08	GoPro Camera	N			euc leaves	Good	Nil	Nil	
OH2Ku	O1	234	Scan	07/08/2018	8:59	GoPro Camera	N			euc leaves	Good	Nil	Nil	
OH2Ku	P1	235	Poss	02/08/2018	16:22	GoPro Camera	N			woody debris nest	Good	Nil	Nil	
OH2Ku	P1	236	Parr	02/08/2018	16:17	GoPro Camera	N			conical leaf nest	Good	Nil	Nil	
OH2Ku	P1	237	SG	02/08/2018	16:15	GoPro Camera	N			conical leaf nest	Good	Nil	Nil	
OH2Ku	P1	238	Scan	02/08/2018	16:09	GoPro Camera	Y	Possible Squirrel Glider	N	occupied	Good	Nil	Nil	
OH2Ku	P2	239	LG	02/08/2018	15:52	GoPro Camera	N			euc leaf nest	Good	Nil	Nil	
OH2Ku	P2	240	SG	02/08/2018	16:05	GoPro Camera	N			conical leaf nest	Good	Nil	Nil	
OH2Ku	P2	242	Parr	02/08/2018	16:02	GoPro Camera	N	Ants	P	Nil	Good	Nil	Nil	ant nest
OH2Ku	P2	243	Scan	02/08/2018	15:57	GoPro Camera	Y	Possible Squirrel Glider	N	occupied	Good	Nil	Nil	
OH2Ku	P3	241	Scan	07/08/2018	10:09	GoPro Camera	N	Ants	P	Nil	Good	Nil	Nil	active ant nest
OH2Ku	P3	244	Poss	07/08/2018	10:12	GoPro Camera	N			pieces of landscape wood	Good	Nil	Nil	
OH2Ku	P3	245	Scan	07/08/2018	10:10	GoPro Camera	N			conical euc leaf nest	Good	Nil	Nil	
OH2Ku	Q1	367	LG	07/08/2018	9:33	GoPro Camera	N			leaves in corner	Good	Nil	Nil	
OH2Ku	Q1	368	Scan	07/08/2018	9:50	GoPro Camera	N			Nil	Good	Nil	Nil	insect debris. monitor condition
OH2Ku	Q1	369	Po	07/08/2018	9:39	GoPro Camera	N			shredded bark and leaves	Good	Nil	Nil	
OH2Ku	Q1	370	LFO	30/8//18	9:21	Tree Climber	N			shredded bark	Good	Nil	Nil	
OH2Ku	Q1	371	Poss	07/08/2018	9:34	GoPro Camera	N			shredded bark and leaves	Good	Nil	Nil	
OH2Ku	Q2	372	LG	07/08/2018	9:42	GoPro Camera	N			euc leaves, wasp nest, old beehive	Good	Nil	Nil	
OH2Ku	R1	320	Poss	03/08/2018	10:33	GoPro Camera	N			woody debris	Good	Nil	Nil	
OH2Ku	R1	321	MB	03/08/2018	10:30	Torch	N			Nil	Good	Nil	Nil	
OH2Ku	R1	322	LFO	03/08/2018	10:21	GoPro Camera	N			woody debris	Good	Nil	Nil	

Section	Zone/ cluster	Box #	Box type	Check Date	Time	Inspect type	Vert Fauna Y/N	Species	Native /Pest	Vert Signs of use	Box Cond	Maintenance required	Changes in surrounds	Notes
OH2Ku	R1	323	Add poss.	03/08/2018	10:25	GoPro Camera	N			leaf and woody debris	Good	Nil	Nil	
OH2Ku	R1	324	Scan	03/08/2018	10:28	GoPro Camera	N			euc leaf	Good	Nil	Nil	
OH2Ku	R2	325	SG	03/08/2018	10:37	GoPro Camera	N			leaf and bark	Good	Nil	Nil	
OH2Ku	R2	326	Scan	03/08/2018	10:36	GoPro Camera	N			conical euc leaf nest	Good	Nil	Nil	
OH2Ku	R2	327	MB	03/08/2018	10:39	Torch	N			Nil	Good	Nil	Nil	
OH2Ku	R2	328	Parr	03/08/2018	10:40	GoPro Camera	N			Nil	Good	Nil	Nil	damp
OH2Ku	R2	329	Poss	03/08/2018	10:42	GoPro Camera	N			woody debris	Good	Nil	Nil	
OH2Ku	R3	330	LG	03/08/2018	9:44	GoPro Camera	N			leaf litter	Good	Nil	Nil	monitor rot
OH2Ku	R3	331	Poss	03/08/2018	9:58	GoPro Camera	N			woody debris	Good	Nil	Nil	damp marks
OH2Ku	R3	332	Co	29/08/2018	9:00	Tree Climber	N			Nil	Good	Nil	Nil	
OH2Ku	R3	333	add Poss	03/08/2018	9:53	GoPro Camera	N			Nil	bottom rot	Nil	Nil	
OH2Ku	R3	334	LG	03/08/2018	9:42	GoPro Camera	N			bark and leaf	rotting	Nil	Nil	monitor rot
OH2Ku	R4	335	Scan	03/08/2018	9:29	GoPro Camera	N			rotting leaves	damp	Nil	Nil	monitor rot
OH2Ku	R4	336	SG	03/08/2018	9:31	GoPro Camera	N			conical leaf nest	Good	Nil	Nil	
OH2Ku	R4	337	Parr	03/08/2018	9:33	GoPro Camera	N			woody debris	rotting, lid coming off	Nil	Nil	
OH2Ku	R4	338	LG	03/08/2018	9:24	GoPro Camera	N			Nil	damp	Nil	Nil	monitor rot
OH2Ku	R4	339	Poss	03/08/2018	9:25	GoPro Camera	N			shredded bark and leaves	Good	Nil	Nil	
OH2Ku	R5	340	LG	03/08/2018	8:58	GoPro Camera	N			Nil	damp	Nil	Nil	
OH2Ku	R5	341	Poss	03/08/2018	8:57	GoPro Camera	N			shredded bark	Good	Nil	Nil	
OH2Ku	R5	342	Parr	03/08/2018	9:00	GoPro Camera	N			shredded bark	Good	Nil	Nil	
OH2Ku	R5	343	MB	03/08/2018	8:56	Torch	N			Nil	Good	Nil	Nil	
OH2Ku	R5	344	SG	03/08/2018	8:52	GoPro Camera	N			euc leaves	Good	Nil	Nil	
OH2Ku	R6	345	Scan	03/08/2018	9:04	GoPro Camera	N			euc leaves	damp	Nil	Nil	monitor rot
OH2Ku	R6	346	LG	03/08/2018	9:07	GoPro Camera	N			euc leaves	damp	Nil	Nil	monitor rot

Annex 3 – Weather

Date	Temperature (C)	Rainfall	Cloud cover (%)	Wind (km/hr)
16/01/2018	26	0	20	22
17/01/2018	27	0	0	17
19/01/2018	30	0	0	7
22/01/2018	29	0	0	13
23/01/2017	31	0	0	4
24/01/2018	31	0	0	6
05/02/2018	27	0	0	11
06/02/2018	27	0	0	13
07/02/2018	27	0.8	90	4
08/02/2018	28	0	20	11
26/02/2018	24	8.2	80	17
28/02/2018	30	0	0	7
30/07/2018	21	0	0	7
31/07/2018	21	0	0	13
02/08/2018	21	0	0	11
03/08/2018	23	0	0	13
07/08/2018	20	0	0	0
09/08/2018	20	0	0	9
14/08/2018	20	0	0	9
16/08/2018	24	0	0	2
28/08/2018	18	0	20	13
29/08/2018	19	0	0	11
30/08/2018	20	0	0	15

Climate Data Sourced form BOM app for current location and Kempsey weather station (station number 0590007).

Niche Environment and Heritage

A specialist environmental and heritage consultancy.

Head Office

Niche Environment and Heritage

PO Box 2443 North Parramatta NSW 1750

Email: info@niche-eh.com

All mail correspondence should be through our Head Office

Appendix H Bat Box



Microbat Roost Box Monitoring 2018

Oxley Highway to Kempsey, Pacific Highway Upgrade

Prepared for Roads and Maritime Services

September 2018

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Excellence in your environment.
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Head Office

Level 1, 460 Church Street
Parramatta NSW 2150
All mail correspondence to:
PO Box 2443
North Parramatta NSW 1750
Phone: **02 9630 5658**
Email: **info@niche-eh.com**

Locations

Sydney
Central Coast
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Cover photograph: Microbat use of pipe culvert immediately south of dedicated fauna culvert 26.4 (right) and culvert C35.7 (left).

Executive summary

Context

This report documents findings for the 2018 monitoring period, the first of three operational monitoring periods for the Microbat Roost Boxes, 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.

Aims

The aims of this report are to summarise the methods and results of the summer and winter 2018 roost box inspections and determine if performance measures have been met, as per the EMP.

Methods

Monitoring was undertaken in accordance with the EMP, in summer from 19 January 2018 – 8 February 2018 and in winter from 30 July 2018 – 14 August 2018. Each roost box was visually inspected using a wireless camera attached to the end of an extendable pole, or a hand held torch. Details recorded for each roost box included occupation by fauna, species if present, signs of use by fauna, box condition, any maintenance required, changes to surrounding landscape and daily weather conditions.

Key Results

Microbats were not recorded using any of the 141 inspected roost boxes during the 2018 monitoring period. Mud wasp nests were recorded in four (2.8%) roost boxes in summer and in six (4.3%) in winter. Leaf nests were recorded in 24 (17%) roost boxes in summer and in 25 (17.7%) in winter. The use of roost boxes by non-target fauna is not considered to be influencing the uptake by Microbat species as Microbats have exhibited a very limited overall use of roost boxes regardless of the presence or absence of non-target fauna. Only four (2.8%) boxes required maintenance, including the replacement of one deteriorated box.

As part of Fauna Underpass Monitoring for the Project, fourteen culverts were monitored in autumn for fauna activity. Of these, three were noted as being occupied by or showing signs of use by Microbats. Opportunistic observations of Microbat activity within culverts and under bridges were also made during other Project monitoring programs.

Conclusions

The installation of roost boxes as a management measure for the target species has been unsuccessful. However, additional structure monitoring in the Ku2K section of the Project has found that newly installed bridges and culverts have provided additional roost habitat for these species and that these structures are rapidly colonised (within four months of construction). Incidental observations on the OH2Ku section of the Project have recorded use of at least one bridge and two culverts by Microbats.

Management Implications

Continued monitoring of additional structures for the Ku2K section of the Project is not considered necessary as a number of structures have been classified as high conservation habitat value with probable ongoing use. A number of culvert and bridge structures are present within the OH2Ku section of the Project and are also likely to provide roosting habitat, as supported by incidental observations. Inspection of additional structures should however be conducted to confirm use of these structures and determine their use by target species prior to consideration of relocation of roost boxes to culverts.

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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.

1.1.1 Monitoring framework

The EMP states the following regarding monitoring timing:

“Monitoring of bat boxes will commence six months after their installation (Year 1), followed by quarterly inspections (each season) for two years (Years 2 and 3), before addressing corrective actions. After the first two years of monitoring, monitoring of the bat roost boxes will continue twice a year (summer and winter of Year 4, 6 and 8) up until Year 8.”

Roost boxes were installed prior to the commencement of construction (Year 0) in 2013, which was 6-12 months prior to the planned exclusion of Microbats from existing structures. Due to the installation of roost boxes occurring in 2013 instead of 2014, an additional three biannual construction monitoring events were undertaken (Events 9 – 11). Biannual operational monitoring commenced in summer 2018. For the Microbat Roost Box Monitoring the Project has been divided into two sections:

- Oxley Highway to Kundabung (Ch. 0 - 24040), hereafter referred to as OH2Ku.
- Kundabung to Kempsey (Ch. 24040 - 37850), hereafter referred to as Ku2K.

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

- Construction monitoring: quarterly inspections
 - Event 1 winter 2014, Event 2 spring 2014, Event 3 summer 2015, Event 4 autumn 2015, Event 5 winter 2015 (Niche 2015).
 - Event 6 spring 2015, Event 7 summer 2016, Event 8 autumn 2016 (Niche 2016).
- Construction monitoring: biannual inspections
 - Event 9 (Niche 2017) including:
 - winter 2016 Ku2K: 4 – 22 August 2016 (Lewis 2016).
 - spring 2016 OH2Ku: 26 – 27 September (Sandpiper 2016).
 - Event 10 summer 2017 (Niche 2017) including:
 - OH2Ku: 11 January 2017 (Sandpiper 2017a).
 - Ku2K: 27 – 28 February 2017 (Lewis 2017a).
 - Event 11 winter 2017 (Niche 2018) including:
 - OH2Ku: 5 September 2017 (Sandpiper 2017b).
 - Ku2K: 31 July and 1 August 2017 (Lewis 2017b).
- Operational monitoring: biannual inspections
 - Event 12 (summer 2018) and Event 13 (winter 2018): current report

1.1.2 Purpose of this report

The aims of this report are to summarise the methods and results of the 2018 summer and winter Microbat roost box monitoring, and determine if performance measures have been met, as per the EMP.

1.2 Performance Measures

The EMP specifies the following Indicators of success for the installation of Microbat Roost Boxes as a mitigation measure:

- *Use of bat roost boxes by microbats.*
- *Low rate of use of roost boxes by introduced fauna species.*
- *Low level of maintenance of roost boxes*

1.3 Monitoring Timing

Operational monitoring is to occur in summer and winter of Year 4, 6 and 8.

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.

2. Survey Methods

2.1 Boxes Monitored

Monitoring was undertaken by Niche ecologists in summer between 19 January and 8 February 2018 and in winter between 30 July and 14 August 2018. **Error! Reference source not found.** shows the location of Microbat roost boxes. It also includes underpasses monitored as part of the Fauna Underpass Monitoring for the Project.

A total of 158 bat roost boxes were installed in late September/early October 2013. All installed boxes were initially tree mounted. Four boxes were destroyed in a wildfire in November 2016 and were replaced but relocated to adjacent culverts in January 2018. Since summer 2017 monitoring, a further 12 boxes (zones 49, 50 and 51) were removed from private property by the landowner. One roost box (zone 47, box 120) could not be located in Event 12 or 13. A total of 141 boxes were therefore monitored during Event 12 and 13 in 2018.

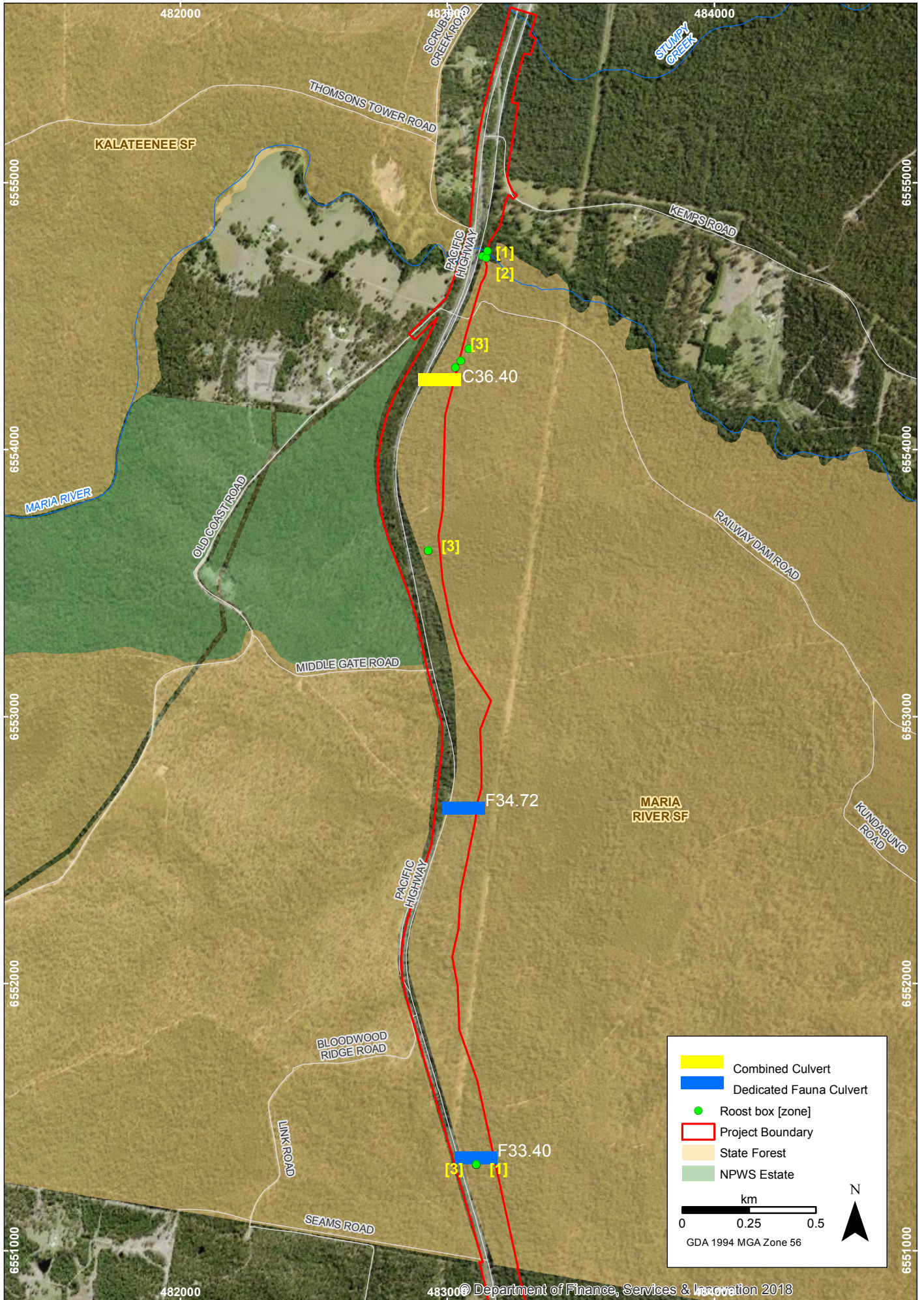
In addition to the roost boxes, a number of newly installed structures (including culverts and bridges) that may be used as roost habitat were identified during Event 9 and monitored during Event 10 and 11 as part of the recommended corrective actions (Niche 2018). The monitoring of these structures was not determined to be an ongoing monitoring requirement, as such, targeted monitoring of additional structures was not undertaken during the current monitoring period.

2.2 Methods

The EMP, in accordance with the *Microchiropteran Bat Management Strategy* (MBMS) (Lewis 2013), states that roost box monitoring is to involve a visual inspection of each roost box, and at each monitoring period the following information will be collected for each roost box:

- Inspection date, weather conditions (rain, wind, cloud cover, ambient temperature) and time each bat roost box was inspected.
- Bat roost box identification number.
- If the bat roost box is occupied by microbats, and if so, the species present. If the bat roost box is not occupied by a native species, record any signs of use by microbats.
- Presence of pest species such as European Bees.
- Deterioration of the bat roost box and if any maintenance required.
- Any changes to the surrounding habitats, such as changes to flyways or vegetation structure.

Drawn by: RJ Project Manager: RM Project Number: 1702 PI 5.14 Date: 24/09/2018



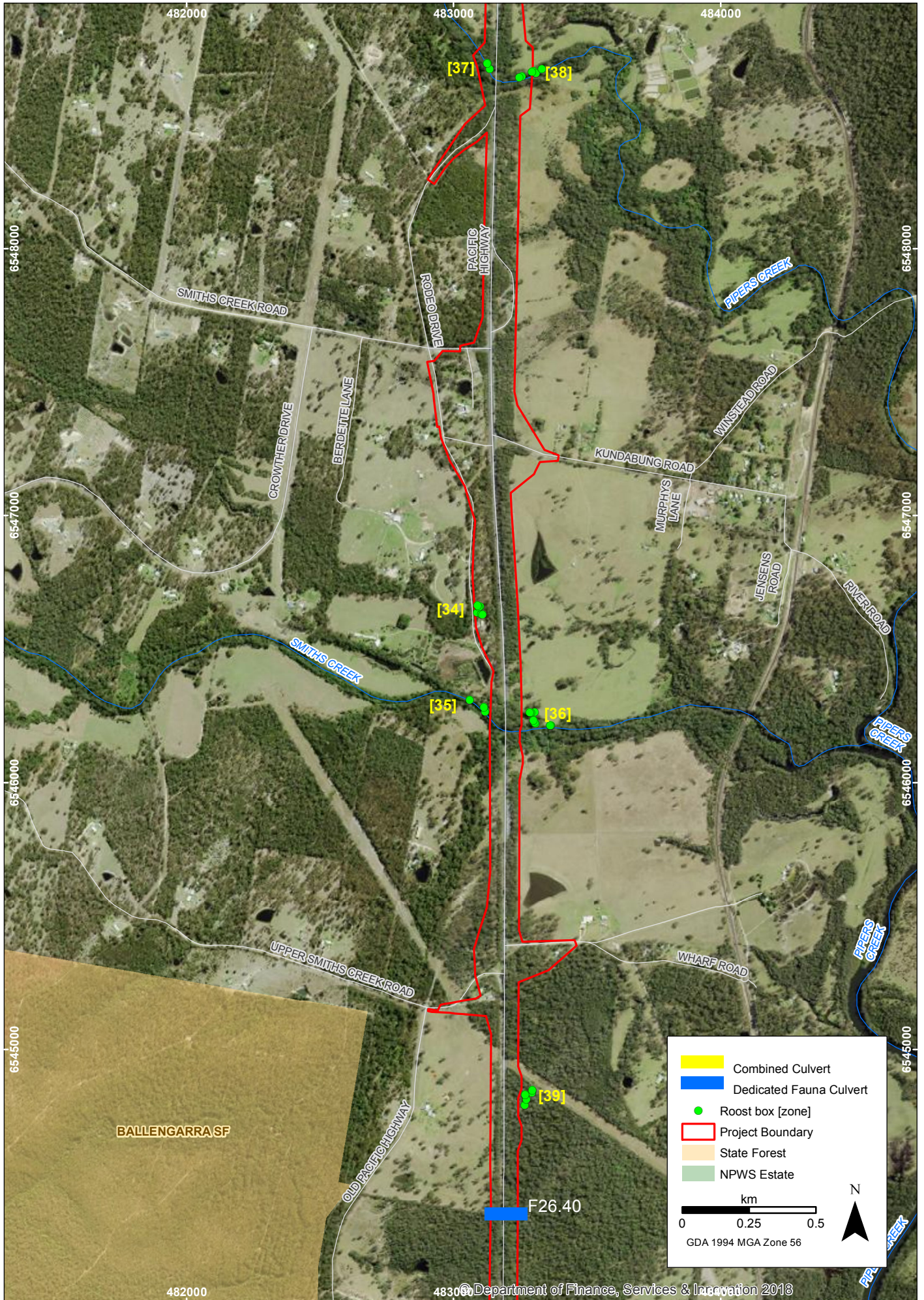
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Roost Box Locations

Microbat Roost Boxes: Pacific Highway Upgrade – Oxley Highway to Kempsey

FIGURE 1.1

Drawn by: RJ Project Manager: RM Project Number: 1702 PI 5.14 Date: 24/09/2018



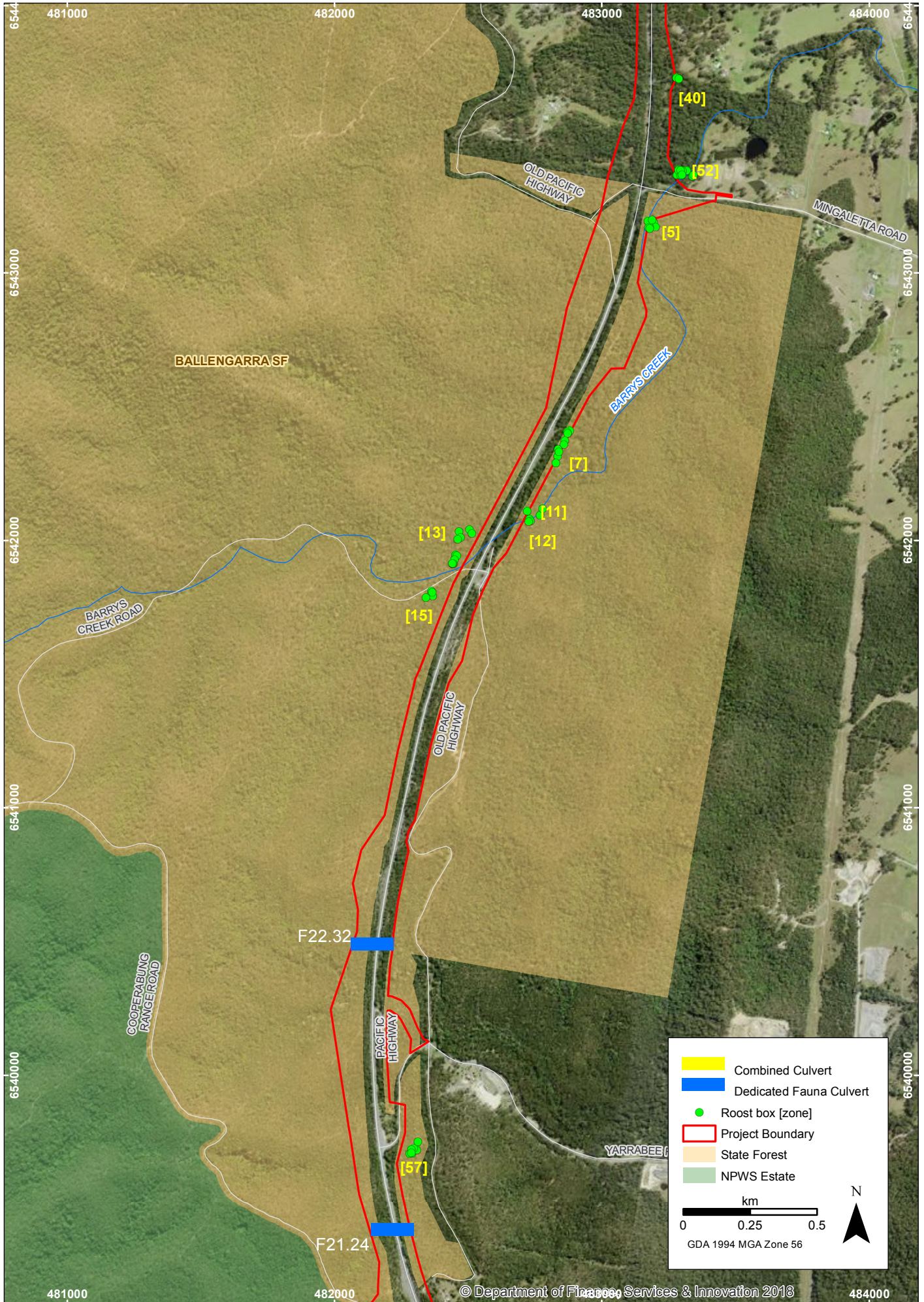
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Roost Box Locations

Microbat Roost Boxes: Pacific Highway Upgrade – Oxley Highway to Kempsey

FIGURE 1.2

Drawn by: RJ Project Manager: RM Project Number: 1702 PI 5.14 Date: 24/09/2018

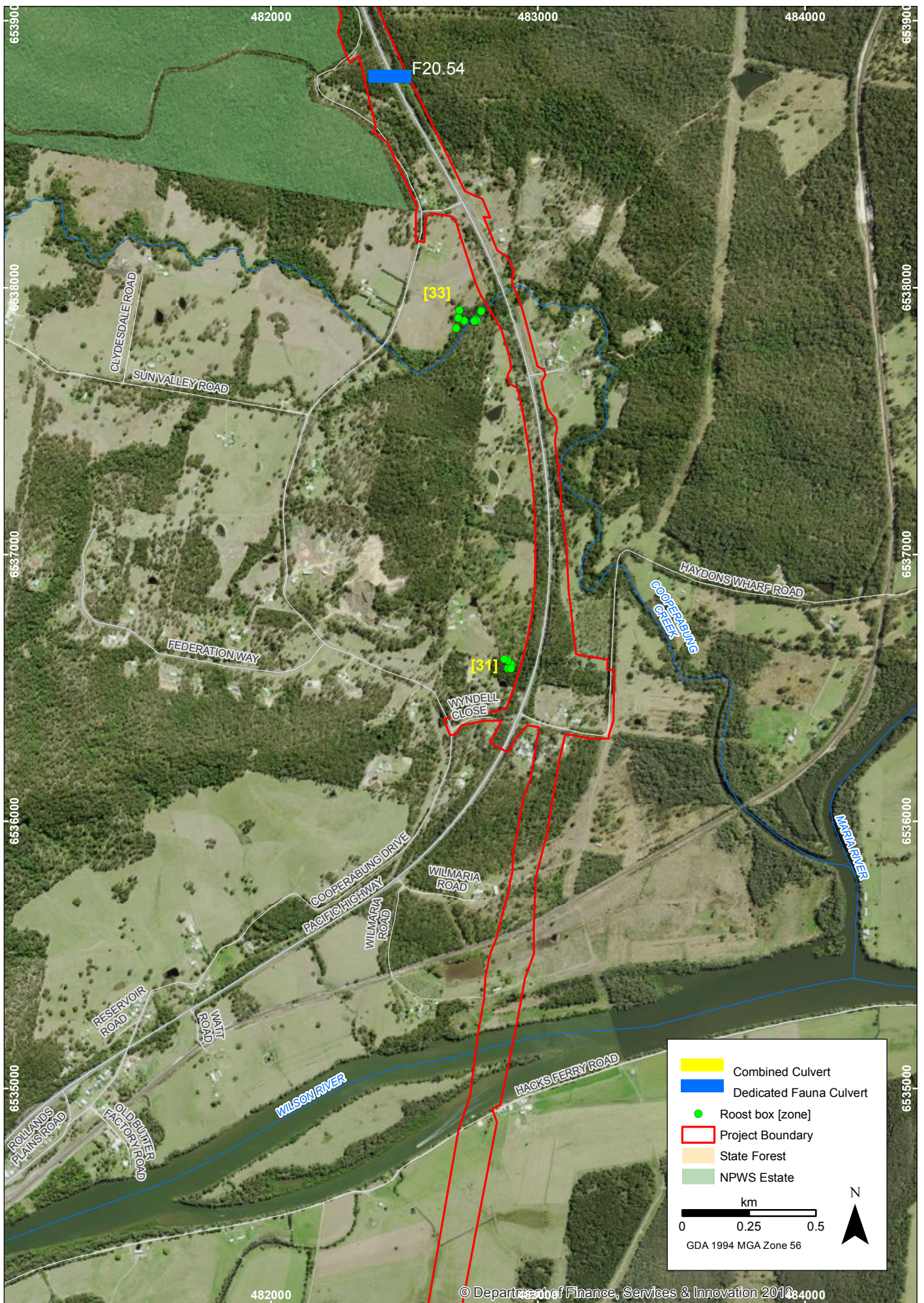


Roost Box Locations

Microbat Roost Boxes: Pacific Highway Upgrade – Oxley Highway to Kempsey

FIGURE 1.3

Drawn by: RJ Project Manager: RM Project Number: 1702 PI 5.14 Date: 24/09/2018

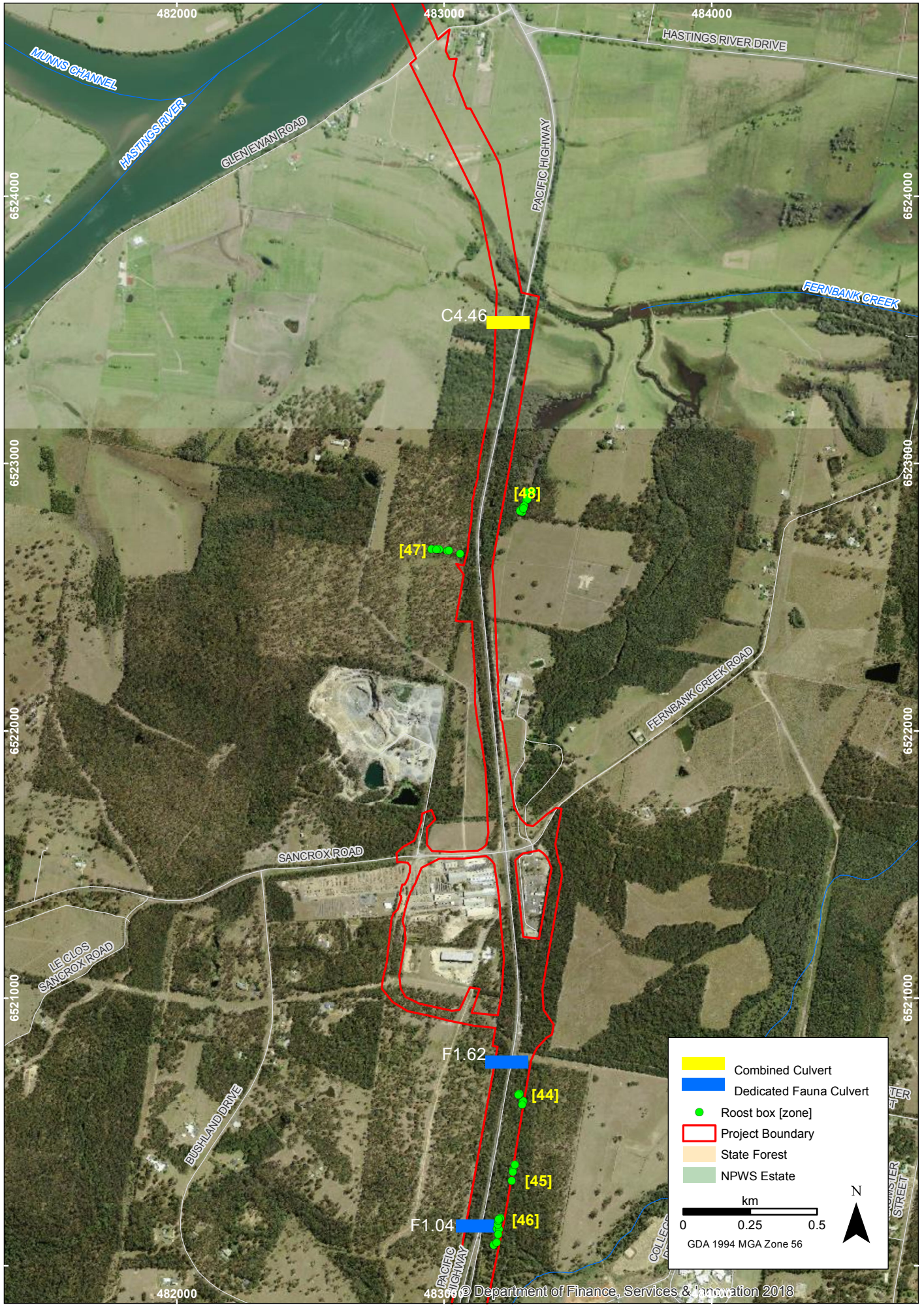


Roost Box Locations

Microbat Roost Boxes: Pacific Highway Upgrade – Oxley Highway to Kempsey

FIGURE 1.4

Drawn by: RJ Project Manager: RM Project Number: 1702 PI 5.14 Date: 24/09/2018



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Roost Box Locations

Microbat Roost Boxes: Pacific Highway Upgrade – Oxley Highway to Kempsey

FIGURE 1.5



3. Results

3.1 2018 Monitoring Results

Field data are provided in Annex 1 and Annex 2.

3.1.1 Use by Microbats

A total of 141 roost boxes were monitored in Events 12 and 13 (summer and winter 2018) and no Microbats were recorded using the roost boxes.

3.1.2 Use by introduced/ non-target species

During the 2018 monitoring event 33 (23.4%) and 34 (24.1%) roost boxes in summer and winter respectively were found to show evidence of use by mud wasps, insects and likely use by small gliders or *Antechinus* spp. Mud wasp nests were recorded in four (2.8%) roost boxes in summer and in six (4.3%) in winter and leaf nests were recorded in 24 (17%) roost boxes in summer and in 25 (17.7%) in winter. The use of roost boxes by non-target fauna is not considered to be influencing the uptake by Microbat species as Microbats have exhibited a very limited overall use of roost boxes regardless of the presence or absence of non-target fauna.

3.1.3 Fauna recorded

To date (including all previous monitoring events) the following species have been recorded occupying the roost boxes:

- Gould's Long-eared Bat (*Nyctophilus gouldi*)
- Lesser Long-eared Bat (*Nyctophilus geoffroyi*)
- Peron's Tree Frog (*Litoria peronii*)
- Lace monitor (*Varanus varius*)
- Brown Antechinus (*Antechinus stuartii*)

No additional fauna species were identified during the 2018 monitoring.

3.1.4 Maintenance

A total of four (2.8%) boxes were identified as requiring the following maintenance:

- Box 13 (zone 34, Ku2K): requires rubber hose to be added to the wiring.
- Box 8 (zone 36, Ku2K): requires removal of vegetation blocking the entrance.
- Box 119 (zone 47, OH2Ku): has fallen to the ground and needs to be re-installed.
- Box 126 (zone 33, OH2Ku): has deteriorated and needs replacing.

As mentioned, a number of roost boxes have been filled with leaf litter and are likely being used by native species including small gliders and *Antechinus* spp. The preclusion of Microbat uptake of roost boxes by non-target fauna is not considered to warrant maintenance due to the very limited overall occupation rate by Microbats.

3.2 Additional Roost Structures

In addition to the roost boxes, 34 newly installed structures in the Ku2K section of the Project were monitored during Event 10 and 11 as part of the recommended corrective actions (Lewis 2017c). Of the 34 structures monitored, Microbats were recorded using 24 (70.5%) (Niche 2018). While continued monitoring of these structures for Microbat use is not required, a number of incidental observations of Microbats were made whilst undertaking other monitoring components of the Project and are listed in Table 1.

As part of Fauna Underpass Monitoring for the Project, fourteen culverts were monitored in autumn for fauna activity. Of these, three were noted as being occupied by or showing signs of use by Microbats. As these were incidental observations, data regarding species and number of individuals were not recorded.

Table 1: Microbat use of additional structures

Project Monitoring component	Season	Type	Location	Section	Observation
Fauna Underpass	Autumn	Box culvert	Underpass C7.26	OH2Ku	guano
Fauna Underpass	Autumn	Box culvert	Underpass C32.35	Ku2K	guano
Fauna Underpass	Autumn	Box culvert	Underpass C36.4	Ku2K	occupied
Quoll	Autumn	Pipe culvert	South of C26.4	Ku2K	occupied
Microbat roost box	Winter	Box culvert	Underpass F33.4	Ku2K	occupied
Multiple	Summer/autumn	Bridge	Maria River twin bridges	Ku2K	occupied
Multiple	Winter	Bridge	Cooperabung Bridge	OH2Ku	occupied
Roads and Maritime	Autumn	Box culvert	Underpass C17.70	OH2Ku	occupied

3.3 Comparison with Previous Monitoring Events

The use of roost boxes by Microbats for all survey events is provided in Table 2. Microbats have not been recorded using roost boxes since autumn 2016. The highest occupation rate (3.8%) by Microbats was recorded in summer 2015 and summer 2016. The Microbat species recorded included two species of Long-eared Bats (*Nyctophilus* spp.), which were not identified in the MBMS as inhabiting the mitigated structures. The target species for mitigation efforts, i.e. those identified during MBMS surveys: Little Bent-wing Bat (*Miniopterus australis*), Eastern Horseshoe Bat (*Rhinolophus megaphyllus*), Southern Myotis (*Myotis macropus*) and Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*), have to date not been recorded using the installed roost boxes.

Table 2: Microbat use of roost boxes for all monitoring events.

Monitoring period	Event	Season	% Use by Microbats (# roost boxes occupied)
2018	12 and 13	summer, winter	0
2017	11	winter	0
2016/2017	9 and 10	winter, spring, summer	0
2015/2016	8	autumn	1.9 (3)
	7	summer	3.8 (6)
	6	spring	1.3 (2)
2014/2015	5	winter	2.5 (4)
	4	spring	0
	3	summer	3.8 (6)
	2	autumn	0.63 (1)
	1	Winter	3.6 (5)

4. Discussion

4.1 Performance Measures

A summary of 2018 survey results in relation to the performance measures is provided in Table 3. Given none of the target species has been recorded using the roost boxes to date, the use of roost boxes as a mitigation measure for the target species is considered unsuccessful. However, additional structure monitoring in the Ku2K section of the Project has found that newly installed bridges and culverts have provided additional roost habitat for these species and that these structures are rapidly colonised (within four months of construction). Incidental observations on the OH2Ku section of the Project have recorded use of at least one bridge and two culverts by Microbats.

Table 3: Performance indicators

Indicators of success	Discussion
Use of bat roost boxes by microbats	<p>This performance measure has not been met. Microbats were not detected using roost boxes during Event 12 and 13. The absence of target species and the very low rate of use by Microbat species indicates that the use of timber roost boxes as a management measure for the target species has to date been unsuccessful.</p> <p>Four species of Microbats, including three threatened MBMS target species, have been detected using newly installed culverts and bridges along the Project alignment (Lewis 2017c).</p>
Low rate of use of roost boxes by introduced fauna species	<p>This performance measure has been met. Whilst 23.4% and 24% were found to show evidence of use by non-target species these are likely to be native fauna. The use of the roost boxes by non-target fauna is not considered a limiting factor in the occupation of the roost boxes by Microbat species.</p>
Low level of maintenance of roost boxes	<p>This performance measure has been met. Only four (2.85%) boxes required maintenance.</p> <p>Due to the low overall occupation of roost boxes by Microbats, the replacement of the missing/removed roost boxes is not considered necessary.</p>

*= as per Niche 2015, these levels/rates were not specified in the EMP, as such an arbitrary level/rate of ≤10% has been assigned.

4.2 Recommendations

In order to address the ongoing lack of use of the roost boxes by Microbats, several recommendations were made at the conclusion of the previous (2016/2017) monitoring period (Niche 2017). These included preliminary and ongoing inspection of additional structures, relocation of roost boxes, provision of supplementary roost habitat in culverts and under bridges, and the enhancement of habitat within artificial structures. The outcome of those recommendations have been addressed and discussed in Niche (2018). The general determination was that continued monitoring of additional structures for the Ku2K section of the Project is not necessary as Microbats (including the MBMS target species: Little Bent-wing Bat (*Miniopterus australis*), Southern Myotis (*Myotis macropus*) and Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*)) have been recorded using a number of these structures, with a number of them being classified as high conservation habitat value with probable ongoing use. Recommendations for ongoing monitoring are discussed in Table 4.

Table 4: 2018 roost box recommendations

Recommendation	Action
Inspection of additional structures within the Project with the potential to be used by Microbats.	<p>Ku2K: microbats have been recorded using 24 of the 34 inspected additional structures. These structures are considered to provide a combination of low, medium and high conservation value habitat (Lewis 2017c). Continued monitoring of these structures is not considered necessary.</p> <p>OH2Ku: To date an inspection of the structures in the OH2Ku section of the Project has not been undertaken. A number of culvert and bridge structures are present within this section of the Project and may provide roosting habitat. This is supported by the outcome of Ku2K additional structure surveys and incidental records by Niche and Roads and Maritime (current report). In addition, Sandpiper 2017b report that “<i>newly constructed culverts and bridges along the OH2K alignment provide greater and more suitable roosting habitat for target species</i>”. An inspection of additional structures should be conducted to confirm use of these structures and determine their use by target species.</p>
Relocation of bat roost boxes into adjacent culverts and under bridges.	<p>Ku2K: not considered necessary as target microbat species have been recorded using the existing features of the additional structures.</p> <p>OH2Ku: Sandpiper 2017b suggest that consideration be given to relocating a subset of bat roost boxes from forested areas to culverts and bridges. As use of the existing features of culverts and bridges by microbats has been shown in the Ku2K section of the Project, relocation of roost boxes may not be necessary and should be considered once microbat use of construction features within additional structures can be confirmed.</p>
Assessment of adequacy of the new bridge/culvert structures as suitable and alternative mitigation for the Project.	<p>The provision of roost boxes was recommended in the MBMS to provide the opportunity for passive relocation of Microbats displaced by the proposed alteration/removal/replacement of existing bridges/culverts, which provided known roost habitat for the target species (Lewis 2013).</p> <p>As roost boxes have been unsuccessful in providing alternative roost habitat, it is recommended that, once Microbat use of artificial structures for the entire Project is determined, an assessment be undertaken that considers the number and type of artificial structures inspected and used by Microbats during surveys for the MBMS, against the number and type of artificial structures associated with the Project that are now available and being used by the MBMS target species post-construction. This comparison would provide the necessary information to determine the need for ongoing monitoring and to determine if further corrective actions are required to mitigate against any determined loss of Microbat roost habitat.</p>

References

- Lewis, B. D. (2013). Pacific Highway Upgrade: Oxley Highway to Kempsey Microchiropteran Bat Management Strategy. Prepared for Roads and Maritime Services by Lewis Ecological Surveys.
- Lewis, B. (2016). Kundabung to Kempsey Bat Box Monitoring: Episode 9 Winter (2016). Letter Report by Lewis Ecological Surveys to McConnell Dowell Constructors (Aust) Pty Ltd.
- Lewis, B. (2017a). Kundabung to Kempsey Bat Box Monitoring: Episode 10 Summer (2017). Letter Report by Lewis Ecological Surveys to McConnell Dowell Constructors (Aust) Pty Ltd.
- Lewis, B. (2017b). Kundabung to Kempsey Bat Box Monitoring: Episode 11 Winter (2017). Letter Report by Lewis Ecological Surveys to McConnell Dowell Constructors (Aust) Pty Ltd.
- Lewis, B. (2017c). Micro bat monitoring of newly installed structures on the Kundabung to Kempsey Pacific Highway Upgrade. Letter report prepared by Lewis Ecological Surveys for the Kundabung to Kempsey Joint Venture.
- Niche (2015). OH2K Pacific Highway Upgrade. Annual Ecological Monitoring Report 2015. Prepared by Niche Environment and Heritage Pty Ltd for Roads and Maritime Services, Port Macquarie, NSW.
- Niche (2016). OH2K Pacific Highway Upgrade. Annual Ecological Monitoring Report 2016. Prepared by Niche Environment and Heritage Pty Ltd for Roads and Maritime Services, Port Macquarie, NSW.
- Niche (2017). OH2K Pacific Highway Upgrade. Annual Ecological Monitoring Report 2017. Prepared by Niche Environment and Heritage Pty Ltd for Roads and Maritime Services, Port Macquarie, NSW.
- Niche (2018). OH2K Pacific Highway Upgrade. Contractor Ecological Monitoring Report 2018. 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.
- Sandpiper (2016). Pacific Highway Upgrade: OH2K bat box monitoring and corrective action assessment–spring 2016. Letter report prepared for Lendlease Engineering by Sandpiper Ecological Surveys.
- Sandpiper (2017a). Pacific Highway Upgrade: OH2K bat box monitoring– summer 2016. Letter report prepared for Lendlease Engineering by Sandpiper Ecological Surveys.
- Sandpiper (2017b). Pacific Highway Upgrade: OH2K bat box monitoring– winter 2017. Letter report prepared for Lendlease Engineering by Sandpiper Ecological Surveys.

Annex 1. Field Data

Table 5: Summer 2018 roost box results

Section	Zone	ID	Roost box type	H (m)	Aspect	Tree species	Date	Time	Inspect type	Species	Native /Pest	Signs of use	Box condition	Maintenance	Changes in landscape/other
Ku2K	1	Box 46	Light green box	4	North-west	Flooded Gum	07/02/2018	9:49	Cam			leaves and insect activity	good	nil	previous fire
Ku2K	1	Box 49	Dark green wedge box	3.5	North-west	Lost in fire									replaced Jan 2018 and relocated to culvert 33.4
Ku2K	2	Box 47	Hollow home narrow box	3.8	North-west	Lophostemon	07/02/2018	9:46	Cam			nil	good	nil	previous fire
Ku2K	2	Box 51	Hollow home standard box	4	North	Flooded Gum	07/02/2018	9:52	Cam			nil	good	nil	previous fire
Ku2K	3	Box 50	Dark green slot box	3.4	North	Melaleuca sp.	07/02/2018	10:30	Cam			nil	good	nil	previous fire
Ku2K	3	Box 52	Hollow home narrow box	3.6	North-west	Lost in fire									replaced Jan 2018 and relocated to culvert 33.4
Ku2K	3	Box 53	Dark green box	3.3	North	Mahogany sp.	07/02/2018	10:34	Cam			nil	good	nil	previous fire
Ku2K	3	Box 54	Hollow home standard box	3.7	North	Lost in fire									replaced Jan 2018 and relocated to culvert 35.7
Ku2K	3	Box 55	Hollow home narrow box	3.6	North	Small-fruited Grey Gum	07/02/2018	10:26	Cam			nil	good	nil	previous fire
Ku2K	3	Box 56	Black wedge box	3.7	North-west	Lost in fire									replaced Jan 2018 and relocated to culvert 35.7
Ku2K	5	Box 100	Light green slot box	3.4	North-east	Flooded Gum	05/02/2018	12:47	Cam			leaf litter	good	nil	nil
Ku2K	5	Box 101	Black slot box	3.5	North	Blackbutt	05/02/2018	13:20	Cam			nil	good	nil	nil
Ku2K	5	Box 95	Hollow home slot box	3.8	North-west	Lophostemon	05/02/2018	12:50	Cam			nil	good	nil	nil
Ku2K	5	Box 96	Hollow home slot box	3.8	North	Lophostemon	05/02/2018	12:59	Cam			nil	good	nil	nil
Ku2K	5	Box 97	Hollow home standard box	3.7	North	Blackbutt	05/02/2018	13:25	Cam			nil	good	nil	nil

Section	Zone	ID	Roost box type	H (m)	Aspect	Tree species	Date	Time	Inspect type	Species	Native /Pest	Signs of use	Box condition	Maintenance	Changes in landscape/other
Ku2K	5	Box 98	Dark green wedge box	4	North-west	Blackbutt	05/02/2018	13:29	Cam			nil	good	nil	nil
Ku2K	5	Box 99	Black box	3.1	North-east	Bloodwood	05/02/2018	13:22	Cam			leaf litter	good	nil	nil
Ku2K	7	Box 31	Dark green wedge box	3.4	North-east	Lophostemon	08/02/2018	15:03	Cam			leaf litter	good	nil	nil
Ku2K	7	Box 36	Hollow home slot box	3.1	North-west	Flooded Gum	08/02/2018	15:00	Cam			nil	good	nil	nil
Ku2K	7	Box 37	Hollow home narrow box	3.5	North	Flooded Gum	08/02/2018	15:02	Cam			nil	good	nil	nil
Ku2K	7	Box 38	Light green box	3.6	North-west	Flooded Gum	08/02/2018	15:05	Cam			leaf litter	good	nil	nil
Ku2K	7	Box 64	Hollow home slot box	3.3	North-west	Flooded Gum	08/02/2018	15:06	Cam			nil	good	nil	nil
Ku2K	7	Box 65	Hollow home standard box	3.5	North	Bloodwood	08/02/2018	15:10	Cam			nil	good	nil	nil
Ku2K	7	Box 66	Dark green box	3.2	North	Lophostemon	08/02/2018	15:07	Cam			leaf litter	good	nil	nil
Ku2K	7	Box 67	Black box	3.3	North-east	Bloodwood	08/02/2018	15:09	Cam			leaf litter	good	nil	nil
Ku2K	7	Box 68	Black wedge box	3.5	North	Small-fruited Grey Gum	08/02/2018	15:11	Visual			leaves and insect nest	good	nil	nil
Ku2K	11	Box 63	Black box	3.1	North	Ironbark	08/02/2018	15:21	Cam			leaf litter	good	nil	nil
Ku2K	12	Box 57	Dark green wedge box	3.5	North	Stringybark	08/02/2018	15:29	Cam			nil	good	nil	nil
Ku2K	12	Box 58	Black slot box	3.1	North	Stringybark	08/02/2018	15:30	Cam			nil	good	nil	nil
Ku2K	12	Box 59	Hollow home standard box	3.8	North-west	Flooded Gum	08/02/2018	15:22	Cam			nil	good	nil	nil
Ku2K	12	Box 61	Hollow home narrow box	3.3	North-west	Stringybark	08/02/2018	15:25	Cam			wasp nest	good	nil	nil
Ku2K	12	Box 62	Light green wedge box	3.2	North	Flooded Gum	08/02/2018	15:27	Cam			nil	good	nil	nil
Ku2K	34	Box 10	Dark green slot box	3.6	North-east	Scribbly Gum	06/02/2018	10:06	Visual			nil	good	rehang	on ground
Ku2K	34	Box 11	Light green wedge box	3	North	Tallowwood	06/02/2018	10:03	Cam			full of leaf litter	good	nil	nil
Ku2K	34	Box 12	Hollow home standard box	3.6	North	Scribbly Gum	06/02/2018	10:02	Cam			nil	good	nil	nil
Ku2K	34	Box 13	Hollow home standard box	3.6	North	Tallowwood	06/02/2018	10:05	Cam			scats on roof	good	nil	nil
Ku2K	34	Box 14	Black wedge box	3.6	North-west	Scribbly Gum	06/02/2018	9:00	Cam			nil	good	nil	nil
Ku2K	34	Box 15	Dark green box	3.4	North-west	Mahogany sp.	06/02/2018	9:58	Cam			nil	good	nil	nil
Ku2K	35	Box 30	Hollow home standard box	3.6	North	Lophostemon	08/02/2018	13:06	Cam			nil	good	nil	nil

Section	Zone	ID	Roost box type	H (m)	Aspect	Tree species	Date	Time	Inspect type	Species	Native /Pest	Signs of use	Box condition	Maintenance	Changes in landscape/other
Ku2K	35	Box 32	Hollow home narrow box	3.3	North-west	Flooded Gum	08/02/2018	13:10	Cam			nil	good	nil	nil
Ku2K	35	Box 35	Light green slot box	3	North	Bloodwood	08/02/2018	12:12	Visual			nil	good	nil	nil
Ku2K	36	Box 2	Dark green wedge box	3.3	North-east	Lophostemon	08/02/2018	12:43	Cam			nil	good	nil	nil
Ku2K	36	Box 3	Light green box	3.2	North		08/02/2018								missing-hanging mark on tree.
Ku2K	36	Box 4	Black slot box	3.1	North	Flooded Gum	08/02/2018	12:45	Torch			nil	good	nil	nil
Ku2K	36	Box 5	Light green wedge box	3.3	North-east	Bloodwood	08/02/2018	12:55	Cam			leaf litter	good	nil	nil
Ku2K	36	Box 6	Light green box	3.3	North-east	Flooded Gum	08/02/2018	12:57	Cam			leaf litter	good	nil	nil
Ku2K	36	Box 7	Hollow home standard box	3.8	North	Flooded Gum	08/02/2018	12:59	Cam			nil	good	nil	nil
Ku2K	36	Box 8	Hollow home standard box	3.6	North-west	Flooded Gum	08/02/2018	12:50	Cam			nil	good	nil	nil
Ku2K	36	Box 9	Black wedge box	3.6	North	Flooded Gum	08/02/2018	12:52	Cam			leaf litter	good	nil	nil
Ku2K	37	Box 28	Hollow home narrow box	3.7	North-west	Flooded Gum	06/02/2018	10:40	Torch			nil	good	nil	nil
Ku2K	37	Box 28b	Black wedge box	3.4	North	Tallowwood	06/02/2018	10:38	Cam			nil	good	nil	nil
Ku2K	37	Box 29	Dark green slot box	3	North	Tallowwood	06/02/2018	10:37	Cam			nil	good	nil	nil
Ku2K	38	Box 22	Black slot box	3	North-west	Flooded Gum	06/02/2018	10:54	Cam			nil	good	nil	nil
Ku2K	38	Box 23	Hollow home narrow box	3.8	North-west	Flooded Gum	06/02/2018	10:58	Cam			nil	good	nil	nil
Ku2K	38	Box 24	Light green wedge box	3.5	North-west	Flooded Gum	06/02/2018	11:00	Cam			nil	good	nil	nil
Ku2K	38	Box 25	Light green wedge box	3.7	North	Flooded Gum	06/02/2018	10:48	Cam			nil	good	nil	nil
Ku2K	38	Box 26	Black box	3	North	Flooded Gum	06/02/2018	10:47	Cam			leaves and insect nest	good	nil	nil
Ku2K	38	Box 27	Hollow home slot box	3	North	Flooded Gum	06/02/2018	10:53	Cam			nil	good	nil	nil
Ku2K	39	Box 16	Light green slot box	2.9	North	River Red Gum	07/02/2018	15:49	Cam			nil	good	nil	recent adjacent vegetation clearing
Ku2K	39	Box 17	Black wedge box	3.1	North	River Red Gum	07/02/2018	15:51	Cam			leaf litter	good	nil	recent adjacent vegetation clearing
Ku2K	39	Box 18	Dark green box	3.5	North-west	Melaleuca sp.	07/02/2018	15:40	Cam			leaf litter	good	nil	recent adjacent vegetation clearing

Section	Zone	ID	Roost box type	H (m)	Aspect	Tree species	Date	Time	Inspect type	Species	Native /Pest	Signs of use	Box condition	Maintenance	Changes in landscape/other
Ku2K	39	Box 19	Hollow home narrow box	3.5	North-west	River Red Gum	07/02/2018	15:44	Cam			nil	good	nil	nil
Ku2K	39	Box 20	Light green wedge box	3.1	North-west	Melaleuca sp.	07/02/2018	13:46	Cam			nil	good	nil	nil
Ku2K	39	Box 21	Hollow home slot box	3.3	North-west	River Red Gum	07/02/2018	15:52	Cam			melaleuca leaf	good	nil	recent adjacent vegetation clearing
Ku2K	40	Box 139	Hollow homes standard box	3.9	North	Blackbutt	05/02/2018	15:32	Cam			nil	good	nil	nil
Ku2K	40	Box 140	Hollow home slot box	3.6	North-west	Blackbutt	05/02/2018	15:34	Cam			nil	good	nil	nil
Ku2K	52	Box 130	Hollow home narrow box	3.6	North	Bloodwood	05/02/2018	15:12	Cam			nil	good	nil	nil
Ku2K	52	Box 131	Dark green slot box	3.6	North-west	Bloodwood	05/02/2018	14:25	Cam			nil	good	nil	nil
Ku2K	52	Box 132	Hollow home slot box	3.7	North	Lophostemon	05/02/2018	14:02	Cam			nil	good	nil	nil
Ku2K	52	Box 133	Hollow home slot box	3.6	North-east	Melaleuca sp.	05/02/2018	14:16	Cam			nil	good	nil	nil
Ku2K	52	Box 134	Hollow home slot box	3.1	North-east	Lophostemon	05/02/2018	13:58	Cam			nil	good	nil	nil
Ku2K	52	Box 135	Black slot box	3.2	North	Tallowwood	05/02/2018	14:17	Cam			nil	good	nil	nil
Ku2K	52	Box 136	Hollow home slot box	3.8	North	Blue Gum	05/02/2018	14:20	Cam			nil	good	nil	nil
Ku2K	52	Box 137	Hollow home slot box	3.3	North-west	Tallowwood	05/02/2018	15:13	Cam			nil	good	nil	nil
Ku2K	52	Box 138	Hollow home standard box	3.7	North	Lophostemon	05/02/2018	14:28	Cam			nil	good	nil	nil
OH2KU	13	Box 73	Black slot box	3.1	North	Lophostemon	23/01/2018	12:19	Cam			nil	good	nil	nil
OH2KU	13	Box 74	Dark green wedge box	3.5	North-east	Tallowwood	23/01/2018	12:09	Cam			nil	good	nil	nil
OH2KU	13	Box 75	Hollow home standard box	3.5	North	Tallowwood	23/01/2018	12:17	Cam			nil	good	nil	nil
OH2KU	13	Box 76	Light green box	3.6	North	Tallowwood	23/01/2018	12:07	Cam	Ants	pest	infested	good	nil	nil
OH2KU	13	Box 77	Hollow home narrow box	3.3	North-west	Flooded Gum	23/01/2018	12:06	Cam			nil	good	nil	nil
OH2KU	15	Box 153	Hollow home narrow box	3.8	North	Small-fruited Grey Gum	23/01/2018	11:46	Cam			nil	good	nil	nil
OH2KU	15	Box 154	Hollow home narrow box	3.8	North	Small-fruited Grey Gum	23/01/2018	11:51	Cam			nil	good	nil	nil
OH2KU	15	Box 155	Hollow home standard box	3.8	North	Tallowwood	23/01/2018	11:48	Cam			nil	good	nil	nil

Section	Zone	ID	Roost box type	H (m)	Aspect	Tree species	Date	Time	Inspect type	Species	Native /Pest	Signs of use	Box condition	Maintenance	Changes in landscape/other
OH2KU	15	Box 157	Hollow home slot box	3.5	North	Bloodwood	23/01/2018	11:29	Cam			nil	good	nil	nil
OH2KU	15	Box 158	Black slot box	3.5	North	Small-fruited Grey Gum	23/01/2018	11:28	Cam			nil	good	nil	nil
OH2KU	15	Box 159	Light green box	3.3	North	Lophostemon	23/01/2018	11:33	Cam			nil	good	nil	nil
OH2KU	15	Box 69	Hollow home standard box	3.7	North-west	Turpentine	23/01/2018	9:39	Cam			nil	good	nil	nil
OH2KU	15	Box 70	Dark green box	3.2	North-east	Lophostemon	23/01/2018	9:43	Cam			leaves	good	nil	nil
OH2KU	15	Box 71	Light green slot box	3	North	Small-fruited Grey Gum	23/01/2018	9:42	Cam			nil	good	nil	nil
OH2KU	15	Box 72	Light green box	3.5	North	Turpentine	23/01/2018	9:41	Cam			leaf and insect nest	good	nil	nil
OH2KU	15	Box 73	Hollow home narrow box	3.6	North	Lophostemon	23/01/2018	9:47	Cam			nil	good	nil	nil
OH2KU	31	Box 78	Hollow home narrow box	3.7	North	Casuarina	22/01/2018	10:13	Cam			nil	good	nil	nil
OH2KU	31	Box 79	Hollow home narrow box	3.7	North-west	Casuarina	22/01/2018	10:15	Cam			nil	good	nil	nil
OH2KU	31	Box 80	Hollow home narrow box	3.7	North	Casuarina	22/01/2018	10:20	Cam			nil	good	nil	nil
OH2KU	31	Box 81	Hollow home narrow box	3.6	North-west	Casuarina	22/01/2018	10:22	Cam			insect nest	good	nil	nil
OH2KU	31	Box 82	Hollow home narrow box	3.8	North	Casuarina	22/01/2018	10:29	Cam			nil	good	nil	nil
OH2KU	31	Box 83	Hollow home narrow box	3.7	North-east	Casuarina	22/01/2018	10:21	Cam			nil	good	nil	nil
OH2KU	33	Box 121	Light green slot box	3.6	North	No ID	22/01/2018	14:32	Cam			nil	good	nil	nil
OH2KU	33	Box 122	Hollow home slot box	3.4	North-west	No ID	22/01/2018	16:16	Cam			nil	good	nil	nil
OH2KU	33	Box 124	Black slot box	3	North-west	Flooded Gum	22/01/2018	16:30	Cam			nil	good	nil	nil
OH2KU	33	Box 125	Hollow-home slot box	3.5	North	Flooded Gum	22/01/2018	16:30	Cam			nil	good	nil	nil
OH2KU	33	Box 126	Black box	4.9	North-west		22/01/2018	16:25	Visual			leaf litter	good	nil	nil
OH2KU	33	Box 127	Hollow home slot box	4	North-west	Bloodwood	22/01/2018	16:10	Cam			nil	good	nil	nil
OH2KU	33	Box 128	Black box	3.3	North	Flooded Gum	22/01/2018	16:14	Cam			leaf litter	poor	replace soon	nil
OH2KU	33	Box 129	Black slot box	3.1	North	Bloodwood	22/01/2018	16:20	Cam			nil	good	nil	nil
OH2Ku	44	Box 84	Light green box	3.7	North	Blackbutt	23/01/2018	14:29	Cam			nil	good	nil	nil

Section	Zone	ID	Roost box type	H (m)	Aspect	Tree species	Date	Time	Inspect type	Species	Native /Pest	Signs of use	Box condition	Maintenance	Changes in landscape/other
OH2Ku	44	Box 85	Hollow home slot box	3.8	North	Tallowwood	23/01/2018	14:32	Cam			nil	good	nil	nil
OH2Ku	44	Box 86	Dark green wedge box	3.5	North-west	Blackbutt	23/01/2018	14:52	Cam			nil	good	nil	nil
OH2Ku	44	Box 87	Hollow home standard box	3.6	North	Blackbutt	23/01/2018	14:55	Cam			nil	good	nil	nil
OH2Ku	44	Box 88	Dark green slot box	3.7	North	Melaleuca sp.	23/01/2018	14:45	Cam			nil	good	nil	nil
OH2Ku	45	Box 146	Hollow home slot box	3.2	North	Turpentine	23/01/2018	15:46	Cam			nil	good	nil	nil
OH2Ku	45	Box 147	Dark green slot box	3.2	North	Stringybark	23/01/2018	15:59	Cam			nil	good	nil	nil
OH2Ku	45	Box 148	Hollow home narrow box	3.7	North	Turpentine	23/01/2018	15:47	Cam			nil	good	nil	nil
OH2Ku	45	Box 149	Hollow home narrow box	3.6	North	Stringybark	23/01/2018	15:42	Cam			nil	good	nil	nil
OH2Ku	46	Box 150	Light green slot box	3.2	North	Bloodwood	23/01/2018	16:17	Cam			nil	good	nil	nil
OH2Ku	46	Box 151	Black wedge box	3.7	North-east	Bloodwood	23/01/2018	16:30	Cam			nil	good	nil	nil
OH2Ku	46	Box 152	Hollow home standard box	3.4	North	Turpentine	23/01/2018	16:29	Cam			nil	good	nil	nil
OH2Ku	46	Box 89	Hollow home slot box	3.4	North	Stringybark	23/01/2018	16:24	Cam			nil	good	nil	nil
OH2Ku	46	Box 90	Black wedge box	3.4	North-west	Bloodwood	23/01/2018	16:22	Cam			nil	good	nil	nil
OH2Ku	46	Box 91	Dark green box	3.5	North	Swamp mahogany	23/01/2018	16:15	Cam			nil	good	nil	nil
OH2Ku	46	Box 92	Hollow home narrow box	3.3	North-east	Tallowwood	23/01/2018	16:20	Cam			nil	good	nil	nil
OH2Ku	46	Box 93	Hollow home narrow box	3.2	North-east	Turpentine	23/01/2018	16:27	Cam			nil	good	nil	nil
OH2Ku	46	Box 94	Hollow home standard box	3.4	North	Bloodwood	23/01/2018	16:19	Cam			nil	good	nil	nil
OH2Ku	47	Box 115	Dark green slot box	3.7	North	Tallowwood	19/01/2018	13:15	Cam			nil	good	nil	nil
OH2Ku	47	Box 116	Dark green box	3.8	North-east	Mahogany sp.	19/01/2018	13:05	Cam			leaves, spider web	good	nil	nil
OH2Ku	47	Box 117	Light green wedge box	3.7	North	Mahogany sp.	19/01/2018	13:00	Cam			mud wasp, cocoon	good	nil	nil
OH2Ku	47	Box 118	Black box	3.2	North	Mahogany sp.	19/01/2018	12:56	Cam			mud wasp, cocoon	good	nil	nil
OH2Ku	47	Box 119	Hollow home slot box	3.5	North	Mahogany sp.	19/01/2018	13:10	Cam			mud wasp	good	nil	nil
OH2Ku	47	Box 120	Hollow home standard box	3.7	North		19/01/2018								not located
OH2Ku	48	Box 156	Hollow home standard box	3.4	North-west	Swamp mahogany	19/01/2018	10:43	Cam			nil	good	nil	nil

Section	Zone	ID	Roost box type	H (m)	Aspect	Tree species	Date	Time	Inspect type	Species	Native /Pest	Signs of use	Box condition	Maintenance	Changes in landscape/other
OH2Ku	48	Box 33	Dark green box	3.9	North	Melaleuca sp.	19/01/2018	10:30	Cam			full of leaf litter	good	nil	nil
OH2Ku	48	Box 39	Hollow home standard box	3.7	North-west	Melaleuca sp.	19/01/2018	11:28	Cam			nil	good	nil	nil
OH2Ku	48	Box 40	Black wedge box	3.5	North	Melaleuca sp.	19/01/2018	11:23	Cam			nil	good	nil	nil
OH2Ku	48	Box 41	Hollow home narrow box	3.6	North	Melaleuca sp.	19/01/2018	10:52	Cam			nil	good	nil	nil
OH2Ku	48	Box 42	Light green wedge box	3.4	North-west	Melaleuca sp.	19/01/2018	10:37	Cam			leaves	good	nil	nil
OH2Ku	48	Box 43	Hollow home standard box	3.4	North	Melaleuca sp.	19/01/2018	11:36	Cam			nil	good	nil	nil
OH2Ku	48	Box 44	Light green wedge box	3.3	North	Melaleuca sp.	19/01/2018	10:00	Cam			nil	good	nil	nil
OH2Ku	48	Box 45	Hollow home standard box	3.4	North	Melaleuca sp.	19/01/2018	11:04	Cam			leaves	good	nil	nil
OH2Ku	48	Box 48	Dark green slot box	3.1	North-west	Melaleuca sp.	19/01/2018	10:23	Cam			nil	good	nil	nil
OH2Ku	49	Box 112	Light green box	3.9	North		Removed by landowner								
OH2Ku	49	Box 113	Hollow home narrow box	3.8	North-west		Removed by landowner								
OH2Ku	49	Box 114	Hollow home standard box	3.9	North-east		Removed by landowner								
OH2Ku	50	Box 109	Hollow home slot box	3.2	North		Removed by landowner								
OH2Ku	50	Box 110	Light green wedge box	3.7	North		Removed by landowner								
OH2Ku	50	Box 111	Black box	3.7	North		Removed by landowner								
OH2Ku	51	Box 102	Hollow home slot box	3.1	North-east		Removed by landowner								
OH2Ku	51	Box 103	Hollow home slot box	3.3	North		Removed by landowner								
OH2Ku	51	Box 104	Hollow home standard box	3.4	North-east		Removed by landowner								
OH2Ku	51	Box 106	Light green slot box	3.2	North		Removed by								

Section	Zone	ID	Roost box type	H (m)	Aspect	Tree species	Date	Time	Inspect type	Species	Native /Pest	Signs of use	Box condition	Maintenance	Changes in landscape/other
							landowner								
OH2Ku	51	Box 107	Black box	3.7	North-east		Removed by landowner								
OH2Ku	51	Box 108	Light green wedge box	3.6	North		Removed by landowner								
OH2Ku	57	Box 1	Light green slot box	3.6	North-east	Small-fruited Grey Gum	22/01/2018	13:54	Cam			nil	good	nil	nil
OH2Ku	57	Box 123	Light green slot box	3.4	North-west	Bloodwood	22/01/2018	14:00	Cam			nil	good	nil	nil
OH2Ku	57	Box 141	Hollow home slot box	3.6	North	Tallowood	22/01/2018	13:46	Cam			nil	good	nil	nil
OH2Ku	57	Box 142	Light green slot box	3.4	North-west	Bloodwood	22/01/2018	13:43	Cam			nil	good	nil	nil
OH2Ku	57	Box 143	Hollow home narrow box	3.5	North	Small-fruited Grey Gum	22/01/2018	13:52	Cam			nil	good	nil	nil
OH2Ku	57	Box 144	Hollow home slot box	3.4	North-east	Tallowood	22/01/2018	13:50	Cam			nil	good	nil	nil
OH2Ku	57	Box 145	Hollow home narrow box	3.8	North	Tallowood	22/01/2018	13:53	Cam			insect nest	good	nil	nil

Table 6: Winter 2018 roost box results

Stage	Zone	ID	Roost Box Type	H (m)	Aspect	Tree species	Date	Time	Inspect type	Species	Native/ Pest	Signs of use	Box condition	Maintenance	Changes in landscape/other
Ku2K	1	Box 46	Light green box	4	North-west	Flooded Gum	30/07/2018	9:46	Visual			leaf litter & debris	good	nil	nil
Ku2K	1	Box 49	Hollow home standard box	na	East - West	Culvert F33.4	27/08/2018	13:25	Torch			nil	good	nil	Microbats roosting in culvert joins
Ku2K	2	Box 47	Hollow home narrow box	3.8	North-west	Lophostemon	30/07/2018	9:44	Torch			nil	good	nil	nil
Ku2K	2	Box 51	Hollow home standard box	4	North	Flooded Gum	30/07/2018	9:51	Torch			nil	good	nil	nil
Ku2K	3	Box 50	Dark green slot box	3.4	North	Melaleuca sp.	30/07/2018	10:24	Torch			nil	good	nil	nil
Ku2K	3	Box 52	Hollow home standard box	na	East - West	Culvert F33.4	27/08/2018	13:27	Torch			nil	good	nil	Microbats roosting in culvert joins

Stage	Zone	ID	Roost Box Type	H (m)	Aspect	Tree species	Date	Time	Inspect type	Species	Native/ Pest	Signs of use	Box condition	Maintenance	Changes in landscape/other
Ku2K	3	Box 53	Dark green box	3.3	North	Mahogany sp.	30/07/2018	10:18	Torch			nil	good	nil	nil
Ku2K	3	Box 54	Hollow home standard box	na	East - West	Culvert C35.7	27/08/2018	13:30	Torch			nil	Good	nil	nil
Ku2K	3	Box 55	Hollow home narrow box	3.6	North	Small-fruited Grey Gum	30/07/2018	10:23	Torch			nil	good	nil	nil
Ku2K	3	Box 56	Hollow home standard box	na	East - West	Culvert C35.7	27/08/2018	13:30	Torch			nil	Good	nil	nil
Ku2K	5	Box 100	Light green slot box	3.4	North-east	Flooded Gum	31/07/2018	15:33	Visual			nil	good	nil	nil
Ku2K	5	Box 101	Black slot box	3.5	North	Blackbutt	31/07/2018	15:55	Torch			nil	good	nil	nil
Ku2K	5	Box 95	Hollow home slot box	3.8	North-west	Lophostemon	31/07/2018	15:32	Torch			nil	good	nil	nil
Ku2K	5	Box 96	Hollow home slot box	3.8	North	Lophostemon	31/07/2018	15:30	Torch			nil	good	nil	nil
Ku2K	5	Box 97	Hollow home standard box	3.7	North	Blackbutt	31/07/2018	15:48	Torch			nil	good	nil	nil
Ku2K	5	Box 98	Dark green wedge box	4	North-west	Blackbutt	31/07/2018	15:52	Cam			nil	good	nil	nil
Ku2K	5	Box 99	Black box	3.1	North-east	Bloodwood	31/07/2018	15:50	Torch			euc leaves	good	nil	nil
Ku2K	7	Box 31	Dark green wedge box	3.4	North-east	Lophostemon	02/08/2018	15:08	Cam			leaves	good	nil	nil
Ku2K	7	Box 36	Hollow home slot box	3.1	North-west	Flooded Gum	02/08/2018	15:05	Torch			insect nest	good	nil	nil
Ku2K	7	Box 37	Hollow home narrow box	3.5	North	Flooded Gum	02/08/2018	15:07	Cam			nil	good	nil	nil
Ku2K	7	Box 38	Light green box	3.6	North-west	Flooded Gum	02/08/2018	15:03	Cam			euc leaves	good	nil	nil
Ku2K	7	Box 64	Hollow home slot box	3.3	North-west	Flooded Gum	02/08/2018	15:02	Torch			nil	good	nil	nil
Ku2K	7	Box 65	Hollow home standard box	3.5	North	Bloodwood	02/08/2018	14:58	Torch			wasp nest	good	nil	nil
Ku2K	7	Box 66	Dark green box	3.2	North	Lophostemon	02/08/2018	15:00	Cam			euc leaves	good	nil	nil
Ku2K	7	Box 67	Black box	3.3	North-east	Bloodwood	02/08/2018	14:59	Cam			euc leaves	good	nil	nil
Ku2K	7	Box 68	Black wedge box	3.5	North	Small-fruited Grey Gum	02/08/2018	14:56	Cam			euc leaves	good	nil	nil
Ku2K	11	Box 63	Black box	3.1	North	Ironbark	02/08/2018	14:14	Cam			nil	good	nil	nil
Ku2K	12	Box 57	Dark green wedge box	3.5	North	Stringybark	02/08/2018	13:57	Cam			nil	good	nil	nil
Ku2K	12	Box 58	Black slot box	3.1	North	Stringybark	02/08/2018	13:55	Torch			nil	good	nil	nil
Ku2K	12	Box 59	Hollow home standard box	3.8	North-west	Flooded Gum	02/08/2018	14:12	Torch			nil	good	nil	nil

Stage	Zone	ID	Roost Box Type	H (m)	Aspect	Tree species	Date	Time	Inspect type	Species	Native/Pest	Signs of use	Box condition	Maintenance	Changes in landscape/other
Ku2K	12	Box 61	Hollow home narrow box	3.3	North-west	Stringybark	02/08/2018	14:07	Torch			nil	good	nil	nil
Ku2K	12	Box 62	Light green wedge box	3.2	North	Flooded Gum	02/08/2018	14:09	Cam			nil	good	nil	nil
Ku2K	34	Box 10	Dark green slot box	3.6	North-east	Scribbly Gum	30/07/2018	14:57	Torch			nil	good	nil	nil
Ku2K	34	Box 11	Light green wedge box	3	North	Tallowwood	30/07/2018	14:35	Cam			leaf litter	good	nil	nil
Ku2K	34	Box 12	Hollow home standard box	3.6	North	Scribbly Gum	30/07/2018	14:25	Torch			nil	good	nil	nil
Ku2K	34	Box 13	Hollow home standard box	3.6	North	Tallowwood	30/07/2018	14:55	Torch			nil	good	add hose	nil
Ku2K	34	Box 14	Black wedge box	3.6	North-west	Scribbly Gum	30/07/2018	14:27	Cam			nil	good	nil	nil
Ku2K	34	Box 15	Dark green box	3.4	North-west	Mahogany sp.	30/07/2018	14:28	Cam			nil	good	nil	nil
Ku2K	35	Box 30	Hollow home standard box	3.6	North	Lophostemon	30/07/2018	16:30	Torch			nil	good	nil	nil
Ku2K	35	Box 32	Hollow home narrow box	3.3	North-west	Flooded Gum	30/07/2018	16:32	Torch			nil	good	nil	nil
Ku2K	35	Box 35	Light green slot box	3	North	Bloodwood	30/07/2018	16:33	Torch			nil	good	nil	nil
Ku2K	36	Box 2	Dark green wedge box	3.3	North-east	Lophostemon	30/07/2018	16:12	Cam			nil	good	nil	nil
Ku2K	36	Box 3	Light green box	3.2	North		30/07/2018	16:14	Cam			nil	good	nil	nil
Ku2K	36	Box 4	Black slot box	3.1	North	Flooded Gum	30/07/2018	16:13	Torch			nil	good	nil	nil
Ku2K	36	Box 5	Light green wedge box	3.3	North-east	Bloodwood	30/07/2018	16:22	Visual			full of leaf	good	nil	nil
Ku2K	36	Box 6	Light green box	3.3	North-east	Flooded Gum	30/07/2018	16:25	Cam			full of leaf	good	nil	nil
Ku2K	36	Box 7	Hollow home standard box	3.8	North	Flooded Gum	30/07/2018	16:26	Torch			nil	good	nil	nil
Ku2K	36	Box 8	Hollow home standard box	3.6	North-west	Flooded Gum	30/07/2018	16:19	Cam			nil	good	clear vine	vine blocking entrance
Ku2K	36	Box 9	Black wedge box	3.6	North	Flooded Gum	30/07/2018	16:18	Cam			full of leaf	good	nil	nil
Ku2K	37	Box 28	Hollow home narrow box	3.7	North-west	Flooded Gum	30/07/2018	15:32	Cam			nil	good	nil	nil
Ku2K	37	Box 28b	Black wedge box	3.4	North	Tallowwood	30/07/2018	15:31	Cam			nil	good	nil	nil
Ku2K	37	Box 29	Dark green slot box	3	North	Tallowwood	30/07/2018	15:30	Torch			nil	good	nil	nil
Ku2K	38	Box 22	Black slot box	3	North-west	Flooded Gum	30/07/2018	15:17	Torch			nil	good	nil	nil
Ku2K	38	Box 23	Hollow home narrow box	3.8	North-west	Flooded Gum	30/07/2018	15:18	Cam			nil	good	nil	nil
Ku2K	38	Box 24	Light green wedge box	3.5	North-west	Flooded Gum	30/07/2018	15:20	Cam			full of leaf	good	nil	nil

Stage	Zone	ID	Roost Box Type	H (m)	Aspect	Tree species	Date	Time	Inspect type	Species	Native/ Pest	Signs of use	Box condition	Maintenance	Changes in landscape/other
Ku2K	38	Box 25	Light green wedge box	3.7	North	Flooded Gum	30/07/2018	15:11	Cam			nil	good	nil	nil
Ku2K	38	Box 26	Black box	3	North	Flooded Gum	30/07/2018	15:09	Cam			full of leaf	good	nil	nil
Ku2K	38	Box 27	Hollow home slot box	3	North	Flooded Gum	30/07/2018	15:16	Torch			nil	good	nil	nil
Ku2K	39	Box 16	Light green slot box	2.9	North	River Red Gum	31/07/2018	13:17	Torch			nil	good	nil	nil
Ku2K	39	Box 17	Black wedge box	3.1	North	River Red Gum	31/07/2018	13:18	Torch			melaleuca leaf nest	good	nil	nil
Ku2K	39	Box 18	Dark green box	3.5	North-west	Melaleuca sp.	31/07/2018	13:24	Cam			leaf debris	good	nil	nil
Ku2K	39	Box 19	Hollow home narrow box	3.5	North-west	River Red Gum	31/07/2018	13:21	Torch			nil	good	nil	nil
Ku2K	39	Box 20	Light green wedge box	3.1	North-west	Melaleuca sp.	31/07/2018	13:32	Cam			nil	good	nil	nil
Ku2K	39	Box 21	Hollow home slot box	3.3	North-west	River Red Gum	31/07/2018	13:16	Torch			melaleuca leaf nest	good	nil	nil
Ku2K	40	Box 139	Hollow home standard box	3.9	North	Blackbutt	31/07/2018	13:42	Torch			wasp nest	good	nil	nil
Ku2K	40	Box 140	Hollow home slot box	3.6	North-west	Blackbutt	31/07/2018	13:40	Torch			nil	good	nil	nil
Ku2K	52	Box 130	Hollow home narrow box	3.6	North	Bloodwood	31/07/2018	13:57	Torch			nil	good	nil	nil
Ku2K	52	Box 131	Dark green slot box	3.6	North-west	Bloodwood	31/07/2018	14:07	Torch			nil	good	nil	nil
Ku2K	52	Box 132	Hollow home slot box	3.7	North	Lophostemon	31/07/2018	14:11	Torch			nil	good	nil	nil
Ku2K	52	Box 133	Hollow home slot box	3.6	North-east	Melaleuca sp.	31/07/2018	14:02	Torch			nil	good	nil	nil
Ku2K	52	Box 134	Hollow home slot box	3.1	North-east	Lophostemon	31/07/2018	14:00	Torch			nil	good	nil	nil
Ku2K	52	Box 135	Black slot box	3.2	North	Tallowwood	31/07/2018	14:06	Torch			nil	good	nil	nil
Ku2K	52	Box 136	Hollow home slot box	3.8	North	Blue Gum	31/07/2018	14:05	Torch			nil	good	nil	nil
Ku2K	52	Box 137	Hollow home slot box	3.3	North-west	Tallowwood	31/07/2018	13:56	Torch			nil	good	nil	nil
Ku2K	52	Box 138	Hollow home standard box	3.7	North	Lophostemon	31/07/2018	14:01	Torch			wasp nest	good	nil	nil
OH2KU	13	Box 73	Black slot box	3.1	North	Lophostemon	03/08/2018	10:18	Torch			nil	good	nil	nil
OH2KU	13	Box 74	Dark green wedge box	3.5	North-east	Tallowwood	03/08/2018	10:14	Cam			nil	good	nil	nil
OH2KU	13	Box 75	Hollow home standard box	3.5	North	Tallowwood	03/08/2018	10:19	Torch			nil	good	nil	nil
OH2KU	13	Box 76	Light green box	3.6	North	Tallowwood	03/08/2018	10:12	Cam			leaves	good	nil	nil
OH2KU	13	Box 77	Hollow home narrow box	3.3	North-west	Flooded Gum	03/08/2018	10:13	Torch			nil	damp	nil	nil

Stage	Zone	ID	Roost Box Type	H (m)	Aspect	Tree species	Date	Time	Inspect type	Species	Native/Pest	Signs of use	Box condition	Maintenance	Changes in landscape/other
OH2KU	15	Box 153	Hollow home narrow box	3.8	North	Small-fruited Grey Gum	03/08/2018	10:08	Torch			old wasp nest	good	nil	nil
OH2KU	15	Box 154	Hollow home narrow box	3.8	North	Small-fruited Grey Gum	03/08/2018	10:09	Torch			wasp nest	good	nil	nil
OH2KU	15	Box 155	Hollow home standard box	3.8	North	Tallowood	03/08/2018	10:07	Torch			nil	good	nil	nil
OH2KU	15	Box 157	Hollow home slot box	3.5	North	Bloodwood	03/08/2018	9:48	Torch			nil	good	nil	nil
OH2KU	15	Box 158	Black slot box	3.5	North	Small-fruited Grey Gum	03/08/2018	9:47	Torch			nil	good	nil	nil
OH2KU	15	Box 159	Light green box	3.3	North	Lophostemon	03/08/2018	9:49	Cam			euc leaves	good	nil	nil
OH2KU	15	Box 69	Hollow home standard box	3.7	North-west	Turpentine	03/08/2018	9:17	Torch			nil	good	nil	nil
OH2KU	15	Box 70	Dark green box	3.2	North-east	Lophostemon	03/08/2018	9:16	Cam			euc leaves	good	nil	nil
OH2KU	15	Box 71	Light green slot box	3	North	Small-fruited Grey Gum	03/08/2018	9:15	Torch			nil	good	nil	nil
OH2KU	15	Box 72	Light green box	3.5	North	Turpentine	03/08/2018	9:15	Cam			euc leaves	good	nil	nil
OH2KU	15	Box 73	Hollow home narrow box	3.6	North	Lophostemon	03/08/2018	9:14	Torch			nil	good	nil	nil
OH2KU	31	Box 78	Hollow home narrow box	3.7	North	Casuarina	07/08/2018	11:31	Torch			nil	good	nil	nil
OH2KU	31	Box 79	Hollow home narrow box	3.7	North-west	Casuarina	07/08/2018	11:34	Torch			nil	good	nil	nil
OH2KU	31	Box 80	Hollow home narrow box	3.7	North	Casuarina	07/08/2018	11:35	Torch			nil	good	nil	nil
OH2KU	31	Box 81	Hollow home narrow box	3.6	North-west	Casuarina	07/08/2018	11:37	Torch			nil	good	nil	nil
OH2KU	31	Box 82	Hollow home narrow box	3.8	North	Casuarina	07/08/2018	11:32	Torch			nil	good	nil	nil
OH2KU	31	Box 83	Hollow home narrow box	3.7	North-east	Casuarina	07/08/2018	11:36	Torch			nil	good	nil	nil
OH2KU	33	Box 121	Light green slot box	3.6	North	No ID	07/08/2018	10:55	Torch			nil	good	nil	nil
OH2KU	33	Box 122	Hollow home slot box	3.4	North-west	No ID	07/08/2018	10:39	Torch			nil	good	nil	nil
OH2KU	33	Box 124	Black slot box	3	North-west	Flooded Gum	07/08/2018	10:41	Cam			nil	good	nil	nil
OH2KU	33	Box 125	Hollow-home slot box	3.5	North	Flooded Gum	07/08/2018	10:42	Torch			nil	good	nil	nil
OH2KU	33	Box 126	Black box	4.9	North-west		07/08/2018	10:43	Torch			leaves	poor	replace	deteriorated, split open

Stage	Zone	ID	Roost Box Type	H (m)	Aspect	Tree species	Date	Time	Inspect type	Species	Native/Pest	Signs of use	Box condition	Maintenance	Changes in landscape/other
OH2KU	33	Box 127	Hollow home slot box	4	North-west	Bloodwood	07/08/2018	10:35	Torch			nil	good	nil	nil
OH2KU	33	Box 128	Black box	3.3	North	Flooded Gum	07/08/2018	10:37	Visual			leaves	good	nil	nil
OH2KU	33	Box 129	Black slot box	3.1	North	Bloodwood	07/08/2018	10:38	Torch			nil	good	nil	nil
OH2Ku	44	Box 84	Light green box	3.7	North	Blackbutt	14/08/2018	12:42	Cam			nil	good	nil	nil
OH2Ku	44	Box 85	Hollow home slot box	3.8	North	Tallowwood	14/08/2018	12:41	Torch			nil	good	nil	nil
OH2Ku	44	Box 86	Dark green wedge box	3.5	North-west	Blackbutt	14/08/2018	12:38	Cam			nil	good	nil	nil
OH2Ku	44	Box 87	Hollow home standard box	3.6	North	Blackbutt	14/08/2018	12:39	Torch			nil	good	nil	nil
OH2Ku	44	Box 88	Dark green slot box	3.7	North	Melaleuca sp.	14/08/2018	12:41	Torch			nil	good	nil	nil
OH2Ku	45	Box 146	Hollow home slot box	3.2	North	Turpentine	14/08/2018	13:17	Torch			nil	good	nil	nil
OH2Ku	45	Box 147	Dark green slot box	3.2	North	Stringybark	14/08/2018	13:25	Torch			nil	good	nil	nil
OH2Ku	45	Box 148	Hollow home narrow box	3.7	North	Turpentine	14/08/2018	13:18	Torch			nil	good	nil	nil
OH2Ku	45	Box 149	Hollow home narrow box	3.6	North	Stringybark	14/08/2018	13:13	Torch			nil	good	nil	nil
OH2Ku	46	Box 150	Light green slot box	3.2	North	Bloodwood	14/08/2018	13:34	Torch			nil	good	nil	nil
OH2Ku	46	Box 151	Black wedge box	3.7	North-east	Bloodwood	14/08/2018	13:56	Cam			nil	good	nil	nil
OH2Ku	46	Box 152	Hollow home standard box	3.4	North	Turpentine	14/08/2018	13:58	Torch			nil	good	nil	nil
OH2Ku	46	Box 89	Hollow home slot box	3.4	North	Stringybark	14/08/2018	13:38	Torch			nil	good	nil	nil
OH2Ku	46	Box 90	Black wedge box	3.4	North-west	Bloodwood	14/08/2018	13:37	Cam			nil	good	nil	nil
OH2Ku	46	Box 91	Dark green box	3.5	North	Swamp mahogany	14/08/2018	13:33	Cam			nil	good	nil	nil
OH2Ku	46	Box 92	Hollow home narrow box	3.3	North-east	Tallowwood	14/08/2018	13:36	Torch			nil	good	nil	nil
OH2Ku	46	Box 93	Hollow home narrow box	3.2	North-east	Turpentine	14/08/2018	13:44	Torch			nil	good	nil	nil
OH2Ku	46	Box 94	Hollow home standard box	3.4	North	Bloodwood	14/08/2018	13:35	Torch			nil	good	nil	nil
OH2Ku	47	Box 115	Dark green slot box	3.7	North	Tallowwood	14/08/2018	10:32	Torch			nil	good	nil	nil
OH2Ku	47	Box 116	Dark green box	3.8	North-east	Mahogany sp.	14/08/2018	10:34	Cam			full of leaf	good	nil	nil
OH2Ku	47	Box 117	Light green wedge box	3.7	North	Mahogany sp.	14/08/2018	10:35	Cam			wasp nest	good	nil	nil

Stage	Zone	ID	Roost Box Type	H (m)	Aspect	Tree species	Date	Time	Inspect type	Species	Native/ Pest	Signs of use	Box condition	Maintenance	Changes in landscape/other
OH2Ku	47	Box 118	Black box	3.2	North	Mahogany sp.	14/08/2018	10:36	Cam			insect nest	good	nil	nil
OH2Ku	47	Box 119	Hollow home slot box	3.5	North	Mahogany sp.	14/08/2018	10:33	Torch			nil	poor	rehang, fallen down	nil
OH2Ku	47	Box 120	Hollow home standard box	3.7	North		Not found								
OH2Ku	48	Box 156	Hollow home standard box	3.4	North-west	Swamp mahogany	14/08/2018	11:46	Torch			nil	good	nil	nil
OH2Ku	48	Box 33	Dark green box	3.9	North	Melaleuca sp.	14/08/2018	11:51	Cam			full of leaf	good	nil	nil
OH2Ku	48	Box 39	Hollow home standard box	3.7	North-west	Melaleuca sp.	14/08/2018	11:54	Torch			nil	good	nil	nil
OH2Ku	48	Box 40	Black wedge box	3.5	North	Melaleuca sp.	14/08/2018	11:53	Cam			nil	good	nil	nil
OH2Ku	48	Box 41	Hollow home narrow box	3.6	North	Melaleuca sp.	14/08/2018	11:47	Torch			nil	good	nil	nil
OH2Ku	48	Box 42	Light green wedge box	3.4	North-west	Melaleuca sp.	14/08/2018	11:52	Cam			full of leaf	good	nil	nil
OH2Ku	48	Box 43	Hollow home standard box	3.4	North	Melaleuca sp.	14/08/2018	11:45	Torch			nil	good	nil	nil
OH2Ku	48	Box 44	Light green wedge box	3.3	North	Melaleuca sp.	14/08/2018	11:44	Torch			nil	good	nil	nil
OH2Ku	48	Box 45	Hollow home standard box	3.4	North	Melaleuca sp.	14/08/2018	11:45	Torch			nil	good	nil	nil
OH2Ku	48	Box 48	Dark green slot box	3.1	North-west	Melaleuca sp.	14/08/2018	11:47	Torch			nil	good	nil	nil
OH2Ku	49	Box 112	Light green box	3.9	North	Removed by landowner	Removed by landowner								
OH2Ku	49	Box 113	Hollow home narrow box	3.8	North-west	Removed by landowner	Removed by landowner								
OH2Ku	49	Box 114	Hollow home standard box	3.9	North-east	Removed by landowner	Removed by landowner								
OH2Ku	50	Box 109	Hollow home slot box	3.2	North	Removed by landowner	Removed by landowner								
OH2Ku	50	Box 110	Light green wedge box	3.7	North	Removed by landowner	Removed by landowner								
OH2Ku	50	Box 111	Black box	3.7	North	Removed by	Removed by								

Stage	Zone	ID	Roost Box Type	H (m)	Aspect	Tree species	Date	Time	Inspect type	Species	Native/ Pest	Signs of use	Box condition	Maintenance	Changes in landscape/other
						landowner	landowner								
OH2Ku	51	Box 102	Hollow home slot box	3.1	North-east	Removed by landowner	Removed by landowner								
OH2Ku	51	Box 103	Hollow home slot box	3.3	North	Removed by landowner	Removed by landowner								
OH2Ku	51	Box 104	Hollow home standard box	3.4	North-east	Removed by landowner	Removed by landowner								
OH2Ku	51	Box 106	Light green slot box	3.2	North	Removed by landowner	Removed by landowner								
OH2Ku	51	Box 107	Black box	3.7	North-east	Removed by landowner	Removed by landowner								
OH2Ku	51	Box 108	Light green wedge box	3.6	North	Removed by landowner	Removed by landowner								
OH2Ku	57	Box 1	Light green slot box	3.6	North-east	Small-fruited Grey Gum	02/08/2018	15:37	Torch			nil	good	nil	nil
OH2Ku	57	Box 123	Light green slot box	3.4	North-west	Bloodwood	02/08/2018	15:33	Torch			nil	good	nil	nil
OH2Ku	57	Box 141	Hollow home slot box	3.6	North	Tallowwood	02/08/2018	15:34	Torch			nil	good	nil	nil
OH2Ku	57	Box 142	Light green slot box	3.4	North-west	Bloodwood	02/08/2018	15:30	Torch			nil	good	nil	nil
OH2Ku	57	Box 143	Hollow home narrow box	3.5	North	Small-fruited Grey Gum	02/08/2018	15:38	Torch			nil	good	nil	nil
OH2Ku	57	Box 144	Hollow home slot box	3.4	North-east	Tallowwood	02/08/2018	15:36	Torch			nil	good	nil	nil
OH2Ku	57	Box 145	Hollow home narrow box	3.8	North	Tallowwood	02/08/2018	15:39	Torch			insect nest	good	nil	nil

Annex 2. Weather

Table 7: 2018 survey conditions

Date	Temperature (°C)	Rainfall (mm)	Cloud cover (%)	Wind (km/hr)
19/01/2018	30	0	0	7
22/01/2018	29	0	0	13
23/01/2018	31	0	0	4
05/02/2018	27	0	0	11
06/02/2018	27	0	0	13
07/02/2018	27	0.8	90	4
08/02/2018	28	0	20	11
30/07/2018	21	0	0	7
31/07/2018	21	0	0	13
02/08/2018	21	0	0	11
03/08/2018	23	0	0	13
07/08/2018	20	0	0	0
14/08/2018	20	0	0	9

Data source: BOM app for current location and Kempsey Weather Station 0590007.

Niche Environment and Heritage

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Head Office

Niche Environment and Heritage

PO Box 2443 North Parramatta NSW 1750

Email: info@niche-eh.com

All mail correspondence should be through our Head Office

Appendix I Contractor's Ecological Monitoring

(including nest box, bat box, road kill and landscape monitoring undertaken by the Contractor's Project Ecologists during the construction period)



Contractor Ecological Monitoring Report 2017/2018

Oxley Highway to Kempsey, Pacific Highway Upgrade

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Project Manager: Radika Michniewicz

Authors: Radika Michniewicz

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Cover photograph: OH2K dual carriageway and widened median.

Executive summary

Context

This report documents findings for the 2017/2018 contractor ecological monitoring associated with the Oxley Highway to Kempsey (OH2K) Pacific Highway Upgrade (the Project), as required by the Oxley Highway to Kempsey (OH2K) Ecological Monitoring Program (EMP, RMS 2016).

The EMP details the schedule of ecological monitoring requirements for the life of the Project. Those monitoring components that were undertaken during the 2017/2018 monitoring period by contractors and that are reported on in this document are listed below.

- **Road kill monitoring**
- **Pre-clearing and clearing procedures**
- **Nest boxes**
- **Microbat roost boxes**
- **Landscaping and revegetation**

Key results and implications

- Road kill:
 - Construction monitoring was undertaken from 4 August 2017 – 28 March 2018. As the Project opened in three stages, construction monitoring involved surveys of gradually reducing sections of the Project. Construction monitoring surveys covering the entire length of the Project were undertaken weekly for 13 weeks from 4 August 2017 – 30 October 2017 and were used for comparison with baseline surveys. There were a total of 39 road kill records, including 12 identifiable species and an average weekly road kill of 3.0, in comparison to an average weekly road kill rate of 8.0 for baseline surveys.
 - No threatened fauna were identified as road kill during the 2017/2018 construction monitoring surveys.
 - Twelve week post-opening surveys were undertaken during different twelve week periods for the three sections of the Project due to a staged opening. Pooled road kill records for the 12-week post-opening monitoring period from all sections, revealed a total of 54 road kill records, resulting in an average weekly post-opening survey road kill of 4.5.
 - **Performance indicators of success relating to reduced road kill incidence from baseline and the installation of required fauna fence have been met. The performance indicator relating to mitigation measures (rope bridges and underpasses) will be assessed after operational monitoring has commenced.**
- Pre-clearing and clearing procedures:
 - A total of 432 individual animals, comprising 32 species, were captured and relocated.
 - Stop work and unexpected find procedures were implemented for a Koala and Stephen's Banded Snake.
 - Reported mortality of native fauna resulting from clearing operations was low at 3.5 % of the recorded number of successfully relocated individuals.
 - No aquatic fauna mortalities were reported.

- No threatened fauna mortalities due to clearing operations were reported.
- An additional 46 hollow-bearing trees were removed (due mainly to changes in design footprint and clearing limit) but there was a 39% reduction in the number of functional hollows removed from the predicted number.
- **All performance indicators of success were met.**
- Nest boxes:
 - Of the 474 nest boxes inspected, 34 (7%) were occupied and 211 (45%) showed signs of use. Therefore, a total of 245 nest boxes (52%) were occupied or showed signs of use by native vertebrate fauna at least once during winter 2017 (Event 3).
 - One threatened species (Squirrel Glider (*Petaurus norfolcensis*)), not recorded in monitoring events undertaken to date, was recorded.
 - Eighteen species of native fauna have been identified using nest boxes to date, including three threatened species, the Yellow-bellied Glider (*Petaurus australis*), Greater Glider (*Petauroides volans*) and Squirrel Glider.
 - Non-native species: exotic birds were not recorded using nest boxes and 7% of nest boxes showed signs of use by European Bees.
 - Only 1.3% of boxes (six boxes) required maintenance/replacement.
 - **All performance indicators of success have been met except for design-specific use of 4 of the 9 nest box types.** Nest box types P/L (medium parrots/lorikeets), Co (cockatoos), SO (small owls) and LFO (large forest owls) did not show signs of use by target fauna, however these nest box types were used by other vertebrate fauna groups. The target fauna of these boxes were not recorded using any nest box type, with the exception of two Lorikeet records from the same SG (small glider) box. Additional monitoring events are required to evaluate the success of these box types for the target species.
- Microbat roost boxes:
 - No bats were recorded using the 152 roost boxes inspected during winter 2017 (Event 11).
 - Microbats were recorded using 70% of the inspected additional structures (culverts and bridges) in the Ku2K section.
 - 31% of roost boxes showed evidence of use by mud wasps and other native non-target vertebrate fauna.
 - All inspected boxes were in good condition, excluding one that required replacement.
 - **The performance indicator relating to use of roost boxes by microbats has not been met.** The use of bat roost boxes as a management measure for the target species has been unsuccessful to date. However, additional structure monitoring in the Ku2K section of the Project has found that newly installed bridges and culverts have provided additional roost habitat for these species and that these structures have been rapidly colonised (within four months of construction).
 - Corrective actions are not required for the Ku2K section of the Project.
 - An inspection of additional structures in the OH2Ku section of the Project has not been undertaken to date.

- Landscaping and revegetation:
 - Of the 148 native seeding sites that have undergone a 12 month assessment to date, 105 (70.9%) have met the minimum 12 month criteria.
 - Of the 201 native planting sites that have undergone a 12 month assessment to date, 145 (72.1%) have met the minimum 12 month criteria.
 - It is recommended that those sites that have not yet met minimum criteria should continue to be monitored and all actions deemed appropriate, such as replanting, herbicide treatment, respraying or reworking, should be undertaken.

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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.

Note that threatened species identified within the EMP that were listed under the repealed NSW *Threatened Species Conservation Act 1995* (TSC Act) are now listed under the NSW *Biodiversity Conservation Act 2016* (BC Act). References made to TSC Act listed species within the EMP are therefore taken as referring to BC Act listed species.

For a number of the monitoring components the Project has been divided into two sections:

- Oxley Highway to Kundabung (Ch. 0 - 24040), hereafter referred to as OH2Ku.
- Kundabung to Kempsey (Ch. 24040 - 37850), hereafter referred to as Ku2K.

1.2 Purpose of this Report

This report summarises the findings of the 2017/2018 construction contractor ecological monitoring surveys undertaken as part of the OH2K section of the Pacific Highway Upgrade Project. These were undertaken in accordance with the EMP from July 2017 to July 2018 (the current reporting period).

The EMP details the schedule of ecological monitoring requirements for the life of the Project. These are shown in Table 1. Monitoring components of the EMP that were undertaken by the construction contractors during the 2017/2018 monitoring period that are reported on in this document are:

- Road kill (construction and 12-week post-opening surveys encompassing July 2017 - June 2018)
- Pre-clearing and clearing procedures (Ku2K November 2014 – May 2018)
- Nest boxes (Event 3: winter 2017)
- Microbat roost boxes (Event 11: winter 2017)
- Landscaping and revegetation (July 2017 – July 2018)

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"> • Ku2K: from 3 November 2017 • OH2Ku Stage 1: from 17 November 2017 • OH2Ku Stage 2: from 30 March 2018 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)

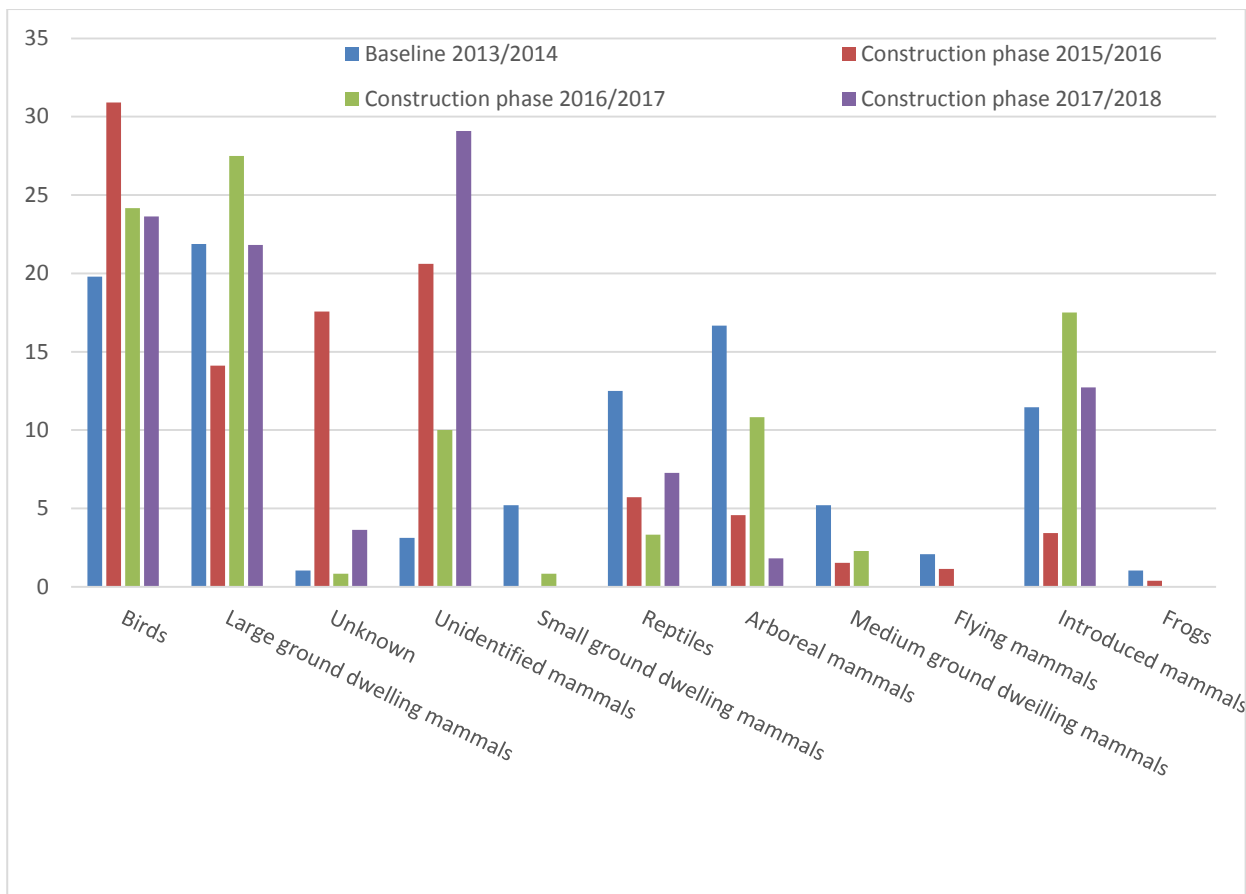
There were a total of nine road kill records from November 17 2017 - 28 March 2018 in this section of the Project, including three identified species and an average weekly road kill of 0.5 (number of weeks = 19). For this period, monitoring occurred in spring, summer and autumn, with an average weekly 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"> • Koala • Grey-headed Flying Fox (2)
Clearing (Niche 2015)	2014-2015	<ul style="list-style-type: none"> • Koala (4) • Grey-headed Flying Fox • Masked Owl (2) • Spotted-tail Quoll
Construction (Niche 2016b)	2015-2016	<ul style="list-style-type: none"> • Koala (3)
Construction (Niche 2017b)	2016-2017	<ul style="list-style-type: none"> • Koala (2)
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.

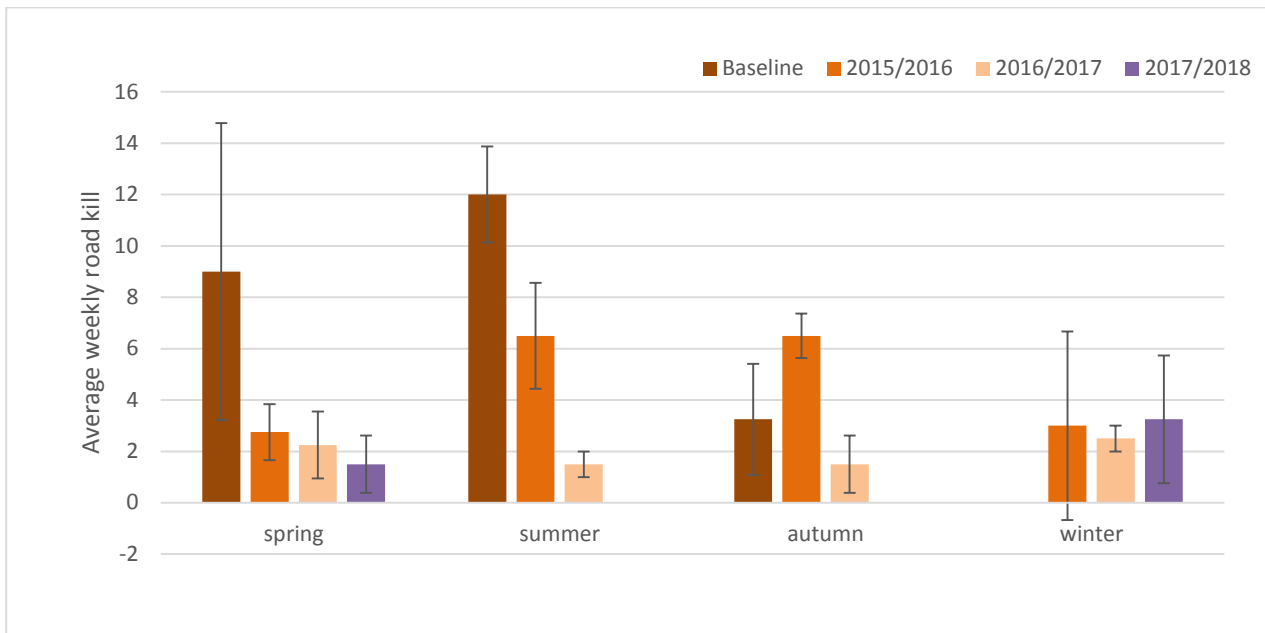
The average weekly road kill for the baseline surveys and construction monitoring periods for all survey events is presented in Table 5. Graph 2 shows the seasonal average weekly road kill for each of the same four week period in baseline and construction monitoring periods. The location of road kill 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.	This performance measure was not assessed for the 2017/2018 monitoring period. 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.	This performance measure was met for the 2017/2018 construction phase. 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.	This performance measure has been met. 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.

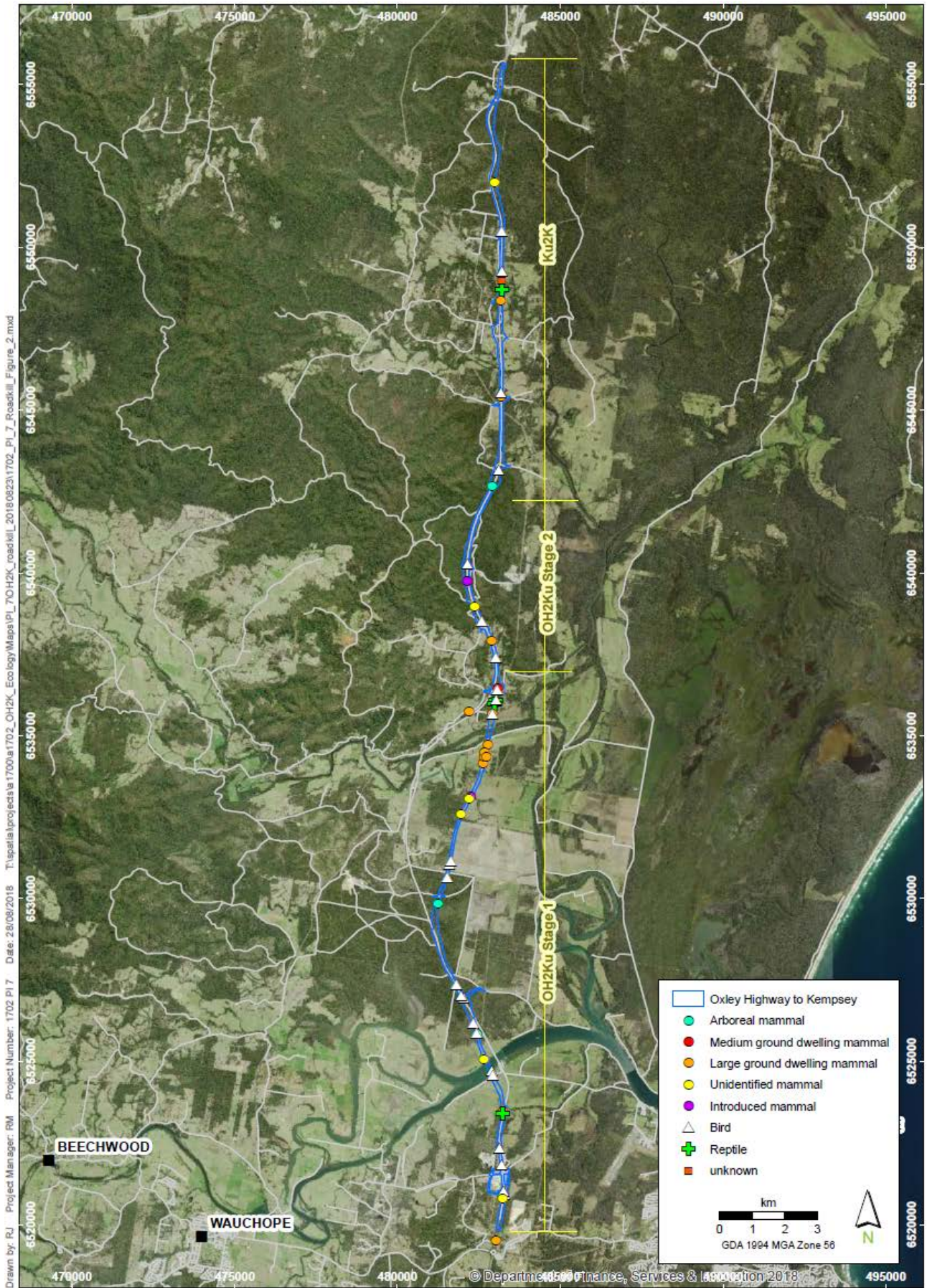
2.7.2 Recommendations

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.



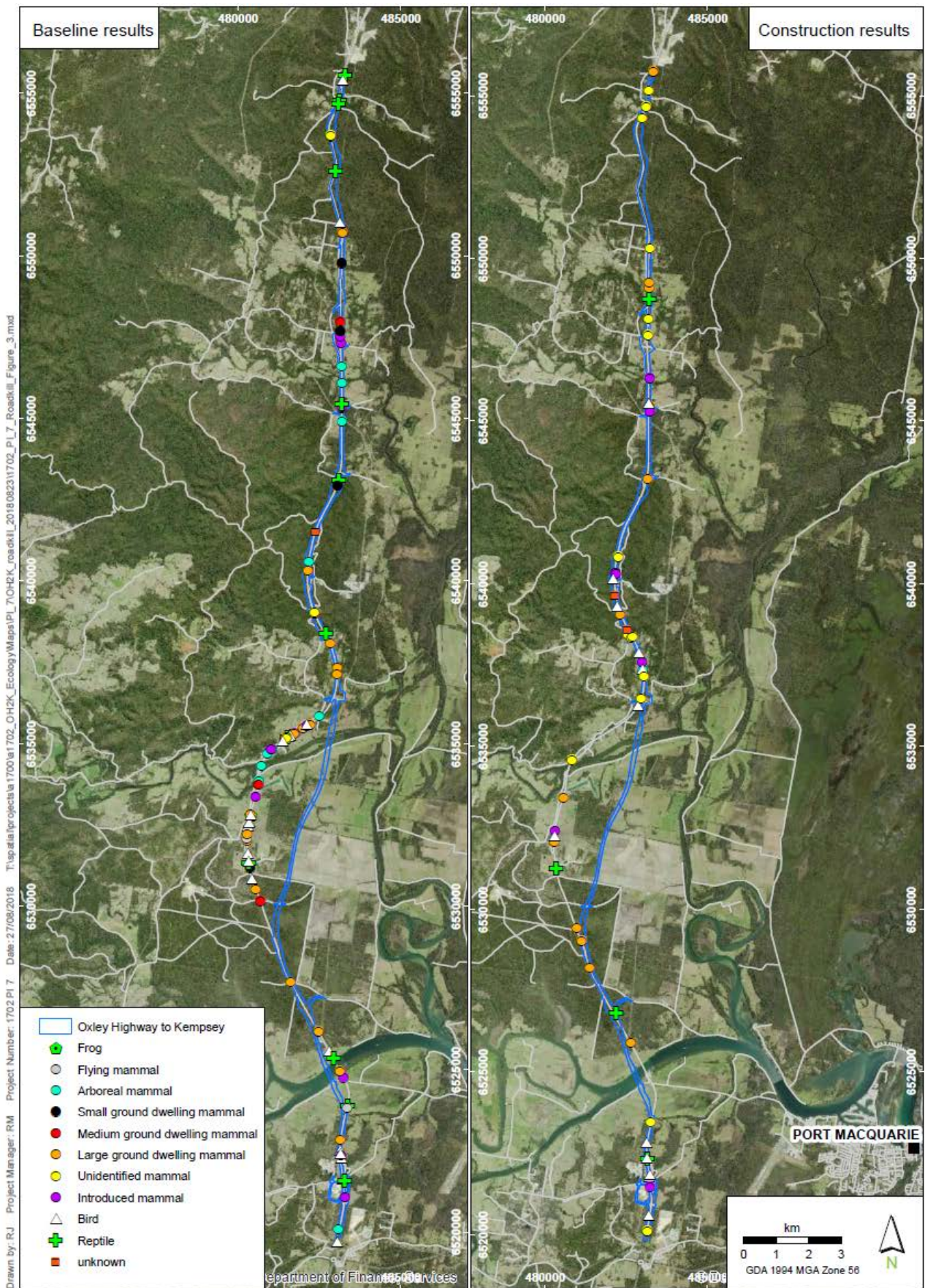
Distribution of road kill records: all construction monitoring 2017/2018

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



Drawn by: RJ | Project Manager: RM | Project Number: 1702 PI 7 | Date: 27/08/2018 | T:\spatial\project\1700\at1702_OH2K_Ecology\Maps\PI_7\OH2K_roadkill_2018\08231702_PI7_Roadkill_Figure_3.mxd

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

3. Pre-clearing and Clearing Procedures

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.	This performance indicator has been met for terrestrial and aquatic fauna. 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. This performance indicator has been met for threatened fauna. 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).	This performance indicator has been met. 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.	This performance indicator has been met. 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.	This performance indicator has been met. 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. This contingency measure was relevant and appropriate action was taken.
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. This potential problem was not encountered.
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. This potential problem was not encountered.
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. This potential problem was not encountered

4. Nest Boxes

The nest box data for the winter 2017 monitoring period has been provided by two sources. The OH2Ku section was monitored by Sandpiper Ecological Services (Sandpiper 2017a) and the Ku2K section was monitored by Lewis Ecological Surveys (Lewis 2017a). These reports are provided in Annex 3. The results are summarised below.

4.1 Monitoring Framework and Timing

The EMP specifies that nest boxes were to be installed in Year 1 (2015) and Year 2 (2016) (construction phase), with monitoring to be undertaken biannually, commencing in summer and winter shortly after the installation period (2016) and to be continued in Year 4 (2018), Year 6 (2020) and Year 8 (2022).

To date, three construction monitoring events have occurred and been reported on as follows:

- *Event 1-winter 2016:* Niche 2017b.
 - OH2Ku: 20 – 23 June 2016 and 8 – 9 August 2016 (Sandpiper 2017b).
 - Ku2K: 20 August 2016– 25 September 2016 (Lewis 2017b).
- *Event 2-summer 2017:* Niche 2017b.
 - OH2Ku: 16 – 20 January 2017 and 13 - 14 March 2017 (Sandpiper 2017c).
 - Ku2K: 9 – 14 March 2017 (Lewis 2017b).
- *Event 3-winter 2017:* current report.
 - OH2Ku: 21 – 24 July 2017 and 4 September 2017 (Sandpiper 2017a).
 - Ku2K: 31 July – 7 August 2017 (Lewis 2017a).

Events 1 and 2 were the first of the biannual inspections after installation. As the nest boxes were installed early in 2016, monitoring commenced in winter 2016, six months ahead of the scheduled first monitoring event in summer 2017. Therefore, an additional monitoring event (Event 3) was undertaken in winter 2017 and is the subject of the current report. Subsequent biannual operational monitoring required in Years 4, 6 and 8 of the Project, commenced in summer (January/February) 2018 (Event 4). The first two of these monitoring events (Events 4 and 5) have been reported on separately in a stand-alone report (Niche 2018a).

4.2 Performance Measures

The EMP specifies the performance measures for nest boxes.

“Indicators of success of nest boxes include:

- *Use of nest boxes by a wide range of native fauna species.*
- *Use of nest boxes designed for specific species by those same species.*
- *Low rate of use of nest boxes by introduced fauna species.*
- *Low level of maintenance of nest boxes.”*

4.3 Nest Boxes Monitored

The *Nest Box Plan of Management* (NBPoM, Lewis 2013a) describes the number, type and distribution of nest boxes required to mitigate the loss of hollows, and the ongoing management of the nest boxes. The boxes were installed in two phases: 60% prior to or during clearing to provide temporal refuge habitat and the remaining 40% once a final count of functional tree hollows was made during the clearing supervision. Phase 2 calculations required an additional four boxes for OH2Ku and 101 for Ku2K. The number of nest boxes installed and monitored are provided in Table 9. Phase 2 installations for OH2Ku were undertaken prior to Event 2, and are now complete for Ku2K, with the final 101 boxes installed in winter 2017. The nest box installation area was divided into zones to provide clusters of nest boxes in areas requiring mitigation for the loss of hollows.

Table 9: Nest box installation and monitoring

	Specified in the EMP	Phase 1 installation / Event 1 (winter 2016)	Phase 2 calculation: additional boxes	Event 2 (summer 2017)	Event 3 (winter 2017)	Nest boxes to be monitored Event 4 (summer 2018)
OH2Ku	469	263	4 (installed prior to Event 2)	269 [*]	269 [*]	269 [*]
Ku2K	254	156	101 (53 installed prior to Event 3 [^])	156	205 ⁺	257
	723	419		425	474	526

* = two extra boxes were installed due to Masked Owl observations during clearing; ⁺ = this excludes the four boxes that were burnt and discontinued and replaced with new boxes and box numbers; [^] = 53 of the phase 2 nest boxes were installed prior to Event 3 monitoring, the remaining 48 were installed post-monitoring and will be monitored for the first time during summer 2018 (Event 4).

4.4 Methods

The EMP, in accordance with the NBPoM, states that monitoring will involve a visual inspection of each nest box, and at each monitoring period, the following information will be collected:

- Inspection date, weather conditions (rain, wind, cloud cover, ambient temperature) and time each nest box was inspected.
- Nest box identification number.
- If the nest box is occupied by native fauna, and if so, the species. If the nest box is not occupied by a native species, record any signs of use by native species, such as feathers, droppings, scats, hair or nesting material.
- If the nest box is occupied by a pest species such as European bees, or Common Myna.
- Deterioration of the nest box and if any maintenance required.
- Any changes to the surrounding habitats, such as clearing or installation of wildlife crossing structures.

4.5 Key Results

4.5.1 Seasonal results

To provide an overall picture of nest box results for the Project, OH2Ku and Ku2K results have been grouped in the following summary.

A total of 474 nest boxes were monitored in Event 3. Of these 34 (7%) were occupied and a further 211 (45%) showed signs of use by native vertebrate fauna. A total of 245 nest boxes (52%) were therefore either occupied or showed signs of use by native vertebrate fauna during Event 3 surveys. Table 10 shows the occupation rates during all monitoring events to date.

Table 10: Nest box use by native vertebrate fauna

	Event 1	Event 2	Event 3
Number of boxes inspected	419	425 (389 available to fauna)	474
Boxes occupied by vertebrate fauna	44 (11%)	30 (8%)	34 (7%)
Boxes showing signs of use by vertebrate fauna.	167 (40%)	173 (44%)	211 (45%)
Boxes occupied or showing signs of use by vertebrate fauna	211 (50%)	203 (52%)	245 (52%)

4.5.2 Native fauna use

Table 11 lists the native vertebrate fauna recorded during the current and previous surveys, with threatened species highlighted in bold. Two threatened species were recorded during Event 3 monitoring: the Yellow-bellied Glider and the Squirrel Glider, both listed as vulnerable under the NSW *Biodiversity Conservation Act 2016* (BC Act).

The Yellow-bellied Glider was recorded in zone AA NBT03 (Small Owl type box) in Event 3; and previously a pair were detected during Event 2 in zone AA box NBT08 (Large Glider type box).

The Squirrel Glider was detected during Event 3 in zone NEW ZONE box NBT96 (Possum type box). The Squirrel Glider was not recorded in previous surveys.

Of particular note is the detection of the Greater Glider, and an active native beehive was also observed (in a Small Glider type box).

The threatened Greater Glider (listed as vulnerable under the EPBC Act) was not detected during Event 3 despite previously being recorded during Event 2 on two occasions (in zone R1 box 322, Large Forest Owl type box, and zone R3 box 334, Large Glider type box). This was considered likely to be the same individual as the inspections took place on different dates and the two boxes are within 180 metres.

Table 11: Nest box fauna

Fauna Group	Species	Event 1	Event 2	Event 3
Arboreal mammals	Short-eared Possum (<i>Trichosurus caninus</i>)		✓	
	Common Brushtail Possum (<i>Trichosurus vulpecula</i>)	✓	✓	✓
	Yellow-bellied Glider (<i>Petaurus australis</i>)		✓	✓
	Sugar Glider (<i>Petaurus breviceps</i>)	✓	✓	✓
	Greater Glider (<i>Petauroides volans</i>)		✓	
	Common Ringtail Possum (<i>Pseudocheirus peregrinus</i>)	✓	✓	
	Feathertail Glider (<i>Acrobates pygmaeus</i>)	✓	✓	✓
	Squirrel Glider (<i>Petaurus norfolkensis</i>)			✓
Scansorial mammals	Brown Antechinus (<i>Antechinus stuartii</i>)	✓	✓	✓
Flying mammals	Gould's Long-eared Bat (<i>Nyctophilus gouldi</i>)	✓	✓	✓
	Chocolate Wattled Bat (<i>Chalinolobus morio</i>)		✓	
	Lesser Long-eared Bat (<i>Nyctophilus geoffroyi</i>)			✓
Birds	Australian Owlet Nightjar (<i>Aegotheles chrisoptus</i>)	✓	✓	✓
	Scaly-breasted Lorikeet (<i>Trichoglossus chlorolepidotus</i>)		✓	✓
	Eastern Rosella (<i>Platycercus eximius</i>)			✓
	White-throated Treecreeper (<i>Cormobates leucophaea</i>)			✓
Reptiles	Lace Monitor (<i>Varanus varius</i>)	✓	✓	✓
	Carpet Python (<i>Morelia spilota</i>)		✓	

4.5.3 Design-specific use

The NBPoM proposed the installation of the following types of nest boxes:

- Scansorial fauna (Antechinus) (SF)
- Small glider (Feathertail Glider and Sugar Glider) (SG)
- Larger glider (Squirrel Glider, Yellow-bellied Glider, Greater Glider) (LG)
- Possum (Common Brushtail Possum, Short-eared Possum and Common Ringtail Possum) (Po)
- Microchiropteran bat (fluttering and direct flying species that utilise tree hollows) (MB)
- Medium sized parrot/Lorikeet (P/L)
- Cockatoo (Black Cockatoos)(Co)
- Small Owl (Southern Boobook and Barn Owl) (SO)
- Large Forest Owl (Masked Owl, Sooty Owl, Powerful Owl) (LFO)

Fauna observed to be occupying nest boxes at the time of monitoring or that were positively identified from feathers have been grouped into the above target groups. The cumulative fauna records (Events 1, 2 and 3) and their nest box use are provided in Table 12.

Scansorial fauna and small gliders have been found using boxes other than SF and SG boxes, but mostly in smaller sized nest box types (SF and SG). Large gliders were recorded in LG boxes and in the larger LFO and SO boxes, and the Microbat records were from MB type boxes. Possums have been recorded in a variety of

nest box types and sizes with most records from Po and LG boxes. The two Lorikeet records were from the same SG box, and other birds (White-throated Treecreeper and Owlet Nightjars) have been found occupying a range of box types. Similarly, reptiles have been found occupying a range of nest box types.

Overall, box types SF, SG, LG, Po, MB have all recorded occupancy by the target fauna group. P/L box type was used by non-target fauna, with the two Lorikeet records occurring in SG boxes, which are similar in dimensions to, but with a smaller entrance and shallower than, the P/L boxes. Box types Co, SO and LFO were not used by their target fauna, and these bird groups were not recorded using nest boxes.

Table 12: Nest box use

Fauna group	Nest box type								
	Scansorial Fauna	Small Glider	Large Glider	Possum	Microchiropteran Bat	Parrot/Lorikeet	Cockatoo	Small Owl	Large Forest Owl
Scansorial fauna	1	2			1			1	
Small Gliders	12	17		1	2	4			
Large Gliders			2					1	1
Possums			9	13		1	1	1	2
Microbats					5				
Parrots/lorikeets		2							
Cockatoos									
Small Owls									
Large Forest Owls									
Other birds	1		1	3		3		4	1
Reptiles	1		1	3		4	1	2	

4.5.4 Use by introduced or non-target species

The NBPoM identifies native and non-native pest species including the European Bee (*Apis mellifera*), exotic birds including Common Myna (*Acridotheres tristis*) and Common Starling (*Sturnus vulgaris*), and termites and ants. These fauna are considered pests for the nest box program as they compete with native/target fauna for nesting resources, create nests/hives that exclude target fauna, and introduce maintenance and longevity issues.

Use of nest boxes by ant or wasp (native and/or introduced) species was observed in 28 (6%) nest boxes, which is lower than the 62 (15%) of nest boxes observed in Events 1 and 2 combined.

Exotic birds were not recorded using the nest boxes while a total of 33 (7%) showed signs of use by European Bees (*cf.* 13% in Events 1 and 2). However the majority of the bee hives had been destroyed by the Small Hive Beetle and only one was observed to be active at the time of monitoring.

4.5.5 Maintenance

Overall, boxes were found to be in good condition with only six nest boxes (1.3%, *cf.* 3% in Events 1 and 2) requiring maintenance. Maintenance actions undertaken included the unblocking of drainage holes (two

boxes) and re-installation of fallen boxes (two boxes, E1_200 SO and A3_383 Po). Moderate termite damage was observed in two boxes (I7_314 LG and I7_315 MB), which will continue to be monitored for deterioration. Two Small Owl boxes (J1_255 and N1_362b) exhibited severe termite damage. These boxes were replaced on 21 February 2018. The old J1_255 was left in place (currently an active European Beehive) and the new box was installed above it.

4.6 Discussion

A summary of the cumulative monitoring results in relation to the performance indicators are provided in Table 13.

Table 13: Nest box performance indicators of success

Performance indicators of success	Discussion
Use of nest boxes by a wide range of native fauna species.	This performance indicator has been met. Eighteen native vertebrate fauna species, including three threatened species, have been recorded occupying boxes. Notable absentees were larger forest birds. Hollow-dependant hylid tree frogs were not observed, however some of these species may prefer hollows that retain water, which nest boxes are designed not to do.
Use of nest boxes designed for specific species by those same species.	This performance indicator has been met by 5 of the 9 nest box types. Nest box types SF, SG, LG, Po and MB boxes have all recorded use by target species. Nest box types P/L, Co, SO and LFO have not shown signs of use by target fauna (however these nest box types were used by other vertebrate fauna groups). The target fauna of these boxes were not recorded using any nest box type, with the exception of two Lorikeet records from the same SG box in consecutive inspections. Additional monitoring events are required to determine either the success of these box types or the need to review the use of these nest box types as compensatory habitat.
Low rate of use of nest boxes by introduced fauna species.*	This performance indicator has been met. Exotic birds have not been recorded using nest boxes and 7% of nest boxes showed signs of use by European Bees at the end of Event 3. The majority of hives had been destroyed by the Small Hive Beetle with only one active European Beehive at the end of Event 3.
Low level of maintenance of nest boxes.*	This performance indicator has been met. Only 1.3% of boxes required maintenance/replacement at the end of Event 3.

*= as per the bat roost boxes (Niche 2015), these levels/rates were not specified in the EMP, as such an arbitrary level/rate of ≤10% has been assigned.

4.7 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 nest box monitoring program are listed and discussed in Table 14.

Monitoring to date has shown high rates of use of nest boxes by native vertebrate fauna. Future monitoring events will provide information regarding the ongoing use of the nest boxes. The current recommendation is to continue monitoring as per the EMP.

Table 14: Nest box contingency measures

Potential Problem	Contingency Measure proposed in EMP	Discussion of proposed measure
Nest box being used by non-target species.	Review number and design of nest boxes.	<p>All nest box types showed use by non-target vertebrate fauna. As generalists, reptiles were expected, and observed to use a range of nest box types.</p> <p>LG boxes showed a relatively high use by possums which may exclude/compete with the targeted large gliders. Additional monitoring events are required to determine a trend or an increase in use of other box types by possums. Future consideration of exclusion methods for Brushtail Possums, such as installing metal guards around trees, to prevent predation and resource competition may be necessary.</p> <p>At this stage, the level of use by non-target native vertebrate fauna is not considered to warrant contingency measures.</p> <p>At this stage, the use of 6% of nest boxes by ants and wasps is not considered to warrant contingency measures. However should future monitoring observe ongoing and/or increasing use by these species, contingency measures may be required.</p> <p>This contingency measure is not considered relevant.</p>
Nest boxes become occupied by exotic or invasive fauna such as European Bees.	Review/modify nest box design to exclude undesirable species, treat nest boxes to deter/eradicate pest species, or relocate nest boxes.	<p>Exotic birds were not recorded using nest boxes and 7% of nest boxes showed signs of use by European Bees. The majority of hives had been destroyed by the Small Hive Beetle and only one nest box showed signs of recent use by this pest.</p> <p>This contingency measure is not considered relevant.</p>
Poor uptake or usage by native fauna species.	Review the types and numbers of nest box designs, their location or positioning within the tree.	<p>Eighteen species have been identified during monitoring, including three threatened species, and 51% of nest boxes were occupied or showed signs of use by native vertebrate fauna during Event 3. Nest box types P/L, Co, SO and LFO have not shown signs of use by target fauna (however these nest box types were used by other vertebrate fauna groups). The target fauna of these boxes were not recorded using any nest box type, with the exception of two Lorikeet records from the same SG box in consecutive inspections. Additional monitoring events are required to determine either the success of these box types or the need to review the use of these nest box types as compensatory habitat for these species. This contingency measure is not considered relevant.</p>
Nest boxes deteriorating rapidly and requiring maintenance.	Identify causes of nest box failure, modify design and construct accordingly.	<p>Only 1.3% of boxes required maintenance/replacement. Of these boxes two were severely damaged by termites and were replaced, others required unblocking of drainage holes or re-installation after falling from the tree. This contingency measure is not considered relevant.</p>

5. Microbat Roost Boxes

The roost box data for the winter 2017 monitoring period has been provided by two sources. The OH2Ku section was monitored by Sandpiper Ecological Services (Sandpiper 2017d) and the Ku2K section was monitored by Lewis Ecological Surveys (Lewis 2017c and Lewis 2017d). The reports and results are provided in Annex 4 and are summarised below.

5.1 Monitoring Framework and Timing

Roost boxes were installed prior to the commencement of construction (Year 0) in 2013, which was 6-12 months prior to the planned exclusion of bats from existing structures. The EMP states the following regarding monitoring timing:

“Monitoring of bat boxes will commence six months after their installation (Year 1), followed by quarterly inspections (each season) for two years (Years 2 and 3), before addressing corrective actions. After the first two years of monitoring, monitoring of the bat roost boxes will continue twice a year (summer and winter of Year 4, 6 and 8) up until Year 8.”

To date, the following construction monitoring events have been conducted and reported on as follows:

- Quarterly inspections:
 - Event 1-winter 2014, Event 2-spring 2014, Event 3-summer 2015, Event 4-autumn 2015, Event 5-winter 2015: (Niche 2015).
 - Event 6-spring 2015, Event 7-summer 2016, Event 8-autumn 2016: (Niche 2016b).
- Biannual inspections:
 - *Event 9-winter 2016* Ku2K: 4 – 22 August 2016 (Lewis 2016 and Niche 2017b).
 - *Event 9-spring 2016* OH2Ku: 26 – 27 September (Sandpiper 2016 and Niche 2017b).
 - *Event 10-summer 2017*: Niche 2017b.
 - OH2Ku: 11 January 2017 (Sandpiper 2017e).
 - Ku2K: 27 – 28 February 2017 (Lewis 2017e).
 - Event 11-winter 2017: current report.
 - OH2Ku: 5 September 2017 (Sandpiper 2017d).
 - Ku2K: 31 July – 1 August 2017 (Lewis 2017c).

Event 11 was the third biannual inspection after two years (Events 1- 8) of quarterly inspections. Due to the installation of roost boxes occurring in 2013 instead of 2014, an additional three biannual monitoring events were undertaken (Events 9 – 11). Three years (Years 4, 6 and 8 of the Project) of biannual operational monitoring commenced in summer 2018. The first two operational monitoring events (Events 12 and 13) have been reported on separately in a stand-alone report (Niche 2018b).

5.2 Performance Measures

The EMP specifies the performance indicators for roost boxes.

“Indicators of success of bat roost boxes include:

- *Use of bat roost boxes by microbats.*
- *Low rate of use of roost boxes by introduced fauna species.*
- *Low level of maintenance of roost boxes.”*

5.3 Roost Boxes and Additional Roost Structures Monitored

A total of 158 roost boxes were installed in late September/early October 2013. All installed boxes were initially tree mounted. Four boxes were destroyed in a wildfire in November 2016 and were replaced but relocated to adjacent culverts in January 2018 and were therefore not monitored in winter 2017. Another 12 boxes were removed by a landowner, resulting in a total of 142 bat roost boxes monitored during Event 11.

In addition to the roost boxes, 34 newly installed structures (including culverts and bridges) that may be used as roost habitat were identified during Event 9 and monitored during Event 10 as part of the recommended corrective actions (Niche 2016b and Niche 2017b). These structures were again monitored on two occasions in 2017 (summer and winter). Table 15 summarises the number of roost boxes and culverts monitored during biannual surveys.

Table 15: Roost box monitoring

	Event 9		Event 10		Event 11	
	Boxes	New structures	Boxes	New structures	Boxes	New structures
Ku2K	75	6	71	32	71	34
OH2Ku	83	0	83	0	71	0
Total	158	0	154	32	142	34

5.4 Methods

Roost boxes

The EMP, in accordance with the *Microchiropteran Bat Management Strategy* (MBMS) (Lewis 2013b), states that roost box monitoring will involve a visual inspection of each roost box and at each monitoring period, the following information will be collected for each roost box:

- Inspection date, weather conditions (rain, wind, cloud cover, ambient temperature) and time each bat roost box was inspected.
- Bat roost box identification number.
- If the bat roost box is occupied by Microbats, and if so, the species present. If the roost box is not occupied by a native species, record any signs of use by Microbats.
- Presence of pest species such as European Bees.
- Deterioration of the bat roost box and if any maintenance required.
- Any changes to the surrounding habitats, such as changes to flyways or vegetation structure.

Additional structures

Lewis 2017d states the following regarding monitoring of additional structures “Roost surveys involved a visual inspection of each culvert where it was safe to do so. This generally involved the use of a hand held torch (~200 lumens) to inspect each void with each bat identified to species level”.

5.5 Key results

To provide an overall picture of roost box results for the Project, OH2Ku and Ku2K results have been grouped in the following summary.

5.5.1 Roost boxes

Use by Microbats

No Microbats were recorded using the 152 inspected roost boxes during Event 11. This is generally consistent with monitoring results to date. Previously, occupation by Microbats has ranged from 0 to a maximum of approximately 4% during any one survey event. The Microbat species recorded have been Long-eared Bats (*Nyctophilus* spp.), which were not identified in the MBMS as inhabiting the mitigated structures. The target species, i.e. those identified during MBMS surveys: Little Bent-wing Bat (*Miniopterus australis*), Eastern Horseshoe Bat (*Rhinolophus megaphyllus*), Southern Myotis (*Myotis macropus*) and Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*), have to date not been recorded using the installed microbat roost boxes. As discussed in Niche 2016b, three of these target species are cave dwelling bats (Little Bent-wing Bat, Eastern Horseshoe Bat and Eastern Bent-wing Bat), and the Southern Myotis has only been found to use timber roost boxes when positioned directly over water. It is considered unlikely that these species will use the bat roost boxes currently installed due to their location and design.

Use by introduced/non-target species

Forty-four (31%) bat roost boxes were found to be occupied or show evidence of use by wasps, and likely use by Feathertail Gliders and *Antechinus* spp.. Evidence included mud wasp (*Sceliphron* sp.) nests (19 boxes, 13%), and leaf nests and scats (23 boxes, 16%). Two boxes were occupied at the time of inspection by Brown Antechinus (*Antechinus stuartii*) and a juvenile Lace Monitor (*Varanus varius*).

Fauna recorded

To date the following species have been recorded occupying the roost boxes:

- Gould’s Long-eared Bat (*Nyctophilus gouldi*)
- Lesser Long-eared Bat (*Nyctophilus geoffroyi*)
- Peron’s Tree Frog (*Litoria peronii*)
- Lace monitor
- Brown Antechinus.

Maintenance

All inspected boxes were in good condition except box 128 (ch.19650), which had collapsed from advanced dry rot. This box has since been replaced.

5.5.2 Additional roost structures

Of the 34 structures monitored (32 in summer 2017 and 34 in winter 2017), Microbats were recorded using seven structures during the summer surveys and 21 during the winter monitoring, resulting in known use by Microbats of 24 (70.5%) of the 34 structures. The following species were recorded using the structures:

- Little Bent-wing Bat: recorded from 16 structures including box culverts, round concrete pipes and bridges,
- Eastern Bent-wing Bat: recorded from two individuals using a box culvert,
- Southern Myotis: recorded from four box culverts; and
- Gould's Long-eared Bat: recorded from two box culverts.

While Gould's Long-eared bat has been recorded using the installed roost boxes, the Little Bent-wing Bat, Eastern Bent-wing Bat and Southern Myotis are new records for the Microbat monitoring and account for three of the four Microbat species identified as target species in the MBMS. These three species are currently listed as vulnerable species under the BC Act.

5.6 Discussion

A summary of Event 11 monitoring results in relation to the performance indicators is provided in Table 16. The use of roost boxes as a management measure for the target species has been unsuccessful. However, additional potential roost structure monitoring in the Ku2K section of the Project has found that newly installed bridges and culverts have provided additional roost habitat for these species and that these structures are rapidly colonised (within four months of construction).

Table 16: Roost box performance indicators of success

Performance indicators of success	Discussion
Use of bat roost boxes by microbats.	This performance indicator has not been met for Event 11. Microbats were not detected using roost boxes during Event 11. The absence of target species and the very low rate of use by Microbat species indicates that the use of timber roost boxes as a management measure for these species has to date been unsuccessful. Four species of Microbats, including three threatened MBMS target species, were detected using 24 of the 34 newly installed culverts and bridges along the Project alignment.
Low rate of use of roost boxes by introduced fauna species*.	This performance indicator has been met. 13% of boxes were used by mud wasps. There are both native and introduced <i>Sceliphron</i> species and a distinction was not possible. The use of the roost boxes by mud wasps is not considered a limiting factor in the occupation of the roost boxes by Microbat species.
Low level of maintenance of roost boxes*.	This performance indicator has been met. Only a single roost box required maintenance.

*= as per Niche 2015, these levels/rates were not specified in the EMP, as such an arbitrary level/rate of ≤10% has been assigned.

5.7 Recommendations

5.7.1 Corrective actions results

As required by the EMP, a number of corrective actions based on the absence of the target species from roost boxes were recommended at the end of two years of quarterly monitoring (Events 1 – 8) (Niche 2016b). The outcomes of the corrective actions undertaken in 2016/2017 were reported in Niche 2017b and new recommendations were made. The recommendations from Niche 2017b and the actions undertaken and outcomes are provided below in Table 17. Recommendations for ongoing monitoring are discussed in Table 18.

Table 17: Roost box 2016/2017 recommendations discussion

2016/2017 Recommendation	2016/2017 Recommendation/Action	Action outcome
Preliminary summer and winter inspection of additional structures within the Project with the potential to be used by microbats.	OH2Ku: As an inspection of the structures in the OH2Ku section of the Project was not undertaken in summer 2017, an inspection should be undertaken as soon as possible to determine the use of these structures by target species.	Ku2K: inspections of additional structures were undertaken, resulting in 24 of the 34 inspected structures showing signs of use by Microbats. OH2Ku: additional structure inspections were not undertaken.
Continued biannual (Year 4 and 6) inspection of additional structures.	The need for continued monitoring should be assessed once additional structures in both OH2Ku and Ku2K have been inspected and monitoring should be implemented prior to the next bat roost box monitoring event (summer 2018). If the additional structures are determined to provide suitable roosting habitat continued monitoring is not required.	Ku2K: continued biannual inspections of additional structures are not considered necessary as these structures have been found to provide suitable roosting habitat. OH2Ku: additional structure inspections have not been undertaken.
Subject to the outcome of the above recommendations, additional corrective actions may be required:		
Relocation of bat roost boxes directly above water.	The need to relocate installed roost boxes will be assessed based on the outcome of the summer/winter 2017 additional structures monitoring.	Ku2K: not considered necessary as Southern Myotis has been recorded using the additional structures. OH2Ku: additional structure inspections have not been undertaken.
Provisions of supplementary roosting habitat of different design / material in culverts and bridges	The four boxes that were burnt will be replaced and relocated to suitable underpass structures. The need to provide supplementary habitat in, or modify, culvert and bridge habitat to make it more suitable will be assessed based on the outcome of the summer/winter 2017 additional structures monitoring.	The four burnt boxes were replaced and relocated to underpasses in January 2018. Ku2k: not considered necessary as target Microbat species have been recorded using the additional structures. OH2Ku: additional structure inspections have not been undertaken.
Enhancement of habitat within artificial structures.	The need to enhance culvert and bridge habitat to make it more suitable will be assessed based on the outcome of the summer/winter 2017 additional structures monitoring.	Ku2k: not considered necessary as target Microbat species have been recorded using the additional structures. OH2Ku: additional structure inspections have not been undertaken.

Table 18: Roost box recommendations

Recommendation	Action
<p>Inspection of additional structures within the Project with the potential to be used by microbats.</p>	<p>Ku2K: Microbats have been recorded using 24 of the 34 inspected additional structures. These structures are considered to provide a combination of low, medium and high conservation value habitat (Lewis 2017d). Continued monitoring of these structures is not considered necessary.</p> <p>OH2Ku: To date an inspection of the structures in the OH2Ku section of the Project has not been undertaken. A number of culvert and bridge structures are present within the section of the Project and may provide roosting habitat. This is supported by the outcome of Ku2K additional structure surveys. In addition, Sandpiper 2017d report that <i>“newly constructed culverts and bridges along the OH2K alignment provide greater and more suitable roosting habitat for target species”</i>. An inspection of additional structures should be conducted to confirm use of these structures and determine their use by target species.</p>
<p>Relocation of bat roost boxes into adjacent culverts and under bridges.</p>	<p>Ku2K: not considered necessary as target Microbat species have been recorded using the construction features of the additional structures.</p> <p>OH2Ku: Sandpiper 2017d suggest that consideration be given to relocating a subset of bat roost boxes from forested areas to culverts and bridges. As use of the construction features of culverts and bridges by microbats has been shown in the Ku2K section of the Project, relocation of roost boxes may not be necessary and should be considered once Microbat use of additional structures can be confirmed.</p>

6. Landscape Monitoring

The landscaping and revegetation data for the 2017/2018 monitoring period has been provided by two sources: OH2Ku was provided by Lendlease and Ku2K was provided by Roads and Maritime Services. The data are provided in Annex 5. The results are summarised below.

6.1 Monitoring Framework and Timing

The EMP specifies the timing of the landscaping and revegetation monitoring as follows:

- *“Monitoring of landscaping would be conducted at 8 months and 12 months. The need for additional monitoring would be determined following analysis of the monitoring data.*
- *Maintenance of the landscaping and weeds would continue for the duration of the three year maintenance period or until such time as the revegetation is determined successful and is no longer requiring active management to maintain its survival.”*

To date, landscape and revegetation monitoring events have been reported on as follows:

- *2015/2016 monitoring: Niche 2016b*
- *2016/2017 monitoring: Niche2017b*
- *2017/2018 monitoring: current report*

Maintenance will continue for all sites for three years or until revegetation is determined successful, as per the EMP. Monitoring is to continue until all sites have undergone a 12 month inspection. Those sites that have not met the performance indicators at the 12 month inspection will be moved into the non-conformance system and, as per the EMP, will be closed out to the satisfaction of Roads and Maritime Services and the Landscape Representative or the Project Ecologist. These sites do not require any further formal monitoring. A final assessment of the success of the revegetation will be made at the end of the maintenance period and the need for further monitoring will be determined.

6.2 Performance Measures

The EMP specifies the following performance indicators for landscaping and revegetation:

“Indicators of success of landscaping and revegetation include:

- *Each area revegetated by native seeding must achieve the following minimum standards as assessed at 12 months following revegetation:*
 - *One native plant every 6 m²*
 - *Average minimum height of 15 cm, and*
 - *Native vegetation diversity to be assessed to the satisfaction of the Landscape Representative or the Project Ecologist.*
- *All areas required to be revegetated by native planting must achieve the following minimum standards as assessed at 12 months following revegetation:*
 - *Minimum plant growth of 30 cm following planting.*
 - *Minimum plant survival rate of 80%.*
- *Weed cover is less than 5% per restored area.”*

6.3 Monitoring Sites

6.3.1 Native seeding

A total of 188 native seeding revegetation monitoring sites exist within the Project for both the OH2Ku and Ku2K sections. Of the 188 sites, 91 have completed the 12 month monitoring period and were assessed in Niche 2017. The number of sites at each monitoring stage is provided in Table 19.

Table 19: Landscaping and revegetation monitoring stage

Section (data source)	8 month inspection (also 12 month)	12 month inspection (also 8 month)	Not commenced	Completed 12 month period	Total
OH2Ku (Lendlease)	58 (24)	29 (24)	1	37	101
Ku2K (McConnell Dowell OHL JV)	22 (18)	27 (18)	2	54	87
Total	80	56	3	91	188

6.3.2 Native planting

A total of 403 native planting monitoring sites exist within the Project for both the OH2Ku and Ku2K sections. Of the 403 sites, 201 underwent a 12 month inspection in the current monitoring period (July 2017 – July 2018 inclusive). The outcome of the 12 month inspection for these sites is discussed.

6.4 Methods

Monitoring of landscaping was conducted at eight months and 12 months.

6.4.1 Data limitations and assumptions

As discussed in Niche 2016b, a number of limitations exist in relation to the landscape monitoring data. These include:

- Data collection was not standardised across the two monitoring contractors.
- Parameters identified in the performance measures were not always specified in the data provided.
- Species information was not provided.
- Where information with respect to plant growth, density and distribution was provided, the data were generally descriptive, which does not allow for direct assessment against performance measures.

Roads and Maritime undertook a review of all the data, considering both recorded parameters as well as the descriptive records for each site to enable review and assessment against the required performance measures.

6.5 Native Seeding Results

Field data for monitoring surveys that were undertaken during the 2017/2018 monitoring period are provided in Annex 5. All 188 sites are listed and those sites that have met minimum criteria in the current or previous monitoring period are highlighted.

6.5.1 Eight month inspection

A total of 80 sites underwent an eight month inspection during the current monitoring period. Inspection results and eight month comments are provided in Annex 5. Forty-one of these sites also underwent a 12 month inspection, of which 19 (highlighted) were found to meet all 12 month minimum requirements.

6.5.2 Twelve month inspection

Twelve month inspection results are provided in Table 20 (OH2Ku) and Table 21 (Ku2K). A total of 57 sites were scheduled for a twelve month inspection during the current monitoring period. One site was not inspected as scheduled.

Of the 56 inspected sites, 24 were initially found to fulfil all minimum criteria with follow up surveys in July 2018 finding an additional four sites had met minimum criteria (highlighted). An additional 15 sites were considered to be progressing well but not yet meeting minimum height criteria. Four sites underwent additional treatment.

Table 20: Landscaping and revegetation – 12 month inspection data OH2Ku.

Site	C'way	12 month inspection date	12 month performance criteria met?	12 month inspection comments
Fill 2	NB	Oct-17	Y	Complies
Cut 3	NB	Jan-18	Y	Some issues with native seed mix strike, however still complies. Weed spray conducted during last monitoring period
Cut 3	SB	May-18	Y	Some issues with native seed mix strike, however still complies.
Fill 5A	SB	Jul-18	Missed inspection	
Fill 6	SB	Aug-17	N	Frangible shrubs growing. Suggest leaving these to keep weeds down. NCR raised and suggestion put forward to change design to Frangible Mix. Would meet criteria for frangible mix.
Fill 11	NB	Feb-18	N	Frangible shrubs growing. Suggest leaving these to keep weeds down. NCR raised and suggestion put forward to change design to Frangible Mix. Would meet criteria for frangible mix.
Fill 11	median	Feb-18	N	Frangible shrubs growing. Suggest leaving these to keep weeds down. NCR raised and suggestion put forward to change design to Frangible Mix. Would meet criteria for frangible mix.
Fill 11	SB	Feb-18	N	Frangible shrubs growing. Suggest leaving these to keep weeds down. NCR raised and suggestion put forward to change design to Frangible Mix. Would meet criteria for frangible mix.
Cut 12	SB	Oct-17	Y	Complies
Fill 13A		Feb-18	N	Convert to a pasture grass mix. Outside influences (farming) will dominate outcomes. NCR raised to change to pasture grass. Would meet 12-month criteria for pasture grass.
Fill 13B		Feb-18	N	Convert to a pasture grass mix. Outside influences (farming) will dominate outcomes. NCR raised to change to pasture grass. Would meet 12-month criteria for pasture grass.
Cut 14	NB	Jan-18	Y	Complies

Site	C'way	12 month inspection date	12 month performance criteria met?	12 month inspection comments
Cut 14	SB	Jan-18	Y	Complies
Fill 14	NB	Apr-18	Y	Complies
Fill 14	SB	Apr-18	Y	Complies
Cut 15	NB	Jan-18	Y	Complies - good native growth
Cut 15	SB	Jan-18	Y	Complies - good native growth
Haydons Wharf Interchange	East Inside	Jan-18	Y	Complies
Cut 16	NB	Jan-18	Y	Complies
Cut 17	NB	Jan-18	Y	Complies
Fill 17	NB	Jan-18	N	Weeds
Fill 18	NB	Feb-18	N	Weeds
Cut19B	NB	Oct-17	Y	Complies
Fill 19	NB	Jan-18	Y	Complies
Fill 20	NB	Jan-18	Y	Complies
Cut 22	NB	Feb-18	Y	Complies
Fill 22	NB	Oct-17	Y	Complies
Cut 23	NB	Feb-18	Y	Complies
Cut 23	SB	Feb-18	Y	Complies

C'way = carriageway, NB = northbound, SB = southbound, NA = not applicable as monitoring to be restarted, Y = yes, N = no.

Table 21: Landscaping and revegetation –12 month inspection data Ku2K.

Site	C'way	12 month inspection date	12 month performance criteria met	12 month inspection comments	Comments as at July 2018
Cut 2	NB	Dec-17	N	Similar observations to 8-month inspection.	Meets all criteria except height. Progressing well with good variation of natives. Continue to monitor to ensure height of natives reaches standard.
Cut 3	SB	Sep-17	N	Coverage OK, height and diversity improving but does not yet meet criteria. Weed spray undertaken.	Met criteria by Feb 2018
Fill 4	NB	Jul-18	Y - except height	Progressing well with good variation of natives. Continue to monitor to ensure height of natives reaches standard.	
Site 12	NB	May-18	Y - except height	Progressing well with good variation of natives. Continue to monitor to ensure height of natives reaches standard.	
Fill 5	NB	Mar-18	Y - except height	Progressing well with good variation of natives. Continue to monitor to ensure height of natives reaches standard.	
Fill 6	NB	Mar-18	Y	Meets criteria	
Fill 7	NB	Mar-18	Y - except height	Progressing well with good variation of natives. Continue to monitor to ensure height of natives reaches standard.	
Fill 8	NB	Jan-18	N	Coverage OK, however does not meet other criteria	Now meets all criteria except height: Progressing well with good variation of natives. Continue to monitor to ensure

Site	C'way	12 month inspection date	12 month performance criteria met	12 month inspection comments	Comments as at July 2018
					height of natives reaches standard.
Cut 8	NB	Dec-17	N	Coverage OK, height and diversity poor	Now meets all criteria except height: Progressing well with good variation of natives. Continue to monitor to ensure height of natives reaches standard.
Site 26A+B	NB	Jul-18	N	Coverage OK, height and diversity improving but does not yet meet criteria	
Fill 9	NB	Nov-17	N	Coverage OK, height and diversity poor	Progressing well - continue to monitor
Fill 10	NB	Apr-18	Y	Quantity, variety and condition meets standard.	
Cut 10	NB	Aug-17	Y	Quantity, variety and condition meets standard.	
Site 10	SB	Oct-17	N	Coverage OK, height and diversity poor	Met criteria by Feb 2018
Site 5B	SB	Oct-17	N	Coverage OK, height and diversity poor	Met criteria by Feb 2018
Fill 14	NB	May-18	Y	Complies	
Fill 15	NB	May-18	N	Coverage OK, height and diversity improving but does not yet meet criteria. Continue to monitor weed and native emergence.	
Fill 16	NB	May-18	Y - except height	Progressing well with good variation of natives. Continue to monitor to ensure height of natives reaches standard.	
Fill 19	SB	Dec-17	N	Coverage OK, height and diversity improving but does not yet meet criteria. Weed spray undertaken.	Met criteria by May 2018
Fill 19	NB	Dec-17	N	Poor batter coverage, height and native species diversity	Progressing well - continue to monitor
Cut 19	SB	Aug-17	N	Has required native diversity but height and coverage is low. Resprayed Oct-17 & Ecoblanket strips applied June-18	Continue to monitor to assess success of respray
Cut 19	NB	Sep-17	N	Has required native diversity but height and coverage is low. Resprayed Oct-17 & Ecoblanket strips applied June-18	Continue to monitor to assess success of respray
Cut 20	SB	Aug-17	N	Does not meet any criteria. Resprayed Oct-17 & Ecoblanket strips applied June-18	Continue to monitor to assess success of respray
Cut 20	NB	Sep-17	N	Does not meet any criteria. Resprayed Oct-17 & Ecoblanket strips applied June-18	Continue to monitor to assess success of respray
Cut 22A	NB	Apr-18	N	Coverage OK, however does not meet other criteria. Continue to monitor height and native emergence	Progressing well - continue to monitor
Cut 22B	NB	Mar-18	N	Coverage OK, however does not meet other criteria. Continue to monitor height and native emergence	Progressing well - continue to monitor
Cut 23	NB	Mar-18	N	Coverage OK, however does not meet other criteria. Continue to monitor height and native emergence	Progressing well - continue to monitor

C'way = carriageway, NB = northbound, SB = southbound, Y = yes, N = no.

6.5.3 Completed sites

Of the 92 sites where the 12 month monitoring period had been previously completed (2016/2017 monitoring), 56 had not met minimum performance criteria at the 12 month monitoring event (Table 22). Since this time, a follow-up monitoring event was undertaken by Roads and Maritime. As at July 2018, 41 of these sites were determined to meet the minimum criteria. Of the remaining 15 sites, six underwent further treatment and the remaining nine are expected to achieve minimum criteria within a year.

Table 22: Post 12 month sites requiring completion

Section	Site	C'way	Date of Sowing	8 month	12 month	Criteria met Jul-18	Comments
OH2Ku	Cut 1	NB	Mar-16	Nov-16	Mar-17	Y	Weed spraying in April 2018. Now meets criteria.
OH2Ku	Fill 1	NB	Mar-16	Nov-16	Mar-17	N	Issues with native grass mix - typically takes a long time to germinate
OH2Ku	Fill 10	SB	Dec-2015	Aug-16	Dec-16	Y	Complies
OH2Ku	Fill 13C		Jul-2016	Mar-17	Jul-17	N	Convert to a pasture grass mix. Outside influences (farming) will dominate outcomes. NCR raised to change to pasture grass. Would meet 12-month criteria for pasture grass.
OH2Ku	Cut 18	NB	May-2016	Jan-17	May-17	N	Needs weed spraying - done during reporting period.
OH2Ku	Cut 20	NB	Dec-2015	Aug-16	Dec-16	Y	Complies
OH2Ku	Cut 21	NB	Dec-2015	Aug-16	Dec-16	Y	Complies
OH2Ku	Blackmans Pt. I/change	East	Sep-2015	May-16	Sep-16	Y	Complies
OH2Ku	Cut 12	NB	Nov-2015	Jul-16	Nov-16	Y	Although greater % of tall shrubs than frangibles
OH2Ku	Fill 7	SB	Jul-2015	Mar-16	Jul-16	Y	Complies
OH2Ku	Cut 9	NB	Sep 2015	May-16	Sep-16	N	Doesn't meet quantity requirement - should improve with time so propose to continue monitoring. Good native grass, no wattle
OH2Ku	Cut 10	NB	Nov-2015	Jul-16	Nov-16	Y	Complies
OH2Ku	Cut 11	SB	Sep-2015	May-16	Sep-16	Y	Complies
OH2Ku	Cut 13	NB	Sep-2015	May-16	Sep-16	Y	Complies
OH2Ku	Fill 16	NB	Sep-2015	May-16	Sep-16	Y	Complies
OH2Ku	Cut 19A	NB	Dec-15	Aug-16	Dec-16	N	Needs weed spraying - done during reporting period.
OH2Ku	Fill 23	NB	Jun-2015	Feb-16	Jun-16	Y	Complies
OH2Ku	Cut 24	NB	Sep-2015	May-16	Sep-16	Y	Complies
Ku2K	Fill 1	SB	Aug-2015	Apr-16	Aug-16	Y	Met criteria by Feb 2018
Ku2K	Fill 2	SB	Aug-2015	Apr-16	Aug-16	Y	Met criteria by Feb 2018
Ku2K	Cut 3	NB	Sep-2015	May-16	Sep-16	Y	Met criteria by Feb 2018
Ku2K	Fill 4	SB	Jul-2015	Mar-16	Jul-16	Y	Met criteria by Feb 2018
Ku2K	Fill 5	SB	Sep-2015	May-16	Sep-16	Y	Met criteria by Feb 2018
Ku2K	Fill 6	SB	Sep-2015	May-16	Sep-16	Y	Met criteria by Feb 2018
Ku2K	Fill 7	SB	Oct-2015	Jun-16	Oct-16	Y	Met criteria by Feb 2018
Ku2K	Cut 7	SB	Sep-2015	May-16	Sep-16	Y	Met criteria by Feb 2018
Ku2K	Fill 8	SB	Oct-2015	Jun-16	Oct-16	Y	Met criteria by Feb 2018
Ku2K	Fill 9	SB	Aug-2015	Apr-16	Aug-16	Y	Met criteria by Feb 2018
Ku2K	Fill 9	SB	Jan-2016	Sep-16	Jan-17	Y	Met criteria by Feb 2018

Section	Site	C'way	Date of Sowing	8 month	12 month	Criteria met Jul-18	Comments
Ku2K	Fill 10	SB	Apr-2016	Dec-16	Apr-17	Y	Met criteria by Feb 2018
Ku2K	Fill 10	NB	Jan-2016	Sep-16	Jan-17	Y	Met criteria by May 2018
Ku2K	Cut 10	SB	Feb-2016	Oct-16	Feb-17	Y	Met criteria by July 2018
Ku2K	Cut 10	NB	Feb-2016	Oct-16	Feb-17	N	Meets all criteria except height
Ku2K	Site 2	NB	Feb-2016	Oct-16	Feb-17	N	Meets all criteria except height
Ku2K	Fill 11	SB	Nov-2015	Jul-16	Nov-16	N	High clay content in topsoil causing compaction issues. Old TB29.55 footprint supplemented with plantings, otherwise vegetation coverage meeting standard.
Ku2K	Fill 11	NB	Nov-2015	Jul-16	Nov-16	N	Part of batter resprayed. Continue to monitor the rest of batter ensure height of natives reaches standard.
Ku2K	Cut 12	SB	Oct-2015	Jun-16	Oct-16	Y	Met criteria by Feb 2018
Ku2K	Fill 13	SB	Sep-2015	May-16	Sep-16	Y	Met criteria by Feb 2018
Ku2K	Cut 13	SB	Oct-2015	Jun-16	Oct-16	Y	Met criteria by Feb 2018
Ku2K	Fill 16	SB	Apr-2016	Dec-16	Apr-17	N	Meets all criteria except height
Ku2K	Cut 16	SB	Mar-2016	Nov-16	Mar-17	Y	Met criteria by July 2018
Ku2K	Fill 17	NB	May-2016	Jan-17	May-17	N	Progressing well - continue to monitor
Ku2K	Cut 17	SB	Dec-2015	Aug-16	Dec-16	Y	Met criteria by Feb 2018
Ku2K	Fill 18	NB	Nov-2015	Jul-16	Nov-16	N	Progressing well - continue to monitor
Ku2K	Fill 18	SB	Jun-2016	Feb-17	Jun-17	Y	Met criteria by May 2018
Ku2K	Cut 18	SB	Sep-2015	May-16	Sep-16	N	Does not meet any criteria. Resprayed Oct-17 & Ecoblanket strips applied June-18
Ku2K	Cut 18	NB	Sep-2015	May-16	Sep-16	N	Does not meet any criteria. Resprayed Oct-17 & Ecoblanket strips applied June-18
Ku2K	Fill 20	SB	Sep-2015	May-16	Sep-16	Y	Met criteria by Feb 2018
Ku2K	Cut 20	SB	Sep-2015	May-16	Sep-16	Y	Met criteria by Feb 2018
Ku2K	Cut 20	SB	Dec-2015	Aug-16	Dec-16	Y	Met criteria by Feb 2018
Ku2K	Fill 21	SB	Mar-2016	Nov-16	Mar-17	Y	Met criteria by Feb 2018
Ku2K	Fill 21	NB	Apr-2016	Dec-16	Apr-17	Y	Met criteria by Feb 2018
Ku2K	Cut 21	NB	Dec-2015	Aug-16	Dec-16	N	Meets all criteria except height
Ku2K	Fill 22	SB	Apr-2016	Dec-16	Apr-17	Y	Met criteria by Feb 2018
Ku2K	Fill 22	NB	Nov-2015	Jul-16	Nov-16	Y	Met criteria by Feb 2018
Ku2K	Fill 23	SB	Apr-2016	Dec-16	Apr-17	Y	Met criteria by Feb 2018

C'way = carriageway, NB = northbound, SB = southbound, Y = yes, N = no.

6.6 Native Planting Results

Field data for monitoring surveys that were undertaken during the 2017/2018 monitoring period are provided in Annex 5. All 403 sites are listed and those sites that have met minimum criteria are highlighted.

6.6.1 Twelve month inspection

Of the 201 sites that underwent a 12 month inspection, 145 were determined to have met all the 12 month minimum criteria. Table 23 summarises the monitoring sites and the sites that have met the minimum 12 month criteria for both sections of the Project. While the majority of sites from the OH2Ku section of the Project were determined to have met the minimum 12 month criteria, only 25% of the Ku2K sites met minimum criteria. The majority of the Ku2K sites that did not meet minimum criteria were due to a low plant survival rate. These sites have been included in a plant replacement program.

Table 23: Native planting site and result summary

Section (data source)	Monitoring sites	Completed 12 month period	12 month criteria met
OH2Ku (Lendlease)	263	112	109 (97.3%)
Ku2K (McConnell Dowell OHL JV)	140	140	36 (25.7%)
Total	403	201	145 (72.1%)

6.7 Discussion

A summary of the 2017/2018 monitoring results in relation to the performance measures for native seeding and native planting is provided in Table 24.

Table 24: Landscaping and revegetation performance measures

Performance indicators of success	Discussion
<p>Each area revegetated by native seeding must achieve the following minimum standards as assessed at 12 months following revegetation:</p> <ul style="list-style-type: none"> One native plant every 6 m² Average minimum height of 15 cm Native vegetation diversity to be assessed to the satisfaction of the Landscape Representative or the Project Ecologist <p>Weed cover is less than 5% per restored area.</p>	<p>These performance indicators of success have been met to date by 105 (70.9%) of the 148 sites that have reached the 12 month monitoring point.</p> <p>The remaining 43 sites are considered to be progressing well, with only 10 requiring further treatment.</p>
<p>All areas required to be revegetated by native planting must achieve the following minimum standards as assessed at 12 months following revegetation:</p> <ul style="list-style-type: none"> Minimum plant growth of 30 cm following planting. Minimum plant survival rate of 80%. Weed cover is less than 5% per restored area. 	<p>These performance indicators of success has been met to date by 145 (72.1%) of the 201 sites that have reached the 12 month monitoring point.</p> <p>The majority of the remaining sites that have reached the 12 month monitoring point require plant replacement.</p>

6.8 Recommendations

The EMP lists potential problems and contingency measures for various components of the monitoring program, however specific contingency measures for landscaping and revegetation monitoring have not been provided within the EMP. However, the EMP states:

“Maintenance of the landscaping and weeds would continue for the duration of the three year maintenance period as outlined in Section 6 or until such time as the revegetation is determined successful and is no longer requiring active management to maintain its survival.” And, “If these performance indicators are not achieved a non-conformance would be raised, to be closed out to the satisfaction of Roads and Maritime, and the Landscape Representative or the Project Ecologist.”

6.8.1 Native seeding

Of the 148 sites that have undergone a 12 month assessment to date, 43 have not met the performance indicators. Although formal monitoring is no longer required at these sites, it is recommended that monitoring should continue while monitoring of other sites is ongoing, and all actions deemed appropriate, such as herbicide treatment, respraying or reworking, should be undertaken. This may result in more sites reaching minimum standards, as growth and density may improve with time. A complete assessment of landscaping and revegetation works should be undertaken once all sites have undergone a 12 month assessment, as per the EMP.

6.8.2 Native planting

Of the 201 sites that have undergone a 12 month assessment, 56 have not met the performance indicators. Minimum plant survival rates were not achieved at the majority of these sites. As such, Roads and Maritime have commenced a plant replacement program, resulting in the gradual replacement of plants at these sites. It is recommended that monitoring should continue while monitoring of other sites is ongoing, and all actions deemed appropriate, such as plant replacement, herbicide treatment, respraying or reworking, should be undertaken to maximise survival and chances of meeting the 12 month performance indicators.

References

GHD (2010) Oxley Highway to Kempsey Environmental Assessment. Report prepared for the Roads and Maritime Services.

Lewis, B.D (2013a). Oxley Highway to Kempsey: Nest Box Plan of Management. Report prepared for SMEC-Hyder Joint Venture by Lewis Ecological Surveys.

Lewis, B. D. (2013b). Pacific Highway Upgrade: Oxley Highway to Kempsey Microchiropteran Bat Management Strategy. Prepared for Roads and Maritime Services by Lewis Ecological Surveys.

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

Lewis, B. (2016). Kundabung to Kempsey Bat Box Monitoring: Episode 9 Winter (2016). Letter Report by Lewis Ecological Surveys to McConnell Dowell Constructors (Aust) Pty Ltd.

Lewis, B.D. (2017a). Kundabung to Kempsey Nest Box Monitoring: Year 2 (Winter). Report prepared for the K2K Joint Venture by Lewis Ecological Surveys.

Lewis, B.D. (2017b). Kundabung to Kempsey Nest Box Monitoring: Year 1. Report prepared for the K2K Joint Venture by Lewis Ecological Surveys.

Lewis, B. (2017c). Kundabung to Kempsey Bat Box Monitoring: Episode 11 Winter (2017). Letter Report by Lewis Ecological Surveys to McConnell Dowell Constructors (Aust) Pty Ltd.

Lewis, B. (2017d). Micro bat monitoring of newly installed structures on the Kundabung to Kempsey Pacific Highway Upgrade. Letter report prepared by Lewis Ecological Surveys for the Kundabung to Kempsey Joint Venture.

Lewis, B. (2017e). Kundabung to Kempsey Bat Box Monitoring: Episode 10 Summer (2017). Letter Report by Lewis Ecological Surveys to McConnell Dowell Constructors (Aust) Pty Ltd

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

Niche (2015). OH2K Pacific Highway Upgrade. Annual Ecological Monitoring Report 2015. Prepared by Niche Environment and Heritage Pty Ltd for Roads and Maritime Services, Port Macquarie, NSW.

Niche (2016a). Road kill report 2015/2016- Oxley Highway to Kempsey, Pacific Highway Upgrade. Prepared by Niche Environment and Heritage Pty Ltd for Roads and Maritime Services, Port Macquarie, NSW.

Niche (2016b). OH2K Pacific Highway Upgrade. Annual Ecological Monitoring Report 2016. Prepared by Niche Environment and Heritage Pty Ltd for Roads and Maritime Services, Port Macquarie, NSW.

Niche (2017a). Road kill monitoring 2016/2017- Oxley Highway to Kempsey, Pacific Highway Upgrade. Prepared by Niche Environment and Heritage Pty Ltd for Roads and Maritime Services, Port Macquarie, NSW.

Niche (2017b). OH2K Pacific Highway Upgrade. Annual Ecological Monitoring Report 2017. Prepared by Niche Environment and Heritage Pty Ltd for Roads and Maritime Services, Port Macquarie, NSW.

Niche (2018a). Nest box monitoring 2017/2018 - Oxley Highway to Kempsey, Pacific Highway Upgrade. Prepared by Niche Environment and Heritage Pty Ltd for Roads and Maritime Services, Port Macquarie, NSW.

Niche (2018b). Microbat roost box monitoring 2017/2018 - Oxley Highway to Kempsey, 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.

Sandpiper (2016). Pacific Highway Upgrade: OH2K bat box monitoring and corrective action assessment – spring 2016. Letter report prepared for Lendlease Engineering by Sandpiper Ecological Surveys.

Sandpiper (2017a). Pacific Highway Upgrade: Oxley Highway to Kundabung Nest box monitoring – winter 2017. Letter report prepared for Lendlease Engineering by Sandpiper Ecological Surveys

Sandpiper (2017b). Pacific Highway Upgrade: Oxley Highway to Kundabung Nest box monitoring – winter 2016. Letter report prepared for Lendlease Engineering by Sandpiper Ecological Surveys.

Sandpiper (2017c). Pacific Highway Upgrade: Oxley Highway to Kundabung Nest box monitoring – summer 2017. Letter report prepared for Lendlease Engineering by Sandpiper Ecological Surveys.

Sandpiper (2017d). Pacific Highway Upgrade: OH2K bat box monitoring – winter 2017. Letter report prepared for Lendlease Engineering by Sandpiper Ecological Surveys.

Sandpiper (2017e). Pacific Highway Upgrade: OH2K bat box monitoring – summer 2016. Letter report prepared for Lendlease Engineering by Sandpiper Ecological Surveys.

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	Wilsons 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	Wilsons floodplain	482627	6534164	Eastern Grey Kangaroo	Large ground dwelling mammal
117	Opening	OH2Ku stage 1	summer	01/12/2017	7:30	8:30	Wilsons 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 Wilsons 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)

Field data is provided within the report.

Annex 3. Nest box monitoring winter 2017

Event 3 – OH2Ku winter 2017 report (Sandpiper 2017a)

Field data is provided within the report.

Event 3 – Ku2K winter 2017 report (Lewis 2017a)

Field data is provided within the report.

Annex 4. Microbat roost box monitoring winter 2017

Event 11– OH2Ku winter 2017 report (Sandpiper 2017d)

Field data is provided within the report.

Event 11 – Ku2K winter 2017 report (Lewis 2017c)

Field data provided by Ben Lewis below.

Event 11 – Ku2K winter 2017 data

Box	Roost Box Type	Height of Roost Box (m)	Aspect	Tenure	APO (MRS Identifier)	Easting	Northing	Lewis Record Number	Date Recorded	Bats	Species Name	Common Name	Number	Comments
2	Dark green wedge box	3.3	North-east	Private property (Tipping)	72	483308	6546221	55	31.07.2017	-	-	-	-	
3	Light green box	3.2	North	Private property (Tipping)	72	483304	6546224	56	31.07.2017	-	-	-	-	old leaves
4	Black slot box	3.1	North	Private property (Tipping)	72	483300	6546234	57	31.07.2017	-	-	-	-	
5	Light green wedge box	3.3	North-east	Private property (Tipping)	72	483304	6546265	52	31.07.2017	-	-	-	-	old leaves
6	Light green box	3.3	North-east	Private property (Tipping)	72	483291	6546261	51	31.07.2017	-	-	-	-	old leaves
7	Hollow home standard box	3.8	North	Private property (Tipping)	72	483285	6546263	50	31.07.2017	-	-	-	-	
8	Hollow home standard box	3.6	North-west	Private property (Tipping)	72	483365	6546215	53	31.07.2017	-	-	-	-	
9	Black wedge box	3.6	North	Private property (Tipping)	72	483363	6546214	54	31.07.2017	-	-	-	-	
10	Dark green slot box	3.6	North-east	RMS. Within project boundary	-	483089	6546636	8	31.07.2017	-	-	-	-	
11	Light green wedge box	3	North	RMS. Within project boundary	-	483104	6546631	7	31.07.2017	-	-	-	-	
12	Hollow home standard box	3.6	North	RMS. Within project boundary	-	483099	6546659	5	31.07.2017	-	-	-	-	
13	Hollow home standard box	3.6	North	RMS. Within project boundary	-	483108	6546629	6	31.07.2017	-	-	-	-	
14	Black wedge box	3.6	North-west	RMS. Within project boundary	-	483094	6546659	4	31.07.2017	-	-	-	-	
15	Dark green box	3.4	North-west	RMS. Within project boundary	-	483090	6546663	3	31.07.2017	-	-	-	-	
16	Light green slot box	2.9	North	Private property (Toepfer)	63	483297	6544838	10	31.07.2017	-	-	-	-	
17	Black wedge box	3.1	North	Private property (Toepfer)	63	483294	6544837	11	31.07.2017	-	-	-	-	old leaves

Box	Roost Box Type	Height of Roost Box (m)	Aspect	Tenure	APO (MRS Identifier)	Easting	Northing	Lewis Record Number	Date Recorded	Bats	Species Name	Common Name	Number	Comments
18	Dark green box	3.5	North-west	Private property (Toepfer)	63	483266	6544792	14	31.07.2017	-	-	-	-	old leaves
19	Hollow home narrow box	3.5	North-west	Private property (Toepfer)	63	483273	6544815	13	31.07.2017	-	-	-	-	
20	Light green wedge box	3.1	North-west	Private property (Toepfer)	63	483269	6544829	12	31.07.2017	-	-	-	-	
21	Hollow home slot box	3.3	North-west	Private property (Toepfer)	63	483295	6544847	9	31.07.2017	-	-	-	-	new leaves
22	Black slot box	3	North-west	Private property (Hambly)	81	483300	6548665	41	31.07.2017	-	-	-	-	
23	Hollow home narrow box	3.8	North-west	Private property (Hambly)	81	483309	6548657	43	31.07.2017	-	-	-	-	
24	Light green wedge box	3.5	North-west	Private property (Hambly)	81	483331	6548673	44	31.07.2017	-	-	-	-	old leaves
25	Light green wedge box	3.7	North	RMS. Within project boundary	-	483256	6548645	46	31.07.2017	-	-	-	-	
26	Black box	3	North	RMS. Within project boundary	-	483247	6548642	45	31.07.2017	-	-	-	-	old leaves
27	Hollow home slot box	3	North	RMS. Within project boundary	-	483293	6548662	42	31.07.2017	-	-	-	-	mud wasps
28	Hollow home narrow box	3.7	North-west	RMS. Within project boundary	-	483128	6548696	49	31.07.2017	-	-	-	-	
29	Dark green slot box	3	North	RMS. Within project boundary	-	483136	6548674	47	31.07.2017	-	-	-	-	
30	Hollow home standard box	3.6	North	Private property (Brayley)	70	483119	6546266	59	31.07.2017	-	-	-	-	
31	Dark green wedge box	3.4	North-east	RMS. Within project boundary	-	482881	6542409	69	01.08.2017	-	-	-	-	old leaves
32	Hollow home narrow box	3.3	North-west	Private property (Brayley)	70	483113	6546282	58	01.08.2017	-	-	-	-	

Box	Roost Box Type	Height of Roost Box (m)	Aspect	Tenure	APO (MRS Identifier)	Easting	Northing	Lewis Record Number	Date Recorded	Bats	Species Name	Common Name	Number	Comments
35	Light green slot box	3	North	Private property (Brayley)	70	483060	6546309	60	01.08.2017	-	-	-	-	Brown Antechinus x 2 photographed
36	Hollow home slot box	3.1	North-west	RMS. Within project boundary	-	482871	6542405	68	01.08.2017	-	-	-	-	leaves on inner chamber mud wasp on outer chamber
37	Hollow home narrow box	3.5	North	RMS. Within project boundary	-	482873	6542400	67	01.08.2017	-	-	-	-	
38	Light green box	3.6	North-west	RMS. Within project boundary	-	482861	6542374	66	01.08.2017	-	-	-	-	old leaves
46	Light green box	4	North-west	RMS. Within project boundary	-	483133	6554725	32	31.07.2017	-	-	-	-	old leaves
47	Hollow home narrow box	3.8	North-west	State Forest	87	483146	6554719	33	31.07.2017	-	-	-	-	
49	Dark green wedge box	3.5	North-west	RMS. Within project boundary	-	483141	6554709	34	31.07.2017	Burnt	Burnt	Burnt	Burnt	Burnt
50	Dark green slot box	3.4	North	RMS. Within project boundary	-	483030	6554309	38	31.07.2017	-	-	-	-	
51	Hollow home standard box	4	North	State Forest	87	483152	6554745	31	31.07.2017	-	-	-	-	
52	Hollow home narrow box	3.6	North-west	State Forest	87	483074	6554384	39	31.07.2017	Burnt	Burnt	Burnt	Burnt	Burnt
53	Dark green box	3.3	North	State Forest	87	483082	6554378	40	31.07.2017	Burnt	Burnt	Burnt	Burnt	Burnt
54	Hollow home standard box	3.7	North	RMS. Within project boundary	-	483040	6554317	37	31.07.2017	Burnt	Burnt	Burnt	Burnt	Burnt
55	Hollow home narrow box	3.6	North	State Forest	87	483051	6554333	36	31.07.2017	-	-	-	-	
56	Black wedge box	3.7	North-west	State Forest	87	483051	6554342	35						
57	Dark green wedge box	3.5	North	State Forest	57	482770	6542094	73	01.08.2017	-	-	-	-	
58	Black slot box	3.1	North	State Forest	57	482779	6542119	74	01.08.2017	-	-	-	-	
59	Hollow home standard box	3.8	North-	State Forest	57	482730	6542081	71	01.08.2017	-	-	-	-	mud wasps

Box	Roost Box Type	Height of Roost Box (m)	Aspect	Tenure	APO (MRS Identifier)	Easting	Northing	Lewis Record Number	Date Recorded	Bats	Species Name	Common Name	Number	Comments
			west											
61	Hollow home narrow box	3.3	North-west	State Forest	57	482734	6542074	70	01.08.2017	-	-	-	-	mud wasps
62	Light green wedge box	3.2	North	State Forest	57	482727	6542070	75	01.08.2017	-	-	-	-	mud wasps
63	Black box	3.1	North	RMS. Within project boundary	-	482722	6542109	72	01.08.2017	-	-	-	-	old leaves
64	Hollow home slot box	3.3	North-west	State Forest	57	482859	6542360	65	01.08.2017	-	-	-	-	
65	Hollow home standard box	3.5	North	State Forest	57	482834	6542316	64	01.08.2017	-	-	-	-	mud wasps
66	Dark green box	3.2	North	RMS. Within project boundary	-	482837	6542340	63	01.08.2017	-	-	-	-	old leaves
67	Black box	3.3	North-east	RMS. Within project boundary	-	482839	6542332	62	01.08.2017	-	-	-	-	old leaves
68	Black wedge box	3.5	North	State Forest	57	482829	6542290	61	01.08.2017	-	-	-	-	old leaves
95	Hollow home slot box	3.8	North-west	State Forest	57	483195	6543189	29	01.08.2017	-	-	-	-	
96	Hollow home slot box	3.8	North	State Forest	57	483201	6543172	28	01.08.2017	-	-	-	-	mud wasps inner chamber
97	Hollow home standard box	3.7	North	State Forest	57	483180	6543172	27	01.08.2017	-	-	-	-	
98	Dark green wedge box	4	North-west	RMS. Within project boundary	0	483172	6543195	24	01.08.2017	-	-	-	-	
99	Black box	3.1	North-east	State Forest	57	483175	6543170	25	01.08.2017	-	-	-	-	old leaves
100	Light green slot box	3.4	North-east	State Forest	57	483189	6543198	30	01.08.2017	-	-	-	-	
101	Black slot box	3.5	North	State Forest	57	483180	6543166	26	01.08.2017	-	-	-	-	
130	Hollow home narrow box	3.6	North	Private property (Parkin property)	58	483339	6543362	22	31.07.2017	-	-	-	-	
131	Dark green slot box	3.6	North-	Private property (Parkin	58	483322	6543389	17	31.07.2017	-	-	-	-	

Box	Roost Box Type	Height of Roost Box (m)	Aspect	Tenure	APO (MRS Identifier)	Easting	Northing	Lewis Record Number	Date Recorded	Bats	Species Name	Common Name	Number	Comments
			west	property)										
132	Hollow home slot box	3.7	North	Private property (Parkin property)	58	483280	6543368	21	31.07.2017	-	-	-	-	
133	Hollow home slot box	3.6	North-east	Private property (Parkin property)	58	483288	6543386	18	31.07.2017	-	-	-	-	
134	Hollow home slot box	3.1	North-east	Private property (Parkin property)	58	483302	6543361	19	31.07.2017	-	-	-	-	
135	Black slot box	3.2	North	Private property (Parkin property)	58	483303	6543387	16	31.07.2017	-	-	-	-	
136	Hollow home slot box	3.8	North	Private property (Parkin property)	58	483298	6543382	15	31.07.2017	-	-	-	-	
137	Hollow home slot box	3.3	North-west	Private property (Parkin property)	58	483343	6543367	23	31.07.2017	-	-	-	-	
138	Hollow home standard box	3.7	North	Private property (Parkin property)	58	483306	6543364	20	31.07.2017	-	-	-	-	mud wasps
139	Hollow homes standard box	3.9	North	Private property (Mobbs)	60	483279	6543729	1	31.07.2017	-	-	-	-	mud wasps
140	Hollow home slot box	3.6	North-west	Private property (Mobbs)	60	483288	6543727	2	31.07.2017	-	-	-	-	
28B	Black wedge box	3.4	North	RMS. Within project boundary	-	483127	6548693	48	31.07.2017	-	-	-	-	

2017 Additional structures survey report (Lewis 2017d)

Field data is provided within the report.

Annex 5. Landscape and revegetation monitoring 2017/2018

Native seeding data OH2Ku.

Refined data provided by Roads and Maritime (extracted by Roads and Maritime from data collected by Lendlease). Sites that have reached minimum 12 month criteria in the current or previous monitoring periods are highlighted. C'way = carriageway, NB = northbound, SB = southbound.

Site	C'way	Vegetation Community Type	Date of Hydromulch	8 month inspection	8 month inspection comments	12 month inspection	12 month criteria met	12 month inspection comments	As at July 2018 comments (12 month criteria met)
Cut 1	NB	Tall Shrubs	Mar-16	Nov-16		Mar-17			Weed spraying in April 2018. Now meets criteria.
Fill 1	NB	Frangible Shrubs	Mar-16	Nov-16		Mar-17			Issues with native grass mix - typically takes a long time to germinate
Fill 1	SB	Native Grasses/ frangible shrubs	Nov-17	Jul-18	Weeds sprayed April 2018	Nov-18			
Cut 2A	NB	Tall Shrubs	Feb-2016	Oct-16		Feb-17	Y		Met in 2016/2017 monitoring
Cut 2B	NB	Tall Shrubs	Feb-2016	Oct-16		Feb-17	Y		Met in 2016/2017 monitoring
Cut 2	SB	Tall Shrubs	Nov-2017	Jul-18	Good growth	Nov-18			
Fill 2	NB	Tall Shrubs	Oct-16	Jun-17		Oct-17	Y	Complies	
Fill 2	SB	Tall Shrubs	Nov-2017	Jul-18	Upper batter re sprayed for finishing works. Rest of batter conforms	Nov-18			
Cut 3	NB	Frangible Shrubs/Native Grasses	Jan-17	Sep-17	Complies	Jan-18	Y	Some issues with native seed mix strike, however still complies. Weed spray conducted during last monitoring period	
Cut 3	SB	Frangible Shrubs/Native Grasses	May-17	Jan-18	Meets requirement for 12 months	May-18	Y	Some issues with native seed mix strike, however still complies.	
Fill 3	NB	Native Grasses	May-16	Jan-17		May-17	Y		Met in 2016/2017 monitoring
Fill 3	SB	Frangible shrubs/ tall shrubs	Oct-2017	Jun-18	Complies	Oct-18			
Cut 4	SB	Frangible shrubs	Oct-2017	Jun-18	Complies. Weed spray conducted during	Oct-18			

Site	C'way	Vegetation Community Type	Date of Hydromulch	8 month inspection	8 month inspection comments	12 month inspection	12 month criteria met	12 month inspection comments	As at July 2018 comments (12 month criteria met)
					last reporting period				
Cut 4	NB	Frangible Shrubs/Native Grasses	Oct-17	Jun-18	Some issues with native seed mix strike, however still complies. Fleabane present summer 2018	Oct-18			
Fill 4	NB	Native Grasses	Jul-2016	Mar-17		Jul-17	Y		Met in 2016/2017 monitoring
Fill 4	SB	Tall shrubs	Oct-2017	Jun-18	Does not comply, however this batter is predominantly retained veg dominated by lantana	Oct-18			
Cut 5	NB	Tall shrubs/Frangible Shrubs	Sep-15	May-16		Sep-16	Y		Met in 2016/2017 monitoring
Cut 5	SB	Frangible Shrubs/Native Grasses	Oct-2017	Jun-18	Complies	Oct-18			
Cut 5	Service Road	Frangible Shrubs/Tall shrubs/Native Grasses	Oct-2017	Jun-18	Did not comply due to weeds - weed spray conducted during last reporting period	Oct-18			
Fill 5A	NB	Frangible Shrubs/Native Grasses	Oct-2017	Jun-18	Did not comply due to weeds - weed spray conducted during last reporting period	Oct-18			
Fill 5A	SB	Frangible Shrubs/Native Grasses	July-2017	Mar-18	Thick cover crop suppressing potential seed germination.	Jul-18	Missed inspection		
Fill 5A	Service Road	Frangible Shrubs/Native Grasses	Oct-2017	Jun-18	Thick cover crop suppressing potential seed germination. Review after 12 month period as per Section 8 of R178	Oct-18			
Fill 5B	NB	Frangible Shrubs/Native Grasses	Nov-2017	Jul-18	Thick cover crop suppressing potential seed germination. Review after 12 month period as per Section 8 of R178	Nov-18			
Fill 5B	SB	Frangible Shrubs/Native Grasses	Oct-2017	Jun-18	Thick cover crop suppressing potential seed germination. Review after 12 month period as per Section 8 of R179	Oct-18			
Fill 5B	Service Road	Frangible Shrubs/Native Grasses	Nov-2017	Jul-18	Weed control required - sprayed during last reporting period	Nov-18			
Fill 5C	NB	Pasture Grasses	Nov-2017	Jul-18	Pasture is present, requires another season	Nov-18			

Site	C'way	Vegetation Community Type	Date of Hydromulch	8 month inspection	8 month inspection comments	12 month inspection	12 month criteria met	12 month inspection comments	As at July 2018 comments (12 month criteria met)
Fill 5C	SB	Pasture Grasses	Nov-2017	Jul-18	Pasture is present, requires another season	Nov-18			
Fill 5D	NB	Pasture Grasses	Nov-2017	Jul-18	Pasture is present, requires another season	Nov-18			
Fill 5D	SB	Pasture Grasses	Nov-2017	Jul-18	Pasture is present, requires another season	Nov-18			
Fill 5E	NB	Pasture Grasses	Sep-2017	May-18	Pasture is present, requires another season	Sep-18			
Fill 5E	SB	Pasture Grasses	Sep-2017	May-18	Pasture is present, requires another season	Sep-18			
Cut 6	NB	Native Grasses	Nov-2017	Jul-18	Issues with native grass mix - typically takes a long time to germinate	Nov-18			
Cut 6	SB	Native Grasses	Nov-2017	Jul-18	Issues with native grass mix - typically takes a long time to germinate	Nov-18			
Fill 6	NB	Frangible Shrubs/Native Grasses	Jul-2015	Mar-16		Jul-16	Y		Met in 2016/2017 monitoring
Fill 6	SB	Native Grasses	Aug-2016	Apr-17		Aug-17	N	Frangible shrubs growing. Suggest leaving these to keep weeds down. NCR raised and suggestion put forward to change design to Frangible Mix. Would meet criteria for frangible mix.	
Workshop site	NB		Nov-2017	Jul-18	Weed control required - sprayed during last reporting period	Nov-18			
Cut 7	NB	Frangible Shrubs	Jul-2015	Mar-16		Jul-16	Y		Met in 2016/2017 monitoring
Cut 7	SB	Frangible Shrubs	Jul-2015	Mar-16		Jul-16	Y		Met in 2016/2017 monitoring
Fill 7	NB	Frangible Shrubs/Native Grasses	Jul-2015	Mar-16		Jul-16	Y		Met in 2016/2017 monitoring
Fill 7	SB	Frangible Shrubs/Native Grasses	Jul-2015	Mar-16		Jul-16	Y		complies
Cut 8	NB	Tall shrubs/Frangible	Jul-2015	Mar-16		Jul-16	Y		Met in 2016/2017 monitoring

Site	C'way	Vegetation Community Type	Date of Hydromulch	8 month inspection	8 month inspection comments	12 month inspection	12 month criteria met	12 month inspection comments	As at July 2018 comments (12 month criteria met)
		Shrubs							
Cut 8	SB	Tall shrubs/Frangible Shrubs	Jul-2015	Mar-16		Jul-16	Y		Met in 2016/2017 monitoring
Cut 9	NB	Frangible Shrubs	Sep 2015	May-16		Sep-16			Doesn't meet quantity requirement - should improve with time so propose to continue monitoring. Good native grass, no wattle
Cut 9	SB	Frangible Shrubs	Sep 2015	May-16		Sep-16	Y		Met in 2016/2017 monitoring
Blackmans Point Interchange	West	Tall Shrubs	Dec-2017	Aug-18		Dec-18			
Blackmans Point Interchange	East	Frangible Shrubs	Sep-2015	May-16		Sep-16	Y		complies
Blackmans Point Road	Blackmans Point Road	Frangible Shrubs/Native Grasses	Apr-16	Dec-16		Apr-17	Y		Met in 2016/2017 monitoring
Fill 9	NB	Tall Shrubs	Nov-2017	Jul-18	Weed control required - sprayed during last reporting period	Nov-18			
Fill 9	SB	Tall Shrubs	Nov-2017	Jul-18	Weed control required - sprayed during last reporting period	Nov-18			
Cut 10	NB	Native Grasses	Nov-2015	Jul-16		Nov-16	Y		Complies
Fill 10	NB	Native Grasses	Nov-2017	Jul-18	Complies	Nov-18			
Fill 10	SB	Tall shrubs/Native Grasses	Dec-2015	Aug-16		Dec-16	Y		complies
Cut 11	NB	Frangible Shrubs	Nov-2015	Jul-16		Nov-16	Y		Met in 2016/2017 monitoring
Cut 11	SB	Tall shrubs/Frangible Shrubs	Sep-2015	May-16		Sep-16	Y		complies
Cut 11	Centre	Tall shrubs/Frangible	Sept-2017	May-18	Some growth although low in numbers -	Sep-18			

Site	C'way	Vegetation Community Type	Date of Hydromulch	8 month inspection	8 month inspection comments	12 month inspection	12 month criteria met	12 month inspection comments	As at July 2018 comments (12 month criteria met)
		Shrubs			re-asses at 12 month anniversary				
Fill 11	NB	Native Grasses	Feb-17	Oct-17	See 12 month comments	Feb-18	N	Frangible shrubs growing. Suggest leaving these to keep weeds down. NCR raised and suggestion put forward to change design to Frangible Mix. Would meet criteria for frangible mix.	
Fill 11	median	Native Grasses	Feb-17	Oct-17	See 12 month comments	Feb-18	N	Frangible shrubs growing. Suggest leaving these to keep weeds down. NCR raised and suggestion put forward to change design to Frangible Mix. Would meet criteria for frangible mix.	
Fill 11	SB	Native Grasses	Feb-17	Oct-17	See 12 month comments	Feb-18	N	Frangible shrubs growing. Suggest leaving these to keep weeds down. NCR raised and suggestion put forward to change design to Frangible Mix. Would meet criteria for frangible mix.	
Cut 12	NB	Tall shrubs/Frangible Shrubs	Nov-2015	Jul-16		Nov-16	Y		Met in 2016/2017 monitoring
Cut 12	SB	Frangible Shrubs	Oct-16	Jun-17		Oct-17	Y	Complies	
Fill 12	NB	Frangible Shrubs	Nov-2015	Jul-16		Nov-16	Y		Met in 2016/2017 monitoring
Fill 12	SB	Frangible Shrubs	Nov-2015	Jul-16		Nov-16	Y		Met in 2016/2017 monitoring
Cut 13	NB	Frangible Shrubs	Sep-2015	May-16		Sep-16	Y		complies
Fill 13A		Native Grasses	Feb-17	Oct-17	See 12 month comments	Feb-18	N	Convert to a pasture grass mix. Outside influences (farming) will dominate outcomes. NCR raised to change to pasture grass. Would meet 12-month criteria for pasture grass.	
Fill 13B		Native Grasses	Feb-17	Oct-17	See 12 month comments	Feb-18	N	Convert to a pasture grass mix. Outside influences (farming) will dominate outcomes. NCR raised to change to pasture grass. Would meet 12-month criteria for pasture grass.	

Site	C'way	Vegetation Community Type	Date of Hydromulch	8 month inspection	8 month inspection comments	12 month inspection	12 month criteria met	12 month inspection comments	As at July 2018 comments (12 month criteria met)
Fill 13C		Pasture Grasses	Jul-2016	Mar-17		Jul-17			Convert to a pasture grass mix. Outside influences (farming) will dominate outcomes. NCR raised to change to pasture grass. Would meet 12-month criteria for pasture grass.
Fill 13D		Pasture Grasses	Nov-2017	Jul-18	Convert to a pasture grass mix. Outside influences (farming) will dominate outcomes. NCR raised to change to pasture grass.	Nov-18			
Fill 13E	NB	Tall Shrubs	Sept-2017	May-18	Convert to a pasture grass mix. Outside influences (farming) will dominate outcomes. NCR raised to change to pasture grass.	Sep-18			
Fill 13E	SB	Tall Shrubs	Nov-2017	Jul-18	Convert to a pasture grass mix. Outside influences (farming) will dominate outcomes. NCR raised to change to pasture grass.	Nov-18			
Fill 13F		Tall shrubs/Frangible Shrubs	Nov-2017	Jul-18	Convert to a pasture grass mix. Outside influences (farming) will dominate outcomes. NCR raised to change to pasture grass.	Nov-18			
Cut 14	NB	Frangible Shrubs	Jan-17	Sep-17	Complies	Jan-18	Y	Complies	
Cut 14	SB	Frangible Shrubs	Jan-17	Sep-17	Complies	Jan-18	Y	Complies	
Fill 14	NB	Frangible Shrubs/Native Grasses	April-2017	Dec-17	Complies	Apr-18	Y	Complies	
Fill 14	SB	Frangible Shrubs/Native Grasses	April-2017	Dec-17	Complies	Apr-18	Y	Complies	
Cut 15	NB	Frangible Shrubs	Jan-17	Sep-17	Did not comply	Jan-18	Y	Complies - good native growth	
Cut 15	SB	Frangible Shrubs	Jan-17	Sep-17	Did not comply	Jan-18	Y	Complies - good native growth	
Fill 15	NB	Frangible Shrubs	Nov-2017	Jul-18	Weeds - sprayed during last reporting period	Nov-18			

Site	C'way	Vegetation Community Type	Date of Hydromulch	8 month inspection	8 month inspection comments	12 month inspection	12 month criteria met	12 month inspection comments	As at July 2018 comments (12 month criteria met)
Fill 15	SB	Frangible Shrubs	Nov-2017	Jul-18	Weeds - sprayed during last reporting period	Nov-18			
Haydons Wharf Interchange	East Inside	Frangible Shrubs	Jan-17	Sep-17	Complies	Jan-18	Y	Complies	
Cut 16	NB	Frangible Shrubs	Jan-17	Sep-17	Complies	Jan-18	Y	Complies	
Fill 16	NB	Frangible Shrubs	Sep-2015	May-16		Sep-16	Y		Complies
Cut 17	NB	Frangible Shrubs	Jan-17	Sep-17	Complies	Jan-18	Y	Complies	
Fill 17	NB	Tall shrubs/Native Grasses	Jan-17	Sep-17	Needs weed spray - done during reporting period.	Jan-18	N	Weeds	
Cut 18	NB	Frangible Shrubs/Native Grasses	May-2016	Jan-17		May-17			Needs weed spraying - done during reporting period.
Fill 18	NB	Tall Shrubs	Feb-17	Oct-17	Needs weed spray - done during reporting period.	Feb-18	N	Weeds	
Cut 19A	NB	Frangible Shrubs	Dec-15	Aug-16		Dec-16			Needs weed spraying - done during reporting period.
Cut19B	NB	Tall Shrubs	Oct-16	Jun-17		Oct-17	Y	Complies	
Fill 19	NB	Tall Shrubs	Jan-17	Sep-17	Did not comply	Jan-18	Y	Complies	
Cut 20	NB	Tall Shrubs	Dec-2015	Aug-16		Dec-16	Y		Complies
Fill 20	NB	Tall Shrubs	Jan-17	Sep-17	Did not comply	Jan-18	Y	Complies	
Cut 21	NB	Tall Shrubs	Dec-2015	Aug-16		Dec-16	Y		complies
Cut 22	NB	Tall Shrubs	Feb-17	Oct-17	Complies	Feb-18	Y	Complies	
Fill 22	NB	Tall Shrubs	Oct-16	Jun-17		Oct-17	Y	Complies	
Yarrabee NB island	NB	Frangible Shrubs	Sept-2017	May-18	Complies although needs weed spray - done during reporting period.	Sep-18			
Cut 23	NB	Tall Shrubs	Feb-2017	Oct-17	Complies	Feb-18	Y	Complies	
Fill 23	NB	Frangible Shrubs	June-2015	Feb-16		Jun-16	Y		Complies

Site	C'way	Vegetation Community Type	Date of Hydromulch	8 month inspection	8 month inspection comments	12 month inspection	12 month criteria met	12 month inspection comments	As at July 2018 comments (12 month criteria met)
Cut 23	SB	Frangible Shrubs	Feb-17	Oct-17	Complies	Feb-18	Y	Complies	
Fill 23	SB	Frangible Shrubs	June-2015	Feb-16		Jun-16	Y		Met in 2016/2017 monitoring
Cut 24	NB	Tall shrubs/Frangible Shrubs	Sept-2015	May-16		Sep-16	Y		Complies
Cut 24	SB	Tall shrubs/Frangible Shrubs	Sep-2015	May-16		Sep-16	Y		Met in 2016/2017 monitoring
Fill 24	SB	Frangible Shrubs	Sep-2015	May-16		Sep-16	Y		Met in 2016/2017 monitoring

Native seeding data Ku2K

Refined data provided by Roads and Maritime (extracted by Roads and Maritime from data collected by Roads and Maritime). Sites that have met the minimum 12 month criteria in the current or in previous monitoring periods are highlighted. C'way = carriageway. NB = northbound, SB = southbound.

Cut/Fill	C'way	Bench	Hydroseed / Hydromulch Date	8 month inspection	8 month inspection comments	12 month inspection	12 month criteria met	12 month inspection comments	Comments as at July 2018 (12 month criteria met)
Fill 1	SB		Aug-2015	Apr-16		Aug-16	Y		Met criteria by Feb 2018
Fill 1	NB		Aug-2017	Apr-18		Aug-18			Meets all criteria except height
Fill 2	SB		Aug-2015	Apr-16		Aug-16	Y		Met criteria by Feb 2018
Cut 2	NB		Dec-2016	Aug-17	Poor batter coverage, height and native species diversity	Dec-17	N	Similar observations to 8-month inspection.	Meets all criteria except height. Progressing well with good variation of natives. Continue to monitor to ensure height of natives reaches standard.
Cut 3	NB	Bottom	Sep-2015	May-16		Sep-16	Y		Met in 2016/2017 monitoring
Cut 3	NB	Top	Sep-2015	May-16		Sep-16	Y		Met criteria by Feb 2018
Cut 3	SB		Sep-2016	May-17		Sep-17	N	Coverage OK, height and diversity improving but does not yet meet criteria. Weed spray undertaken.	Met criteria by Feb 2018
Cut 3	SB	rest area median	Jun-2016	Feb-17		Jun-17	Y		Met in 2016/2017 monitoring
Fill 4	SB		Jul-2015	Mar-16		Jul-16	Y		Met criteria by Feb 2018
Fill 4	SB	Nth Mingaletta	Sep-2015	May-16		Sep-16	Y		Met in 2016/2017 monitoring
Fill 4	NB		Jul-2017	Mar-18	Poor batter coverage, height and native species diversity	Jul-18	Y - except height	Progressing well with good variation of natives. Continue to monitor to ensure height of natives reaches standard.	
Site 12	NB		May-2017	Jan-18	Meets coverage criteria but not other criteria	May-18	Y - except height	Progressing well with good variation of natives. Continue to monitor to ensure height of natives reaches standard.	
Fill 5	SB	Drainage	Sep-2015	May-16		Sep-16	Y		Met in 2016/2017 monitoring
Fill 5	SB		Sep-2015	May-16		Sep-16	Y		Met criteria by Feb 2018

Cut/Fill	C'way	Bench	Hydroseed / Hydromulch Date	8 month inspection	8 month inspection comments	12 month inspection	12 month criteria met	12 month inspection comments	Comments as at July 2018 (12 month criteria met)
Fill 5	NB		Mar-2017	Nov-17	Coverage OK, height and diversity poor	Mar-18	Y - except height	Progressing well with good variation of natives. Continue to monitor to ensure height of natives reaches standard.	
Cut 5	SB		Jul-2015	Mar-16		Jul-16	Y		Met in 2016/2017 monitoring
Fill 6	SB		Sep-2015	May-16		Sep-16	Y		Met criteria by Feb 2018
Fill 6	NB		Mar-2017	Nov-17	Coverage OK, height and diversity poor	Mar-18	Y	Meets criteria	
Cut 6	SB		Jul-2015	Mar-16		Jul-16	Y		Met in 2016/2017 monitoring
Fill 7	SB		Oct-2015	Jun-16		Oct-16	Y		Met criteria by Feb 2018
Fill 7	NB		Mar-2017	Nov-17	Coverage OK, height and diversity poor	Mar-18	Y - except height	Progressing well with good variation of natives. Continue to monitor to ensure height of natives reaches standard.	
Cut 7	SB		Sep-2015	May-16		Sep-16	Y		Met criteria by Feb 2018
Fill 8	SB		Oct-2015	Jun-16		Oct-16	Y		Met criteria by Feb 2018
Fill 8	NB		Jan-2017	Sep-17	Coverage OK, height and diversity poor	Jan-18	N	Coverage OK, however does not meet other criteria	Now meets all criteria except height: Progressing well with good variation of natives. Continue to monitor to ensure height of natives reaches standard.
Cut 8	SB		Oct-2015	Jun-16		Oct-16	Y		Met in 2016/2017 monitoring
Cut 8	NB	sth Upper Smiths	Dec-2016	Aug-17	Poor batter coverage, height and native species diversity	Dec-17	N	Coverage OK, height and diversity poor	Now meets all criteria except height: Progressing well with good variation of natives. Continue to monitor to ensure height of natives reaches standard.
Cut 8	NB		Aug-2017	Apr-18	Progressing well with good variation of natives. Continue to monitor to ensure height of natives reaches standard.	Aug-18			
Site 26A+B	NB		Jul-2017	Mar-18	Coverage OK, height and diversity improving but does not yet meet criteria	Jul-18	N	Coverage OK, height and diversity improving but does not yet meet criteria	

Cut/Fill	C'way	Bench	Hydroseed / Hydromulch Date	8 month inspection	8 month inspection comments	12 month inspection	12 month criteria met	12 month inspection comments	Comments as at July 2018 (12 month criteria met)
Fill 9	SB	drainage	Aug-2015	Apr-16		Aug-16	Y		Met criteria by Feb 2018
Fill 9	SB		Jan-2016	Sep-16		Jan-17	Y		Met criteria by Feb 2018
Fill 9	NB		Nov-2016	Jul-17		Nov-17	N	Coverage OK, height and diversity poor	Progressing well - continue to monitor
Fill 10	SB		Apr-2016	Dec-16		Apr-17	Y		Met criteria by Feb 2018
Fill 10	NB	Smiths Creek to C28.68	Jan-2016	Sep-16		Jan-17	Y		Met criteria by May 2018
Fill 10	NB	C28.68 to off ramp drain	Apr-2017	Dec-17	Coverage OK, height and diversity poor	Apr-18	Y	Quantity, variety and condition meets standard.	
Cut 10	SB		Feb-2016	Oct-16		Feb-17	Y		Met criteria by July 2018
Cut 10	NB	Off ramp drain	Aug-2016	Apr-17		Aug-17	Y	Quantity, variety and condition meets standard.	
Cut 10	NB		Feb-2016	Oct-16		Feb-17			Meets all criteria except height
Site 16	SB	Material Reuse Site No 16	Apr-2016	Dec-16		Apr-17	Y		Met in 2016/2017 monitoring
Site 2	NB	Material Reuse Site No 2	Feb-2016	Oct-16		Feb-17			Meets all criteria except height
Fill 11	SB		Nov-2015	Jul-16		Nov-16			High clay content in topsoil causing compaction issues. Old TB29.55 footprint supplemented with plantings, otherwise vegetation coverage meeting standard.
Fill 11	NB		Nov-2015	Jul-16		Nov-16			Part of batter resprayed. Continue to monitor the rest of batter ensure height of natives reaches standard.
Site 10	SB		Oct-2016	Jun-17		Oct-17	N	Coverage OK, height and diversity poor	Met criteria by Feb 2018
Cut 11	SB		Sep-2015	May-16		Sep-16	Y		Met in 2016/2017 monitoring

Cut/Fill	C'way	Bench	Hydroseed / Hydromulch Date	8 month inspection	8 month inspection comments	12 month inspection	12 month criteria met	12 month inspection comments	Comments as at July 2018 (12 month criteria met)
Fill 12	SB		Oct-2015	Jun-16		Oct-16	Y		Met in 2016/2017 monitoring
Fill 12	NB		Aug-2017	Apr-18	Progressing well with good variation of natives. Continue to monitor to ensure height of natives reaches standard.	Aug-18			
Site 5B	SB		Oct-2016	Jun-17		Oct-17	N	Coverage OK, height and diversity poor	Met criteria by Feb 2018
Cut 12	SB		Oct-2015	Jun-16		Oct-16	Y		Met criteria by Feb 2018
Fill 13	SB		Sep-2015	May-16		Sep-16	Y		Met criteria by Feb 2018
Cut 13	SB		Oct-2015	Jun-16		Oct-16	Y		Met criteria by Feb 2018
Fill 14	SB		Mar-2016	Nov-16		Mar-17	Y		Met in 2016/2017 monitoring
Fill 14	NB		May-2017	Jan-18	Poor batter coverage, height and native species diversity	May-18	Y	complies	
Cut 14	SB		Mar-2016	Nov-16		Mar-17	Y		Met in 2016/2017 monitoring
Fill 15	SB		Mar-2016	Nov-16		Mar-17	Y		Met in 2016/2017 monitoring
Fill 15	NB		May-2017	Jan-18	Poor batter coverage, height and native species diversity	May-18	N	Coverage OK, height and diversity improving but does not yet meet criteria. Continue to monitor weed and native emergence.	
Cut 15	SB		Jan-2016	Sep-16		Jan-17	Y		Met in 2016/2017 monitoring
Cut 15	NB		Sep-2018	May-19		Sep-19			
Fill 16	SB		Apr-2016	Dec-16		Apr-17			Meets all criteria except height
Fill 16	NB		May-2017	Jan-18	Some deep rilling to be repaired (done). Area below verge sprayed Sept-18.	May-18	Y - except height	Progressing well with good variation of natives. Continue to monitor to ensure height of natives reaches standard.	
Cut 16	SB		Mar-2016	Nov-16		Mar-17	Y		Met criteria by July 2018
Cut 16	NB		Sep-2018	May-19		Sep-19			

Cut/Fill	C'way	Bench	Hydroseed / Hydromulch Date	8 month inspection	8 month inspection comments	12 month inspection	12 month criteria met	12 month inspection comments	Comments as at July 2018 (12 month criteria met)
Fill 17	NB		May-2016	Jan-17		May-17			Progressing well - continue to monitor
Cut 17	SB		Dec-2015	Aug-16		Dec-16	Y		Met criteria by Feb 2018
Fill 18	NB		Nov-2015	Jul-16		Nov-16			Progressing well - continue to monitor
Fill 18	SB		Jun-2016	Feb-17		Jun-17	Y		Met criteria by May 2018
Cut 18	SB		Sep-2015	May-16		Sep-16			Does not meet any criteria. Resprayed Oct-17 & Ecoblanket strips applied June-18
Cut 18	NB		Sep-2015	May-16		Sep-16			Does not meet any criteria. Resprayed Oct-17 & Ecoblanket strips applied June-18
Fill 19	SB		Dec-2016	Aug-17	Coverage OK, height and diversity poor	Dec-17	N	Coverage OK, height and diversity improving but does not yet meet criteria. Weed spray undertaken.	Met criteria by May 2018
Fill 19	NB		Dec-2016	Aug-17	Poor batter coverage, height and native species diversity	Dec-17	N	Poor batter coverage, height and native species diversity	Progressing well - continue to monitor
Cut 19	SB		Aug-2016	Apr-17		Aug-17	N	Has required native diversity but height and coverage is low. Resprayed Oct-17 & Ecoblanket strips applied June-18	Continue to monitor to assess success of respray
Cut 19	NB		Sep-2016	May-17		Sep-17	N	Has required native diversity but height and coverage is low. Resprayed Oct-17 & Ecoblanket strips applied June-18	Continue to monitor to assess success of respray
Fill 20	SB		Sep-2015	May-16		Sep-16	Y		Met criteria by Feb 2018
Fill 20	NB		Sep-2015	May-16		Sep-16	Y		Met in 2016/2017 monitoring
Cut 20	SB	Top	Sep-2015	May-16		Sep-16	Y		Met criteria by Feb 2018
Cut 20	SB	Middle	Dec-2015	Aug-16		Dec-16	Y		Met criteria by Feb 2018
Cut 20	SB	Bottom	Aug-2016	Apr-17		Aug-17	N	Does not meet any criteria. Resprayed Oct-17 & Ecoblanket strips applied June-18	Continue to monitor to assess success of respray
Cut 20	NB		Sep-2016	May-17		Sep-17	N	Does not meet any criteria. Resprayed Oct-17 & Ecoblanket strips applied June-18	Continue to monitor to assess success of respray

Cut/Fill	C'way	Bench	Hydroseed / Hydromulch Date	8 month inspection	8 month inspection comments	12 month inspection	12 month criteria met	12 month inspection comments	Comments as at July 2018 (12 month criteria met)
Fill 21	SB		Mar-2016	Nov-16		Mar-17	Y		Met criteria by Feb 2018
Fill 21	NB		Apr-2016	Dec-16		Apr-17	Y		Met criteria by Feb 2018
Cut 21	NB		Dec-2015	Aug-16		Dec-16			Meets all criteria except height
Cut 21	SB		Dec-2015	Aug-16		Dec-16	Y		Met in 2016/2017 monitoring
Fill 22	SB		Apr-2016	Dec-16		Apr-17	Y		Met criteria by Feb 2018
Fill 22	NB		Nov-2015	Jul-16		Nov-16	Y		Met criteria by Feb 2018
Cut 22A	NB		Apr-2017	Dec-17	Coverage OK, height and diversity poor	Apr-18	N	Coverage OK, however does not meet other criteria. Continue to monitor height and native emergence	Progressing well - continue to monitor
Cut 22B	NB		Mar-2017	Nov-17	Coverage OK, height and diversity poor	Mar-18	N	Coverage OK, however does not meet other criteria. Continue to monitor height and native emergence	Progressing well - continue to monitor
Fill 23	SB		Apr-2016	Dec-16		Apr-17	Y		Met criteria by Feb 2018
Fill 23	NB		Aug-2017	Apr-18	Coverage OK, however does not meet other criteria. Continue to monitor height and native emergence	Aug-18	Y		Met in 2016/2017 monitoring
Cut 23	NB		Mar-2017	Nov-17	Coverage OK, height and diversity poor	Mar-18	N	Coverage OK, however does not meet other criteria. Continue to monitor height and native emergence	Progressing well - continue to monitor

Native planting data OH2Ku

Refined data provided by Roads and Maritime (extracted by Roads and Maritime from data collected by Lendlease). Sites that have met the minimum 12 month criteria are highlighted.

RMS Bed ID	Planting Date	12 month Review Due	12 month compliance	12 month comments
285	27/07/2016	Jul-17	Yes	
288	27/07/2016	Jul-17	Yes	
290	27/07/2016	Jul-17	Yes	
291	27/07/2016	Jul-17	Yes	
292	27/07/2016	Jul-17	Yes	
293	27/07/2016	Jul-17	Yes	
294	27/07/2016	Jul-17	Yes	
295	27/07/2016	Jul-17	Yes	
296	27/07/2016	Jul-17	Yes	
297	27/07/2016	Jul-17	Yes	
303	27/07/2016	Jul-17	Yes	
305	27/07/2016	Jul-17	Yes	
306	27/07/2016	Jul-17	Yes	
120	15/09/2016	Sep-17	Yes	
120B	15/09/2016	Sep-17	Yes	
121	15/09/2016	Sep-17	Yes	
122	15/09/2016	Sep-17	Yes	
123	15/09/2016	Sep-17	Yes	
131	15/09/2016	Sep-17	Yes	
133	15/09/2016	Sep-17	Yes	
298	15/09/2016	Sep-17	Yes	
299	15/09/2016	Sep-17	Yes	
300	15/09/2016	Sep-17	Yes	
11	20/09/2016	Sep-17	Yes	Treat diseased tree species by B&K
12	20/09/2016	Sep-17	Yes	Treat diseased tree species by B&K
136	20/09/2016	Sep-17	Yes	
301	20/09/2016	Sep-17	Yes	
2	21/09/2016	Sep-17	Yes	
3	21/09/2016	Sep-17	Yes	
6	21/09/2016	Sep-17	Yes	
7	21/09/2016	Sep-17	Yes	
9	21/09/2016	Sep-17	Yes	
10	21/09/2016	Sep-17	Yes	
16	21/09/2016	Sep-17	Yes	
17	21/09/2016	Sep-17	Yes	
19	21/09/2016	Sep-17	Yes	
20	21/09/2016	Sep-17	Yes	
21	21/09/2016	Sep-17	Yes	

RMS Bed ID	Planting Date	12 month Review Due	12 month compliance	12 month comments
127	21/09/2016	Sep-17	Yes	
132	21/09/2016	Sep-17	Yes	
200	21/09/2016	Sep-17	Yes	Reduced numbers to 200 per a bed
202	21/09/2016	Sep-17	Yes	
22	20/10/2016	Oct-17	Yes	
25	20/10/2016	Oct-17	Yes	
26	20/10/2016	Oct-17	Yes	
27	20/10/2016	Oct-17	Yes	
28	20/10/2016	Oct-17	Yes	
29	20/10/2016	Oct-17	Yes	
30	20/10/2016	Oct-17	Yes	
34	21/10/2016	Oct-17	Yes	
35	21/10/2016	Oct-17	Yes	
36	21/10/2016	Oct-17	Yes	
39	21/10/2016	Oct-17	Yes	
46	21/10/2016	Oct-17	Yes	
47	21/10/2016	Oct-17	Yes	
63	21/10/2016	Oct-17	Yes	
65	21/10/2016	Oct-17	Yes	
8	25/10/2016	Oct-17	No	
225	16/11/2016	Nov-17	Yes	
226	16/11/2016	Nov-17	Yes	
227	16/11/2016	Nov-17	Yes	
228	16/11/2016	Nov-17	Yes	
234	02/02/2017	Feb-18	Yes	
235	02/02/2017	Feb-18	Yes	
240	02/02/2017	Feb-18	Yes	
246	02/02/2017	Feb-18	Yes	
249	02/02/2017	Feb-18	Yes	
254	02/02/2017	Feb-18	Yes	
255	02/02/2017	Feb-18	Yes	
257	03/02/2017	Feb-18	Yes	
258	03/02/2017	Feb-18	Yes	
261	03/02/2017	Feb-18	Yes	
262	03/02/2017	Feb-18	Yes	
263	03/02/2017	Feb-18	Yes	
264	03/02/2017	Feb-18	Yes	
265	03/02/2017	Feb-18	Yes	
268	03/02/2017	Feb-18	Yes	
269	06/02/2017	Feb-18	Yes	
271	06/02/2017	Feb-18	Yes	

RMS Bed ID	Planting Date	12 month Review Due	12 month compliance	12 month comments
282	06/02/2017	Feb-18	Yes	
284	06/02/2017	Feb-18	Yes	
286	07/02/2017	Feb-18	Yes	
287	07/02/2017	Feb-18	Yes	
241	22/02/2017	Feb-18	Yes	
242	22/02/2017	Feb-18	Yes	
145	14/06/2017	Jun-18	Yes	
148	14/06/2017	Jun-18	Yes	
150	14/06/2017	Jun-18	Yes	
151	14/06/2017	Jun-18	Yes	
153	14/06/2017	Jun-18	Yes	
158	14/06/2017	Jun-18	Yes	
159	14/06/2017	Jun-18	Yes	
160	14/06/2017	Jun-18	Yes	
161	14/06/2017	Jun-18	Yes	
162	14/06/2017	Jun-18	Yes	
163	14/06/2017	Jun-18	Yes	
164	14/06/2017	Jun-18	Yes	
165	14/06/2017	Jun-18	Yes	
166A	14/06/2017	Jun-18	Yes	
166B	14/06/2017	Jun-18	Yes	
167	14/06/2017	Jun-18	Yes	
169	14/06/2017	Jun-18	Yes	
170	14/06/2017	Jun-18	Yes	
168	16/06/2017	Jun-18	Yes	
175	16/06/2017	Jun-18	Yes	
176	16/06/2017	Jun-18	Yes	
178	16/06/2017	Jun-18	Yes	
179	16/06/2017	Jun-18	Yes	
183	05/07/2017	Jul-18	Yes	
184	05/07/2017	Jul-18	Yes	
185	05/07/2017	Jul-18	No	
277	05/07/2017	Jul-18	No	
134	15/09/2017	Sep-18		
134B	15/09/2017	Sep-18		
173	16/09/2017	Sep-18		
95	22/09/2017	Sep-18		
114	22/09/2017	Sep-18		
94	22/09/2017	Sep-18		
96	22/09/2017	Sep-18		
97	22/09/2017	Sep-18		

RMS Bed ID	Planting Date	12 month Review Due	12 month compliance	12 month comments
98	22/09/2017	Sep-18		
99	22/09/2017	Sep-18		
100	22/09/2017	Sep-18		
101	22/09/2017	Sep-18		
102	22/09/2017	Sep-18		
103	22/09/2017	Sep-18		
104	22/09/2017	Sep-18		
105	22/09/2017	Sep-18		
106	22/09/2017	Sep-18		
108	22/09/2017	Sep-18		
109	22/09/2017	Sep-18		
110	22/09/2017	Sep-18		
111	22/09/2017	Sep-18		
112	22/09/2017	Sep-18		
113	22/09/2017	Sep-18		
115	22/09/2017	Sep-18		
116	22/09/2017	Sep-18		
119	22/09/2017	Sep-18		
135	22/09/2017	Sep-18		
147	22/09/2017	Sep-18		
149	22/09/2017	Sep-18		
171	25/09/2017	Sep-18		
172	25/09/2017	Sep-18		
174	25/09/2017	Sep-18		
177	25/09/2017	Sep-18		
180	25/09/2017	Sep-18		
181A	25/09/2017	Sep-18		
182	25/09/2017	Sep-18		
186	25/09/2017	Sep-18		
187	25/09/2017	Sep-18		
201	25/09/2017	Sep-18		
205	25/09/2017	Sep-18		
206	25/09/2017	Sep-18		
207	25/09/2017	Sep-18		
208	25/09/2017	Sep-18		
209	25/09/2017	Sep-18		
210	25/09/2017	Sep-18		
211	25/09/2017	Sep-18		
195	25/09/2017	Sep-18		
196	25/09/2017	Sep-18		
197	25/09/2017	Sep-18		

RMS Bed ID	Planting Date	12 month Review Due	12 month compliance	12 month comments
198	25/09/2017	Sep-18		
199	25/09/2017	Sep-18		
203	25/09/2017	Sep-18		
213	25/09/2017	Sep-18		
214	25/09/2017	Sep-18		
229	25/09/2017	Sep-18		
230	25/09/2017	Sep-18		
37A	01/10/2017	Oct-18		
37B	01/10/2017	Oct-18		
38	01/10/2017	Oct-18		
57A	01/10/2017	Oct-18		
57B	01/10/2017	Oct-18		
58	01/10/2017	Oct-18		
59	01/10/2017	Oct-18		
60	01/10/2017	Oct-18		
154	01/10/2017	Oct-18		
155	01/10/2017	Oct-18		
1a	24/10/2017	Oct-18		
1b	24/10/2017	Oct-18		
4	25/10/2017	Oct-18		
5	25/10/2017	Oct-18		
13	25/10/2017	Oct-18		
14	25/10/2017	Oct-18		
15	25/10/2017	Oct-18		
18	25/10/2017	Oct-18		
23	25/10/2017	Oct-18		
24	25/10/2017	Oct-18		
141	01/11/2017	Nov-18		
142	01/11/2017	Nov-18		
143	01/11/2017	Nov-18		
144	01/11/2017	Nov-18		
87	01/11/2017	Nov-18		
88	01/11/2017	Nov-18		
90	01/11/2017	Nov-18		
91	01/11/2017	Nov-18		
92	01/11/2017	Nov-18		
93	01/11/2017	Nov-18		
107	01/11/2017	Nov-18		
117	01/11/2017	Nov-18		
118	01/11/2017	Nov-18		
126	01/11/2017	Nov-18		

RMS Bed ID	Planting Date	12 month Review Due	12 month compliance	12 month comments
128	01/11/2017	Nov-18		
129	01/11/2017	Nov-18		
130	01/11/2017	Nov-18		
146	01/11/2017	Nov-18		
194	01/11/2017	Nov-18		
89	03/11/2017	Nov-18		
42	21/11/2017	Nov-18		
43	21/11/2017	Nov-18		
52	21/11/2017	Nov-18		
53	21/11/2017	Nov-18		
54	21/11/2017	Nov-18		
56	21/11/2017	Nov-18		
212	14/03/2018	Mar-19		
215	14/03/2018	Mar-19		
216	14/03/2018	Mar-19		
217	14/03/2018	Mar-19		
218	14/03/2018	Mar-19		
219	14/03/2018	Mar-19		
220	14/03/2018	Mar-19		
221	14/03/2018	Mar-19		
222	14/03/2018	Mar-19		
223	14/03/2018	Mar-19		
224	14/03/2018	Mar-19		
231	14/03/2018	Mar-19		
236	14/03/2018	Mar-19		
237	14/03/2018	Mar-19		
238	14/03/2018	Mar-19		
239	14/03/2018	Mar-19		
244	14/03/2018	Mar-19		
250	14/03/2018	Mar-19		
251	14/03/2018	Mar-19		
252	14/03/2018	Mar-19		
253	14/03/2018	Mar-19		
256	14/03/2018	Mar-19		
259	14/03/2018	Mar-19		
260	14/03/2018	Mar-19		
266	14/03/2018	Mar-19		
267	14/03/2018	Mar-19		
270	14/03/2018	Mar-19		
272	14/03/2018	Mar-19		
283	14/03/2018	Mar-19		

RMS Bed ID	Planting Date	12 month Review Due	12 month compliance	12 month comments
73	01/04/2018	Apr-19		
74	01/04/2018	Apr-19		
273	30/04/2018	Apr-19		
274	30/04/2018	Apr-19		
275	30/04/2018	Apr-19		
276	30/04/2018	Apr-19		
302	01/05/2018	May-19		
304	01/05/2018	May-19		
95A	01/05/2018	May-19		
125	01/05/2018	May-19		
137	01/05/2018	May-19		
138	01/05/2018	May-19		
139	01/05/2018	May-19		
140	01/05/2018	May-19		
278	01/05/2018	May-19		
278B	01/05/2018	May-19		
279	01/05/2018	May-19		
280	01/05/2018	May-19		
281	01/05/2018	May-19		
196A	01/06/2018	Jun-19		

Native planting data Ku2K

Refined data provided by Roads and Maritime (extracted by Roads and Maritime from data collected by Roads and Maritime). Sites that have met the minimum 12 month criteria are highlighted. C'way = carriageway, NB = northbound, SB = southbound, Y = yes, N = no.

C'way	Chainage	Description	Date Planted	12 month inspection date	Plant Growth exceeds 30cm (Y/N)	Minimum Plant Survival Rate Achieved (Y/N)	Weed Coverage less than 5% (Y/N)	All 12 month criteria met	Actions Taken (June / July 2018)	Recommendations
SB	25550	Mingaletta bus stop	Jul-16	Jul-17	N	N	Y	N		Planting area destroyed by truck accident. Replanting required.
SB	25700	Koala feed tree reallocation	Jul-16	Jul-17	N	N	Y	N		Planting area destroyed by in appropriate public car parking. Replanting required.
SB	28100	Tubestock tree planting	Jul-16	Jul-17	N	N	Y	N	17 replacements	Include in replacement plant program
SB	28200	Tubestock tree planting	Jul-16	Jul-17	Y	Y	N	N	22 replacement	Weed management required
SB	28300	Tubestock tree planting	Jul-16	Jul-17	Y	N	N	N	34 replacements	Include in replacement plant program
SB	25900	Tubestock tree planting	Aug-16	Aug-17	Y	N	Y	N		Include in replacement plant program
SB	28800	Tubestock tree planting	Aug-16	Aug-17	N	N	Y	N		Include in replacement plant program
SB	28800	Water quality basin	Aug-16	Aug-17	N	N	Y	N		Include in replacement plant program
SB	24500	Koala feed tree reallocation	Nov-16	Nov-17	Y	N	Y	N		Include in replacement plant program
SB	28400	Water quality basin	Nov-16	Nov-17	N	N	Y	N		Include in replacement plant program
SB	29100	Tubestock tree planting	Nov-16	Nov-17	N	N	Y	N	12 replacements	Include in replacement plant program
SB	29200	Material Reuse Site 16	Nov-16	Nov-17	Y	N	Y	N	11 replacements	Include in replacement plant program
SB	31200	Tubestock tree planting	Dec-16	Dec-17	Y	Y	N	N		Continue to monitor for weeds
SB	33100	Fauna culvert planting	Jan-17	Jan-18	N	N	Y	N		Include in replacement plant program
SB	33400	Fauna culvert planting	Jan-17	Jan-18	N	N	Y	N	11 replacements	Include in replacement plant program
SB	33500	Tubestock tree planting	Jan-17	Jan-18	N	N	Y	N		Include in replacement plant program
SB	34800	Tubestock tree planting	Jan-17	Jan-18	N	N	Y	N		Include in replacement plant program
SB	34850	Water quality basin	Jan-17	Jan-18	N	N	Y	N		Include in replacement plant program
SB	35400	Water quality basin	Jan-17	Jan-18	N	N	Y	N		Include in replacement plant program

C'way	Chainage	Description	Date Planted	12 month inspection date	Plant Growth exceeds 30cm (Y/N)	Minimum Plant Survival Rate Achieved (Y/N)	Weed Coverage less than 5% (Y/N)	All 12 month criteria met	Actions Taken (June / July 2018)	Recommendations
SB	35400	Tubestock tree planting	Jan-17	Jan-18	N	N	Y	N		Include in replacement plant program
SB	35600	Tubestock tree planting	Jan-17	Jan-18	N	N	Y	N		Include in replacement plant program
SB	35800	Koala feed tree reallocation	Jan-17	Jan-18	N	N	Y	N	8 replacements	Include in replacement plant program
SB	37300	Tubestock tree planting	Jan-17	Jan-18	N	N	N	N		Include in replacement plant program
SB	34600	Koala feed tree reallocation	Feb-17	Feb-18	N	N	Y	N		Include in replacement plant program
SB	34700	Fauna culvert planting	Feb-17	Feb-18	N	N	Y	N	12 replacements	Include in replacement plant program
SB	36300	Fauna culvert planting	Feb-17	Feb-18	N	N	Y	N	11 replacements	Include in replacement plant program
SB	36400	Tubestock tree planting	Feb-17	Feb-18	N	N	Y	N		Include in replacement plant program
SB	36500	Tubestock tree planting	Feb-17	Feb-18	N	N	Y	N		Include in replacement plant program
NB	34100	Fauna culvert planting	Mar-17	Mar-18	N	Y	Y	N	6 replacements	Continue to monitor for weeds
NB	36300	Tubestock tree planting	Mar-17	Mar-18	N	N	N	N	20 replacements	Include in replacement plant program
SB	33000	Tubestock tree planting	Mar-17	Mar-18	N	N	Y	N		Include in replacement plant program
NB	29100	Kundabung Interchange feature trees	Apr-17	Apr-18	Y	N	Y	N	6 replacements	Include in replacement plant program
SB	37700	Water quality basin	Apr-17	Apr-18	N	N	Y	N		Include in replacement plant program
SB	37700	Bridge fauna path and creek crossing	Apr-17	Apr-18	Y	Y	N	N		Weed management required
NB	36850	Tubestock tree planting	Jun-17	Jun-18	Y	Y	N	N		Weed management required
NB	36900	Tubestock tree planting	Jun-17	Jun-18	Y	Y	N	N		Weed management required
SB	36800	Water quality basin	Jun-17	Jun-18	N	N	Y	N		Include in replacement plant program
SB	36800	Tubestock tree planting	Jun-17	Jun-18	N	N	Y	N	9 replacements	Include in replacement plant program
SB	36900	Tubestock tree planting	Jun-17	Jun-18	N	N	N	N		Include in replacement plant program
SB	36950	Water quality basin	Jun-17	Jun-18	N	N	Y	N		Include in replacement plant program
NB	28200	Reallocation of water quality basin tubestock planting	Jul-17	Jul-18	N	N	Y	N		Include in replacement plant program
NB	28200	Bridge fauna path and creek crossing	Jul-17	Jul-18	N	N	Y	N	58 replacements	Include in replacement plant program

C'way	Chainage	Description	Date Planted	12 month inspection date	Plant Growth exceeds 30cm (Y/N)	Minimum Plant Survival Rate Achieved (Y/N)	Weed Coverage less than 5% (Y/N)	All 12 month criteria met	Actions Taken (June / July 2018)	Recommendations
NB	28300	Bridge fauna path and creek crossing	Jul-17	Jul-18	N	N	Y	N	216 replacements	Include in replacement plant program
NB	28300	Tubestock tree planting	Jul-17	Jul-18	N	N	N	N	78 replacements	Include in replacement plant program
NB	28650	Fauna culvert planting	Jul-17	Jul-18	N	Y	Y	N		Continue to monitor for weeds
SB	24600	Effluent irrigation area	Jul-17	Jul-18	N	N	N	N	400 replacements	Area inhibited by spread effluent irrigation and weed growth. Include in replacement plant program and ensure regular slashing.
SB	24700	Koala feed tree reallocation	Jul-17	Jul-18	Y	N	Y	N	4 replacements	Include in replacement plant program
SB	28200	Bridge fauna path and creek crossing	Jul-17	Jul-18	N	N	Y	N	194 replacements	Include in replacement plant program
SB	28300	Bridge fauna path and creek crossing	Jul-17	Jul-18	N	N	Y	N	188 replacements	Include in replacement plant program
SB	30750	Tubestock tree planting	Jul-17	Jul-18	N	N	N	N		Include in replacement plant program
SB	30800	Water quality basin	Jul-17	Jul-18	N	N	Y	N		Include in replacement plant program
SB	31500	Headlight screen planting	Jul-17	Jul-18	N	N	Y	N	353 replacements	Include in replacement plant program
SB	31900	Headlight screen planting	Jul-17	Jul-18	N	N	Y	N	234 replacements	Include in replacement plant program
SB	24400	Reallocation of water quality basin tubestock planting	Jul-16	Jul-17	Y	Y	Y	Y		Continue to monitor for weeds
SB	25200	Glider Crossing	Jul-16	Jul-17	Y	Y	Y	Y		Continue to monitor for weeds
SB	25300	Glider Crossing	Jul-16	Jul-17	Y	Y	Y	Y		Continue to monitor for weeds
SB	25400	Fauna culvert planting	Jul-16	Jul-17	Y	Y	Y	Y		Continue to monitor for weeds
SB	25700	Fauna culvert planting	Jul-16	Jul-17	Y	Y	Y	Y		Continue to monitor for weeds
SB	25700	Reallocation of water quality basin tubestock planting	Jul-16	Jul-17	Y	Y	Y	Y		Continue to monitor for weeds
SB	25800	Fauna culvert planting	Jul-16	Jul-17	Y	Y	Y	Y		Continue to monitor for weeds
SB	26800	Fauna culvert planting	Jul-16	Jul-17	Y	Y	Y	Y		Continue to monitor for weeds
SB	27600	Tubestock tree planting	Jul-16	Jul-17	Y	Y	Y	Y		Continue to monitor for weeds
SB	28700	Fauna culvert planting	Aug-16	Aug-17	Y	Y	Y	Y		Continue to monitor for weeds

C'way	Chainage	Description	Date Planted	12 month inspection date	Plant Growth exceeds 30cm (Y/N)	Minimum Plant Survival Rate Achieved (Y/N)	Weed Coverage less than 5% (Y/N)	All 12 month criteria met	Actions Taken (June / July 2018)	Recommendations
SB	28700	Reallocation of water quality basin tubestock planting	Aug-16	Aug-17	Y	Y	Y	Y		Continue to monitor for weeds
SB	30100	Fauna culvert planting	Aug-16	Aug-17	Y	Y	Y	Y		Continue to monitor for weeds
SB	25400	Culvert screen planting	Sep-16	Sep-17	Y	Y	Y	Y		Continue to monitor for weeds
SB	26400	Fauna culvert planting	Sep-16	Sep-17	Y	Y	Y	Y	7 replacements	Continue to monitor for weeds
SB	30600	Tubestock tree planting	Nov-16	Nov-17	Y	Y	Y	Y		Continue to monitor for weeds
SB	31900	Fauna culvert planting	Dec-16	Dec-17	Y	Y	Y	Y		Continue to monitor for weeds
SB	32300	Fauna culvert planting	Dec-16	Dec-17	Y	Y	Y	Y		Continue to monitor for weeds
SB	33900	Glider Crossing	Jan-17	Jan-18	Y	Y	Y	Y		Continue to monitor for weeds
SB	34100	Fauna culvert planting	Jan-17	Jan-18	Y	Y	Y	Y		Continue to monitor for weeds
SB	34900	Tubestock tree planting	Jan-17	Jan-18	Y	Y	Y	Y		Continue to monitor for weeds
SB	35700	Fauna culvert planting	Jan-17	Jan-18	Y	Y	Y	Y	6 replacements	Continue to monitor for weeds
NB	33900	Glider Crossing	Mar-17	Mar-18	Y	Y	Y	Y	7 replacements	Continue to monitor for weeds
NB	35700	Glider Crossing	Mar-17	Mar-18	Y	Y	Y	Y		Continue to monitor for weeds
NB	35700	Fauna culvert planting	Mar-17	Mar-18	Y	Y	Y	Y	9 replacements	Continue to monitor for weeds
NB	35700	Reallocation of water quality basin tubestock planting	Mar-17	Mar-18	Y	Y	Y	Y		Continue to monitor for weeds
NB	36100	Koala feed tree reallocation	Mar-17	Mar-18	Y	Y	Y	Y	13 replacements	Continue to monitor for weeds
NB	36200	Tubestock tree planting	Mar-17	Mar-18	Y	Y	Y	Y		Continue to monitor for weeds
NB	36400	Tubestock tree planting	Mar-17	Mar-18	Y	Y	Y	Y		Continue to monitor for weeds
SB	24800	Rest area feature trees	Mar-17	Mar-18	Y	Y	Y	Y		Continue to monitor for weeds
SB	29800	Material Reuse Site 10	Mar-17	Mar-18	Y	Y	Y	Y		Continue to monitor for weeds
SB	24800	Rest area tubestock	Apr-17	Apr-18	Y	Y	Y	Y		Water during dry periods. Continue to monitor for weeds.
SB	29200	Kundabung Interchange feature trees	Apr-17	Apr-18	Y	Y	Y	Y		Continue to monitor for weeds

C'way	Chainage	Description	Date Planted	12 month inspection date	Plant Growth exceeds 30cm (Y/N)	Minimum Plant Survival Rate Achieved (Y/N)	Weed Coverage less than 5% (Y/N)	All 12 month criteria met	Actions Taken (June / July 2018)	Recommendations
SB	33800	HVIB tubestock	Apr-17	Apr-18	Y	Y	Y	Y		Continue to monitor for weeds
SB	33800	HVIB feature trees	Apr-17	Apr-18	Y	Y	Y	Y		Continue to monitor for weeds
NB	28650	Reallocation of water quality basin tubestock planting	Jul-17	Jul-18	Y	Y	Y	Y	7 replacements	Continue to monitor for weeds
SB	28350	Reallocation of water quality basin tubestock planting	Jul-17	Jul-18	Y	Y	Y	Y		Continue to monitor for weeds
NB	25200	Glider Crossing	Aug-17	Aug-18						
NB	25300	Glider Crossing	Aug-17	Aug-18						
NB	25400	Reallocation of water quality basin tubestock planting	Aug-17	Aug-18						
NB	25400	Fauna culvert planting	Aug-17	Aug-18						
NB	25400	Material Reuse Site 12	Aug-17	Aug-18						
NB	25700	Fauna culvert planting	Aug-17	Aug-18						
NB	25800	Fauna culvert planting	Aug-17	Aug-18						
NB	26700	Tubestock tree planting	Aug-17	Aug-18						
NB	26800	Fauna culvert planting	Aug-17	Aug-18						
NB	30100	Fauna culvert planting	Aug-17	Aug-18						
NB	30650	Bridge fauna path and creek crossing	Aug-17	Aug-18						
NB	30700	Bridge fauna path and creek crossing	Aug-17	Aug-18						
NB	31900	Fauna culvert planting	Aug-17	Aug-18						
NB	32350	Fauna culvert planting	Aug-17	Aug-18						
NB	32500	Material Reuse Site 18 (west Ravenswood Rd)	Aug-17	Aug-18						

C'way	Chainage	Description	Date Planted	12 month inspection date	Plant Growth exceeds 30cm (Y/N)	Minimum Plant Survival Rate Achieved (Y/N)	Weed Coverage less than 5% (Y/N)	All 12 month criteria met	Actions Taken (June / July 2018)	Recommendations
NB	32660	Fauna culvert planting	Aug-17	Aug-18						
NB	32800	Headlight screen planting	Aug-17	Aug-18						
NB	37400	Headlight screen planting	Aug-17	Aug-18						
NB	37800	Headlight screen planting	Aug-17	Aug-18						
SB	30650	Bridge fauna path and creek crossing	Aug-17	Aug-18						
SB	30700	Bridge fauna path and creek crossing	Aug-17	Aug-18						
NB	26400	Fauna culvert planting	Sep-17	Sep-18						
NB	30600	Headlight screen planting	Sep-17	Sep-18						
NB	30800	Headlight screen planting	Sep-17	Sep-18						
NB	29300	Kundabung Interchange feature trees	Oct-17	Oct-18						
NB	29600	Tubestock tree planting	Oct-17	Oct-18						
SB	29300	Kundabung Interchange feature trees	Oct-17	Oct-18						
NB	24900	Rest area feature trees	Nov-17	Nov-18						
NB	24700	Reallocation of water quality basin tubestock planting	Dec-17	Dec-18						
NB	24700	Koala feed tree reallocation	Dec-17	Dec-18						
NB	24900	Rest area tubestock	Dec-17	Dec-18						
NB	27150	Bus Stop - Upper Smiths Creek Rd	Dec-17	Dec-18						
NB	27500	Material Reuse Site 26	Dec-17	Dec-18						
NB	27500	Fauna culvert planting	Dec-17	Dec-18						
NB	29650	Bus Stop - Rodeo Dr	Dec-17	Dec-18						
NB	32400	Fauna culvert planting	Dec-17	Dec-18						

C'way	Chainage	Description	Date Planted	12 month inspection date	Plant Growth exceeds 30cm (Y/N)	Minimum Plant Survival Rate Achieved (Y/N)	Weed Coverage less than 5% (Y/N)	All 12 month criteria met	Actions Taken (June / July 2018)	Recommendations
NB	33100	Fauna culvert planting	Dec-17	Dec-18						
NB	33400	Fauna culvert planting	Dec-17	Dec-18						
SB	27400	Bus Stop - Wharf Road	Dec-17	Dec-18						
NB	25000	Water quality basin	Feb-18	Feb-19						
NB	25100	Rest area effluent irrigation area	Feb-18	Feb-19						
NB	32500	Material Reuse Site 18 (east Ravenswood Rd)	Feb-18	Feb-19						
NB	34600	Tubestock tree planting	Feb-18	Feb-19	N	N	Y			Include in replacement plant program
NB	34700	Fauna culvert planting	Feb-18	Feb-19	N	Y	Y			Continue to monitor for weeds
NB	36350	Fauna culvert planting	Feb-18	Feb-19	N	N	Y			Include in replacement plant program
NB	37700	Bridge fauna path and creek crossing	Feb-18	Feb-19	N	Y	Y			Continue to monitor for weeds
SB	33800	HVIB Effluent Irrigation area	Mar-18	Mar-19	N	Y	Y			Continue to monitor for weeds
NB	26900	Tubestock tree planting	Jun-18	Jun-19	N	N	Y			Include in replacement plant program
NB	31000	Material Reuse Site 22	Jun-18	Jun-19	N	N	N			Include in replacement plant program
SB	29500	Tubestock tree planting	Jun-18	Jun-19	N	N	Y			Include in replacement plant program
SB	32660	Fauna culvert planting	Jun-18	Jun-19	N	Y	Y			Continue to monitor for weeds

Niche Environment and Heritage

A specialist environmental and heritage consultancy.

Head Office

Niche Environment and Heritage

PO Box 2443 North Parramatta NSW 1750

Email: info@niche-eh.com

All mail correspondence should be through our Head Office

Appendix J Pre-Clearing and Clearing, Kundabung to Kempsey



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



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

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1.0 INTRODUCTION

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.

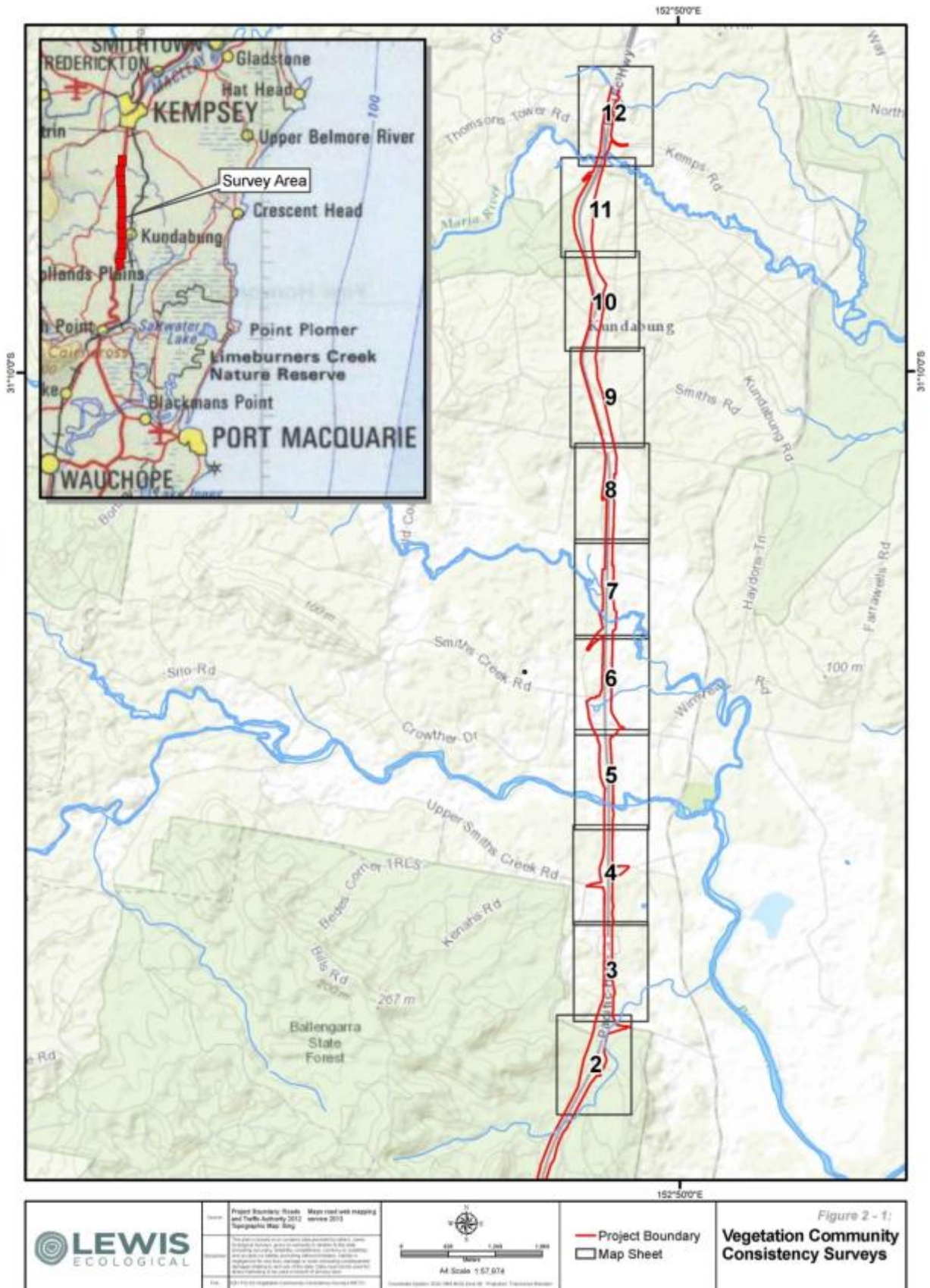


Figure 1-1. Location of the Kundabung to Kempsey Project.

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 decorticated 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 triglochinos</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)
Sub-Tropical Coastal Floodplain Forest EEC	
Moist Floodplain Closed Forest with Rainforest Elements	0.07
Riparian Forest	5.90
Swamp Sclerophyll Forest EEC	
Paperbark Swamp Forest	0.56
Swamp Mahogany/Forest Red Gum Swamp Forest	0.00
Swamp Oak Floodplain Forest EEC	
Swamp Oak Forest	0.00
Freshwater Wetland EEC	
Freshwater Wetland	0.00
Other	
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
Total	89.15

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 m². 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
Frogs								
<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> ^v	Green-thighed Frog^v	√		√			√	√
<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> ^e	Giant Barred Frog^e	√		√				
<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				√		√	
Reptiles								
<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					√		
<i>Hoplocephalus stephensi</i> v	Stephens Banded Snake v					√		
<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	√				√		
Mammals								
<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> ^v	Little Bent-wing Bat ^v	√	√					
<i>Miniopterus schreibersii</i> ^v	Eastern Bent-wing Bat ^v	√	√					
<i>Mus musculus</i> *	House Mouse *	√					√	
<i>Myotis macropus</i> ^v	Southern Myotis ^v	√	√				√	
<i>Oryctolagus cuniculus</i> *	European Rabbit *	√			√			
<i>Perameles nasuta</i>	Long-nosed Bandicoot	√						
<i>Petauroides volans</i>	Greater Glider	√						
<i>Petaurus australis</i> ^v	Yellow-bellied Glider ^v	√						
<i>Petaurus breviceps</i>	Sugar Glider	√				√		
<i>Phascolarctos cinereus</i> ^v	Koala ^v	√						
<i>Pseudocheirus peregrinus</i>	Common Ringtail Possum	√				√		
<i>Pteropus poliocephalus</i> ^v	Grey-headed Flying Fox ^v	√						
<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	√			√		√	
Birds								
<i>Accipiter novaehollandiae</i>	Grey Goshawk	√						
<i>Aegotheles cristatus</i>	Australian Owlet Nightjar	√				√		
<i>Ephippiorhynchus asiaticus</i> ^e	Black-necked Stork ^e						√	
<i>Lophoictinia isura</i> ^v	Square-tailed Kite ^v	√					√	
<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> ^v	Sooty Owl ^v	√						
<i>Daphoenositta chrysoptera</i> ^v	Varied Sitella ^v	√			√		√	
<i>Calyptorhynchus lathami</i> ^v	Glossy Black Cockatoo ^v	√						
<i>Glossopsitta pusilla</i> ^v	Little Lorikeet ^v	√			√			

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 (16th 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	
Reptiles				
<i>Hoplocephalus stephensii</i>	Stephens Banded Snake	V		One individual from ch. 34975 mapped as Moist Slopes Forest in the Environmental Assessment (GHD 2010).
Frogs				
<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.
Mammals				
<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 th 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.
Birds				
<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 th 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"> • Barrys Creek to Mingaletta Road; • Pipers Creek • Maria River State Forest from 32600 to 36000

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
			Total	94 + tadpoles

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 joints 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 th September 2014	17 th September 2014	18 th September 2014	22 nd September 2014	23 rd September 2014	29 th September 2014	30 th September 2014
Culverts							
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					
Bridges							
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 th September 2016	15 th September 2016	16 th September	17 th 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 th September 2016	15 th September 2016	16 th September	17 th 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
Northern Zone		22nd September 2016	23rd September 2016	24th September	
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 <i>in situ</i> 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

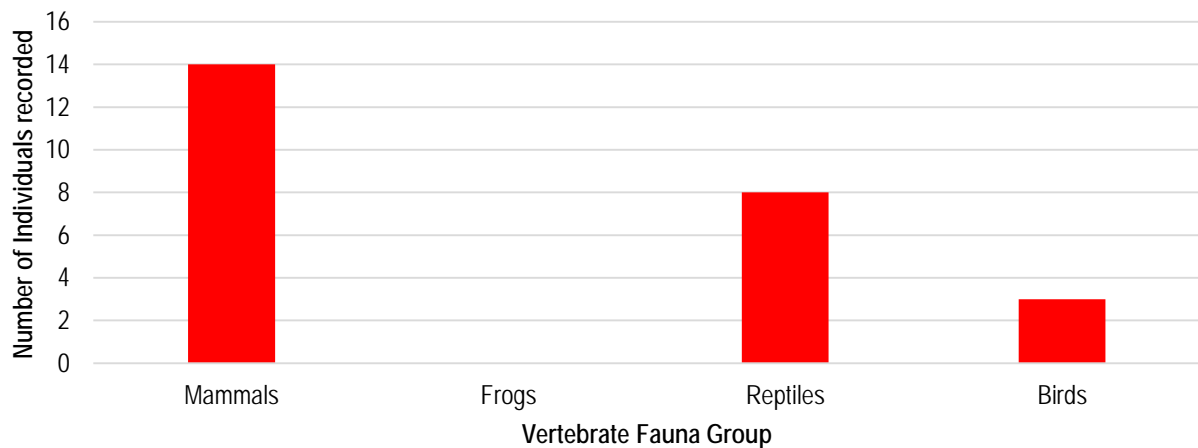


Figure 3-1. Pre-construction weekly road kill monitoring performed in October and November 2014.

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.*).

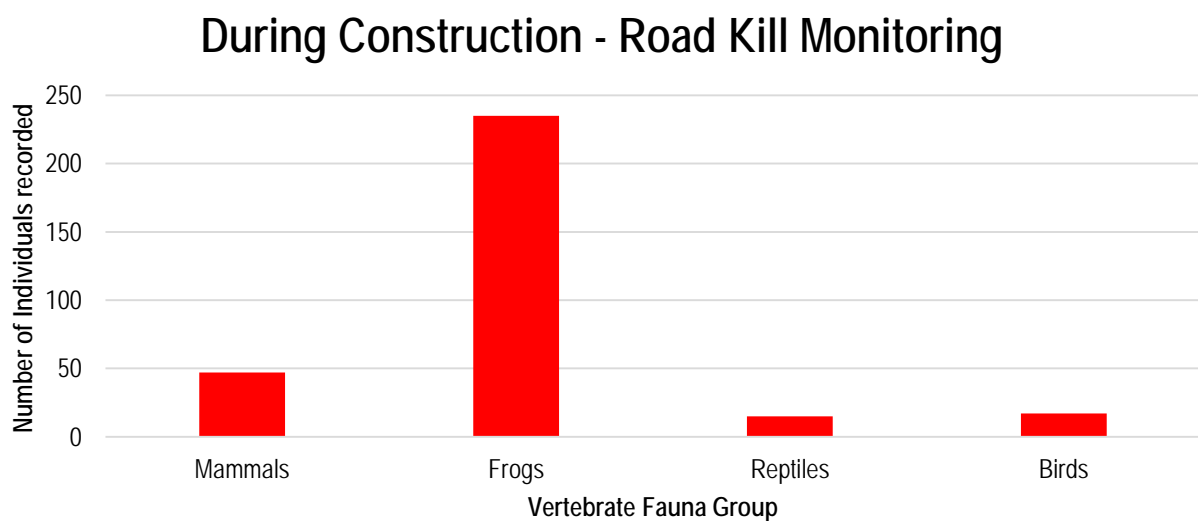


Figure 3-2. Numbers of road kill fauna recorded during construction monitoring.

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.

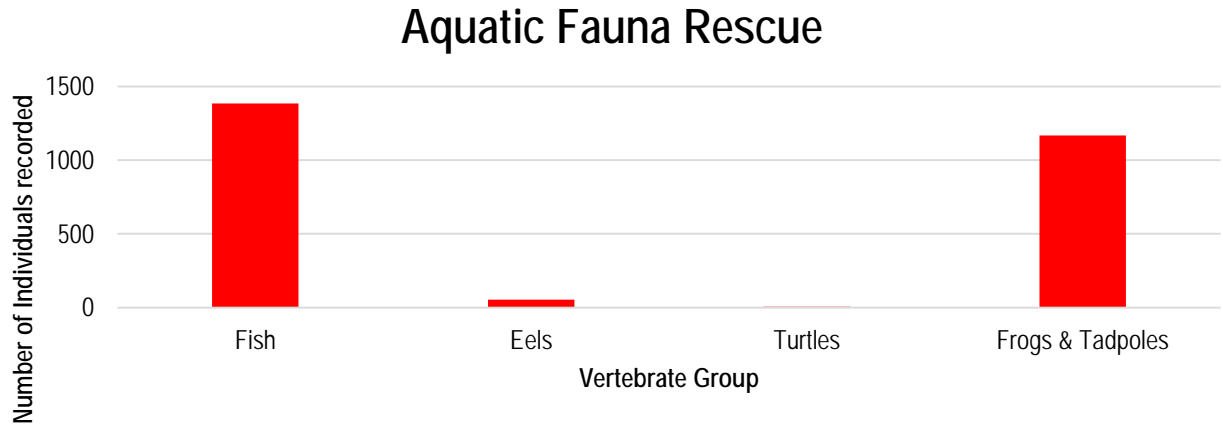


Figure 3-3. Aquatic vertebrate captures during the construction phase of K2K project.

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><u>1. Identification and protection of Giant Barred Frog habitat</u></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><u>2. Pre-clearing Surveys</u></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><u>3. Frog Fencing</u></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><u>4. Unexpected finds procedure</u></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><u>1. Protection of existing habitat</u></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"> 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; 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 pre-clearing surveys were undertaken in these areas. <p><u>2. Protection of existing habitat</u> At some locations existing habitat was protected via temporary fencing and later permanent fencing in accordance with the strategy.</p> <p><u>3. Pre-clearing surveys</u> 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><u>6. Unexpected finds procedure linking to strategies 2-5 and 7</u> 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 pumulis</i>) was killed during HBT removal.</p> <p><u>3. Planned Roost Exclusion</u> No microbats were killed during work on culverts identified in the Microbat Management Plan.</p> <p><u>4. Seasonal limitation</u> 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. 5. Protection of existing habitat 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

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

- GHD (2010). Oxley Highway to Kempsey Environmental Assessment. Report prepared for the Roads and Maritime Services.
- Gibbons, P. & Lindenmayer, D. (2002). *Tree Hollows and Wildlife Conservation in Australia*. CSIRO Publishing, Collingwood, Victoria.
- Lewis, B.D (2013a). Oxley Highway to Kempsey: Nest Box Plan of Management. Report prepared for SMEC-Hyder Joint Venture by Lewis Ecological Surveys. ©
- Lewis, B.D (2013b). Oxley Highway to Kempsey: Giant Barred Frog Management Strategy. Report prepared for SMEC-Hyder Joint Venture by Lewis Ecological Surveys. ©
- Lewis, B.D (2013c). Oxley Highway to Kempsey: Green-thighed Frog Management Strategy. Report prepared for SMEC-Hyder Joint Venture by Lewis Ecological Surveys. ©
- Lewis, B.D (2013d). Oxley Highway to Kempsey: Microbat Management Strategy. Report prepared for SMEC-Hyder Joint Venture by Lewis Ecological Surveys. ©
- Lewis, B. (2014a). Post Clearing Report: Kempsey Bypass. Report prepared for Kempsey Bypass Alliance by Lewis Ecological Surveys.
- Lewis, B. (2014b). Kundabung to Kempsey Bat Box Monitoring: Episode 1 Winter Period 2014. Letter Report to McConnell Dowell Constructors (Aust) Pty Ltd.
- Lewis, B. (2014c). Kundabung to Kempsey Bat Box Monitoring: Episode 2 Spring Period 2014. Letter Report to McConnell Dowell Constructors (Aust) Pty Ltd.
- Lewis, B. (2015a). Kundabung to Kempsey Bat Box Monitoring: Episode 3 Summer Period 2015. Letter Report to McConnell Dowell Constructors (Aust) Pty Ltd.
- Lewis, B. (2015b). Kundabung to Kempsey Bat Box Monitoring: Episode 4 Autumn Period 2015. Letter Report to McConnell Dowell Constructors (Aust) Pty Ltd.
- Lewis, B. (2015b). Kundabung to Kempsey Bat Box Monitoring: Episode 5 Winter Period 2015. Letter Report to McConnell Dowell Constructors (Aust) Pty Ltd.
- McConnell Dowell – OHL (2014). Flora and Fauna Management Plan. Prepared by McConnell Dowell – OHL for the K2K Upgrade.
- Sandpiper Ecological Surveys (2015). *Pacific Highway Upgrade. Oxley Highway to Kundabung: Clearing Report*. Unpublished report prepared for Lend Lease Engineering.
- Smith, A.C.M. and Lewis, B.D. (2014). Pacific Highway Upgrade: Kundabung to Kempsey Noxious Weed Surveys and Rehabilitation Advice. Report prepared for the McConnell Dowell OLA Joint Venture by Lewis Ecological Surveys. ©

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

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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	Eastings	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	East	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	East	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	East	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	East	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					Ants nest
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	ratty smell	NA	NA	NA	NA					Ratty 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					

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
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					

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
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					

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
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

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
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

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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

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
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	Feather-tailed 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

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
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

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
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 nigriceps</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); Pseudoecheirus 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	Myotis macropus	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 gracilentata (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
					Pre-construction	25
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
					During Construction Totals	313

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
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.		



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



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Customer feedback
Roads and Maritime
Locked Bag 928,
North Sydney NSW 2059

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